INSTRUCTOR ANSWER GUIDE

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Elementary

Algebra

Elementary Algebra
1: Foundations
1.1 Introduction to Whole Numbers

Use Place Value with Whole Numbers In the following exercises, find the place value of each digit in the given numbers.

1. 51,493
(a) 1
(b) 4
(c) 9
(d) 5
(e) 3
Answer: (a) thousands (b) hundreds (c) tens (d) ten thousands (e) ones

2. 87,210
(a) 2
(b) 8
(c) 0
(d) 7
(e) 1
Answer: (a) hundreds (b) ten thousands (c) ones (d) thousands (e) tens

3. 164,285
(a) 5
(b) 6
(c) 1
(d) 8
(e) 2
Answer: (a) ones (b) ten thousands (c) hundred thousands (d) tens (e) hundreds

4. 395,076
(a) 5
(b) 3
(c) 7
(d) 0
(e) 9
Answer: (a) thousands (b) hundred thousands (c) tens (d) hundreds (e) ten thousands

5. 93,285,170
(a) 9
(b) 8
(c) 7
(d) 5
(e) 3
Answer: (a) ten millions (b) ten thousands (c) tens (d) thousands (e) millions

6. 36,084,215
(a) 8
(b) 6
(c) 5
(d) 4
(e) 3
Answer: (a) ten thousands (b) millions (c) ones (d) thousands (e) ten millions

7. 7,284,915,860,132
(a) 7
(b) 4
(c) 5
(d) 3
(e) 0
Answer: (a) trillions (b) billions (c) millions (d) tens (e) thousands

8. 2,850,361,159,433
(a) 9
(b) 8
(c) 6
(d) 4
(e) 2
Answer: (a) thousands (b) hundred billions (c) ten millions (d) hundreds (e) trillions

In the following exercises, name each number using words.

9. 1,078
Answer: one thousand, seventy-eight

10. 5,902
Answer: five thousand, nine hundred two

11. 364,510
Answer: three hundred sixty-four thousand, five hundred ten

12. 146,023
Answer: one hundred forty-six thousand, twenty-three

13. 5,846,103
Answer: five million, eight hundred forty-six thousand, one hundred three

14. 1,458,398
Answer: one million, four hundred fifty-eight thousand, three hundred ninety-eight

15. 37,889,005
Answer: thirty-seven million, eight hundred eighty-nine thousand, five

16. 62,008,465
Answer: sixty-two million, eight thousand, four hundred sixty-five

In the following exercises, write each number as a whole number using digits.

17. four hundred twelve
Answer: 412

18. two hundred fifty-three
Answer: 253

19. thirty-five thousand, nine hundred seventy-five
Answer: 35,975

20. sixty-one thousand, four hundred fifteen
Answer: 61,415

21. eleven million, forty-four thousand, one hundred sixty-seven
Answer: 11,044,167

22. eighteen million, one hundred two thousand, seven hundred eighty-three
Answer: 18,102,783

23. three billion, two hundred twenty-six million, five hundred twelve thousand, seventeen
Answer: 3,226,512,017

24. eleven billion, four hundred seventy-one million, thirty-six thousand, one hundred six
Answer: 11,471,036,106

In the following, round to the indicated place value.

25. Round to the nearest ten.
(a) 386 (b) 2,931
Answer: (a) 390 (b) 2,930

26. Round to the nearest ten.
(a) 792 (b) 5,647
Answer: (a) 790 (b) 5,650

27. Round to the nearest hundred.
(a) 13,748 (b) 391,794
Answer: (a) 13,700 (b) 391,800

28. Round to the nearest hundred.
(a) 28,166 (b) 481,628
Answer: (a) 28,200 (b)481,600

29. Round to the nearest ten.
(a) 1,492 (b) 1,497
Answer: (a) 1,490 (b) 1,500

30. Round to the nearest ten.
(a) 2,791 (b) 2,795
Answer: (a) 2,790 (b) 2,800

31. Round to the nearest hundred.
(a) 63,994 (b) 63,040
Answer: (a) 64,000 (b) 63,940

32. Round to the nearest hundred.
(a) 49,584 (b) 49,548
Answer: (a) 49,600 (b) 49,500

In the following exercises, round each number to the nearest (a) hundred; (b) thousand; and (c) ten thousand.

33. 392,546
Answer: (a) 392,500 (b) 393,000 (c) 390,000

34. 619,348
Answer: (a) 619,300 (b) 619,000 (c) 620,000

35. 2,586,991

Answer: (a) 2,587,000 (b) 2,587,000 (c) 2,590,000

36. 4,287,965
Answer: (a) 4,288,000 (b) 4,288,000 (c) 4,290,000

Identify Multiples and Factors In the following exercises, use the divisibility tests to determine whether each number is divisible by 2, 3, 5, 6, and 10.

37. 84
Answer: divisible by 2, 3, and 6

38. 9,696
Answer: divisible by 2, 3, and 6

39. 75
Answer: divisible by 3 and 5

40. 78
Answer: divisible by 2, 3, and 6

41. 900
Answer: divisible by 2, 3, 5, 6, and 10

42. 800
Answer: divisible by 2, 5, and 10

43. 986
Answer: divisible by 2

44. 942
Answer: divisible by 2, 3, and 6

45. 350
Answer: divisible by 2, 5, and 10

46. 550
Answer: divisible by 2, 5, and 10

47. 22,335
Answer: divisible by 3 and 5

48. 39,075
Answer: divisible by 3 and 5

Find Prime Factorizations and Least Common Multiples In the following exercises, find the prime factorization.

49. 86
Answer: $2 \cdot 43$

50. 78
Answer: $2 \cdot 3 \cdot 13$

51. 132
Answer: $2 \cdot 2 \cdot 3 \cdot 11$

52. 455
Answer: $5 \cdot 7 \cdot 13$

53. 693
Answer: $3 \cdot 3 \cdot 7 \cdot 11$

54. 400
Answer: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$

55. 432
Answer: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$

56. 627
Answer: $3 \cdot 11 \cdot 19$

57. 2,160
Answer: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5$

58. 2,520
Answer: $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 7$

In the following exercises, find the least common multiple of the each pair of numbers using the multiples method.

59. 8, 12
Answer: 24

60. 4, 3
Answer: 12

61. 12, 16

Answer: 48

62. 30, 40
Answer: 120

63. 20, 30
Answer: 60

64. 44, 55
Answer: 220

In the following exercises, find the least common multiple of each pair of numbers using the prime factors method.

65. 8, 12
Answer: 24

66. 12, 16
Answer: 48

67. 28, 40
Answer: 280

68. 84, 90
Answer: 1,260

69. 55, 88
Answer: 440

70. 60, 72
Answer: 360

Everyday Math

71. **Writing a Check** Jorge bought a car for $24,493. He paid for the car with a check. Write the purchase price in words.
Answer: twenty-four thousand, four hundred ninety-three dollars

72. **Writing a Check** Marissa's kitchen remodeling cost $18,549. She wrote a check to the contractor. Write the amount paid in words.
Answer: eighteen thousand, five hundred forty-nine dollars

73. **Buying a Car** Jorge bought a car for $24,493. Round the price to the nearest (a) ten; (b) hundred; (c) thousand; and (d) ten-thousand.

Answer: (a) $24,490 (b) $24,500 (c)$24,000 (d) $20,000

74. **Remodeling a Kitchen** Marissa's kitchen remodeling cost $18,549, Round the cost to the nearest (a) ten; (b) hundred; (c) thousand; and (d) ten-thousand.
Answer: (a) $18,550 (b) $18,500 (c) $19,000 (d) $20,000

75. **Population** The population of China was 1,339,724,852 on November 1, 2010. Round the population to the nearest (a) billion; (b) hundred-million; and (c) million.
Answer: (a) 1,000,000,000 (b) 1,300,000,000 (c) 1,340,000,000

76. **Astronomy** The average distance between Earth and the sun is 149,597,888 kilometers. Round the distance to the nearest (a) hundred-million; b) ten-million; and (c) million.
Answer: (a) 100,000,000 (b) 150,000,000 (c) 150,000,000

77. **Grocery Shopping** Hot dogs are sold in packages of 10, but hot dog buns come in packs of eight. What is the smallest number that makes the hot dogs and buns come out even?
Answer: 40

78. **Grocery Shopping** Paper plates are sold in packages of 12 and party cups come in packs of eight. What is the smallest number that makes the plates and cups come out even?
Answer: 24

Writing Exercises

79. Give an everyday example where it helps to round numbers.
Answer: Answers may vary

80. If a number is divisible by 2 and by 3 why is it also divisible by 6?
Answer: Answers may vary

81. What is the difference between prime numbers and composite numbers?
Answer: Answers may vary

82. Explain in your own words how to find the prime factorization of a composite number, using any method you prefer.
Answer: Answers may vary

Elementary Algebra
1: Foundations
1.2 Use the Language of Algebra

Use Variables and Algebraic Symbols In the following exercises, translate from algebra to English.

83. $16-9$
Answer: 16 minus 9, the difference of sixteen and nine

84. $3\cdot 9$
Answer: 3 times 9, the product of three and nine

85. $28\div 4$
Answer: 28 divided by 4, the quotient of twenty-eight and four

86. $x+11$
Answer: x plus 11, the sum of x and eleven

87. $(2)(7)$
Answer: 2 times 7, the product of two and seven

88. $(4)(8)$
Answer: 4 times 8, the product of four and eight

89. $14<21$
Answer: fourteen is less than twenty-one

90. $17<35$
Answer: seventeen is less than thirty-five

91. $36\geq 19$
Answer: thirty-six is greater than or equal to nineteen

92. $6n=36$
Answer: 6 times n equals 36, the product of six and n equals thirty-six

93. $y-1>6$
Answer: y minus 1 is greater than 6, the difference of y and one is greater than six

94. $y-4>8$
Answer: y minus 4 is greater than 8, the difference of y and four is greater than eight

95. $2\leq 18\div 6$
Answer: 2 is less than or equal to 18 divided by 6; 2 is less than or equal to the quotient of eighteen and six

96. $a \neq 1 \cdot 12$

Answer: a is not equal to 1 times 12, a is not equal to the product of one and twelve

In the following exercises, determine if each is an expression or an equation.

97. $9 \cdot 6 = 54$

Answer: equation

98. $7 \cdot 9 = 63$

Answer: equation

99. $5 \cdot 4 + 3$

Answer: expression

100. $x + 7$

Answer: expression

101. $x + 9$

Answer: expression

102. $y - 5 = 25$

Answer: equation

Simplify Expressions Using the Order of Operations In the following exercises, simplify each expression.

103. 5^3

Answer: 125

104. 8^3

Answer: 512

105. 2^8

Answer: 256

106. 10^5

Answer: 100,000

In the following exercises, simplify using the order of operations.

107. (a) $3 + 8 \cdot 5$ (b) $(3 + 8) \cdot 5$

Answer: (a) 43 (b) 55

108. (a) $2 + 6 \cdot 3$ (b) $(2 + 6) \cdot 3$

Answer: (a) 20 (b) 24

109. $2^3 - 12 \div (9 - 5)$

Answer: 5

110. $3^2 - 18 \div (11 - 5)$

Answer: 6

111. $3 \cdot 8 + 5 \cdot 2$

Answer: 34

112. $4 \cdot 7 + 3 \cdot 5$

Answer: 43

113. $2 + 8(6 + 1)$

Answer: 58

114. $4 + 6(3 + 6)$

Answer: 58

115. $4 \cdot 12 / 8$

Answer: 6

116. $2 \cdot 36 / 6$

Answer: 12

117. $(6 + 10) \div (2 + 2)$

Answer: 4

118. $(9 + 12) \div (3 + 4)$

Answer: 3

119. $20 \div 4 + 6 \cdot 5$

Answer: 35

120. $33 \div 3 + 8 \cdot 2$

Answer: 27

121. $3^2 + 7^2$

Answer: 58

122. $(3 + 7)^2$

Answer: 100

123. $3(1+9\cdot 6)-4^2$

Answer: 149

124. $5(2+8\cdot 4)-7^2$

Answer: 121

125. $2\left[1+3(10-2)\right]$

Answer: 50

126. $5\left[2+4(3-2)\right]$

Answer: 30

Evaluate an Expression In the following exercises, evaluate the following expressions.

127. $7x+8$ when $x=2$

Answer: 22

128. $8x-6$ when $x=7$

Answer: 50

129 x^2 when $x=12$

Answer: 144

130. x^3 when $x=5$

Answer: 125

131. x^5 when $x=2$

Answer: 32

132. 4^x when $x=2$

Answer: 16

133. x^2+3x-7 when $x=4$

Answer: 21

134. $6x+3y-9$ when $x=6,\ y=9$

Answer: 54

135. $(x-y)^2$ when $x=10,\ y=7$

Answer: 9

136. $(x+y)^2$ when $x=6,\ y=9$

Answer: 225

137. a^2+b^2 when $a=3,\ b=8$

Answer: 73

138. $r^2 - s^2$ when $r = 12, s = 5$

Answer: 119

139. $2l + 2w$ when $l = 15, w = 12$

Answer: 54

140. $2l + 2w$ when $l = 18, w = 14$

Answer: 64

Simplify Expressions by Combining Like Terms In the following exercises, identify the coefficient of each term.

141. $8a$

Answer: 8

142. $13m$

Answer: 13

143. $5r^2$

Answer: 5

144. $6x^3$

Answer: 6

In the following exercises, identify the like terms.

145. $x^3, 8x, 14, 8y, 5, 8x^3$

Answer: x^3 and $8x^3$, 14 and 5

146. $6z, 3w^2, 1, 6z^2, 4z, w^2$

Answer: $6z$ and $4z$, $3w^2$ and w^2

147. $9a, a^2, 16, 16b^2, 4, 9b^2$

Answer: 16 and 4, $16b^2$ and $9b^2$

148. $3, 25r^2, 10s, 10r, 4r^2, 3s$

Answer: $25r^2$ and $4r^2$, $10s$ and $3s$

In the following exercises, identify the terms in each expression.

149. $15x^2 + 6x + 2$

Answer: $15x^2, 6x, 2$

150. $11x^2 + 8x + 5$

Answer: $11x^2, 8x, 5$

151. $10y^3 + y + 2$

Answer: $10y^3, y, 2$

152. $9y^3 + y + 5$

Answer: $9y^3, y, 5$

In the following exercises, simplify the following expressions by combining like terms.

153. $10x + 3x$

Answer: $13x$

154. $15x + 4x$

Answer: $19x$

155. $4c + 2c + c$

Answer: $7c$

156. $6y + 4y + y$

Answer: $11y$

157. $7u + 2 + 3u + 1$

Answer: $10u + 3$

158. $8d + 6 + 2d + 5$

Answer: $10d + 11$

159. $10a + 7 + 5a - 2 + 7a - 4$

Answer: $22a + 1$

160. $7c + 4 + 6c - 3 + 9c - 1$

Answer: $22c$

161. $3x^2 + 12x + 11 + 14x^2 + 8x + 5$

Answer: $17x^2 + 20x + 16$

162. $5b^2 + 9b + 10 + 2b^2 + 3b - 4$

Answer: $7b^2 + 12b + 6$

Translate an English Phrase to an Algebraic Expression In the following exercises, translate the phrases into algebraic expressions.

163. the difference of 14 and 9

Answer: $14 - 9$

164. the difference of 19 and 8

Answer: $19-8$

165. the product of 9 and 7

Answer: $9\cdot 7$

166. the product of 8 and 7

Answer: $8\cdot 7$

167. the quotient of 36 and 9

Answer: $36\div 9$

168. the quotient of 42 and 7

Answer: $42\div 7$

169. the sum of *8x* and 3*x*

Answer: $8x+3x$

170. the sum of *13x* and 3*x*

Answer: $13x+3x$

171. the quotient of *y* and 3

Answer: $\frac{y}{3}$

172. the quotient of *y* and 8

Answer: $\frac{y}{8}$

173. eight times the difference of *y* and nine

Answer: $8(y-9)$

174. seven times the difference of *y* and one

Answer: $7(y-1)$

175. Eric has rock and classical CDs in his car. The number of rock CDs is 3 more than the number of classical CDs. Let *c* represent the number of classical CDs. Write an expression for the number of rock CDs.

Answer: $c+3$

176. The number of girls in a second-grade class is 4 less than the number of boys. Let *b* represent the number of boys. Write an expression for the number of girls.

Answer: $b-4$

177. Greg has nickels and pennies in his pocket. The number of pennies is seven less than twice the number of nickels. Let *n* represent the number of nickels. Write an expression for the number of pennies.

Answer: $2n-7$

178. Jeannette has $5 and $10 bills in her wallet. The number of fives is three more than six times the number of tens. Let t represent the number of tens. Write an expression for the number of fives.
Answer: $6t+3$

Everyday Math

179. **Car insurance** Justin's car insurance has a $750 deductible per incident. This means that he pays $750 and his insurance company will pay all costs beyond $750. If Justin files a claim for $2,100.
(a) how much will he pay?
(b) how much will his insurance company pay?
Answer: (a) $750; (b) $1,350

180. Home insurance Armando's home insurance has a $2,500 deductible per incident. This means that he pays $2,500 and the insurance company will pay all costs beyond $2,500 . If Armando files a claim for $19,400
(a) how much will he pay?
(b) how much will the insurance company pay?
Answer: (a) $2,500 (b) $16,900

Writing Exercises

181. Explain the difference between an expression and an equation.
Answer: Answers may vary

182. Why is it important to use the order of operations to simplify an expression?
Answer: Answers may vary

183. Explain how you identify the like terms in the expression $8a^2+4a+9-a^2-1$.
Answer: Answers may vary

184. Explain the difference between the phrases "4 times the sum of x and y" and "the sum of 4 times x and y."
Answer: Answers may vary

Elementary Algebra
1: Foundations
1.3 Add and Subtract Integers

Use Negatives and Opposites of Integers In the following exercises, order each of the following pairs of numbers, using < or >.

185. (a) $9 \_\_\_ 4$ (b) $-3 \_\_\_ 6$ (c) $-8 \_\_\_ -2$ (d) $1 \_\_\_ -10$

Answer: (a) > (b) < (c) < (d) >

186. (a) $-7 \_\_\_ 3$ (b) $-10 \_\_\_ -5$ (c) $2 \_\_\_ -6$ (d) $8 \_\_\_ 9$

Answer: (a) < (b) < (c) > (d) <

In the following exercises, find the opposite of each number.

187. (a) 2 (b) -6

Answer: (a) -2 (b) 6

188. (a) 9 (b) -4

Answer: (a) -9 (b) 4

In the following exercises, simplify.

189. $-(-4)$

Answer: 4

190. $-(-8)$

Answer: 8

191. $-(-15)$

Answer: 15

192. $-(-11)$

Answer: 11

In the following exercises, evaluate.

193. $-c$ when (a) $c = 12$ (b) $c = -12$

Answer: (a) -12 (b) 12

194. $-d$ when (a) $d = 21$ (b) $d = -21$

Answer: (a) -21 (b) 21

Simplify Expressions with Absolute Value In the following exercises, simplify.

195. (a) $|-32|$ (b) $|0|$ (c) $|16|$

Answer: (a) 32 (b) 0 (c) 16

196. (a) $|0|$ (b) $|-40|$ (c) $|22|$

Answer: (a) 0 (b) 40 (c) 22

In the following exercises, fill in < , >, or $=$ for each of the following pairs of numbers.

197. (a) $-6 \_\_\_ |-6|$ (b) $-|-3| \_\_\_ -3$

Answer: (a) < (b) $=$

198. (a) $|-5| \_\_\_ -|-5|$ (b) $9 \_\_\_ -|-9|$

Answer: (a) > (b) >

In the following exercises, simplify.

199. $-(-5)$ and $-|-5|$

Answer: $5, -5$

200. $-|-9|$ and $-(-9)$

Answer: $-9, 9$

201. $8|-7|$

Answer: 56

202. $5|-5|$

Answer: 25

203. $|15-7|-|14-6|$

Answer: 0

204. $|17-8|-|13-4|$

Answer: 0

205. $18-|2(8-3)|$

Answer: 8

206. $18-\left|3(8-5)\right|$

Answer: 9

In the following exercises, evaluate**.**

207. (a) $-|p|$ when $p=19$ (b) $-|q|$ when $q=-33$

Answer: (a) -19 (b) -33

208. (a) $-|a|$ when $a=60$ (b) $-|b|$ when $b=-12$

Answer: (a) $-60s$ (b) -12

Add Integers In the following exercises, simplify each expression.

209. $-21+(-59)$

Answer: -80

210. $-35+(-47)$

Answer: -82

211. $48+(-16)$

Answer: 32

212. $34+(-19)$

Answer: 15

213. $-14+(-12)+4$

Answer: -22

214. $-17+(-18)+6$

Answer: -29

215. $135+(-110)+83$

Answer: 108

216. $-38+27+(-8)+12$

Answer: -7

217. $19+2(-3+8)$

Answer: 29

218. $24+3(-5+9)$

Answer: 36

Subtract Integers In the following exercises, simplify.

219. $8-2$

Answer: 6

220. $-6-(-4)$

Answer: -2

221. $-5-4$

Answer: -9

222. $-7-2$

Answer: -9

223. $8-(-4)$

Answer: 12

224. $7-(-3)$

Answer: 10

225. (a) $44-28$ (b) $44+(-28)$

Answer: (a) 16 (b) 16

226. (a) $35-16$ (b) $35+(-16)$

Answer: (a) 19 (b) 19

227. (a) $27-(-18)$ (b) $27+18$

Answer: (a) 45 (b) 45

228. (a) $46-(-37)$ (b) $46+37$

Answer: (a) 83 (b) 83

In the following exercises, simplify each expression.

229. $15-(-12)$

Answer: 27

230. $14-(-11)$

Answer: 25

231. $48-87$

Answer: -39

232. $45-69$

Answer: -24

233. $-17-42$

Answer: -59

234. $-19-46$

Answer: -65

235. $-103-(-52)$

Answer: -51

236. $-105-(-68)$

Answer: -37

237. $-45-(-54)$

Answer: -99

238. $-58-(-67)$

Answer: 9

239. $8-3-7$

Answer: -2

240. $9-6-5$

Answer: -2

241. $-5-4+7$

Answer: -2

242. $-3-8+4$

Answer: -7

243. $-14-(-27)+9$

Answer: 22

244. $64+(-17)-9$

Answer: 38

245. $(2-7)-(3-8)$

Answer: 0

246. $(1-8)-(2-9)$

Answer: 0

247. $-(6-8)-(2-4)$

Answer: 4

248. $-(4-5)-(7-8)$

Answer: 2

249. $25-[10-(3-12)]$

Answer: 6

250. $32-[5-(15-20)]$

Answer: 22

251. $6.3-4.3-7.2$

Answer: -5.2

252. $5.7-8.2-4.9$

Answer: -7.4

253. 5^2-6^2

Answer: -11

254. 6^2-7^2

Answer: -13

Everyday Math

255. **Elevation** The highest elevation in the United States is Mount McKinley, Alaska, at 20,320 feet above sea level. The lowest elevation is Death Valley, California, at 282 feet below sea level. Use integers to write the elevation of:
(a) Mount McKinley.

(b) Death Valley.

Answer: (a) 20,329 (b) -282

256. **Extreme temperatures** The highest recorded temperature on Earth was 58° Celsius, recorded in the Sahara Desert in 1922. The lowest recorded temperature was 90° below 0° Celsius, recorded in Antarctica in 1983. Use integers to write the:
(a) highest recorded temperature.
(b) lowest recorded temperature.

Answer: (a) 58° (b) 90°

257. **State budgets** In June, 2011, the state of Pennsylvania estimated it would have a budget surplus of $540 million. That same month, Texas estimated it would have a budget deficit of $27 billion. Use integers to write the budget of:
(a) Pennsylvania.
(b) Texas.

Answer: (a) $540 million (b) $-\$27$ billion

258. **College enrollments** Across the United States, community college enrollment grew by 1,400,000 students from Fall 2007 to Fall 2010. In California, community college enrollment declined by 110,171 students from Fall 2009 to Fall 2010.
Use integers to write the change in enrollment:
(a) in the US from Fall 2007 to Fall 2010.
(b) in California from Fall 2009 to Fall 2010.

Answer: (a) $1,400,000$ students (b) $-110{,}171$ students

259. **Stock Market** The week of September 15, 2008 was one of the most volatile weeks ever for the US stock market. The closing numbers of the Dow Jones Industrial Average each day were:

Monday	-504
Tuesday	$+142$
Wednesday	-449
Thursday	$+410$
Friday	$+369$

What was the overall change for the week? Was it positive or negative?

Answer: -32

260. **Stock Market** During the week of June 22, 2009, the closing numbers of the Dow Jones Industrial Average each day were:

Monday	-201
Tuesday	-16
Wednesday	-23
Thursday	$+172$
Friday	-34

What was the overall change for the week? Was it positive or negative?

Answer: -102

Writing Exercises

261. Give an example of a negative number from your life experience.

Answer: Answers may vary

262. What are the three uses of the "$-$" sign in algebra? Explain how they differ.

Answer: Answers may vary

263. Explain why the sum of -8 and 2 is negative, but the sum of 8 and -2 is positive.

Answer: Answers may vary

264. Give an example from your life experience of adding two negative numbers.

Answer: Answers may vary

Elementary Algebra
1: Foundations
1.4 Multiply and Divide Integers

Multiply Integers In the following exercises, multiply.

265. $-4 \cdot 8$

Answer: -32

266. $-3 \cdot 9$

Answer: -27

267. $9(-7)$

Answer: -63

268. $13(-5)$

Answer: -65

269. -1.6

Answer: -6

270. -1.3

Answer: -3

271. $-1(-14)$

Answer: 14

272. $-1(-19)$

Answer: 19

Divide Integers In the following exercises, divide.

273. $-24 \div 6$

Answer: -4

274. $35 \div (-7)$

Answer: -5

275. $-52 \div (-4)$

Answer: 13

276. $-84 \div (-6)$

Answer: 14

277. $-180 \div 15$

Answer: -12

278. $-192 \div 12$

Answer: -16

Simplify Expressions with Integers In the following exercises, simplify each expression.

279. $5(-6)+7(-2)-3$

Answer: -47

280. $8(-4)+5(-4)-6$

Answer: -58

281. $(-2)^6$

Answer: 64

282. $(-3)^5$

Answer: -243

283. -4^2

Answer: -16

284. -6^2

Answer: -36

285. $-3(-5)(6)$

Answer: 90

286. $-4(-6)(3)$

Answer: 72

287. $(8-11)(9-12)$

Answer: 9

288. $(6-11)(8-13)$

Answer: 25

289. $26-3(2-7)$

Answer: 41

290. $23-2(4-6)$

Answer: 27

291. $65\div(-5)+(-28)\div(-7)$

Answer: -9

292. $52\div(-4)+(-32)\div(-8)$

Answer: -9

293. $9-2\left[3-8(-2)\right]$

Answer: -29

294. $11-3\left[7-4(-2)\right]$

Answer: -34

295. $(-3)^2-24\div(8-2)$

Answer: 5

296. $(-4)^2-32\div(12-4)$

Answer: 12

Evaluate Variable Expressions with Integers In the following exercises, evaluate each expression.

297. $y+(-14)$ when (a) $y=-33$, (b) $y=30$

Answer: (a) -47 (b) 16

298. $x+(-21)$ when (a) $x=-27$, (b) $x=44$

Answer: (a) -48 (b) 23

299. (a) $a+3$ when $a=-7$, (b) $-a+3$ when $a=-7$

Answer: (a) -4 (b) 10

300. (a) $d+(-9)$ when $d=-8$ (b) $-d+(-9)$ when $d=-8$

Answer: (a) -17 (b) -1

301. $m+n$ when $m=-15,\ n=7$

Answer: -8

302. $p+q$ when $p=-9,\ q=17$

Answer: 8

303. $r+s$ when $r=-9,\ s=-7$

Answer: -16

304. $t+u$ when $t=-6,\ u=-5$

Answer: -11

305. $(x+y)^2$ when $x=-3,\ y=14$

Answer: 121

306. $(y+z)^2$ when $y=-3,\ z=15$

Answer: 144

307. $-2x+17$ when (a) $x=8$ (b) $x=-8$

Answer: (a) 1 (b) 33

308. $-5y+14$ when (a) $y=9$ (b) $y=-9$

Answer: (a) -31 (b) 59

309. $10-3m$ when (a) $m=5$ (b) $m=-5$

Answer: (a) -5 (b) 25

310. $18-4n$ when (a) $n=3$; (b) $n=-3$

Answer: (a) 6 (b) 30

311. $2w^2-3w+7$ when $w=-2$

Answer: 21

312. $3u^2-4u+5$ when $u=-3$

Answer: 44

313. $9a-2b-8$ when $a=-6$ and $b=-3$

Answer: -56

314. $7m-4n-2$ when $m=-4$ and $n=-9$

Answer: 6

Translate English Phrases to Algebraic Expressions In the following exercises, translate to an algebraic expression and simplify if possible.

315. the sum of 3 and -15, increased by 7

Answer: $\left(3+\left(-15\right)\right)+7;-5$

316. the sum of -8 and -9, increased by 23

Answer: $\left(-8+\left(-9\right)\right)+23;6$

317. the difference of 10 and -18

Answer: $10-\left(-18\right);28$

318. subtract 11 from -25

Answer: $-25-11;-36$

319. the difference of -5 and -30

Answer: $-5-\left(-30\right);25$

320. subtract -6 from -13

Answer: $-13-\left(-6\right);-7$

321. the product of -3 and 15

Answer: $-3\cdot 15;-45$

322. the product of -4 and 16

Answer: $-4\cdot 16;-64$

323. the quotient of -60 and -20

Answer: $-60\div\left(-20\right);3$

324. the quotient of -40 and -20

Answer: $-40\div\left(-20\right);2$

325. the quotient of -6 and the sum of a and b

Answer: $\frac{-6}{a+b}$

326. the quotient of -7 and the sum of m and n

Answer: $\frac{-7}{m+n}$

327. the product of -10 and the difference of p and q

Answer: $-10(p-q)$

328. the product of -13 and the difference of c and d

Answer: $-13(c-d)$

Use Integers in Applications In the following exercises, solve.

329. **Temperature** On January 15, the high temperature in Anaheim, California, was $84°$. That same day, the high temperature in Embarrass, Minnesota was $-12°$. What was the difference between the temperature in Anaheim and the temperature in Embarrass?

Answer: $96°$

330. **Temperature** On January 21, the high temperature in Palm Springs, California, was $89°$, and the high temperature in Whitefield, New Hampshire was $-31°$. What was the difference between the temperature in Palm Springs and the temperature in Whitefield?

Answer: $120°$

331. **Football** At the first down, the Chargers had the ball on their 25 yard line. On the next three downs, they lost 6 yards, gained 10 yards, and lost 8 yards. What was the yard line at the end of the fourth down?

Answer: 21

332. **Football** At the first down, the Steelers had the ball on their 30 yard line. On the next three downs, they gained 9 yards, lost 14 yards, and lost 2 yards. What was the yard line at the end of the fourth down?

Answer: 23

333. **Checking Account** Mayra has $124 in her checking account. She writes a check for $152. What is the new balance in her checking account?

Answer: $-\$28$

334. **Checking Account** Selina has $165 in her checking account. She writes a check for $207. What is the new balance in her checking account?

Answer: $-\$42$

335. **Checking Account** Diontre has a balance of $-\$38$ in his checking account. He deposits $225 to the account. What is the new balance?

Answer: $187

336. **Checking Account** Reymonte has a balance of $-\$49$ in his checking account. He deposits $281 to the account. What is the new balance?

Answer: $232

Everyday Math

337. **Stock market** Javier owns 300 shares of stock in one company. On Tuesday, the stock price dropped $12 per share. What was the total effect on Javier's portfolio?

Answer: $-\$3600$

338. **Weight loss** In the first week of a diet program, eight women lost an average of 3 pounds each. What was the total weight change for the eight women?

Answer: -24 pounds

Writing Exercises

339. In your own words, state the rules for multiplying integers.

Answer: Answers may vary

340. In your own words, state the rules for dividing integers.

Answer: Answers may vary

341. Why is $-2^4 \neq (-2)^4$?

Answer: Answers may vary

342. Why is $-4^3 = (-4)^3$?

Answer: Answers may vary

Elementary Algebra
1: Foundations
1.5 Visualize Fractions

Find Equivalent Fractions In the following exercises, find three fractions equivalent to the given fraction. Show your work, using figures or algebra.

343. $\frac{3}{8}$

Answer: $\frac{6}{16}, \frac{9}{24}, \frac{12}{32}$ answers may vary

344. $\frac{5}{8}$

Answer: $\frac{10}{16}, \frac{15}{24}, \frac{20}{32}$ answers may vary

345. $\frac{5}{9}$

Answer: $\frac{10}{18}, \frac{15}{27}, \frac{20}{36}$ answers may vary

346. $\frac{1}{8}$

Answer: $\frac{2}{16}, \frac{3}{24}, \frac{4}{32}$ answers may vary

Simplify Fractions In the following exercises, simplify.

347. $-\frac{40}{88}$

Answer: $-\frac{5}{11}$

348. $-\frac{63}{99}$

Answer: $-\frac{7}{11}$

349. $-\frac{108}{63}$

Answer: $-\frac{12}{7}$

350. $-\frac{104}{48}$

Answer: $-\frac{13}{6}$

351. $\frac{120}{252}$

Answer: $\frac{10}{21}$

352. $\frac{182}{294}$

Answer: $\frac{13}{21}$

353. $-\frac{3x}{12y}$

Answer: $-\frac{x}{4y}$

354. $-\frac{4x}{32y}$

Answer: $-\frac{x}{8y}$

355. $\frac{14x^2}{21y}$

Answer: $\frac{2x^2}{3y}$

356. $\frac{24a}{32b^2}$

Answer: $\frac{3a}{4b^2}$

Multiply Fractions In the following exercises, multiply.

357. $\frac{3}{4} \cdot \frac{9}{10}$

Answer: $\frac{27}{40}$

358. $\frac{4}{5} \cdot \frac{2}{7}$

Answer: $\frac{8}{35}$

359. $-\frac{2}{3}\left(-\frac{3}{8}\right)$

Answer: $\frac{1}{4}$

360. $-\frac{3}{4}\left(-\frac{4}{9}\right)$

Answer: $\frac{1}{3}$

361. $-\frac{5}{9} \cdot \frac{3}{10}$

Answer: $-\frac{1}{6}$

362. $-\frac{3}{8} \cdot \frac{4}{15}$

Answer: $-\frac{1}{10}$

363. $\left(-\frac{14}{15}\right)\left(\frac{9}{20}\right)$

Answer: $-\frac{21}{50}$

364. $\left(-\frac{9}{10}\right)\left(\frac{25}{33}\right)$

Answer: $-\frac{15}{22}$

365. $\left(-\frac{63}{84}\right)\left(-\frac{44}{90}\right)$

Answer: $\frac{11}{30}$

366. $\left(-\frac{63}{60}\right)\left(-\frac{40}{88}\right)$

Answer: $\frac{1}{4}$

367. $4\cdot\frac{5}{11}$

Answer: $\frac{20}{11}$

368. $5\cdot\frac{8}{3}$

Answer: $\frac{40}{3}$

369. $\frac{3}{7}\cdot 21n$

Answer: $9n$

370. $\frac{5}{6}\cdot 30m$

Answer: $25m$

371. $-8\left(\frac{17}{4}\right)$

Answer: -34

372. $(-1)\left(-\frac{6}{7}\right)$

Answer: $\frac{6}{7}$

Divide Fractions In the following exercises, divide.

373. $\frac{3}{4} \div \frac{2}{3}$

Answer: $\frac{9}{8}$

374. $\frac{4}{5} \div \frac{3}{4}$

Answer: $\frac{16}{15}$

375. $-\frac{7}{9} \div \left(-\frac{7}{4}\right)$

Answer: 1

376. $-\frac{5}{6} \div \left(-\frac{5}{6}\right)$

Answer: 1

377. $\frac{3}{4} \div \frac{x}{11}$

Answer: $\frac{33}{4x}$

378. $\frac{2}{5} \div \frac{y}{9}$

Answer: $\frac{18}{5y}$

379. $\frac{5}{18} \div \left(-\frac{15}{24}\right)$

Answer: $-\frac{4}{9}$

380. $\frac{7}{18} \div \left(-\frac{14}{27}\right)$

Answer: $-\frac{3}{4}$

381. $\frac{8u}{15} \div \frac{12v}{25}$

Answer: $\frac{10u}{9v}$

382. $\frac{12r}{25} \div \frac{18s}{35}$

Answer: $\frac{14r}{15s}$

383. $-5 \div \frac{1}{2}$

Answer: -10

384. $-3 \div \frac{1}{4}$

Answer: -12

385. $\frac{3}{4} \div (-12)$

Answer: $-\frac{1}{16}$

386. $-15 \div \left(-\frac{5}{3}\right)$

Answer: 9

In the following exercises, simplify.

387. $\frac{-\frac{8}{21}}{\frac{12}{35}}$

Answer: $-\frac{10}{9}$

388. $\frac{-\frac{9}{16}}{\frac{33}{40}}$

Answer: $-\frac{15}{22}$

389. $\dfrac{-\frac{4}{5}}{2}$

Answer: $-\dfrac{2}{5}$

390. $\dfrac{5}{\frac{3}{10}}$

Answer: $\dfrac{50}{3}$

391. $\dfrac{\frac{m}{3}}{\frac{n}{2}}$

Answer: $\dfrac{2m}{3n}$

392. $\dfrac{-\frac{3}{8}}{-\frac{y}{12}}$

Answer: $\dfrac{9}{2y}$

Simplify Expressions Written with a Fraction Bar In the following exercises, simplify.

393. $\dfrac{22+3}{10}$

Answer: $\dfrac{5}{2}$

394. $\dfrac{19-4}{6}$

Answer: $\dfrac{5}{2}$

395. $\dfrac{48}{24-15}$

Answer: $\dfrac{16}{3}$

396. $\frac{46}{4+4}$

Answer: $\frac{23}{4}$

397. $\frac{-6+6}{8+4}$

Answer: 0

398. $\frac{-6+3}{17-8}$

Answer: $-\frac{1}{3}$

399. $\frac{4\cdot 3}{6\cdot 6}$

Answer: $\frac{1}{3}$

400. $\frac{6\cdot 6}{9\cdot 2}$

Answer: 2

401. $\frac{4^2-1}{25}$

Answer: $\frac{3}{5}$

402. $\frac{7^2+1}{60}$

Answer: $\frac{5}{6}$

403. $\frac{8\cdot 3+2\cdot 9}{14+3}$

Answer: $2\frac{8}{17}$

404. $\frac{9\cdot 6-4\cdot 7}{22+3}$

Answer: $1\frac{1}{25}$

405. $\frac{5\cdot 6-3\cdot 4}{4\cdot 5-2\cdot 3}$

Answer: $\frac{3}{5}$

406. $\frac{8\cdot 9-7\cdot 6}{5\cdot 6-9\cdot 2}$

Answer: $\frac{5}{6}$

407. $\frac{5^2-3^2}{3-5}$

Answer: -8

408. $\frac{6^2-4^2}{4-6}$

Answer: -8

409. $\frac{7\cdot 4-2(8-5)}{9\cdot 3-3\cdot 5}$

Answer: $\frac{11}{6}$

410. $\frac{9\cdot 7-3(12-8)}{8\cdot 7-6\cdot 6}$

Answer: $\frac{51}{20}$

411. $\frac{9(8-2)-3(15-7)}{6(7-1)-3(17-9)}$

Answer: $\frac{5}{2}$

412. $\frac{8(9-2)-4(14-9)}{7(8-3)-3(16-9)}$

Answer: $\frac{18}{7}$

Translate Phrases to Expressions with Fractions In the following exercises, translate each English phrase into an algebraic expression.

413. the quotient of *r* and the sum of *s* and 10

Answer: $\frac{r}{s+10}$

414. the quotient of *A* and the difference of 3 and *B*

Answer: $\frac{A}{3-B}$

415. the quotient of the difference of x and y, and -3

Answer: $\frac{x-y}{-3}$

416. the quotient of the sum of m and n, and $4q$

Answer: $\frac{m+n}{4q}$

Everyday Math

417. **Baking.** A recipe for chocolate chip cookies calls for $\frac{3}{4}$ cup brown sugar. Imelda wants to double the recipe. (a) How much brown sugar will Imelda need? Show your calculation. (b) Measuring cups usually come in sets of $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}$, and 1 cup. Draw a diagram to show two different ways that Imelda could measure the brown sugar needed to double the cookie recipe.

Answer: (a) $1\frac{1}{2}$ cups (b) answers will vary

418. **Baking.** Nina is making 4 pans of fudge to serve after a music recital. For each pan, she needs $\frac{2}{3}$ cup of condensed milk. (a) How much condensed milk will Nina need? Show your calculation. (b) Measuring cups usually come in sets of $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}$, and 1 cup. Draw a diagram to

show two different ways that Nina could measure the condensed milk needed for 4 pans of fudge.

Answer: (a) $2\frac{1}{3}$ (b) answers will vary

419. **Portions** Don purchased a bulk package of candy that weighs 5 pounds. He wants to sell the candy in little bags that hold $\frac{1}{4}$ pound. How many little bags of candy can he fill from the bulk package?

Answer: 20 bags

420. **Portions** Kristen has $\frac{3}{4}$ yards of ribbon that she wants to cut into 6 equal parts to make hair ribbons for her daughter's 6 dolls. How long will each doll's hair ribbon be?

Answer: $\frac{1}{8}$ yard

Writing Exercises

421. Rafael wanted to order half a medium pizza at a restaurant. The waiter told him that a medium pizza could be cut into 6 or 8 slices. Would he prefer 3 out of 6 slices or 4 out of 8 slices? Rafael replied that since he wasn't very hungry, he would prefer 3 out of 6 slices. Explain what is wrong with Rafael's reasoning.

Answer: Answers may vary

422. Give an example from everyday life that demonstrates how $\frac{1}{2} \cdot \frac{2}{3}$ is $\frac{1}{3}$.

Answer: Answers may vary

423. Explain how you find the reciprocal of a fraction.

Answer: Answers may vary

424. Explain how you find the reciprocal of a negative number.

Answer: Answers may vary

Elementary Algebra
1: Foundations
1.6 Add and Subtract Fractions

Add and Subtract Fractions with a Common Denominator In the following exercises, add.

425. $\frac{6}{13}+\frac{5}{13}$

Answer: $\frac{11}{13}$

426. $\frac{4}{15}+\frac{7}{15}$

Answer: $\frac{11}{15}$

427. $\frac{x}{4}+\frac{3}{4}$

Answer: $\frac{x+3}{4}$

428. $\frac{8}{q}+\frac{6}{q}$

Answer: $\frac{14}{q}$

429. $-\frac{3}{16}+\left(-\frac{7}{16}\right)$

Answer: $-\frac{5}{8}$

430. $-\frac{5}{16}+\left(-\frac{9}{16}\right)$

Answer: $-\frac{7}{8}$

431. $-\frac{8}{17}+\frac{15}{17}$

Answer: $\frac{7}{17}$

432. $-\frac{9}{19}+\frac{17}{19}$

Answer: $\frac{8}{19}$

433. $\frac{6}{13}+\left(-\frac{10}{13}\right)+\left(-\frac{12}{13}\right)$

Answer: $-\frac{16}{13}$

434. $\frac{5}{12}+\left(-\frac{7}{12}\right)+\left(-\frac{11}{12}\right)$

Answer: $-\frac{13}{12}$

In the following exercises, subtract.

435. $\frac{11}{15}-\frac{7}{15}$

Answer: $\frac{4}{15}$

436. $\frac{9}{13}-\frac{4}{13}$

Answer: $\frac{5}{13}$

437. $\frac{11}{12}-\frac{5}{12}$

Answer: $\frac{1}{2}$

438. $\frac{7}{12}-\frac{5}{12}$

Answer: $\frac{1}{6}$

439. $\frac{19}{21}-\frac{4}{21}$

Answer: $\frac{5}{7}$

440. $\frac{17}{21}-\frac{8}{21}$

Answer: $\frac{3}{7}$

441. $\frac{5y}{8}-\frac{7}{8}$

Answer: $\frac{5y-7}{8}$

442. $\frac{11z}{13}-\frac{8}{13}$

Answer: $\frac{11z-8}{13}$

443. $-\frac{23}{u}-\frac{15}{u}$

Answer: $-\frac{38}{u}$

444. $-\frac{29}{v}-\frac{26}{v}$

Answer: $-\frac{55}{v}$

445. $-\frac{3}{5}-\left(-\frac{4}{5}\right)$

Answer: $\frac{1}{5}$

446. $-\frac{3}{7}-\left(-\frac{5}{7}\right)$

Answer: $\frac{2}{7}$

447. $-\frac{7}{9}-\left(-\frac{5}{9}\right)$

Answer: $-\frac{2}{9}$

448. $-\frac{8}{11}-\left(-\frac{5}{11}\right)$

Answer: $-\frac{3}{11}$

Mixed Practice In the following exercises, simplify.

449. $-\frac{5}{18}\cdot\frac{9}{10}$

Answer: $-\frac{1}{4}$

450. $-\frac{3}{14}\cdot\frac{7}{12}$

Answer: $-\frac{1}{8}$

451. $\frac{n}{5}-\frac{4}{5}$

Answer: $\frac{n-4}{5}$

452. $\frac{6}{11}-\frac{s}{11}$

Answer: $\frac{6-s}{11}$

453. $-\frac{7}{24}+\frac{2}{24}$

Answer: $-\frac{5}{24}$

454. $-\frac{5}{18}+\frac{1}{18}$

Answer: $-\frac{2}{9}$

455. $\frac{8}{15}\div\frac{12}{5}$

Answer: $\frac{2}{9}$

456. $\frac{7}{12}\div\frac{9}{28}$

Answer: $\frac{49}{27}$

Add or Subtract Fractions with Different Denominators In the following exercises, add or subtract**.**

457. $\frac{1}{2}+\frac{1}{7}$

Answer: $\frac{9}{14}$

458. $\frac{1}{3}+\frac{1}{8}$

Answer: $\frac{11}{24}$

459. $\frac{1}{3}-\left(-\frac{1}{9}\right)$

Answer: $\frac{4}{9}$

460. $\frac{1}{4}-\left(-\frac{1}{8}\right)$

Answer: $\frac{3}{8}$

461. $\frac{7}{12}+\frac{5}{8}$

Answer: $\frac{29}{24}$

462. $\frac{5}{12}+\frac{3}{8}$

Answer: $\frac{19}{24}$

463. $\frac{7}{12}-\frac{9}{16}$

Answer: $\frac{1}{48}$

464. $\frac{7}{16}-\frac{5}{12}$

Answer: $\frac{1}{48}$

465. $\frac{2}{3}-\frac{3}{8}$

Answer: $\frac{7}{24}$

466. $\frac{5}{6}-\frac{3}{4}$

Answer: $\frac{1}{12}$

467. $-\frac{11}{30}+\frac{27}{40}$

Answer: $\frac{37}{120}$

468. $-\frac{9}{20}+\frac{17}{30}$

Answer: $\frac{7}{60}$

469. $-\frac{13}{30}+\frac{25}{42}$

Answer: $\frac{17}{105}$

470. $-\frac{23}{30}+\frac{5}{48}$

Answer: $-\frac{53}{80}$

471. $-\frac{39}{56}-\frac{22}{35}$

Answer: $-\frac{53}{40}$

472. $-\frac{33}{49}-\frac{18}{35}$

Answer: $-\frac{291}{245}$

473. $-\frac{2}{3}-\left(-\frac{3}{4}\right)$

Answer: $\frac{1}{12}$

474. $-\frac{3}{4}-\left(-\frac{4}{5}\right)$

Answer: $\frac{1}{20}$

475. $1+\frac{7}{8}$

Answer: $\frac{15}{8}$

476. $1-\frac{3}{10}$

Answer: $\frac{7}{10}$

477. $\frac{x}{3}+\frac{1}{4}$

Answer: $\frac{4x+3}{12}$

478. $\frac{y}{2}+\frac{2}{3}$

Answer: $\frac{3y+4}{6}$

479. $\frac{y}{4}-\frac{3}{5}$

Answer: $\frac{4y-12}{20}$

480. $\frac{x}{5}-\frac{1}{4}$

Answer: $\frac{4x-5}{20}$

Mixed Practice In the following exercises, simplify.

481. (a) $\frac{2}{3}+\frac{1}{6}$ (b) $\frac{2}{3}\div\frac{1}{6}$

Answer: (a) $\frac{5}{6}$ (b) 4

482. (a) $-\frac{2}{5}-\frac{1}{8}$ (b) $-\frac{2}{5}\cdot\frac{1}{8}$

Answer: (a) $-\frac{21}{40}$ (b) $-\frac{1}{20}$

483. (a) $\frac{5n}{6}\div\frac{8}{15}$ (b) $\frac{5n}{6}-\frac{8}{15}$

Answer: (a) $\frac{25n}{16}$ (b) $\frac{25n-16}{30}$

484. (a) $\frac{3a}{8} \div \frac{7}{12}$ (b) $\frac{3a}{8} - \frac{7}{12}$

Answer: (a) $\frac{9a}{14}$ (b) $\frac{9a-14}{24}$

485. $-\frac{3}{8} \div \left(-\frac{3}{10}\right)$

Answer: $\frac{5}{4}$

486. $-\frac{5}{12} \div \left(-\frac{5}{9}\right)$

Answer: $\frac{3}{4}$

487. $-\frac{3}{8} + \frac{5}{12}$

Answer: $\frac{1}{24}$

488. $-\frac{1}{8} + \frac{7}{12}$

Answer: $\frac{11}{24}$

489. $\frac{5}{6} - \frac{1}{9}$

Answer: $\frac{13}{18}$

490. $\frac{5}{9} - \frac{1}{6}$

Answer: $\frac{7}{18}$

491. $-\frac{7}{15} - \frac{y}{4}$

Answer: $\frac{-28-15y}{60}$

492. $-\frac{3}{8}-\frac{x}{11}$

Answer: $\frac{-33-8x}{88}$

493. $\frac{11}{12a}\cdot\frac{9a}{16}$

Answer: $\frac{33}{64}$

494. $\frac{10y}{13}\cdot\frac{8}{15y}$

Answer: $\frac{16}{39}$

Use the Order of Operations to Simplify Complex Fractions In the following exercises, simplify.

495. $\frac{2^3+4^2}{\left(\frac{2}{3}\right)^2}$

Answer: 54

496. $\frac{3^3-3^2}{\left(\frac{3}{4}\right)^2}$

Answer: 32

497. $\frac{\left(\frac{3}{5}\right)^2}{\left(\frac{3}{7}\right)^2}$

Answer: $\frac{49}{25}$

498. $\frac{\left(\frac{3}{4}\right)^2}{\left(\frac{5}{8}\right)^2}$

Answer: $\frac{36}{25}$

499. $\frac{2}{\frac{1}{3}+\frac{1}{5}}$

Answer: $\frac{15}{4}$

500. $\frac{5}{\frac{1}{4}+\frac{1}{3}}$

Answer: $\frac{60}{7}$

501. $\frac{\frac{7}{8}-\frac{2}{3}}{\frac{1}{2}+\frac{3}{8}}$

Answer: $\frac{5}{21}$

502. $\frac{\frac{3}{4}-\frac{3}{5}}{\frac{1}{4}+\frac{2}{5}}$

Answer: $\frac{3}{13}$

503. $\frac{1}{2}+\frac{2}{3}.\frac{5}{12}$

Answer: $\frac{7}{9}$

504. $\frac{1}{3}+\frac{2}{5}.\frac{3}{4}$

Answer: $\frac{19}{30}$

505. $1-\frac{3}{5}\div\frac{1}{10}$

Answer: -5

506. $1-\frac{5}{6}\div\frac{1}{12}$

Answer: -9

507. $\frac{2}{3}+\frac{1}{6}+\frac{3}{4}$

Answer: $\frac{19}{12}$

508. $\frac{2}{3}+\frac{1}{4}+\frac{3}{5}$

Answer: $\frac{91}{60}$

509. $\frac{3}{8}-\frac{1}{6}+\frac{3}{4}$

Answer: $\frac{23}{24}$

510. $\frac{2}{5}+\frac{5}{8}-\frac{3}{4}$

Answer: $\frac{11}{40}$

511. $12\left(\frac{9}{20}-\frac{4}{15}\right)$

Answer: $\frac{11}{5}$

512. $8\left(\frac{15}{16}-\frac{5}{6}\right)$

Answer: $\frac{5}{6}$

513. $\dfrac{\frac{5}{8}+\frac{1}{6}}{\frac{19}{24}}$

Answer: 1

514. $\dfrac{\frac{1}{6}+\frac{3}{10}}{\frac{14}{30}}$

Answer: 1

515. $\left(\frac{5}{9}+\frac{1}{6}\right)\div\left(\frac{2}{3}-\frac{1}{2}\right)$

Answer: $\frac{13}{3}$

516. $\left(\frac{3}{4}+\frac{1}{6}\right)\div\left(\frac{5}{8}-\frac{1}{3}\right)$

Answer: $\frac{22}{7}$

Evaluate Variable Expressions with Fractions In the following exercises, evaluate.

517. $x+\left(-\frac{5}{6}\right)$ when

(a) $x=\frac{1}{3}$

(b) $x=-\frac{1}{6}$

Answer: (a) $-\frac{1}{2}$ (b) -1

518. $x+\left(-\frac{11}{12}\right)$ when

(a) $x=\frac{11}{12}$

(b) $x=\frac{3}{4}$

Answer: (a) 0 (b) $-\frac{1}{6}$

519. $x-\frac{2}{5}$ when

(a) $x=\frac{3}{5}$

(b) $x=-\frac{3}{5}$

Answer: (a) $\frac{1}{5}$ (b) -1

520. $x-\frac{1}{3}$ when

(a) $x=\frac{2}{3}$

(b) $x=-\frac{2}{3}$

Answer: (a) $\frac{1}{3}$ (b) -1

521. $\frac{7}{10}-w$ when

(a) $w=\frac{1}{2}$

(b) $w=-\frac{1}{2}$

Answer: (a) $\frac{1}{5}$ (b) $\frac{6}{5}$

522. $\frac{5}{12}-w$ when

(a) $w=\frac{1}{4}$

(b) $w=-\frac{1}{4}$

Answer: (a) $\frac{1}{6}$ (b) $\frac{2}{3}$

523. $2x^2y^3$ when $x=-\frac{2}{3}$ and $y=-\frac{1}{2}$

Answer: $-\frac{1}{9}$

524. $8u^2v^3$ when $u=-\frac{3}{4}$ and $v=-\frac{1}{2}$

Answer: $-\frac{9}{16}$

525. $\frac{a+b}{a-b}$ when $a=-3,\ b=8$

Answer: $-\frac{5}{11}$

526. $\frac{r-s}{r+s}$ when $r=10,\ s=-5$

Answer: 3

Everyday Math

527. **Decorating** Laronda is making covers for the throw pillows on her sofa. For each pillow cover, she needs $\frac{1}{2}$ yard of print fabric and $\frac{3}{8}$ yard of solid fabric. What is the total amount of fabric Laronda needs for each pillow cover?

Answer: $\frac{7}{8}$ yard

528. **Baking** Vanessa is baking chocolate chip cookies and oatmeal cookies. She needs $\frac{1}{2}$ cup of sugar for the chocolate chip cookies and $\frac{1}{4}$ of sugar for the oatmeal cookies. How much sugar does she need altogether?

Answer: $\frac{3}{4}$ cup

Writing Exercises

529. Why do you need a common denominator to add or subtract fractions? Explain.

Answer: Answers may vary

530. How do you find the LCD of 2 fractions?

Answer: Answers may vary

Elementary Algebra
1: Foundations
1.7 Decimals

Name and Write Decimals In the following exercises, write as a decimal.

531. Twenty-nine and eighty-one hundredths
Answer: 29.81

532. Sixty-one and seventy-four hundredths
Answer: 61.74

533. Seven tenths
Answer: 0.7

534. Six tenths
Answer: 0.6

535. Twenty-nine thousandth
Answer: 0.029

536. Thirty-five thousandths
Answer: 0.035

537. Negative eleven and nine ten-thousandths
Answer: -11.0009

538. Negative fifty-nine and two ten-thousandths
Answer: -59.0002

In the following exercises, name each decimal.

539. 5.5
Answer: five and five tenths

540. 14.02
Answer: fourteen and two hundredths

541. 8.71

Answer: eight and seventy-one hundredths

542. 2.64
Answer: two and sixty-four hundredths

543. 0.002
Answer: two thousandths

544. 0.479
Answer: four hundred seventy-nine thousandths

545. -17.9
Answer: negative seventeen and nine tenths

546. -31.4
Answer: negative thirty-one and four tenths

Round Decimals In the following exercises, round each number to the nearest tenth.

547. 0.67
Answer: 0.7

548. 0.49
Answer: 0.5

549. 2.84
Answer: 2.8

550. 4.63
Answer: 4.6

In the following exercises, round each number to the nearest hundredth.

551. 0.845
Answer: 0.85

552. 0.761
Answer: 0.76

553. 0.299
Answer: 0.30

554. 0.697
Answer: 0.70

555. 4.098
Answer: 4.10

556. 7.096
Answer: 7.10

In the following exercises, round each number to the nearest (a) hundredth; (b) tenth; (c) whole number.

557. 5.781
Answer: (a) 5.78 (b) 5.8 (c) 6

558. 1.6381
Answer: (a) 1.64 (b) 1.6 (c) 2

559. 63.479
Answer: (a) 63.48 (b) 63.5 (c) 63

560. 84.281
Answer: (a) 84.28 (b) 84.3 (c) 84

Add and Subtract Decimals In the following exercises, add or subtract.

561. $16.92 + 7.56$
Answer: 24.48

562. $248.25 - 91.29$
Answer: 156.96

563. $21.76 - 30.99$
Answer: -9.23

564. $38.6 + 13.67$
Answer: 52.27

565. $-16.53 - 24.38$
Answer: -40.91

566. $-19.47 - 32.58$
Answer: -52.05

567. $-38.69 + 31.47$
Answer: -7.22

568. $29.83 + 19.76$
Answer: -10.07

569. $72.5 - 100$

Answer: -27.5

570. $86.2 - 100$

Answer: -13.8

571. $15 + 0.73$

Answer: 15.73

572. $27 + 0.87$

Answer: 27.87

573 $91.95 - (-10.462)$

Answer: 102.212

574. $94.69 - (-12.678)$

Answer: 107.368

575. $55.01 - 3.7$

Answer: 51.31

576. $59.08 - 4.6$

Answer: 54.48

577. $2.51 - 7.4$

Answer: -4.89

578. $3.84 - 6.1$

Answer: -2.26

Multiply and Divide Decimals In the following exercises, multiply.

579. $(0.24)(0.6)$

Answer: 0.144

580. $(0.81)(0.3)$

Answer: 0.243

581. $(5.9)(7.12)$

Answer: 42.008

582. $(2.3)(9.41)$

Answer: 21.643

583. $(-4.3)(2.71)$

Answer: -11.653

584. $(-8.5)(1.69)$

Answer: -14.365

585. $(-5.18)(-65.23)$

Answer: 337.8914

586. $(-9.16)(-68.34)$

Answer: 625.9944

587. $(0.06)(21.75)$

Answer: 1.305

588. $(0.08)(52.45)$

Answer: 4.196

589. $(9.24)(10)$

Answer: 92.4

590. $(6.531)(10)$

Answer: 65.31

591. $(55.2)(1000)$

Answer: 55,200

592. $(99.4)(1000)$

Answer: 99,400

In the following exercises, divide.

593. $4.75 \div 25$

Answer: 0.19

594. $12.04 \div 43$

Answer: 0.28

595. $\$117.25 \div 48$
Answer: \$2.44

596. $\$109.24 \div 36$
Answer: \$3.03

597. $0.6 \div 0.2$
Answer: 3

598. $0.8 \div 0.4$
Answer: 2

599. $1.44 \div (-0.3)$
Answer: -4.8

600. $1.25 \div (-0.5)$
Answer: -2.5

601. $-1.75 \div (-0.05)$
Answer: 35

602. $-1.15 \div (-0.05)$
Answer: 23

603. $5.2 \div 2.5$
Answer: 2.08

604. $6.5 \div 3.25$
Answer: 2

605. $11 \div 0.55$
Answer: 20

606. $14 \div 0.35$
Answer: 40

Convert Decimals, Fractions and Percents In the following exercises, write each decimal as a fraction.

607. 0.04

Answer: $\frac{1}{25}$

608. 0.19

Answer: $\frac{19}{100}$

609. 0.52

Answer: $\frac{13}{25}$

610. 0.78

Answer: $\frac{39}{50}$

611. 1.25

Answer: $\frac{5}{4}$

612. 1.35

Answer: $\frac{27}{20}$

613. 0.375

Answer: $\frac{3}{8}$

614. 0.464

Answer: $\frac{58}{125}$

615. 0.095

Answer: $\frac{19}{200}$

616. 0.085

Answer: $\frac{17}{200}$

In the following exercises, convert each fraction to a decimal.

617. $\frac{17}{20}$

Answer: 0.85

618. $\frac{13}{20}$

Answer: 0.65

619. $\frac{11}{4}$

Answer: 2.75

620. $\frac{17}{4}$

Answer: 4.25

621. $-\frac{310}{25}$

Answer: -12.4

622. $-\frac{284}{25}$

Answer: -11.36

623. $\frac{15}{11}$

Answer: $1.\overline{36}$

624. $\frac{18}{11}$

Answer: $1.\overline{63}$

625. $\frac{15}{111}$

Answer: $0.\overline{135}$

626. $\frac{25}{111}$

Answer: $0.\overline{225}$

627. $2.4+\frac{5}{8}$

Answer: 3.025

628. $3.9+\frac{9}{20}$

Answer: 4.35

In the following exercises, convert each percent to a decimal.

629. 1%

Answer: 0.011

630. 2%

Answer: 0.02

631. 63%

Answer: 0.63

632. 71%

Answer: 0.71

633. 150%

Answer: 1.5

634. 250%

Answer: 2.5

635. 21.4%

Answer: 0.214

636. 39.3%

Answer: 0.393

637. 7.8%

Answer: 0.078

638. 6.4%

Answer: 0.064

In the following exercises, convert each decimal to a percent.

639. 0.01

Answer: 1%

640. 0.03
Answer: 3%

641. 1.35
Answer: 135%

642. 1.56
Answer: 156%

643. 3
Answer: 300%

644. 4
Answer: 400%

645. 0.0875
Answer: 8.75%

646. 0.0625
Answer: 6.25%

647. 2.254
Answer: 225.4%

648. 2.317
Answer: 231.7%

Everyday Math

649. **Salary Increase** Danny got a raise and now makes $58,965.95 a year. Round this number to the nearest (a) dollar (b) thousand dollars (c) ten thousand dollars.
Answer: (a) $58,966 (b) $59,000 (c) $60,000

650. **New Car Purchase** Selena's new car cost $23,795.95. Round this number to the nearest (a) dollar (b) thousand dollars (c) ten thousand dollars.
Answer: (a) $23,796 (b) $24,000 (c) $20,000

651. **Sales Tax** Hyo Jin lives in San Diego. She bought a refrigerator for $1,624.99 and when the clerk calculated the sales tax it came out to exactly $142.186625. Round the sales tax to the nearest (a) penny and (b) dollar.
Answer: (a) $142.19 (b) $142

652. **Sales Tax** Jennifer bought a $1,038.99 dining room set for her home in Cincinnati. She calculated the sales tax to be exactly $67.53435. Round the sales tax to the nearest (a) penny and (b) dollar.
Answer: (a) $67.53 (b) $68

653. **Paycheck** Annie has two jobs. She gets paid $14.04 per hour for tutoring at City College and $8.75 per hour at a coffee shop. Last week she tutored for 8 hours and worked at the coffee shop for 15 hours.
(a) How much did she earn?
(b) If she had worked all 23 hours as a tutor instead of working both jobs, how much more would she have earned?
Answer: (a) $243.57 (b) $79.35

654. **Paycheck** Jake has two jobs. He gets paid $7.95 per hour at the college cafeteria and$20.25 at the art gallery. Last week he worked 12 hours at the cafeteria and 5 hours at the art gallery.
(a) How much did he earn?
(b)If he had worked all 17 hours at the art gallery instead of working both jobs, how much more would he have earned?
Answer: (a) $196.65 (b) $344.25

Writing Exercises

655. How does knowing about US money help you learn about decimals?
Answer: Answers may vary

656. Explain how you write “three and nine hundredths” as a decimal.
Answer: Answers may vary

657. Without solving the problem “44 is 80% of what number” think about what the solution might be. Should it be a number that is greater than 44 or less than 44? Explain your reasoning.
Answer: Answers may vary

658. When the Szetos sold their home, the selling price was 500% of what they had paid for the house 30 years ago. Explain what 500% means in this context.
Answer: Answers may vary

Elementary Algebra
1: Foundations
1.8 The Real Numbers

Simplify Expressions with Square Roots In the following exercises, simplify.

659. $\sqrt{36}$
Answer: 6

660. $\sqrt{4}$
Answer: 2

661. $\sqrt{64}$
Answer: 8

662. $\sqrt{169}$
Answer: 13

663. $\sqrt{9}$
Answer: 3

664. $\sqrt{16}$
Answer: 4

665. $\sqrt{100}$
Answer: 10

666. $\sqrt{144}$
Answer: 12

667. $-\sqrt{4}$
Answer: -2

668. $-\sqrt{100}$
Answer: -10

669. $-\sqrt{1}$
Answer: -1

670. $-\sqrt{121}$
Answer: -11

Identify Integers, Rational Numbers, Irrational Numbers, and Real Numbers In the following exercises, write as the ratio of two integers.

671. (a) 5 (b) 3.19

Answer: (a) $\frac{5}{1}$ (b) $\frac{319}{100}$

672. (a) 8 (b) 1.61

Answer: (a) $\frac{8}{1}$ (b) $\frac{161}{100}$

673. (a) -12 (b) 9.279

Answer: (a) $\frac{-12}{1}$ (b) $\frac{9297}{1000}$

674. (a) -16 (b) 4.399

Answer: (a) $-\frac{16}{1}$ (b) $\frac{4399}{1000}$

In the following exercises, list the (a) rational numbers, (b) irrational numbers.

675. $0.75, 0.22\overline{3}, 1.39174$

Answer: (a) $0.75, 0.22\overline{3}$ (b) $1.39174...$

676. $0.36, 0.94729..., 2.52\overline{8}$

Answer: (a) $0.36, 2.52\overline{8}$ (b) $0.94729...$

677. $0.4\overline{5}, 1.919293..., 3.59$

Answer: (a) $0.4\overline{5}, 3.59$ (b) $1.919293...$

678. $0.1\overline{3}, 0.42982..., 1.875$

Answer: (a) $0.1\overline{3}, 1.875$ (b) $0.42982...$

In the following exercises, identify whether each number is rational or irrational.

679. (a) $\sqrt{25}$ (b) $\sqrt{30}$

Answer: (a) rational (b) irrational

680. (a) $\sqrt{44}$ (b) $\sqrt{49}$

Answer: (a) irrational (b) rational

681. (a) $\sqrt{164}$ (b) $\sqrt{169}$

Answer: (a) irrational (b) rational

682. (a) $\sqrt{225}$ (b) $\sqrt{216}$

Answer: (a) rational (b) irrational

In the following exercises, identify whether each number is a real number or not a real number.

683. (a) $-\sqrt{81}$ (b) $\sqrt{-121}$

Answer: (a) real number (b) not a real number

684. (a) $-\sqrt{64}$ (b) $\sqrt{-9}$

Answer: (a) real number (b) not a real number

685. (a) $\sqrt{-36}$ (b) $-\sqrt{144}$

Answer: (a) not a real number (b) real number

686. (a) $\sqrt{-49}$ (b) $-\sqrt{144}$

Answer: (a) not a real number (b) real number

In the following exercises, list the (a) whole numbers, (b) integers, (c) rational numbers, (d) irrational numbers, (e) real numbers for each set of numbers.

687. $-8, 0, 1.95286\ldots, \frac{12}{5}, \sqrt{36}, 9$

Answer: (a) $0, \sqrt{36}, 9$ (b) $-8, \sqrt{36}, 9$ (c) $-8, 0, \frac{12}{5}, \sqrt{36}, 9$ (d) $1.95286\ldots$

(e) $-8, 0, 1.95286\ldots, \frac{12}{5}, \sqrt{36}, 9$

688. $-9, -3\frac{4}{9}, -\sqrt{9}, 0.40\overline{9}, \frac{11}{6}, 7$

Answer: (a) 7 (b) $-9, -\sqrt{9}, 7$ (c) $-9, -3\frac{4}{9}, -\sqrt{9}, 0.4\overline{09}, \frac{11}{6}, 7$ (d) none

(e) $-9, -3\frac{4}{9}, -\sqrt{9}, 0.4\overline{09}, \frac{11}{6}, 7$

689. $-\sqrt{100}, -7, -\frac{8}{3}, -1, 0.77, 3\frac{1}{4}$

Answer: (a) none (b) $-\sqrt{100}, -7, -1$ (c) $-\sqrt{100}, -7, -\frac{8}{3}, -1, 0.77, 3\frac{1}{4}$ (d) none

(e) $-\sqrt{100}, -7, -\frac{8}{3}, -1, 0.77, 3\frac{1}{4}$

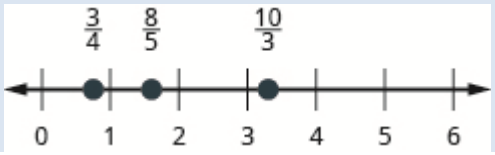
690. $-6, -\frac{5}{2}, 0, 0.\overline{714285}, 2\frac{1}{5}, \sqrt{14}$

Answer: (a) 0 (b) $-6, 0$ (c) $-6, -\frac{5}{2}, 0, 0.\overline{714285}, 2\frac{1}{5}$ (d) $\sqrt{14}$ (e) $-6, -\frac{5}{2}, 0, 0.\overline{714285}, 2\frac{1}{5}, \sqrt{14}$

Locate Fractions on the Number Line In the following exercises, locate the numbers on a number line.

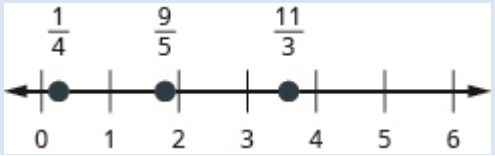
691. $\frac{3}{4}, \frac{8}{5}, \frac{10}{3}$

Answer:



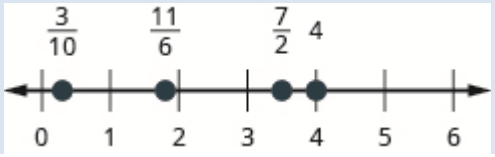
692. $\frac{1}{4}, \frac{9}{5}, \frac{11}{3}$

Answer:



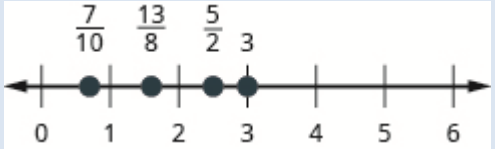
693. $\frac{3}{10}, \frac{7}{2}, \frac{11}{6}, 4$

Answer:



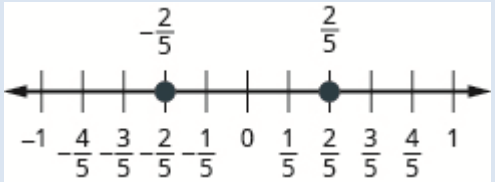
693. $\frac{7}{10}, \frac{5}{2}, \frac{13}{8}, 3$

Answer:



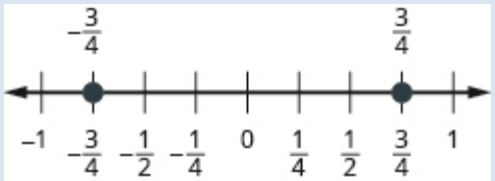
695. $\frac{2}{5}, -\frac{2}{5}$

Answer:



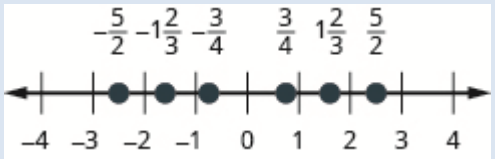
696. $\frac{3}{4}, -\frac{3}{4}$

Answer:



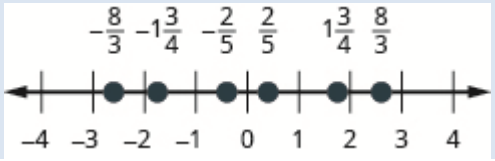
697. $\frac{3}{4}, -\frac{3}{4}, 1\frac{2}{3}, -1\frac{2}{3}, \frac{5}{2}, -\frac{5}{2}$

Answer:



698. $\frac{1}{5}, -\frac{2}{5}, 1\frac{3}{4}, -1\frac{3}{4}, \frac{8}{3}, -\frac{8}{3}$

Answer:



In the following exercises, order each of the pairs of numbers, using < or >.

699. $-1 \_\_ -\frac{1}{4}$

Answer: <

700. $-1 \_\_ -\frac{1}{3}$

Answer: <

701. $-2\frac{1}{2} \_\_ -3$

Answer: >

702. $-1\frac{3}{4} \_\_ -2$

Answer: >

703. $-\frac{5}{12} \_\_ -\frac{7}{12}$

Answer: >

704. $-\frac{9}{10} \_\_ -\frac{3}{10}$

Answer: <

705. $-3 \_\_ -\frac{13}{5}$

Answer: <

706. $-4 \_\_ -\frac{23}{6}$

Answer: <

Locate Decimals on the Number Line In the following exercises, locate the number on the number line.

707. 0.8

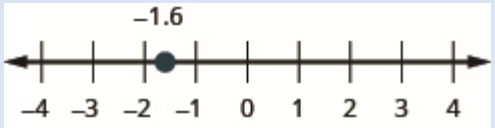
Answer:

708. -0.9

Answer:

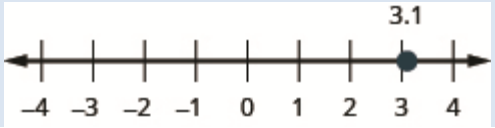
709. -1.6

Answer:



710. 3.1

Answer:



In the following exercises, order each pair of numbers, using < or >.

711. $0.37 \_\_ \ 0.63$

Answer: <

712. $0.86 \_\_ 0.69$

Answer: >

713. $0.91 \_\_ 0.901$

Answer: >

714. $0.415 \_\_ 0.41$

Answer: >

715. $-0.5 \_\_ \ -0.3$

Answer: <

716. $-0.1 \_\_ \ -0.4$

Answer: >

717. $-0.62 \_\_ \ -0.619$

Answer: <

718. $-7.31 \_\_ \ -7.3$

Answer: <

Everyday Math

719. **Field trip** All the 5th graders at Lincoln Elementary School will go on a field trip to the science museum. Counting all the children, teachers, and chaperones, there will be 147 people. Each bus holds 44 people.
(a) How many busses will be needed?
(b) Why must the answer be a whole number?
(c) Why shouldn't you round the answer the usual way, by choosing the whole number closest to the exact answer?
Answer: (a) 4 busses (b) answers may vary (c) answers may vary

720. **Child care** Serena wants to open a licensed child care center. Her state requires there be no more than 12 children for each teacher. She would like her child care center to serve 40 children.
(a) How many teachers will be needed?
(b) Why must the answer be a whole number?
(c) Why shouldn't you round the answer the usual way, by choosing the whole number closest to the exact answer?
Answer: (a) 4 teachers (b) answers may vary (c) answers may vary

Writing Exercises

721. In your own words, explain the difference between a rational number and an irrational number.
Answer: Answers may vary

722. Explain how the sets of numbers (counting, whole, integer, rational, irrationals, reals) are related to each other.
Answer: Answers may vary

Elementary Algebra
1: Foundations
1.9 Properties of Real Numbers

Use the Commutative and Associative Properties In the following exercises, use the associative property to simplify.

723. $3(4x)$

Answer: $12x$

724. $4(7m)$

Answer: $28m$

725. $(y+12)+28$

Answer: $y+40$

726. $(n+17)+33$

Answer: $n+50$

In the following exercises, simplify.

727. $\frac{1}{2}+\frac{7}{8}+\left(-\frac{1}{2}\right)$

Answer: $\frac{7}{8}$

728. $\frac{2}{5}+\frac{5}{12}+\left(-\frac{2}{5}\right)$

Answer: $\frac{5}{12}$

729. $\frac{3}{20}.\frac{49}{11}.\frac{20}{3}$

Answer: $\frac{49}{11}$

730. $\frac{13}{18}.\frac{25}{7}.\frac{18}{13}$

Answer: $\frac{25}{7}$

731. $-24.7.\frac{3}{8}$

Answer: -63

732. $-36 \cdot 11.\frac{4}{9}$

Answer: -176

733. $\left(\frac{5}{6}+\frac{8}{15}\right)+\frac{7}{15}$

Answer: $1\frac{5}{6}$

734. $\left(\frac{11}{12}+\frac{4}{9}\right)+\frac{5}{9}$

Answer: $1\frac{11}{12}$

735. 17(0.25)(4)

Answer: 17

736. 36(0.2)(5)

Answer: 36

737. [2.48(12)](0.5)

Answer: 14.88

738. [9.731(4)](0.75)

Answer: 29.193

739. 7(4*a*)

Answer: 28*a*

740. 9(8*w*)

Answer: 72*w*

741. $-15(5m)$

Answer: $-75m$

742. $-23(2n)$

Answer: $-46n$

743. $12\left(\frac{5}{6}p\right)$

Answer: $10p$

744. $20\left(\frac{3}{5}q\right)$

Answer: $12q$

745. $43m+(-12n)+(-16m)+(-9n)$

Answer: $27m+(-21n)$

746. $-22p+17q+(-35p)+(-27q)$

Answer: $-57p+(-10q)$

747. $\frac{3}{8}g+\frac{1}{12}h+\frac{7}{8}g+\frac{5}{12}h$

Answer: $\frac{5}{4}g+\frac{1}{2}h$

748. $\frac{5}{6}a+\frac{3}{10}b+\frac{1}{6}a+\frac{9}{10}b$

Answer: $a+\frac{6}{5}b$

749. $6.8p+9.14.q+(-4.37p)+(-0.88q)$

Answer: $2.43p+8.26q$

750. $9.6m+7.22n+(-2.19m)+(-0.65n)$

Answer: $7.41m+6.57n$

Use the Identity and Inverse Properties of Addition and Multiplication In the following exercises, find the additive inverse of each number.

751. (a) $\frac{2}{5}$ (b) 4.3 (c) -8 (d) $-\frac{10}{3}$

Answer: (a) $-\frac{2}{5}$ (b) -4.3 (c) 8 (d) $\frac{10}{3}$

752. (a) $\frac{5}{9}$ (b) 2.1 (c) -3 (d) $-\frac{9}{5}$

Answer: (a) $-\frac{5}{9}$ (b) -2.1 (c) 3 (d) $\frac{9}{5}$

753. (a) $-\frac{7}{6}$ (b) -0.075 (c) 23 (d) $\frac{1}{4}$

Answer: (a) $\frac{7}{6}$ (b) 0.075 (c) -23 (d) $-\frac{1}{4}$

754. (a) $-\frac{8}{3}$ (b) -0.019 (c) 52 (d) $\frac{5}{6}$

Answer: (a) $\frac{8}{3}$ (b) 0.019 (c) -52 (d) $-\frac{5}{6}$

In the following exercises, find the multiplicative inverse of each number.

755. (a) 6 (b) $-\frac{3}{4}$ (c) 0.7

Answer: (a) $\frac{1}{6}$ (b) $-\frac{4}{3}$ (c) $\frac{10}{7}$

756. (a) 12 (b) $-\frac{9}{2}$ (c) 0.13

Answer: (a) $\frac{1}{12}$ (b) $-\frac{2}{9}$ (c) $\frac{100}{13}$

757. (a) $\frac{11}{12}$ (b) -1.1 (c) -4

Answer: (a) $\frac{12}{11}$ (b) $-\frac{10}{11}$ (c) $-\frac{1}{4}$

758. (a) $\frac{17}{20}$ (b) -1.5 (c) -3

Answer: (a) $\frac{20}{17}$ (b) $-\frac{2}{3}$ (c) $-\frac{1}{3}$

Use the Properties of Zero In the following exercises, simplify.

759. $\frac{0}{6}$

Answer: 0

760. $\frac{3}{0}$

Answer: undefined

761. $0 \div \frac{11}{12}$

Answer: 0

762. $\frac{6}{0}$

Answer: undefined

763. $\frac{0}{3}$

Answer: 0

764. $0.\frac{8}{15}$

Answer: 0

765. $(-3.14)(0)$

Answer: 0

766. $\frac{\frac{1}{10}}{0}$

Answer: 0

Mixed Practice In the following exercises, simplify.

767. $19a + 44 - 19a$

Answer: 44

768. $27c + 16 - 27c$

Answer: 16

769. $10(0.1d)$

Answer: d

770. $100(0.01p)$

Answer: p

771. $\frac{0}{u-4.99}$, where $u \neq 4.99$

Answer: 0

772. $\frac{0}{v-65.1}$, where $v \neq 65.1$

Answer: 0

773. $0 \div \left(x-\frac{1}{2}\right)$, where $x \neq \frac{1}{2}$

Answer: 0

774. $0 \div \left(y-\frac{1}{6}\right)$, where $x \neq \frac{1}{6}$

Answer: 0

775. $\frac{32-5a}{0}$, where $32-5a \neq 0$

Answer: undefined

776. $\frac{28-9b}{0}$, where $28-9b \neq 0$

Answer: undefined

777. $\left(\frac{3}{4}+\frac{9}{10}m\right) \div 0$ where $\frac{3}{4}+\frac{9}{10}m \neq 0$

Answer: undefined

778. $\left(\frac{5}{16}n-\frac{3}{7}\right) \div 0$ where $\frac{5}{16}n-\frac{3}{7} \neq 0$

Answer: undefined

779. $15.\frac{3}{5}(4d+10)$

Answer: $36d+90$

780. $18.\frac{5}{6}(15h+24)$

Answer: $225h+360$

Simplify Expressions Using the Distributive Property In the following exercises, simplify using the distributive property.

781. $8(4y+9)$

Answer: $32y+72$

782. $9(3w+7)$

Answer: $27w+63$

783. $6(c-13)$

Answer: $6c-78$

784. $7(y-13)$

Answer: $7y-91$

785. $\frac{1}{4}(3q+12)$

Answer: $\frac{3}{4}q+3$

786. $\frac{1}{5}(4m+20)$

Answer: $\frac{4}{5}m+4$

787. $9\left(\frac{5}{9}y-\frac{1}{3}\right)$

Answer: $5y-3$

788. $10\left(\frac{3}{10}x-\frac{2}{5}\right)$

Answer: $3x-4$

789. $12\left(\frac{1}{4}+\frac{2}{3}r\right)$

Answer: $3+8r$

790. $12\left(\frac{1}{6}+\frac{3}{4}s\right)$

Answer: $2+9s$

791. $r(s-18)$

Answer: $rs-18r$

792. $u(v-10)$

Answer: $uv-10u$

793. $(y+4)p$

Answer: $yp+4p$

794. $(a+7)x$

Answer: $ax+7x$

795. $-7(4p+1)$

Answer: $-28p-7$

796. $-9(9a+4)$

Answer: $-81a-36$

797. $-3(x-6)$

Answer: $-3x+18$

798. $-4(q-7)$

Answer: $-4q+28$

799. $-(3x-7)$

Answer: $-3x+7$

800. $-(5p-4)$

Answer: $-5p+4$

801. $16-3(y+8)$

Answer: $-3y-8$

802. $18-4(x+2)$

Answer: $-4x+10$

803. $4-11(3c-2)$

Answer: $-33c+26$

804. $9-6(7n-5)$

Answer: $-42n+39$

805. $22-(a+3)$

Answer: $-a+19$

806. $8-(r-7)$

Answer: $-r+15$

807. $(5m-3)-(m+7)$

Answer: $4m-10$

808. $(4y-1)-(y-2)$

Answer: $3y+1$

809. $5(2n+9)+12(n-3)$

Answer: $22n+9$

810. $9(5u+8)+2(u-6)$

Answer: $47u+60$

811. $9(8x-3)-(-2)$

Answer: $72x-25$

812. $4(6x-1)-(-8)$

Answer: $24x+4$

813. $14(c-1)-8(c-6)$

Answer: $6c+34$

814. $11(n-7)-5(n-1)$

Answer: $6n-72$

815. $6(7y+8)-(30y-15)$

Answer: $12y+63$

816. $7(3n+9)-(4n-13)$

Answer: $17n+76$

Everyday Math

817. **Insurance copayment** Carrie had to have 5 fillings done. Each filling cost $80. Her dental insurance required her to pay 20% of the cost as a copay. Calculate Carrie's copay:
(a) first, by multiplying 0.20 by 80 to find her copay for each filling and then multiplying your answer by 5 to find her total copay for 5 fillings.
(b) next, by multiplying [5(0.20)](80)
(c) Which of the properties of real numbers says that your answers to parts (a), where you multiplied 5[(0.20)(80)] and (b), where you multiplied [5(0.20)](80), should be equal?

Answer: (a) $80; (b) $80; (c) answers will vary

818. **Cooking time** Helen bought a 24-pound turkey for her family's Thanksgiving dinner and wants to know what time to put the turkey in to the oven. She wants to allow 20 minutes per pound cooking time. Calculate the length of time needed to roast the turkey:
(a) first, by multiplying $24 \cdot 20$ to find the total number of minutes and then multiplying the answer by $\frac{1}{60}$ to convert minutes into hours.
(b) next, by multiplying $24\left(20.\frac{1}{60}\right)$.
(c) Which of the properties of real numbers says that your answers to parts (a), where you multiplied $(24 \cdot 20)\frac{1}{60}$, and (b), where you multiplied $24\left(20.\frac{1}{60}\right)$, should be equal?

Answer: (a) 8 hours (b) 8 (c) answers will vary

819. **Buying by the case** Trader Joe's grocery stores sold a bottle of wine they called "Two Buck Chuck" for $1.99. They sold a case of 12 bottles for $23.88. To find the cost of 12 bottles at $1.99, notice that 1.99 is $2-0.01$.
(a) Multiply 12(1.99) by using the distributive property to multiply $12(2-0.01)$.
(b) Was it a bargain to buy "Two Buck Chuck" by the case?

Answer: (a) $23.88 (b) no, the price is the same

820. **Multi-pack purchase** Adele's shampoo sells for $3.99 per bottle at the grocery store. At the warehouse store, the same shampoo is sold as a 3 pack for $10.49. To find the cost of 3 bottles at $3.99, notice that 3.99 is $4-0.01$.
(a) Multiply 3(3.99) by using the distributive property to multiply $3(4-0.01)$.
(b) How much would Adele save by buying 3 bottles at the warehouse store instead of at the grocery store?

Answer: (a) $11.97 (b) $1.48

Writing Exercises

821. In your own words, state the commutative property of addition.

Answer: Answers may vary

822. What is the difference between the additive inverse and the multiplicative inverse of a number?

Answer: Answers may vary

823. Simplify $8\left(x-\frac{1}{4}\right)$ using the distributive property and explain each step.

Answer: Answers may vary

824. Explain how you can multiply 4($5.97) without paper or calculator by thinking of $5.97 as $6-0.03$ and then using the distributive property.

Answer: Answers may vary

Elementary Algebra
1: Foundations
1.10 Systems of Measurement

Make Unit Conversions in the US System In the following exercises, convert the units.

825. A park bench is 6 feet long. Convert the length to inches.
Answer: 72 inches

826. A floor tile is 2 feet wide. Convert the width to inches.
Answer: 24 inches

827. A ribbon is 18 inches long. Convert the length to feet.
Answer: 1.5 feet

828. Carson is 45 inches tall. Convert his height to feet.
Answer: 3.75 feet

829. A football field is 160 feet wide. Convert the width to yards.
Answer: $53\frac{1}{3}$ yards

830. On a baseball diamond, the distance from home plate to first base is 30 yards. Convert the distance to feet.
Answer: 90 feet

831. Ulises lives 1.5 miles from school. Convert the distance to feet.
Answer: 7,920 feet

832. Denver, Colorado, is 5,183 feet above sea level. Convert the height to miles.
Answer: 0.98 mile

833. A killer whale weighs 4.6 tons. Convert the weight to pounds.
Answer: 9,200 pounds

834. Blue whales can weigh as much as 150 tons. Convert the weight to pounds.
Answer: 300,000 pounds

835. An empty bus weighs 35,000 pounds. Convert the weight to tons.
Answer: $17\frac{1}{2}$ tons

836. At take-off, an airplane weighs 220,000 pounds. Convert the weight to tons.
Answer: 110 tons

837. Rocco waited $1\frac{1}{2}$ hours for his appointment. Convert the time to seconds.

Answer: 5,400 s

838. Misty's surgery lasted $2\frac{1}{4}$ hours. Convert the time to seconds.

Answer: 4,500 s

839. How many teaspoons are in a pint?

Answer: 96 teaspoons

840. How many tablespoons are in a gallon?

Answer: 256 tablespoons

841. JJ's cat, Posy, weighs 14 pounds. Convert her weight to ounces.

Answer: 224 ounces

842. April's dog, Beans, weighs 8 pounds. Convert his weight to ounces.

Answer: 128 ounces

843. Crista will serve 20 cups of juice at her son's party. Convert the volume to gallons.

Answer: $1\frac{1}{4}$ gallons

844. Lance needs 50 cups of water for the runners in a race. Convert the volume to gallons.

Answer: $3\frac{1}{8}$ gallons

845. Jon is 6 feet 4 inches tall. Convert his height to inches.

Answer: 26 in.

846. Faye is 4 feet 10 inches tall. Convert her height to inches.

Answer: 58 inches

847. The voyage of the *Mayflower* took 2 months and 5 days. Convert the time to days.

Answer: 65 days

848. Lynn's cruise lasted 6 days and 18 hours. Convert the time to hours.

Answer: 162 hours

849. Baby Preston weighed 7 pounds 3 ounces at birth. Convert his weight to ounces.

Answer: 115 ounces

850. Baby Audrey weighted 6 pounds 15 ounces at birth. Convert her weight to ounces.
Answer: 111 ounces

Use Mixed Units of Measurement in the US System In the following exercises, solve.

851. Eli caught three fish. The weights of the fish were 2 pounds 4 ounces, 1 pound 11 ounces, and 4 pounds 14 ounces. What was the total weight of the three fish?
Answer: 8 lbs. 13 oz.

852. Judy bought 1 pound 6 ounces of almonds, 2 pounds 3 ounces of walnuts, and 8 ounces of cashews. How many pounds of nuts did Judy buy?
Answer: 4 lbs. 1 oz.

853. One day Anya kept track of the number of minutes she spent driving. She recorded 45, 10, 8, 65, 20, and 35. How many hours did Anya spend driving?
Answer: 3.05 hours

854. Last year Eric went on 6 business trips. The number of days of each was 5, 2, 8, 12, 6, and 3. How many weeks did Eric spend on business trips last year?
Answer: 5.14 weeks

855. Renee attached a 6 feet 6 inch extension cord to her computer's 3 feet 8 inch power cord. What was the total length of the cords?
Answer: 10 ft. 2 in.

856. Fawzi's SUV is 6 feet 4 inches tall. If he puts a 2 feet 10 inch box on top of his SUV, what is the total height of the SUV and the box?
Answer: 9 ft. 2 in.

857. Leilani wants to make 8 placemats. For each placemat she needs 18 inches of fabric. How many yards of fabric will she need for the 8 placemats?
Answer: 4 yards

858. Mireille needs to cut 24 inches of ribbon for each of the 12 girls in her dance class. How many yards of ribbon will she need altogether?
Answer: 8 yards

Make Unit Conversions in the Metric System In the following exercises, convert the units.

859. Ghalib ran 5 kilometers. Convert the length to meters.
Answer: 5,000 meters

860. Kitaka hiked 8 kilometers. Convert the length to meters.
Answer: 8,000 meters

861. Estrella is 1.55 meters tall. Convert her height to centimeters.
Answer: 155 centimeters

862. The width of the wading pool is 2.45 meters. Convert the width to centimeters.
Answer: 245 centimeters

863. Mount Whitney is 3,072 meters tall. Convert the height to kilometers.
Answer: 3.072 kilometers

864. The depth of the Mariana Trench is 10,911 meters. Convert the depth to kilometers.
Answer: 10.911 kilometers

865. June's multivitamin contains 1,500 milligrams of calcium. Convert this to grams.
Answer: 1.5 grams

866. A typical ruby-throated hummingbird weights 3 grams. Convert this to milligrams.
Answer: 3,000 milligrams

867. One stick of butter contains 91.6 grams of fat. Convert this to milligrams.
Answer: 91,600 milligrams

868. One serving of gourmet ice cream has 25 grams of fat. Convert this to milligrams.
Answer: 25,000 milligrams

869. The maximum mass of an airmail letter is 2 kilograms. Convert this to grams.
Answer: 2,000 grams

870. Dimitri's daughter weighed 3.8 kilograms at birth. Convert this to grams.
Answer: 3,800 grams

871. A bottle of wine contained 750 milliliters. Convert this to liters.
Answer: 0.75 liters

872. A bottle of medicine contained 300 milliliters. Convert this to liters.
Answer: 0.3 liters

Use Mixed Units of Measurement in the Metric System In the following exercises, solve.

873. Matthias is 1.8 meters tall. His son is 89 centimeters tall. How much taller is Matthias than his son?
Answer: 91 centimeters

874. Stavros is 1.6 meters tall. His sister is 9595 centimeters tall. How much taller is Stavros than his sister?
Answer: 65 centimeters

875. A typical dove weighs 345 grams. A typical duck weighs 1.2 kilograms. What is the difference, in grams, of the weights of a duck and a dove?
Answer: 855 grams

876. Concetta had a 2-kilogram bag of flour. She used 180 grams of flour to make biscotti. How many kilograms of flour are left in the bag?
Answer: 1.82 kilograms

877. Harry mailed 5 packages that weighed 420 grams each. What was the total weight of the packages in kilograms?
Answer: 2.1 kilograms

878. One glass of orange juice provides 560 milligrams of potassium. Linda drinks one glass of orange juice every morning. How many grams of potassium does Linda get from her orange juice in 30 days?
Answer: 16.8 grams

879. Jonas drinks 200 milliliters of water 8 times a day. How many liters of water does Jonas drink in a day?
Answer: 1.6 liters

880. One serving of whole grain sandwich bread provides 6 grams of protein. How many milligrams of protein are provided by 7 servings of whole grain sandwich bread?
Answer: 42,000 milligrams

Convert Between the US and the Metric Systems of Measurement In the following exercises, make the unit conversions. Round to the nearest tenth.

881. Bill is 75 inches tall. Convert his height to centimeters.
Answer: 190.5 centimeters

882. Frankie is 42 inches tall. Convert his height to centimeters.
Answer: 106.7 centimeters

883. Marcus passed a football 24 yards. Convert the pass length to meters
Answer: 21.9 meters

884. Connie bought 9 yards of fabric to make drapes. Convert the fabric length to meters.
Answer: 8.2 meters

885. Each American throws out an average of 1,650 pounds of garbage per year. Convert this weight to kilograms.
Answer: 742.5 kilograms

886. An average American will throw away 90,000 pounds of trash over his or her lifetime. Convert this weight to kilograms.
Answer: 41,500 kilograms

887. A 5K run is 5 kilometers long. Convert this length to miles.
Answer: 3.1 miles

888. Kathryn is 1.6 meters tall. Convert her height to feet.
Answer: 5.2 feet

889. Dawn's suitcase weighed 20 kilograms. Convert the weight to pounds.
Answer: 44 pounds

890. Jackson's backpack weighed 15 kilograms. Convert the weight to pounds.
Answer: 33 pounds

891. Ozzie put 14 gallons of gas in his truck. Convert the volume to liters.
Answer: 53.2 liters

892. Bernard bought 8 gallons of paint. Convert the volume to liters.
Answer: 30.4 liters

Convert between Fahrenheit and Celsius Temperatures In the following exercises, convert the Fahrenheit temperatures to degrees Celsius. Round to the nearest tenth.

893. $86\ ^{\circ}$ Fahrenheit
Answer: $30\ ^{\circ}\text{C}$

894. $77\ ^{\circ}$ Fahrenheit
Answer: $25\ ^{\circ}\text{C}$

895. $104\ ^{\circ}$ Fahrenheit
Answer: $40\ ^{\circ}\text{C}$

896. $14\ ^{\circ}$ Fahrenheit
Answer: $-10\ ^{\circ}\text{C}$

897. $72\ ^{\circ}$ Fahrenheit
Answer: $22.2\ ^{\circ}\text{C}$

898. $4\ ^{\circ}$ Fahrenheit
Answer: $-15.5\ ^{\circ}\text{C}$

899. $0\ ^{\circ}$ Fahrenheit
Answer: $-17.8\ ^{\circ}\text{C}$

900. $120\ ^{\circ}$ Fahrenheit
Answer: $48.9\ ^{\circ}\text{C}$

In the following exercises, convert the Celsius temperatures to degrees Fahrenheit. Round to the nearest tenth.

901. $5\ ^{\circ}$ Celsius
Answer: $41\ ^{\circ}\text{F}$

902. $25\ ^{\circ}$ Celsius
Answer: $77\ ^{\circ}\text{F}$

903. $-10\ ^{\circ}$ Celsius
Answer: $14\ ^{\circ}\text{F}$

904. $-15\ ^{\circ}$ Celsius
Answer: $5\ ^{\circ}\text{F}$

905. $22\ ^{\circ}$ Celsius
Answer: $71.6\ ^{\circ}\text{F}$

906. $8\ ^{\circ}$ Celsius
Answer: $46.4\ ^{\circ}\text{F}$

907. $43\ ^{\circ}$ Celsius
Answer: $109.4\ ^{\circ}\text{F}$

908. $16\ ^{\circ}$ Celsius
Answer: $60.8\ ^{\circ}\text{F}$

Everyday Math

909. **Nutrition** Julian drinks one can of soda every day. Each can of soda contains 40 grams of sugar. How many kilograms of sugar does Julian get from soda in 1 year?
Answer: 14.6 kilograms

910. **Reflectors** The reflectors in each lane-marking stripe on a highway are spaced 16 yards apart. How many reflectors are needed for a one mile long lane-marking stripe?
Answer: 110 reflectors

Writing Exercises

911. Some people think that $65\ ^{\circ}$to $75\ ^{\circ}$ Fahrenheit is the ideal temperature range.
(a) What is your ideal temperature range? Why do you think so?
(b) Convert your ideal temperatures from Fahrenheit to Celsius.
Answer: Answers may vary

912.
(a) Did you grow up using the US or the metric system of measurement?
(b) Describe two examples in your life when you had to convert between the two systems of measurement.
Answer: Answers may vary

Chapter Review

1.1 Introduction to Whole Numbers

Use Place Value with Whole Number In the following exercises find the place value of each digit.

913. 26,915
(a) 1 (b) 2 (c) 9 (d) 5 (e) 6
Answer: (a) tens (b) ten thousands (c) hundreds (d) ones (e) thousands

914. 359,417
(a) 9 (b) 3 (c) 4 (d)7 (e) 1
Answer: (a) thousands (b) hundred thousands (c) hundreds (d) ones (e) tens

915. 58,129,304
(a) 5 (b) 0 (c) 1 (d) 8 (e) 2
Answer: (a) ten millions (b) tens (c) hundred thousands (d) millions (e) ten thousands

916. 9,430,286,157
(a) 6 (b) 4 (c) 9 (d) 0 (e) 5
Answer: (a) thousands (b) hundred millions (c) billions (d) millions (e) tens

In the following exercises, name each number.

917. 6,104
Answer: six thousand, one hundred four

918. 493,068
Answer: four hundred ninety-three thousand, sixty eight

919. 3,975,284
Answer: three million, nine hundred seventy-five thousand, two hundred eighty-four

920. 85,620,435
Answer: eighty-five million, six hundred twenty thousand, four hundred thirty-five

In the following exercises, write each number as a whole number using digits.

921. three hundred fifteen
Answer: 315

922. sixty-five thousand, nine hundred twelve
Answer: 65,912

923. ninety million, four hundred twenty-five thousand, sixteen
Answer: $90,425,016$

924. one billion, forty-three million, nine hundred twenty-two thousand, three hundred eleven
Answer: $1,043,922,311$

In the following exercises, round to the indicated place value.

925. Round to the nearest ten.
(a) 407 (b) 8,564
Answer: (a) 410 (b) $8,560$

926. Round to the nearest hundred.
(a) 25,846 (b) 25,864
Answer: (a) $25,800$ (b) $25,900$

In the following exercises, round each number to the nearest (a) hundred (b) thousand (c) ten thousand.

927. 864,951
Answer: (a) $865,000$ (b) $865,000$ (c) $860,000$

928. 3,972,849
Answer: (a) $3,972,800$ (b) $3,973,000$ (c) $3,970,000$

Identify Multiples and Factors In the following exercises, use the divisibility tests to determine whether each number is divisible by 2, by 3, by 5, by 6, and by 10.

929. 168
Answer: by $2,\ 3,\ 6$

930. 264
Answer: by $2,\ 3,\ 6$

931. 375
Answer: by $3,\ 5$

932. 750
Answer: by $2,\ 3,\ 5,\ 6,\ 10$

933. 1430
Answer: by $2,\ 5,\ 10$

934. 1080
Answer: by 2, 3, 5, 6, 10

Find Prime Factorizations and Least Common Multiples In the following exercises, find the prime factorization.

935. 420
Answer: $2 \cdot 2 \cdot 3 \cdot 5 \cdot 7$

936. 115
Answer: $5 \cdot 23$

937. 225
Answer: $3 \cdot 3 \cdot 5 \cdot 5$

938. 2475
Answer: $3 \cdot 3 \cdot 5 \cdot 5 \cdot 11$

939. 1560
Answer: $2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 13$

940. 56
Answer: $2 \cdot 2 \cdot 2 \cdot 7$

941. 72
Answer: $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$

942. 168
Answer: $2 \cdot 2 \cdot 2 \cdot 3 \cdot 7$

943. 252
Answer: $2 \cdot 2 \cdot 3 \cdot 3 \cdot 7$

944. 391
Answer: $17 \cdot 23$

In the following exercises, find the least common multiple of the following numbers using the multiples method.

945. 6,15
Answer: 30

946. 60, 75
Answer: 300

In the following exercises, find the least common multiple of the following numbers using the prime factors method.

947. 24, 30
Answer: 120

948. 70, 84
Answer: 420

1.2 Use the Language of Algebra

Use Variables and Algebraic Symbols In the following exercises, translate the following from algebra to English.

949. $25 - 7$
Answer: 25 minus 7, the difference of twenty-five and seven

950. $5 \cdot 6$
Answer: 5 times 6, the product of five and six

951. $45 \div 5$
Answer: 45 divided by 5, the quotient of forty-five and five

952. $x + 8$
Answer: x plus 8, the sum of x and eight

953. $42 \geq 27$
Answer: forty-two is greater than or equal to twenty-seven

954. $3n = 24$
Answer: 3 times n equals 24, the product of three and n equals twenty-four

955. $3 \leq 20 \div 4$
Answer: 3 is less than or equal to 20 divided by 4, three is less than or equal to the quotient of twenty and four

956. $a \neq 7 \cdot 4$
Answer: a is not equal to 7 times 4, a is not equal to the product of seven and four

In the following exercises, determine if each is an expression or an equation.

957. $6 \cdot 3 + 5$

Answer: expression

958. $y - 8 = 32$

Answer: equation

Simplify Expressions Using the Order of Operations In the following exercises, simplify each expression.

959. 3^5

Answer: 243

960. 10^8

Answer: 100,000,000

In the following exercises, simplify

961. $6 + 10 / 2 + 2$

Answer: 13

962. $9 + 12 / 3 + 4$

Answer: 17

963. $20 \div (4 + 6) \cdot 5$

Answer: 10

964. $33 \div (3 + 8) \cdot 2$

Answer: 6

965. $4^2 + 5^2$

Answer: 41

966. $(4 + 5)^2$

Answer: 81

Evaluate an Expression In the following exercises, evaluate the following expressions.

967. $9x + 7$ when $x = 3$

Answer: 34

968. $5x-4$ when $x=6$

Answer: 26

969. x^4 when $x=3$

Answer: 81

970. 3^x when $x=3$

Answer: 27

971. x^2+5x-8 when $x=6$

Answer: 58

972. $2x+4y-5$ when $x=7,\ y=8$

Answer: 41

Simplify Expressions by Combining Like Terms In the following exercises, identify the coefficient of each term.

973. $12n$

Answer: 12

974. $9x^2$

Answer: 9

In the following exercises, identify the like terms.

975. $3n,\ n^2,\ 12,\ 12p^2,\ 3,\ 3n^2$

Answer: 12 and 3, n^2 and $3n^2$

976. $5,\ 18r^2,\ 9s,\ 9r,\ 5r^2,\ 5s$

Answer: $18r^2$ and $5r^2$, $9s$ and $5s$

In the following exercises, identify the terms in each expression.

977. $11x^2+3x+6$

Answer: $11x^2,\ 3x,\ 6$

978. $22y^3+y+15$

Answer: $22y^3+y+15$

In the following exercises, simplify the following expressions by combining like terms.

979. $17a + 9a$
Answer: $26a$

980. $18z + 9z$
Answer: $27z$

981. $9x + 3x + 8$
Answer: $12x + 8$

982. $8a + 5a + 9$
Answer: $13a + 9$

983. $7p + 6 + 5p - 4$
Answer: $12p + 2$

984. $8x + 7 + 4x - 5$
Answer: $12x + 2$

Translate an English Phrase to an Algebraic Expression In the following exercises, translate the following phrases into algebraic expressions.

985. the sum of 8 and 12
Answer: $8 + 12$

986. the sum of 9 and 1
Answer: 9+1

987. the difference of x and 4
Answer: $x - 4$

988. the difference of x and 3
Answer: $x - 3$

989. the product of 6 and y
Answer: $6y$

990. the product of 9 and y
Answer: $9y$

991. Adele bought a skirt and a blouse. The skirt cost $15 more than the blouse. Let b represent the cost of the blouse. Write an expression for the cost of the skirt.

Answer: $b+15$

992. Marcella has 6 fewer boy cousins than girl cousins. Let g represent the number of girl cousins. Write an expression for the number of boy cousins.

Answer: $c-6$

1.3 Add and Subtract Integers

Use Negatives and Opposites of Integers In the following exercises, order each of the following pairs of numbers, using < or >.

993. (a) $6 \_\_\_ 2$ (b) $-7 \_\_\_ 4$ (c) $-9 \_\_\_ -1$ (d) $9 \_\_\_ -3$

Answer: (a) > (b) < (c) < (d) >

994. (a) $-5 \_\_\_ 1$ (b) $-4 \_\_\_ -9$ (c) $6 \_\_\_ 10$ (d) $3 \_\_\_ -8$

Answer: (a) < (b) > (c) < (d) >

In the following exercises,, find the opposite of each number.

995. (a) -8 (b) 1

Answer: (a) 8 (b) -1

996. (a) -2 (b) 6

Answer: (a) 2 (b) -6

In the following exercises, simplify.

997. $-(-19)$

Answer: 19

998. $-(-53)$

Answer: 53

In the following exercises, simplify.

999. $-m$ when (a) $m=3$ (b) $m=-3$

Answer: (a) -3 (b) 3

1000. $-p$ when (a) $p=6$ (b) $p=-6$

Answer: (a) -6 (b) 6

Simplify Expressions with Absolute Value In the following exercises, simplify.

1001. (a) $|7|$ (b) $|-25|$ (c) $|0|$

Answer: (a) 7 (b) 25 (c) 0

1002. (a) $|5|$ (b) $|0|$ (c) $|-19|$

Answer: (a) 5 (b) 0 (c) 19

In the following exercises, fill in $<$, $>$, or = for each of the following pairs of numbers.

1003. (a) $-8 \_\_\_ |-8|$ (b) $-|-2| \_\_\_ -2$

Answer: (a) < (b) =

1004. (a) $|-3| \_\_\_ -|-3|$ (b) $4 \_\_\_ -|-4|$

Answer: (a) >(b) >

In the following exercises, simplify.

1005. $|8-4|$

Answer: 4

1006. $|9-6|$

Answer: 3

1007. $8\left(14-2|-2|\right)$

Answer: 80

1008. $6\left(13-4|-2|\right)$

Answer: 30

In the following exercises, evaluate.

1009. (a) $|x|$ when $x=-28$ (b)

Answer: (a) 28 (b) 15

1010. (a) $|y|$ when $y=-37$ (b) $|-z|$ when $z=-24$

Answer: (a) 37 (b) 24

Add Integers In the following exercises, simplify each expression.

1011. $-200+65$

Answer: -135

1012. $-150+45$

Answer: -105

1013. $2+(-8)+6$

Answer: 0

1014. $4+(-9)+7$

Answer: 2

1015. $140+(-75)+67$

Answer: 132

1016. $-32+24+(-6)+10$

Answer: -4

Subtract Integers In the following exercises, simplify.

1017. $9-3$

Answer: 6

1018. $-5-(-1)$

Answer: -4

1019. (a) $15-6$ (b) $15+(-6)$

Answer: (a) 9 (b) 9

1020. (a) $12-9$ (b) $12+(-9)$

Answer: (a) 3 (b) 3

1021. (a) $8-(-9)$ (b) $8+9$

Answer: (a) 17 (b) 17

1022. (a) $4-(-4)$ (b) $4+4$

Answer: (a) 8 (b) 8

In the following exercises, simplify each expression.

1023. $10-(-19)$

Answer: 29

1024. $11-(-18)$

Answer: 29

1025. $31-79$

Answer: -48

1026. $39-81$

Answer: -42

1027. $-31-11$

Answer: -42

1028. $-32-18$

Answer: -50

1029. $-15-(-28)+5$

Answer: 18

1030. $71+(-10)-8$

Answer: 53

1031. $-16-(-4+1)-7$

Answer: -20

1032. $-15-(-6+4)-3$

Answer: -16

Multiply Integers In the following exercises,multiply.

1033. $-5(7)$

Answer: -35

1034. $-8(6)$

Answer: -48

1035. $-18(-2)$

Answer: 36

1036. $-10(-6)$

Answer: 60

Divide Integers In the following exercises, divide.

1037. $-28 \div 7$

Answer: -4

1038. $56 \div (-7)$

Answer: -8

1039. $-120 \div (-20)$

Answer: 6

1040. $-200 \div 25$

Answer: -8

Simplify Expressions with Integers In the following exercises, simplify each expression.

1041. $-8(-2) - 3(-9)$

Answer: 43

1042. $-7(-4) - 5(-3)$

Answer: 43

1043. $(-5)^3$

Answer: -125

1044. $(-4)^3$

Answer: -64

1045. $-4 \cdot 2 \cdot 11$

Answer: -88

1046. $-5 \cdot 3 \cdot 10$

Answer: -150

1047. $-10(-4)\div(-8)$

Answer: -5

1048. $-8(-6)\div(-4)$

Answer: -12

1049. $31-4(3-9)$

Answer: 55

1050. $24-3(2-10)$

Answer: 48

Evaluate Variable Expressions with Integers In the following exercises, evaluate each expression.

1051. $x+8$ when (a) $x=-26$; (b) $x=-95$

Answer: (a) -18 (b) -87

1052. $y+9$ when (a) $y=-29$ (b) $y=-84$

Answer: (a) -20 (b) -75

1053. When $b=-11$, evaluate: (a) $b+6$ (b) $-b+6$

Answer: (a) -5 (b) 17

1054. When $c=-9$, evaluate: (a) $c+(-4)$ (b) $-c+(-4)$

Answer: (a) -13 (b) 5

1055. p^2-5p+2 when $p=-1$

Answer: 8

1056. q^2-2q+9 when $q=-2$

Answer: 17

1057. $6x-5y+15$ when $x=3$ and $y=-1$

Answer: 38

1058. $3p-2q+9$ when $p=8$ and $q=-2$

Answer: 37

Translate English Phrases to Algebraic Expressions In the following exercises, translate to an algebraic expression and simplify if possible.

1059. the sum of -4 and -17, increased by 32

Answer: $\left(-4+\left(-17\right)\right)+32;\ 11$

1060. (a) the difference of 15 and -7 (b) subtract 15 from -7

Answer: (a) $15-\left(-7\right);\ 22$ (b) $-7-15;\ -22$

1061. the quotient of -45 and -9

Answer: $\frac{-45}{-9};\ 5$

1062. the product of -12 and the difference of c and d

Answer: $-12\left(c-d\right)$

Use Integers in Applications In the following exercises, solve.

1063. **Temperature** The high temperature one day in Miami Beach, Florida, was 76^0. That same day, the high temperature in Buffalo, New York was -8^0. What was the difference between the temperature in Miami Beach and the temperature in Buffalo?

Answer: 84 degrees

1064. **Checking Account** Adrianne has a balance of $-\$22$ in her checking account. She deposits $301 to the account. What is the new balance?

Answer: $279

1.5 Visualize Fractions

Find Equivalent Fractions In the following exercises,find three fractions equivalent to the given fraction. Show your work, using figures or algebra.

1065. $\frac{1}{4}$

Answer: $\frac{2}{8}, \frac{3}{12}, \frac{4}{16}$ answers may vary

1066. $\frac{1}{3}$

Answer: $\frac{2}{6}, \frac{3}{9}, \frac{4}{12}$ answers may vary

1067. $\frac{5}{6}$

Answer: $\frac{10}{12}, \frac{15}{18}, \frac{20}{24}$ answers may vary

1068. $\frac{2}{7}$

Answer: $\frac{4}{14}, \frac{6}{21}, \frac{8}{28}$ answers may vary

Simplify Fractions In the following exercises, simplify.

1069. $\frac{7}{21}$

Answer: $\frac{1}{3}$

1070. $\frac{8}{24}$

Answer: $\frac{1}{3}$

1071. $\frac{15}{20}$

Answer: $\frac{3}{4}$

1072. $\frac{12}{18}$

Answer: $\frac{2}{3}$

1073. $-\frac{168}{192}$

Answer: $-\frac{7}{8}$

1074. $-\frac{140}{224}$

Answer: $-\frac{5}{8}$

1075. $\frac{11x}{11y}$

Answer: $\frac{x}{y}$

1076. $\frac{15a}{15b}$

Answer: $\frac{a}{b}$

Multiply Fractions In the following exercises, multiply.

1077. $\frac{2}{5}\cdot\frac{1}{3}$

Answer: $\frac{2}{15}$

1078. $\frac{1}{2}\cdot\frac{3}{8}$

Answer: $\frac{3}{18}$

1079. $\frac{7}{12}\left(-\frac{8}{21}\right)$

Answer: $-\frac{2}{9}$

1080. $\frac{5}{12}\left(-\frac{8}{15}\right)$

Answer: $-\frac{2}{9}$

1081. $-28p\left(-\frac{1}{4}\right)$

Answer: $7p$

1082. $-51q\left(-\frac{1}{3}\right)$

Answer: $17q$

1083. $\frac{14}{5}(-15)$

Answer: -42

1084. $-1\left(-\frac{3}{8}\right)$

Answer: $\frac{3}{8}$

Divide Fractions In the following exercises, divide.

1085. $\frac{1}{2} \div \frac{1}{4}$

Answer: 2

1086. $\frac{1}{2} \div \frac{1}{8}$

Answer: 4

1087. $-\frac{4}{5} \div \frac{4}{7}$

Answer: $-\frac{7}{5}$

1088. $-\frac{3}{4} \div \frac{3}{5}$

Answer: $-\frac{5}{4}$

1089. $\frac{5}{8} \div \frac{a}{10}$

Answer: $\frac{25}{4a}$

1090. $\frac{5}{6} \div \frac{c}{15}$

Answer: $\frac{25}{2c}$

1091. $\frac{7p}{12} \div \frac{21p}{8}$

Answer: $\frac{2}{9}$

1092. $\frac{5q}{12} \div \frac{15q}{8}$

Answer: $\frac{2}{9}$

1093. $\frac{2}{5} \div (-10)$

Answer: $-\frac{1}{25}$

1094. $-18 \div -\left(\frac{9}{2}\right)$

Answer: 4

In the following exercises, simplify.

1095. $\frac{\frac{2}{3}}{\frac{8}{9}}$

Answer: $\frac{3}{4}$

1096. $\frac{\frac{4}{5}}{\frac{8}{15}}$

Answer: $\frac{3}{2}$

1097. $\frac{-\frac{9}{10}}{3}$

Answer: $-\frac{3}{10}$

1098. $\frac{2}{\frac{5}{8}}$

Answer: $\frac{16}{5}$

1099. $\frac{\frac{r}{5}}{\frac{s}{3}}$

Answer: $\frac{3r}{5s}$

1100. $\frac{-\frac{x}{6}}{-\frac{8}{9}}$

Answer: $\frac{3x}{16}$

Simplify Expressions Written with a Fraction Bar In the following exercises,simplify.

1101. $\frac{4+11}{8}$

Answer: $\frac{15}{8}$

1102. $\frac{9+3}{7}$

Answer: $\frac{12}{7}$

1103. $\frac{30}{7-12}$

Answer: -6

1104. $\frac{15}{4-9}$

Answer: -3

1105. $\frac{22-14}{19-13}$

Answer: $\frac{4}{3}$

1106. $\frac{15+9}{18+12}$

Answer: $\frac{4}{5}$

1107. $\frac{5\cdot 8}{-10}$

Answer: -4

1108. $\frac{3\cdot 4}{-24}$

Answer: $-\frac{1}{2}$

1109. $\frac{15\cdot 5-5^2}{2\cdot 10}$

Answer: $\frac{5}{2}$

1110. $\frac{12 \cdot 9 - 3^2}{3 \cdot 18}$

Answer: $\frac{11}{6}$

1111. $\frac{2 + 4(3)}{-3 - 2^2}$

Answer: -2

1112. $\frac{7 + 3(5)}{-2 - 3^2}$

Answer: -2

Translate Phrases to Expressions with Fractions In the following exercises, translate each English phrase into an algebraic expression.

1113. the quotient of c and the sum of d and 9.

Answer: $\frac{c}{d + 9}$

1114. the quotient of the difference of h and k, and -5.

Answer: $\frac{h - k}{-5}$

1.6 Add and Subtract Fractions

Add and Subtract Fractions with a Common Denominator In the following exercises, add.

1115. $\frac{4}{9} + \frac{1}{9}$

Answer: $\frac{5}{9}$

1116. $\frac{2}{9} + \frac{5}{9}$

Answer: $\frac{7}{9}$

1117. $\frac{y}{3} + \frac{2}{3}$

Answer: $\frac{y + 2}{3}$

1118. $\frac{7}{p}+\frac{9}{p}$

Answer: $\frac{16}{p}$

1119. $-\frac{1}{8}+\left(-\frac{3}{8}\right)$

Answer: $-\frac{1}{2}$

1120. $-\frac{1}{8}+\left(-\frac{5}{8}\right)$

Answer: $-\frac{3}{4}$

In the following exercises, subtract.

1121. $\frac{4}{5}-\frac{1}{5}$

Answer: $\frac{3}{5}$

1122. $\frac{4}{5}-\frac{3}{5}$

Answer: $\frac{1}{5}$

1123. $\frac{y}{17}-\frac{9}{17}$

Answer: $\frac{y-9}{17}$

1124. $\frac{x}{19}-\frac{8}{19}$

Answer: $\frac{x-8}{19}$

1125. $-\frac{8}{d}-\frac{3}{d}$

Answer: $-\frac{11}{d}$

1126. $-\frac{7}{c}-\frac{7}{c}$

Answer: $-\frac{14}{c}$

Add or Subtract Fractions with Different Denominators In the following exercises, add or subtract**.**

1127. $\frac{1}{3}+\frac{1}{5}$

Answer: $\frac{8}{15}$

1128. $\frac{1}{4}+\frac{1}{5}$

Answer: $\frac{9}{20}$

1129. $\frac{1}{5}-\left(-\frac{1}{10}\right)$

Answer: $\frac{3}{10}$

1130. $\frac{1}{2}-\left(-\frac{1}{6}\right)$

Answer: $\frac{2}{3}$

1131. $\frac{2}{3}+\frac{3}{4}$

Answer: $\frac{17}{12}$

1132. $\frac{3}{4}+\frac{2}{5}$

Answer: $\frac{23}{20}$

1133. $\frac{11}{12}-\frac{3}{8}$

Answer: $\frac{13}{24}$

1134. $\frac{5}{8}-\frac{7}{12}$

Answer: $\frac{1}{24}$

1135. $-\frac{9}{16}-\left(-\frac{4}{5}\right)$

Answer: $\frac{19}{80}$

1136. $-\frac{7}{20}-\left(-\frac{5}{8}\right)$

Answer: $\frac{11}{40}$

1137. $1+\frac{5}{6}$

Answer: $\frac{11}{6}$

1138. $1-\frac{5}{9}$

Answer: $\frac{4}{9}$

Use the Order of Operations to Simplify Complex Fractions In the following exercises, simplify.

1139. $\frac{\left(\frac{1}{5}\right)^2}{2+3^2}$

Answer: $\frac{1}{275}$

1140. $\frac{\left(\frac{1}{3}\right)^2}{5+2^2}$

Answer: $\frac{1}{81}$

1141. $\frac{\frac{2}{3}+\frac{1}{2}}{\frac{3}{4}-\frac{2}{3}}$

Answer: 14

1142. $\frac{\frac{3}{4}+\frac{1}{2}}{\frac{5}{6}-\frac{2}{3}}$

Answer: $\frac{15}{2}$

Evaluate Variable Expressions with Fractions In the following exercises, evaluate.

1143. $x+\frac{1}{2}$ when (a) $x=-\frac{1}{8}$ (b) $x=-\frac{1}{2}$

Answer: (a) $\frac{3}{8}$;(b) 0

1144. $x+\frac{2}{3}$ when (a) $x=-\frac{1}{6}$ (b) $x=-\frac{5}{3}$

Answer: (a) $\frac{1}{2}$;(b) -1

1145. $4p^2q$ when $p=-\frac{1}{2}$ and $q=\frac{5}{9}$

Answer: $\frac{5}{9}$

1146. $5m^2n$ when $m=-\frac{2}{5}$ and $n=\frac{1}{3}$

Answer: $\frac{4}{15}$

1147. $\frac{u+v}{w}$ when $u=-4,\ v=-8, w=2$

Answer: -6

1148. $\frac{m+n}{p}$ when $m=-6,\ n=-2, p=4$

Answer: -2

1.7 Decimals

Name and Write Decimals In the following exercises, write as a decimal.

1149. Eight and three hundredths

Answer: 8.03

1150. Nine and seven hundredths

Answer: 9.07

1151. One thousandth

Answer: 0.001

1152. Nine thousandths

Answer: 0.009

In the following exercises, name each decimal.

1153. 7.8
Answer: seven and eight tenths

1154. 5.01
Answer: five and one hundredth

1155. 0.005
Answer: five thousandths

1156. 0.381
Answer: three hundred eighty-one thousandths

Round Decimals In the following exercises, round each number to the nearest (a) hundredth (b) tenth (c) whole number.

1157. 5.7932
Answer: (a) 5.79 (b) 5.8(c) 6

1158. 3.6284
Answer: (a) 3.63 (b) 3.6(c) 4

1159. 12.4768
Answer: (a) 12.48 (b) 12.5 (c) 12

1160. 25.8449
Answer: (a) 25.84 (b) 25.8 (c) 26

Add and Subtract Decimals In the following exercises, add or subtract.

1161. $18.37 + 9.36$
Answer: 27.73

1162. $256.37 - 85.49$
Answer: 170.88

1163. $15.35 - 20.88$
Answer: -5.53

1164. $37.5 + 12.23$
Answer: 49.73

1165. $-4.2+(-9.3)$

Answer: −13.5

1166. $-8.6+(-8.6)$

Answer: −17.2

1167. $100-64.2$

Answer: 35.8

1168. $100-65.83$

Answer: 34.17

1169. $2.51+40$

Answer: 42.51

1170. $9.38+60$

Answer: 69.38

Multiply and Divide Decimals In the following exercises, multiply.

1171. $(0.3)(0.4)$

Answer: 0.12

1172. $(0.6)(0.7)$

Answer: 0.42

1173. $(8.52)(3.14)$

Answer: 26.7528

1174. $(5.32)(4.86)$

Answer: 25.8552

1175. $(0.09)(24.78)$

Answer: 2.2302

1176. $(0.04)(36.89)$

Answer: 1.4756

In the following exercises, divide.

1177. $0.15\div 5$

Answer: 0.03

1178. $0.27 \div 3$
Answer: 0.09

1179. $\$8.49 \div 12$
Answer: $0.71

1180. $\$16.99 \div 9$
Answer: $1.89

1181. $12 \div 0.08$
Answer: 150

1182. $5 \div 0.04$
Answer: 125

Convert Decimals, Fractions and Percents In the following exercises, write each decimal as a fraction.

1183. 0.08
Answer: $\frac{2}{25}$

1184. 0.17
Answer: $\frac{17}{100}$

1185. 0.425
Answer: $\frac{17}{40}$

1186. 0.184
Answer: $\frac{23}{125}$

1187. 1.75
Answer: $\frac{7}{4}$

1188. 0.035
Answer: $\frac{7}{200}$

In the following exercises, convert each fraction to a decimal.

1189. $\frac{2}{5}$

Answer: 0.4

1190. $\frac{4}{5}$

Answer: 0.8

1191. $-\frac{3}{8}$

Answer: -0.375

1192. $-\frac{5}{8}$

Answer: -0.625

1193. $\frac{5}{9}$

Answer: $0.\overline{5}$

1194. $\frac{2}{9}$

Answer: $0.\overline{2}$

1195. $\frac{1}{2}+6.5$

Answer: 7

1196. $\frac{1}{4}+10.75$

Answer: 11

In the following exercises, convert each percent to a decimal.

1197. 5%

Answer: 0.05

1198. 9%

Answer: 0.09

1199. 40%

Answer: 0.4

1200. 50%

Answer: 0.5

1201. 115%
Answer: 1.15

1202. 125%
Answer: 1.25

In the following exercises, convert each decimal to a percent.

1203. 0.18
Answer: 18%

1204. 0.15
Answer: 15%

1205. 0.009
Answer: 0.9%

1206. 0.008
Answer: 0.8%

1207. 1.5
Answer: 150%

1208. 2.2
Answer: 220%

1.8 The Real Numbers

Simplify Expressions with Square Roots In the following exercises, simplify.

1209. $\sqrt{64}$
Answer: 8

1210. $\sqrt{144}$
Answer: 12

1211. $-\sqrt{25}$
Answer: −5

1212. $-\sqrt{81}$
Answer: −9

Identify Integers, Rational Numbers, Irrational Numbers, and Real Numbers In the following exercises, write as the ratio of two integers.

1213. (a) 9 (b) 8.47

Answer: (a) $\frac{9}{1}$ (b) $\frac{847}{100}$

1214. (a) -15 (b) 3.591

Answer: (a) $-\frac{15}{1}$ (b) $\frac{3591}{1000}$

In the following exercises, list the (a) rational numbers, (b) irrational numbers.

1215. $0.84, 0.79132..., 1.\overline{3}$

Answer: (a) $0.84, 1.\overline{3}$ (b) $0.79132...,$

1216. $2.3\overline{8}, 0.572, 4.93814...$

Answer: (a) $2.3\overline{8}, 0.572$ (b) $4.93814...$

In the following exercises, identify whether each number is rational or irrational.

1217. (a) $\sqrt{121}$ (b) $\sqrt{48}$

Answer: (a) rational (b) irrational

1218. (a) $\sqrt{56}$ (b) $\sqrt{16}$

Answer: (a) irrational (b) rational

In the following exercises, identify whether each number is a real number or not a real number.

1219. (a) $\sqrt{-9}$ (b) $-\sqrt{169}$

Answer: (a) not a real number;(b) real number

1220. (a) $\sqrt{-64}$ (b) $-\sqrt{81}$

Answer: (a) not a real number;(b) real number

In the following exercises, list the (a) whole numbers, (b) integers, (c) rational numbers, (d) irrational numbers, (e) real numbers for each set of numbers.

1221. $-4, 0, \frac{5}{6}, \sqrt{16}, \sqrt{18}, 5.2537...$

Answer: (a) $0, \sqrt{16}$ (b) $-4, 0, \sqrt{16}$ (c) $-4, 0, \frac{5}{6}, \sqrt{16}$ (d) $\sqrt{18}, 5.2537...$ (e) $-4, 0, \frac{5}{6}, \sqrt{16}, \sqrt{18}, 5.2537...$

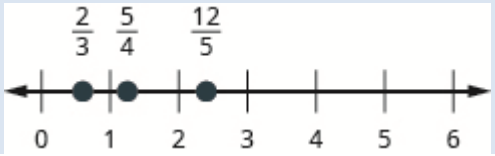
1222. $-\sqrt{4}, 0.\overline{36}, \frac{13}{3}, 6.9152..., \sqrt{48}, 10\frac{1}{2}$

Answer: (a) none (b) $-\sqrt{4}$ (c) $-\sqrt{4},\ 0.\overline{36},\ \frac{13}{3}, 10\frac{1}{2}$ (d) $6.9152\ldots,\ \sqrt{48}$ (e) $-\sqrt{4},\ 0.\overline{36},\ \frac{13}{3},\ 6.9152\ldots,\ \sqrt{48}, 10\frac{1}{2}$

Locate Fractions on the Number Line In the following exercises, locate the numbers on a number line.

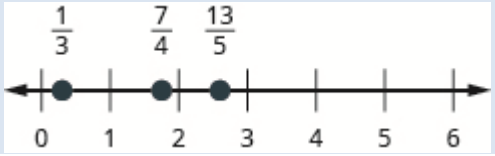
1223. $\frac{2}{3}, \frac{5}{4}, \frac{12}{5}$

Answer:



1224. $\frac{1}{3}, \frac{7}{4}, \frac{13}{5}$

Answer:

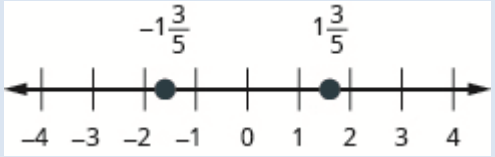


1225. $2\frac{1}{3}, -2\frac{1}{3}$

Answer:

1226. $1\frac{3}{5}, -1\frac{3}{5}$

Answer:



In the following exercises, order each of the following pairs of numbers, using < or >.

1227. $-1 \_\_\_ -\frac{1}{8}$

Answer: <

1228. $-3\frac{1}{4} \_\_\_ -4$

Answer: >

1229. $-\frac{7}{9} \_\_\_ -\frac{4}{9}$

Answer: <

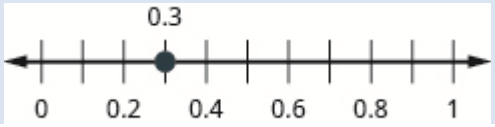
1230. $-2 \_\_\_ -\frac{19}{8}$

Answer: >

Locate Decimals on the Number Line In the following exercises, locate on the number line.

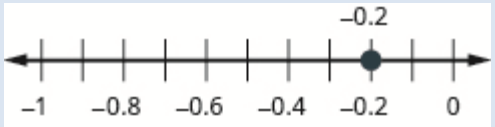
1231. 0.3

Answer:



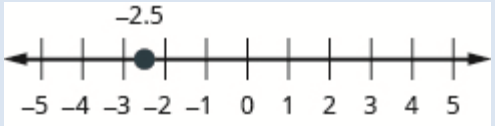
1232. −0.2

Answer:



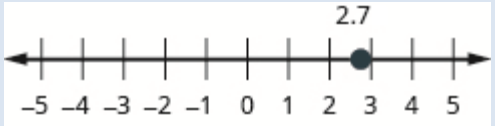
1233. −2.5

Answer:



1234. 2.7

Answer:



In the following exercises, order each of the following pairs of numbers, using < or >.

1235. 0 .9__ 0.6

Answer: >

1236. 0 .7__0 .8

Answer: <

1237. $-0.6\_\_\_-0.59$

Answer: <

1238. $-0.27\_\_\_-0.3$

Answer: >

1.9 Properties of Real Numbers

Use the Commutative and Associative Properties In the following exercises, use the Associative Property to simplify.

1239. $-12(4m)$

Answer: $-48m$

1240. $30\left(\frac{5}{6}q\right)$

Answer: $25q$

1241. $(a+16)+31$

Answer: $a+47$

1242. $(c+0.2)+0.7$

Answer: $c+0.9$

In the following exercises, simplify.

1243. $6y+37+(-6y)$

Answer: 37

1244. $\frac{1}{4}+\frac{11}{15}+\left(-\frac{1}{4}\right)$

Answer: $\frac{11}{15}$

1245. $\frac{14}{11}\cdot\frac{35}{9}\cdot\frac{14}{11}$

Answer: $\frac{35}{9}$

1246. $-18 \cdot 15 \cdot \frac{2}{9}$

Answer: -60

1247. $\left(\frac{7}{12}+\frac{4}{5}\right)+\frac{1}{5}$

Answer: $1\frac{7}{12}$

1248. $(3.98d+0.75d)+1.25d$

Answer: $5.98d$

1249. $11x+8y+16x+15y$

Answer: $27x+23y$

1250. $52m+(-20n)+(-18m)+(-5n)$

Answer: $34m+(-25n)$

Use the Identity and Inverse Properties of Addition and Multiplication In the following exercises, find the additive inverse of each number.

1251. (a) $\frac{1}{3}$ (b) 5.1 (c) -14 (d) $-\frac{8}{5}$

Answer: (a) $-\frac{1}{3}$ (b) -5.1 (c) 14 (d) $\frac{8}{5}$

1252. (a) $-\frac{7}{8}$ (b) -0.03 (c) 17 (d) $\frac{12}{5}$

Answer: (a) $\frac{7}{8}$ (b) 0.03 (c) -17 (d) $-\frac{12}{5}$

In the following exercises, find the multiplicative inverse of each number.

1253. (a) 10 (b) $-\frac{4}{9}$ (c) 0.6

Answer: (a) $\frac{1}{10}$; (b) $-\frac{9}{4}$; (c) $\frac{5}{3}$

1254. (a) $-\frac{9}{2}$ (b) -7 (c) 2.1

Answer: (a) $-\frac{2}{9}$ (b) $-\frac{1}{7}$ (c) $\frac{10}{21}$

Use the Properties of Zero In the following exercises, simplify.

1255. $83 \cdot 0$

Answer: 0

1256. $\frac{0}{9}$

Answer: 0

1257. $\frac{5}{0}$

Answer: undefined

1258. $0 \div \frac{2}{3}$

Answer: 0

In the following exercises, simplify.

1259. $43 + 39 + (-43)$

Answer: 39

1260. $(n + 6.75) + 0.25$

Answer: $n + 7$

1261. $\frac{5}{13} \cdot 57 \cdot \frac{13}{5}$

Answer: 57

1262. $\frac{1}{6} \cdot 17 \cdot 12$

Answer: 34

1263. $\frac{2}{3} \cdot 28 \cdot \frac{3}{7}$

Answer: 8

1264. $9(6x - 11) + 15$

Answer: $54x - 84$

Simplify Expressions Using the Distributive Property In the following exercises, simplify using the Distributive Property.

1265. $7(x+9)$

Answer: $7x+63$

1266. $9(u-4)$

Answer: $9y-36$

1267. $-3(6m-1)$

Answer: $-18m+3$

1268. $-8(-7a-12)$

Answer: $56a+96$

1269. $\frac{1}{3}(15n-6)$

Answer: $5n-2$

1270. $(y+10)\cdot p$

Answer: $yp+10p$

1271. $(a-4)-(6a+9)$

Answer: $-5a-13$

1272. $4(x+3)-8(x-7)$

Answer: $-4x+68$

1.10 Systems of Measurement

Define U.S. Units of Measurement and Convert from One Unit to Another In the following exercises, convert the units. Round to the nearest tenth.

1273. A floral arbor is 7 feet tall. Convert the height to inches.

Answer: 84 inches

1274. A picture frame is 42 inches wide. Convert the width to feet.

Answer: 3.5 feet

1275. Kelly is 5 feet 4 inches tall. Convert her height to inches.

Answer: 64 inches

1276. A playground is 45 feet wide. Convert the width to yards.

Answer: 15 yards

1277. The height of Mount Shasta is 14,179 feet. Convert the height to miles.
Answer: 2.7 miles

1278. Shamu weights 4.5 tons. Convert the weight to pounds.
Answer: 9,000 pounds

1279. The play lasted $1\frac{3}{4}$ hours. Convert the time to minutes.
Answer: 105 minutes

1280. How many tablespoons are in a quart?
Answer: 64 tablespoons

1281. Naomi's baby weighed 5 pounds 14 ounces at birth. Convert the weight to ounces.
Answer: 94 ounces

1282. Trinh needs 30 cups of paint for her class art project. Convert the volume to gallons.
Answer: 1.9 gallons

Use Mixed Units of Measurement in the U.S. System. In the following exercises, solve.

1283. John caught 4 lobsters. The weights of the lobsters were 1 pound 9 ounces, 1 pound 12 ounces, 4 pounds 2 ounces, and 2 pounds 15 ounces. What was the total weight of the lobsters?
Answer: 10 lbs. 6 oz.

1284. Every day last week Pedro recorded the number of minutes he spent reading. The number of minutes were 50, 25, 83, 45, 32, 60, 135. How many hours did Pedro spend reading?
Answer: 7.2 hours

1285. Fouad is 6 feet 2 inches tall. If he stands on a rung of a ladder 8 feet 10 inches high, how high off the ground is the top of Fouad's head?
Answer: 15 feet

1286. Dalila wants to make throw pillow covers. Each cover takes 30 inches of fabric. How many yards of fabric does she need for 4 covers?
Answer: 3.3 yards

Make Unit Conversions in the Metric System In the following exercises, convert the units.
1287. Donna is 1.7 meters tall. Convert her height to centimeters.
Answer: 170 centimeters
1288. Mount Everest is 8,850 meters tall. Convert the height to kilometers.
Answer: 8.85 kilometers

1289. One cup of yogurt contains 488 milligrams of calcium. Convert this to grams.
Answer: 0.488 grams

1290. One cup of yogurt contains 13 grams of protein. Convert this to milligrams.
Answer: 13,000 milligrams

1291. Sergio weighed 2.9 kilograms at birth. Convert this to grams.
Answer: 2,900 grams

1292. A bottle of water contained 650 milliliters. Convert this to liters.
Answer: 0.65 liters

Use Mixed Units of Measurement in the Metric System In the following exerices, solve.

1293. Minh is 2 meters tall. His daughter is 88 centimeters tall. How much taller is Minh than his daughter?
Answer: 1.12 meter

1294. Selma had a 1 liter bottle of water. If she drank 145 milliliters, how much water was left in the bottle?
Answer: 855 milliliters

1295. One serving of cranberry juice contains 30 grams of sugar. How many kilograms of sugar are in 30 servings of cranberry juice?
Answer: 0.9 kilograms

1296. One ounce of tofu provided 2 grams of protein. How many milligrams of protein are provided by 5 ounces of tofu?
Answer: 10,000 milligrams

Convert between the U.S. and the Metric Systems of Measurement In the following exercises, make the unit conversions. Round to the nearest tenth.

1297. Majid is 69 inches tall. Convert his height to centimeters.
Answer: 175.3 centimeters

1298. A college basketball court is 84 feet long. Convert this length to meters.
Answer: 25.6 meters

1299. Caroline walked 2.5 kilometers. Convert this length to miles.
Answer: 1.6 miles
1300. Lucas weighs 78 kilograms. Convert his weight to pounds.
Answer: 171.6 pounds

1301. Steve's car holds 55 liters of gas. Convert this to gallons.
Answer: 14.6 gallons

1302. A box of books weighs 25 pounds. Convert the weight to kilograms.
Answer: 11.4 kilograms

Convert between Fahrenheit and Celsius Temperatures In the following exercises, convert the Fahrenheit temperatures to degrees Celsius. Round to the nearest tenth.

1303. 95^{o} Fahrenheit
Answer: 35^{o} C

1304. 23^{o} Fahrenheit
Answer: -5^{o} C

1305. 20^{o} Fahrenheit
Answer: -6.7^{o} C

1306. 64^{o} Fahrenheit
Answer: 17.8^{o} C

In the following exercises, convert the Celsius temperatures to degrees Fahrenheit. Round to the nearest tenth.

1307. 30^{o} Celsius
Answer: 86^{o} F

1308. -5^{o} Celsius
Answer: 23^{o} F

1309. -12^{o} Celsius
Answer: 10.4^{o} F

1310. 24^{o} Celsius
Answer: 75.2^{o} F

Chapter Practice Test

1311. Write as a whole number using digits: two hundred five thousand, six hundred seventeen.
Answer: 205,617
1312. Find the prime factorization of 504.
Answer: $2 \cdot 2 \cdot 2 \cdot 7 \cdot 9$

1313. Find the Least Common Multiple of 18 and 24.

Answer: 72

1314. Combine like terms: $5n+8+2n-1$

Answer: $7n+7$

In the following exercises, evaluate.

1315. $-|x|$ when $x=-2$

Answer: -2

1316. $11-a$ when $a=-3$

Answer: 14

1317. Translate to an algebraic expression and simplify: twenty less than negative 7

Answer: $-7-20;-27$

1318. Monique has a balance of $-\$18$ in her checking account. She deposits $152 to the account. What is the new balance?

Answer: $134

1319. Round 677.1348 to the nearest hundredth.

Answer: 677.13

1320. Convert $\frac{4}{5}$ to a decimal.

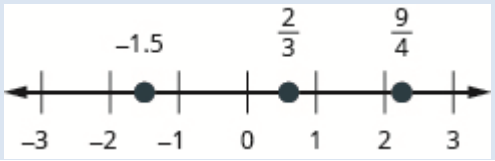
Answer: 0.8

1321. Convert 1.85 to a percent.

Answer: 185%

1322. Locate $\frac{2}{3}, -1.5,$ and $\frac{9}{4}$ on a number line.

Answer:



In the following exercises, simplify each expression.

1323. $4+10(3+9)-5^2$

Answer: 99

1324. $-85+42$

Answer: -43

1325. $-19-25$

Answer: -44

1326. $(-2)^4$

Answer: 16

1327. $-5(-9)\div 15$

Answer: 3

1328. $\frac{3}{8}\cdot\frac{11}{12}$

Answer: $\frac{11}{32}$

1329. $\frac{4}{5}\div\frac{9}{20}$

Answer: $\frac{16}{9}$

1330. $\frac{12+3\cdot 5}{15-6}$

Answer: 3

1331. $\frac{m}{7}+\frac{10}{7}$

Answer: $\frac{m+10}{7}$

1332. $\frac{7}{12}-\frac{3}{8}$

Answer: $\frac{5}{24}$

1333. $-5.8+(-4.7)$

Answer: -10.5

1334. $100-64.25$

Answer: 35.75

1335. $(0.07)(31.95)$

Answer: 2.2365

1336. $9 \div 0.05$

Answer: 180

1337. $-14\left(\frac{5}{7}p\right)$

Answer: $-10p$

1338. $(u+8)-9$

Answer: $u-1$

1339. $6x+(-4y)+9x+8y$

Answer: $15x+4y$

1340. $\frac{0}{23}$

Answer: 0

1341. $\frac{75}{0}$

Answer: undefined

1342. $-2(13q-5)$

Answer: $-26q+10$

1343. A movie lasted $1\frac{2}{3}$ hours. How many minutes did it last? (*1 hour = 60 minutes)*

Answer: 100 minutes

1344. Mike's SUV is 5 feet 11 inches tall. He wants to put a rooftop cargo bag on the the SUV. The cargo bag is 1 foot 6 inches tall. What will the total height be of the SUV with the cargo bag on the roof? *(1 foot = 12 inches)*

Answer: 7 feet 5 inches

1345. Jennifer ran 2.8 miles. Convert this length to kilometers. (*1 mile = 1.61 kilometers)*

Answer: 4.508 km

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.1 Solve Equations using the Subtraction and Addition Properties of Equality

Verify a Solution of an Equation In the following exercises, determine whether the given value is a solution to the equation.

1. Is $y=\frac{5}{3}$ a solution of $6y+10=12y$?

Answer: yes

2. Is $x=\frac{9}{4}$ a solution of $4x+9=8x$?

Answer: yes

3. Is $u=-\frac{1}{2}$ a solution of $8u-1=6u$?

Answer: no

4. Is $v=-\frac{1}{3}$ a solution of $9v-2=3v$?

Answer: no

Solve Equations using the Subtraction and Addition Properties of Equality In the following exercises, solve each equation using the Subtraction and Addition Properties of Equality.

5. $x+24=35$

Answer: $x=11$

6. $x+17=22$

Answer: $x=5$

7. $y+45=-66$

Answer: $y=-111$

8. $y+39=-83$

Answer: $y=-122$

9. $b+\frac{1}{4}=\frac{3}{4}$

Answer: $b=\frac{1}{2}$

10. $a+\frac{2}{5}=\frac{4}{5}$

Answer: $a=\frac{2}{5}$

11. $p+2.4=-9.3$

Answer: $p=-11.7$

12. $m+7.9=11.6$

Answer: $m=3.7$

13. $a-45=76$

Answer: $a=121$

14. $a-30=57$

Answer: $a=87$

15. $m-18=-200$

Answer: $m=-182$

16. $m-12=-12$

Answer: $m=0$

17. $x-\frac{1}{3}=2$

Answer: $x=\frac{7}{3}$

18. $x-\frac{1}{5}=4$

Answer: $x=\frac{21}{5}$

19. $y-3.8=10$

Answer: $y=13.8$

20. $y-7.2=5$

Answer: $y=12.2$

21. $x-165=-420$

Answer: $x=-255$

22. $z-101=-314$

Answer: $z=-213$

23. $z+0.52=-8.5$

Answer: $z=-9.02$

24. $x+0.93=-4.1$

Answer: $x=-5.03$

25. $q+\frac{3}{4}=\frac{1}{2}$

Answer: $q=-\frac{1}{4}$

26. $p+\frac{1}{3}=\frac{5}{6}$

Answer: $p=\frac{1}{2}$

27. $p-\frac{2}{5}=\frac{2}{3}$

Answer: $p=\frac{16}{15}$

28. $y-\frac{3}{4}=\frac{3}{5}$

Answer: $y=\frac{27}{20}$

Solve Equations that Require Simplification In the following exercises, solve each equation.

29. $c+31-10=46$

Answer: $c=25$

30. $m+16-28=5$

Answer: $m=17$

31. $9x+5-8x+14=20$

Answer: $x=1$

32. $6x+8-5x+16=32$

Answer: $x=8$

33. $-6x-11+7x-5=-16$

Answer: $x=0$

34. $-8n-17+9n-4=-41$

Answer: $n=-20$

35. $5(y-6)-4y=-6$

Answer: $y=8$ $y=24$

36. $9(y-2)-8y=-16$

Answer: $y=2$

37. $8(u+1.5)-7u=4.9$

Answer: $u=-7.1$

38. $5(w+2.2)-4w=9.3$

Answer: $w=-1.7$

39. $6a-5(a-2)+9=-11$

Answer: $a=-30$

40. $8c-7(c-3)+4=-16$

Answer: $c=-41$

41. $6(y-2)-5y=4(y+3)-4(y-1)$

Answer: $y=28$

42. $9(x-1)-8x=-3(x+5)+3(x-5)$

Answer: $x=-21$

43. $3(5n-1)-14n+9=10(n-4)-6n-4(n+1)$

Answer: $n=-50$

44. $2(8m+3)-15m-4=9(m+6)-2(m-1)-7m$

Answer: $m=54$

45. $-(j+2)+2j-1=5$

Answer: $j=8$

46. $-(k+7)+2k+8=7$

Answer: $k=6$

47. $-\left(\frac{1}{4}a-\frac{3}{4}\right)+\frac{5}{4}a=-2$

Answer: $a=-\frac{11}{4}$

48. $-\left(\frac{2}{3}d-\frac{1}{3}\right)+\frac{5}{3}d=-4$

Answer: $d=-\frac{13}{3}$

49. $8(4x+5)-5(6x)-x=53-6(x+1)+3(2x+2)$

Answer: $x=13$

50. $6(9y-1)-10(5y)-3y=22-4(2y-12)+8(y-6)$

Answer: $y=28$

Translate to an Equation and Solve In the following exercises, translate to an equation and then solve it.

51. Nine more than x is equal to 52.

Answer: $x+9=52$; $x=43$

52. The sum of x and -15 is 23.

Answer: $x+(-15)=23$; $x=38$

53. Ten less than m is -14.

Answer: $m-10=-14$; $m=-4$

54. Three less than y is -19.

Answer: $y-3=-19$; $y=-16$

55. The sum of y and -30 is 40.

Answer: $y+(-30)=40$; $y=70$

56. Twelve more than p is equal to 67.

Answer: $p+12=67$; $p=55$

57. The difference of $9x$ and $8x$ is 107.

Answer: $9x-8x=107$;107

58. The difference of $5c$ and $4c$ is 602.

Answer: $5c-4c=602$;602

59. The difference of n and $\frac{1}{6}$ is $\frac{1}{2}$.

Answer: $n-\frac{1}{6}=\frac{1}{2}$; $\frac{2}{3}$

60. The difference of f and $\frac{1}{3}$ is $\frac{1}{12}$.

Answer: $f-\frac{1}{3}=\frac{1}{12};\frac{5}{12}$

61. The sum of $-4n$ and $5n$ is -82.

Answer: $-4n+5n=-82;-82$

62. The sum of $-9m$ and $10m$ is -95.

Answer: $-9m+10m=-95;-95$

Translate and Solve Applications In the following exercises, translate into an equation and solve.

63. **Distance** Avril rode her bike a total of 18 miles, from home to the library and then to the beach. The distance from Avril's house to the library is 7 miles. What is the distance from the library to the beach?

Answer: 11 miles

64. **Reading** Jeff read a total of 54 pages in his History and Sociology textbooks. He read 41 pages in his History textbook. How many pages did he read in his Sociology textbook?

Answer: 13 pages

65. **Age** Eva's daughter is 15 years younger than her son. Eva's son is 22 years old. How old is her daughter?

Answer: 7 years old

66. **Age** Pablo's father is 3 years older than his mother. Pablo's mother is 42 years old. How old is his father?

Answer: 45 years old

67. **Groceries** For a family birthday dinner, Celeste bought a turkey that weighed 5 pounds less than the one she bought for Thanksgiving. The birthday turkey weighed 16 pounds. How much did the Thanksgiving turkey weigh?

Answer: 21 pounds

68. **Weight** Allie weighs 8 pounds less than her twin sister Lorrie. Allie weighs 124 pounds. How much does Lorrie weigh?

Answer: 132 pounds

69. **Health** Connor's temperature was 0.7 degrees higher this morning than it had been last night. His temperature this morning was 101.2 degrees. What was his temperature last night?

Answer: 100.5 degrees

70. **Health** The nurse reported that Tricia's daughter had gained 4.2 pounds since her last checkup and now weighs 31.6 pounds. How much did Tricia's daughter weigh at her last checkup?

Answer: 27.4 pounds

71. **Salary** Ron's paycheck this week was $17.43 less than his paycheck last week. His paycheck this week was $103.76. How much was Ron's paycheck last week?

Answer: $121.19

72. **Textbooks** Melissa's math book cost $22.85 less than her art book cost. Her math book cost $93.75. How much did her art book cost?

Answer: $116.60

Everyday Math

73. **Construction** Miguel wants to drill a hole for a $\frac{5}{8}$ inch screw. The hole should be $\frac{1}{12}$ inch smaller than the screw. Let d equal the size of the hole he should drill. Solve the equation $d+\frac{1}{12}=\frac{5}{8}$ to see what size the hole should be.

Answer: $d=\frac{13}{24}$ inch

74. **Baking** Kelsey needs $\frac{2}{3}$ cup of sugar for the cookie recipe she wants to make. She only has $\frac{3}{8}$ cup of sugar and will borrow the rest from her neighbor. Let s equal the amount of sugar she will borrow. Solve the equation $\frac{3}{8}+s=\frac{2}{3}$ to find the amount of sugar she should ask to borrow.

Answer: $s=\frac{7}{24}$ cup

Writing Exercises

75. Is -8 a solution to the equation $3x=16-5x$? How do you know?

Answer: No. Justifications will vary.

76. What is the first step in your solution to the equation $10x+2=4x+26$?

Answer: Answers may vary

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.2 Solve Equations using the Division and Multiplication Properties of Equality

Solve Equations Using the Division and Multiplication Properties of Equality In the following exercises, solve each equation using the Division and Multiplication Properties of Equality and check the solution.

77. $8x = 56$

Answer: $x = 7$

78. $7p = 63$

Answer: $p = 9$

79. $-5c = 55$

Answer: $c = -11$

80. $-9x = -27$

Answer: $x = 3$

81. $-809 = 15y$

Answer: $y = -\frac{809}{15}$

82. $-731 = 19y$

Answer: $y = -\frac{731}{19}$

83. $-37p = -541$

Answer: $p = -\frac{541}{37}$

84. $-19m = -586$

Answer: $m = -\frac{586}{29}$

85. $0.25z = 3.25$

Answer: $z = 13$

86. $0.75a = 11.25$

Answer: $a = 15$

87. $-13x = 0$

Answer: $x = 0$

88. $24x = 0$

Answer: $x = 0$

89. $\frac{x}{4} = 35$

Answer: $x = 140$

90. $\frac{z}{2} = 54$

Answer: $z = 108$

91. $-20 = \frac{q}{-5}$

Answer: $q = 100$

92. $\frac{c}{-3} = -12$

Answer: $c = 36$

93. $\frac{y}{9} = -16$

Answer: $y = -144$

94. $\frac{q}{6} = -38$

Answer: $q = -228$

95. $\frac{m}{-12} = 45$

Answer: $m = -540$

96. $-24 = \frac{p}{-20}$

Answer: $p = 480$

97. $-y = 6$

Answer: $y = -6$

98. $-u = 15$

Answer: $u = -15$

99. $-v = -72$

Answer: $v = 72$

100. $-x = -39$

Answer: $x = 39$

101. $\frac{2}{3}y = 48$

Answer: $y = 72$

102. $\frac{3}{5}r = 75$

Answer: $r = 125$

103. $-\frac{5}{8}w = 40$

Answer: $w = -64$

104. $24 = -\frac{3}{4}x$

Answer: $x = -32$

105. $-\frac{2}{5} = \frac{1}{10}a$

Answer: $a = -4$

106. $-\frac{1}{3}q = -\frac{5}{6}$

Answer: $q = \frac{5}{2}$

107. $-\frac{7}{10}x = -\frac{14}{3}$

Answer: $x = \frac{20}{3}$

108. $\frac{3}{8}y = -\frac{1}{4}$

Answer: $y = -\frac{2}{3}$

109. $\frac{7}{12} = -\frac{3}{4}p$

Answer: $p = -\frac{7}{9}$

110. $\frac{11}{18}=-\frac{5}{6}q$

Answer: $q=-\frac{11}{15}$

111. $-\frac{5}{18}=-\frac{10}{9}u$

Answer: $u=\frac{1}{4}$

112. $-\frac{7}{20}=-\frac{7}{4}v$

Answer: $v=\frac{1}{5}$

Solve Equations That Require Simplification In the following exercises, solve each equation requiring simplification.

113. $100-16=4p-10p-p$

Answer: $p=-12$

114. $-18-7=5t-9t-6t$

Answer: $t=\frac{5}{2}$

115. $\frac{7}{8}n-\frac{3}{4}n=9+2$

Answer: $n=88$

116. $\frac{5}{12}q+\frac{1}{2}q=25-3$

Answer: $q=24$

117. $0.25d+0.10d=6-0.75$

Answer: $d=15$

118. $0.05p-0.01p=2+0.24$

Answer: $p=56$

119. $-10(q-4)-57=93$

Answer: $q=-11$

120. $-12(d-5)-29=43$

Answer: $d=-1$

121. $-10(x+4)-19=85$

Answer: $x=-\frac{72}{5}$

122. $-15(z+9)-11=75$

Answer: $z=-\frac{221}{15}$

Mixed Practice In the following exercises, solve each equation.

123. $\frac{9}{10}x=90$

Answer: $x=100$

124. $\frac{5}{12}y=60$

Answer: $y=144$

125. $y+46=55$

Answer: $y=9$

126. $x+33=41$

Answer: $x=8$

127. $\frac{w}{-2}=99$

Answer: $w=-198$

128. $\frac{s}{-3}=-60$

Answer: $s=180$

129. $27=6a$

Answer: $a=\frac{9}{2}$

130. $-a=7$

Answer: $a=-7$

131. $-x = 2$
Answer: $x = -2$

132. $z - 16 = -59$
Answer: $z = -43$

133. $m - 41 = -14$
Answer: $m = 27$

134. $0.04r = 52.60$
Answer: $r = 1315$

135. $63.90 = 0.03p$
Answer: $p = 2130$

136. $-15x = -120$
Answer: $x = 8$

137. $84 = -12z$
Answer: $y = -7$

138. $19.36 = x - 0.2x$
Answer: $x = 24.2$

139. $c - 0.3c = 35.70$
Answer: $c = 51$

140. $-y = -9$
Answer: $y = 9$

141. $-x = -8$
Answer: $x = 8$

Translate to an Equation and Solve In the following exercises, translate to an equation and then solve.

142. 187 is the product of -17 and m.
Answer: $187 = -17m; m = -11$

143. 133 is the product of -19 and n.
Answer: $133 = -19n; n = -7$

144. -184 is the product of 23 and p.

Answer: $-184 = 23p;\ p = -8$

145. -152 is the product of 8 and q.

Answer: $-152 = 8q; q = -19$

146. u divided by 7 is equal to -49.

Answer: $\frac{u}{7} = -49; u = -343$

147. r divided by 12 is equal to -48.

Answer: $\frac{r}{12} = -48; r = -576$

148. h divided by -13 is equal to -65.

Answer: $\frac{h}{-13} = -65; h = 845$

149. j divided by -20 is equal to -80.

Answer: $\frac{j}{-20} = -80;\ j = 1,600$

150. The quotient c and -19 is 38.

Answer: $\frac{c}{-19} = 38; c = -722$

151. The quotient of b and -6 is 18.

Answer: $\frac{b}{-6} = 18; b = -108$

152. The quotient of h and 26 is -52.

Answer: $\frac{h}{26} = -52; h = -1,352$

153. The quotient k and 22 is -66.

Answer: $\frac{k}{22} = -66; k = -1,452$

154. Five-sixths of y is 15.

Answer: $\frac{5}{6}y = 15; y = 18$

155. Three-tenths of *x* is 15.

Answer: $\frac{3}{10}x = 15; x = 50$

156. Four-thirds of *w* is 36.

Answer: $\frac{4}{3}w = 36; w = 27$

157. Five-halves of *v* is 50.

Answer: $\frac{5}{2}v = 50; v = 20$

158. The sum of nine-tenths and *g* is two-thirds.

Answer: $\frac{9}{10} + g = \frac{2}{3}; g = -\frac{7}{30}$

159. The sum of two-fifths and *f* is one-half.

Answer: $\frac{2}{5} + f = \frac{1}{2}; f = \frac{1}{10}$

160. The difference of *p* and one-sixth is two-thirds.

Answer: $p - \frac{1}{6} = \frac{2}{3}; p = \frac{5}{6}$

161. The difference of *q* and one-eighth is three-fourths.

Answer: $q - \frac{1}{8} = \frac{3}{4}; q = \frac{7}{8}$

Translate and Solve Applications In the following exercises, translate into an equation and solve.

162. **Kindergarten** Connie's kindergarten class has 24 children. She wants them to get into 4 equal groups. How many children will she put in each group?

Answer: 6 children

163. **Balloons** Ramona bought 18 balloons for a party. She wants to make 3 equal bunches. How many balloons did she use in each bunch?

Answer: 6 balloons

164. **Tickets** Mollie paid $36.25 for 5 movie tickets. What was the price of each ticket?

Answer: $7.25

165.**Shopping** Serena paid $12.96 for a pack of 12 pairs of sport socks. What was the price of pair of sport socks?
Answer: $1.08

166. **Sewing** Nancy used 14 yards of fabric to make flags for one-third of the drill team. How much fabric, would Nancy need to make flags for the whole team?
Answer: 42 yards

167. **MPG** John's SUV gets 18 miles per gallon (mpg). This is half as many mpg as his wife's hybrid car. How many miles per gallon does the hybrid car get?
Answer: 36 mpg

168. **Height** Aiden is 27 inches tall. He is $\frac{3}{8}$ as tall as his father. How tall is his father?
Answer: 72 inches

169. **Real estate** Bea earned $11,700 commission for selling a house, calculated as $\frac{6}{100}$ of the selling price. What was the selling price of the house?
Answer: $195,000

Everyday Math

170. **Commission** Every week Perry gets paid $150 plus 12% of his total sales amount. Solve the equation $840 = 150 + 0.12(a - 1250)$ for *a*, to find the total amount Perry must sell in order to be paid $840 one week.
Answer: $7,000

171. **Stamps** Travis bought $9.45 worth of 49-cent stamps and 21-cent stamps. The number of 21-cent stamps was 5 less than the number of 49-cent stamps. Solve the equation $0.49s + 0.21(s - 5) = 9.45$ for *s*, to find the number of 49-cent stamps Travis bought.
Answer: 15 49-cent stamps

Writing Exercises

172. Frida started to solve the equation $-3x = 36$ by adding 3 to both sides. Explain why Frida's method will not solve the equation.
Answer: Answers will vary.

173. Emiliano thinks $x = 40$ is the solution to the equation $\frac{1}{2}x = 80$. Explain why he is wrong.
Answer: Answers will vary.

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.3 Solve Equations with Variables and Constants on Both Sides

Solve Equations with Constants on Both Sides In the following exercises, solve the following equations with constants on both sides.

174. $9x-3=60$
Answer: $x=7$

175. $12x-8=64$
Answer: $x=6$

176. $14w+5=117$
Answer: $w=8$

177. $15y+7=97$
Answer: $y=6$

178. $2a+8=-28$
Answer: $a=-18$

179. $3m+9=-15$
Answer: $m=-8$

180. $-62=8n-6$
Answer: $n=-7$

181. $-77=9b-5$
Answer: $b=-8$

182. $35=-13y+9$
Answer: $y=-2$

183. $60=-21x-24$
Answer: $x=-4$

184. $-12p-9=9$
Answer: $p=-\frac{3}{2}$

185. $-14q-2=16$
Answer: $q=-\frac{9}{7}$

Solve Equations with Variables on Both Sides In the following exercises, solve the following equations with variables on both sides.

186. $19z = 18z - 7$

Answer: $z = -7$

187. $21k = 20k - 11$

Answer: $k = -11$

188. $9x + 36 = 15x$

Answer: $x = 6$

189. $8x + 27 = 11x$

Answer: $x = 9$

190. $c = -3c - 20$

Answer: $c = -5$

191. $b = -4b - 15$

Answer: $b = -3$

192. $9q = 44 - 2q$

Answer: $q = 4$

193. $5z = 39 - 8z$

Answer: $z = 3$

194. $6y + \frac{1}{2} = 5y$

Answer: $y = -\frac{1}{2}$

195. $4x + \frac{3}{4} = 3x$

Answer: $x = -\frac{3}{4}$

196. $-18a - 8 = -22a$

Answer: $a = 2$

197. $-11r - 8 = -7r$

Answer: $r = -2$

Solve Equations with Variables and Constants on Both Sides In the following exercises, solve the following equations with variables and constants on both sides.

198. $8x-15=7x+3$

Answer: $x=18$

199. $6x-17=5x+2$

Answer: $x=19$

200. $26+13d=14d+11$

Answer: $d=15$

201. $21+18f=19f+14$

Answer: $f=7$

202. $2p-1=4p-33$

Answer: $p=16$

203. $12q-5=9q-20$

Answer: $q=-5$

204. $4a+5=-a-40$

Answer: $a=-9$

205. $8c+7=-3c-37$

Answer: $c=-4$

206. $5y-30=-5y+30$

Answer: $y=6$

207. $7x-17=-8x+13$

Answer: $x=2$

208. $7s+12=5+4s$

Answer: $s=-\frac{7}{3}$

209. $9p+14=6+4p$

Answer: $p=-\frac{8}{5}$

210. $2z-6=23-z$

Answer: $z=\frac{29}{3}$

211. $3y-4=12-y$

Answer: $y=4$

212. $\frac{5}{3}c-3=\frac{2}{3}c-16$

Answer: $c=-13$

213. $\frac{7}{4}m-7=\frac{3}{4}m-13$

Answer: $m=-6$

214. $8-\frac{2}{5}q=\frac{3}{5}q+6$

Answer: $q=2$

215. $11-\frac{1}{5}a=\frac{4}{5}a+4$

Answer: $a=7$

216. $\frac{4}{3}n+9=\frac{1}{3}n-9$

Answer: $n=-18$

217. $\frac{5}{4}a+15=\frac{3}{4}a-5$

Answer: $a=-40$

218. $\frac{1}{4}y+7=\frac{3}{4}y-3$

Answer: $y=20$

219. $\frac{3}{5}p+2=\frac{4}{5}p-1$

Answer: $p=15$

220. $14n+8.25=9n+19.60$

Answer: $n=2.27$

221. $13z+6.45=8z+23.75$

Answer: $z=3.46$

222. $2.4w - 100 = 0.8w + 28$
Answer: $w = 80$

223. $2.7w - 80 = 1.2w + 10$
Answer: $w = 60$

224. $5.6r + 13.1 = 3.5r + 57.2$
Answer: $r = 21$

225. $6.6x - 18.9 = 3.4x + 54.7$
Answer: $x = 23$

Everyday Math

226. **Concert tickets** At a school concert the total value of tickets sold was $1504. Student tickets sold for $6 and adult tickets sold for $7. The number of adult tickets sold was 5 less than 3 times the number of student tickets. Find the number of student tickets sold, *s*, by solving the equation $6s + 27s - 45 = 1506$.
Answer: 47 tickets

227. **Making a fence** Jovani has 150 feet of fencing to make a rectangular garden in his backyard. He wants the length to be 15 feet more than the width. Find the width, *w*, by solving the equation $150 = 2w + 30 + 2w$.
Answer: 30 feet

Writing Exercises

228. Solve the equation $\frac{6}{5}y - 8 = \frac{1}{5}y + 7$ explaining all the steps of your solution as in the examples in this section.
Answer: $y = 15$ Justifications will vary.

229. Solve the equation $10x + 14 = -2x + 38$ explaining all the steps of your solution as in the examples in this section.
Answer: $x = 2$ Justifications will vary.

230. When solving an equation with variables on both sides, why is it usually better to choose the side with the larger coefficient of x to be the "variable" side?
Answer: Answers will vary.

231. Is $x = -2$ a solution to the equation $5 - 2x = -4x + 1$? How do you know?
Answer: Yes. Justifications will vary.

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.4 Use a General Strategy to Solve Linear Equations

Solve Equations Using the General Strategy for Solving Linear Equations In the following exercises, solve each linear equation.

232. $15(y-9)=-60$

Answer: $y=5$

233. $21(y-5)=-42$

Answer: $y=3$

234. $-9(2n+1)=36$

Answer: $n=-\frac{5}{2}$

235. $-16(3n+4)=32$

Answer: $n=-2$

236. $8(22+11r)=0$

Answer: $r=-2$

237. $5(8+6p)=0$

Answer: $p=-\frac{4}{3}$

238. $-(w-12)=30$

Answer: $w=-18$

239. $-(t-19)=28$

Answer: $t=-9$

240. $9(6a+8)+9=81$

Answer: $a=0$

241. $8(9b-4)-12=100$

Answer: $b=2$

242. $32+3(z+4)=41$

Answer: $z=-1$

243. $21+2(m-4)=25$

Answer: $m=6$

244. $51+5(4-q)=56$

Answer: $q=3$

245. $-6+6(5-k)=15$

Answer: $k=\frac{3}{2}$

246. $2(9s-6)-62=16$

Answer: $s=5$

247. $8(6t-5)-35=-27$

Answer: $t=1$

248. $3(10-2x)+54=0$

Answer: $x=14$

249. $-2(11-7x)+54=4$

Answer: $x=-2$

250. $\frac{2}{3}(9c-3)=22$

Answer: $c=4$

251. $\frac{3}{5}(10x-5)=27$

Answer: $x=5$

252. $\frac{1}{5}(15c+10)=c+7$

Answer: $c=\frac{5}{2}$

253. $\frac{1}{4}(20d+12)=d+7$

Answer: $d=1$

254. $18-(9r+7)=-16$

Answer: $r=3$

255. $15-(3r+8)=28$

Answer: $r=-7$

256. $5-(n-1)=19$

Answer: $n=-13$

257. $-3-(m-1)=13$

Answer: $m=-15$

258. $11-4(y-8)=43$

Answer: $y=0$

259. $18-2(y-3)=32$

Answer: $y=-4$

260. $24-8(3v+6)=0$

Answer: $v=-1$

261. $35-5(2w+8)=-10$

Answer: $w=\frac{1}{2}$

262. $4(a-12)=3(a+5)$

Answer: $a=63$

263. $-2(a-6)=4(a-3)$

Answer: $a=4$

264. $2(5-u)=-3(2u+6)$

Answer: $u=-7$

265. $5(8-r)=-2(2r-16)$

Answer: $r=8$

266. $3(4n-1)-2=8n+3$

Answer: $n=2$

267. $9(2m-3)-8=4m+7$

Answer: $m=3$

268. $12+2(5-3y)=-9(y-1)-2$

Answer: $y=-5$

269. $-15+4(2-5y)=-7(y-4)+4$

Answer: $y=-3$

270. $8(x-4)-7x=14$

Answer: $x=46$

271. $5(x-4)-4x=14$

Answer: $x=34$

272. $5+6(3s-5)=-3+2(8s-1)$

Answer: $s=10$

273. $-12+8(x-5)=-4+3(5x-2)$

Answer: $x=-6$

274. $4(u-1)-8=6(3u-2)-7$

Answer: $u=\frac{1}{2}$

275. $7(2n-5)=8(4n-1)-9$

Answer: $n=-1$

276. $4(p-4)-(p+7)=5(p-3)$

Answer: $p=-4$

277. $3(a-2)-(a+6)=4(a-1)$

Answer: $a=-4$

278. $-(9y+5)-(3y-7)=16-(4y-2)$

Answer: $y=-2$

279. $-(7m+4)-(2m-5)=14-(5m-3)$

Answer: $m=-4$

280. $4[5-8(4c-3)]=12(1-13c)-8$

Answer: $c=-4$

281. $5\left[9-2\left(6d-1\right)\right]=11\left(4-10d\right)-139$

Answer: $d=-3$

282. $3\left[-9+8\left(4h-3\right)\right]=2\left(5-12h\right)-19$

Answer: $h=\frac{3}{4}$

283. $3\left[-14+2\left(15k-6\right)\right]=8\left(3-5k\right)-24$

Answer: $k=\frac{3}{5}$

284. $5\left[2\left(m+4\right)+8\left(m-7\right)\right]=2\left[3\left(5+m\right)-\left(21-3m\right)\right]$

Answer: $m=6$

285. $10\left[5\left(n+1\right)+4\left(n-1\right)\right]=11\left[7\left(5+n\right)-\left(25-3n\right)\right]$

Answer: $n=-5$

286. $5\left(1.2u-4.8\right)=-12$

Answer: $u=2$

287. $4\left(2.5v-0.6\right)=7.6$

Answer: $v=1$

288. $0.25(q-6)=0.1\left(q+18\right)$

Answer: $q=22$

289. $0.2(p-6)=0.4\left(p+14\right)$

Answer: $p=-34$

290. $0.2\left(30n+50\right)=28$

Answer: $n=3$

291. $0.5\left(16m+34\right)=-15$

Answer: $m=-4$

Classify Equations In the following exercises, classify each equation as a conditional equation, an identity, or a contradiction and then state the solution.

292. $23z+19=3\left(5z-9\right)+8z+46$

Answer: identity; all real numbers

293. $15y+32=2(10y-7)-5y+46$

Answer: identity; all real numbers

294. $5(b-9)+4(3b+9)=6(4b-5)-7b+21$

Answer: identity; all real numbers

295. $9(a-4)+3(2a+5)=7(3a-4)-6a+7$

Answer: identity; all real numbers

296. $18(5j-1)+29=47$

Answer: conditional equation; $j=\frac{2}{5}$

297. $24(3d-4)+100=52$

Answer: conditional equation; $d=\frac{2}{3}$

298. $22(3m-4)=8(2m+9)$

Answer: conditional equation; $m=\frac{16}{5}$

299. $30(2n-1)=5(10n+8)$

Answer: conditional equation; $n=7$

300. $7v+42=11(3v+8)-2(13v-1)$

Answer: contradiction; no solution

301. $18u-51=9(4u+5)-6(3u-10)$

Answer: contradiction; no solution

302. $3(6q-9)+7(q+4)=5(6q+8)-5(q+1)$

Answer: contradiction; no solution

303. $5(p+4)+8(2p-1)=9(3p-5)-6(p-2)$

Answer: contradiction; no solution

304. $12(6h-1)=8(8h+5)-4$

Answer: conditional equation; $h=6$

305. $9(4k-7)=11(3k+1)+4$

Answer: conditional equation; $k=26$

306. $45(3y-2)=9(15y-6)$

Answer: contradiction; no solution

307. $60(2x-1)=15(8x+5)$

Answer: contradiction; no solution

308. $16(6n+15)=48(2n+5)$

Answer: identity; all real numbers

309. $36(4m+5)=12(12m+15)$

Answer: identity; all real numbers

310. $9(14d+9)+4d=13(10d+6)+3$

Answer: identity; all real numbers

311. $11(8c+5)-8c=2(40c+25)+5$

Answer: identity; all real numbers

Everyday Math

312. **Fencing** Micah has 44 feet of fencing to make a dog run in his yard. He wants the length to be 9. 5 feet more than the width. Find the length, L, by solving the equation $2L+2(L-2.5)=44$.

Answer: 19. 25 feet

313. **Coins** Rhonda has $8. 90 in nickels and dimes. The number of dimes is one less than twice the number of nickels. Find the number of nickels, n, by solving the equation $0.05n+0.10(2n-1)=1.90$.

Answer: 8 nickels

Writing Exercises

314. Using your own words, list the steps in the general strategy for solving linear equations.

Answer: Answers will vary.

315. Explain why you should simplify both sides of an equation as much as possible before collecting the variable terms to one side and the constant terms to the other side.

Answer: Answers will vary.

316. What is the first step you take when solving the equation $3-7(y-4)=38$? Why is this your first step?

Answer: Answers will vary.

317. Solve the equation $\frac{1}{4}(8x+20)=3x-4$ explaining all the steps of your solution as in the examples in this section.

Answer: Answers will vary.

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.5 Solve Equations with Fractions or Decimals

Solve Equations with Fraction Coefficients In the following exercises, solve each equation with fraction coefficients.

318. $\frac{1}{4}x-\frac{1}{2}=-\frac{3}{4}$

Answer: $x=-1$

319. $\frac{3}{4}x-\frac{1}{2}=\frac{1}{4}$

Answer: $x=1$

320. $\frac{5}{6}y-\frac{2}{3}=-\frac{3}{2}$

Answer: $y=-1$

321. $\frac{5}{6}y-\frac{1}{3}=-\frac{7}{6}$

Answer: $y=-1$

322. $\frac{1}{2}a+\frac{3}{8}=\frac{3}{4}$

Answer: $a=\frac{3}{4}$

323. $\frac{5}{8}b+\frac{1}{2}=-\frac{3}{4}$

Answer: $b=-2$

324. $2=\frac{1}{3}x-\frac{1}{2}x+\frac{2}{3}x$

Answer: $x=4$

325. $2=\frac{3}{5}x-\frac{1}{3}x+\frac{2}{5}x$

Answer: $x=3$

326. $\frac{1}{4}m-\frac{4}{5}m+\frac{1}{2}m=-1$

Answer: $m=20$

327. $\frac{5}{6}n-\frac{1}{4}n-\frac{1}{2}n=-2$

Answer: $n=-24$

328. $x+\frac{1}{2}=\frac{2}{3}x-\frac{1}{2}$

Answer: $x=-3$

329. $x+\frac{3}{4}=\frac{1}{2}x-\frac{5}{4}$

Answer: $x=-4$

330. $\frac{1}{3}w+\frac{5}{4}=w-\frac{1}{4}$

Answer: $w=\frac{9}{4}$

331. $\frac{3}{2}z+\frac{1}{3}=z-\frac{2}{3}$

Answer: $z=-2$

332. $\frac{1}{2}x-\frac{1}{4}=\frac{1}{12}x+\frac{1}{6}$

Answer: $x=1$

333. $\frac{1}{2}a-\frac{1}{4}=\frac{1}{6}a+\frac{1}{12}$

Answer: $a=1$

334. $\frac{1}{3}b+\frac{1}{5}=\frac{2}{5}b-\frac{3}{5}$

Answer: $b=12$

335. $\frac{1}{3}x+\frac{2}{5}=\frac{1}{5}x-\frac{2}{5}$

Answer: $x=-6$

336. $1=\frac{1}{6}(12x-6)$

Answer: $x=1$

337. $1=\frac{1}{5}(15x-10)$

Answer: $x=1$

338. $\frac{1}{4}(p-7)=\frac{1}{3}(p+5)$

Answer: $p=-41$

339. $\frac{1}{5}(q+3)=\frac{1}{2}(q-3)$

Answer: $q=7$

340. $\frac{1}{2}(x+4)=\frac{3}{4}$

Answer: $x=-\frac{5}{2}$

341. $\frac{1}{3}(x+5)=\frac{5}{6}$

Answer: $x=-\frac{5}{2}$

342. $\frac{5q-8}{5}=\frac{2q}{10}$

Answer: $q=2$

343. $\frac{4m+2}{6}=\frac{m}{3}$

Answer: $m=-1$

344. $\frac{4n+8}{4}=\frac{n}{3}$

Answer: $n=-3$

345. $\frac{3p+6}{3}=\frac{p}{2}$

Answer: $p=-4$

346. $\frac{u}{3}-4=\frac{u}{2}-3$

Answer: $u=-6$

347. $\frac{v}{10}+1=\frac{v}{4}-2$

Answer: $v=20$

348. $\frac{c}{15}+1=\frac{c}{10}-1$

Answer: $c=60$

349. $\frac{d}{6}+3=\frac{d}{8}+2$

Answer: $d=-24$

350. $\frac{3x+4}{2}+1=\frac{5x+10}{8}$

Answer: $x=-2$

351. $\frac{10y-2}{3}+3=\frac{10y+1}{9}$

Answer: $y=-1$

352. $\frac{7u-1}{4}-1=\frac{4u+8}{5}$

Answer: $u=3$

353. $\frac{3v-6}{2}+5=\frac{11v-4}{5}$

Answer: $v=4$

Solve Equations with Decimal Coefficients In the following exercises, solve each equation with decimal coefficients.

354. $0.6y+3=9$

Answer: $y=10$

355. $0.4y-4=2$

Answer: $y=15$

356. $3.6j-2=5.2$

Answer: $j=2$

357. $2.1k+3=7.2$

Answer: $k=2$

358. $0.4x+0.6=0.5x-1.2$

Answer: $x=18$

359. $0.7x+0.4=0.6x+2.4$

Answer: $x=20$

360. $0.23x+1.47=0.37x-1.05$

Answer: $x=18$

361. $0.48x + 1.56 = 0.58x - 0.64$

Answer: $x = 22$

362. $0.9x - 1.25 = 0.75x + 1.75$

Answer: $x = 20$

363. $1.2x - 0.91 = 0.8x + 2.29$

Answer: $x = 8$

364. $0.05n + 0.10(n + 8) = 2.15$

Answer: $n = 9$

365. $0.05n + 0.10(n + 7) = 3.55$

Answer: $n = 19$

366. $0.10d + 0.25(d + 5) = 4.05$

Answer: $d = 8$

367. $0.10d + 0.25(d + 7) = 5.25$

Answer: $d = 10$

368. $0.05(q - 5) + 0.25q = 3.05$

Answer: $q = 11$

369. $0.05(q - 8) + 0.25q = 4.10$

Answer: $q = 15$

Everyday Math

370. **Coins** Taylor has $2.00 in dimes and pennies. The number of pennies is 2 more than the number of dimes. Solve the equation $0.10d + 0.01(d + 2) = 2$ for d, the number of dimes.

Answer: $d = 18$

371. **Stamps** Paula bought $22.82 worth of 49-cent stamps and 21-cent stamps. The number of 21-cent stamps was 8 less than the number of 49-cent stamps. Solve the equation $0.49s + 0.21(s - 8) = 22.82$ for s, to find the number of 49-cent stamps Paula bought.

Answer: $s = 35$

Writing Exercises

372. Explain how you find the least common denominator of $\frac{3}{8}$, $\frac{1}{6}$, and $\frac{2}{3}$.

Answer: Answers will vary.

373. If an equation has several fractions, how does multiplying both sides by the LCD make it easier to solve?

Answer: Answers will vary.

374. If an equation has fractions only on one side, why do you have to multiply both sides of the equation by the LCD?

Answer: Answers will vary.

375. In the equation $0.35x + 2.1 = 3.85$ what is the LCD? How do you know?

Answer: 106. Justifications will vary.

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.6 Solve a Formula for a Specific Value

Use the Distance, Rate, and Time Formula In the following exercises, solve.

376. Steve drove for $8\frac{1}{2}$ hours at 72 miles per hour. How much distance did he travel?

Answer: 612 miles

377. Socorro drove for $4\frac{5}{6}$ hours at 60 miles per hour. How much distance did she travel?

Answer: 290 miles

378. Yuki walked for $1\frac{3}{4}$ hours at 4 miles per hour. How far did she walk?

Answer: 7 miles

379. Francie rode her bike for $2\frac{1}{2}$ hours at 12 miles per hour. How far did she ride?

Answer: 30 miles

380. Connor wants to drive from Tucson to the Grand Canyon, a distance of 338 miles. If he drives at a steady rate of 52 miles per hour, how many hours will the trip take?

Answer: 6.5 hours

381. Megan is taking the bus from New York City to Montreal. The distance is 380 miles and the bus travels at a steady rate of 76 miles per hour. How long will the bus ride be?

Answer: 5 hours

382. Aurelia is driving from Miami to Orlando at a rate of 65 miles per hour. The distance is 235 miles. To the nearest tenth of an hour, how long will the trip take?

Answer: 3.6 hours

383. Kareem wants to ride his bike from St. Louis to Champaign, Illinois. The distance is 180 miles. If he rides at a steady rate of 16 miles per hour, how many hours will the trip take?

Answer: 11.25 hours

384. Javier is driving to Bangor, 240 miles away. If he needs to be in Bangor in 4 hours, at what rate does he need to drive?

Answer: 60 mph

385. Alejandra is driving to Cincinnati, 450 miles away. If she wants to be there in 6 hours, at what rate does she need to drive?

Answer: 75 mph

386. Aisha took the train from Spokane to Seattle. The distance is 280 miles and the trip took 3.5 hours. What was the speed of the train?

Answer: 80 mph

387. Philip got a ride with a friend from Denver to Las Vegas, a distance of 750 miles. If the trip took 10 hours, how fast was the friend driving?

Answer: 75 mph

Solve a Formula for a Specific Variable In the following exercises, use the formula. $d = rt$.

388. Solve for t (a) when $d = 350$ and $r = 70$ (b) in general

Answer: (a) $t = 5$ (b) $t = \frac{d}{r}$

389. Solve for t (a) when $d = 240$ and $r = 60$ (b) in general

Answer: (a) $t = 4$ (b) $t = \frac{d}{r}$

390. Solve for t (a) when $d = 510$ and $r = 60$ (b) in general

Answer: (a) $t = 8.5$ (b) $t = \frac{d}{r}$

391. Solve for t (a) when $d = 175$ and $r = 50$ (b) in general

Answer: (a) $t = 3.5$ (b) $t = \frac{d}{r}$

392. Solve for r (a) when $d = 204$ and $t = 3$ (b) in general

Answer: (a) $r = 68$ (b) $r = \frac{d}{t}$

393. Solve for r (a) when $d = 420$ and $t = 6$ (b) in general

Answer: (a) $r = 70$ (b) $r = \frac{d}{t}$

394. Solve for r (a) when $d = 160$ and $t = 2.5$ (b) in general

Answer: (a) $r = 64$ (b) $r = \frac{d}{t}$

395. Solve for r (a) when $d = 180$ and $t = 4.5$ (b) in general

Answer: (a) $r = 40$ (b) $r = \frac{d}{t}$

In the following exercises, use the formula $A = \frac{1}{2}bh$.

396. Solve for b (a) when $A = 126$ and $h = 18$ (b) in general

Answer: (a) $b = 14$ (b) $b = \frac{2A}{h}$

397. Solve for h (a) when $A = 176$ and $b = 22$ (b) in general

Answer: (a) $h = 16$ (b) $h = \frac{2A}{b}$

398. Solve for h (a) when $A = 375$ and $b = 25$ (b) in general

Answer: (a) $h = 30$ (b) $h = \frac{2A}{b}$

399. Solve for b (a) when $A = 65$ and $h = 13$ (b) in general

Answer: (a) $b = 10$ (b) $b = \frac{2A}{h}$

In the following exercises, use the formula $I = Prt$.

400. Solve for the principal, P for (a) $I = \$5480, r = 4\%, t = 7\,\text{years}$ (b) in general

Answer: (a) $P = \$19{,}57143$ (b) $P = \frac{I}{rt}$

401. Solve for the principal, P for (a) $I = \$3950, r = 6\%, t = 5\,\text{years}$ (b) in general

Answer: (a) $P = \$13{,}166.67$ (b) $P = \frac{I}{rt}$

402. Solve for the time, t for (a) $I = \$2376, P = \$9000, r = 4.4\%$ (b) in general

Answer: (a) $t = 6$ years (b) $t = \frac{I}{\text{Pr}}$

403. Solve for the time, t for (a) $I = \$624,\ P = \$6000, r = 5.2\%$ (b) in general

Answer: (a) $t = 2$ years (b) $t = \frac{I}{\text{Pr}}$

In the following exercises, solve.

404. Solve the formula $2x + 3y = 12$ for y (a) when $x = 3$ (b) in general

Answer: (a) $y = 2$ (b) $y = \frac{12 - 2x}{3}$

405. Solve the formula $5x+2y=10$ for y (a) when $x=4$ (b) in general

Answer: (a) $y=-5$ (b) $y=\frac{10-5x}{2}$

406. Solve the formula $3x+y=7$ for y (a) when $x=-2$ (b) in general

Answer: (a) $y=13$ (b) $y=7-3x$

407. Solve the formula $4x+y=5$ for y (a) when $x=-3$ (b) in general

Answer: (a) $y=17$ (b) $y=5-4x$

408. Solve $a+b=90$ for b.

Answer: $b=90-a$

409. Solve $a+b=90$ for a.

Answer: $a=90-b$

410. Solve $180=a+b+c$ for a.

Answer: $a=180-b-c$

411. Solve $180=a+b+c$ for c.

Answer: $c=180-a-b$

412. Solve the formula $8x+y=15$ for y.

Answer: $y=15-8x$

413. Solve the formula $9x+y=13$ for y.

Answer: $y=13-9x$

414. Solve the formula $-4x+y=-6$ for y.

Answer: $y=-6+4x$

415. Solve the formula $-5x+y=-1$ for y.

Answer: $y=-1+5x$

416. Solve the formula $4x+3y=7$ for y.

Answer: $y=\frac{7-4x}{3}$

417. Solve the formula $3x+2y=11$ for y.

Answer: $y=\frac{11-3x}{4}$

418. Solve the formula $x - y = -4$ for y.

Answer: $y = 4 + x$

419. Solve the formula $x - y = -3$ for y.

Answer: $y = 3 + x$

420. Solve the formula $P = 2L + 2W$ for L.

Answer: $L = \frac{P - 2W}{2}$

421. Solve the formula $P = 2L + 2W$ for W.

Answer: $W = \frac{P - 2L}{2}$

422. Solve the formula $C = \pi d$ for d.

Answer: $d = \frac{C}{\pi}$

423. Solve the formula $C = \pi d$ for π.

Answer: $\pi = \frac{C}{d}$

424. Solve the formula $V = LWH$ for L.

Answer: $L = \frac{V}{WH}$

425. Solve the formula $V = LWH$ for H.

Answer: $H = \frac{V}{WL}$

Everyday Math

426. **Converting temperature** While on a tour in Greece, Tatyana saw that the temperature was 40° Celsius. Solve for F in the formula $C = \frac{5}{9}(F - 32)$ to find the Fahrenheit temperature.

Answer: 104° F

427. **Converting temperature** Yon was visiting the United States and he saw that the temperature in Seattle one day was 50° Fahrenheit. Solve for C in the formula $F = \frac{9}{5}C + 32$ to find the Celsius temperature.

Answer: 10°C

Writing Exercises

428. Solve the equation $2x+3y=6$ for y (a) when $x=-3$ (b) in general (c) Which solution is easier for you, (a) or (b)? Why?

Answer: Answers will vary.

429. Solve the equation $5x-2y=10$ for x a) when $y=10$ (b) in general (c) Which solution is easier for you, (a) or (b)? Why?

Answer: Answers will vary.

Elementary Algebra
2: Solving Linear Equations and Inequalities
2.7 Solve Linear Inequalities

Graph Inequalities on the Number Line In the following exercises, graph each inequality on the number line.

430. (a) $x \leq 2$ (b) $x > -1$ (c) $x < 0$

Answer:

(a)

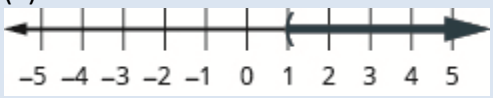
(b)

(c)

431. (a) $x > 1$ (b) $x < -2$ (c) $x \geq -3$

Answer:

(a)



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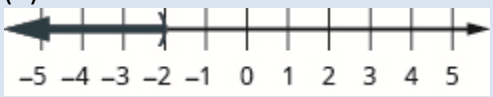

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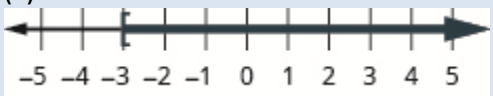
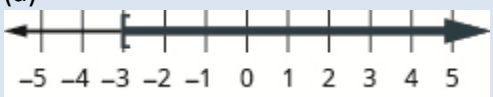


432. (a) $x \geq -3$ (b) $x < 4$ (c) $x \leq -2$

Answer:

(a)



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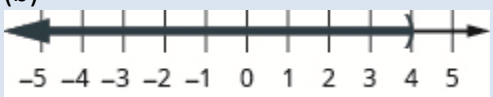

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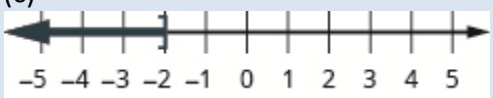
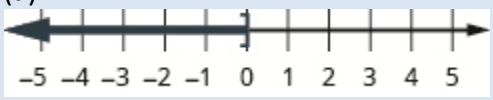


433. (a) $x \leq 0$ (b) $x > -4$ (c) $x \geq -1$

Answer:

(a)



(b)

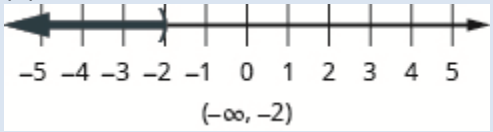
(c)

In the following exercises, graph each inequality on the number line and write in interval notation.

434. (a) $x < -2$ (b) $x \geq -3.5$ (c) $x \leq \frac{2}{3}$

Answer:

(a)



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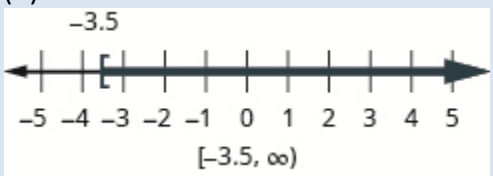

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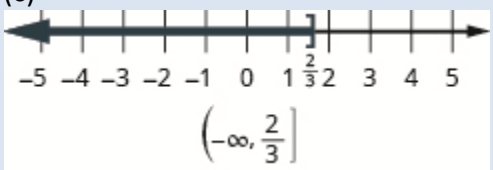
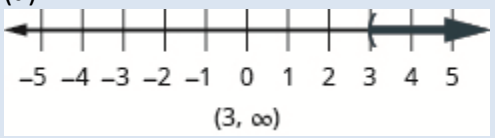


435. (a) $x > 3$ (b) $x \leq -0.5$ (c) $x \geq \frac{1}{3}$

Answer:

(a)



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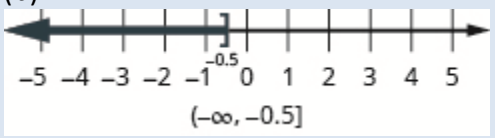

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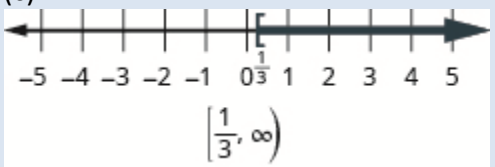
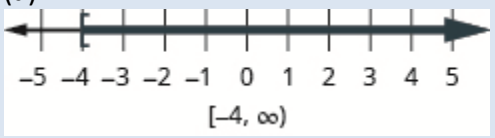


436. (a) $x \geq -4$ (b) $x < 2.5$ (c) $x > -\frac{3}{2}$

Answer:

(a)



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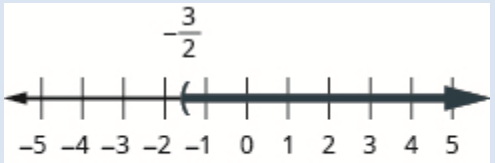
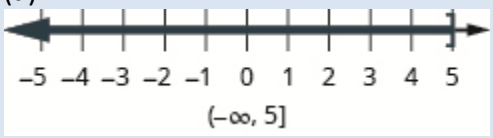


437. (a) $x \leq 5$ (b) $x \geq -1.5$ (c) $x < -\frac{7}{3}$

Answer:

(a)



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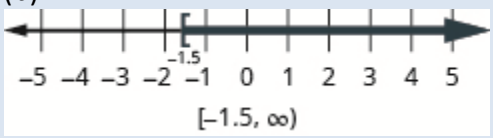

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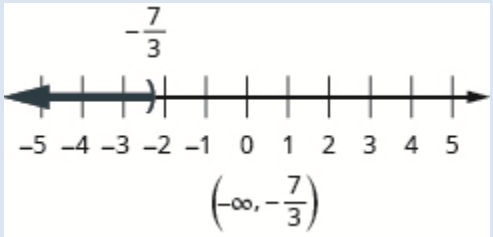
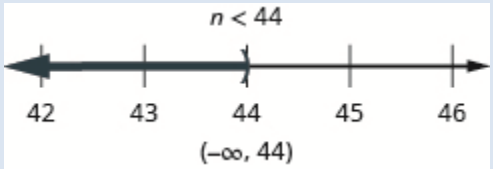


Solve Inequalities using the Subtraction and Addition Properties of Inequality In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

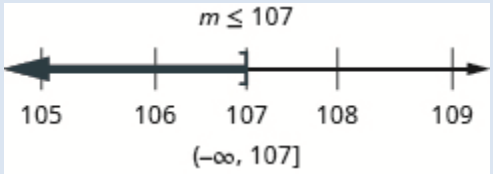
438. $n - 11 < 33$

Answer:



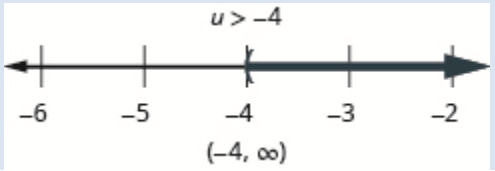
439. $m - 45 \leq 62$

Answer:



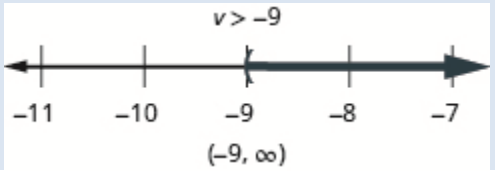
440. $u + 25 > 21$

Answer:



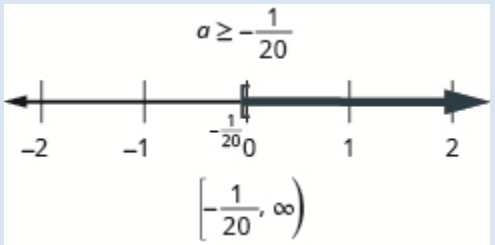
441. $v + 12 > 3$

Answer:



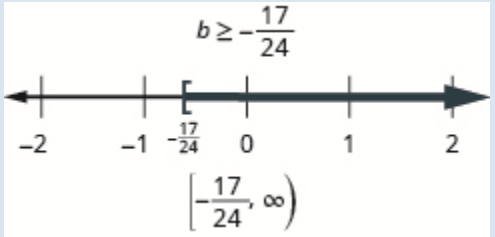
442. $a + \frac{3}{4} \geq \frac{7}{10}$

Answer:



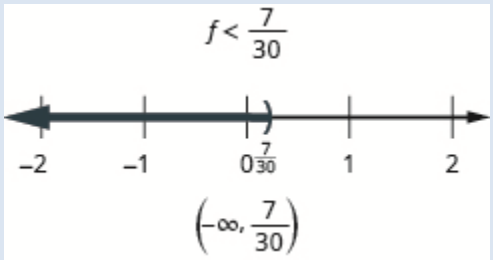
443. $b + \frac{7}{8} \geq \frac{1}{6}$

Answer:



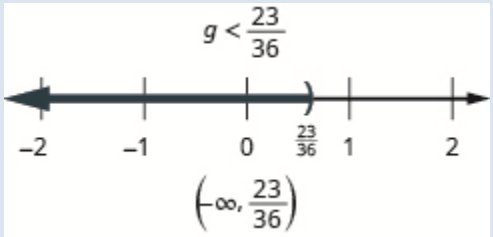
444. $f - \frac{13}{20} < -\frac{5}{12}$

Answer:



445. $g - \frac{11}{12} < -\frac{5}{18}$

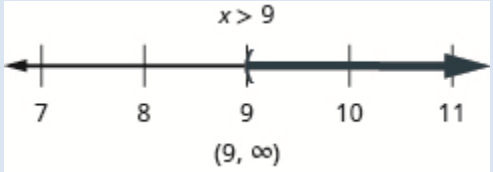
Answer:



Solve Inequalities using the Division and Multiplication Properties of Inequality In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

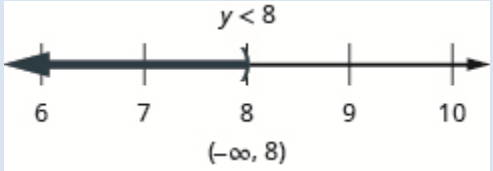
446. $8x > 72$

Answer:



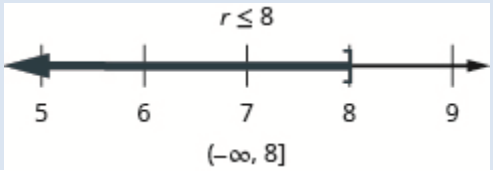
447. $6y < 48$

Answer:



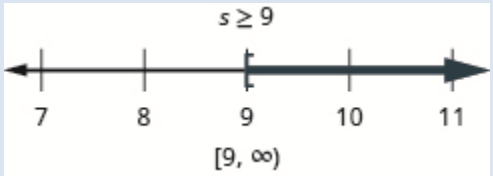
448. $7r \leq 56$

Answer:



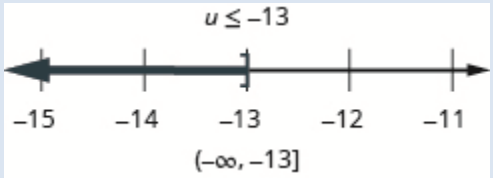
449. $9s \geq 81$

Answer:



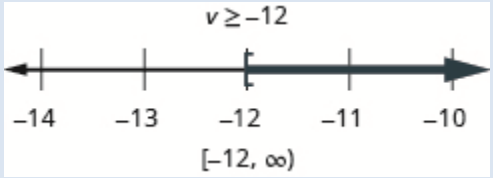
450. $-5u \geq 65$

Answer:



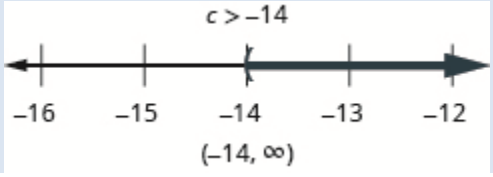
451. $-8v \leq 96$

Answer:



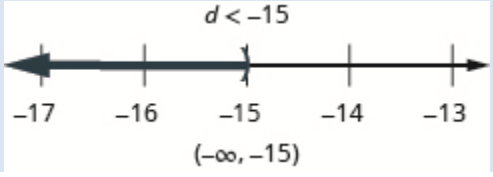
452. $-9c < 126$

Answer:



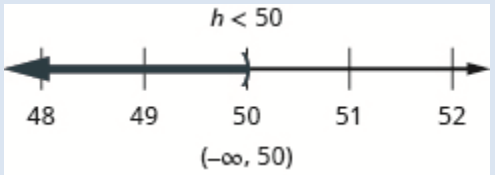
453. $-7d > 105$

Answer:



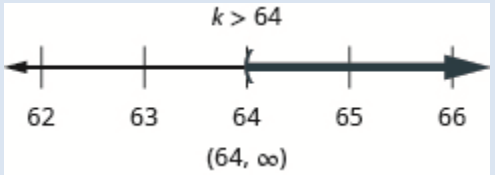
454. $20 > \frac{2}{5}h$

Answer:



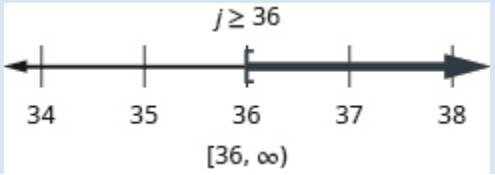
455. $40 < \frac{5}{8}k$

Answer:



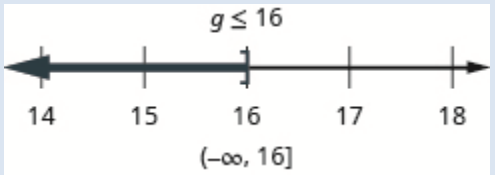
456. $\frac{7}{6}j \geq 42$

Answer:



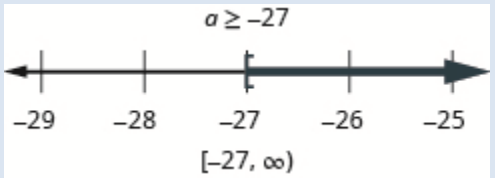
457. $\frac{9}{4}g \leq 36$

Answer:



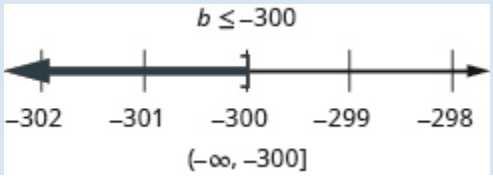
458. $\frac{a}{-3} \leq 9$

Answer:



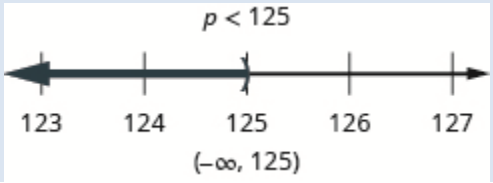
459. $\frac{b}{-10} \geq 30$

Answer:



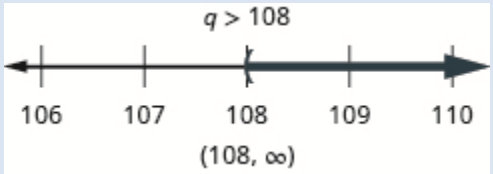
460. $-25 < \frac{p}{-5}$

Answer:



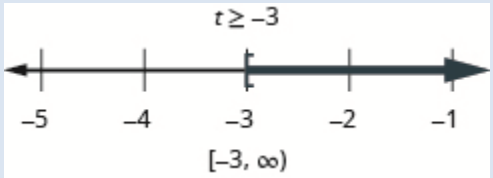
461. $-18 > \frac{q}{-6}$

Answer:



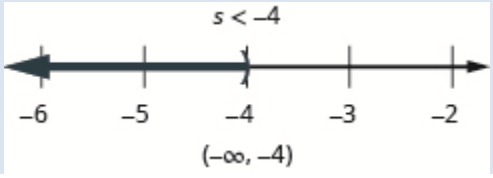
462. $9t \geq -27$

Answer:



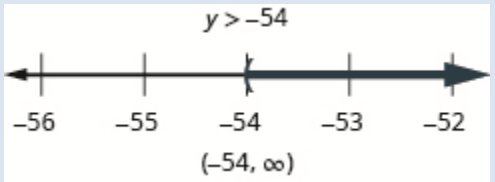
463. $7s < -28$

Answer:



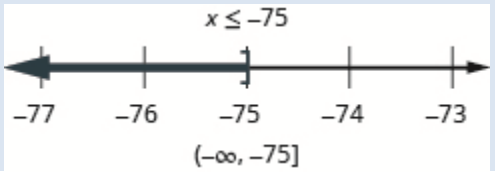
464. $\frac{2}{3}y > -36$

Answer:



465. $\frac{3}{5}x \leq -45$

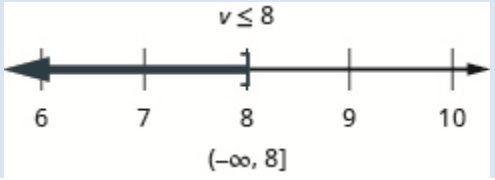
Answer:



Solve Inequalities That Require Simplification In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

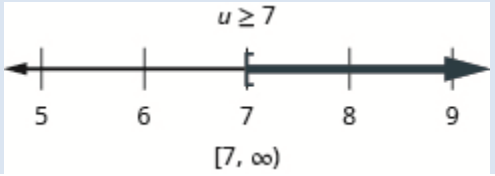
466. $4v \geq 9v - 40$

Answer:



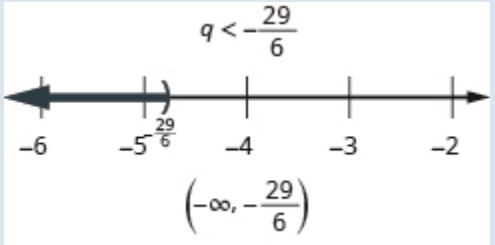
467. $5u \leq 8u - 21$

Answer:



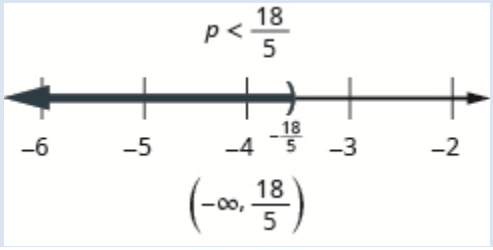
468. $13q < 7q - 29$

Answer:



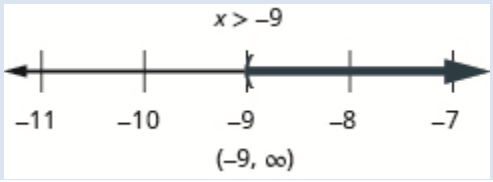
469. $9p > 14p - 18$

Answer:



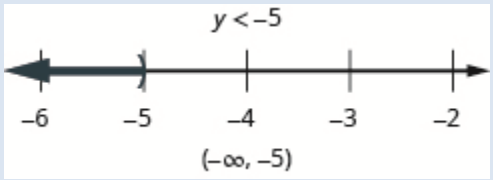
470. $12x + 3(x + 7) > 10x - 24$

Answer:



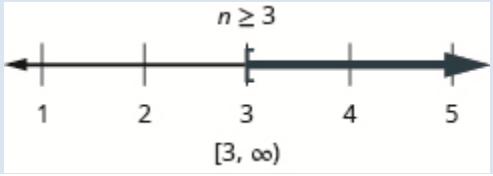
471. $9y + 5(y + 3) < 4y - 35$

Answer:



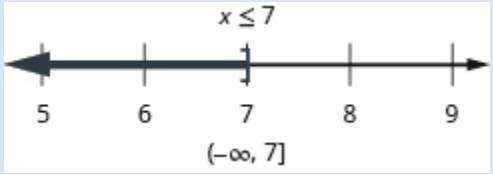
472. $6h - 4(h - 1) \leq 7h - 11$

Answer:



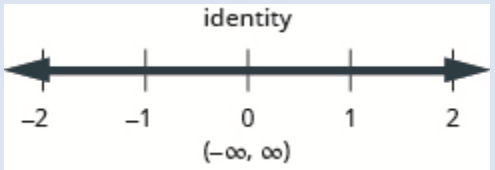
473. $4k - (k - 2) \geq 7k - 26$

Answer:



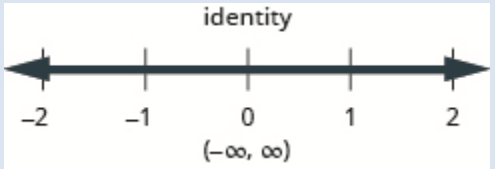
474. $8m-2(14-m)\geq 7(m-4)+3m$

Answer:



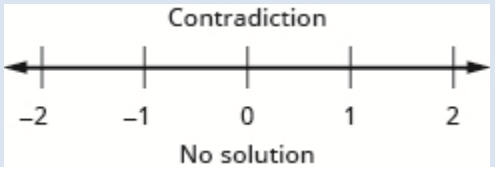
475. $6n-12(3-n)\leq 9(n-4)+9n$

Answer:



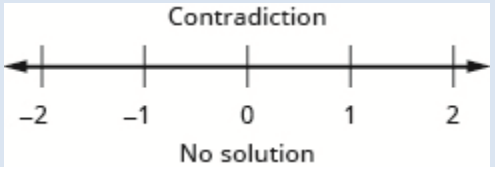
476. $\frac{3}{4}b-\frac{1}{3}b<\frac{5}{12}b-\frac{1}{2}$

Answer:



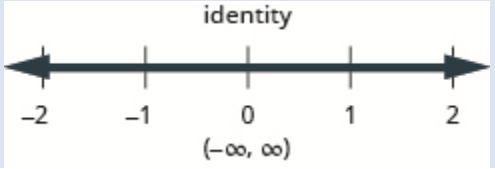
477. $9u+5(2u-5)\geq 12(u-1)+7u$

Answer:



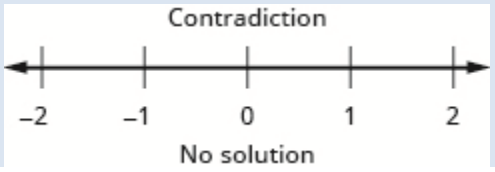
478. $\frac{2}{3}g-\frac{1}{2}(g-14)\leq\frac{1}{6}(g+42)$

Answer:



479. $\frac{5}{6}a-\frac{1}{4}a>\frac{7}{12}a+\frac{2}{3}$

Answer:

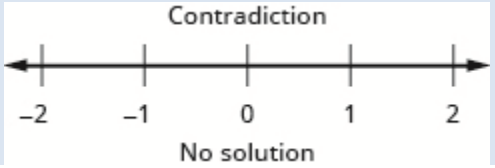


480. $\frac{4}{5}h-\frac{2}{3}(h-9)\geq\frac{1}{15}(2h+90)$

Answer:

481. $12v+3(4v-1)\leq 19(v-2)+5v$

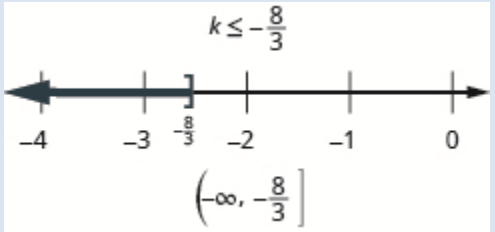
Answer:



Mixed practice In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

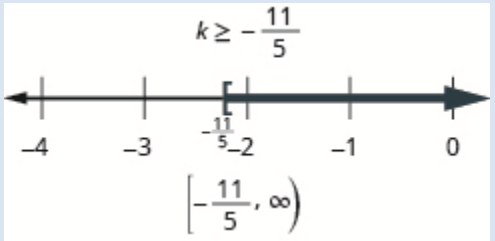
482. $15k\leq -40$

Answer:



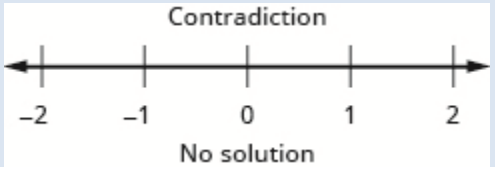
483. $35k\geq -77$

Answer:



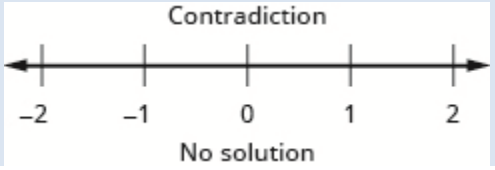
484. $23p-2(6-5p)>3(11p-4)$

Answer:



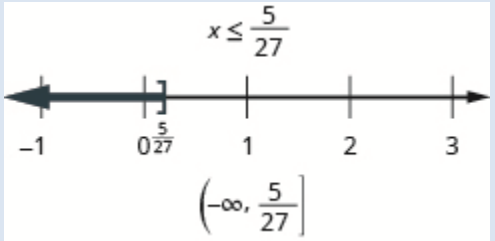
485. $18q-4(10-3q)<5(6q-8)$

Answer:



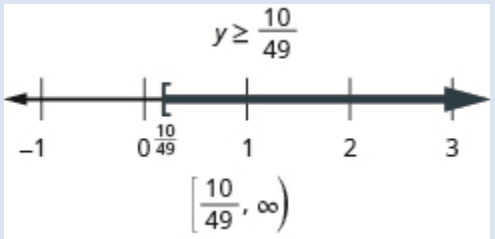
486. $-\frac{9}{4}x\geq-\frac{5}{12}$

Answer:



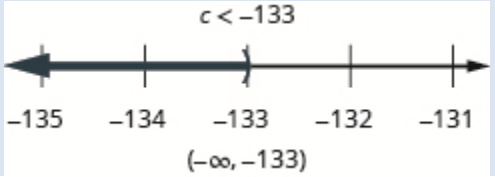
487. $-\frac{21}{8}y\leq-\frac{15}{28}$

Answer:



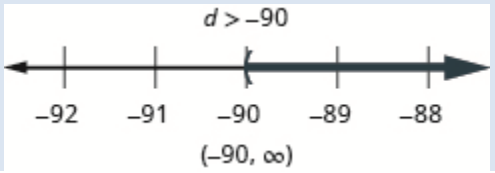
488. $c+34<-99$

Answer:



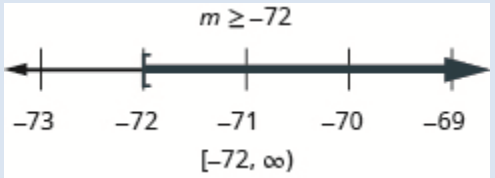
489. $d + 29 > -61$

Answer:



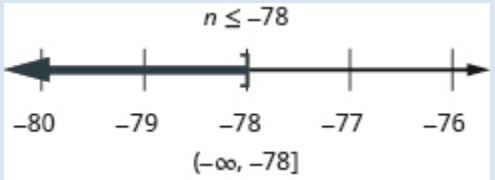
490. $\frac{m}{18} \geq -4$

Answer:



491. $\frac{n}{13} \leq -6$

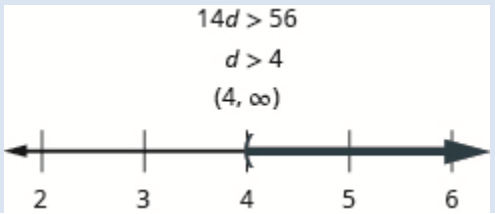
Answer:



Translate to an Inequality and Solve In the following exercises, translate and solve .Then write the solution in interval notation and graph on the number line.

492. Fourteen times *d* is greater than 56.

Answer:



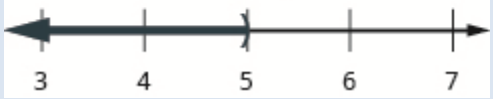
493. Ninety times c is less than 450.

Answer:

$90c < 450$

$c < 5$

$(-\infty, 5)$



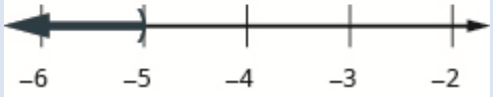
494. Eight times z is smaller than -40.

Answer:

$8z < -40$

$z < -5$

$(-\infty, -5)$



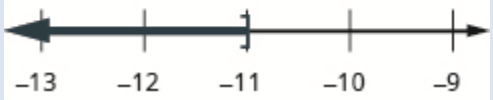
495. Ten times y is at most -110.

Answer:

$-10y \leq -110$

$y \leq -11$

$(-\infty, -11]$



496. Three more than h is no less than 25.

Answer:

$h + 3 \geq 25$

$h \geq 22$

$[22, \infty)$

497. Six more than k exceeds 29.

Answer:

$k + 6 > 25$

$k > 19$

$(19, \infty)$

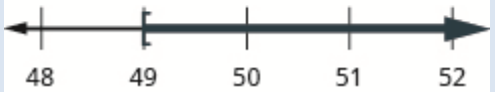
498. Ten less than w is at least 39.

Answer:

$w - 10 \geq 39$

$w \geq 49$

$[49, \infty)$



499. Twelve less than x is no less than 21.

Answer:

$x - 12 \geq 21$

$x \geq 33$

$[33, \infty)$

500. Negative five times r is no more than 95.

Answer:

$-5r \leq 95$

$r \geq -19$

$[19, \infty)$

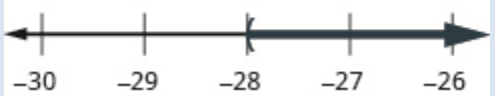
501. Negative two times s is lower than 50.

Answer:

$-2s < 56$

$s > -28$

$(-28, \infty)$



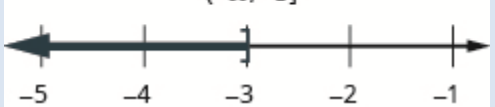
502. Nineteen less than b is at most -22.

Answer:

$b - 19 \leq -22$

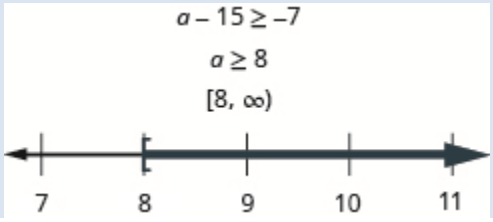
$b \leq -3$

$(-\infty, -3]$



503. Fifteen less than a is at least -7.

Answer:



Everyday Math

504. **Safety** A child's height, h, must be at least 57 inches for the child to safely ride in the front seat of a car. Write this as an inequality.

Answer: $h \geq 57$

505. **Fighter pilots** The maximum height, h, of a fighter pilot is 77 inches. Write this as an inequality.

Answer: $h \leq 77$

506. **Elevators** The total weight, w, of an elevator's passengers can be no more than 1,200 pounds. Write this as an inequality.

Answer: $w \leq 1,200$

507. **Shopping** The number of items, n, a shopper can have in the express check-out lane is at most 2. Write this as an inequality.

Answer: $n \leq 8$

Writing Exercises

508. Give an example from your life using the phrase 'at least'.

Answer: Answers will vary.

509. Give an example from your life using the phrase 'at most'.

Answer: Answers will vary.

510. Explain why it is necessary to reverse the inequality when solving $-5x > 10$.

Answer: Answers will vary.

511. Explain why it is necessary to reverse the inequality when solving $\frac{n}{-3} < 12$.

Answer: Answers will vary.

Chapter Review

2.1 Solve Equations using the Subtraction and Addition Properties of Equality

Verify a Solution of an Equation In the following exercises, determine whether each number is a solution to the equation.

512. $10x-1=5x; x=\frac{1}{5}$

Answer: yes

513. $w+2=\frac{5}{8}; w=\frac{3}{8}$

Answer: no

514. $-12n+5=8n; n=-\frac{5}{4}$

Answer: no

515. $6a-3=-7a,\ a=\frac{3}{13}$

Answer: yes

Solve Equations using the Subtraction and Addition Properties of Equality In the following exercises, solve each equation using the Subtraction Property of Equality

516. $x+7=19$

Answer: $x=12$

517. $y+2=-6$

Answer: $y=-8$

518. $a+\frac{1}{3}=\frac{5}{3}$

Answer: $a=\frac{4}{3}$

519. $n+3.6=5.1$

Answer: $n=1.5$

In the following exercises, solve each equation using the Addition Property of Equality.

520. $u-7=10$

Answer: $u=17$ b

521. $x-9=-4$

Answer: $x=5$

522. $c-\frac{3}{11}=\frac{9}{11}$

Answer: $c=\frac{12}{11}$

523. $p-4.8=14$

Answer: $p=18.8$

In the following exercises, solve each equation.

524. $n-12=32$

Answer: $n=44$

525. $y+16=-9$

Answer: $y=-25$

526. $f+\frac{2}{3}=4$

Answer: $f=\frac{10}{3}$

527. $d-3.9=8.2$

Answer: $d=12.1$

Solve Equations That Require Simplification In the following exercises, solve each equation.

528. $y+8-15=-3$

Answer: $y=4$

529. $7x+10-6x+3=5$

Answer: $x=-8$

530. $6(n-1)-5n=-14$

Answer: $n=-8$

531. $8(3p+5)-23(p-1)=35$

Answer: $p=-28$

Translate to an Equation and Solve In the following exercises, translate each English sentence into an algebraic equation and then solve it.

532. The sum of -6 and m is 25.

Answer: $-6+m=25; m=31$

533. Four less than n is 13.

Answer: $n-4=13; n=17$

Translate and Solve Applications In the following exercises, translate into an algebraic equation and solve.

534. Rochelle's daughter is 11 years old. Her son is 3 years younger. How old is her son?

Answer: 8 years old

535. Tan weighs 146 pounds. Minh weighs 15 pounds more than Tan. How much does Minh weigh?

Answer: 161 pounds

536. Peter paid $9.75 to go to the movies, which was $46.25 less than he paid to go to a concert. How much did he pay for the concert?

Answer: $56.00

537. Elissa earned $152.84 this week, which was $21.65 more than she earned last week. How much did she earn last week?

Answer: $131.19

2.2 Solve Equations using the Division and Multiplication Properties of Equality

Solve Equations Using the Division and Multiplication Properties of Equality In the following exercises, solve each equation using the division and multiplication properties of equality and check the solution.

538. $8x=72$

Answer: $x=9$

539. $13a=-65$

Answer: $a=-5$

540. $0.25p = 5.25$

Answer: $p = 21$

541. $-y = 4$

Answer: $y = -4$

542. $\frac{n}{6} = 18$

Answer: $n = 108$

543. $\frac{y}{-10} = 30$

Answer: $y = -300$

544. $36 = \frac{3}{4}x$

Answer: $x = 48$

545. $\frac{5}{8}u = \frac{15}{16}$

Answer: $u = \frac{3}{2}$

546. $-18m = -72$

Answer: $m = 4$

547. $\frac{c}{9} = 36$

Answer: $c = 324$

548. $0.45x = 6.75$

Answer: $x = 15$

549. $\frac{11}{12} = \frac{2}{3}y$

Answer: $y = \frac{11}{8}$

Solve Equations That Require Simplification In the following exercises, solve each equation requiring simplification.

550. $5r-3r+9r=35-2$

Answer: $r=3$

551. $24x+8x-11x=-7-14$

Answer: $x=-1$

552. $\frac{11}{12}n-\frac{5}{6}n=9-5$

Answer: $n=48$

553. $-9(d-2)-15=-24$

Answer: $d=3$

Translate to an Equation and Solve In the following exercises, translate to an equation and then solve.

554. 143 is the product of -11 and *y*.

Answer: $143=-11y; y=-13$

555. The quotient of *b* and and 9 is -27 .

Answer: $\frac{b}{9}=-27; b=-243$

556. The sum of *q* and one-fourth is one.

Answer: $q-\frac{1}{4}=1; q=\frac{3}{4}$

557. The difference of *s* and one-twelfth is one fourth.

Answer: $s-\frac{1}{12}=\frac{1}{4}; s=\frac{1}{3}$

Translate and Solve Applications In the following exercises, translate into an equation and solve.

558. Ray paid $21 for 12 tickets at the county fair. What was the price of each ticket?

Answer: $1.75

559. Janet gets paid $24 per hour. She heard that this is $\frac{3}{4}$ of what Adam is paid. How much is Adam paid per hour?

Answer: $32

2.3 Solve Equations with Variables and Constants on Both Sides

Solve an Equation with Constants on Both Sides In the following exercises, solve the following equations with constants on both sides.

560. $8p+7=47$

Answer: $p=5$

561. $10w-5=65$

Answer: $w=7$

562. $3x+19=-47$

Answer: $x=-22$

563. $32=-4-9n$

Answer: $n=-4$

Solve an Equation with Variables on Both Sides In the following exercises, solve the following equations with variables on both sides.

564. $7y=6y-13$

Answer: $y=-13$

565. $5a+21=2a$

Answer: $a=-7$

566. $k=-6k-35$

Answer: $k=-5$

567. $4x-\frac{3}{8}=3x$

Answer: $x=\frac{3}{8}$

Solve an Equation with Variables and Constants on Both Sides In the following exercises, solve the following equations with variables and constants on both sides.

568. $12x-9=3x+45$

Answer: $x=6$

569. $5n-20=-7n-80$

Answer: $n=-5$

570. $4u+16=-19-u$

Answer: $u=-7$

571. $\frac{5}{8}c-4=\frac{3}{8}c+4$

Answer: $c=32$

2.4 Use a General Strategy for Solving Linear Equations

Solve Equations Using the General Strategy for Solving Linear Equations In the following exercises, solve each linear equation.

572. $6(x+6)=24$

Answer: $x=-2$

573. $9(2p-5)=72$

Answer: $p=\frac{13}{2}$

574. $-(s+4)=18$

Answer: $s=-22$

575. $8+3(n-9)=17$

Answer: $n=12$

576. $23-3(y-7)=8$

Answer: $y=12$

577. $\frac{1}{3}(6m+21)=m-7$

Answer: $m=-14$

578. $4(3.5y+0.25)=365$

Answer: $y=26$

579. $0.25(q-8)=0.1(q+7)$

Answer: $q=18$

580. $8(r-2)=6(r+10)$

Answer: $r=38$

581. $5+7(2-5x)=2(9x+1)-(13x-57)$

Answer: $x=-1$

582. $(9n+5)-(3n-7)=20-(4n-2)$

Answer: $n=1$

583. $2[-16+5(8k-6)]=8(3-4k)-32$

Answer: $k=\frac{3}{4}$

Classify Equations In the following exercises, classify each equation as a conditional equation, an identity, or a contradiction and then state the solution.

584. $17y-3(4-2y)=11(y-1)+12y-1$

Answer: identity; all real numbers

585. $9u+32=15(u-4)-3(2u+21)$

Answer: contradiction; no solution

586. $-8(7m+4)=-6(8m+9)$

Answer: conditional ; $m=\frac{11}{4}$

587. $21(c-1)-19(c+1)=2(c-20)$

Answer: identity; all real numbers

2.5 Solve Equations with Fractions and Decimals

Solve Equations with Fraction Coefficients In the following exercises, solve each equation with fraction coefficients.

588. $\frac{2}{5}n-\frac{1}{10}=\frac{7}{10}$

Answer: $n=2$

589. $\frac{1}{3}x+\frac{1}{5}x=8$

Answer: $x=15$

590. $\frac{3}{4}a-\frac{1}{3}=\frac{1}{2}a-\frac{5}{6}$

Answer: $a=\frac{14}{3}$

591. $\frac{1}{2}(k-3)=\frac{1}{3}(k+16)$

Answer: $k=41$

592. $\frac{3x-2}{5}=\frac{3x+4}{8}$

Answer: $x=4$

593. $\frac{5y-1}{3}+4=\frac{-8y+4}{6}$

Answer: $y=-1$

Solve Equations with Decimal Coefficients In the following exercises, solve each equation with decimal coefficients.

594. $0.8x-0.3=0.7x+0.2$

Answer: $x=5$

595. $0.36u+2.55=0.41u+6.8$

Answer: $u=-85$

596. $0.6p-1.9=0.78p+1.7$

Answer: $p=-20$

597. $0.6p - 1.9 = 0.78p + 1.7$

Answer: $d = -20$

2.6 Solve a Formula for a Specific Variable

Use the Distance, Rate, and Time Formula In the following exercises, solve.

598. Natalie drove for $7\frac{1}{2}$ hours at 60 miles per hour. How much distance did she travel?

Answer: 450 miles

599. Mallory is taking the bus from St. Louis to Chicago. The distance is 300 miles and the bus travels at a steady rate of 60 miles per hour. How long will the bus ride be?

Answer: 5 hours

600. Aaron's friend drove him from Buffalo to Cleveland. The distance is 187 miles and the trip took 2.75 hours. How fast was Aaron's friend driving?

Answer: 68 mph

601. Link rode his bike at a steady rate of 15 miles per hour for $2\frac{1}{2}$ hours. How much distance did he travel?

Answer: 37.5 miles

Solve a Formula for a Specific Variable In the following exercises, solve.

602. Use the formula. $d = rt$ to solve for t (a) when $d = 510$ and $r = 60$ (b) in general

Answer: (a) $t = 8.5 \text{ h}$; (b) $t = \frac{D}{r}$

603. Use the formula. $d = rt$ to solve for r (a) when when $d = 451$ and $t = 5.5$ (b) in general

Answer: (a) $r = 82 \text{ mph}$; (b) $r = \frac{D}{t}$

604. Use the formula $A = \frac{1}{2}bh$ to solve for b (a) when $A = 390$ and $h = 26$ (b) in general

Answer: (a) $b = 30$; (b) $b = \frac{2A}{h}$

605. Use the formula $A=\frac{1}{2}bh$ to solve for h (a) when $A=153$ and $b=18$ (b) in general

Answer: (a) $h=17$ (b) $h=\frac{2A}{b}$

606. Use the formula $I=Prt$ to solve for the principal, *P* for (a) $I=\$2,501, r=4.1\%, t=5$ years (b) in general

Answer: (a) $12,200 (b) $P=\frac{I}{rt}$

607. Solve the formula $4x+3y=6$ for *y* (a) when $x=-2$ (b) in general

Answer: (a) $y=\frac{14}{3}$ (b) $y=\frac{6-4x}{3}$

608. Solve $180=a+b+c$ for c.

Answer: $c=180-a-b$

609. Solve the formula $V=LWH$ for H.

Answer: $H=\frac{V}{LW}$

2.7 Solve Linear Inequalities

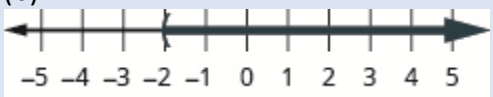
Graph Inequalities on the Number Line In the following exercises, graph each inequality on the number line.

610. (a) $x\le 4$ (b) $x>-2$ (c) $x<1$

Answer:

(a)

(b)



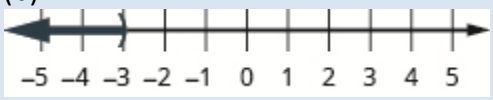
(c)

611. (a) $x > 0$ (b) $x < -3$ (c) $x \geq -1$

Answer:

(a)

(b)



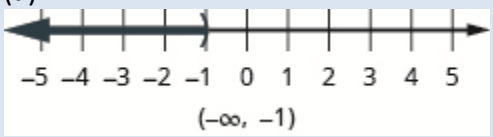
(c)

In the following exercises, graph each inequality on the number line and write in interval notation.

612. (a) $x < -1$ (b) $x \geq -2.5$ (c) $x \leq \frac{5}{4}$

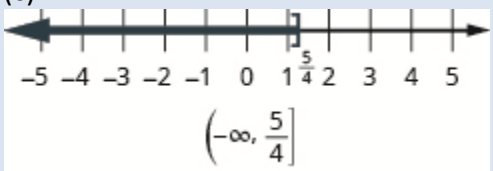
Answer:

(a)



(b)

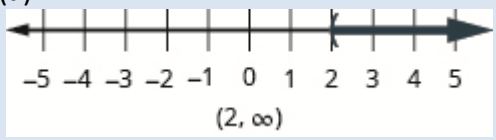
(c)



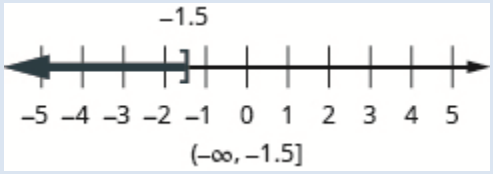
613. (a) $x > 2$ (b) $x \leq -1.5$ (c) $x \geq \frac{5}{3}$

Answer:

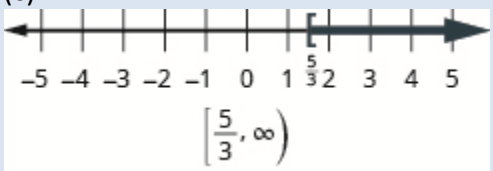
(a)



(b)



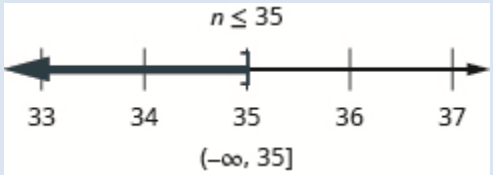
(c)



Solve Inequalities using the Subtraction and Addition Properties of Inequality In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

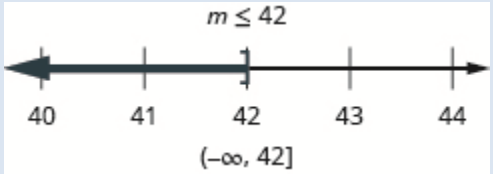
614. $n - 12 \leq 23$

Answer:



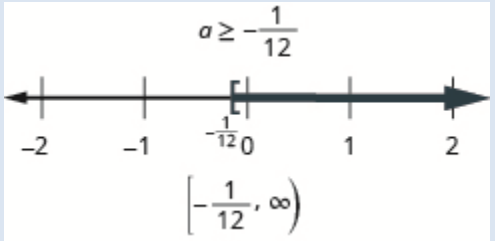
615. $m + 14 \leq 56$

Answer:



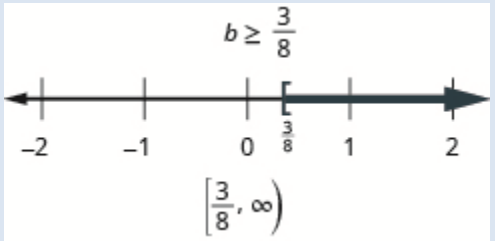
616. $a+\frac{2}{3}\geq\frac{7}{12}$

Answer:



617. $b-\frac{7}{8}\geq-\frac{1}{2}$

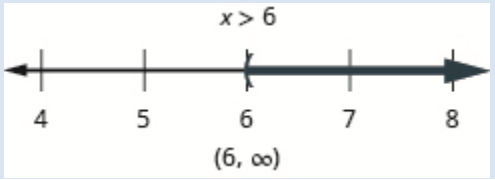
Answer:



Solve Inequalities using the Division and Multiplication Properties of Inequality In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

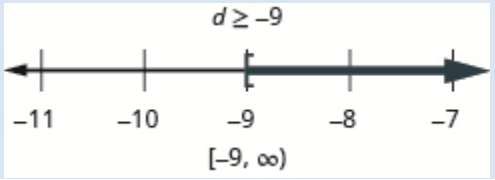
618. $9x>54$

Answer:



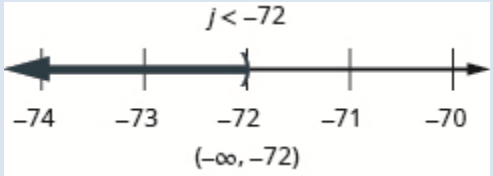
619. $-12d\leq108$

Answer:



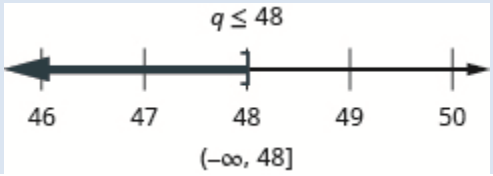
620. $\frac{5}{6}j < -60$

Answer:



621. $\frac{q}{-2} \geq -24$

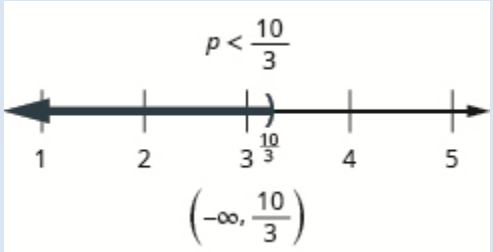
Answer:



Solve Inequalities That Require Simplification In the following exercises, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

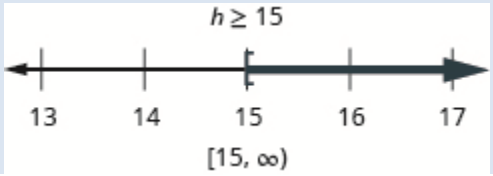
622. $6p > 15p - 30$

Answer:



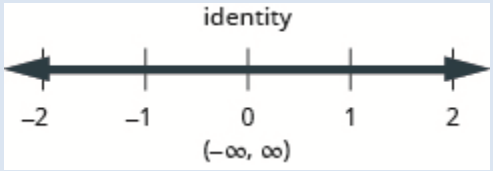
623. $9h - 7(h-1) \leq 4h - 23$

Answer:



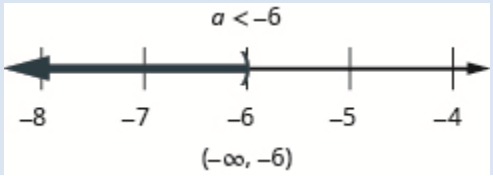
624. $5n-15(4-n)<10(n-6)+10n$

Answer:



625. $\frac{3}{8}a-\frac{1}{12}a>\frac{5}{12}a+\frac{3}{4}$

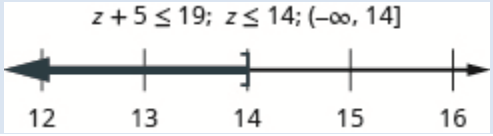
Answer:



Translate to an Inequality and Solve In the following exercises, translate and solve. Then write the solution in interval notation and graph on the number line.

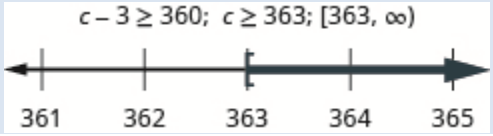
626. Five more than z is at most 19.

Answer:



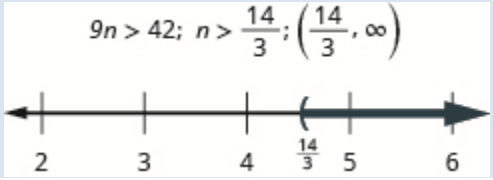
627. Three less than c is at least 360.

Answer:



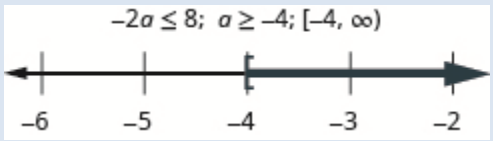
628. Nine times n exceeds 42.

Answer:



629. Negative two times a is no more than 8.

Answer:



Everyday Math

630. Describe how you have used two topics from this chapter in your life outside of your math class during the past month.

Answer: Answers will vary.

Chapter Practice Test

631. Determine whether each number is a solution to the equation $6x-3=x+20$.

(a) 5 (b) $\frac{23}{5}$

Answer: (a) no (b) yes

In the following exercises, solve each equation.

632. $n-\frac{2}{3}=\frac{1}{4}$

Answer: $n=-\frac{5}{12}$

633. $\frac{9}{2}c=144$

Answer: $c=32$

634. $4y-8=16$

Answer: $y=6$

635. $-8x-15+9x-1=-21$

Answer: $x=-5$

636. $-15a=120$

Answer: $a=-8$

637. $\frac{2}{3}x=6$

Answer: $x=9$

638. $x-3.8=8.2$

Answer: $x=12.0$

639. $10y=-5y-60$

Answer: $y=-4$

640. $8n-2=6n-12$

Answer: $n=-5$

641. $9m-2-4m-m=42-8$

Answer: $m=9$

642. $-5(2x-1)=45$

Answer: $x=-4$

643. $-(d-9)=23$

Answer: $d=-14$

644. $\frac{1}{4}(12m-28)=6-2(3m-1)$

Answer: $m=\frac{5}{3}$

645. $2(6x-5)-8=-22$

Answer: $x=-\frac{1}{3}$

646. $8(3a-5)-7(4a-3)=20-3a$

Answer: $a=-39$

647. $\frac{1}{4}p-\frac{1}{3}=\frac{1}{2}$

Answer: $p=\frac{10}{3}$

648. $0.1d+0.25(d+8)=4.1$

Answer: $d=6$

649. $14n-3(4n+5)=-9+2(n-8)$

Answer: contradiction; no solution

650. $9(3u-2)-4[6-8(u-1)]=3(u-2)$

Answer: $u=\frac{17}{14}$

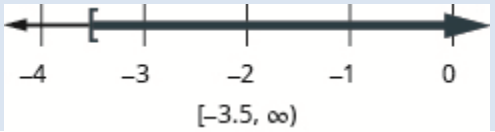
651. Solve the formula $x-2y=5$ for y (a) when $x=-3$ (b) in general

Answer: (a) $y=4$ (b) $y=\frac{5-x}{2}$

In the following exercises, graph on the number line and write in interval notation.

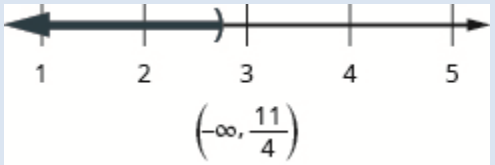
652. $x \geq -3.5$

Answer:



653. $x < \frac{11}{4}$

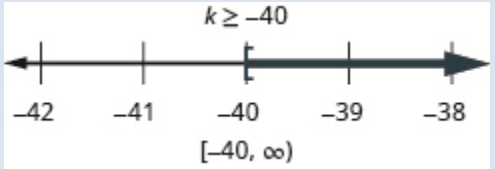
Answer:



In the following exercises,, solve each inequality, graph the solution on the number line, and write the solution in interval notation.

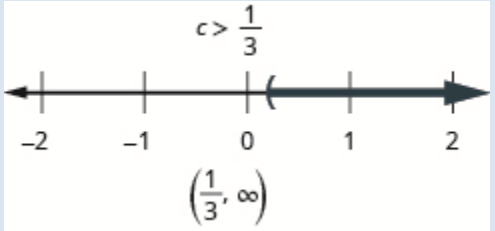
654. $8k \geq 5k - 120$

Answer:



655. $3c - 10(c - 2) < 5c + 16$

Answer:



In the following exercises, translate to an equation or inequality and solve.

656. 4 less than twice *x* is 16.

Answer: $2x - 4 = 16; x = 10$

657. Fifteen more than *n* is at least 48.

Answer: $n + 15 \geq 48; n \geq 33$

658. Samuel paid $25.82 for gas this week, which was $3.47 less than he paid last week. How much had he paid last week?

Answer: $g - 3.47 = 25.82$; He paid $29.29 last week.

659. Jenna bought a coat on sale for $120, which was $\frac{2}{3}$ of the original price. What was the original price of the coat?

Answer: $120 = \frac{2}{3}p$; The original price was $180.

660. Sean took the bus from Seattle to Bois e, a distance of 506 miles. If the trip took $7\frac{2}{3}$ hours, what was the speed of the bus?

Answer: $506 = \frac{23}{3}r$; The rate of the bus was 66 miles per hour.

Elementary Algebra
3: Math Models
3.1 Use a Problem-Solving Strategy

Use the Approach Word Problems with a Positive Attitude For the following exercises, prepare the lists described.

1. List five positive thoughts you can say to yourself that will help you approach word problems with a positive attitude. You may want to copy them on a sheet of paper and put it in the front of your notebook, where you can read them often.

Answer: Answers will vary

2. List five negative thoughts that you have said to yourself in the past that will hinder your progress on word problems. You may want to write each one on a small piece of paper and rip it up to symbolically destroy the negative thoughts.

Answer: Answers will vary

Use a Problem-Solving Strategy for Word Problems In the following exercises, solve using the problem solving strategy for word problems. Remember to write a complete sentence to answer each question.

3. Two-thirds of the children in the fourth-grade class are girls. If there are 20 girls, what is the total number of children in the class?

Answer: 30

4. Three-fifths of the members of the school choir are women. If there are 24 women, what is the total number of choir members?

Answer: 40

5. Zachary has 25 country music CDs, which is one-fifth of his CD collection. How many CDs does Zachary have?

Answer: 125

6. One-fourth of the candies in a bag of M&M's are red. If there are 23 red candies, how many candies are in the bag?

Answer: 92

7. There are 16 girls in a school club. The number of girls is four more than twice the number of boys. Find the number of boys.

Answer: 6

8. There are 18 Cub Scouts in Pack 645. The number of scouts is three more than five times the number of adult leaders. Find the number of adult leaders.

Answer: 3

9. Huong is organizing paperback and hardback books for her club's used book sale. The number of paperbacks is 12 less than three times the number of hardbacks. Huong had 162 paperbacks. How many hardback books were there?
Answer: 58

10. Jeff is lining up children's and adult bicycles at the bike shop where he works. The number of children's bicycles is nine less than three times the number of adult bicycles. There are 42 adult bicycles. How many children's bicycles are there?
Answer: 117

11. Philip pays $1,620 in rent every month. This amount is $120 more than twice what his brother Paul pays for rent. How much does Paul pay for rent?
Answer: $750

12. Marc just bought an SUV for $54,000. This is $7,400 less than twice what his wife paid for her car last year. How much did his wife pay for her car?
Answer: $30,700

13. Laurie has $46,000 invested in stocks and bonds. The amount invested in stocks is $8,000 less than three times the amount invested in bonds. How much does Laurie have invested in bonds?
Answer: $13,500

14. Erica earned a total of $50,450 last year from her two jobs. The amount she earned from her job at the store was $1,250 more than three times the amount she earned from her job at the college. How much did she earn from her job at the college?
Answer: $16,400

Solve Number Problems In the following exercises, solve each number word problem.

15. The sum of a number and eight is 12. Find the number.
Answer: 4

16. The sum of a number and nine is 17. Find the number.
Answer: 8

17. The difference of a number and 12 is three. Find the number.
Answer: 15

18. The difference of a number and eight is four. Find the number.
Answer: 12

19. The sum of three times a number and eight is 23. Find the number.
Answer: 5

20. The sum of twice a number and six is 14. Find the number.
Answer: 4

21. The difference of twice a number and seven is 17. Find the number.
Answer: 12

22. The difference of four times a number and seven is 21. Find the number.
Answer: 7

23. Three times the sum of a number and nine is 12. Find the number.
Answer: -5

24. Six times the sum of a number and eight is 30. Find the number.
Answer: -3

25. One number is six more than the other. Their sum is 42. Find the numbers.
Answer: 18, 24

26. One number is five more than the other. Their sum is 33. Find the numbers.
Answer: 14, 19

27. The sum of two numbers is 20. One number is four less than the other. Find the numbers.
Answer: 8, 12

28. The sum of two numbers is 27. One number is seven less than the other. Find the numbers.
Answer: 10, 17

29. The sum of two numbers is -45. One number is nine more than the other. Find the numbers.
Answer: $-18,\ -27$

30. The sum of two numbers is -61. One number is 35 more than the other. Find the numbers.
Answer: $-13,\ -48$

31. The sum of two numbers is -316. One number is 94 less than the other. Find the numbers.
Answer: $-111,\ -205$

32. The sum of two numbers is -284. One number is 62 less than the other. Find the numbers.
Answer: $-111,\ -173$

33. One number is 14 less than another. If their sum is increased by seven, the result is 85. Find the numbers.
Answer: 32, 46

34. One number is 11 less than another. If their sum is increased by eight, the result is 71. Find the numbers.
Answer: 26, 37

35. One number is five more than another. If their sum is increased by nine, the result is 60. Find the numbers.
Answer: 23, 28

36. One number is eight more than another. If their sum is increased by 17, the result is 95. Find the numbers.
Answer: 35, 43

37. One number is one more than twice another. Their sum is -5. Find the numbers.
Answer: $-2,\ -3$

38. One number is six more than five times another. Their sum is six. Find the numbers.
Answer: 0, 6

39. The sum of two numbers is 14. One number is two less than three times the other. Find the numbers.
Answer: 4, 10

40. The sum of two numbers is zero. One number is nine less than twice the other. Find the numbers.
Answer: $3,\ -3$

41. The sum of two consecutive integers is 77. Find the integers.
Answer: 38, 39

42. The sum of two consecutive integers is 89. Find the integers.
Answer: 44, 45

43. The sum of two consecutive integers is -23. Find the integers.
Answer: $-11,\ -12$

44. The sum of two consecutive integers is -37. Find the integers.
Answer: $-18,\ -19$

45. The sum of three consecutive integers is 78. Find the integers.
Answer: 25, 26, 27

46. The sum of three consecutive integers is 60. Find the integers.
Answer: 19, 20, 21

47. Find three consecutive integers whose sum is -36.
Answer: $-11,\ -12,\ -13$

48. Find three consecutive integers whose sum is -3.
Answer: $0,\ -1,\ -2$

49. Find three consecutive even integers whose sum is 258.
Answer: 84, 86, 88

50. Find three consecutive even integers whose sum is 222.
Answer: 72, 74, 76

51. Find three consecutive odd integers whose sum is 171.
Answer: 55, 57, 59

52. Find three consecutive odd integers whose sum is 291.
Answer: 95, 97, 99

53. Find three consecutive even integers whose sum is -36.
Answer: $-10,\ -12,\ -14$

54. Find three consecutive even integers whose sum is -84.
Answer: $-26,\ -28,\ -30$

55. Find three consecutive odd integers whose sum is -213.
Answer: $-69,\ -71,\ -73$

56. Find three consecutive odd integers whose sum is -267.
Answer: $-87,\ -89,\ -91$

Everyday Math

57. **Sale Price** Patty paid $35 for a purse on sale for $10 off the original price. What was the original price of the purse?
Answer: $45

58. **Sale Price** Travis bought a pair of boots on sale for $25 off the original price. He paid $60 for the boots. What was the original price of the boots?
Answer: $85

59. **Buying in Bulk** Minh spent $6.25 on five sticker books to give his nephews. Find the cost of each sticker book.
Answer: $1.25

60. **Buying in Bulk** Alicia bought a package of eight peaches for $3.20. Find the cost of each peach.
Answer: $0.40

61. **Price before Sales Tax** Tom paid $1,166.40 for a new refrigerator, including $86.40 tax. What was the price of the refrigerator?
Answer: $1080

62. **Price before Sales Tax** Kenji paid $2,279 for a new living room set, including $129 tax. What was the price of the living room set?
Answer: $2150

Writing Exercises

63. What has been your past experience solving word problems?
Answer: answers will vary

64. When you start to solve a word problem, how do you decide what to let the variable represent?
Answer: answers may vary

65. What are consecutive odd integers? Name three consecutive odd integers between 50 and 60.
Answer: Consecutive odd integers are odd numbers that immediately follow each other. An example of three consecutive odd integers between 50 and 60 would be 51, 53, and 55.

66. What are consecutive even integers? Name three consecutive even integers between -50 and -40.
Answer: Consecutive even integers are even numbers that immediately follow each other. An example of three consecutive even integers between -40 and -50 would be $-42,\ -44,$ and -46.

Elementary Algebra
3: Math Models
3.2 Solve Percent Applications

Translate and Solve Basic Percent Equations In the following exercises, translate and solve.

67. What number is 45% of 120?
Answer: 54

68. What number is 65% of 100?
Answer: 65

69. What number is 24% of 112?
Answer: 26.88

70. What number is 36% of 124?
Answer: 44.64

71. 250% of 65 is what number?
Answer: 162.5

72. 150% of 90 is what number?
Answer: 135

73. 800% of 2250 is what number?
Answer: 18,000

74. 600% of 1740 is what number?
Answer: 10,440

75. 28 is 25% of what number?
Answer: 112

76. 36 is 25% of what number?
Answer: 144

77. 81 is 75% of what number?
Answer: 108

78. 93 is 75% of what number?
Answer: 124

79. 8.2% of what number is $2.87?
Answer: $35

80. 6.4% of what number is $2.88?
Answer: $45

81. 11.5% of what number is $108.10?
Answer: $940

82. 12.3% of what number is $92.25?
Answer: $750

83. What percent of 260 is 78?
Answer: 30%

84. What percent of 215 is 86?
Answer: 40%

85. What percent of 1500 is 540?
Answer: 36%

86. What percent of 1800 is 846?
Answer: 47%

87. 30 is what percent of 20?
Answer: 150%

88. 50 is what percent of 40?
Answer: 125%

89. 840 is what percent of 480?
Answer: 175%

90. 790 is what percent of 395?
Answer: 200%

Solve Percent Applications For the following exercises, solve.

91. Geneva treated her parents to dinner at their favorite restaurant. The bill was $74.25. Geneva wants to leave 16% of the total bill as a tip. How much should the tip be?
Answer: $11.88

92. When Hiro and his co-workers had lunch at a restaurant near their work, the bill was $90.50. They want to leave 18% of the total bill as a tip. How much should the tip be?
Answer: $16.29

93. Trong has 12% of each paycheck automatically deposited to his savings account. His last paycheck was $2165. How much money was deposited to Trong's savings account?
Answer: $259.80

94. Cherise deposits 8% of each paycheck into her retirement account. Her last paycheck was $1,485. How much did Cherise deposit into her retirement account?
Answer: $118.80

95. One serving of oatmeal has eight grams of fiber, which is 33% of the recommended daily amount. What is the total recommended daily amount of fiber?
Answer: 24.2 g

96. One serving of trail mix has 67 grams of carbohydrates, which is 22% of the recommended daily amount. What is the total recommended daily amount of carbohydrates?
Answer: 304.5 g

97. A bacon cheeseburger at a popular fast food restaurant contains 2070 milligrams (mg) of sodium, which is 86% of the recommended daily amount. What is the total recommended daily amount of sodium?
Answer: 2407 mg

98. A grilled chicken salad at a popular fast food restaurant contains 650 milligrams (mg) of sodium, which is 27% of the recommended daily amount. What is the total recommended daily amount of sodium?
Answer: 2407 mg

99. After 3 months on a diet, Lisa had lost 12% of her original weight. She lost 21 pounds. What was Lisa's original weight?
Answer: 175 lb.

100. Tricia got a 6% raise on her weekly salary. The raise was $30 per week. What was her original salary?
Answer: $500

101. Yuki bought a dress on sale for $72. The sale price was 60% of the original price. What was the original price of the dress?
Answer: $120

102. Kim bought a pair of shoes on sale for $40.50. The sale price was 45% of the original price. What was the original price of the shoes?
Answer: $90

103. Tim left a $9 tip for a $50 restaurant bill. What percent tip did he leave?
Answer: 18%

104. Rashid left a $15 tip for a $75 restaurant bill. What percent tip did he leave?
Answer: 20%

105. The nutrition fact sheet at a fast food restaurant says the fish sandwich has 380 calories, and 171 calories are from fat. What percent of the total calories is from fat?
Answer: 45%

106. The nutrition fact sheet at a fast food restaurant says a small portion of chicken nuggets has 190 calories, and 114 calories are from fat. What percent of the total calories is from fat?
Answer: 60%

107. Emma gets paid $3,000 per month. She pays $750 a month for rent. What percent of her monthly pay goes to rent?
Answer: 25%

108. Dimple gets paid $3,200 per month. She pays $960 a month for rent. What percent of her monthly pay goes to rent?
Answer: 30%

Find Percent Increase and Percent Decrease For the following exercises, solve.

109. Tamanika got a raise in her hourly pay, from $15.50 to $17.36. Find the percent increase.
Answer: 12%

110. Ayodele got a raise in her hourly pay, from $24.50 to $25.48. Find the percent increase.
Answer: 4%

111. Annual student fees at the University of California rose from about $4,000 in 2000 to about $12,000 in 2010. Find the percent increase.
Answer: 200%

112. The price of a share of one stock rose from $12.50 to $50. Find the percent increase.
Answer: 300%

113. According to *Time* magazine annual global seafood consumption rose from 22 pounds per person in the 1960s to 38 pounds per person in 2011. Find the percent increase. (Round to the nearest tenth of a percent.)
Answer: 72.7%

114. In one month, the median home price in the Northeast rose from $225,400 to $241,500. Find the percent increase. (Round to the nearest tenth of a percent.)
Answer: 71.4%

115. A grocery store reduced the price of a loaf of bread from $2.80 to $2.73. Find the percent decrease.
Answer: 2.5%

116. The price of a share of one stock fell from $8.75 to $8.54. Find the percent decrease.
Answer: 2.4%

117. Hernando's salary was $49,500 last year. This year his salary was cut to $44,055. Find the percent decrease.
Answer: 11%

118. In 10 years, the population of Detroit fell from 950,000 to about 712,500. Find the percent decrease.
Answer: 25%

119. In 1 month, the median home price in the West fell from $203,400 to $192,300. Find the percent decrease. (Round to the nearest tenth of a percent.)
Answer: 5.5%

120. Sales of video games and consoles fell from $1,150 million to $1,030 million in 1 year. Find the percent decrease. (Round to the nearest tenth of a percent.)
Answer: 10.4%

Solve Simple Interest Applications For the following exercises, solve.

121. Casey deposited $1,450 in a bank account with interest rate 4%. How much interest was earned in two years?
Answer: $116

122. Terrence deposited $5,720 in a bank account with interest rate 6%. How much interest was earned in 4 years?
Answer: $1,372.80

123. Robin deposited $31,000 in a bank account with interest rate 5.2%. How much interest was earned in 3 years?
Answer: $4,836

124. Carleen deposited $16,400 in a bank account with interest rate 3.9%. How much interest was earned in 8 years?
Answer: $5,116.80

125. Hilaria borrowed $8,000 from her grandfather to pay for college. Five years later, she paid him back the $8,000, plus $1,200 interest. What was the rate of interest?
Answer: 3%

126. Kenneth loaned his niece $1,200 to buy a computer. Two years later, she paid him back the $1,200, plus $96 interest. What was the rate of interest?
Answer: 4%

127. Lebron loaned his daughter $20,000 to help her buy a condominium. When she sold the condominium four years later, she paid him the $20,000, plus $3,000 interest. What was the rate of interest?
Answer: 3.75%

128. Pablo borrowed $50,000 to start a business. Three years later, he repaid the $50,000, plus $9,375 interest. What was the rate of interest?
Answer: 6.25%

129. In 10 years, a bank account that paid 5.25% earned $18,375 interest. What was the principal of the account?
Answer: $35,000

130. In 25 years, a bond that paid 4.75% earned $2,375 interest. What was the principal of the bond?
Answer: $2,000

131. Joshua's computer loan statement said he would pay $1,244.34 in interest for a 3-year loan at 12.4%. How much did Joshua borrow to buy the computer?
Answer: $3,345

132. Margaret's car loan statement said she would pay $7,683.20 in interest for a 5-year loan at 9.8%. How much did Margaret borrow to buy the car?
Answer: $15,680

Solve Applications with Discount or Mark-up For the following exercises, find the sale price.

133. Perla bought a cell phone that was on sale for $50 off. The original price of the cell phone was $189.
Answer: $139

134. Sophie saw a dress she liked on sale for $15 off. The original price of the dress was $96.
Answer: $81

135. Rick wants to buy a tool set with original price $165. Next week the tool set will be on sale for $40 off.
Answer: $125

136. Angelo's store is having a sale on televisions. One television, with original price $859, is selling for $125 off.
Answer: $734

For the following exercises, find (a) the amount of discount and (b) the sale price.

137. Janelle bought a beach chair on sale at 60% off. The original price was $44.95.
Answer: (a) $26.97 (b) $17.98

138. Errol bought a skateboard helmet on sale at 40% off. The original price was $49.95.
Answer: (a)$19.98(b) $29.97

139. Kathy wants to buy a camera that lists for $389. The camera is on sale with a 33% discount.
Answer: (a) $128.37 (b) $260.63

140. Colleen bought a suit that was discounted 25% from an original price of $245.
Answer: (a) $61.25 (b) $183.75

141. Erys bought a treadmill on sale at 35% off. The original price was $949.95 (round to the nearest cent.)
Answer: (a) $332.48 (b) $617.47

142. Jay bought a guitar on sale at 45% off. The original price was $514.75 (round to the nearest cent.)
Answer: (a) $231.64 (b) $283.11

For the following exercises, find (a) the amount of discount and (b) the discount rate. (Round to the nearest tenth of a percent if needed.)

143. Larry and Donna bought a sofa at the sale price of $1,344. The original price of the sofa was $1,920.
Answer: (a) $576 (b) 30%

144. Hiroshi bought a lawnmower at the sale price of $240. The original price of the lawnmower is $300.
Answer: (a) $60 (b) 20%

145. Patty bought a baby stroller on sale for $301.75. The original price of the stroller was $355.
Answer: (a) $53.25 (b) 15%

146. Bill found a book he wanted on sale for $20.80. The original price of the book was $32.
Answer: (a) $11.20 (b) 35%

147. Nikki bought a patio set on sale for $480. The original price was $850. To the nearest tenth of a percent, what was the rate of discount?
Answer: (a) $370 (b) 43.5%

148. Stella bought a dinette set on sale for $725. The original price was $1299. To the nearest tenth of a percent, what was the rate of discount?
Answer: (a) $574 (b) 44.2%

For the following exercises, find (a) the amount of the mark-up and (b) the list price.

149. Daria bought a bracelet at original cost $16 to sell in her handicraft store. She marked the price up 45%.
Answer: (a) $7.20 (b) $23.20

150. Regina bought a handmade quilt at original cost $120 to sell in her quilt store. She marked the price up 55%.
Answer: (a) $66 (b) $186

151. Tom paid $0.60 a pound for tomatoes to sell at his produce store. He added a 33% mark-up.
Answer: (a) $0.20 (b) $0.80

152. Flora paid her supplier $0.74 a stem for roses to sell at her flower shop. She added an 85% mark-up.
Answer: (a) $0.63 (b) $1.37

153. Alan bought a used bicycle for $115. After re-conditioning it, he added 225% mark-up and then advertised it for sale.
Answer: (a) $258.75 (b) $373.75

154. Michael bought a classic car for $8500. He restored it, then added 150% mark-up before advertising it for sale.
Answer: (a) $12,750 (b) $21,250

Everyday Math

155. At the campus coffee cart, a medium coffee costs $1.65. MaryAnne brings $2.00 with her when she buys a cup of coffee and leaves the change as a tip. What percent tip does she leave?
Answer: 21.2%

156. Four friends went out to lunch and the bill came to $53.75. They decided to add enough tip to make a total of $64, so that they could easily split the bill evenly among themselves. What percent tip did they leave?
Answer: 19%

Writing Exercises

157. Without solving the problem “44 is 80% of what number” think about what the solution might be. Should it be a number that is greater than 44 or less than 44? Explain your reasoning.

Answer: The number should be greater than 44. Since 80% equals 0.8 in decimal form, 0.8 is less than one, and we must multiply the number by 0.8 to get 44, the number must be greater than 44.

158. Without solving the problem “What is 20% of 300?” think about what the solution might be. Should it be a number that is greater than 300 or less than 300? Explain your reasoning.

Answer: The number should be less than 300. Since 20% equals 0.2 in decimal form, 0.2 is less than one, and we must multiply 300 by 0.2 to get the number, the number must be less than 300.

159. After returning from vacation, Alex said he should have packed 50% fewer shorts and 200% more shirts. Explain what Alex meant.

Answer: He meant that he should have packed half the shorts and twice the shirts.

160. Because of road construction in one city, commuters were advised to plan that their Monday morning commute would take 150% of their usual commuting time. Explain what this means.

Answer: This means that the commute will take 50% longer than usual. For example, if the normal commute is one hour, they should expect their commute on Monday morning to be an hour and a half.

Elementary Algebra
3: Math Models
3.3 Solve Mixture Applications

Solve Coin Word Problems In the following exercises, solve each coin word problem.

161. Jaime has $2.60 in dimes and nickels. The number of dimes is 14 more than the number of nickels. How many of each coin does he have?
Answer: 8 nickels, 22 dimes

162. Lee has $1.75 in dimes and nickels. The number of nickels is 11 more than the number of dimes. How many of each coin does he have?
Answer: 8 dimes, 19 nickels

163. Ngo has a collection of dimes and quarters with a total value of $3.50. The number of dimes is seven more than the number of quarters. How many of each coin does he have?
Answer: 15 dimes, 8 quarters

164. Connor has a collection of dimes and quarters with a total value of $6.30. The number of dimes is 14 more than the number of quarters. How many of each coin does he have?
Answer: 28 dimes, 14 quarters

165. A cash box of $1 and $5 bills is worth $45. The number of $1 bills is three more than the number of $5 bills. How many of each bill does it contain?
Answer: 10 at $1, 7 at $5

166. Joe's wallet contains $1 and $5 bills worth $47. The number of $1 bills is five more than the number of $5 bills. How many of each bill does he have?
Answer: 12 at $1, 7 at $5

167. Rachelle has $6.30 in nickels and quarters in her coin purse. The number of nickels is twice the number of quarters. How many coins of each type does she have?
Answer: 18 quarters, 36 nickels

168. Deloise has $1.20 in pennies and nickels in a jar on her desk. The number of pennies is three times the number of nickels. How many coins of each type does she have?
Answer: 15 nickels, 45 pennies

169. Harrison has $9.30 in his coin collection, all in pennies and dimes. The number of dimes is three times the number of pennies. How many coins of each type does he have?
Answer: 30 pennies, 90 dimes

170. Ivan has $8.75 in nickels and quarters in his desk drawer. The number of nickels is twice the number of quarters. How many coins of each type does he have?
Answer: 25 quarters, 50 nickels

171. In a cash drawer there is $125 in $5 and $10 bills. The number of $10 bills is twice the number of $5 bills. How many of each are in the drawer?
Answer: 10 at $10, 5 at $5

172. John has $175 in $5 and $10 bills in his drawer. The number of $5 bills is three times the number of $10 bills. How many of each are in the drawer?
Answer: 7 at $10, 21 at $5

173. Carolyn has $2.55 in her purse in nickels and dimes. The number of nickels is nine less than three times the number of dimes. Find the number of each type of coin.
Answer: 12 dimes and 27 nickels

174. Julio has $2.75 in his pocket in nickels and dimes. The number of dimes is 10 less than twice the number of nickels. Find the number of each type of coin.
Answer: 15 nickels, 20 dimes

175. Chi has $11.30 in dimes and quarters. The number of dimes is three more than three times the number of quarters. How many of each are there?
Answer: 63 dimes, 20 quarters

176. Tyler has $9.70 in dimes and quarters. The number of quarters is eight more than four times the number of dimes. How many of each coin does he have?
Answer: 7 dimes, 36 quarters

177. Mukul has $3.75 in quarters, dimes and nickels in his pocket. He has five more dimes than quarters and nine more nickels than quarters. How many of each coin are in his pocket?
Answer: 16 nickels, 12 dimes, 7 quarters

178. Vina has $4.70 in quarters, dimes and nickels in her purse. She has eight more dimes than quarters and six more nickels than quarters. How many of each coin are in her purse?
Answer: 15 nickels, 17 dimes, 9 quarters

Solve Ticket and Stamp Word Problems In the following exercises, solve each ticket or stamp word problem.

179. The school play sold $550 in tickets one night. The number of $8 adult tickets was 10 less than twice the number of $5 child tickets. How many of each ticket were sold?
Answer: 30 child tickets, 50 adult tickets

180. If the number of $8 child tickets is seventeen less than three times the number of $12 adult tickets and the theater took in $584, how many of each ticket were sold?
Answer: 43 child tickets, 20 adult tickets

181. The movie theater took in $1,220 one Monday night. The number of $7 child tickets was ten more than twice the number of $9 adult tickets. How many of each were sold?
Answer: 110 child tickets, 50 adult tickets

182. The ball game sold $1,340 in tickets one Saturday. The number of $12 adult tickets was 15 more than twice the number of $5 child tickets. How many of each were sold?
Answer: 40 child tickets, 95 adult tickets

183. The ice rink sold 95 tickets for the afternoon skating session, for a total of $828. General admission tickets cost $10 each and youth tickets cost $8 each. How many general admission tickets and how many youth tickets were sold?
Answer: 34 general, 61 youth

184. For the 7:30 show time, 140 movie tickets were sold. Receipts from the $13 adult tickets and the $10 senior tickets totaled $1,664. How many adult tickets and how many senior tickets were sold?
Answer: 88 adult, 52 senior

185. The box office sold 360 tickets to a concert at the college. The total receipts were $4170. General admission tickets cost $15 and student tickets cost $10. How many of each kind of ticket was sold?
Answer: 114 general, 246 student

186. Last Saturday, the museum box office sold 281 tickets for a total of $3954. Adult tickets cost $15 and student tickets cost $12. How many of each kind of ticket was sold?
Answer: 87 student, 194 adult

187. Julie went to the post office and bought both $0.41 stamps and $0.26 postcards. She spent $51.40. The number of stamps was 20 more than twice the number of postcards. How many of each did she buy?
Answer: 40 postcards, 100 stamps

188. Jason went to the post office and bought both $0.41 stamps and $0.26 postcards and spent $10.28. The number of stamps was four more than twice the number of postcards. How many of each did he buy?
Answer: 8 postcards, 20 stamps

189. Maria spent $12.50 at the post office. She bought three times as many $0.41 stamps as $0.02 stamps. How many of each did she buy?
Answer: 30 at $0.41, 10 at $0.02

190. Hector spent $33.20 at the post office. He bought four times as many $0.41 stamps as $0.02 stamps. How many of each did he buy?
Answer: 80 at $0.41, 20 at $0.02

191. Hilda has $210 worth of $10 and $12 stock shares. The numbers of $10 shares is five more than twice the number of $12 shares. How many of each does she have?
Answer: 15 $10 shares, 5 $12 shares

192. Mario invested $475 in $45 and $25 stock shares. The number of $25 shares was five less than three times the number of $45 shares. How many of each type of share did he buy?
Answer: 10 at $25, 5 at $45

Solve Mixture Word Problems In the following exercises, solve each mixture word problem.

193. Lauren in making 15 liters of mimosas for a brunch banquet. Orange juice costs her $1.50 per liter and champagne costs her $12 per liter. How many liters of orange juice and how many liters of champagne should she use for the mimosas to cost Lauren $5 per liter?
Answer: 5 liters champagne, 10 liters orange juice

194. Macario is making 12 pounds of nut mixture with macadamia nuts and almonds. Macadamia nuts cost $9 per pound and almonds cost $5.25 per pound. How many pounds of macadamia nuts and how many pounds of almonds should Macario use for the mixture to cost $6.50 per pound to make?
Answer: 4 pounds macadamia nuts, 8 pounds almonds

195. Kaapo is mixing Kona beans and Maui beans to make 25 pounds of coffee blend. Kona beans cost Kaapo $15 per pound and Maui beans cost $24 per pound. How many pounds of each coffee bean should Kaapo use for his blend to cost him $17.70 per pound?
Answer: 7.5 lbs Maui beans, 17.5 Kona beans

196. Estelle is making 30 pounds of fruit salad from strawberries and blueberries. Strawberries cost $1.80 per pound and blueberries cost $4.50 per pound. If Estelle wants the fruit salad to cost her $2.52 per pound, how many pounds of each berry should she use?
Answer: 22 lb. strawberries, 8 lb. blueberries

197. Carmen wants to tile the floor of his house. He will need 1000 square feet of tile. He will do most of the floor with a tile that costs $1.50 per square foot, but also wants to use an accent tile that costs $9.00 per square foot. How many square feet of each tile should he plan to use if he wants the overall cost to be $3 per square foot?
Answer: 800 at $1.50, 200 at $9.00

198. Riley is planning to plant a lawn in his yard. He will need nine pounds of grass seed. He wants to mix Bermuda seed that costs $4.80 per pound with Fescue seed that costs $3.50 per pound. How much of each seed should he buy so that the overall cost will be $4.02 per pound?
Answer: 3.6 lb. Bermuda seed, 5.4 lb. Fescue seed

199. Vartan was paid $25,000 for a cell phone app that he wrote and wants to invest it to save for his son's education. He wants to put some of the money into a bond that pays 4% annual interest and the rest into stocks that pay 9% annual interest. If he wants to earn 7.4% annual interest on the total amount, how much money should he invest in each account?
Answer: $8,000 at 4%, $17,000 at 9%

200. Vern sold his 1964 Ford Mustang for $55,000 and wants to invest the money to earn him 5.8% interest per year. He will put some of the money into Fund A that earns 3% per year and the rest in Fund B that earns 10% per year. How much should he invest into each fund if he wants to earn 5.8% interest per year on the total amount?
Answer: $33,000 in Fund A, $22,000 in Fund B

201. Stephanie inherited $40,000. She wants to put some of the money in a certificate of deposit that pays 2.1% interest per year and the rest in a mutual fund account that pays 6.5% per year. How much should she invest in each account if she wants to earn 5.4% interest per year on the total amount?
Answer: $10,000 in CD, $30,000 in mutual fund

202. Avery and Caden have saved $27,000 towards a down payment on a house. They want to keep some of the money in a bank account that pays 2.4% annual interest and the rest in a stock fund that pays 7.2% annual interest. How much should they put into each account so that they earn 6% interest per year?
Answer: $6750 bank account, $20,250 stock fund

203. Dominic pays 7% interest on his $15,000 college loan and 12% interest on his $11,000 car loan. What average interest rate does he pay on the total $26,000 he owes? (Round your answer to the nearest tenth of a percent.)
Answer: 9.1%

204. Liam borrowed a total of $35,000 to pay for college. He pays his parents 3% interest on the $8,000 he borrowed from them and pays the bank 6.8% on the rest. What average interest rate does he pay on the total $35,000? (Round your answer to the nearest tenth of a percent.)
Answer: 5.9%

Everyday Math

205. As the treasurer of her daughter's Girl Scout troop, Laney collected money for some girls and adults to go to a 3-day camp. Each girl paid $75 and each adult paid $30. The total amount of money collected for camp was $765. If the number of girls is three times the number of adults, how many girls and how many adults paid for camp?
Answer: 9 girls, 3 adults

206. Laurie was completing the treasurer's report for her son's Boy Scout troop at the end of the school year. She didn't remember how many boys had paid the $15 full-year registration fee and how many had paid the $10 partial-year fee. She knew that the number of boys who paid for a full-year was ten more than the number who paid for a partial-year. If $250 was collected for all the registrations, how many boys had paid the full-year fee and how many had paid the partial-year fee?

Answer: 14 full-year, 4 partial-year

Writing Exercises

207. Suppose you have six quarters, nine dimes, and four pennies. Explain how you find the total value of all the coins.

Answer: Answers will vary.

208. Do you find it helpful to use a table when solving coin problems? Why or why not?

Answer: Answers will vary.

209. In the table used to solve coin problems, one column is labeled "number" and another column is labeled "value." What is the difference between the "number" and the "value?"

Answer: Answers will vary.

210. What similarities and differences did you see between solving the coin problems and the ticket and stamp problems?

Answer: Answers will vary.

Elementary Algebra
3: Math Models
3.4 Solve Geometric Applications: Triangles, Rectangles and the Pythagorean Theorem

Solving Applications Using Triangle Properties In the following exercises, solve using triangle properties.

211. The measures of two angles of a triangle are 26 and 98 degrees. Find the measure of the third angle.
Answer: 56 degrees

212. The measures of two angles of a triangle are 61 and 84 degrees. Find the measure of the third angle.
Answer: 35 degrees

213. The measures of two angles of a triangle are 105 and 31 degrees. Find the measure of the third angle.
Answer: 44 degrees

214. The measures of two angles of a triangle are 47 and 72 degrees. Find the measure of the third angle.
Answer: 61 degrees

215. The perimeter of a triangular pool is 36 yards. The lengths of two sides are 10 yards and 15 yards. How long is the third side?
Answer: 11 feet

216. A triangular courtyard has perimeter 120 meters. The lengths of two sides are 30 meters and 50 meters. How long is the third side?
Answer: 40 meters

217. If a triangle has sides 6 feet and 9 feet and the perimeter is 23 feet, how long is the third side?
Answer: 8 feet

218. If a triangle has sides 14 centimeters and 18 centimeters and the perimeter is 49 centimeters, how long is the third side?
Answer: 17 centimeters

219. A triangular flag has base one foot and height 1.5 foot. What is its area?
Answer: 0.75 sq. ft.

220. A triangular window has base eight feet and height six feet. What is its area?
Answer: 24 sq. ft.

221. What is the base of a triangle with area 207 square inches and height 18 inches?
Answer: 23 inches

222. What is the height of a triangle with area 893 square inches and base 38 inches?
Answer: 47 inches

223. One angle of a right triangle measures 33 degrees. What is the measure of the other acute angle?
Answer: 57

224. One angle of a right triangle measures 51 degrees. What is the measure of the other acute angle?
Answer: 39

225. One angle of a right triangle measures 22.5 degrees. What is the measure of the other acute angle?
Answer: 67.5

226. One angle of a right triangle measures 36.5 degrees. What is the measure of the other acute angle?
Answer: 53.5

227. The perimeter of a triangle is 39 feet. One side of the triangle is one foot longer than the second side. The third side is two feet longer than the second side. Find the length of each side.
Answer: 13 ft., 12 ft., 14 ft.

228. The perimeter of a triangle is 35 feet. One side of the triangle is five feet longer than the second side. The third side is three feet longer than the second side. Find the length of each side.
Answer: 14 ft., 9 ft., 12 ft.

229. One side of a triangle is twice the shortest side. The third side is five feet more than the shortest side. The perimeter is 17 feet. Find the lengths of all three sides.
Answer: 3 ft., 6 ft., 8 ft.

230. One side of a triangle is three times the shortest side. The third side is three feet more than the shortest side. The perimeter is 13 feet. Find the lengths of all three sides.
Answer: 2 ft., 6 ft., 5 ft.

231. The two smaller angles of a right triangle have equal measures. Find the measures of all three angles.
Answer: $45^\circ, 45^\circ, 90^\circ$

232. The measure of the smallest angle of a right triangle is 20° less than the measure of the next larger angle. Find the measures of all three angles.

Answer: $35^\circ, 55^\circ, 90^\circ$

233. The angles in a triangle are such that one angle is twice the smallest angle, while the third angle is three times as large as the smallest angle. Find the measures of all three angles.

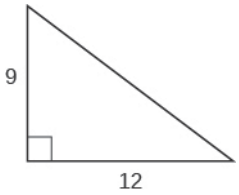
Answer: $30^\circ, 60^\circ, 90^\circ$

234. The angles in a triangle are such that one angle is 20° more than the smallest angle, while the third angle is three times as large as the smallest angle. Find the measures of all three angles.

Answer: $32^\circ, 52^\circ, 96^\circ$

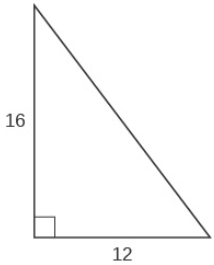
Use the Pythagorean Theorem In the following exercises, use the Pythagorean Theorem to find the length of the hypotenuse.

235.



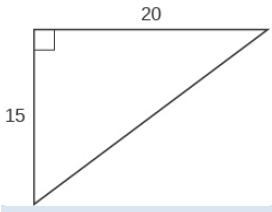
Answer: 15

236.



Answer: 20

237.



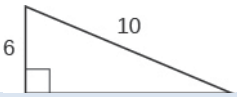
Answer: 25

238.

Answer: 13

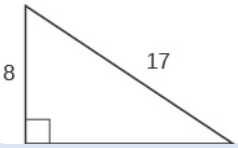
In the following exercises, use the Pythagorean Theorem to find the length of the leg. Round to the nearest tenth, if necessary.

239.



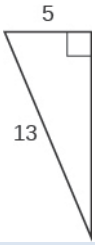
Answer: 8

240.



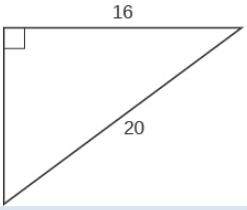
Answer: 15

241.



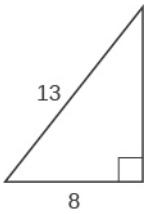
Answer: 12

242.



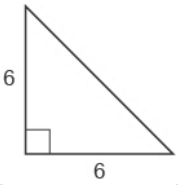
Answer: 12

243.



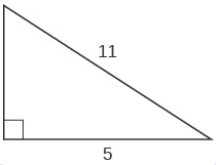
Answer: 10.2

244.



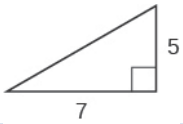
Answer: 8.5

245.



Answer: 9.8

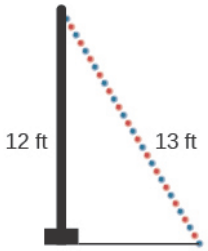
246.



Answer: 8.6

In the following exercises, solve using the Pythagorean Theorem. Approximate to the nearest tenth, if necessary.

247. A 13-foot string of lights will be attached to the top of a 12-foot pole for a holiday display, as shown below. How far from the base of the pole should the end of the string of lights be anchored?



Answer: 5 feet

248. Pam wants to put a banner across her garage door, as shown below, to congratulate her son for his college graduation. The garage door is 12 feet high and 16 feet wide. How long should the banner be to fit the garage door?

Answer: 20 feet

249. Chi is planning to put a path of paving stones through her flower garden, as shown below. The flower garden is a square with side 10 feet. What will the length of the path be?

Answer: 14.1 feet

250. Brian borrowed a 20 foot extension ladder to use when he paints his house. If he sets the base of the ladder six feet from the house, as shown below, how far up will the top of the ladder reach?

Answer: 19.1 feet

Solve Applications Using Rectangle Properties In the following exercises, solve using rectangle properties.

251. The length of a rectangle is 85 feet and the width is 45 feet. What is the perimeter?
Answer: 260 feet

252. The length of a rectangle is 26 inches and the width is 58 inches. What is the perimeter?
Answer: 168 inches

253. A rectangular room is 15 feet wide by 14 feet long. What is its perimeter?
Answer: 58 feet

254. A driveway is in the shape of a rectangle 20 feet wide by 35 feet long. What is its perimeter?
Answer: 110 feet

255. The area of a rectangle is 414 square meters. The length is 18 meters. What is the width?
Answer: 23 meters

256. The area of a rectangle is 782 square centimeters. The width is 17 centimeters. What is the length?
Answer: 46 meters

257. The width of a rectangular window is 24 inches. The area is 624 square inches. What is the length?
Answer: 26 inches

258. The length of a rectangular poster is 28 inches. The area is 1316 square inches. What is the width?
Answer: 47 inches

259. Find the length of a rectangle with perimeter 124 and width 38.
Answer: 24

260. Find the width of a rectangle with perimeter 92 and length 19.
Answer: 27

261. Find the width of a rectangle with perimeter 16.2 and length 3.2.
Answer: 4.9

262. Find the length of a rectangle with perimeter 20.2 and width 7.8.
Answer: 2.3

263. The length of a rectangle is nine inches more than the width. The perimeter is 46 inches. Find the length and the width.
Answer: 16 in., 7 in.

264. The width of a rectangle is eight inches more than the length. The perimeter is 52 inches. Find the length and the width.
Answer: 9 in., 17 in.

265. The perimeter of a rectangle is 58 meters. The width of the rectangle is five meters less than the length. Find the length and the width of the rectangle.
Answer: 17 m, 12 m

266. The perimeter of a rectangle is 62 feet. The width is seven feet less than the length. Find the length and the width.
Answer: 19 ft., 12 ft.

267. The width of the rectangle is 0.7 meters less than the length. The perimeter of a rectangle is 52.6 meters. Find the dimensions of the rectangle.
Answer: 13.5 m length, 12.8 m width

268. The length of the rectangle is 1.1 meters less than the width. The perimeter of a rectangle is 49.4 meters. Find the dimensions of the rectangle.
Answer: 12.9 m, 11.8 m width

269. The perimeter of a rectangle is 150 feet. The length of the rectangle is twice the width. Find the length and width of the rectangle.
Answer: 50 ft., 25 ft.

270. The length of a rectangle is three times the width. The perimeter of the rectangle is 72 feet. Find the length and width of the rectangle.
Answer: 27 ft., 9 ft.

271. The length of a rectangle is three meters less than twice the width. The perimeter of the rectangle is 36 meters. Find the dimensions of the rectangle.
Answer: 7 m width, 11 m length

272. The length of a rectangle is five inches more than twice the width. The perimeter is 34 inches. Find the length and width.
Answer: 13 in., 4 in.

273. The perimeter of a rectangular field is 560 yards. The length is 40 yards more than the width. Find the length and width of the field.
Answer: 160 yd., 120 yd.

274. The perimeter of a rectangular atrium is 160 feet. The length is 16 feet more than the width. Find the length and width of the atrium.
Answer: 48 ft., 32 ft.

275. A rectangular parking lot has perimeter 250 feet. The length is five feet more than twice the width. Find the length and width of the parking lot.
Answer: 85 ft., 40 ft.

276. A rectangular rug has perimeter 240 inches. The length is 12 inches more than twice the width. Find the length and width of the rug.
Answer: 84 in., 36 in.

Everyday Math

277. Christa wants to put a fence around her triangular flowerbed. The sides of the flowerbed are six feet, eight feet and 10 feet. How many feet of fencing will she need to enclose her flowerbed?
Answer: 24 feet

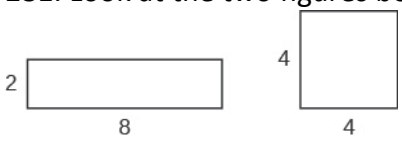
278. Jose just removed the children's playset from his back yard to make room for a rectangular garden. He wants to put a fence around the garden to keep out the dog. He has a 50 foot roll of fence in his garage that he plans to use. To fit in the backyard, the width of the garden must be 10 feet. How long can he make the other length?
Answer: 15 feet

Writing Exercises

279. If you need to put tile on your kitchen floor, do you need to know the perimeter or the area of the kitchen? Explain your reasoning.
Answer: area; answers will vary

280. If you need to put a fence around your backyard, do you need to know the perimeter or the area of the backyard? Explain your reasoning.
Answer: perimeter; answers will vary

281. Look at the two figures below.



(a) Which figure looks like it has the larger area?
(b) Which looks like it has the larger perimeter?
(c) Now calculate the area and perimeter of each figure.
(d) Which has the larger area?
(e) Which has the larger perimeter?

Answer: (a) Answers will vary. (b) Answers will vary. (c) Answers will vary. (d) The areas are the same. (e) The 2x8 rectangle has a larger perimeter than the 4x4 square.

282. Write a geometry word problem that relates to your life experience, then solve it and explain all your steps.

Answer: Answers will vary.

Elementary Algebra
3: Math Models
3.5 Solve Uniform Motion Applications

Solve Uniform Motion Applications In the following exercises, solve.

283. Lilah is moving from Portland to Seattle. It takes her three hours to go by train. Mason leaves the train station in Portland and drives to the train station in Seattle with all Lilah's boxes in his car. It takes him 2.4 hours to get to Seattle, driving at 15 miles per hour faster than the speed of the train. Find Mason's speed and the speed of the train.
Answer: Mason 75 mph, train 60 mph

284. Kathy and Cheryl are walking in a fundraiser. Kathy completes the course in 4.8 hours and Cheryl completes the course in 8 hours. Kathy walks two miles per hour faster than Cheryl. Find Kathy's speed and Cheryl's speed.
Answer: Kathy 5 mph, Cheryl 3 mph

285. Two busses go from Sacramento for San Diego. The express bus makes the trip in 6.8 hours and the local bus takes 10.2 hours for the trip. The speed of the express bus is 25 mph faster than the speed of the local bus. Find the speed of both busses.
Answer: express bus 75mph, local 50 mph

286. A commercial jet and a private airplane fly from Denver to Phoenix. It takes the commercial jet 1.1 hours for the flight, and it takes the private airplane 1.8 hours. The speed of the commercial jet is 210 miles per hour faster than the speed of the private airplane. Find the speed of both airplanes.
Answer: commercial 540 mph, private plane 330 mph

287. Saul drove his truck 3 hours from Dallas towards Kansas City and stopped at a truck stop to get dinner. At the truck stop he met Erwin, who had driven 4 hours from Kansas City towards Dallas. The distance between Dallas and Kansas City is 542 miles, and Erwin's speed was eight miles per hour slower than Saul's speed. Find the speed of the two truckers.
Answer: Saul 82 mph, Erwin 74 mph

288. Charlie and Violet met for lunch at a restaurant between Memphis and New Orleans. Charlie had left Memphis and drove 4.8 hours towards New Orleans. Violet had left New Orleans and drove 2 hours towards Memphis, at a speed 10 miles per hour faster than Charlie's speed. The distance between Memphis and New Orleans is 394 miles. Find the speed of the two drivers.
Answer: Violet 65 mph, Charlie 55 mph

289. Sisters Helen and Anne live 332 miles apart. For Thanksgiving, they met at their other sister's house partway between their homes. Helen drove 3.2 hours and Anne drove 2.8 hours. Helen's average speed was four miles per hour faster than Anne's. Find Helen's average speed and Anne's average speed.
Answer: Helen 60 mph, Anne 56 mph

290. Ethan and Leo start riding their bikes at the opposite ends of a 65-mile bike path. After Ethan has ridden 1.5 hours and Leo has ridden 2 hours, they meet on the path. Ethan's speed is six miles per hour faster than Leo's speed. Find the speed of the two bikers.
Answer: Ethan 22 mph, Leo 16 mph

291. Elvira and Aletheia live 3.1 miles apart on the same street. They are in a study group that meets at a coffee shop between their houses. It took Elvira half an hour and Aletheia two-thirds of an hour to walk to the coffee shop. Aletheia's speed is 0.6 miles per hour slower than Elvira's speed. Find both women's walking speeds.
Answer: Aletheia 2.4 mph, Elvira 3 mph

292. DaMarcus and Fabian live 23 miles apart and play soccer at a park between their homes. DaMarcus rode his bike for three-quarters of an hour and Fabian rode his bike for half an hour to get to the park. Fabian's speed was six miles per hour faster than DaMarcus' speed. Find the speed of both soccer players.
Answer: DaMarcus16 mph, Fabian 22 mph

293. Cindy and Richard leave their dorm in Charleston at the same time. Cindy rides her bicycle north at a speed of 18 miles per hour. Richard rides his bicycle south at a speed of 14 miles per hour. How long will it take them to be 96 miles apart?
Answer: 3 hours

294. Matt and Chris leave their uncle's house in Phoenix at the same time. Matt drives west on I-60 at a speed of 76 miles per hour. Chris drives east on I-60 at a speed of 82 miles per hour. How many hours will it take them to be 632 miles apart?
Answer: 4 hours

295. Two busses leave Billings at the same time. The Seattle bus heads west on I-90 at a speed of 73 miles per hour while the Chicago bus heads east at a speed of 79 miles an hour. How many hours will it take them to be 532 miles apart?
Answer: 3.5 hours

296. Two boats leave the same dock in Cairo at the same time. One heads north on the Mississippi River while the other heads south. The northbound boat travels four miles per hour. The southbound boat goes eight miles per hour. How long will it take them to be 54 miles apart?
Answer: 4.5 hours

297. Lorena walks the path around the park in 30 minutes. If she jogs, it takes her 20 minutes. Her jogging speed is 1.5 miles per hour faster than her walking speed. Find Lorena's walking speed and jogging speed.
Answer: walking 3 mph, jogging 4.5 mph

298. Julian rides his bike uphill for 45 minutes, then turns around and rides back downhill. It takes him 15 minutes to get back to where he started. His uphill speed is 3.2 miles per hour slower than his downhill speed. Find Julian's uphill and downhill speed.
Answer: uphill 1.6 mph, downhill 4.8 mph

299. Cassius drives his boat upstream for 45 minutes. It takes him 30 minutes to return downstream. His speed going upstream is three miles per hour slower than his speed going downstream. Find his upstream and downstream speeds.
Answer: upstream 6 mph, downstream 9 mph

300. It takes Darline 20 minutes to drive to work in light traffic. To come home, when there is heavy traffic, it takes her 36 minutes. Her speed in light traffic is 24 miles per hour faster than her speed in heavy traffic. Find her speed in light traffic and in heavy traffic.
Answer: light traffic 54 mph, heavy traffic 30 mph

301. At 1:30 Marlon left his house to go to the beach, a distance of 7.6 miles. He rode his skateboard until 2:15, then walked the rest of the way. He arrived at the beach at 3:00. Marlon's speed on his skateboard is 2.5 times his walking speed. Find his speed when skateboarding and when walking.
Answer: skateboarding 8 mph, walking 3.2 mph

302. Aaron left at 9:15 to drive to his mountain cabin 108 miles away. He drove on the freeway until 10:45, and then he drove on the mountain road. He arrived at 11:05. His speed on the freeway was three times his speed on the mountain road. Find Aaron's speed on the freeway and on the mountain road.
Answer: freeway 72 mph, mountain road 24 mph

303. Marisol left Los Angeles at 2:30 to drive to Santa Barbara, a distance of 95 miles. The traffic was heavy until 3:20. She drove the rest of the way in very light traffic and arrived at 4:20. Her speed in heavy traffic was 40 miles per hour slower than her speed in light traffic. Find her speed in heavy traffic and in light traffic.
Answer: heavy traffic 30mph, light traffic 70 mph

304. Lizette is training for a marathon. At 7:00 she left her house and ran until 8:15, then she walked until 11:15. She covered a total distance of 19 miles. Her running speed was five miles per hour faster than her walking speed. Find her running and walking speeds.
Answer: running 8 mph, walking 3 mph

Everyday Math

305. John left his house in Irvine at 8:35am to drive to a meeting in Los Angeles, 45 miles away. He arrived at the meeting at 9:50. At 3:30 pm, he left the meeting and drove home. He arrived home at 5:18.
(a) What was his average speed on the drive from Irvine to Los Angeles?
(b) What was his average speed on the drive from Los Angeles to Irvine?
(c) What was the total time he spent driving to and from this meeting?
(d) John drove a total of 90 miles roundtrip. Find his average speed. (Round to the nearest tenth.)
Answer: (a) 36 mph (b) 25 mph (c) 3.05 hours (d) 29.5 mph

306. Sarah wants to arrive at her friend's wedding at 3:00. The distance from Sarah's house to the wedding is 95 miles. Based on usual traffic patterns, Sarah predicts she can drive the first 15 miles at 60 miles per hour, the next 10 miles at 30 miles per hour, and the remainder of the drive at 70 miles per hour.
(a) How long will it take Sarah to drive the first 15 miles?
(b) How long will it take Sarah to drive the next 10 miles?
(c) How long will it take Sarah to drive the rest of the trip?
(d) What time should Sarah leave her house?
Answer: (a) 15 minutes (b) 20 minutes (c) 1 hour (d) 1:25

Writing Exercises

307. When solving a uniform motion problem, how does drawing a diagram of the situation help you?
Answer: Answers will vary.

308. When solving a uniform motion problem, how does creating a table help you?
Answer: Answers will vary.

Elementary Algebra
3: Math Models
3.6 Solve Applications with Linear Inequalities

Solve Applications with Linear Inequalities In the following exercises, solve.

309. Mona is planning her son's birthday party and has a budget of $285. The Fun Zone charges $19 per child. How many children can she have at the party and stay within her budget?
Answer: 15 children

310. Andre is looking at apartments with three of his friends. They want the monthly rent to be no more than $2360. If the roommates split the rent evenly among the four of them, what is the maximum rent each will pay?
Answer: $590

311. A water taxi has a maximum load of 1,800 pounds. If the average weight of one person is 150 pounds, how many people can safely ride in the water taxi?
Answer: 12 people

312. Marcela is registering for her college classes, which cost $105 per unit. How many units can she take to have a maximum cost of $1,365?
Answer: 13 units

313. Arleen got a $20 gift card for the coffee shop. Her favorite iced drink costs $3.79. What is the maximum number of drinks she can buy with the gift card?
Answer: five drinks

314. Teegan likes to play golf. He has budgeted $60 next month for the driving range. It costs him $10.55 for a bucket of balls each time he goes. What is the maximum number of times he can go to the driving range next month?
Answer: five times

315. Joni sells kitchen aprons online for $32.50 each. How many aprons must she sell next month if she wants to earn at least $1,000?
Answer: 31 aprons

316. Ryan charges his neighbors $17.50 to wash their car. How many cars must he wash next summer if his goal is to earn at least $1,500?
Answer: 86 cars

317. Keshad gets paid $2,400 per month plus 6% of his sales. His brother earns $3,300 per month. For what amount of total sales will Keshad's monthly pay be higher than his brother's monthly pay?
Answer: $15,000

318. Kimuyen needs to earn $4,150 per month in order to pay all her expenses. Her job pays her $3,475 per month plus 4% of her total sales. What is the minimum Kimuyen's total sales must be in order for her to pay all her expenses?
Answer: $16,875

319. Andre has been offered an entry-level job. The company offered him $48,000 per year plus 3.5% of his total sales. Andre knows that the average pay for this job is $62,000. What would Andre's total sales need to be for his pay to be at least as high as the average pay for this job?
Answer: $400,000

320. Nataly is considering two job offers. The first job would pay her $83,000 per year. The second would pay her $66,500 plus 15% of her total sales. What would her total sales need to be for her salary on the second offer be higher than the first?
Answer: $110,000

321. Jake's water bill is $24.80 per month plus $2.20 per ccf (hundred cubic feet) of water. What is the maximum number of ccf Jake can use if he wants his bill to be no more than $60?
Answer: 16 ccf

322. Kiyoshi's phone plan costs $17.50 per month plus $0.15 per text message. What is the maximum number of text messages Kiyoshi can use so the phone bill is no more than $56.50?
Answer: 260 messages

323. Marlon's TV plan costs $49.99 per month plus $5.49 per first-run movie. How many first-run movies can he watch if he wants to keep his monthly bill to be a maximum of $100?
Answer: nine movies

324. Kellen wants to rent a banquet room in a restaurant for her cousin's baby shower. The restaurant charges $350 for the banquet room plus $32.50 per person for lunch. How many people can Kellen have at the shower if she wants the maximum cost to be $1,500?
Answer: 35 people

325. Moshde runs a hairstyling business from her house. She charges $45 for a haircut and style. Her monthly expenses are $960. She wants to be able to put at least $1,200 per month into her savings account order to open her own salon. How many "cut & styles" must she do to save at least $1,200 per month?
Answer: 48 cut & styles

326. Noe installs and configures software on home computers. He charges $125 per job. His monthly expenses are $1,600. How many jobs must he work in order to make a profit of at least $2,400?
Answer: 32 jobs

327. Katherine is a personal chef. She charges $115 per four-person meal. Her monthly expenses are $3,150. How many four-person meals must she sell in order to make a profit of at least $1,900?
Answer: 44 meals

328. Melissa makes necklaces and sells them online. She charges $88 per necklace. Her monthly expenses are $3745. How many necklaces must she sell if she wants to make a profit of at least $1,650?
Answer: 62 necklaces

329. Five student government officers want to go to the state convention. It will cost them $110 for registration, $375 for transportation and food, and $42 per person for the hotel. There is $450 budgeted for the convention in the student government savings account. They can earn the rest of the money they need by having a car wash. If they charge $5 per car, how many cars must they wash in order to have enough money to pay for the trip?
Answer: 49 cars

330. Cesar is planning a 4-day trip to visit his friend at a college in another state. It will cost him $198 for airfare, $56 for local transportation, and $45 per day for food. He has $189 in savings and can earn $35 for each lawn he mows. How many lawns must he mow to have enough money to pay for the trip?
Answer: seven lawns

331. Alonzo works as a car detailer. He charges $175 per car. He is planning to move out of his parents' house and rent his first apartment. He will need to pay $120 for application fees, $950 for security deposit, and first and last months' rent at $1,140 per month. He has $1,810 in savings. How many cars must he detail to have enough money to rent the apartment?
Answer: 9 cars

332. Eun-Kyung works as a tutor and earns $60 per hour. She has $792 in savings. She is planning an anniversary party for her parents. She would like to invite 40 guests. The party will cost her $1,520 for food and drinks and $150 for the photographer. She will also have a favor for each of the guests, and each favor will cost $7.50. How many hours must she tutor to have enough money for the party?
Answer: 20 hours

Everyday Math

333. **Maximum Load on a Stage** In 2014, a high school stage collapsed in Fullerton, California, when 250 students got on stage for the finale of a musical production. Two dozen students were injured. The stage could support a maximum of 12,750 pounds. If the average weight of a student is assumed to be 140 pounds, what is the maximum number of students who could safely be on the stage?
Answer: 91 students

334. **Maximum Weight on a Boat** In 2004, a water taxi sank in Baltimore harbor and five people drowned. The water taxi had a maximum capacity of 3,500 pounds (25 people with average weight 140 pounds). The average weight of the 25 people on the water taxi when it sank was 168 pounds per person. What should the maximum number of people of this weight have been?

Answer: 20 people

335. **Wedding Budget** Adele and Walter found the perfect venue for their wedding reception. The cost is $9,850 for up to 100 guests, plus $38 for each additional guest. How many guests can attend if Adele and Walter want the total cost to be no more than $12,500?

Answer: 169 guests

336. **Shower Budget** Penny is planning a baby shower for her daughter-in-law. The restaurant charges $950 for up to 25 guests, plus $31.95 for each additional guest. How many guests can attend if Penny wants the total cost to be no more than $1,500?

Answer: 42 guests

Writing Exercises

337. Find your last month's phone bill and the hourly salary you are paid at your job. (If you do not have a job, use the hourly salary you would realistically be paid if you had a job.) Calculate the number of hours of work it would take you to earn at least enough money to pay your phone bill by writing an appropriate inequality and then solving it.

Answer: Answers will vary.

338. Find out how many units you have left, after this term, to achieve your college goal and estimate the number of units you can take each term in college. Calculate the number of terms it will take you to achieve your college goal by writing an appropriate inequality and then solving it.

Answer: Answers will vary.

Chapter Review

3.1 Using a Problem Solving Strategy

Approach Word Problems with a Positive Attitude In the following exercises, reflect on your approach to word problems.

339. How has your attitude towards solving word problems changed as a result of working through this chapter? Explain.
Answer: Answers will vary.

340. Did the problem-solving strategy help you solve word problems in this chapter? Explain.
Answer: Answers will vary.

Use a Problem-Solving Strategy for Word Problems In the following exercises, solve using the problem-solving strategy for word problems. Remember to write a complete sentence to answer each question.

341. Three-fourths of the people at a concert are children. If there are 87 children, what is the total number of people at the concert?
Answer: 116

342. There are nine saxophone players in the band. The number of saxophone players is one less than twice the number of tuba players. Find the number of tuba players.
Answer: five

Solve Number Problems In the following exercises, solve each number word problem.

343. The sum of a number and three is forty-one. Find the number.
Answer: 38

344. Twice the difference of a number and ten is fifty-four. Find the number.
Answer: 37

345. One number is nine less than another. Their sum is negative twenty-seven. Find the numbers.
Answer: $-18,\ -9$

346. One number is eleven more than another. If their sum is increased by seventeen, the result is 90. Find the numbers.
Answer: 31, 42

347. One number is two more than four times another. Their sum is -13. Find the numbers.
Answer: $-3,\ -10$

348. The sum of two consecutive integers is -135. Find the numbers.
Answer: $-68,\ -67$

349. Find three consecutive integers whose sum is -141.
Answer: $-48,\ -47,\ -46$

350. Find three consecutive even integers whose sum is 234.
Answer: 76, 78, 80

351. Find three consecutive odd integers whose sum is 51.
Answer: 15, 17, 19

352. Koji has $5502 in his savings account. This is $30 less than six times the amount in his checking account. How much money does Koji have in his checking account?
Answer: $922

3.2 Solve Percent Applications

Translate and Solve Basic Percent Equations In the following exercises, translate and solve.

353. What number is 67% of 250?
Answer: 167.5

354. 300% of 82 is what number?
Answer: 246

355. 12.5% of what number is 20?
Answer: 160

356. 72 is 30% of what number?
Answer: 240

357. What percent of 125 is 150?
Answer: 120%

358. 127.5 is what percent of 850?
Answer: 15%

Solve Percent Applications In the following exercises, solve.

359. The bill for Dino's lunch was $19.45. He wanted to leave 20% of the total bill as a tip. How much should the tip be?
Answer: $3.89

360. Reza was very sick and lost 15% of his original weight. He lost 27 pounds. What was his original weight?
Answer: 180 pounds

361. Dolores bought a crib on sale for $350. The sale price was 40% of the original price. What was the original price of the crib?
Answer: $875

362. Jaden earns $2680 per month. He pays $938 a month for rent. What percent of his monthly pay goes to rent?
Answer: 35%

Find Percent Increase and Percent Decrease In the following exercises, solve.

363. Angel's got a raise in his annual salary from $55,400 to $56,785. Find the percent increase.
Answer: 2.5%

364. Rowena's monthly gasoline bill dropped from $83.75 last month to $56.95 this month. Find the percent decrease.
Answer: 32%

Solve Simple Interest Applications In the following exercises, solve.

365. Winston deposited $3294 in a bank account with interest rate 2.6%. How much interest was earned in 5 years?
Answer: $428.22

366. Moira borrowed $4500 from her grandfather to pay for her first year of college. Three years later, she repaid the $4500 plus $243 interest. What was the rate of interest?
Answer: 1.8%

367. Jaime's refrigerator loan statement said he would pay $1026 in interest for a 4-year loan at 13.5%. How much did Jaime borrow to buy the refrigerator?
Answer: $1,900

368. In 12 years, a bond that paid 6.35% interest earned $7620 interest. What was the principal of the bond?
Answer: $10,000

Solve Applications with Discount or Mark-up In the following exercises, find the sale price.

369. The original price of a handbag was $84. Carole bought it on sale for $21 off.
Answer: $63

370. Marian wants to buy a coffee table that costs $495. Next week the coffee table will be on sale for $149 off.
Answer: $346

In the following exercises, find (a) the amount of discount and (b) the sale price.

371. Emmett bought a pair of shoes on sale at 40% off from an original price of $138.
Answer: (a) $55.20 (b) $82.80

372. Anastasia bought a dress on sale at 75% off from an original price of $280.
Answer: (a) $210 (b) $70

In the following exercises, find (a) the amount of discount and (b) the discount rate. (Round to the nearest tenth of a percent, if needed.)

373. Zack bought a printer for his office that was on sale for $380. The original price of the printer was $450.
Answer: (a) $70 (b) 15.6%

374. Lacey bought a pair of boots on sale for $95. The original price of the boots was $200.
Answer: (a) $105 (b) 52.5%

In the following exercises, find (a) the amount of the mark-up and (b) the list price.

375. Nga and Lauren bought a chest at a flea market for $50. They re-finished it and then added a 350% mark-up.
Answer: (a) $175 (b) $225

376. Carly bought bottled water for $0.24 per bottle at the discount store. She added a 75% mark-up before selling them at the football game.
Answer: (a) $0.18 (b) $0.42

3.3 Solve Mixture Applications

Solve Coin Word Problems In the following exercises, solve each coin word problem.

377. Francie has $4.35 in dimes and quarters. The number of dimes is five more than the number of quarters. How many of each coin does she have?
Answer: 16 dimes, 11 quarters

378. Scott has $0.39 in pennies and nickels. The number of pennies is eight times the number of nickels. How many of each coin does he have?
Answer: 24 pennies, three nickels

379. Paulette has $140 in $5 and $10 bills. The number of $10 bills is one less than twice the number of $5 bills. How many of each does she have?
Answer: six $5 bills, 11 $10 bills

380. Lenny has $3.69 in pennies, dimes, and quarters. The number of pennies is three more than the number of dimes. The number of quarters is twice the number of dimes. How many of each coin does he have?
Answer: nine pennies, six dimes, 12 quarters

Solve Ticket and Stamp Word Problems In the following exercises, solve each ticket or stamp word problem.

381. A church luncheon made $842. Adult tickets cost $10 each and children's tickets cost $6 each. The number of children was 12 more than twice the number of adults. How many of each ticket were sold?
Answer: 35 adults, 82 children

382. Tickets for a basketball game cost $2 for students and $5 for adults. The number of students was three less than 10 times the number of adults. The total amount of money from ticket sales was $619. How many of each ticket were sold?
Answer: 25 adults, 247 students

383. 125 tickets were sold for the jazz band concert for a total of $1022. Student tickets cost $6 each and general admission tickets cost $10 each. How many of each kind of ticket were sold?
Answer: 57 students, 68 adults

384. One afternoon the water park sold 525 tickets for a total of $13,545. Child tickets cost $19 each and adult tickets cost $40 each. How many of each kind of ticket were sold?
Answer: 355 child, 170 adult

385. Ana spent $4.06 buying stamps. The number of $0.41 stamps she bought was five more than the number of $0.26 stamps. How many of each did she buy?
Answer: three $0.26 stamps, eight $0.41 stamps

386. Yumi spent $34.15 buying stamps. The number of $0.56 stamps she bought was 10 less than four times the number of $0.41 stamps. How many of each did she buy?
Answer: 15 $0.41 stamps, 50 $0.56 stamps

Solve Mixture Word Problems In the following exercises, solve each mixture word problem.

387. Marquese is making 10 pounds of trail mix from raisins and nuts. Raisins cost $3.45 per pound and nuts cost $7.95 per pound. How many pounds of raisins and how many pounds of nuts should Marquese use for the trail mix to cost him $6.96 per pound?
Answer: 2.2 lb. of raisins, 7.8 lb. of nuts

388. Amber wants to put tiles on the backsplash of her kitchen counters. She will need 36 square feet of tile. She will use basic tiles that cost $8 per square foot and decorator tiles that cost $20 per square foot. How many square feet of each tile should she use so that the overall cost of the backsplash will be $10 per square foot?
Answer: 30 basic tiles, six decorator tiles

389. Shawn has $15,000 to invest. She will put some of it into a fund that pays 4.5% annual interest and the rest in a certificate of deposit that pays 1.8% annual interest. How much should she invest in each account if she wants to earn 4.05% annual interest on the total amount?
Answer: $12,500 at 4.5%, $2,500 at 1.8%

390. Enrique borrowed $23,500 to buy a car. He pays his uncle 2% interest on the $4500 he borrowed from him, and he pays the bank 11.5% interest on the rest. What average interest rate does he pay on the total $23,500? (Round your answer to the nearest tenth of a percent.)
Answer: 9.7%

3.4 Solve Geometry Applications: Triangles, Rectangles and the Pythagorean Theorem

Solve Applications Using Triangle Properties In the following exercises, solve using triangle properties.

391. The measures of two angles of a triangle are 22 and 85 degrees. Find the measure of the third angle.
Answer: 73°

392. The playground at a shopping mall is a triangle with perimeter 48 feet. The lengths of two sides are 19 feet and 14 feet. How long is the third side?
Answer: 15 feet

393. A triangular road sign has base 30 inches and height 40 inches. What is its area?
Answer: 600 square inches

394. What is the height of a triangle with area 67.5 square meters and base 9 meters?
Answer: 15 meters

395. One angle of a triangle is 30° more than the smallest angle. The largest angle is the sum of the other angles. Find the measures of all three angles.
Answer: $30^\circ, 60^\circ, 90^\circ$

396. One angle of a right triangle measures 58°. What is the measure of the other angles of the triangle?
Answer: $32^\circ, 90^\circ$

397. The measure of the smallest angle in a right triangle is 45° less than the measure of the next larger angle. Find the measures of all three angles.

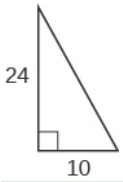
Answer: $22.5^\circ, 67.5^\circ, 90^\circ$

398. The perimeter of a triangle is 97 feet. One side of the triangle is eleven feet more than the smallest side. The third side is six feet more than twice the smallest side. Find the lengths of all sides.

Answer: 20 ft., 31 ft., 46 ft.

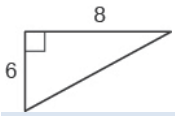
Use the Pythagorean Theorem In the following exercises, use the Pythagorean Theorem to find the length of the hypotenuse.

399.



Answer: 26

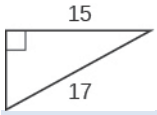
400.



Answer: 10

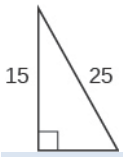
In the following exercises, use the Pythagorean Theorem to find the length of the missing side. Round to the nearest tenth, if necessary.

401.



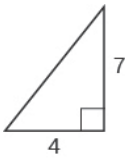
Answer: 8

402.



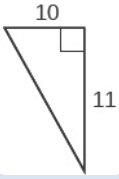
Answer: 20

403.



Answer: 8.1

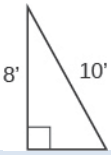
404.



Answer: 14.9

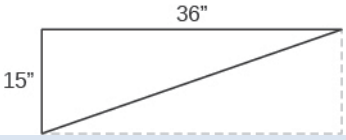
In the following exercises, solve. Approximate to the nearest tenth, if necessary.

405. Sergio needs to attach a wire to hold the antenna to the roof of his house, as shown in the figure. The antenna is 8 feet tall and Sergio has 10 feet of wire. How far from the base of the antenna can he attach the wire?



Answer: 6′

406. Seong is building shelving in his garage. The shelves are 36 inches wide and 15 inches tall. He wants to put a diagonal brace across the back to stabilize the shelves, as shown. How long should the brace be?



Answer: 39″

Solve Applications Using Rectangle Properties In the following exercises, solve using rectangle properties.

407. The length of a rectangle is 36 feet and the width is 19 feet. Find the (a) perimeter (b) area.

Answer: (a) 110 ft. (b) 684 sq. ft.

408. A sidewalk in front of Kathy's house is in the shape of a rectangle four feet wide by 45 feet long. Find the (a) perimeter (b) area.

Answer: (a) 98 ft. (b) 180 sq. ft.

409. The area of a rectangle is 2356 square meters. The length is 38 meters. What is the width?
Answer: 62 m

410. The width of a rectangle is 45 centimeters. The area is 2,700 square centimeters. What is the length?
Answer: 60 cm

411. The length of a rectangle is 12 cm more than the width. The perimeter is 74 cm. Find the length and the width.
Answer: 24.5 cm, 12.5 cm

412. The width of a rectangle is three more than twice the length. The perimeter is 96 inches. Find the length and the width.
Answer: 33 in., 15 in.

3.5 Solve Uniform Motion Applications

Solve Uniform Motion Applications In the following exercises, solve.

413. When Gabe drives from Sacramento to Redding it takes him 2.2 hours. It takes Elsa 2 hours to drive the same distance. Elsa's speed is seven miles per hour faster than Gabe's speed. Find Gabe's speed and Elsa's speed.
Answer: Gabe 70 mph, Elsa 77 mph

414. Louellen and Tracy met at a restaurant on the road between Chicago and Nashville. Louellen had left Chicago and drove 3.2 hours towards Nashville. Tracy had left Nashville and drove 4 hours towards Chicago, at a speed one mile per hour faster than Louellen's speed. The distance between Chicago and Nashville is 472 miles. Find Louellen's speed and Tracy's speed.
Answer: Louellen 65 mph, Tracy 66 mph

415. Two busses leave Amarillo at the same time. The Albuquerque bus heads west on the I-40 at a speed of 72 miles per hour, and the Oklahoma City bus heads east on the I-40 at a speed of 78 miles per hour. How many hours will it take them to be 375 miles apart?
Answer: 2.5 hours

416. Kyle rowed his boat upstream for 50 minutes. It took him 30 minutes to row back downstream. His speed going upstream is two miles per hour slower than his speed going downstream. Find Kyle's upstream and downstream speeds.
Answer: upstream 3 mph, downstream 5 mph

417. At 6:30, Devon left her house and rode her bike on the flat road until 7:30. Then she started riding uphill and rode until 8:00. She rode a total of 15 miles. Her speed on the flat road was three miles per hour faster than her speed going uphill. Find Devon's speed on the flat road and riding uphill.

Answer: flat road 11 mph, uphill 8 mph

418. Anthony drove from New York City to Baltimore, a distance of 192 miles. He left at 3:45 and had heavy traffic until 5:30. Traffic was light for the rest of the drive, and he arrived at 7:30. His speed in light traffic was four miles per hour more than twice his speed in heavy traffic. Find Anthony's driving speed in heavy traffic and light traffic.

Answer: heavy traffic 32 mph, light traffic 68 mph

3.6 Solve Applications with Linear Inequalities

Solve Applications with Linear Inequalities In the following exercises, solve.

419. Julianne has a weekly food budget of $231 for her family. If she plans to budget the same amount for each of the seven days of the week, what is the maximum amount she can spend on food each day?

Answer: $33 per day

420. Rogelio paints watercolors. He got a $100 gift card to the art supply store and wants to use it to buy $12'' \times 16''$ canvases. Each canvas costs $10.99. What is the maximum number of canvases he can buy with his gift card?

Answer: nine canvases

421. Briana has been offered a sales job in another city. The offer was for $42,500 plus 8% of her total sales. In order to make it worth the move, Briana needs to have an annual salary of at least $66,500. What would her total sales need to be for her to move?

Answer: at least $300,000

422. Renee's car costs her $195 per month plus $0.09 per mile. How many miles can Renee drive so that her monthly car expenses are no more than $250?

Answer: at most 611 miles

423. Costa is an accountant. During tax season, he charges $125 to do a simple tax return. His expenses for buying software, renting an office, and advertising are $6000. How many tax returns must he do if he wants to make a profit of at least $8000?

Answer: at least 112 jobs

424. Jenna is planning a 5-day resort vacation with three of her friends. It will cost her $279 for airfare, $300 for food and entertainment, and $65 per day for her share of the hotel. She has $550 saved towards her vacation and can earn $25 per hour as an assistant in her uncle's photography studio. How many hours must she work in order to have enough money for her vacation?

Answer: at least 15 hours

Chapter Practice Test

425. Four-fifths of the people on a hike are children. If there are 12 children, what is the total number of people on the hike?

Answer: 15

426. One number is three more than twice another. Their sum is -63. Find the numbers.

Answer: $-22, -41$

427. The sum of two consecutive odd integers is -96. Find the numbers.

Answer: $-49, -47$

428. Marla's breakfast was 525 calories. This was 35% of her total calories for the day. How many calories did she have that day?

Answer: 1,500

429. Humberto's hourly pay increased from $16.25 to $17.55. Find the percent increase.

Answer: 8%

430. Melinda deposited $5985 in a bank account with an interest rate of 1.9%. How much interest was earned in 2 years?

Answer: $227.43

431. Dotty bought a freezer on sale for $486.50. The original price of the freezer was $695. Find (a) the amount of discount and (b) the discount rate.

Answer: (a) $208.50 (b) 30%

432. Bonita has $2.95 in dimes and quarters in her pocket. If she has five more dimes than quarters, how many of each coin does she have?

Answer: 12 dimes, seven quarters

433. At a concert, $1,600 in tickets were sold. Adult tickets were $9 each and children's tickets were $4 each. If the number of adult tickets was 30 less than twice the number of children's tickets, how many of each kind were sold?

Answer: 140 adult, 85 children

434. Kim is making eight gallons of punch from fruit juice and soda. The fruit juice costs $6.04 per gallon and the soda costs $4.28 per gallon. How much fruit juice and how much soda should she use so that the punch costs $5.71 per gallon?

Answer: 6.5 gallons of juice, 1.5 gallons of soda

435. The measure of one angle of a triangle is twice the measure of the smallest angle. The measure of the third angle is 14 more than the measure of the smallest angle. Find the measures of all three angles.

Answer: $41.5^\circ, 55.5^\circ, 83^\circ$

436. What is the height of a triangle with area 277.2 square inches and base 44 inches?

Answer: 12.6 inches

In the following exercises, use the Pythagorean Theorem to find the length of the missing side. Round to the nearest tenth, if necessary.

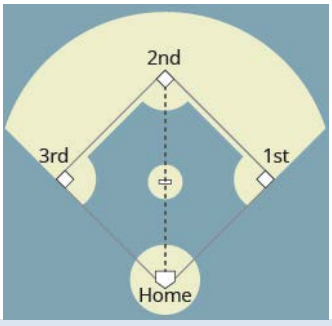
437.

Answer: 10

438.

Answer: 10.8

439. A baseball diamond is really a square with sides of 90 feet. How far is it from home plate to second base, as shown?



Answer: 127.3 ft.

440. The length of a rectangle is two feet more than five times the width. The perimeter is 40 feet. Find the dimensions of the rectangle.

Answer: 3 ft. by 17 ft.

441. Two planes leave Dallas at the same time. One heads east at a speed of 428 miles per hour. The other plane heads west at a speed of 382 miles per hour. How many hours will it take them to be 2025 miles apart?

Answer: 2.5 hours

442. Leon drove from his house in Cincinnati to his sister's house in Cleveland, a distance of 252 miles. It took him $4\frac{1}{2}$ hours. For the first half hour he had heavy traffic, and the rest of the time his speed was five miles per hour less than twice his speed in heavy traffic. What was his speed in heavy traffic?

Answer: 32 mph

443. Chloe has a budget of $800 for costumes for the 18 members of her musical theater group. What is the maximum she can spend for each costume?

Answer: at most $44.44 per costume

444. Frank found a rental car deal online for $49 per week plus $0.24 per mile. How many miles could he drive if he wants the total cost for one week to be no more than $150?

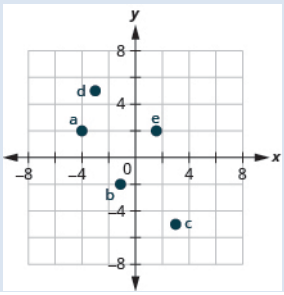
Answer: at most 420.8 miles

Elementary Algebra
4: Graphs
4.1 Use the Rectangular Coordinate System

Plot Points in a Rectangular Coordinate System In the following exercises, plot each point in a rectangular coordinate system and identify the quadrant in which the point is located.

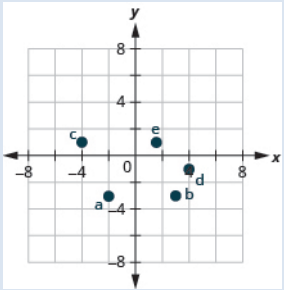
1. (a) $(-4,2)$ (b) $(-1,-2)$ (c) $(3,-5)$ (d) $(-3,5)$ (e) $\left(\frac{5}{3},2\right)$

Answer:



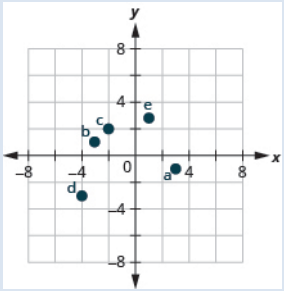
2. (a) $(-2,-3)$ (b) $(3,-3)$ (c) $(-4,1)$ (d) $(4,-1)$ (e) $\left(\frac{3}{2},1\right)$

Answer:



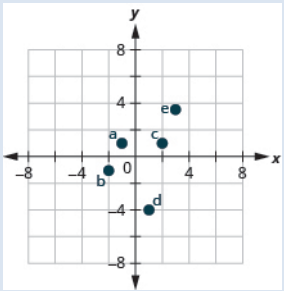
3. (a) $(3,-1)$ (b) $(-3,1)$ (c) $(-2,\ 2)$ (d) $(-4,-3)$ (e) $\left(1,\ \frac{14}{5}\right)$

Answer:



4. (a) $(-1,\ 1)$ (b) $(-2,-1)$ (c) $(2,1)$ (d) $(1,-4)$ (e) $\left(3,\ \frac{7}{2}\right)$

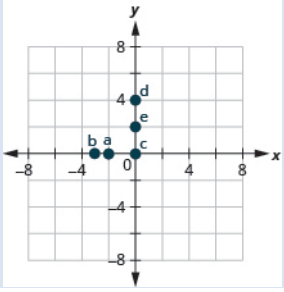
Answer:



In the following exercises, plot each point in a rectangular coordinate system.

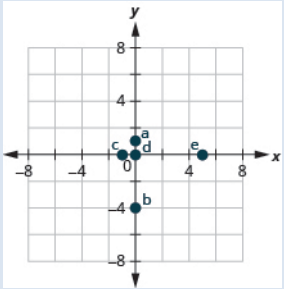
5. (a) $(-2,\ 0)$ (b) $(-3,0)$ (c) $(0,0)$ (d) $(0,\ 4)$ (e) $(0,2)$

Answer:



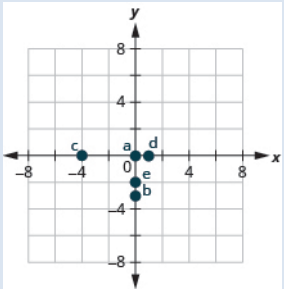
6. (a) $(0,1)$ (b) $(0,-4)$ (c) $(-1,0)$ (d) $(0,\ 0)$ (e) $(5,0)$

Answer:



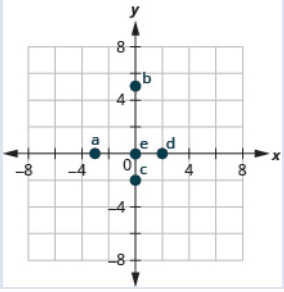
7. (a) $(0, 0)$ (b) $(0, -3)$ (c) $(-4, 0)$ (d) $(1, 0)$ (e) $(0, -2)$

Answer:



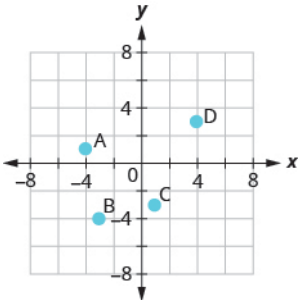
8. (a) $(-3, 0)$ (b) $(0, 5)$ (c) $(0, -2)$ (d) $(2, 0)$ (e) $(0, 0)$

Answer:



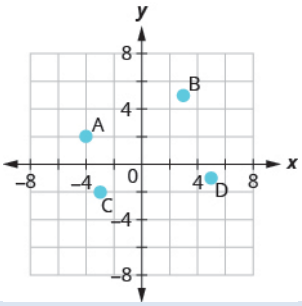
In the following exercises, name the ordered pair of each point shown in the rectangular coordinate system.

9.



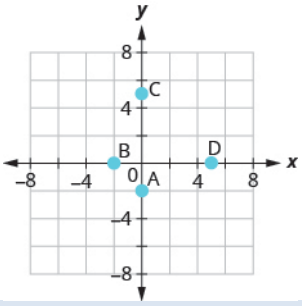
Answer: A: $(-4, 1)$ B: $(-3, -4)$ C: $(1, -3)$ D: $(4, 3)$

10.



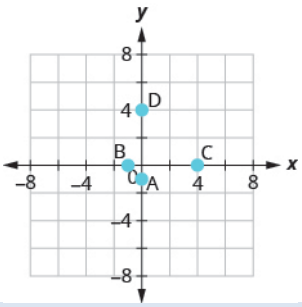
Answer: A: $(-4,2)$ B: $(3,5)$ C: $(-3,-2)$ D: $(5,-1)$

11.



Answer: A: $(0,-2)$ B: $(-2,0)$ C: $(0,5)$ D: $(5,0)$

12.



Answer: A: $(0,-1)$ B: $(-1,0)$ C: $(4,0)$ D: $(0,4)$

Verify Solutions to an Equation in Two Variables In the following exercises, which ordered pairs are solutions to the given equations?

13. $2x+y=6$

(a) $(1,4)$

(b) $(3,0)$

(c) $(2,3)$

Answer: a, b

14. $x+3y=9$

(a) $(0,3)$

(b) $(6,1)$

(c) $(-3,-3)$

Answer: a, b

15. $4x-2y=8$

(a) $(3,2)$

(b) $(1,4)$

(c) $(0,-4)$

Answer: a, c

16. $3x-2y=12$

(a) $(4,\ 0)$

(b) $(2,-3)$

(c) $(1,6)$

Answer: a, b

17. $y=4x+3$

(a) $(4,3)$

(b) $(-1,-1)$

(c) $\left(\frac{1}{2},\ 5\right)$

Answer: b, c

18. $y = 2x - 5$

(a) $(0, -5)$

(b) $(2, 1)$

(c) $\left(\frac{1}{2}, -4\right)$

Answer: a, c

19. $y = \frac{1}{2}x - 1$

(a) $(2, 0)$

(b) $(-6, -4)$

(c) $(-4, -1)$

Answer: a, b

20. $y = \frac{1}{3}x + 1$

(a) $(-3, 0)$

(b) $(9, 4)$

(c) $(-6, -1)$

Answer: a, b, c

Complete a Table of Solutions to a Linear Equation In the following exercises, complete the table to find solutions to each linear equation.

21. $y = 2x - 4$

x	y	(x, y)
0		
2		
-1		

Answer:

x	y	(x, y)
0	-4	$(0, -4)$
2	0	$(2, 0)$
-1	-6	$(-1, -6)$

22. $y = 3x - 1$

x	y	(x, y)
0		
2		
-1		

Answer:

x	y	(x, y)
0	-1	$(0, -1)$
2	5	$(2, 5)$
-1	-4	$(-1, -4)$

23. $y = -x + 5$

x	y	(x, y)
0		
3		
-2		

Answer:

x	y	(x, y)
0	5	$(0, 5)$
3	2	$(3, 2)$
-2	7	$(-2, 7)$

24. $y = -x + 2$

x	y	(x, y)
0		
3		
-2		

Answer:

x	y	(x, y)
0	2	$(0, 2)$
3	-1	$(3, -1)$
-2	4	$(-2, 4)$

25. $y=\frac{1}{3}x+1$

x	y	(x,y)
0		
3		
6		

Answer:

x	y	(x,y)
0	1	$(0,1)$
3	2	$(3,2)$
6	3	$(6,3)$

26. $y=\frac{1}{2}x+4$

x	y	(x,y)
0		
2		
4		

Answer:

x	y	(x,y)
0	4	$(0,4)$
2	5	$(2,5)$
4	6	$(4,6)$

27. $y=-\frac{3}{2}x-2$

x	y	(x,y)
0		
2		
-2		

Answer:

x	y	(x,y)
0	-2	$(0,-2)$
2	-5	$(2,-5)$
-2	1	$(-2,1)$

28. $y=-\frac{2}{3}x-1$

x	y	(x,y)
0		
3		
-3		

Answer:

x	y	(x,y)
0	-1	$(0,-1)$
3	-3	$(3,-3)$
-3	1	$(-3,1)$

29. $x+3y=6$

x	y	(x,y)
0		
3		
	0	

Answer:

x	y	(x,y)
0	2	$(0,2)$
3	4	$(3,1)$
6	0	$(6,0)$

30. $x+2y=8$

x	y	(x,y)
0		
4		
	0	

Answer:

x	y	(x,y)
0	4	$(0,4)$
4	2	$(4,2)$
8	0	$(8,0)$

31. $2x-5y=10$

x	y	(x,y)
0		
10		
	0	

Answer:

x	y	(x,y)
0	-2	$(0,-2)$
10	2	$(10,2)$
5	0	$(5,0)$

32. $3x-4y=12$

x	y	(x,y)
0		
8		
	0	

Answer:

x	y	(x,y)
0	-3	$(0,-3)$
8	3	$(8,3)$
4	0	$(4,0)$

Find Solutions to a Linear Equation In the following exercises, find three solutions to each linear equation.

33. $y=5x-8$

Answer: Answers will vary.

34. $y=3x-9$

Answer: Answers will vary.

35. $y=-4x+5$

Answer: Answers will vary.

36. $y=-2x+7$

Answer: Answers will vary.

37. $x+y=8$

Answer: Answers will vary.

38. $x+y=6$

Answer: Answers will vary.

39. $x+y=-2$

Answer: Answers will vary.

40. $x+y=-1$

Answer: Answers will vary.

41. $3x+y=5$

Answer: Answers will vary.

42. $2x+y=3$

Answer: Answers will vary.

43. $4x-y=8$

Answer: Answers will vary.

44. $5x-y=10$

Answer: Answers will vary.

45. $2x+4y=8$

Answer: Answers will vary.

46. $3x+2y=6$

Answer: Answers will vary.

47. $5x-2y=10$

Answer: Answers will vary.

48. $4x-3y=12$

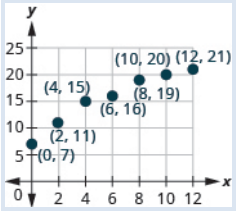
Answer: Answers will vary.

Everyday Math

49. **Weight of a baby** Mackenzie recorded her baby's weight every two months. The baby's age, in months, and weight, in pounds, are listed in the table below, and shown as an ordered pair in the third column.
(a) Plot the points on a coordinate plane. (b) Why is only Quadrant I needed?

Age x	**Weight** y	(x, y)
0	7	$(0,7)$
2	11	$(2,11)$
4	15	$(4,15)$
6	16	$(6,16)$
8	19	$(8,19)$
10	20	$(10,20)$
12	21	$(12,21)$

Answer: (a)

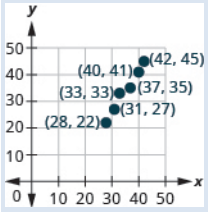


(b) Age and weight are only positive.

50. **Weight of a child** Latresha recorded her son's height and weight every year. His height, in inches, and weight, in pounds, are listed in the table below, and shown as an ordered pair in the third column. (a) Plot the points on a coordinate plane. (b) Why is only Quadrant I needed?

Height x	**Weight** y	$(x,\ y)$
28	22	$(28,22)$
31	27	$(31,27)$
33	33	$(33,33)$
37	35	$(37,35)$
40	41	$(40,41)$
42	45	$(42,45)$

Answer: (a)



(b)Height and weight are only positive.

Writing Exercises

51. Explain in words how you plot the point $(4,-2)$ in a rectangular coordinate system.

Answer: Answers will vary.

52. How do you determine if an ordered pair is a solution to a given equation?

Answer: Answers will vary.

53. Is the point $(-3,0)$ on the *x*-axis or *y*-axis? How do you know?

Answer: Answers will vary.

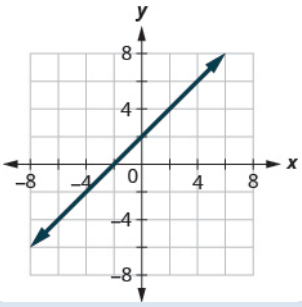
54. Is the point $(0,8)$ on the *x*-axis or *y*-axis? How do you know?

Answer: Answers will vary.

Elementary Algebra
4: Graphs
4. 2 Graph Linear Equations in Two Variables

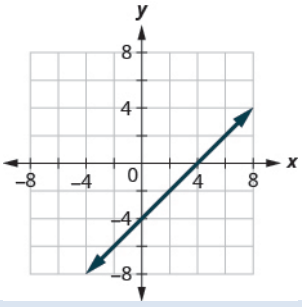
Recognize the Relationship Between the Solutions of an Equation and its Graph In the following exercises, for each ordered pair, decide:
(a) Is the ordered pair a solution to the equation? (b) Is the point on the line?

55. $y = x + 2$
(a) $(0,\ 2)$ (b) $(1,\ 2)$ (c) $(-1,\ 1)$ (d) $(-3, -1)$.



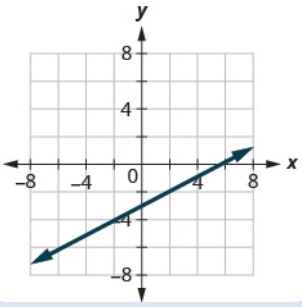
Answer: (a) yes; no (b) no; no (c) yes; yes (d) : yes; yes

56. $y = x - 4$
(a) $(0, -4)$ (b) $(3, -1)$ (c) $(2,\ 2)$ (d) $(1, -5)$.



Answer: (a) yes; yes (b) yes; yes (c) no; no (d) no; no

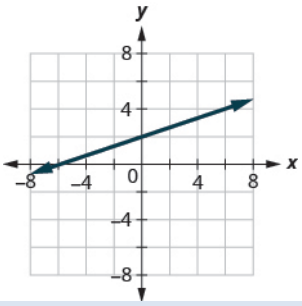
57. $y = \frac{1}{2}x - 3$
(a) $(0,\ -3)$ (b) $(2,\ -2)$ (c) $(-2,\ -4)$ (d) $(4,\ 1)$



Answer: (a) yes; yes (b) yes; yes (c) yes; yes (d) no; no

58. $y = \frac{1}{3}x + 2$

(a) $(0, 2)$ (b) $(3, 3)$ (c) $(-3, 2)$ (d) $(-6, 0)$.

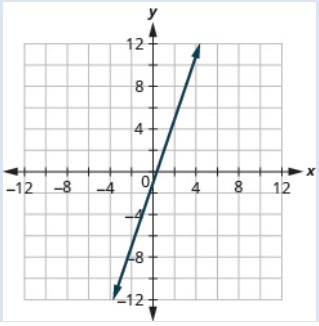


Answer: (a) yes; yes (b) yes; yes (c) no; no (d) yes; yes

Graph a Linear Equation by Plotting Points In the following exercises, graph by plotting points.

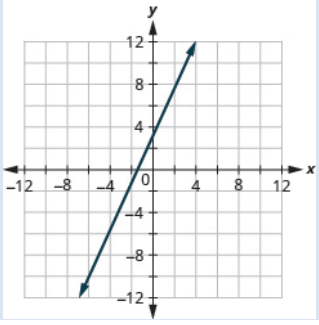
59. $y = 3x - 1$

Answer:



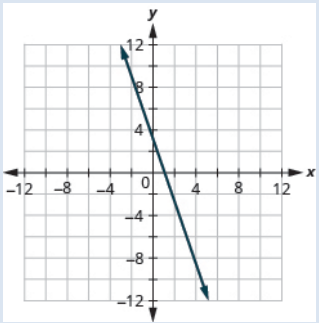
60. $y = 2x + 3$

Answer:



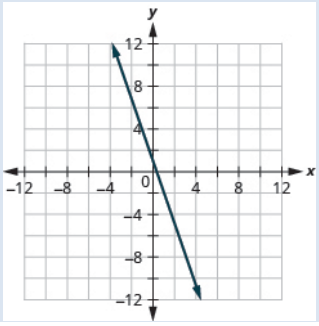
61. $y = -2x + 2$

Answer:



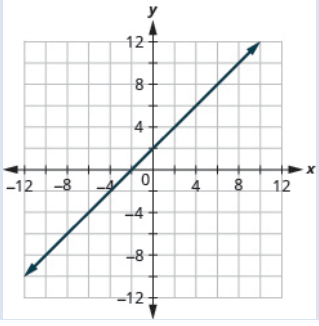
62. $y = -3x + 1$

Answer:



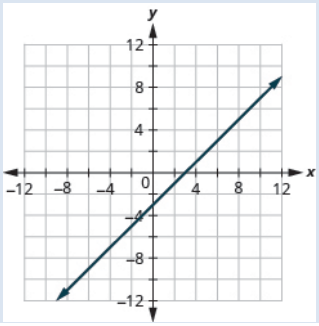
63. $y = x + 2$

Answer:



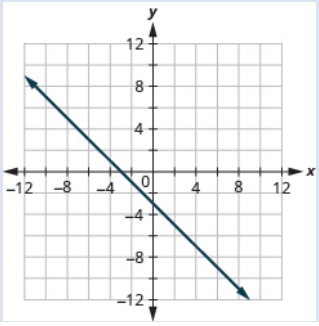
64. $y = x - 3$

Answer:



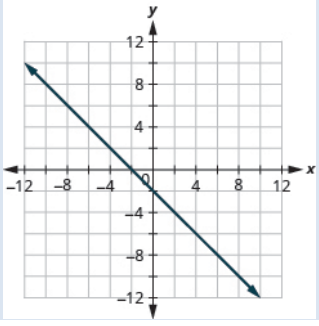
65. $y = -x - 3$

Answer:



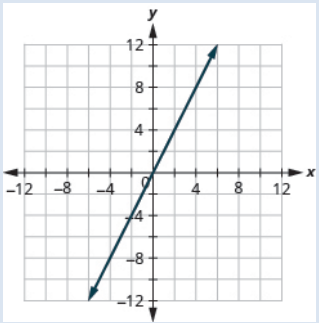
66. $y = -x - 2$

Answer:



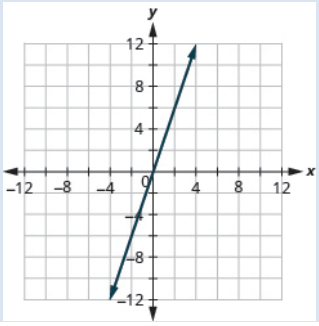
67. $y = 2x$

Answer:



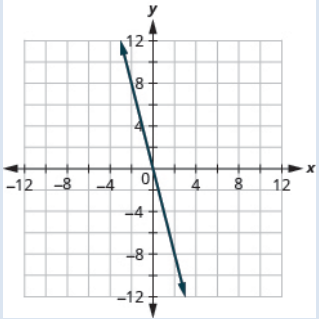
68. $y = 3x$

Answer:



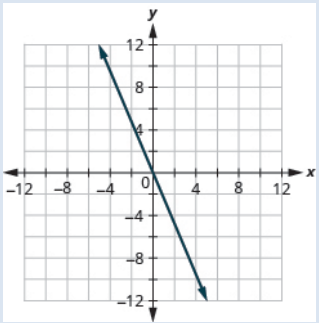
69. $y = -4x$

Answer:



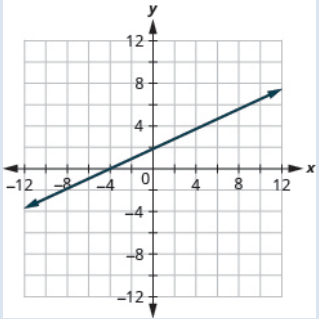
70. $y = -2x$

Answer:



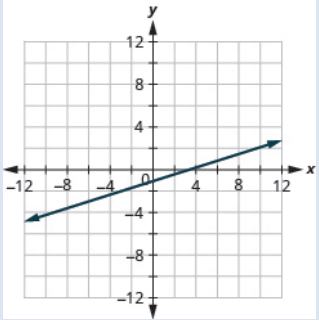
71. $y = \frac{1}{2}x + 2$

Answer:



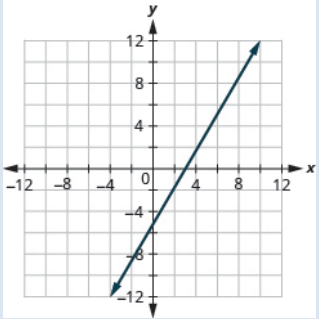
72. $y = \frac{1}{3}x - 1$

Answer:



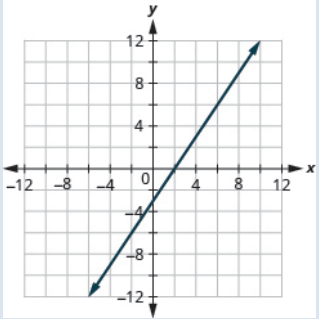
73. $y=\frac{4}{3}x-5$

Answer:



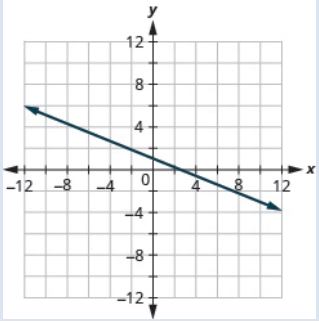
74. $y=\frac{3}{2}x-3$

Answer:



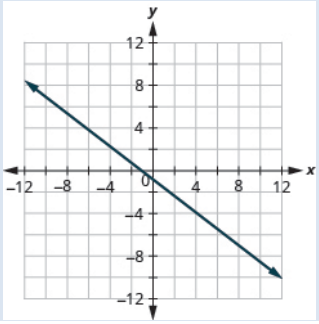
75. $y=-\frac{2}{5}x+1$

Answer:



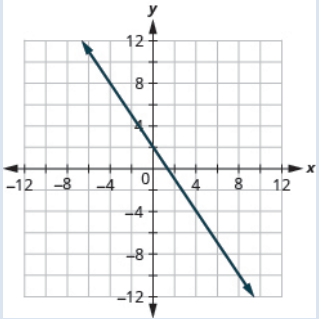
76. $y=-\frac{4}{5}x-1$

Answer:



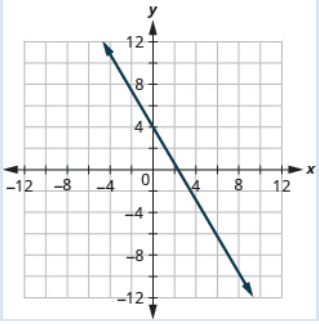
77. $y=-\frac{3}{2}x+2$

Answer:



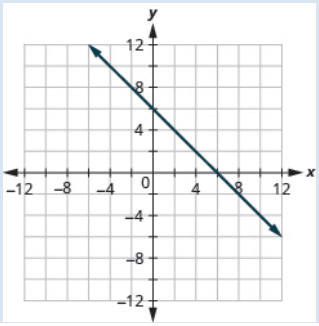
78. $y=-\frac{5}{3}x+4$

Answer:



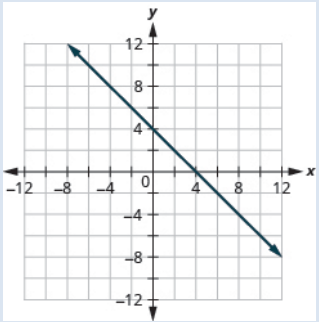
79. $x + y = 6$

Answer:



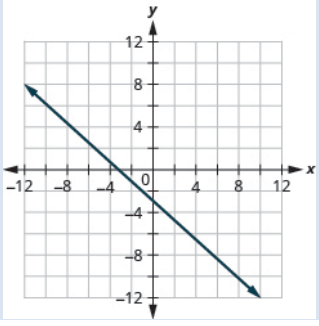
80. $x + y = 4$

Answer:



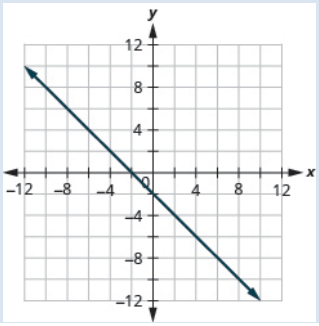
81. $x + y = -3$

Answer:



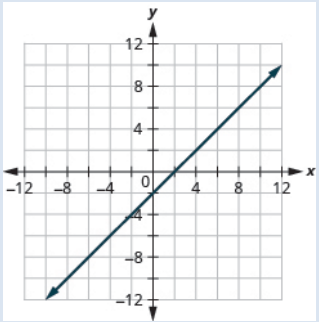
82. $x + y = -2$

Answer:



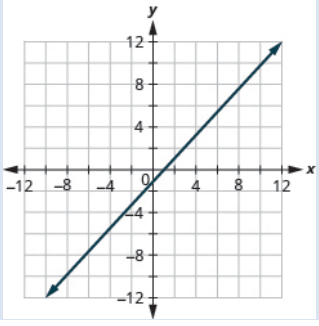
83. $x - y = 2$

Answer:



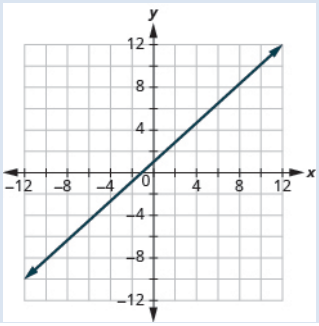
84. $x - y = 1$

Answer:



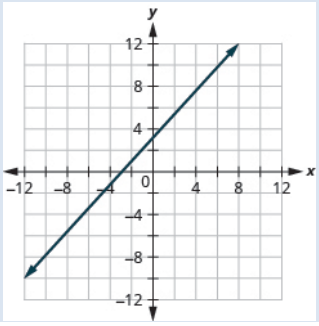
85. $x - y = -1$

Answer:



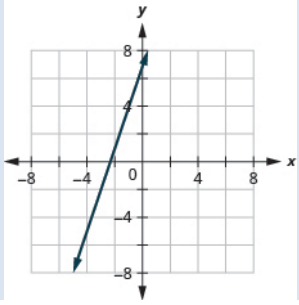
86. $x - y = -3$

Answer:



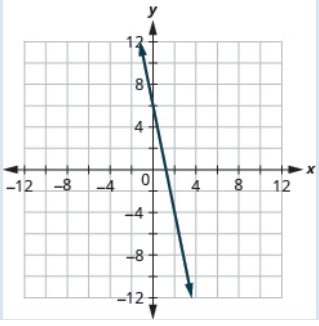
87. $3x + y = 7$

Answer:



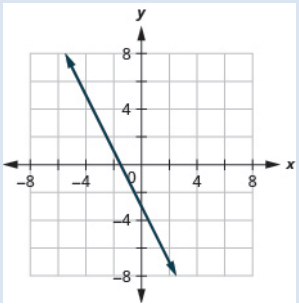
88. $5x + y = 6$

Answer:



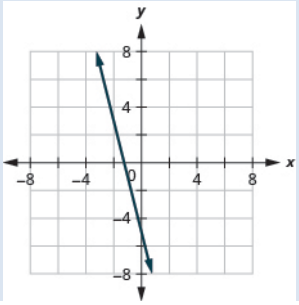
89. $2x + y = -3$

Answer:



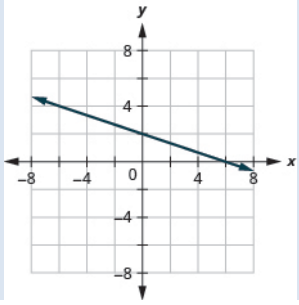
90. $4x + y = -5$

Answer:



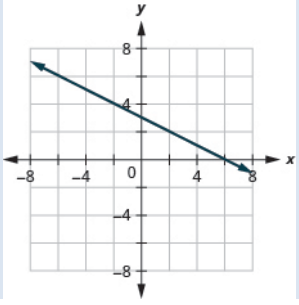
91. $\frac{1}{3}x + y = 2$

Answer:



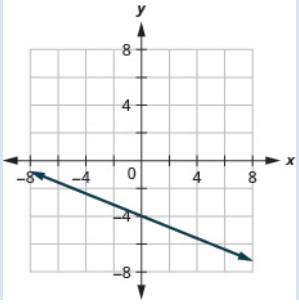
92. $\frac{1}{2}x + y = 3$

Answer:



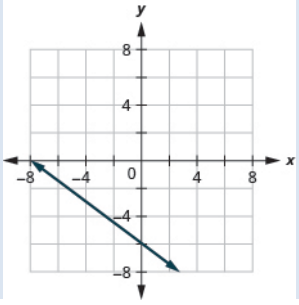
93. $\frac{2}{5}x - y = 4$

Answer:



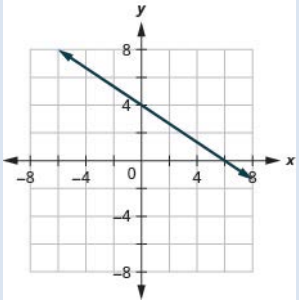
94. $\frac{3}{4}x - y = 6$

Answer:



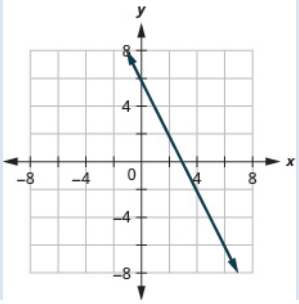
95. $2x + 3y = 12$

Answer:



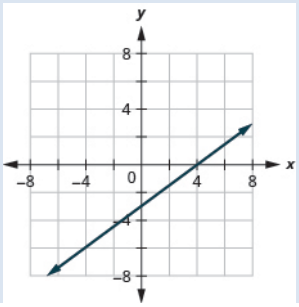
96. $4x + 2y = 12$

Answer:



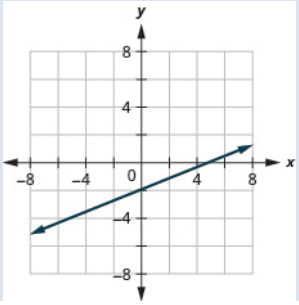
97. $3x-4y=12$

Answer:



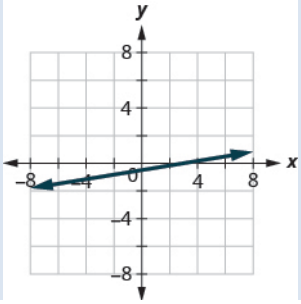
98. $2x-5y=10$

Answer:



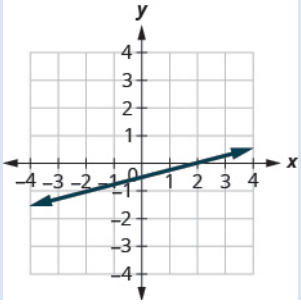
99. $x-6y=3$

Answer:



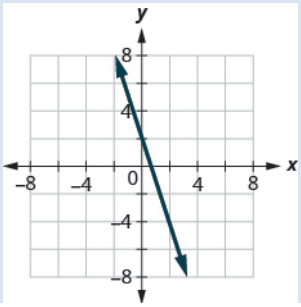
100. $x-4y=2$

Answer:



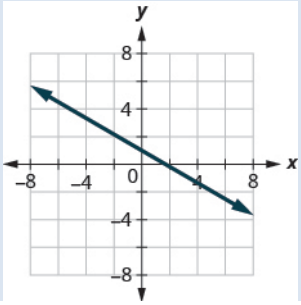
101. $5x + 2y = 4$

Answer:



102. $3x + 5y = 5$

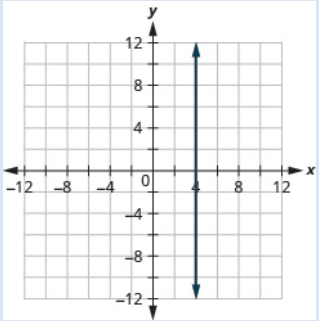
Answer:



Graph Vertical and Horizontal Lines In the following exercises, graph each equation.

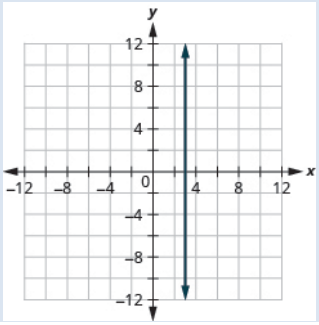
103. $x = 4$

Answer:



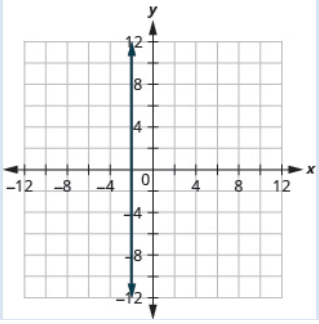
104. $x = 3$

Answer:



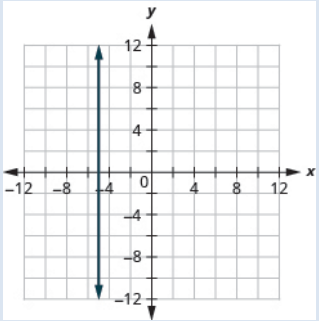
105. $x = -2$

Answer:



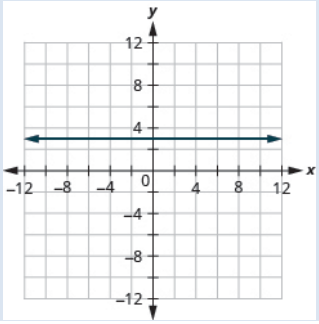
106. $x = -5$

Answer:



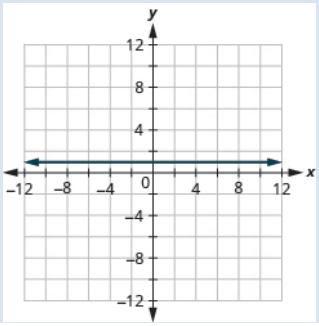
107. $y = 3$

Answer:



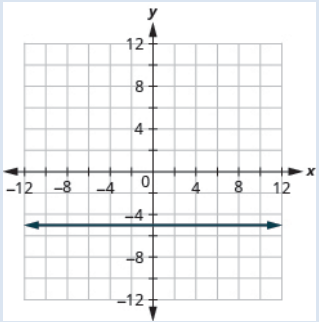
108. $y = 1$

Answer:



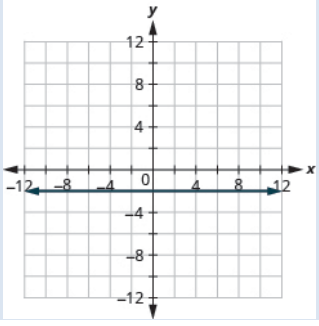
109. $y = -5$

Answer:



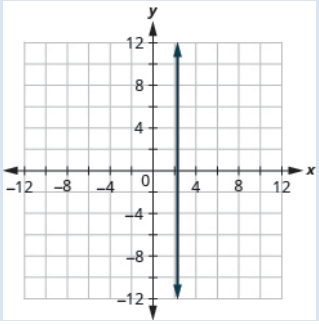
110. $y = -2$

Answer:



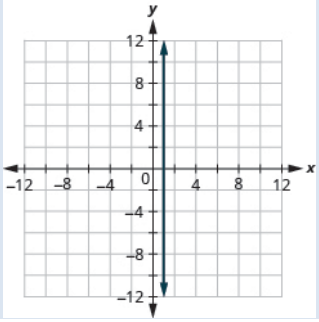
111. $x = \frac{7}{3}$

Answer:



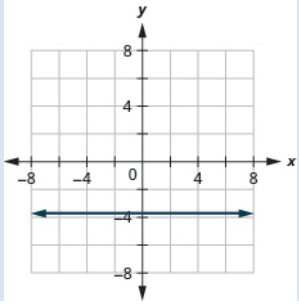
112. $x = \frac{5}{4}$

Answer:



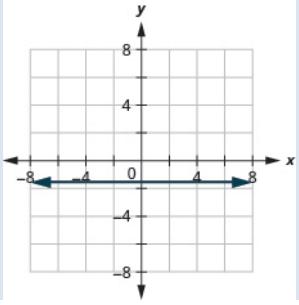
113. $y = -\frac{15}{4}$

Answer:



114. $y=-\frac{5}{3}$

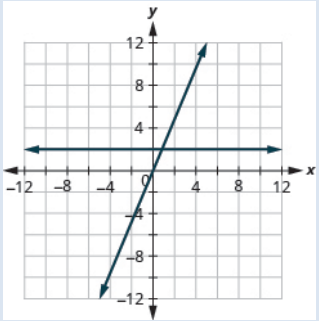
Answer:



In the following exercises, graph each pair of equations in the same rectangular coordinate system.

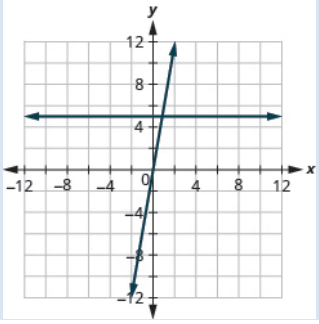
115. $y=2x$ and $y=2$

Answer:



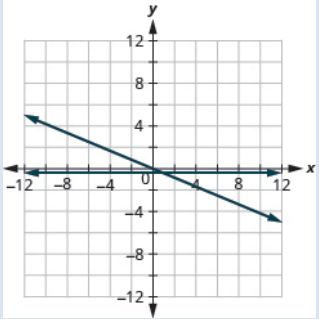
116. $y=5x$ and $y=5$

Answer:



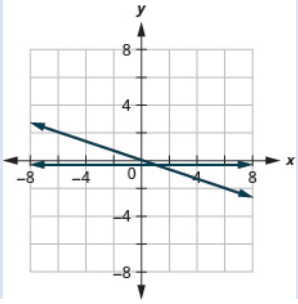
117. $y=-\frac{1}{2}x$ and $y=-\frac{1}{2}$

Answer:



118. $y=-\frac{1}{3}x$ and $y=-\frac{1}{3}$

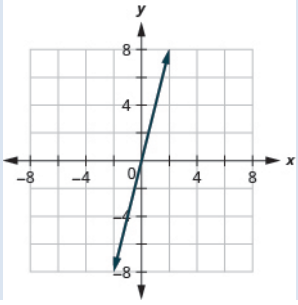
Answer:



Mixed Practice In the following exercises, graph each equation.

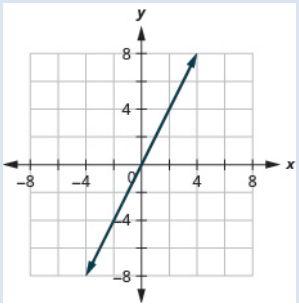
119. $y=4x$

Answer:



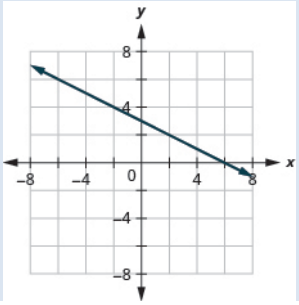
120. $y = 2x$

Answer:



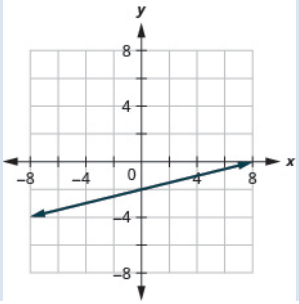
121. $y = -\frac{1}{2}x + 3$

Answer:



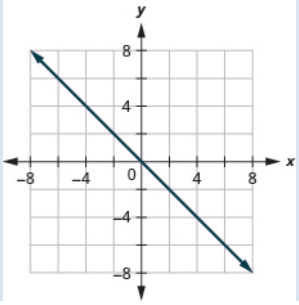
122. $y = \frac{1}{4}x - 2$

Answer:



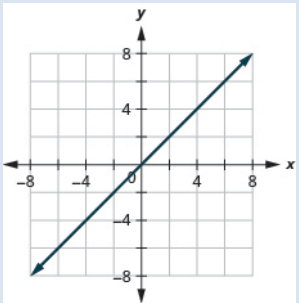
123. $y = -x$

Answer:



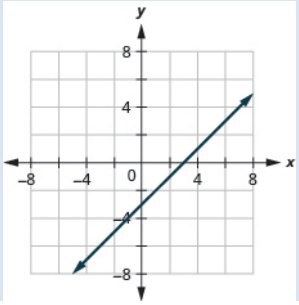
124. $y = x$

Answer:



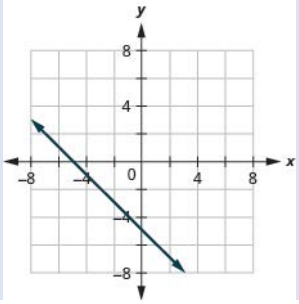
125. $x - y = 3$

Answer:



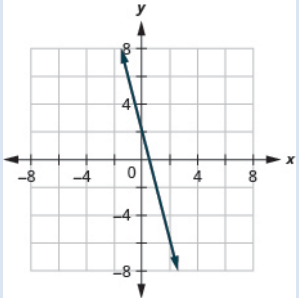
126. $x + y = -5$

Answer:



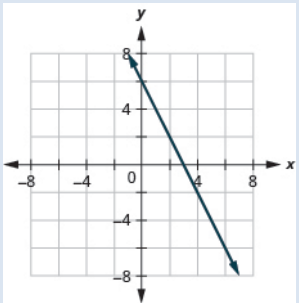
127. $4x + y = 2$

Answer:



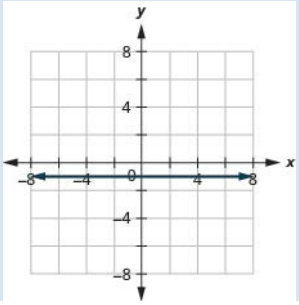
128. $2x + y = 6$

Answer:



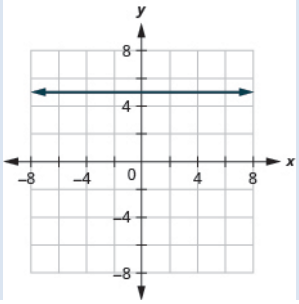
129. $y = -1$

Answer:



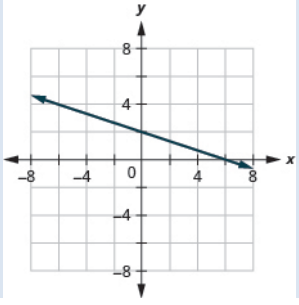
130. $y = 5$

Answer:



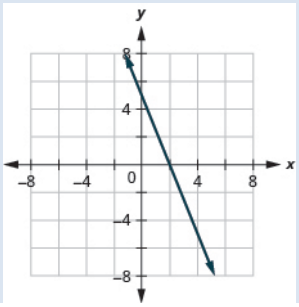
131. $2x + 6y = 12$

Answer:



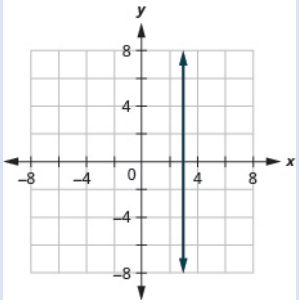
132. $5x+2y=10$

Answer:



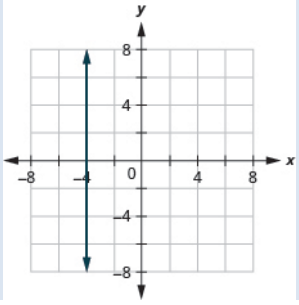
133. $x=3$

Answer:



134. $x=-4$

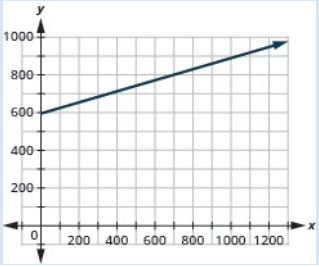
Answer:



Everyday Math

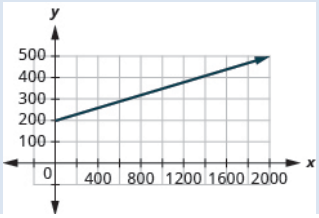
135. **Motor home cost** The Robinsons rented a motor home for one week to go on vacation. It cost them $594 plus $0.32 per mile to rent the motor home, so the linear equation $y = 594 + 0.32x$ gives the cost, y, for driving x miles. Calculate the rental cost for driving 400, 800, and 1200 miles, and then graph the line.

Answer: $722, $850, $978



136. **Weekly earnings** At the art gallery where he works, Salvador gets paid $200 per week plus 15% of the sales he makes, so the equation $y = 200 + 0.15x$ gives the amount, y, he earns for selling x dollars of artwork. Calculate the amount Salvador earns for selling $900, $1600, and $2000, and then graph the line.

Answer: $335, $440, $500



Writing Exercises

137. Explain how you would choose three *x*- values to make a table to graph the line $y = \frac{1}{5}x - 2$.

Answer: Answers will vary.

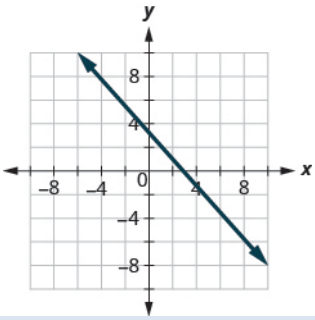
138. What is the difference between the equations of a vertical and a horizontal line?

Answer: Answers will vary.

Elementary Algebra
4: Graphs
4.3 Graph with Intercepts

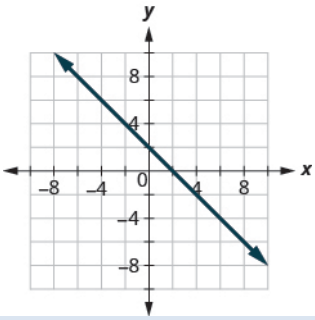
Identify the *x*- and *y*-Intercepts on a Graph In the following exercises, find the *x*- and *y*-intercepts on each graph.

139.



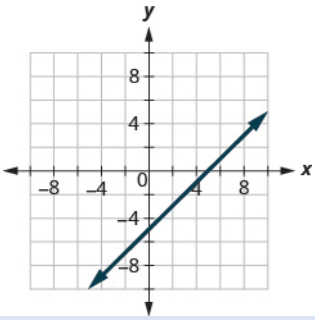
Answer: $(3,0),\ (0,3)$

140.



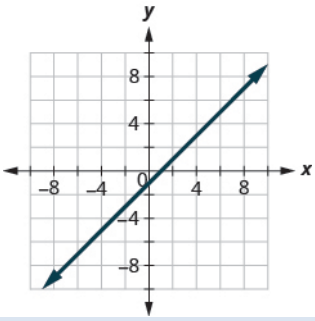
Answer: $(2,0),\ (0,2)$

141.



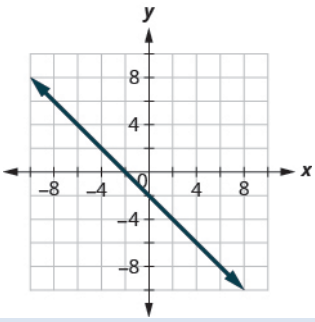
Answer: $(5,0),\ (0,-5)$

142.



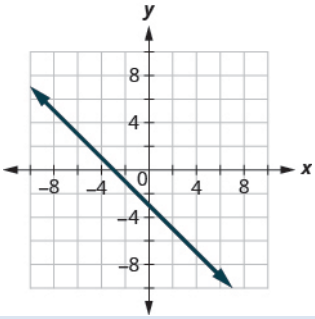
Answer: $(1,0),\ (0,-1)$

143.



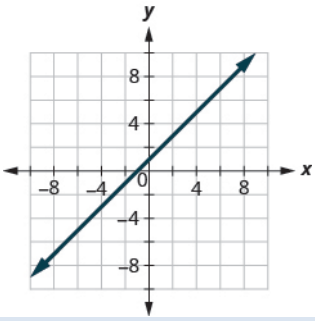
Answer: $(-2,1),\ (1,-2)$

144.



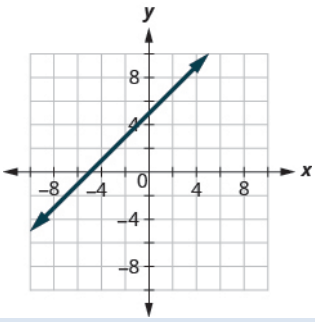
Answer: $(-3,0),\ (0,-3)$

145.



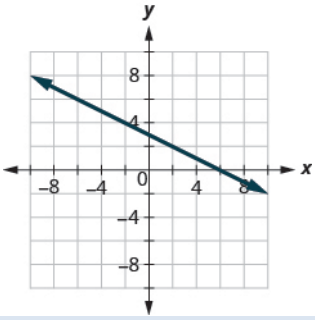
Answer: $(-1,0),\ (0,1)$

146.



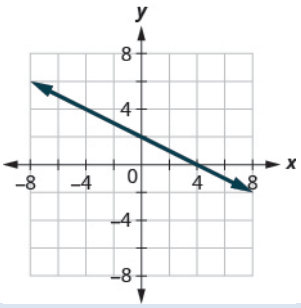
Answer: $(-5,0),\ (0,5)$

147.



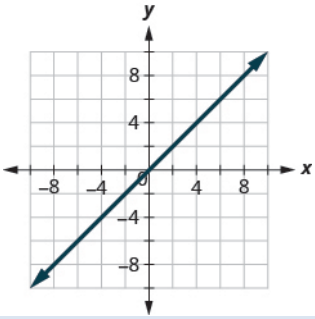
Answer: $(6,0),\ (0,3)$

148.



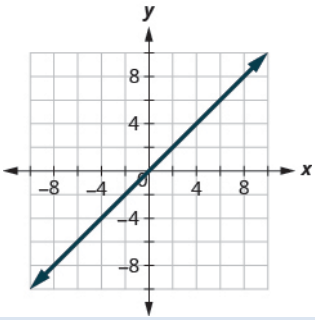
Answer: $(4,0),\ (0,2)$

149.



Answer: $(0,0)$

150.



Answer: $(0,0)$

Find the *x*- and *y*- Intercepts from an Equation of a Line In the following exercises, find the intercepts for each equation.

151. $x+y=4$

Answer: $(4,0),\ (0,4)$

152. $x+y=3$

Answer: $(3,0),\ (0,3)$

153. $x+y=-2$

Answer: $(-2,0),\ (0,-2)$

154. $x+y=-5$

Answer: $(-5,0),\ (0,-5)$

155. $x-y=5$

Answer: $(5,0),\ (0,-5)$

156. $x-y=1$

Answer: $(1,0),\ (0,-1)$

157. $x-y=-3$

Answer: $(-3,0),\ \ (0,3)$

158. $x-y=-4$

Answer: $(-4,0),\ (0,4)$

159. $x+2y=8$

Answer: $(8,0),\ (0,4)$

160. $x+2y=10$

Answer: $(10,0),\ (0,5)$

161. $3x+y=6$

Answer: $(2,0),\ (0,6)$

162. $3x+y=9$

Answer: $(3,0),\ (0,9)$

163. $x-3y=12$

Answer: $(12,0),\ (0,-4)$

164. $x-2y=8$

Answer: $(8,0),\ (0,-4)$

165. $4x-y=8$

Answer: $(2,0),\ (0,-8)$

166. $5x-y=5$

Answer: $(1,0),\ (0,-5)$

167. $2x+5y=10$

Answer: $(5,0),\ (0,2)$

168. $2x+3y=6$

Answer: $(3,0),\ (0,2)$

169. $3x-2y=12$

Answer: $(4,0),\ (0,-6)$

170. $3x-5y=30$

Answer: $(10,0),\ (0,-6)$

171. $y=\frac{1}{3}x+1$

Answer: $(-3,0),\ (0,1)$

172. $y=\frac{1}{4}x-1$

Answer: $(4,0),\ (0,-1)$

173. $y=\frac{1}{5}x+2$

Answer: $(-10,0),\ (0,2)$

174. $y=\frac{1}{3}x+4$

Answer: $(-12,0),\ (0,4)$

175. $y=3x$

Answer: $(0,0)$

176. $y = -2x$

Answer: $(0,0)$

177. $y = -4x$

Answer: $(0,0)$

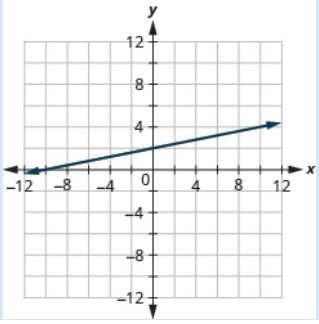
178. $y = 5x$

Answer: $(0,0)$

Graph a Line Using the Intercepts In the following exercises, graph using the intercepts.

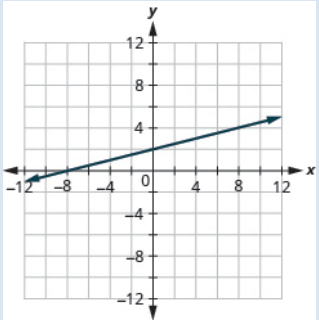
179. $-x + 5y = 10$

Answer:



180. $-x + 4y = 8$

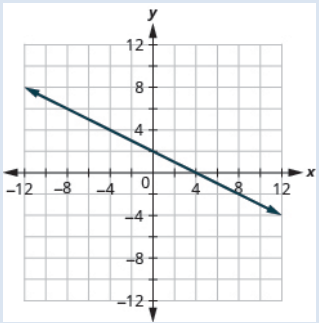
Answer:



OpenStax
4.3 Graph with Intercepts

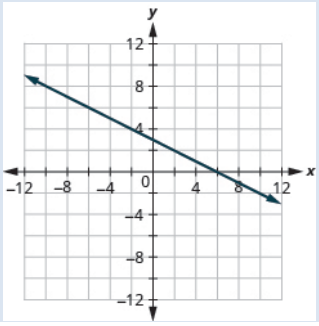
181. $x+2y=4$

Answer:



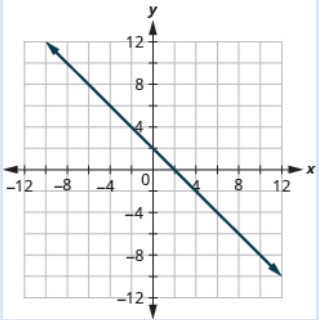
182. $x+2y=6$

Answer:



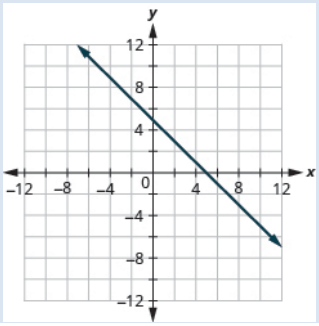
183. $x+y=2$

Answer:



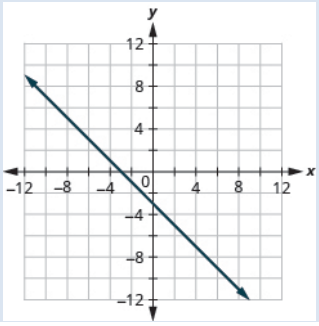
184. $x+y=5$

Answer:



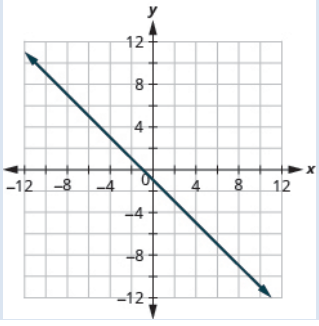
185. $x+y=-3$

Answer:



186. $x+y=-1$

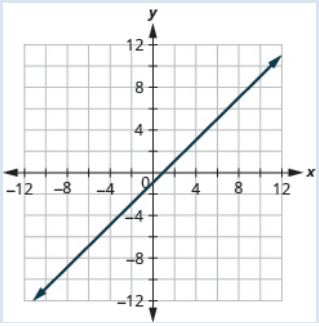
Answer:



OpenStax
4.3 Graph with Intercepts

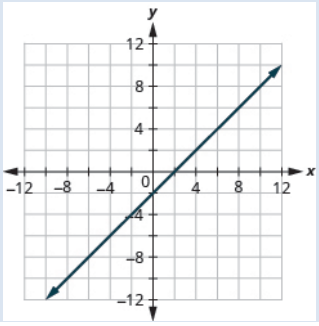
187. $x - y = 1$

Answer:



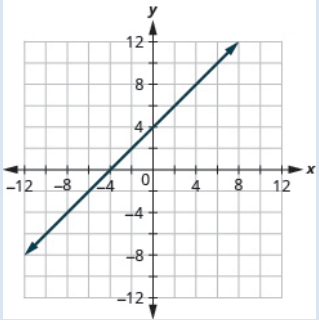
188. $x - y = 2$

Answer:



189. $x - y = -4$

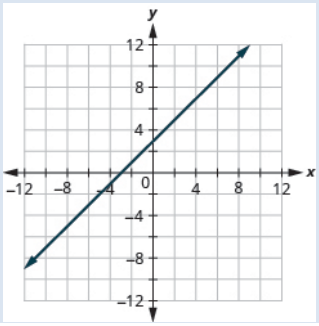
Answer:



OpenStax
4.3 Graph with Intercepts

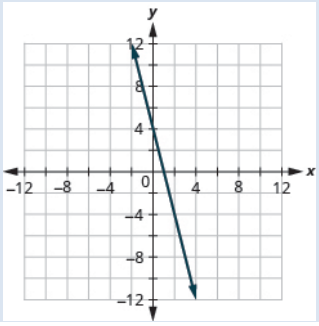
190. $x - y = -3$

Answer:



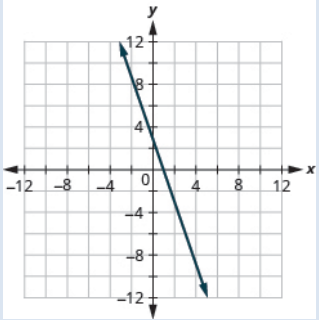
191. $4x + y = 4$

Answer:



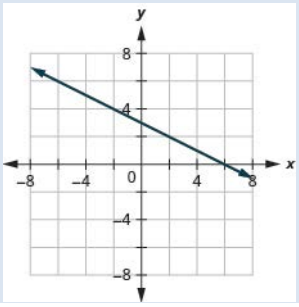
192. $3x + y = 3$

Answer:



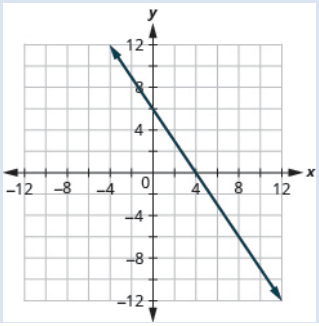
193. $2x+4y=12$

Answer:



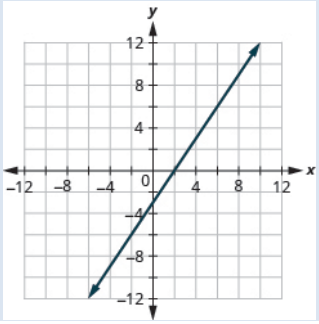
194. $3x+2y=12$

Answer:



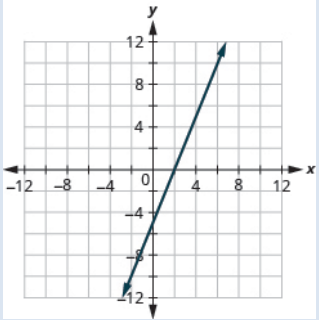
195. $3x-2y=6$

Answer:



196. $5x-2y=10$

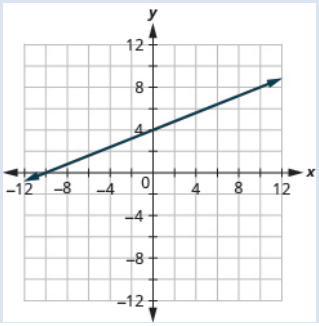
Answer:



OpenStax
4.3 Graph with Intercepts

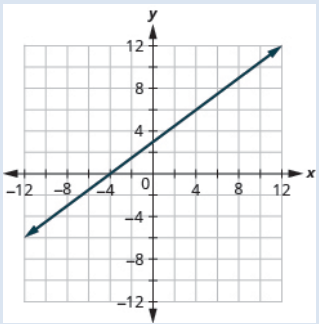
197. $2x-5y=-20$

Answer:



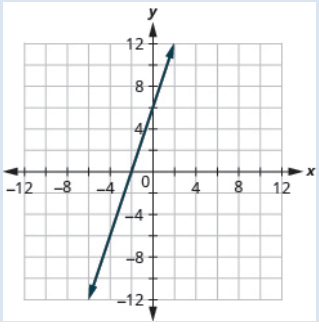
198. $3x-4y=-12$

Answer:



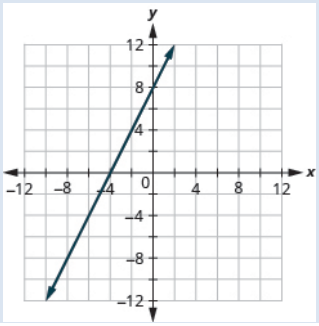
199. $3x-y=-6$

Answer:



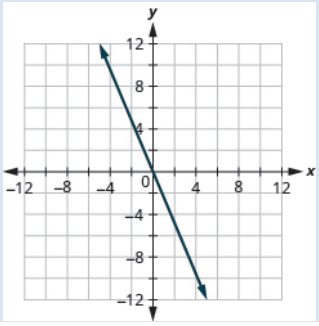
200. $2x - y = -8$

Answer:



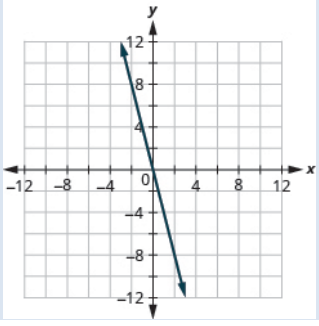
201. $y = -2x$

Answer:



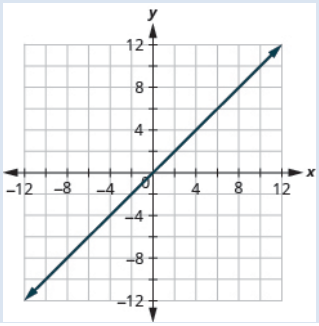
202. $y = -4x$

Answer:



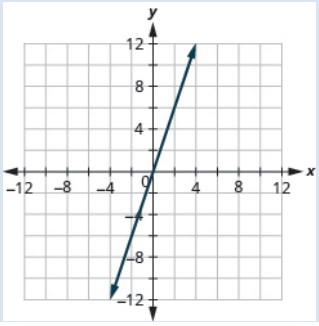
203. $y = x$

Answer:



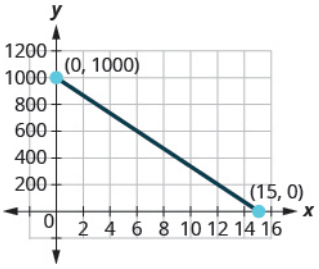
204. $y = 3x$

Answer:



Everyday Math

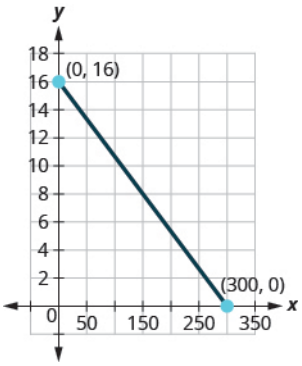
205. Road trip. Damien is driving from Chicago to Denver, a distance of 1000 miles. The *x*- axis on the graph below shows the time in hours since Damien left Chicago. The *y*- axis represents the distance he has left to drive.



(a) Find the *x*- and *y*- intercepts.
(b) Explain what the *x*- and *y*- intercepts mean for Damien.

Answer: (a) $(0,1000)$, $(15,0)$ (b) At $(0,1000)$, he has been gone 0 hours and has 1000 miles left. At $(15,0)$, he has been gone 15 hours and has 0 miles left to go.

206. Road trip. Ozzie filled up the gas tank of his truck and headed out on a road trip. The *x*- axis on the graph below shows the number of miles Ozzie drove since filling up. The *y*- axis represents the number of gallons of gas in the truck's gas tank.



(a) Find the *x*- and *y*- intercepts.
(b) Explain what the *x*- and *y*- intercepts mean for Ozzie.

Answer: (a) $(0,16)$, $(300,0)$ (b) At $(0,16)$, he has driven 0 miles and has 16 gallons of gas in the tank. At $(300,0)$, he has driven 300 miles and has 0 gallons of gas.

Writing Exercises

207. How do you find the *x*- intercept of the graph of $3x-2y=6$?

Answer: Answers will vary.

208. Do you prefer to use the method of plotting points or the method using the intercepts to graph the equation $4x+y=-4$? Why?

Answer: Answers will vary.

209. Do you prefer to use the method of plotting points or the method using the intercepts to graph the equation $y=\frac{2}{3}x-2$? Why?

Answer: Answers will vary.

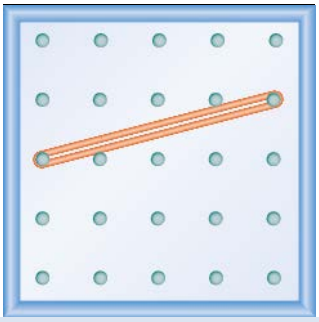
210. Do you prefer to use the method of plotting points or the method using the intercepts to graph the equation $y=6$? Why?

Answer: Answers will vary.

Elementary Algebra
4: Graphs
4.4 Understand Slope of a Line

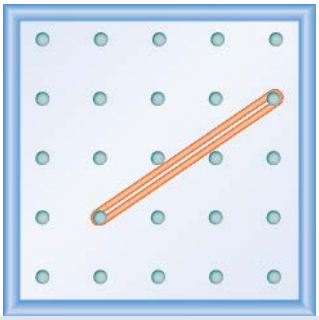
Use Geoboards to Model Slope In the following exercises, find the slope modeled on each geoboard.

211.



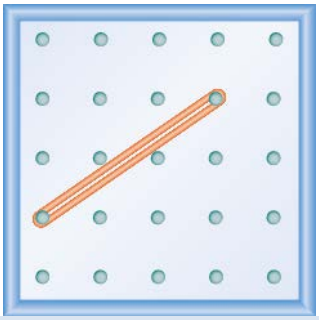
Answer: $\frac{1}{4}$

212.



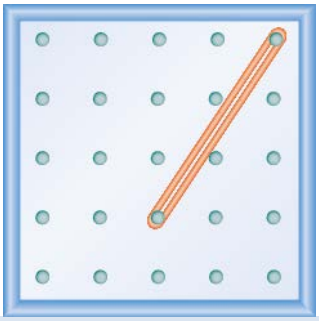
Answer: $\frac{2}{3}$

213.



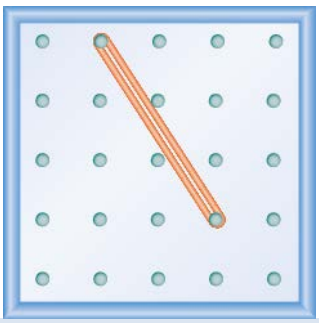
Answer: $\frac{2}{3}$

214.



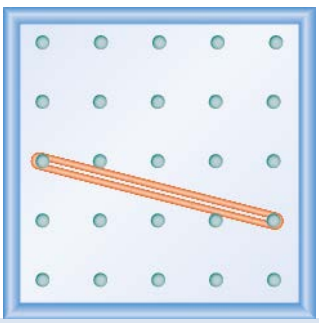
Answer: $\frac{3}{2}$

215.



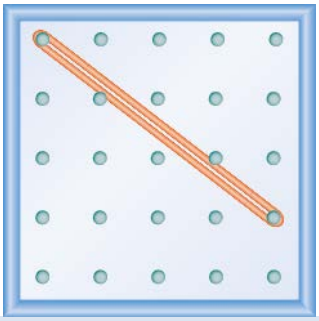
Answer: $\frac{-3}{2}=-\frac{3}{2}$

216.



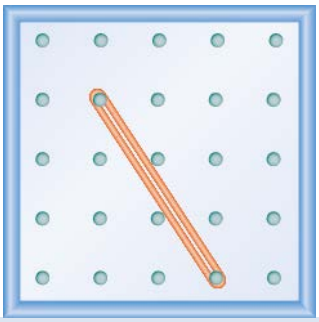
Answer: $\frac{-1}{4}=-\frac{1}{4}$

217.



Answer: $-\frac{2}{3}$

218.

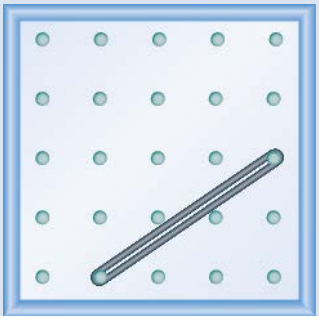


Answer: $-\frac{3}{2}$

In the following exercises, model each slope. Draw a picture to show your results.

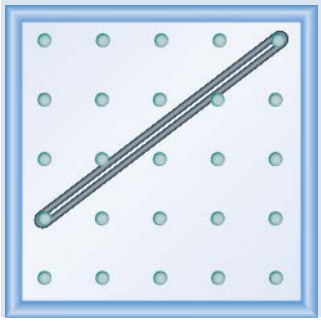
219. $\frac{2}{3}$

Answer:



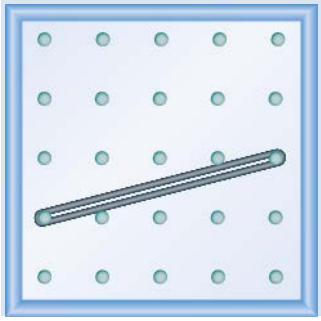
220. $\frac{3}{4}$

Answer:



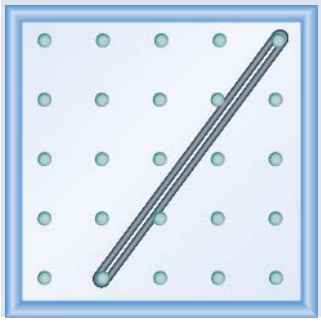
221. $\frac{1}{4}$

Answer:



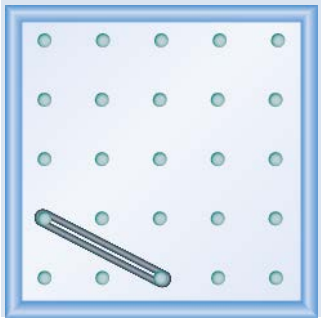
222. $\frac{4}{3}$

Answer:



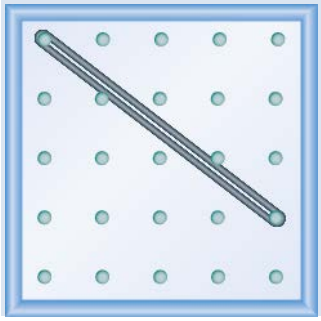
223. $-\frac{1}{2}$

Answer:



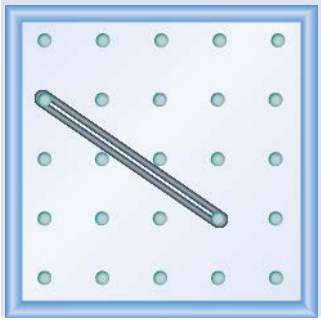
224. $-\frac{3}{4}$

Answer:



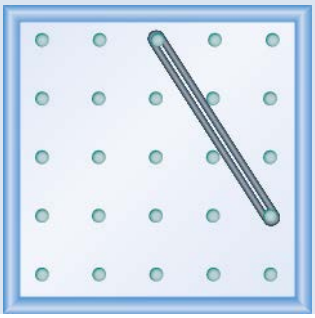
225. $-\frac{2}{3}$

Answer:



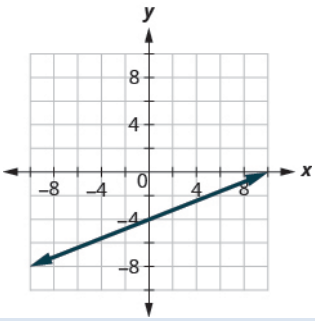
226. $-\frac{3}{2}$

Answer:



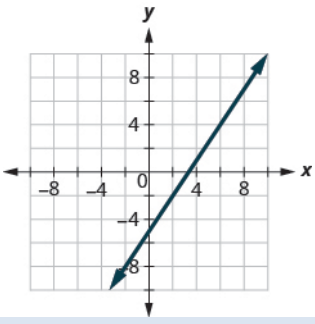
Use $m = \frac{\text{rise}}{\text{run}}$ to find the Slope of a Line from its Graph In the following exercises, find the slope of each line shown.

227.



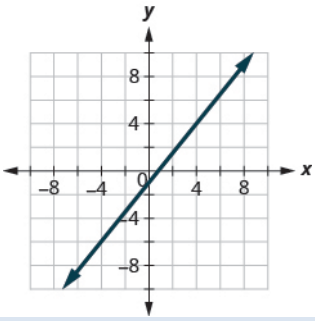
Answer: $\frac{2}{5}$

228.



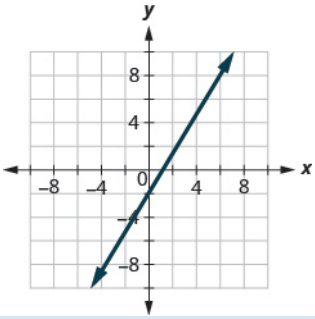
Answer: $\frac{3}{2}$

229.



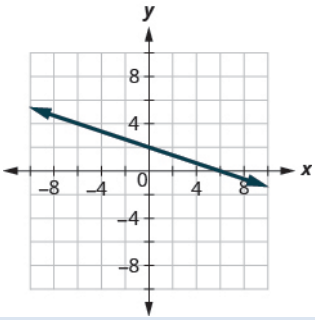
Answer: $\frac{5}{4}$

230.



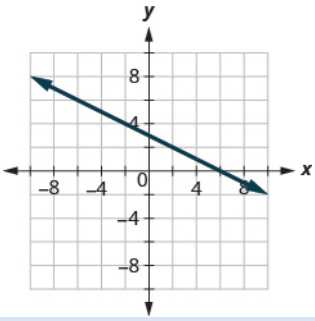
Answer: $\frac{5}{3}$

231.



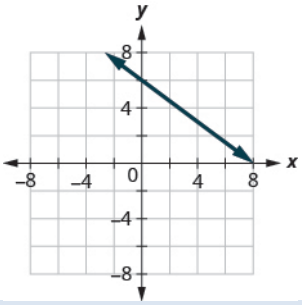
Answer: $-\frac{1}{3}$

232.



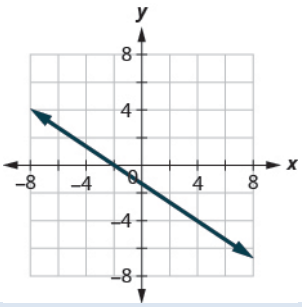
Answer: $-\frac{1}{2}$

233.



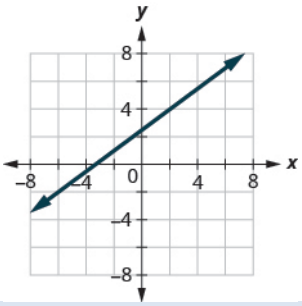
Answer: $-\frac{3}{4}$

234.



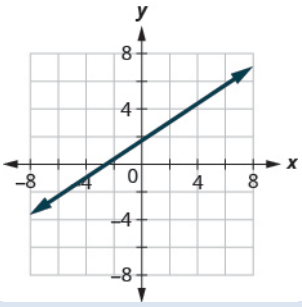
Answer: $-\frac{2}{3}$

235.



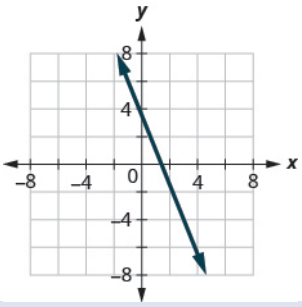
Answer: $\frac{3}{4}$

236.



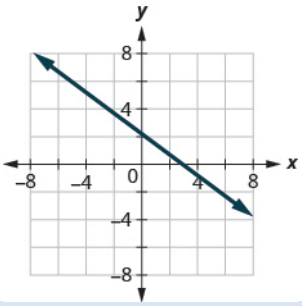
Answer: $\frac{2}{3}$

237.



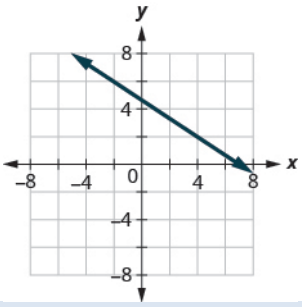
Answer: $-\frac{5}{2}$

238.



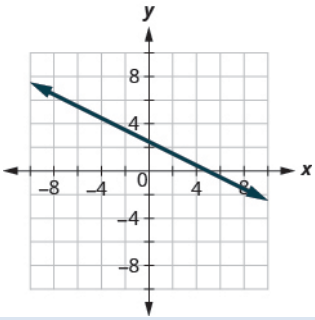
Answer: $-\frac{3}{4}$

239.



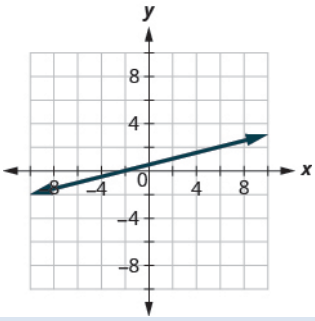
Answer: $-\frac{2}{3}$

240.



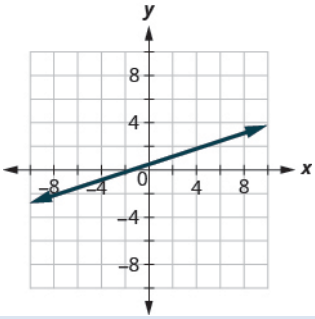
Answer: $-\frac{1}{2}$

241.



Answer: $\frac{1}{4}$

242.



Answer: $\frac{1}{3}$

Find the Slope of Horizontal and Vertical Lines In the following exercises, find the slope of each line.

243. $y=3$

Answer: 0

244. $y=1$

Answer: 0

245. $x=4$

Answer: undefined

246. $x=2$

Answer: undefined

247. $y=-2$

Answer: 0

248. $y=-3$

Answer: 0

249. $x = -5$

Answer: undefined

250. $x = -4$

Answer: undefined

Use the Slope Formula to find the Slope of a Line between Two Points In the following exercises, use the slope formula to find the slope of the line between each pair of points.

251. $(1,4),\ (3,9)$

Answer: $\frac{5}{2}$

252. $(2,3),\ (5,7)$

Answer: $\frac{4}{3}$

253. $(0,3),\ (4,6)$

Answer: $\frac{3}{4}$

254. $(0,1),\ (5,4)$

Answer: $\frac{3}{5}$

255. $(2,5),\ (4,0)$

Answer: $-\frac{5}{2}$

256. $(3,6),\ (8,0)$

Answer: $-\frac{6}{5}$

257. $(-3,3),\ (4,-5)$

Answer: $-\frac{8}{7}$

258. $(-2,4),\ (3,-1)$

Answer: -1

259. $(-1,-2),\ (2,5)$

Answer: $\frac{7}{3}$

260. $(-2,-1),\ (6,5)$

Answer: $\frac{3}{4}$

261. $(4,-5),\ (1,-2)$

Answer: -1

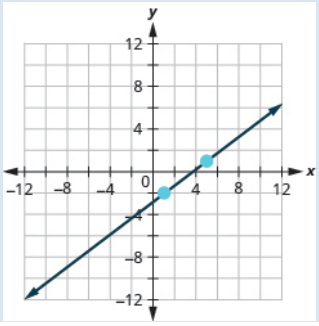
262. $(3,-6),\ (2,-2)$

Answer: -4

Graph a Line Given a Point and the Slope In the following exercises, graph each line with the given point and slope.

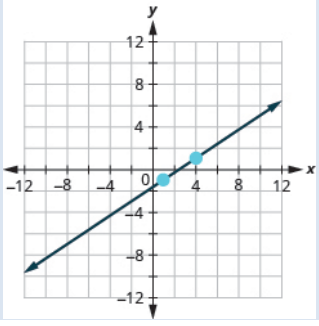
263. $(1,-2);\ m=\frac{3}{4}$

Answer:



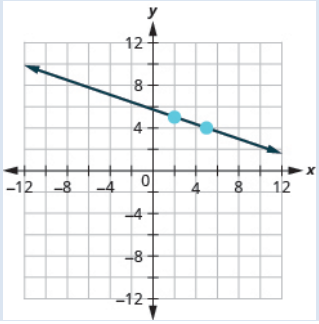
264. $(1,-1);\ m=\frac{2}{3}$

Answer:



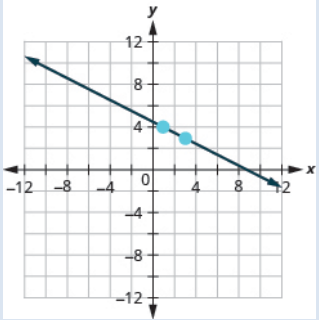
265. $(2,5)$; $m=-\frac{1}{3}$

Answer:



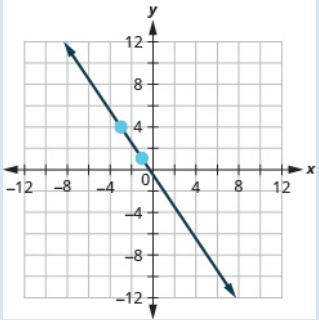
266. $(1,4)$; $m=-\frac{1}{2}$

Answer:



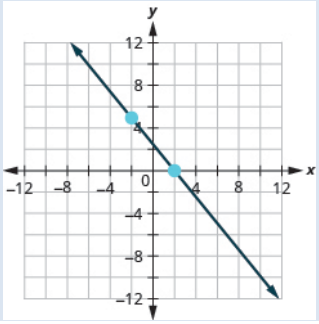
267. $(-3,4)$; $m=-\frac{3}{2}$

Answer:



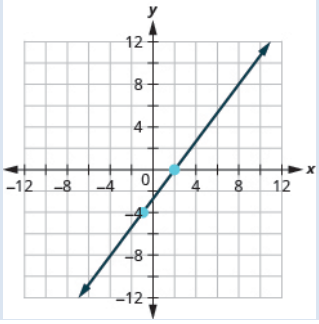
268. $(-2,5)$; $m=-\frac{5}{4}$

Answer:



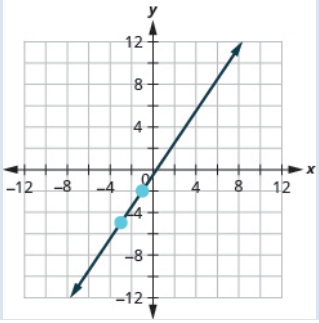
269. $(-1,-4)$; $m=\frac{4}{3}$

Answer:



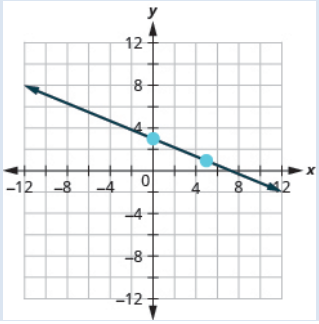
270. $(-3,-5)$; $m=\frac{3}{2}$

Answer:



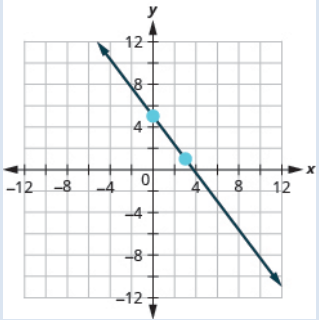
271. *y*-intercept 3; $m = -\frac{2}{5}$

Answer:



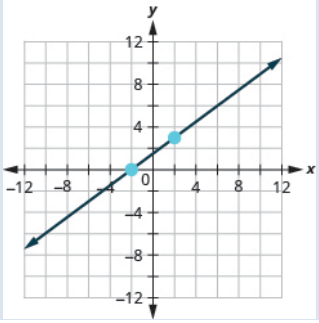
272. *y*-intercept 5; $m = -\frac{4}{3}$

Answer:



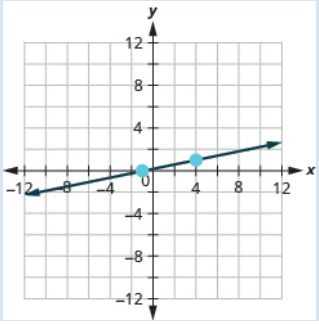
273. *x*-intercept -2; $m = \frac{3}{4}$

Answer:



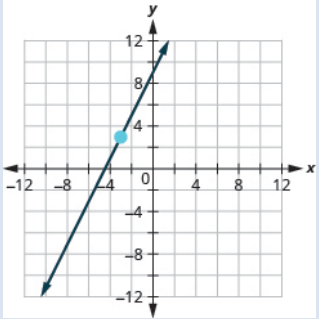
274. x-intercept -1; $m=\frac{1}{5}$

Answer:



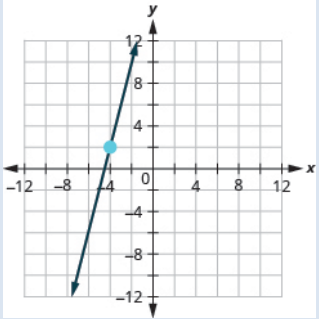
275. $(-3,3)$; $m=2$

Answer:



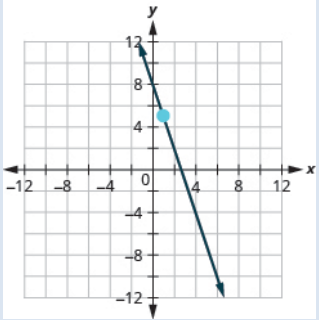
276. $(-4,2)$; $m=4$

Answer:



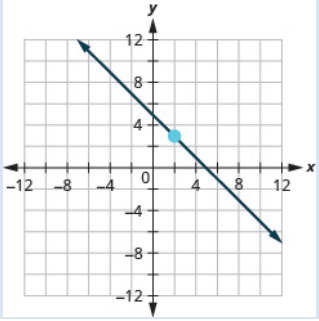
277. $(1,5)$; $m=-3$

Answer:



278. $(2,3)$; $m=-1$

Answer:



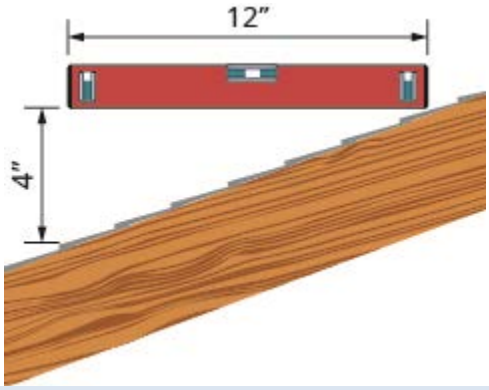
Everyday Math

279. **Slope of a roof.** An easy way to determine the slope of a roof is to set one end of a 12 inch level on the roof surface and hold it level. Then take a tape measure or ruler and measure from the other end of the level down to the roof surface. This will give you the slope of the roof.

Builders, sometimes, refer to this as pitch and state it as an "x 12 pitch" meaning $\frac{x}{12}$, where x is the measurement from the roof to the level—the rise. It is also sometimes stated as an "x-in-12 pitch".

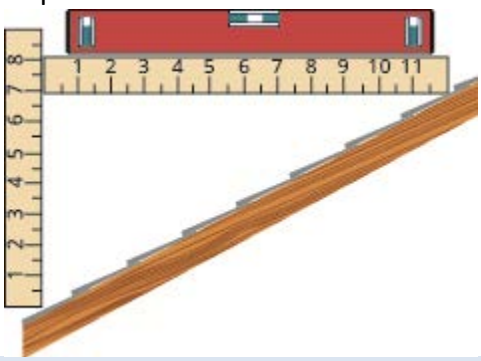
(a) What is the slope of the roof in this picture?

(b) What is the pitch in construction terms?



Answer: (a) $\frac{1}{3}$ (b) 4 12 pitch or 4-in-12 pitch

280. The slope of the roof shown here is measured with a 12" level and a ruler. What is the slope of this roof?



Answer: $\frac{7}{12}$

281. Road grade. A local road has a grade of 64. The grade of a road is its slope expressed as a percent. Find the slope of the road as a fraction and then simplify. What rise and run would reflect this slope or grade?

Answer: $\frac{3}{50}$; rise = 3, run = 50

282. Highway grade. A local road rises 2 feet for every 50 feet of highway.
(a) What is the slope of the highway? (b) The grade of a highway is its slope expressed as a percent. What is the grade of this highway?

Answer: (a) $\frac{2}{50}$ (b) 4%

283. Wheelchair ramp. The rules for wheelchair ramps require a maximum 1-inch rise for a 12-inch run. (a) How long must the ramp be to accommodate a 24-inch rise to the door? (b) Create a model of this ramp.

Answer: (a) 288 inches (24 feet) (b) Models will vary.

284. Wheelchair ramp. A 1-inch rise for a 16-inch run makes it easier for the wheelchair rider to ascend a ramp. (a) How long must a ramp be to easily accommodate a 24-inch rise to the door? (b) Create a model of this ramp.

Answer: (a) 384 inches (32 feet) (b) Models will vary.

Writing Exercises

285. What does the sign of the slope tell you about a line?

Answer: When the slope is a positive number the line goes up from left to right. When the slope is a negative number the line goes down from left to right.

286. How does the graph of a line with slope $m=\frac{1}{2}$ differ from the graph of a line with slope $m=2$?

Answer: A line with slope 2 will be steeper than a line with slope $\frac{1}{2}$.

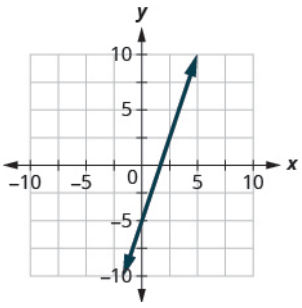
287. Why is the slope of a vertical line “undefined”?

Answer: A vertical line has 0 run and since division by 0 is undefined the slope is undefined.

Elementary Algebra
4: Graphs
4. 5 Use the Slope-Intercept Form of an Equation of a Line

Recognize the Relation Between the Graph and the Slope–Intercept Form of an Equation of a Line In the following exercises, use the graph to find the slope and y-intercept of each line. Compare the values to the equation $y = mx + b$.

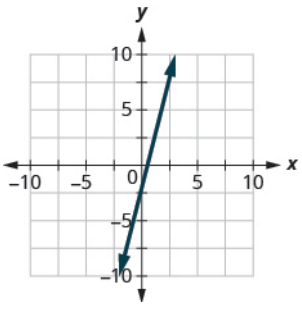
288.



$y = 3x - 5$

Answer: slope $m = 3$ and *y*-intercept $(0, -5)$

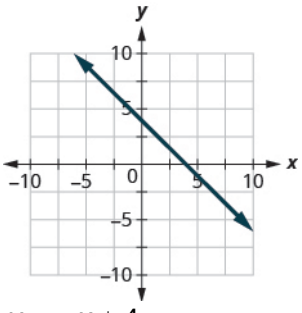
289.



$y = 4x - 2$

Answer: slope $m = 4$ and *y*-intercept $(0, -2)$

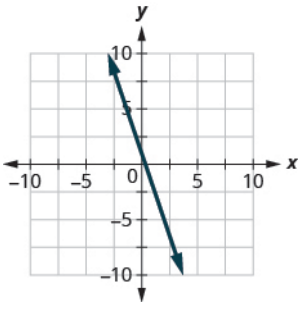
290.



$y = -x + 4$

Answer: slope $m = -1$ and *y*-intercept $(0, 4)$

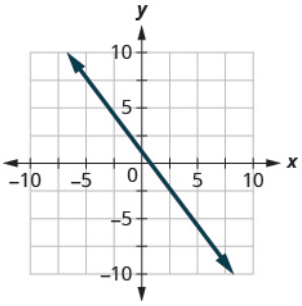
291.



$y = -3x + 1$

Answer: slope $m = -3$ and y-intercept $(0,1)$

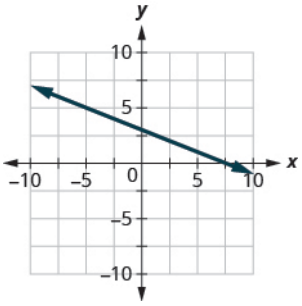
292.



$y = -\frac{4}{3}x + 1$

Answer: slope $m = -\frac{4}{3}$ and y-intercept $(0,1)$

293.



$y = -\frac{2}{5}x + 3$

Answer: slope $m = -\frac{2}{5}$ and y-intercept $(0,3)$

Identify the Slope and y-Intercept From an Equation of a Line In the following exercises, identify the slope and y-intercept of each line.

294. $y=-7x+3$

Answer: $-7;(0,3)$

295. $y=-9x+7$

Answer: $-9;(0,7)$

296. $y=6x-8$

Answer: $6;(0,-8)$

297. $y=4x-10$

Answer: $4;(0,-10)$

298. $3x+y=5$

Answer: $-3;(0,5)$

299. $4x+y=8$

Answer: $-4;(0,8)$

300. $6x+4y=12$

Answer: $-\frac{3}{2};(0,3)$

301. $8x+3y=12$

Answer: $-\frac{8}{3};(0,4)$

302. $5x-2y=6$

Answer: $\frac{5}{2};(0,-3)$

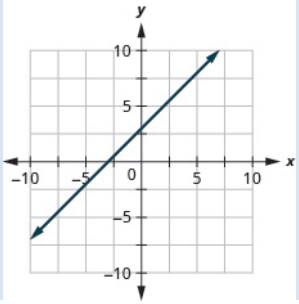
303. $7x-3y=9$

Answer: $\frac{7}{3};(0,-3)$

Graph a Line Using Its Slope and Intercept In the following exercises, graph the line of each equation using its slope and y-intercept.

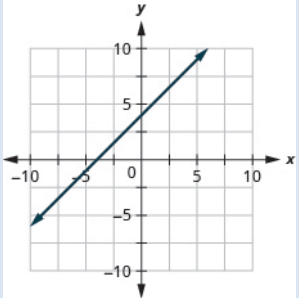
304. $y = x + 3$

Answer:



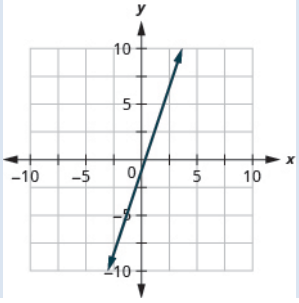
305. $y = x + 4$

Answer:



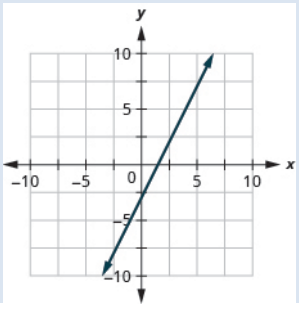
306. $y = 3x - 1$

Answer:



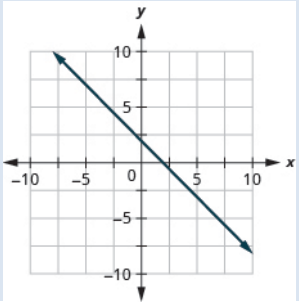
307. $y = 2x - 3$

Answer:



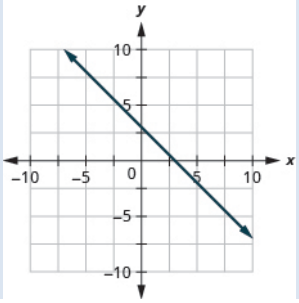
308. $y = -x + 2$

Answer:



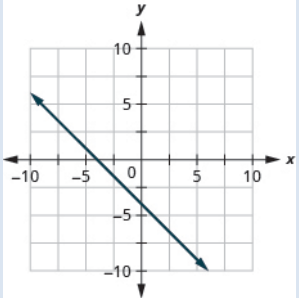
309. $y = -x + 3$

Answer:



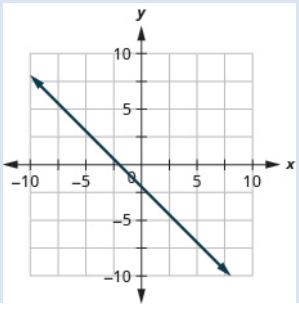
310. $y = -x - 4$

Answer:



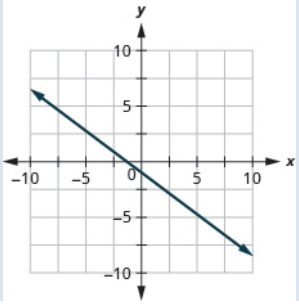
311. $y = -x - 2$

Answer:



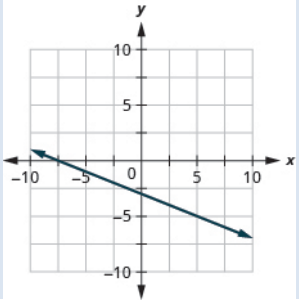
312. $y = -\frac{3}{4}x - 1$

Answer:



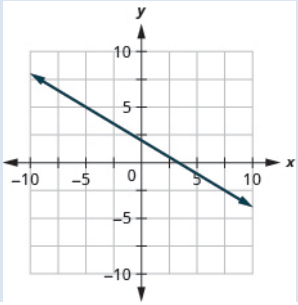
313. $y = -\frac{2}{5}x - 3$

Answer:



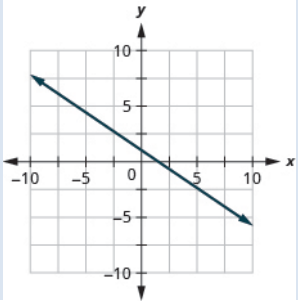
314. $y=-\frac{3}{5}x+2$

Answer:



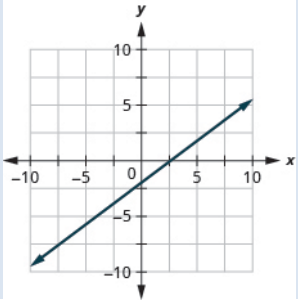
315. $y=-\frac{2}{3}x+1$

Answer:



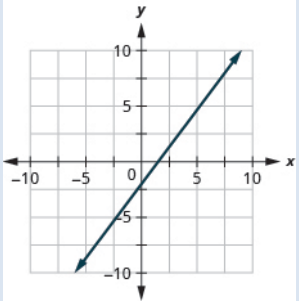
316. $3x-4y=8$

Answer:



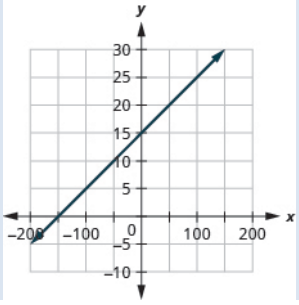
317. $4x-3y=6$

Answer:



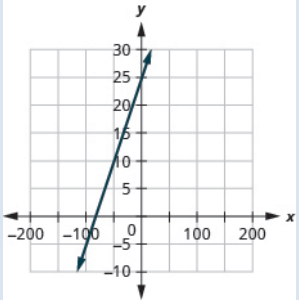
318. $y = 0.1x + 15$

Answer:



319. $y = 0.3x + 25$

Answer:



Choose the Most Convenient Method to Graph a Line In the following exercises, determine the most convenient method to graph each line.

320. $x = 2$

Answer: vertical line

321. $y = 4$

Answer: horizontal line

322. $y = 5$

Answer: horizontal line

323. $x = -3$

Answer: vertical line

324. $y=-3x+4$

Answer: slope–intercept

325. $y=-5x+2$

Answer: slope–intercept

326. $x-y=5$

Answer: intercepts

327. $x-y=1$

Answer: intercepts

328. $y=\frac{2}{3}x-1$

Answer: slope–intercept

329. $y=\frac{4}{5}x-3$

Answer: slope–intercept

330. $y=-3$

Answer: horizontal line

331. $y=-1$

Answer: horizontal line

332. $3x-2y=-12$

Answer: intercepts

333. $2x-5y=-10$

Answer: intercepts

334. $y=-\frac{1}{4}x+3$

Answer: slope–intercept

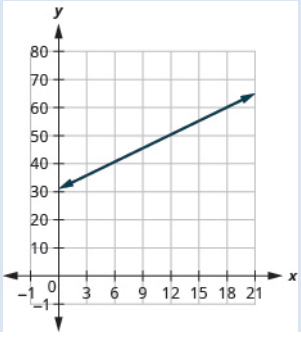
335. $y=-\frac{1}{3}x+5$

Answer: slope–intercept

Graph and Interpret Applications of Slope–Intercept

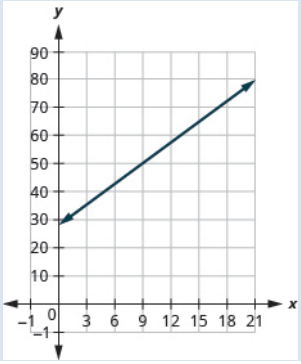
336. The equation $P = 31 + 1.75w$ models the relation between the amount of Tuyet's monthly water bill payment, P, in dollars, and the number of units of water, w, used.
(a) Find Tuyet's payment for a month when 0 units of water are used.
(b) Find Tuyet's payment for a month when 12 units of water are used.
(c) Interpret the slope and P-intercept of the equation.
(d) Graph the equation.

Answer: (a) $31
(b) $52
(c) The slope, 1.75, means that the payment, P, increases by $1.75 when the number of units of water used, w, increases by 1. The P–intercept means that when the number units of water Tuyet used is 0, the payment is $31.;
(d)



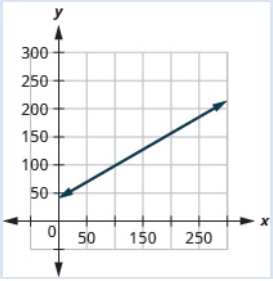
337. The equation $P = 28 + 2.54w$ models the relation between the amount of Randy's monthly water bill payment, P, in dollars, and the number of units of water, w, used.
(a) Find the payment for a month when Randy used 0 units of water.
(b) Find the payment for a month when Randy used 15 units of water.
(c) Interpret the slope and P-intercept of the equation.
(d) Graph the equation.

Answer: (a) $28
(b) $66.10
(c) The slope, 2.54, means that Randy's payment, P, increases by $2.54 when the number of units of water he used, w, increases by 1. The P–intercept means that if the number units of water Randy used was 0, the payment would be $28.
(d)



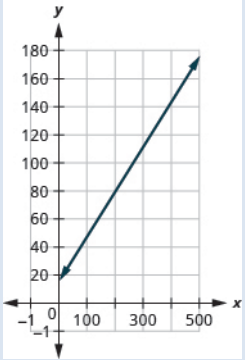
338. Bruce drives his car for his job. The equation $R = 0.575m + 42$ models the relation between the amount in dollars, *R*, that he is reimbursed and the number of miles, *m*, he drives in one day.
(a) Find the amount Bruce is reimbursed on a day when he drives 0 miles.
(b) Find the amount Bruce is reimbursed on a day when he drives 220 miles.
(c) Interpret the slope and *R*-intercept of the equation.
(d) Graph the equation.

Answer: (a) $42
(b) $168.50
(c) The slope, 0.575, means that the amount he is reimbursed, *R*, increases by $0.575 when the number of miles driven, *m,* increases by 1. The *R*-intercept means that when the number miles driven is 0, the amount reimbursed is $42.
(d)



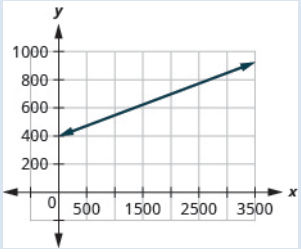
339. Janelle is planning to rent a car while on vacation. The equation $C = 0.32m + 15$ models the relation between the cost in dollars, *C*, per day and the number of miles, *m*, she drives in one day.
(a) Find the cost if Janelle drives the car 0 miles one day.
(b) Find the cost on a day when Janelle drives the car 400 miles.
(c) Interpret the slope and *C*–intercept of the equation.
(d) Graph the equation.

Answer: (a) $15
(b) $143
(c) The slope, 0.32, means that the cost, *C*, increases by $0.32 when the number of miles driven, *m,* increases by 1. The *C*-intercept means that if Janelle drives 0 miles one day, the cost would be $15.
(d)



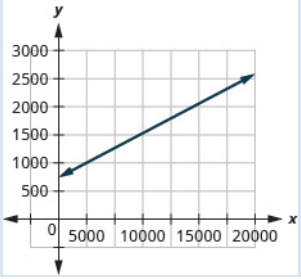
340. Cherie works in retail and her weekly salary includes commission for the amount she sells. The equation $S = 400 + 0.15c$ models the relation between her weekly salary, *S*, in dollars and the amount of her sales, *c*, in dollars.
(a) Find Cherie's salary for a week when her sales were 0.
(b) Find Cherie's salary for a week when her sales were 3600.
(c) Interpret the slope and *S*–intercept of the equation.
(d) Graph the equation.

Answer: (a) $400
(b) $940
(c) The slope, 0.15, means that Cherie's salary, *S*, increases by $0.15 for every $1 increase in her sales. The *S*-intercept means that when her sales are $0, her salary is $400.
(d)



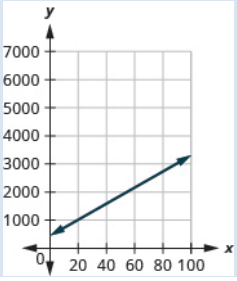
341. Patel's weekly salary includes a base pay plus commission on his sales. The equation $S = 750 + 0.09c$ models the relation between his weekly salary, *S*, in dollars and the amount of his sales, *c*, in dollars.
(a) Find Patel's salary for a week when his sales were 0.
(b) Find Patel's salary for a week when his sales were 18,540.
(c) Interpret the slope and *S*-intercept of the equation.
(d) Graph the equation.

Answer: (a) $750
(b) $2418.60
(c) The slope, 0.09, means that Patel's salary, *S*, increases by $0.09 for every $1 increase in his sales. The *S*-intercept means that when his sales are $0, his salary is $750.
(d)



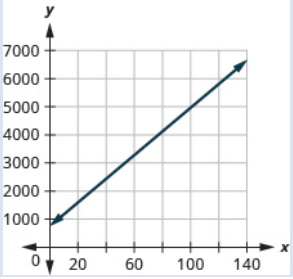
342. Costa is planning a lunch banquet. The equation $C = 450 + 28g$ models the relation between the cost in dollars, C, of the banquet and the number of guests, g.
(a) Find the cost if the number of guests is 40.
(b) Find the cost if the number of guests is 80.
(c) Interpret the slope and C-intercept of the equation.
(d) Graph the equation.

Answer: (a) $1570
(b) $5690
(c) The slope, 28, means that the cost, C, increases by $28 when the number of guests increases by 1. The C-intercept means that if the number of guests was 0, the cost would be $450.
(d)



343. Margie is planning a dinner banquet. The equation $C = 750 + 42g$ models the relation between the cost in dollars, C of the banquet and the number of guests, g.
(a) Find the cost if the number of guests is 50.
(b) Find the cost if the number of guests is 100.
(c) Interpret the slope and C–intercept of the equation.
(d) Graph the equation.

Answer: (a) $2850
(b) $4950
(c) The slope, 42, means that the cost, C, increases by $42 for when the number of guests increases by 1. The C-intercept means that when the number of guests is 0, the cost would be $750.
(d)



Use Slopes to Identify Parallel Lines In the following exercises, use slopes and y-intercepts to determine if the lines are parallel.

344. $y=\frac{3}{4}x-3;\quad 3x-4y=-2$

Answer: parallel

345. $y=\frac{2}{3}x-1;\quad 2x-3y=-2$

Answer: parallel

346. $2x-5y=-3;\quad y=\frac{2}{5}x+1$

Answer: parallel

347. $3x-4y=-2;\quad y=\frac{3}{4}x-3$

Answer: parallel

348. $2x-4y=6;\quad x-2y=3$

Answer: not parallel

349. $6x-3y=9;\quad 2x-y=3$

Answer: not parallel

350. $4x+2y=6;\quad 6x+3y=3$

Answer: parallel

351. $8x+6y=6;\ 12x+9y=12$

Answer: parallel

352. $x=5;\quad x=-6$

Answer: parallel

353. $x = 7; \quad x = -8$

Answer: parallel

354. $x = -4; \quad x = -1$

Answer: parallel

355. $x = -3; \quad x = -2$

Answer: parallel

356. $y = 2; \quad y = 6$

Answer: parallel

357. $y = 5; \quad y = 1$

Answer: parallel

358. $y = -4; \quad y = 3$

Answer: parallel

359. $y = -1; \quad y = 2$

Answer: parallel

360. $x - y = 2; \quad 2x - 2y = 4$

Answer: not parallel

361. $4x + 4y = 8; \quad x + y = 2$

Answer: not parallel

362. $x - 3y = 6; \quad 2x - 6y = 12$

Answer: not parallel

363. $5x - 2y = 11; \quad 5x - y = 7$

Answer: not parallel

364. $3x - 6y = 12; \quad 6x - 3y = 3$

Answer: not parallel

365. $4x - 8y = 16; \quad x - 2y = 4$

Answer: not parallel

366. $9x - 3y = 6; \; 3x - y = 2$

Answer: not parallel

367. $x-5y=10;\quad 5x-y=-10$

Answer: not parallel

368. $7x-4y=8;\quad 4x+7y=14$

Answer: not parallel

369. $9x-5y=4;\quad 5x+9y=-1$

Answer: not parallel

Use Slopes to Identify Perpendicular Lines In the following exercises, use slopes and y-intercepts to determine if the lines are perpendicular.

370. $3x-2y=8;\quad 2x+3y=6$

Answer: perpendicular

371. $x-4y=8;\quad 4x+y=2$

Answer: perpendicular

372. $2x+5y=3;\quad 5x-2y=6$

Answer: perpendicular

373. $2x+3y=5;\quad 3x-2y=7$

Answer: perpendicular

374. $3x-2y=1;\quad 2x-3y=2$

Answer: not perpendicular

375. $3x-4y=8;\quad 4x-3y=6$

Answer: not perpendicular

376. $5x+2y=6;\quad 2x+5y=8$

Answer: not perpendicular

377. $2x+4y=3;\quad 6x+3y=2$

Answer: not perpendicular

378. $4x-2y=5;\quad 3x+6y=8$

Answer: perpendicular

379. $2x-6y=4;\quad 12x+4y=9$

Answer: perpendicular

380. $6x-4y=5;\ \ 8x+12y=3$

Answer: perpendicular

381. $8x-2y=7;\ \ 3x+12y=9$

Answer: perpendicular

Everyday Math

382. The equation $C=\frac{5}{9}F-17.8$ can be used to convert temperatures *F*, on the Fahrenheit scale to temperatures, *C*, on the Celsius scale.
(a) Explain what the slope of the equation means.
(b) Explain what the *C*–intercept of the equation means.

Answer: (a) For every increase of nine degrees Fahrenheit, the Celsius temperature increases by five degrees.
(b) The Celsius temperature is -17.8^{o} when the Fahrenheit temperature is 0^{o} .

383. The equation $n=4T-160$ is used to estimate the number of cricket chirps, *n*, in one minute based on the temperature in degrees Fahrenheit, *T*.
(a) Explain what the slope of the equation means.
(b) Explain what the *n*–intercept of the equation means. Is this a realistic situation?

Answer: (a) For every increase of one degree Fahrenheit, the number of chirps increases by four.
(b) There would be -160 chirps when the Fahrenheit temperature is 0^{o} .(Notice that this does not make sense; this model cannot be used for all possible temperatures.)

Writing Exercises

384. Explain in your own words how to decide which method to use to graph a line.

Answer: Answers will vary.

385. Why are all horizontal lines parallel?

Answer: Answers will vary.

Elementary Algebra
4: Graphs
4. 6 Find the Equation of a Line

Find an Equation of the Line Given the Slope and *y*-Intercept In the following exercises, find the equation of a line with given slope and y-intercept. Write the equation in slope–intercept form.

386. slope 3 and *y*-intercept $(0,5)$

Answer: $y=3x+5$

387. slope 4 and *y*-intercept $(0,1)$

Answer: $y=4x+1$

388. slope 6 and *y*-intercept $(0,-4)$

Answer: $y=6x-4$

389. slope 8 and *y*-intercept $(0,-6)$

Answer: $y=8x-6$

390. slope -1 and *y*-intercept $(0,\ 3)$

Answer: $y=-x+3$

391. slope -1 and *y*-intercept $(0,\ 7)$

Answer: $y=-x+7$

392. slope -2 and *y*-intercept $(0,-3)$

Answer: $y=-2x-3$

393. slope -3 and *y*-intercept $(0,-1)$

Answer: $y=-3x-1$

394. slope $\frac{3}{5}$ and *y*-intercept t $(0,-1)$

Answer: $y=\frac{3}{5}x-1$

395. slope $\frac{1}{5}$ and *y*-intercept $(0,-5)$

Answer: $y=\frac{1}{5}x-5$

396. slope $-\frac{3}{4}$ and *y*-intercept $(0,-2)$

Answer: $y=-\frac{3}{4}x-2$

397. slope $-\frac{2}{3}$ and *y*-intercept $(0,-3)$

Answer: $y=-\frac{2}{3}x-3$

398. slope 0 and *y*-intercept $(0,-1)$

Answer: $y=-1$

399. slope 0 and *y*-intercept $(0,\ 2)$

Answer: $y=2$

400. slope -3 and *y*-intercept $(0,0)$

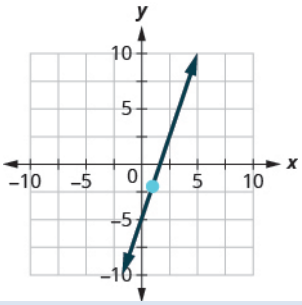
Answer: $y=-3x$

401. slope -4 and *y*-intercept $(0,0)$

Answer: $y=-4x$

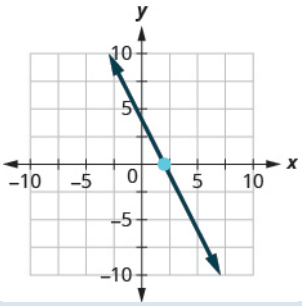
In the following exercises, find the equation of the line shown in each graph. Write the equation in slope–intercept form.

402.



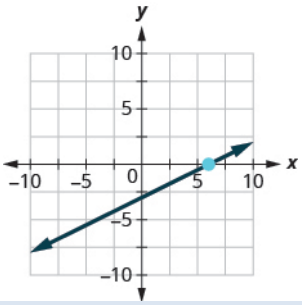
Answer: $y=3x-5$

403.



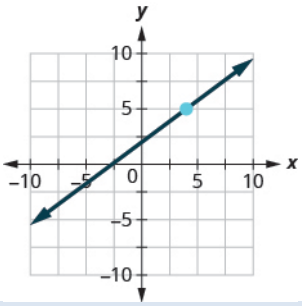
Answer: $y = -2x + 4$

404.



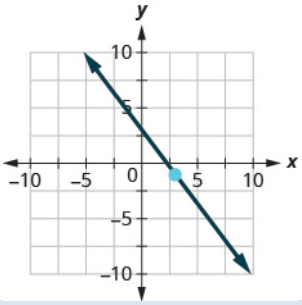
Answer: $y = \frac{1}{2}x - 3$

405.



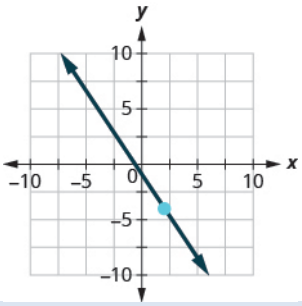
Answer: $y = \frac{3}{4}x + 2$

406.



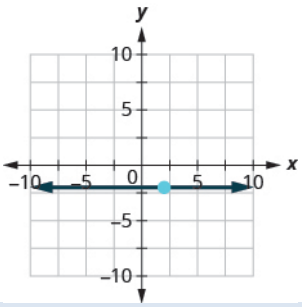
Answer: $y = -\frac{4}{3}x + 3$

407.



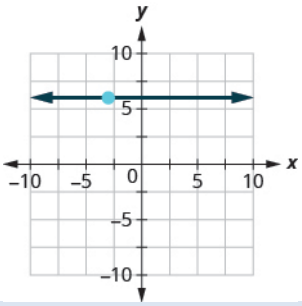
Answer: $y = -\frac{3}{2}x - 1$

408.



Answer: $y = -2$

409.



Answer: $y = 6$

Find an Equation of the Line Given the Slope and a Point In the following exercises, find the equation of a line with given slope and containing the given point. Write the equation in slope–intercept form.

410. $m = \frac{5}{8}$, point $(8, 3)$

Answer: $y = \frac{5}{8}x - 2$

411. $m=\frac{3}{8}$, point $(8, 2)$

Answer: $y=\frac{3}{8}x-1$

412. $m=\frac{1}{6}$, point $(6, 1)$

Answer: $y=\frac{1}{6}x$

413. $m=\frac{5}{6}$, point $(6, 7)$

Answer: $y=\frac{5}{6}x+2$

414. $m=-\frac{3}{4}$, point $(8, -5)$

Answer: $y=-\frac{3}{4}x+1$

415. $m=-\frac{3}{5}$, point $(10, -5)$

Answer: $y=-\frac{3}{5}x+1$

416. $m=-\frac{1}{4}$, point $(-12, -6)$

Answer: $y=-\frac{1}{4}x-9$

417. $m=-\frac{1}{3}$, point $(-9, -8)$

Answer: $y=-\frac{1}{3}x-11$

418. Horizontal line containing $(-2, 5)$

Answer: $y=5$

419. Horizontal line containing $(-1, 4)$

Answer: $y=4$

420. Horizontal line containing $(-2, -3)$

Answer: $y=-3$

421. Horizontal line containing $(-1, -7)$

Answer: $y = -7$

422. $m = -\frac{3}{2}$, point $(-4, -3)$

Answer: $y = -\frac{3}{2}x - 9$

423. $m = -\frac{5}{2}$, point $(-8, -2)$

Answer: $y = -\frac{5}{2}x - 22$

424. $m = -7$, point $(-1, -3)$

Answer: $y = -7x - 10$

425. $m = -4$, point $(-2, -3)$

Answer: $y = -4x - 11$

426. Horizontal line containing $(2, -3)$

Answer: $y = -3$

427. Horizontal line containing $(4, -8)$

Answer: $y = -8$

Find an Equation of the Line Given Two Points In the following exercises, find the equation of a line containing the given points. Write the equation in slope–intercept form.

428. $(2, 6)$ and $(5,3)$

Answer: $y = -x + 8$

429. $(3, 1)$ and $(2,5)$

Answer: $y = -4x + 13$

430. $(4, 3)$ and $(8,1)$

Answer: $y = -\frac{1}{2}x + 5$

431. $(2, 7)$ and $(3,8)$

Answer: $y = x + 5$

432. $(-3,-4)$ and $(5-2)$

Answer: $y=\frac{1}{4}x-\frac{13}{4}$

433. $(-5,-3)$ and $(4,-6)$

Answer: $y=-\frac{1}{3}x-\frac{14}{3}$

434. $(-1,3)$ and $(-6,-7)$

Answer: $y=2x+5$

435. $(-2,8)$ and $(-4,-6)$

Answer: $y=7x+22$

436. $(6,-4)$ and $(-2,5)$

Answer: $y=-\frac{9}{8}x+\frac{11}{4}$

437. $(3,-2)$ and $(-4,\ 4)$

Answer: $y=-\frac{6}{7}x+\frac{4}{7}$

438. $(0,\ 4)$ and $(2,-3)$

Answer: $y=-\frac{7}{2}x+4$

439. $(0,-2)$ and $(-5,-3)$

Answer: $y=\frac{1}{5}x-2$

440. $(7,2)$ and $(7,-2)$

Answer: $x=7$

441. $(4,2)$ and $(4,-3)$

Answer: $x=4$

442. $(-7,-1)$ and $(-7,-4)$

Answer: $x=-7$

443. $(-2,1)$ and $(-2,-4)$

Answer: $x=-2$

444. $(6, 1)$ and $(0, 1)$

Answer: $y = 1$

445. $(6, 2)$ and $(-3, 2)$

Answer: $y = 2$

446. $(3, -4)$ and $(5, -4)$

Answer: $y = -4$

447. $(-6, -3)$ and $(-1, -3)$

Answer: $y = -3$

448. $(4, 3)$ and $(8, 0)$

Answer: $y = -\frac{3}{4}x + 6$

449. $(0, 0)$ and $(1, 4)$

Answer: $y = 4x$

450. $(-2, -3)$ and $(-5, -6)$

Answer: $y = x - 1$

451. $(-3, 0)$ and $(-7, -2)$

Answer: $y = \frac{1}{2}x + \frac{3}{2}$

452. $(8, -1)$ and $(8, -5)$

Answer: $x = 8$

453. $(3, 5)$ and $(-7, 5)$

Answer: $y = 5$

Find an Equation of a Line Parallel to a Given Line In the following exercises, find an equation of a line parallel to the given line and contains the given point. Write the equation in slope–intercept form.

454. line $y = 4x + 2$, point $(1, 2)$

Answer: $y = 4x - 2$

455. line $y = 3x + 4$, point $(2, 5)$

Answer: $y = 3x - 1$

456. line $y = -2x - 3$, point $(-1, 3)$

Answer: $y = -2x + 1$

457. line $y = -3x - 1$, point $(2, -3)$

Answer: $y = -3x + 3$

458. line $3x - y = 4$, point $(3, 1)$

Answer: $y = 3x - 8$

459. line $2x - y = 6$, point $(3, 0)$

Answer: $y = 2x - 6$

460. line $4x + 3y = 6$, point $(0, -3)$

Answer: $y = -\frac{4}{3}x - 3$

461. line $2x + 3y = 6$, point $(0, 5)$

Answer: $y = -\frac{2}{3}x + 5$

462. line $x = -3$, point $(-2, -1)$

Answer: $x = -2$

463. line $x = -4$, point $(-3, -5)$

Answer: $x = -3$

464. line $x - 2 = 0$, point $(1, -2)$

Answer: $x = 1$

465. line $x - 6 = 0$, point $(4, -3)$

Answer: $x = 4$

466. line $y = 5$, point $(2, -2)$

Answer: $y = -2$

467. line $y = 1$, point $(3, -4)$

Answer: $y = -4$

468. line $y+2=0$, point $(3,-3)$

Answer: $y=-3$

469. line $y+7=0$, point $(1,-1)$

Answer: $y=-1$

Find an Equation of a Line Perpendicular to a Given Line In the following exercises, find an equation of a line perpendicular to the given line and contains the given point. Write the equation in slope–intercept form.

470. line $y=-2x+3$, point $(2,2)$

Answer: $y=\frac{1}{2}x+1$

471. line $y=-x+5$, point $(3,3)$

Answer: $y=x$

472. line $y=\frac{3}{4}x-2$, point $(-3\ 4)$

Answer: $y=-\frac{4}{3}x$

473. line $y=\frac{2}{3}x-4$, point $(2,-4)$

Answer: $y=-\frac{3}{2}x-1$

474. line $2x-3y=8$, point $(4,-1)$

Answer: $y=-\frac{3}{2}x+5$

475. line $4x-3y=5$, point $(-3,2)$

Answer: $y=-\frac{3}{4}x-\frac{1}{4}$

476. line $2x+5y=6$, point $(0,0)$

Answer: $y=\frac{5}{2}x$

477. line $4x+5y=-3$, point $(0,0)$

Answer: $y=\frac{5}{4}x$

478. line $y-3=0$, point $(-2,-4)$

Answer: $x=-2$

479. line $y-6=0$, point $(-5,-3)$

Answer: $x=-5$

480. line *y*-axis, point $(3,\ 4)$

Answer: $y=4$

481. line *y*-axis, point $(2,1)$

Answer: $y=1$

Mixed Practice In the following exercises, find the equation of each line. Write the equation in slope–intercept form.

482. Containing the points $(4,3)$ and $(8,1)$

Answer: $y=-\frac{1}{2}x+5$

483. Containing the points $(2,7)$ and $(3,8)$

Answer: $y=x+5$

484. $m=\frac{1}{6}$, containing point $(6,1)$

Answer: $y=\frac{1}{6}x$

485. $m=\frac{5}{6}$, containing point $(6,7)$

Answer: $y=\frac{5}{6}x+2$

486. Parallel to the line $4x+3y=6$, containing point $(0,-3)$

Answer: $y=-\frac{4}{3}x-3$

487. Parallel to the line $2x+3y=6$, containing point $(0,5)$

Answer: $y=-\frac{2}{3}x+5$

488. $m=-\frac{3}{4}$, containing point $(8,-5)$

Answer: $y=-\frac{3}{4}x+1$

489. $m=-\frac{3}{5}$, containing point $(10,-5)$

Answer: $y=-\frac{3}{5}x+1$

490. Perpendicular to the line $y-1=0$, point $(-2,6)$

Answer: $x=-2$

491. Perpendicular to the line *y*-axis, point $(-6,\ 2)$

Answer: $y=2$

492. Containing the points $(4,3)$ and $(8,1)$

Answer: $y=-\frac{1}{2}x+5$

493. Containing the points $(-2,0)$ and $(-3,-2)$

Answer: $y=x+2$

494. Parallel to the line $x=-3$, containing point $(-2,-1)$

Answer: $x=-2$

495. Parallel to the line $x=-4$, containing point $(-3,-5)$

Answer: $x=-3$

496. Containing the points $(-3,-4)$ and $(2,-5)$

Answer: $y=-\frac{1}{5}x-\frac{23}{5}$

497. Containing the points $(-5,-3)$ and $(4,-6)$

Answer: $y=-\frac{1}{3}x-\frac{14}{3}$

498. Perpendicular to the line $x-2y=5$, containing point $(-2,2)$

Answer: $y=-2x-2$

499. Perpendicular to the line $4x+3y=1$, containing point $(0,0)$

Answer: $y=\frac{3}{4}x$

Everyday Math

500. Cholesterol. The age, x, and LDL cholesterol level, y, of two men are given by the points $(18,68)$ and $(27,122)$. Find a linear equation that models the relationship between age and LDL cholesterol level.

Answer: $y=6x-40$

501. Fuel consumption. The city mpg, x, and highway mpg, y, of two cars are given by the points $(29,40)$ and $(19,28)$. Find a linear equation that models the relationship between city mpg and highway mpg.

Answer: $y=1.2x+5.2$

Writing Exercises

502. Why are all horizontal lines parallel?

Answer: Answers will vary.

503. Explain in your own words why the slopes of two perpendicular lines must have opposite signs.

Answer: Answers will vary.

Elementary Algebra
4: Graphs
4. 7 Graphs of Linear Inequalities

Verify Solutions to an Inequality in Two Variables In the following exercises, determine whether each ordered pair is a solution to the given inequality.

504. Determine whether each ordered pair is a solution to the inequality $y > x - 1$:
(a) $(0,1)$
(b) $(-4,-1)$
(c) $(4,2)$
(d) $(3,0)$
(e) $(-2,-3)$

Answer: (a) yes (b) yes (c) no (d) no (e) no

505. Determine whether each ordered pair is a solution to the inequality $y > x - 3$:
(a) $(0,0)$
(b) $(2,1)$
(c) $(-1,-5)$
(d) $(-6,-3)$
(e) $(1,0)$

Answer: (a) yes (b) no (c) no (d) yes (e) no

506. Determine whether each ordered pair is a solution to the inequality $y < x + 2$:
(a) $(0,3)$
(b) $(-3,-2)$
(c) $(-2,0)$
(d) $(0,0)$
(e) $(-1,4)$

Answer: (a) no (b) yes (c) no (d) yes (e) no

507. Determine whether each ordered pair is a solution to the inequality $y < x + 5$:
(a) $(-3,0)$
(b) $(1,6)$
(c) $(-6,-2)$
(d) $(0,1)$
(e) $(5,-4)$

Answer: (a) yes (b) no (c) no (d) yes (e) yes

508. Determine whether each ordered pair is a solution to the inequality $x+y>4$:

(a) $(5,1)$

(b) $(-2,6)$

(c) $(3,2)$

(d) $(10,-5)$

(e) $(0,0)$

Answer: (a) yes (b) no (c) yes (d) yes (e) no

509. Determine whether each ordered pair is a solution to the inequality $x+y>2$:

(a) $(1,1)$

(b) $(4,-3)$

(c) $(0,0)$

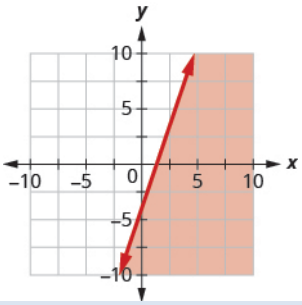
(d) $(-8,12)$

(e) $(3,0)$

Answer: (a) no (b) no (c) no (d) yes (e) yes

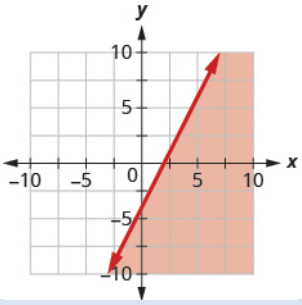
Recognize the Relation Between the Solutions of an Inequality and its Graph In the following exercises, write the inequality shown by the shaded region.

510. Write the inequality shown by the graph with the boundary line



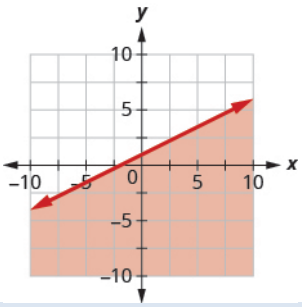
Answer: $y<3x-4$

511. Write the inequality shown by the graph with the boundary line $y=2x-4$.



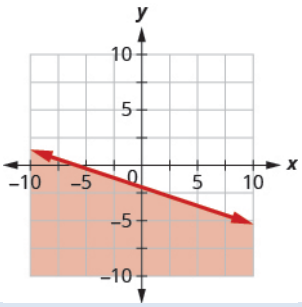
Answer: $y<2x-4$

512. Write the inequality shown by the graph with the boundary line $y = -\frac{1}{2}x + 1$.



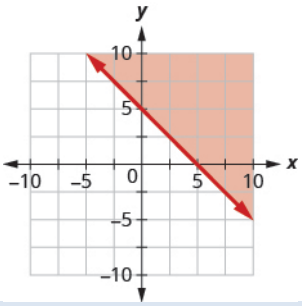
Answer: $y \leq -\frac{1}{2}x + 1$

513. Write the inequality shown by the graph with the boundary line $y = -\frac{1}{3}x - 2$.



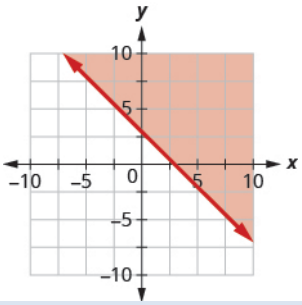
Answer: $y \leq -\frac{1}{3}x - 2$

514. Write the inequality shown by the shaded region in the graph with the boundary line $x + y = 5$.



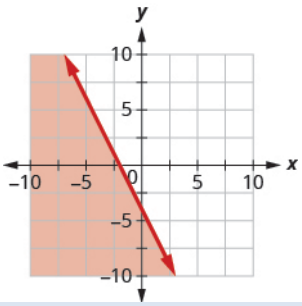
Answer: $x + y \geq 5$

515. Write the inequality shown by the shaded region in the graph with the boundary line $x+y=3$.



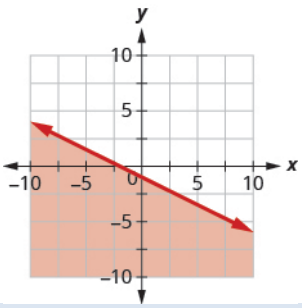
Answer: $x+y\geq 3$

516. Write the inequality shown by the shaded region in the graph with the boundary line $2x+y=-4$.



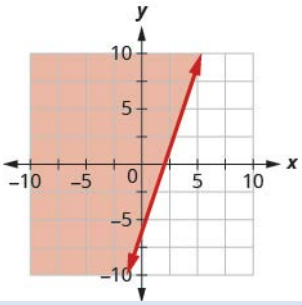
Answer: $2x+y\geq -4$

517. Write the inequality shown by the shaded region in the graph with the boundary line $x+2y=-2$.



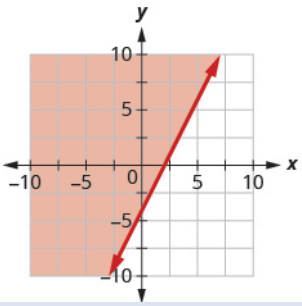
Answer: $x+2y\geq -2$

518. Write the inequality shown by the shaded region in the graph with the boundary line $3x - y = 6$.



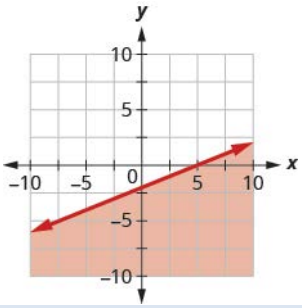
Answer: $3x - y < 6$

519. Write the inequality shown by the shaded region in the graph with the boundary line $2x - y = 4$.



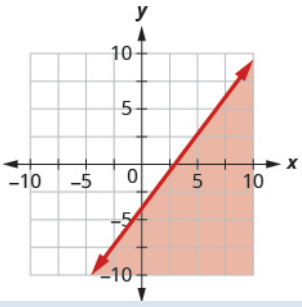
Answer: $2x - y < 4$

520. Write the inequality shown by the shaded region in the graph with the boundary line $2x - 5y = 10$.



Answer: $2x - 5y > 10$

521. Write the inequality shown by the shaded region in the graph with the boundary line $4x-3y=12$.

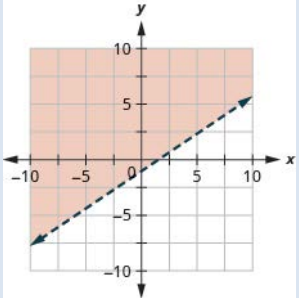


Answer: $4x-3y>12$

Graph Linear Inequalities In the following exercises, graph each linear inequality.

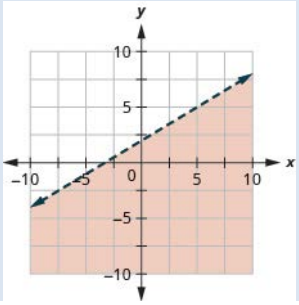
522. Graph the linear inequality $y>\frac{2}{3}x-1$.

Answer:



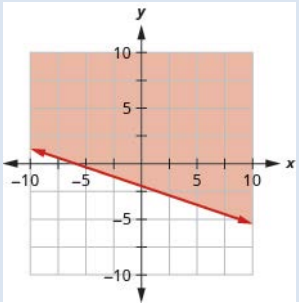
523. Graph the linear inequality $y<\frac{3}{5}x+2$.

Answer:



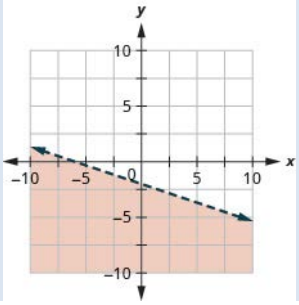
524. Graph the linear inequality $y \leq -\frac{1}{2}x + 4$.

Answer:



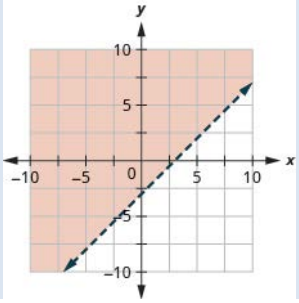
525. Graph the linear inequality $y \geq -\frac{1}{3}x - 2$.

Answer:



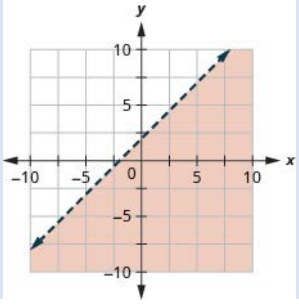
526. Graph the linear inequality $x - y \leq 3$.

Answer:



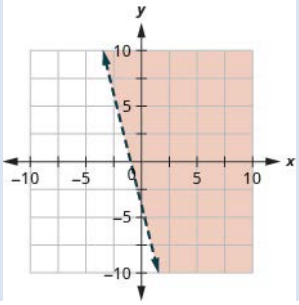
527. Graph the linear inequality $x - y \geq -2$.

Answer:



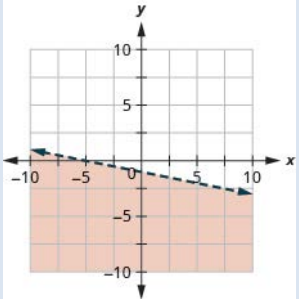
528. Graph the linear inequality $4x + y > -4$.

Answer:



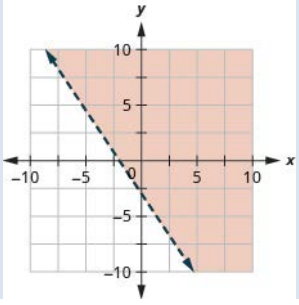
529. Graph the linear inequality $x + 5y < -5$.

Answer:



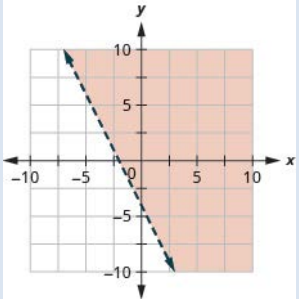
530. Graph the linear inequality $3x + 2y \geq -6$.

Answer:



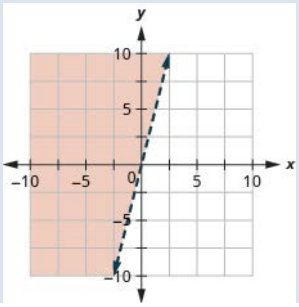
531. Graph the linear inequality $4x + 2y \geq -8$.

Answer:



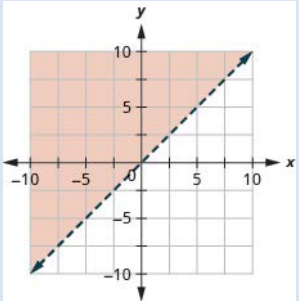
532. Graph the linear inequality $y > 4x$.

Answer:



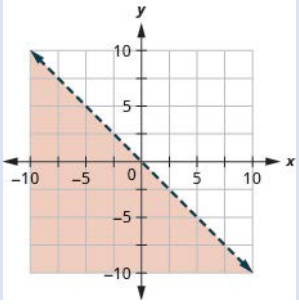
533. Graph the linear inequality $y > x$.

Answer:



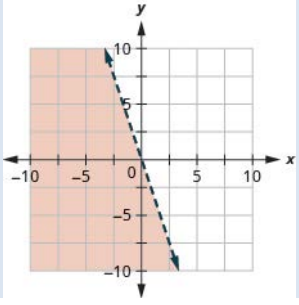
534. Graph the linear inequality $y \leq -x$.

Answer:



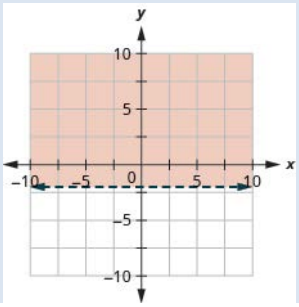
535. Graph the linear inequality $y \leq -3x$.

Answer:



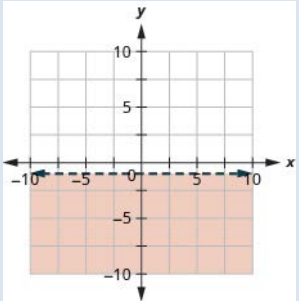
536. Graph the linear inequality $y \geq -2$.

Answer:



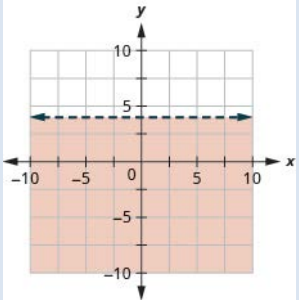
537. Graph the linear inequality $y < -1$.

Answer:



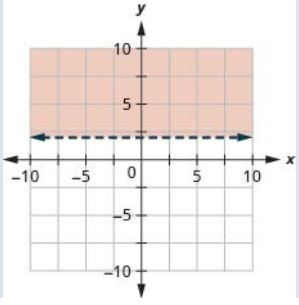
538. Graph the linear inequality $y < 4$.

Answer:



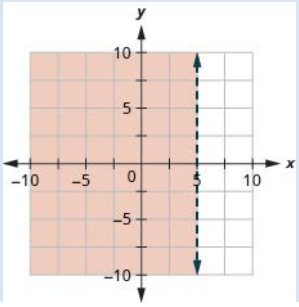
539. Graph the linear inequality $y \geq 2$.

Answer:



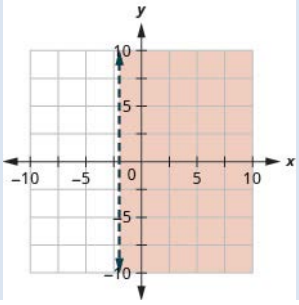
540. Graph the linear inequality $x \leq 5$.

Answer:



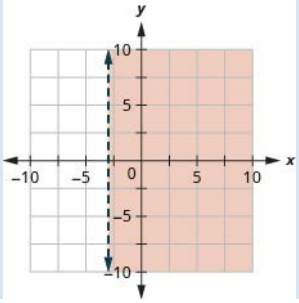
541. Graph the linear inequality $x > -2$.

Answer:



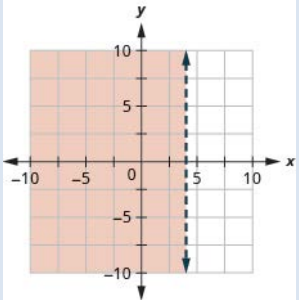
542. Graph the linear inequality $x > -3$.

Answer:



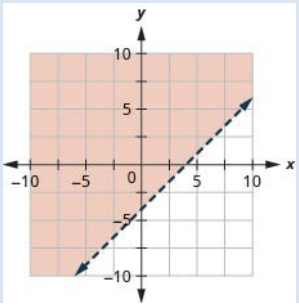
543. Graph the linear inequality $x \leq 4$.

Answer:



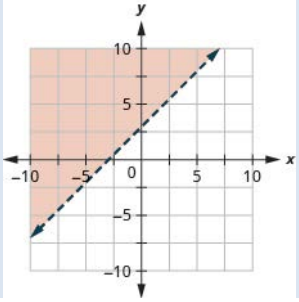
544. Graph the linear inequality $x - y < 4$.

Answer:



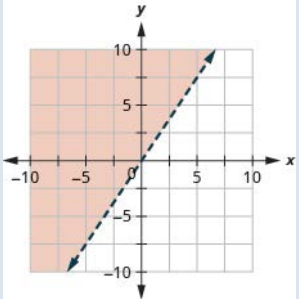
545. Graph the linear inequality $x - y < -3$.

Answer:



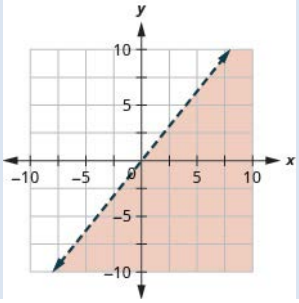
546. Graph the linear inequality $y \geq \frac{3}{2}x$.

Answer:



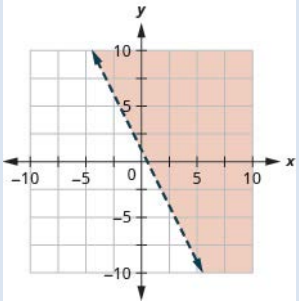
547. Graph the linear inequality $y \leq \frac{5}{4}x$.

Answer:



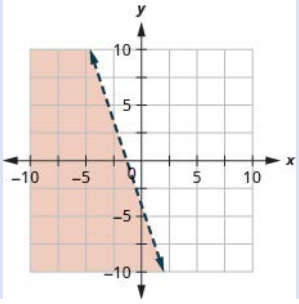
548. Graph the linear inequality $y > -2x + 1$.

Answer:



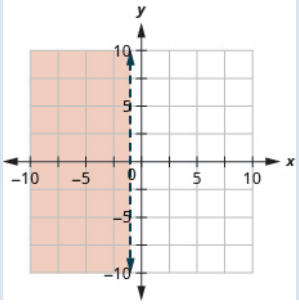
549. Graph the linear inequality $y < -3x - 4$.

Answer:



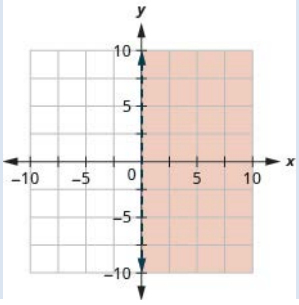
550. Graph the linear inequality $x \leq -1$.

Answer:



551. Graph the linear inequality $x \geq 0$.

Answer:



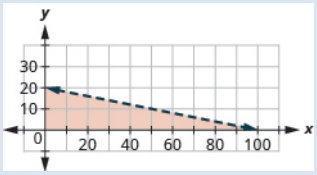
Everyday Math

552. Money. Gerry wants to have a maximum of $100 cash at the ticket booth when his church carnival opens. He will have $1 bills and $5 bills. If *x* is the number of $1 bills and *y* is the number of $5 bills, the inequality $x + 5y \leq 100$ models the situation.

(a) Graph the inequality.

(b) List three solutions to the inequality $x + 5y \leq 100$ where both *x* and *y* are integers.

Answer: (a)



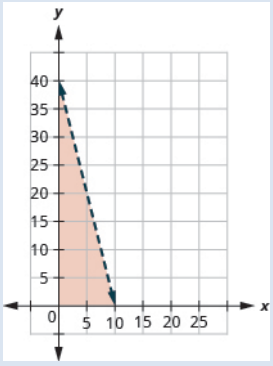
(b) Answers will vary.

553. Shopping. Tula has $20 to spend at the used book sale. Hardcover books cost $2 each and paperback books cost $0.50 each. If *x* is the number of hardcover books Tula can buy and *y* is the number of paperback books she can buy, the inequality $2x + \frac{1}{2}y \leq 20$ models the situation.

(a) Graph the inequality.

(b) List three solutions to the inequality $2x + \frac{1}{2}y \leq 20$ where both *x* and *y* are whole numbers.

Answer: (a)



(b) Answers will vary.

Writing Exercises

554. Lester thinks that the solution of any inequality with a > sign is the region above the line and the solution of any inequality with a < sign is the region below the line. Is Lester correct? Explain why or why not.

Answer: Answers will vary.

555. Explain why in some graphs of linear inequalities the boundary line is solid but in other graphs it is dashed.

Answer: Answers will vary.

Chapter Review

4.1 Use the Rectangular Coordinate System

Plot Points in a Rectangular Coordinate System In the following exercises, plot each point in a rectangular coordinate system.

556.

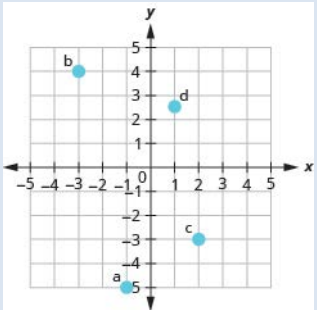
(a) $(-1,-5)$

(b) $(-3,4)$

(c) $(2,-3)$

(d) $\left(1,\frac{5}{2}\right)$

Answer:



557.

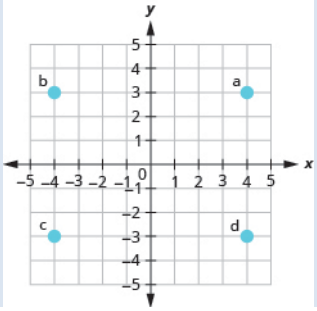
(a) $(4,3)$

(b) $(-4,3)$

(c) $(-4,-3)$

(d) $(4,-3)$

Answer:



558.

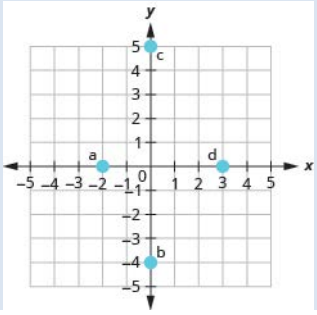
(a) $(-2,0)$

(b) $(0,-4)$

(c) $(0,5)$

(d) $(3,0)$

Answer:



559.

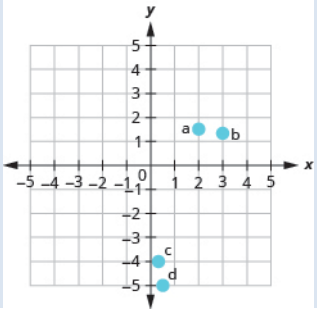
(a) $\left(2,\frac{3}{2}\right)$

(b) $\left(3,\frac{4}{3}\right)$

(c) $\left(\frac{1}{3},-4\right)$

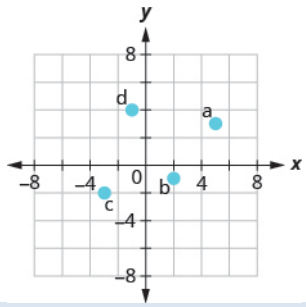
(d) $\left(\frac{1}{2},-5\right)$

Answer:



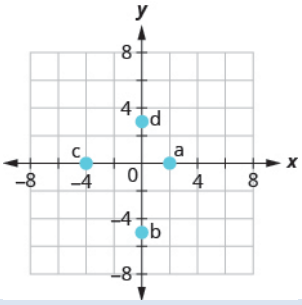
Identify Points on a Graph In the following exercises, name the ordered pair of each point shown in the rectangular coordinate system.

560.



Answer: (a) $(5,3)$ (b) $(2,-1)$ (c) $(-3,-2)$ (d) $(-1,4)$

561.



Answer: (a) $(2,0)$ (b) $(0,-5)$ (c) (-4.0) (d) $(0,3)$

Verify Solutions to an Equation in Two Variables In the following exercises, which ordered pairs are solutions to the given equations?

562. $5x+y=10$

(a) $(5,1)$

(b) $(2,0)$

(c) $(4,-10)$

Answer: b, c

563. $y=6x-2$

(a) $(1,4)$

(b) $\left(\frac{1}{3},0\right)$

(c) $(6,-2)$

Answer: a, b

Complete a Table of Solutions to a Linear Equation in Two Variables In the following exercises, complete the table to find solutions to each linear equation.

564. $y = 4x - 1$

x	y	(x,y)
0		
1		
-2		

Answer:

x	y	(x,y)
0	-1	$(0,-1)$
1	3	$(1,3)$
-2	-9	$(-2,-9)$

565. $y = -\frac{1}{2}x + 3$

x	y	(x,y)
0		
4		
-2		

Answer:

x	y	(x,y)
0	3	$(0,3)$
4	1	(4, 1)
-2	4	$(-2,4)$

566. $x + 2y = 5$

x	y	(x,y)
	0	
1		
-1		

Answer:

x	y	(x,y)
5	0	$(5,0)$
1	2	$(1,2)$
-1	3	$(-1,3)$

567. $3x+2y=6$

x	y	(x,y)
0		
	0	
-2		

Answer:

x	y	(x,y)
0	-3	$(0,-3)$
2	0	$(2,0)$
-2	-6	$(-2,-6)$

Find Solutions to a Linear Equation in Two Variables In the following exercises, find three solutions to each linear equation.

568. $x+y=3$

Answer: Answers will vary.

569. $x+y=-4$

Answer: Answers will vary.

570. $y=3x+1$

Answer: Answers will vary.

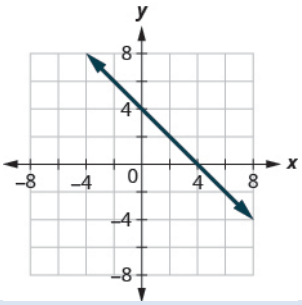
571. $y=-x-1$

Answer: Answers will vary.

4.2 Graph Linear Equations in Two Variables

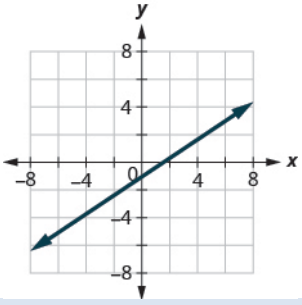
Recognize the Relation Between the Solutions of an Equation and its Graph In the following exercises, for each ordered pair, decide:
(a) Is the ordered pair a solution to the equation?
(b) Is the point on the line?

572. $y=-x+4$
$(0,4)$ $(-1,3)$
$(2,2)$ $(-2,6)$



Answer: (a) yes; no (b) yes; yes

573. $y=\frac{2}{3}x-1$
$(0,-1)$ (3,1)
$(-3,-3)$ (6,4)

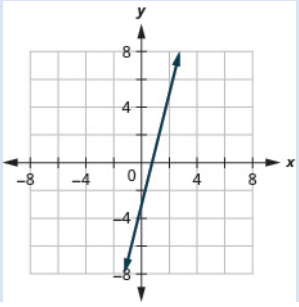


Answer: (a) yes; yes(b) yes; no

Graph a Linear Equation by Plotting Points In the following exercises, graph by plotting points.

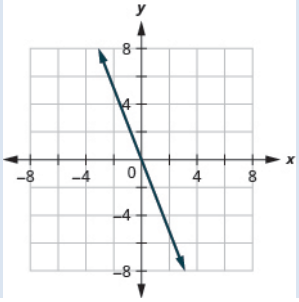
574. $y = 4x - 3$

Answer:



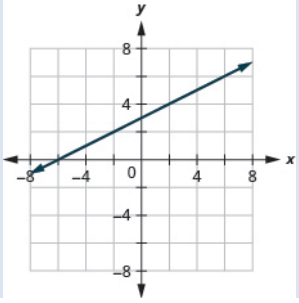
575. $y = -3x$

Answer:



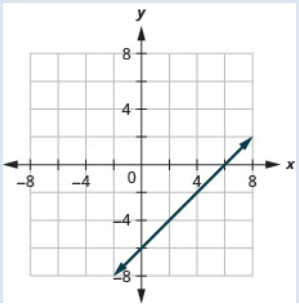
576. $y = \frac{1}{2}x + 3$

Answer:



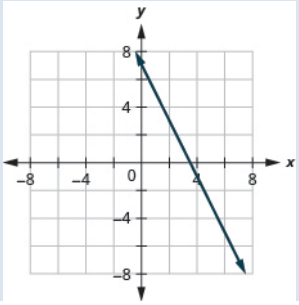
577. $x - y = 6$

Answer:



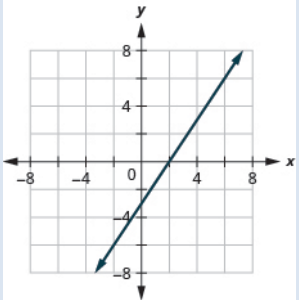
578. $2x + y = 7$

Answer:



579. $3x - 2y = 6$

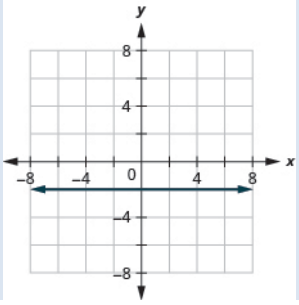
Answer:



Graph Vertical and Horizontal lines In the following exercises, graph each equation.

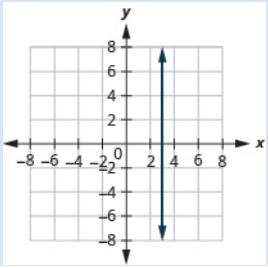
580. $y = -2$

Answer:



581. $x = 3$

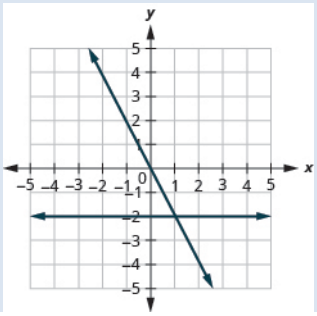
Answer:



In the following exercises, graph each pair of equations in the same rectangular coordinate system.

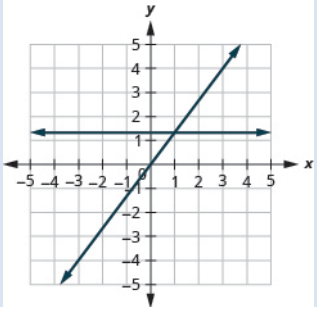
582. $y = -2x$ and $y = -2$

Answer:



583. $y = \frac{4}{3}x$ and $y = \frac{4}{3}$

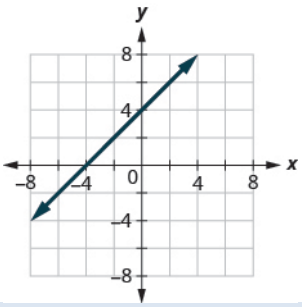
Answer:



4.3 Graph with Intercepts

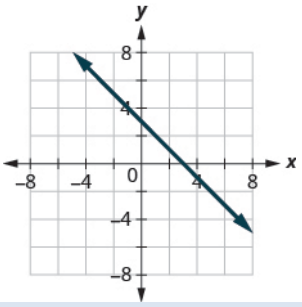
Identify the *x*- and *y*-Intercepts on a Graph In the following exercises, find the *x*- and *y*-intercepts.

584.



Answer: $(-4,0)$, $(0,4)$

585.



Answer: $(3,0),(0,3)$

Find the *x*- and *y*-Intercepts from an Equation of a Line In the following exercises, find the intercepts of each equation.

586. $x+y=5$

Answer: $(5,0),(0,5)$

587. $x-y=-1$

Answer: $(-1,0),(0,1)$

588. $x+2y=6$

Answer: $(6,0),(0,3)$

589. $2x+3y=12$

Answer: $(6,0)$, $(0,4)$

590. $y=\frac{3}{4}x-12$

Answer: $(16,0),(0,-12)$

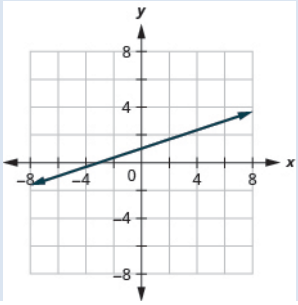
591. $y=3x$

Answer: $(0,0)$

Graph a Line Using the Intercepts In the following exercises, graph using the intercepts.

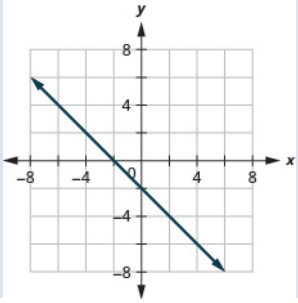
592. $-x+3y=3$

Answer:



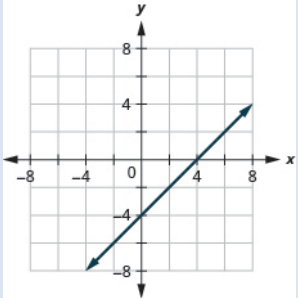
593. $x+y=-2$

Answer:



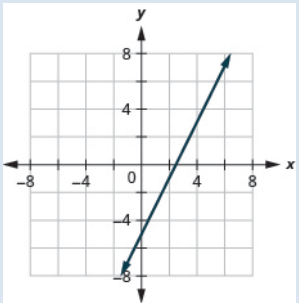
594. $x-y=4$

Answer:



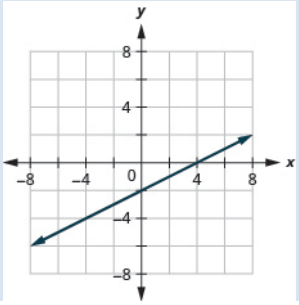
595. $2x - y = 5$

Answer:



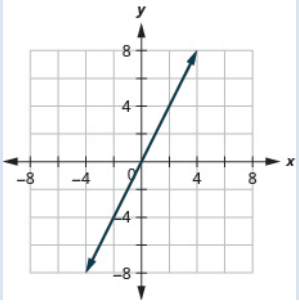
596. $2x - 4y = 8$

Answer:



597. $y = 2x$

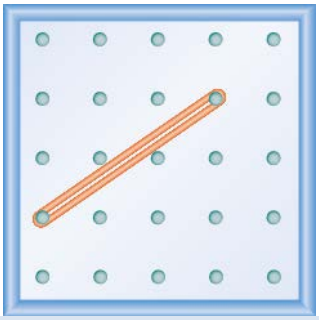
Answer:



4.4 Understand Slope of a Line

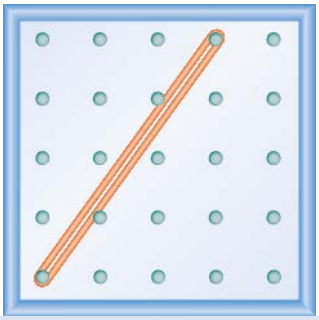
Use Geoboards to Model Slope In the following exercises, find the slope modeled on each geoboard.

598.



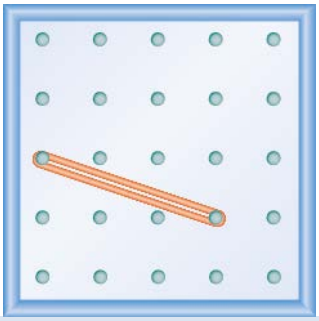
Answer: $\frac{2}{3}$

599.



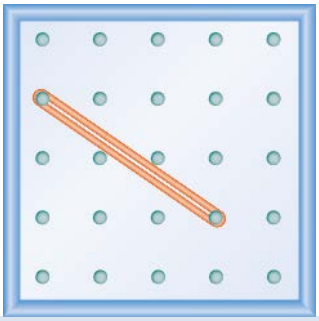
Answer: $\frac{4}{3}$

600.



Answer: $-\frac{1}{3}$

601.

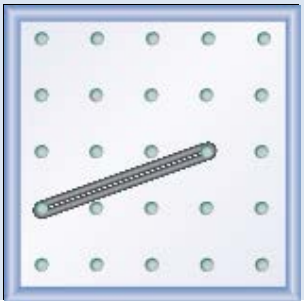


Answer: $-\frac{2}{3}$

In the following exercises, model each slope. Draw a picture to show your results.

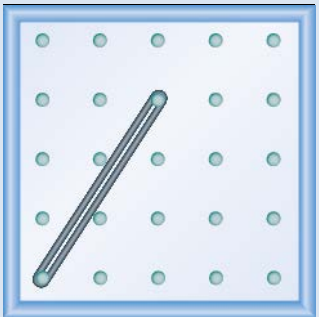
602.

Answer:



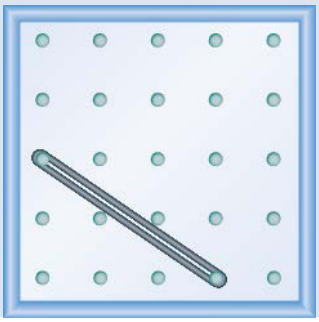
603. $\frac{3}{2}$

Answer:



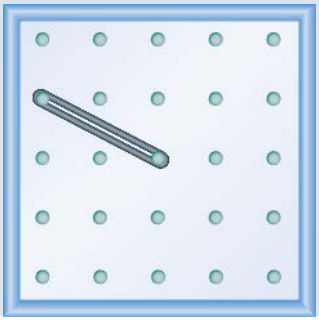
604. $-\frac{2}{3}$

Answer:



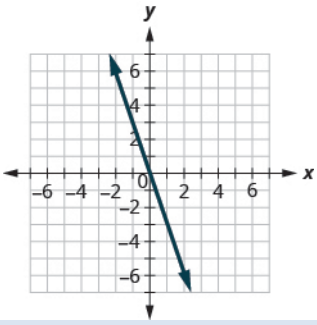
605. $-\frac{1}{2}$

Answer:



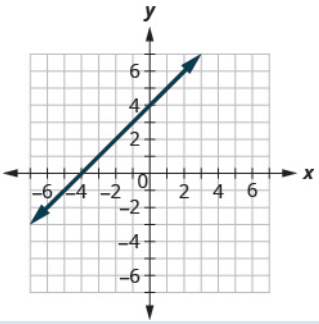
Use $m = \frac{\text{rise}}{\text{run}}$ to find the Slope of a Line from its Graph In the following exercises, find the slope of each line shown.

606.



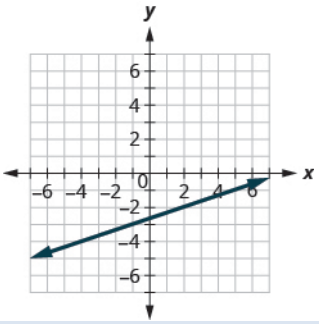
Answer: -3

607.



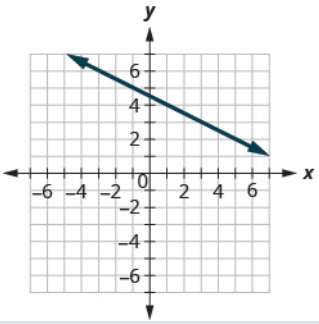
Answer: 1

608.



Answer: $\frac{1}{3}$

609.



Answer: $-\frac{1}{2}$

Find the Slope of Horizontal and Vertical Lines In the following exercises, find the slope of each line.

610. $y = 2$

Answer: 0

611. $x = 5$

Answer: undefined

612. $x = -3$

Answer: undefined

613. $y = -1$

Answer: 0

Use the Slope Formula to find the Slope of a Line between Two Points In the following exercises, use the slope formula to find the slope of the line between each pair of points.

614. $(-1,-1),\ (0,5)$

Answer: 6

615. $(3,5),\ (4,-1)$

Answer: -6

616. $(-5,-2),\ (3,2)$

Answer: $\frac{1}{2}$

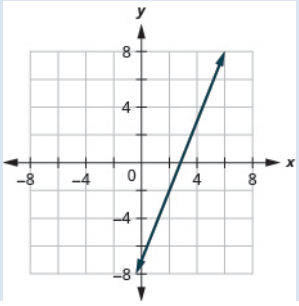
617. $(2,1),\ (4,6)$

Answer: $\frac{5}{2}$

Graph a Line Given a Point and the Slope In the following exercises, graph each line with the given point and slope.

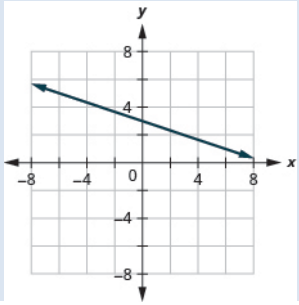
618. $(2,-2);\ m = \frac{5}{2}$

Answer:



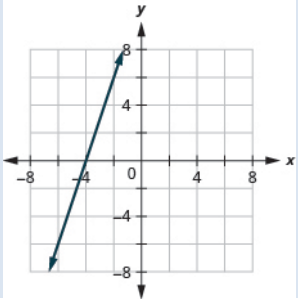
619. $(-3,4)$; $m=-\frac{1}{3}$

Answer:



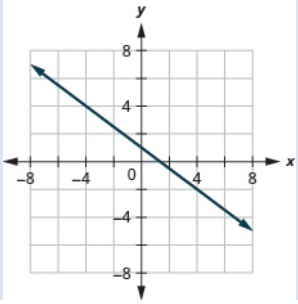
620. x-intercept -4; $m=3$

Answer:



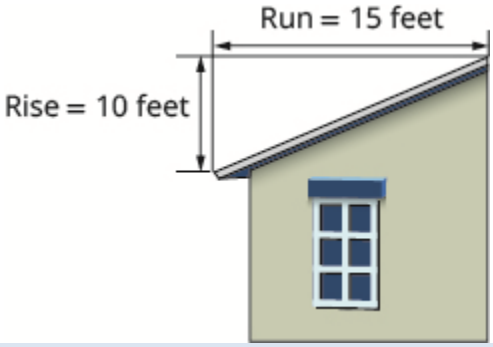
621. y-intercept 1; $m=-\frac{3}{4}$

Answer:



Solve Slope Applications In the following exercises, solve these slope applications.

622. The roof pictured below has a rise of 10 feet and a run of 15 feet. What is its slope?



Answer: $\frac{2}{3}$

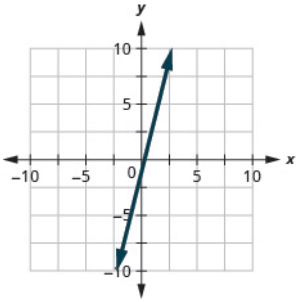
623. A mountain road rises 50 feet for a 500-foot run. What is its slope?

Answer: $\frac{1}{10}$

4.5 Use the Slope–Intercept Form of an Equation of a Line

Recognize the Relation Between the Graph and the Slope–Intercept Form of an Equation of a Line In the following exercises, use the graph to find the slope and *y*-intercept of each line. Compare the values to the equation $y = mx + b$.

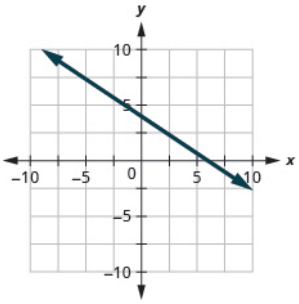
624.



$y = 4x - 1$

Answer: slope $m = 4$ and *y*-intercept $(0, -1)$

625.



$y = -\frac{2}{3}x + 4$

Answer: slope $m = -\frac{2}{3}$ and *y*-intercept $(0, 4)$

Identify the Slope and y-Intercept from an Equation of a Line In the following exercises, identify the slope and *y*-intercept of each line.

626. $y = -4x + 9$

Answer: $-4; (0, 9)$

627. $y = \frac{5}{3}x - 6$

Answer: $\frac{5}{3}; (0, -6)$

628. $5x + y = 10$

Answer: $-5; (0, 10)$

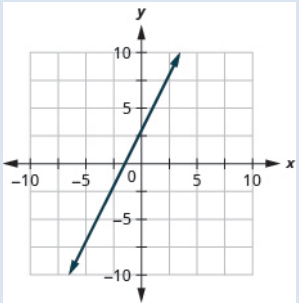
629. $4x - 5y = 8$

Answer: $\frac{4}{5}; \left(0, -\frac{8}{5}\right)$

Graph a Line Using Its Slope and Intercept In the following exercises, graph the line of each equation using its slope and *y*-intercept.

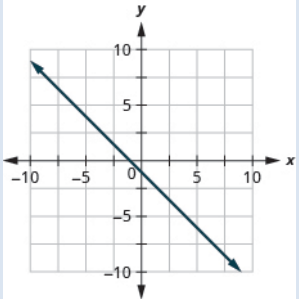
630. $y = 2x + 3$

Answer:



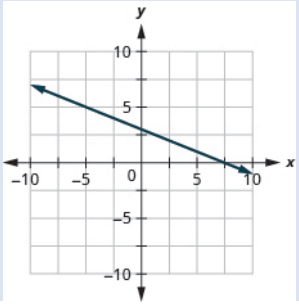
631. $y = -x - 1$

Answer:



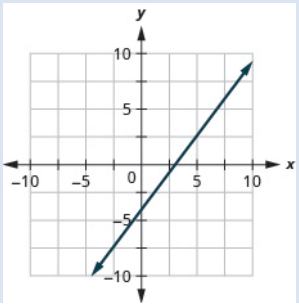
632. $y = -\frac{2}{5}x + 3$

Answer:



633. $4x-3y=12$

Answer:



In the following exercises, determine the most convenient method to graph each line.

634. $x=5$

Answer: vertical line

635. $y=-3$

Answer: horizontal line

636. $2x+y=5$

Answer: intercepts

637. $x-y=2$

Answer: intercepts

638. $y=x+2$

Answer: plotting points

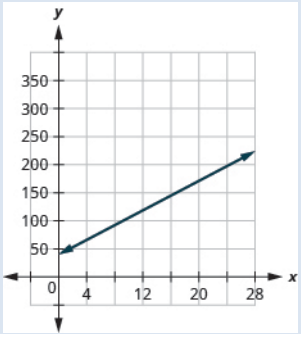
639. $y=\frac{3}{4}x-1$

Answer: plotting points

Graph and Interpret Applications of Slope–Intercept

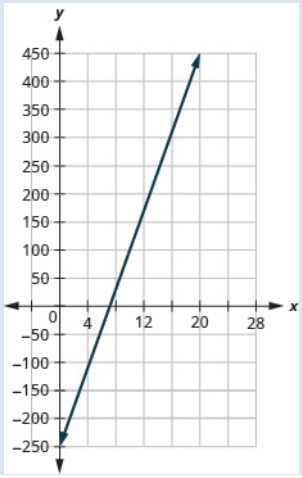
640. Katherine is a private chef. The equation $C = 6.5m + 42$ models the relation between her weekly cost, *C*, in dollars and the number of meals, *m*, that she serves.
(a) Find Katherine's cost for a week when she serves no meals.
(b) Find the cost for a week when she serves 14 meals.
(c) Interpret the slope and *C*-intercept of the equation.
(d) Graph the equation.

Answer: (a) $42
(b) $133
(c) The slope, 6.5, means that Katherine's weekly cost, *C*, increases by $6.50 when the number of meals, *m*, increases by 1. The *C*–intercept means that when the number of meals is 0, the weekly cost is $42.
(d)



641. Marjorie teaches piano. The equation $P = 35h - 250$ models the relation between her weekly profit, *P*, in dollars and the number of student lessons, *s*, that she teaches.
(a) Find Marjorie's profit for a week when she teaches no student lessons.
(b) Find the profit for a week when she teaches 20 student lessons.
(c) Interpret the slope and *P*–intercept of the equation.
(d) Graph the equation.

Answer: (a) –$250
(b) $450
(c) The slope, 35, means that Marjorie's weekly profit, *P*, increases by $35 for each additional student lesson she teaches. The *P*–intercept means that when the number of lessons is 0, Marjorie loses $250.
(d)



Use Slopes to Identify Parallel Lines In the following exercises, use slopes and y-intercepts to determine if the lines are parallel.

642. $4x - 3y = -1; \quad y = \frac{4}{3}x - 3$

Answer: parallel

643. $2x - y = 8; \quad x - 2y = 4$

Answer: not parallel

Use Slopes to Identify Perpendicular Lines In the following exercises, use slopes and y-intercepts to determine if the lines are perpendicular.

644. $y = 5x - 1; \quad 10x + 2y = 0$

Answer: not perpendicular

645. $3x-2y=5;\quad 2x+3y=6$

Answer: perpendicular

4.6 Find the Equation of a Line

Find an Equation of the Line Given the Slope and *y*-Intercept In the following exercises, find the equation of a line with given slope and y-intercept. Write the equation in slope–intercept form.

646. slope $\frac{1}{3}$ and $y-$intercept $(0,-6)$

Answer: $y=\frac{1}{3}x-6$

647. slope -5 and $y-$intercept $(0,-3)$

Answer: $y=-5x-3$

648. slope 0 and $y-$intercept $(0,4)$

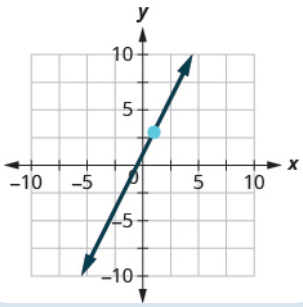
Answer: $y=4$

649. slope -2 and $y-$intercept $(0,0)$

Answer: $y=-2x$

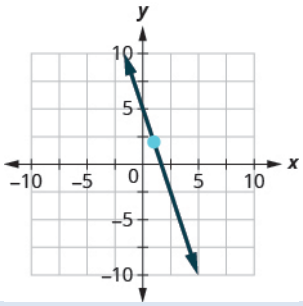
In the following exercises, find the equation of the line shown in each graph. Write the equation in slope–intercept form.

650.



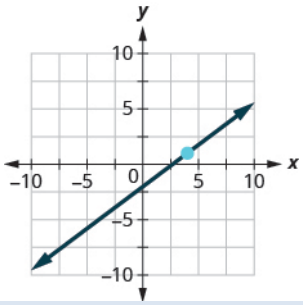
Answer: $y=2x+1$

651.



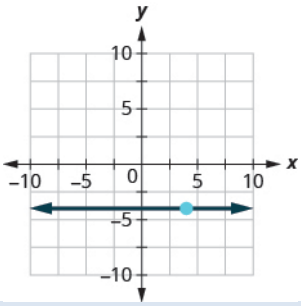
Answer: $y = -3x + 5$

652.



Answer: $y = \frac{3}{4}x - 2$

653.



Answer: $y = -4$

Find an Equation of the Line Given the Slope and a Point In the following exercises, find the equation of a line with given slope and containing the given point. Write the equation in slope–intercept form.

654. $m = -\frac{1}{4}$, point $(-8, 3)$

Answer: $y = -\frac{1}{4}x + 1$

655. $m=\frac{3}{5}$, point $(10, 6)$

Answer: $y=\frac{3}{5}x$

656. Horizontal line containing $(-2, 7)$

Answer: $y=7$

657. $m=-2$, point $(-1,-3)$

Answer: $y=-2x-5$

Find an Equation of the Line Given Two Points In the following exercises, find the equation of a line containing the given points. Write the equation in slope–intercept form.

658. $(2, 10)$ and $(-2,-2)$

Answer: $y=3x+4$

659. $(7, 1)$ and $(5, 0)$

Answer: $y=\frac{1}{2}x-\frac{5}{2}$

660. $(3, 8)$ and $(3,-4)$.

Answer: $x=3$

661. $(5, 2)$ and $(-1, 2)$

Answer: $y=2$

Find an Equation of a Line Parallel to a Given Line In the following exercises, find an equation of a line parallel to the given line and contains the given point. Write the equation in slope–intercept form.

662. line $y=-3x+6$, point $(1,-5)$

Answer: $y=-3x-2$

663. line $2x+5y=-10$, point $(10, 4)$

Answer: $y=-\frac{2}{5}x+8$

664. line $x=4$, point $(-2,-1)$

Answer: $x=-2$

665. line $y=-5$, point $(-4,3)$

Answer: $y=3$

Find an Equation of a Line Perpendicular to a Given Line In the following exercises, find an equation of a line perpendicular to the given line and contains the given point. Write the equation in slope–intercept form.

666. line $y=-\frac{4}{5}x+2$, point $(8,9)$

Answer: $y=\frac{5}{4}x-1$

667. line $2x-3y=9$, point $(-4,0)$

Answer: $y=-\frac{3}{2}x-6$

668. line $y=3$, point $(-1,-3)$

Answer: $x=-1$

669. line $x=-5$ point $(2,1)$

Answer: $y=1$

4.7 Graph Linear Inequalities

Verify Solutions to an Inequality in Two Variables In the following exercises, determine whether each ordered pair is a solution to the given inequality.

670. Determine whether each ordered pair is a solution to the inequality $y<x-3$:
(a) $(0,1)$ (b) $(-2,-4)$ (c) $(5,2)$ (d) $(3,-1)$ (e) $(-1,-5)$

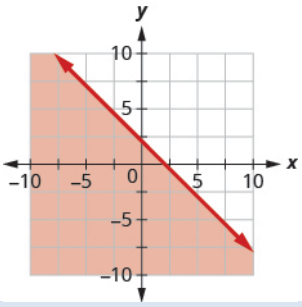
Answer: (a) no (b) no (c) no (d) yes (e) yes

671. Determine whether each ordered pair is a solution to the inequality $x+y>4$:
(a) $(6,1)$
(b) $(-3,6)$
(c) $(3,2)$
(d) $(-5,10)$
(e) $(0,0)$

Answer: (a) yes (b) no (c) yes (d) yes (e) no

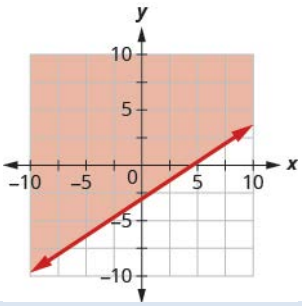
Recognize the Relation Between the Solutions of an Inequality and its Graph In the following exercises, write the inequality shown by the shaded region.

672. Write the inequality shown by the graph with the boundary line $y = -x + 2$.



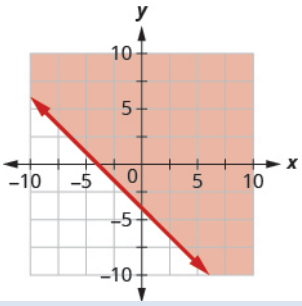
Answer: $y \leq -x + 2$

673. Write the inequality shown by the graph with the boundary line $y = \frac{2}{3}x - 3$.



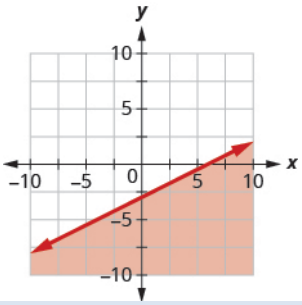
Answer: $y > \frac{2}{3}x - 3$

674. Write the inequality shown by the shaded region in the graph with the boundary line $x + y = -4$.



Answer: $x + y > -4$

675. Write the inequality shown by the shaded region in the graph with the boundary line $x-2y=6$.

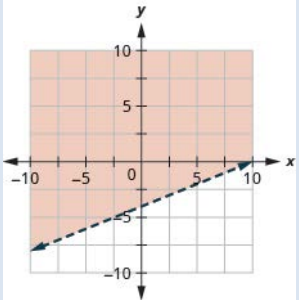


Answer: $x-2y\geq 6$

Graph Linear Inequalities In the following exercises, graph each linear inequality.

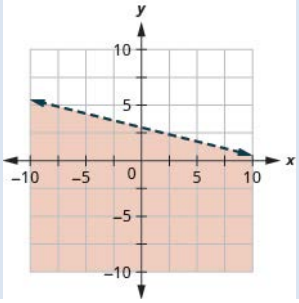
676. Graph the linear inequality $y>\frac{2}{5}x-4$.

Answer:



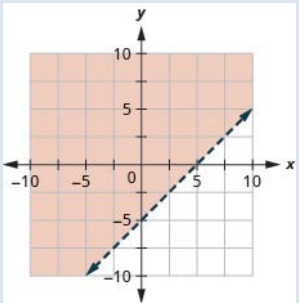
677. Graph the linear inequality $y\leq -\frac{1}{4}x+3$.

Answer:



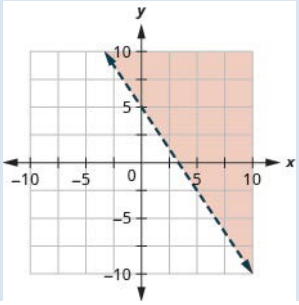
678. Graph the linear inequality $x - y \leq 5$.

Answer:



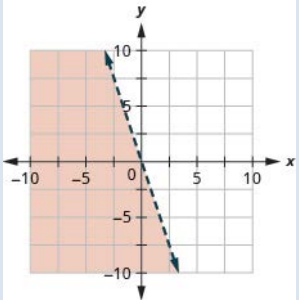
679. Graph the linear inequality $3x + 2y > 10$.

Answer:



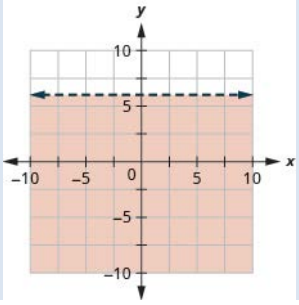
680. Graph the linear inequality $y \leq -3x$.

Answer:



681. Graph the linear inequality $y < 6$.

Answer:



Chapter Practice Test

682. Plot each point in a rectangular coordinate system.

(a) $(2,5)$

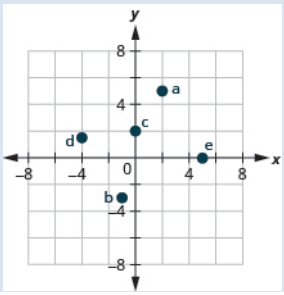
(b) $(-1,-3)$

(c) $(0,2)$

(d) $\left(-4,\frac{3}{2}\right)$

(e) $(5,0)$

Answer:



683. Which of the given ordered pairs are solutions to the equation $3x-y=6$?

(a) $(3,3)$

(b) $(2,0)$

(c) $(4,-6)$

Answer: (a) yes (b) yes (c) no

684. Find three solutions to the linear equation $y=-2x-4$.

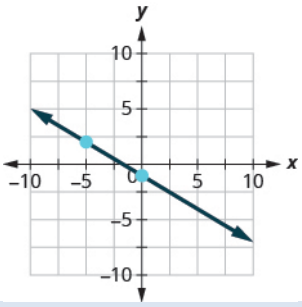
Answer: Answers will vary.

685. Find the *x*- and *y*-intercepts of the equation $4x-3y=12$.

Answer: $(3,0),(0,-4)$

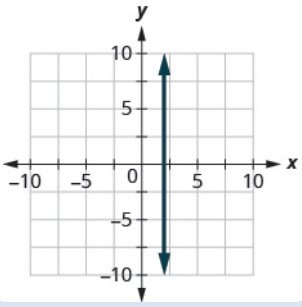
Find the slope of each line shown.

686.



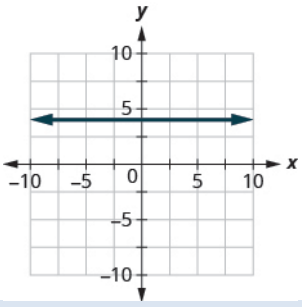
Answer: $-\frac{3}{5}$

687.



Answer: undefined

688.



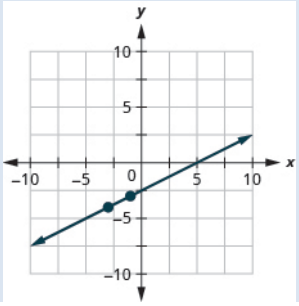
Answer: 0

689. Find the slope of the line between the points $(5, 2)$ and $(-1, -4)$.

Answer: 1

690. Graph the line with slope $\frac{1}{2}$ containing the point $(-3, -4)$.

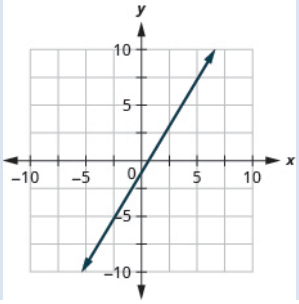
Answer:



Graph the line for each of the following equations.

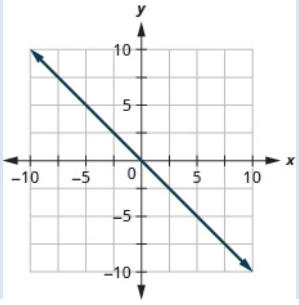
691. $y = \frac{5}{3}x - 1$

Answer:



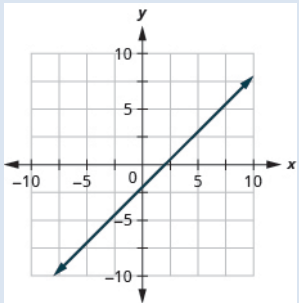
692. $y = -x$

Answer:



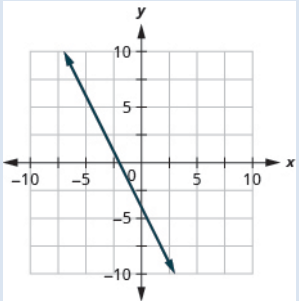
693. $x - y = 2$

Answer:



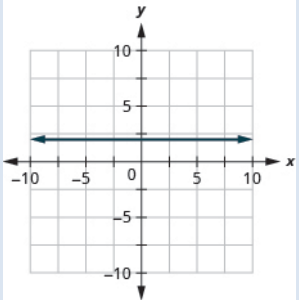
694. $4x + 2y = -8$

Answer:



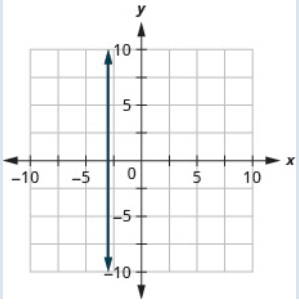
695. $y = 2$

Answer:



696. $x = -3$

Answer:



Find the equation of each line. Write the equation in slope–intercept form.

697. slope $-\frac{3}{4}$ and *y*-intercept $(0,-2)$

Answer: $y=-\frac{3}{4}x-2$

698. $m=2$, point $(-3,-1)$

Answer: $y=2x+5$

699. containing $(10,1)$ and $(6,-1)$

Answer: $y=\frac{1}{2}x-4$

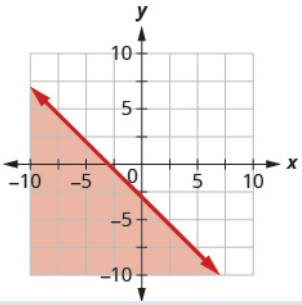
700. parallel to the line $y=-\frac{2}{3}x-1$, containing the point $(-3,8)$

Answer: $y=-\frac{2}{3}x+6$

701. perpendicular to the line $y=\frac{5}{4}x+2$, containing the point $(-10,3)$

Answer: $y=-\frac{4}{5}x-5$

702. Write the inequality shown by the graph with the boundary line $y=-x-3$.

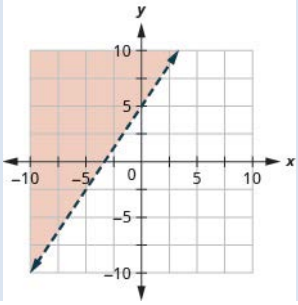


Answer: $y\le -x-3$

Graph each linear inequality.

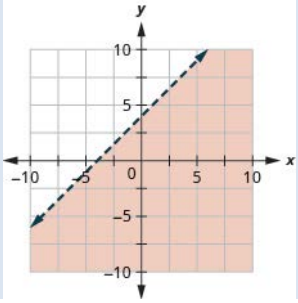
703. $y > \frac{3}{2}x + 5$

Answer:



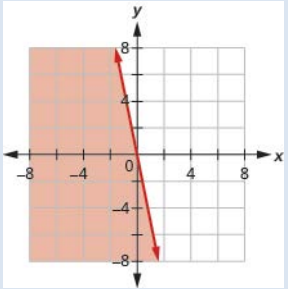
704. $x - y \geq -4$

Answer:



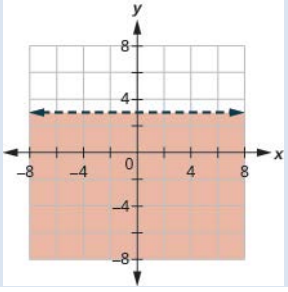
705. $y \leq -5x$

Answer:



706. $y < 3$

Answer:



Elementary Algebra
5: Systems of Linear Equations
5.1 Solve Systems of Linear Equations

Determine Whether an Ordered Pair is a Solution of a System of Equations. In the following exercises, determine if the following points are solutions to the given system of equations.

1. $\begin{cases} 2x-6y=0 \\ 3x-4y=5 \end{cases}$

(a) $(3,1)$ (b) $(-3,4)$

Answer: (a) yes (b) no

2. $\begin{cases} 7x-4y=-1 \\ -3x-2y=1 \end{cases}$

(a) $(1,2)$ (b) $(1,-2)$

Answer: (a) no (b) no

3. $\begin{cases} 2x+y=5 \\ x+y=1 \end{cases}$

(a) $(4,-3)$ (b) $(2,0)$

Answer: (a) yes (b) no

4. $\begin{cases} -3x+y=8 \\ -x+2y=-9 \end{cases}$

(a) $(-5,-7)$ (b) $(-5,7)$

Answer: (a) yes (b) no

5. $\begin{cases} x+y=2 \\ y=\frac{3}{4}x \end{cases}$

(a) $\left(\frac{8}{7},\frac{6}{7}\right)$ (b) $\left(1,\frac{3}{4}\right)$

Answer: (a) yes (b) no

6. $\begin{cases} x+y=1 \\ y=\frac{2}{5}x \end{cases}$

(a) $\left(\frac{5}{7},\frac{2}{7}\right)$ (b) $(5,2)$

Answer: (a) yes (b) no

7. $\begin{cases} x+5y=10 \\ y=\frac{3}{5}x+1 \end{cases}$

(a) $(-10, 4)$ (b) $\left(\frac{5}{4}, \frac{7}{4}\right)$

Answer: (a) no (b) yes

8. $\begin{cases} x+3y=9 \\ y=\frac{2}{3}x-2 \end{cases}$

(a) $(-6, 5)$ (b) $\left(5, \frac{4}{3}\right)$

Answer: (a) no (b) yes

Solve a System of Linear Equations by Graphing In the following exercises**,** solve the following systems of equations by graphing.

9. $\begin{cases} 3x+y=-3 \\ 2x+3y=5 \end{cases}$

Answer: $(-2,3)$

10. $\begin{cases} -x+y=2 \\ 2x+y=-4 \end{cases}$

Answer: $(-2,0)$

11. $\begin{cases} -3x+y=-1 \\ 2x+y=4 \end{cases}$

Answer: $(1,2)$

12. $\begin{cases} -2x+3y=-3 \\ x+y=4 \end{cases}$

Answer: $(3,1)$

13. $\begin{cases} y=x+2 \\ y=-2x+2 \end{cases}$

Answer: $(0,2)$

14. $\begin{cases} y = x - 2 \\ y = -3x + 2 \end{cases}$

Answer: $(1, -1)$

15. $\begin{cases} y = \frac{3}{2}x + 1 \\ y = -\frac{1}{2}x + 5 \end{cases}$

Answer: $(2, 4)$

16. $\begin{cases} y = \frac{2}{3}x - 2 \\ y = -\frac{1}{3}x - 5 \end{cases}$

Answer: $(-3, -4)$

17. $\begin{cases} -x + y = -3 \\ 4x + 4y = 4 \end{cases}$

Answer: $(2, -1)$

18. $\begin{cases} x - y = 3 \\ 2x - y = 4 \end{cases}$

Answer: $(1, -2)$

19. $\begin{cases} -3x + y = -1 \\ 2x + y = 4 \end{cases}$

Answer: $(1, 2)$

20. $\begin{cases} -3x + y = -2 \\ 4x - 2y = 6 \end{cases}$

Answer: $(-1, -5)$

21. $\begin{cases} x + y = 5 \\ 2x - y = 4 \end{cases}$

Answer: $(3, 2)$

22. $\begin{cases} x-y=2 \\ 2x-y=6 \end{cases}$

Answer: $(4,2)$

23. $\begin{cases} x+y=2 \\ x-y=0 \end{cases}$

Answer: $(1,1)$

24. $\begin{cases} x+y=6 \\ x-y=-8 \end{cases}$

Answer: $(-1,7)$

25. $\begin{cases} x+y=-5 \\ x-y=3 \end{cases}$

Answer: $(-1,-4)$

26. $\begin{cases} x+y=4 \\ x-y=0 \end{cases}$

Answer: $(2,2)$

27. $\begin{cases} x+y=-4 \\ -x+2y=-2 \end{cases}$

Answer: $(3,3)$

28. $\begin{cases} -x+3y=3 \\ x+3y=3 \end{cases}$

Answer: $(1,0)$

29. $\begin{cases} -2x+3y=3 \\ x+3y=12 \end{cases}$

Answer: $(-5,6)$

30. $\begin{cases} 2x-y=4 \\ 2x+3y=12 \end{cases}$

Answer: $(-2,-2)$

31. $\begin{cases} 2x+3y=6 \\ y=-2 \end{cases}$

Answer: $(6,-2)$

32. $\begin{cases} -2x+y=2 \\ y=4 \end{cases}$

Answer: $(1,4)$

33. $\begin{cases} x-3y=-3 \\ y=2 \end{cases}$

Answer: $(3,2)$

34. $\begin{cases} 2x-2y=8 \\ y=-3 \end{cases}$

Answer: $(1,-3)$

35. $\begin{cases} 2x-y=-1 \\ x=1 \end{cases}$

Answer: $(1,3)$

36. $\begin{cases} x+2y=2 \\ x=-2 \end{cases}$

Answer: $(-2,2)$

37. $\begin{cases} x-3y=-6 \\ x=-3 \end{cases}$

Answer: $(-3,1)$

38. $\begin{cases} x+y=4 \\ x=1 \end{cases}$

Answer: $(1,3)$

39. $\begin{cases} 4x-3y=8 \\ 8x-6y=14 \end{cases}$

Answer: no solution

40. $\begin{cases} x+3y=4 \\ -2x-6y=3 \end{cases}$

Answer: no solution

41. $\begin{cases} -2x+4y=4 \\ y=\frac{1}{2}x \end{cases}$

Answer: no solution

42. $\begin{cases} 3x+5y=10 \\ y=-\frac{3}{5}x+1 \end{cases}$

Answer: no solution

43. $\begin{cases} x=-3y+4 \\ 2x+6y=8 \end{cases}$

Answer: no solution

44. $\begin{cases} 4x=3y+7 \\ 8x-6y=14 \end{cases}$

Answer: no solution

45. $\begin{cases} 2x+y=6 \\ -8x-4y=-24 \end{cases}$

Answer: infinitely many solutions

46. $\begin{cases} 5x+2y=7 \\ -10x-4y=-14 \end{cases}$

Answer: infinitely many solutions

47. $\begin{cases} x+3y=-6 \\ 4y=-\frac{4}{3}x-8 \end{cases}$

Answer: infinitely many solutions

48. $\begin{cases} -x+2y=-6 \\ y=-\frac{1}{2}x-1 \end{cases}$

Answer: $(2,-2)$

49. $\begin{cases} -3x+2y=-2 \\ y=-x+4 \end{cases}$

Answer: $(2,2)$

50. $\begin{cases} -x+2y=-2 \\ y=-x-1 \end{cases}$

Answer: $(0,-1)$

Determine the Number of Solutions of a Linear System Without graphing the following systems of equations, determine the number of solutions.

51. $\begin{cases} y=\frac{2}{3}x+1 \\ -2x+3y=5 \end{cases}$

Answer: 0 solutions

52. $\begin{cases} y=\frac{1}{3}x+2 \\ x-3y=9 \end{cases}$

Answer: 0 solutions

53. $\begin{cases} y=-2x+1 \\ 4x+2y=8 \end{cases}$

Answer: 0 solutions

54. $\begin{cases} y=3x+4 \\ 9x-3y=18 \end{cases}$

Answer: 0 solutions

55. $\begin{cases} y=\frac{2}{3}x+1 \\ 2x-3y=7 \end{cases}$

Answer: 0 solutions

56. $\begin{cases} 3x+4y=12 \\ y=-3x-1 \end{cases}$

Answer: consistent, 1 solution

57. $\begin{cases} 4x+2y=10 \\ 4x-2y=-6 \end{cases}$

Answer: consistent, 1 solution

58. $\begin{cases} 5x+3y=4 \\ 2x-3y=5 \end{cases}$

Answer: consistent, 1 solution

59. $\begin{cases} y=-\frac{1}{2}x+5 \\ x+2y=10 \end{cases}$

Answer: infinitely many solutions

60. $\begin{cases} y=x+1 \\ -x+y=1 \end{cases}$

Answer: infinitely many solutions

61. $\begin{cases} y=2x+3 \\ 2x-y=-3 \end{cases}$

Answer: infinitely many solutions

62. $\begin{cases} 5x-2y=10 \\ y=\frac{5}{2}x-5 \end{cases}$

Answer: infinitely many solutions

Solve Applications of Systems of Equations by Graphing In the following exercises, solve.

63. Molly is making strawberry infused water. For each ounce of strawberry juice, she uses three times as many ounces of water as juice. How many ounces of strawberry juice and how many ounces of water does she need to make 64 ounces of strawberry infused water?

Answer: Molly needs 16 ounces of strawberry juice and 48 ounces of water.

64. Jamal is making a snack mix that contains only pretzels and nuts. For every ounce of nuts, he will use 2 ounces of pretzels. How many ounces of pretzels and how many ounces of nuts does he need to make 45 ounces of snack mix?

Answer: Jamal needs 16 ounces of nuts and 30 ounces of pretzels.

65. Enrique is making a party mix that contains raisins and nuts. For each ounce of nuts, he uses twice the amount of raisins. How many ounces of nuts and how many ounces of raisins does he need to make 24 ounces of party mix?
Answer: Enrique needs 8 ounces of nuts and 16 ounces of water.

66. Owen is making lemonade from concentrate. The number of quarts of water he needs is 4 times the number of quarts of concentrate. How many quarts of water and how many quarts of concentrate does Owen need to make 100 quarts of lemonade?
Answer: Owen needs 20 quarts of concentrate and 80 of water.

Everyday Math

67. Leo is planning his spring flower garden. He wants to plant tulip and daffodil bulbs. He will plant 6 times as many daffodil bulbs as tulip bulbs. If he wants to plant 350 bulbs, how many tulip bulbs and how many daffodil bulbs should he plant?
Answer: Leo should plant 50 tulips and 300 daffodils.

68. A marketing company surveys 1200 people. They surveyed twice as many females as males. How many males and females did they survey?
Answer: The marketing company surveyed 400 males and 800 females.

Writing Exercises

69. In a system of linear equations, the two equations have the same slope. Describe the possible solutions to the system.
Answer: Given that it is only known that the slopes of both linear equations are the same, there are either no solutions (the graphs of the equations are parallel) or infinitely many.

70. In a system of linear equations, the two equations have the same intercepts. Describe the possible solutions to the system.
Answer: There is one possible solution to the system of equations.

Elementary Algebra
5: Systems of Linear Equations
5.2 Solve Systems of Equations by Substitution

Solve a System of Equations by Substitution In the following exercises, solve the systems of equations by substitution.

71. $\begin{cases} 2x+y=-4 \\ 3x-2y=-6 \end{cases}$

Answer: $(-2,0)$

72. $\begin{cases} 2x+y=-2 \\ 3x-y=7 \end{cases}$

Answer: $(1,-4)$

73. $\begin{cases} x-2y=-5 \\ 2x-3y=-4 \end{cases}$

Answer: $(7,6)$

74. $\begin{cases} x-3y=-9 \\ 2x+5y=4 \end{cases}$

Answer: $(-3,2)$

75. $\begin{cases} 5x-2y=-6 \\ y=3x+3 \end{cases}$

Answer: $(0,3)$

76. $\begin{cases} -2x+2y=6 \\ y=-3x+1 \end{cases}$

Answer: $(-1,4)$

77. $\begin{cases} 2x+3y=3 \\ y=-x+3 \end{cases}$

Answer: $(6,-3)$

78. $\begin{cases} 2x+5y=-14 \\ y=-2x+2 \end{cases}$

Answer: $(-2,-2)$

79. $\begin{cases} 2x+5y=1 \\ y=\frac{1}{3}x-2 \end{cases}$

Answer: $(3,-1)$

80. $\begin{cases} 3x+4y=1 \\ y=-\frac{2}{5}x+2 \end{cases}$

Answer: $(-5,4)$

81. $\begin{cases} 3x-2y=6 \\ y=\frac{2}{3}x+2 \end{cases}$

Answer: $(6,6$

82. $\begin{cases} -3x-5y=3 \\ y=\frac{1}{2}x-5 \end{cases}$

Answer: $(4,-3)$

83. $\begin{cases} 2x+y=10 \\ -x+y=-5 \end{cases}$

Answer: $(5,0)$

84. $\begin{cases} -2x+y=10 \\ -x+2y=16 \end{cases}$

Answer: $(12,14)$

85. $\begin{cases} 3x+y=1 \\ -4x+y=15 \end{cases}$

Answer: $(-2,7)$

86. $\begin{cases} x+y=0 \\ 2x+3y=-4 \end{cases}$

Answer: $(4,-4)$

87. $\begin{cases} x+3y=1 \\ 3x+5y=-5 \end{cases}$

Answer: $(-5,2)$

88. $\begin{cases} x+2y=-1 \\ 2x+3y=1 \end{cases}$

Answer: $(5,-3)$

89. $\begin{cases} 2x+y=5 \\ x-2y=-15 \end{cases}$

Answer: $(-1,7)$

90. $\begin{cases} 4x+y=10 \\ x-2y=-20 \end{cases}$

Answer: $(0,10)$

91. $\begin{cases} y=-2x-1 \\ y=-\frac{1}{3}x+4 \end{cases}$

Answer: $(-3,5)$

92. $\begin{cases} y=x-6 \\ y=-\frac{3}{2}x+4 \end{cases}$

Answer: $(4,-2)$

93. $\begin{cases} y=2x-8 \\ y=\frac{3}{5}x+6 \end{cases}$

Answer: $(10,12)$

94. $\begin{cases} y=-x-1 \\ y=x+7 \end{cases}$

Answer: $(-4,3)$

95. $\begin{cases} 4x+2y=8 \\ 8x-y=1 \end{cases}$

Answer: $(\frac{1}{2},3)$

96. $\begin{cases} -x-12y=-1 \\ 2x-8y=-6 \end{cases}$

Answer: $(\frac{1}{2},3)$

97. $\begin{cases} 15x+2y=6 \\ -5x+2y=-4 \end{cases}$

Answer: $\left(\frac{1}{2},-\frac{3}{4}\right)$

98. $\begin{cases} 2x-15y=7 \\ 12x+2y=-4 \end{cases}$

Answer: $\left(-\frac{1}{4},-\frac{1}{2}\right)$

99. $\begin{cases} y=3x \\ 6x-2y=0 \end{cases}$

Answer: Infinitely many solutions

100. $\begin{cases} x=2y \\ 4x-8y=0 \end{cases}$

Answer: Infinitely many solutions

101. $\begin{cases} 2x+16y=8 \\ -x-8y=-4 \end{cases}$

Answer: Infinitely many solutions

102. $\begin{cases} 15x+4y=6 \\ -30x-8y=-12 \end{cases}$

Answer: Infinitely many solutions

103. $\begin{cases} y=-4x \\ 4x+y=1 \end{cases}$

Answer: No solution

104. $\begin{cases} y = -\frac{1}{4}x \\ x + 4y = 8 \end{cases}$

Answer: No solution

105. $\begin{cases} y = \frac{7}{8}x + 4 \\ -7x + 8y = 6 \end{cases}$

Answer: No solution

106. $\begin{cases} y = -\frac{2}{3}x + 5 \\ 2x + 3y = 11 \end{cases}$

Answer: No solution

Solve Applications of Systems of Equations by Substitution In the following exercises, translate to a system of equations and solve.

107. The sum of two numbers is 15. One number is 3 less than the other. Find the numbers.

Answer: The numbers are 6 and 9.

108. The sum of two number is 30. One number is 4 less than the other. Find the numbers.

Answer: The numbers are 13 and 17.

109. The sum of two number is –26. One number is 12 less than the other. Find the numbers.

Answer: The numbers are –7 and –19.

110. The perimeter of a rectangle is 50. The length is 5 more than the width. Find the length and width.

Answer: The length is 15 and the width 10.

111. The perimeter of a rectangle is 60. The length is 10 more than the width. Find the length and width.

Answer: The length is 20 and the width is 10.

112. The perimeter of a rectangle is 58. The length is 5 more than three times the width. Find the length and width.

Answer: The length 23 and the width is 6.

113. The perimeter of a rectangle is 84. The length is 10 more than three times the width. Find the length and width.

Answer: The length is 34 and the width is 8.

114. The measure of one of the small angles of a right triangle is 14 more than 3 times the measure of the other small angle. Find the measure of both angles.
Answer: The measures are 19° and 71°.

115. The measure of one of the small angles of a right triangle is 26 more than 3 times the measure of the other small angle. Find the measure of both angles.
Answer: The measures are 16° and 74°.

116. The measure of one of the small angles of a right triangle is 15 less than twice the measure of the other small angle. Find the measure of both angles.
Answer: The measures are 35° and 55°.

117. The measure of one of the small angles of a right triangle is 45 less than twice the measure of the other small angle. Find the measure of both angles.
Answer: The measures are 45° and 45°.

118. Maxim has been offered positions by two car companies. The first company pays a salary of $10,000 plus a commission of $1,000 for each car sold. The second pays a salary of $20,000 plus a commission of $500 for each car sold. How many cars would need to be sold to make the total pay the same?
Answer: 20 cars would need to be sold.

119. Jackie has been offered positions by two cable companies. The first company pays a salary of $ 14,000 plus a commission of $100 for each cable package sold. The second pays a salary of $20,000 plus a commission of $25 for each cable package sold. How many cable packages would need to be sold to make the total pay the same?
Answer: 80 cable packages would need to be sold.

120. Amara currently sells televisions for company A at a salary of $17,000 plus a $100 commission for each television she sells. Company B offers her a position with a salary of $29,000 plus a $20 commission for each television she sells. How televisions would Amara need to sell for the options to be equal?
Answer: Amara would need to sell 150 televisons.

121. Mitchell currently sells stoves for company A at a salary of $12,000 plus a $150 commission for each stove he sells. Company B offers him a position with a salary of $24,000 plus a $50 commission for each stove he sells. How many stoves would Mitchell need to sell for the options to be equal?
Answer: Mitchell would need to sell 120 stoves.

Everyday Math

122. When Gloria spent 15 minutes on the elliptical trainer and then did circuit training for 30 minutes, her fitness app says she burned 435 calories. When she spent 30 minutes on the elliptical trainer and 40 minutes circuit training she burned 690 calories. Solve the system $\begin{cases}15e+30c=435\\30e+40c=690\end{cases}$ for e, the number of calories she burns for each minute on the elliptical trainer, and c, the number of calories she burns for each minute of circuit training.

Answer: $e=11$ calories, $c=9$ calories

123. Stephanie left Riverside, California, driving her motorhome north on Interstate 15 towards Salt Lake City at a speed of 56 miles per hour. Half an hour later, Tina left Riverside in her car on the same route as Stephanie, driving 70 miles per hour. Solve the system $\begin{cases}56s=70t\\s=t+\frac{1}{2}\end{cases}$.

(a) for t to find out how long it will take Tina to catch up to Stephanie.
(b) what is the value of s, the number of hours Stephanie will have driven before Tina catches up to her?

Answer: (a) $t=2$ hours (b) $s=2\frac{1}{2}$ hours

Writing Exercises

124. Solve the system of equations $\begin{cases}x+y=10\\x-y=6\end{cases}$

(a) by graphing.
(b) by substitution.
(c) Which method do you prefer? Why?

Answer: Answers will vary.

125. Solve the system of equations $\begin{cases}3x+y=12\\x=y-8\end{cases}$ by substitution and explain all your steps in words.

Answer: Answers will vary.

Elementary Algebra
5: Systems of Linear Equations
5.3 Solve Systems of Equations by Elimination

Solve a System of Equations by Elimination In the following exercises, solve the systems of equations by elimination.

126. $\begin{cases} 5x+2y=2 \\ -3x-y=0 \end{cases}$

Answer: $(-2,6)$

127. $\begin{cases} -3x+y=-9 \\ x-2y=-12 \end{cases}$

Answer: (6, 9)

128. $\begin{cases} 6x-5y=-1 \\ 2x+y=13 \end{cases}$

Answer: (4, 5)

129. $\begin{cases} 3x-y=-7 \\ 4x+2y=-6 \end{cases}$

Answer: $(-2,1)$

130. $\begin{cases} x+y=-1 \\ x-y=-5 \end{cases}$

Answer: $(-3,\ 2)$

131. $\begin{cases} x+y=-8 \\ x-y=-6 \end{cases}$

Answer: $(-7,\ -1)$

132. $\begin{cases} 3x-2y=1 \\ -x+2y=9 \end{cases}$

Answer: (5, 7)

133. $\begin{cases} -7x+6y=-10 \\ x-6y=22 \end{cases}$

Answer: $(-2,\ -4)$

134. $\begin{cases} 3x+2y=-3 \\ -x-2y=-19 \end{cases}$

Answer: $(-11,\ 15)$

135. $\begin{cases} 5x+2y=1 \\ -5x-4y=-7 \end{cases}$

Answer: $(-1,3)$

136. $\begin{cases} 6x+4y=-4 \\ -6x-5y=8 \end{cases}$

Answer: $(2,-4)$

137. $\begin{cases} 3x-4y=-11 \\ x-2y=-5 \end{cases}$

Answer: $(-1,2)$

138. $\begin{cases} 5x-7y=29 \\ x+3y=-3 \end{cases}$

Answer: $(3,-2)$

139. $\begin{cases} 6x-5y=-75 \\ -x-2y=-13 \end{cases}$

Answer: $(-5,9)$

140. $\begin{cases} -x+4y=8 \\ 3x+5y=10 \end{cases}$

Answer: (0, 2)

141. $\begin{cases} 2x-5y=7 \\ 3x-y=17 \end{cases}$

Answer: (6, 1)

142. $\begin{cases} 5x-3y=-1 \\ 2x-y=2 \end{cases}$

Answer: (7, 12)

143. $\begin{cases} 7x+y=-4 \\ 13x+3y=4 \end{cases}$

Answer: $(-2,10)$

144. $\begin{cases} -3x+5y=-13 \\ 2x+y=-26 \end{cases}$

Answer: $(-9,-8)$

145. $\begin{cases} 3x-5y=-9 \\ 5x+2y=16 \end{cases}$

Answer: (2, 3)

146. $\begin{cases} 4x-3y=3 \\ 2x+5y=-31 \end{cases}$

Answer: $(-3,-5)$

147. $\begin{cases} 4x+7y=14 \\ -2x+3y=32 \end{cases}$

Answer: $(-7,6)$

148. $\begin{cases} 5x+2y=21 \\ 7x-4y=9 \end{cases}$

Answer: (3, 3)

149. $\begin{cases} 3x+8y=-3 \\ 2x+5y=-3 \end{cases}$

Answer: $(-9,3)$

150. $\begin{cases} 11x+9y=-5 \\ 7x+5y=-1 \end{cases}$

Answer: $(2,-3)$

151. $\begin{cases} 3x+8y=67 \\ 5x+3y=60 \end{cases}$

Answer: (9, 5)

152. $\begin{cases} 2x+9y=-4 \\ 3x+13y=-7 \end{cases}$

Answer: $(-11,2)$

153. $\begin{cases} \frac{1}{3}x-y=-3 \\ x+\frac{5}{2}y=2 \end{cases}$

Answer: $(-3,2)$

154. $\begin{cases} x+\frac{1}{2}y=\frac{3}{2} \\ \frac{1}{5}x-\frac{1}{5}y=3 \end{cases}$

Answer: $(6,-9)$

155. $\begin{cases} x+\frac{1}{3}y=-1 \\ \frac{1}{2}x-\frac{1}{3}y=-2 \end{cases}$

Answer: $(-2,3)$

156. $\begin{cases} \frac{1}{3}x-y=-3 \\ \frac{2}{3}x+\frac{5}{2}y=3 \end{cases}$

Answer: $(-3,2)$

157. $\begin{cases} 2x+y=3 \\ 6x+3y=9 \end{cases}$

Answer: infinitely many solutions

158. $\begin{cases} x-4y=-1 \\ -3x+12y=3 \end{cases}$

Answer: infinitely many solutions

159. $\begin{cases} -3x-y=8 \\ 6x+2y=-16 \end{cases}$

Answer: infinitely many solutions

160. $\begin{cases} 4x+3y=2 \\ 20x+15y=10 \end{cases}$

Answer: infinitely many solutions

161. $\begin{cases} 3x+2y=6 \\ -6x-4y=-12 \end{cases}$

Answer: infinitely many solutions

162. $\begin{cases} 5x-8y=12 \\ 10x-16y=20 \end{cases}$

Answer: inconsistent, no solution

163. $\begin{cases} -11x+12y=60 \\ -22x+24y=90 \end{cases}$

Answer: inconsistent, no solution

164. $\begin{cases} 7x-9y=16 \\ -21x+27y=-24 \end{cases}$

Answer: inconsistent, no solution

165. $\begin{cases} 5x-3y=15 \\ y=\frac{5}{3}x-2 \end{cases}$

Answer: inconsistent, no solution

166. $\begin{cases} 2x+4y=7 \\ y=-\frac{1}{2}x-4 \end{cases}$

Answer: inconsistent, no solution

Solve Applications of Systems of Equations by Elimination In the following exercises, translate to a system of equations and solve.

167. The sum of two numbers is 65. Their difference is 25. Find the numbers.

Answer: The numbers are 20 and 45.

168. The sum of two numbers is 37. Their difference is 9. Find the numbers.

Answer: The numbers are 14 and 23.

169. The sum of two numbers is –27. Their difference is –59. Find the numbers.
Answer: The numbers are 16 and -43.

170. The sum of two numbers is –45. Their difference is –89. Find the numbers.
Answer: The numbers are 22 and -67.

171. Andrea is buying some new shirts and sweaters. She is able to buy 3 shirts and 2 sweaters for $114 or she is able to buy 2 shirts and 4 sweaters for $164. How much does a shirt cost? How much does a sweater cost?
Answer: A shirt costs $16 and a sweater costs $33.

172. Peter is buying office supplies. He is able to buy 3 packages of paper and 4 staplers for $40 or he is able to buy 5 packages of paper and 6 staplers for $62. How much does a package of paper cost? How much does a stapler cost?
Answer: A package of paper costs $4. A stapler costs $7.

173. The total amount of sodium in 2 hot dogs and 3 cups of cottage cheese is 4720 mg. The total amount of sodium in 5 hot dogs and 2 cups of cottage cheese is 6300 mg. How much sodium is in a hot dog? How much sodium is in a cup of cottage cheese?
Answer: There are 860 mg in a hot dog. There are 1,000 mg in a cup of cottage cheese.

174. The total number of calories in 2 hot dogs and 3 cups of cottage cheese is 960 calories. The total number of calories in 5 hot dogs and 2 cups of cottage cheese is 1190 calories. How many calories are in a hot dog? How many calories are in a cup of cottage cheese?
Answer: There are 150 calories in a hot dog. There are 220 calories in a cup of cottage cheese.

Choose the Most Convenient Method to Solve a System of Linear Equations
In the following exercises, decide whether it would be more convenient to solve the system of equations by substitution or elimination.

175. (a) $\begin{cases} 8x-15y=-32 \\ 6x+3y=-5 \end{cases}$ (b) $\begin{cases} x=4y-3 \\ 4x-2y=-6 \end{cases}$
Answer: (a) elimination (b) substitution

176. (a) $\begin{cases} y=7x-5 \\ 3x-2y=16 \end{cases}$ (b) $\begin{cases} 12x-5y=-42 \\ 3x+7y=-15 \end{cases}$
Answer: (a) substitution (b) elimination

177. (a) $\begin{cases} y=4x+9 \\ 5x-2y=-21 \end{cases}$ (b) $\begin{cases} 9x-4y=24 \\ 3x+5y=-14 \end{cases}$
Answer: (a) substitution (b) elimination

178. (a) $\begin{cases} 14x-15y=-30 \\ 7x+2y=10 \end{cases}$ (b) $\begin{cases} x=9y-11 \\ 2x-7y=-27 \end{cases}$

Answer: (a) elimination (b) substitution

Everyday Math

179. Norris can row 3 miles upstream against the current in the same amount of time it takes him to row 5 miles downstream, with the current. Solve the system. $\begin{cases} r-c=3 \\ r+c=5 \end{cases}$

(a) for r, his rowing speed in still water.
(b) Then solve for c, the speed of the river current.

Answer: $(a)\ r=4\ \ (b)c=1$

180. Josie wants to make 10 pounds of trail mix using nuts and raisins, and she wants the total cost of the trail mix to be $54. Nuts cost $6 per pound and raisins cost $3 per pound. Solve the system $\begin{cases} n+r=10 \\ 6n+3r=54 \end{cases}$ to find n, the number of pounds of nuts, and r, the number of pounds of raisins she should use.

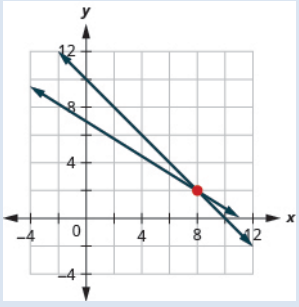
Answer: $n=8, r=2$

Writing Exercises

181. Solve the system $\begin{cases} x+y=10 \\ 5x+8y=56 \end{cases}$

(a) by substitution
(b) by graphing
(c) Which method do you prefer? Why?

Answer:
(a) (8, 2)
(b)



(c) Answers will vary.

182. Solve the system $\begin{cases} x + y = -12 \\ y = 4 - \frac{1}{2}x \end{cases}$

(a) by substitution

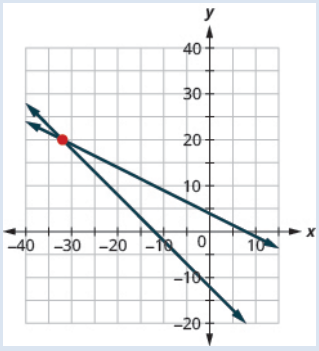
(b) by graphing

(c) Which method do you prefer? Why?

Answer:

(a) $(-32, 20)$

(b)



(c) Answers will vary.

Elementary Algebra
5: Systems of Linear Equations
5.4 Solve Applications with Systems of Equations

Translate to a System of Equations For the following exercises, translate to a system of equations and solve the system.

183. The sum of two numbers is fifteen. One number is three less than the other. Find the numbers.

Answer: The numbers are 6 and 9.

184. The sum of two numbers is twenty-five. One number is five less than the other. Find the numbers.

Answer: The numbers are 10 and 15.

185. The sum of two numbers is negative thirty. One number is five times the other. Find the numbers.

Answer: The numbers are -5 and -25.

186. The sum of two numbers is negative sixteen. One number is seven times the other. Find the numbers.

Answer: The numbers are -2 and -14.

187. Twice a number plus three times a second number is twenty-two. Three times the first number plus four times the second is thirty-one. Find the numbers.

Answer: The numbers are 5 and 4.

188. Six times a number plus twice a second number is four. Twice the first number plus four times the second number is eighteen. Find the numbers.

Answer: The numbers are -1 and 5.

189. Three times a number plus three times the second is fifteen. Four times the first plus twice the second number is fourteen. Find the numbers.

Answer: The numbers are 2 and 3.

190. Twice a number plus three times a second number is negative one. The first number plus four times the second number is two. Find the numbers.

Answer: The numbers are -2 and 1.

191. A married couple together earn $ 75,000. The husband earns $15,000 more than five times what his wife earns. What does the wife earn?

Answer: $10,000

192. During two years in college, a student earned $9,500. The second year she earned $500 more than twice the amount she earned the first year. How much did she earn the first year?
Answer: $3,000

193. Daniela invested a total of $50,000, some in a certificate of deposit (CD) and the remainder in bonds. The amount invested in bonds was $5000 more than twice the amount she put into the CD. How much did she invest in each account?
Answer: She put $15,000 into a CD and $35,000 in bonds.

194. Jorge invested $28,000 into two accounts. The amount he put in his money market account was $2000 less than twice what he put into a CD. How much did he invest in each account?
Answer: He put $10,000 into a CD and $18,000 in a money market account.

195. In her last two years in college, Marlene received $42,000 in loans. The first year she received a loan that was $6000 less than three times the amount of the second year's loan. What was the amount of her loan for each year?
Answer: The amount of the first year's loan was $30,000 and the amount of the second year's loan was $12,000.

196. Jen and David owe $22,000 in loans for their two cars. The amount of the loan for Jen's car is $2000 less than twice the amount of the loan for David's car. How much is each car loan?
Answer: The amount of Jen's car loan is $14,000 and the amount of David's car loan is $8000.

Solve Direct Translation Applications For the following exercises, translate to a system of equations and solve.

197. Alyssa is twelve years older than her sister, Bethany. The sum of their ages is forty-four. Find their ages.
Answer: Bethany is 16 years old and Alyssa is 28 years old.

198. Robert is 15 years older than his sister, Helen. The sum of their ages is sixty-three. Find their ages.
Answer: Helen is 24 years old and Robert is 39 years old.

199. The age of Noelle's dad is six less than three times Noelle's age. The sum of their ages is seventy-four. Find their ages.
Answer: Noelle is 20 years old and her dad is 54 years old.

200. The age of Mark's dad is 4 less than twice Marks's age. The sum of their ages is ninety-five. Find their ages.
Answer: Mark is 33 years old and his dad is 62 years old

201. Two containers of gasoline hold a total of fifty gallons. The big container can hold ten gallons less than twice the small container. How many gallons does each container hold?
Answer: The small container holds 20 gallons and the large container holds 30 gallons.

202. June needs 48 gallons of punch for a party and has two different coolers to carry it in. The bigger cooler is five times as large as the smaller cooler. How many gallons can each cooler hold?
Answer: The smaller cooler holds 8 gallons and the bigger cooler holds 40 gallons.

203. Shelly spent 10 minutes jogging and 20 minutes cycling and burned 300 calories. The next day, Shelly swapped times, doing 20 minutes of jogging and 10 minutes of cycling and burned the same number of calories. How many calories were burned for each minute of jogging and how many for each minute of cycling?
Answer: There were 10 calories burned jogging and 10 calories burned cycling.

204. Drew burned 1800 calories Friday playing one hour of basketball and canoeing for two hours. Saturday he spent two hours playing basketball and three hours canoeing and burned 3200 calories. How many calories did he burn per hour when playing basketball?
Answer: There were 1000 calories burned playing basketball and 400 calories burned canoeing.

205. Troy and Lisa were shopping for school supplies. Each purchased different quantities of the same notebook and thumb drive. Troy bought four notebooks and five thumb drives for $116. Lisa bought two notebooks and three thumb dives for $68. Find the cost of each notebook and each thumb drive.
Answer: Notebooks are $4 and thumb drives are $20.

206. Nancy bought seven pounds of oranges and three pounds of bananas for $17. Her husband later bought three pounds of oranges and six pounds of bananas for $12. What was the cost per pound of the oranges and the bananas?
Answer: Oranges cost $2 per pound and bananas cost $1 per pound.

Solve Geometry Applications In the following exercises, translate to a system of equations and solve.

207. The difference of two complementary angles is 30 degrees. Find the measures of the angles.
Answer: The measures are 60 degrees and 30 degrees.

208. The difference of two complementary angles is 68 degrees. Find the measures of the angles.
Answer: The measures are 79 degrees and 11 degrees.

209. The difference of two supplementary angles is 70 degrees. Find the measures of the angles.
Answer: The measures are 125 degrees and 55 degrees.

210. The difference of two supplementary angles is 24 degrees. Find the measure of the angles.
Answer: The measures are 102 degrees and 78 degrees.

211. The difference of two supplementary angles is 8 degrees. Find the measures of the angles.
Answer: 94 degrees and 86 degrees

212. The difference of two supplementary angles is 88 degrees. Find the measures of the angles.
Answer: 134 degrees and 46 degrees

213. The difference of two complementary angles is 55 degrees. Find the measures of the angles.
Answer: 72.5 degrees and 17.5 degrees

214. The difference of two complementary angles is 17 degrees. Find the measures of the angles.
Answer: 53.5 degrees and 36.5 degrees

215. Two angles are supplementary. The measure of the larger angle is four more than three times the measure of the smaller angle. Find the measures of both angles.
Answer: The measures are 44 degrees and 136 degrees.

216. Two angles are supplementary. The measure of the larger angle is five less than four times the measure of the smaller angle. Find the measures of both angles.
Answer: The measures are 37 degrees and 143 degrees.

217. Two angles are complementary. The measure of the larger angle is twelve less than twice the measure of the smaller angle. Find the measures of both angles.
Answer: The measures are 34 degrees and 56 degrees.

218. Two angles are complementary. The measure of the larger angle is ten more than four times the measure of the smaller angle. Find the measures of both angles.
Answer: The measures are 16 degrees and 74 degrees.

219. Wayne is hanging a string of lights 45 feet long around the three sides of his rectangular patio, which is adjacent to his house. The length of his patio, the side along the house, is five feet longer than twice its width. Find the length and width of the patio.
Answer: The width is 10 feet and the length is 25 feet.

220. Darrin is hanging 200 feet of Christmas garland on the three sides of fencing that enclose his rectangular front yard. The length, the side along the house, is five feet less than three times the width. Find the length and width of the fencing.
Answer: The width is 41 feet and the length is 118 feet.

221. A frame around a rectangular family portrait has a perimeter of 60 inches. The length is fifteen less than twice the width. Find the length and width of the frame.
Answer: The width is 15 feet and the length is 15 feet.

222. The perimeter of a rectangular toddler play area is 100 feet. The length is ten more than three times the width. Find the length and width of the play area.
Answer: The width is 10 feet and the length is 40 feet.

Solve Uniform Motion Applications In the following exercises, translate to a system of equations and solve.

223. Sarah left Minneapolis heading east on the interstate at a speed of 60 mph. Her sister followed her on the same route, leaving two hours later and driving at a rate of 70 mph. How long will it take for Sarah's sister to catch up to Sarah?
Answer: It took Sarah's sister 12 hours.

224. College roommates John and David were driving home to the same town for the holidays. John drove 55 mph, and David, who left an hour later, drove 60 mph. How long will it take for David to catch up to John?
Answer: It took David 11 hours.

225. At the end of spring break, Lucy left the beach and drove back towards home, driving at a rate of 40 mph. Lucy's friend left the beach for home 30 minutes (half an hour) later, and drove 50 mph. How long did it take Lucy's friend to catch up to Lucy?
Answer: It took Lucy's friend 2 hours.

226. Felecia left her home to visit her daughter driving 45 mph. Her husband waited for the dog sitter to arrive and left home twenty minutes (1/3 hour) later. He drove 55 mph to catch up to Felecia. How long before he reaches her?
Answer: It took Felicia's husband 1 ½ hours.

227. The Jones family took a 12 mile canoe ride down the Indian River in two hours. After lunch, the return trip back up the river took three hours. Find the rate of the canoe in still water and the rate of the current.
Answer: The canoe rate is 5 mph and the current rate is 1 mph.

228. A motor boat travels 60 miles down a river in three hours but takes five hours to return upstream. Find the rate of the boat in still water and the rate of the current.
Answer: The boat rate is 16 mph and the current rate is 4 mph.

229. A motor boat traveled 18 miles down a river in two hours but going back upstream, it took 4.5 hours due to the current. Find the rate of the motor boat in still water and the rate of the current. (Round to the nearest hundredth.).
Answer: The boat rate is 6.5 mph and the current rate is 2.5 mph.

230. A river cruise boat sailed 80 miles down the Mississippi River for four hours. It took five hours to return. Find the rate of the cruise boat in still water and the rate of the current. (Round to the nearest hundredth.).
Answer: The boat rate is 18 mph and the current rate is 2 mph.

231. A small jet can fly 1072 miles in 4 hours with a tailwind but only 848 miles in 4 hours into a headwind. Find the speed of the jet in still air and the speed of the wind.
Answer: The jet rate is 240 mph and the wind speed is 28 mph.

232. A small jet can fly 1435 miles in 5 hours with a tailwind but only 1215 miles in 5 hours into a headwind. Find the speed of the jet in still air and the speed of the wind.
Answer: The jet rate is 265 mph and the wind speed is 22 mph.

233. A commercial jet can fly 868 miles in 2 hours with a tailwind but only 792 miles in 2 hours into a headwind. Find the speed of the jet in still air and the speed of the wind.
Answer: The jet rate is 415 mph and the wind speed is 19 mph.

234. A commercial jet can fly 1320 miles in 3 hours with a tailwind but only 1170 miles in 3 hours into a headwind. Find the speed of the jet in still air and the speed of the wind.
Answer: The jet rate is 415 mph and the wind speed is 25 mph.

Everyday Math

235. At a school concert, 425 tickets were sold. Student tickets cost $5 each and adult tickets cost $8 each. The total receipts for the concert were $2851. Solve the system

$$\begin{cases} s + a = 425 \\ 5s + 8a = 2851 \end{cases}$$

to find s, the number of student tickets and a, the number of adult tickets.
Answer: $s = 183, a = 242$

236. The first graders at one school went on a field trip to the zoo. The total number of children and adults who went on the field trip was 115. The number of adults was $\frac{1}{4}$ the number of children. Solve the system

$$\begin{cases} c + a = 115 \\ a = \frac{1}{4}c \end{cases}$$

to find c, the number of children and a, the number of adults.
Answer: $c = 92, a = 23$

Writing Exercises

237. Write an application problem similar to Example 5.37 using the ages of two of your friends or family members. Then translate to a system of equations and solve it.

Answer: Answers will vary.

238. Write a uniform motion problem similar to Example 1.42 that relates to where you live with your friends or family members. Then translate to a system of equations and solve it.

Answer: Answers will vary.

Elementary Algebra
5: Systems of Linear Equations
5.5 Solve Mixture Applications with Systems of Equations

Solve Mixture Applications For the following exercises, translate to a system of equations and solve.

239. Tickets to a Broadway show cost $35 for adults and $15 for children. The total receipts for 1650 tickets at one performance were $47,150. How many adult and how many child tickets were sold?
Answer: There 1120 adult tickets and 530 child tickets sold.

240. Tickets for a show are $70 for adults and $50 for children. One evening performance had a total of 300 tickets sold and the receipts totaled $17,200. How many adult and how many child tickets were sold?
Answer: There were 110 adult tickets and 190 child tickets sold.

241. Tickets for a train cost $10 for children and $22 for adults. Josie paid $1200 for a total of 72 tickets. How many children tickets and how many adult tickets did Josie buy?
Answer: Josie bought 40 adult tickets and 32 children tickets.

242. Tickets for a baseball game are $69 for Main Level seats and $39 for Terrace Level seats. A group of sixteen friends went to the game and spent a total of $804 for the tickets. How many of Main Level and how many Terrace Level tickets did they buy?
Answer: The friends bought 6 main level seats and 10 terrace level seats.

243. Tickets for a dance recital cost $15 for adults and $7 dollars for children. The dance company sold 253 tickets and the total receipts were $2771. How many adult tickets and how many child tickets were sold?
Answer: There were 125 adult tickets and 128 children tickets sold.

244. Tickets for the community fair cost $12 for adults and $5 dollars for children. On the first day of the fair, 312 tickets were sold for a total of $2204. How many adult tickets and how many child tickets were sold?
Answer: There were 92 adult tickets and 220 children tickets sold.

245. Brandon has a cup of quarters and dimes with a total value of $3.80. The number of quarters is four less than twice the number of dimes. How many quarters and how many dimes does Brandon have?
Answer: Brandon has 12 quarters and 8 dimes.

246. Sherri saves nickels and dimes in a coin purse for her daughter. The total value of the coins in the purse is $0.95. The number of nickels is two less than five times the number of dimes. How many nickels and how many dimes are in the coin purse?
Answer: There are 13 nickels and 3 dimes in the coin purse.

247. Peter has been saving his loose change for several days. When he counted his quarters and nickels, he found they had a total value $13.10. The number of quarters was fifteen more than three times the number of dimes. How many quarters and how many dimes did Peter have?
Answer: Peter had 11 dimes and 48 quarters.

248. Lucinda had a pocketful of dimes and quarters with a value of $ $6.20. The number of dimes is eighteen more than three times the number of quarters. How many dimes and how many quarters does Lucinda have?
Answer: Lucinda had 42 dimes and 8 quarters.

249. A cashier has 30 bills, all of which are $10 or $20 bills. The total value of the money is $460. How many of each type of bill does the cashier have?
Answer: The cashier has fourteen $10 bills and sixteen $20 bills.

250. A cashier has 54 bills, all of which are $10 or $20 bills. The total value of the money is $910. How many of each type of bill does the cashier have?
Answer: The cashier has seventeen $10 bills and thirty-seven $20 bills.

251. Marissa wants to blend candy selling for $1.80 per pound with candy costing $1.20 per pound to get a mixture that costs her $1.40 per pound to make. She wants to make 90 pounds of the candy blend. How many pounds of each type of candy should she use?
Answer: Marissa should use 60 pounds of the $1.20/lb candy and 30 pounds of the $1.80/lb candy.

252. How many pounds of nuts selling for $6 per pound and raisins selling for $3 per pound should Kurt combine to obtain 120 pounds of trail mix that cost him $5 per pound?
Answer: Kurt should combine 80 pounds of nuts and 40 pounds of raisins.

253. Hannah has to make twenty-five gallons of punch for a potluck. The punch is made of soda and fruit drink. The cost of the soda is $1.79 per gallon and the cost of the fruit drink is $2.49 per gallon. Hannah's budget requires that the punch cost $2.21 per gallon. How many gallons of soda and how many gallons of fruit drink does she need?
Answer: Hannah needs 10 gallons of soda and 15 gallons of fruit drink.

254. Joseph would like to make 12 pounds of a coffee blend at a cost of $6.25 per pound. He blends Ground Chicory at $4.40 a pound with Jamaican Blue Mountain at $8.84 per pound. How much of each type of coffee should he use?
Answer: Joseph should use 7 pounds of Chicory coffee and 5 pounds of Jamaican Blue Mountain coffee.

255. Julia and her husband own a coffee shop. They experimented with mixing a City Roast Columbian coffee that cost $7.80 per pound with French Roast Columbian coffee that cost $8.10 per pound to make a 20 pound blend. Their blend should cost them $7.92 per pound. How much of each type of coffee should they buy?
Answer: Julia and her husband should buy 12 pounds of City Roast Columbian coffee and 8 pounds of French Roast Columbian coffee.

256. Melody wants to sell bags of mixed candy at her lemonade stand. She will mix chocolate pieces that cost $4.89 per bag peanut butter pieces that cost $3.79 per bag to get a total of twenty-five bags of mixed candy. Melody wants the bags of mixed candy to cost her $4.23 a bag to make. How many bags of chocolate pieces and how many bags of peanut butter pieces should she use?
Answer: Melody should use 10 bags of chocolate pieces and 15 bags of peanut butter pieces.

257. Jotham needs 70 liters of a 50% alcohol solution. He has a 30% and an 80% solution available. How many liters of the 30% and how many liters of the 80% solutions should he mix to make the 50% solution?
Answer: Jotham should mix 42 liters of the 30% solution and 28 liters of the 80% solution.

258. Joy is preparing 15 liters of a 25% saline solution. She only has 40% and 10% solution in her lab. How many liters of the 40% and how many liters of the 10% should she mix to make the 25% solution?
Answer: Joy should mix 7.5 liters of each solution.

259. A scientist needs 65 liters of a 15% alcohol solution. She has available a 25% and a 12% solution. How many liters of the 25% and how many liters of the 12% solutions should she mix to make the 15% solution?
Answer: The scientist should mix 15 liters of the 25% solution and 50 liters of the 12% solution.

260. A scientist needs 120 liters of a 20% acid solution for an experiment. The lab has available a 25% and a 10% solution. How many liters of the 25% and how many liters of the 10% solutions should the scientist mix to make the 20% solution?
Answer: The scientist should mix 80 liters of the 25% solution and 40 liters of the 10% solution.

261. A 40% antifreeze solution is to be mixed with a 70% antifreeze solution to get 240 liters of a 50% solution. How many liters of the 40% and how many liters of the 70% solutions will be used?
Answer: 160 liters of the 40% solution and 80 liters of the 70% solution will be used.

262. A 90% antifreeze solution is to be mixed with a 75% antifreeze solution to get 360 liters of a 85% solution. How many liters of the 90% and how many liters of the 75% solutions will be used?
Answer: 240 liters of the 90% solution and 120 liters of the 75% solution will be used

Solve Interest Applications For the following exercises, translate to a system of equations and solve.

263. Hattie had $3,000 to invest and wants to earn 10.6% interest per year. She will put some of the money into an account that earns 12% per year and the rest into an account that earns 10% per year. How much money should she put into each account?
Answer: Hattie should invest $900 at 12% and $2,100 at 10%.

264. Carol invested $2,560 into two accounts. One account paid 8% interest and the other paid 6% interest i. She earned 7.25% interest on the total investment. How much money did she put in each account?
Answer: Carol invested $1,600 at 8% and $960 at 6%.

265. Sam invested $48,000, some at 6% interest and the rest at 10%. How much did he invest at each rate if he received $4,000 in interest in one year?
Answer: Sam invested $28,000 at 10% and $20,000 at 6%.

266. Arnold invested $64,000, some at 5.5% interest and the rest at 9%. How much did he invest at each rate if he received $4,500 in interest in one year?
Answer: Arnold invested $28,000 at 9% and $36,000 at 5.5%.

267. After four years in college, Josie owes $65, 800 in student loans. The interest rate on the federal loans is 4.5% and the rate on the private bank loans is 2%. The total interest she owes for one year was $2878.50. What is the amount of each loan?
Answer: The federal loan is $62,500 and the bank loan is $3,300.

268. Mark wants to invest $10,000 to pay for his daughter's wedding next year. He will invest some of the money in a short term CD that pays 12% interest and the rest in a money market savings account that pays 5% interest. How much should he invest at each rate if he wants to earn $1095 in interest in one year?
Answer: Mark should invest $8,500 in the CD and $1,500 in the savings account.

269. A trust fund worth $25,000 is invested in two different portfolios. This year, one portfolio is expected to earn 5.25% interest and the other is expected to earn 4%. Plans are for the total interest on the fund to be $1150 in one year. How much money should be invested at each rate?
Answer: $12,000 should be invested at 5.25% and $13,000 should be invested at 4%.

270. A business has two loans totaling $85,000. One loan has a rate of 6% and the other has a rate of 4.5%. This year, the business expects to pay $4650 in interest on the two loans. How much is each loan?
Answer: There is a $55,000 loan at 6% and a $30,000 loan at 4.5%.

Everyday Math

For the following exercises, translate to a system of equations and solve.

271. Laurie was completing the treasurer's report for her son's Boy Scout troop at the end of the school year. She didn't remember how many boys had paid the $15 full-year registration fee and how many had paid the $10 partial-year fee. She knew that the number of boys who paid for a full-year was ten more than the number who paid for a partial-year. If $250 was collected for all the registrations, how many boys had paid the full-year fee and how many had paid the partial-year fee?

Answer: 14 boys paid the full-year fee. 4 boys paid the partial-year fee.

272. As the treasurer of her daughter's Girl Scout troop, Laney collected money for some girls and adults to go to a three-day camp. Each girl paid $75 and each adult paid $30. The total amount of money collected for camp was $765. If the number of girls is three times the number of adults, how many girls and how many adults paid for camp?

Answer: There were 9 girls and 3 adults that paid for the camp.

Writing Exercises

273. Take a handful of two types of coins, and write a problem similar to Example 5.46 relating the total number of coins and their total value. Set up a system of equations to describe your situation and then solve it.

Answer: Answers will vary.

274. In Example 5.50 we solved the system of equations $\begin{cases} b+f=21{,}540 \\ 0.105b+0.059f=1669.68 \end{cases}$ by substitution. Would you have used substitution or elimination to solve this system? Why?

Answer: Answers will vary.

Elementary Algebra
5: Systems of Linear Equations
5.6 Graphing Systems of Linear Equations

Determine Whether an Ordered Pair is a Solution of a System of Linear Inequalities In the following exercises, determine whether each ordered pair is a solution to the system.

275. $\begin{cases} 3x+y>5 \\ 2x-y\le 10 \end{cases}$

(a) $(3,-3)$ (b) $(7,1)$

Answer: (a) true (b) false

276. $\begin{cases} 4x-y<10 \\ -2x+2y>-8 \end{cases}$

(a) $(5,-2)$ (b) $(-1,3)$

Answer: (a) false (b) true

277. $\begin{cases} y>\frac{2}{3}x-5 \\ x+\frac{1}{2}y\le 4 \end{cases}$

(a) $(6,-4)$ (b) $(3,0)$

Answer: (a) false (b) true

278. $\begin{cases} y<\frac{3}{2}x+3 \\ \frac{3}{4}x-2y<5 \end{cases}$

(a) $(-4,-1)$ (b) $(8,3)$

Answer: (a) false (b) true

279. $\begin{cases} 7x+2y>14 \\ 5x-y\le 8 \end{cases}$

(a) $(2,3)$ (b) $(7,-1)$

Answer: (a) true (b) false

280 $\begin{cases} 6x-5y<20 \\ -2x+7y>-8 \end{cases}$

(a) $(1,-3)$ (b) $(-4,4)$

Answer: (a) false (b) true

281. $\begin{cases} 2x+3y \geq 2 \\ 4x-6y < -1 \end{cases}$

(a) $\left(\frac{3}{2},\frac{4}{3}\right)$ (b) $\left(\frac{1}{4},\frac{7}{6}\right)$

Answer: (a) true (b) true

282. $\begin{cases} 5x-3y < -2 \\ 10x+6y > 4 \end{cases}$

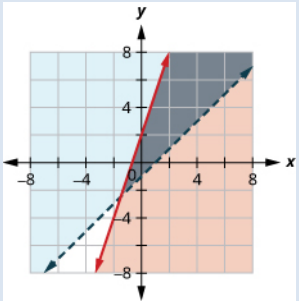
(a) $\left(\frac{1}{5},\frac{2}{3}\right)$ (b) $\left(-\frac{3}{10},\frac{7}{6}\right)$

Answer: (a) false (b) false

Solve a System of Linear Inequalities by Graphing In the following exercises, solve each system by graphing.

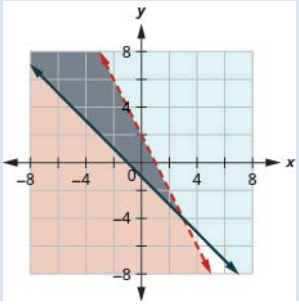
283. $\begin{cases} y \leq 3x+2 \\ y > x-1 \end{cases}$

Answer:



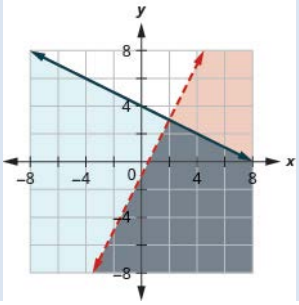
284. $\begin{cases} y < -2x+2 \\ y \geq -x-1 \end{cases}$

Answer:



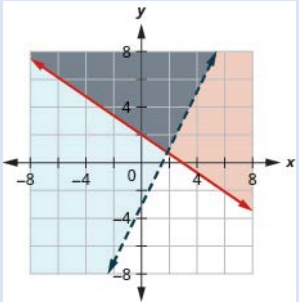
285. $\begin{cases} y < 2x - 1 \\ y \leq -\frac{1}{2}x + 4 \end{cases}$

Answer:



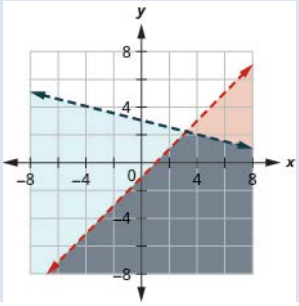
286. $\begin{cases} y \geq -\frac{2}{3}x + 2 \\ y > 2x - 3 \end{cases}$

Answer:



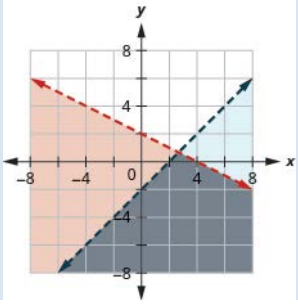
287. $\begin{cases} x - y > 1 \\ y < -\frac{1}{4}x + \end{cases}$ 3

Answer:



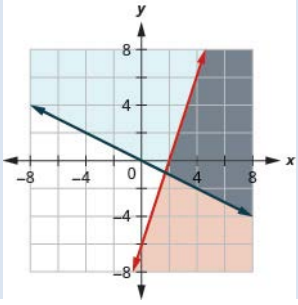
288. $\begin{cases} x+2y<4 \\ y<x-2 \end{cases}$

Answer:



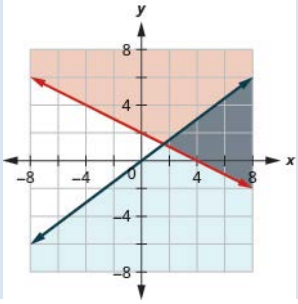
289. $\begin{cases} 3x-y\le 6 \\ y\ge -\frac{1}{2}x \end{cases}$

Answer:



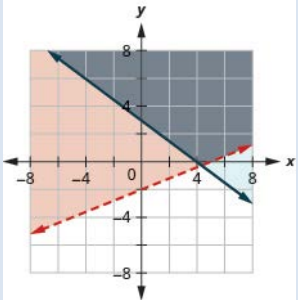
290. $\begin{cases} 2x+4y\ge 8 \\ y\le \frac{3}{4}x \end{cases}$

Answer:



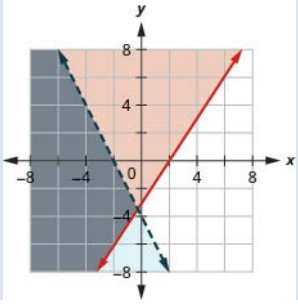
291. $\begin{cases} 2x-5y<10 \\ 3x+4y\geq 12 \end{cases}$

Answer:



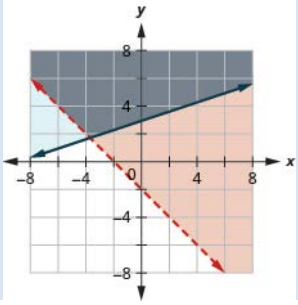
292. $\begin{cases} 3x-2y\leq 6 \\ -4x-2y>8 \end{cases}$

Answer:



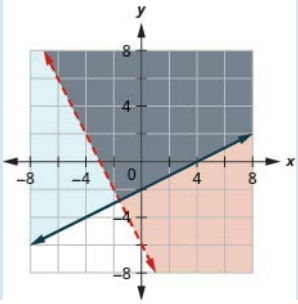
293. $\begin{cases} 2x+2y>-4 \\ -x+3y\geq 9 \end{cases}$

Answer:



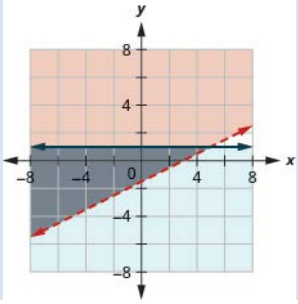
294. $\begin{cases} 2x + y > -6 \\ -x + 2y \geq -4 \end{cases}$

Answer:



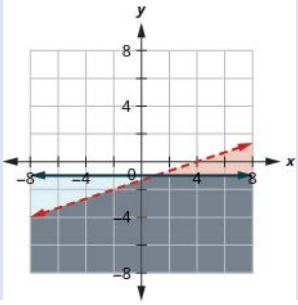
295. $\begin{cases} x - 2y < 3 \\ y \leq 1 \end{cases}$

Answer:



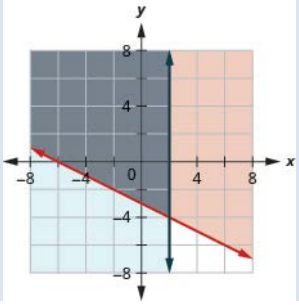
296. $\begin{cases} x - 3y > 4 \\ y \leq -1 \end{cases}$

Answer:



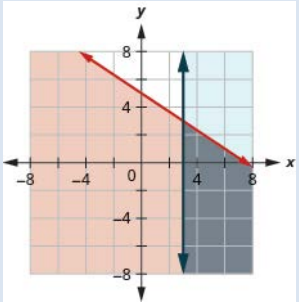
297. $\begin{cases} y \geq -\frac{1}{2}x - 3 \\ x \leq 2 \end{cases}$

Answer:



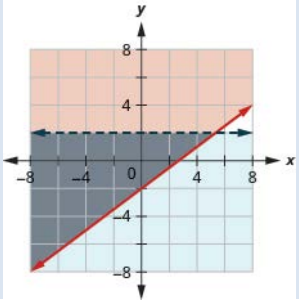
298. $\begin{cases} y \leq -\frac{2}{3}x + 5 \\ x \geq 3 \end{cases}$

Answer:



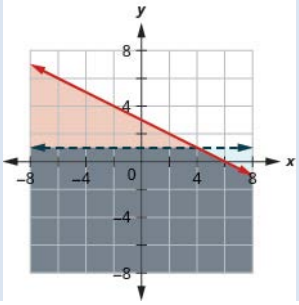
299. $\begin{cases} y \geq \frac{3}{4}x - 2 \\ y < 2 \end{cases}$

Answer:



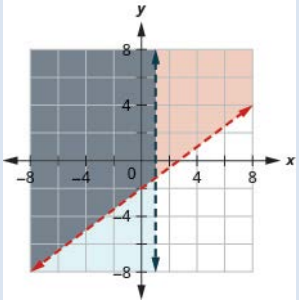
300. $\begin{cases} y \le -\frac{1}{2}x + 3 \\ y < 1 \end{cases}$

Answer:



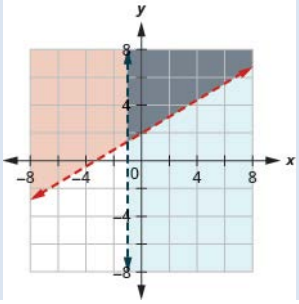
301. $\begin{cases} 3x - 4y < 8 \\ x < 1 \end{cases}$

Answer:



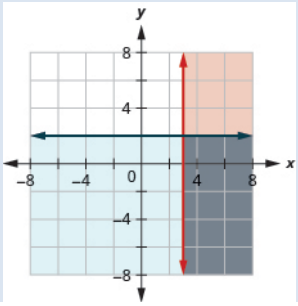
302. $\begin{cases} -3x + 5y > 10 \\ x > -1 \end{cases}$

Answer:



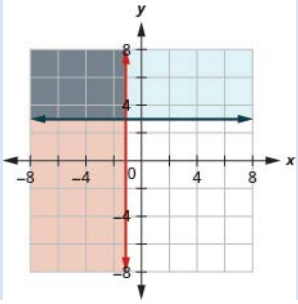
303. $\begin{cases} x \geq 3 \\ y \leq 2 \end{cases}$

Answer:



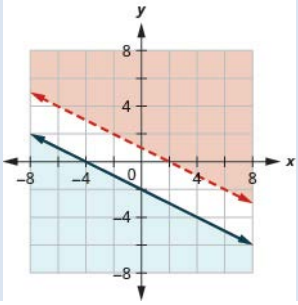
304. $\begin{cases} x \leq -1 \\ y \geq 3 \end{cases}$

Answer:



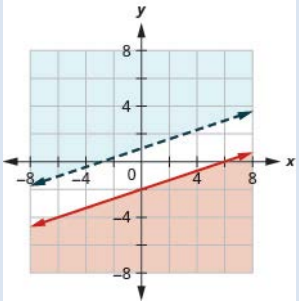
305. $\begin{cases} 2x + 4y > 4 \\ y \leq -\frac{1}{2}x - 2 \end{cases}$

Answer: No solution



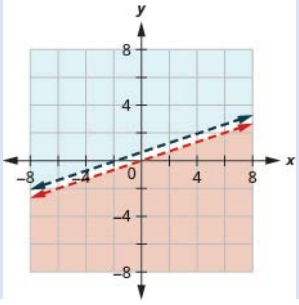
306. $\begin{cases} x-3y \geq 6 \\ y > \frac{1}{3}x+1 \end{cases}$

Answer: No solution



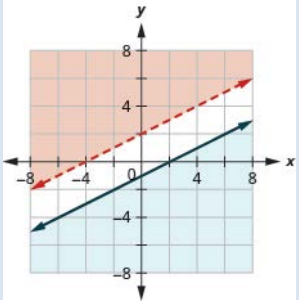
307. $\begin{cases} -2x+6y < 0 \\ 6y > 2x+4 \end{cases}$

Answer: No solution



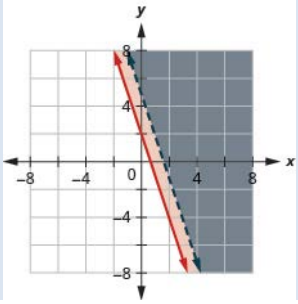
308. $\begin{cases} -3x+6y > 12 \\ 4y \leq 2x-4 \end{cases}$

Answer: No solution



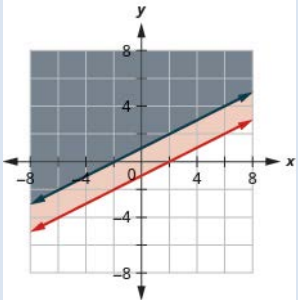
309. $\begin{cases} y \geq -3x + 2 \\ 3x + y > 5 \end{cases}$

Answer:



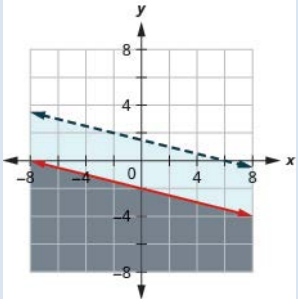
310. $\begin{cases} y \geq \frac{1}{2}x - 1 \\ -2x + 4y \geq 4 \end{cases}$

Answer: $-2x + 4y \geq 4$



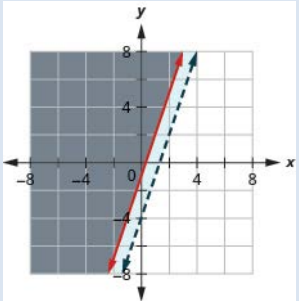
311. $\begin{cases} y \leq -\frac{1}{4}x - 2 \\ x + 4y < 6 \end{cases}$

Answer: $x + 4y < 6$



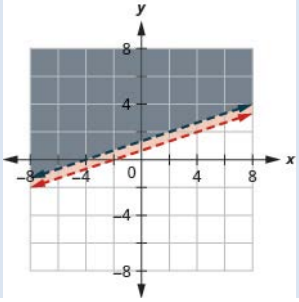
312. $\begin{cases} y \geq 3x - 1 \\ -3x + y > -4 \end{cases}$

Answer: $-3x + y > -4$



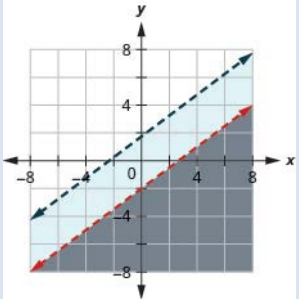
313. $\begin{cases} 3y > x + 2 \\ -2x + 6y > 8 \end{cases}$

Answer: $-2x + 6y > 8$



314. $\begin{cases} y < \frac{3}{4}x - 2 \\ -3x + 4y < 7 \end{cases}$

Answer:

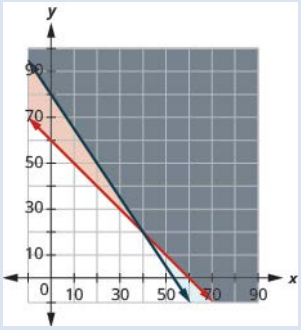


Solve Applications of Systems of Inequalities In the following exercises, translate to a system of inequalities and solve.

315. Caitlyn sells her drawings at the county fair. She wants to sell at least 60 drawings and has portraits and landscapes. She sells the portraits for $15 and the landscapes for $10. She needs to sell at least $800 worth of drawings in order to earn a profit.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Will she make a profit if she sells 20 portraits and 35 landscapes?
(d) Will she make a profit if she sells 50 portraits and 20 landscapes?

Answer: (a) $\begin{cases} p+l \geq 60 \\ 15p+10l \geq 800 \end{cases}$

(b)

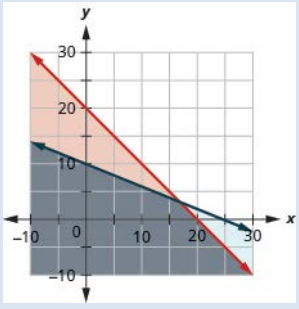


(c) No
(d) Yes

316. Jake does not want to spend more than $50 on bags of fertilizer and peat moss for his garden. Fertilizer costs $2 a bag and peat moss costs $5 a bag. Jake's van can hold at most 20 bags.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Can he buy 15 bags of fertilizer and 4 bags of peat moss?
(d) Can he buy 10 bags of fertilizer and 10 bags of peat moss?

Answer: (a) $\begin{cases} f+p \leq 20 \\ 2f+5p \leq 50 \end{cases}$

(b)

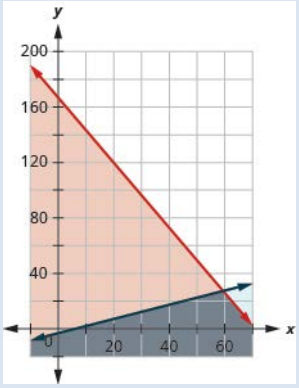


(c) Yes
(d) No

317. Reiko needs to mail her Christmas cards and packages and wants to keep her mailing costs to no more than $500. The number of cards is at least 4 more than twice the number of packages. The cost of mailing a card (with pictures enclosed) is $3 and for a package the cost is $7.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Can she mail 60 cards and 26 packages?
(d) Can she mail 90 cards and 40 packages?

Answer: (a) $\begin{cases} 7p+3c \le 500 \\ p \ge 2c+4 \end{cases}$

(b)

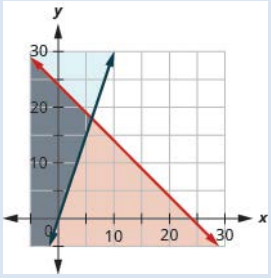


(c) Yes
(d) No

318. Juan is studying for his final exams in Chemistry and Algebra. He knows he only has 24 hours to study, and it will take him at least three times as long to study for Algebra than Chemistry.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Can he spend 4 hours on Chemistry and 20 hours on Algebra?
(d) Can he spend 6 hours on Chemistry and 18 hours on Algebra?

Answer: (a) $\begin{cases} c+a \le 24 \\ a \ge 3c \end{cases}$

(b)

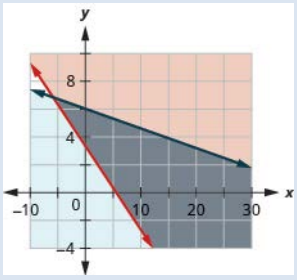


(c) Yes
(d) No

319. Jocelyn is pregnant and needs to eat at least 500 more calories a day than usual. When buying groceries one day with a budget of $15 for the extra food, she buys bananas that have 90 calories each and chocolate granola bars that have 150 calories each. The bananas cost $0.35 each and the granola bars cost $2.50 each.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Could she buy 5 bananas and 6 granola bars?
(d) Could she buy 3 bananas and 4 granola bars?

Answer: (a) $\begin{cases} 90b+150g \geq 500 \\ 0.35b+2.50g \leq 15 \end{cases}$

(b)

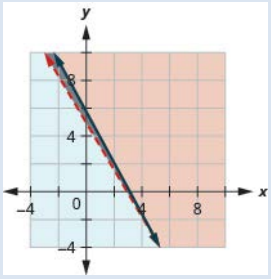


(c) No
(d) Yes

320. Mark is attempting to build muscle mass and so he needs to eat at least an additional 80 grams of protein a day. A bottle of protein water costs $3.20 and a protein bar costs $1.75. The protein water supplies 27 grams of protein and the bar supplies 16 gram. If he has $ 10 dollars to spend
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Could he buy 3 bottles of protein water and 1 protein bar?
(d) Could he buy no bottles of protein water and 5 protein bars?

Answer: (a) $\begin{cases} 27w+16b \geq 80 \\ 3.20\text{w}+1.75b \leq 10 \end{cases}$

(b)

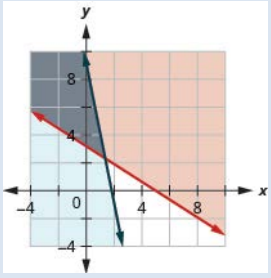


(c) No
(d) Yes

321 Jocelyn desires to increase both her protein consumption and caloric intake. She desires to have at least 35 more grams of protein each day and no more than an additional 200 calories daily. An ounce of cheddar cheese has 7 grams of protein and 110 calories. An ounce of parmesan cheese has 11 grams of protein and 22 calories.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Could she eat 1 ounce of cheddar cheese and 3 ounces of parmesan cheese?
(d) Could she eat 2 ounces of cheddar cheese and 1 ounce of parmesan cheese?

Answer: (a) $\begin{cases} 7c+11p \geq 35 \\ 110\text{c}+22p \leq 200 \end{cases}$

(b)

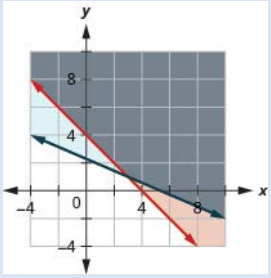


(c) Yes
(d) No

322. Mark is increasing his exercise routine by running and walking at least 4 miles each day. His goal is to burn a minimum of 1,500 calories from this exercise. Walking burns 270 calories/mile and running burns 650 calories.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Could he meet his goal by walking 3 miles and running 1 mile?
(d) Could he his goal by walking 2 miles and running 2 mile

Answer: (a) $\begin{cases} w+r \geq 4 \\ 270\text{w}+650r \geq 1500 \end{cases}$

(b)



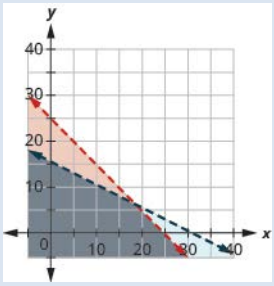
(c) No
(d) Yes

Everyday Math

323. Tickets for an American Baseball League game for 3 adults and 3 children cost less than $75, while tickets for 2 adults and 4 children cost less than $62.
(a) Write a system of inequalities to model this problem.
(b) Graph the system.
(c) Could the tickets cost $20 for adults and $8 for children?
(d) Could the tickets cost $15 for adults and $5 for children?

Answer: (a) $\begin{cases} 3a+3c<75 \\ 2a+4c<62 \end{cases}$

(b)

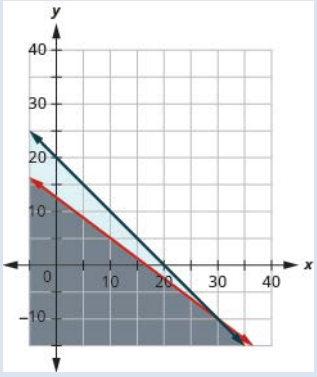


(c) No
(d) Yes

324. Grandpa and Grandma are treating their family to the movies. Matinee tickets cost $4 per child and $4 per adult. Evening tickets cost $6 per child and $8 per adult. They plan on spending no more than $80 on the matinee tickets and no more than $100 on the evening tickets.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Could they take 9 children and 4 adults to both shows?
(d) Could they take 8 children and 5 adults to both shows?

Answer: (a) $\begin{cases} 6c+8a\le 100 \\ 4c+4a\le 80 \end{cases}$

(b)



(c) Yes
(d) No

Writing Exercises

325. Graph the inequality $x - y \geq 3$. How do you know which side of the line $x - y = 3$ should be shaded?

Answer: Answers will vary.

326. Graph the system $\begin{cases} x + 2y \leq 6 \\ y \geq -\frac{1}{2}x - 4 \end{cases}$. What does the solution mean?

Answer: Answers will vary.

Chapter Review

5.1 Solve Systems of Equations by Graphing

Determine Whether an Ordered Pair is a Solution of a System of Equations.
In the following exercises, determine if the following points are solutions to the given system of equations.

327. $\begin{cases} x+3y=-9 \\ 2x-4y=12 \end{cases}$

(a) $(-3,-2)$ (b) $(0,-3)$

Answer: (a) no (b) yes

328. $\begin{cases} x+y=8 \\ y=x-4 \end{cases}$

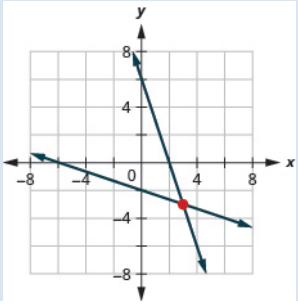
(a) $(6, 2)$ (b) $(9, -1)$

Answer: (a) yes (b) no

Solve a System of Linear Equations by Graphing In the following exercises, solve the following systems of equations by graphing.

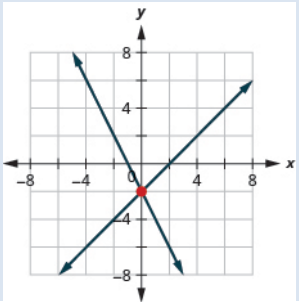
329. $\begin{cases} 3x+y=6 \\ x+3y=-6 \end{cases}$

Answer: $(3,-3)$



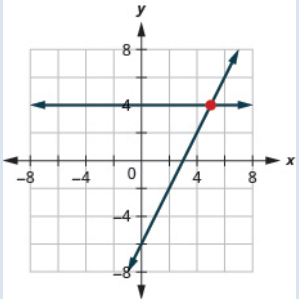
330. $\begin{cases} y = x - 2 \\ y = -2x - 2 \end{cases}$

Answer: $(0, -2)$



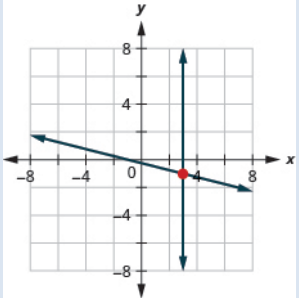
331. $\begin{cases} 2x - y = 6 \\ y = 4 \end{cases}$

Answer: $(5, 4)$



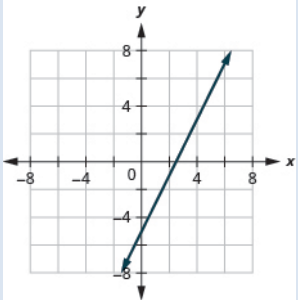
332. $\begin{cases} x + 4y = -1 \\ x = 3 \end{cases}$

Answer: $(3, -1)$



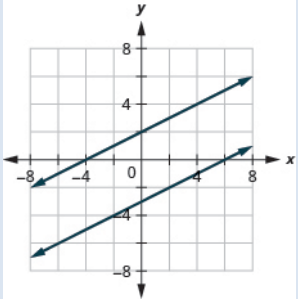
333. $\begin{cases} 2x-y=5 \\ 4x-2y=10 \end{cases}$

Answer: coincident lines



334. $\begin{cases} -x+2y=4 \\ y=\frac{1}{2}x-3 \end{cases}$

Answer: no solution



Determine the Number of Solutions of a Linear System In the following exercises, without graphing determine the number of solutions and then classify the system of equations.

335. $\begin{cases} y=\frac{2}{5}x+2 \\ -2x+5y=10 \end{cases}$

Answer: infinitely many solutions, consistent system, dependent equations

336. $\begin{cases} 3x+2y=6 \\ y=-3x+4 \end{cases}$

Answer: one solution, consistent system, independent equations

337. $\begin{cases} 5x-4y=0 \\ y=\frac{5}{4}x-5 \end{cases}$

Answer: no solutions, inconsistent system, independent equations

338. $\begin{cases} y=-\frac{3}{4}x+1 \\ 6x+8y=8 \end{cases}$

Answer: infinitely many solutions, consistent system, dependent equations

Solve Applications of Systems of Equations by Graphing

339. LaVelle is making a pitcher of caffe mocha. For each ounce of chocolate syrup, she uses five ounces of coffee. How many ounces of chocolate syrup and how many ounces of coffee does she need to make 48 ounces of caffe mocha?

Answer: LaVelle needs 8 ounces of chocolate syrup and 40 ounces of coffee.

340. Eli is making a party mix that contains pretzels and chex. For each cup of pretzels, he uses three cups of chex. How many cups of pretzels and how many cups of chex does he need to make 12 cups of party mix?

Answer: Eli needs 3 cups of pretzels and 9 cups of chex.

5.2 Solve Systems of Equations by Substitution

Solve a System of Equations by Substitution In the following exercises, solve the systems of equations by substitution.

341. $\begin{cases} 3x-y=-5 \\ y=2x+4 \end{cases}$

Answer: $(-1, 2)$

342. $\begin{cases} 3x-2y=2 \\ y=\frac{1}{2}x+3 \end{cases}$

Answer: $(4,5)$

343. $\begin{cases} x-y=0 \\ 2x+5y=-14 \end{cases}$

Answer: $(-2,-2)$

344. $\begin{cases} y=-2x+7 \\ y=\frac{2}{3}x-1 \end{cases}$

Answer: $(3, 1)$

345. $\begin{cases} y=-5x \\ 5x+y=6 \end{cases}$

Answer: no solution

346. $\begin{cases} y=-\frac{1}{3}x+2 \\ x+3y=6 \end{cases}$

Answer: infinitely many solutions

Solve Applications of Systems of Equations by Substitution In the following exercises, translate to a system of equations and solve.

347. The sum of two number is 55. One number is 11 less than the other. Find the numbers.

Answer: The numbers are 22 and 33.

348. The perimeter of a rectangle is 128. The length is 16 more than the width. Find the length and width.

Answer: The length is 40 and theperimeter is 24.

349. The measure of one of the small angles of a right triangle is 2 less than 3 times the measure of the other small angle. Find the measure of both angles.

Answer: The measures are 23 degrees and 67 degrees.

350. Gabriela works for an insurance company that pays her a salary of $32,000 plus a commission of $100 for each policy she sells. She is considering changing jobs to a company that would pay a salary of $40,000 plus a commission of $80 for each policy sold. How many policies would Gabriela need to sell to make the total pay the same?

Answer: Gabriela would need to sell 400 policies.

5.3 Solve Systems of Equations by Elimination

Solve a System of Equations by Elimination In the following exercises, solve the systems of equations by elimination.

351. $\begin{cases} x+y=12 \\ x-y=-10 \end{cases}$

Answer: $(1, 11)$

352. $\begin{cases} 4x+2y=2 \\ -4x-3y=-9 \end{cases}$

Answer: $(-3, 7)$

353. $\begin{cases} 3x-8y=20 \\ x+3y=1 \end{cases}$

Answer: $(4,-1)$

354. $\begin{cases} 3x-2y=6 \\ 4x+3y=8 \end{cases}$

Answer: $(2,0)$

355. $\begin{cases} 9x+4y=2 \\ 5x+3y=5 \end{cases}$

Answer: $(-2,5)$

356. $\begin{cases} -x+3y=8 \\ 2x-6y=-20 \end{cases}$

Answer: no solution

Solve Applications of Systems of Equations by Elimination In the following exercises, translate to a system of equations and solve.

357. The sum of two numbers is -90. Their difference is 16. Find the numbers.

Answer: The numbers are -37 and -53.

358. Omar stops at a donut shop every day on his way to work. Last week he had 8 donuts and 5 cappuccinos, which gave him a total of 3000 calories. This week he had 6 donuts and 3 cappuccinos, which was a total of 2160 calories. How many calories are in one donut? How many calories are in one cappuccino?

Answer: There are 300 calories in one donut, There are 120 calories one cappuccino.

Choose the Most Convenient Method to Solve a System of Linear Equations In the following exercises, decide whether it would be more convenient to solve the system of equations by substitution or elimination.

359. $\begin{cases} 6x-5y=27 \\ 3x+10y=-24 \end{cases}$

Answer: elimination

360. $\begin{cases} y=3x-9 \\ 4x-5y=23 \end{cases}$

Answer: substitution

5.4 Solve Applications with Systems of Equations

Translate to a System of Equations In the following exercises, translate to a system of equations. Do not solve the system.

361. The sum of two numbers is -32. One number is two less than twice the other. Find the numbers.

Answer: $\begin{cases} x+y=-32 \\ x=2y-2 \end{cases}$

362. Four times a number plus three times a second number is -9. Twice the first number plus the second number is three. Find the numbers.

Answer: $\begin{cases} 4m+3n=-9 \\ 2m+n=3 \end{cases}$

363. Last month Jim and Debbie earned $7200. Debbie earned $1,600 more than Jim earned. How much did they each earn?

Answer: $\begin{cases} j+d=7200 \\ d=j+1600 \end{cases}$

364. Henri has $24,000 invested in stocks and bonds. The amount in stocks is $6,000 more than three times the amount in bonds. How much is each investment?

Answer: $\begin{cases} s+b=24{,}000 \\ s=3b+6000 \end{cases}$

Solve Direct Translation Applications In the following exercises, translate to a system of equations and solve.

365. Pam is 3 years older than her sister, Jan. The sum of their ages is 99. Find their ages.

Answer: Pam is 51 and Jan is 48.

366. Mollie wants to plant 200 bulbs in her garden. She wants all irises and tulips. She wants to plant three times as many tulips as irises. How many irises and how many tulips should she plant?

Answer: Mollie can plant 50 irises and 150 tulips.

Solve Geometry Applications In the following exercises, translate to a system of equations and solve.

367. The difference of two supplementary angles is 58 degrees. Find the measures of the angles.

Answer: The measures are 119 degrees and 61 degrees.

368. Two angles are complementary. The measure of the larger angle is five more than four times the measure of the smaller angle. Find the measures of both angles.
Answer: The measures are 73 degrees and 17 degrees.

369. Becca is hanging a 28 foot floral garland on the two sides and top of a pergola to prepare for a wedding. The height is four feet less than the width. Find the height and width of the pergola.
Answer: The pergola is 8 feet high and 12 feet wide.

370. The perimeter of a city rectangular park is 1428 feet. The length is 78 feet more than twice the width. Find the length and width of the park.
Answer: The length is 450 feet and the width is 264 feet.

Solve Uniform Motion Applications In the following exercises, translate to a system of equations and solve.

371. Sheila and Lenore were driving to their grandmother's house. Lenore left one hour after Sheila. Sheila drove at a rate of 45 mph, and Lenore drove at a rate of 60 mph. How long will it take for Lenore to catch up to Sheila?
Answer: It will take Lenore 3 hours.

372. Bob left home, riding his bike at a rate of 10 miles per hour to go to the lake. Cheryl, his wife, left 45 minutes ($\frac{3}{4}$ hour) later, driving her car at a rate of 25 miles per hour. How long will it take Cheryl to catch up to Bob?
Answer: It will take Cheryl $\frac{1}{2}$ hour.

373. Marcus can drive his boat 36 miles down the river in three hours but takes four hours to return upstream. Find the rate of the boat in still water and the rate of the current.
Answer: The rate of the boat is 10.5 mph. The rate of the current is 1.5 mph.

374. A passenger jet can fly 804 miles in 2 hours with a tailwind but only 776 miles in 2 hours into a headwind. Find the speed of the jet in still air and the speed of the wind.
Answer: The rate of the jet is 395 mph. The rate of the wind is 7 mph.

5.5 Solve Mixture Applications with Systems of Equations

Solve Mixture Applications In the following exercises, translate to a system of equations and solve.

375. Lynn paid a total of $2,780 for 261 tickets to the theater. Student tickets cost $10 and adult tickets cost $15. How many student tickets and how many adult tickets did Lynn buy?
Answer: Lynn bought 227 student tickets and 34 adult tickets.

376. Priam has dimes and pennies in a cup holder in his car. The total value of the coins is $4.21. The number of dimes is three less than four times the number of pennies. How many dimes and how many pennies are in the cup?

Answer: There are 41 dimes and 11 pennies in the cup.

377. Yumi wants to make 12 cups of party mix using candies and nuts. Her budget requires the party mix to cost her $1.29 per cup. The candies are $2.49 per cup and the nuts are $0.69 per cup. How many cups of candies and how many cups of nuts should she use?

Answer: Yumi should use 4 cups of candies and 8 cups of nuts.

378. A scientist needs 70 liters of a 40% solution of alcohol. He has a 30% and a 60% solution available. How many liters of the 30% and how many liters of the 60% solutions should he mix to make the 40% solution?

Answer: The scientist should mix $46\frac{2}{3}$ liters of 30% solution and $23\frac{1}{3}$ liters of 60% solution.

Solve Interest Applications In the following exercises, translate to a system of equations and solve.

379. Jack has $12,000 to invest and wants to earn 7.5% interest per year. He will put some of the money into a savings account that earns 4% per year and the rest into CD account that earns 9% per year. How much money should he put into each account?

Answer: Jack should put $3600 into savings and $8400 into the CD.

380. When she graduates college, Linda will owe $43,000 in student loans. The interest rate on the federal loans is 4.5% and the rate on the private bank loans is 2%. The total interest she owes for one year was $1585. What is the amount of each loan?

Answer: There is $29,000 for the federal loan and $14,000 for the private loan.

5.6 Graphing Systems of Equations

Determine Whether an Ordered Pair is a Solution of a System of Linear Inequalities In the following exercises, determine whether each ordered pair is a solution to the system.

381. $\begin{cases} 4x + y > 6 \\ 3x - y \leq 12 \end{cases}$

(a) $(2, -1)$ (b) $(3, -2)$

Answer: (a) yes (b) no

382. $\begin{cases} y > \frac{1}{3}x + 2 \\ x - \frac{1}{4}y \leq 10 \end{cases}$

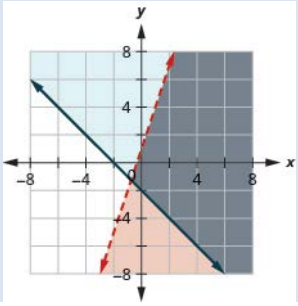
(a) $(6,5)$ (b) $(15,8)$

Answer: (a) yes (b) no

Solve a System of Linear Inequalities by Graphing In the following exercises, solve each system by graphing.

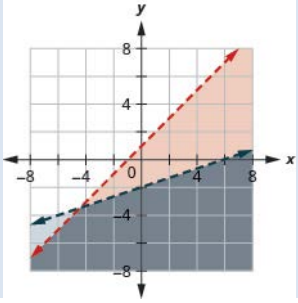
383. $\begin{cases} y < 3x + 1 \\ y \geq -x - 2 \end{cases}$

Answer:



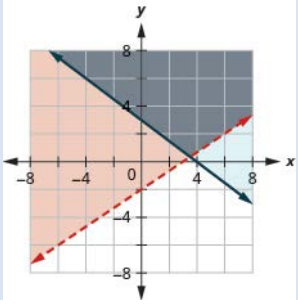
384. $\begin{cases} x - y > -1 \\ y < \frac{1}{3}x - 2 \end{cases}$

Answer:



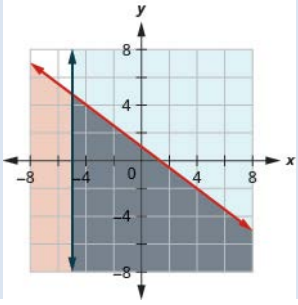
385. $\begin{cases} 2x-3y<6 \\ 3x+4y\geq 12 \end{cases}$

Answer:



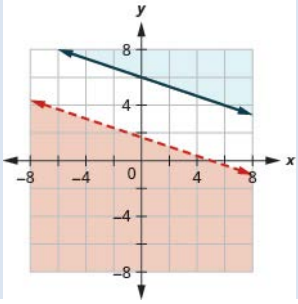
386. $\begin{cases} y\leq -\frac{3}{4}x+1 \\ x\geq -5 \end{cases}$

Answer:



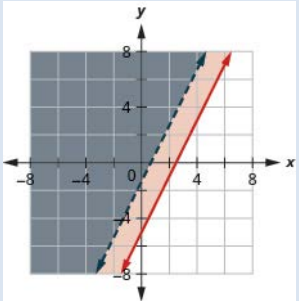
387. $\begin{cases} x+3y<5 \\ y\geq -\frac{1}{3}x+6 \end{cases}$

Answer: No solution



388. $\begin{cases} y \geq 2x - 5 \\ -6x + 3y > -4 \end{cases}$

Answer: $-6x + 3y > -4$



Solve Applications of Systems of Inequalities In the following exercises, translate to a system of inequalities and solve.

389. Roxana makes bracelets and necklaces and sells them at the farmers' market. She sells the bracelets for $12 each and the necklaces for $18 each. At the market next weekend she will have room to display no more than 40 pieces, and she needs to sell at least $500 worth in order to earn a profit.

(a) Write a system of inequalities to model this situation.

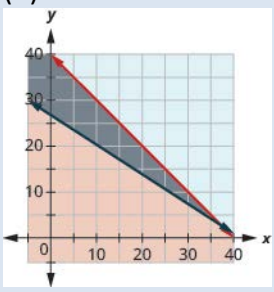
(b) Graph the system.

(c) Should she display 26 bracelets and 14 necklaces?

(d) Should she display 39 bracelets and 1 necklace?

Answer: (a) $\begin{cases} b + n \leq 40 \\ 12b + 18n \geq 500 \end{cases}$

(b)



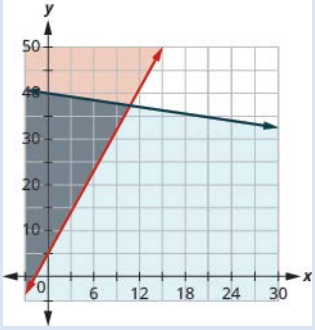
(c) yes

(d) no

390. Annie has a budget of $600 to purchase paperback books and hardcover books for her classroom. She wants the number of hardcover to be at least 5 more than three times the number of paperback books. Paperback books cost $4 each and hardcover books cost $15 each.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Can she buy 8 paperback books and 40 hardcover books?
(d) Can she buy 10 paperback books and 37 hardcover books?

Answer: (a) $\begin{cases} h \geq 3p+5 \\ 4p+15h \leq 600 \end{cases}$

(b)



(c) no
(d) yes

Chapter Practice Test

391. $\begin{cases} x-4y=-8 \\ 2x+5y=10 \end{cases}$

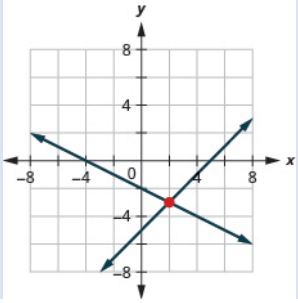
(a) $(0,2)$ (b) $(4,3)$

Answer: (a) yes (b) no

In the following exercises, solve the following systems by graphing.

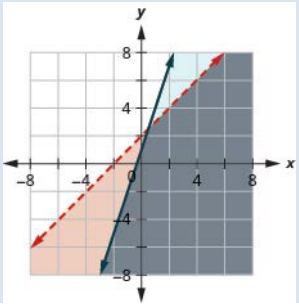
392. $\begin{cases} x-\ \ y=5 \\ x+2y=-4 \end{cases}$

Answer: $(2,-3)$



393. $\begin{cases} x - y > -2 \\ y \le 3x + 1 \end{cases}$

Answer:



In the following exercises, solve each system of equations. Use either substitution or elimination.

394. $\begin{cases} 3x - 2y = 3 \\ y = 2x - 1 \end{cases}$

Answer: $(-1, -3)$

395. $\begin{cases} x + y = -3 \\ x - y = 11 \end{cases}$

Answer: $(4, -7)$

396. $\begin{cases} 4x - 3y = 7 \\ 5x - 2y = 0 \end{cases}$

Answer: $(-2, -5)$

397. $\begin{cases} y = -\frac{4}{5}x + 1 \\ 8x + 10y = 10 \end{cases}$

Answer: infinitely many solutions

398. $\begin{cases} 2x + 3y = 12 \\ -4x + 6y = -16 \end{cases}$

Answer: no solution

In the following exercises, translate to a system of equations and solve.

399. The sum of two numbers is -24. One number is 104 less than the other. Find the numbers.

Answer: The numbers are 40 and 64

400. Ramon wants to plant cucumbers and tomatoes in his garden. He has room for 16 plants, and he wants to plant three times as many cucumbers as tomatoes. How many cucumbers and how many tomatoes should he plant?
Answer: He should plant 12 cucumbers and 4 tomatoes.

401. Two angles are complementary. The measure of the larger angle is six more than twice the measure of the smaller angle. Find the measures of both angles.
Answer: The measures of the angles are 28 degrees and 62 degrees.

402. On Monday, Lance ran for 30 minutes and swam for 20 minutes. His fitness app told him he had burned 610 calories. On Wednesday, the fitness app told him he burned 695 calories when he ran for 25 minutes and swam for 40 minutes. How many calories did he burn for one minute of running? How many calories did he burn for one minute of swimming?
Answer: He burned 15 calories from 1 minute of running and 8 calories from 1 minute of swimming.

403. Kathy left home to walk to the mall, walking quickly at a rate of 4 miles per hour. Her sister Abby left home 15 minutes later and rode her bike to the mall at a rate of 10 miles per hour. How long will it take Abby to catch up to Kathy?
Answer: It will take Kathy $\frac{1}{6}$ of an hour (or 10 minutes).

404. It takes $5\frac{1}{2}$ hours for a jet to fly 2,475 miles with a headwind from San Jose, California to Lihue, Hawaii. The return flight from Lihue to San Jose with a tailwind, takes 5 hours. Find the speed of the jet in still air and the speed of the wind.
Answer: The speed of the jet is 472.5 mph. The speed of the wind is 22.5 mph.

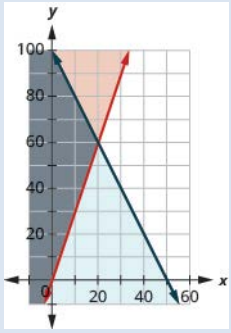
405. Liz paid $160 for 28 tickets to take the Brownie troop to the science museum. Children's tickets cost $5 and adult tickets cost $9. How many children's tickets and how many adult tickets did Liz buy?
Answer: Liz bought 23 children's tickets and 5 adult tickets.

406. A pharmacist needs 20 liters of a 2% saline solution. He has a 1% and a 5% solution available. How many liters of the 1% and how many liters of the 5% solutions should she mix to make the 2% solution?
Answer: The pharmacist should mix 15 liters of 1% solution and 5 liters of 5% solution.

407. Translate to a system of inequalities and solve.
Andi wants to spend no more than $50 on Halloween treats. She wants to buy candy bars that cost $1 each and lollipops that cost $0.50 each, and she wants the number of lollipops to be at least three times the number of candy bars.
(a) Write a system of inequalities to model this situation.
(b) Graph the system.
(c) Can she buy 20 candy bars and 70 lollipops?
(d) Can she buy 15 candy bars and 65 lollipops?

Answer: (a) $\begin{cases} C + 0.5L \leq 50 \\ L \geq 3C \end{cases}$

(b)



(c) no
(d) yes

Elementary Algebra
6: Polynomials
6.1 Add and Subtract Polynomials

Identify Polynomials, Monomials, Binomials, and Trinomials In the following exercises, determine if each of the following polynomials is a monomial, binomial, trinomial, or other polynomial.

1. (a) $81b^5 - 24b^3 + 1$
(b) $5c^3 + 11c^2 - c - 8$
(c) $\frac{14}{15}y + \frac{1}{7}$
(d) 5
(e) $4y + 17$

Answer: (a) trinomial (b) polynomial (c) binomial (d) monomial (e) binomial

2. (a) $x^2 - y^2$
(b) $-13c^4$
(c) $x^2 + 5x - 7$
(d) $x^2y^2 - 2xy + 8$
(e) 19

Answer: (a) binomial (b) monomial (c) trinomial (d) trinomial (e) monomial

3. (a) $8 - 3x$
(b) $z^2 - 5z - 6$
(c) $y^3 - 8y^2 + 2y - 16$
(d) $81b^5 - 24b^3 + 1$
(e) -18

Answer: (a) binomial (b) trinomial (c) polynomial (d) trinomial (e) monomial

4. (a) $11y^2$
(b) -73
(c) $6x^2 - 3xy + 4x - 2y + y^2$
(d) $4y + 17$
(e) $5c^3 + 11c^2 - c - 8$

Answer: (a) monomial (b) monomial (c) polynomial (d) binomial (e) polynomial

Determine the Degree of Polynomials In the following exercises, determine the degree of each polynomial.

5. (a) $6a^2+12a+14$
(b) $18xy^2z$
(c) $5x+2$
(d) $y^3-8y^2+2y-16$
(e) -24
Answer: (a) 2 (b) 4 (c) 1 (d) 3 (e) 0

6. (a) $9y^3-10y^2+2y-6$
(b) $-12p^4$
(c) $a^2+9a+18$
(d) $20x^2y^2-10a^2b^2+30$
(e) 17
Answer: (a) 3 (b) 4 (c) 2 (d) 4 (e) 0

7. (a) $14-29x$
(b) z^2-5z-6
(c) $y^3-8y^2+2y-16$
(d) $23ab^2-14$
(e) -3
Answer: (a) 1 (b) 2 (c) 3 (d) 3 (e) 0

8. (a) $62y^2$
(b) 15
(c) $6x^2-3xy+4x-2y+y^2$
(d) $10-9x$
(e) $m^4+4m^3+6m^2+4m+1$
Answer: (a) 2 (b) 0 (c) 2 (d) 1 (e) 4

Add and Subtract Monomials In the following exercises, add or subtract the monomials.

9. $7x^2+5x^2$
Answer: $12x^2$

10. $4y^3+6y^3$
Answer: $10y^3$

11. $-12w+18w$
Answer: $6w$

12. $-3m+9m$

Answer: $6m$

13. $4a-9a$

Answer: $-5a$

14. $-y-5y$

Answer: $-6y$

15. $28x-(-12x)$

Answer: $40x$

16. $13z-(-4z)$

Answer: $17z$

17. $-5b-17b$

Answer: $-22b$

18. $-10x-35x$

Answer: $-45x$

19. $12a+5b-22a$

Answer: $-10a+5b$

20. $14x-3y-13x$

Answer: $x-3y$

21. $2a^2+b^2-6a^2$

Answer: $-4a^2+b^2$

22. $5u^2+4v^2-6u^2$

Answer: $-u^2+4v^2$

23. $xy^2-5x-5y^2$

Answer: $xy^2-5x-5y^2$

24. $pq^2-4p-3q^2$

Answer: $pq^2-4p-3q^2$

25. $a^2b-4a-5ab^2$

Answer: $a^2b-4a-5ab^2$

26. $x^2y-3x+7xy^2$

Answer: $x^2y-3x+7xy^2$

27. $12a+8b$

Answer: $12a+8b$

28. $19y+5z$

Answer: $19y+5z$

29. Add: $4a, -3b, -8a$

Answer: $-4a-3b$

30. Add: $4x, 3y, -3x$

Answer: $x+3y$

31. Subtract $5x^6$ from $-12x^6$.

Answer: $-17x^6$

32. Subtract $2p^4$ from $-7p^4$.

Answer: $-9p^4$

Add and Subtract Polynomials In the following exercises, add or subtract the polynomials.

33. $(5y^2+12y+4)+(6y^2-8y+7)$

Answer: $11y^2+4y+11$

34. $(4y^2+10y+3)+(8y^2-6y+5)$

Answer: $12y^2+4y+8$

35. $(x^2+6x+8)+(-4x^2+11x-9)$

Answer: $-3x^2+17x-1$

36. $(y^2+9y+4)+(-2y^2-5y-1)$

Answer: $-y^2+4y+3$

37. $(8x^2-5x+2)+(3x^2+3)$

Answer: $11x^2-5x+5$

38. $(7x^2-9x+2)+(6x^2-4)$

Answer: $13x^2-9x-2$

39. $(5a^2+8)+(a^2-4a-9)$

Answer: $6a^2-4a-1$

40. $(p^2-6p-18)+(2p^2+11)$

Answer: $3p^2-6p-7$

41. $(4m^2-6m-3)-(2m^2+m-7)$

Answer: $2m^2-7m+4$

42. $(3b^2-4b+1)-(5b^2-b-2)$

Answer: $-2b^2-3b+3$

43. $a^2+8a+5)-(a^2-3a+2)$

Answer: $5a+3$

44. $(b^2-7b+5)-(b^2-2b+9)$

Answer: $-5b-4$

45. $(12s^2-15s)-(s-9)$

Answer: $12s^2-16s+9$

46. $(10r^2-20r)-(r-8)$

Answer: $10r^2-21r+8$

47. Subtract $\left(9x^2+2\right)$ from $\left(12x^2-x+6\right)$.

Answer: $3x^2-x+4$

48. Subtract $\left(5y^2-y+12\right)$ from $\left(10y^2-8y-20\right)$.

Answer: $5y^2-7y-32$

49. Subtract $\left(7w^2-4w+2\right)$ from $\left(8w^2-w+6\right)$.

Answer: w^2+3w+4

50. Subtract $\left(5x^2-x+12\right)$ from $\left(9x^2-6x-20\right)$.

Answer: $4x^2-5x-32$

51. Find the sum of $\left(2p^3-8\right)$ and $\left(p^2+9p+18\right)$.

Answer: $2p^3+p^2+9p+10$

52. Find the sum of $\left(q^2+4q+13\right)$ and $\left(7q^3-3\right)$.

Answer: $7q^3+q^2+4q+10$

53. Find the sum of $\left(8a^3-8a\right)$ and $\left(a^2+6a+12\right)$.

Answer: $8a^3+a^2-2a+12$

54. Find the sum of $\left(b^2+5b+13\right)$ and $\left(4b^3-6\right)$.

Answer: $4b^3+b^2+5b+7$

55. Find the difference of $\left(w^2+w-42\right)$ and $\left(w^2-10w+24\right)$.

Answer: $11w-64$

56. Find the difference of $\left(z^2-3z-18\right)$ and $\left(z^2+5z-20\right)$.

Answer: $-8z+2$

57. Find the difference of $\left(c^2+4c-33\right)$ and $\left(c^2-8c+12\right)$.

Answer: $12c-45$

58. Find the difference of $\left(t^2-5t-15\right)$ and $\left(t^2+4t-17\right)$.

Answer: $-9t+2$

59. $\left(7x^2-2xy+6y^2\right)+\left(3x^2-5xy\right)$

Answer: $10x^2-7xy+6y^2$

60. $\left(-5x^2-4xy-3y^2\right)+\left(2x^2-7xy\right)$

Answer: $-3x^2-11xy-3y^2$

61. $\left(7m^2+mn-8n^2\right)+\left(3m^2+2mn\right)$

Answer: $10m^2+3mn-8n^2$

62. $\left(2r^2-3rs-2s^2\right)+\left(5r^2-3rs\right)$

Answer: $7r^2-6rs-2s^2$

63. $\left(a^2-b^2\right)-\left(a^2+3ab-4b^2\right)$

Answer: $-3ab+3b^2$

64. $\left(m^2+2n^2\right)-\left(m^2-8mn-n^2\right)$

Answer: $8mn+3n^2$

65. $\left(u^2 - v^2\right) - \left(u^2 - 4uv - 3v^2\right)$

Answer: $4uv + 2v^2$

66. $\left(j^2 - k^2\right) - \left(j^2 - 8jk - 5k^2\right)$

Answer: $8jk + 4k^2$

67. $\left(p^3 - 3p^2q\right) + \left(2pq^2 + 4q^3\right) - \left(3p^2q + pq^2\right)$

Answer: $p^3 - 6p^2q + pq^2 + 4q^3$

68. $\left(a^3 - 2a^2b\right) + \left(ab^2 + b^3\right) - \left(3a^2b + 4ab^2\right)$

Answer: $a^3 - 5a^2b3ab^2 + b^3$

69. $\left(x^3 - x^2y\right) - \left(4xy^2 - y^3\right) + \left(3x^2y - xy^2\right)$

Answer: $x^3 + 2x^2y - 5xy^2 + y^3$

70. $\left(x^3 - 2x^2y\right) - \left(xy^2 - 3y^3\right) - \left(x^2y - 4xy^2\right)$

Answer: $x^3 - 3x^2y + 3xy^2 + 3y^3$

Evaluate a Polynomial for a Given Value In the following exercises, evaluate each polynomial for the given value.

71. Evaluate $8y^2 - 3y + 2$ when:
(a) $y = 5$
(b) $y = -2$
(c) $y = 0$

Answer: (a) 187 (b) 46 (c) 2

72. Evaluate $5y^2 - y - 7$ when:
(a) $y = -4$
(b) $y = 1$
(c) $y = 0$

Answer: (a) 77 (b) –1 –3 (c) –7

73. Evaluate $4 - 36x$ when:
(a) $x = 3$
(b) $x = 0$
(c) $x = -1$

Answer: (a) –104 (b) 4 (c) 40

74. Evaluate $16-36x^2$ when:
(a) $x=-1$
(b) $x=0$
(c) $x=2$
Answer: (a) –20 (b) 16 (c) –128

75. A painter drops a brush from a platform 75 feet high. The polynomial $-16t^2+75$ gives the height of the brush t seconds after it was dropped. Find the height after $t=2$ seconds.
Answer: 11

76. A girl is throwing a ball off the cliff into the ocean. The polynomial $-16t^2+250$ gives the height of a ball t seconds after it is dropped from a 250-foot tall cliff. Find the height after $t=2$ seconds.
Answer: 186

77. A manufacturer of stereo sound speakers has found that the revenue received from selling the speakers at a cost of p dollars each is given by the polynomial $-4p^2+420p$. Find the revenue received when $p=60$ dollars.
Answer: $10,800

78. A manufacturer of the latest basketball shoes has found that the revenue received from selling the shoes at a cost of p dollars each is given by the polynomial $-4p^2+420p$. Find the revenue received when $p=90$ dollars.
Answer: $5,400

Everyday Math

79. **Fuel Efficiency** The fuel efficiency (in miles per gallon) of a car going at a speed of x miles per hour is given by the polynomial $-\frac{1}{150}x^2+\frac{1}{3}x$. Find the fuel efficiency when $x=30\text{mph}$.
Answer: 4

80. **Stopping Distance** The number of feet it takes for a car traveling at x miles per hour to stop on dry, level concrete is given by the polynomial $0.06x^2+1.1x$. Find the stopping distance when $x=40\text{mph}$.
Answer: 140

81. **Rental Cost** The cost to rent a rug cleaner for d days is given by the polynomial $5.50d+25$. Find the cost to rent the cleaner for 6 days.
Answer: $58

82. **Height of Projectile** The height (in feet) of an object projected upward is given by the polynomial $-16t^2+60t+90$ where t represents time in seconds. Find the height after $t=2.5$ seconds.

Answer: 140

83. **Temperature Conversion** The temperature in degrees Fahrenheit is given by the polynomial $\frac{9}{5}c+32$ where c represents the temperature in degrees Celsius. Find the temperature in degrees Fahrenheit when $c=65°$.

Answer: 149

Writing Exercises

84. Using your own words, explain the difference between a monomial, a binomial, and a trinomial.

Answer: Answers will vary.

85. Using your own words, explain the difference between a polynomial with five terms and a polynomial with a degree of 5.

Answer: Answers will vary.

86. Ariana thinks the sum $6y^2+5y^4$ is $11y^6$. What is wrong with her reasoning?

Answer: Answers will vary.

87. Jonathan thinks that $\frac{1}{3}$ and $\frac{1}{x}$ are both monomials. What is wrong with his reasoning?

Answer: Answers will vary.

Elementary Algebra
6: Polynomials
6.2 Use Multiplication Properties of Exponents

Simplify Expressions with Exponents In the following exercises, simplify each expression with exponents.

88. (a) 3^5 (b) 9^1 (c) $\left(\frac{1}{3}\right)^2$ (d) $(0.2)^4$

Answer: (a) 243 (b) 9 (c) $\frac{1}{9}$ (d) 0.0016

89. (a) 10^4 (b) 17^1 (c) $\left(\frac{2}{9}\right)^2$ (d) $(0.5)^3$

Answer: (a) 10,000 (b) 17 (c) $\frac{4}{81}$ (d) 0.125

90. (a) 2^6 (b) 14^1 (c) $\left(\frac{2}{5}\right)^3$ (d) $(0.7)^2$

Answer: (a) 64 (b) 14 (c) $\frac{8}{125}$ (d) 0.49

91. (a) 8^3 (b) 8^1 (c) $\left(\frac{3}{4}\right)^3$ (d) $(0.4)^3$

Answer: (a) 512 (b) 8 (c) $\frac{27}{64}$ (d) 0.064

92. (a) $(-6)^4$ (b) -6^4

Answer: (a) 1296 (b) -1296

93. (a) $(-2)^6$ (b) -2^6

Answer: (a) 64 (b) -64

94. (a) $-\left(\frac{1}{4}\right)^4$ (b) $\left(-\frac{1}{4}\right)^4$

Answer: (a) $-\frac{1}{256}$ (b) $\frac{1}{256}$

95. (a) $-\left(\frac{2}{3}\right)^2$ (b) $\left(-\frac{2}{3}\right)^2$

Answer: (a) $-\frac{4}{9}$ (b) $\frac{4}{9}$

96. (a) -0.5^2 (b) $(-0.5)^2$

Answer: (a) -0.25 (b) 0.25

97. (a) -0.1^4 (b) $(-0.1)^4$

Answer: (a) -0.0001 (b) 0.0001

Simplify Expressions Using the Product Property for Exponents In the following exercises, simplify each expression using the Product Property for Exponents.

98. $d^3 \cdot d^6$

Answer: d^9

99. $x^4 \cdot x^2$

Answer: x^6

100. $n^{19} \cdot n^{12}$

Answer: n^{31}

101. $q^{27} \cdot q^{15}$

Answer: q^{42}

102. (a) $4^5 \cdot 4^9$ (b) $8^9 \cdot 8$

Answer: (a) 4^{14} (b) 8^{10}

103. (a) $3^{10} \cdot 3^6$ (b) $5 \cdot 5^4$

Answer: (a) 3^{16} (b) 5^5

104. (a) $y \cdot y^3$ (b) $z^{25} \cdot z^8$

Answer: (a) y^4 (b) z^{33}

105. (a) $w^5 \cdot w$ (b) $u^{41} \cdot u^{53}$

Answer: (a) w^6 (b) u^{94}

106. $w \cdot w^2 \cdot w^3$

Answer: w^6

107. $y \cdot y^3 \cdot y^5$

Answer: y^9

108. $a^4 \cdot a^3 \cdot a^9$

Answer: a^{16}

109. $c^5 \cdot c^{11} \cdot c^2$

Answer: c^{18}

110. $m^x \cdot m^3$

Answer: m^{x+3}

111. $n^y \cdot n^2$

Answer: n^{y+2}

112. $y^a \cdot y^b$

Answer: y^{a+b}

113. $x^p \cdot x^q$

Answer: x^{p+q}

Simplify Expressions Using the Power Property for Exponents In the following exercises, simplify each expression using the Power Property for Exponents.

114. (a) $(m^4)^2$ (b) $(10^3)^6$

Answer: (a) m^8 (b) 10^{18}

115. (a) $(b^2)^7$ (b) $(3^8)^2$

Answer: (a) b^{14} (b) 3^{16}

116. (a) $\left(y^3\right)^x$ (b) $\left(5^x\right)^y$

Answer: (a) y^{3x} (b) 5^{xy}

117. (a) $\left(x^2\right)^y$ (b) $\left(7^a\right)^b$

Answer: (a) x^{2y} (b) 7^{ab}

Simplify Expressions Using the Product to a Power Property In the following exercises, simplify each expression using the Product to a Power Property.

118. (a) $(6a)^2$ (b) $(3xy)^2$

Answer: (a) $36a^2$ (b) $9x^2y^2$

119. (a) $(5x)^2$ (b) $(4ab)^2$

Answer: (a) $25x^2$ (b) $16a^2b^2$

120. (a) $(-4m)^3$ (b) $(5ab)^3$

Answer: (a) $-64m^3$ (b) $125a^3b^3$

121. (a) $(-7n)^3$ (b) $(3xyz)^4$

Answer: (a) $-343n^3$ (b) $81x^4y^4z^4$

Simplify Expressions by Applying Several Properties In the following exercises, simplify each expression.

122. (a) $\left(y^2\right)^4 \cdot \left(y^3\right)^2$ (b) $(10a^2b)^3$

Answer: (a) y^{14} (b) $1000a^6b^3$

123. (a) $\left(w^4\right)^3 \cdot \left(w^5\right)^2$ (b) $(2xy^4)^5$

Answer: (a) w^{22} (b) $32x^5y^{20}$

124. (a) $(-2r^3s^2)^4$ (b) $\left(m^5\right)^3 \cdot \left(m^9\right)^4$

Answer: (a) $16r^{12}s^8$ (b) m^{51}

125. (a) $(-10q^2p^4)^3$ (b) $\left(n^3\right)^{10} \cdot \left(n^5\right)^2$

Answer: (a) $-1000q^6p^{12}$ (b) n^{40}

126. (a) $(3x)^2(5x)$ (b) $(5t^2)^3(3t)^2$

Answer: (a) $45x^3$ (b) $1125t^8$

127. (a) $(2y)^3(6y)$ (b) $(10k^4)^3(5k^6)^2$

Answer: (a) $48y^4$ (b) $25{,}000k^{24}$

128. (a) $\left(5a\right)^2\left(2a\right)^3$ (b) $(\frac{1}{2}y^2)^3(\frac{2}{3}y)^2$

Answer: (a) $200a^5$ (b) $\frac{1}{18}y^8$

129. (a) $\left(4b\right)^2\left(3b\right)^3$ (b) $(\frac{1}{2}j^2)^5(\frac{2}{5}j^3)^2$

Answer: (a) $432b^5$ (b) $\frac{1}{200}j^{16}$

130. (a) $\left(\frac{2}{5}x^2y\right)^3$ (b) $\left(\frac{8}{9}xy^4\right)^2$

Answer: (a) $\frac{8}{125}x^6y^3$ (b) $\frac{64}{81}x^2y^8$

131. (a) $(2r^2)^3(4r)^2$ (b) $(3x^3)^3(x^5)^4$

Answer: (a) $128r^8$ (b) $\frac{1}{200}j^{16}$

132. (a) $(m^2n)^2(2mn^5)^4$ (b) $(3pq^4)^2(6p^6q)^2$

Answer: (a) $16m^8n^{22}$ (b) $324p^{14}q^{10}$

Multiply Monomials In the following exercises, multiply the monomials.

133. $\left(6y^7\right)\left(-3y^4\right)$

Answer: $-18y^{11}$

134. $\left(-10x^5\right)\left(-3x^3\right)$

Answer: $30x^8$

135. $(-8u^6)(-9u)$

Answer: $72u^7$

136. $(-6c^4)(-12c)$

Answer: $72c^5$

137. $(\frac{1}{5}f^8)(20f^3)$

Answer: $4f^{11}$

138. $(\frac{1}{4}d^5)(36d^2)$

Answer: $9d^7$

139. $(4a^3b)(9a^2b^6)$

Answer: $36a^5b^7$

140. $(6m^4n^3)(7mn^5)$

Answer: $42m^5n^8$

141. $\left(\frac{4}{7}rs^2\right)\left(14rs^3\right)$

Answer: $8r^2s^5$

142. $\left(\frac{5}{8}x^3y\right)\left(24x^5y\right)$

Answer: $15x^8y^2$

143. $\left(\frac{2}{3}x^2y\right)\left(\frac{3}{4}xy^2\right)$

Answer: $\frac{1}{2}x^3y^3$

144. $\left(\frac{3}{5}m^3n^2\right)\left(\frac{5}{9}m^2n^3\right)$

Answer: $\frac{1}{3}m^5n^5$

Mixed Practice In the following exercises, simplify each expression.

145. $\left(x^2\right)^4 \cdot \left(x^3\right)^2$

Answer: x^{14}

146. $\left(y^4\right)^3 \cdot \left(y^5\right)^2$

Answer: y^{22}

147. $\left(a^2\right)^6 \cdot \left(a^3\right)^8$

Answer: a^{36}

148. $\left(b^7\right)^5 \cdot \left(b^2\right)^6$

Answer: b^{47}

149. $(2m^6)^3$

Answer: $8m^{18}$

150. $(3y^2)^4$

Answer: $81y^8$

151. $(10x^2y)^3$

Answer: $1000x^6y^3$

152. $(2mn^4)^5$

Answer: $32m^5n^{20}$

153. $(-2a^3b^2)^4$

Answer: $16a^{12}b^8$

154. $(-10u^2v^4)^3$

Answer: $-1000u^6v^{12}$

155. $\left(\frac{2}{3}x^2y\right)^3$

Answer: $\frac{8}{27}x^6y^3$

156. $\left(\frac{7}{9}pq^4\right)^2$

Answer: $\frac{49}{81}p^2q^8$

157. $(8a^3)^2(2a)^4$

Answer: $1024a^{10}$

158. $(5r^2)^3(3r)^2$

Answer: $1125r^8$

159. $(10p^4)^3(5p^6)^2$

Answer: $25000p^{24}$

160. $(4x^3)^3(2x^5)^4$

Answer: $1024x^{29}$

161. $\left(\frac{1}{2}x^2y^3\right)^4\left(4x^5y^3\right)^2$

Answer: $x^{18}y^{18}$

162. $\left(\frac{1}{3}m^3n^2\right)^4\left(9m^8n^3\right)^2$

Answer: $m^{28}n^{14}$

163. $(3m^2n)^2(2mn^5)^4$

Answer: $144m^8n^{22}$

164. $(2pq^4)^3(5p^6q)^2$

Answer: $200p^{15}q^{14}$

Everyday Math

165. **Email** Kate emails a flyer to ten of her friends and tells them to forward it to ten of their friends, who forward it to ten of their friends, and so on. The number of people who receive the email on the second round is 10^2, on the third round is 10^3, as shown in the table below. How many people will receive the email on the sixth round? Simplify the expression to show the number of people who receive the email.

Round	Number of people
1	10
2	10^2
3	10^3
…	…
6	?

Answer: $1,000,000$

166. **Salary** Jamal's boss gives him a 3% raise every year on his birthday. This means that each year, Jamal's salary is 1.03 times his last year's salary. If his original salary was $35,000, his salary after 1 year was $\$35{,}000(1.03)$, after 2 years was $\$35{,}000(1.03)^2$, after 3 years was $\$35{,}000(1.03)^3$, as shown in the table below. What will Jamal's salary be after 10 years? Simplify the expression, to show Jamal's salary in dollars.

Year	Salary
1	$\$35{,}000(1.03)$
2	$\$35{,}000(1.03)^2$
3	$\$35{,}000(1.03)^3$
…	…
10	?

Answer: $47,037

167. **Clearance** A department store is clearing out merchandise in order to make room for new inventory. The plan is to mark down items by 30% each week. This means that each week the cost of an item is 70% of the previous week's cost. If the original cost of a sofa was $1,000, the cost for the first week would be $\$1{,}000(0.70)$ and the cost of the item during the second week would be $\$1{,}000(0.70)^2$ .Complete the table shown below. What will be the cost of the sofa during the fifth week? Simplify the expression, to show the cost in dollars.

Week	Cost
1	$\$1{,}000(0.70)$
2	$\$1{,}000(0.70)^2$
3	
…	…
8	?

Answer: $168.07

168. **Depreciation** Once a new car is driven away from the dealer, it begins to lose value. Each year, a car loses 10% of its value. This means that each year the value of a car is 90% of the previous year's value. If a new car was purchased for $20,000, the value at the end of the first year would be $\$20{,}000(0.90)$ and the value of the car after the end of the second year would be $\$20{,}000(0.90)^2$. Complete the table shown below. What will be the value of the car at the end of the eighth year? Simplify the expression, to show the value in dollars.

Week	Cost
1	$\$20{,}000(0.90)$
2	$\$20{,}000(0.90)^2$
3	
4	…
5	?

Answer: $8,609.3

Writing Exercises

169. Use the Product Property for Exponents to explain why $x \cdot x = x^2$.

Answer: Answers will vary.

170. Explain why $-5^3 = (-5)^3$ but $-5^4 \neq (-5)^4$.

Answer: Answers will vary.

171. Jorge thinks $\left(\frac{1}{2}\right)^2$ is 1. What is wrong with his reasoning?

Answer: Answers will vary.

172. Explain why $x^3 \cdot x^5$ is x^8, and not x^{15}.

Answer: Answers will vary.

Elementary Algebra
6: Polynomials
6.3 Multiply Polynomials

Multiply a Polynomial by a Monomial In the following exercises, multiply.

173. $4(w+10)$

Answer: $4w+40$

174. $6(b+8)$

Answer: $6b+48$

175. $-3(a+7)$

Answer: $-3a-21$

176. $-5(p+9)$

Answer: $-5p-45$

177. $2(x-7)$

Answer: $2x-14$

178. $7(y-4)$

Answer: $7y-28$

179. $-3(k-4)$

Answer: $-3k+12$

180. $-8(j-5)$

Answer: $-8j+40$

181. $q(q+5)$

Answer: q^2+5q

182. $k(k+7)$

Answer: k^2+7k

183. $-b(b+9)$

Answer: $-b^2-9b$

184. $-y(y+3)$

Answer: $-y^2-3y$

185. $-x(x-10)$

Answer: $-x^2+10x$

186. $-p(p-15)$

Answer: $-p^2+15p$

187. $6r(4r+s)$

Answer: $24r^2+6rs$

188. $5c(9c+d)$

Answer: $45c^2+5cd$

189. $12x(x-10)$

Answer: $12x^2-120x$

190. $9m(m-11)$

Answer: $9m^2-99m$

191. $-9a(3a+5)$

Answer: $-27a^2-45a$

192. $-4p(2p+7)$

Answer: $-8p^2-28p$

193. $3(p^2+10p+25)$

Answer: $3p^2+30p+75$

194. $6(y^2+8y+16)$

Answer: $6y^2+48y+96$

195. $-8x(x^2+2x-15)$

Answer: $-8x^3-16x^2+120x$

196. $-5t(t^2+3t-18)$

Answer: $-5t^3-15t^2+90t$

197. $5q^3\left(q^3-2q+6\right)$

Answer: $5q^6-10q^4+30q^3$

198. $4x^3\left(x^4-3x+7\right)$

Answer: $4x^7-12x^4+28x^3$

199. $-8y(y^2+2y-15)$

Answer: $-8y^3-16y^2+120y$

200. $-5m(m^2+3m-18)$

Answer: $-5m^3-15m^2+90m$

201. $5q^3(q^2-2q+6)$

Answer: $5q^5-10q^4+30q^3$

202. $9r^3(r^2-3r+5)$

Answer: $9r^5-27r^4+45r^3$

203. $-4z^2(3z^2+12z-1)$

Answer: $-12z^4-48z^3+4z^2$

204. $-3x^2(7x^2+10x-1)$

Answer: $-21x^4-30x^3+3x^2$

205. $(2m-9)m$

Answer: $2m^2-9m$

206. $(8j-1)j$

Answer: $8j^2-j$

207. $(w-6)\cdot 8$

Answer: $8w-48$

208. $(k-4)\cdot 5$

Answer: $5k-20$

209. $4(x+10)$

Answer: $4x+40$

210. $6(y+8)$

Answer: $6y+48$

211. $15(r-24)$

Answer: $15r-360$

212. $12(v-30)$

Answer: $12v-360$

213. $-3(m+11)$

Answer: $-3m-33$

214. $-4(p+15)$

Answer: $-4p-60$

215. $-8(z-5)$

Answer: $-8z+40$

216. $-3(x-9)$

Answer: $-3x+27$

217. $u(u+5)$

Answer: u^2+5u

218. $q(q+7)$

Answer: q^2+7q

219. $n(n^2-3n)$

Answer: n^3-3n^2

220. $s(s^2-6s)$

Answer: s^3-6s^2

221. $6x(4x+y)$

Answer: $24x^2+6xy$

222. $5a(9a+b)$

Answer: $45a^2+5ab$

223. $5p(11p-5q)$

Answer: $55p^2-25pq$

224. $12u(3u-4v)$

Answer: $36u^2+12uv$

225. $3(v^2+10v+25)$

Answer: $3v^2+30v+75$

226. $6(x^2+8x+16)$

Answer: $6x^2+48x+96$

227. $2n(4n^2-4n+1)$

Answer: $8n^3-8n^2+2n$

228. $3r(2r^2-6r+2)$

Answer: $6r^3-18r^2+6r$

229. $-8y(y^2+2y-15)$

Answer: $-8y^3-16y^2+120y$

230. $-5m(m^2+3m-18)$

Answer: $-5m^3-15m^2+90m$

231. $5q^3(q^2-2q+6)$

Answer: $5q^5-10q^4+30q^3$

232. $9r^3(r^2-3r+5)$

Answer: $9r^5-27r^4+45r^3$

233. $-4z^2(3z^2+12z-1)$

Answer: $-12z^4-48z^3+4z^2$

234. $-3x^2(7x^2+10x-1)$

Answer: $-21x^4-30x^3+3x^2$

235. $(2y-9)y$

Answer: $18y^2-9y$

236. $(8b-1)b$

Answer: $8b^2-b$

Multiply a Binomial by a Binomial In the following exercises, multiply the following binomials using: (a) the Distributive Property (b) the FOIL method (c) the Vertical Method.

237. $(w+5)(w+7)$

Answer: $w^2+12w+35$

238. $(y+9)(y+3)$

Answer: $y^2+12y+27$

239. $(p+11)(p-4)$

Answer: $p^2+7p-44$

240. $(q+4)(q-8)$

Answer: $q^2-4q-32$

In the following exercises, multiply the binomials. Use any method.

241. $(x+8)(x+3)$

Answer: $x^2+11x+24$

242. $(y+7)(y+4)$

Answer: $y^2+11y+28$

243. $(y-6)(y-2)$

Answer: $y^2-8y+12$

244. $(x-7)(x-2)$

Answer: $x^2-9x+14$

245. $(w-4)(w+7)$

Answer: $w^2+3w-28$

246. $(q-5)(q+8)$

Answer: $q^2+3q-40$

247. $(p+12)(p-5)$

Answer: $p^2+7p-60$

248. $(m+11)(m-4)$

Answer: $m^2+7m-44$

249. $(6p+5)(p+1)$

Answer: $6p^2+11p+5$

250. $(7m+1)(m+3)$

Answer: $7m^2+22m+3$

251. $(2t-9)(10t+1)$

Answer: $20t^2-88t-9$

252. $(3r-8)(11r+1)$

Answer: $33r^2-85r-8$

253. $(5x-y)(3x-6)$

Answer: $15x^2-3xy-30x+6y$

254. $(10a-b)(3a-4)$

Answer: $30a^2-3ab-40a+4b$

255. $(a+b)(2a+3b)$

Answer: $2a^2+5ab+3b^2$

256. $(r+s)(3r+2s)$

Answer: $3r^2+5rs+2s^2$

257. $(4z-y)(z-6)$

Answer: $4z^2-24z-zy+6y$

258. $(5x-y)(x-4)$

Answer: $5x^2-20x-xy+4y$

259. $(x^2+3)(x+2)$

Answer: x^3+2x^2+3x+6

260. $(y^2-4)(y+3)$

Answer: $y^3+3y^2-4y-12$

261. $(x^2+8)(x^2-5)$

Answer: x^4+3x^2-40

262. $(y^2-7)(y^2-4)$

Answer: y^4-11y^2+28

263. $(5ab-1)(2ab+3)$

Answer: $10a^2b^2+13ab-3$

264. $(2xy+3)(3xy+2)$

Answer: $6x^2y^2+13xy+6$

265. $(6pq-3)(4pq-5)$

Answer: $24p^2q^2-42pq+15$

266. $(3rs-7)(3rs-4)$

Answer: $9r^2s^2-33rs+28$

Multiply a Trinomial by a Binomial In the following exercises, multiply using (a) the Distributive Property (b) the Vertical Method.

267. $(x+5)(x^2+4x+3)$

Answer: $x^3+9x^2+23x+15$

268. $(u+4)(u^2+3u+2)$

Answer: $u^3+7u^2+14u+8$

269. $(y+8)(4y^2+y-7)$

Answer: $4y^3+33y^2+y-56$

270. $(a+10)(3a^2+a-5)$

Answer: $3a^3+31a^2+5a-50$

In the following exercises, multiply. Use either method.

271. $(w-7)(w^2-9w+10)$

Answer: $w^3-16w^2+73w-70$

272. $(p-4)(p^2-6p+9)$

Answer: $x^3+9x^2+23x+15$

273. $(3q+1)(q^2-4q-5)$

Answer: $3q^3-11q^2-19q-5$

274. $(6r+1)(r^2-7r-9)$

Answer: $6r^3-41r^2-61r-9$

Mixed Practice

275. $(10y-6)+(4y-7)$

Answer: $14y-13$

276. $(15p-4)+(3p-5)$

Answer: $18p-9$

277. $\left(x^2-4x-34\right)-\left(x^2+7x-6\right)$

Answer: $-11x-28$

278. $\left(j^2-8j-27\right)-\left(j^2+2j-12\right)$

Answer: $-10j-15$

279. $5q(3q^2-6q+11)$

Answer: $15q^3-30q^2+55q$

280. $8t(2t^2-5t+6)$

Answer: $16t^3-40t^2+48t$

281. $(s-7)(s+9)$

Answer: $s^2+2s-63$

282. $(x-5)(x+13)$

Answer: $x^2+8x-65$

283. $\left(y^2-2y\right)(y+1)$

Answer: y^3-y^2-2y

284. $\left(a^2-3a\right)(4a+5)$

Answer: $4a^3-7a^2-15a$

285. $(3n-4)\left(n^2+n-7\right)$

Answer: $3n^3-n^2-25n+28$

286. $(6k-1)(k^2+2k-4)$

Answer: $6k^3-11k^2-26k+4$

287. $(7p+10)(7p-10)$

Answer: $49p^2-100$

288. $(3y+8)(3y-8)$

Answer: $9y^2-64$

289. $(4m^2-3m-7)m^2$

Answer: $4m^4-3m^3-7m^2$

290. $(15c^2-4c+5)c^4$

Answer: $15c^6-4c^5+5c^4$

291. $(5a+7b)(5a+7b)$

Answer: $25a^2+70ab+49b^2$

292. $(3x-11y)(3x-11y)$

Answer: $9x^2-66xy+121y^2$

293. $(4y+12z)(4y-12z)$

Answer: $16y^2-144z^2$

Everyday Math

294. **Mental math** You can use binomial multiplication to multiply numbers without a calculator. Say you need to multiply 13 times 15. Think of 13 as $10+3$ and 15 as $10+5$.
(a) Multiply $(10+3)(10+5)$ by the FOIL method.
(b) Multiply $13 \cdot 15$ without using a calculator.
(c) Which way is easier for you? Why?

Answer: (a) 195 (b) 195 (c) Answers will vary.

295. **Mental math** You can use binomial multiplication to multiply numbers without a calculator. Say you need to multiply 18 times 17. Think of 18 as $20-2$ and 17 as $20-3$.
(a) Multiply $(20-2)(20-3)$ by the FOIL method.
(b) Multiply $18 \cdot 17$ without using a calculator.
(c) Which way is easier for you? Why?

Answer: (a) 306 (b) 306 (c) Answers will vary.

Writing Exercises

296. Which method do you prefer to use when multiplying two binomials: the Distributive Property, the FOIL method, or the Vertical Method? Why?

Answer: Answers will vary.

297. Which method do you prefer to use when multiplying a trinomial by a binomial: the Distributive Property or the Vertical Method? Why?

Answer: Answers will vary.

298. Multiply the following:

$(x+2)(x-2)$

$(y+7)(y-7)$

$(w+5)(w-5)$

Explain the pattern that you see in your answers.

Answer: Answers may vary.

299. Multiply the following:

$(m-3)(m+3)$

$(n-10)(n+10)$

$(p-8)(p+8)$

Explain the pattern that you see in your answers.

Answer: Answers may vary.

300. Multiply the following:

$(p+3)(p+3)$

$(q+6)(q+6)$

$(r+1)(r+1)$

Explain the pattern that you see in your answers.

Answer: Answers may vary.

301. Multiply the following:

$(x-4)(x-4)$

$(y-1)(y-1)$

$(z-7)(z-7)$

Explain the pattern that you see in your answers.

Answer: Answers may vary.

Elementary Algebra
6: Polynomials
6.4 Special Products

Square a Binomial Using the Binomial Squares Pattern In the following exercises, square each binomial using the Binomial Squares Pattern.

302. $(w+4)^2$

Answer: $w^2+8w+16$

303. $(q+12)^2$

Answer: $q^2+24q+144$

304. $\left(y+\frac{1}{4}\right)^2$

Answer: $y^2+\frac{1}{2}y+\frac{1}{16}$

305. $\left(x+\frac{2}{3}\right)^2$

Answer: $x^2+\frac{4}{3}x+\frac{4}{9}$

306. $(b-7)^2$

Answer: $b^2-14b+49$

307. $(y-6)^2$

Answer: $y^2-12y+36$

308. $(m-15)^2$

Answer: $m^2-30m+225$

309. $(p-13)^2$

Answer: $p^2-26p+169$

310. $(3d+1)^2$

Answer: $9d^2+6d+1$

311. $(4a+10)^2$

Answer: $16a^2+80a+100$

312. $(2q+\frac{1}{3})^2$

Answer: $4q^2+\frac{4}{3}q+\frac{1}{9}$

313. $\left(3z+\frac{1}{5}\right)^2$

Answer: $9z^2+\frac{6}{5}z+\frac{1}{25}$

314. $\left(3x-y\right)^2$

Answer: $9x^2-6xy+y^2$

315. $\left(2y-3z\right)^2$

Answer: $4y^2-12yz+9z^2$

316. $\left(\frac{1}{5}x-\frac{1}{7}y\right)^2$

Answer: $\frac{1}{25}x^2-\frac{2}{35}xy+\frac{1}{49}y^2$

317. $\left(\frac{1}{8}x-\frac{1}{9}y\right)^2$

Answer: $\frac{1}{64}x^2-\frac{1}{36}xy+\frac{1}{81}y^2$

318. $(3x^2+2)^2$

Answer: $9x^4+12x^2+4$

319. $(5u^2+9)^2$

Answer: $25u^4+90u^2+81$

320. $(4y^3-2)^2$

Answer: $16y^6-16y^3+4$

321. $(8p^3-3)^2$

Answer: $64p^6-48p^3+9$

Multiply Conjugates Using the Product of Conjugates Pattern In the following exercises, multiply each pair of conjugates using the Product of Conjugates Pattern.

322. $(m-7)(m+7)$

Answer: m^2-49

323. $(c-5)(c+5)$

Answer: c^2-25

324. $\left(x+\frac{3}{4}\right)\left(x-\frac{3}{4}\right)$

Answer: $x^2-\frac{9}{16}$

325. $\left(b+\frac{6}{7}\right)\left(b-\frac{6}{7}\right)$

Answer: $b^2-\frac{36}{49}$

326. $(5k+6)(5k-6)$

Answer: $25k^2-36$

327. $(8j+4)(8j-4)$

Answer: $64j^2-16$

328. $(11k+4)(11k-4)$

Answer: $121k^2-16$

329. $(9c+5)(9c-5)$

Answer: $81c^2-25$

330. $(11-b)(11+b)$

Answer: $121-b^2$

331. $(13-q)(13+q)$

Answer: $169-q^2$

332. $(5-3x)(5+3x)$

Answer: $25-9x^2$

333. $(4-6y)(4+6y)$

Answer: $16-36y^2$

334. $(9c-2d)(9c+2d)$

Answer: $81c^2-4d^2$

335. $(7w+10x)(7w-10x)$

Answer: $49w^2-100x^2$

336. $\left(m+\frac{2}{3}n\right)\left(m-\frac{2}{3}n\right)$

Answer: $m^2-\frac{4}{9}n^2$

337. $\left(p+\frac{4}{5}q\right)\left(p-\frac{4}{5}q\right)$

Answer: $p^2-\frac{16}{25}q^2$

338. $(ab-4)(ab+4)$

Answer: a^2b^2-16

339. $(xy-9)(xy+9)$

Answer: x^2y^2-81

340. $(uv-\frac{3}{5})(uv+\frac{3}{5})$

Answer: $u^2v^2-\frac{9}{25}$

341. $(rs-\frac{2}{7})(rs+\frac{2}{7})$

Answer: $r^2s^2-\frac{4}{49}$

342. $(2x^2-3y^4)(2x^2+3y^4)$

Answer: $4x^4-9y^8$

343. $(6m^3-4n^5)(6m^3+4n^5)$

Answer: $36m^6-16n^{10}$

344. $(12p^3-11q^2)(12p^3+11q^2)$

Answer: $144p^6-121q^4$

345. $(15m^2-8n^4)(15m^2+8n^4)$

Answer: $225m^4-64n^8$

Recognize and Use the Appropriate Special Product Pattern In the following exercises, find each product.

346. (a) $(p-3)(p+3)$
(b) $(t-9)^2$
(c) $(m+n)^2$
(d) $(2x+y)(x-2y)$
Answer: (a) p^2-9 (b) $t^2-18t+81$ (c) $m^2+2mn+n^2$ (d) $2x^2-3xy-2y^2$

347. (a) $(2r+12)^2$
(b) $(3p+8)(3p-8)$
(c) $(7a+b)(a-7b)$
(d) $(k-6)^2$
Answer: (a) $4r^2+48r+144$ (b) $9p^2-64$ (c) $7a^2-48ab-7b^2$ (d) $k^2-12k+36$

348. (a) $(a^5-7b)^2$
(b) $(x^2+8y)(8x-y^2)$
(c) $(r^6+s^6)(r^6-s^6)$
(d) $(y^4+2z)^2$
Answer: (a) $a^{10}-14a^5b+49b^2$ (b) $8x^3-x^2y^2+64xy-8y^3$ (c) $r^{12}-s^{12}$ (d) $y^8+4y^4z+4z^2$

349. (a) $(x^5+y^5)(x^5-y^5)$
(b) $(m^3-8n)^2$
(c) $(9p+8q)^2$
(d) $(r^2-s^3)(r^3+s^2)$
Answer: (a) $x^{10}-y^{10}$ (b) $m^6-16m^3n+64n^2$ (c) $81p^2+144pq+64q^2$ (d) $r^5+r^2s^2-r^3s^3-s^5$

Everyday Math

350. **Mental math** You can use the product of conjugates pattern to multiply numbers without a calculator. Say you need to multiply 47 times 53. Think of 47 as $50-3$ and 53 as $50+3$.
(a) Multiply $(50-3)(50+3)$ by using the product of conjugates pattern, $(a-b)(a+b)=a^2-b^2$.
(b) Multiply $47 \cdot 53$ without using a calculator.
(c) Which way is easier for you? Why?
Answer: (a) 2491 (b) 2491 (c) Answers will vary.

351. **Mental math** You can use the binomial squares pattern to multiply numbers without a calculator. Say you need to square 65. Think of 65 as $60+5$.

(a) Multiply $(60+5)^2$ by using the binomial squares pattern, $(a+b)^2 = a^2 + 2ab + b^2$.

(b) Square 65 without using a calculator.

(c) Which way is easier for you? Why?

Answer: (a) 4,225 (b) 4,225 (c) Answers will vary.

Writing Exercises

352. How do you decide which pattern to use?

Answer: Answers will vary.

353. Why does $(a+b)^2$ result in a trinomial, but $(a-b)(a+b)$ result in a binomial?

Answer: Answers will vary.

354. Marta did the following work on her homework paper:

$$(3-y)^2$$

$$3^2 - y^2$$

$$9 - y^2$$

Explain what is wrong with Marta's work.

Answer: Answers will vary.

355. Use the order of operations to show that $(3+5)^2$ is 64, and then use that numerical example to explain why $(a+b)^2 \neq a^2 + b^2$.

Answer: Answers will vary.

Elementary Algebra
6: Polynomials
6.5 Divide Monomials

Simplify Expressions Using the Quotient Property for Exponents In the following exercises, simplify.

356. (a) $\frac{x^{18}}{x^3}$ (b) $\frac{5^{12}}{5^3}$

Answer: (a) x^{15} (b) 5^9

357. (a) $\frac{y^{20}}{y^{10}}$ (b) $\frac{7^{16}}{7^2}$

Answer: (a) y^{10} (b) 7^{14}

358. (a) $\frac{p^{21}}{p^7}$ (b) $\frac{4^{16}}{4^4}$

Answer: (a) p^{14} (b) 4^{12}

359. (a) $\frac{u^{24}}{u^3}$ (b) $\frac{9^{15}}{9^5}$

Answer: (a) u^{21} (b) 9^{10}

360. (a) $\frac{q^{18}}{q^{36}}$ (b) $\frac{10^2}{10^3}$

Answer: (a) $\frac{1}{q^{18}}$ (b) $\frac{1}{10}$

361. (a) $\frac{t^{10}}{t^{40}}$ (b) $\frac{8^3}{8^5}$

Answer: (a) $\frac{1}{t^{30}}$ (b) $\frac{1}{64}$

362. (a) $\frac{b}{b^9}$ (b) $\frac{4}{4^6}$

Answer: (a) $\frac{1}{b^8}$ (b) $\frac{1}{4^5}$

363. (a) $\frac{x}{x^7}$ (b) $\frac{10}{10^3}$

Answer: (a) $\frac{1}{x^6}$ (b) $\frac{1}{100}$

Simplify Expressions with Zero Exponents In the following exercises, simplify.

364. (a) 20^0 (b) b^0

Answer: (a) 1 (b) 1

365. (a) 13^0 (b) k^0

Answer: (a) 1 (b) 1

366. (a) -27^0 (b) $-\left(27^0\right)$

Answer: (a) -1 (b) -1

367. (a) -15^0 (b) $-\left(15^0\right)$

Answer: (a) -1 (b) -1

368. (a) $\left(25x\right)^0$ (b) $25x^0$

Answer: (a) 1 (b) 25

369. (a) $\left(6y\right)^0$ (b) $6y^0$

Answer: (a) 1 (b) 6

370. (a) $\left(12x\right)^0$ (b) $\left(-56p^4q^3\right)^0$

Answer: (a) 1 (b) 1

371. (a) $7y^0\ \left(17y\right)^0$ (b) $\left(-93c^7d^{15}\right)^0$

Answer: (a) 7 (b) 1

372. (a) $12n^0-18m^0$ (b) $\left(12n\right)^0-\left(18m\right)^0$

Answer: (a) -6 (b) 0

373. (a) $15r^0-22s^0$ (b) $\left(15r\right)^0-\left(22s\right)^0$

Answer: (a) -7 (b) 0

Simplify Expressions Using the Quotient to a Power Property In the following exercises, simplify.

374. (a) $\left(\frac{3}{4}\right)^3$ (b) $\left(\frac{p}{2}\right)^5$ (c) $\left(\frac{x}{y}\right)^6$

Answer: (a) $\frac{27}{64}$ (b) $\frac{p^5}{32}$ (c) $\frac{x^6}{y^6}$

375. (a) $\left(\frac{2}{5}\right)^2$ (b) $\left(\frac{x}{3}\right)^4$ (c) $\left(\frac{a}{b}\right)^5$

Answer: (a) $\frac{4}{25}$ (b) $\frac{x^4}{81}$ (c) $\frac{a^5}{b^5}$

376. (a) $\left(\frac{a}{3b}\right)^4$ (b) $\left(\frac{5}{4m}\right)^2$

Answer: (a) $\frac{a^2}{9b^2}$ (b) $\frac{25}{16m^2}$

377. (a) $\left(\frac{x}{2y}\right)^3$ (b) $\left(\frac{10}{3q}\right)^4$

Answer: (a) $\frac{x^3}{8y^3}$ (b) $\frac{10,000}{81q^4}$

Simplify Expressions by Applying Several Properties In the following exercises, simplify.

378. $\frac{\left(a^2\right)^3}{a^4}$

Answer: a^2

379. $\frac{\left(p^3\right)^4}{p^5}$

Answer: p^7

380. $\frac{\left(y^3\right)^4}{y^{10}}$

Answer: y^2

381. $\frac{\left(x^4\right)^5}{x^{15}}$

Answer: x^5

382. $\frac{u^6}{\left(u^3\right)^2}$

Answer: 1

383. $\frac{v^{20}}{\left(v^4\right)^5}$

Answer: 1

384. $\frac{m^{12}}{\left(m^8\right)^3}$

Answer: $\frac{1}{m^{12}}$

385. $\frac{n^8}{\left(n^6\right)^4}$

Answer: $\frac{1}{n^{16}}$

386. $\left(\frac{p^9}{p^3}\right)^5$

Answer: p^{30}

387. $\left(\frac{q^8}{q^2}\right)^3$

Answer: q^{18}

388. $\left(\frac{r^2}{r^6}\right)^3$

Answer: $\frac{1}{r^{12}}$

389. $\left(\frac{m^4}{m^7}\right)^4$

Answer: $\frac{1}{m^{12}}$

390. $\left(\frac{p}{r^{11}}\right)^2$

Answer: $\frac{p^2}{r^{22}}$

391. $\left(\frac{a}{b^6}\right)^3$

Answer: $\frac{a^3}{b^{18}}$

392. $\left(\frac{w^5}{x^3}\right)^8$

Answer: $\frac{w^{40}}{x^{24}}$

393. $\left(\frac{y^4}{z^{10}}\right)^5$

Answer: $\frac{y^{20}}{z^{50}}$

394. $\left(\frac{2j^3}{3k}\right)^4$

Answer: $\frac{16j^{12}}{81k^4}$

395. $\left(\frac{3m^5}{5n}\right)^3$

Answer: $\frac{27m^{15}}{125n^3}$

396. $\left(\frac{3c^2}{4d^6}\right)^3$

Answer: $\frac{27c^6}{64d^{18}}$

397. $\left(\frac{5u^7}{2v^3}\right)^4$

Answer: $\frac{625u^{28}}{16v^{12}}$

398. $\left(\frac{k^2k^8}{k^3}\right)^2$

Answer: k^{14}

399. $\left(\frac{j^2j^5}{j^4}\right)^3$

Answer: j^9

400. $\frac{\left(t^2\right)^5\left(t^4\right)^2}{\left(t^3\right)^7}$

Answer: $\frac{1}{t^3}$

401. $\frac{\left(q^3\right)^6\left(q^2\right)^3}{\left(q^4\right)^8}$

Answer: $\frac{1}{q^8}$

402. $\frac{\left(-2p^2\right)^4\left(3p^4\right)^2}{\left(-6p^3\right)^2}$

Answer: $4p^{10}$

403. $\frac{\left(-2k^3\right)^2\left(6k^2\right)^4}{\left(9k^4\right)^2}$

Answer: $64k^6$

404. $\dfrac{\left(-4m^3\right)^2\left(5m^4\right)^3}{\left(-10m^6\right)^3}$

Answer: -2

405. $\dfrac{\left(-10n^2\right)^3\left(4n^5\right)^2}{\left(2n^8\right)^2}$

Answer: $-4,000$

Divide Monomials In the following exercises, divide the monomials.

406. $56b^8 \div 7b^2$

Answer: $8b^6$

407. $63v^{10} \div 9v^2$

Answer: $7v^8$

408. $-88y^{15} \div 8y^3$

Answer: $-11y^{12}$

409. $-72u^{12} \div 12u^4$

Answer: $-6u^8$

410. $\dfrac{45a^6b^8}{-15a^{10}b^2}$

Answer: $-\dfrac{3b^6}{a^4}$

411. $\dfrac{54x^9y^3}{-18x^6y^{15}}$

Answer: $-\dfrac{3x^3}{y^{12}}$

412. $\dfrac{15r^4s^9}{18r^9s^2}$

Answer: $\dfrac{-5s^7}{6r^5}$

413. $\frac{20m^8n^4}{30m^5n^9}$

Answer: $\frac{-2m^3}{3n^5}$

414. $\frac{18a^4b^8}{-27a^9b^5}$

Answer: $\frac{-2b^3}{3a^5}$

415. $\frac{45x^5y^9}{-60x^8y^6}$

Answer: $\frac{-3y^3}{4x^3}$

416. $\frac{64q^{11}r^9s^3}{48q^6r^8s^5}$

Answer: $\frac{4q^5r}{3s^2}$

417. $\frac{65a^{10}b^8c^5}{42a^7b^6c^8}$

Answer: $\frac{65a^3b^2}{42c^3}$

418. $\frac{\left(10m^5n^4\right)\left(5m^3n^6\right)}{25m^7n^5}$

Answer: $2mn^5$

419. $\frac{\left(-18p^4q^7\right)\left(-6p^3q^8\right)}{-36p^{12}q^{10}}$

Answer: $\frac{-3q^5}{p^5}$

420. $\frac{\left(6a^4b^3\right)\left(4ab^5\right)}{\left(12a^2b\right)\left(a^3b\right)}$

Answer: $2b^6$

421. $\frac{\left(4u^2v^5\right)\left(15u^3v\right)}{\left(12u^3v\right)\left(u^4v\right)}$

Answer: $\frac{5v^4}{u^2}$

Mixed Practice

422. (a) $24a^5+2a^5$ (b) $24a^5-2a^5$ (c) $24a^5 \cdot 2a^5$ (d) $24a^5 \div 2a^5$

Answer: (a) $26a^5$ (b) $22a^5$ (c) $48a^{10}$ (d) 12

423. (a) $15n^{10}+3n^{10}$ (b) $15n^{10}-3n^{10}$ (c) $15n^{10} \cdot 3n^{10}$ (d) $15n^{10} \div 3n^{10}$

Answer: (a) $18n^{10}$ (b) $12n^{10}$ (c) $45n^{20}$ (d) 5

424. (a) $p^4 \cdot p^6$ (b) $\left(p^4\right)^6$

Answer: (a) p^{10} (b) p^{24}

425. (a) $q^5 \cdot q^3$ (b) $\left(q^5\right)^3$

Answer: (a) q^8 (b) q^{15}

426. (a) $\frac{y^3}{y}$ (b) $\frac{y}{y^3}$

Answer: (a) y^2 (b) $\frac{1}{y^2}$

427. (a) $\frac{z^6}{z^5}$ (b) $\frac{z^5}{z^6}$

Answer: (a) z (b) $\frac{1}{z}$

428. $\left(8x^5\right)(9x) \div 6x^3$

Answer: $12x^3$

429. $(4y)\left(12y^7\right) \div 8y^2$

Answer: $6y^6$

430. $\frac{27a^7}{3a^3}+\frac{54a^9}{9a^5}$

Answer: $15a^4$

431. $\frac{32c^{11}}{4c^5}+\frac{42c^9}{6c^3}$

Answer: $15c^6$

432. $\frac{32y^5}{8y^2}-\frac{60y^{10}}{5y^7}$

Answer: $-8y^3$

433. $\frac{48x^6}{6x^4}-\frac{35x^9}{7x^7}$

Answer: $3x^2$

434. $\frac{63r^6s^3}{9r^4s^2}-\frac{72r^2s^2}{6s}$

Answer: $-5r^2s$

435. $\frac{56y^4z^5}{7y^3z^3}-\frac{45y^2z^2}{5y}$

Answer: $-yz^2$

Everyday Math

436. **Memory** One megabyte is approximately 10^6 bytes. One gigabyte is approximately 10^9 bytes. How many megabytes are in one gigabyte?

Answer: 10^3

437. **Memory** One gigabyte is approximately 10^9 bytes. One terabyte is approximately 10^{12} bytes. How many gigabytes are in one terabyte?

Answer: 10^3

Writing Exercises

438. Jennifer thinks the quotient $\frac{a^{24}}{a^6}$ simplifies to a^4. What is wrong with her reasoning?

Answer: Answers will vary.

439. Maurice simplifies the quotient $\frac{d^7}{d}$ by writing $\frac{\cancel{d}^7}{\cancel{d}}=7$. What is wrong with his reasoning?

Answer: Answers will vary.

440. When Drake simplified -3^0 and $(-3)^0$ he got the same answer. Explain how using the Order of Operations correctly gives different answers.

Answer: Answers will vary.

441. Robert thinks x^0 simplifies to 0. What would you say to convince Robert he is wrong?

Answer: Answers will vary.

Elementary Algebra
6: Polynomials
6.6 Divide Polynomials

In the following exercises, divide each polynomial by the monomial.

442. $\frac{45y+36}{9}$

Answer: $5y+4$

443. $\frac{30b+75}{5}$

Answer: $6b+15$

444. $\frac{8d^2-4d}{2}$

Answer: $4d^2-2d$

445. $\frac{42x^2-14x}{7}$

Answer: $6x^2-2x$

446. $\left(16y^2-20y\right)\div 4y$

Answer: $4y-5$

447. $\left(55w^2-10w\right)\div 5w$

Answer: $11w-2$

448. $\left(9n^4+6n^3\right)\div 3n$

Answer: $3n^3+2n^2$

449. $\left(8x^3+6x^2\right)\div 2x$

Answer: $4x^2+3x$

450. $\frac{18y^2-12y}{-6}$

Answer: $-3y^2+2y$

451. $\frac{20b^2-12b}{-4}$

Answer: $-5b^2+3b$

452. $\frac{35a^4+65a^2}{-5}$

Answer: $-7a^4-13a^2$

453. $\frac{51m^4+72m^3}{-3}$

Answer: $-17m^4-24m^3$

454. $\frac{310y^4-200y^3}{5y^2}$

Answer: $62y^2-40y$

455. $\frac{412z^8-48z^5}{4z^3}$

Answer: $103z^5-12z^2$

456. $\frac{46x^3+38x^2}{2x^2}$

Answer: $23x+19$

457. $\frac{51y^4+42y^2}{3y^2}$

Answer: $17y^2+14$

458. $\left(24p^2-33p\right)\div\left(-3p\right)$

Answer: $-8p+11$

459. $\left(35x^4-21x\right)\div\left(-7x\right)$

Answer: $-5x^3+3$

460. $\left(63m^4-42m^3\right)\div\left(-7m^2\right)$

Answer: $-9m^2+6m$

461. $\left(48y^4-24y^3\right)\div\left(-8y^2\right)$

Answer: $-6y^2+3y$

462. $\left(63a^2b^3+72ab^4\right)\div\left(9ab\right)$

Answer: $7ab^2+8b^3$

463. $\left(45x^3y^4+60xy^2\right)\div\left(5xy\right)$

Answer: $9x^2y^3+12y$

464. $\dfrac{52p^5q^4+36p^4q^3-64p^3q^2}{4p^2q}$

Answer: $13p^3q^3+9p^2q^2-16pg$

465. $\dfrac{49c^2d^2-70c^3d^3-35c^2d^4}{7cd^2}$

Answer: $7c-10c^2d-5cd^2$

466. $\dfrac{66x^3y^2-110x^2y^3-44x^4y^3}{11x^2y^2}$

Answer: $6x-10y-4x^2y$

467. $\dfrac{72r^5s^2+132r^4s^3-96r^3s^5}{12r^2s^2}$

Answer: $6r^3+11r^2s-8rs^3$

468. $\dfrac{4w^2+2w-5}{2w}$

Answer: $2w+1-\dfrac{5}{2w}$

469. $\dfrac{12q^2+3q-1}{3q}$

Answer: $4q+1-\dfrac{1}{3q}$

470. $\dfrac{10x^2+5x-4}{-5x}$

Answer: $-2x-1+\dfrac{4}{5x}$

471. $\dfrac{20y^2+12y-1}{-4y}$

Answer: $-5y-3+\dfrac{1}{4y}$

472. $\frac{36p^3+18p^2-12p}{6p^2}$

Answer: $6p+3-\frac{2}{p}$

473. $\frac{63a^3-108a^2+99a}{9a^2}$

Answer: $7a-12+\frac{11}{a}$

Divide a Polynomial by a Binomial In the following exercises, divide each polynomial by the binomial.

474. $\left(y^2+7y+12\right)\div(y+3)$

Answer: $y+4$

475. $\left(d^2+8d+12\right)\div(d+2)$

Answer: $d+6$

476. $\left(x^2-3x-10\right)\div(x+2)$

Answer: $x-5$

477. $\left(a^2-2a-35\right)\div(a+5)$

Answer: $a-7$

478. $\left(t^2-12t+36\right)\div(t-6)$

Answer: $t-6$

479. $\left(x^2-14x+49\right)\div(x-7)$

Answer: $x-7$

480. $\left(6m^2-19m-20\right)\div(m-4)$

Answer: $6m+5$

481. $\left(4x^2-17x-15\right)\div(x-5)$

Answer: $4x+3$

482. $\left(q^2+2q+20\right)\div(q+6)$

Answer: $q-4+\frac{44}{q+6}$

483. $\left(p^2+11p+16\right)\div(p+8)$

Answer: $p+3-\dfrac{8}{p+8}$

484. $\left(y^2-3y-15\right)\div(y-8)$

Answer: $y+5+\dfrac{25}{y-8}$

485. $\left(x^2+2x-30\right)\div(x-5)$

Answer: $x+7+\dfrac{5}{x-5}$

486. $\left(3b^3+b^2+2\right)\div(b+1)$

Answer: $3b^2-2b+2$

487. $\left(2n^3-10n+24\right)\div(n+3)$

Answer: $2n^2-6n+8$

488. $\left(2y^3-6y-36\right)\div(y-3)$

Answer: $2y^2+6y+12$

489. $\left(7q^3-5q-2\right)\div(q-1)$

Answer: $7q^2+7q+2$

490. $\left(z^3+1\right)\div(z+1)$

Answer: z^2-z+1

491. $\left(m^3+1000\right)\div(m+10)$

Answer: $m^2-10m+100$

492. $\left(a^3-125\right)\div(a-5)$

Answer: $a^2+5a+25$

493. $\left(x^3-216\right)\div(x-6)$

Answer: $x^2+6x+36$

494. $\left(64x^3-27\right)\div(4x-3)$

Answer: $16x^2+12x+9$

495. $\left(125y^3-64\right)\div\left(5y-4\right)$

Answer: $25y^2+20x+16$

Everyday Math

496. **Average cost** Pictures Plus produces digital albums. The company's average cost (in dollars) to make x albums is given by the expression $\frac{7x+500}{x}$.

(a) Find the quotient by dividing the numerator by the denominator.
(b) What will the average cost (in dollars) be to produce 20 albums?

Answer: (a) $7-\frac{500}{x}$ (b) $32

497. **Handshakes** At a company meeting, every employee shakes hands with every other employee. The number of handshakes is given by the expression $\frac{n^2-n}{2}$, where n represents the number of employees. How many handshakes will there be if there are 10 employees at the meeting?

Answer: 45

Writing Exercises

498. James divides $48y+6$ by 6 this way: $\frac{48y+\cancel{6}}{\cancel{6}}=48y$. What is wrong with his reasoning?

Answer: Answers will vary.

499. Divide $\frac{10x^2+x-12}{2x}$ and explain with words how you get each term of the quotient.

Answer: Answers will vary.

Elementary Algebra
6: Polynomials
6.7 Integer Exponents and Scientific Notation

Use the Definition of a Negative Exponent In the following exercises, simplify.

500. (a) 4^{-2} (b) 10^{-3}

Answer: (a) $\frac{1}{16}$ (b) $\frac{1}{1000}$

501. (a) 3^{-4} (b) 10^{-2}

Answer: (a) $\frac{1}{81}$ (b) $\frac{1}{100}$

502. (a) 5^{-3} (b) 10^{-5}

Answer: (a) $\frac{1}{125}$ (b) $\frac{1}{10000}$

503. (a) 2^{-8} (b) 10^{-2}

Answer: (a) $\frac{1}{256}$ (b) $\frac{1}{100}$

504. (a) $\frac{1}{c^{-5}}$ (b) $\frac{1}{3^{-2}}$

Answer: (a) c^5 (b) 9

505. (a) $\frac{1}{c^{-5}}$ (b) $\frac{1}{5^{-2}}$

Answer: (a) c^5 (b) 25

506. (a) $\frac{1}{q^{-10}}$ (b) $\frac{1}{10^{-3}}$

Answer: (a) q^{10} (b) 1000

507. (a) $\frac{1}{t^{-9}}$ (b) $\frac{1}{10^{-4}}$

Answer: (a) t^9 (b) 10000

508. (a) $\left(\frac{5}{8}\right)^{-2}$ (b) $\left(-\frac{3m}{n}\right)^{-2}$

Answer: (a) $\frac{64}{25}$ (b) $\frac{n^2}{9m^2}$

509. (a) $\left(\frac{3}{10}\right)^{-2}$ (b) $\left(-\frac{2}{cd}\right)^{-3}$

Answer: (a) $\frac{100}{9}$ (b) $-\frac{c^3d^3}{8}$

510. (a) $\left(\frac{4}{9}\right)^{-3}$ (b) $\left(-\frac{u^2}{2v}\right)^{-5}$

Answer: (a) $\frac{729}{64}$ (b) $-\frac{32v^5}{u^{10}}$

511. (a) $\left(\frac{7}{2}\right)^{-3}$ (b) $\left(-\frac{3}{xy^2}\right)^{-3}$

Answer: (a) $\frac{8}{343}$ (b) $-\frac{x^3y^6}{27}$

512. (a) $(-5)^{-2}$ (b) -5^{-2} (c) $\left(-\frac{1}{5}\right)^{-2}$ (d) $-\left(\frac{1}{5}\right)^{-2}$

Answer: (a) $\frac{1}{25}$ (b) $-\frac{1}{25}$ (c) 25 (d) -25

513. (a) $(-7)^{-2}$ (b) -7^{-2} (c) $\left(-\frac{1}{7}\right)^{-2}$ (d) $-\left(\frac{1}{7}\right)^{-2}$

Answer: (a) $\frac{1}{49}$ (b) $-\frac{1}{49}$ (c) 49 (d) -49

514. (a) -3^{-3} (b) $\left(-\frac{1}{3}\right)^{-3}$ (c) $-\left(\frac{1}{3}\right)^{-3}$ (d) $(-3)^{-3}$

Answer: (a) $-\frac{1}{27}$ (b) -27 (c) -27 (d) $-\frac{1}{27}$

515. (a) -5^{-3} (b) $\left(-\frac{1}{5}\right)^{-3}$ (c) $-\left(\frac{1}{5}\right)^{-3}$ (d) $(-5)^{-3}$

Answer: (a) $-\frac{1}{125}$ (b) -125 (c) -125 (d) $-\frac{1}{125}$

516. (a) $3 \cdot 5^{-1}$ (b) $(3 \cdot 5)^{-1}$

Answer: (a) $\frac{3}{5}$ (b) $\frac{1}{15}$

517. (a) $2 \cdot 5^{-1}$ (b) $(2 \cdot 5)^{-1}$

Answer: (a) $\frac{2}{5}$ (b) $\frac{1}{10}$

518. (a) $4 \cdot 5^{-2}$ (b) $(4 \cdot 5)^{-2}$

Answer: (a) $\frac{4}{25}$ (b) $\frac{1}{400}$

519. (a) $3 \cdot 4^{-2}$ (b) $(3 \cdot 4)^{-2}$

Answer: (a) $\frac{3}{16}$ (b) $\frac{1}{144}$

520. (a) m^{-4} (b) $\left(x^{3}\right)^{-4}$

Answer: (a) $\frac{1}{m^{4}}$ (b) $\frac{1}{x^{12}}$

521. (a) b^{-5} (b) $\left(k^{2}\right)^{-5}$

Answer: (a) $\frac{1}{b^{5}}$ (b) $\frac{1}{k^{10}}$

522. (a) p^{-10} (b) $\left(q^{6}\right)^{-8}$

Answer: (a) $\frac{1}{p^{10}}$ (b) $\frac{1}{q^{48}}$

523. (a) s^{-8} (b) $\left(a^{9}\right)^{-10}$

Answer: (a) $\frac{1}{s^{8}}$ (b) $\frac{1}{a^{90}}$

524. (a) $7n^{-1}$ (b) $(7n)^{-1}$ (c) $(-7n)^{-1}$

Answer: (a) $\frac{7}{n}$ (b) $\frac{1}{7n}$ (c) $-\frac{1}{7n}$

525. (a) $6r^{-1}$ (b) $(6r)^{-1}$ (c) $(-6r)^{-1}$

Answer: (a) $\frac{6}{r}$ (b) $\frac{1}{6r}$ (c) $-\frac{1}{6r}$

526. (a) $(3p)^{-2}$ (b) $3p^{-2}$ (c) $-3p^{-2}$

Answer: (a) $\frac{1}{9p^2}$ (b) $\frac{3}{p^2}$ (c) $-\frac{3}{p^2}$

527. (a) $(2q)^{-4}$ (b) $2q^{-4}$ (c) $-2q^{-4}$

Answer: (a) $\frac{1}{16q^4}$ (b) $\frac{2}{q^4}$ (c) $-\frac{2}{q^4}$

Simplify Expressions with Integer Exponents In the following exercises, simplify.

528. (a) b^4b^{-8} (b) $r^{-2}r^5$ (c) $x^{-7}x^{-3}$

Answer: (a) $\frac{1}{b^4}$ (b) r^3 (c) $\frac{1}{x^{10}}$

529. (a) $s^3 \cdot s^{-7}$ (b) $q^{-8} \cdot q^3$ (c) $y^{-2} \cdot y^{-5}$

Answer: (a) $\frac{1}{s^4}$ (b) $\frac{1}{q^5}$ (c) $\frac{1}{y^7}$

530. (a) $a^3 \cdot a^{-3}$ (b) $a \cdot a^3$ (c) $a \cdot a^{-3}$

Answer: (a) 1 (b) a^4 (c) $\frac{1}{a^2}$

531. (a) $y^5 \cdot y^{-5}$ (b) $y \cdot y^5$ (c) $y \cdot y^{-5}$

Answer: (a) 1 (b) y^6 (c) $\frac{1}{y^4}$

532. $p^5 \cdot p^{-2} \cdot p^{-4}$

Answer: $\frac{1}{p}$

533. $x^4 \cdot x^{-2} \cdot x^{-3}$

Answer: $\frac{1}{x}$

534. $\left(w^4x^{-5}\right)\left(w^{-2}x^{-4}\right)$

Answer: $\frac{w^2}{x^9}$

535. $\left(m^3n^{-3}\right)\left(m^{-5}n^{-1}\right)$

Answer: $\dfrac{1}{m^2n^4}$

536. $\left(uv^{-2}\right)\left(u^{-5}v^{-3}\right)$

Answer: $\dfrac{1}{u^4v^5}$

537. $\left(pq^{-4}\right)\left(p^{-6}q^{-3}\right)$

Answer: $\dfrac{1}{p^5q^7}$

538. $\left(-6c^{-3}d^9\right)\left(2c^4d^{-5}\right)$

Answer: $-\dfrac{12d^4}{c}$

539. $\left(-2j^{-5}k^8\right)\left(7j^2k^{-3}\right)$

Answer: $-\dfrac{14k^5}{j^3}$

540. $\left(-4r^{-2}s^{-8}\right)\left(9r^4s^3\right)$

Answer: $-\dfrac{36r^2}{s^5}$

541. $\left(-5m^4n^6\right)\left(8m^{-5}n^{-3}\right)$

Answer: $-\dfrac{40n^3}{m}$

542. $\left(5x^2\right)^{-2}$

Answer: $\dfrac{1}{25x^4}$

543. $\left(4y^3\right)^{-3}$

Answer: $\dfrac{1}{64y^9}$

544. $\left(3z^{-3}\right)^2$

Answer: $\frac{9}{z^6}$

545. $\left(2p^{-5}\right)^2$

Answer: $\frac{4}{p^{10}}$

546. $\frac{t^9}{t^{-3}}$

Answer: t^{12}

547. $\frac{n^5}{n^{-2}}$

Answer: n^7

548. $\frac{x^{-7}}{x^{-3}}$

Answer: $\frac{1}{x^4}$

549. $\frac{y^{-5}}{y^{-10}}$

Answer: y^5

Convert from Decimal Notation to Scientific Notation In the following exercises, write each number in scientific notation.

550. 57,000

Answer: 5.7×10^4

551. 340,000

Answer: 3.4×10^5

552. 8,750,000

Answer: 8.75×10^6

553. 1,290,000

Answer: 1.29×10^6

554. 0.026
Answer: 2.6×10^{-2}

555. 0.041
Answer: 4.1×10^{-2}

556. 0.00000871
Answer: 8.71×10^{-6}

557. 0.00000103
Answer: 1.03×10^{-6}

Convert Scientific Notation to Decimal Form In the following exercises, convert each number to decimal form.

558. 5.2×10^{2}
Answer: 520

559. 8.3×10^{2}
Answer: 830

560. 7.5×10^{6}
Answer: 7,500,000

561. 1.6×10^{10}
Answer: 16,000,000,000

562. 2.5×10^{-2}
Answer: 0.025

563. 3.8×10^{-2}
Answer: 0.038

564. 4.13×10^{-5}
Answer: 0.0000413

565. 1.93×10^{-5}
Answer: 0.0000193

Multiply and Divide Using Scientific Notation In the following exercises, multiply. Write your answer in decimal form.

566. $\left(3\times10^{-5}\right)\left(3\times10^{9}\right)$

Answer: 90,000

567. $\left(2\times10^{2}\right)\left(1\times10^{-4}\right)$

Answer: 0.02

568. $\left(7.1\times10^{-2}\right)\left(2.4\times10^{-4}\right)$

Answer: 1.704×10^{-7}

569. $\left(3.5\times10^{-4}\right)\left(1.6\times10^{-2}\right)$

Answer: 5.6×10^{-6}

In the following exercises, divide. Write your answer in decimal form.

570. $\frac{7\times10^{-3}}{1\times10^{-7}}$

Answer: 70,000

571. $\frac{5\times10^{-2}}{1\times10^{-10}}$

Answer: 500,000,000

572. $\frac{6\times10^{4}}{3\times10^{-2}}$

Answer: 2,000,000

573. $\frac{8\times10^{6}}{4\times10^{-1}}$

Answer: 20,000,000

Everyday Math

574. The population of the United States on July 4, 2010 was almost 310,000,000. Write the number in scientific notation.

Answer: 3.1×10^{8}

575. The population of the world on July 4, 2010 was more than 6,850,000,000. Write the number in scientific notation

Answer: 6.85×10^{9}.

576. The average width of a human hair is 0.0018 centimeters. Write the number in scientific notation.

Answer: 1.8×10^{-3}

577. The probability of winning the 2010 Megamillions lottery is about 0.0000000057. Write the number in scientific notation.

Answer: 5.7×10^{-9}

578. In 2010, the number of Facebook users each day who changed their status to 'engaged' was 2×10^{4}. Convert this number to decimal form.

Answer: 20,000

579. At the start of 2012, the US federal budget had a deficit of more than $\$1.5\times10^{13}$. Convert this number to decimal form.

Answer: 15,000,000,000,000

580. The concentration of carbon dioxide in the atmosphere is 3.9×10^{-4}. Convert this number to decimal form.

Answer: 0.00039

581. The width of a proton is 1×10^{-5} of the width of an atom. Convert this number to decimal form.

Answer: 0.00001

582. **Health care costs** The Centers for Medicare and Medicaid projects that consumers will spend more than $4 trillion on health care by 2014.
(a) Write 4 trillion in decimal notation.
(b) Write 4 trillion in scientific notation.

Answer: (a) 4,000,000,000,000 (b) 4×10^{12}

583. **Coin production** In 1942, the U. S. Mint produced 154,500,000 nickels. Write 154,500,000 in scientific notation.

Answer: 1.545×10^{8}

584. **Distance** The distance between Earth and one of the brightest stars in the night star is 33.7 light years. One light year is about 6,000,000,000,000 (6 trillion), miles.
(a) Write the number of miles in one light year in scientific notation.
(b)Use scientific notation to find the distance between Earth and the star in miles. Write the answer in scientific notation.
Answer: (a) 6×10^{12} (b) 2.022×10^{14}

585. **Debt** At the end of fiscal year 2015 the gross United States federal government debt is estimated to be approximately $18,600,000,000,000 ($18.6 trillion), according to the Federal Budget. The population of the United States will be approximately 300,000,000 people at the end of fiscal year 2015.
(a) Write the debt in scientific notation.
(b) Write the population in scientific notation.
(c) Find the amount of debt per person by using scientific notation to divide the debt by the population. Write the answer in scientific notation.
Answer: (a) 1.86×10^{13} (b) 3×10^{8} (c) 6.2×10^{4}

Writing Exercises

586. (a) Explain the meaning of the exponent in the expression 2^3.
(b) Explain the meaning of the exponent in the expression 2^{-3}.
Answer: (a) answers will vary (b) answers will vary

587. When you convert a number from decimal notation to scientific notation, how do you know if the exponent will be positive or negative?
Answer: answers will vary

Chapter Review

6.1 Add and Subtract Polynomials

Identify Polynomials, Monomials, Binomials and Trinomials In the following exercises, determine if each of the following polynomials is a monomial, binomial, trinomial, or other polynomial.

588.
(a) $11c^4 - 23c^2 + 1$
(b) $9p^3 + 6p^2 - p - 5$
(c) $\frac{3}{7}x + \frac{5}{14}$
(d) 10
(e) $2y - 12$
Answer: (a) trinomial (b) other polynomial (c) binomial (d) monomial (e) binomial

589.
(a) $a^2 - b^2$
(b) $24d^3$
(c) $x^2 + 8x - 10$
(d) $m^2n^2 - 2mn + 6$
(e) $7y^3 + y^2 - 2y - 4$
Answer: (a) binomial (b) monomial (c) trinomial (d) trinomial (e) other polynomial

Determine the Degree of Polynomials In the following exercises, determine the degree of each polynomial.

590.
(a) $3x^2 + 9x + 10$
(b) $14a^2bc$
(c) $6y + 1$
(d) $n^3 - 4n^2 + 2n - 8$
(e) -19
Answer: (a) 2 (b) 4 (c) 1 (d) 3 (e) 0

591.
(a) $5p^3 - 8p^2 + 10p - 4$
(b) $-20q^4$
(c) $x^2 + 6x + 12$
(d) $23r^2s^2 - 4rs + 5$
(e) 100
Answer: (a) 3 (b) 4 (c) 2 (d) 4 (e) 0

Add and Subtract Monomials In the following exercises, add or subtract the monomials.

592. $5y^3 + 8y^3$

Answer: $13y^3$

593. $-14k + 19k$

Answer: $5k$

594. $12q - (-6q)$

Answer: $18q$

595. $-9c - 18c$

Answer: $-27c$

596. $12x - 4y - 9x$

Answer: $3x - 4y$

597. $3m^2 + 7n^2 - 3m^2$

Answer: $7n^2$

598. $6x^2y - 4x + 8xy^2$

Answer: $6x^2y - 4x + 8xy^2$

599. $13a + b$

Answer: $13a + b$

Add and Subtract Polynomials In the following exercises, add or subtract the polynomials.

600. $(5x^2 + 12x + 1) + (6x^2 - 8x + 3)$

Answer: $11x^2 + 4x + 4$

601. $(9p^2 - 5p + 3) + (4p^2 - 4)$

Answer: $13p^2 - 5p - 1$

602. $(10m^2 - 8m - 1) - (5m^2 + m - 2)$

Answer: $5m^2 - 9m + 1$

603. $(7y^2 - 8y) - (y - 4)$

Answer: $7y^2 - 9y + 4$

604. Subtract $\left(3s^2+10\right)$ from $\left(15s^2-2s+8\right)$

Answer: $12s^2-2s-2$

605. Find the sum of $\left(a^2+6a+9\right)$ and $\left(5a^3-7\right)$

Answer: $5a^3+a^2+6a+2$

Evaluate a Polynomial for a Given Value of the Variable In the following exercises, evaluate each polynomial for the given value.

606. Evaluate $3y^2-y+1$ when:
(a) $y=5$
(b) $y=-1$
(c) $y=0$

Answer: (a) 71 (b) 5 (c) 1

607. Evaluate $10-12x$ when:
(a) $x=3$
(b) $x=0$
(c) $x=-1$

Answer: (a) -26 (b) 10 (c) 22

608. Randee drops a stone off the 200 foot high cliff into the ocean. The polynomial $-16t^2+200$ gives the height of a stone t seconds after it is dropped from the cliff. Find the height after $t=3$ seconds.

Answer: 56 feet

609. A manufacturer of stereo sound speakers has found that the revenue received from selling the speakers at a cost of p dollars each is given by the polynomial $-4p^2+460p$. Find the revenue received when $p=75$ dollars.

Answer: 12,000

6.2 Use Multiplication Properties of Exponents

Simplify Expressions with Exponents In the following exercises, simplify.

610. 10^4

Answer: 10,000

611. 17^1

Answer: 17

612. $\left(\frac{2}{9}\right)^2$

Answer: $\frac{4}{81}$

613. $(0.5)^3$

Answer: 0. 125

614. $(-2)^6$

Answer: 64

615. -2^6

Answer: -64

Simplify Expressions Using the Product Property for Exponents In the following exercises, simplify each expression.

616. $x^4 \cdot x^3$

Answer: x^7

617. $p^{15} \cdot p^{16}$

Answer: p^{31}

618. $4^{10} \cdot 4^6$

Answer: 4^{16}

619. $8 \cdot 8^5$

Answer: 8^6

620. $n \cdot n^2 \cdot n^4$

Answer: n^7

621. $y^c \cdot y^3$

Answer: y^{c+3}

Simplify Expressions Using the Power Property for Exponents In the following exercises, simplify each expression.

622. $(m^3)^5$

Answer: m^{15}

623. $(5^3)^2$

Answer: 5^6

624. $\left(y^4\right)^x$

Answer: y^{4x}

625. $\left(3^r\right)^s$

Answer: 3^{rs}

Simplify Expressions Using the Product to a Power Property In the following exercises, simplify each expression.

626. $(4a)^2$

Answer: $16a^2$

627. $(-5y)^3$

Answer: $-125y^3$

628. $(2mn)^5$

Answer: $32m^5n^5$

629. $(10xyz)^3$

Answer: $1000x^3y^3z^3$

Simplify Expressions by Applying Several Properties In the following exercises, simplify each expression.

630. $\left(p^2\right)^5 \cdot \left(p^3\right)^6$

Answer: p^{28}

631. $(4a^3b^2)^3$

Answer: $64a^9b^6$

632. $(5x)^2(7x)$

Answer: $175x^3$

633. $(2q^3)^4(3q)^2$

Answer: $48q^{14}$

634. $\left(\frac{1}{3}x^2\right)^2\left(\frac{1}{2}x\right)^3$

Answer: $\frac{1}{72}x^7$

635. $\left(\frac{2}{5}m^2n\right)^3$

Answer: $\frac{8}{125}m^6n^3$

Multiply Monomials In the following exercises8, multiply the monomials.

636. $\left(-15x^2\right)\left(6x^4\right)$

Answer: $-90x^6$

637. $(-9n^7)(-16n)$

Answer: $144n^8$

638. $(7p^5q^3)(8pq^9)$

Answer: $56p^6q^{12}$

639. $\left(\frac{5}{9}ab^2\right)\left(27ab^3\right)$

Answer: $15a^2b^5$

6.3 Multiply Polynomials

Multiply a Polynomial by a Monomial In the following exercises, multiply.

640. $7(a+9)$

Answer: $7a+63$

641. $-4(y+13)$

Answer: $-4y-52$

642. $-5(r-2)$

Answer: $-5r+10$

643. $p(p+3)$

Answer: p^2+3p

644. $-m(m+15)$

Answer: $-m^2-15m$

645. $-6u(2u+7)$

Answer: $-12u^2-42u$

646. $9(b^2+6b+8)$

Answer: $9b^2+54b+72$

647. $3q^2(q^2-7q+6)$ 3

Answer: $3q^4-21q^3+18q^2$

648. $(5z-1)z$

Answer: $5z^2-z$

649. $(b-4)\cdot 11$

Answer: $11b-44$

Multiply a Binomial by a Binomial In the following exercises, multiply the binomials using: (a) the Distributive Property, (b) the FOIL method, (c) the Vertical Method.

650. $(x-4)(x+10)$

Answer: (a) $x^2+6x-40$ (b) $x^2+6x-40$ (c) $x^2+6x-40$

651. $(6y-7)(2y-5)$

Answer: (a) $12y^2-44y+35$ (b) $12y^2-44y+35$ (c) $12y^2-44y+35$

In the following exercises, multiply the binomials. Use any method.

652. $(x+3)(x+9)$

Answer: $x^2+12x+27$

653. $(y-4)(y-8)$

Answer: $y^2-12y+32$

654. $(p-7)(p+4)$

Answer: $p^2-3p-28$

655. $(q+16)(q-3)$

Answer: $q^2+13q-48$

656. $(5m-8)(12m+1)$

Answer: $60m^2-91m-8$

657. $(u^2+6)(u^2-5)$

Answer: u^4+u^2-30

658. $(9x-y)(6x-5)$

Answer: $54x^2-45x-6xy+5y$

659. $(8mn+3)(2mn-1)$

Answer: $16m^2n^2-2mn-3$

Multiply a Trinomial by a Binomial In the following exercises, multiply using (a) the Distributive Property, (b) the Vertical Method.

660. $(n+1)(n^2+5n-2)$

Answer: (a) n^3+6n^2+3n-2 (b) n^3+6n^2+3n-2

661. $(3x-4)(6x^2+x-10)$

Answer: (a) $18x^3-21x^2-34x+40$ (b) $18x^3-21x^2-34x+40$

In the following exercises, multiply. Use either method.

662. $(y-2)(y^2-8y+9)$

Answer: $y^3-10y^2+25y-18$

663. $(7m+1)(m^2-10m-3)$

Answer: $7m^3-69m^2-31m-3$

6.4 Special Products

Square a Binomial Using the Binomial Squares Pattern In the following exercises, square each binomial using the Binomial Squares Pattern.

664. $(c+11)^2$

Answer: $c^2+22c+121$

665. $(q-15)^2$

Answer: $q^2-30q+225$

666. $\left(x+\frac{1}{3}\right)^2$

Answer: $x^2+\frac{2}{3}x+\frac{1}{9}$

667. $(8u+1)^2$

Answer: $64u^2+16u+1$

668. $(3n^3-2)^2$

Answer: $9n^6-12n^3+4$

669. $\left(4a-3b\right)^2$

Answer: $16a^2-24ab+9b^2$

Multiply Conjugates Using the Product of Conjugates Pattern In the following exercises, multiply each pair of conjugates using the Product of Conjugates Pattern.

670. $(s-7)(s+7)$

Answer: s^2-49

671. $\left(y+\frac{2}{5}\right)\left(y-\frac{2}{5}\right)$

Answer: $y^2-\frac{4}{25}$

672. $(12c+13)(12c-13)$

Answer: $144c^2-169$

673. $(6-r)(6+r)$

Answer: $36-r^2$

674. $\left(u+\frac{3}{4}v\right)\left(u-\frac{3}{4}v\right)$

Answer: $u^2-\frac{9}{16}v^2$

675. $(5p^4-4q^3)(5p^4+4q^3)$

Answer: $25p^8-16q^6$

Recognize and Use the Appropriate Special Product Pattern In the following exercises, find each product.

676. $(3m+10)^2$

Answer: $9m^2+30m+100$

677. $(6a+11)(6a-11)$

Answer: $36a^2-121$

678. $(5x+y)(x-5y)$

Answer: $5x^2-24xy-5y^2$

679. $(c^4+9d)^2$

Answer: $c^8+18c^4d+81d^2$

680. $(p^5+q^5)(p^5-q^5)$

Answer: $p^{10}-q^{10}$

681. $(a^2+4b)(4a-b^2)$

Answer: $4a^3+3a^2b-4b^3$

6.5 Divide Monomials

Simplify Expressions Using the Quotient Property for Exponents In the following exercises, simplify.

682. $\frac{u^{24}}{u^6}$

Answer: u^{18}

683. $\frac{10^{25}}{10^5}$

Answer: 10^{20}

684. $\frac{3^4}{3^6}$

Answer: $\frac{1}{9}$

685. $\frac{v^{12}}{v^{48}}$

Answer: $\frac{1}{v^{36}}$

686. $\frac{x}{x^5}$

Answer: $\frac{1}{x^4}$

687. $\frac{5}{5^8}$

Answer: $\frac{1}{5^7}$

Simplify Expressions with Zero Exponents In the following exercises, simplify.

688. 75^0

Answer: 1

689. x^0

Answer: 1

690. -12^0

Answer: -1

691. $\left(-12^0\right)\left(-12\right)^0$

Answer: 1

692. $25x^0$

Answer: 25

693. $\left(25x\right)^0$

Answer: 1

694. $19n^0 - 25m^0$

Answer: -6

695. $(19n)^0 - (25m)^0$

Answer: 0

Simplify Expressions Using the Quotient to a Power Property In the following exercises, simplify.

696. $\left(\frac{2}{5}\right)^3$

Answer: $\frac{8}{125}$

697. $\left(\frac{m}{3}\right)^4$

Answer: $\frac{m^4}{81}$

698. $\left(\frac{r}{s}\right)^8$

Answer: $\frac{r^8}{s^8}$

699. $\left(\frac{x}{2y}\right)^6$

Answer: $\frac{x^6}{64y^6}$

Simplify Expressions by Applying Several Properties In the following exercises, simplify.

700. $\frac{\left(x^3\right)^5}{x^9}$

Answer: x^6

701. $\frac{n^{10}}{\left(n^5\right)^2}$

Answer: 1

702. $\left(\frac{q^6}{q^8}\right)^3$

Answer: $\frac{1}{q^6}$

703. $\left(\frac{r^8}{r^3}\right)^4$

Answer: r^{20}

704. $\left(\frac{c^2}{d^5}\right)^9$

Answer: $\frac{c^{18}}{d^{45}}$

705. $\left(\frac{3x^4}{2y^2}\right)^5$

Answer: $\frac{343x^{20}}{32y^{10}}$

706. $\left(\frac{v^3v^9}{v^6}\right)^4$

Answer: v^{24}

707. $\frac{\left(3n^2\right)^4\left(-5n^4\right)^3}{\left(-2n^5\right)^2}$

Answer: $-\frac{10{,}125n^{10}}{4}$

Divide Monomials In the following exercises, divide the monomials.

708. $-65y^{14} \div 5y^2$

Answer: $-13y^{12}$

709. $\frac{64a^5b^9}{-16a^{10}b^3}$

Answer: $-\frac{4b^6}{a^5}$

710. $\frac{144x^{15}y^8z^3}{18x^{10}y^2z^{12}}$

Answer: $\frac{8x^5y^6}{z^9}$

711. $\frac{\left(8p^6q^2\right)\left(9p^3q^5\right)}{16p^8q^7}$

Answer: $\frac{9p}{2}$

6.6 Divide Polynomials

Divide a Polynomial by a Monomial In the following exercises, divide each polynomial by the monomial.

712. $\frac{42z^2-18z}{6}$

Answer: $7z^2-3z$

713. $\left(35x^2-75x\right)\div 5x$

Answer: $7x-15$

714. $\frac{81n^4+105n^2}{-3}$

Answer: $-27n^4-35n^2$

715. $\frac{550p^6-300p^4}{10p^3}$

Answer: $55p^3-30p$

716. $\left(63xy^3+56x^2y^4\right)\div\left(7xy\right)$

Answer: $9y^2-8xy^3$

717. $\frac{96a^5b^2-48a^4b^3-56a^2b^4}{8ab^2}$

Answer: $12a^4-6a^3b-7ab^2$

718. $\frac{57m^2-12m+1}{-3m}$

Answer: $-19m+4-\frac{1}{3m}$

719. $\frac{105y^5+50y^3-5y}{5y^3}$

Answer: $21y^2+10-\frac{1}{y^2}$

Divide a Polynomial by a Binomial In the following exercises, divide each polynomial by the binomial.

720. $\left(k^2-2k-99\right)\div(k+9)$

Answer: $k-11$

721. $\left(v^2-16v+64\right)\div(v-8)$

Answer: $v-8$

722. $\left(3x^2-8x-35\right)\div(x-5)$

Answer: $3x+7$

723. $\left(n^2-3n-14\right)\div(n+3)$

Answer: $n-6+\frac{4}{n+3}$

724. $\left(4m^3+m-5\right)\div(m-1)$

Answer: $4m^2+4m+5$

725. $\left(u^3-8\right)\div(u-2)$

Answer: u^2+2u+4

6.7 Integer Exponents and Scientific Notation

Use the Definition of a Negative Exponent In the following exercises, simplify.

726. 9^{-2}

Answer: $\frac{1}{81}$

727. $(-5)^{-3}$

Answer: $-\frac{1}{125}$

728. $3\cdot 4^{-3}$

Answer: $\frac{3}{64}$

729. $(6u)^{-3}$

Answer: $\frac{1}{216u^3}$

730. $\left(\frac{2}{5}\right)^{-1}$

Answer: $\frac{5}{2}$

731. $\left(\frac{3}{4}\right)^{-2}$

Answer: $\frac{16}{9}$

Simplify Expressions with Integer Exponents In the following exercises, simplify.

732. $p^{-2} \cdot p^{8}$

Answer: p^{6}

733. $q^{-6} \cdot q^{-5}$

Answer: $\frac{1}{q^{11}}$

734. $\left(c^{-2}d\right)\left(c^{-3}d^{-2}\right)$

Answer: $\frac{1}{c^{5}d}$

735. $\left(y^{8}\right)^{-1}$

Answer: $\frac{1}{y^{8}}$

736. $\left(q^{-4}\right)^{-3}$

Answer: q^{12}

737. $\frac{a^{8}}{a^{12}}$

Answer: $\frac{1}{a^{4}}$

738. $\frac{n^{5}}{n^{-4}}$

Answer: n^{9}

739. $\frac{r^{-2}}{r^{-3}}$

Answer: r

Convert from Decimal Notation to Scientific Notation In the following exercises, write each number in scientific notation.

740. 8,500,000

Answer: 8.5×10^{6}

741. 0.00429

Answer: 4.29×10^{-3}

742. The thickness of a dime is about 0.053 inches.

Answer: 5.3×10^{-2}

743. In 2015, the population of the world was about 7,200,000,000 people.

Answer: 7.2×10^{9}

Convert Scientific Notation to Decimal Form In the following exercises, convert each number to decimal form.

744. 3.8×10^{5}

Answer: 380,000

745. 1.5×10^{10}

Answer: 15,000,000,000

746. 9.1×10^{-7}

Answer: 0.00000091

747. 5.5×10^{-1}

Answer: 0.55

Multiply and Divide Using Scientific Notation In the following exercises, multiply and write your answer in decimal form.

748. $\left(2\times10^{5}\right)\left(4\times10^{-3}\right)$

Answer: 800

749. $\left(3.5\times10^{-2}\right)\left(6.2\times10^{-1}\right)$

Answer: 0.0217

In the following exercises, divide and write your answer in decimal form.

750. $\frac{8\times10^{5}}{4\times10^{-1}}$

Answer: 2,000,000

751. $\frac{9\times10^{-5}}{3\times10^{2}}$

Answer: 0.0000003

Chapter Practice Test

752. For the polynomial $10x^4+9y^2-1$
(a) Is it a monomial, binomial, or trinomial?
(b) What is its degree?

Answer: (a) trinomial (b) 4

In the following exercises , simplify each expression.

753. $\left(12a^2-7a+4\right)+\left(3a^2+8a-10\right)$

Answer: $15a^2+a-6$

754. $\left(9p^2-5p+1\right)-\left(2p^2-6\right)$

Answer: $7p^2-5p+7$

755. $\left(-\frac{2}{5}\right)^3$

Answer: $-\frac{8}{125}$

756. $u\cdot u^4$

Answer: u^5

757. $\left(4a^3b^5\right)^2$

Answer: $16a^6b^{10}$

758. $\left(-9r^4s^5\right)\left(4rs^7\right)$

Answer: $-36r^5s^{12}$

759. $3k\left(k^2-7k+13\right)$

Answer: $3k^3-21k^2+39k$

760. $(m+6)(m+12)$

Answer: $m^2+18m+72$

761. $(v-9)(9v-5)$

Answer: $9v^2-86v+45$

762. $(4c-11)(3c-8)$

Answer: $12c^2-65c+88$

763. $(n-6)(n^2-5n+4)$

Answer: $n^3-11n^2+34n-24$

764. $(2x-15y)(5x+7y)$

Answer: $10x^2-61xy-105y^2$

765. $(7p-5)(7p+5)$

Answer: $49p^2-25$

766. $(9v-2)^2$

Answer: $81v^2-36v+4$

767. $\frac{3^8}{3^{10}}$

Answer: $\frac{1}{9}$

768. $\left(\frac{m^4 \cdot m}{m^3}\right)^6$

Answer: m^{12}

769. $(87x^{15}y^3z^{22})^0$

Answer: 1

770. $\frac{80c^8d^2}{16cd^{10}}$

Answer: $\frac{5c^7}{d^8}$

771. $\frac{12x^2+42x-6}{2x}$

Answer: $6x+21-\frac{3}{x}$

772. $\left(70xy^4+95x^3y\right)\div 5xy$

Answer: $14y^3+19x^2$

773. $\frac{64x^3-1}{4x-1}$

Answer: $16x^2+4x+1$

774. $\left(y^2-5y-18\right)\div(y+3)$

Answer: $y-8+\frac{6}{y+3}$

775. 5^{-2}

Answer: $\frac{1}{25}$

776. $(4m)^{-3}$

Answer: $\frac{1}{64m^3}$

777. $q^{-4}\cdot q^{-5}$

Answer: $\frac{1}{q^9}$

778. $\frac{n^{-2}}{n^{-10}}$

Answer: n^8

779. Convert 83,000,000 to scientific notation.

Answer: 8.3×10^7

780. Convert 6.91×10^{-5} to decimal form.

Answer: 0.0000691

In the following exercises, simplify, and write your answer in decimal form.

781. $\left(3.4\times 10^9\right)\left(2.2\times 10^{-5}\right)$

Answer: 74,800

782. $\frac{8.4\times10^{-3}}{4\times10^{3}}$

Answer: 0.0000021

783. A helicopter flying at an altitude of 1000 feet drops a rescue package. The polynomial $-16t^2+1000$ gives the height of the package t seconds a after it was dropped. Find the height when $t=6$ seconds.

Answer: 424 feet

Elementary Algebra
7: Factoring
7.1 Greatest Common Factor and Factor by Grouping

Find the Greatest Common Factor of Two or More Expressions In the following exercises, find the greatest common factor.

1. 8, 18

Answer: 2

2. 24, 40

Answer: 8

3. 72, 162

Answer: 18

4. 150, 275

Answer: 25

5. $10a$, 50

Answer: 10

6. $5b$, 30

Answer: 5

7. $3x$, $10x^2$

Answer: x

8. $21b^2$,$14b$

Answer: $7b$

9. $8w^2$, $24w^3$

Answer: $8w^2$

10. $30x^2$, $18x^3$

Answer: $6x^2$

11. $10p^3q, 12pq^2$

Answer: $2pq$

12. $8a^2b^3, 10ab^2$

Answer: $2ab$

13. $12m^2n^3, 30m^5n^3$

Answer: $6m^2n^3$

14. $28x^2y^4, 42x^4y^4$

Answer: $14x^2y^4$

15. $10a^3, 12a^2, 14a$

Answer: $2a$

16. $20y^3, 28y^2, 40y$

Answer: $4y$

17. $35x^3,\ 10x^4,\ 5x^5$

Answer: $5x^3$

18. $27p^2,\ 45p^3,\ 9p^4$

Answer: $9p^2$

Factor the Greatest Common Factor from a Polynomial In the following exercises, factor the greatest common factor from each polynomial.

19. $4x+20$

Answer: $4(x+5)$

20. $8y\ +\ 16$

Answer: $8(y+2)$

21. $6m\ +\ 9$

Answer: $3(2m+3)$

22. $14p+35$

Answer: $7(2p+5)$

23. $9q+9$

Answer: $9(q+1)$

24. $7r+7$

Answer: $7(r+1)$

25. $8m-8$

Answer: $8(m-1)$

26. $4n-4$

Answer: $4(n-1)$

27. $9n\ -\ 63$

Answer: $9(n-7)$

28. $45b-18$

Answer: $9(5b-2)$

29. $3x^2+6x-9$

Answer: $3(x^2+2x-3)$

30. $4y^2+8y-4$

Answer: $4(y^2+2y-1)$

31. $8p^2+4p+2$

Answer: $2(4p^2+2p+1)$

32. $10q^2+14q+20$

Answer: $2(5q^2+7q+10)$

33. $8y^3+16y^2$

Answer: $8y^2(y+2)$

34. $12x^3-10x$

Answer: $2x(6x^2-5)$

35. $5x^3-15x^2+20x$

Answer: $5x(x^2-3x+4)$

36. $8m^2-40m+16$

Answer: $8(m^2-5m+2)$

37. $12xy^2+18x^2y^2-30y^3$

Answer: $6y^2(2x+3x^2-5y)$

38. $21pq^2 + 35p^2q^2 - 28q^3$

Answer: $7q^2(3p + 5p^2 - 4q)$

39. $-2x - 4$

Answer: $-2(x + 2)$

40. $-3b + 12$

Answer: $-3(b - 4)$

41. $5x(x + 1) + 3(x + 1)$

Answer: $(x + 1)(5x + 3)$

42. $2x(x - 1) + 9(x - 1)$

Answer: $(x - 1)(2x + 9)$

43. $3b(b - 2) - 13(b - 2)$

Answer: $(b - 2)(3b - 13)$

44. $6m(m - 5) - 7(m - 5)$

Answer: $(m - 5)(6m - 7)$

Factor by Grouping In the following exercises, factor by grouping.

45. $xy + 2y + 3x + 6$

Answer: $(y + 3)(x + 2)$

46. $mn + 4n + 6m + 24$

Answer: $(n + 6)(m + 4)$

47. $uv - 9u + 2v - 18$

Answer: $(u + 2)(v - 9)$

48. $pq - 10p + 8q - 80$

Answer: $(p + 8)(q - 10)$

49. $b^2 + 5b - 4b - 20$

Answer: $(b - 4)(b + 5)$

50. $m^2+6m-12m-72$

Answer: $(m+6)(m-12)$

51. $p^2+4p-9p-36$

Answer: $(p-9)(p+4)$

52. $x^2+5x-3x-15$

Answer: $(x+5)(x-3)$

Mixed Practice In the following exercises, factor.

53. $-20x-10$

Answer: $-10(2x+1)$

54. $5x^3-x^2+x$

Answer: $x(5x^2-x+1)$

55. $3x^3-7x^2+6x-14$

Answer: $(x^2+2)(3x-7)$

56. x^3+x^2-x-1

Answer: $(x^2-1)(x+1)$

57. $x^2+xy+5x+5y$

Answer: $(x+y)(x+5)$

58. $5x^3-3x^2-5x-3\ 5x^3+3x^2-5x-3$

Answer: $(5x+3)(x^2-1)$

Everyday Math

59. **Area of a rectangle** The area of a rectangle with length 6 less than the width is given by the expression w^2-6w, where $w=$ width. Factor the greatest common factor from the polynomial.

Answer: $w(w-6)$

60. **Height of a baseball** The height of a baseball *t* seconds after it is hit is given by the expression $-16t^2+80t+4$. Factor the greatest common factor from the polynomial.

Answer: $-4(4t^2-20t-1)$

Writing Exercises

61. The greatest common factor of 36 and 60 is 12. Explain what this means.

Answer: Answers will vary.

62. What is the GCF of y^4, y^5, and y^{10}? Write a general rule that tells you how to find the GCF of y^a, y^b, and y^c.

Answer: Answers will vary.

Elementary Algebra
7: Factoring
7.2 Factor Trinomials of the Form x^2+bx+c

Factor Trinomials of the Form x^2+bx+c In the following exercises, factor each trinomial of the form x^2+bx+c.

63. x^2+4x+3

Answer: $(x+1)(x+3)$

64. y^2+8y+7

Answer: $(y+1)(y+7)$

65. $m^2+12m+11$

Answer: $(m+1)(m+11)$

66. $b^2+12b+13$ $b^2+14b+13$

Answer: $(x+1)(x+13)$

67. $a^2+9a+20$

Answer: $(a+4)(a+5)$

68. $m^2+7m+12$

Answer: $(m+3)(m+4)$

69. $p^2+11p+30$

Answer: $(p+5)(p+6)$

70. $w^2+10x+21$

Answer: $(w+3)(w+7)$

71. $n^2+19n+48$

Answer: $(n+3)(n+16)$

72. $b^2+14b+48$

Answer: $(b+6)(b+8)$

73. $a^2+25a+100$

Answer: $(a+5)(a+20)$

74. $u^2+101u+100$

Answer: $(u+1)(u+100)$

75. $x^2-8x+12$

Answer: $(x-2)(x-6)$

76. $q^2-13q+36$

Answer: $(q-4)(q-9)$

77. $y^2-18y+45$

Answer: $(y-3)(y-15)$

78. $m^2-13m+30$

Answer: $(m-10)(m-3)$

79. x^2-8x+7

Answer: $(x-1)(x-7)$

80. y^2-5y+6

Answer: $(y-1)(y-7)$ $(y-2)(y-3)$

81. p^2+5p-6

Answer: $(p-1)(p+6)$

82. n^2+6n-7

Answer: $(n-1)(n+7)$

83. y^2-6y-7

Answer: $(y+1)(y-7)$

84. v^2-2v-3

Answer: $(v+1)(v-3)$

85. x^2-x-12

Answer: $(x-4)(x+3)$

86. r^2-2r-8

Answer: $(r-4)(r+2)$

87. $a^2-3a-28$
Answer: $(a-7)(a+4)$

88. $b^2-13b-30$
Answer: $(b-15)(b+2)$

89. $w^2-5w-36$
Answer: $(w-9)(w+4)$

90. $t^2-3t-54$
Answer: $(t+6)(t-9)$

91. x^2+x+5
Answer: prime

92. x^2-3x-9
Answer: prime

93. $8-6x+x^2$
Answer: $(x-4)(x-2)$

94. $7x+x^2+6$
Answer: $(x+1)(x+6)$

95. $x^2-12-11x$
Answer: $(x-12)(x+1)$

96. $-11-10x+x^2$
Answer: $(x-11)(x+1)$

Factor Trinomials of the Form $x^2+bx+cy^2$ For the following exercises, factor each trinomial of the form $x^2+bxy+cy^2$.

97. $p^2+3pq+2q^2$
Answer: $(p+q)(p+2q)$

98. $m^2+6mn+5n^2$
Answer: $(m+n)(m+5n)$

99. $r^2+15rs+36s^2$
Answer: $(r+3s)(r+12s)$

100. $u^2+10uv+24v^2$
Answer: $(u+4v)(u+6v)$

101. $m^2-12mn+20n^2$
Answer: $(m-2n)(m-10n)$

102. $p^2-16pq+63q^2$
Answer: $(p-7q)(p-9q)$

103. $x^2-2xy-80y^2$
Answer: $(x+8y)(x-10y)$

104. $p^2-8pq-65q^2$
Answer: $(p+5q)(p-13q)$

105. $m^2-64mn-65n^2$
Answer: $(m+n)(m-65n)$

106. $p^2-2pq-35q^2$
Answer: $(p-7q)(p+5q)$

107. $a^2+5ab-24b^2$
Answer: $(a+8b)(a-3b)$

108. $r^2+3rs-28s^2$
Answer: $(r+7s)(r-4s)$

109. $x^2-3xy-14y^2$
Answer: prime

110. $u^2-8uv-24v^2$
Answer: prime

111. $m^2-5mn+30n^2$
Answer: prime

112. $c^2-7cd+18d^2$
Answer: prime

Mixed Practice For the following exercises, factor each expression.

113. $u^2-12u+36$
Answer: $(u-6)(u-6)$

114. $w^2+4w-32$
Answer: $(w+8)(w-4)$

115. $x^2-14x-32$
Answer: $(x+2)(x-16)$

116. $y^2+41y+40$
Answer: $(y+1)(y+40)$

117. $r^2-20rs+64s^2$
Answer: $(r-4s)(r-16s)$

118. $x^2-16xy+64y^2$
Answer: $(x-8y)(x-8y)$

119. $k^2+34k+120$
Answer: $(k+4)(k+30)$

120. $m^2+29m+120$
Answer: $(m+5)(m+24)$

121. $y^2+10y+15$
Answer: prime

122. $z^2-3z+28$
Answer: prime

123. $m^2+mn-56n^2$
Answer: $(m+8n)(m-7n)$

124. $q^2-29qr-96r^2$
Answer: $(q+3r)(q-32r)$

125. $u^2-17uv+30v^2$
Answer: $(u-15v)(u-2v)$

126. $m^2-31mn+30n^2$
Answer: $(m-n)(m-30n)$

127. $c^2-8cd+26d^2$
Answer: prime

128. $r^2+11rs+36s^2$
Answer: prime

Everyday Math

129. **Consecutive integers** Deirdre is thinking of two consecutive integers whose product is 56. The trinomial x^2+x-56 describes how these numbers are related. Factor the trinomial.
Answer: $(x+8)(x-7)$

130. **Consecutive integers** Deshawn is thinking of two consecutive integers whose product is 182. The trinomial $x^2+x-182$ describes how these numbers are related. Factor the trinomial.
Answer: $(x+14)(x-13)$

Writing Exercises

131. Many trinomials of the form x^2+bx+c factor into the product of two binomials $(x+m)(x+n)$. Explain how you find the values of m and n.
Answer: Answers may vary

132. How do you determine whether to use plus or minus signs in the binomial factors of a trinomial of the form x^2+bx+c where b and c may be positive or negative numbers?
Answer: Answers may vary

133. Will factored x^2-x-20 as $(x+5)(x-4)$. Bill factored it as $(x+4)(x-5)$. Phil factored it as $(x-5)(x-4)$. Who is correct? Explain why the other two are wrong.
Answer: Answers may vary

134. Look at Example 7.19, where we factored $y^2+17y+60$. We made a table listing all pairs of factors of 60 and their sums. Do you find this kind of table helpful? Why or why not?
Answer: Answers may vary

Elementary Algebra
7: Factoring
7.3 Factor Trinomials of the Form ax^2+bx+c

Recognize a Preliminary Strategy to Factor Polynomials Completely In the following exercises, identify the best method to use to factor each polynomial.

135. (a) $10q^2+50$
(b) $a^2-5a-14$
(c) $uv+2u+3v+6$
Answer: (a) factor the GCF, binomial (b) Undo FOIL (c) factor by grouping

136. (a) $n^2+10n+24$
(b) $8u^2+16$
(c) $pq+5p+2q+10$
Answer: (a) undo FOIL (b) factor the GCF, binomial (c) factor by grouping

137. (a) $x^2+4x-21$
(b) $ab+10b+4a+40$
(c) $6c^2+24$
Answer: (a) undo FOIL (b) factor by grouping (c) factor the GCF, binomial

138. (a) $20x^2+100$
(b) $uv+6u+4v+24$
(c) $y^2-8y+15$
Answer: (a) factor the GCF, binomial (b) factor by grouping (c) undo FOIL

Factor Trinomials of the form ax^2+bx+c with a GCF In the following exercises, factor completely.

139. $5x^2+35x+30$
Answer: $5(x+1)(x+6)$

140. $12s^2+24s+12$
Answer: $12(s+1)(s+1)$

141. $2z^2-2z-24$
Answer: $2(z-4)(z+3)$

142. $3u^2-12u-36$
Answer: $3(u+2)(u-6)$

143. $7v^2-63v+56$
Answer: $7(v-1)(v-8)$

144. $5w^2-30w+45$
Answer: $5(w-3)(w-3)$

145. p^3-8p^2-20p
Answer: $p(p-10)(p+2)$

146. q^3-5q^2-24q
Answer: $q(q-8)(q+3)$

147. $3m^3-21m^2+30m$
Answer: $3m(m-5)(m-2)$

148. $11n^3-55n^2+44n$
Answer: $11n(n-4)(n-1)$

149. $5x^4+10x^3-75x^2$
Answer: $5x^2(x-3)(x+5)$

150. $6y^4+12y^3-48y^2$
Answer: $6(y-2)(y+4)$

Factor Trinomials Using Trial and Error In the following exercises, factor.

151. $2t^2+7t+5$
Answer: $(2t+5)(t+1)$

152. $5y^2+16y+11$
Answer: $(5y+11)(y+1)$

153. $11x^2+34x+3$
Answer: $(11x+1)(x+3)$

154. $7b^2+50b+7$
Answer: $(7b+1)(b+7)$

155. $4w^2-5w+1$
Answer: $(4w-1)(w-1)$

156. $5x^2-17x+6$
Answer: $(5x-2)(x-3)$

157. $6p^2-19p+10$

Answer: $(3p-2)(2p-5)$

158. $21m^2-29m+10$

Answer: $(7m-5)(3m-2)$

159. $4q^2-7q-2$

Answer: $(4q+1)(q-2)$

160. $10y^2-53y-11$

Answer: $(5y+1)(2y-11)$

161. $4p^2+17p-15$

Answer: $(4p-3)(p+5)$

162. $6u^2+5u-14$

Answer: $(u+2)(6u-7)$

163. $16x^2-32x+16$

Answer: $16(x-1)(x-1)$

164. $81a^2+153a-18$

Answer: $9(9a-1)(a+2)$

165. $30q^3+140q^2+80q$

Answer: $10q(3q+2)(q+4)$

166. $5y^3+30y^2-35y$

Answer: $5y(y+1)(y-7)$

Factor Trinomials using the 'ac' Method In the following exercises, factor.

167. $5n^2+21n+4$

Answer: $(5n+1)(n+4)$

168. $8w^2+25w+3$

Answer: $(8w+1)(w+3)$

169. $9z^2+15z+4$

Answer: $(3z+1)(3z+4)$

170. $3m^2+26m+48$

Answer: $(3m+8)(m+6)$

171. $4k^2-16k+15$

Answer: $(2k-3)(2k-5)$

172. $4q^2-9q+5$

Answer: $(4q-5)(q-1)$

173. $5s^2-9s+4$

Answer: $(5s-4)(s-1)$

174. $4r^2-20r+25$

Answer: $(2r-5)(2r-5)$

175. $6y^2+y-15$

Answer: $(3y+5)(2y-3)$

176. $6p^2+p-22$

Answer: $(6p-11)(p+2)$

177. $2n^2-27n-45$

Answer: $(2n+3)(n-15)$

178. $12z^2-41z-11$

Answer: $(3z-11)(4z+1)$

179. $3x^2+5x+4$

Answer: prime

180. $4y^2+15y+6$

Answer: prime

181. $60y^2+290y-50$

Answer: $10(6y-1)(y+5)$

182. $6u^2-46u-16$

Answer: $2(3u+1)(u-8)$

183. $48z^3-102z^2-45z$
Answer: $3z(8z+3)(2z-5)$

184. $90n^3+42n^2-216n$
Answer: $6n(5n+9)(3n-4)$

185. $16s^2+40s+24$
Answer: $8(2s+3)(s+1)$

186. $24p^2+160p+96$
Answer: $8(3p+2)(p+6)$

187. $48y^2+12y-36$
Answer: $12(4y-3)(y+1)$

188. $30x^2+105x-60$
Answer: $15(2x-1)(x+4)$

Mixed Practice In the following exercises, factor.

189. $12y^2-29y+14$
Answer: $(4y-7)(3y-2)$

190. $12x^2+36y-24z$
Answer: $12(x^2+3y-2z)$

191. a^2-a-20
Answer: $(a-5)(a+4)$

192. m^2-m-12
Answer: $(m-4)(m+3)$

193. $6n^2+5n-4$
Answer: $(2n-1)(3n+4)$

194. $12y^2-37y+21$
Answer: $(4y-3)(3y-7)$

195. $2p^2+4p+3$
Answer: prime

196. $3q^2+6q+2$

Answer: prime

197. $13z^2+39z-26$

Answer: $13(z^2+3z-2)$

198. $5r^2+25r+30$

Answer: $5(r+2)(r+3)$

199. $x^2+3x-28$

Answer: $(x+7)(x-4)$

200. $6u^2+7u-5$

Answer: $(2u-1)(3u+5)$

201. $3p^2+21p$

Answer: $3p(p+7)$

202. $7x^2-21x$

Answer: $7x(x-3)$

203. $6r^2+30r+36$

Answer: $6(r+2)(r+3)$

204. $18m^2+15m+3$

Answer: $3(2m+1)(3m+1)$

205. $24n^2+20n+4$

Answer: $4(2n+1)(3n+1)$

206. $4a^2+5a+2$

Answer: prime

207. $x^2+2x-24$

Answer: $(x+6)(x-4)$

208. $2b^2-7b+4$

Answer: prime

Everyday Math

209. **Height of a toy rocket** The height of a toy rocket launched with an initial speed of 80 feet per second from the balcony of an apartment building is related to the number of seconds, *t*, since it is launched by the trinomial $-16t^2+80t+96$. Completely factor the trinomial.

Answer: $-16(t-6)(t+1)$

210. **Height of a beach ball** The height of a beach ball tossed up with an initial speed of 12 feet per second from a height of 4 feet is related to the number of seconds, *t*, since it is tossed by the trinomial $-16t^2+12t+4$. Completely factor the trinomial.

Answer: $-4(t-1)(4t+1)$

Writing Exercises

211. List, in order, all the steps you take when using the "ac" method to factor a trinomial of the form ax^2+bx+c.

Answer: Answers may vary.

212. How is the "ac" method similar to the "undo FOIL" method? How is it different?

Answer: Answers may vary.

213. What are the questions, in order, that you ask yourself as you start to factor a polynomial? What do you need to do as a result of the answer to each question?

Answer: Answers may vary.

214. On your paper draw the chart that summarizes the factoring strategy. Try to do it without looking at the book. When you are done, look back at the book to finish it or verify it.

Answer: Answers may vary.

Elementary Algebra
7: Factoring
7.4 Factor Special Products

Factor Perfect Square Trinomials In the following exercises, factor.

215. $16y^2 + 24y + 9$

Answer: $(4y + 3)^2$

216. $25v^2 + 20v + 4$

Answer: $(5v + 2)^2$

217. $36s^2 + 84s + 49$

Answer: $(6s + 7)^2$

218. $49s^2 + 154s + 121$

Answer: $(7s + 11)^2$

219. $100x^2 - 20x + 1$

Answer: $(10x - 1)^2$

220. $64z^2 - 16z + 1$

Answer: $(8z - 1)^2$

221. $25n^2 - 120n + 144$

Answer: $(5n - 12)^2$

222. $4p^2 - 52p + 169$

Answer: $(2p - 13)^2$

223. $49x^2 - 28xy + 4y^2$

Answer: $(7x - 2y)^2$

224. $25r^2 - 60rs + 36s^2$

Answer: $(5r - 6s)^2$

225. $25n^2 + 25n + 4$

Answer: $(5n + 4)(5n + 1)$

226. $100y^2 - 20y + 1$

Answer: $(10y - 1)^2$

227. $64m^2 - 16m + 1$

Answer: $(8m-1)^2$

228. $100x^2 - 25x + 1$

Answer: $(20x-1)(5x-1)$

229. $10k^2 + 80k + 160$

Answer: $10(k+4)^2$

230. $64x^2 - 96x + 36$

Answer: $4(4x-3)^2$

231. $75u^3 - 30u^2v + 3uv^2$

Answer: $3u(5u-v)^2$

232. $90p^3 + 300p^2q + 250pq^2$

Answer: $10p(3p+5q)^2$

Factor Differences of Squares In the following exercises, factor.

233. $x^2 - 16$

Answer: $(x-4)(x+4)$

234. $n^2 - 9$

Answer: $(n-3)(n+3)$

235. $25v^2 - 1$

Answer: $(5v-1)(5v+1)$

236. $169q^2 - 1$

Answer: $(13q-1)(13q+1)$

237. $121x^2 - 144y^2$

Answer: $(11x-12y)(11x+12y)$

238. $49x^2 - 81y^2$

Answer: $(7x-9y)(7x+9y)$

239. $169c^2 - 36d^2$

Answer: $(13c-6d)(13c+6d)$

240. $36p^2 - 49q^2$

Answer: $(6p - 7q)(6p + 7q)$

241. $4 - 49x^2$

Answer: $(7x - 2)(7x + 2)$ $(2 - 7x)(2 + 7x)$

242. $121 - 25s^2$

Answer: $(11 - 5s)(11 + 5s)$

243. $16z^4 - 1$

Answer: $(2z - 1)(2z + 1)(4z^2 + 1)$

244. $m^4 - n^4$

Answer: $(m - n)(m + n)(m^2 + n^2)$

245. $5q^2 - 45$

Answer: $5(q - 3)(q + 3)$

246. $98r^3 - 72r$

Answer: $2r(7r - 6)(7r + 6)$

247. $24p^2 + 54$

Answer: $6\left(4p^2 + 9\right)$

248. $20b^2 + 140$

Answer: $20(b^2 + 7)$

Factor Sums and Differences of Cubes In the following exercises, factor.

249. $x^3 + 125$

Answer: $(x + 5)(x^2 - 5x + 25)$

250. $n^3 + 512$

Answer: $\left(n + 8\right)\left(n^2 - 8n + 64\right)$

251. $z^3 - 27$

Answer: $(z - 3)(z^2 + 3z + 9)$

252. $v^3 - 216$

Answer: $(v - 6)(v^2 + 6v + 36)$

253. $8-343t^3$

Answer: $(2-7t)(4+14t+49t^2)$

254. $125-27w^3$

Answer: $(5-3w)(25+15w+9w^2)$

255. $8y^3-125z^3$

Answer: $(2y-5z)(4y^2+10yz+25z^2)$

256. $27x^3-64y^3$

Answer: $(3x-4y)(9x^2+12xy+16y^2)$

257. $7k^3+56$

Answer: $7(k+2)(k^2-2k+4)$

258. $6x^3-48y^3$

Answer: $6(x-2y)(x^2+2xy+4y^2)$

259. $2-16y^3$

Answer: $2(1-2y)(1+2y+4y^2)$

260. $-2x^3-16y^3$

Answer: $-2(x+2y)(x^2-2xy+4y^2)$

Mixed Practice In the following exercises, factor.

261. $64a^2-25$

Answer: $(8a-5)(8a+5)$

262. $121x^2-144$

Answer: $(11x-12)(11x+12)$

263. $27q^2-3$

Answer: $3(3q-1)(3q+1)$

264. $4p^2-100$

Answer: $4(p-5)(p+5)$

265. $16x^2 - 72x + 81$

Answer: $(4x - 9)^2$

266. $36y^2 + 12y + 1$

Answer: $(6y + 1)^2$

267. $8p^2 + 2$

Answer: $2(4p^2 + 1)$

268. $81x^2 + 169$

Answer: prime

269. $125 - 8y^3$

Answer: $(5 - 2y)(25 + 10y + 4y^2)$

270. $27u^3 + 1000$

Answer: $(3u + 10)(9u^2 - 30u + 100)$

271. $45n^2 + 60n + 20$

Answer: $5(3n + 2)^2$

272. $48q^3 - 24q^2 + 3q$

Answer: $3q(4q - 1)^2$

Everyday Math

273. **Landscaping** Sue and Alan are planning to put a 15 foot square swimming pool in their backyard. They will surround the pool with a tiled deck, the same width on all sides. If the width of the deck is *w*, the total area of the pool and deck is given by the trinomial $4w^2 + 60w + 225$. Factor the trinomial.

Answer: $(2w + 15)^2$

274. **Home repair** The height a twelve foot ladder can reach up the side of a building if the ladder's base is *b* feet from the building is the square root of the binomial $144 - b^2$. Factor the binomial.

Answer: $(12 - b)(12 + b)$

Writing Exercises

275. Why was it important to practice using the binomial squares pattern in the chapter on multiplying polynomials?

Answer: Answers may vary.

276. How do you recognize the binomial squares pattern?

Answer: Answers may vary.

277. Explain why $n^2 + 25 \neq (n + 5)^2$. Use algebra, words, or pictures.

Answer: Answers may vary.

278. Maribel factored $y^2 - 30y + 81$ as $(y - 9)^2$. Was she right or wrong? How do you know?

Answer: Answers may vary.

Elementary Algebra
7: Factoring
7.5 General Strategy for Factoring Polynomials

Recognize and Use the Appropriate Method to Factor a Polynomial Completely In the following exercises, factor completely.

279. $10x^4 + 35x^3$

Answer: $5x^3(2x + 7)$

280. $18p^6 + 24p^3$

Answer: $6p^3\left(3p^3 + 4\right)$

281. $y^2 + 10y - 39$

Answer: $(y - 3)(y + 13)$

282. $b^2 - 17b + 60$

Answer: $(b - 5)(b - 12)$

283. $2n^2 + 13n - 7$

Answer: $(2n - 1)(n + 7)$

284. $8x^2 - 9x - 3$

Answer: prime

285. $a^5 + 9a^3$

Answer: $a^3(a^2 + 9)$

286. $75m^3 + 12m$

Answer: $3m\left(25m^2 + 4\right)$

287. $121r^2 - s^2$

Answer: $(11r - s)(11r + s)$

288. $49b^2 - 36a^2$

Answer: $(7b - 6a)(7b + 6a)$

289. $8m^2 - 32$

Answer: $8(m - 2)(m + 2)$

290. $36q^2 - 100$

Answer: $4(3q - 5)(3q + 5)$

291. $25w^2 - 60w + 36$

Answer: $(5w - 6)^2$

292. $49b^2 - 112b + 64$

Answer: $(7b - 8)^2$

293. $m^2 + 14mn + 49n^2$

Answer: $(m + 7n)^2$

294. $64x^2 + 16xy + y^2$

Answer: $(8x + y)^2$

295. $7b^2 + 7b - 42$

Answer: $7(b + 3)(b - 2)$

296. $3n^2 + 30n + 72$

Answer: $3(n + 6)(n + 4)$

297. $3x^3 - 81$

Answer: $3(x - 3)(x^2 + 3x + 9)$

298. $5t^3 - 40$

Answer: $5(t - 2)(t^2 + 2t + 4)$

299. $k^4 - 16$

Answer: $(k - 2)(k + 2)(k^2 + 4)$

300. $m^4 - 81$

Answer: $(m - 3)(m + 3)(m^2 + 9)$

301. $15pq - 15p + 12q - 12$

Answer: $3(5p + 4)(q - 1)$

302. $12ab - 6a + 10b - 5$

Answer: $(6a + 5)(2b - 1)$

303. $4x^2 + 40x + 84$

Answer: $4(x + 3)(x + 7)$

304. $5q^2 - 15q - 90$

Answer: $5(q+3)(q-6)$

305. u^5+u^2

Answer: $u^2(u+1)(u^2-u+1)$

306. $5n^3+320$

Answer: $5(n+4)(n^2-4n+16)$

307. $4c^2+20cd+81d^2$

Answer: prime

308. $25x^2+35xy+49y^2$

Answer: prime

309. $10m^4-6250$

Answer: $10(m-5)(m+5)(m^2+25)$

310. $3v^4-768$

Answer: $3(v-4)(v+4)(v^2+16)$

Everyday Math

311. **Watermelon drop** A springtime tradition at the University of California San Diego is the Watermelon Drop, where a watermelon is dropped from the seventh story of Urey Hall.
(a) The binomial $-16t^2+80$ gives the height of the watermelon t seconds after it is dropped. Factor the greatest common factor from this binomial.
(b) If the watermelon is thrown down with initial velocity 8 feet per second, its height after t seconds is given by the trinomial $-16t^2-8t+80$. Completely factor this trinomial.

Answer: (a) $-16(t^2-5)$ (b) $-8(2t+5)(t-2)$

312. **Pumpkin drop** A fall tradition at the University of California San Diego is the Pumpkin Drop, where a pumpkin is dropped from the eleventh story of Tioga Hall.
(a) The binomial $-16t^2+128$ gives the height of the pumpkin t seconds after it is dropped. Factor the greatest common factor from this binomial.
(b) If the pumpkin is thrown down with initial velocity 32 feet per second, its height after t seconds is given by the trinomial $-16t^2-32t+128$. Completely factor this trinomial.

Answer: (a) $-16(t^2-8)$ (b) $-16(t+4)(t-2)$

Writing Exercises

313. The difference of squares y^4-625 can be factored as $(y^2-25)(y^2+25)$. But it is not *completely* factored. What more must be done to completely factor

Answer: Answers will vary.

314. Of all the factoring methods covered in this chapter (GCF, grouping, undo FOIL, ‘ac’ method, special products) which is the easiest for you? Which is the hardest? Explain your answers.

Answer: Answers will vary.

Elementary Algebra
7: Factoring
7.6 Quadratic Equations

Use the Zero Product Property In the following exercises, solve.

315. $(x-3)(x+7)=0$

Answer: $x=3,\ x=-7$

316. $(y-11)(y+1)=0$

Answer: $y=11,\ y=-1$

317. $(3a-10)(2a-7)=0$

Answer: $a=10/3,\ a=7/2$

318. $(5b+1)(6b+1)=0$

Answer: $b=-1/5,\ b=-1/6$

319. $6m(12m-5)=0$

Answer: $m=0,\ m=5/12$

320. $2x(6x-3)=0$

Answer: $x=0,\ x=1/2$

321. $(y-3)^2=0$

Answer: $y=3$

322. $(b+10)^2=0$

Answer: $b=-10$

323. $(2x-1)^2=0$

Answer: $x=1/2$

324. $(3y+5)^2=0$

Answer: $y=-5/3$

Solve Quadratic Equations by Factoring In the following exercises, solve.

325. $x^2+7x+12=0$

Answer: $x=-3,\ x=-4$

326. $y^2 - 8y + 15 = 0$

Answer: $y = 3, y = 5$

327. $5a^2 - 26a = 24$

Answer: $a = -4/5, a = 6$

328. $4b^2 + 7b = -3$

Answer: $b = -1, b = -3/4$

329. $4m^2 = 17m - 15$

Answer: $m = 5/4, m = 3$

330. $n^2 = 5 - 6n \quad n^2 = 5n - 6$

Answer: $n = 3, n = 2$

331. $7a^2 + 14a = 7a$

Answer: $a = -1, a = 0$

332. $12b^2 - 15b = -9b$

Answer: $b = 0, \text{b} = 1/2$

333. $49m^2 = 144$

Answer: $m = 12/7, m = -12/7$

334. $625 = x^2$

Answer: $x = 25, x = -25$

335. $(y - 3)(y + 2) = 4y$

Answer: $y = -1, y = 6$

336. $(p - 5)(p + 3) = -7$

Answer: $p = -2, p = 4$

337. $(2x + 1)(x - 3) = -4x$

Answer: $x = 3/2, x = -1$

338. $(x + 6)(x - 3) = -8$

Answer: $x = 2, x = -5$

339. $16p^3 = 24p^2 - 9p$

Answer: $p = 0, p = ¾$

340. $m^3 - 2m^2 = -m$

Answer: $m = 0, m = 1$

341. $20x^2 - 60x = -45$

Answer: $x = 3/2$

342. $3y^2 - 18y = -27$

Answer: $y = 3$

Solve Applications Modeled by Quadratic Equations In the following exercises, solve.

343. The product of two consecutive integers is 56. Find the integers.

Answer: 7 and $8; -8$ and -7

344. The product of two consecutive integers is 42. Find the integers.

Answer: -7 and -6

345. The area of a rectangular carpet is 28 square feet. The length is three feet more than the width. Find the length and the width of the carpet.

Answer: 4 feet and 7 feet

346. A rectangular retaining wall has area 15 square feet. The height of the wall is two feet less than its length. Find the height and the length of the wall.

Answer: 3 feet and 5 feet

347. A pennant is shaped like a right triangle, with hypotenuse 10 feet. The length of one side of the pennant is two feet longer than the length of the other side. Find the length of the two sides of the pennant.

Answer: 6 feet and 8 feet

348. A reflecting pool is shaped like a right triangle, with one leg along the wall of a building. The hypotenuse is 9 feet longer than the side along the building. The third side is 7 feet longer than the side along the building. Find the lengths of all three sides of the reflecting pool.

Answer: 7 feet, 24 feet,and 25 feet

Mixed Practice In the following exercises, solve.

349. $(x + 8)(x - 3) = 0$

Answer: $x = -8, x = 3$

350. $(3y-5)(y+7)=0$

Answer: $y = 5/3, y = -7$

351. $p^2+12p+11=0$

Answer: $p = -1, p = -11$

352. $q^2-12q-13=0$

Answer: $q = -1, q = 13$

353. $m^2=6m+16$

Answer: $m = -2, m = 8$

354. $4n^2+19n=5$

Answer: $n = ¼, n = -5$

355. $a^3-a^2-42a=0$

Answer: $a = 0, a = -6, a = 7$

356. $4b^2-60b+224=0$

Answer: $b = 7, b = 8$

357. The product of two consecutive integers is 110. Find the integers.

Answer: 10 and 11; -11 and -10

358. The length of one leg of a right triangle is three more than the other leg. If the hypotenuse is 15, find the lengths of the two legs.

Answer: 9 and 12

Everyday Math

359. **Area of a patio** If each side of a square patio is increased by 4 feet, the area of the patio would be 196 square feet. Solve the equation $(s+4)^2=196$ for *s* to find the length of a side of the patio.

Answer: 10 feet

360. **Watermelon drop** A watermelon is dropped from the tenth story of a building. Solve the equation $-16t^2+144=0$ for t to find the number of seconds it takes the watermelon to reach the ground.

Answer: 3 seconds

Writing Exercises

361. Explain how you solve a quadratic equation. How many answers do you expect to get for a quadratic equation?

Answer: Answers may vary.

362. Give an example of a quadratic equation that has a GCF and none of the solutions to the equation is zero.

Answer: Answers may vary.

Chapter Review

7. 1 Greatest Common Factor and Factor by Grouping

Find the Greatest Common Factor of Two or More Expressions In the following exercises, find the greatest common factor.

363. $42,\ 60$

Answer: 6

364. $450,\ 420$

Answer: 30

365. $90,\ 150,\ 105$

Answer: 15

366. $60,\ 294,\ 630$

Answer: 6

Factor the Greatest Common Factor from a Polynomial In the following exercises, factor the greatest common factor from each polynomial.

367. $24x-42$

Answer: $6(4x-7)$

368. $35y+84$

Answer: $7(5y+12)$

369. $15m^4+6m^2n$

Answer: $3m^2(5m^2+2n)$

370. $24pt^4+16t^7$

Answer: $8t^3(3pt+2t^4)$

Factor by Grouping In the following exercises, factor by grouping.

371. $ax\ -\ ay\ +\ bx\ -\ by$

Answer: $(a\ +\ b)(x\ -\ y)$

372. $x^2y-xy^2+2x-2y$

Answer: $(xy + 2)(x - y)$

373. $x^2 + 7x - 3x - 21$

Answer: $(x - 3)(x + 7)$

374. $4x^2 - 16x + 3x - 12$

Answer: $(x - 4)(4x + 3)$

375. $m^3 + m^2 + m + 1$

Answer: $(m^2 + 1)(m + 1)$

376. $5x - 5y - y + x$

Answer: $6(x - y)$

7. 2 Factor Trinomials of the form $x^2 + bx + c$

Factor Trinomials of the Form $x^2 + bx + c$ In the following exercises, factor each trinomial of the form $x^2 + bx + c$.

377. $u^2 + 17u + 72$

Answer: $(u + 8)(u + 9)$

378. $a^2 + 14a + 33$

Answer: $(a + 3)(a + 11)$

379. $k^2 - 16k + 60$

Answer: $(k - 6)(k - 10)$

380. $r^2 - 11r + 28$

Answer: $(r - 4)(r - 7)$

381. $y^2 + 6y - 7$

Answer: $(y + 7)(y - 1)$

382. $m^2 + 3m - 54$

Answer: $(m + 9)(m - 6)$

383. $s^2 - 2s - 8$

Answer: $(s-4)(s+2)$

384. $x^2-3x-10$

Answer: $(x-5)(x+2)$

Factor Trinomials of the Form $x^2+bx+cy^2$ In the following examples, factor each trinomial of the form $x^2+bxy+cy^2$.

385. $x^2+12xy+35y^2$

Answer: $(x+5y)(x+7y)$

386. $u^2+14uv+48v^2$

Answer: $(u+6v)(u+8v)$

387. $a^2+4ab-21b^2$

Answer: $(a+7b)(a-3b)$

388. $p^2-5pq-36q^2$

Answer: $(p-9q)(p+4q)$

7. 3 Factoring Trinomials of the form ax^2+bx+c

Recognize a Preliminary Strategy to Factor Polynomials Completely In the following exercises, identify the best method to use to factor each polynomial.

389. $y^2-17y+42$

Answer: Undo FOIL

390. $12r^2+32r+5$

Answer: Use the “ac” method

391. $8a^3+72a$

Answer: Factor the GCF

392. $4m-mn-3n+12$

Answer: Factor by grouping

Factor Trinomials of the Form ax^2+bx+c with a GCF In the following exercises, factor completely.

393. $6x^2+42x+60$

Answer: $6(x+2)(x+5)$

394. $8a^2+32a+24$

Answer: $8(a+1)(a+3)$

395. $3n^4-12n^3-96n^2$

Answer: $3n^2(n-8)(n+4)$

396. $5y^4+25y^2-70y$

Answer: $5y(y+7)(y-2)$

Factor Trinomials Using the "ac" Method In the following exercises, factor.

397. $2x^2+9x+4$

Answer: $(x+4)(2x+1)$

398. $3y^2+17y+10$

Answer: $(y+5)(3y+2)$

399. $18a^2-9a+1$

Answer: $(3a-1)(6a-1)$

400. $8u^2-14u+3$

Answer: $(2u-3)(4u-1)$

401. $15p^2+2p-8$

Answer: $(5p+4)(3p-2)$

402. $15x^2+6x-2$ $15x^2+x-2$

Answer: $(3x-1)(5x+2)$

403. $40s^2-s-6$

Answer: $(5s-2)(8s+3)$

404. $20n^2-7n-3$

Answer: $(4n+1)(5n-3)$

Factor Trinomials with a GCF Using the "ac" Method In the following exercises, factor.

405. $3x^2+3x-36$

Answer: $3(x+4)(x-3)$

406. $4x^2+4x-8$

Answer: $4(x+2)(x-1)$

407. $60y^2-85y-25$

Answer: $5(4y+1)(3y-5)$

408. $18a^2-57a-21$

Answer: $3(2a-7)(3a+1)$

7. 4 Factoring Special Products

Factor Perfect Square Trinomials In the following exercises, factor.

409. $25x^2+30x+9$

Answer: $(5x+3)^2$

410. $16y^2+72y+81$

Answer: $(4y+9)^2$

411. $36a^2-84ab+49b^2$

Answer: $(6a-7b)^2$

412. $64r^2-176rs+121s^2$

Answer: $(8r-11s)^2$

413. $40x^2+360x+810$

Answer: $10(2x+9)^2$

414. $75u^2+180u+108$

Answer: $3(5u+6)^2$

415. $2y^3-16y^2+32y$

Answer: $2y(y-4)^2$

416. $5k^3-70k^2+245k$

Answer: $5k(k-7)^2$

Factor Differences of Squares In the following exercises, factor.

417. $81r^2-25$

Answer: $(9r-5)(9r+5)$

418. $49a^2-144$

Answer: $(7a-12)(7a+12)$

419. $169m^2-n^2$

Answer: $(13m+n)(13m-n)$

420. $64x^2-y^2$

Answer: $(8x+y)(8x-y)$

421. $25p^2-1$

Answer: $(5p-1)(5p+1)$

422. $1-16s^2$

Answer: $(1-4s)(1+4s)$

423. $9-121y^2$

Answer: $(3+11y)(3-11y)$

424. $100k^2-81$

Answer: $(10k+9)(10k-9)$

425. $20x^2 - 125$

Answer: $5(2x-5)(2x+5)$

426. $18y^2 - 98$

Answer: $2(3y-7)(3y+7)$

427. $49u^3 - 9u$

Answer: $u(7u+3)(7u-3)$

428. $169n^3 - n$

Answer: $n(13n+1)(13n-1)$

Factor Sums and Differences of Cubes In the following exercises, factor.

429. $a^3 - 125$

Answer: $(a-5)(a^2+5a+25)$

430. $b^3 - 216$

Answer: $(b-6)(b^2+6b+36)$

431. $2m^3 + 54$

Answer: $2(m+3)(m^2-3m+9)$

432. $81x^3 + 3$

Answer: $3(3x+3)(9x^2-3x+1)$

7. 5 General Strategy for Factoring Polynomials

Recognize and Use the Appropriate Method to Factor a Polynomial Completely In the following exercises, factor completely.

433. $24x^3 + 44x^2$

Answer: $4x^2(6x+11)$

434. $24a^4 - 9a^3$

Answer: $3a^3(8a-3)$

435. $16n^2 - 56mn + 49m^2$

Answer: $(4n-7m)^2$

436. $6a^2 - 25a - 9$

Answer: $(2a-9)(3a+1)$

437. $5r^2 + 22r - 48$

Answer: $(r+6)(5r-8)$

438. $5u^4 - 45u^2$

Answer: $5u^2(u+3)(u-3)$

439. $n^4 - 81$

Answer: $(n^2+9)(n+3)(n-3)$

440. $64j^2 + 225$

Answer: prime

441. $5x^2 + 5x - 60$

Answer: $5(x-3)(x+4)$

442. $b^3 - 64$

Answer: $(b-4)(b^2+4b+16)$

443. $m^3 + 125$

Answer: $(m+5)(m^2-5m+25)$

444. $2b^2 - 2bc + 5cb - 5c^2$

Answer: $(2b+5c)(b-c)$

7. 6 Quadratic Equations

Use the Zero Product Property In the following exercises, solve.

445. $(a-3)(a+7)=0$

Answer: $a=3 \quad a=-7$

446. $(b-3)(b+10)=0$

Answer: $b=3 \quad b=-10$

447. $3m(2m-5)(m+6)=0$

Answer: $m=0; m=\frac{5}{2}; m=-6$

448. $7n(3n+8)(n-5)=0$

Answer: $n=0 \quad n=5 \quad n=-\frac{8}{3}$

Solve Quadratic Equations by Factoring

In the following exercises, solve.

449. $x^2+9x+20=0$

Answer: $x=-4, \; x=-5$

450. $y^2-y-72=0$

Answer: $y=-8, \quad y=9$

451. $2p^2-11p=40$

Answer: $p=-\frac{5}{2}, \; p=8$

452. $q^3+3q^2+2q=0$

Answer: $q=0, \quad q=-1, \quad q=-2$

453. $144m^2-25=0$

Answer: $m=\frac{5}{12}, \; m=-\frac{5}{12}$

454. $4n^2=36$

Answer: $n=3, \; n=-3$

Solve Applications Modeled by Quadratic Equations In the following exercises, solve.

455. The product of two consecutive numbers is 462. Find the numbers.

Answer: $-21,\ -22\quad 21, 22$

456. The area of a rectangular shaped patio is 400 square feet. The length of the patio is 9 feet more than its width. Find the length and width.

Answer: $16 \text{ ft},\ 25 \text{ ft}$

Chapter Practice Test

In the following exercises, find the Greatest Common Factor in each expression.

457. $14y - 42$

Answer: $7(y\ -\ 6)$

458. $-6x^2 - 30x$

Answer: $-6x(x\ +\ 5)$

459. $80a^2 + 120a^3$

Answer: $40a^2(2+3a)$

460. $5m(m-1)+3(m-1)$

Answer: $(m\ -\ 1)(5m\ +\ 3)$

In the following exercises, factor completely.

461. $x^2+13x+36\quad x^2+13x+42$

Answer: $(x+7)(x+6)$

462. $p^2 + pq - 12q^2$

Answer: $(p-3q)(p+4q)$

463. $3a^3 - 6a^2 - 72a$

Answer: $3a(a+4)(a-6)$

464. $s^2 - 25s + 84$

Answer: $(s\ -4)(s\ -\ 21)$

465. $5n^2 + 30n + 45$

Answer: $5\left(n+3\right)^2$

466. $64y^2-49$

Answer: $\left(8y\ -\ 7\right)\left(8y\ +\ 7\right)$

467. $xy-8y+7x-56$

Answer: $\left(x\ -\ 8\right)\left(y\ +\ 7\right)$

468. $40r^2+810$

Answer: $10(4r^2+81)$

469. $9s^2-12s+4$

Answer: $(3s-2)^2$

470. $n^2+12n+36$

Answer: $(n+6)^2$

471. $100-a^2$

Answer: $\left(10\ -\ a\right)\left(10\ +\ a\right)$

472. $6x^2-11x-10$

Answer: $\left(2x\ -\ 5\right)\left(3x\ +\ 2\right)$

473. $3x^2-75y^2$

Answer: $3\left(x\ +\ 5y\right)\left(x\ -\ 5y\right)$

474. $c^3-1000d^3$

Answer: $\left(c-10d\right)\left(c^2-10cd+100d^2\right)$

475. $ab-3b-2a+6$

Answer: $\left(a\ -\ 3\right)\left(b\ -\ 2\right)$

476. $6u^2+3u-18$

Answer: $3\left(2u\ -\ 3\right)\left(u\ +\ 2\right)$

477. $8m^2+22m+5$

Answer: $\left(4m\ +\ 1\right)\left(2m\ +\ 5\right)$

In the following exercises, solve.

478. $x^2+9x+20=0$

Answer: $x = -4,\ x = -5$

479. $y^2 = y+132$

Answer: $y = -11,\ y = 12$

480. $5a^2+26a=24$

Answer: $a = \frac{4}{5},\ a = -6$

481. $9b^2-9=0$

Answer: $b=1,\ b=-1$

482. $16-m^2=0$

Answer: $m=-4,\quad m=4$

483. $4n^2+19n+21=0$

Answer: $n=-\frac{7}{4},\quad n=-3$

484. $(x-3)(x+2) = 6$

Answer: $x=-3,\quad x=4$

485. The product of two consecutive integers is 156. Find the integers.

Answer: 12 and $13; -13$ and -12

486. The area of a rectangular place mat is 168 square inches. Its length is two inches longer than the width. Find the length and width of the placemat.

Answer: $12, 14$

Elementary Algebra
8: Rational Expressions and Equations
8.1 Simplify Rational Expressions

In the following exercises, determine the values for which the rational expression is undefined.

1. (a) $\frac{2x}{z}$
(b) $\frac{4p-1}{6p-5}$
(c) $\frac{n-3}{n^2+2n-8}$

Answer: (a) $z=0$ (b) $p=\frac{5}{6}$ (c) $n=-4, n=2$

2. (a) $\frac{10m}{11n}$
(b) $\frac{6y+13}{4y-9}$
(c) $\frac{b-8}{b^2-36}$

Answer: (a) $n=0$ (b) $y=\frac{9}{4}$ (c) $b=6, b=-6$

3. (a) $\frac{4x^2y}{3y}$
(b) $\frac{3x-2}{2x+1}$
(c) $\frac{u-1}{u^2-3u-28}$

Answer: (a) $y=0$ (b) $x=-\frac{1}{2}$ (c) $u=-4, u=7$

4. (a) $\frac{5pq^2}{9q}$
(b) $\frac{7a-4}{3a+5}$
(c) $\frac{1}{x^2-4}$

Answer: (a) $q=0$ (b) $a=-\frac{5}{3}$ (c) $x=2, x=-2$

Evaluate Rational Expressions In the following exercises, evaluate the rational expression for the given values.

5. $\frac{2x}{x-1}$

(a) $x=0$

(b) $x=2$

(c) $x=-1$

Answer: (a) 0 (b) 4 (c) 1

6. $\frac{4y-1}{5y-3}$

(a) $y=0$

(b) $y=2$

(c) $y=-1$

Answer: (a) $\frac{1}{3}$ (b) 1 (c) $\frac{5}{8}$

7. $\frac{2p+3}{p^2+1}$

(a) $p=0$

(b) $p=1$

(c) $p=-2$

Answer: (a) 3 (b) $\frac{5}{2}$ (c) $-\frac{1}{5}$

8. $\frac{x+3}{2-3x}$

(a) $x=0$

(b) $x=1$

(c) $x=-2$

Answer: (a) $\frac{3}{2}$ (b) -4 (c) $\frac{1}{8}$

9. $\frac{y^2+5y+6}{y^2-1}$

(a) $y=0$

(b) $y=2$

(c) $y=-2$

Answer: (a) -6 (b) $\frac{20}{3}$ (c) 0

10. $\frac{z^2+3z-10}{z^2-1}$

(a) $z=0$

(b) $z=2$

(c) $z=-2$

Answer: (a) 10 (b) 0 (c) -4

11. $\frac{a^2-4}{a^2+5a+4}$

(a) $a=0$

(b) $a=1$

(c) $a=-2$

Answer: (a) -1 (b) $-\frac{3}{10}$ (c) 0

12. $\frac{b^2+2}{b^2-3b-4}$

(a) $b=0$

(b) $b=2$

(c) $b=-2$

Answer: (a) $-\frac{1}{2}$ (b) -1 (c) 1

13. $\frac{x^2+3xy+2y^2}{2x^3y}$

(a) $x=1, y=-1$

(b) $x=2, y=1$

(c) $x=-1, y=-2$

Answer: (a) 0 (b) $\frac{3}{4}$ (c) $\frac{15}{4}$

14. $\frac{c^2+cd-2d^2}{cd^3}$

(a) $c=2, d=-1$

(b) $c=1, d=-1$

(c) $c=-1, d=2$

Answer: (a) 0 (b) 0 (c) $\frac{9}{8}$

15. $\frac{m^2-4n^2}{5mn^3}$

(a) $m=2, n=1$

(b) $m=-1, n=-1$

(c) $m=3, n=2$

Answer: (a) 0 (b) $-\frac{3}{5}$ (c) $-\frac{7}{20}$

16) $\frac{2s^2t}{s^2-9t^2}$

(a) $s=4, t=1$

(b) $s=-1, t=-1$

(c) $s=0, t=2$

Answer: (a) $\frac{22}{7}$ (b) 4 (c) 0

Simplify Rational Expressions In the following exercises, simplify.

17. $-\frac{4}{52}$

Answer: $-\frac{1}{13}$

18. $-\frac{44}{55}$

Answer: $-\frac{4}{5}$

19. $\frac{56}{63}$

Answer: $\frac{8}{9}$

20. $\frac{65}{104}$

Answer: $\frac{5}{8}$

21. $\frac{6ab^2}{12a^2b}$

Answer: $\frac{b}{2a}$

22. $\frac{15xy}{3x^3y^3}$

Answer: $\frac{5}{x^2y^2}$

23. $\frac{8m^3n}{12mn^2}$

Answer: $\frac{2m^2}{3n}$

24. $\frac{36v^3w^2}{27vw^3}$

Answer: $\frac{4v^2}{3w}$

25. $\frac{3a+6}{4a+8}$

Answer: $\frac{3}{4}$

26. $\frac{5b+5}{6b+6}$

Answer: $\frac{5}{6}$

27. $\frac{3c-9}{5c-15}$

Answer: $\frac{3}{5}$

28. $\frac{4d+8}{9d+18}$

Answer: $\frac{4}{9}$

29. $\frac{7m+63}{5m+45}$

Answer: $\frac{7}{5}$

30. $\frac{8n-96}{3n-36}$

Answer: $\frac{8}{3}$

31. $\frac{12p-240}{5p-100}$

Answer: $\frac{12}{5}$

32. $\frac{6q+210}{5q+175}$

Answer: $\frac{6}{5}$

33. $\frac{a^2-a-12}{a^2-8a+16}$

Answer: $\frac{a+3}{a-4}$

34. $\frac{x^2+4x-5}{x^2-2x+1}$

Answer: $\frac{x+5}{x-1}$

35. $\frac{y^2+3y-4}{y^2-6y+5}$

Answer: $\frac{y+4}{y-5}$

36. $\frac{v^2+8v+15}{v^2-v-12}$

Answer: $\frac{v+5}{v-4}$

37. $\frac{x^2-25}{x^2+2x-15}$

Answer: $\frac{x-5}{x-3}$

38. $\frac{a^2-4}{a^2+6a-16}$

Answer: $\frac{a+2}{a+8}$

39. $\frac{y^2-2y-3}{y^2-9}$

Answer: $\frac{y+1}{y+3}$

40. $\frac{b^2+9b+18}{b^2-36}$

Answer: $\frac{b+3}{b-6}$

41. $\frac{y^3+y^2+y+1}{y^2+2y+1}$

Answer: $\frac{y^2+1}{y+1}$

42. $\frac{p^3+3p^2+4p+12}{p^2+p-6}$

Answer: $\frac{p^2+4}{p-2}$

43. $\frac{x^3-2x^2-25x+50}{x^2-25}$

Answer: $x-2$

44. $\frac{q^3+3q^2-4q-12}{q^2-4}$

Answer: $q+3$

45. $\frac{3a^2+15a}{6a^2+6a-36}$

Answer: $\frac{a(a+5)}{2(a+3)(a-2)}$

46. $\frac{8b^2-32b}{2b^2-6b-80}$

Answer: $\frac{4b(b-4)}{(b+5)(b-8)}$

47. $\frac{-5c^2-10c}{-10c^2+30c+100}$

Answer: $\frac{c}{2(c-5)}$

48. $\frac{4d^2-24d}{2d^2-4d-48}$

Answer: $\frac{2d}{d+4}$

49. $\frac{3m^2+30m+75}{4m^2-100}$

Answer: $\frac{3(m+5)}{4(m-5)}$

50. $\frac{5n^2+30n+45}{2n^2-18}$

Answer: $\frac{5(n+3)}{2(n-3)}$

51. $\frac{5r^2+30r-35}{r^2-49}$

Answer: $\frac{5(r-1)}{r+7}$

52. $\frac{3s^2+30s+24}{3s^2-48}$

Answer: $\frac{s+6}{s-4}$

53. $\frac{t^3-27}{t^2-9}$

Answer: $\frac{t^2+3t+9}{t+3}$

54. $\frac{v^3-1}{v^2-1}$

Answer: $\frac{v^2+v+1}{v+1}$

55. $\frac{w^3+216}{w^2-36}$

Answer: $\frac{w^2-6w+36}{w-6}$

56. $\frac{v^3+125}{v^2-25}$

Answer: $\frac{v^2-5v+25}{v-5}$

Simplify Rational Expressions with Opposite Factors In the following exercises, simplify each rational expression.

57. $\frac{a-5}{5-a}$

Answer: -1

58. $\frac{b-12}{12-b}$

Answer: -1

59. $\frac{11-c}{c-11}$

Answer: -1

60. $\frac{5-d}{d-5}$

Answer: -1

61. $\frac{12-2x}{x^2-36}$

Answer: $-\frac{2}{x+6}$

62. $\frac{20-5y}{y^2-16}$

Answer: $-\frac{5}{y+4}$

63. $\frac{4v-32}{64-v^2}$

Answer: $-\frac{4}{8+v}$

64. $\frac{7w-21}{9-w^2}$

Answer: $-\frac{7}{3+w}$

65. $\frac{y^2-11y+24}{9-y^2}$

Answer: $-\frac{(y-8)}{3+y}$

66. $\frac{z^2-9z+20}{16-z^2}$

Answer: $-\frac{z-5}{4+z}$

67. $\frac{a^2-5z-36}{81-a^2}$

Answer: $-\frac{a+4}{9+a}$

68. $\frac{b^2+b-42}{36-b^2}$

Answer: $-\frac{b+7}{6+b}$

Everyday Math

69. **Tax Rates** For the tax year 2015, the amount of tax owed by a single person earning between $37,450 and $90,750, can be found by evaluating the formula $0.25x - 4206.25$, where *x* is income. The average tax rate for this income can be found by evaluating the formula $\frac{0.25x - 4206.25}{x}$. What would be the average tax rate for a single person earning $50,000?

Answer: 16.5%

70. **Work** The length of time it takes for two people for perform the same task if they work together can be found by evaluating the formula $\frac{xy}{x+y}$. If Tom can paint the den in $x = 45$ minutes and his brother Bobby can paint it in $y = 60$ minutes, how many minutes will it take them if they work together?

Answer: 25.7 minutes

Writing Exercises

71. Explain how you find the values of *x* for which the rational expression $\frac{x^2 - x - 20}{x^2 - 4}$ is undefined.

Answer: Answers will vary, but all should reference setting the denominator function to zero.

72. Explain all the steps you take to simplify the rational expression $\frac{p^2 + 4p - 21}{9 - p^2}$.

Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.2 Multiply and Divide Rational Expressions

Multiply Rational Expressions In the following exercises, multiply.

73. $\frac{12}{16} \cdot \frac{4}{10}$

Answer: $\frac{3}{10}$

74. $\frac{32}{5} \cdot \frac{16}{24}$

Answer: $\frac{64}{15}$

75. $\frac{18}{10} \cdot \frac{4}{30}$

Answer: $\frac{6}{25}$

76. $\frac{21}{36} \cdot \frac{45}{24}$

Answer: $\frac{35}{32}$

77. $\frac{5x^2y^4}{12xy^3} \cdot \frac{6x^2}{20y^2}$

Answer: $\frac{x^3}{8y}$

78. $\frac{8w^3y}{9y^2} \cdot \frac{3y}{4w^4}$

Answer: $\frac{2}{3w}$

79. $\frac{12a^3b}{b^2} \cdot \frac{2ab^2}{9b^3}$

Answer: $\frac{8a^3}{3b^2}$

80. $\frac{4mn^2}{5n^3} \cdot \frac{mn^3}{8m^2n^2}$

Answer: $\frac{n^3}{10m^3}$

81. $\frac{5p^2}{p^2-5p-36}\cdot\frac{p^2-16}{10p}$

Answer: $\frac{p(p-4)}{2(p-9)}$

82. $\frac{3q^2}{q^2+q-6}\cdot\frac{q^2-9}{9q}$

Answer: $\frac{q(q-3)}{3(q-2)}$

83. $\frac{4r}{r^2-3r-10}\cdot\frac{r^2-25}{8r^2}$

Answer: $\frac{r+5}{2r(r+2)}$

84. $\frac{s}{s^2-9s+14}\cdot\frac{s^2-49}{7s^2}$

Answer: $\frac{s+7}{7(s-2)}$

85. $\frac{x^2-7x}{x^2+6x+9}\cdot\frac{x+3}{4x}$

Answer: $\frac{x-7}{4(x+3)}$

86. $\frac{2y^2-10y}{y^2+10y+25}\cdot\frac{y+5}{6y}$

Answer: $\frac{y-5}{3(y+5)}$

87. $\frac{z^2+3z}{z^2-3z-4}\cdot\frac{z-4}{z^2}$

Answer: $\frac{z+3}{z(z+1)}$

88. $\frac{2a^2+8a}{a^2-9a+20}\cdot\frac{a-5}{a^2}$

Answer: $\frac{2(a+4)}{a(a-4)}$

89. $\frac{28-4b}{3b-3}\cdot\frac{b^2+8b-9}{b^2-49}$

Answer: $-\frac{4(b+9)}{3(b+7)}$

90. $\frac{18c-2c^2}{6c+30}\cdot\frac{c^2+7c+10}{c^2-81}$

Answer: $-\frac{c(c+2)}{3(c+9)}$

91. $\frac{35d-7d^2}{d^2+7d}\cdot\frac{d^2+12d+35}{d^2-25}$

Answer: -7

92. $\frac{72m-12m^2}{8m+32}\cdot\frac{m^2+10m+24}{m^2-36}$

Answer: $\frac{-3m}{2}$

93. $\frac{4n+20}{n^2+n-20}\cdot\frac{n^2-16}{4n+16}$

Answer: 1

94. $\frac{6p^2-6p}{p^2+7p-18}\cdot\frac{p^2-81}{3p^2-27p}$

Answer: $\frac{2(p-1)}{(p-2)}$

95. $\frac{q^2-2q}{q^2+6q-16}\cdot\frac{q^2-64}{q^2-8q}$

Answer: 1

96. $\frac{2r^2-2r}{r^2+4r-5}\cdot\frac{r^2-25}{2r^2-10r}$

Answer: 1

Divide Rational Expressions In the following exercises, divide.

97. $\frac{t-6}{3-t} \div \frac{t^2-9}{t-5}$

Answer: $-\frac{2t}{t^3-5t-9}$

98. $\frac{v-5}{11-v} \div \frac{v^2-25}{v-11}$

Answer: $-\frac{1}{v+5}$

99. $\frac{10+w}{w-8} \div \frac{100-w^2}{8-w}$

Answer: $-\frac{1}{10-w}$

100. $\frac{7+x}{x-6} \div \frac{49-x^2}{x+6}$

Answer: $\frac{x+6}{(x-6)(7-x)}$

101. $\frac{27y^2}{3y-21} \div \frac{3y^2+18}{y^2+13y+42}$

Answer: $\frac{3y^2(y+6)(y+7)}{(y-7)(y^2+6)}$

102. $\frac{24z^2}{2z-8} \div \frac{4z-28}{z^2-11z+28}$

Answer: $3z^2$

103. $\frac{16a^2}{4a+36} \div \frac{4a^2-24a}{a^2+4a-45}$

Answer: $\frac{a(a-5)}{a-6}$

104. $\frac{24b^2}{2b-4} \div \frac{12b^2+36b}{b^2-11b+18}$

Answer: $\frac{b(b-9)}{b+3}$

105. $\frac{5c^2+9c+2}{c^2-25} \div \frac{3c^2-14c-5}{c^2+10c+25}$

Answer: $\frac{(c+2)(c+2)}{(c-2)(c-3)}$

106. $\frac{2d^2+d-3}{d^2-16} \div \frac{2d^2-9d-18}{d^2-8d+16}$

Answer: $\frac{(d-1)(d-4)}{(d+4)(d-6)}$

107. $\frac{6m^2-2m-10}{9-m^2} \div \frac{6m^2+29m-20}{m^2-6m+9}$

Answer: $-\frac{(m-2)(m-3)}{(3+m)(m+4)}$

108. $\frac{2n^2-3n-14}{25-n^2} \div \frac{2n^2-13n+21}{n^2-10n+25}$

Answer: $-\frac{(n+2)(n-5)}{(5+n)(n-3)}$

109. $\frac{3s^2}{s^2-16} \div \frac{s^3-4s^2+16s}{s^3-64}$

Answer: $\frac{3s}{s+4}$

110. $\frac{r^2-9}{15} \div \frac{r^3-27}{5r^2+15r+45}$

Answer: $\frac{(r+3)(r^2+3r+9)}{3(r^2-3r+9)}$

111. $\frac{p^3+q^3}{3p^2+3pq+3q^2} \div \frac{p^2-q^2}{12}$

Answer: $\frac{4(p^2-pq+q^2)}{(p-q)(p^2+pq+q^2)}$

112. $\frac{v^3-8w^3}{2v^2+4vw+8w^2} \div \frac{v^2-4w^2}{4}$

Answer: $\frac{2}{v+2w}$

113. $\frac{t^2-9}{2t} \div (t^2-6t+9)$

Answer: $\frac{t+3}{2t(t-3)}$

114. $\frac{x^2+3x-10}{4x} \div (2x^2+20x+50)$

Answer: $\frac{x-2}{8x}$

115. $\frac{2y^2-10yz-48z^2}{2y-1} \div (4y^2-32yz)$

Answer: $\frac{y+3z}{2y(2y-1)}$

116. $\frac{2m^2-98n^2}{2m+6} \div (m^2-7mn)$

Answer: $\frac{(m+7n)}{m(m+3)}$

117. $\frac{\frac{2a^2-a-21}{5a+20}}{\frac{a^2+7a+12}{a^2+8a+16}}$

Answer: $\frac{2a-7}{5}$

118. $\frac{\frac{3b^2+2b-8}{12b+18}}{\frac{3b^2+2b-8}{2b^2-7b-15}}$

Answer: $\frac{b-5}{6}$

119. $\frac{\frac{12c^2-12}{2c^2-3c+1}}{\frac{4c+4}{6c^2-13c+5}}$

Answer: $3(3c-5)$

120. $\dfrac{\dfrac{4d^2+7d-2}{35d+10}}{\dfrac{d^2-4}{7d^2-12d-4}}$

Answer: $\dfrac{4d-1}{5}$

121. $\dfrac{10m^2+80m}{3m-9}\cdot\dfrac{m^2+4m-21}{m^2-9m+20}\div\dfrac{5m^2+10m}{2m-10}$

Answer: $\dfrac{4(m+8)(m+7)}{3(m-4)(m+2)}$

122. $\dfrac{4n^2+32n}{3n+2}\cdot\dfrac{3n^2-n-2}{n^2+n-30}\div\dfrac{108n^2-24n}{n+6}$

Answer: $\dfrac{(n+8)(n-1)}{3(n-5)(9n-2)}$

123. $\dfrac{12p^2+3p}{p+3}\div\dfrac{p^2+2p-63}{p^2-p-12}\cdot\dfrac{p-7}{9p^3-9p^2}$

Answer: $\dfrac{(4p+1)(p-7)}{3p(p+9)(p-1)}$

124. $\dfrac{6q+3}{9q^2-9q}\div\dfrac{q^2+14q+33}{q^2+4q-5}\cdot\dfrac{4q^2+12q}{12q+6}$

Answer: $\dfrac{2(2q+1)(q+5)}{3(q+11)(6q+3)}$

Everyday Math

125. **Probability** The director of large company is interviewing applicants for two identical jobs. If $w=$ the number of women applicants and $m=$ the number of men applicants, then the probability that two women are selected for the jobs is $\dfrac{w}{w+m}\cdot\dfrac{w-1}{w+m-1}$.

(a) Simplify the probability by multiplying the two rational expressions.
(b) Find the probability that two women are selected when $w=5$ and $m=10$.

Answer: (a) $\dfrac{w(w-1)}{(w+m)(w+m-1)}$ (b) $\dfrac{2}{21}$

126. **Area of a triangle** The area of a triangle with base b and height h is $\frac{bh}{2}$. If the triangle is stretched to make a new triangle with base and height three times as much as in the original triangle, the area is $\frac{9bh}{2}$. Calculate how the area of the new triangle compares to the area of the original triangle by dividing $\frac{9bh}{2}$ by $\frac{bh}{2}$.

Answer: 9 times as large

Writing Exercises

127. (a) Multiply $\frac{7}{4} \cdot \frac{9}{10}$ and explain all your steps.

(b) Multiply $\frac{n}{n-3} \cdot \frac{9}{n+3}$ and explain all your steps.

(c) Evaluate your answer to part (b) when $n = 7$. Did you get the same answer you got in part (a) ? Why or why not?

Answer: Answers will vary.

128. (a) Divide $\frac{24}{5} \div 6$ and explain all your steps.

(b) Divide $\frac{x^2 - 1}{x} \div (x + 1)$ and explain all your steps.

(c) Evaluate your answer to part (b) when $x = 5$. Did you get the same answer you got in part (a) ? Why or why not?

Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.3 Add and Subtract Rational Expressions with a Common Denominator

Add Rational Expressions with a Common Denominator In the following exercises, add.

129. $\frac{2}{15}+\frac{7}{15}$

Answer: $\frac{3}{5}$

130. $\frac{4}{21}+\frac{3}{21}$

Answer: $\frac{1}{7}$

131. $\frac{7}{24}+\frac{11}{24}$

Answer: $\frac{3}{4}$

132. $\frac{7}{36}+\frac{13}{36}$

Answer: $\frac{5}{9}$

133. $\frac{3a}{a-b}+\frac{1}{a-b}$

Answer: $\frac{3a+1}{a-b}$

134. $\frac{3c}{4c-5}+\frac{5}{4c-5}$

Answer: $\frac{3c+5}{4c-5}$

135. $\frac{d}{d+8}+\frac{5}{d+8}$

Answer: $\frac{d+5}{d+8}$

136. $\frac{7m}{2m+n}+\frac{4}{2m+n}$

Answer: $\frac{7m+4}{2m+n}$

137. $\frac{p^2+10p}{p+2}+\frac{16}{p+2}$

Answer: $p+8$

138. $\frac{q^2+12q}{q+3}+\frac{27}{q+3}$

Answer: $q+9$

139. $\frac{2r^2}{2r-1}+\frac{15r-8}{2r-1}$

Answer: $r+8$

140. $\frac{3s^2}{3s-2}+\frac{13s-10}{3s-2}$

Answer: $s+5$

141. $\frac{8t^2}{t+4}+\frac{32t}{t+4}$

Answer: $8t$

142. $\frac{6v^2}{v+5}+\frac{30v}{v+5}$

Answer: $6v$

143. $\frac{2w^2}{w^2-16}+\frac{8w}{w^2-16}$

Answer: $\frac{2w}{w-4}$

144. $\frac{7x^2}{x^2-9}+\frac{21x}{x^2-9}$

Answer: $\frac{7x}{x-3}$

Subtract Rational Expressions with a Common Denominator In the following exercises, subtract.

145. $\frac{y^2}{y+8}-\frac{64}{y+8}$

Answer: $y-8$

146. $\frac{z^2}{z+2}-\frac{4}{z+2}$

Answer: $z-2$

147. $\frac{9a^2}{3a-7}-\frac{49}{3a-7}$

Answer: $3a+7$

148. $\frac{25b^2}{5b-6}-\frac{36}{5b-6}$

Answer: $5b+6$

149. $\frac{c^2}{c-8}-\frac{6c+16}{c-8}$

Answer: $c+2$

150. $\frac{d^2}{d-9}-\frac{6d+27}{d-9}$

Answer: $d+3$

151. $\frac{3m^2}{6m-30}-\frac{21m-30}{6m-30}$

Answer: $\frac{m-2}{3}$

152. $\frac{2n^2}{4n-32}-\frac{30n-16}{4n-32}$

Answer: $\frac{n-1}{2}$

153. $\frac{6p^2+3p+4}{p^2+4p-5}-\frac{5p^2+p+7}{p^2+4p-5}$

Answer: $\frac{p+3}{p+5}$

154. $\frac{5q^2+3q-9}{q^2+6q+8}-\frac{4q^2+9q+7}{q^2+6q+8}$

Answer: $\frac{q-8}{q+4}$

155. $\frac{5r^2+7r-33}{r^2-49}-\frac{4r^2-5r-30}{r^2-49}$

Answer: $\frac{r+9}{r+7}$

156. $\frac{7t^2-t-4}{t^2-25}-\frac{6t^2+2t-1}{t^2-25}$

Answer: $\frac{t-8}{t+5}$

Add and Subtract Rational Expressions whose Denominators are Opposites In the following exercises, add.

157. $\frac{10v}{2v-1}+\frac{2v+4}{1-2v}$

Answer: 4

158. $\frac{20w}{5w-2}+\frac{5w+6}{2-5w}$

Answer: 3

159. $\frac{10x^2+16x-7}{8x-3}+\frac{2x^2+3x-1}{3-8x}$

Answer: $x+2$

160. $\frac{6y^2+2y-11}{3y-7}+\frac{3y^2-3y+17}{7-3y}$

Answer: $y+4$

In the following exercises, subtract.

161. $\frac{z^2+6z}{z^2-25}-\frac{3z+20}{25-z^2}$

Answer: $\frac{z+4}{z-5}$

162. $\frac{a^2+3a}{a^2-9}-\frac{3a-27}{9-a^2}$

Answer: $\frac{a+9}{a+3}$

163. $\frac{2b^2+30b-13}{b^2-49}-\frac{2b^2-5b-8}{49-b^2}$

Answer: $\frac{4b-3}{b-7}$

164. $\frac{c^2+5c-10}{c^2-16}-\frac{c^2-8c-10}{16-c^2}$

Answer: $\frac{2c+5}{c+4}$

Everyday Math

165. Sarah ran 8 miles and then biked 24 miles. Her biking speed is 4 mph faster than her running speed. If r represents Sarah's speed when she ran, then her running time is modeled by the expression $\frac{8}{r}$ and her biking time is modeled by the expression $\frac{24}{r+4}$. Add the rational expressions $\frac{8}{r}+\frac{24}{r+4}$ to get an expression for the total amount of time Sarah ran and biked.

Answer: $\frac{32r+32}{r(r+4)}$

166. If Pete can paint a wall in p hours, then in one hour he can paint $\frac{1}{p}$ of the wall. It would take Penelope 3 hours longer than Pete to paint the wall, so in one hour she can paint $\frac{1}{p+3}$ of the wall. Add the rational expressions $\frac{1}{p}+\frac{1}{p+3}$ to get an expression for the part of the wall Pete and Penelope would paint in one hour if they worked together.

Answer: $\frac{2p+3}{p(p+3)}$

Writing Exercises

167. Donald thinks that $\frac{3}{x}+\frac{4}{x}$ is $\frac{7}{2x}$. Is Donald correct? Explain.

Answer: Answers will vary.

168. Explain how you find the Least Common Denominator of x^2+5x+4 and x^2-16.

Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.4 Add and Subtract Rational Expressions with Unlike Denominators

In the following exercises, find the LCD.

169. $\frac{5}{x^2-2x-8}, \frac{2x}{x^2-x-12}$

Answer: $(x-4)(x+2)(x+3)$

170. $\frac{8}{y^2+12y+35}, \frac{3y}{y^2+y-42}$

Answer: $(y+7)(y+5)(y-6)$

171. $\frac{9}{z^2+2z-8}, \frac{4z}{z^2-4}$

Answer: $(z-2)(z+4)(z+2)$

172. $\frac{6}{a^2+14a+45}, \frac{5a}{a^2-81}$

Answer: $(a+9)(a+5)(a-9)$

173. $\frac{4}{b^2+6b+9}, \frac{2b}{b^2-2b-15}$

Answer: $(b+3)(b+3)(b-5)$

174. $\frac{5}{c^2-4c+4}, \frac{3c}{c^2-10c+16}$

Answer: $(c-2)(c-2)(c-8)$

175. $\frac{2}{3d^2+14d-5}, \frac{5d}{3d^2-19d+6}$

Answer: $(3d-1)(d+5)(d-6)$

176. $\frac{3}{5m^2-3m-2}, \frac{6m}{5m^2+17m+6}$

Answer: $(5m+2)(m-1)(m+3)$

In the following exercises, write as equivalent rational expressions with the given LCD.

177. $\frac{5}{x^2-2x-8}, \frac{2x}{x^2-x-12}$ LCD $(x-4)(x+2)(x+3)$

Answer: $\frac{5x+15}{(x-4)(x+2)(x+3)}, \frac{2x^2+4x}{(x-4)(x+2)(x+3)}$

178. $\frac{8}{y^2+12y+35}, \frac{3y}{y^2+y-42}$ LCD $(y+7)(y+5)(y-6)$

Answer: $\frac{8y-48}{(y+7)(y+5)(y-6)}, \frac{3y^2+15y}{(y+7)(y+5)(y-6)}$

179. $\frac{9}{z^2+2z-8}, \frac{4z}{z^2-4}$ LCD $(z-2)(z+4)(z+2)$

Answer: $\frac{9z+18}{(z-2)(z+4)(z+2)}, \frac{4z^2+16}{(z-2)(z+4)(z+2)}$

180. $\frac{6}{a^2+14a+45}, \frac{5a}{a^2-81}$ LCD $(a+9)(a+5)(a-9)$

Answer: $\frac{6a-54}{(a+9)(a+5)(a-9)}, \frac{5a^2+25a}{(a+9)(a+5)(a-9)}$

181. $\frac{4}{b^2+6b+9}, \frac{2b}{b^2-2b-15}$ LCD $(b+3)(b+3)(b-5)$

Answer: $\frac{4b-20}{(b+3)(b+3)(b-5)}, \frac{2b^2+6b}{(b+3)(b+3)(b-5)}$

182. $\frac{5}{c^2-4c+4}, \frac{3c}{c^2-10c+10}$ LCD $(c-2)(c-2)(c-8)$

Answer: $\frac{5c-40}{(c-2)(c-2)(c-8)}, \frac{3c^2-6c}{(c-2)(c-2)(c-8)}$

183. $\frac{2}{3d^2+14d-5}, \frac{5d}{3d^2-19d+6}$ LCD $(3d-1)(d+5)(d-6)$

Answer: $\frac{2d-12}{(3d-1)(d+5)(d-6)}, \frac{5d^2+25d}{(3d-1)(d+5)(d-6)}$

184. $\frac{3}{5m^2-3m-2}, \frac{6m}{5m^2+17m+6}$ LCD $(5m+2)(m-1)(m+3)$

Answer: $\frac{3m+9}{(5m+2)(m-1)(m+3)}, \frac{6m^2-6m}{(5m+2)(m-1)(m+3)}$

In the following exercises, add.

185. $\frac{5}{24}+\frac{11}{36}$

Answer: $\frac{37}{72}$

186. $\frac{7}{30}+\frac{13}{45}$

Answer: $\frac{47}{90}$

187. $\frac{9}{20}+\frac{11}{30}$

Answer: $\frac{49}{60}$

188. $\frac{8}{27}+\frac{7}{18}$

Answer: $\frac{37}{54}$

189. $\frac{7}{10x^2y}+\frac{4}{15xy^2}$

Answer: $\frac{21y+8x}{30x^2y^2}$

190. $\frac{1}{12a^3b^2}+\frac{5}{9a^2b^3}$

Answer: $\frac{3b+20a}{36a^3b^3}$

191. $\frac{1}{2m}+\frac{7}{8m^2n}$

Answer: $\frac{mn+14}{16m^2n}$

192. $\frac{5}{6p^2q}+\frac{1}{4p}$

Answer: $\frac{10+3pq}{12p^2q}$

193. $\frac{3}{r+4}+\frac{2}{r-5}$

Answer: $\frac{5r-7}{(r+4)(r-5)}$

194. $\frac{4}{s-7}+\frac{5}{s+3}$

Answer: $\frac{9s-23}{(s-7)(s+3)}$

195. $\frac{8}{t+5}+\frac{6}{t-5}$

Answer: $\frac{14t-10}{(t+5)(t-5)}$

196. $\frac{7}{v+5}+\frac{9}{v-5}$

Answer: $\frac{16v+10}{(v+5)(v-5)}$

197. $\frac{5}{3w-2}+\frac{2}{w+1}$

Answer: $\frac{11w+1}{(3w-2)(w+1)}$

198. $\frac{4}{2x+5}+\frac{2}{x-1}$

Answer: $\frac{8x+6}{(2x+5)(x-1)}$

199. $\frac{2y}{y+3}+\frac{3}{y-1}$

Answer: $\frac{2y^2+y+9}{(y+3)(y-1)}$

200. $\frac{3z}{z-2}+\frac{1}{z+5}$

Answer: $\frac{3z^2+16z-2}{(z-2)(z+5)}$

201. $\frac{5b}{a^2b-2a^2}+\frac{2b}{b^2-4}$

Answer: $\frac{b(5b+10+2a^2)}{a^2(b-2)(b+2)}$

202. $\frac{4}{cd+3c}+\frac{1}{d^2-9}$

Answer: $\frac{4d-12+c}{c(d+3)(d-3)}$

203. $\frac{2m}{3m-3}+\frac{5m}{m^2+3m-4}$

Answer: $\frac{2m^2+23m}{3(m-1)(m+4)}$

204. $\frac{3}{4n+4}+\frac{6}{n^2-n-2}$

Answer: $\frac{3(n+6)}{4(n+1)(n-2)}$

205. $\frac{3}{n^2+3n-18}+\frac{4n}{n^2+8n+12}$

Answer: $\frac{4n^2-9n+6}{(n-3)(n+6)(n+2)}$

206. $\frac{6}{q^2-3q-10}+\frac{5q}{q^2-8q+15}$

Answer: $\frac{5q^2+16q-18}{(q-5)(q+2)(q-3)}$

207. $\frac{3r}{r^2+7r+6}+\frac{9}{r^2+4r+3}$

Answer: $\frac{3(r^2+6r+18)}{(r+1)(r+6)(r+3)}$

208. $\frac{2s}{s^2+2s-8}+\frac{4}{s^2+3s-10}$

Answer: $\frac{2(s^2+7s+8)}{(s+4)(s-2)(s+5)}$

In the following exercises, subtract.

209. $\frac{t}{t-6}-\frac{t-2}{t+6}$

Answer: $\frac{2(7t-6)}{(t-6)(t+6)}$

210. $\frac{v}{v-3}-\frac{v-6}{v+1}$

Answer: $\frac{2(5v-9)}{(v-3)(v+1)}$

211. $\frac{w+2}{w+4}-\frac{w}{w-2}$

Answer: $\frac{-4(1+w)}{(w+4)(w-2)}$

212. $\frac{x-3}{x+6}-\frac{x}{x+3}$

Answer: $\frac{-3(3+2x)}{(x+6)(x+3)}$

213. $\frac{y-4}{y+1}-\frac{1}{y+7}$

Answer: $\frac{y^2+2y-29}{(y+1)(y+7)}$

214. $\frac{z+8}{z-3}-\frac{z}{z-2}$

Answer: $\frac{2(3z-11)}{(z-3)(z-2)}$

215. $\frac{5a}{a+3}-\frac{a+2}{a+6}$

Answer: $\frac{4a^2+25a-6}{(a+3)(a+6)}$

216. $\frac{3b}{b-2}-\frac{b-6}{b-8}$

Answer: $\frac{2(b^2-8b-6)}{(b-2)(b-8)}$

217. $\frac{6c}{c^2-25}-\frac{3}{c+5}$

Answer: $\frac{3}{c-5}$

218. $\frac{4d}{d^2-81}-\frac{2}{d+9}$

Answer: $\frac{2}{d-9}$

219. $\frac{6}{m+6}-\frac{12m}{m^2-36}$

Answer: $\frac{-6}{m-6}$

220. $\frac{4}{n+4}-\frac{8n}{n^2-16}$

Answer: $\frac{-4}{n-4}$

221. $\frac{-9p-17}{p^2-4p-21}-\frac{p+1}{7-p}$

Answer: $\frac{p+2}{p+3}$

222. $\frac{7q+8}{q^2-2q-24}-\frac{q+2}{4-q}$

Answer: $\frac{q-1}{q-6}$

223. $\frac{-2r-16}{r^2+6r-16}-\frac{5}{2-r}$

Answer: $\frac{3}{r-2}$

224. $\frac{2t-30}{t^2+6t-27}-\frac{2}{3-t}$

Answer: $\frac{4}{t+9}$

225. $\frac{5v-2}{v+3}-4$

Answer: $\frac{-v-14}{v+3}$

226. $\frac{6w+5}{w-1}+2$

Answer: $\frac{4w+3}{w-1}$

227. $\frac{2x+7}{10x-1}+3$

Answer: $\frac{4(8x+1)}{10x-1}$

228. $\frac{8y-4}{5y+2}-6$

Answer: $\frac{-2(11y+8)}{5y+2}$

In the following exercises, add and subtract.

229. $\frac{5a}{a-2}+\frac{9}{a}-\frac{2a+18}{a^2-2a}$

Answer: $\frac{5a^2+7a-36}{a(a-2)}$

230. $\frac{2b}{b-5}+\frac{3}{2b}-\frac{2b-15}{2b^2-10b}$

Answer: $\frac{4b+1}{2(b-5)}$

231. $\frac{c}{c+2}+\frac{5}{c-2}-\frac{11c}{c^2-4}$

Answer: $\frac{c-5}{c+2}$

232. $\frac{6d}{d-5}+\frac{1}{d+4}-\frac{7d-5}{d^2-d-20}$

Answer: $\frac{6d}{d+4}$

In the following exercises, simplify.

233. $\frac{6a}{3ab+b^2}+\frac{3a}{9a^2-b^2}$

Answer: $\frac{3a(6a-b)}{b(3a+b)(3a-b)}$

234. $\frac{2c}{2c+10}+\frac{7c}{c^2+9c+20}$

Answer: $\frac{2c(c+11)}{2(c+4)(c+5)}$

235. $\frac{6d}{d^2-64}-\frac{3}{d-8}$

Answer: $\frac{3}{d+8}$

236. $\frac{5}{n+7}-\frac{10n}{n^2-49}$

Answer: $-\frac{5}{n-7}$

237. $\frac{4m}{m^2+6m-7}+\frac{2}{m^2+10m+21}$

Answer: $\frac{2(2m^2+7m-1)}{(m+7)(m-1)(m+3)}$

238. $\frac{3p}{p^2+4p-12}+\frac{1}{p^2+p-30}$

Answer: $\frac{3p^2-14p-2}{(p-2)(p+6)(p-5)}$

239. $\frac{-5n-5}{n^2+n-6}+\frac{n+1}{2-n}$

Answer: $\frac{n+1}{n+3}$

240. $\frac{-4b-24}{b^2+b-30}+\frac{b+7}{5-b}$

Answer: $\frac{b+3}{b-5}$

241. $\frac{7}{15p}+\frac{5}{18pq}$

Answer: $\frac{42q+25}{90pq}$

242. $\frac{3}{20a^2}+\frac{11}{12ab^2}$

Answer: $\frac{9b^2+55a}{60a^2b^2}$

243. $\frac{4}{x-2}+\frac{3}{x+5}$

Answer: $\frac{7(x+2)}{(x-2)(x+5)}$

244. $\frac{6}{m+4}+\frac{9}{m-8}$

Answer: $\frac{15m-12}{(m+4)(m-8)}$

245. $\frac{2q+7}{y+4}-2$

Answer: $\frac{17q+2}{3q-1}$

246. $\frac{3y-1}{y+4}-2$

Answer: $\frac{y-9}{y+4}$

247. $\frac{z+2}{z-5}-\frac{z}{z+1}$

Answer: $\frac{8z+2}{(z-5)(z+1)}$

248. $\frac{t}{t-5}-\frac{t-1}{t+5}$

Answer: $\frac{11t-5}{(t-5)(t+5)}$

249. $\frac{3d}{d+2}+\frac{4}{d}-\frac{d+8}{d^2+2d}$

Answer: $\frac{3(d+1)}{d+2}$

250. $\frac{2q}{q+5}+\frac{3}{q-3}-\frac{13q+15}{q^2+2q-15}$

Answer: $\frac{d+1}{d+2}$

Everyday Math

251. **Decorating cupcakes** Victoria can decorate an order of cupcakes for a wedding in t hours, so in 1 hour she can decorate $\frac{1}{t}$ of the cupcakes. It would take her sister 3 hours longer to decorate the same order of cupcakes, so in 1 hour she can decorate $\frac{1}{t+3}$ of the cupcakes.

(a) Find the fraction of the decorating job that Victoria and her sister, working together, would complete in one hour by adding the rational expressions $\frac{1}{t}+\frac{1}{t+3}$.

(b) Evaluate your answer to part (a) when $t=5$.

Answer: (a) $\frac{2t+3}{t(t+3)}$ (b) $\frac{13}{40}$

252. **Kayaking** When Trina kayaks upriver**,** it takes her $\frac{5}{3-c}$ hours to go 5 miles, where c is the speed of the river current. It takes her $\frac{5}{3+c}$ hours to kayak 5 miles down the river.

(a) Find an expression for the number of hours it would take Trina to kayak 5 miles up the river and then return by adding $\frac{5}{3-c}+\frac{5}{3+c}$.

(b) Evaluate your answer to part (a) when $c=1$ to find the number of hours it would take Trina if the speed of the river current is 1 mile per hour.

Answer: (a) $\frac{30}{(3-c)(3+c)}$ (b) $3\frac{3}{4}$ hours

Writing Exercises

253. Felipe thinks $\frac{1}{x}+\frac{1}{y}$ is $\frac{2}{x+y}$.

(a) Choose numerical values for *x* and *y* and evaluate $\frac{1}{x}+\frac{1}{y}$.

(b) Evaluate $\frac{2}{x+y}$ for the same values of *x* and *y* you used in part (a).

(c) Explain why Felipe is wrong.

(d) Find the correct expression for $\frac{1}{x}+\frac{1}{y}$.

Answer: Answers may vary.

254. Simplify the expression $\frac{4}{n^2+6n+9}-\frac{1}{n^2-9}$ and explain all your steps.

Answer: Answers may vary.

Elementary Algebra
8: Rational Expressions and Equations
8.5 Simplify Complex Rational Expressions

Simplify a Complex Rational Expression by Writing It as Division In the following exercises, simplify.

255. $\dfrac{\dfrac{2a}{a+4}}{\dfrac{4a^2}{a^2-16}}$

Answer: $\dfrac{a-4}{2a}$

256. $\dfrac{\dfrac{3b}{b-5}}{\dfrac{b^2}{b^2-25}}$

Answer: $\dfrac{3(b+5)}{b}$

257. $\dfrac{\dfrac{5}{c^2+5c-14}}{\dfrac{10}{c+7}}$

Answer: $\dfrac{1}{2(c-2)}$

258. $\dfrac{\dfrac{8}{d^2+9d+18}}{\dfrac{12}{d+6}}$

Answer: $\dfrac{2}{3(d+3)}$

259. $\dfrac{\frac{1}{2}+\frac{5}{6}}{\frac{2}{3}+\frac{7}{9}}$

Answer: $\dfrac{24}{26}$

260. $\dfrac{\frac{1}{2}+\frac{3}{4}}{\frac{3}{5}+\frac{7}{10}}$

Answer: $\dfrac{25}{26}$

261. $\dfrac{\frac{2}{3}-\frac{1}{9}}{\frac{3}{4}+\frac{5}{6}}$

Answer: $\dfrac{20}{57}$

262. $\dfrac{\frac{1}{2}-\frac{1}{6}}{\frac{2}{3}+\frac{3}{4}}$

Answer: $\dfrac{4}{17}$

263. $\dfrac{\frac{n}{m}+\frac{1}{n}}{\frac{1}{n}-\frac{n}{m}}$

Answer: $\dfrac{n^2+m}{m-n^2}$

264. $\dfrac{\frac{1}{p}+\frac{p}{q}}{\frac{q}{p}-\frac{1}{q}}$

Answer: $\dfrac{q+p^2}{q^2-p}$

265. $\dfrac{\frac{1}{r}+\frac{1}{t}}{\frac{1}{r^2}-\frac{1}{t^2}}$

Answer: $\dfrac{rt}{t-r}$

266. $\dfrac{\dfrac{2}{v}+\dfrac{2}{w}}{\dfrac{1}{v^2}-\dfrac{1}{w^2}}$

Answer: $\dfrac{2vw}{w-v}$

267. $\dfrac{x-\dfrac{2x}{x+3}}{\dfrac{1}{x+3}+\dfrac{1}{x-3}}$

Answer: $\dfrac{(x+1)(x-3)}{2}$

268. $\dfrac{y-\dfrac{2y}{y-4}}{\dfrac{2}{y-4}-\dfrac{2}{y+4}}$

Answer: $\dfrac{(y-6)(y+4)}{4}$

269. $\dfrac{2-\dfrac{2}{a+3}}{\dfrac{1}{a+3}+\dfrac{a}{2}}$

Answer: $\dfrac{4}{a+1}$

270. $\dfrac{4-\dfrac{4}{b-5}}{\dfrac{1}{b-5}+\dfrac{b}{4}}$

Answer: $\dfrac{16}{b-1}$

Simplify a Complex Rational Expression by Using the LCD In the following exercises, simplify.

271. $\dfrac{\frac{1}{3}+\frac{1}{8}}{\frac{1}{4}+\frac{1}{12}}$

Answer: $\frac{11}{8}$

272. $\dfrac{\frac{1}{4}+\frac{1}{9}}{\frac{1}{6}+\frac{1}{12}}$

Answer: $\frac{13}{18}$

273. $\dfrac{\frac{5}{6}+\frac{2}{9}}{\frac{7}{18}-\frac{1}{3}}$

Answer: 19

274. $\dfrac{\frac{1}{6}+\frac{4}{15}}{\frac{3}{5}-\frac{1}{2}}$

Answer: $\frac{13}{3}$

275. $\dfrac{\frac{c}{d}+\frac{1}{d}}{\frac{1}{d}-\frac{d}{c}}$

Answer: $\frac{c^2+c}{c-d^2}$

276. $\dfrac{\frac{1}{m}+\frac{m}{n}}{\frac{n}{m}-\frac{1}{n}}$

Answer: $\frac{n+m^2}{n^2-m}$

277. $\frac{\frac{1}{p}+\frac{1}{q}}{\frac{1}{p^2}-\frac{1}{q^2}}$

Answer: $\frac{pq}{q-p}$

278. $\frac{\frac{2}{r}+\frac{2}{t}}{\frac{1}{r^2}-\frac{1}{t^2}}$

Answer: $\frac{2rt}{t+r}$

279. $\frac{\frac{2}{x+5}}{\frac{3}{x-5}+\frac{1}{x^2-25}}$

Answer: $\frac{2x-10}{3x+16}$

280. $\frac{\frac{5}{y-4}}{\frac{3}{y+4}+\frac{2}{y^2-16}}$

Answer: $\frac{5y+20}{3y-10}$

281. $\frac{\frac{5}{z^2-64}+\frac{3}{z+8}}{\frac{1}{z+8}+\frac{2}{z-8}}$

Answer: $\frac{3z-19}{3z+8}$

282. $\frac{\frac{3}{s+6}+\frac{5}{s-6}}{\frac{1}{s^2-36}+\frac{4}{s+6}}$

Answer: $\frac{8s+48}{4s-23}$

283. $\frac{\frac{4}{a^2-2a-15}}{\frac{1}{a-5}+\frac{2}{a+3}}$

Answer: $\frac{4}{3a-2}$

284. $\frac{\frac{5}{b^2-6b-27}}{\frac{3}{b-9}+\frac{1}{b+3}}$

Answer: $\frac{5}{4b}$

285. $\frac{\frac{5}{c+2}-\frac{3}{c+7}}{\frac{5c}{c^2+9c+14}}$

Answer: $\frac{2c+29}{5c}$

286. $\frac{\frac{6}{d-4}-\frac{2}{d+7}}{\frac{2d}{d^2+3d-28}}$

Answer: $\frac{2d+25}{d}$

287. $\frac{2+\frac{1}{p-3}}{\frac{5}{p-3}}$

Answer: $\frac{(2p-5)}{5}$

288. $\frac{\frac{n}{n-2}}{3+\frac{5}{n-2}}$

Answer: $\frac{n}{3n-1}$

289. $\frac{\frac{m}{m+5}}{4+\frac{1}{m-5}}$

Answer: $\frac{m(m-5)}{4m^2+m-95}$

290. $\frac{7+\frac{2}{q-2}}{\frac{1}{q+2}}$

Answer: $\frac{7q^2+2q-24}{q+2}$

Simplify In the following exercises, use either method.

291. $\frac{\frac{3}{4}-\frac{2}{7}}{\frac{1}{2}+\frac{5}{14}}$

Answer: $\frac{13}{24}$

292. $\frac{\frac{v}{w}+\frac{1}{v}}{\frac{1}{v}-\frac{v}{w}}$

Answer: $\frac{v^2+w}{w-v^2}$

293. $\frac{\frac{2}{a+4}}{\frac{1}{a^2-16}}$

Answer: $2(a-4)$

294. $\dfrac{\dfrac{3}{b^2-3b-40}}{\dfrac{5}{b+5}-\dfrac{2}{b-8}}$

Answer: $\dfrac{3}{3b-50}$

295. $\dfrac{\dfrac{3}{m}+\dfrac{3}{n}}{\dfrac{1}{m^2}-\dfrac{1}{n^2}}$

Answer: $\dfrac{3mn}{n-m}$

296. $\dfrac{\dfrac{2}{r-9}}{\dfrac{1}{r+9}+\dfrac{3}{r^2-81}}$

Answer: $\dfrac{2(r+9)}{r-6}$

297. $\dfrac{x-\dfrac{3x}{x+2}}{\dfrac{3}{x+2}+\dfrac{3}{x-2}}$

Answer: $\dfrac{(x-1)(x-2)}{6}$

298. $\dfrac{\dfrac{y}{y+3}}{2+\dfrac{1}{y-3}}$

Answer: $\dfrac{y(y-3)}{(y+3)(2y-5)}$

Everyday Math

299. **Electronics** The resistance of a circuit formed by connecting two resistors in parallel is $\dfrac{1}{\dfrac{1}{R_1}+\dfrac{1}{R_2}}$.

(a) Simplify the complex fraction $\dfrac{1}{\dfrac{1}{R_1}+\dfrac{1}{R_2}}$.

(b) Find the resistance of the circuit when $R_1=8$ and $R_2=12$.

Answer: (a) $\dfrac{R_1R_2}{R_2+R_1}$ (b) $\dfrac{24}{5}$

300. **Ironing** Lenore can do the ironing for her family's business in h hours. Her daughter would take $h+2$ hours to get the ironing done. If Lenore and her daughter work together, using 2 irons, the number of hours it would take them to do all the ironing is $\dfrac{1}{\dfrac{1}{h}+\dfrac{1}{h+2}}$.

(a) Simplify the complex fraction $\dfrac{1}{\dfrac{1}{h}+\dfrac{1}{h+2}}$.

(b) Find the number of hours it would take Lenore and her daughter, working together, to get the ironing done if $h=4$.

Answer: (a) $\dfrac{h(h+2)}{2h+2}$ (b) $2\dfrac{2}{5}$ hours

Writing Exercises

301. In this section, you learned to simplify the complex fraction $\dfrac{\dfrac{3}{x+2}}{\dfrac{x}{x^2-4}}$ two ways:

- rewriting it as a division problem
- multiplying the numerator and denominator by the LCD

Which method do you prefer? Why?

Answer: Answers will vary.

302. Efraim wants to start simplifying the complex fraction $\dfrac{\dfrac{1}{a}+\dfrac{1}{b}}{\dfrac{1}{a}-\dfrac{1}{b}}$ by cancelling the variables from the numerator and denominator. Explain what is wrong with Efraim's plan.

Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.6 Solve Rational Equations

Solve Rational Equations In the following exercises, solve.

303. $\frac{1}{a}+\frac{2}{5}=\frac{1}{2}$

Answer: 10

304. $\frac{5}{6}+\frac{3}{b}=\frac{1}{3}$

Answer: -6

305. $\frac{5}{2}-\frac{1}{c}=\frac{3}{4}$

Answer: $\frac{4}{7}$

306. $\frac{6}{3}-\frac{2}{d}=\frac{4}{9}$

Answer: $\frac{9}{7}$

307. $\frac{4}{5}+\frac{1}{4}=\frac{2}{v}$

Answer: $\frac{40}{21}$

308. $\frac{3}{7}+\frac{2}{3}=\frac{1}{w}$

Answer: $\frac{21}{23}$

309. $\frac{7}{9}+\frac{1}{x}=\frac{2}{3}$

Answer: -9

310. $\frac{3}{8}+\frac{2}{y}=\frac{1}{4}$

Answer: -16

311. $1-\frac{2}{m}=\frac{8}{m^2}$

Answer: $-2, 4$

312. $1+\frac{4}{n}=\frac{21}{n^2}$

Answer: $-7, 3$

313. $1+\frac{9}{p}=\frac{-20}{p^2}$

Answer: $-5, -4$

314. $1-\frac{7}{q}=\frac{-6}{q^2}$

Answer: $1, 6$

315. $\frac{1}{r+3}=\frac{4}{2r}$

Answer: -6

316. $\frac{3}{t-6}=\frac{1}{t}$

Answer: -3

317. $\frac{5}{3v-2}=\frac{7}{4v}$

Answer: 14

318. $\frac{8}{2w+1}=\frac{3}{w}$

Answer: $\frac{3}{2}$

319. $\frac{3}{x+4}+\frac{7}{x-4}=\frac{8}{x^2-16}$

Answer: $-\frac{4}{5}$

320. $\frac{5}{y-9}+\frac{1}{y+9}=\frac{18}{y^2-81}$

Answer: -3

321. $\frac{8}{z-10}+\frac{7}{z+10}=\frac{5}{z^2-100}$

Answer: $-\frac{1}{3}$

322. $\frac{9}{a+11}+\frac{6}{a-11}=\frac{7}{a^2-121}$

Answer: $\frac{8}{3}$

323. $\frac{1}{q+4}-\frac{7}{q-2}=1$

Answer: no solution

324. $\frac{3}{r+10}-\frac{4}{r-4}=1$

Answer: $-4,-3$

325. $\frac{1}{t+7}-\frac{5}{t-5}=1$

Answer: $-5,-1$

326. $\frac{2}{s+7}-\frac{3}{s-3}=1$

Answer: $-3,-2$

327. $\frac{v-10}{v^2-5v+4}=\frac{3}{v-1}-\frac{6}{v-4}$

Answer: no solution

328. $\frac{w+8}{w^2-11w+28}=\frac{5}{w-7}+\frac{2}{w-4}$

Answer: no solution

329. $\frac{x-10}{x^2+8x+12}=\frac{3}{x+2}+\frac{4}{x+6}$

Answer: no solution

330. $\frac{y-3}{y^2-4y-5}=\frac{1}{y+1}+\frac{8}{y-5}$

Answer: no solution

331. $\frac{z}{16}+\frac{z+2}{4z}=\frac{1}{2z}$

Answer: -4

332. $\frac{a}{9}+\frac{a+3}{3a}=\frac{1}{a}$

Answer: -3

333. $\frac{b+3}{3b}+\frac{b}{24}=\frac{1}{b}$

Answer: -8

334. $\frac{c+3}{12c}+\frac{c}{36}=\frac{1}{4c}$

Answer: -3

335. $\frac{d}{d+3}=\frac{18}{d^2-9}+4$

Answer: 2

336. $\frac{m}{m+5}=\frac{50}{m^2-25}+6$

Answer: 4

337. $\frac{n}{n+2}=\frac{8}{n^2-4}+3$

Answer: 1

338. $\frac{p}{p+7}=\frac{98}{p^2-49}+8$

Answer: 6

339. $\frac{q}{3q-9}-\frac{3}{4q+12}=\frac{7q^2+6q+63}{24q^2-216}$

Answer: no solution

340. $\frac{r}{3r-15}-\frac{1}{4r+20}=\frac{3r^2+17r+40}{12r^2-300}$

Answer: no solution

341. $\frac{s}{2s+6}-\frac{2}{5s+5}=\frac{5s^2-3s-7}{10s^2+40s+30}$

Answer: no solution

342. $\frac{t}{6t-12}-\frac{5}{2t+10}=\frac{t^2-23t+70}{12t^2+36t-120}$

Answer: no solution

Solve a Rational Equation for a Specific Variable In the following exercises, solve.

343. $\frac{C}{r}=2\pi$ for r

Answer: $r=\frac{C}{2\pi}$

344. $\frac{I}{r}=P$ for r

Answer: $r=\frac{I}{P}$

345. $\frac{V}{h}=lw$ for h

Answer: $h=\frac{v}{lw}$

346. $\frac{2A}{b}=h$ for b

Answer: $b=\frac{2A}{h}$

347. $\frac{v+3}{w-1}=\frac{1}{2}$ for w

Answer: $w=2v+7$

348. $\frac{x+5}{2-y}=\frac{4}{3}$ for y

Answer: $y=\frac{3x+7}{-4}$

349. $a=\frac{b+3}{c-2}$ for c

Answer: $c=\dfrac{b+3+2a}{a}$

350. $m=\dfrac{n}{2-n}$ for n

Answer: $n=\dfrac{2m}{1+m}$

351. $\dfrac{1}{p}+\dfrac{2}{q}=4$ for p

Answer: $p=\dfrac{q}{4q-2}$

352. $\dfrac{3}{s}+\dfrac{1}{t}=2$ for s

Answer: $s=\dfrac{3t}{2t-1}$

353. $\dfrac{2}{v}+\dfrac{1}{5}=\dfrac{1}{2}$ for v

Answer: $w=\dfrac{15v}{10+v}$

354. $\dfrac{6}{x}+\dfrac{2}{3}=\dfrac{1}{y}$ for y

Answer: $y=\dfrac{3x}{8+2x}$

355. $\dfrac{m+3}{n-2}=\dfrac{4}{5}$ for n

Answer: $n=\dfrac{5m+23}{n}$

356. $\dfrac{E}{c}=m^2$ for c

Answer: $c=\dfrac{E}{m^2}$

357. $\dfrac{3}{x}-\dfrac{5}{y}=\dfrac{1}{4}$ for y

Answer: $y=\frac{20x}{12-x}$

358. $\frac{R}{T}=W$ for T

Answer: $T=\frac{R}{W}$

359. $r=\frac{s}{3-t}$ for t

Answer: $t=\frac{3r-s}{r}$

360. $c=\frac{2}{a}+\frac{b}{5}$ for a

Answer: $a=\frac{10+5b}{5c}$

Everyday Math

361. **House Painting** Alain can paint a house in 4 days. Spiro would take 7 days to paint the same house. Solve the equation $\frac{1}{4}+\frac{1}{7}=\frac{1}{t}$ for t to find the number of days it would take them to paint the house if they worked together.

Answer: $2\frac{6}{11}$ days

362. **Boating** Ari drive his boat 18 miles with the current in the same amount of time it takes to drive 10 miles against the current. If the speed of the boat is 7 knots, solve the equation $\frac{18}{7+c}=\frac{10}{7-c}$ for c to find the speed of the current.

Answer: 2 knots

Writing Exercises

363. Why is there no solution to the equation $\frac{3}{x-2}=\frac{5}{x-2}$?

Answer: Answers will vary.

364. Pete thinks the equation $\frac{y}{y+6}=\frac{72}{y^2-36}+4$ has two solutions, $y=-6$ and $y=4$. Explain why Pete is wrong.

Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.7 Solve Proportion and Similar Figure Applications

Solve Proportions In the following exercises, solve.

365. $\frac{x}{56}=\frac{7}{8}$

Answer: 49

366. $\frac{n}{91}=\frac{8}{13}$

Answer: 56

367. $\frac{49}{63}=\frac{z}{9}$

Answer: 7

368. $\frac{56}{72}=\frac{y}{9}$

Answer: 7

369. $\frac{5}{a}=\frac{65}{117}$

Answer: 9

370. $\frac{4}{b}=\frac{64}{144}$

Answer: 9

371. $\frac{98}{154}=\frac{-7}{p}$

Answer: -11

372. $\frac{72}{156}=\frac{-6}{q}$

Answer: -13

373. $\frac{a}{-8}=\frac{-42}{48}$

Answer: 7

374. $\frac{b}{-7}=\frac{-30}{42}$

Answer: 5

375. $\frac{2.7}{j}=\frac{0.9}{0.2}$

Answer: 0.6

376. $\frac{2.8}{k}=\frac{2.1}{1.5}$

Answer: 2

377. $\frac{a}{a+12}=\frac{4}{7}$

Answer: 16

378. $\frac{b}{b-16}=\frac{11}{9}$

Answer: $\frac{11}{9}$

379. $\frac{c}{c-104}=-\frac{5}{8}$

Answer: $-\frac{5}{8}$

380. $\frac{d}{d-48}=-\frac{13}{3}$

Answer: $-\frac{13}{3}$

381. $\frac{m+90}{25}=\frac{m+30}{15}$

Answer: 60

382. $\frac{n+10}{4}=\frac{40-n}{6}$

Answer: 10

383. $\frac{2p+4}{8}=\frac{p+18}{6}$

Answer: 30

384. $\frac{q-2}{2}=\frac{2q-7}{18}$

Answer: 8

385. Pediatricians prescribe 5 milliliters (ml) of acetaminophen for every 25 pounds of a child's weight. How many milliliters of acetaminophen will the doctor prescribe for Jocelyn, who weighs 45 pounds?

Answer: 9 ml

386. Brianna, who weighs 6 kg, just received her shots and needs a pain killer. The pain killer is prescribed for children at 15 milligrams (mg) for every 1 kilogram (kg) of the child's weight. How many milligrams will the doctor prescribe?

Answer: 90 ml

387. A veterinarian prescribed Sunny, a 65 pound dog, an antibacterial medicine in case an infection emerges after her teeth were cleaned. If the dosage is 5 mg for every pound, how much medicine was Sunny given?

Answer: 325 mg

388. Belle, a 13 pound cat, is suffering from joint pain. How much medicine should the veterinarian prescribe if the dosage is 1.8 mg per pound?

Answer: 23.4 mg

389. A new energy drink advertises 106 calories for 8 ounces. How many calories are in 12 ounces of the drink?

Answer: 159 calories

390. One 12 ounce can of soda has 150 calories. If Josiah drinks the big 32 ounce size from the local mini-mart, how many calories does he get?

Answer: 400 calories

391. A new 7 ounce lemon ice drink is advertised for having only 140 calories. How many ounces could Sally drink if she wanted to drink just 100 calories?

Answer: 5 oz

392. Reese loves to drink healthy green smoothies. A 16 ounce serving of smoothie has 170 calories. Reese drinks 24 ounces of these smoothies in one day. How many calories of smoothie is he consuming in one day?

Answer: 255 calories

393. Janice is traveling to Canada and will change $250 US dollars into Canadian dollars. At the current exchange rate, $1 US is equal to $1.01 Canadian. How many Canadian dollars will she get for her trip?
Answer: 252.5 Canadian dollars

394. Todd is traveling to Mexico and needs to exchange $450 into Mexican pesos. If each dollar is worth 12.29 pesos, how many pesos will he get for his trip?
Answer: 5530.5 pesos

395. Steve changed $600 into 480 Euros. How many Euros did he receive for each US dollar?
Answer: 0.80 Euros

396. Martha changed $350 US into 385 Australian dollars. How many Australian dollars did she receive for each US dollar?
Answer: 0.10 Australian dollars

397. When traveling to Great Britain, Bethany exchanged her $900 into 570 British pounds. How many pounds did she receive for each American dollar?
Answer: 0.63 British pounds

398. A missionary commissioned to South Africa had to exchange his $500 for the South African Rand which is worth 12.63 for every dollar. How many Rand did he have after the exchange?
Answer: 6315 Rands

399. Ronald needs a morning breakfast drink that will give him at least 390 calories. Orange juice has 130 calories in one cup. How many cups does he need to drink to reach his calorie goal?
Answer: 3 cups

400. Sarah drinks a 32-ounce energy drink containing 80 calories per 12 ounce. How many calories did she drink?
Answer: 213.3 calories

401. Elizabeth is returning to the United States from Canada. She changes the remaining 300 Canadian dollars she has to $230.05 in American dollars . What was $1 worth in Canadian dollars?
Answer: 1.30 Canadian dollars

402. Ben needs to convert $1000 to the Japanese Yen. One American dollar is worth 123.3 Yen. How much Yen will he have?
Answer: 123,300 yen

403. A golden retriever weighing 85 pounds has diarrhea. His medicine is to 1 teaspoon per 5 pounds. How much medicine should he be given?

Answer: 17 tsp

404. Five year old Lacy was bitten by a bee. The dosage for the anti-inch liquid is 150 mg for her weight of 40 pounds. What is the dosage per pound?

Answer: 3.75 mg

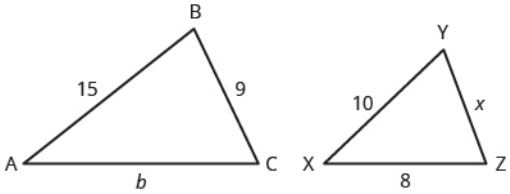
405. Karen eats $\frac{1}{2}$ cup of oatmeal that counts for 2 points on her weight loss program. Her husband, Joe, can have 3 points of oatmeal for breakfast. How much oatmeal can he have?

Answer: $\frac{3}{4}$ cup

406. An oatmeal cookie recipe calls for $\frac{1}{2}$ cup of butter to make 4 dozen cookies. Hilda needs to make 10 dozen cookies for the bake sale. How many cups of butter will she need?

Answer: $1\frac{1}{4}$ cups

Solve Similar Figure Applications In the following exercises, $\triangle ABC$ is similar to $\triangle XYZ$. Find the length of the indicated side.



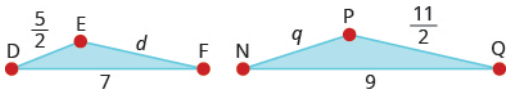
407. side *b*

Answer: 12

408. side *x*

Answer: 5.3

In the following exercises,, $\triangle DEF$ is similar to $\triangle NPQ$.



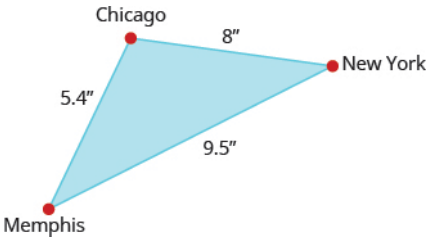
409. Find the length of side *d*.

Answer: $\frac{77}{18}$

410. Find the length of side q.

Answer: $\frac{45}{14}$

In the following two exercises, use the map shown. On the map, New York City, Chicago, and Memphis form a triangle whose sides are shown in the figure below. The actual distance from New York to Chicago is 800 miles.



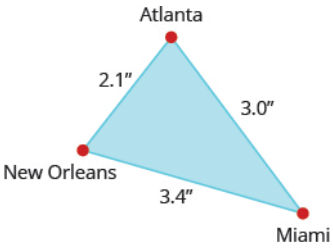
411. Find the actual distance from New York to Memphis.

Answer: 950 miles

412. Find the actual distance from Chicago to Memphis.

Answer: 540 miles

In the following two exercises, use the map shown. On the map, Atlanta, Miami, and New Orleans form a triangle whose sides are shown in the figure below. The actual distance from Atlanta to New Orleans is 420 miles.



413. Find the actual distance from New Orleans to Miami.

Answer: 680 miles

414. Find the actual distance from Atlanta to Miami.

Answer: 600 miles

415. A 2 foot tall dog casts a 3 foot shadow at the same time a cat casts a one foot shadow. How tall is the cat?

Answer: $\frac{2}{3}$ foot (8 in)

416. Larry and Tom were standing next to each other in the backyard when Tom challenged Larry to guess how tall he was. Larry knew his own height is 6.5 feet and when they measured their shadows, Larry's shadow was 8 feet and Tom's was 7.75 feet long. What is Tom's height?
Answer: 6.3 feet

417. The tower portion of a windmill is 212 feet tall. A six foot tall person standing next to the tower casts a seven foot shadow. How long is the windmill's shadow?
Answer: 247.3 feet

418. The height of the Statue of Liberty is 305 feet. Nicole, who is standing next to the statue, casts a 6 foot shadow and she is 5 feet tall. How long should the shadow of the statue be?
Answer: 366 feet

Everyday Math

419. **Heart Rate** At the gym, Carol takes her pulse for 10 sec and counts 19 beats.
(a) How many beats per minute is this?
(b) Has Carol met her target heart rate of 140 beats per minute?
Answer: (a) 114 beats per minute (b) no

420. **Heart Rate** Kevin wants to keep his heart rate at 160 beats per minute while training. During his workout he counts 27 beats in 10 seconds.
(a) How many beats per minute is this?
(b) Has Kevin met his target heart rate?
Answer: (a) 162 beats per minute (b) yes

421. **Cost of a Road Trip** Jesse's car gets 30 miles per gallon of gas.
(a) If Las Vegas is 285 miles away, how many gallons of gas are needed to get there and then home?
(b) If gas is $3.09 per gallon, what is the total cost of the gas for the trip?
Answer: (a) 19 gallons (b) $58.71

422. **Cost of a Road Trip** Danny wants to drive to Phoenix to see his grandfather. Phoenix is 370 miles from Danny's home and his car gets 18.5 miles per gallon.
(a) How many gallons of gas will Danny need to get to and from Phoenix?
(b) If gas is $3.19 per gallon, what is the total cost for the gas to drive to see his grandfather?
Answer: (a) 40 gallons (b) $127.60

423. **Lawn Fertilizer** Phil wants to fertilize his lawn. Each bag of fertilizer covers about 4,000 square feet of lawn. Phil's lawn is approximately 13,500 square feet. How many bags of fertilizer will he have to buy?
Answer: 4 bags

424. **House Paint** April wants to paint the exterior of her house. One gallon of paint covers about 350 square feet, and the exterior of the house measures approximately 2000 square feet. How many gallons of paint will she have to buy?

Answer: 6 gallons

425. **Cooking** Natalia's pasta recipe calls for 2 pounds of pasta for 1 quart of sauce. How many pounds of pasta should Natalia cook if she has 2.5 quarts of sauce?

Answer: 5

426. **Heating Oil** A 275 gallon oil tank costs $400 to fill. How much would it cost to fill a 180 gallon oil tank?

Answer: $261.82

Writing Exercises

427. Marisol solves the proportion $\frac{144}{a}=\frac{9}{4}$ by 'cross multiplying, so her first step looks like $4 \cdot 144 = 9 \cdot a$. Explain how this differs from the method of solution shown in Example 8.72.

Answer: Answers will vary.

428. Find a printed map and then write and solve an application problem similar to Example 8.79.

Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.8 Solve Uniform Motion and Work Applications

In the following exercises, solve uniform motion applications

429. Mary takes a sightseeing tour on a helicopter that can fly 450 miles against a 35 mph headwind in the same amount of time it can travel 702 miles with a 35 mph tailwind. Find the speed of the helicopter.

Answer: 160 mph

430. A private jet can fly 1210 miles against a 25 mph headwind in the same amount of time it can fly 1694 miles with a 25 mph tailwind. Find the speed of the jet.

Answer: 150 mph

431. A boat travels 140 miles downstream in the same time as it travels 92 miles upstream. The speed of the current is 6mph. What is the speed of the boat?

Answer: 29 mph

432. Darrin can skateboard 2 miles against a 4mph wind in the same amount of time he skateboards 6 miles with a 4 mph wind. Find the speed Darrin skateboards with no wind.

Answer: 8 mph

433. Jane spent 2 hours exploring a mountain with a dirt bike. When she rode the 40 miles up the hill, she went 5 mph slower than when she reached the peak and rode for 12 miles along the summit. What was her rate along the summit?

Answer: 30 mph

434. Jill wanted to lose some weight so she planned a day of exercising. She spent a total of 2 hours riding her bike and jogging. She biked for 12 miles and jogged for 6 miles. Her rate for jogging was 10 mph less than biking rate. What was her rate when jogging?

Answer: 5 mph

435. Bill wanted to try out different water craft. He went 62 miles downstream in a motor boat and 27 miles downstream on a jet ski. His speed on the jet ski was 10 mph faster than in the motor boat. Bill spent a total of 4 hours on the water. What was his rate of speed in the motor boat?

Answer: 20 mph

436. Nancy took a 3 hour drive. She went 50 miles before she got caught in a storm. Then she drove 68 miles at 9 mph less than she had driven when the weather was good. What was her speed driving in the storm?

Answer: 36 mph

437. Chester rode his bike uphill 24 miles and then back downhill at 2 mph faster than his uphill rate. If it took him 2 hours longer to ride uphill than downhill, l, what was his uphill rate?
Answer: 4 mph

438. Matthew jogged to his friend's house 12 miles away and then got a ride back home. It took him 2 hours longer to jog there than ride back. His jogging rate was 25 mph slower than the rate when he was riding. What was his jogging rate?
Answer: 5 mph

439. Hudson travels 1080 miles in a jet and then 240 miles by car to get to a business meeting. The jet goes 300 mph faster than the rate of the car, and the car ride takes 1 hour longer than the jet. What is the speed of the car?
Answer: 60 mph

440. Nathan walked on an asphalt pathway for 12 miles. He walked the 12 miles back to his car on a gravel road through the forest. On the asphalt he walked 2 miles per hour faster than on the gravel. The walk on the gravel took one hour longer than the walk on the asphalt. How fast did he walk on the gravel?
Answer: 4 mph

441. John can fly his airplane 2800 miles with a wind speed of 50 mph in the same time he can travel 2400 miles against the wind. If the speed of the wind is 50 mph, find the speed of his airplane.
Answer: 650 mph

442. Jim's speedboat can travel 20 miles upstream against a 3 mph current in the same amount of time it travels 22 miles downstream with a 3 mph current speed. Find the speed of the Jim's boat.
Answer: 63 mph

443. Hazel needs to get to her granddaughter's house by taking an airplane and a rental car. She travels 900 miles by plane and 250 miles by car. The plane travels 250 mph faster than the car. If she drives the rental car for 2 hours more than she rode the plane, find the speed of the car.
Answer: 50 mph

444. Stu trained for 3 hours yesterday. He ran 14 miles and then biked 40 miles. His biking speed is 6 mph faster than his running speed. What is his running speed?
Answer: 14 mph

445. When driving the 9 hour trip home, Sharon drove 390 miles on the interstate and 150 miles on country roads. Her speed on the interstate was 15 more than on country roads. What was her speed on country roads?
Answer: 50 mph

446. Two sisters like to compete on their bike rides. Tamara can go 4mph faster than her sister, Samantha. If it takes Samantha 1 hours longer than Tamara to go 80 miles, how fast can Samantha ride her bike?
Answer: 16 mph

In the following exercises, solve work applications.
447. Mike, an experienced bricklayer, can build a wall in 3 hours, while his son, who is learning, can do the job in 6 hours. How long does it take for them to build a wall together?
Answer: 2 hours

448. It takes Sam 4 hours to rake the front lawn while his brother, Dave, can rake the lawn in 2 hours. How long will it take them to rake the lawn working together?
Answer: 1 hour and 20 minutes

449. Mary can clean her apartment in 6 hours while her roommate can clean the apartment in 5 hours. If they work together, how long would it take them to clean the apartment?
Answer: 2 hours and 44 minutes

450. Brian can lay a slab of concrete in 6 hours, while Greg can do it in 4 hours. If Brian and Greg work together, how long will it take?
Answer: 2 hours and 24 minutes

451. Leeson can proofread a newspaper copy in 4 hours. If Ryan helps, they can do the job in 3 hours. How long would it take for Ryan proofreader to do his job alone?
Answer: 12 hours

452. Paul can clean a floor of classroom in 3 hours. When his assistant helps him, the job takes 2 hours. How long would it take the assistant to do it alone?
Answer: 6 hours

453. Josephine can correct her students' test papers in 5 hours, but if her teacher's assistant helps, it would take them 3 hours. How long would it take the assistant to do it alone?
Answer: 7 hours and 30 minutes

454. Washing his dad's car alone, eight year old Levi takes 2. 5 hours. If his dad helps him, then it takes 1 hour. How long does it take the Levi's dad to wash the car by himself?
Answer: 1 hour and 40 minutes

455. Jackson can remove the shingles off of a house in 7 hours, while Martin can remove the shingles in 5 hours. How long will it take them to remove the shingles if they work together?
Answer: 2 hours and 55 minutes

456. At the end of the day Dodie can clean her hair salon in 15 minutes. Ann, who works with her, can clean the salon in 30 minutes. How long would it take them to clean the shop if they work together?
Answer: 10 min

457. Ronald can shovel the driveway in 4 hours, but if his brother Donald helps it would take 2 hours. How long would it take Donald to shovel the driveway alone?
Answer: 4 hours

458. It takes Tina 3 hours to frost her holiday cookies, but if Candy helps her it takes 2 hours. How long would it take Candy to frost the holiday cookies by herself?
Answer: 6 hours

Everyday Math

459. Dana enjoys taking her dog for a walk, but sometimes her dog gets away and she has to run after him. Dana walked her dog for 7 miles but then had to run for 1 mile, spending a total time of 2. 5 hours with her dog. Her running speed was 3 mph faster than her walking speed. Find her walking speed.
Answer: 3 mph

460. Ken and Joe leave their apartment to go to a football game 45 miles away. Ken drives his car 30 mph faster Joe can ride his bike. If it takes Joe 2 hours longer than Ken to get to the game, what is Joe's speed?
Answer: 15 mph

Writing Exercises

461. In Example 8.83, the solution $h = -4$ is crossed out. Explain why.
Answer: Answers will vary.

462. Paula and Yuki are roommates. It takes Paula 3 hours to clean their apartment. It takes Yuki 4 hours to clean the apartment. The equation $\frac{1}{3} + \frac{1}{4} = \frac{1}{t}$ can be used to find t, the number of hours it would take both of them, working together, to clean their apartment. Explain how this equation models the situation.
Answer: Answers will vary.

Elementary Algebra
8: Rational Expressions and Equations
8.9 Use Direct and Inverse Variation

In the following exercises, solve.

463. If y varies directly as x and $y=14$, when $x=3$, find the equation that relates x and y.

Answer: $y=\frac{14}{3}x$

464. If p varies directly as q and $p=5$, when $q=2$, find the equation that relates p and q.

Answer: $p=\frac{5}{2}q$

465. If v varies directly as w and $v=24$, when $w=8$, find the equation that relates v and w.

Answer: $u=3w$

466. If a varies directly as b and $a=16$, when $b=4$, find the equation that relates a and b.

Answer: $a=4b$

467. If p varies directly as q and $p=9.6$, when $q=3$, find the equation that relates p and q.

Answer: $p=3.2q$

468. If y varies directly as x and $y=12.4$, when $x=4$, find the equation that relates x and y

Answer: $y=3.1x$

469. If a varies directly as b and $a=6$, when $b=\frac{1}{3}$, find the equation that relates a and b.

Answer: $a=18b$

470. If v varies directly as w and $v=8$, when $w=\frac{1}{2}$, find the equation that relates v and w.

Answer: $v=16w$

471. The amount of money Sally earns, *P*, varies directly with the number, *n*, of necklaces she sells. When Sally sells 15 necklaces she earns $150.
(a) Write the equation that relates *P* and *n*.
(b) How much money would she earn if she sold 4 necklaces?

Answer: (a) $P=10n$ (b) $\$40$

472. The price, P, that Eric pays for gas varies directly with the number of gallons, g, he buys. It costs him \$50 to buy 20 gallons of gas.
(a) Write the equation that relates P and g.
(b) How much would 33 gallons cost Eric?
Answer: (a) $P = 2.5g$ (b) $\$82.50$

473. Terri needs to make some pies for a fundraiser. The number of apples, a, varies directly with number of pies, p. It takes nine apples to make two pies.
(a) Write the equation that relates a and p.
(b) How many apples would Terri need for six pies?
Answer: (a) $a = 4.5p$ (b) 27 apples

474. Joseph is traveling on a road trip. The distance, d, he travels before stopping for lunch varies directly with the speed, v, he travels. He can travel 120 miles at a speed of 60 mph.
(a) Write the equation that relates d and v.
(b) How far would he travel before stopping for lunch at a rate of 65 mph?
Answer: (a) $d = 2v$ (b) 130 miles

475. The price of gas that Jesse purchased varies directly to how many gallons he purchased. He purchased 10 gallons of gas for \$39.80.
(a) Write the equation that relates the price to the number of gallons.
(b) How much will it cost Jesse for 15 gallons of gas?
Answer: (a) $p = 3.98g$ (b) $\$59.70$

476. The distance that Sarah travels varies directly to how long she drives. She travels 440 miles in 8 hours.
(a) Write the equation that relates the distance to the number of hours.
(b) How far can Sally travel in 6 hours?
Answer: (a) $d = 55h$ (b) 330 miles

477. The mass of a liquid varies directly with its volume. A liquid with mass 16 kilograms has a volume of 2 liters.
(a) Write the equation that relates the mass to the volume.
(b) What is the volume of this liquid if its mass is 128 kilograms?
Answer: (a) $m = 8v$ (b) 16 liters

478. The length that a spring stretches varies directly with a weight placed at the end of the spring. When Sarah placed a 10 pound watermelon on a hanging scale, the spring stretched 5 inches.
(a) Write the equation that relates the length of the spring to the weight.
(b) What weight of watermelon would stretch the spring 6 inches??
Answer: (a) $L = 0.5p$ (b) 12 pounds

479. The distance an object falls varies directly to the square of the time it falls. A ball falls 45 feet in 3 seconds.
(a) Write the equation that relates the distance to the time.
(b) How far will the ball fall in 7 seconds?
Answer: (a) $d = 5t^2$ (b) 245 feet

480. The maximum load a beam will support varies directly with the square of the diagonal of the beam's cross-section. A beam with diagonal 6 inch will support a maximum load of 108 pounds.
(a) Write the equation that relates the load to the diagonal of the cross-section.
(b) What load will a beam with a 10 inch diagonal support?
Answer: (a) $L = 3d^2$ (b) 300 pounds

481. The area of a circle varies directly as the square of the radius. A circular pizza with a radius of 6 inches has an area of 113.04 square inches.
(a) Write the equation that relates the area to the radius.
(b) What is the area of a personal pizza with a radius 4 inches?
Answer: (a) $A = 3.14r^2$ (b) 50.24 sq. in.

482. The distance an object falls varies directly to the square of the time it falls. A ball falls 72 feet in 3 seconds,
(a) Write the equation that relates the distance to the time.
(b) How far will the ball have fallen in 8 seconds?
Answer: (a) $d = 8t^2$ (b) 512 feet

483. If y varies inversely with x and $y = 5$ when $x = 4$ find the equation that relates x and y.
Answer: $y = \frac{20}{x}$

484. If p varies inversely with q and $p = 2$ when $q = 1$ find the equation that relates p and q.
Answer: $p = \frac{2}{q}$

485. If v varies inversely with w and $v = 6$ when $w = \frac{1}{2}$ find the equation that relates v and w.
Answer: $v = \frac{3}{w}$

486. If a varies inversely with b and $a=12$ when $b=\frac{1}{3}$ find the equation that relates a and b.

Write an inverse variation equation to solve the following problems.

Answer: $a=\frac{4}{b}$

487. The fuel consumption (mpg) of a car varies inversely with its weight. A Toyota Corolla weighs 2800 pounds getting 33 mpg on the highway.
(a) Write the equation that relates the mpg to the car's weight.
(b) What would the fuel consumption be for a Toyota Sequoia that weighs 5400 pounds?

Answer: (a) $g=\frac{92{,}400}{w}$ (b) 16.8 mpg

488. A car's value varies inversely with its age. Jackie bought a 10 year old car for $2,400.
(a) Write the equation that relates the car's value to its age.
(b) What will be the value of Jackie's car when it is 15 years old ?

Answer: (a) $v=\frac{24{,}000}{a}$ (b) $1,600

489. The time required to empty a tank varies inversely as the rate of pumping. It took Janet 5 hours to pump her flooded basement using a pump that was rated at 200 gpm (gallons per minute).
(a) Write the equation that relates the number of hours to the pump rate.
(b) How long would it take Janet to pump her basement if she used a pump rated at 400 gpm?

Answer: (a) $t=\frac{1000}{r}$ (b) 2.5 hours

490. The volume of a gas in a container varies inversely as pressure on the gas. A container of helium has a volume of 370 cubic inches under a pressure of 15 psi.
(a) Write the equation that relates the volume to the pressure.
(b) What would be the volume of this gas if the pressure was increased to 20 psi?

Answer: (a) $v=\frac{5{,}550}{p}$ (b) 277.5 cub. in.

491. On a string instrument, the length of a string varies inversely as the frequency of its vibrations. An 11-inch string on a violin has a frequency of 400 cycles per second.
(a) Write the equation that relates the string length to its frequency.
(b) What is the frequency of a 10-inch string?

Answer: (a) $L=\frac{4{,}400}{f}$ (b) 440 cycles per second

492. Paul, a dentist, determined that the number of cavities that develops in his patient's mouth each year varies inversely to the number of minutes spent brushing each night. His patient, Lori, had 4 cavities when brushing her teeth 30 seconds (0.5 minutes) each night.
(a) Write the equation that relates the number of cavities to the time spent brushing.
(b) How many cavities would Paul expect Lori to have if she had brushed her teeth for 2 minutes each night?

Answer: (a) $c = \frac{2}{t}$ (b) 1 cavity

493. The number of tickets for a sports fundraiser varies inversely to the price of each ticket. Brianna can buy 25 tickets at $5.
(a) Write the equation that relates the number of tickets to the price of each ticket.
(b) How many tickets could Brianna buy if the price of each ticket was $2.50?

Answer: (a) $t = \frac{125}{p}$ (b) 50 tickets

494. Boyle's Law states that if the temperature of a gas stays constant, then the pressure varies inversely to the volume of the gas. Braydon, a scuba diver, has a tank that holds 6 liters of air under a pressure of 220 psi.
(a) Write the equation that relates pressure to volume.
(b) If the pressure increases to 330 psi, how much air can Braydon's tank hold?

Answer: (a) $p = \frac{1{,}320}{v}$ (b) 4 liters

Mixed Practice

495. If y varies directly as x and $y = 5,$ when $x = 3.$, find the equation that relates x and y.

Answer: $y = \frac{5}{3}x$

496. If p varies inversely with q and $p = 5$ when $q = 6$, find the equation that relates p and q.

Answer: $p = \frac{30}{q}$

497. If v varies directly as w and $v = 21,$ when $w = 8.$ find the equation that relates v and w.

Answer: $v = \frac{21}{8}w$

498. If y varies inversely with x and $y = 11$ when $x = 3$ find the equation that relates x and y.

Answer: $y = \frac{33}{x}$

499. If p varies directly as q and $p = 10$, when $q = 2$. find the equation that relates p and q.

Answer: $p = 5q$

500. If v varies inversely with w and $v = 18$ when $w = \frac{1}{3}$ find the equation that relates v and w.

Answer: $v = \frac{6}{w}$

501. The force needed to break a board varies inversely with its length. If Tom uses 20 pounds of pressure to break a 1.5-foot long board, how many pounds of pressure would he need to use to break a 6 foot long board?

Answer: 5 pounds

502. The number of hours it takes for ice to melt varies inversely with the air temperature. A block of ice melts in 2.5 hours when the temperature is 54 degrees. How long would it take for the same block of ice to melt if the temperature was 45 degrees?

Answer: 3 hours

503. The length a spring stretches varies directly with a weight placed at the end of the spring. When Meredith placed a 6-pound cantaloupe on a hanging scale, the spring stretched 2 inches. How far would the spring stretch if the cantaloupe weighed 9 pounds?

Answer: 3 inches

504. The amount that June gets paid varies directly the number of hours she works. When she worked 15 hours, she got paid $111. How much will she be paid for working 18 hours?

Answer: $133.20

505. The fuel consumption (mpg) of a car varies inversely with its weight. A Ford Focus weighs 3000 pounds and gets 28.7 mpg on the highway. What would the fuel consumption be for a Ford Expedition that weighs 5,500 pounds? Round to the nearest tenth.

Answer: 15.6 mpg

506. The volume of a gas in a container varies inversely as the pressure on the gas. If a container of argon has a volume of 336 cubic inches under a pressure of 2,500 psi, what will be its volume if the pressure is decreased to 2,000 psi?

Answer: 420 psi

507. The distance an object falls varies directly to the square of the time it falls. If an object falls 52.8 feet in 4 seconds, how far will it fall in 9 seconds?

Answer: 267.3 feet

508. The area of the face of a Ferris wheel varies directly with the square of its radius. If the area of one face of a Ferris wheel with diameter 150 feet is 70,650 square feet, what is the area of one face of a Ferris wheel with diameter of 16 feet?

Answer: 803.84 sq. ft.

Everyday Math

509. **Ride Service** It costs $35 for a ride from the city center to the airport, 14 miles away.
(a) Write the equation that relates the cost, *c*, with the number of miles, *m*.
(b) What would it cost to travel 22 miles with this service?

Answer: (a) $c = 2.5m$ (b) $54

510. **Road Trip** The number of hours it takes Jack to drive from Boston to Bangor is inversely proportional to his average driving speed. When he drives at an average speed of 40 miles per hour, it takes him 6 hours for the trip.
(a) Write the equation that relates the number of hours, *h*, with the speed, *s.*
(b) How long would the trip take if his average speed was 75 miles per hour?

Answer: (a) $h = \frac{240}{s}$ (b) 3.2 hours

Writing Exercises

511. In your own words, explain the difference between direct variation and inverse variation.

Answer: Answers will vary.

512. Make up an example from your life experience of inverse variation.

Answer: Answers will vary.

Chapter Review

8.1 Simplify Rational Expressions

Determine the Values for Which a Rational Expression is Undefined In the following exercises, determine the values for which the rational expression is undefined.

513. $\frac{2a+1}{3a-2}$

Answer: $a \neq \frac{2}{3}$

514. $\frac{b-3}{b^2-16}$

Answer: $b \neq -4, 4$

515. $\frac{3xy^2}{5y}$

Answer: $y \neq 0$

516. $\frac{u-3}{u^2-u-30}$

Answer: $u \neq -5, 6$

Evaluate Rational Expressions In the following exercises, evaluate the rational expressions for the given values.

517. $\frac{4p-1}{p^2+5}$ when $p=-1$

Answer: $-\frac{5}{6}$

518. $\frac{q^2-5}{q+3}$ when $q=7$

Answer: $\frac{9}{2}$

519. $\frac{y^2-8}{y^2-y-2}$ when $y=1$

Answer: $\frac{7}{2}$

520. $\frac{z^2+2}{4z-z^2}$ when $z=3$

Answer: $\frac{8}{3}$

Simplify Rational Expressions In the following exercises, simplify.

521. $\frac{10}{24}$

Answer: $\frac{5}{12}$

522. $\frac{8m^4}{16mn^3}$

Answer: $\frac{m^3}{2n^3}$

523. $\frac{14a-14}{a-1}$

Answer: 14

524. $\frac{b^2+7b+12}{b^2+8b+16}$

Answer: $\frac{b+3}{b+4}$

Simplify Rational Expressions with Opposite Factors In the following exercises, simplify.

525. $\frac{c^2-c-2}{4-c^2}$

Answer: $-\frac{c+1}{c+2}$

526. $\frac{d-16}{16-d}$

Answer: -1

527. $\frac{7v-35}{25-v^2}$

Answer: $-\frac{7}{5+v}$

528. $\frac{w^2-3w-28}{49-w^2}$

Answer: $-\frac{(w+4)}{(7+w)}$

8.2 Multiply and Divide Rational Expressions

Multiply Rational Expressions In the following exercises, multiply.

529. $\frac{3}{8}\bullet\frac{2}{15}$

Answer: $\frac{1}{20}$

530. $\frac{2xy^2}{8y^3}\bullet\frac{16y}{24x}$

Answer: $\frac{1}{6}$

531. $\frac{3a^2+21a}{a^2+6a-7}\cdot\frac{a-1}{ab}$

Answer: $\frac{3}{b}$

532. $\frac{5z^2}{5z^2+40z+35}\bullet\frac{z^2-1}{3z}$

Answer: $\frac{z(z-1)}{3(z+7)}$

Divide Rational Expressions In the following exercises, divide.

533. $\frac{t^2-4t-12}{t^2+8t+12}\div\frac{t^2-36}{6t}$

Answer: $\frac{6t}{(t+6)^2}$

534. $\frac{r^2-16}{4}\div\frac{r^3-64}{2r^2-8r+32}$

Answer: $\frac{2(r^2+4r+16)}{(r-4)(r^2+4r+16)}$

535. $\frac{11+w}{w-9} \div \frac{121-w^2}{9-w}$

Answer: $\frac{1}{11+w}$

536. $\frac{3y^2-12y-63}{4y+3} \div (6y^2-42y)$

Answer: $\frac{y+3}{2y(4y+3)}$

537. $\frac{\frac{c^2-64}{3c^2+26c+16}}{\frac{c^2-4c-32}{15c+10}}$

Answer: $\frac{5}{c+4}$

538. $\frac{8m^2-8m}{m-4} \cdot \frac{m^2+2m-24}{m^2+7m+10} \div \frac{2m^2-6m}{m+5}$

Answer: $\frac{4(m-1)(m+6)}{(m+2)(m-3)}$

8.3 Add and Subtract Rational Expressions with a Common Denominator

Add Rational Expressions with a Common Denominator In the following exercises, add.

539. $\frac{3}{5}+\frac{2}{5}$

Answer: 1

540. $\frac{4a^2}{2a-1}-\frac{1}{2a-1}$

Answer: $2a+1$

541. $\frac{p^2+10p}{p+5}+\frac{25}{p+5}$

Answer: $p+5$

542. $\frac{3x}{x-1}+\frac{2}{x-1}$

Answer: $\frac{3x+2}{x-1}$

Subtract Rational Expressions with a Common Denominator In the following exercises, subtract.

543. $\frac{d^2}{d+4}-\frac{3d+28}{d+4}$

Answer: $d-7$

544. $\frac{z^2}{z+10}-\frac{100}{z+10}$

Answer: $z-10$

545. $\frac{4q^2-q+3}{q^2+6q+5}-\frac{3q^2+q+6}{q^2+6q+5}$

Answer: $\frac{q-3}{q+5}$

546. $\frac{5t+4t+3}{t^2-25}-\frac{4t^2-8t-32}{t^2-25}$

Answer: $\frac{t+7}{t-5}$

Add and Subtract Rational Expressions whose Denominators are Opposites In the following exercises, add and subtract.

547. $\frac{18w}{6w-1}+\frac{3w-2}{1-6w}$

Answer: $\frac{15w+2}{6w-1}$

548. $\frac{a^2+3a}{a^2-4}-\frac{3a-8}{4-a^2}$

Answer: $\frac{a+2}{a-4}$

549. $\frac{2b^2+3b-15}{b^2-49}-\frac{b^2+16b-1}{49-b^2}$

Answer: $\frac{3b-2}{b+7}$

550. $\frac{8y^2-10y+7}{2y-5}+\frac{2y^2+7y+2}{5-2y}$

Answer: $3y-1$

8.4 Add and Subtract Rational Expressions With Unlike Denominators

Find the Least Common Denominator of Rational Expressions In the following exercises, find the LCD.

551. $\frac{4}{m^2-3m-10}, \frac{2m}{m^2-m-20}$

Answer: $(m+2)(m-5)(m+4)$

552. $\frac{6}{n^2-4}, \frac{2n}{n^2-4n+4}$

Answer: $(n-2)(n-2)(n+2)$

553. $\frac{5}{3p^2+17p-6}, \frac{2m}{3p^2-23p-8}$

Answer: $(3p+1)(p+6)(p+8)$

Find Equivalent Rational Expressions In the following exercises, rewrite as equivalent rational expressions with the given denominator.

554. Rewrite as equivalent rational expressions with denominator $(m+2)(m-5)(m+4)$;
$\frac{4}{m^2-3m-10}, \frac{2m}{m^2-m-20}$

Answer: $\frac{4m+16}{(m+2)(m-5)(m+4)}, \frac{2m^2+4m}{(m+2)(m-5)(m+4)}$

555. Rewrite as equivalent rational expressions with denominator $(n-2)(n-2)(n+2)$:
$\frac{6}{n^2-4n+4}, \frac{2n}{n^2-4}$

Answer: $\frac{6n+12}{(n-2)(n-2)(n+2)}, \frac{2n^2-4n}{(n-2)(n-2)(n+2)}$

556. Rewrite as equivalent rational expressions with denominator $(3p+1)(p+6)(p+8)$

$$\frac{5}{3p^2+19p+6},\ \frac{7p}{3p^2+25p+8}$$

Answer: $\frac{5p+40}{(3p+1)(p+6)(p+8)},\ \frac{7p^2+42p}{(3p+1)(p+6)(p+8)}$

Add Rational Expressions with Different Denominators In the following exercises, add.

557. $\frac{2}{3}+\frac{3}{5}$

Answer: $\frac{19}{15}$

558. $\frac{7}{5a}+\frac{3}{2b}$

Answer: $\frac{14b+15a}{10ab}$

559. $\frac{2}{c-2}+\frac{9}{c+3}$

Answer: $\frac{11c-12}{(c-2)(c+3)}$

560. $\frac{3d}{d^2-9}+\frac{5}{d^2+6d+9}$

Answer: $\frac{3d^2+14d-15}{(d+3)(d+3)(d-3)}$

561. $\frac{2x}{x^2+10x+24}+\frac{3x}{x^2+8x+16}$

Answer: $\frac{5x^2+26x}{(x+4)(x+4)(x+6)}$

562. $\frac{5q}{p^2q-p^2}+\frac{4q}{q^2-1}$

Answer: $\frac{q(5q+5+4p^2)}{p^2(q-1)(q+1)}$

Subtract Rational Expressions with Different Denominators In the following exercises, subtract and add.

563. $\frac{3v}{v+2}-\frac{v+2}{v+8}$

Answer: $\frac{2(v^2+10v-2)}{(v+2)(v+8)}$

564. $\frac{-3w-15}{w^2+w-20}-\frac{w+2}{4-w}$

Answer: $\frac{w-1}{w-4}$

565. $\frac{7m+3}{m+2}-5$

Answer: $\frac{2m-7}{m+2}$

566. $\frac{n}{n+3}+\frac{2}{n-3}-\frac{n-9}{n^2-9}$

Answer: $\frac{n-5}{n+3}$

567. $\frac{8d}{d^2-64}-\frac{4}{d+8}$

Answer: $\frac{4}{d-8}$

568. $\frac{5}{12x^2y}+\frac{7}{20xy^3}$

Answer: $\frac{25y^2+21x}{60x^2y^3}$

8.5 Simplify Complex Rational Expressions

Simplify a Complex Rational Expression by Writing it as Division In the following exercises, simplify.

569. $\dfrac{\dfrac{5a}{a+2}}{\dfrac{10a^2}{a^2-4}}$

Answer: $\dfrac{a-2}{2a}$

570. $\dfrac{\dfrac{2}{5}+\dfrac{5}{6}}{\dfrac{1}{3}+\dfrac{1}{4}}$

Answer: $\dfrac{74}{35}$

571. $\dfrac{x-\dfrac{3x}{x+5}}{\dfrac{1}{x+5}+\dfrac{1}{x-5}}$

Answer: $\dfrac{(x-8)(x-5)}{2}$

572. $\dfrac{\dfrac{2}{m}+\dfrac{m}{n}}{\dfrac{n}{m}-\dfrac{1}{n}}$

Answer: $\dfrac{2n+m^2}{n^2-m}$

Simplify a Complex Rational Expression by Using the LCD In the following exercises, simplify.

573. $\dfrac{6+\dfrac{2}{q-4}}{\dfrac{5}{q+4}}$

Answer: $\dfrac{(q-2)(q+4)}{5(q-4)}$

574. $\dfrac{\dfrac{3}{a^2}-\dfrac{1}{b}}{\dfrac{1}{a}+\dfrac{1}{b^2}}$

Answer: $\dfrac{3b^2-a^2b}{ab^2+a^2}$

575. $\dfrac{\dfrac{2}{z^2-49}+\dfrac{1}{z+7}}{\dfrac{9}{z+7}+\dfrac{12}{z-7}}$

Answer: $\dfrac{z-5}{21z+21}$

576. $\dfrac{\dfrac{3}{y^2-4y-32}}{\dfrac{2}{y-8}+\dfrac{1}{y+4}}$

Answer: $\dfrac{1}{y}$

8.6 Solve Rational Equations

Solve Rational Equations In the following exercises, solve.

577. $\dfrac{1}{2}+\dfrac{2}{3}=\dfrac{1}{x}$

Answer: $\dfrac{6}{7}$

578. $1-\dfrac{2}{m}=\dfrac{8}{m^2}$

Answer: $-2, 4$

579. $\dfrac{1}{b-2}+\dfrac{1}{b+2}=\dfrac{3}{b^2-4}$

Answer: $\dfrac{3}{2}$

580. $\dfrac{3}{q+8}-\dfrac{2}{q-2}=1$

Answer: 3

581. $\frac{v-15}{v^2-9v+18}=\frac{4}{v-3}+\frac{2}{v-6}$

Answer: no solution

582. $\frac{z}{12}+\frac{z+3}{3z}=\frac{1}{z}$

Answer: -4

Solve a Rational Equation for a Specific Variable In the following exercises, solve for the indicated variable.

583. $\frac{V}{l}=hw$ for l

Answer: $l=\frac{V}{hw}$

584. $\frac{1}{x}-\frac{2}{y}=5$ for y

Answer: $y=\frac{2x}{1-5x}$

585. $x=\frac{y+5}{z-7}$ for z

Answer: $z=\frac{y+5+7x}{x}$

586. $P=\frac{k}{V}$ for V

Answer: $V=\frac{k}{P}$

8.7 Solve Proportion and Similar Figure Applications Similarity

Solve Proportions In the following exercises, solve.

587. $\frac{x}{4}=\frac{3}{5}$

Answer: $\frac{12}{5}$

588. $\frac{3}{y}=\frac{9}{5}$

Answer: $\frac{5}{3}$

589. $\frac{s}{s+20}=\frac{3}{7}$

Answer: 15

590. $\frac{t-3}{5}=\frac{t+2}{9}$

Answer: $\frac{37}{4}$

In the following exercises, solve using proportions.

591. Rachael had a 21 ounce strawberry shake that has 739 calories. How many calories are there in a 32 ounce shake?

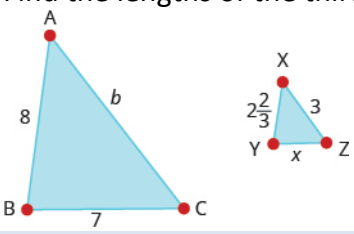
Answer: 1161 calories

592. Leo went to Mexico over Christmas break and changed $525 dollars into Mexican pesos. At that time, the exchange rate had $1 US is equal to 16.25 Mexican pesos. How many Mexican pesos did he get for his trip?

Answer: 8531.51 pesos

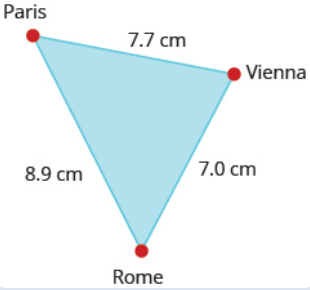
Solve Similar Figure Applications In the following exercises, solve.

593. ΔABC is similar to ΔXYZ. The lengths of two sides of each triangle are given in the figure. Find the lengths of the third sides.



Answer: $b=9;\ x=2\frac{1}{3}$

594. On a map of Europe, Paris, Rome, and Vienna form a triangle whose sides are shown in the figure below. If the actual distance from Rome to Vienna is 700 miles, find the distance from (a) Paris to Rome (b) Paris to Vienna



Answer: (a) 890 miles (b) 770 miles

595. Tony is 5.75 feet tall. Late one afternoon, his shadow was 8 feet long. At the same time, the shadow of a nearby tree was 32 feet long. Find the height of the tree.

Answer: 23 feet

596. The height of a lighthouse in Pensacola, Florida is 150 feet. Standing next to the statue, 5.5 foot tall Natalie cast a 1.1 foot shadow How long would the shadow of the lighthouse be?

Answer: 30 feet

8.8 Solve Uniform Motion and Work Applications Problems

Solve Uniform Motion Applications In the following exercises, solve.

597. When making the 5-hour drive home from visiting her parents, Lisa ran into bad weather. She was able to drive 176 miles while the weather was good, but then driving 10 mph slower, went 81 miles when it turned bad. How fast did she drive when the weather was bad?

Answer: 45 mph

598. Mark is riding on a plane that can fly 490 miles with a tailwind of 20 mph in the same time that it can fly 350 miles against a tailwind of 20 mph. What is the speed of the plane?

Answer: 120 mph

599. John can ride his bicycle 8 mph faster than Luke can ride his bike. It takes Luke 3 hours longer than John to ride 48 miles. How fast can John ride his bike?

Answer: 16 mph

600. Mark was training for a triathlon. He ran 8 kilometers and biked 32 kilometers in a total of 3 hours. His running speed was 8 kilometers per hour less than his biking speed. What was his running speed?

Answer: 8 km/hr

Solve Work Applications In the following exercises, solve.

601. Jerry can frame a room in 1 hour, while Jake takes 4 hours. How long could they frame a room working together?

Answer: $\frac{4}{5}$ hour

602. Lisa takes 3 hours to mow the lawn while her cousin, Barb, takes 2 hours. How long will it take them working together?

Answer: $1\frac{1}{5}$ hour

603. Jeffrey can paint a house in 6 days, but if he gets a helper he can do it in 4 days. How long would it take the helper to paint the house alone?

Answer: 12 days

604. Sue and Deb work together writing a book that takes them 90 days. If Sue worked alone it would take her 120 days. How long would it take Deb to write the book alone?

Answer: 360 days

8.9 Use Direct and Inverse Variation

Solve Direct Variation Problems In the following exercises, solve.

605. If y varies directly as x, when $y=9$ and $x=3$, find x when $y=21$.

Answer: 7

606. If y varies inversely as x, when $y=20$ and $x=2$ find y when $x=4$.

Answer: 10

607. If m varies inversely with the square of n, when $m=4$ and $n=6$ find m when $n=2$.

Answer: 36

608. Vanessa is traveling to see her fiancé. The distance, *d*, varies directly with the speed, *v*, she drives. If she travels 258 miles driving 60 mph, how far would she travel going 70 mph?

Answer: 301 mph

609. If the cost of a pizza varies directly with its diameter, and if an 8” diameter pizza costs $12, how much would a 6” diameter pizza cost?

Answer: $9

610. The distance to stop a car varies directly with the square of its speed. It takes 200 feet to stop a car going 50 mph. How many feet would it take to stop a car going 60 mph?

Answer: 288 feet

Solve Inverse Variation Problems In the following exercises, solve.

611. The number of tickets for a music fundraiser varies inversely with the price of the tickets. If Madelyn has just enough money to purchase 12 tickets for $6, how many tickets can Madelyn afford to buy if the price increased to $8?

Answer: 97 tickets

612. On a string instrument, the length of a string varies inversely with the frequency of its vibrations. If an 11-inch string on a violin has a frequency of 360 cycles per second, what frequency does a 12 inch string have?

Answer: 330 vibrations

Chapter Practice Test

In the following exercises, simplify.

613. $\frac{3a^2b}{6ab^2}$

Answer: $\frac{a}{2b}$

614. $\frac{5b-25}{b^2-25}$

Answer: $\frac{5}{b+5}$

In the following exercises, perform the indicated operation and simplify.

615. $\frac{4x}{x+2} \cdot \frac{x^2+5x+6}{12x^2}$

Answer: $\frac{x+3}{3x}$

616. $\frac{5y}{4y-8} \cdot \frac{y^2-4}{10}$

Answer: $\frac{y(y+2)}{8}$

617. $\frac{4}{pq}+\frac{5}{p}$

Answer: $\frac{4+5q}{pq}$

618. $\frac{1}{z-9}-\frac{3}{z+9}$

Answer: $\frac{-2(z-18)}{(z-9)(z+9)}$

619. $\frac{\frac{2}{3}+\frac{3}{5}}{\frac{2}{5}}$

Answer: $\frac{19}{16}$

620. $\frac{\frac{1}{m}-\frac{1}{n}}{\frac{1}{n}+\frac{1}{m}}$

Answer: $\frac{n-m}{m+n}$

In the following exercises, solve each equation.

621. $\frac{1}{2}+\frac{2}{7}=\frac{1}{x}$

Answer: $\frac{14}{11}$

622. $\frac{5}{y-6}=\frac{3}{y+6}$

Answer: -24

623. $\frac{1}{z-5}+\frac{1}{z+5}=\frac{1}{z^2-25}$

Answer: $\frac{1}{2}$

624. $\frac{t}{4}=\frac{3}{5}$

Answer: $\frac{12}{5}$

625. $\frac{2}{r-2}=\frac{3}{r-1}$

Answer: 4

In the following exercises, solve.

626. If y varies directly with x, and $x=5$ when $y=30$, find x when $y=42$.

Answer: 7

627. If y varies inversely with x and $x=6$ when $y=20$ find y when $x=2$.

Answer: 60

628. If y varies inversely with the square of x and $x=3$ when $y=9$ find y when $x=4$.

Answer: $\frac{81}{16}$

629. The recommended erythromycin dosage for dogs, is 5 mg for every pound the dog weighs. If Daisy weighs 25 pounds, how many milligrams of erythromycin should her veterinarian prescribe?

Answer: 125 mg

630. Julia spent 4 hours Sunday afternoon exercising at the gym. She ran on the treadmill for 10 miles and then biked for 20 miles. Her biking speed was 5 mph faster than her running speed on the treadmill. What was her running speed?

Answer: 5 mph

631. Kurt can ride his bike for 30 miles with the wind in the same amount of time that he can go 21 miles against the wind. If the wind's speed is 6 mph, what is Kurt's speed on his bike?

Answer: 14 mph

632. Amanda jogs to the park 8 miles using one route and then returns via a 14-mile route. The return trip takes her 1 hour longer than her jog to the park. Find her jogging rate.

Answer: 6 mph

633. An experienced window washer can wash all the windows in Mike's house in 2 hours, while a new trainee can wash all the windows in 7 hours. How long would it take them working together?

Answer: $1\frac{5}{9}$ hours

634. Josh can split a truckload of logs in 8 hours, but working with his dad they can get it done in 3 hours. How long would it take Josh's dad working alone to split the logs?

Answer: $4\frac{4}{5}$ hours

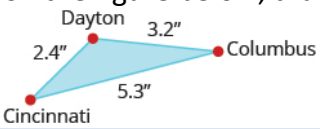
635. The price that Tyler pays for gas varies directly with the number of gallons he buys. If 24 gallons cost him $59.76, what would 30 gallons cost?

Answer: $74.70

636. The volume of a gas in a container varies inversely with the pressure on the gas. If a container of nitrogen has a volume of 29.5 liters with 2000 psi, what is the volume if the tank has a 14.7 psi rating? Round to the nearest whole number.

Answer: 420 psi

637. The cities of Dayton, Columbus, and Cincinnati form a triangle in southern Ohio, as shown on the figure below, that gives the map distances between these cities in inches.



Answer: 63 miles

Elementary Algebra
9: Roots and Radicals
9.1 Simplify and Use Square Roots

Simplify Expressions with Square Roots In the following exercises, simplify.

1. $\sqrt{36}$
Answer: 6

2. $\sqrt{4}$
Answer: 2

3. $\sqrt{64}$
Answer: 8

4. $\sqrt{169}$
Answer: 13

5. $\sqrt{9}$
Answer: 3

6. $\sqrt{16}$
Answer: 4

7. $\sqrt{100}$
Answer: 10

8. $\sqrt{144}$
Answer: 12

9. $-\sqrt{4}$
Answer: -2

10. $-\sqrt{100}$
Answer: -10

11. $-\sqrt{1}$
Answer: -1

12. $-\sqrt{121}$
Answer: -11

13. $\sqrt{-121}$
Answer: not a real number

14. $\sqrt{-36}$
Answer: not a real number

15. $\sqrt{-9}$
Answer: not a real number

16. $\sqrt{-49}$
Answer: not a real number

17. $\sqrt{9+16}$
Answer: 5

18. $\sqrt{25+144}$
Answer: 13

19. $\sqrt{9}+\sqrt{16}$
Answer: 7

20. $\sqrt{25}+\sqrt{144}$
Answer: 17

Estimate Square Roots In the following exercises, estimate each square root between two consecutive whole numbers.

21. $\sqrt{70}$
Answer: $8<\sqrt{70}<9$

22. $\sqrt{55}$
Answer: $7<\sqrt{55}<8$

23. $\sqrt{200}$
Answer: $14<\sqrt{200}<15$

24. $\sqrt{172}$
Answer: $13<\sqrt{172}<14$

Approximate Square Roots In the following exercises, approximate each square root and round to two decimal places.

25. $\sqrt{19}$
Answer: 4.36

26. $\sqrt{21}$

Answer: 4.58

27. $\sqrt{53}$

Answer: 7.28

28. $\sqrt{47}$

Answer: 6.86

Simplify Variable Expressions with Square Roots In the following exercises, simplify.

29. $\sqrt{y^2}$

Answer: y

30. $\sqrt{b^2}$

Answer: b

31. $\sqrt{a^{14}}$

Answer: a^7

32. $\sqrt{w^{24}}$

Answer: w^{12}

33. $\sqrt{49x^2}$

Answer: $7x$

34. $\sqrt{100y^2}$

Answer: $10y$

35. $\sqrt{121m^{20}}$

Answer: $11m^{10}$

36. $\sqrt{25h^{44}}$

Answer: $5h^{22}$

37. $\sqrt{81x^{36}}$

Answer: $9x^{18}$

38. $\sqrt{144z^{84}}$

Answer: $12z^{42}$

39. $-\sqrt{81x^{18}}$

Answer: $-9x^9$

40. $-\sqrt{100m^{32}}$

Answer: $-10m^{16}$

41. $-\sqrt{64a^2}$

Answer: $-8a$

42. $-\sqrt{25x^2}$

Answer: $-5x$

43. $\sqrt{144x^2y^2}$

Answer: $12xy$

44. $\sqrt{196a^2b^2}$

Answer: $14ab$

45. $\sqrt{169w^8y^{10}}$

Answer: $13w^4y^5$

46. $\sqrt{81p^{24}q^6}$

Answer: $9p^{12}q^3$

47. $\sqrt{9c^8d^{12}}$

Answer: $3c^4d^6$

48. $\sqrt{36r^6s^{20}}$

Answer: $6r^3s^{10}$

Everyday Math

49. **Decorating** Denise wants to have a square accent of designer tiles in her new shower. She can afford to buy 625 square centimeters of the designer tiles. How long can a side of the accent be?

Answer: 25 centimeters

50. **Decorating** Morris wants to have a square mosaic inlaid in his new patio. His budget allows for 2025 square inch tiles. How long can a side of the mosaic be?

Answer: 45 inches

Writing Exercises

51. Why is there no real number equal to $\sqrt{-64}$?

Answer: Answers will vary.

52. What is the difference between 9^2 and $\sqrt{9}$?

Answer: Answers will vary.

Elementary Algebra
9: Roots and Radicals
9.2 Simplify Square Roots

Use the Product Property to Simplify Square Roots In the following exercises, simplify.

53. $\sqrt{27}$

Answer: $3\sqrt{3}$

54. $\sqrt{80}$

Answer: $4\sqrt{5}$

55. $\sqrt{125}$

Answer: $5\sqrt{5}$

56. $\sqrt{96}$

Answer: $4\sqrt{6}$

57. $\sqrt{200}$

Answer: $10\sqrt{2}$

58. $\sqrt{147}$

Answer: $7\sqrt{3}$

59. $\sqrt{450}$

Answer: $15\sqrt{2}$

60. $\sqrt{252}$

Answer: $6\sqrt{7}$

61. $\sqrt{800}$

Answer: $20\sqrt{2}$

62. $\sqrt{288}$

Answer: $12\sqrt{2}$

63. $\sqrt{675}$

Answer: $15\sqrt{3}$

64. $\sqrt{1250}$

Answer: $25\sqrt{2}$

65. $\sqrt{x^7}$

Answer: $x^3\sqrt{x}$

66. $\sqrt{y^{11}}$

Answer: $y^5\sqrt{y}$

67. $\sqrt{p^3}$

Answer: $p\sqrt{p}$

68. $\sqrt{q^5}$

Answer: $q^2\sqrt{q}$

69. $\sqrt{m^{13}}$

Answer: $m^6\sqrt{m}$

70. $\sqrt{n^{21}}$

Answer: $n^{10}\sqrt{n}$

71. $\sqrt{r^{25}}$

Answer: $r^{12}\sqrt{r}$

72. $\sqrt{s^{33}}$

Answer: $s^{16}\sqrt{s}$

73. $\sqrt{49n^{17}}$

Answer: $7n^8\sqrt{n}$

74. $\sqrt{25m^9}$

Answer: $5m^4\sqrt{m}$

75. $\sqrt{81r^{15}}$

Answer: $9r^7\sqrt{r}$

76. $\sqrt{100s^{19}}$

Answer: $10s^9\sqrt{s}$

77. $\sqrt{98m^5}$

Answer: $7m^2\sqrt{2m}$

78. $\sqrt{32n^{11}}$

Answer: $4n^5\sqrt{2n}$

79. $\sqrt{125r^{13}}$

Answer: $5r^6\sqrt{5r}$

80. $\sqrt{80s^{15}}$

Answer: $4s^7\sqrt{5s}$

81. $\sqrt{200p^{13}}$

Answer: $10\,p^6\sqrt{2\,p}$

82. $\sqrt{128q^3}$

Answer: $8q\sqrt{2q}$

83. $\sqrt{242m^{23}}$

Answer: $11m^{11}\sqrt{2m}$

84. $\sqrt{175n^{13}}$

Answer: $5n^6\sqrt{7n}$

85. $\sqrt{147m^7n^{11}}$

Answer: $7m^3n^5\sqrt{3mn}$

86. $\sqrt{48m^7n^5}$

Answer: $4m^3n^2\sqrt{3mn}$

87. $\sqrt{75r^{13}s^9}$

Answer: $5r^6s^4\sqrt{3rs}$ 70)

88. $\sqrt{96r^3s^3}$

Answer: $4rs\sqrt{6rs}$

89. $\sqrt{300p^9q^{11}}$

Answer: $10p^4q^5\sqrt{3pq}$

90. $\sqrt{192q^3r^7}$

Answer: $8qr^3\sqrt{3qr}$

91. $\sqrt{242m^{13}n^{21}}$

Answer: $11m^6n^{10}\sqrt{2mn}$

92. $\sqrt{150m^9n^3}$

Answer: $5m^4n\sqrt{6mn}$

93. $5+\sqrt{12}$

Answer: $5+2\sqrt{3}$

94. $8+\sqrt{96}$

Answer: $8+4\sqrt{6}$

95. $1+\sqrt{45}$

Answer: $1+3\sqrt{5}$

96. $3+\sqrt{125}$

Answer: $3+5\sqrt{5}$

97. $\frac{10-\sqrt{24}}{2}$

Answer: $5-\sqrt{6}$

98. $\frac{8-\sqrt{80}}{4}$

Answer: $2-\sqrt{5}$

99. $\frac{3+\sqrt{90}}{3}$

Answer: $1+\sqrt{10}$

100. $\frac{15+\sqrt{75}}{5}$

Answer: $3+\sqrt{3}$

Use the Quotient Property to Simplify Square Roots In the following exercises, simplify.

101. $\sqrt{\frac{49}{64}}$

Answer: $\frac{7}{8}$

102. $\sqrt{\frac{100}{36}}$

Answer: $\frac{5}{3}$

103. $\sqrt{\frac{121}{16}}$

Answer: $\frac{11}{4}$

104. $\sqrt{\frac{144}{169}}$

Answer: $\frac{12}{13}$

105. $\sqrt{\frac{72}{98}}$

Answer: $\frac{6}{7}$

106. $\sqrt{\frac{75}{12}}$

Answer: $\frac{5}{2}$

107. $\sqrt{\frac{45}{125}}$

Answer: $\frac{3}{5}$

108. $\sqrt{\frac{300}{243}}$

Answer: $\frac{10}{9}$

109. $\sqrt{\frac{x^{10}}{x^6}}$

Answer: x^2

110. $\sqrt{\frac{p^{20}}{p^{10}}}$

Answer: p^5

111. $\sqrt{\frac{y^4}{y^8}}$

Answer: $\frac{1}{y^2}$

112. $\sqrt{\frac{q^8}{q^{14}}}$

Answer: $\frac{1}{q^3}$

113. $\sqrt{\frac{200x^7}{2x^3}}$

Answer: $10x^2$

114. $\sqrt{\frac{98y^{11}}{2y^5}}$

Answer: $7y^3$

115. $\sqrt{\frac{96p^9}{6p}}$

Answer: $4p^4$

116. $\sqrt{\frac{108q^{10}}{3q^2}}$

Answer: $4q^6$

117. $\sqrt{\frac{36}{35}}$

Answer: $\frac{6}{\sqrt{35}}$

118. $\sqrt{\frac{144}{65}}$

Answer: $\frac{12}{\sqrt{65}}$

119. $\sqrt{\frac{20}{81}}$

Answer: $\frac{2\sqrt{5}}{9}$

120. $\sqrt{\frac{21}{196}}$

Answer: $\frac{\sqrt{21}}{14}$

121. $\sqrt{\frac{96x^7}{121}}$

Answer: $\frac{4x^3\sqrt{6x}}{11}$

122. $\sqrt{\frac{108y^4}{49}}$

Answer: $\frac{6y^2\sqrt{3}}{7}$

123. $\sqrt{\frac{300m^5}{64}}$

Answer: $\frac{10m^2\sqrt{3m}}{8}$

124. $\sqrt{\frac{125n^7}{169}}$

Answer: $\frac{5n^3\sqrt{5n}}{13}$

125. $\sqrt{\frac{98r^5}{100}}$

Answer: $\frac{7r^2\sqrt{2r}}{10}$

126. $\sqrt{\frac{180s^{10}}{144}}$

Answer: $\frac{6s^5\sqrt{5}}{12}$

127. $\sqrt{\frac{28q^6}{225}}$

Answer: $\frac{2q^3\sqrt{7}}{15}$

128. $\sqrt{\frac{150r^3}{256}}$

Answer: $\frac{5r\sqrt{6r}}{16}$

129. $\sqrt{\frac{75r^9}{s^8}}$

Answer: $\frac{5r^4\sqrt{3r}}{s^4}$

130. $\sqrt{\frac{72x^5}{y^6}}$

Answer: $\frac{6x^2\sqrt{2x}}{y^3}$

131. $\sqrt{\frac{28p^7}{q^2}}$

Answer: $\frac{4p^3\sqrt{7p}}{q}$

132. $\sqrt{\frac{45r^3}{s^{10}}}$

Answer: $\frac{3r\sqrt{5r}}{s^5}$

133. $\sqrt{\frac{100x^5}{36x^3}}$

Answer: $\frac{5x}{3}$

134. $\sqrt{\frac{49r^{12}}{16r^6}}$

Answer: $\frac{7r^3}{8}$

135. $\sqrt{\frac{121p^5}{81p^2}}$

Answer: $\frac{11p\sqrt{p}}{9}$

136. $\sqrt{\frac{25r^8}{64r}}$

Answer: $\frac{5r^3\sqrt{r}}{8}$

137. $\sqrt{\frac{32x^5y^3}{18x^3y}}$

Answer: $\frac{4xy}{3}$

138. $\sqrt{\frac{75r^6s^8}{48rs^4}}$

Answer: $\frac{5r^2s^2\sqrt{r}}{4}$

139. $\sqrt{\frac{27p^2q}{108p^5q^3}}$

Answer: $\frac{1}{2pq\sqrt{p}}$

140. $\sqrt{\frac{50r^5s^2}{128r^2s^5}}$

Answer: $\frac{5r\sqrt{r}}{8s\sqrt{s}}$

Everyday Math

141. (a) Elliott decides to construct a square garden that will take up 288 square feet of his yard. Simplify $\sqrt{288}$ to determine the length and the width of his garden. Round to the nearest tenth of a foot.
(b) Suppose Elliott decides to reduce the size of his square garden so that he can create a 5-foot-wide walking path on the north and east sides of the garden. Simplify $\sqrt{288}-5$ to determine the length and width of the new garden. Round to the nearest tenth of a foot.

Answer: (a) 17.0 feet (b) 15.0 feet

142. (a) Melissa accidentally drops a pair of sunglasses from the top of a roller coaster, 64 feet above the ground. Simplify $\sqrt{\frac{64}{16}}$ to determine the number of seconds it takes for the sunglasses to reach the ground.
(b) Suppose the sunglasses in the previous example were dropped from a height of 144 feet. Simplify $\sqrt{\frac{144}{16}}$ to determine the number of seconds it takes for the sunglasses to reach the ground.

Answer: (a) 2 seconds (b) 3 seconds

Writing Exercises

143. Explain why $\sqrt{x^4}=x^2$. Then explain why $\sqrt{x^{16}}=x^8$.

Answer: Answers will vary

144. Explain why $7+\sqrt{9}$ is not equal to $\sqrt{7+9}$.

Answer: Answers will vary.

Elementary Algebra
9: Roots and Radicals
9.3 Add and Subtract Square Roots

Add and Subtract Like Square Roots In the following exercises, simplify.

145. $8\sqrt{2}-5\sqrt{2}$
Answer: $3\sqrt{2}$

146. $7\sqrt{2}-3\sqrt{2}$
Answer: $4\sqrt{2}$

147. $3\sqrt{5}+6\sqrt{5}$
Answer: $9\sqrt{5}$

148. $4\sqrt{5}+8\sqrt{5}$
Answer: $12\sqrt{5}$

149. $9\sqrt{7}-10\sqrt{7}$
Answer: $-\sqrt{7}$

150. $11\sqrt{7}-12\sqrt{7}$
Answer: $-\sqrt{7}$

151. $7\sqrt{y}+2\sqrt{y}$
Answer: $9\sqrt{y}$

152. $9\sqrt{n}+3\sqrt{n}$
Answer: $12\sqrt{n}$

153. $\sqrt{a}-4\sqrt{a}$
Answer: $-3\sqrt{a}$

154. $\sqrt{b}-6\sqrt{b}$
Answer: $-5\sqrt{b}$

155. $5\sqrt{c}+2\sqrt{c}$
Answer: $7\sqrt{c}$

156. $7\sqrt{d}+2\sqrt{d}$
Answer: $9\sqrt{d}$

157. $8\sqrt{a}-2\sqrt{b}$

Answer: $8\sqrt{a}-2\sqrt{b}$

158. $5\sqrt{c}-3\sqrt{d}$

Answer: $2\sqrt{d}$

159. $5\sqrt{m}+\sqrt{n}$

Answer: $5\sqrt{m}+\sqrt{n}$

160. $\sqrt{n}+3\sqrt{p}$

Answer: $\sqrt{n}+3\sqrt{p}$

161. $8\sqrt{7}+2\sqrt{7}+3\sqrt{7}$

Answer: $13\sqrt{7}$

162. $6\sqrt{5}+3\sqrt{5}+\sqrt{5}$

Answer: $10\sqrt{5}$

163. $3\sqrt{11}+2\sqrt{11}-8\sqrt{11}$

Answer: $-3\sqrt{11}$

164. $2\sqrt{15}+5\sqrt{15}-9\sqrt{15}$

Answer: $-2\sqrt{15}$

165. $3\sqrt{3}-8\sqrt{3}+7\sqrt{5}$

Answer: $-5\sqrt{3}+7\sqrt{5}$

166. $5\sqrt{7}-8\sqrt{7}+6\sqrt{3}$

Answer: $-3\sqrt{7}+6\sqrt{3}$

167. $6\sqrt{2}+2\sqrt{2}-3\sqrt{5}$

Answer: $8\sqrt{2}-3\sqrt{5}$

168. $7\sqrt{5}+\sqrt{5}-8\sqrt{10}$

Answer: $8\sqrt{5}-8\sqrt{10}$

169. $3\sqrt{2a}-4\sqrt{2a}+5\sqrt{2a}$

Answer: $4\sqrt{2a}$

170. $\sqrt{11b}-5\sqrt{11b}+3\sqrt{11b}$

Answer: $-\sqrt{11b}$

171. $8\sqrt{3c}+2\sqrt{3c}-9\sqrt{3c}$

Answer: $\sqrt{3c}$

172. $3\sqrt{5d}+8\sqrt{5d}-11\sqrt{5d}$
Answer: 0

173. $5\sqrt{3ab}+\sqrt{3ab}-2\sqrt{3ab}$
Answer: $4\sqrt{3ab}$

174. $8\sqrt{11cd}+5\sqrt{11cd}-9\sqrt{11cd}$
Answer: $4\sqrt{11cd}$

175. $2\sqrt{pq}-5\sqrt{pq}+4\sqrt{pq}$
Answer: $\sqrt{pq}$

176. $11\sqrt{2rs}-9\sqrt{2rs}+3\sqrt{2rs}$
Answer: $5\sqrt{2rs}$

Add and Subtract Square Roots that Need Simplification In the following exercises, simplify.

177. $\sqrt{50}+4\sqrt{2}$
Answer: $9\sqrt{2}$

178. $\sqrt{48}+2\sqrt{3}$
Answer: $6\sqrt{3}$

179. $\sqrt{80}-3\sqrt{5}$
Answer: $\sqrt{5}$

180. $\sqrt{28}-4\sqrt{7}$
Answer: $-2\sqrt{7}$

181. $\sqrt{27}-\sqrt{75}$
Answer: $-2\sqrt{3}$

182. $\sqrt{72}-\sqrt{98}$
Answer: $-\sqrt{2}$

183. $\sqrt{48}+\sqrt{27}$
Answer: $7\sqrt{3}$

184. $\sqrt{45}+\sqrt{80}$
Answer: $7\sqrt{5}$

185. $2\sqrt{50}-3\sqrt{72}$

Answer: $-8\sqrt{2}$

186. $3\sqrt{98}-\sqrt{128}$

Answer: $13\sqrt{2}$

187. $2\sqrt{12}+3\sqrt{48}$

Answer: $16\sqrt{3}$

188. $4\sqrt{75}+2\sqrt{108}$

Answer: $32\sqrt{3}$

189. $\frac{2}{3}\sqrt{72}+\frac{1}{5}\sqrt{50}$

Answer: $5\sqrt{2}$

190. $\frac{2}{5}\sqrt{75}+\frac{3}{4}\sqrt{48}$

Answer: $5\sqrt{3}$

191. $\frac{1}{2}\sqrt{20}-\frac{2}{3}\sqrt{45}$

Answer: $-\sqrt{5}$

192. $\frac{2}{3}\sqrt{54}-\frac{3}{4}\sqrt{96}$

Answer: $-\sqrt{6}$

193. $\frac{1}{6}\sqrt{27}-\frac{3}{8}\sqrt{48}$

Answer: $-\sqrt{3}$

194. $\frac{1}{8}\sqrt{32}-\frac{1}{10}\sqrt{50}$

Answer: 0

195. $\frac{1}{4}\sqrt{98}-\frac{1}{3}\sqrt{128}$

Answer: $-\frac{3}{4}\sqrt{2}$

196. $\frac{1}{3}\sqrt{24}+\frac{1}{4}\sqrt{54}$

Answer: $\frac{11}{12}\sqrt{6}$

197. $\sqrt{72a^5}-\sqrt{50a^5}$

Answer: $a^2\sqrt{2a}$

198. $\sqrt{48b^5}-\sqrt{75b^5}$

Answer: $-b^2\sqrt{3b}$

199. $\sqrt{80c^7}-\sqrt{20c^7}$

Answer: $2c^3\sqrt{5c}$

200. $\sqrt{96d^9}-\sqrt{24d^9}$

Answer: $2d^4\sqrt{6d}$

201. $9\sqrt{80p^4}-6\sqrt{98p^4}$

Answer: $36p^2\sqrt{5}-42p^2\sqrt{2}$

202. $8\sqrt{72q^6}-3\sqrt{75q^6}$

Answer: $6q^3\sqrt{2}-3q^3\sqrt{3}$

203. $2\sqrt{50r^8}+4\sqrt{54r^8}$

Answer: $10r^4\sqrt{2}+12r^4\sqrt{6}$

204. $5\sqrt{27s^6}+2\sqrt{20s^6}$

Answer: $15s^3\sqrt{3}+10s^3\sqrt{5}$

205. $3\sqrt{20x^2}-4\sqrt{45x^2}+5x\sqrt{80}$

Answer: $14x\sqrt{5}$

206. $2\sqrt{28x^2}-\sqrt{63x^2}+6x\sqrt{7}$

Answer: $7x\sqrt{7}$

207. $3\sqrt{128y^2}+4y\sqrt{162}-8\sqrt{98y^2}$

Answer: $-12y\sqrt{2}$

208. $3\sqrt{75y^2}+8y\sqrt{48}-\sqrt{300y^2}$

Answer: $37y\sqrt{3}$

Mixed Practice

209. $2\sqrt{8}+6\sqrt{8}-5\sqrt{8}$

Answer: $3\sqrt{8}$

210. $\frac{2}{3}\sqrt{27}+\frac{3}{4}\sqrt{48}$

Answer: $5\sqrt{3}$

211. $\sqrt{175k^4}-\sqrt{63k^4}$

Answer: $2k^2\sqrt{7}$

212. $\frac{5}{6}\sqrt{162}+\frac{3}{16}\sqrt{128}$

Answer: $9\sqrt{2}$

213. $2\sqrt{363}-2\sqrt{300}$

Answer: $2\sqrt{3}$

214. $\sqrt{150}+4\sqrt{6}$

Answer: $9\sqrt{6}$

215. $9\sqrt{2}-8\sqrt{2}$

Answer: $\sqrt{2}$

216. $5\sqrt{x}-8\sqrt{y}$

Answer: $5\sqrt{x}-8\sqrt{y}$

217. $8\sqrt{13}-4\sqrt{13}-3\sqrt{13}$

Answer: $\sqrt{13}$

218. $5\sqrt{12c^4}-3\sqrt{27c^6}$

Answer: $6c^2\sqrt{3}-9c^3\sqrt{3}$

219. $\sqrt{80a^5}-\sqrt{45a^5}$

Answer: $a^2\sqrt{5a}$

220. $\frac{3}{5}\sqrt{75}-\frac{1}{4}\sqrt{48}$

Answer: $2\sqrt{3}$

221. $21\sqrt{19}-2\sqrt{19}$
Answer: $19\sqrt{19}$

222. $\sqrt{500}+\sqrt{405}$
Answer: $19\sqrt{5}$

223. $\frac{5}{6}\sqrt{27}+\frac{5}{8}\sqrt{48}$
Answer: $5\sqrt{3}$

226. $11\sqrt{11}-10\sqrt{11}$
Answer: $\sqrt{11}$

225. $\sqrt{75}-\sqrt{108}$
Answer: $-\sqrt{3}$

226. $2\sqrt{98}-4\sqrt{72}$
Answer: $-10\sqrt{2}$

227. $4\sqrt{24x^2}-\sqrt{54x^2}+3x\sqrt{6}$
Answer: $8x\sqrt{6}$

228. $8\sqrt{80y^6}-6\sqrt{48y^6}$
Answer: $32y^3\sqrt{5}-24y^3\sqrt{3}$

Everyday Math

229. A decorator decides to use square tiles as an accent strip in the design of a new shower, but she wants to rotate the tiles to look like diamonds. She will use 9 large tiles that measure 8 inches on a side and 8 small tiles that measure 2 inches on a side. $9\left(8\sqrt{2}\right)+8\left(2\sqrt{2}\right)$. Determine the width of the accent strip by simplifying the expression $9\left(8\sqrt{2}\right)+8\left(2\sqrt{2}\right)$. (Round to the nearest tenth of an inch.)
Answer: 124.5 inches

230. Suzy wants to use square tiles on the border of a spa she is installing in her backyard. She will use large tiles that have area of 12 square inches, medium tiles that have area of 8 square inches, and small tiles that have area of 4 square inches. Once section of the border will require 4 large tiles, 8 medium tiles, and 10 small tiles to cover the width of the wall. Simplify the expression $4\sqrt{12}+8\sqrt{8}+10\sqrt{4}$ to determine the width of the wall.
Answer: 56.5 inches

Writing Exercises

231. Explain the difference between like radicals and unlike radicals. Make sure your answer makes sense for radicals containing both numbers and variables.

Answer: Answers will vary.

232. Explain the process for determining whether two radicals are like or unlike. Make sure your answer makes sense for radicals containing both numbers and variables.

Answer: Answers will vary.

Elementary Algebra
9: Roots and Radicals
9.4 Multiply Square Roots

Multiply Square Roots In the following exercises, simplify.

233. (a) $\sqrt{2}\cdot\sqrt{8}$ (b) $\left(3\sqrt{3}\right)\left(2\sqrt{18}\right)$

Answer: (a) 4 (b) $18\sqrt{6}$

234. (a) $\sqrt{6}\cdot\sqrt{6}$ (b) $\left(3\sqrt{2}\right)\left(2\sqrt{32}\right)$

Answer: (a) 6 (b) 48

235. (a) $\sqrt{7}\cdot\sqrt{14}$ (b) $\left(4\sqrt{8}\right)\left(5\sqrt{8}\right)$

Answer: $7\sqrt{2}$ (b) 160

236. (a) $\sqrt{6}\cdot\sqrt{12}$ (b) $\left(2\sqrt{5}\right)\left(2\sqrt{10}\right)$

Answer: (a) 48 (b) $20\sqrt{2}$

237. $\left(5\sqrt{2}\right)\left(3\sqrt{6}\right)$

Answer: $30\sqrt{3}$

238. $\left(2\sqrt{3}\right)\left(4\sqrt{6}\right)$

Answer: $24\sqrt{2}$

239. $\left(-2\sqrt{3}\right)\left(3\sqrt{18}\right)$

Answer: $-18\sqrt{6}$

240. $\left(-4\sqrt{5}\right)\left(5\sqrt{10}\right)$

Answer: $-100\sqrt{2}$

241. $\left(5\sqrt{6}\right)\left(-\sqrt{12}\right)$

Answer: $-30\sqrt{2}$

242. $\left(6\sqrt{2}\right)\left(-\sqrt{10}\right)$

Answer: $-12\sqrt{5}$

243. $\left(-2\sqrt{7}\right)\left(-2\sqrt{14}\right)$

Answer: $28\sqrt{2}$

244. $\left(-2\sqrt{11}\right)\left(-4\sqrt{22}\right)$

Answer: $88\sqrt{2}$

245. (a) $\left(\sqrt{15y}\right)\left(\sqrt{5y^3}\right)$ (b) $\left(\sqrt{2n^2}\right)\left(\sqrt{18n^3}\right)$

Answer: (a) $5y^2\sqrt{3}$ (b) $6n^2\sqrt{n}$

246. (a) $\left(\sqrt{14x^3}\right)\left(\sqrt{7x^3}\right)$ (b) $\left(\sqrt{3q^2}\right)\left(\sqrt{48q^3}\right)$

Answer: (a) $7x^3\sqrt{2}$ (b) $12q^2\sqrt{q}$

247. (a) $\left(\sqrt{16y^2}\right)\left(\sqrt{8y^4}\right)$ (b) $\left(\sqrt{11s^6}\right)\left(\sqrt{11s}\right)$

Answer: (a) $8y^3\sqrt{2}$ (b) $11s^3\sqrt{s}$

248. (a) $\left(\sqrt{8x^3}\right)\left(\sqrt{3x}\right)$ (b) $\left(\sqrt{7r}\right)\left(\sqrt{7r^8}\right)$

Answer: (a) $2x^2\sqrt{6}$ (b) $7r^4\sqrt{r}$

249. $\left(2\sqrt{5b^3}\right)\left(4\sqrt{15b}\right)$

Answer: $40b^2\sqrt{3}$

250. $\left(3\sqrt{8c^5}\right)\left(2\sqrt{6c^3}\right)$

Answer: $24c^4\sqrt{3}$

251. $\left(6\sqrt{3d^3}\right)\left(4\sqrt{12d^5}\right)$

Answer: $144d^4$

252. $\left(2\sqrt{5b^3}\right)\left(4\sqrt{15b}\right)$

Answer: $40b^2\sqrt{3}$

253. $\left(6\sqrt{3d^3}\right)\left(4\sqrt{12d^5}\right)$

Answer: $144d^4$

254. $\left(-2\sqrt{7z^3}\right)\left(3\sqrt{14z^8}\right)$

Answer: $-42z^5\sqrt{2z}$

255. $\left(4\sqrt{2k^5}\right)\left(-3\sqrt{32k^6}\right)$

Answer: $-96k^5\sqrt{k}$

256. (a) $\left(\sqrt{7}\right)^2$ (b) $\left(-\sqrt{15}\right)^2$

Answer: (a) 7 (b) 15

257. (a) $\left(\sqrt{11}\right)^2$ (b) $\left(-\sqrt{21}\right)^2$

Answer: (a) 11(b) 21

258. (a) $\left(\sqrt{19}\right)^2$ (b) $\left(-\sqrt{5}\right)^2$

Answer: (a) 19 (b) 5

259. (a) $\left(\sqrt{23}\right)^2$ (b) $\left(-\sqrt{3}\right)^2$

Answer: (a) 23 (b) 3

260. (a) $\left(4\sqrt{11}\right)\left(-3\sqrt{11}\right)$ (b) $\left(5\sqrt{3}\right)^2$

Answer: (a) -132 (b) 75

261. (a) $\left(2\sqrt{13}\right)\left(-9\sqrt{13}\right)$ (b) $\left(6\sqrt{5}\right)^2$

Answer: (a) –234 (b) 180

262. (a) $\left(-3\sqrt{12}\right)\left(-2\sqrt{6}\right)$ (b) $\left(-4\sqrt{10}\right)^2$

Answer: (a) $36\sqrt{2}$ (b) 160

263. (a) $\left(-7\sqrt{5}\right)\left(-3\sqrt{10}\right)$ (b) $\left(-2\sqrt{14}\right)^2$

Answer: (a) $105\sqrt{2}$ (b) 56

Use Polynomial Multiplication to Multiply Square Roots In the following exercises, simplify.

264. (a) $3\left(4-\sqrt{3}\right)$ (b) $\sqrt{2}\left(4-\sqrt{6}\right)$

Answer: (a) $12-3\sqrt{3}$ (b) $4\sqrt{2}-2\sqrt{3}$

265. (a) $4\left(6-\sqrt{11}\right)$ (b) $\sqrt{2}\left(5-\sqrt{12}\right)$

Answer: (a) $24-4\sqrt{11}$ (b) $5\sqrt{2}-2\sqrt{6}$

266. (a) $5\left(3-\sqrt{7}\right)$ (b) $\sqrt{3}\left(4-\sqrt{15}\right)$

Answer: (a) $15-5\sqrt{7}$ (b) $4\sqrt{3}-3\sqrt{5}$

267. (a) $7\left(-2-\sqrt{11}\right)$ (b) $\sqrt{7}\left(6-\sqrt{14}\right)$

Answer: (a) $-14-7\sqrt{11}$ (b) $6\sqrt{7}-7\sqrt{2}$

268. (a) $\sqrt{7}\left(5+2\sqrt{7}\right)$ b) $\sqrt{5}\left(\sqrt{10}+\sqrt{18}\right)$

Answer: (a) $14+5\sqrt{7}$ (b) $5\sqrt{2}+3\sqrt{10}$

269. (a) $\sqrt{11}\left(8+4\sqrt{11}\right)$ (b) $\sqrt{3}\left(\sqrt{12}+\sqrt{27}\right)$

Answer: (a) $44+8\sqrt{11}$ (b) 15

270. (a) $\sqrt{11}\left(-3+4\sqrt{11}\right)$ (b) $\sqrt{3}\left(\sqrt{15}-\sqrt{18}\right)$

Answer: (a) $44-3\sqrt{11}$ (b) $3\sqrt{5}-3\sqrt{6}$

271. (a) $\sqrt{2}\left(-5+9\sqrt{2}\right)$ (b) $\sqrt{7}\left(\sqrt{3}-\sqrt{21}\right)$

Answer: (a) $18-5\sqrt{2}$ (b) $\sqrt{21}-7\sqrt{3}$

272. $\left(8+\sqrt{3}\right)\left(2-\sqrt{3}\right)$

Answer: $13-6\sqrt{3}$

273. $\left(7+\sqrt{3}\right)\left(9-\sqrt{3}\right)$

Answer: $60+2\sqrt{3}$

274. $\left(8-\sqrt{2}\right)\left(3+\sqrt{2}\right)$

Answer: $22+5\sqrt{2}$

275. $\left(9-\sqrt{2}\right)\left(6+\sqrt{2}\right)$

Answer: $52+3\sqrt{2}$

276. $\left(3-\sqrt{7}\right)\left(5-\sqrt{7}\right)$

Answer: $22-8\sqrt{7}$

277. $\left(5-\sqrt{7}\right)\left(4-\sqrt{7}\right)$

Answer: $27-9\sqrt{7}$

278. $\left(1+3\sqrt{10}\right)\left(5-2\sqrt{10}\right)$

Answer: $-55+13\sqrt{10}$

279. $\left(7-2\sqrt{5}\right)\left(4+9\sqrt{5}\right)$

Answer: $-62+55\sqrt{5}$

280. $\left(\sqrt{3}+\sqrt{10}\right)\left(\sqrt{3}+2\sqrt{10}\right)$

Answer: $-17-\sqrt{30}$

281. $\left(\sqrt{11}+\sqrt{5}\right)\left(\sqrt{11}+6\sqrt{5}\right)$

Answer: $41+7\sqrt{55}$

282. $\left(2\sqrt{7}-5\sqrt{11}\right)\left(4\sqrt{7}+9\sqrt{11}\right)$

Answer: $-439-2\sqrt{77}$

283. $\left(4\sqrt{6}+7\sqrt{13}\right)\left(8\sqrt{6}-3\sqrt{13}\right)$

Answer: $-81+44\sqrt{78}$

284. $\left(5-\sqrt{u}\right)\left(3+\sqrt{u}\right)$

Answer: $15+2\sqrt{u}-u$

285. $\left(9-\sqrt{w}\right)\left(2+\sqrt{w}\right)$

Answer: $18+7\sqrt{w}-w$

286. $\left(7+2\sqrt{m}\right)\left(4+9\sqrt{m}\right)$

Answer: $28+71\sqrt{m}+18m$

287. $\left(6+5\sqrt{n}\right)\left(11+3\sqrt{n}\right)$

Answer: $66+73\sqrt{n}+15n$

288. (a) $\left(3+\sqrt{5}\right)^2$ (b) $\left(2-5\sqrt{3}\right)^2$

Answer: (a) $14+6\sqrt{5}$ (b) $79-20\sqrt{3}$

289. (a) $\left(4+\sqrt{11}\right)^2$ (b) $\left(3-2\sqrt{5}\right)^2$

Answer: (a) $27+8\sqrt{11}$ (b) $29-12\sqrt{5}$

290. (a) $\left(9-\sqrt{6}\right)^2$ (b) $\left(10+3\sqrt{7}\right)^2$

Answer: (a) $117-18\sqrt{6}$ (b) $163+60\sqrt{7}$

291. (a) $\left(5-\sqrt{10}\right)^2$ (b) $\left(8+3\sqrt{2}\right)^2$

Answer: (a) $35-10\sqrt{10}$ (b) $82+48\sqrt{2}$

292. $\left(3-\sqrt{5}\right)\left(3+\sqrt{5}\right)$

Answer: 4

293. $\left(10-\sqrt{3}\right)\left(10+\sqrt{3}\right)$

Answer: 97

294. $\left(4+\sqrt{2}\right)\left(4-\sqrt{2}\right)$

Answer: 14

295. $\left(7+\sqrt{10}\right)\left(7-\sqrt{10}\right)$

Answer: 39

296. $\left(4+9\sqrt{3}\right)\left(4-9\sqrt{3}\right)$

Answer: -227

297. $\left(1+8\sqrt{2}\right)\left(1-8\sqrt{2}\right)$

Answer: -127

298. $\left(12-5\sqrt{5}\right)\left(12+5\sqrt{5}\right)$

Answer: 19

299. $\left(9-4\sqrt{3}\right)\left(9+4\sqrt{3}\right)$

Answer: 33

Mixed Practice In 57–66, simplify.

300. $\sqrt{3} \cdot \sqrt{21}$

Answer: $3\sqrt{7}$

301. $\left(4\sqrt{6}\right)\left(-\sqrt{18}\right)$

Answer: $-24\sqrt{3}$

302. $\left(-5+\sqrt{7}\right)\left(6+\sqrt{21}\right)$

Answer: $-30-5\sqrt{21}+6\sqrt{7}+7\sqrt{3}$

303. $\left(-5\sqrt{7}\right)\left(6\sqrt{21}\right)$

Answer: $-210\sqrt{3}$

304. $\left(-4\sqrt{2}\right)\left(2\sqrt{18}\right)$

Answer: -48

305. $\left(\sqrt{35y^3}\right)\left(\sqrt{7y^3}\right)$

Answer: $7y^3\sqrt{5}$

306. $\left(4\sqrt{12x^5}\right)\left(2\sqrt{6x^3}\right)$

Answer: $48x^4\sqrt{2}$

307. $\left(\sqrt{29}\right)^2$

Answer: 29

308. $\left(-4\sqrt{17}\right)\left(-3\sqrt{17}\right)$

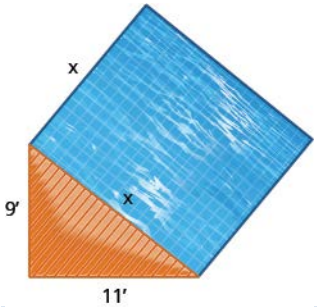
Answer: 204

309. $\left(-4+\sqrt{17}\right)\left(-3+\sqrt{17}\right)$

Answer: $29-7\sqrt{17}$

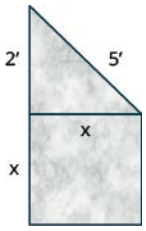
Everyday Math

310. A landscaper wants to put a square reflecting pool next to a triangular deck, as shown below. The triangular deck is a right triangle, with legs of length 9 feet and 11 feet, and the pool will be adjacent to the hypotenuse.
(a) Use the Pythagorean Theorem to find the length of a side of the pool. Round your answer to the nearest tenth of a foot.
(b) Find the exact area of the pool.



Answer: (a) 14.2 feet (b) 202 sq. feet

311. An artist wants to make a small monument in the shape of a square base topped by a right triangle, as shown below. The square base will be adjacent to one leg of the triangle. The other leg of the triangle will measure 2 feet and the hypotenuse will be 5 feet.
(a) Use the Pythagorean Theorem to find the length of a side of the square base. Round your answer to the nearest tenth of a foot.



(b) Find the exact area of the face of the square base.

Answer: (a) 4.6 feet (b) 21 sq. feet

312. A square garden will be made with a stone border on one edge. If only $3+\sqrt{10}$ feet of stone are available, simplify $\left(3+\sqrt{10}\right)^2$ to determine the area of the largest such garden.

Answer: 38.0 feet

313. A garden will be made so as to contain two square sections, one section with side length $\sqrt{5}+\sqrt{6}$ yards and one section with side length $\sqrt{2}+\sqrt{3}$ yards. Simplify $\left(\sqrt{5}+\sqrt{6}\right)^2+\left(\sqrt{2}+\sqrt{3}\right)^2$ to determine the total area of the garden.

Answer: 31.9 yards

314. Suppose a third section will be added to the garden in the previous example. The third section is to have a width of $\sqrt{432}$ feet. Write an expression that gives the total area of the garden.

Answer: $\left(\sqrt{5}+\sqrt{6}\right)^2+\left(\sqrt{2}+\sqrt{3}\right)^2+432$

Writing Exercises

315. (a) Explain why $\left(-\sqrt{n}\right)^2$ is always positive, for $n \geq 0$.

(b) Explain why $\left(-\sqrt{n}\right)^2$ is always negative, for $n \geq 0$.

Answer: (a) when squaring a negative, it becomes a positive (b) since the negative is not included in the parenthesis, it is not squared, and remains negative

316. Use the binomial square pattern to simplify $\left(3+\sqrt{2}\right)^2$. Explain all your steps.

Answer: Binomial square pattern is $a^2+2ab+b^2$. So a^2 means $3^2=9,\ 2ab$ means $2(3)\left(\sqrt{2}\right)=6\sqrt{2},$ and b^2 means $\left(\sqrt{2}\right)^2=2.$ Combine the like terms of 9 and $2.$ Therefore, the simplified answer is $11+6\sqrt{2}.$

Elementary Algebra
9: Roots and Radicals
9.5 Divide Square Roots

Divide Square Roots In the following exercises, simplify.

317. $\frac{\sqrt{27}}{6}$

Answer: $\frac{\sqrt{3}}{2}$

318. $\frac{\sqrt{50}}{10}$

Answer: $\frac{\sqrt{2}}{2}$

319. $\frac{\sqrt{72}}{9}$

Answer: $\frac{2\sqrt{2}}{3}$

320. $\frac{\sqrt{243}}{6}$

Answer: $\frac{3\sqrt{3}}{2}$

321. $\frac{2-\sqrt{32}}{8}$

Answer: $\frac{1-2\sqrt{2}}{4}$

322. $\frac{3+\sqrt{27}}{9}$

Answer: $\frac{1+\sqrt{3}}{3}$

323. $\frac{6+\sqrt{45}}{6}$

Answer: $\frac{2+\sqrt{5}}{2}$

324. $\frac{10-\sqrt{200}}{20}$

Answer: $\frac{1-\sqrt{2}}{2}$

325. $\frac{\sqrt{80}}{\sqrt{125}}$

Answer: $\frac{4}{5}$

326. $\frac{\sqrt{72}}{\sqrt{200}}$

Answer: $\frac{3}{5}$

327. $\frac{\sqrt{128}}{\sqrt{72}}$

Answer: $\frac{4}{3}$

328. $\frac{\sqrt{48}}{\sqrt{75}}$

Answer: $\frac{4}{5}$

329. (a) $\frac{\sqrt{8x^6}}{\sqrt{2x^2}}$ (b) $\frac{\sqrt{200m^5}}{\sqrt{98m}}$

Answer: (a) $2x^2$ (b) $\frac{10m^2}{7}$

330. (a) $\frac{\sqrt{10y^3}}{\sqrt{5y}}$ (b) $\frac{\sqrt{108n^7}}{\sqrt{243n^3}}$

Answer: (a) $y\sqrt{2}$ (b) $\frac{2n^2}{3}$

331. $\frac{\sqrt{75r^3}}{\sqrt{108r}}$

Answer: $\frac{5r}{6}$

332. $\frac{\sqrt{196q^5}}{\sqrt{484q}}$

Answer: $\frac{7q^2}{11}$

333. $\frac{\sqrt{108p^5q^2}}{\sqrt{34p^3q^6}}$

Answer: $\frac{3p\sqrt{102}}{17q^2}$

334. $\frac{\sqrt{98rs^{10}}}{\sqrt{2r^3s^4}}$

Answer: $\frac{7s^3}{r}$

335. $\frac{\sqrt{320mn^5}}{\sqrt{45m^7n^3}}$

Answer: $\frac{8n}{3m^3}$

336. $\frac{\sqrt{810c^3d^7}}{\sqrt{1000c^5d}}$

Answer: $\frac{9d^3}{10c}$

337. $\frac{\sqrt{98}}{14}$

Answer: $\frac{\sqrt{2}}{2}$

338. $\frac{\sqrt{72}}{18}$

Answer: $\frac{\sqrt{2}}{3}$

339. $\frac{5+\sqrt{125}}{15}$

Answer: $\frac{1+\sqrt{3}}{3}$

340. $\frac{6-\sqrt{45}}{12}$

Answer: $\frac{2-\sqrt{5}}{4}$

341. $\frac{\sqrt{96}}{\sqrt{150}}$

Answer: $\frac{4}{5}$

342. $\frac{\sqrt{28}}{\sqrt{63}}$

Answer: $\frac{2}{3}$

343. $\frac{\sqrt{26y^7}}{\sqrt{2y}}$

Answer: $y^3\sqrt{13}$

344. $\frac{\sqrt{15x^3}}{\sqrt{3x}}$

Answer: $x\sqrt{5}$

Rationalize a One-Term Denominator In the following exercises, simplify and rationalize the denominator.

345. $\frac{10}{\sqrt{6}}$

Answer: $\frac{5\sqrt{6}}{3}$

346. $\frac{8}{\sqrt{3}}$

Answer: $\frac{8\sqrt{3}}{3}$

347. $\frac{6}{\sqrt{7}}$

Answer: $\frac{6\sqrt{7}}{7}$

348. $\frac{4}{\sqrt{5}}$

Answer: $\frac{4\sqrt{5}}{5}$

349. $\frac{3}{\sqrt{13}}$

Answer: $\frac{3\sqrt{13}}{13}$

350. $\frac{10}{\sqrt{11}}$

Answer: $\frac{10\sqrt{11}}{11}$

351. $\frac{10}{3\sqrt{10}}$

Answer: $\frac{\sqrt{10}}{3}$

352. $\frac{2}{5\sqrt{2}}$

Answer: $\frac{\sqrt{2}}{5}$

353. $\frac{4}{9\sqrt{5}}$

Answer: $\frac{4\sqrt{5}}{45}$

354. $\frac{9}{2\sqrt{7}}$

Answer: $\frac{9\sqrt{7}}{14}$

355. $-\frac{9}{2\sqrt{3}}$

Answer: $-\frac{3\sqrt{3}}{2}$

356. $-\frac{8}{3\sqrt{6}}$

Answer: $-\frac{4\sqrt{6}}{9}$

357. $\sqrt{\frac{3}{20}}$

Answer: $\frac{\sqrt{15}}{10}$

358. $\sqrt{\frac{4}{27}}$

Answer: $\frac{2\sqrt{3}}{9}$

359. $\sqrt{\frac{7}{40}}$

Answer: $\frac{\sqrt{70}}{20}$

360. $\sqrt{\frac{8}{45}}$

Answer: $\frac{2\sqrt{10}}{15}$

361. $\sqrt{\frac{19}{175}}$

Answer: $\frac{\sqrt{133}}{35}$

362. $\sqrt{\frac{17}{192}}$

Answer: $\frac{\sqrt{51}}{24}$

Rationalize a Two-Term Denominator In the following exercises, simplify by rationalizing the denominator.

363. (a) $\frac{3}{3+\sqrt{11}}$ (b) $\frac{8}{1-\sqrt{5}}$

Answer: (a) $\frac{3\left(3-\sqrt{11}\right)}{-2}$ (b) $-2\left(1+\sqrt{5}\right)$

364. (a) $\frac{4}{4+\sqrt{7}}$ (b) $\frac{7}{2-\sqrt{6}}$

Answer: (a) $\frac{4\left(4-\sqrt{7}\right)}{9}$ (b) $-\frac{7\left(2-\sqrt{6}\right)}{2}$

365. (a) $\frac{5}{5+\sqrt{6}}$ (b) $\frac{6}{3-\sqrt{7}}$

Answer: (a) $\frac{5\left(5-\sqrt{6}\right)}{19}$ (b) $3\left(3+\sqrt{7}\right)$

366. (a) $\frac{6}{6+\sqrt{5}}$ (b) $\frac{5}{4-\sqrt{11}}$

Answer: (a) $\frac{6\left(6-\sqrt{5}\right)}{31}$ (b) $\sqrt{11}+4$

367. $\frac{\sqrt{3}}{\sqrt{m}-\sqrt{5}}$

Answer: $\frac{\sqrt{3}\left(\sqrt{m}+\sqrt{5}\right)}{m-5}$

368. $\frac{\sqrt{5}}{\sqrt{n}-\sqrt{7}}$

Answer: $\frac{\sqrt{5}\left(\sqrt{n}+\sqrt{7}\right)}{n-7}$

369. $\frac{\sqrt{2}}{\sqrt{x}-\sqrt{6}}$

Answer: $\frac{\sqrt{2}\left(\sqrt{x}+\sqrt{3}\right)}{x-6}$

370. $\frac{\sqrt{7}}{\sqrt{y}+\sqrt{3}}$

Answer: $\frac{\sqrt{7}\left(\sqrt{y}-\sqrt{3}\right)}{y-3}$

371. $\frac{\sqrt{r}+\sqrt{5}}{\sqrt{r}-\sqrt{5}}$

Answer: $\frac{\left(\sqrt{r}+\sqrt{5}\right)^2}{r-5}$

372. $\frac{\sqrt{s}-\sqrt{6}}{\sqrt{s}+\sqrt{6}}$

Answer: $\frac{\left(\sqrt{s}-\sqrt{6}\right)^2}{s-6}$

373. $\frac{\sqrt{150x^2y^6}}{\sqrt{6x^4y^2}}$

Answer: $\frac{5y^2}{x}$

374. $\frac{\sqrt{80p^3q}}{\sqrt{5pq^5}}$

Answer: $\frac{4p}{q^2}$

375. $\frac{15}{\sqrt{5}}$

Answer: $3\sqrt{5}$

376. $\frac{3}{5\sqrt{8}}$

Answer: $\frac{3\sqrt{2}}{20}$

377. $\sqrt{\frac{8}{54}}$

Answer: $\frac{2\sqrt{3}}{9}$

378. $\sqrt{\frac{12}{20}}$

Answer: $\frac{\sqrt{15}}{5}$

379. $\frac{3}{5+\sqrt{5}}$

Answer: $\frac{3\left(5-\sqrt{5}\right)}{20}$

380. $\frac{20}{4-\sqrt{3}}$

Answer: $\frac{20\left(4+\sqrt{3}\right)}{13}$

381. $\frac{\sqrt{2}}{\sqrt{x}-\sqrt{3}}$

Answer: $\frac{\sqrt{2}\left(\sqrt{x}+\sqrt{3}\right)}{x-3}$

382. $\frac{\sqrt{5}}{\sqrt{y}-\sqrt{7}}$

Answer: $\frac{\sqrt{5}\left(\sqrt{y}+\sqrt{7}\right)}{y-7}$

383. $\frac{\sqrt{x}+\sqrt{8}}{\sqrt{x}-\sqrt{8}}$

Answer: $\frac{\left(\sqrt{x}+2\sqrt{2}\right)^2}{x-8}$

384. $\frac{\sqrt{m}-\sqrt{3}}{\sqrt{m}+\sqrt{3}}$

Answer: $\frac{\left(\sqrt{m}-\sqrt{3}\right)^2}{m-3}$

Everyday Math

385. A supply kit is dropped from an airplane flying at an altitude of 250 feet. Simplify $\sqrt{\frac{250}{16}}$ to determine how many seconds it takes for the supply kit to reach the ground.

Answer: $\frac{5\sqrt{10}}{4}$ seconds

386. A flare is dropped into the ocean from an airplane flying at an altitude of 1,200 feet. Simplify $\sqrt{\frac{1200}{16}}$ to determine how many seconds it takes for the flare to reach the ocean.

Answer: $5\sqrt{3}$ seconds

Writing Exercises

387. (a) Simplify $\sqrt{\frac{27}{3}}$ and explain all your steps.

(b) Simplify $\sqrt{\frac{27}{5}}$ and explain all your steps.

(c) Why are the two methods of simplifying square roots different?

Answer: Answers will vary.

388. (a) Approximate $\frac{1}{\sqrt{2}}$ by dividing $\frac{1}{1.414}$ using long division without a calculator.

(b) Rationalizing the denominator of $\frac{1}{\sqrt{2}}$ gives $\frac{\sqrt{2}}{2}$. Approximate $\frac{\sqrt{2}}{2}$ by dividing $\frac{1.414}{2}$ using long division without a calculator.

(c) Do you agree that rationalizing the denominator makes calculations easier? Why or why not?

Answer: Answers will vary.

Elementary Algebra
9: Roots and Radicals
9.6 Solve Equations with Square Roots

Solve Radical Equations In the following exercises, check whether the given values are solutions.

389. For the equation $\sqrt{x+12}=x$:
(a) Is $x=4$ a solution? (b) Is $x=-3$ a solution?
Answer: (a) yes (b) no

390. For the equation $\sqrt{-y+20}=y$:
(a) Is $y=4$ a solution? (b) Is $y=-5$ a solution?
Answer: (a) yes (b) no

391. For the equation $\sqrt{t+6}=t$:
(a) Is $t=-2$ a solution? (b) Is $t=3$ a solution?
Answer: (a) no (b) yes

392. For the equation $\sqrt{u+42}=u$:
(a) Is $u=-6$ a solution? (b) Is $u=7$ a solution?
Answer: (a) no (b) yes

In the following exercises, solve.

393. $\sqrt{5y+1}=4$
Answer: 3

394. $\sqrt{7z+15}=6$
Answer: 3

395. $\sqrt{5x-6}=8$
Answer: 14

396. $\sqrt{4x-3}=7$
Answer: 13

397. $\sqrt{2m-3}-5=0$
Answer: 14

398. $\sqrt{2n-1}-3=0$
Answer: 5

399. $\sqrt{6v-2}-10=0$

Answer: 17

400. $\sqrt{4u+2}-6=0$

Answer: $\frac{17}{2}$

401. $\sqrt{5q+3}-4=0$

Answer: $\frac{13}{5}$

402. $\sqrt{4m+2}+2=6$

Answer: $\frac{7}{2}$

403. $\sqrt{6n+1}+4=8$

Answer: $\frac{5}{2}$

404. $\sqrt{2u-3}+2=0$

Answer: no solution

405. $\sqrt{5v-2}+5=0$

Answer: no solution

406. $\sqrt{3z-5}+2=0$

Answer: no solution

407. $\sqrt{2m+1}+4=0$

Answer: no solution

408. (a) $\sqrt{u-3}+3=u$ (b) $\sqrt{x+1}-x+1=0$

Answer: (a) $3,4$ (b) 3

409. (a) $\sqrt{v-10}+10=v$ (b) $\sqrt{y+4}-y+2=0$

Answer: (a) $10,11$ (b) 5

410. (a) $\sqrt{r-1}-r=-1$ (b) $\sqrt{z+100}-z+10=0$

Answer: (a) $1,2$ (b) 21

411. (a) $\sqrt{s-8}-s=-8$ (b) $\sqrt{w+25}-w+5=0$

Answer: (a) $8,9$ (b) 11

412. $3\sqrt{2x-3}-20=7$

Answer: 42

413. $2\sqrt{5x+1}-8=0$

Answer: 3

414. $2\sqrt{8r+1}-8=2$

Answer: 3

415. $3\sqrt{7y+1}-10=8$

Answer: 5

416. $\sqrt{3u-2}=\sqrt{5u+1}$

Answer: not a real number

417. $\sqrt{4v+3}=\sqrt{v-6}$

Answer: not a real number

418. $\sqrt{8+2r}=\sqrt{3r+10}$

Answer: -2

419. $\sqrt{12c+6}=\sqrt{10-4c}$

Answer: $\frac{1}{4}$

420. (a) $\sqrt{a}+2=\sqrt{a+4}$ (b) $\sqrt{b-2}+1=\sqrt{3b+2}$

Answer: (a) 0 (b) no solution

421. (a) $\sqrt{r}+6=\sqrt{r+8}$ (b) $\sqrt{s-3}+2=\sqrt{s+4}$

Answer: (a) no solution (b) $\frac{57}{16}$

422. (a) $\sqrt{u}+1=\sqrt{u+4}$ (b) $\sqrt{n-5}+4=\sqrt{3n+7}$

Answer: (a) $\frac{9}{4}$ (b) 6

423. (a) $\sqrt{x}+10=\sqrt{x+2}$ (b) $\sqrt{y-2}+2=\sqrt{2y+4}$

Answer: (a) no solution (b) 6

424. $\sqrt{2y+4}+6=0$

Answer: no solution

425. $\sqrt{8u+1}+9=0$

Answer: no solution

426. $\sqrt{a}+1=\sqrt{a+5}$

Answer: 4

427. $\sqrt{d}-2=\sqrt{d-20}$

Answer: 36

428. $\sqrt{6s+4}=\sqrt{8s-28}$

Answer: 16

429. $\sqrt{9p+9}=\sqrt{10p-6}$

Answer: 15

Use Square Roots in Applications In the following exercises, solve. Round approximations to one decimal place.

430. **Landscaping** Reed wants to have a square garden plot in his backyard. He has enough compost to cover an area of 75 square feet. Use the formula $s=\sqrt{A}$ to find the length of each side of his garden. Round your answer to the nearest tenth of a foot.

Answer: 8.7 feet

431. **Landscaping** Vince wants to make a square patio in his yard. He has enough concrete to pave an area of 130 square feet. Use the formula $s=\sqrt{A}$ to find the length of each side of his patio. Round your answer to the nearest tenth of a foot.

Answer: 11.4 feet

432. **Gravity** While putting up holiday decorations, Renee dropped a light bulb from the top of a 64 foot tall tree. Use the formula $t=\frac{\sqrt{h}}{4}$ to find how many seconds it took for the light bulb to reach the ground.

Answer: 2 seconds

433. **Gravity** An airplane dropped a flare from a height of 1024 feet above a lake. Use the formula $t=\frac{\sqrt{h}}{4}$ to find how many seconds it took for the flare to reach the water.

Answer: 8 seconds

434. **Gravity** A hang glider dropped his cell phone from a height of 350 feet. Use the formula $t=\frac{\sqrt{h}}{4}$ to find how many seconds it took for the cell phone to reach the ground.

Answer: 4.7 seconds

435. **Gravity** A construction worker dropped a hammer while building the Grand Canyon skywalk, 4000 feet above the Colorado River. Use the formula $t=\frac{\sqrt{h}}{4}$ to find how many seconds it took for the hammer to reach the river.

Answer: 15.8 seconds

436. **Accident investigation** The skid marks for a car involved in an accident measured 54 feet. Use the formula $s=\sqrt{24d}$ to find the speed of the car before the brakes were applied. Round your answer to the nearest tenth.

Answer: 36.0 seconds

437. **Accident investigation** The skid marks for a car involved in an accident measured 216 feet. Use the formula $s=\sqrt{24d}$ to find the speed of the car before the brakes were applied. Round your answer to the nearest tenth.

Answer: 72 feet

438. **Accident investigation** An accident investigator measured the skid marks of one of the vehicles involved in an accident. The length of the skid marks was 175 feet. Use the formula $s=\sqrt{24d}$ to find the speed of the vehicle before the brakes were applied. Round your answer to the nearest tenth.

Answer: 64.8 feet

439. **Accident investigation** An accident investigator measured the skid marks of one of the vehicles involved in an accident. The length of the skid marks was 117 feet. Use the formula $s=\sqrt{24d}$ to find the speed of the vehicle before the brakes were applied. Round your answer to the nearest tenth.

Answer: 53.0 feet

Writing Exercises

440. Explain why an equation of the form $\sqrt{x}+1=0$ has no solution.

Answer: Answers will vary.

441. (a) Solve the equation $\sqrt{r+4}-r+2=0$.
(b) Explain why one of the “solutions” that was found was not actually a solution to the equation.

Answer: Answers will vary.

Elementary Algebra
9: Roots and Radicals
9.7 Higher Roots

Simplify Expressions with Higher Roots In the following exercises, simplify.

442. (a) $\sqrt[3]{216}$ (b) $\sqrt[4]{256}$ (c) $\sqrt[5]{32}$

Answer: (a) 6 (b) 4 (c) 2

443. (a) $\sqrt[3]{27}$ (b) $\sqrt[4]{16}$ (c) $\sqrt[5]{243}$

Answer: (a) 3 (b) 2 (c) 3

444. (a) $\sqrt[3]{512}$ (b) $\sqrt[4]{81}$ (c) $\sqrt[5]{1}$

Answer: (a) 8 (b) 3 (c) 1

445. (a) $\sqrt[3]{125}$ (b) $\sqrt[4]{1296}$ (c) $\sqrt[5]{1024}$

Answer: (a) 5 (b) 6 (c) 4

446. (a) $\sqrt[3]{-8}$ (b) $\sqrt[4]{-81}$ (c) $\sqrt[5]{-32}$

Answer: (a) -2 (b) not real (c) -2

447. (a) $\sqrt[3]{-64}$ (b) $\sqrt[4]{-16}$ (c) $\sqrt[5]{-243}$

Answer: (a) -4 (b) not real (c) -3

448. (a) $\sqrt[3]{-125}$ (b) $\sqrt[4]{-1296}$ (c) $\sqrt[5]{-1024}$

Answer: (a) -5 (b) not a real number (c) -4

449. (a) $\sqrt[3]{-512}$ (b) $\sqrt[4]{-81}$ (c) $\sqrt[5]{-1}$

Answer: (a) -8 (b) not a real number (c) -1

450. (a) $\sqrt[5]{u^5}$ (b) $\sqrt[8]{v^8}$

Answer: (a) u (b) $|v|$

451. (a) $\sqrt[3]{a^3}$ (b) $\sqrt[12]{b^{12}}$

Answer: (a) a (b) $|b|$

452. (a) $\sqrt[4]{y^4}$ (b) $\sqrt[7]{m^7}$

Answer: (a) $|y|$ (b) m

453. (a) $\sqrt[8]{k^8}$ (b) $\sqrt[6]{p^6}$

Answer: (a) $|k|$ (b) $|p|$

454. (a) $\sqrt[3]{x^9}$ (b) $\sqrt[4]{y^{12}}$

Answer: (a) $|x^3|$ (b) $|y^3|$

455. (a) $\sqrt[5]{a^{10}}$ (b) $\sqrt[3]{b^{27}}$

Answer: (a) a^2 (b) b^9

456. (a) $\sqrt[4]{m^8}$ (b) $\sqrt[5]{n^{20}}$

Answer: (a) m^2 (b) n^4

457. (a) $\sqrt[6]{r^{12}}$ (b) $\sqrt[3]{s^{30}}$

Answer: (a) r^2 (b) s^{10}

458. (a) $\sqrt[4]{16x^8}$ (b) $\sqrt[6]{64y^{12}}$

Answer: (a) $4x^2$ (b) $2y^2$

459. (a) $\sqrt[3]{-8c^9}$ (b) $\sqrt[3]{125d^{15}}$

Answer: (a) $-2c^3$ (b) $5d^5$

460. (a) $\sqrt[3]{216a^6}$ (b) $\sqrt[5]{32b^{20}}$

Answer: (a) $6a^2$ (b) $2b^4$

461. (a) $\sqrt[7]{128r^{14}}$ (b) $\sqrt[4]{81s^{24}}$

Answer: (a) $2r^2$ (b) $3s^6$

Use the Product Property to Simplify Expressions with Higher Roots In the following exercises, simplify.

462. (a) $\sqrt[3]{r^5}$ (b) $\sqrt[4]{s^{10}}$

Answer: (a) $r\sqrt[3]{r^2}$ (b) $s^2\sqrt[4]{s^2}$

463. (a) $\sqrt[5]{u^7}$ (b) $\sqrt[6]{v^{11}}$

Answer: (a) $u\sqrt[5]{u^2}$ (b) $v\sqrt[6]{v^5}$

464. (a) $\sqrt[4]{m^5}$ (b) $\sqrt[8]{n^{10}}$

Answer: (a) $n\sqrt{m}$ (b) $n\sqrt[8]{n^2}$

465. (a) $\sqrt[5]{p^8}$ (b) $\sqrt[3]{q^8}$

Answer: (a) $p\sqrt[5]{p^3}$ (b) $q^2\sqrt[3]{q^2}$

466. (a) $\sqrt[4]{32}$ (b) $\sqrt[5]{64}$

Answer: (a) $2\sqrt[4]{2}$ (b) $2\sqrt[5]{2}$

467. (a) $\sqrt[3]{625}$ (b) $\sqrt[6]{128}$

Answer: (a) $5\sqrt[3]{5}$ (b) $2\sqrt[6]{2}$

468. (a) $\sqrt[5]{64}$ (b) $\sqrt[3]{256}$

Answer: (a) $2\sqrt[5]{2}$ (b) $4\sqrt[3]{4}$

469. (a) $\sqrt[4]{3125}$ (b) $\sqrt[3]{81}$

Answer: (a) $5\sqrt[4]{5}$ (b) $3\sqrt[3]{3}$

470. (a) $\sqrt[3]{108x^5}$ (b) $\sqrt[4]{48y^6}$

Answer: (a) $3x\sqrt[3]{4x^2}$ (b) $2y\sqrt[4]{3y^2}$

471. (a) $\sqrt[5]{96a^7}$ (b) $\sqrt[3]{375b^4}$

Answer: (a) $2a\sqrt[5]{3a^2}$ (b) $5b\sqrt[3]{3b}$

472. (a) $\sqrt[4]{405m^{10}}$ (b) $\sqrt[5]{160n^8}$

Answer: (a) $3m^2\sqrt[4]{5a^2}$ (b) $2n\sqrt[5]{5n^3}$

473. (a) $\sqrt[3]{512p^5}$ (b) $\sqrt[4]{324q^7}$

Answer: (a) $8p\sqrt[3]{p^2}$ (b) $3q\sqrt[4]{4q^3}$

474. (a) $\sqrt[3]{-864}$ (b) $\sqrt[4]{-256}$

Answer: (a) $-6\sqrt[3]{4}$ (b) not real

475. (a) $\sqrt[5]{-486}$ (b) $\sqrt[6]{-64}$

Answer: (a) $-3\sqrt[5]{2}$ (b) not real

476. (a) $\sqrt[5]{-32}$ (b) $\sqrt[8]{-1}$

Answer: (a) -2 (b) not real

477. (a) $\sqrt[3]{-8}$ (b) $\sqrt[4]{-16}$

Answer: (a) -2 (b) not real

Use the Quotient Property to Simplify Expressions with Higher Roots In the following exercises, simplify.

478. (a) $\sqrt[3]{\frac{p^{11}}{p^2}}$ (b) $\sqrt[4]{\frac{q^{17}}{q^{13}}}$

Answer: (a) p^3 (b) $q^3\sqrt[4]{q^2}$

479. (a) $\sqrt[5]{\frac{d^{12}}{d^7}}$ (b) $\sqrt[8]{\frac{m^{12}}{m^4}}$

Answer: (a) d (b) $|m|$

480. (a) $\sqrt[5]{\frac{u^{21}}{u^{11}}}$ (b) $\sqrt[6]{\frac{v^{30}}{v^{12}}}$

Answer: (a) u^2 (b) v^3

481. (a) $\sqrt[3]{\frac{r^{14}}{r^5}}$ (b) $\sqrt[4]{\frac{c^{21}}{c^9}}$

Answer: (a) r^2 (b) $|c^3|$

482. (a) $\frac{\sqrt[4]{64}}{\sqrt[4]{2}}$ (b) $\frac{\sqrt[5]{128x^8}}{\sqrt[5]{2x^2}}$

Answer: (a) $2\sqrt[4]{2}$ (b) $2x\sqrt[5]{2x}$

483. (a) $\frac{\sqrt[3]{-625}}{\sqrt[3]{5}}$ (b) $\frac{\sqrt[4]{80m^7}}{\sqrt[4]{5m}}$

Answer: (a) -5 (b) $4m\sqrt[4]{m^2}$

484. (a) $\sqrt[3]{\frac{1050}{2}}$ (b) $\sqrt[4]{\frac{486y^9}{2y^3}}$

Answer: (a) $5\sqrt[3]{5}$ (b) $3|y|\sqrt[4]{3y^2}$

485. (a) $\sqrt[3]{\frac{162}{6}}$ (b) $\sqrt[4]{\frac{160r^{10}}{5r^3}}$

Answer: (a) $3\sqrt[3]{6}$ (b) $2|r|\sqrt[4]{2r^3}$

486. (a) $\sqrt[3]{\frac{54a^8}{b^3}}$ (b) $\sqrt[4]{\frac{64c^5}{d^2}}$

Answer: (a) $\frac{3a^2\sqrt[3]{2a^2}}{b}$ (b) $\frac{2c\sqrt[4]{4c}}{d^2}$

487. (a) $\sqrt[5]{\frac{96r^{11}}{s^3}}$ (b) $\sqrt[6]{\frac{128u^7}{v^3}}$

Answer: (a) $\frac{2r^2\sqrt[5]{3r}}{s3}$ (b) $\frac{2u^3\sqrt[6]{2uv3}}{v}$

488. (a) $\sqrt[3]{\frac{81s^8}{t^3}}$ (b) $\sqrt[4]{\frac{64p^{15}}{q^{12}}}$

Answer: (a) $\frac{3s^2\sqrt[3]{3s^2}}{t}$ (b) $\frac{2|p^3|\sqrt[4]{4p^3}}{|q^3|}$

489. (a) $\sqrt[3]{\frac{625u^{10}}{v^3}}$ (b) $\sqrt[4]{\frac{729c^{21}}{d^8}}$

Answer: (a) $\frac{5u^3\sqrt[3]{5u}}{v}$ (b) $\frac{3c^5\sqrt[4]{9c}}{d^2}$

Add and Subtract Higher Roots In the following exercises, simplify.

490. (a) $\sqrt[7]{8p}+\sqrt[7]{8p}$ (b) $3\sqrt[3]{25}-\sqrt[3]{25}$

Answer: (a) $2\sqrt[7]{8p}$ (b) $2\sqrt[3]{25}$

491. (a) $\sqrt[3]{15q}+\sqrt[3]{15q}$ (b) $2\sqrt[4]{27}-6\sqrt[4]{27}$

Answer: (a) $2\sqrt[3]{15q}$ (b) $-4\sqrt[4]{27}$

492. (a) $3\sqrt[5]{9x}+7\sqrt[5]{9x}$ (b) $8\sqrt[7]{3q}-2\sqrt[7]{3q}$

Answer: (a) $10\sqrt[5]{9x}$ (b) $6\sqrt[7]{3q}$

493. (a) $23\sqrt[12]{4y}+19\sqrt[12]{4y}$ (b) $31\sqrt[10]{5z}-17\sqrt[10]{5z}$

Answer: (a) $42\sqrt[12]{4y}$ (b) $14\sqrt[10]{5z}$

494. (a) $\sqrt[3]{81}-\sqrt[3]{192}$ (b) $\sqrt[4]{512}-\sqrt[4]{32}$

Answer: (a) $-\sqrt[3]{3}$ (b) $2\sqrt[4]{2}$

495. (a) $\sqrt[3]{250}-\sqrt[3]{54}$ (b) $\sqrt[4]{243}-\sqrt[4]{1875}$

Answer: (a) $5\sqrt[3]{5}-3\sqrt[3]{2}$ (b) $-2\sqrt[4]{3}$

496. (a) $\sqrt[3]{128}+\sqrt[3]{250}$ (b) $\sqrt[5]{729}+\sqrt[5]{96}$

Answer: (a) $9\sqrt[3]{2}$ (b) $5\sqrt[5]{3}$

497. (a) $\sqrt[4]{243}+\sqrt[4]{1250}$ (b) $\sqrt[3]{2000}+\sqrt[3]{54}$

Answer: (a) $3\sqrt[4]{3}+5\sqrt[4]{2}$ (b) $13\sqrt[3]{2}$

498. (a) $\sqrt[3]{64a^{10}}-\sqrt[3]{-216a^{12}}$ (b) $\sqrt[4]{486u^7}+\sqrt[4]{768u^3}$

Answer: (a) $4a^3\sqrt[3]{a}+6a^4$ (b) $3u\sqrt[4]{6u^3}+4\sqrt[4]{3u^3}$

499. (a) $\sqrt[3]{80b^5}-\sqrt[3]{-270b^3}$ (b) $\sqrt[4]{160v^{10}}-\sqrt[4]{1280v^3}$

Answer: (a) $2b\sqrt[3]{10b^2}+3b\sqrt[3]{10}$ (b) $2v^2\sqrt[4]{10v^2}-4\sqrt[4]{5v^3}$

Mixed Practice In the following exercises, simplify.

500. $\sqrt[4]{16}$

Answer: 2

501. $\sqrt[6]{64}$

Answer: 2

502. $\sqrt[3]{a^3}$

Answer: a

503. $\sqrt[12]{b^{12}}$

Answer: $|b|$

504. $\sqrt[3]{-8c^9}$

Answer: $-2c^3$

505. $\sqrt[3]{125d^{15}}$

Answer: $5d^5$

506. $\sqrt[3]{r^5}$

Answer: $r\sqrt[3]{r^2}$

507. $\sqrt[4]{s^{10}}$

Answer: $s^2\sqrt[4]{s^2}$

508. $\sqrt[3]{108x^5}$

Answer: $3x\sqrt[3]{4x^2}$

509. $\sqrt[4]{48y^6}$

Answer: $2y\sqrt[4]{3y^2}$

510. $\sqrt[5]{-486}$

Answer: $-3\sqrt[5]{2}$

511. $\sqrt[6]{-64}$

Answer: not real

512. $\frac{\sqrt[4]{64}}{\sqrt[4]{2}}$

Answer: $2\sqrt[4]{2}$

513. $\frac{\sqrt[5]{128x^8}}{\sqrt[5]{2x^2}}$

Answer: $2x\sqrt[5]{2x}$

514. $\sqrt[5]{\frac{96r^{11}}{s^3}}$

Answer: $\frac{2r^2\sqrt[5]{3r}}{s3}$

515. $\sqrt[6]{\frac{128u^7}{v^3}}$

Answer: $\frac{2u^3\sqrt[6]{2uv3}}{v}$

516. $\sqrt[3]{81}-\sqrt[3]{192}$

Answer: $-\sqrt[3]{3}$

517. $\sqrt[4]{512}-\sqrt[4]{32}$

Answer: $4\sqrt[4]{2}$

518. $\sqrt[3]{64a^{10}}-\sqrt[3]{-216a^{12}}$

Answer: $4a\sqrt[3]{a}+6a^4$

519. $\sqrt[4]{486u^7}+\sqrt[4]{768u^3}$

Answer: $3u\sqrt[4]{6u^3}+4\sqrt[4]{3u^3}$

Everyday Math

520. **Population growth** The expression $10 \cdot x^n$ models the growth of a mold population after n generations. There were 10 spores at the start, and each had x offspring. So $10 \cdot x^n$ is the number of offspring at the fifth generation. At the fifth generation there were 10,240 offspring. Simplify the expression $\sqrt[5]{\frac{10,240}{10}}$ to determine the number of offspring of each spore.

Answer: 4

521. **Spread of a virus** The expression $3 \cdot x^n$ models the spread of a virus after n cycles. There were three people originally infected with the virus, and each of them infected x people. So $3 \cdot x^4$ is the number of people infected on the fourth cycle. At the fourth cycle 1875 people were infected. Simplify the expression $\sqrt[4]{\frac{1875}{3}}$ to determine the number of people each person infected.

Answer: 5

Writing Exercises

522. Explain how you know that $\sqrt[5]{x^{10}}=x^2$.

Answer: Answers will vary.

523. Explain why $\sqrt[4]{-64}$ is not a real number but $\sqrt[3]{-64}$ is.

Answer: Answers will vary.

Elementary Algebra
9: Roots and Radicals
9.8 Rational Exponents

Simplify Expressions with $a^{\frac{1}{n}}$ In the following, write as a radical expression.

524. (a) $x^{\frac{1}{2}}$ (b) $y^{\frac{1}{3}}$ (c) $z^{\frac{1}{4}}$

Answer: (a) $\sqrt{x}$ (b) $\sqrt[3]{y}$ (c) $\sqrt[4]{z}$

525. (a) $r^{\frac{1}{2}}$ (b) $s^{\frac{1}{3}}$ (c) $t^{\frac{1}{4}}$

Answer: (a) $\sqrt{r}$ (b) $\sqrt[3]{s}$ (c) $\sqrt[4]{t}$

526. (a) $u^{\frac{1}{5}}$ (b) $v^{\frac{1}{9}}$ (c) $w^{\frac{1}{20}}$

Answer: (a) $\sqrt[5]{u}$ (b) $\sqrt[9]{v}$ (c) $\sqrt[20]{w}$

527. (a) $g^{\frac{1}{7}}$ (b) $h^{\frac{1}{5}}$ (c) $j^{\frac{1}{25}}$

Answer: (a) $\sqrt[7]{g}$ (b) $\sqrt[5]{h}$ (c) $\sqrt[25]{j}$

In the following, write with a rational exponent.

528. (a) $-\sqrt[7]{x}$ (b) $\sqrt[9]{y}$ (c) $\sqrt[5]{f}$

Answer: (a) $-x^{\frac{1}{7}}$ (b) $y^{\frac{1}{9}}$ (c) $f^{\frac{1}{5}}$

529. (a) $\sqrt[8]{r}$ (b) $\sqrt[10]{s}$ (c) $\sqrt[4]{t}$

Answer: (a) $r^{\frac{1}{8}}$ (b) $s^{\frac{1}{10}}$ (c) $t^{\frac{1}{4}}$

530. (a) $\sqrt[3]{a}$ (b) $\sqrt[12]{b}$ (c) $\sqrt{c}$

Answer: (a) $a^{\frac{1}{3}}$ (b) $b^{\frac{1}{12}}$ (c) $c^{\frac{1}{2}}$

531. (a) $\sqrt[5]{u}$ (b) $\sqrt{v}$ (c) $\sqrt[16]{w}$

Answer: (a) $u^{\frac{1}{5}}$ (b) $v^{\frac{1}{2}}$ (c) $w^{\frac{1}{16}}$

532. (a) $\sqrt[3]{7c}$ (b) $\sqrt[7]{12d}$ (c) $3\sqrt[4]{5f}$

Answer: (a) $(7c)^{\frac{1}{3}}$ (b) $(12d)^{\frac{1}{7}}$ (c) $3(5f)^{\frac{1}{4}}$

533. (a) $\sqrt[4]{5x}$ (b) $\sqrt[8]{9y}$ (c) $7\sqrt[5]{3z}$

Answer: $(5x)^{\frac{1}{4}}$ (b) $(9y)^{\frac{1}{8}}$ (c) $7(3z)^{\frac{1}{5}}$

534. (a) $\sqrt{21p}$ (b) $\sqrt[4]{8q}$ (c) $4\sqrt[6]{36r}$

Answer: (a) $(21p)^{\frac{1}{2}}$ (b) $(8q)^{\frac{1}{4}}$ (c) $4(36r)^{\frac{1}{6}}$

535. (a) $\sqrt[3]{25a}$ (b) $\sqrt{3b}$ (c) $\sqrt[10]{40c}$

Answer: (a) $(25a)^{\frac{1}{3}}$ (b) $(3b)^{\frac{1}{2}}$ (c) $(40c)^{\frac{1}{10}}$

In the following, simplify.

536. (a) $81^{\frac{1}{2}}$ (b) $125^{\frac{1}{3}}$ (c) $64^{\frac{1}{2}}$

Answer: (a) 9 (b) 5 (c) 8

537. (a) $625^{\frac{1}{4}}$ (b) $243^{\frac{1}{5}}$ (c) $32^{\frac{1}{5}}$

Answer: (a) 5 (b) 3 (c) 2

538. (a) $16^{\frac{1}{4}}$ (b) $16^{\frac{1}{2}}$ (c) $3125^{\frac{1}{5}}$

Answer: (a) 2 (b) 4 (c) 5

539. (a) $216^{\frac{1}{3}}$ (b) $32^{\frac{1}{5}}$ (c) $81^{\frac{1}{4}}$

Answer: (a) 6 (b) 2 (c) 3

540. (a) $(-216)^{\frac{1}{3}}$ (b) $-216^{\frac{1}{3}}$ (c) $(216)^{-\frac{1}{3}}$

Answer: (a) -6 (b) -6 (c) $\frac{1}{6}$

541. (a) $(-243)^{\frac{1}{5}}$ (b) $-243^{\frac{1}{5}}$ (c) $(243)^{-\frac{1}{5}}$

Answer: (a) -3 (b) -3 (c) $\frac{1}{3}$

542. (a) $(-1)^{\frac{1}{3}}$ (b) $-1^{\frac{1}{3}}$ (c) $(1)^{-\frac{1}{3}}$

Answer: (a) -1 (b) -1 (c) 1

543. (a) $(-1000)^{\frac{1}{3}}$ (b) $-1000^{\frac{1}{3}}$ (c) $(1000)^{-\frac{1}{3}}$

Answer: (a) -10 (b) -10 (c) $\frac{1}{10}$

544. (a) $(-81)^{\frac{1}{4}}$ (b) $-81^{\frac{1}{4}}$ (c) $(81)^{-\frac{1}{4}}$

Answer: (a) not a real number (b) -3 (c) $\frac{1}{3}$

545. (a) $(-49)^{\frac{1}{2}}$ (b) $-49^{\frac{1}{2}}$ (c) $(49)^{-\frac{1}{2}}$

Answer: (a) not a real number (b) -7 (c) $\frac{1}{7}$

546. (a) $(-36)^{\frac{1}{2}}$ (b) $-36^{\frac{1}{2}}$ (c) $(36)^{-\frac{1}{2}}$

Answer: (a) not a real number (b) -6 (c) $\frac{1}{6}$

547. (a) $(-1)^{\frac{1}{4}}$ (b) $(1)^{-\frac{1}{4}}$ (c) $-1^{\frac{1}{4}}$

Answer: (a) not a real number (b) 1 (c) -1

548. (a) $(-100)^{\frac{1}{2}}$ (b) $-100^{\frac{1}{2}}$ **(c)** $(100)^{-\frac{1}{2}}$

Answer: (a) not a real number (b) -10 (c) $\frac{1}{10}$

549. (a) $(-32)^{\frac{1}{5}}$ (b) $(243)^{-\frac{1}{5}}$; c) $-125^{\frac{1}{3}}$

Answer: (a) -2 (b) $\frac{1}{3}$ (c) -5

Simplify Expressions with $a^{\frac{m}{n}}$ In the following exercises, write with a rational exponent.

550. (a) $\sqrt{m^5}$ (b) $\sqrt[3]{n^2}$ (c) $\sqrt[4]{p^3}$

Answer: (a) $m^{\frac{5}{2}}$ (b) $n^{\frac{2}{3}}$ (c) $p^{\frac{3}{4}}$

551. (a) $\sqrt[4]{r^7}$ (b) $\sqrt[5]{s^3}$ (c) $\sqrt[3]{t^7}$

Answer: (a) $r^{\frac{7}{4}}$ (b) $s^{\frac{3}{5}}$ (c) $t^{\frac{7}{3}}$

552. (a) $\sqrt[5]{u^2}$ (b) $\sqrt[5]{v^8}$ (c) $\sqrt[9]{w^4}$

Answer: (a) $u^{\frac{2}{5}}$ (b) $v^{\frac{8}{5}}$ (c) $w^{\frac{4}{9}}$

553. (a) $\sqrt[3]{a}$ (b) $\sqrt{b^5}$ (c) $\sqrt[3]{c^5}$

Answer: (a) $a^{\frac{1}{3}}$ (b) $b^{\frac{1}{5}}$ (c) $c^{\frac{5}{3}}$

In the following exercises, simplify.

554. (a) $16^{\frac{3}{2}}$ (b) $8^{\frac{2}{3}}$ (c) $10{,}000^{\frac{3}{4}}$

Answer: (a) 64 (b) 4 (c) 1000

555. (a) $1000^{\frac{2}{3}}$ (b) $25^{\frac{3}{2}}$ (c) $32^{\frac{3}{5}}$

Answer: (a) 100 (b) 125 (c) 8

556. (a) $27^{\frac{5}{3}}$ (b) $16^{\frac{5}{4}}$ (c) $32^{\frac{2}{5}}$

Answer: (a) 243 (b) 32 (c) 4

557. (a) $16^{\frac{3}{2}}$ (b) $125^{\frac{5}{3}}$ (c) $64^{\frac{4}{3}}$

Answer: (a) 64 (b) 3125 (c) 256

558. (a) $32^{\frac{2}{5}}$ (b) $27^{-\frac{2}{3}}$ (c) $25^{-\frac{3}{2}}$

Answer: (a) 4 (b) $\frac{1}{9}$ (c) $\frac{1}{125}$

559. (a) $64^{\frac{5}{2}}$ (b) $81^{-\frac{3}{2}}$ (c) $27^{-\frac{4}{3}}$

Answer: (a) 32,768 (b) $\frac{1}{729}$ (c) $\frac{1}{81}$

560. (a) $25^{\frac{3}{2}}$ (b) $9^{-\frac{3}{2}}$ (c) $\left(-64\right)^{\frac{2}{3}}$

Answer: (a) 125 (b) $\frac{1}{27}$ (c) 16

561. (a) $100^{\frac{3}{2}}$ (b) $49^{-\frac{5}{2}}$ (c) $\left(-100\right)^{\frac{3}{2}}$

Answer: (a) 1000 (b) $\frac{1}{16{,}807}$ (c) not a real number

562. (a) $-9^{\frac{3}{2}}$ (b) $-9^{-\frac{3}{2}}$ (c) $(-9)^{\frac{3}{2}}$

Answer: (a) -27 (b) $-\frac{1}{27}$ (c) not a real number

563. (a) $-64^{\frac{3}{2}}$ (b) $-64^{-\frac{3}{2}}$ (c) $(-64)^{\frac{3}{2}}$

Answer: (a) -512 (b) $-\frac{1}{512}$ (c) not a real number

564. (a) $-100^{\frac{3}{2}}$ (b) $-100^{-\frac{3}{2}}$ (c) $(-100)^{\frac{3}{2}}$

Answer: (a) -1000 (b) $-\frac{1}{1000}$ (c) not a real number

565. (a) $-49^{\frac{3}{2}}$ (b) $-49^{-\frac{3}{2}}$ (c) $(-49)^{\frac{3}{2}}$

Answer: (a) -343 (b) $-\frac{1}{343}$ (c) not a real number

Use the Laws of Exponents to Simplify Expressions with Rational Exponents In the following exercises, simplify.

566. (a) $4^{\frac{5}{8}} \cdot 4^{\frac{11}{8}}$ (b) $m^{\frac{7}{12}} \cdot m^{\frac{17}{12}}$ (c) $p^{\frac{3}{7}} \cdot p^{\frac{18}{7}}$

Answer: (a) 16 (b) m^2 (c) p^3

567. (a) $6^{\frac{5}{2}} \cdot 6^{\frac{1}{2}}$ (b) $n^{\frac{2}{10}} \cdot n^{\frac{8}{10}}$ (c) $q^{\frac{2}{5}} \cdot q^{\frac{13}{5}}$

Answer: (a) 216 (b) n (c) q^3

568. (a) $5^{\frac{1}{2}} \cdot 5^{\frac{7}{2}}$ (b) $c^{\frac{3}{4}} \cdot c^{\frac{9}{4}}$ (c) $d^{\frac{3}{5}} \cdot d^{\frac{2}{5}}$

Answer: (a) 625 (b) c^3 (c) d

569. (a) $10^{\frac{1}{3}} \cdot 10^{\frac{5}{3}}$ (b) $x^{\frac{5}{6}} \cdot x^{\frac{7}{6}}$ (c) $y^{\frac{11}{8}} \cdot y^{\frac{21}{8}}$

Answer: (a) 100 (b) x^2 (c) y^4

570. (a) $\left(m^6\right)^{\frac{5}{2}}$ (b) $\left(n^9\right)^{\frac{4}{3}}$ (c) $\left(p^{12}\right)^{\frac{3}{4}}$

Answer: (a) m^{15} (b) n^{12} (c) p^9

571. (a) $\left(a^{12}\right)^{\frac{1}{6}}$ (b) $\left(b^{15}\right)^{\frac{3}{5}}$ (c) $\left(c^{11}\right)^{\frac{1}{11}}$

Answer: (a) a^2 (b) b^9 (c) c

572. (a) $\left(x^{12}\right)^{\frac{2}{3}}$ (b) $\left(y^{20}\right)^{\frac{2}{5}}$ (c) $\left(z^{16}\right)^{\frac{1}{16}}$

Answer: (a) x^8 (b) y^8 (c) z

573. (a) $\left(h^6\right)^{\frac{4}{3}}$ (b) $\left(k^{12}\right)^{\frac{3}{4}}$ (c) $\left(j^{10}\right)^{\frac{7}{5}}$

Answer: (a) h^8 (b) k^9 (c) j^{14}

574. (a) $\frac{x^{\frac{7}{2}}}{x^{\frac{5}{2}}}$ (b) $\frac{y^{\frac{5}{2}}}{y^{\frac{1}{2}}}$ (c) $\frac{r^{\frac{4}{5}}}{r^{\frac{9}{5}}}$

Answer: (a) x (b) y^2 (c) $\frac{1}{r}$

575. (a) $\frac{s^{\frac{11}{5}}}{s^{\frac{6}{5}}}$ (b) $\frac{z^{\frac{7}{3}}}{z^{\frac{1}{3}}}$ (c) $\frac{w^{\frac{2}{7}}}{w^{\frac{9}{7}}}$

Answer: (a) s (b) z^2 (c) $\frac{1}{w}$

576. (a) $\frac{t^{\frac{12}{5}}}{t^{\frac{7}{5}}}$ (b) $\frac{x^{\frac{3}{2}}}{x^{\frac{1}{2}}}$ (c) $\frac{m^{\frac{13}{8}}}{m^{\frac{5}{8}}}$

Answer: (a) t (b) x (c) m

577. (a) $\frac{u^{\frac{13}{9}}}{u^{\frac{4}{9}}}$ (b) $\frac{r^{\frac{15}{7}}}{r^{\frac{8}{7}}}$ (c) $\frac{n^{\frac{3}{5}}}{n^{\frac{8}{5}}}$

Answer: (a) u (b) r (c) $\frac{1}{n}$

578. (a) $\left(9p^{\frac{2}{3}}\right)^{\frac{5}{2}}$ (b) $\left(27q^{\frac{3}{2}}\right)^{\frac{4}{3}}$

Answer: (a) $243p^{\frac{5}{3}}$ (b) $81q^2$

579. (a) $\left(81r^{\frac{4}{5}}\right)^{\frac{1}{4}}$ (b) $\left(64s^{\frac{3}{7}}\right)^{\frac{1}{6}}$

Answer: (a) $3r^{\frac{1}{5}}$ (b) $2s^{\frac{1}{14}}$

580. (a) $\left(16u^{\frac{1}{3}}\right)^{\frac{3}{4}}$ (b) $\left(100v^{\frac{2}{5}}\right)^{\frac{3}{2}}$

Answer: (a) $8u^{\frac{1}{4}}$ (b) $1000v^{\frac{3}{5}}$

581. (a) $\left(27m^{\frac{3}{4}}\right)^{\frac{2}{3}}$ (b) $\left(625n^{\frac{8}{3}}\right)^{\frac{3}{4}}$

Answer: (a) $9m^{\frac{1}{2}}$ (b) $125n^2$

582. (a) $\left(x^8y^{10}\right)^{\frac{1}{2}}$ (b) $\left(a^9b^{12}\right)^{\frac{1}{3}}$

Answer: (a) x^4y^5 (b) a^3b^4

583. (a) $\left(r^8s^4\right)^{\frac{1}{4}}$ (b) $\left(u^{15}v^{20}\right)^{\frac{1}{5}}$

Answer: (a) r^2s (b) u^3v^4

584. (a) $\left(a^6b^{16}\right)^{\frac{1}{2}}$ (b) $\left(j^9k^6\right)^{\frac{2}{3}}$

Answer: (a) a^3b^8 (b) j^6k^4

585. (a) $\left(r^{16}s^{10}\right)^{\frac{1}{2}}$ (b) $\left(u^{10}v^5\right)^{\frac{4}{5}}$

Answer: (a) r^8s^5 (b) u^8v^4

586. (a) $\dfrac{r^{\frac{5}{2}} \cdot r^{-\frac{1}{2}}}{r^{-\frac{3}{2}}}$ (b) $\dfrac{s^{\frac{1}{5}} \cdot s}{s^{-\frac{9}{5}}}$

Answer: (a) $r^{\frac{7}{2}}$ (b) s^3

587. (a) $\dfrac{a^{\frac{3}{4}} \cdot a^{-\frac{1}{4}}}{a^{-\frac{10}{4}}}$ (b) $\dfrac{b^{\frac{2}{3}} \cdot b}{b^{-\frac{7}{3}}}$

Answer: (a) a^3 (b) b^4

588. (a) $\frac{c^{\frac{5}{3}} \cdot c^{-\frac{1}{3}}}{c^{-\frac{2}{3}}}$ (b) $\frac{d^{\frac{3}{5}} \cdot d}{d^{-\frac{2}{5}}}$

Answer: (a) c^2 (b) d^2

589. (a) $\frac{m^{\frac{7}{4}} \cdot m^{-\frac{5}{4}}}{m^{-\frac{2}{4}}}$ (b) $\frac{n^{\frac{3}{7}} \cdot n}{n^{-\frac{4}{7}}}$

Answer: (a) m (b) n^2

590. $4^{\frac{5}{2}} \cdot 4^{\frac{1}{2}}$

Answer: 64

591. $n^{\frac{2}{6}} \cdot n^{\frac{4}{6}}$

Answer: n

592. $\left(a^{24}\right)^{\frac{1}{6}}$

Answer: a^4

593. $\left(b^{10}\right)^{\frac{3}{5}}$

Answer: b^6

594. $\frac{w^{\frac{2}{5}}}{w^{\frac{7}{5}}}$

Answer: $\frac{1}{w}$

595. $\frac{z^{\frac{2}{3}}}{z^{\frac{8}{3}}}$

Answer: $\frac{1}{z^2}$

596. $\left(27r^{\frac{3}{5}}\right)^{\frac{1}{3}}$

Answer: $3r^{\frac{1}{5}}$

597. $\left(64s^{\frac{3}{5}}\right)^{\frac{1}{6}}$

Answer: $2s^{\frac{1}{10}}$

598. $\left(r^9s^{12}\right)^{\frac{1}{3}}$

Answer: r^3s^4

599. $\left(u^{12}v^{18}\right)^{\frac{1}{6}}$

Answer: u^2v^3

Everyday Math

600. **Landscaping** Joe wants to have a square garden plot in his backyard. He has enough compost to cover an area of 144 square feet. Simplify $144^{\frac{1}{2}}$ to find the length of each side of his garden.

Answer: 12 feet

601. **Landscaping** Elliott wants to make a square patio in his yard. He has enough concrete to pave an area of 242 square feet. Simplify $242^{\frac{1}{2}}$ to find the length of each side of his patio.Round to the nearest tenth of a foot.

Answer: 15.6 feet

602. **Gravity** While putting up holiday decorations, Bob dropped a decoration from the top of a tree that is 12 feet tall. Simplify $\frac{12^{\frac{1}{2}}}{16^{\frac{1}{2}}}$ to find how many seconds it took for the decoration to reach the ground. Round to the nearest tenth of a second.

Answer: 0.9 seconds

603. **Gravity** An airplane dropped a flare from a height of 1024 feet above a lake. Simplify $\frac{1024^{\frac{1}{2}}}{16^{\frac{1}{2}}}$ to find how many seconds it took for the flare to reach the water.

Answer: 8 seconds

Writing Exercises

604. Show two different algebraic methods to simplify $4^{\frac{3}{2}}$. Explain all your steps.

Answer: Answers will vary.

605. Explain why the expression $(-16)^{\frac{3}{2}}$ cannot be evaluated.

Answer: Answers will vary.

Chapter Review

9.1 Simplify and Use Square Roots

Simplify Expressions with Square Roots In the following exercises, simplify.

606. $\sqrt{64}$

Answer: 8

607. $\sqrt{144}$

Answer: 12

608. $-\sqrt{25}$

Answer: -5

609. $-\sqrt{81}$

Answer: -9

610. $\sqrt{-9}$

Answer: not a real number

611. $\sqrt{-36}$

Answer: not a real number

612. $\sqrt{64}+\sqrt{225}$

Answer: 23

613. $\sqrt{64+225}$

Answer: 17

Estimate Square Roots In the following exercises, estimate each square root between two consecutive whole numbers.

614. $\sqrt{28}$

Answer: $5<\sqrt{28}<6$

615. $\sqrt{155}$

Answer: $12<\sqrt{155}<13$

Approximate Square Roots In the following exercises, approximate each square root and round to two decimal places.

616. $\sqrt{15}$

Answer: 3.87

617. $\sqrt{57}$

Answer: 7.55

Simplify Variable Expressions with Square Roots In the following exercises, simplify.

618. $\sqrt{q^2}$

Answer: q

619. $\sqrt{64b^2}$

Answer: $8b$

620. $-\sqrt{121a^2}$

Answer: $-11a$

621. $\sqrt{225m^2n^2}$

Answer: $15mn$

622. $-\sqrt{100q^2}$

Answer: $-10q$

623. $\sqrt{49y^2}$

Answer: $7y$

624. $\sqrt{4a^2b^2}$

Answer: $2ab$

625. $\sqrt{121c^2d^2}$

Answer: $11cd$

9.2 Simplify Square Roots

Use the Product Property to Simplify Square Roots In the following exercises, simplify.

626. $\sqrt{300}$

Answer: $10\sqrt{3}$

627. $\sqrt{98}$

Answer: $7\sqrt{2}$

628. $\sqrt{x^{13}}$

Answer: $x^6\sqrt{x}$

629. 736. $\sqrt{y^{19}}$

Answer: $y^9\sqrt{y}$

630. $\sqrt{16m^4}$

Answer: $4m^2$

631. $\sqrt{36n^{13}}$

Answer: $6n^6\sqrt{n}$

632. $\sqrt{288m^{21}}$

Answer: $12m^{10}\sqrt{2m}$

633. $\sqrt{150n^7}$

Answer: $5n^3\sqrt{6n}$

634. $\sqrt{48r^5s^4}$

Answer: $4r^2s^2\sqrt{3r}$

635. $\sqrt{108r^5s^3}$

Answer: $6r^2s\sqrt{3rs}$

636. $\dfrac{10-\sqrt{50}}{5}$

Answer: $2-\sqrt{2}$

637. 744. $\frac{6+\sqrt{72}}{6}$

Answer: $1+\sqrt{2}$

Use the Quotient Property to Simplify Square Roots In the following exercises, simplify.

638. $\sqrt{\frac{16}{25}}$

Answer: $\frac{4}{5}$

639. $\sqrt{\frac{81}{36}}$

Answer: $\frac{3}{2}$

640. $\sqrt{\frac{x^8}{x^4}}$

Answer: x^2

641. $\sqrt{\frac{y^6}{y^2}}$

Answer: y^2

642. $\sqrt{\frac{98p^6}{2p^2}}$

Answer: $7p^2$

643. $\sqrt{\frac{72q^8}{2q^4}}$

Answer: $6q^2$

644. $\sqrt{\frac{65}{121}}$

Answer: $\frac{\sqrt{65}}{11}$

645. $\sqrt{\frac{26}{169}}$

Answer: $\frac{\sqrt{26}}{13}$

646. 753. $\sqrt{\frac{64x^4}{25x^2}}$

Answer: $\frac{8x}{5}$

647. 754. $\sqrt{\frac{36r^{10}}{16r^5}}$

Answer: $\frac{3r^2\sqrt{r}}{2}$

648. $\sqrt{\frac{48p^3q^5}{27pq}}$

Answer: $\frac{4pq^2}{3}$

649. $\sqrt{\frac{12r^5s^7}{75r^2s}}$

Answer: $\frac{2rs^3\sqrt{r}}{5}$

9.3 Add and Subtract Square Roots

Add and Subtract Like Square Roots In the following exercises, simplify.

650. $3\sqrt{2}+\sqrt{2}$

Answer: $4\sqrt{2}$

651. $5\sqrt{5}+7\sqrt{5}$

Answer: $12\sqrt{5}$

652. $4\sqrt{y}+4\sqrt{y}$

Answer: $8\sqrt{y}$

653. $6\sqrt{m}-2\sqrt{m}$

Answer: $4\sqrt{m}$

654. $-3\sqrt{7}+2\sqrt{7}-\sqrt{7}$

Answer: $-2\sqrt{7}$

655. $8\sqrt{13}+2\sqrt{3}+3\sqrt{13}$

Answer: $11\sqrt{13}+2\sqrt{3}$

656. $3\sqrt{5xy}-\sqrt{5xy}+3\sqrt{5xy}$

Answer: $5\sqrt{5xy}$

657. $2\sqrt{3rs}+\sqrt{3rs}-5\sqrt{rs}$

Answer: $3\sqrt{3rs}-5\sqrt{rs}$

Add and Subtract Square Roots that Need Simplification In the following exercises, simplify.

658. $\sqrt{32}+3\sqrt{2}$

Answer: $7\sqrt{2}$

659. $\sqrt{8}+3\sqrt{2}$

Answer: $5\sqrt{2}$

660. $\sqrt{72}+\sqrt{50}$

Answer: $11\sqrt{2}$

661. $\sqrt{48}+\sqrt{75}$

Answer: $9\sqrt{3}$

662. $3\sqrt{32}+\sqrt{98}$

Answer: $19\sqrt{2}$

663. $\frac{1}{3}\sqrt{27}-\frac{1}{8}\sqrt{192}$

Answer: 0

664. $\sqrt{50y^5}-\sqrt{72y^5}$

Answer: $-y^2\sqrt{2y}$

665. $6\sqrt{18n^4}-3\sqrt{8n^4}+n^2\sqrt{50}$

Answer: $17n^2\sqrt{2}$

9.4 Multiply Square Roots

Multiply Square Roots In the following exercises, simplify.

666. $\sqrt{2}\cdot\sqrt{20}$

Answer: $2\sqrt{10}$

667. $2\sqrt{2}\cdot 6\sqrt{14}$

Answer: $24\sqrt{7}$

668. $\sqrt{2m^2}\cdot\sqrt{20m^4}$

Answer: $2m^3\sqrt{10}$

669. $\left(6\sqrt{2y}\right)\left(3\sqrt{50y^3}\right)$

Answer: $180y^2$

670. $\left(6\sqrt{3v^4}\right)\left(5\sqrt{30v}\right)$

Answer: $90v^2\sqrt{10v}$

671. $\left(\sqrt{8}\right)^2$

Answer: 8

672. $\left(-\sqrt{10}\right)^2$

Answer: 10

673. $\left(2\sqrt{5}\right)\left(5\sqrt{5}\right)$

Answer: 50

674. $\left(-3\sqrt{3}\right)\left(5\sqrt{18}\right)$

Answer: -90

Use Polynomial Multiplication to Multiply Square Roots In the following exercises, simplify.

675. $10(2-\sqrt{7})$

Answer: $20-10\sqrt{7}$

676. $\sqrt{3}\left(4+\sqrt{12}\right)$

Answer: $4\sqrt{3}+6$

677. $\left(5+\sqrt{2}\right)\left(3-\sqrt{2}\right)$

Answer: $13-2\sqrt{2}$

678. $\left(5-3\sqrt{7}\right)\left(1-2\sqrt{7}\right)$

Answer: $47-13\sqrt{7}$

679. $\left(1-3\sqrt{x}\right)\left(5+2\sqrt{x}\right)$

Answer: $5-13\sqrt{x}-6x$

680. $\left(3+4\sqrt{y}\right)\left(10-\sqrt{y}\right)$

Answer: $30+37\sqrt{y}-4y$

681. $\left(1+6\sqrt{p}\right)^2$

Answer: $1+12\sqrt{p}+36p$

682. $\left(2-6\sqrt{5}\right)^2$

Answer: $184-12\sqrt{5}$

683. $\left(3+2\sqrt{7}\right)\left(3-2\sqrt{7}\right)$

Answer: -19

684. $\left(6-\sqrt{11}\right)\left(6+\sqrt{11}\right)$

Answer: 25

9.5 Divide Square Roots

Divide Square Roots In the following exercises, simplify.

685. $\frac{\sqrt{75}}{10}$

Answer: $\frac{\sqrt{3}}{2}$

686. $\frac{2-\sqrt{12}}{6}$

Answer: $\frac{1-\sqrt{3}}{3}$

687. $\frac{\sqrt{48}}{\sqrt{27}}$

Answer: $\frac{4}{3}$

688. $\frac{\sqrt{75x^7}}{\sqrt{3x^3}}$

Answer: $5x^2$

689. $\frac{\sqrt{20y^5}}{\sqrt{2y}}$

Answer: $y^2\sqrt{10}$

690. $\frac{\sqrt{98p^6q^4}}{\sqrt{2p^4q^8}}$

Answer: $\frac{7p}{q^2}$

Rationalize a One Term Denominator In the following exercises, rationalize the denominator.

691. $\frac{10}{\sqrt{15}}$

Answer: $\frac{2\sqrt{15}}{3}$

692. $\frac{6}{\sqrt{6}}$

Answer: $\sqrt{6}$

693. $\frac{5}{3\sqrt{5}}$

Answer: $\frac{\sqrt{5}}{3}$

694. $\frac{10}{2\sqrt{6}}$

Answer: $\frac{5\sqrt{6}}{6}$

695. $\sqrt{\frac{3}{28}}$

Answer: $\frac{\sqrt{21}}{14}$

696. $\sqrt{\frac{9}{75}}$

Answer: $\frac{\sqrt{3}}{5}$

Rationalize a Two Term Denominator In the following exercises, rationalize the denominator.

697. $\frac{4}{4+\sqrt{27}}$

Answer: $\frac{16-12\sqrt{3}}{-11}$

698. $\frac{5}{2-\sqrt{10}}$

Answer: $\frac{10+5\sqrt{10}}{-6}$

699. $\frac{4}{2-\sqrt{5}}$

Answer: $-8-4\sqrt{5}$

700. $\frac{5}{4-\sqrt{8}}$

Answer: $\frac{10-5\sqrt{2}}{-2}$

701. $\frac{\sqrt{2}}{\sqrt{p}+\sqrt{3}}$

Answer: $\frac{\sqrt{2p}-\sqrt{6}}{p-3}$

702. $\dfrac{\sqrt{x}-\sqrt{2}}{\sqrt{x}+\sqrt{2}}$

Answer: $\dfrac{x-2\sqrt{2x}+2}{x-2}$

9.6 Solve Equations with Square Roots

Solve Radical Equations In the following exercises, solve the equation.

703. $\sqrt{7z+1}=6$

Answer: 5

704. $\sqrt{4u-2}-4=0$

Answer: $\dfrac{9}{2}$

705. $\sqrt{6m+4}-5=0$

Answer: $\dfrac{7}{2}$

706. $\sqrt{2u-3}+2=0$

Answer: no solution

707. $\sqrt{u-4}+4=u$

Answer: no solution

708. $\sqrt{v-9}+9=0$

Answer: no solution

709. $\sqrt{r-4}-r=-10$

Answer: 13

710. $\sqrt{s-9}-s=-9$

Answer: 9, 10

711. $2\sqrt{2x-7}-4=8$

Answer: $\dfrac{43}{2}$

712. $\sqrt{2-x}=\sqrt{2x-7}$

Answer: no solution

713. $\sqrt{a}+3=\sqrt{a+9}$

Answer: 0

714. $\sqrt{r}+3=\sqrt{r+4}$

Answer: no solution

715. $\sqrt{u}+2=\sqrt{u+5}$

Answer: $\frac{1}{16}$

716. $\sqrt{n+11}-1=\sqrt{n+4}$

Answer: 5

717. $\sqrt{y+5}+1=\sqrt{2y+3}$

Answer: 11

Use Square Roots in Applications In the following exercises, solve. Round approximations to one decimal place.

718. A pallet of sod will cover an area of about 600 square feet. Trinh wants to order a pallet of sod to make a square lawn in his backyard. Use the formula $s=\sqrt{A}$ to find the length of each side of his lawn.

Answer: 24.5 feet

719. A helicopter dropped a package from a height of 900 feet above a stranded hiker. Use the formula $t=\frac{\sqrt{h}}{4}$ to find how many seconds it took for the package to reach the hiker.

Answer: 7.5 seconds

720. Officer Morales measured the skid marks of one of the cars involved in an accident. The length of the skid marks was 245 feet. Use the formula $s=\sqrt{24d}$ to find the speed of the car before the brakes were applied.

Answer: 76.7 mph

9.7 Higher Roots

Simplify Expressions with Higher Roots In the following exercises, simplify.

721. (a) $\sqrt[6]{64}$ (b) $\sqrt[3]{64}$

Answer: (a) 2 (b) 4

722. (a) $\sqrt[3]{-27}$ (b) $\sqrt[4]{-64}$

Answer: (a) -3 (b) not a real number

723. (a) $\sqrt[9]{d^9}$ (b) $\sqrt[8]{v^8}$

Answer: (a) d (b) $|v|$

724. (a) $\sqrt[5]{a^{10}}$ (b) $\sqrt[3]{b^{27}}$

Answer: (a) a^2 (b) b^9

725. (a) $\sqrt[4]{16x^8}$ (b) $\sqrt[6]{64y^{12}}$

Answer: (a) $2x^2$ (b) $2y^2$

726. (a) $\sqrt[7]{128r^{14}}$ (b) $\sqrt[4]{81s^{24}}$

Answer: (a) $2r^2$ (b) $3s^6$

Use the Product Property to Simplify Expressions with Higher Roots In the following exercises, simplify.

727. (a) $\sqrt[9]{d^9}$ (b) $\sqrt[11]{m^{17}}$

Answer: (a) d (b) $m\sqrt[11]{m^6}$

728. (a) $\sqrt[3]{54}$ (b) $\sqrt[4]{128}$

Answer: (a) $3\sqrt[3]{2}$ (b) $2\sqrt[4]{8}$

729. (a) $\sqrt[5]{64c^8}$ (b) $\sqrt[4]{48d^7}$

Answer: (a) $2c\sqrt[5]{2c^3}$ (b) $2d\sqrt[4]{3d^3}$

730. (a) $\sqrt[3]{343q^7}$ (b) $\sqrt[6]{192r^9}$

Answer: (a) $7q^2\sqrt[3]{q}$ (b) $2r\sqrt[6]{3r^3}$

731. (a) $\sqrt[3]{-500}$ (b) $\sqrt[4]{-16}$

Answer: (a) $-5\sqrt[3]{4}$ (b) not a real number

Use the Quotient Property to Simplify Expressions with Higher Roots In the following exercises, simplify.

732. $\sqrt[5]{\frac{r^{10}}{r^5}}$

Answer: r

733. $\sqrt[3]{\frac{w^{12}}{w^2}}$

Answer: $w^3\sqrt[3]{w}$

734. $\sqrt[4]{\frac{64y^8}{4y^5}}$

Answer: $2\sqrt[4]{y^3}$

735. $\sqrt[3]{\frac{54z^9}{2z^3}}$

Answer: $3z^2$

736. $\sqrt[6]{\frac{64a^7}{b^2}}$

Answer: $2a\sqrt[6]{\frac{a}{b^2}}$

Add and Subtract Higher Roots In the following exercises, simplify.

737. $4\sqrt[5]{20}-2\sqrt[5]{20}$

Answer: $2\sqrt[5]{20}$

738. $4\sqrt[3]{18}+3\sqrt[3]{18}$

Answer: $7\sqrt[3]{18}$

739. $\sqrt[4]{1250}-\sqrt[4]{162}$

Answer: $2\sqrt[4]{2}$

740. $\sqrt[3]{640c^5}-\sqrt[3]{-80c^3}$

Answer: $4c\sqrt[3]{10c^2}+2c\sqrt[3]{10}$

741. $\sqrt[5]{96t^8}+\sqrt[5]{486t^4}$

Answer: $2t\sqrt[5]{3t^3}+3\sqrt[5]{2t^4}$

9.8 Rational Exponents

Simplify Expressions with $a^{\frac{1}{n}}$ In the following exercises, write as a radical expression.

742. $r^{\frac{1}{8}}$

Answer: $\sqrt[8]{r}$

743. $s^{\frac{1}{10}}$

Answer: $\sqrt[10]{s}$

In the following exercises, write with a rational exponent.

744. $\sqrt[5]{u}$

Answer: $u^{\frac{1}{5}}$

745. $\sqrt[6]{v}$

Answer: $v^{\frac{1}{6}}$

746. $\sqrt[3]{9m}$

Answer: $(9m)^{\frac{1}{3}}$

747. $\sqrt[6]{10z}$

Answer: $(10z)^{\frac{1}{6}}$

In the following exercises, simplify.

748. $16^{\frac{1}{4}}$

Answer: 2

749. $32^{\frac{1}{5}}$

Answer: 2

750. $(-125)^{\frac{1}{3}}$

Answer: -5

751. $(125)^{-\frac{1}{3}}$

Answer: $\frac{1}{5}$

752. $(-9)^{\frac{1}{2}}$

Answer: not a real number

753. $(36)^{-\frac{1}{2}}$

Answer: $\frac{1}{6}$

Simplify Expressions with $a^{\frac{m}{n}}$ In the following exercises, write with a rational exponent.

754. $\sqrt[3]{q^5}$

Answer: $q^{\frac{5}{3}}$

755. $\sqrt[5]{n^8}$

Answer: $n^{\frac{8}{5}}$

In the following exercises, simplify.

756. $27^{-\frac{2}{3}}$

Answer: $\frac{1}{9}$

757. $64^{\frac{5}{2}}$

Answer: 32,768

758. $36^{\frac{3}{2}}$

Answer: 216

759. $81^{-\frac{5}{2}}$

Answer: $\frac{1}{59{,}049}$

Use the Laws of Exponents to Simplify Expressions with Rational Exponents In the following exercises, simplify.

760. $3^{\frac{4}{5}} \cdot 3^{\frac{6}{5}}$

Answer: 9

761. $\left(x^{6}\right)^{\frac{4}{3}}$

Answer: x^{8}

762. $\frac{z^{\frac{5}{2}}}{z^{\frac{7}{5}}}$

Answer: $z^{\frac{11}{10}}$

763. $\left(16s^{\frac{9}{4}}\right)^{\frac{1}{4}}$

Answer: $2s^{\frac{9}{16}}$

764. $\left(m^{8}n^{12}\right)^{\frac{1}{4}}$

Answer: $m^{2}n^{3}$

765. $\frac{z^{\frac{2}{3}} \cdot z^{-\frac{1}{3}}}{z^{-\frac{5}{3}}}$

Answer: z^{2}

Chapter Practice Test

In the following, simplify.

766. $\sqrt{81+144}$

Answer: 15

767. $\sqrt{169m^{4}n^{2}}$

Answer: $13m^{2}|n|$

768. $\sqrt{36n^{13}}$

Answer: $6n^6\sqrt{n}$

769. $3\sqrt{13}+5\sqrt{2}+\sqrt{13}$

Answer: $4\sqrt{13}+5\sqrt{2}$

770. $5\sqrt{20}+2\sqrt{125}$

Answer: $20\sqrt{5}$

771. $\left(3\sqrt{6y}\right)\left(2\sqrt{50y^3}\right)$

Answer: $180y^2\sqrt{3}$

772. $\left(2-5\sqrt{x}\right)\left(3+\sqrt{x}\right)$

Answer: $6-13\sqrt{x}-5x$

773. $\left(1-2\sqrt{q}\right)^2$

Answer: $1-4\sqrt{q}+4q$

774. (a) $\sqrt[4]{a^{12}}$ (b) $\sqrt[3]{b^{21}}$

Answer: (a) a^3 (b) b^7

775. (a) $\sqrt[4]{81x^{12}}$ (b) $\sqrt[6]{64y^{18}}$

Answer: (a) $3x^3$ (b) $2y^3$

776. $\sqrt{\dfrac{64r^{12}}{25r^6}}$

Answer: $\dfrac{8r^3}{5}$

777. $\sqrt{\dfrac{14y^3}{7y}}$

Answer: $y\sqrt{2}$

778. $\dfrac{\sqrt[5]{256x^7}}{\sqrt[5]{4x^2}}$

Answer: $2x\sqrt{2}$

779. $\sqrt[4]{512}-2\sqrt[4]{32}$

Answer: 0

780. (a) $256^{\frac{1}{4}}$ (b) $243^{\frac{1}{5}}$

Answer: (a) 4 b) 3

781. $49^{\frac{3}{2}}$

Answer: 343

782. $25^{-\frac{5}{2}}$

Answer: $\frac{1}{3125}$

783. $\frac{w^{\frac{3}{4}}}{w^{\frac{7}{4}}}$

Answer: $\frac{1}{w}$

784. $\left(27s^{\frac{3}{5}}\right)^{\frac{1}{3}}$

Answer: $3s^{\frac{1}{5}}$

In the following, rationalize the denominator.

785. $\frac{3}{2\sqrt{6}}$

Answer: $\frac{\sqrt{6}}{4}$

786. $\frac{\sqrt{3}}{\sqrt{x}+\sqrt{5}}$

Answer: $\frac{\sqrt{3x}-\sqrt{15}}{x-5}$

787. $3\sqrt{2x-3}-20=7$

Answer: 42

788. $\sqrt{3u-2}=\sqrt{5u+1}$

Answer: not a real number

In the following exercise, solve.

789. A helicopter flying at an altitude of 600 feet dropped a package to a lifeboat. Use the formula $t=\frac{\sqrt{h}}{4}$ to find how many seconds it took for the package to reach the hiker. Round your answer to the nearest tenth of a second.

Answer: 6.1 seconds

Elementary Algebra
10: Quadratic Equations
10.1 Solve Quadratic Equations Using the Square Root Property

Solve Quadratic Equations of the Form $ax^2 = k$ Using the Square Root Property In the following exercises, solve the quadratic equations.

1. $a^2 = 49$

Answer: $a = \pm 7$

2. $b^2 = 144$

Answer: $b = \pm 12$

3. $r^2 - 24 = 0$

Answer: $r = \pm 2\sqrt{6}$

4. $t^2 - 75 = 0$

Answer: $t = \pm 5\sqrt{3}$

5. $u^2 - 300 = 0$

Answer: $u = \pm 10\sqrt{3}$

6. $v^2 - 80 = 0$

Answer: $v = \pm 4\sqrt{5}$

7. $4m^2 = 36$

Answer: $m = \pm 3$

8. $3n^2 = 48$

Answer: $n = \pm 4$

9. $x^2 + 20 = 0$

Answer: no real solution

10. $y^2 + 64 = 0$

Answer: no real solution

11. $\frac{2}{5}a^2 + 3 = 11$

Answer: $a = \pm 2\sqrt{5}$

12. $\frac{3}{2}b^2 - 7 = 41$

Answer: $b = \pm 4\sqrt{2}$

13. $7p^2 + 10 = 26$

Answer: $p = \pm \frac{4\sqrt{7}}{7}$

14. $2q^2 + 5 = 30$

Answer: $q = \pm \frac{5\sqrt{2}}{2}$

Solve Quadratic Equations of the Form $a(x-h)^2 = k$ Using the Square Root Property In the following exercises, solve the quadratic equations.

15. $(x+2)^2 = 9$

Answer: $x = 1, x = -5$

16. $(y-5)^2 = 36$

Answer: $y = -1, y = 11$

17. $(u-6)^2 = 64$

Answer: $u = 14, u = -2$

18. $(v+10)^2 = 121$

Answer: $v = 1, v = -21$

19. $(m-6)^2 = 20$

Answer: $m = 6 \pm 2\sqrt{5}$

20. $(n+5)^2 = 32$

Answer: $n = -5 \pm 4\sqrt{2}$

21. $\left(r - \frac{1}{2}\right)^2 = \frac{3}{4}$

Answer: $r = \frac{1}{2} \pm \frac{\sqrt{3}}{2}$

22. $\left(t-\frac{5}{6}\right)^2=\frac{11}{25}$

Answer: $t=\frac{5}{6}\pm\frac{\sqrt{11}}{5}$

23. $(a-7)^2+5=55$

Answer: $a=7\pm5\sqrt{2}$

24. $(b-1)^2-9=39$

Answer: $b=1\pm4\sqrt{3}$

25. $(5c+1)^2=-27$

Answer: no real solution

26. $(8d-6)^2=-24$

Answer: no real solution

27. $m^2-4m+4=8$

Answer: $m=2\pm2\sqrt{2}$

28. $n^2+8n+16=27$

Answer: $n=-4\pm3\sqrt{3}$

29. $25x^2-30x+9=36$

Answer: $x=-\frac{3}{5}, x=\frac{9}{5}$

30. $9y^2+12y+4=9$

Answer: $y=-\frac{5}{3}, y=\frac{1}{3}$

Mixed Practice In the following exercises, solve using the Square Root Property.

31. $2r^2=32$

Answer: $r=\pm4$

32. $4t^2=16$

Answer: $t=\pm2$

33. $(a-4)^2 = 28$

Answer: $a = 4 \pm 2\sqrt{7}$

34. $(b+7)^2 = 8$

Answer: $b = -7 \pm 2\sqrt{2}$

35. $9w^2 - 24w + 16 = 1$

Answer: $w = 1, w = \frac{5}{3}$

36. $4z^2 + 4z + 1 = 49$

Answer: $z = 3, z = -4$

37. $a^2 - 18 = 0$

Answer: $a = \pm 3\sqrt{2}$

38. $b^2 - 108 = 0$

Answer: $b = \pm 6\sqrt{3}$

39. $\left(p - \frac{1}{3}\right)^2 = \frac{7}{9}$

Answer: $p = \frac{1}{3} \pm \frac{\sqrt{7}}{3}$

40. $\left(q - \frac{3}{5}\right)^2 = \frac{3}{4}$

Answer: $q = \frac{3}{5} \pm \frac{\sqrt{3}}{2}$

41. $m^2 + 12 = 0$

Answer: no real solution

42. $n^2 + 48 = 0$

Answer: no real solution

43. $u^2 - 14u + 49 = 72$

Answer: $u = 7 \pm 6\sqrt{2}$

44. $v^2 + 18v + 81 = 50$

Answer: $v = -9 \pm 5\sqrt{2}$

45. $(m-4)^2+3=15$

Answer: $m=4\pm 2\sqrt{3}$

46. $(n-7)^2-8=64$

Answer: $n=7\pm 6\sqrt{2}$

47. $(x+5)^2=4$

Answer: $x=-3, x=-7$

48. $(y-4)^2=64$

Answer: $y=-4, y=12$

49. $6c^2+4=29$

Answer: $c=\pm\frac{5\sqrt{6}}{6}$

50. $2d^2-4=77$

Answer: $d=\pm\frac{9\sqrt{2}}{2}$

51. $(x-6)^2+7=3$

Answer: no real solution

52. $(y-4)^2+10=9$

Answer: no real solution

Everyday Math

53. Paola has enough mulch to cover 48 square feet. She wants to use it to make three square vegetable gardens of equal sizes. Solve the equation $3s^2=48$ to find s, the length of each garden side.

Answer: 4 feet

54. Kathy is drawing up the blueprints for a house she is designing. She wants to have four square windows of equal size in the living room, with a total area of 64 square feet. Solve the equation $4s^2=64$ to find s, the length of the sides of the windows.

Answer: 4 feet

Writing Exercises

55. Explain why the equation $x^2+12=8$ has no solution.

Answer: Answer will vary.

56. Explain why the equation $y^2 + 8 = 12$ has two solutions.

Answer: Answer will vary.

Elementary Algebra
10: Quadratic Equations
10.2 Solve Quadratic Equations by Completing the Square

Complete the Square of a Binomial Expression In the following exercises, complete the square to make a perfect square trinomial. Then, write the result as a binomial squared.

57. a^2+10a

Answer: $(a+5)^2$

58. b^2+12b

Answer: $(b+6)^2$

59. m^2+18m

Answer: $(m+9)^2$

60. n^2+16n

Answer: $(n+8)^2$

61. m^2-24m

Answer: $(m-12)^2$

62. n^2-16n

Answer: $(n-8)^2$

63. p^2-22p

Answer: $(p-11)^2$

64. q^2-6q

Answer: $(q-3)^2$

65. x^2-9x

Answer: $\left(x-\frac{9}{2}\right)^2$

66. y^2+11y

Answer: $\left(y+\frac{11}{2}\right)^2$

67. $p^2 - \frac{1}{3}p$

Answer: $\left(p - \frac{1}{6}\right)^2$

68. $q^2 + \frac{3}{4}q$

Answer: $\left(q + \frac{3}{8}\right)^2$

Solve Quadratic Equations of the Form $x^2 + bx + c = 0$ by Completing the Square In the following exercises, solve by completing the square.

69. $v^2 + 6v = 40$

Answer: $v = -10,\ v = 4$

70. $w^2 + 8w = 65$

Answer: $w = 5,\ w = -13$

71. $u^2 + 2u = 3$

Answer: $u = -3,\ u = 1$

72. $z^2 + 12z = -11$

Answer: $z = -1,\ z = -11$

73. $c^2 - 12c = 13$

Answer: $c = -1,\ c = 13$

74. $d^2 - 8d = 9$

Answer: $d = -1,\ d = 9$

75. $x^2 - 20x = 21$

Answer: $x = -1,\ x = 21$

76. $y^2 - 2y = 8$

Answer: $y = -2,\ y = 4$

77. $m^2 + 4m = -44$

Answer: no real solution

78. $n^2 - 2n = -3$

Answer: no real solution

79. $r^2 + 6r = -11$

Answer: no real solution

80. $t^2 - 14t = -50$

Answer: no real solution

81. $a^2 - 10a = -5$

Answer: $a = 5 \pm 2\sqrt{5}$

82. $b^2 + 6b = 41$

Answer: $b = -3 \pm 5\sqrt{2}$

83. $u^2 - 14u + 12 = -1$

Answer: $u = 1,\ u = 13$

84. $z^2 + 2z - 5 = 2$

Answer: $z = -1 \pm 2\sqrt{2}$

85. $v^2 = 9v + 2$

Answer: $v = \frac{9}{2} \pm \frac{\sqrt{89}}{2}$

86. $w^2 = 5w - 1$

Answer: $w = \frac{5}{2} \pm \frac{\sqrt{21}}{2}$

87. $(x + 6)(x - 2) = 9$

Answer: $x = -7,\ x = 3$

88. $(y + 9)(y + 7) = 79$

Answer: $y = -8 \pm 4\sqrt{5}$

Solve Quadratic Equations of the Form $ax^2+bx+c=0$ by Completing the Square In the following exercises, solve by completing the square.

89. $3m^2+30m-27=6$

Answer: $m=-11,\ m=1$

90. $2n^2+4n-26=0$

Answer: $n=1\pm 2\sqrt{3}$

91. $2c^2+c=6$

Answer: $c=-2,\ c=\frac{3}{2}$

92. $3d^2-4d=15$

Answer: $d=-\frac{5}{3},\ d=3$

93. $2p^2+7p=14$

Answer: $p=-\frac{7}{4}\pm\frac{\sqrt{161}}{4}$

94. $3q^2-5q=9$

Answer: $q=\frac{5}{6}\pm\frac{\sqrt{133}}{6}$

Everyday Math

95. Rafi is designing a rectangular playground to have an area of 320 square feet. He wants one side of the playground to be four feet longer than the other side. Solve the equation $p^2+4p=320$ for p, the length of one side of the playground. What is the length of the other side?

Answer: 16 feet, 20 feet

96. Yvette wants to put a square swimming pool in the corner of her backyard. She will have a 3 foot deck on the south side of the pool and a 9 foot deck on the west side of the pool. She has a total area of 1080 square feet for the pool and two decks. Solve the equation $(s+3)(s+9)=1080$ for s, the length of a side of the pool.

Answer: 27 feet

Writing Exercises

97. Solve the equation $x^2 + 10x = -25$ (a) by using the Square Root Property and (b) by completing the square. (c) Which method do you prefer? Why?

Answer: (a) -5 (b) -5 (c)Answers will vary.

98. Solve the equation $y^2 + 8y = 48$ by completing the square and explain all your steps.

Answer: $-12, 4$

Elementary Algebra
10: Quadratic Equations
10.3 Solve Quadratic Equations Using the Quadratic Formula

Solve Quadratic Equations Using the Quadratic Formula In the following exercises, solve by using the Quadratic Formula.

99. $4m^2+m-3=0$

Answer: $m=-1,\ m=\frac{3}{4}$

100. $4n^2-9n+5=0$

Answer: $n=1,\ n=\frac{5}{4}$

101. $2p^2-7p+3=0$

Answer: $p=\frac{1}{2},\ p=3$

102. $3q^2+8q-3=0$

Answer: $q=-3,\ q=\frac{1}{3}$

103. $p^2+7p+12=0$

Answer: $p=-4,\ p=-3$

104. $q^2+3q-18=0$

Answer: $q=-6,\ q=3$

105. $r^2-8r-33=0$

Answer: $r=-3,\ r=11$

106. $t^2+13t+40=0$

Answer: $t=-8,\ t=-5$

107. $3u^2+7u-2=0$

Answer: $u=\frac{-7\pm\sqrt{73}}{6}$

108. $6z^2-9z+1=0$

Answer: no real solution

109. $2a^2 - 6a + 3 = 0$

Answer: $a = \frac{3 \pm \sqrt{3}}{2}$

110. $5b^2 + 2b - 4 = 0$

Answer: $b = \frac{-1 \pm \sqrt{21}}{5}$

111. $2x^2 + 3x + 9 = 0$

Answer: no real solution

112. $6y^2 - 5y + 2 = 0$

Answer: no real solution

113. $v(v + 5) - 10 = 0$

Answer: $v = \frac{-5 \pm \sqrt{65}}{2}$

114. $3w(w - 2) - 8 = 0$

Answer: $w = \frac{3 \pm \sqrt{33}}{3}$

115. $\frac{1}{3}m^2 + \frac{1}{12}m = \frac{1}{4}$

Answer: $m = -1, m = \frac{3}{4}$

116. $\frac{1}{3}n^2 + n = -\frac{1}{2}$

Answer: $n = \frac{-3 \pm \sqrt{3}}{2}$

117. $16c^2 + 24c + 9 = 0$

Answer: $c = -\frac{3}{4}$

118. $25d^2 - 60d + 36 = 0$

Answer: $d = \frac{6}{5}$

119. $5m^2+2m-7=0$

Answer: $m=-\frac{7}{5}, m=1$

120. $8n^2-3n+3=0$

Answer: no real solution

121. $p^2-6p-27=0$

Answer: $p=-3,\ p=9$

122. $25q^2+30q+9=0$

Answer: $q=-\frac{3}{5}$

123. $4r^2+3r-5=0$

Answer: $r=\frac{-3\pm\sqrt{89}}{8}$

124. $3t(t-2)=2$

Answer: $t=\frac{3\pm\sqrt{15}}{3}$

125. $2a^2+12a+5=0$

Answer: $a=\frac{-6\pm\sqrt{26}}{2}$

126. $4d^2-7d+2=0$

Answer: $d=\frac{7\pm\sqrt{17}}{8}$

127. $\frac{3}{4}b^2+\frac{1}{2}b=\frac{3}{8}$

Answer: $b=\frac{-2\pm\sqrt{11}}{6}$

128. $\frac{1}{9}c^2+\frac{2}{3}c=3$

Answer: $c=-9,\ c=3$

129. $2x^2+12x-3=0$

Answer: $x=\frac{-6\pm\sqrt{42}}{4}$

130. $16y^2+8y+1=0$

Answer: $y=-\frac{1}{4}$

Use the Discriminant to Predict the Number of Solutions of a Quadratic Equation In the following exercises, determine the number of solutions to each quadratic equation.

131. (a) $4x^2-5x+16=0$ (b) $36y^2+36y+9=0$ (c) $6m^2+3m-5=0$ (d) $18n^2-7n+3=0$

Answer: (a) no real solutions (b) 1 (c) 2 (d) no real solutions

132. (a) $9v^2-15v+25=0$ (b) $100w^2+60w+9=0$ (c) $5c^2+7c-10=0$ (d) $15d^2-4d+8=0$

Answer: (a) no real solutions (b) 1 (c) 2 (d) no real solutions

133. (a) $r^2+12r+36=0$ (b) $8t^2-11t+5=0$ (c) $4u^2-12u+9=0$ (d) $3v^2-5v-1=0$

Answer: (a) 1 (b) no real solutions (c) 1 (d) 2

134. (a) $25p^2+10p+1=0$ (b) $7q^2-3q-6=0$ (c) $7y^2+2y+8=0$ (d) $25z^2-60z+36=0$

Answer: (a) 1 (b) 2 (c) no real solutions (d) 1

Identify the Most Appropriate Method to Use to Solve a Quadratic Equation In the following exercises, identify the most appropriate method (Factoring, Square Root, or Quadratic Formula) to use to solve each quadratic equation. Do not solve.

135. (a) $x^2-5x-24=0$ (b) $(y+5)^2=12$ (c) $14m^2+3m=11$

Answer: (a) factor (b) square root(c) Quadratic Formula

136. (a) $(8v+3)^2=81$ (b) $w^2-9w-22=0$ (c) $4n^2-10=6$

Answer: (a) square root (b) factor(c) factor

137. (a) $6a^2+14=20$ (b) $\left(x-\frac{1}{4}\right)^2=\frac{5}{16}$ (c) $y^2-2y=8$

Answer: (a) factor (b) square root(c) factor

138. (a) $8b^2+15b=4$ (b) $\frac{5}{9}v^2-\frac{2}{3}v=1$ (c) $\left(w+\frac{4}{3}\right)^2=\frac{2}{9}$

Answer: (a) Quadratic Formula (b) Quadratic Formula (c) square root

Everyday Math

139. A flare is fired straight up from a ship at sea. Solve the equation $16\left(t^2-13t+40\right)=0$ for t, the number of seconds it will take for the flare to be at an altitude of 640 feet.

Answer: 5 seconds, 8 seconds

140. An architect is designing a hotel lobby. She wants to have a triangular window looking out to an atrium, with the width of the window 6 feet more than the height. Due to energy restrictions, the area of the window must be 140 square feet. Solve the equation $\frac{1}{2}h^2+3h=140$ for h, the height of the window.

Answer: 14 feet

Writing Exercises

141. Solve the equation $x^2+10x=200$ (a) by completing the square (b) using the Quadratic Formula. (c) Which method do you prefer? Why?

Answer: (a) $-20,10$ (b) $-20,10$ (c) answers will vary

142. Solve the equation $12y^2+23y=24$ (a) by completing the square (b) using the Quadratic Formula. (c) Which method do you prefer? Why?

Answer: (a) $-\frac{8}{3},\frac{3}{4}$ (b) $-\frac{8}{3},\frac{3}{4}$ (c) answers will vary

Elementary Algebra
10: Quadratic Equations
10.4 Solve Applications Modeled by Quadratic Equations

Solve Applications of the Quadratic Formula In the following exercises, solve by using methods of factoring, the square root principle, or the Quadratic Formula. Round your answers to the nearest tenth.

143. The product of two consecutive odd numbers is Find the numbers.
Answer: Two consecutive odd numbers whose product is 255 are 15 and 17, and -15 and -17.

144. The product of two consecutive even numbers is Find the numbers.
Answer: Two consecutive even numbers whose product is 360 are 18 and 20, and -18 and -20.

145. The product of two consecutive even numbers is Find the numbers.
Answer: Two consecutive even numbers whose product is 624 are 24 and 26, and -26 and -24.

146. The product of two consecutive odd numbers is 1Find the numbers.
Answer: Two consecutive odd numbers whose product is 1023 are 31 and 33, and -31 and -33.

147. The product of two consecutive odd numbers is Find the numbers.
Answer: Two consecutive odd numbers whose product is 483 are 21 and 23, and -21 and -23.

148. The product of two consecutive even numbers is Find the numbers.
Answer: Two consecutive even numbers whose product is 528 are 22 and 24, and -22 and -24.

149. A triangle with area 45 square inches has a height that is two less than four times the width. Find the height and width of the triangle.
Answer: The width of the triangle is 5 inches and the height is 18 inches.

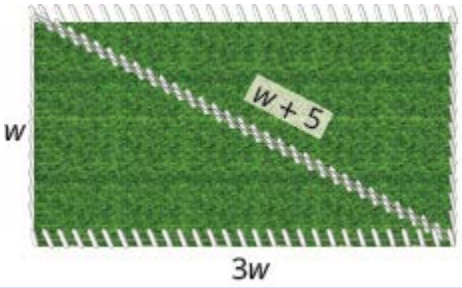
150. The width of a triangle is six more than twice the height. The area of the triangle is 88 square yards. Find the height and width of the triangle.
Answer: The width of the triangle is 22 yards and the height is 8 yards.

151. The hypotenuse of a right triangle is twice the length of one of its legs. The length of the other leg is three feet. Find the lengths of the three sides of the triangle. Round to the nearest tenth.
Answer: The leg of the right triangle is 1.7 feet and the hypotenuse is 3.4 feet.

152. The hypotenuse of a right triangle is 10 cm long. One of the triangle's legs is three times the length of the other leg. Round to the nearest tenth. Find the lengths of the three sides of the triangle.

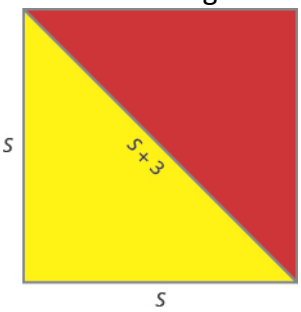
Answer: The lengths of the legs of the right triangle are 3.2 and 9.6 cm.

153. A farmer plans to fence off sections of a rectangular corral. The diagonal distance from one corner of the corral to the opposite corner is five yards longer than the width of the corral. The length of the corral is three times the width. Find the length of the diagonal of the corral. Round to the nearest tenth.



Answer: The length of the fence is 7.1 units.

154. Nautical flags are used to represent letters of the alphabet. The flag for the letter O consists of a yellow right triangle and a red right triangle which are sewn together along their hypotenuse to form a square. The adjoining side of the two triangles is three inches longer than a side of the flag. Find the length of the side of the flag. Round to the nearest tenth.



Answer: The length of the side of the flag is 7.2 inches.

155. The length of a rectangular driveway is five feet more than three times the width. The area is 350 square feet. Find the length and width of the driveway.

Answer: The width of the driveway is 10 feet and its length is 35 feet.

156. A rectangular lawn has area 140 square yards. Its width that is six less than twice the length. What are the length and width of the lawn?

Answer: The width of the yard is 14 yards and the length is 10 yards.

157. A firework rocket is shot upward at a rate of 640 ft/sec. Use the projectile formula $h = -16t^2 + v_0 t$ to determine when the height of the firework rocket will be 1200 feet.

Answer: The rocket will reach 1,200 feet on its way up in 2 seconds and on the way down in 38 seconds.

158. An arrow is shot vertically upward at a rate of 220 feet per second. Use the projectile formula $h = -16t^2 + v_0 t$ to determine when height of the arrow will be 400 feet. Round to the nearest tenth.

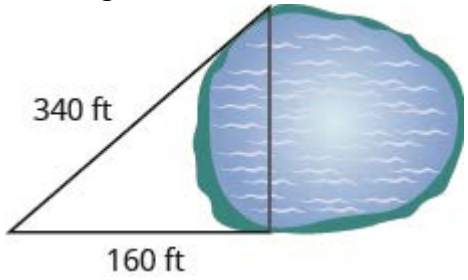
Answer: The arrow will reach 400 feet on its way in 2.8 seconds and on the way down in 11 seconds.

Everyday Math

159. A bullet is fired straight up from a BB gun with initial velocity 1120 feet per second at an initial height of 8 feet. Use the formula $h = -16t^2 + v_0 t + 8$ to determine how many seconds it will take for the bullet to hit the ground. (That is, when will $h = 0$?)

Answer: 70 seconds

160. A city planner wants to build a bridge across a lake in a park. To find the length of the bridge, he makes a right triangle with one leg and the hypotenuse on land and the bridge as the other leg. The length of the hypotenuse is 340 feet and the leg is 160 feet. Find the length of the bridge.



Answer: 300 feet

Writing Exercises

161. Make up a problem involving the product of two consecutive odd integers. Start by choosing two consecutive odd integers. (a) What are your integers? (b) What is the product of your integers? (c) Solve the equation $n(n+2) = p$, where p is the product you found in part (b). (d) Did you get the numbers you started with?

Answer: (a) answers will vary (b) answers will vary (c) answers will vary (d) answers will vary

162. Make up a problem involving the product of two consecutive even integers. Start by choosing two consecutive even integers. (a) What are your integers? (b) What is the product of your integers? (c) Solve the equation $n(n+2) = p$, where p is the product you found in part (b). (d) Did you get the numbers you started with?

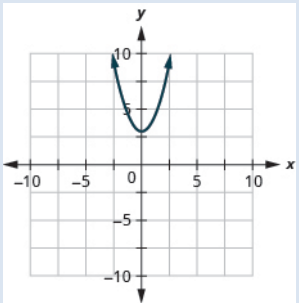
Answer: (a) answers will vary (b) answers will vary (c) answers will vary (d) answers will vary

Elementary Algebra
10: Quadratic Equations
10.5 Graphing Quadratic Equations

Recognize the Graph of a Quadratic Equation in Two Variables In the following exercises, graph:

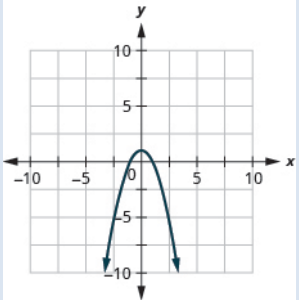
163. $y = x^2 + 3$

Answer:



164. $y = -x^2 + 1$

Answer:



In the following exercises, determine if the parabola opens up or down.

165. $y = -2x^2 - 6x - 7$

Answer: down

166. $y = 6x^2 + 2x + 3$

Answer: up

167. $y = 4x^2 + x - 4$

Answer: up

168. $y = -9x^2 - 24x - 16$

Answer: down

Find the Axis of Symmetry and Vertex of a Parabola In the following exercises, find (a) the axis of symmetry and (b) the vertex.

169. $y = x^2 + 8x - 1$

Answer: (a) $x = -4$ (b) $(-4, -17)$

170. $y = x^2 + 10x + 25$

Answer: (a) $x = -5$ (b) $(-5, 0)$

171. $y = -x^2 + 2x + 5$

Answer: (a) $x = 1$ (b) $(1, 6)$

172. $y = -2x^2 - 8x - 3$

Answer: (a) $x = -2$ (b) $(-2, 5)$

Find the Intercepts of a Parabola In the following exercises, find the *x*- and *y*-intercepts.

173. $y = x^2 + 7x + 6$

Answer: $y: (0, 6);\ x: (-1, 0), (-6, 0)$

174. $y = x^2 + 10x - 11$

Answer: y: $(0, 11)$; x: $(1, 0)$,$(-11, 0)$

175. $y = -x^2 + 8x - 19$

Answer: $y: (0, 19);\quad x: \text{none}$

176. $y = x^2 + 6x + 13$

Answer: $y: (0, 13);\ x: \text{none}$

177. $y = 4x^2 - 20x + 25$

Answer: $y: (0, 25);\ x: (\frac{5}{2}, 0)$

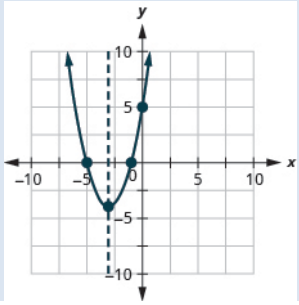
178. $y = -x^2 - 14x - 49$

Answer: $y: (0, 49);\ x: (-7, 0)$

Graph Quadratic Equations in Two Variables In the following exercises, graph by using intercepts, the vertex, and the axis of symmetry.

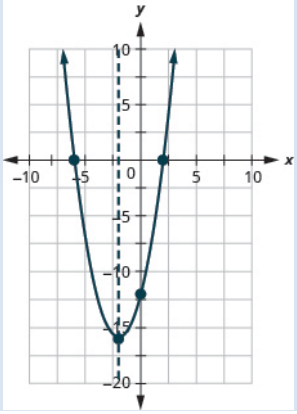
179. $y = x^2 + 6x + 5$

Answer: $y: (0,5)$; $x: (-1,0), (-5,0)$; axis: $x = -3$; vertex: $(-3,-4)$



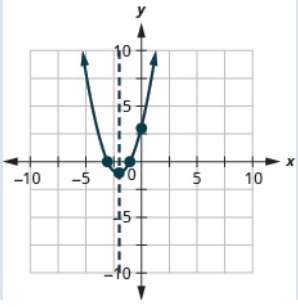
180. $y = x^2 + 4x - 12$

Answer: $y: (0,-12)$; $x: (-6,0), (2,0)$; axis: $x = -2$; vertex: $(-2,-16)$



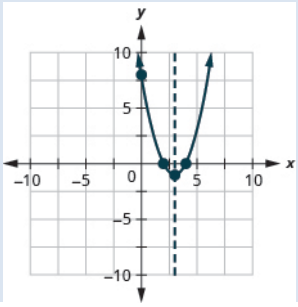
181. $y = x^2 + 4x + 3$

Answer: $y: (0,3)$; $x: (-1,0), (-3,0)$; axis: $x = -2$; vertex: $(-2,-1)$



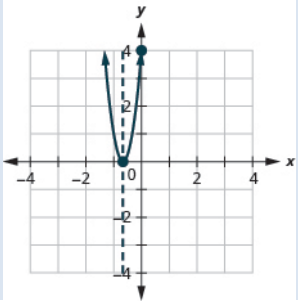
182. $y = x^2 - 6x + 8$

Answer: $y:(0,8)\ x:(2,0),(4,0)$; axis: $x = 3$; vertex: $(3,-1)$



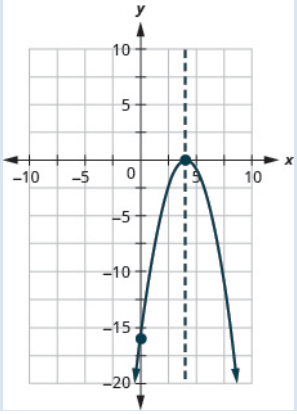
183. $y = 9x^2 + 12x + 4$

Answer: $y:(0,4)\ x:(-\frac{2}{3},0)$; axis: $x = -\frac{2}{3}$; vertex: $(-\frac{2}{3},0)$



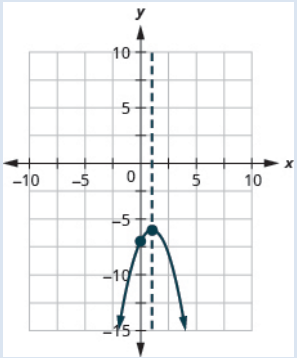
184. $y = -x^2 + 8x - 16$

Answer: $y:(0,-16)\ x:(4,0)$; axis: $x = 4$; vertex: $(4,0)$



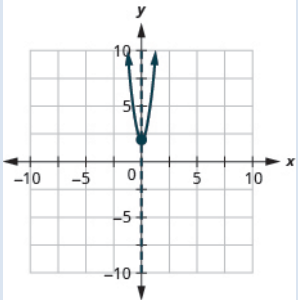
185. $y = -x^2 + 2x - 7$

Answer: $y: (0, -7)$; $x:$ none; axis : $x = 1$; vertex : $(1, -6)$



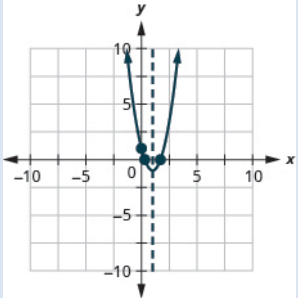
186. $y = 5x^2 + 2$

Answer: $y: (0, 2)$; $x:$ none; axis : $x = 0$; vertex : $(0, 2)$



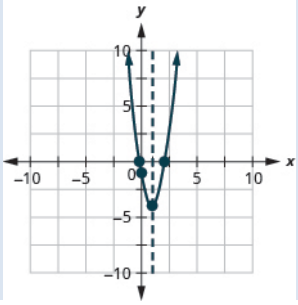
187. $y = 2x^2 - 4x + 1$

Answer: $y: (0, 1)$; $x: (1.7, 0), (0.3, 0)$; axis : $x = 1$; vertex : $(1, -1)$



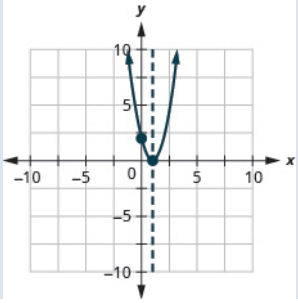
188. $y = 3x^2 - 6x - 1$

Answer: $y: (0, -1)$ $x: (2.2, 0), (-0.2, 0)$; axis: $x = 1$; vertex: $(1, -4)$



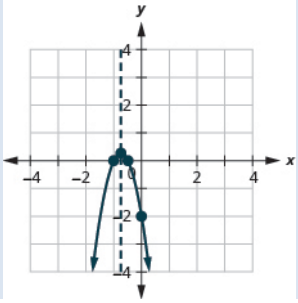
189. $y = 2x^2 - 4x + 2$

Answer: $y: (0, 2)$ $x: (1, 0)$; axis: $x = 1$; vertex: $(1, 0)$



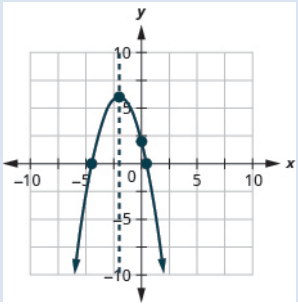
190. $y = -4x^2 - 6x - 2$

Answer: $y: (0, -2)$; $x: \left(-\frac{1}{2}, 0\right), (-1, 0)$; axis : $x = -\frac{3}{4}$; vertex : $\left(-\frac{3}{4}, \frac{1}{4}\right)$



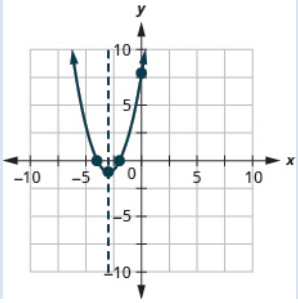
191. $y = -x^2 - 4x + 2$

Answer: $y: (0, 2)$ $x: (-4.4, 0), (0.4, 0)$; axis: $x = -2$; vertex: $(-2, 6)$



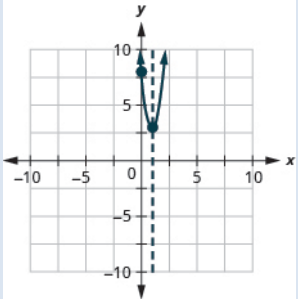
192. $y = x^2 + 6x + 8$

Answer: $y: (0, 8)$; $x: (-2, 0), (-4, 0)$; axis : x = −3; vertex : $(-3, -1)$



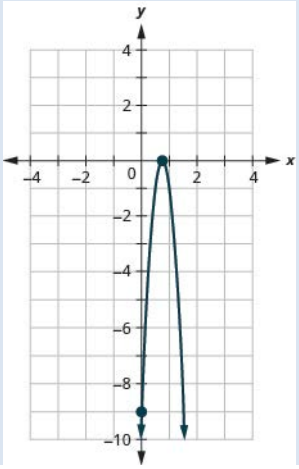
193. $y = 5x^2 - 10x + 8$

Answer: $y: (0, 8)$; $x:$ none; axis : $x = 1$; vertex : $(1, 3)$



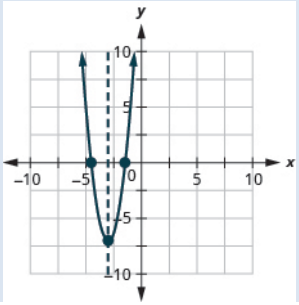
194. $y = -16x^2 + 24x - 9$

Answer: $y: (0, -9);\ x: \left(\frac{3}{4}, 0\right);\ \text{axis}: x = \frac{3}{4};\ \text{vertex}: \left(\frac{3}{4}, 0\right)$



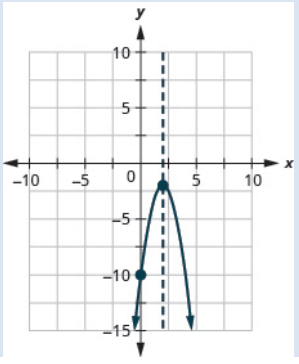
195. $y = 3x^2 + 18x + 20$

Answer: $y: (0, 20)\ x: (-4.5, 0),\ (-1.5, 0);\ \text{axis: } x = -3;\ \text{vertex: } (-3, -7)$



196. $y = -2x^2 + 8x - 10$

Answer: $y: (0, -10);\ x: \text{none};\ \text{axis}: x = 2;\ \text{vertex}: (2, -2)$



Solve Maximum and Minimum Applications In the following exercises, find the maximum or minimum value.

197. $y = 2x^2 + x - 1$

Answer: The minimum value is $-\frac{9}{8}$ when $x = -\frac{1}{4}$.

198. $y = -4x^2 + 12x - 5$

Answer: The maximum value is 4 when $x = \frac{4}{3}$.

199. $y = x^2 - 6x + 15$

Answer: The minimum value is 6 when $x = 3$.

200. $y = -x^2 + 4x - 5$

Answer: The maximum value is -1 when $x = 2$.

201. $y = -9x^2 + 16$

Answer: The maximum value is 16 when $x = 0$.

202. $y = 4x^2 - 49$

Answer: The minimum value is 49 when $x = 0$.

In the following exercises, solve. Round answers to the nearest tenth.

203. An arrow is shot vertically upward from a platform 45 feet high at a rate of 168 ft/sec. Use the quadratic equation $h = -16t^2 + 168t + 45$ to find how long it will take the arrow to reach its maximum height, and then find the maximum height.

Answer: In 5. 3 sec the arrow will reach maximum height of 486 ft.

204. A stone is thrown vertically upward from a platform that is 20 feet high at a rate of 160 ft/sec. Use the quadratic equation $h = -16t^2 + 160t + 20$ to find how long it will take the stone to reach its maximum height, and then find the maximum height.

Answer: In 5 sec the stone will reach maximum height of 420 ft.

205. A computer store owner estimates that by charging x dollars each for a certain computer, he can sell $40 - x$ computers each week. The quadratic equation $R = -x^2 + 40x$ is used to find the revenue, R, received when the selling price of a computer is x. Find the selling price that will give him the maximum revenue, and then find the amount of the maximum revenue.

Answer: 20 computers will give the maximum of $400 in receipts.

206. A retailer who sells backpacks estimates that, by selling them for x dollars each, he will be able to sell $100-x$ backpacks a month. The quadratic equation $R=-x^2+100x$ is used to find the R received when the selling price of a backpack is x. Find the selling price that will give him the maximum revenue, and then find the amount of the maximum revenue.

Answer: 50 backpacks will give the maximum revenue of $2,

207. A rancher is going to fence three sides of a corral next to a river. He needs to maximize the corral area using 240 feet of fencing. The quadratic equation $A=x(240-2x)$ gives the area of the corral, A, for the length, x, of the corral along the river. Find the length of the corral along the river that will give the maximum area, and then find the maximum area of the corral.

Answer: The length of the side along the river of the corral is 120 feet and the maximum area is 7,200 sq ft.

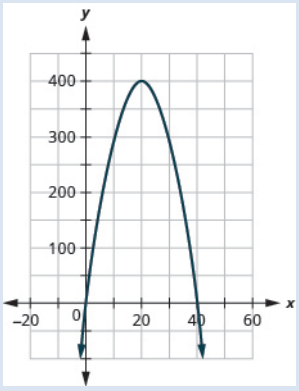
208. A veterinarian is enclosing a rectangular outdoor running area against his building for the dogs he cares for. He needs to maximize the area using 100 feet of fencing. The quadratic equation $A=x(100-2x)$ gives the area, A, of the dog run for the length, x, of the building that will border the dog run. Find the length of the building that should border the dog run to give the maximum area, and then find the maximum area of the dog run.

Answer: The length of the dog run along the building is 50 feet and the maximum area is 1250 sq ft.

Everyday Math

209. In Exercise 65, you worked with the quadratic equation $R=-x^2+40x$ that modeled the revenue received from selling computers at a price of x dollars. You found the selling price that would give the maximum revenue and calculated the maximum revenue. Now you will look at more characteristics of this model. (a) Graph the equation $R=-x^2+40x$. (b) Find the values of the *x*-intercepts.

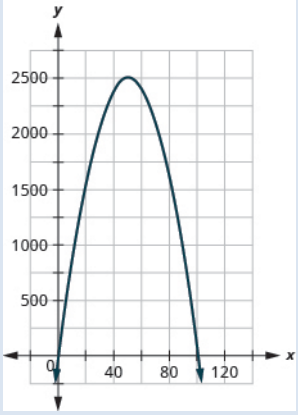
Answer: (a)



(b) $(0, 0), (40, 0)$

210. In the previous set of exercises, you worked with the quadratic equation $R = -x^2 + 100x$ that modeled the revenue received from selling backpacks at a price of x dollars. You found the selling price that would give the maximum revenue and calculated the maximum revenue. Now you will look at more characteristics of this model. (a) Graph the equation $R = -x^2 + 100x$. (b) Find the values of the *x*-intercepts.

Answer: (a)



(b) $(0, 0), (100, 0)$

Writing Exercises

211. For the revenue model in exercises 65 and 69, explain what the *x*-intercepts mean to the computer store owner.

Answer: Answers will vary.

212. For the revenue model in exercises 66 and 70, explain what the *x*-intercepts mean to the backpack retailer.

Answer: Answers will vary.

Chapter 10 Review Exercises

10.1 Solve Quadratic Equations Using the Square Root Property

In the following exercises, solve using the Square Root Property

213. $x^2 = 100$

Answer: $x = \pm 10$

214. $y^2 = 144$ $y^2 = 144$

Answer: $y = \pm 12$

215. $m^2 - 40 = 0$

Answer: $m = \pm 2\sqrt{10}$

216. $n^2 - 80 = 0$

Answer: $n = \pm 4\sqrt{5}$

217. $4a^2 = 100$

Answer: $a = \pm 5$

218. $2b^2 = 72$

Answer: $b = \pm 6$

219. $r^2 + 32 = 0$

Answer: no solution

220. $t^2 + 18 = 0$

Answer: no solution

221. $\frac{4}{3}v^2 + 4 = 28$

Answer: $v = \pm 3\sqrt{2}$

222. $\frac{2}{3}w^2 - 20 = 30$

Answer: $w = \pm 5\sqrt{3}$

223. $5c^2 + 3 = 19$

Answer: $c = \pm \frac{4\sqrt{5}}{5}$

224. $3d^2 - 6 = 43$

Answer: $d = \pm\frac{7\sqrt{3}}{3}$

In the following exercises, solve using the Square Root Property

225. $(p-5)^2 + 3 = 19$

Answer: $p = 1, 9$

226. $(q+4)^2 = 9$

Answer: $q = -7, -1$

227. $(u+1)^2 = 45$

Answer: $u = -1 \pm 3\sqrt{5}$

228. $(z-5)^2 = 50$

Answer: $z = 5 \pm 5\sqrt{2}$

229. $\left(x - \frac{1}{4}\right)^2 = \frac{3}{16}$

Answer: $x = \frac{1}{4} \pm \frac{\sqrt{3}}{4}$

230. $\left(y - \frac{2}{3}\right)^2 = \frac{2}{9}$

Answer: $y = \frac{2}{3} \pm \frac{\sqrt{2}}{3}$

231. $(m-7)^2 + 6 = 30$

Answer: $m = 7 \pm 2\sqrt{6}$

232. $(n-4)^2 - 50 = 150$

Answer: $n = 4 \pm 10\sqrt{2}$

233. $(5c+3)^2 = -20$

Answer: no solution

234. $(4c-1)^2=-18$

Answer: no solution

235. $m^2-6m+9=48$

Answer: $m=3\pm 4\sqrt{3}$

236. $n^2+10n+25=12$

Answer: $n=-5\pm 2\sqrt{3}$

237. $64a^2+48a+9=81$

Answer: $a=-\frac{3}{2},\frac{3}{4}$

238. $4b^2-28b+49=25$

Answer: $b=1,6$

10.2 Solve Quadratic Equations Using Completing the Square

In the following exercises, complete the square to make a perfect square trinomial. Then write the result as a binomial squared.

239. x^2+22x

Answer: $(x+11)^2$

240. y^2+6y

Answer: $(y+3)^2$

241. m^2-8m

Answer: $(m-4)^2$

242. n^2-10n

Answer: $(n-5)^2$

243. a^2-3a

Answer: $\left(a-\frac{3}{2}\right)^2$

244. b^2+13b

Answer: $\left(b+\frac{13}{2}\right)^2$

245. $p^2+\frac{4}{5}p$

Answer: $\left(p+\frac{2}{5}\right)^2$

246. $q^2-\frac{1}{3}q$

Answer: $\left(q-\frac{1}{6}\right)^2$

In the following exercises, solve by completing the square.

247. $c^2+20c=21$

Answer: $c=1,-21$

248. $d^2+14d=-13$

Answer: $d=-13,-1$

249. $x^2-4x=32$

Answer: $x=-4,8$

250. $y^2-16y=36$

Answer: $y=-2,18$

251. $r^2+6r=-100$

Answer: no solution

252. $t^2-12t=-40$

Answer: no solution

253. $v^2-14v=-31$

Answer: $v=7\pm3\sqrt{2}$

254. $w^2-20w=100$

Answer: $w=10\pm10\sqrt{2}$

255. $m^2+10m-4=-13$

Answer: $m=-9,-1$

256. $n^2-6n+11=34$

Answer: $n=3\pm 4\sqrt{2}$

257. $a^2=3a+8$

Answer: $a=\frac{3}{2}\pm\frac{\sqrt{41}}{2}$

258. $b^2=11b-5$

Answer: $b=\frac{11}{2}\pm\frac{\sqrt{101}}{2}$

259. $(u+8)(u+4)=14$

Answer: $u=-6\pm 2\sqrt{2}$

260. $(z-10)(z+2)=28$

Answer: $z=-4,12$

261. $3p^2-18p+15=15$

Answer: $p=0,6$

262. $5q^2+70q+20=0$

Answer: $q=-7\pm 3\sqrt{5}$

263. $4y^2-6y=4$

Answer: $y=-\frac{1}{2},2$

264. $2x^2+2x=4$

Answer: $x=-2,1$

265. $3c^2+2c=9$

Answer: $c=-\frac{1}{3}\pm\frac{2\sqrt{7}}{3}$

266. $4d^2 - 2d = 8$

Answer: $d = \frac{1}{4} \pm \frac{\sqrt{33}}{4}$

10.3 Solve Quadratic Equations Using the Quadratic Formula

In the following exercises, solve by using the Quadratic Formula

267. $4x^2 - 5x + 1 = 0$

Answer: $x = \frac{1}{4}, 1$

268. $7y^2 + 4y - 3 = 0$

Answer: $y = -1, \frac{3}{7}$

269. $r^2 - r - 42 = 0$

Answer: $r = -6, 7$

270. $t^2 + 13t + 22 = 0$

Answer: $t = -11, -2$

271. $4v^2 + v - 5 = 0$

Answer: $v = -\frac{5}{4}, 1$

272. $2w^2 + 9w + 2 = 0$

Answer: $w = \frac{-9 \pm \sqrt{65}}{4}$

273. $3m^2 + 8m + 2 = 0$

Answer: $m = \frac{-4 \pm \sqrt{10}}{3}$

274. $5n^2 + 2n - 1 = 0$

Answer: $n = \frac{-1 \pm \sqrt{6}}{5}$

275. $6a^2 - 5a + 2 = 0$

Answer: no real solution

276. $4b^2 - b + 8 = 0$

Answer: no real solution

277. $u(u-10)+3=0$

Answer: $u = 5 \pm \sqrt{22}$

278. $5z(z-2)=3$

Answer: $z = \frac{5 \pm 2\sqrt{10}}{5}$

279. $\frac{1}{8}p^2 - \frac{1}{5}p = -\frac{1}{20}$

Answer: $p = \frac{4 \pm \sqrt{6}}{5}$

280. $\frac{2}{5}q^2 + \frac{3}{10}q = \frac{1}{10}$

Answer: $q = \frac{1}{4}, -1$

281. $4c^2 + 4c + 1 = 0$

Answer: $c = -\frac{1}{2}$

282. $9d^2 - 12d = -4$

Answer: $d = \frac{2}{3}$

In the following exercises, determine the number of solutions to each quadratic equation.

283. (a) $9x^2 - 6x + 1 = 0$ (b) $3y^2 - 8y + 1 = 0$ (c) $7m^2 + 12m + 4 = 0$ (d) $5n^2 - n + 1 = 0$

Answer: (a) 1 (b) 2 (c) 2 (d) none

284. (a) $5x^2 - 7x - 8 = 0$ (b) $7x^2 - 10x + 5 = 0$ (c) $25x^2 - 90x + 81 = 0$ (d) $15x^2 - 8x + 4 = 0$

Answer: (a) 2 (b) none (c) 1 (d) none

In the following exercises, identify the most appropriate method (Factoring, Square Root, or Quadratic Formula) to use to solve each quadratic equation.

285. (a) $16r^2 - 8r + 1 = 0$ (b) $5t^2 - 8t + 3 = 9$ (c) $3(c+2)^2 = 15$

Answer: (a) factor (b) Quadratic Formula (c) square root

286. (a) $4d^2+10d-5=21$ (b) $25x^2-60x+36=0$ (c) $6(5v-7)^2=150$

Answer: (a) Quadratic Formula (b) factor (c) square root

10.4 Solve Applications Modeled by Quadratic Equations

In the following exercises, solve by using methods of factoring, the square root principle, or the Quadratic Formula.

287. Find two consecutive odd numbers whose product is

Answer: Two consecutive odd numbers whose product is 323 are 17 and 19, and -17 and -19.

288. Find two consecutive even numbers whose product is

Answer: Two consecutive even numbers whose product is 624 are 24 and 26, and -24 and -26.

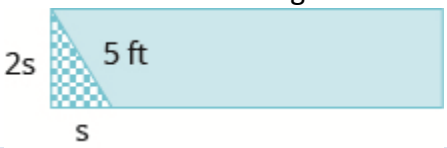
289. A triangular banner has an area of 351 square centimeters. The length of the base is two centimeters longer than four times the height. Find the height and length of the base.

Answer: The height of the banner is 13 cm and the length of the side is 54 cm.

290. Julius built a triangular display case for his coin collection. The height of the display case is six inches less than twice the width of the base. The area of the of the back of the case is 70 square inches. Find the height and width of the case.

Answer: The height is 14 inches and the width is 10 inches.

291. A tile mosaic in the shape of a right triangle is used as the corner of a rectangular pathway. The hypotenuse of the mosaic is 5 feet. One side of the mosaic is twice as long as the other side. What are the lengths of the sides? Round to the nearest tenth.



Answer: The lengths of the sides of the mosaic are 2. 2 and 4. 4 feet.

292. A rectangular piece of plywood has a diagonal which measures two feet more than the width. The length of the plywood is twice the width. What is the length of the plywood's diagonal? Round to the nearest tenth.

Answer: The length of the diagonal is 3. 6 feet.

293. The front walk from the street to Pam's house has an area of 250 square feet. Its length is two less than four times its width. Find the length and width of the sidewalk. Round to the nearest tenth.

Answer: The width of the front walk is 8. 1 feet and its length is 30. 8 feet.

294. For Sophia's graduation party, several tables of the same width will be arranged end to end to give a serving table with a total area of 75 square feet. The total length of the tables will be two more than three times the width. Find the length and width of the serving table so Sophia can purchase the correct size tablecloth. Round answer to the nearest tenth.

Answer: The width of the serving table is 4. 7 feet and the length is 16. 1 feet.

295. A ball is thrown vertically in the air with a velocity of 160 ft/sec. Use the formula $h = -16t^2 + v_0 t$ to determine when the ball will be 384 feet from the ground. Round to the nearest tenth.

Answer: The ball will reach 384 feet on its way up in 4 seconds and on the way down in 6 seconds.

296. A bullet is fired straight up from the ground at a velocity of 320 ft/sec. Use the formula $h = -16t^2 + v_0 t$ to determine when the bullet will reach 800 feet. Round to the nearest tenth.

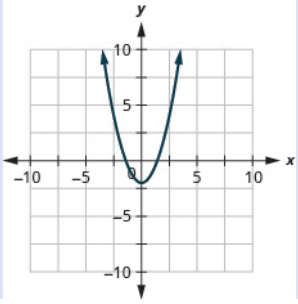
Answer: The bullet will reach 800 feet on its way up in 3 seconds and on the way down in 17 seconds.

10.5 Graphing Quadratic Equations in Two Variables

In the following exercises, graph by plotting point.

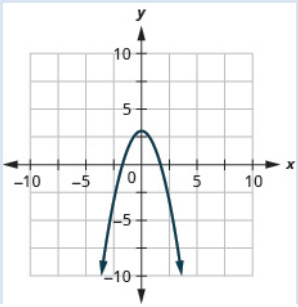
297. Graph $y = x^2 - 2$

Answer:



298. Graph $y = -x^2 + 3$

Answer:



In the following exercises, determine if the following parabolas open up or down

299. $y = -3x^2 + 3x - 1$

Answer: down

300. $y = 5x^2 + 6x + 3$

Answer: up

301. $y = x^2 + 8x - 1$

Answer: up

302. $y = -4x^2 - 7x + 1$

Answer: down

In the following exercises, find a) the axis of symmetry and b) the vertex.

303. $y = -x^2 + 6x + 8$

Answer: (a) $x = 3$ (b) $(3,17)$

304. $y = 2x^2 - 8x + 1$

Answer: (a) $x = 2$ (b) $(2,-7)$

In the following exercises, find the *x*- and *y*-intercepts.

305. $y = x^2 - 4x + 5$

Answer: $y:(0,5);\ x:(5,0),(-1,0)$

306. $y = x^2 - 8x + 15$

Answer: $y:(0,15);\ x:(3,0),(5,0)$

307. $y = x^2 - 4x + 10$

Answer: $y : (0,10)$; x : none

308. $y = -5x^2 - 30x - 46$

Answer: $y : (0,-46)$; x : none

309. $y = 16x^2 - 8x + 1$

Answer: $y : (0,1)$; $x : \left(\frac{1}{4}, 0\right)$

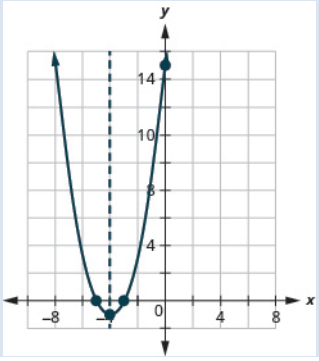
310. $y = x^2 + 16x + 64$

Answer: $y : (0,64)$; $x : (-8,0)$

In the following exercises, graph by using intercepts, the vertex, and the axis of symmetry.

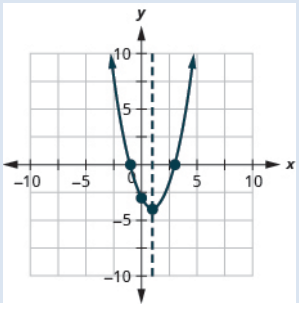
311. $y = x^2 + 8x + 15$

Answer: $y : (0,15)$; $x : (-3,0), (-5,0)$; axis : $x = -4$; vertex : $(-4,-1)$



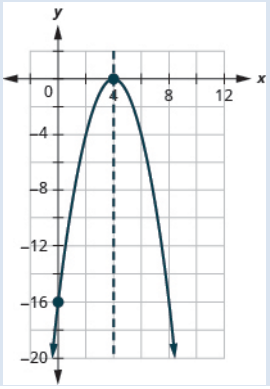
312. $y = x^2 - 2x - 3$

Answer: $y : (0,-3)$ $x : (-1,0), (3,0)$; axis: $x = 1$; vertex: $(1,-4)$



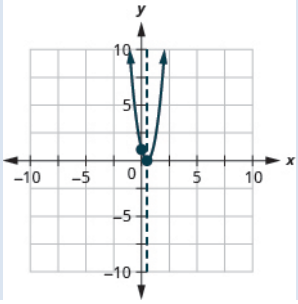
313. $y = -x^2 + 8x - 16$

Answer: $y: (0, -16)$; $x: (4, 0)$; axis: $x = 4$; vertex: $(4, 0)$



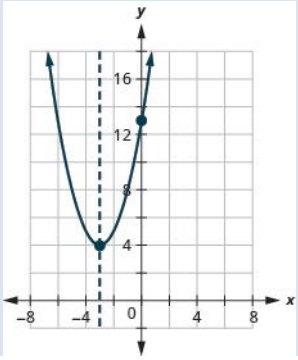
314. $y = 4x^2 - 4x + 1$

Answer: $y: (0,1)$ $x: (\frac{1}{2}, 0)$; axis: $x = \frac{1}{2}$; vertex: $(\frac{1}{2}, 0)$



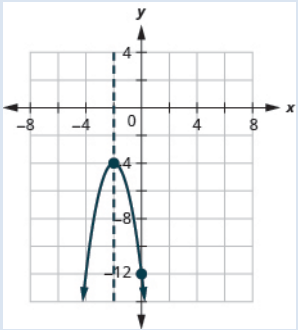
315. $y = x^2 + 6x + 13$

Answer: $y: (0,13)$; $x:$ none; axis: $x = -3$; vertex: $(-3, 4)$



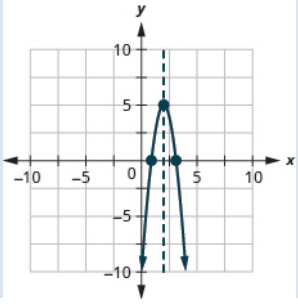
316. $y = -2x^2 - 8x - 12$

Answer: $y: (0, -12)$; $x:$ none; axis : $x = -2$; vertex : $(-2, -4)$



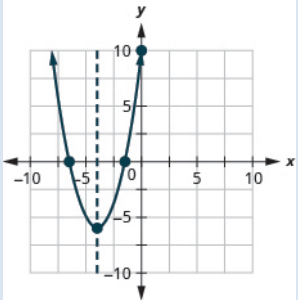
317. $y = -4x^2 + 16x - 11$

Answer: $y: (0, -11)$ $x: (3.1, 0), (0.9, 0)$; axis: $x = 2$; vertex: $(2, 5)$



318. $y = x^2 + 8x + 10$

Answer: $y: (0, 10)$; $x: (-1.6, 0), (-6.4, 0)$; axis : $x = -4$; vertex : $(-4, -6)$



In the following exercises, find the minimum or maximum value.

319. $y = 7x^2 + 14x + 6$

Answer: The minimum value is -1 when $x = -1$.

320. $y = -3x^2 + 12x - 10$

Answer: The maximum value is 2 when $x = 2$.

In the following exercises, solve. Rounding answers to the nearest tenth.

321. A ball is thrown upward from the ground with an initial velocity of 112 ft/sec. Use the quadratic equation $h=-16t^2+112t$ to find how long it will take the ball to reach maximum height, and then find the maximum height.

Answer: In 3. 5 seconds the ball is at its maximum height of 196 feet.

322. A daycare facility is enclosing a rectangular area along the side of their building for the children to play outdoors. They need to maximize the area using 180 feet of fencing on three sides of the yard. The quadratic equation $A=-2x^2+180x$ gives the area, A, of the yard for the length, x, of the building that will border the yard. Find the length of the building that should border the yard to maximize the area, and then find the maximum area.

Answer: The length adjacent to the building is 90 feet, giving a maximum area of 4050 square feet.

Chapter Practice Test

323. Use the Square Root Property to solve the quadratic equation: $3(w+5)^2=27$.

Answer: $w=-2,-8$

324. Use Completing the Square to solve the quadratic equation: $a^2-8a+7=23$.

Answer: $a=4\pm 4\sqrt{2}$

325. Use the Quadratic Formula to solve the quadratic equation: $2m^2-5m+3=0$.

Answer: $m=1,\frac{3}{2}$

In the following exercises, solve the quadratic equations. Use any method.

326. $8v^2+3=35$

Answer: $v=\pm 2$

327. $3n^2+8n+3=0$

Answer: $n=\frac{-4\pm\sqrt{7}}{3}$

328. $2b^2+6b-8=0$

Answer: $b=-4,1$

329. $x(x+3)+12=0$

Answer: no real solution

330. $\frac{4}{3}y^2 - 4y + 3 = 0$

Answer: $y = \frac{3}{2}$

In the following exercises, use the discriminant to determine the number of solutions of each quadratic equation.

331. $6p^2 - 13p + 7 = 0$

Answer: 2

332. $3q^2 - 10q + 12 = 0$

Answer: none

In the following exercises, solve by factoring, the Square Root Property, or the Quadratic Formula.

333. Find two consecutive even numbers whose product is

Answer: Two consecutive even number are -20 and -18 and 18 and 20.

334. The length of a diagonal of a rectangle is three more than the width. The length of the rectangle is three times the width. Find the length of the diagonal. (Round to the nearest tenth.)

Answer: The diagonal is 4. 4 units long.

In the following exercises, for each parabola, find (a) which ways it opens, (b) the axis of symmetry, (c) the vertex, (d) the *x*- and *y*-intercepts, and (e) the maximum or minimum value.

335. $y = 3x^2 + 6x + 8$

Answer: (a) up (b) $x = -1$ (c) $(-1,5)$ (d) $y:(0,8); x:\text{none}$ (e) minimum value of 5 when $x = -1$

336. $y = x^2 - 4$

Answer: (a) up (b) $x = 0$ (c) $(0,-4)$ (d) $y;(0,-4); x:(-2,0),(2,0)$ (e) minimum value of -4 when $x = 0$

337. $y = x^2 + 10x + 24$

Answer: (a) up (b) $x = -5$ (c) $(-5,-1)$ (d) $y;(0,24); x:(-6,0),(-4,0)$ (e) minimum value of -5 when $x = -1$

338. $y=-3x^2+12x-8$

Answer: (a) down (b) $x=2$ (c) $(2,4)$ (d) $y;(0,-8);\ x:(2.9,0),(1.2,0)$ (e) maximum value of 4 when $x=2$

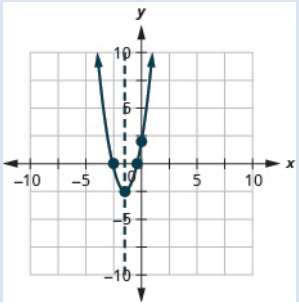
339. $y=-x^2-8x+16$

Answer: (a) down (b) $x=-4$ (c) $(-4,32)$ (d) $y;(0,16);\ x:(-9.7,0),(1.7,0)$ (e) maximum value of 32 when $x=-4$

In the following exercises, graph the parabolas by using intercepts, the vertex, and the axis of symmetry.

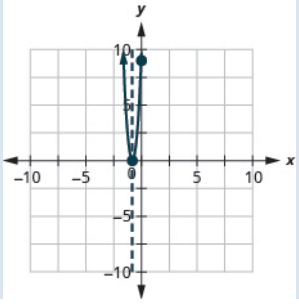
340. $y=2x^2+6x+2$

Answer: $y:(0,2);\ x:(-2.6,0),(-0.4,0);\ \text{axis}:x=-\frac{3}{2};\ \text{vertex}:\left(-\frac{3}{2},-\frac{5}{2}\right)$



341. $y=16x^2+24x+9$

Answer: $y:(0,9);\ x:\left(-\frac{3}{4},0\right);\ \text{axis}:x=-\frac{3}{4};\ \text{vertex}:\left(-\frac{3}{4},0\right)$



In the following exercise, solve.

342. A water balloon is launched upward at the rate of 86 ft/sec. Using the formula $h=-16t^2+86t$, find how long it will take the balloon to reach the maximum height and then find the maximum height. Round to the nearest tenth.

Answer: In 2. 7 seconds, the water balloon is at its highest point of 6 feet

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10.5 Graphing Quadratic Equations