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Chapter 2

Exercise Set 2.1

1. In the expression $5x - 3y + 17 - 2x$, 17 is called a constant term.

2. When we apply the distributive property to $-2(2x - 3y - 9)$, we obtain $-4x + 6y + 18$.

3. In the expression $5x - 3y + 17 - 2x$, $5x$ and $-2x$ are called like terms.

4. In the expression $5x - 3y + 17 - 2x$, -3 is called the coefficient of the second term.

5. In the expression $5x - 3y + 17 - 2x$, $5x$ and $-3y$ are called unlike terms.

6. In the expression $12x + 17$, 12 and x are factors of the first term.

7. In the expression $4x^2 + 17x - 90$, the parts $-4x^2$, $17x$, and -90 are called terms.

8. In the expression $17x$, x is called a variable.

9. $3x + 9x = 12x$

10. $5y + 8y = 13y$

11. There are no like terms.
$3x + 6$

12. There are no like terms.
$4x + 3y$

13. $y + 3 + 4y = y + 4y + 3$
$= 5y + 3$

14. $4x - 7x + 4 = -3x + 4$

15. $-2w - 3w + 5 = -5w + 5$

16. $-8y - 4y - 7 = -12y - 7$

17. $3a + 5b - 7a = -4a + 5b$

18. $-5c + 4d + 2c = -3c + 4d$

19. $-x + 2 - x - 2 = -x - x + 2 - 2$
$= -2x$

20. $-3a + 4 + 3a - 13 = -3a + 3a + 4 - 13$
$= -9$

21. $3 + 6x - 3 - 6x = 6x - 6x + 3 - 3 = 0$

22. $-5y + 7 - 7 + 5y = -5y + 5y + 7 - 7$
$= 0$

23. $5 + 2t - 4t + 16 = 2t - 4t + 5 + 16$
$= -2t + 21$

24. $7 + d - 13 - 5d = d - 5d + 7 - 13$
$= -4d - 6$

25. $4p - 6 - 16p - 2 = 4p - 16p - 6 - 2$
$= -12p - 8$

26. $-6t + 5 + 2t - 9 = -6t + 2t + 5 - 9$
$= -4t - 4$

27. $-2x + 4x - 8 = 2x - 8$

28. $4 - x + 4x - 8 = -x + 4x + 4 - 8$
$= 3x - 4$

29. $2x - 7y - 5x + 2y = 2x - 5x - 7y + 2y$
$= -3x - 5y$

30. $3x - 7 - 9 + 4x = 3x + 4x - 7 - 9$
$= 7x - 16$

31. $-x^2 + 2x^2 + y = x^2 + y$

32. $1 + x^2 + 6 - 3x^2 = x^2 - 3x^2 + 1 + 6$
$= -2x^2 + 7$

33. There are no like terms.
$5w^3 + 2w^2 + w + 3$

34. There are no like terms.
$3m^3 - 7m^2 + 7m - 2$

35. $3x^2 - 9y^2 + 7x^2 - 5 - y^2 - 2$
$= 3x^2 + 7x^2 - 9y^2 - y^2 - 5 - 2$
$= 10x^2 - 10y^2 - 7$

36. $-4x^2 - 6y - 3x^2 + 6 - y - 1$
$= -4x^2 - 3x^2 - 6y - y + 6 - 1$
$= -7x^2 - 7y + 5$

37. $4 - 3n^2 + 9 - 2n = -3n^2 - 2n + 4 + 9$
$= -3n^2 - 2n + 13$

38. $-5x^2 + 1 - 3x^2 + x = -5x^2 - 3x^2 + x + 1$
$= -8x^2 + x + 1$

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39. $\frac{3}{4}a-\frac{6}{11}a=\frac{33}{44}a-\frac{24}{44}a$
$=\frac{9}{44}a$

40. $\frac{3}{4}p-\frac{2}{7}p=\frac{21}{28}p-\frac{8}{28}p$
$=\frac{13}{28}p$

41. $b+4+\frac{3}{5}=b+\frac{20}{5}+\frac{3}{5}$
$=b+\frac{23}{5}$

42. $\frac{3}{4}y+2+y=\frac{3}{4}y+y+2$
$=\frac{3}{4}y+\frac{4}{4}y+2$
$=\frac{7}{4}y+2$

43. There are no like terms.
$-\frac{2}{3}x+\frac{5}{9}y+\frac{1}{9}$

44. There are no like terms.
$\frac{3}{4}p+\frac{1}{7}q+\frac{1}{4}$

45. $\frac{3}{5}x-3-\frac{7}{4}x-2=\frac{3}{5}x-\frac{7}{4}x-3-2$
$=\frac{12}{20}x-\frac{35}{20}x-5$
$=-\frac{23}{20}x-5$

46. $\frac{1}{2}y-4+\frac{3}{4}x-\frac{1}{5}y=\frac{3}{4}x+\frac{1}{2}y-\frac{1}{5}y-4$
$=\frac{3}{4}x+\frac{5}{10}y-\frac{2}{10}y-4$
$=\frac{3}{4}x+\frac{3}{10}y-4$

47. $5.1n+6.42-4.3n=5.1n-4.3n+6.42$
$=0.8n+6.42$

48. $-2.53c+8.1-9.1c=-2.53c-9.1c+8.1$
$=-11.63c+8.1$

49. $13.4x+1.2x+8.3=14.6x+8.3$

50. $-4x^2-3.1-5.2=-4x^2-8.3$

51. $-19.36+40.02x+12.25-18.3x$
$=40.02x-18.3x-19.36+12.25$
$=21.72x-7.11$

52. $-3.4k+13.01-1.09k-17.3$
$=-3.4k-1.09k+13.01-17.3$
$=-4.49k-4.29$

53. $2z-5z^3-2z^3-z^2=-5z^3-2z^3-z^2+2z$
$=-7z^3-z^2+2z$

54. $c^3-7+4c^2-2c^2-5c^3=c^3-5c^3+4c^2-2c^2-7$
$=-4c^3+2c^2-7$

55. $2x^2+2x-5x-5=2x^2-3x-5$

56. $x^2-3xy-2xy+6=x^2-5xy+6$

57. $2a^3-6a^2+2a+a^2-3a+1$
$=2a^3-6a^2+a^2+2a-3a+1$
$=2a^3-5a^2-a+1$

58. $3b^3-3b^2+6b+2b^2-2b+4$
$=3b^3-3b^2+2b^2+6b-2b+4$
$=3b^3-b^2+4b+4$

59. $5(x+2)=5x+5(2)$
$=5x+10$

60. $5(x+4)=5x+5(4)$
$=5x+20$

61. $3(4x-1)=3(4x)+3(-1)$
$=12x-3$

62. $7(2b-5)=7[2b+(-5)]$
$=7(2b)+7(-5)$
$=14b+(-35)$
$=14b-35$

63. $2(-3c+4)=2(-3c)+2(4)$
$=-6c+8$

64. $5(-9d+2)=5(-9d)+5(2)$
$=-45d+10$

65. $4(-3v-4)=4[-3v+(-4)]$
$=4(-3v)+4(-4)$
$=-12v+(-16)$
$=-12v-16$

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66. $8(-2w-5)=8[-2w+(-5)]$
$=8(-2w)+8(-5)$
$=-16w+(-40)$
$=-16w-40$

67. $-3(2p+7)=-3(2p)+(-3)(7)$
$=-6p-21$

68. $-9(5q+8)=-9(5q)+(-9)(8)$
$=-45q-72$

69. $-5(3m-2)=-5[3m+(-2)]$
$=-5(3m)+(-5)(-2)$
$=-15m+10$

70. $-8(6n-7)=-8[6n+(-7)]$
$=-8(6n)+(-8)(-7)$
$=-48n+56$

71. $-2(-3x+9)=-2(-3x)+(-2)(9)$
$=6x+(-18)$
$=6x-18$

72. $-5(-4y+3)=-5(-4y)+(-5)(3)$
$=20y+(-15)$
$=20y-15$

73. $-4(-6t-7)=-4[-6t+(-7)]$
$=-4(-6t)+(-4)(-7)$
$=24t+28$

74. $-3(-6s-9)=-3[-6s+(-9)]$
$=-3(-6s)+(-3)(-9)$
$=18s+27$

75. $-\frac{1}{3}(3r-12)=-\frac{1}{3}(3r)+\left(-\frac{1}{3}\right)(-12)$
$=-r+4$

76. $-\frac{5}{6}(12x-18)=-\frac{5}{6}[12x+(-18)]$
$=-\frac{5}{6}(12x)+\left(-\frac{5}{6}\right)(-18)$
$=-10x+15$

77. $-0.3(3x^2+5)=-0.3(3x^2)+(-0.3)(5)$
$=-0.9x^2+(-1.5)$
$=-0.9x^2-1.5$

78. $-0.3(5x-0.9)=-0.3(5x)+(-0.3)(-0.9)$
$=-1.5x+0.27$

79. $-(-x+y)=-1(-x+y)$
$=-1(-x)+(-1)(y)$
$=x+(-y)$
$=x-y$

80. $-(-p-q)=-1[(-p)+(-q)]$
$=-1(-p)+(-1)(-q)$
$=p+q$

81. $-(2x+4y-8)=-1[2x+4y+(-8)]$
$=-1(2x)+(-1)(4y)+(-1)(-8)$
$=-2x-4y+8$
$=-2x-4y+8$

82. $-3(2a+3b-7)=-3[(2a)+(3b)+(-7)]$
$=-3(2a)+(-3)(3b)+(-3)(-7)$
$=-6a-9b+21$

83. $(2x-9y)5=(2x)5+(-9y)5$
$=10x-45y$

84. $(8b-1)7=(8b)7+(-1)7$
$=56b-7$

85. $-3(-x+2y+4)=-3(-x)+(-3)(2y)+(-3)(4)$
$=3x+(-6y)+(-12)$
$=3x-6y-12$

86.

$-4(-2m-3n+8)=-4(-2m)+(-4)(-3n)+(-4)(8)$
$=8m+12n-32$

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87. $-\frac{2}{3}(-9x+5) = -\frac{2}{3}(-9x) + \left(-\frac{2}{3}\right)(5)$

$= \frac{18}{3}x - \frac{10}{3}$

$= 6x - \frac{10}{3}$

88. $-\frac{3}{4}(5x-8) = -\frac{3}{4}\left[5x + (-8)\right]$

$= -\frac{3}{4}(5x) + \left(-\frac{3}{4}\right)(-8)$

$= -\frac{15}{4}x + \frac{24}{4}$

$= -\frac{15}{4}x + 6$

89. $(7x-5) - (2x-3) = 7x - 5 - 2x + 3$

$= 7x - 2x - 5 + 3$

$= 5x - 2$

90. $(9x-1) - (2x-9) = 9x - 1 - 2x + 9$

$= 9x - 2x - 1 + 9$

$= 7x + 8$

91. $-2(3-x) + 7 = -6 + 2x + 7$

$= 2x - 6 + 7$

$= 2x + 1$

92. $-(3t-3) + 5 = -3t + 3 + 5$

$= -3t + 8$

93. $6x + 2(4x+9) = 6x + 8x + 18$

$= 14x + 18$

94. $3(x+y) + 2y = 3x + 3y + 2y$

$= 3x + 5y$

95. $2(x-y) + 2x + 3 = 2x - 2y + 2x + 3$

$= 2x + 2x - 2y + 3$

$= 4x - 2y + 3$

96. $6 + (x-5) + 3x = 6 + x - 5 + 3x$

$= x + 3x + 6 - 5$

$= 4x + 1$

97. $4(2c-3) - 3(c-4) = 8c - 12 - 3c + 12$

$= 8c - 3c - 12 + 12$

$= 5c$

98. $-5(-3d+2) + 6(4d-5) = 15d - 10 + 24d - 30$

$= 15d + 24d - 10 - 30$

$= 39d - 40$

99. $8x - (x-3) = 8x - x + 3$

$= 7x + 3$

100. $-(x-5) - 3x + 4 = -x + 5 - 3x + 4$

$= -x - 3x + 5 + 4$

$= -4x + 9$

101. $-(3s+4) - (s+2) = -3s - 4 - s - 2$

$= -3s - s - 4 - 2$

$= -4s - 6$

102. $6 - 2(2w+3) + 5w = 6 - 4w - 6 + 5w$

$= -4w + 5w + 6 - 6$

$= w$

103. $4(x-1) + 2(3-x) - 4 = 4x - 4(1) + 2(3) - 2x - 4$

$= 4x - 4 + 6 - 2x - 4$

$= 4x - 2x - 4 + 6 - 4$

$= 2x - 2$

104. $4(3b-2) - 5(c-4) - 6b$

$= 4(3b) + 4(-2) - 5(c) - 5(-4) - 6b$

$= 12b - 8 - 5c + 20 - 6b$

$= 12b - 6b - 5c + 20 - 8$

$= 6b - 5c + 12$

105. $4(m+3) - 4m - 12 = 4m + 4(3) - 4m - 12$

$= 4m + 12 - 4m - 12$

$= 4m - 4m + 12 - 12$

$= 0$

106. $-3(a+2b) + 3(a+2b) = -3a - 3(2b) + 3a + 3(2b)$

$= -3a - 6b + 3a + 6b$

$= -3a + 3a - 6b + 6b$

$= 0$

107. $4 + (3x-4) - 5 = 4 + 3x - 4 - 5$

$= 3x + 4 - 4 - 5$

$= 3x - 5$

108. $2y - 6(y-2) + 3 = 2y - 6y - 6(-2) + 3$

$= 2y - 6y + 12 + 3$

$= -4y + 15$

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109. $4(x+2)-3(x-4)-5$
$=4x+4(2)-3x-3(-4)-5$
$=4x+8-3x+12-5$
$=4x-3x+8+12-5$
$=x+15$

110. $6-(a-5)-(2b+1)=6-a+5-2b-1$
$=-a-2b+6+5-1$
$=-a-2b+10$

111. $-6x+7y-(3+x)+(x+3)$
$=-6x+7y-3-x+x+3$
$=-6x-x+x+7y-3+3$
$=-6x+7y$

112. $3(t-2)-2(t+4)-6=3t-6-2t-8-6$
$=3t-2t-6-8-6$
$=t-14-6$
$=t-20$

113. $-\left(\frac{3}{4}x-\frac{1}{3}\right)+2x=-\frac{3}{4}x+\frac{1}{3}+2x$
$=-\frac{3}{4}x+2x+\frac{1}{3}$
$=-\frac{3}{4}x+\frac{8}{4}x+\frac{1}{3}$
$=\frac{5}{4}x+\frac{1}{3}$

114. $-\left(\frac{7}{8}x-\frac{1}{2}\right)-3x=-\frac{7}{8}x+\frac{1}{2}-3x$
$=-\frac{7}{8}x-3x+\frac{1}{2}$
$=-\frac{7}{8}x-\frac{24}{8}+\frac{1}{2}$
$=-\frac{31}{8}x+\frac{1}{2}$

115. $\frac{2}{3}x+\frac{1}{2}(5x-4)=\frac{2}{3}x+\frac{5}{2}x-2$
$=\frac{4}{6}x+\frac{15}{6}x-2$
$=\frac{19}{6}x-2$

116. $\frac{4}{5}x+\frac{1}{7}(3x-1)=\frac{4}{5}x+\frac{3}{7}x-\frac{1}{7}$
$=\frac{28}{35}x+\frac{15}{35}x-\frac{1}{7}$
$=\frac{43}{35}x-\frac{1}{7}$

117. $0.4-(y+5)+0.6-2=0.4-y-5+0.6-2$
$=-y+0.4-5+0.6-2$
$=-y-6$

118. $1.03-(8-0.8a)-0.03+1.2a$
$=1.03-8+0.8a-0.03+1.2a$
$=0.8a+1.2a+1.03-8-0.03$
$=2a-7$

119. $-0.2(6-x)-4(y+0.4)$
$=-0.2(6)-0.2(-x)-4y-4(0.4)$
$=-1.2+0.2x-4y-1.6$
$=0.2x-4y-1.2-1.6$
$=0.2x-4y-2.8$

120. $-1.05(4x-6)+4(1.5y-3.05)$
$=-4.2x+6.3+6y-12.2$
$=-4.2x+6y+6.3-12.2$
$=-4.2x+6y-5.9$

121. $\frac{1}{2}(x+3)+\frac{1}{3}(3x+6)=\frac{1}{2}x+\frac{3}{2}+\frac{3}{3}x+\frac{6}{3}$
$=\frac{1}{2}x+\frac{3}{2}+x+2$
$=\frac{1}{2}x+x+\frac{3}{2}+2$
$=\frac{1}{2}x+\frac{2}{2}x+\frac{3}{2}+\frac{4}{2}$
$=\frac{3}{2}x+\frac{7}{2}$

122. $\frac{2}{3}(r-2)-\frac{1}{2}(r+4)=\frac{2}{3}r-\frac{4}{3}-\frac{1}{2}r-\frac{4}{2}$
$=\frac{2}{3}r-\frac{1}{2}r-\frac{4}{3}-2$
$=\frac{4}{6}r-\frac{3}{6}r-\frac{4}{3}-\frac{6}{3}$
$=\frac{1}{6}r-\frac{10}{3}$

123. $\square+\ominus+\ominus+\square+\ominus=2\square+3\ominus$

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124. $\otimes+\odot+\otimes+\odot+\odot+\odot=2\otimes+4\odot$

125. $x+y+\Delta+\Delta+x+y+y$
$=x+x+y+y+y+\Delta+\Delta$
$=2x+3y+2\Delta$

126. $2+x+2+\ominus+\ominus+2+y$
$=x+y+\ominus+\ominus+2+2+2$
$=x+y+2\ominus+6$

127. $1\cdot18,\ 2\cdot9,\ 3\cdot6$
positive factors: 1, 2, 3, 6, 9, 18

128. $1\cdot24,\ 2\cdot12,\ 3\cdot8,4\cdot6$
positive factors: 1, 2, 3, 4, 6, 8, 12, 24

129. a. To remove the parentheses, multiply the terms inside the parentheses by –1. The signs of all terms inside the parentheses change when the parentheses are removed.

b. $-(x-8)=-1(x)-1(-8)=-x+8$

130. a. Like terms are terms that have the same variable with the same exponent.

b. $3x$ and $4y$ are not like terms because the variables are different.

c. 7 and –2 are like terms because they are both constants.

d. $5x^2$ and $5x$ are not like terms because the variables have different exponents.

e. $4x$ and $-5xy$ are not like terms because the variables are different.

131. $4x^2+5y^2+6\left(3x^2-5y^2\right)-4x+3$
$=4x^2+5y^2+18x^2-30y^2-4x+3$
$=4x^2+18x^2-4x+5y^2-30y^2+3$
$=22x^2-25y^2-4x+3$

132. $2x^2-4x+8x^2-3(x+2)-x^2-2$
$=2x^2-4x+8x^2-3x-6-x^2-2$
$=2x^2+8x^2-x^2-4x-3x-6-2$
$=9x^2-7x-8$

133. $2\left[3+4(x-5)\right]-\left[2-(x-3)\right]$
$=2\left[3+4x-20\right]-\left[2-x+3\right]$
$=6+8x-40-2+x-3$
$=8x+x+6-40-2-3$
$=9x-39$

134. $\frac{1}{4}\left[3-2(y+1)\right]-\frac{1}{3}\left[2-(y-6)\right]$
$=\frac{1}{4}\left[3-2y-2\right]-\frac{1}{3}\left[2-y+6\right]$
$=\frac{1}{4}\left[1-2y\right]-\frac{1}{3}\left[8-y\right]$
$=\frac{1}{4}-\frac{2}{4}y-\frac{8}{3}+\frac{1}{3}y$
$=-\frac{2}{4}y+\frac{1}{3}y+\frac{1}{4}-\frac{8}{3}$
$=-\frac{3}{6}+\frac{2}{6}y+\frac{3}{12}-\frac{32}{12}$
$=-\frac{1}{6}y-\frac{29}{12}$

135. $|-7|=7$

136. $-|-16|=-(16)=-16$

137. $-4-13-(-6)=-4-13+6$
$=-17+6$
$=-11$

138. Answers will vary. The answer should include that the order is parentheses, exponents, multiplication and division from left to right, and addition and subtraction from left to right.

139. Substitute –1 for each x in the expression.
$-x^2+5x-6=-(-1)^2+5(-1)-6$
$=-1+(-5)-6$
$=-6-6$
$=-12$

Exercise Set 2.2

1. To solve the equation $6=x-2$, first add 2 to both sides of the equation.

2. Numbers, which when substituted for the variable, make the equation a true statement, are called solutions.

3. The strategy for solving a linear equation in one variable includes a process to isolate the variable.

4. The symbol $\stackrel{?}{=}$ is used when checking the solution in the given equation.

5. The equation $x-3=-19$ is an example of a linear equation in the variable x.

6. Two equations with the same solutions are called equivalent equations.

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7. A statement of equality between two expressions, like $x + 7 = 19$, is called an equation.

8. To solve the equation $x - 6 = -2$, first add 6 to both sides of the equation.

9. When solving the equation $x + a = b$, the opposite of a is added to both sides.

10. (True or False) The equations $x + 19 = -14$ and $x + 60 = 27$ are equivalent equations. True

11. Substitute 2 for $x = 2$.

$$4x - 3 = 5$$
$$4(2) - 3 = 5$$
$$8 - 3 = 5$$
$$5 = 5 \quad \text{True}$$

Since we obtain true statement, 2 is a solution.

12. Substitute 5 for x, $x = 5$.

$$6x - 17 = 13$$
$$6(5) - 17 = 13$$
$$30 - 17 = 13$$
$$13 = 13 \quad \text{True}$$

Since we obtain a true statement, 5 is a solution.

13. Substitute -3 for x, $x = -3$.

$$2x - 5 = 5(x + 2)$$
$$2(-3) - 5 = 5[(-3) + 2]$$
$$-6 - 5 = 5(-1)$$
$$-11 = -5 \quad \text{False}$$

Since we obtain a false statement, -3 is not a solution.

14. Substitute -7 for q, $q = -7$.

$$3(q - 11) - 7q = 5$$
$$3(-7 - 11) - 7(-7) = 5$$
$$3(-18) + 49 = 5$$
$$-54 + 49 = 5$$
$$-5 = 5 \quad \text{False}$$

Since we obtain a false statement, -7 is not a solution.

15. Substitute -15 for p, $p = -15$.

$$2p - 5(p + 7) = 10$$
$$2(-15) - 5(-15 + 7) = 10$$
$$-30 - 5(-8) = 10$$
$$-30 + 40 = 10$$
$$10 = 10 \quad \text{True}$$

Since we obtain a true statement, -15 is a solution.

16. Substitute -2 for k, $k = -2$.

$$5k - 6(k - 1) = 8$$
$$5(-2) - 6(-2 - 1) = 8$$
$$-10 - 6(-3) = 8$$
$$-10 + 18 = 8$$
$$8 = 8 \quad \text{True}$$

Since we obtain a true statement, -2 is a solution.

17. Substitute 3 for m, $m = 3$.

$$-3(m + 4) + 7(m - 5) = 35$$
$$-3(3 + 4) + 7(3 - 5) = 35$$
$$-3(7) + 7(-2) = 35$$
$$-21 + (-14) = 35$$
$$-35 = 35 \quad \text{False}$$

Since we obtain a false statement, 3 is not a solution.

18. Substitute 4 for n, $n = 4$.

$$8(n - 1) - 6(3n - 4) = 24$$
$$8(4 - 1) - 6[3(4) - 4] = 24$$
$$8(3) - 6(12 - 4) = 24$$
$$24 - 6(8) = 24$$
$$24 - 48 = 24$$
$$-24 = 24 \quad \text{False}$$

Since we obtain a false statement, 4 is not a solution.

19. Substitute $\frac{1}{2}$ for x, $x = \frac{1}{2}$.

$$4x - 4 = 2x - 2$$
$$4\left(\frac{1}{2}\right) - 4 = 2\left(\frac{1}{2}\right) - 2$$
$$2 - 4 = 1 - 2$$
$$-2 = -1 \quad \text{False}$$

Since we obtain a false statement, $\frac{1}{2}$ is not a solution.

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20. Substitute $\frac{2}{3}$ for x, $x = \frac{2}{3}$.

$$6x - 1 = 12x - 5$$
$$6\left(\frac{2}{3}\right) - 1 = 12\left(\frac{2}{3}\right) - 5$$
$$\frac{12}{3} - 1 = \frac{24}{3} - 5$$
$$4 - 1 = 8 - 5$$
$$3 = 3 \text{ True}$$

Since we obtain a true statement, $\frac{2}{3}$ is a solution.

21. Substitute 3.4 for x, $x = 3.4$.

$$3(x+2) - 3(x-1) = 9$$
$$3(3.4+2) - 3(3.4-1) = 9$$
$$3(5.4) - 3(2.4) = 9$$
$$16.2 - 7.2 = 9$$
$$9 = 9 \text{ True}$$

Since we obtain a true statement, 3.4 is a solution.

22. Substitute 5.5 for x, $x = 5.5$.

$$3(x+3) - 5(x-4) = 18$$
$$3(5.5+3) - 5(5.5-4) = 18$$
$$3(8.5) - 5(1.5) = 18$$
$$25.5 - 7.5 = 18$$
$$18 = 18 \text{ True}$$

Since we obtain a true statement, 5.5 is a solution.

23. $x + 2 = 7$

$$x + 2 - 2 = 7 - 2$$
$$x + 0 = 5$$
$$x = 5$$

Check: $x + 2 = 7$

$$5 + 2 = 7$$
$$7 = 7 \text{ True}$$

24. $x + 6 = 14$

$$x + 6 - 6 = 14 - 6$$
$$x + 0 = 8$$
$$x = 8$$

Check: $x + 6 = 14$

$$8 + 6 = 14$$
$$14 = 14 \text{ True}$$

25. $-6 = x + 1$

$$x + 1 = -6$$
$$x + 1 - 1 = -6 - 1$$
$$x + 0 = -7$$
$$x = -7$$

Check: $x + 1 = -6$

$$-7 + 1 = -6$$
$$-6 = -6 \text{ True}$$

26. $-5 = x + 4$

$$x + 4 = -5$$
$$x + 4 - 4 = -5 - 4$$
$$x + 0 = -9$$
$$x = -9$$

Check: $x + 4 = -5$

$$-9 + 4 = -5$$
$$-5 = -5 \text{ True}$$

27. $x - 4 = -8$

$$x - 4 + 4 = -8 + 4$$
$$x + 0 = -4$$
$$x = -4$$

Check: $x - 4 = 8$

$$-4 - 4 = -8$$
$$-8 = -8 \text{ True}$$

28. $p - 5 = -12$

$$p - 5 + 5 = -12 + 5$$
$$p + 0 = -7$$
$$p = -7$$

Check: $p - 5 = -12$

$$-7 - 5 = -12$$
$$-12 = -12 \text{ True}$$

29. $t + 9 = 52$

$$t + 9 - 9 = 52 - 9$$
$$t + 0 = 43$$
$$t = 43$$

Check: $t + 9 = 52$

$$43 + 9 = 52$$
$$52 = 52 \text{ True}$$

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30. $x+8=17$

$x+8=17$

$x+8-8=17-8$

$x+0=9$

$x=9$

Check: $x+8=17$

$9+8=17$

$17=17$ True

31. $-6+w=9$

$-6+6+w=9+6$

$0+w=15$

$w=15$

Check: $-6+w=9$

$-6+15=9$

$9=9$ True

32. $-10+n=5$

$-10+10+n=5+10$

$0+n=15$

$n=15$

Check: $-10+n=15$

$-10+15=5$

$5=5$ True

33. $27=x+16$

$27-16=x+16-16$

$11=x+0$

$11=x$

Check: $27=x+16$

$27=11+16$

$27=27$ True

34. $50=x-35$

$50+35=x-35+35$

$85=x+0$

$85=x$

Check: $50=x-35$

$50=85-35$

$50=50$ True

35. $-18=x-14$

$-18+14=x-14+14$

$-4=x+0$

$-4=x$

Check: $-18=x-14$

$-18=-4-14$

$-18=-18$ True

36. $-4=w+5$

$-4-5=w+5-5$

$-9=w+0$

$-9=w$

Check: $-4=w+5$

$-4=-9+5$

$-4=-4$ True

37. $9+x=4$

$9-9+x=4-9$

$0+x=-5$

$x=-5$

Check: $9+x=4$

$9+(-5)=4$

$4=4$ True

38. $12+w=9$

$12-12+w=9-12$

$0+w=-3$

$w=-3$

Check: $12+w=9$

$12+(-3)=9$

$9=9$ True

39. $4+x=-8$

$4-4+x=-8-4$

$0+x=-12$

$x=-12$

Check: $4+x=-8$

$4+(-12)=-8$

$-8=-8$ True

40. $7+z=-3$

$7-7+z=-3-7$

$0+z=-10$

$z=-10$

Check: $7+z=-3$

$7+(-10)=-3$

$-3=-3$ True

41. $7+r=-23$

$7+r=-23$

$7-7+r=-23-7$

$0+r=-30$

$r=-30$

Check: $7+r=-23$

$7+(-30)=-23$

$-23=-23$ True

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42. $7+v=-7$
$7-7+v=-7-7$
$0+v=-14$
$v=-14$
Check: $7+v=-7$
$7+(-14)=-7$
$-7=-7$ True

43. $8=8+v$
$8-8=8-8+v$
$0=0+v$
$0=v$
Check: $8=8+v$
$8=8+0$
$8=8$ True

44. $-5=-5+m$
$-5+5=-5+5+m$
$0=0+m$
$0=m$
Check: $-5=-5+m$
$-5=-5+0$
$-5=-5$ True

45. $7+x=-50$
$7-7+x=-50-7$
$0+x=-57$
$x=-57$
Check: $7+x=-50$
$7+(-57)=-50$
$-50=-50$ True

46. $-5+c=-23$
$-5+5+c=-23+5$
$0+c=-18$
$c=-18$
Check: $-5+c=-23$
$-5+(-18)=-23$
$-23=-23$ True

47. $12=16+x$
$12-16=16-16+x$
$-4=0+x$
$-4=x$
Check: $12=16+x$
$12=16+(-4)$
$12=12$ True

48. $62=z-15$
$62+15=z-15+15$
$77=z+0$
$77=z$
Check: $62=z-15$
$62=77-15$
$62=62$ True

49. $15+y=-50$
$15-15+y=-50-15$
$0+y=-65$
$y=-65$
Check: $15+y=-50$
$15+(-65)=-50$
$-50=-50$ True

50. $-20=4+x$
$-20-4=4-4+x$
$-24=0+x$
$-24=x$
Check: $-20=4+x$
$-20=4+(-24)$
$-20=-20$ True

51. $-15+x=-15$
$-15+15+x=-15+15$
$0+x=0$
$x=0$
Check: $-15+x=-15$
$-15+0=-15$
$-15=-15$ True

52. $-7+x=-7$
$-7+7+x=-7+7$
$0+x=0$
$0=x$
Check: $-7+x=-7$
$-7+0=-7$
$-7=-7$ True

53. $5=x-12$
$5+12=x-12+12$
$17=x+0$
$17=x$
Check: $5=x-12$
$5=17-12$
$5=5$ True

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54. $8 = x - 9$

$8 + 9 = x - 9 + 9$

$17 = x + 0$

$17 = x$

Check: $8 = x - 9$

$8 = 17 - 9$

$8 = 8$ True

55. $-50 = x - 24$

$-50 + 24 = x - 24 + 24$

$-26 = x + 0$

$-26 = x$

Check: $-50 = x - 24$

$-50 = -26 - 24$

$-50 = -50$ True

56. $-37 = x - 12$

$-37 + 12 = x - 12 + 12$

$-25 = x + 0$

$-25 = x$

Check: $-37 = x - 12$

$-37 = -25 - 12$

$-37 = -37$ True

57. $43 = 15 + p$

$43 - 15 = 15 - 15 + p$

$28 = 0 + p$

$28 = p$

Check: $43 = 15 + p$

$43 = 15 + 28$

$43 = 43$ True

58. $-25 = 74 + x$

$-25 - 74 = 74 - 74 + x$

$-99 = 0 + x$

$-99 = x$

Check: $-25 = 74 + x$

$-25 = 74 + (-99)$

$-25 = -25$ True

59. $a + \frac{7}{8} = \frac{1}{8}$

$a + \frac{7}{8} - \frac{7}{8} = \frac{1}{8} - \frac{7}{8}$

$a + 0 = -\frac{6}{8}$

$a = -\frac{3}{4}$

Check: $a + \frac{7}{8} = \frac{1}{8}$

$-\frac{3}{4} + \frac{7}{8} = \frac{1}{8}$

$-\frac{6}{8} + \frac{7}{8} = \frac{1}{8}$

$\frac{1}{8} = \frac{1}{8}$ True

60. $b + \frac{5}{6} = \frac{1}{6}$

$b + \frac{5}{6} - \frac{5}{6} = \frac{1}{6} - \frac{5}{6}$

$b + 0 = -\frac{4}{6}$

$b = -\frac{2}{3}$

Check: $b + \frac{5}{6} = \frac{1}{6}$

$-\frac{2}{3} + \frac{5}{6} = \frac{1}{6}$

$-\frac{4}{6} + \frac{5}{6} = \frac{1}{6}$

$\frac{1}{6} = \frac{1}{6}$ True

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61. $c-\frac{1}{9}=\frac{5}{6}$

$c-\frac{1}{9}+\frac{1}{9}=\frac{5}{6}+\frac{1}{9}$

$c-0=\frac{15}{18}+\frac{2}{18}$

$c=\frac{17}{18}$

Check: $c-\frac{1}{9}=\frac{5}{6}$

$\frac{17}{18}-\frac{1}{9}=\frac{5}{6}$

$\frac{17}{18}-\frac{2}{18}=\frac{5}{6}$

$\frac{15}{18}=\frac{5}{6}$

$\frac{5}{6}=\frac{5}{6}$ True

62. $d-\frac{3}{8}=\frac{1}{6}$

$d-\frac{3}{8}+\frac{3}{8}=\frac{1}{6}+\frac{3}{8}$

$d-0=\frac{4}{24}+\frac{9}{24}$

$d=\frac{13}{24}$

Check: $d-\frac{3}{8}=\frac{1}{6}$

$\frac{13}{24}-\frac{3}{8}=\frac{1}{6}$

$\frac{13}{24}-\frac{9}{24}=\frac{1}{6}$

$\frac{4}{24}=\frac{1}{6}$

$\frac{1}{6}=\frac{1}{6}$ True

63. $x-8.77=-17$

$x-8.77+8.77=-17+8.77$

$x+0=-8.23$

$x=-8.23$

Check: $x-8.77=-17$

$-8.23-8.77=-17$

$-17=-17$ True

64. $t-3.41=-11$

$t-3.41+3.41=-11+3.41$

$t+0=-7.59$

$t=-7.59$

Check: $t-3.41=-11$

$-7.59-3.41=-11$

$-11=-11$ True

65. $-5.9=x+4.01$

$-5.9-4.01=x+4.01-4.01$

$-9.91=x+0$

$-9.91=x$

Check: $-5.9=x+4.01$

$-5.9=-9.91+4.01$

$-5.9=-5.9$ True

66. $-13.7=x+7.28$

$-13.7-7.28=x+7.28-7.28$

$-20.98=x+0$

$-20.98=x$

Check: $-13.7=x+7.28$

$-13.7=-20.98+7.28$

$-13.7=-13.7$ True

67. No; there are no real numbers that can make $x+1=x+2$.

68. Yes; infinite number; the equation $x+4=x+4$ is true no matter what real number is substituted for x.

69. To isolate the variable, use properties that allow us to get the variable by itself on one side of the equation.

For example, in the equation $x + 8 = -12$, you would subtract 8 from both sides so that the variable x remains on the left by itself.

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70. All three equations have the same solution, where $x = 1$.

$$2x + 3 = 5$$
$$2x + 3 - 3 = 5 - 3$$
$$2x = 2$$
$$\frac{2x}{2} = \frac{2}{2}$$
$$x = 1$$
$$2x = 2$$
$$\frac{2x}{2} = \frac{2}{2}$$
$$x = 1$$

71.
$$x - \Delta = \square$$
$$x - \Delta + \Delta = \square + \Delta$$
$$x = \square + \Delta$$

72.
$$\square + \odot = \Delta$$
$$\square - \square + \odot = \Delta - \square$$
$$\odot = \Delta - \square$$

73.
$$\odot = \square + \Delta$$
$$\odot - \Delta = \square + \Delta - \Delta$$
$$\odot - \Delta = \square$$

74.
$$\square = \Delta + \odot$$
$$\square - \Delta = \Delta - \Delta + \odot$$
$$\square - \Delta = \odot$$

75. **a.** yes **b.** yes **c.** yes **d.** yes

e. Since the left side of the equation is equal to the right side of the equation, $2x + 6 = 2x + 6$, the solution is all real numbers.

76. $$-\frac{7}{15} + \frac{5}{6} = -\frac{14}{30} + \frac{25}{30} = \frac{-14 + 25}{30} = \frac{11}{30}$$

77. $$-\frac{11}{12} + \left(-\frac{3}{8}\right) = -\frac{22}{24} + \left(-\frac{9}{24}\right) = \frac{-22 + (-9)}{24} = -\frac{31}{24}$$

78.
$$4x + 3(x - 2) - 5x - 7 = 4x + 3x - 6 - 5x - 7$$
$$= 4x + 3x - 5x - 6 - 7$$
$$= 2x - 13$$

79.
$$-(2t + 4) + 3(4t - 7) - 3t$$
$$= -2t - 4 + 12t - 21 - 3t$$
$$= -2t + 12t - 3t - 4 - 21$$
$$= 7t - 25$$

Exercise Set 2.3

1. The expression $\frac{1}{3}x$ can be rewritten as $\frac{x}{3}$.

2. To solve the equation $3x = 5$, multiply both sides of the equation by $\frac{1}{3}$.

3. To solve the equation $\frac{x}{3} = 7$, we multiply both sides of the equation by 3.

4. The strategy for solving a linear equation in one variable includes a process to isolate the variable.

5. The symbol $\stackrel{?}{=}$ is used when checking the solution in the given equation.

6. Another name for the reciprocal of a number is the multiplicative inverse.

7. The reciprocal of $\frac{x}{-7}$ is $-\frac{7}{x}$.

8. Two numbers equal to their own reciprocal are 1 and –1.

9.
$$5x = 20$$
$$\frac{5x}{5} = \frac{20}{5}$$
$$x = 4$$

Check: $5x = 20$
$$5(4) = 20$$
$$20 = 20 \quad \text{True}$$

10.
$$5x = 50$$
$$\frac{5x}{5} = \frac{50}{5}$$
$$x = 10$$

Check: $5x = 50$
$$5(10) = 50$$
$$50 = 50 \quad \text{True}$$

11.
$$-4x = 12$$
$$\frac{-4x}{-4} = \frac{12}{-4}$$
$$x = -3$$

Check: $-4x = 12$
$$-4(-3) = 12$$
$$12 = 12 \quad \text{True}$$

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12. $-6x = 30$

$$\frac{-6x}{-6} = \frac{30}{-6}$$

$$x = -5$$

Check: $-6x = 30$

$$-6(-5) = 30$$

$$30 = 30 \text{ True}$$

13. $\frac{x}{3} = 7$

$$3\left(\frac{x}{3}\right) = 3(7)$$

$$x = 21$$

Check: $\frac{x}{3} = 7$

$$\frac{21}{3} = 7$$

$$7 = 7 \text{ True}$$

14. $\frac{y}{5} = 3$

$$5\left(\frac{y}{5}\right) = 5(3)$$

$$y = 15$$

Check: $\frac{y}{5} = 3$

$$\frac{15}{5} = 3$$

$$3 = 3 \text{ True}$$

15. $\frac{x}{4} = -20$

$$4\left(\frac{x}{4}\right) = 4(-20)$$

$$x = 4(-20)$$

$$x = -80$$

Check: $\frac{x}{4} = -20$

$$\frac{-80}{4} = -20$$

$$-20 = -20 \text{ True}$$

16. $\frac{x}{3} = -3$

$$3\left(\frac{x}{3}\right) = 3(-3)$$

$$x = -9$$

Check: $\frac{x}{3} = -3$

$$\frac{-9}{3} = -3$$

$$-3 = -3 \text{ True}$$

17. $\frac{x}{7} = -3$

$$7\left(\frac{x}{7}\right) = 7(-3)$$

$$x = -21$$

Check: $\frac{x}{7} = -3$

$$\frac{-21}{7} = -3$$

$$-3 = -3 \text{ True}$$

18. $\frac{x}{8} = -3$

$$8\left(\frac{x}{8}\right) = 8(-3)$$

$$x = -24$$

Check: $\frac{x}{8} = -3$

$$\frac{-24}{8} = -3$$

$$-3 = -3 \text{ True}$$

19. $-7t = 49$

$$\frac{-7t}{-7} = \frac{49}{-7}$$

$$t = -7$$

Check: $-7t = 49$

$$-7(-7) = 49$$

$$49 = 49 \text{ True}$$

20. $-27n = 81$

$$\frac{-27n}{-27} = \frac{81}{-27}$$

$$n = -3$$

Check: $-27n = 81$

$$-27(-3) = 81$$

$$81 = 81 \text{ True}$$

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21. $7 = 3r$

$\frac{-7}{3} = \frac{3r}{3}$

$-\frac{7}{3} = r$

Check: $-7 = 3r$

$-7 = 3\left(-\frac{7}{3}\right)$

$-7 = -7$ True

22. $17 = -3z$

$\frac{17}{-3} = \frac{-3z}{-3}$

$-\frac{17}{3} = z$

Check: $17 = -3z$

$17 = -3\left(-\frac{17}{3}\right)$

$17 = 17$ True

23. $-x = 13$

$-1x = 13$

$(-1)(-1x) = (-1)(13)$

$1x = -13$

$x = -13$

Check: $-x = 13$

$-(-13) = 13$

$13 = 13$ True

24. $-x = 9$

$-1x = 9$

$(-1)(-1x) = (-1)(9)$

$1x = -9$

$x = -9$

Check: $-x = 9$

$-(-9) = 9$

$9 = 9$ True

25. $-x = -8$

$-1x = -8$

$(-1)(-1x) = (-1)(-8)$

$1x = 8$

$x = 8$

Check: $-x = -8$

$-8 = -8$ True

26. $-x = -15$

$-1x = -15$

$(-1)(-1x) = (-1)(-15)$

$1x = 15$

$x = 15$

Check: $-x = -15$

$-15 = -15$ True

27. $-\frac{w}{3} = -10$

$\frac{w}{-3} = -10$

$(-3)\left(\frac{w}{-3}\right) = (-3)(-10)$

$w = 30$

Check: $-\frac{w}{3} = -10$

$-\frac{30}{3} = -10$

$-10 = -10$ True

28. $-\frac{v}{5} = -8$

$-5\left(-\frac{v}{5}\right) = -5(-8)$

$v = 40$

Check: $-\frac{v}{5} = -8$

$-\frac{40}{5} = -8$

$-8 = -8$ True

29. $4 = -12x$

$\frac{4}{-12} = \frac{-12x}{-12}$

$-\frac{1}{3} = x$

Check: $4 = -12x$

$4 = -12\left(-\frac{1}{3}\right)$

$4 = 4$ True

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30. $7 = -28x$

$$\frac{7}{-28} = \frac{-28x}{-28}$$

$$-\frac{1}{4} = x$$

Check: $7 = -28x$

$$7 = -28\left(-\frac{1}{4}\right)$$

$7 = 7$ True

31. $-\frac{x}{3} = -2$

$$\frac{x}{-3} = -2$$

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

$x = 6$

Check: $-\frac{x}{3} = -2$

$$-\frac{6}{3} = -2$$

$-2 = -2$ True

32. $-\frac{a}{8} = -7$

$$\frac{a}{-8} = -7$$

$$(-8)\left(\frac{a}{-8}\right) = (-8)(-7)$$

$a = 56$

Check: $-\frac{a}{8} = -7$

$$-\frac{56}{8} = -7$$

$-7 = -7$ True

33. $43t = 26$

$$\frac{43t}{43} = \frac{26}{43}$$

$$t = \frac{26}{43}$$

Check: $43t = 26$

$$43\left(\frac{26}{43}\right) = 26$$

$26 = 26$ True

34. $29 = 37u$

$$\frac{29}{37} = \frac{37u}{37}$$

$$\frac{29}{37} = u$$

Check: $29 = 37u$

$$29 = 37\left(\frac{29}{37}\right)$$

$29 = 29$ True

35. $-35 = -45y$

$$\frac{-35}{-45} = \frac{-45y}{-45}$$

$$\frac{7}{9} = y$$

Check: $-35 = -45y$

$$-35 = -45\left(\frac{7}{9}\right)$$

$$-35 = \frac{-315}{9}$$

$-35 = -35$ True

36. $-24x = -18$

$$\frac{-24x}{-24} = \frac{-18}{-24}$$

$$x = \frac{3}{4}$$

Check: $-24x = -18$

$$-24\left(\frac{3}{4}\right) = -18$$

$-18 = -18$ True

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37. $3x = \frac{3}{5}$

$\frac{1}{3} \cdot 3x = \frac{1}{3} \cdot \frac{3}{5}$

$x = \frac{1}{1} \cdot \frac{1}{5}$

$x = \frac{1 \cdot 1}{1 \cdot 5}$

$x = \frac{1}{5}$

Check: $3x = \frac{3}{5}$

$3\left(\frac{1}{5}\right) = \frac{3}{5}$

$\frac{3}{5} = \frac{3}{5}$ True

38. $4z = \frac{4}{7}$

$\frac{4z}{4} = \frac{4}{7}\left(\frac{1}{4}\right)$

$z = \frac{4}{28}$

$z = \frac{1}{7}$

Check: $4z = \frac{4}{7}$

$4\left(\frac{1}{7}\right) = \frac{4}{7}$

$\frac{4}{7} = \frac{4}{7}$ True

39. $5x = -\frac{3}{8}$

$\frac{1}{5} \cdot 5x = \left(\frac{1}{5}\right) \cdot \left(-\frac{3}{8}\right)$

$x = \frac{1(-3)}{5(8)}$

$x = -\frac{3}{40}$

Check: $5x = -\frac{3}{8}$

$5\left(-\frac{3}{40}\right) = -\frac{3}{8}$

$-\frac{3}{8} = -\frac{3}{8}$ True

40. $7x = -\frac{5}{9}$

$\left(\frac{1}{7}\right)(7x) = \left(\frac{1}{7}\right)\left(-\frac{5}{9}\right)$

$x = \frac{1}{7} \cdot \frac{-5}{9}$

$x = \frac{1 \cdot -5}{7 \cdot 9}$

$x = -\frac{5}{63}$

Check: $7x = -\frac{5}{9}$

$7\left(-\frac{5}{63}\right) = -\frac{5}{9}$

$-\frac{35}{63} = -\frac{5}{9}$

$-\frac{5}{9} = -\frac{5}{9}$ True

41. $16 = -\frac{x}{4}$

$16 = \frac{x}{-4}$

$(-4)(16) = (-4) \cdot \left(\frac{x}{-4}\right)$

$-64 = x$

Check: $16 = -\frac{x}{4}$

$16 = -\frac{(-64)}{4}$

$16 = 16$ True

42. $25 = -\frac{a}{5}$

$25(-5) = -\frac{a}{5}(-5)$

$-125 = a$

Check: $25 = -\frac{a}{5}$

$25 = -\frac{(-125)}{5}$

$25 = 25$ True

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43. $-\frac{b}{4}=-60$

$\frac{b}{-4}=-60$

$-4\left(\frac{b}{-4}\right)=(-4)(-60)$

$b=240$

Check: $-\frac{b}{4}=-60$

$-\frac{240}{4}=-60$

$-60=-60$ True

44. $-\frac{c}{6}=30$

$-\frac{c}{6}(-6)=30(-6)$

$c=-180$

Check: $-\frac{c}{6}=30$

$-\frac{(-180)}{6}=30$

$30=30$ True

45. $\frac{x}{5}=-9$

$5\left(\frac{x}{5}\right)=5(-9)$

$x=-45$

Check: $\frac{x}{5}=-9$

$\frac{-45}{5}=-9$

$-9=-9$ True

46. $\frac{d}{7}=-8$

$\frac{d}{7}(7)=-8(7)$

$d=-56$

Check: $\frac{d}{7}=-8$

$\frac{-56}{7}=-8$

$-8=-8$ True

47. $\frac{2}{3}x=10$

$\frac{3}{2}\left(\frac{2}{3}x\right)=\frac{3}{2}(10)$

$x=\frac{30}{2}$

$x=15$

Check: $\frac{2}{3}x=10$

$\frac{2}{3}(15)=10$

$\frac{30}{3}=10$

$10=10$ True

48. $\frac{5}{7}x=20$

$\frac{7}{5}\left(\frac{5}{7}x\right)=\frac{7}{5}(20)$

$x=\frac{140}{5}$

$x=28$

Check: $\frac{5}{7}x=20$

$\frac{5}{7}(28)=20$

$\frac{140}{7}=20$

$20=20$ True

49. $\frac{3}{5}d=-30$

$\frac{5}{3}\cdot\frac{3}{5}d=\frac{5}{3}(-30)$

$d=-50$

Check: $\frac{3}{5}d=-30$

$\frac{3}{5}(-50)=-30$

$-30=-30$ True

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50. $\frac{5}{8}a = -45$

$\frac{8}{5}\left(\frac{5}{8}a\right) = \frac{8}{5}(-45)$

$a = \frac{-360}{5}$

$a = -72$

Check: $\frac{5}{8}a = -45$

$\frac{5}{8}(-72) = -45$

$\frac{-360}{8} = -45$

$-45 = -45$ True

51. $9x = 0$

$\frac{9x}{9} = \frac{0}{9}$

$x = 0$

Check: $9x = 0$

$(0)x = 0$

$0 = 0$ True

52. $-7x = 0$

$\frac{-7x}{-7} = \frac{0}{-7}$

$x = 0$

Check: $-7x = 0$

$-7(0) = 0$

$0 = 0$ True

53. $\frac{-7}{8}w = 0$

$\frac{8}{-7}\left(\frac{-7}{8}w\right) = \frac{8}{-7}\cdot 0$

$w = 0$

Check: $\frac{-7}{8}w = 0$

$\frac{-7}{8}(0) = 0$

$0 = 0$ True

54. $\frac{9}{-13}z = 0$

$\frac{-13}{9}\left(\frac{9}{-13}\right)z = \frac{-13}{9}(0)$

$z = 0$

Check: $\frac{9}{-13}z = 0$

$\frac{9}{-13}(0) = 0$

$0 = 0$ True

55. $\frac{1}{5}x = 4.5$

$5\left(\frac{1}{5}x\right) = 5(4.5)$

$x = 22.5$

Check: $\frac{1}{5}x = 4.5$

$\frac{1}{5}(22.5) = 4.5$

$4.5 = 4.5$ True

56. $-\frac{1}{5}x = 3.7$

$-5\left(-\frac{1}{5}x\right) = -5(3.7)$

$x = -18.5$

Check: $-\frac{1}{5}x = 3.7$

$-\frac{1}{5}(-18.5) = 3.7$

$3.7 = 3.7$ True

57. $-4 = -\frac{2}{3}z$

$\left(-\frac{3}{2}\right)(-4) = \left(-\frac{3}{2}\right)\left(-\frac{2}{3}\right)z$

$6 = z$

Check: $-4 = -\frac{2}{3}z$

$-4 = -\frac{2}{3}\cdot 6$

$-4 = -4$ True

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58. $-9 = \frac{-5}{3}n$

$\left(\frac{3}{-5}\right)(-9) = \left(\frac{3}{-5}\right)\left(\frac{-5}{3}\right)n$

$\frac{27}{5} = n$

Check: $-9 = \frac{-5}{3}n$

$-9 = \frac{-5}{3} \cdot \frac{27}{5}$

$-9 = -9$ True

59. $-1.4x = 28.28$

$\frac{-1.4x}{-1.4} = \frac{28.28}{-1.4}$

$x = -20.2$

Check: $-1.4x = 28.28$

$-1.4(-20.2) = 28.28$

$28.28 = 28.28$ True

60. $-0.42x = -2.142$

$\frac{-0.42x}{-0.42} = \frac{-2.142}{-0.42}$

$x = 5.1$

Check: $-0.42x = -2.142$

$-0.42(5.1) = -2.142$

$-2.142 = 2.142$ True

61. $-8x = -56$

$x = \frac{-56}{-8}$

$x = 7$

Check: $-8x = -56$

$-8(7) = -56$

$-56 = -56$ True

62. $-9x = -45$

$x = \frac{-45}{-9}$

$x = 5$

Check: $-9x = -45$

$-9(5) = -45$

$-45 = -45$

63. $\frac{2}{3}x = 6$

$x = \frac{3}{2} \cdot 6$

$x = 9$

Check: $\frac{2}{3}x = 6$

$\frac{2}{3}(9) = 6$

$6 = 6$ True

64. $\frac{3}{4}k = 9$

$\frac{4}{3}\left(\frac{3}{4}\right)k = \frac{4}{3}(9)$

$k = 12$

Check: $\frac{3}{4}k = 9$

$\frac{3}{4}(12) = 9$

$9 = 9$ True

65. a. In $5 + x = 10$, 5 is added to the variable, whereas in $5x = 10$, 5 is multiplied by the variable.

b. $5x = 10$

$5 + x - 5 = 10 - 5$

$x = 5$

c. $5x = 10$

$\frac{5x}{5} = \frac{10}{5}$

$x = 2$

66. a. In $3 + x = 6$, 3 is added to the variable, whereas in $3x = 6$, 3 is multiplied by the variable.

b. $3 + x = 6$

$3 + x - 3 = 6 - 3$

$x = 3$

c. $3x = 6$

$\frac{3x}{3} = \frac{6}{3}$

$x = 2$

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67. Multiplying by $\frac{3}{2}$ is easier because the equation involves fractions.

$$\frac{2}{3}x = 4$$

$$\left(\frac{3}{2}\right)\left(\frac{2}{3}\right)x = \left(\frac{3}{2}\right)\left(\frac{4}{1}\right)$$

$$x = \frac{12}{2}$$

$$x = 6$$

68. Multiplying by $\frac{1}{4}$ is easier because the equation involves a fraction.

$$4x = \frac{3}{5}$$

$$\left(\frac{1}{4}\right)4x = \left(\frac{1}{4}\right)\frac{3}{5}$$

$$x = \frac{3}{20}$$

69. Multiplying by $\frac{7}{3}$ is easier because the equation involves fractions.

$$\frac{3}{7}x = \frac{4}{5}$$

$$\left(\frac{7}{3}\right)\frac{3}{7}x = \left(\frac{7}{3}\right)\frac{4}{5}$$

$$x = \frac{28}{15}$$

70. a. ⊙

b. Divide both sides of the equation by □.

c. $\odot = \frac{\Delta}{\square}$

71. a. ⊡

b. Divide both sides of the equation by Δ.

c. $\boxdot = \frac{\text{☺}}{\Delta}$

72. a. ☺

b. Multiply both sides of the equation by △.

c. $\# = \frac{\text{☺}}{\Delta}$

$$\Delta \cdot \# = \Delta \cdot \frac{\text{☺}}{\Delta}$$

$$\Delta \# = \text{☺}$$

73. $-8-(-4) = -8+4$

$= -4$

74. $(-3)(-2)(5)(-1) = 6(5)(-1)$

$= 30(-1)$

$= -30$

75. $4^2 - 2^3 \cdot 6 \div 3 + 6 = 16 - 8 \cdot 6 \div 3 + 6$

$= 16 - 48 \div 3 + 6$

$= 16 - 16 + 6$

$= 0 + 6$

$= 6$

76. Associative property of addition

77. $-48 = x + 9$

$-48 - 9 = x + 9 - 9$

$-57 = x + 0$

$-57 = x$

Exercise Set 2.4

1. The multiplication property of equality allows us to multiply or divide both sides of an equation by the same nonzero number.

2. The addition property of equality allows us to add or subtract the same number from both sides of an equation.

3. In the equation $0.5x - 1.2 = 1.8$ we can eliminate the decimal numbers by multiplying both sides of the equation by 10.

4. In the equation $0.02x + 175 = 335.25$ we can eliminate the decimal numbers by multiplying both sides of the equation by 100.

5. We can eliminate fractions from an equation by multiplying *both* sides of the equation by the least common denomination (LCD) of the fractions within the equation.

6. In the equation $\frac{2}{3}x - \frac{5}{8} = \frac{5}{6}$ we can eliminate the decimal numbers by multiplying both sides of the equation by 24.

7. $3x + 6 = 12$

$3x + 6 - 6 = 12 - 6$

$3x = 6$

$\frac{3x}{3} = \frac{6}{3}$

$x = 2$

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8. $2x+9=21$

$2x+9-9=21-9$

$2x=12$

$\frac{2x}{2}=\frac{12}{2}$

$x=6$

9. $5x-6=19$

$5x-6+6=19+6$

$5x=25$

$\frac{5x}{5}=\frac{25}{5}$

$x=5$

10. $2t-4=8$

$2t-4+4=8+4$

$2t=12$

$\frac{2t}{2}=\frac{12}{2}$

$t=6$

11. $-4w-9=11$

$-4w-9+9=11+9$

$-4w=20$

$\frac{-4w}{-4}=\frac{20}{-4}$

$w=-5$

12. $-5c-7=8$

$-5c-7+7=8+7$

$-5c=15$

$\frac{-5c}{-5}=\frac{15}{-5}$

$c=-3$

13. $5x-2=10$

$5x-2+2=10+2$

$5x=12$

$\frac{5x}{5}=\frac{12}{5}$

$x=\frac{12}{5}$

14. $3y-5=9$

$3y-5+5=9+5$

$3y=14$

$\frac{3y}{3}=\frac{14}{3}$

$y=\frac{14}{3}$

15. $-5k-9=-19$

$-5k-9+9=-19+9$

$-5k=-10$

$\frac{-5k}{-5}=\frac{-10}{-5}$

$k=2$

16. $-7z-6=-20$

$-7z-6+6=-20+6$

$-7z=-14$

$\frac{-7z}{-7}=\frac{-14}{-7}$

$z=2$

17. $12-x=5$

$12-12-x=5-12$

$-x=-7$

$(-1)(-x)=(-1)(-7)$

$x=7$

18. $-13-x=8$

$-13+13-x=8+13$

$-x=21$

$-1(-x)=-1(21)$

$x=-21$

19. $8+3x=19$

$8-8+3x=19-8$

$3x=11$

$\frac{3x}{3}=\frac{11}{3}$

$x=\frac{11}{3}$

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20.
$$5+8x=18$$
$$5-5+8x=18-5$$
$$8x=13$$
$$\frac{8x}{8}=\frac{13}{8}$$
$$x=\frac{13}{8}$$

21.
$$16x+5=-14$$
$$16x+5-5=-14-5$$
$$16x=-19$$
$$\frac{16x}{16}=\frac{-19}{16}$$
$$x=-\frac{19}{16}$$

22.
$$13x-8=-27$$
$$13x-8+8=-27+8$$
$$13x=-19$$
$$\frac{13x}{13}=\frac{-19}{13}$$
$$x=-\frac{19}{13}$$

23.
$$-9+5x=-9$$
$$-9+9+5x=-9+9$$
$$5x=0$$
$$\frac{5x}{5}=\frac{0}{5}$$
$$x=0$$

24.
$$-24+16x=-24$$
$$-24+24+16x=-24+24$$
$$16x=0$$
$$\frac{16x}{16}=\frac{0}{16}$$
$$x=0$$

25.
$$7r-16=-2$$
$$7r-16+16=-2+16$$
$$7r=14$$
$$\frac{7r}{7}=\frac{14}{7}$$
$$r=2$$

26.
$$-2w+4=-8$$
$$-2w+4-4=-8-4$$
$$-2w=-12$$
$$\frac{-2w}{-2}=\frac{-12}{-2}$$
$$w=6$$

27.
$$60=-5s+9$$
$$60-9=-5s+9-9$$
$$51=-5s$$
$$\frac{51}{-5}=\frac{-5s}{-5}$$
$$-\frac{51}{5}=s$$

28.
$$45=-6v-8$$
$$45+8=-6v-8+8$$
$$53=-6v$$
$$\frac{53}{-6}=\frac{-6v}{-6}$$
$$-\frac{53}{6}=v$$

29.
$$14=5x+8-3x$$
$$14=5x-3x+8$$
$$14=2x+8$$
$$14-8=2x+8-8$$
$$6=2x$$
$$\frac{6}{2}=\frac{2x}{2}$$
$$3=x$$

30.
$$15=6x-3+3x$$
$$15=6x+3x-3$$
$$15=9x-3$$
$$15+3=9x-3+3$$
$$18=9x$$
$$\frac{18}{9}=\frac{9x}{9}$$
$$2=x$$

31.
$$2.3x-9.34=6.3$$
$$2.3x-9.34+9.34=6.3+9.34$$
$$2.3x=15.64$$
$$\frac{2.3x}{2.3}=\frac{15.64}{2.3}$$
$$x=6.8$$

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32.
$$1.5q - 1.05 = 3.9$$
$$1.5q - 1.05 + 1.05 = 3.9 + 1.05$$
$$1.5q = 4.95$$
$$\frac{1.5q}{1.5} = \frac{4.95}{1.5}$$
$$q = 3.3$$

33.
$$x + 0.07x = 16.05$$
$$1.07x = 16.05$$
$$\frac{1.07x}{1.07} = \frac{16.05}{1.07}$$
$$x = 15$$

34.
$$x + 0.08x = 17.28$$
$$1.08x = 17.28$$
$$\frac{1.08x}{1.08} = \frac{17.28}{1.08}$$
$$x = 16$$

35.
$$0.91y + 2.25 - 0.01y = 5.85$$
$$0.91y - 0.01y + 2.25 = 5.85$$
$$0.90y + 2.25 = 5.85$$
$$0.90y + 2.25 - 2.25 = 5.85 - 2.25$$
$$0.90y = 3.60$$
$$\frac{0.90y}{0.90} = \frac{3.60}{0.90}$$
$$y = 4$$

36.
$$0.15 = 0.05x - 1.35 - 0.20x$$
$$0.15 = 0.05x - 0.20x - 1.35$$
$$0.15 = -0.15x - 1.35$$
$$0.15 + 1.35 = -0.15x - 1.35 + 1.35$$
$$1.50 = -0.15x$$
$$\frac{1.50}{-0.15} = \frac{-0.15x}{-0.15}$$
$$-10 = x$$

37.
$$\frac{1}{7}(x+6) = 4$$
$$7\left[\frac{1}{7}(x+6)\right] = 7(4)$$
$$x + 6 = 28$$
$$x + 6 - 6 = 28 - 6$$
$$x = 22$$

38.
$$\frac{1}{5}(x+2) = -3$$
$$5\left[\frac{1}{5}(x+2)\right] = 5(-3)$$
$$x + 2 = -15$$
$$x + 2 - 2 = -15 - 2$$
$$x = -17$$

39.
$$\frac{d+3}{7} = 9$$
$$7\left(\frac{d+3}{7}\right) = 7(9)$$
$$d + 3 = 63$$
$$d + 3 - 3 = 63 - 3$$
$$d = 60$$

40.
$$\frac{m-6}{5} = 2$$
$$5\left(\frac{m-6}{5}\right) = 5(2)$$
$$m - 6 = 10$$
$$m - 6 + 6 = 10 + 6$$
$$m = 16$$

41.
$$\frac{1}{3}(t-7) = -7$$
$$3\left[\frac{1}{3}(t-7)\right] = 3(-7)$$
$$t - 7 = -21$$
$$t - 7 + 7 = -21 + 7$$
$$t = -14$$

42.
$$\frac{1}{5}(u-9) = -7$$
$$\frac{5}{1}\left[\frac{1}{5}(u-9)\right] = 5(-7)$$
$$u - 9 = -35$$
$$u - 9 + 9 = -35 + 9$$
$$u = -26$$

43.
$$\frac{3}{4}(x-5) = -12$$
$$\frac{4}{3}\left[\frac{3}{4}(x-5)\right] = \frac{4}{3}(-12)$$
$$x - 5 = -16$$
$$x - 5 + 5 = -16 + 5$$
$$x = -11$$

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44. $\frac{2}{3}(n-3)=8$

$\frac{3}{2}\left[\frac{2}{3}(n-3)\right]=\frac{3}{2}(8)$

$n-3=12$

$n-3+3=12+3$

$n=15$

45. $-\frac{3}{4}(k+5)=9$

$-\frac{4}{3}\left[-\frac{3}{4}(k+5)\right]=-\frac{4}{3}(9)$

$k+5=\frac{-36}{3}$

$k+5-5=-12-5$

$k=-17$

46. $-\frac{5}{8}(x+3)=10$

$-\frac{8}{5}\left[-\frac{5}{8}(x+3)\right]=-\frac{8}{5}(10)$

$x+3=-16$

$x+3-3=-16-3$

$x=-19$

47. $\frac{x+4}{7}=\frac{2}{7}$

$7\left(\frac{x+4}{7}\right)=7\left(\frac{2}{7}\right)$

$x+4=2$

$x+4-4=2-4$

$x=-2$

48. $\frac{y-3}{8}=\frac{7}{8}$

$8\left(\frac{y-3}{8}\right)=8\left(\frac{7}{8}\right)$

$y-3=7$

$y-3+3=7+3$

$y=10$

49. $\frac{3}{4}=\frac{4m-5}{6}$

$12\left(\frac{3}{4}\right)=12\left(\frac{4m-5}{6}\right)$

$9=2(4m-5)$

$9=8m-10$

$9+10=8m-10+10$

$19=8m$

$\frac{19}{8}=\frac{8m}{8}$

$\frac{19}{8}=m$

50. $\frac{5}{6}=\frac{5t-4}{2}$

$6\left(\frac{5}{6}\right)=6\left(\frac{5t-4}{2}\right)$

$5=3(5t-4)$

$5=15t-12$

$5+12=15t-12+12$

$17=15t$

$\frac{17}{15}=\frac{15t}{15}$

$\frac{17}{15}=t$

51. $7(x-1)=14$

$\frac{7(x-1)}{7}=\frac{14}{7}$

$x+-1+1=2+1$

$x=3$

52. $3(x-2)=12$

$3x-6=12$

$3x-6+6=12+6$

$3x=18$

$\frac{3x}{3}=\frac{18}{3}$

$x=6$

53. $-2(x-3)=26$

$-2x+6=26$

$-2x+6-6=26-6$

$-2x=20$

$\frac{-2x}{-2}=\frac{20}{-2}$

$x=-10$

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54. $-3(x-5)=42$

$$\frac{-3(x-5)}{-3}=\frac{42}{-3}$$
$$x-5+5=-14+5$$
$$x=-9$$

55. $-4=-(x+7)$

$$-4=-x-7$$
$$-4+7=-x-7+7$$
$$3=-x$$
$$(-1)(3)=(-1)(-x)$$
$$-3=x$$

56. $-7=-(x-5)$

$$-7=-x+5$$
$$-7-5=-x+5-5$$
$$-12=-x$$
$$(-1)(-12)=(-1)(-x)$$
$$12=x$$

57. $12=4(x-3)$

$$12=4x-12$$
$$12+12=4x-12+12$$
$$24=4x$$
$$\frac{24}{4}=\frac{4x}{4}$$
$$6=x$$

58. $9=-2(a-3)$

$$9=-2a+6$$
$$9-6=-2a+6-6$$
$$3=-2a$$
$$\frac{3}{-2}=\frac{-2a}{-2}$$
$$-\frac{3}{2}=a$$

59. $2x-3(x+5)=6$

$$2x-3x-15=6$$
$$-x-15=6$$
$$-x-15+15=6+15$$
$$-x=21$$
$$x=-21$$

60. $-2(x+8)-5=1$

$$-2x-16-5=1$$
$$-2x-21=1$$
$$-2x-21+21=1+21$$
$$-2x=22$$
$$\frac{-2x}{-2}=\frac{22}{-2}$$
$$x=-11$$

61. $-2q-5(q-7)=13$

$$-2q-5q+35=13$$
$$-7q+35-35=13-35$$
$$-7q=-22$$
$$\frac{-7q}{-7}=\frac{-22}{-7}$$
$$q=\frac{22}{7}$$

62. $-3r-4(r+2)=11$

$$-3r-4r-8=11$$
$$-7r-8=11$$
$$-7r-8+8=11+8$$
$$-7r=19$$
$$\frac{-7r}{-7}=\frac{19}{-7}$$
$$r=-\frac{19}{7}$$

63. $5x+3x-4x-7=9$

$$4x-7=9$$
$$4x-7+7=9+7$$
$$4x=16$$
$$\frac{4x}{4}=\frac{16}{4}$$
$$x=4$$

64. $-7x+4x-2x+11=26$

$$-5x+11=26$$
$$-5x+11-11=26-11$$
$$-5x=15$$
$$\frac{-5x}{-5}=\frac{15}{-5}$$
$$x=-3$$

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65. $0.7(x-3)=1.4$
$0.7x-2.1=1.4$
$0.7x-2.1+2.1=1.4+2.1$
$0.7x=3.5$
$\frac{0.7x}{0.7}=\frac{3.5}{0.7}$
$x=5$

66. $-0.5(x+9)=-6.5$
$\frac{-0.5(x+9)}{-0.5}=\frac{-6.5}{-0.5}$
$x+9=13$
$x+9-9=13-9$
$x=4$

67. $2.5(4q-3)=0.5$
$10q-7.5=0.5$
$10q-7.5+7.5=0.5+7.5$
$10q=8$
$\frac{10q}{10}=\frac{8}{10}$
$q=0.8$

68. $0.15(6r-1)=4.8$
$0.9r-0.15=4.8$
$0.9r-0.15+0.15=4.8+0.15$
$0.9r=4.95$
$\frac{0.9r}{0.9}=\frac{4.95}{0.9}$
$r=5.5$

69. $3-2(x+3)+2=1$
$3-2x-6+2=1$
$-2x+3-6+2=1$
$-2x-1=1$
$-2x-1+1=1+1$
$-2x=2$
$\frac{-2x}{-2}=\frac{2}{-2}$
$x=-1$

70. $7-3(x-4)+5=36$
$7-3x+12+5=36$
$-3x+7+12+5=36$
$-3x+24=36$
$-3x+24-24=36-24$
$-3x=12$
$\frac{-3x}{-3}=\frac{12}{-3}$
$x=-4$

71. $3-(c-5)+7c=13$
$3-c+5+7c=13$
$3+5-c+7c=13$
$8-8+6c=13-8$
$\frac{6c}{6}=\frac{5}{6}$
$c=\frac{5}{6}$

72. $6-(x-4)+5x=13$
$6-x+4+5x=13$
$-x+5x+6+4=13$
$4x+10=13$
$4x+10-10=13-10$
$4x=3$
$\frac{4x}{4}=\frac{3}{4}$
$x=\frac{3}{4}$

73. $4.85-6.4x+1.11=25.8$
$-6.4x+4.85+1.11=25.8$
$-6.4x+5.96=25.8$
$-6.4x+5.96-5.96=25.8-5.96$
$-6.4x=19.84$
$\frac{-6.4x}{-6.4}=\frac{19.84}{-6.4}$
$x=-3.1$

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74.
$$\begin{aligned} 3.68-1.6x+5.32&=11.4\\ -1.6x+3.68+5.32&=11.4\\ -1.6x+9&=11.4\\ -1.6x+9-9&=11.4-9\\ -1.6x&=2.4\\ \frac{-1.6x}{-1.6}&=\frac{2.4}{-1.6}\\ x&=1.5 \end{aligned}$$

75.
$$\begin{aligned} 7&=8-5(m+3)\\ 7&=8-5m-15\\ 7&=-5m-7\\ 7+7&=-5m-7+7\\ 14&=-5m\\ \frac{14}{-5}&=\frac{-5m}{-5}\\ -\frac{14}{5}&=m \end{aligned}$$

76.
$$\begin{aligned} 16&=-5+4(j+7)\\ 16&=-5+4j+28\\ 16&=4j+28-5\\ 16&=4j+23\\ 16-23&=4j+23-23\\ -7&=4j\\ \frac{-7}{4}&=\frac{4j}{4}\\ -\frac{7}{4}&=j \end{aligned}$$

77.
$$\begin{aligned} 9&=\frac{2s+9}{5}\\ 5(9)&=5\left(\frac{2s+9}{5}\right)\\ 45&=2s+9\\ 45-9&=2s+9-9\\ 36&=2s\\ \frac{36}{2}&=\frac{2s}{2}\\ 18&=s \end{aligned}$$

78.
$$\begin{aligned} 12&=\frac{4d-1}{3}\\ 3(12)&=3\left(\frac{4d-1}{3}\right)\\ 36&=4d-1\\ 36+1&=4d-1+1\\ 37&=4d\\ \frac{37}{4}&=\frac{4d}{4}\\ \frac{37}{4}&=d \end{aligned}$$

79.
$$\begin{aligned} x+\frac{2}{3}&=\frac{3}{5}\\ 15\left(x+\frac{2}{3}\right)&=15\left(\frac{3}{5}\right)\\ 15x+10&=9\\ 15x+10-10&=9-10\\ 15x&=-1\\ \frac{15x}{15}&=\frac{-1}{15}\\ x&=-\frac{1}{15} \end{aligned}$$

80.
$$\begin{aligned} n-\frac{1}{4}&=\frac{1}{2}\\ 4\left(n-\frac{1}{4}\right)&=4\left(\frac{1}{2}\right)\\ 4n-1&=2\\ 4n-1+1&=2+1\\ 4n&=3\\ \frac{4n}{4}&=\frac{3}{4}\\ n&=\frac{3}{4} \end{aligned}$$

81.
$$\begin{aligned} \frac{r}{3}+2r&=6\\ 3\left(\frac{r}{3}+2r\right)&=3(6)\\ r+6r&=18\\ 7r&=18\\ \frac{7r}{7}&=\frac{18}{7}\\ r&=\frac{18}{7} \end{aligned}$$

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82. $\frac{x}{4}-6x=23$

$4\left(\frac{x}{4}-6x\right)=4(23)$

$x-24x=92$

$-23x=92$

$\frac{-23x}{-23}=\frac{92}{-23}$

$x=-4$

83. $\frac{3}{7}=\frac{3t}{4}+1$

$28\left(\frac{3}{7}\right)=28\left(\frac{3t}{4}+1\right)$

$12=21t+28$

$12-28=21t+28-28$

$-16=21t$

$\frac{-16}{21}=\frac{21t}{21}$

$-\frac{16}{21}=t$

84. $\frac{5}{8}=\frac{5t}{6}+2$

$24\left(\frac{5}{8}\right)=24\left(\frac{5t}{6}+2\right)$

$15=20t+48$

$15-48=20t+48-48$

$-33=20t$

$\frac{-33}{20}=\frac{20t}{20}$

$-\frac{33}{20}=t$

85. $\frac{1}{2}r+\frac{1}{5}r=7$

$10\left(\frac{1}{2}r+\frac{1}{5}r\right)=10(7)$

$5r+2r=70$

$7r=70$

$\frac{7r}{7}=\frac{70}{7}$

$r=10$

86. $\frac{1}{3}s-\frac{1}{5}s=6$

$\frac{5}{15}s-\frac{3}{15}s=6$

$\frac{2}{15}s=6$

$\frac{15}{2}\left(\frac{2}{15}s\right)=\frac{15}{2}(6)$

$s=\frac{90}{2}$

$s=45$

87. $\frac{x}{3}-\frac{3x}{4}=\frac{1}{12}$

$12\left(\frac{x}{3}-\frac{3x}{4}\right)=12\left(\frac{1}{12}\right)$

$4x-9x=1$

$-5x=1$

$\frac{-5x}{-5}=\frac{1}{-5}$

$x=-\frac{1}{5}$

88. $\frac{x}{4}-\frac{x}{6}=\frac{1}{4}$

$12\left(\frac{x}{4}-\frac{x}{6}\right)=12\left(\frac{1}{4}\right)$

$3x-2x=3$

$x=3$

89. $\frac{1}{2}x+5=\frac{1}{8}$

$8\left(\frac{1}{2}x+5\right)=8\left(\frac{1}{8}\right)$

$4x+40=1$

$4x+40-40=1-40$

$4x=-39$

$\frac{4x}{4}=\frac{-39}{4}$

$x=-\frac{39}{4}$

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90.
$$\frac{4}{5}+n=\frac{1}{3}$$
$$15\left(\frac{4}{5}+n\right)=15\left(\frac{1}{3}\right)$$
$$12+15n=5$$
$$12-12+15n=5-12$$
$$15n=-7$$
$$\frac{15n}{15}=\frac{-7}{15}$$
$$n=-\frac{7}{15}$$

91.
$$\frac{4}{5}s-\frac{3}{4}s=\frac{1}{10}$$
$$20\left(\frac{4}{5}s-\frac{3}{4}s\right)=20\left(\frac{1}{10}\right)$$
$$16s-15s=2$$
$$s=2$$

92.
$$\frac{7}{8}t-\frac{2}{3}t=\frac{5}{12}$$
$$24\left(\frac{7}{8}t-\frac{2}{3}t\right)=24\left(\frac{5}{12}\right)$$
$$21t-16t=10$$
$$5t=10$$
$$\frac{5t}{5}=\frac{10}{5}$$
$$t=2$$

93.
$$\frac{4}{9}=\frac{1}{3}(n-7)$$
$$\frac{4}{9}=\frac{1}{3}n-\frac{7}{3}$$
$$9\left(\frac{4}{9}\right)=9\left(\frac{1}{3}n-\frac{7}{3}\right)$$
$$4=3n-21$$
$$4+21=3n-21+21$$
$$25=3n$$
$$\frac{25}{3}=\frac{3n}{3}$$
$$\frac{25}{3}=n$$

94.
$$-\frac{7}{16}=\frac{3}{8}(h+5)$$
$$-\frac{7}{16}=\frac{3}{8}h+\frac{15}{8}$$
$$16\left(-\frac{7}{16}\right)=16\left(\frac{3}{8}h+\frac{15}{8}\right)$$
$$-7=6h+30$$
$$-7-30=6h+30-30$$
$$-37=6h$$
$$\frac{-37}{6}=\frac{6h}{6}$$
$$-\frac{37}{6}=h$$

95.
$$-\frac{3}{5}=-\frac{1}{6}-\frac{3}{4}q$$
$$60\left(-\frac{3}{5}\right)=60\left(-\frac{1}{6}-\frac{3}{4}q\right)$$
$$-36=-10-45q$$
$$-36+10=-10+10-45q$$
$$-26=-45q$$
$$\frac{-26}{-45}=\frac{-45q}{-45}$$
$$\frac{26}{45}=q$$

96.
$$-\frac{3}{5}=-\frac{1}{6}-\frac{5}{4}m$$
$$60\left(-\frac{3}{5}\right)=60\left(-\frac{1}{6}-\frac{5}{4}m\right)$$
$$-36=-10-75m$$
$$-36+10=-10+10-75m$$
$$-26=-75m$$
$$\frac{-26}{-75}=\frac{-75m}{-75}$$
$$\frac{26}{75}=m$$

97. a. By subtracting first, you will not have to work with fractions.

b.
$$3x+2=11$$
$$3x+2-2=11-2$$
$$3x=9$$
$$\frac{3x}{3}=\frac{9}{3}$$
$$x=3$$

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98. a. By adding first, you will not have to work with fractions.

b.
$$5x-3=12$$
$$5x-3+3=12+3$$
$$5x=15$$
$$\frac{5x}{5}=\frac{15}{5}$$
$$x=3$$

99.
$$3(x-2)-(x+5)-2(3-2x)=18$$
$$3x-6-x-5-6+4x=18$$
$$3x-x+4x-6-5-6=18$$
$$6x-17=18$$
$$6x-17+17=18+17$$
$$6x=35$$
$$\frac{6x}{6}=\frac{35}{6}$$
$$x=\frac{35}{6}$$

100.
$$-6=-(x-5)-3(5+2x)-4(2x-4)$$
$$-6=-x+5-15-6x-8x+16$$
$$-6=-x-6x-8x+5-15+16$$
$$-6=-15x+6$$
$$-6-6=-15x+6-6$$
$$-12=-15x$$
$$\frac{-12}{-15}=\frac{-15x}{-15}$$
$$\frac{-12}{-15}=x$$
$$\frac{4}{5}=x \text{ or } x=\frac{4}{5}$$

101.
$$4\left[3-2(x+4)\right]-(x+3)=13$$
$$4(3-2x-8)-x-3=13$$
$$4(-2x-5)-x-3=13$$
$$-8x-20-x-3=13$$
$$-9x-23=13$$
$$-9x-23+23=13+23$$
$$-9x=36$$
$$\frac{-9x}{-9}=\frac{36}{-9}$$
$$x=-4$$

102.
$$\square\!\!\odot - \nabla = @$$
$$\square\!\!\odot - \nabla + \nabla = @ + \nabla$$
$$\square\!\!\odot = @ + \nabla$$
$$\odot = \underline{@ + \nabla}$$
$$\square$$

103. a. Let x = cost of one box of stationery
$$3x + 6 = 42$$

b.
$$3x+6=42$$
$$3x+6-6=42-6$$
$$3x=36$$
$$x=12$$
A box of stationery costs \$12.00.

104. a. Let x = cost of one roll of candy.
$$3x + 0.5 = 2.75$$

b.
$$3x+0.5=2.75$$
$$3x+0.5-0.5=2.75-0.5$$
$$3x=2.25$$
$$x=0.75$$
A roll of candy costs \$0.75.

105. False. $\sqrt{2}$ is a real number but is irrational.

106.
$$\left[5(2-6)+3(8\div 4)^2\right]^2=\left[5(-4)+3(2)^2\right]^2$$
$$=\left[-20+3(4)\right]^2$$
$$=\left[-20+12\right]^2$$
$$=\left[-8\right]^2$$
$$=64$$

107. To solve an equation, we need to isolate the variable on one side of the equation.

108. To solve the equation, we divide both sides of the equation by –4.

Mid-Chapter Test: Sections 2.1 – 2.4

1.
$$5x-9y-12+4y-7x+6$$
$$=5x-7x-9y+4y-12+6$$
$$=-2x-5y-6$$

2.
$$\frac{2}{5}x-8-\frac{3}{4}x+\frac{1}{2}=\frac{2}{5}x-\frac{3}{4}x-8+\frac{1}{2}$$
$$=\frac{8}{20}x-\frac{15}{20}x-\frac{16}{2}+\frac{1}{2}$$
$$=-\frac{7}{20}x-\frac{15}{2}$$

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3. $-4(2a-3b+16) = -8a+12b-64$

4. $1.6(2.1x-3.4y-5.2) = 3.36x-5.44y-8.32$

5. $5(t-3)-3(t+7)-2 = 5t-15-3t-21-2$
$= 5t-3t-15-21-2$
$= 2t-38$

6. Substitute 2 for x in the following equation .
$3(x-4) = -2(x+1)$
$3(2-4) = -2(2+1)$
$3(-2) = -2(3)$
$-6 = -6$ True
Since we obtained a true statement, 2 is a solution.

7. Substitute $\frac{2}{5}$ for p in the following equation .
$7p-3 = 2p-5$
$7\left(\frac{2}{5}\right)-3 = 2\left(\frac{2}{5}\right)-5$
$\frac{14}{5}-\frac{15}{5} = \frac{4}{5}-\frac{25}{5}$
$-\frac{9}{5} = -\frac{21}{5}$ False
Since we obtained a false statement, $\frac{2}{5}$ is not a solution.

8. $x-5 = -9$
$x-5+5 = -9+5$
$x = -4$
Check: $x-5 = -9$
$-4-5 = -9$
$-9 = -9$ True

9. $120+x = -40$
$120-120+x = -40-120$
$x = -160$
Check: $120+x = -40$
$120+(-160) = -40$
$-40 = -40$

10. $-16 = 7+y$
$-16-7 = 7-7+y$
$-23 = y$
Check: $-16 = 7+y$
$-16 = 7+(-23)$
$-16 = -16$ True

11. Multiply both sides by 4.

12. $4 = 12y$
$\frac{4}{12} = \frac{12y}{12}$
$\frac{1}{3} = y$
Check: $4 = 12y$
$4 = 12\left(\frac{1}{3}\right)$
$4 = 4$ True

13. $\frac{x}{8} = 3$
$8\left(\frac{x}{8}\right) = 8(3)$
$x = 24$
Check: $\frac{x}{8} = 3$
$\frac{24}{8} = 3$
$3 = 3$ True

14. $-\frac{x}{5} = -2$
$\frac{x}{-5} = -2$
$-5\left(\frac{x}{-5}\right) = -5(-2)$
$x = 10$
Check: $-\frac{x}{5} = -2$
$-\frac{10}{5} = -2$
$-2 = -2$ True

15. $-x = \frac{3}{7}$
$-1x = \frac{3}{7}$
$-1(-1x) = -1\left(\frac{3}{7}\right)$
$x = -\frac{3}{7}$
Check: $-x = \frac{3}{7}$
$-\left(-\frac{3}{7}\right) = \frac{3}{7}$
$\frac{3}{7} = \frac{3}{7}$

16. $6x-3 = 12$
$6x = 15$
$x = \frac{15}{6}$
$x = \frac{5}{2}$

17. $-4 = -2w-7$
$3 = -2w$
$-\frac{3}{2} = w$

18. $\frac{3}{8} = \frac{4n-1}{6}$
$24\left(\frac{3}{8}\right) = 24\left(\frac{4n-1}{6}\right)$
$9 = 4(4n-1)$
$9 = 16n-4$
$13 = 16n$
$\frac{13}{16} = n$

19. $-5(x+4)-7 = 3$
$-5x-20-7 = 3$
$-5x-27 = 3$
$-5x = 30$
$x = -6$

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20. $8-9(y+4)+6=-2$

$8-9y-36+6=-2$

$-9y+8-36+6=-2$

$-9y-22=-2$

$-9y=20$

$y=-\frac{20}{9}$

Exercise Set 2.5

1. Our goal in solving a linear equation is to isolate the variable.

2. To eliminate decimal numbers from an equation we can multiply both sides of the equation by a power of ten.

3. To eliminate fractions from an equation we can multiply both sides of the equation by the least common denominator of the fractions in the equation.

4. A conditional equation is true for a specific value or values of the variable.

5. An identity is true for all values of the variable.

6. A contradiction is not true for any value of the variable.

7. When we have an identity, we will state the solution is all real numbers.

8. When we have a contraction, we will state that there is no solution.

9. When solving an equation and we obtain an equation that is always true, we write the answer as *all real numbers*.

10. When solving an equation and we obtain an equation that is never true, we write the answer as *no solution*.

11. $-4x+10=6x$

$-4x+4x+10=6x+4x$

$10=10x$

$\frac{10}{10}=\frac{10x}{10}$

$1=x$

12. $-7a+4=-11a$

$-7a+7a+4=-11a+7a$

$4=-4a$

$\frac{4}{-4}=\frac{-4a}{-4}$

$-1=a$

13. $3x=-2x+10$

$3x+2x=-2x+2x+10$

$5x=10$

$\frac{5x}{5}=\frac{10}{5}$

$x=2$

14. $-3x=-5x+6$

$-3x+5x=-5x+5x+6$

$2x=6$

$\frac{2x}{2}=\frac{6}{2}$

$x=3$

15. $7a+4-2a=2a+5$

$7a-2a-2a+4-4=2a-2a+5-4$

$3a=1$

$\frac{3a}{3}=\frac{1}{3}$

$a=\frac{1}{3}$

16. $9b-3+2b=7b-2$

$9b+2b-7b-3+3=7b-7b-2+3$

$4b=1$

$\frac{4b}{4}=\frac{1}{4}$

$b=\frac{1}{4}$

17. $21-6p=3p-2p$

$21-6p=p$

$21-6p+6p=p+6p$

$21=7p$

$\frac{21}{7}=\frac{7p}{7}$

$3=p$

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18.
$$30+8q=5q+9q$$
$$30+8q-8q=5q+9q-8q$$
$$30=6q$$
$$\frac{30}{6}=\frac{6q}{6}$$
$$5=q$$

19.
$$2x-8=3x-6$$
$$2x-2x-8=3x-2x-6$$
$$-8=x-6$$
$$-8+6=x-6+6$$
$$-2=x$$

20.
$$8-3x=4x+50$$
$$8-3x+3x=4x+3x+50$$
$$8=7x+50$$
$$8-50=7x+50-50$$
$$-42=7x$$
$$\frac{-42}{7}=\frac{7x}{7}$$
$$-6=x$$

21.
$$6-2y=9-8y+6y$$
$$6-2y=9-2y$$
$$6-2y+2y=9-2y+2y$$
$$6=9 \quad \text{False}$$
Since a false statement is obtained, there is no solution.

22.
$$7+8y=3y+2+5y$$
$$7+8y=3y+5y+2$$
$$7+8y=8y+2$$
$$7+8y-8y=8y-8y+2$$
$$7=2 \quad \text{False}$$
Since a false statement is obtained, there is no solution.

23.
$$5x+3=2(x+6)$$
$$5x+3=2x+12$$
$$5x-2x+3=2x-2x+12$$
$$3x+3=12$$
$$3x+3-3=12-3$$
$$3x=9$$
$$\frac{3x}{3}=\frac{9}{3}$$
$$x=3$$

24.
$$x-14=3(x+2)$$
$$x-14=3x+6$$
$$x-x-14=3x-x+6$$
$$-14=2x+6$$
$$-14-6=2x+6-6$$
$$-20=2x$$
$$\frac{-20}{2}=\frac{2x}{2}$$
$$-10=x$$

25.
$$4y-2-8y=19+5y-3$$
$$4y-8y-2=5y+19-3$$
$$-4y-2=5y+16$$
$$-4y+4y-2=5y+4y+16$$
$$-2=9y-16$$
$$-2-16=9y+16-16$$
$$-18=9y$$
$$\frac{-18}{9}=\frac{9y}{9}$$
$$-2=y$$

26.
$$3x-5+9x=2+4x+9$$
$$3x+9x-5=4x+2+9$$
$$12x-5=4x+11$$
$$12x-4x-5=4x-4x+11$$
$$8x-5=11$$
$$8x-5+5=11+5$$
$$8x=16$$
$$\frac{8x}{8}=\frac{16}{8}$$
$$x=2$$

27.
$$2(x-2)=4x-6-2x$$
$$2x-4=4x-2x-6$$
$$2x-4=2x-6$$
$$2x-2x-4=2x-2x-6$$
$$-4=-6 \quad \text{False}$$
Since a false statement is obtained, there is no solution.

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28. $-9x+5+2x=-7(x-1)+6$

$-9x+2x+5=-7x+7+6$

$-7x+5=-7x+13$

$-7x+7x+5=-7x+7x+13$

$5=13$ False

Since a false statement is obtained, there is no solution.

29. $-(w+2)=-6w+11$

$-w-2=-6w+11$

$-w+w-2=-6w+w+11$

$-2=-5w+11$

$-2-11=-5w+11-11$

$-13=-5w$

$\frac{-13}{-5}=\frac{-5w}{-5}$

$\frac{13}{5}=w$

30. $-3v+17=-(v-4)$

$-3v+17=-v+4$

$-3v+3v+17-4=-v+3v+4-4$

$13=2v$

$\frac{13}{2}=\frac{2v}{2}$

$\frac{13}{2}=v$

31. $-3(2t-5)+5=3t+13$

$-6t+15+5=3t+13$

$-6t+20=3t+13$

$-6t+6t+20=3t+6t+13$

$20=9t+13$

$20-13=9t+13-13$

$7=9t$

$\frac{7}{9}=\frac{9t}{9}$

$\frac{7}{9}=t$

32. $7(-3m+5)=3(10-6m)$

$-21m+35=30-18m$

$-21m+21m+35=30-18m+21m$

$35=30+3m$

$35-30=30-30+3m$

$5=3m$

$\frac{5}{3}=\frac{3m}{3}$

$\frac{5}{3}=m$

33. $124.8-9.4x=4.8x+32.5$

$124.8-9.4x+9.4x=4.8x+9.4x+32.5$

$124.8=14.2x+32.5$

$124.8-32.5=14.2x+32.5-32.5$

$92.3=14.2x$

$\frac{92.3}{14.2}=\frac{14.2x}{14.2}$

$6.5=x$

34. $9-0.5x=4.5x+8.5$

$9-0.5x+0.5x=4.5x+0.5x+8.5$

$9=5x+8.5$

$9-8.5=5x+8.5-8.5$

$0.5=5x$

$\frac{0.5}{5}=\frac{5x}{5}$

$\frac{0.5}{5}=x$

$0.1=x$

35. $0.62x-0.65=9.75-2.63x$

$0.62x+2.63x-0.65=9.75-2.63x+2.63x$

$3.25x-0.65=9.75$

$3.25x-0.65+0.65=9.75+0.65$

$3.25x=10.4$

$\frac{3.25x}{3.25}=\frac{10.4}{3.25}$

$x=3.2$

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36.
$$8.71-2.44x=11.02-5.74x$$
$$8.71-2.44x+5.74x=11.02-5.74x+5.74x$$
$$8.71+3.3x=11.02$$
$$8.71-8.71+3.3x=11.02-8.71$$
$$3.3x=2.31$$
$$\frac{3.3x}{3.3}=\frac{2.31}{3.3}$$
$$x=0.7$$

37.
$$\frac{a}{5}=\frac{a-3}{2}$$
$$10\left(\frac{a}{5}\right)=10\left(\frac{a-3}{2}\right)$$
$$2a=5(a-3)$$
$$2a=5a-15$$
$$2a-5a=5a-5a-15$$
$$-3a=-15$$
$$\frac{-3a}{-3}=\frac{-15}{-3}$$
$$a=5$$

38
$$\frac{b}{16}=\frac{b-6}{4}$$
$$16\left(\frac{b}{16}\right)=16\left(\frac{b-6}{4}\right)$$
$$b=4(b-6)$$
$$b=4b-24$$
$$b-4b=4b-4b-24$$
$$-3b=-24$$
$$\frac{-3b}{-3}=\frac{-24}{-3}$$
$$b=8$$

39.
$$\frac{n}{10}=9-\frac{n}{5}$$
$$10\left(\frac{n}{10}\right)=10\left(9-\frac{n}{5}\right)$$
$$n=90-2n$$
$$n+2n=90-2n+2n$$
$$3n=90$$
$$\frac{3n}{3}=\frac{90}{3}$$
$$n=30$$

40.
$$6-\frac{x}{4}=\frac{x}{8}$$
$$8\left(6-\frac{x}{4}\right)=8\left(\frac{x}{8}\right)$$
$$48-2x=x$$
$$48-2x+2x=x+2x$$
$$48=3x$$
$$\frac{48}{3}=\frac{3x}{3}$$
$$16=x$$

41.
$$\frac{7}{2}-\frac{x}{3}=2x$$
$$6\left(\frac{7}{2}-\frac{x}{3}\right)=6(2x)$$
$$21-2x=12x$$
$$21-2x+2x=12x+2x$$
$$21=14x$$
$$\frac{21}{14}=\frac{14x}{14}$$
$$\frac{21}{14}=x$$
$$\frac{3}{2}=x$$

42.
$$\frac{x}{7}+\frac{5}{3}=-2x$$
$$21\left(\frac{x}{7}+\frac{5}{3}\right)=21(-2x)$$
$$3x+35=-42x$$
$$3x+42x+35=-42x+42x$$
$$45x+35=0$$
$$45x+35-35=0-35$$
$$45x=-35$$
$$\frac{45x}{45}=\frac{-35}{45}$$
$$x=-\frac{7}{9}$$

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43. $\frac{5}{8}+\frac{1}{4}a=\frac{1}{2}a$

$8\left(\frac{5}{8}+\frac{1}{4}a\right)=8\left(\frac{1}{2}a\right)$

$5+2a=4a$

$5+2a-2a=4a-2a$

$5=2a$

$\frac{5}{2}=\frac{2a}{2}$

$\frac{5}{2}=a$

44. $\frac{5}{6}b+\frac{7}{3}=\frac{3}{2}b$

$6\left(\frac{5}{6}b+\frac{7}{3}\right)=6\left(\frac{3}{2}b\right)$

$5b+14=9b$

$5b-5b+14=9b-5b$

$14=4b$

$\frac{14}{4}=\frac{4b}{4}$

$\frac{7}{2}=b$

45. $0.1(x+10)=0.3x-4$

$0.1x+1=0.3x-4$

$0.1x-0.1x+1=0.3x-0.1x-4$

$1+4=0.2x-4+4$

$5=0.2x$

$\frac{5}{0.2}=\frac{0.2x}{0.2}$

$25=x$

46. $-0.3(5x-1)=4.3-2x$

$-1.5x+0.3=4.3-2x$

$-1.5x+2x+0.3=4.3-2x+2x$

$0.5x+0.3=4.3$

$0.5x+0.3-0.3=4.3-0.3$

$0.5x=4$

$\frac{0.5x}{0.5}=\frac{4}{0.5}$

$x=8$

47. $2(x+4)=4x+3-2x+5$

$2x+8=4x+3-2x+5$

$2x+8=2x+8$

Since the left side of the equation is identical to the right side, the equation is true for all values of x. Thus the solution is all real numbers.

48. $3(y-1)+9=8y+6-5y$

$3y-3+9=3y+6$

$3y+6=3y+6$

Since the left side of the equation is identical to the right side, the equation is true for all values of x. Thus the solution is all real numbers.

49. $5(3n+3)=2(5n-4)+6n$

$15n+15=10n-8+6n$

$15n+15=16n-8$

$15n-15n+15=16n-15n-8$

$15=n-8$

$15+8=n-8+8$

$23=n$

50. $6(2m-1)=7(3m+2)-4m$

$12m-6=21m+14-4m$

$12m-12m-6-14=21m-4m-12m+14-14$

$-20=5m$

$\frac{-20}{5}=\frac{5m}{5}$

$-4=m$

51. $-(3-p)=-(2p+3)$

$-3+p=-2p-3$

$-3+p+2p=-2p+2p-3$

$-3+3p=-3$

$-3+3+3p=-3+3$

$3p=0$

$\frac{3p}{3}=\frac{0}{3}$

$p=0$

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52.
$$-(3p+7) = -(7-3p)$$
$$-3p-7 = -7+3p$$
$$-3p+3p-7+7 = -7+7+3p+3p$$
$$0 = 6p$$
$$\frac{0}{6} = \frac{6p}{6}$$
$$0 = p$$

53.
$$16z-9 = -5z+3(7z-3)$$
$$16z-9 = -5z+21z-9$$
$$16z-9 = 16z-9$$
Since the left side of the equation is identical to the right side, the equation is true for all values of z. Thus the solution is all real numbers.

54.
$$-3y+8(2y+1) = 13y+8$$
$$-3y+16y+8 = 13y+8$$
$$13y+8 = 13y+8$$
Since the left side of the equation is identical to the right side, the equation is true for all values of y. Thus the solution is all real numbers.

55.
$$35(2x-1) = 7(x+4)+3x$$
$$70x-35 = 7x+28+3x$$
$$70x-35 = 10x+28$$
$$70x-10x-35 = 10x-10x+28$$
$$60x-35 = 28$$
$$60x-35+35 = 28+35$$
$$60x = 63$$
$$\frac{60x}{60} = \frac{63}{60}$$
$$x = \frac{21}{20}$$

56.
$$24(-2x+1) = -7(5x+2)-3x$$
$$-48x+24 = -35x-14-3x$$
$$-48x+24 = -35x-3x-14$$
$$-48x+48x+24 = -38x+48x-14$$
$$24 = 10x-14$$
$$24+14 = 10x-14+14$$
$$38 = 10x$$
$$\frac{38}{10} = \frac{10x}{10}$$
$$\frac{19}{5} = x$$

57.
$$0.4(x+0.7) = 0.6(x-4.2)$$
$$0.4x+0.28 = 0.6x-2.52$$
$$0.4x-0.4x+0.28 = 0.6x-0.4x-2.52$$
$$0.28 = 0.2x-2.52$$
$$0.28+2.52 = 0.2x-2.52+2.52$$
$$2.8 = 0.2x$$
$$\frac{2.8}{0.2} = \frac{0.2x}{0.2}$$
$$14 = x$$

58.
$$0.5(6x-8) = 1.4(x-5)-0.2$$
$$3x-4 = 1.4x-7-0.2$$
$$3x-4 = 1.4x-7.2$$
$$3x-1.4x-4 = 1.4x-1.4x-7.2$$
$$1.6x-4 = -7.2$$
$$1.6x-4+4 = -7.2+4$$
$$1.6x = -3.2$$
$$\frac{1.6x}{1.6} = \frac{-3.2}{1.6}$$
$$x = -2$$

59.
$$\frac{3}{5}x-2 = x-\frac{1}{2}$$
$$10\left(\frac{3}{5}x-2\right) = 10\left(x-\frac{1}{2}\right)$$
$$6x-20 = 10x-5$$
$$6x-6x-20 = 10x-6x-5$$
$$-20 = 4x-5$$
$$-20+5 = 4x-5+5$$
$$-15 = 4x$$
$$\frac{-15}{4} = \frac{4x}{4}$$
$$-\frac{15}{4} = x$$

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60. $-\frac{4}{7}k+2=\frac{1}{2}k-1$

$14\left(-\frac{4}{7}k+2\right)=14\left(\frac{1}{2}k-1\right)$

$-8k+28=7k-14$

$-8k+8k+28=7k+8k-14$

$28=15k-14$

$28+14=15k-14+14$

$42=15k$

$\frac{42}{15}=\frac{15k}{15}$

$\frac{14}{5}=k$

61. $\frac{y}{5}+2=3(y-4)$

$\frac{y}{5}+2=3y-12$

$\frac{y}{5}+2-2=3y-12-2$

$\frac{y}{5}=3y-14$

$5\left(\frac{y}{5}\right)=5(3y-14)$

$y=15y-70$

$y-15y=15y-15y-70$

$-14y=-70$

$\frac{-14y}{-14}=\frac{-70}{-14}$

$y=5$

62. $2(x-4)=\frac{x}{5}+10$

$2x-8=\frac{x}{5}+10$

$2x-8-10=\frac{x}{5}+10-10$

$2x-18=\frac{x}{5}$

$5(2x-18)=5\left(\frac{x}{5}\right)$

$10x-90=x$

$10x-10x-90=x-10x$

$-90=-9x$

$\frac{-90}{-9}=\frac{-9x}{-9}$

$10=x$

63. $12-3x+7x=-2(-5x+6)$

$12+4x=10x-12$

$12+4x-4x=10x-4x-12$

$12=6x-12$

$12+12=6x-12+12$

$24=6x$

$\frac{24}{6}=\frac{6x}{6}$

$4=x$

64. $-2x-3-x=-3(-2x+7)$

$-3x-3=6x-21$

$-3x+3x-3=6x+3x-21$

$-3=9x-21$

$-3+21=9x-21+21$

$18=9x$

$\frac{18}{9}=\frac{9x}{9}$

$2=x$

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65. $3(x-6)-4(3x+1)=x-22$

$$\begin{aligned}3x-18-12x-4&=x-22\\-9x-22&=x-22\\-9x+9x-22&=x+9x-22\\-22&=10x-22\\-22+22&=10x-22+22\\0&=10x\\\frac{0}{10}&=\frac{10x}{10}\\0&=x\end{aligned}$$

66. $-2(-3x+5)+6=4(x-2)$

$$\begin{aligned}6x-10+6&=4x-8\\6x-4&=4x-8\\6x-4x-4&=4x-4x-8\\2x-4&=-8\\2x-4+4&=-8+4\\2x&=-4\\\frac{2x}{2}&=\frac{-4}{2}\\x&=-2\end{aligned}$$

67. $5+2x=6(x+1)-5(x-3)$

$$\begin{aligned}5+2x&=6x+6-5x+15\\5+2x&=x+21\\5+2x-x&=x-x+21\\5+x&=21\\5-5+x&=21-5\\x&=16\end{aligned}$$

68. $3-5x=4(x-3)-7(x+1)$

$$\begin{aligned}3-5x&=4x-12-7x-7\\3-5x&=4x-7x-12-7\\3-5x&=-3x-19\\3-5x+5x&=-3x+5x-19\\3&=2x-19\\3+19&=2x-19+19\\22&=2x\\\frac{22}{2}&=\frac{2x}{2}\\11&=x\end{aligned}$$

69. $7-(-y-5)=2(y+3)-6(y+3)$

$$\begin{aligned}7+y+5&=2y+6-6y-18\\12+y&=-4y-12\\12-12+y&=-4y-12-12\\y&=-4y-24\\y+4y&=-4y+4y-24\\5y&=-24\\\frac{5y}{5}&=\frac{-24}{5}\\y&=-\frac{24}{5}\end{aligned}$$

70. $-3-(4-c)=2(c-7)-5(2c+1)$

$$\begin{aligned}-3-4+c&=2c-14-10c-5\\-7+c&=2c-10c-14-5\\-7+c&=-8c-19\\-7+c+8c&=-8c+8c-19\\-7+9c&=-19\\-7+7+9c&=-19+7\\9c&=-12\\\frac{9c}{9}&=\frac{-12}{9}\\c&=-\frac{4}{3}\end{aligned}$$

71. $\frac{3}{5}(x-6)=\frac{2}{3}(3x-5)$

$$\begin{aligned}\frac{3}{5}x-\frac{18}{5}&=2x-\frac{10}{3}\\15\left(\frac{3}{5}x-\frac{18}{5}\right)&=15\left(2x-\frac{10}{3}\right)\\9x-54&=30x-50\\9x-9x-54&=30x-9x-50\\-54&=21x-50\\-54+50&=21x-50+50\\-4&=21x\\\frac{-4}{21}&=\frac{21x}{21}\\-\frac{4}{21}&=x\end{aligned}$$

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72. $\frac{1}{2}(2d+4)=\frac{1}{3}(4d-4)$

$$d+2=\frac{4d}{3}-\frac{4}{3}$$
$$3(d+2)=3\left(\frac{4d}{3}-\frac{4}{3}\right)$$
$$3d+6=4d-4$$
$$3d-3d+6=4d-3d-4$$
$$6=d-4$$
$$6+4=d-4+4$$
$$10=d$$

73. $\frac{3(2r-5)}{5}=\frac{3r-6}{3}$

$$\frac{6r-15}{5}=\frac{3r-6}{3}$$
$$15\left(\frac{6r-15}{5}\right)=15\left(\frac{3r-6}{3}\right)$$
$$3(6r-15)=5(3r-6)$$
$$18r-45=15r-30$$
$$18r-15r-45=15r-15r-30$$
$$3r-45=-30$$
$$3r-45+45=-30+45$$
$$3r=15$$
$$\frac{3r}{3}=\frac{15}{3}$$
$$r=5$$

74. $\frac{3(x-4)}{4}=\frac{5(2x-3)}{3}$

$$\frac{3x-12}{4}=\frac{10x-15}{3}$$
$$12\left(\frac{3x-12}{4}\right)=12\left(\frac{10x-15}{3}\right)$$
$$3(3x-12)=4(10x-15)$$
$$9x-36=40x-60$$
$$9x-9x-36=40x-9x-60$$
$$-36=31x-60$$
$$-36+60=31x-60+60$$
$$24=31x$$
$$\frac{24}{31}=\frac{31x}{31}$$
$$\frac{24}{31}=x$$

75. $\frac{2}{7}(5x+4)=\frac{1}{2}(3x-4)+1$

$$\frac{10x}{7}+\frac{8}{7}=\frac{3x}{2}-2+1$$
$$\frac{10x}{7}+\frac{8}{7}=\frac{3x}{2}-1$$
$$14\left(\frac{10x}{7}+\frac{8}{7}\right)=14\left(\frac{3x}{2}-1\right)$$
$$20x+16=21x-14$$
$$20x-20x+16=21x-20x-14$$
$$16=x-14$$
$$16+14=x-14+14$$
$$30=x$$

76. $\frac{5}{12}(x+2)=\frac{2}{3}(2x+1)+\frac{1}{6}$

$$\frac{5x}{12}+\frac{10}{12}=\frac{4x}{3}+\frac{2}{3}+\frac{1}{6}$$
$$12\left(\frac{5x}{12}+\frac{10}{12}\right)=12\left(\frac{4x}{3}+\frac{2}{3}+\frac{1}{6}\right)$$
$$5x+10=16x+8+2$$
$$5x+10=16x+10$$
$$5x-5x+10=16x-5x+10$$
$$10=11x+10$$
$$10-10=11x+10-10$$
$$0=11x$$
$$\frac{0}{11}=\frac{11x}{11}$$
$$0=x$$

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77.
$$\frac{a-5}{2}=\frac{3a}{4}+\frac{a-25}{6}$$
$$12\left(\frac{a-5}{2}\right)=12\left(\frac{3a}{4}+\frac{a-25}{6}\right)$$
$$6(a-5)=9a+2(a-25)$$
$$6a-30=9a+2a-50$$
$$6a-30=11a-50$$
$$6a-6a-30=11a-6a-50$$
$$-30=5a-50$$
$$-30+50=5a-50+50$$
$$20=5a$$
$$\frac{20}{5}=\frac{5a}{5}$$
$$4=a$$

78.
$$\frac{a-7}{3}=\frac{a+5}{2}-\frac{7a-1}{6}$$
$$6\left(\frac{a-7}{3}\right)=6\left(\frac{a+5}{2}-\frac{7a-1}{6}\right)$$
$$2(a-7)=3(a+5)-(7a-1)$$
$$2a-14=3a+15-7a+1$$
$$2a-14=-4a+16$$
$$2a+4a-14=-4a+4a+16$$
$$6a-14=16$$
$$6a-14+14=16+14$$
$$6a=30$$
$$\frac{6a}{6}=\frac{30}{6}$$
$$a=5$$

79. a. One example is $x+x+1=x+2$.

b. It has a single solution.

c. Answers will vary. For equation given in part **a)**:
$$x+x+1=x+2$$
$$2x+1=x+2$$
$$2x-x+1=x-x+2$$
$$x+1=2$$
$$x+1-1=2-1$$
$$x=1$$

80. a. One example is $x+2=x+x+1$.

b. It has a single solution.

c. Answers will vary. For equation given in part **a)**:
$$x+2=x+x+1$$
$$x+2=2x+1$$
$$x-x+2=2x-x+1$$
$$2=x+1$$
$$2-1=x+1-1$$
$$1=x$$

81. a. One example is $x+x+1=2x+1$.

b. Both sides simplify to the same expression.

c. The solution is all real numbers.

82. a. One example is $2x+1=x+x+1$.

b. Both sides simplify to the same expression.

c. The solution is all real numbers.

83. a. One example is $x+x+1=2x+2$.

b. It simplifies to a false statement.

c. The solution is that there is no solution.

84. a. One example is $x+x+2=x+x+2+1$

b. It simplifies to a false statement.

c. The solution is that there is no solution.

85.
$$5*-1=4*+5*$$
$$5*-5*-1=9*-5*$$
$$-1=4*$$
$$\frac{-1}{4}=\frac{4*}{4}$$
$$-\frac{1}{4}=*$$

86.
$$2\Delta-4=3\Delta+5-\Delta$$
$$2\Delta-4=2\Delta+5$$
$$2\Delta-2\Delta-4=2\Delta-2\Delta+5$$
$$-4=5 \quad \text{False}$$
No solution

87. $3☺-5=2☺-5+☺$
$3☺-5=3☺-5$
The left side of the equation is identical to the right side. The solution is all real numbers.

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88. $-2(x+3)+5x=3(4-2x)-(x+2)$

$-2x-6+5x=12-6x-x-2$

$3x-6=-7x+10$

$3x+7x-6=-7x+7x+10$

$10x-6=10$

$10x-6+6=10+6$

$10x=16$

$\frac{10x}{10}=\frac{16}{10}$

$x=\frac{8}{5}$

89. $4-[5-3(x+2)]=x-3$

$4-(5-3x-6)=x-3$

$4-5+3x+6=x-3$

$3x+5=x-3$

$3x-x+5=x-x-3$

$2x+5=-3$

$2x+5-5=-3-5$

$2x=-8$

$\frac{2x}{2}=\frac{-8}{2}$

$x=-4$

90. a. Let x be the cost of one chocolate bar.

$2x=x+6$

b. $2x=x+6$

$2x-x=x+6$

$x=6$

A chocolate bar costs \$6.00.

91. a. $|4|=4$

b. $|-7|=7$

c. $|0|=0$

92. $\frac{x^a}{x^b}=x^a\cdot x^{-b}=x^{a-b}$

93. Factors are expressions that are multiplied together; terms are expressions that are added together.

94. $2(x-3)+4x-(4-x)=2x-6+4x-4+x$

$=7x-10$

95. $2(x-3)+4x-(4-x)=0$

$2x-6+4x-4+x=0$

$7x-10=0$

$7x-10+10=0+10$

$7x=10$

$\frac{7x}{7}=\frac{10}{7}$

$x=\frac{10}{7}$

96. $(x+4)-(4x-3)=16$

$x+4-4x+3=16$

$-3x+7=16$

$-3x+7-7=16-7$

$-3x=9$

$\frac{-3x}{-3}=\frac{9}{-3}$

$x=-3$

Exercise Set 2.6

1. An equation used to express a specific relationship mathematically is called a formula.

2. The process of substituting values and performing indicated operations on a formula is called evaluating it.

3. A four-sided figure is called a quadrilateral.

4. Twice the radius of a circle is the diameter of the circle.

5. Simple interest is found by multiplying the principal, the rate, and the time.

6. When calculating simple interest, the rate should be expressed as a decimal number.

7. The circumference of a circle is found by multiplying 2π by the radius.

8. Distance is found by multiplying the rate by the time.

9. A possible unit of measure for volume is cubic feet.

10. A possible unit of measure for area is square inches.

11. Substitute 75 for r and 3 for t.

$d=rt$

$d=75(3)=225$

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12. Substitute 6 for s.

$P = 4s$

$P = 4(6) = 24$

13. Substitute 13 for l and 7 for w.

$A = lw$

$A = 13(7) = 91$

14. Substitute 9 for s.

$A = s^2$

$A = (9)^2 = 81$

15. Substitute 2000 for p, 0.06 for r, and 3 for t.

$i = prt$

$i = 2000(0.06)(3)$

$i = 360$

16. Substitute 8 for l and 10 for w.

$P = 2l + 2w$

$P = 2(8) + 2(10)$

$P = 16 + 20$

$P = 36$

17. Substitute 10 for r.

$A = \pi r^2$

$A = \pi(10)^2$

$A = 100\pi \approx 314.16$

18. Substitute 4 for r and 5 for h.

$V = \pi r^2 h$

$V = \pi\left(4^2\right)5$

$V \approx 251.33$

19. Substitute 8 for r.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(8)^3$

$V = \frac{4}{3}\pi(512) \approx 2144.66$

20. Substitute 6 for r and 7 for h.

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi\left(6^2\right)7$

$V \approx 263.89$

21. Substitute 16 for m and 56 for n.

$A = \frac{m+n}{2}$

$A = \frac{16+56}{2}$

$A = \frac{72}{2}$

$A = 36$

22. Substitute 72 for a, 81 for b, and 93 for c.

$A = \frac{a+b+c}{3}$

$A = \frac{72+81+93}{3}$

$A = \frac{246}{3}$

$A = 82$

23. Substitute 100 for x, 80 for m, and 10 for s.

$z = \frac{x-m}{s}$

$z = \frac{100-80}{10}$

$z = \frac{20}{10} = 2$

24. Substitute 135 for s and 100 for d.

$m = \frac{s-d}{d}$

$m = \frac{135-100}{100}$

$m = 0.35$

25. Substitute 56 for P.

$P = 4s$

$56 = 4s$

$\frac{56}{4} = \frac{4s}{4}$

$14 = s$

26. Substitute 28 for P and 6 for w.

$P = 2l + 2w$

$28 = 2l + 2(6)$

$28 = 2l + 12$

$28 - 12 = 2l + 12 - 12$

$16 = 2l$

$\frac{16}{2} = \frac{2l}{2}$

$8 = l$

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27. Substitute 678.24 for V and 6 for r.

$$V = \pi r^2 h$$
$$678.24 = \pi(6)^2 h$$
$$678.24 = 36\pi h$$
$$\frac{678.24}{36\pi} = \frac{36\pi h}{36\pi}$$
$$\frac{678.24}{36\pi} = h$$
$$6.00 \approx h$$

28. Substitute 188.5 for V and 6 for r.

$$V = \frac{1}{3}\pi r^2 h$$
$$188.5 = \frac{1}{3}\pi\left(6^2\right)h$$
$$188.5 = \frac{1}{3}\pi(36)h$$
$$188.5 = 12\pi h$$
$$5.00 \approx h$$

29. a) Substitute 3 for s.

$$A = s^2$$
$$A = (3)^2$$
$$A = 9 \text{ km}^2$$

b) Substitute 3 for s.

$$P = 4s$$
$$P = 4(3)$$
$$P = 12 \text{ km}$$

30. a) Substitute 7 for s.

$$A = s^2$$
$$A = (7)^2$$
$$A = 49 \text{ mi}^2$$

b) Substitute 7 for s.

$$P = 4s$$
$$P = 4(7)$$
$$P = 28 \text{ mi}$$

31. a) Substitute 11 for l and 7 for w.

$$A = lw$$
$$A = 11(7)$$
$$A = 77 \text{ yd}^2$$

b) Substitute 11 for l and 7 for w.

$$P = 2l + 2w$$
$$P = 2(11) + 2(7)$$
$$P = 22 + 14$$
$$P = 36 \text{ yd}$$

32. a) Substitute 7 for l and 15 for w.

$$A = lw$$
$$A = 7(15)$$
$$A = 105 \text{ mm}^2$$

b) Substitute 7 for l and 15 for w.

$$P = 2l + 2w$$
$$P = 2(7) + 2(15)$$
$$P = 14 + 30$$
$$P = 44 \text{ yd}$$

33. a) Substitute 17 for l and 12 for h.

$$A = lh$$
$$A = 17(12)$$
$$A = 204 \text{ m}^2$$

b) Substitute 17 for l and 13 for w.

$$P = 2l + 2w$$
$$P = 2(17) + 2(13)$$
$$P = 34 + 26$$
$$P = 60 \text{ m}$$

34. a) Substitute 7 for l and 3 for h.

$$A = lh$$
$$A = 7(3)$$
$$A = 21 \text{ mm}^2$$

b) Substitute 7 for l and 5 for w.

$$P = 2l + 2w$$
$$P = 2(7) + 2(5)$$
$$P = 14 + 10$$
$$P = 24 \text{ mm}$$

35. a) Substitute 4 for h, 4 for b and 10 for d.

$$A = \frac{1}{2}h(b + d)$$
$$A = \frac{1}{2}(4)(4 + 10)$$
$$A = \frac{1}{2}(4)(14)$$
$$A = \frac{1}{2}(56)$$
$$A = 28 \text{ cm}^2$$

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b) Substitute 5 for a, 4 for b, 5 for c, and 10 for d.

$P = a + b + c + d$

$P = 5 + 4 + 5 + 10$

$P = 24$ cm

36. a) Substitute 12 for h, 12 for b and 22 for d.

$A = \frac{1}{2}h(b + d)$

$A = \frac{1}{2}(12)(12 + 22)$

$A = \frac{1}{2}(12)(34)$

$A = \frac{1}{2}(408)$

$A = 204$ yd^2

b) Substitute 13 for a, 12 for b, 13 for c, and 22 for d.

$P = a + b + c + d$

$P = 13 + 12 + 13 + 22$

$P = 60$ yd

37. a) Substitute 10 for b and 12 for h.

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(10)(12)$

$A = \frac{1}{2}(120)$

$A = 60$ ft^2

b) Substitute 13 for a, 10 for b, and 13 for c.

$P = a + b + c$

$P = 13 + 10 + 13$

$P = 36$ ft

38. a) Substitute 19 for b and 5 for h.

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(19)(5)$

$A = \frac{1}{2}(95)$

$A = 47.5$ m^2

b) Substitute 8.6 for a, 19 for b, and 13 for c.

$P = a + b + c$

$P = 8.6 + 19 + 13$

$P = 40.6$ m

39. a) Substitute 3 for r.

$A = \pi r^2$

$A = \pi(3^2)$

$A = 9\pi \approx 28.27$ m^2

b) Substitute 3 for r.

$C = 2\pi r$

$C = 2\pi(3)$

$C = 6\pi \approx 18.85$ m

40. a) Substitute $\frac{8}{2} = 4$ for r.

$A = \pi r^2$

$A = \pi(4^2)$

$A = 16\pi \approx 50.27$ ft^2

b)

Substitute $\frac{8}{2} = 4$ for r. $C = 2\pi r$

$C = 2\pi(4)$

$C = 8\pi \approx 25.13$ ft

41. a) Substitute $\frac{14}{2} = 7$ for r.

$A = \pi r^2$

$A = \pi(7^2)$

$A = 49\pi \approx 153.94$ m^2

b) Substitute $\frac{14}{2} = 7$ for r.

$C = 2\pi r$

$C = 2\pi(7)$

$C = 14\pi \approx 43.98$ m

42. a) Substitute 9 for r.

$A = \pi r^2$

$A = \pi(9^2)$

$A = 81\pi \approx 254.47$ in.^{2}

b) Substitute 9 for r.

$C = 2\pi r$

$C = 2\pi(9)$

$C = 18\pi \approx 56.55$ in.

43. Substitute 4 for l, 3 for w, and 5 for h.

$V = lwh$

$V = (4)(3)(5)$

$V = 60$ ft^3

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44. Substitute 7 for l, 2 for w, and 5 for h.

$V = lwh$

$V = = 7(2)(5)$

$V = 14(5)$

$V = 70 \text{ m}^3$

45. Substitute 4 for r and 9 for h.

$V = \pi r^2 h$

$V = \pi(4)^2(9)$

$V = \pi(16)(9)$

$V = 144\pi \approx 452.39 \text{ cm}^3$

46. Substitute $\frac{12}{2} = 6$ for r and 12 for h.

$V = \pi r^2 h$

$V = \pi(6)^2(12)$

$V = \pi(36)(12)$

$V = 432\pi$

$V \approx 1357.17 \text{ in.}^3$

47. Substitute 4 for r and 8 for h.

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi(4)^2(8)$

$V = \frac{1}{3}\pi(16)(8)$

$V = \frac{1}{3}\pi(128)$

$V \approx 134.04 \text{ m}^3$

48. Substitute $\frac{7}{2} = 3.5$ for r and 8 for h.

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi(3.5)^2(8)$

$V = \frac{1}{3}\pi(12.25)(8)$

$V = \frac{1}{3}\pi(98)$

$V \approx 102.63 \text{ cm}^3$

49. Substitute 6 for r.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(6)^3$

$V = \frac{4}{3}\pi(216)$

$V \approx 904.78 \text{ yd}^3$

50. Substitute $\frac{12}{2} = 6$ for r.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(6)^3$

$V = \frac{4}{3}\pi(216)$

$V = 288\pi$

$V = 904.78 \text{ mm}^3$

51. Substitute 50 for F.

$C = \frac{5}{9}(F - 32)$

$C = \frac{5}{9}(50 - 32)$

$= \frac{5}{9}(18)$

$= 10$

The equivalent temperature is 10°C.

52. Substitute 86 for F.

$C = \frac{5}{9}(F - 32)$

$C = \frac{5}{9}(86 - 32)$

$= \frac{5}{9}(54)$

$= 30$

The equivalent temperature is 30°C.

53. Substitute 25 for C.

$F = \frac{9}{5}C + 32$

$F = \frac{9}{5}(25) + 32$

$= 45 + 32$

$= 77$

The equivalent temperature is 77°F.

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54. Substitute –40 for C.

$$F = \frac{9}{5}C + 32$$
$$F = \frac{9}{5}(-40) + 32$$
$$= -72 + 32$$
$$= -40$$

The equivalent temperature is –40°F.

55. $A = lw$

$$\frac{A}{w} = \frac{lw}{w}$$
$$\frac{A}{w} = l$$

56. $P = 4s$

$$\frac{P}{4} = \frac{4s}{4}$$
$$\frac{P}{4} = s$$

57. $i = prt$

$$\frac{i}{pr} = \frac{prt}{pr}$$
$$\frac{i}{pr} = t$$

58. $\frac{C}{\pi} = \frac{\pi d}{\pi}$

$$\frac{C}{\pi} = d$$

59. $A = \frac{1}{2}bh$

$$2A = 2\left(\frac{1}{2}bh\right)$$
$$2A = bh$$
$$\frac{2A}{h} = \frac{bh}{h}$$
$$\frac{2A}{h} = b$$

60. $V = \frac{1}{3}Bh$

$$3(V) = 3\left(\frac{1}{3}Bh\right)$$
$$3V = Bh$$
$$\frac{3V}{B} = \frac{Bh}{B}$$
$$\frac{3V}{B} = h$$

61. $P = 2l + 2w$

$$P - 2l = 2l - 2l + 2w$$
$$P - 2l = 2w$$
$$\frac{P - 2l}{2} = \frac{2w}{2}$$
$$\frac{P - 2l}{2} = w$$

62. $4m + 5n = 25$

$$4m - 4m + 5n = 25 - 4m$$
$$5n = 25 - 4m$$
$$\frac{5n}{5} = \frac{25 - 4m}{5}$$
$$n = \frac{25 - 4m}{5} = \frac{-4m + 25}{5}$$

63. $3 - 2r = n$

$$3 - 3 - 2r = n - 3$$
$$-2r = n - 3$$
$$\frac{-2r}{-2} = \frac{n - 3}{-2}$$
$$r = \frac{n - 3}{-2} = \frac{3 - n}{2}$$

64. $7 - 5p = q$

$$7 - 7 - 5p = q - 7$$
$$-5p = q - 7$$
$$\frac{-5p}{-5} = \frac{q - 7}{-5}$$
$$p = \frac{q - 7}{-5}$$
$$p = \frac{-1}{-1}\left(\frac{q - 7}{-5}\right)$$
$$p = \frac{-q + 7}{5}$$

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65. $y = mx + b$

$y - mx = mx - mx + b$

$y - mx = b$

66. $t = ps + w$

$t - ps = ps - ps + w$

$t - ps = w$

67. $V = \frac{1}{3}\pi r^2 h$

$3V = 3\left(\frac{1}{3}\pi r^2 h\right)$

$3V = \pi r^2 h$

$\frac{3V}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$

$\frac{3V}{\pi r^2} = h$

68. $A = \frac{m + 2d}{3}$

$3A = 3\left(\frac{m + 2d}{3}\right)$

$3A = m + 2d$

$3A - m = m - m + 2d$

$3A - m = 2d$

$\frac{3A - m}{2} = \frac{2d}{2}$

$\frac{3A - m}{2} = d$

69. $A = \frac{m + d}{2}$

$2A = 2\left(\frac{m + d}{2}\right)$

$2A = m + d$

$2A - d = m + d - d$

$2A - d = m$

70. $L = \frac{c + 2d}{4}$

$4L = 4\left(\frac{c + 2d}{4}\right)$

$4L = c + 2d$

$4L - c = c - c + 2d$

$4L - c = 2d$

$\frac{4L - c}{2} = \frac{2d}{2}$

$\frac{4L - c}{2} = d$

71. $-3x + 3y = -18$

$-3x + 3x + 3y = 3x - 18$

$3y = 3x - 18$

$\frac{3y}{3} = \frac{3x - 18}{3}$

$y = \frac{3x}{3} + \frac{-18}{3}$

$y = x - 6$

72. $-2y + 4x = -8$

$-2y + 4x - 4x = -4x - 8$

$-2y = -4x - 8$

$\frac{-2y}{-2} = \frac{-4x - 8}{-2}$

$y = \frac{-4x}{-2} + \frac{-8}{-2}$

$y = 2x + 4$

73. $4x = 6y - 8$

$4x + 8 = 6y - 8 + 8$

$4x + 8 = 6y$

$\frac{4x + 8}{6} = \frac{6y}{6}$

$\frac{4x}{6} + \frac{8}{6} = y$

$\frac{2}{3}x + \frac{4}{3} = y$

$y = \frac{2}{3}x + \frac{4}{3}$

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74.
$$\begin{aligned}-3x &= 9y-6\\ -3x-9y &= 9y-9y-6\\ -3x-9y &= -6\\ -3x+3x-9y &= -6+3x\\ -9y &= -6+3x\\ \frac{-9y}{-9} &= \frac{-6+3x}{-9}\\ y &= \frac{-6}{-9}+\frac{3x}{-9}\\ y &= \frac{2}{3}-\frac{1}{3}x\\ y &= -\frac{1}{3}x+\frac{2}{3}\end{aligned}$$

75.
$$\begin{aligned}5y &= -10+3x\\ \frac{5y}{5} &= \frac{-10+3x}{5}\\ y &= \frac{-10}{5}+\frac{3x}{5}\\ y &= -2+\frac{3}{5}x\\ y &= \frac{3}{5}x-2\end{aligned}$$

76.
$$\begin{aligned}-7y &= 21-9x\\ \frac{-7y}{-7} &= \frac{21-9x}{-7}\\ y &= \frac{21}{-7}+\frac{-9x}{-7}\\ y &= \frac{9}{7}x-3\end{aligned}$$

77.
$$\begin{aligned}15-3x &= -6y\\ \frac{15-3x}{-6} &= \frac{-6y}{-6}\\ \frac{15}{-6}+\frac{-3x}{-6} &= y\\ -\frac{5}{2}+\frac{1}{2}x &= y\\ y &= \frac{1}{2}x-\frac{5}{2}\end{aligned}$$

78.
$$\begin{aligned}-2y &= -3x-18\\ \frac{-2y}{-2} &= \frac{-3x-18}{-2}\\ y &= \frac{-3x}{-2}-\frac{18}{-2}\\ y &= \frac{3}{2}x+9\end{aligned}$$

79.
$$\begin{aligned}y+3 &= -\frac{1}{3}(x-4)\\ y+3 &= -\frac{1}{3}x+\frac{4}{3}\\ y+3-3 &= -\frac{1}{3}x+\frac{4}{3}-3\\ y &= -\frac{1}{3}x+\frac{4}{3}-\frac{9}{3}\\ y &= -\frac{1}{3}x-\frac{5}{3}\end{aligned}$$

80.
$$\begin{aligned}y-3 &= \frac{2}{3}(x+4)\\ y-3 &= \frac{2}{3}x+\frac{8}{3}\\ y-3+3 &= \frac{2}{3}x+\frac{8}{3}+3\\ y &= \frac{2}{3}x+\frac{8}{3}+\frac{9}{3}\\ y &= \frac{2}{3}x+\frac{17}{3}\end{aligned}$$

81.
$$\begin{aligned}y-\frac{1}{5} &= 2\left(x+\frac{1}{3}\right)\\ y-\frac{1}{5} &= 2x+\frac{2}{3}\\ y-\frac{1}{5}+\frac{1}{5} &= 2x+\frac{2}{3}+\frac{1}{5}\\ y &= 2x+\frac{10}{15}+\frac{3}{15}\\ y &= 2x+\frac{13}{15}\end{aligned}$$

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82. $y+5=\frac{3}{4}\left(x+\frac{1}{2}\right)$

$y+5=\frac{3}{4}x+\frac{3}{8}$

$y+5-5=\frac{3}{4}x+\frac{3}{8}-5$

$y=\frac{3}{4}x+\frac{3}{8}-\frac{40}{8}$

$y=\frac{3}{4}x-\frac{37}{8}$

83. a) $i=prt$

$i=(15,000)(0.045)(4)=2700$

He will pay \$2700 interest.

b) $p+i=15,000+2700=17,700$

He will pay a total of \$17,700.

84. a) $i=prt$

$i=(35,000)(0.0375)(5)$

$i=6562.50$

She will pay \$6562.50 interest.

b) $p+i=35,000+6562.50=41,562.50$

She will pay a total of \$41,562.50.

85. $i=prt$

$450=p(0.03)(3)$

$450=0.09p$

$\frac{450}{0.09}=\frac{0.09p}{0.09}$

$5000=p$

She placed \$5000 in the savings account.

86. $i=prt$

$840=(6000)(0.035)(t)$

$840=210t$

$\frac{840}{210}=\frac{210t}{210}$

$4=t$

His money had been in the account for 4 years.

87. $d=rt$

$d=763(0.02)$

$d=15.26$

The car travels 15.26 mi.

88. $d=rt$

$d=(3.4)(2)$

$d=6.8$

She walked 6.8 mi.

89. $d=rt$

$180=r(3)$

$60=r$

Her average speed was 60 mph.

90. $d=rt$

$3900=r(0.3)$

$13,000=r$

The average speed was 13,000 mph.

91. a) $A=lw$

$A=200(90)$

$A=18,000$

The area of the pasture is 18,000 square yards.

b) $P=2l+2w$

$P=2(200)+2(90)$

$P=400+180$

$P=580$

She will need 580 yards of fencing.

92. a) $A=lw$

$A=35(57.4)$

$A=2009$

The area is 2009 square inches.

b) $P=2l+2w$

$P=2(35)+2(57.4)$

$P=70+114.8$

$P=184.8$

The perimeter is 184.8 inches.

93. a) $C=2\pi r$

$C=2\pi\left(\frac{30}{2}\right)$

$C=2\pi(15)$

$C\approx 94.25$

He will need approximately 94.25 feet of fencing.

b) $A=\pi r^2$

$A=\pi(15)^2$

$A=\pi(225)\approx 706.86$

The area of the cover is approximately 706.86 square feet.

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94. a) $A = \pi r^2$

$A = \pi\left(\frac{72}{2}\right)^2$

$A = \pi(36)^2$

$A = \pi(1296) \approx 4071.50$

The area of the helipad is approximately 4071.50 square feet.

b) $C = 2\pi r$

$C = 2\pi(36)$

$C = \pi(72)$

$C \approx 226.19$

The circumference of the helipad is approximately 226.19 feet.

95. $C = 2\pi r$

$62.83 = 2\pi r$

$\frac{62.83}{2\pi} = \frac{2\pi r}{2\pi}$

$10.00 \approx r$

The radius of the garden is approximately 10.00 feet.

96. $C = 2\pi r$

$18.85 = 2\pi r$

$\frac{18.85}{2\pi} = \frac{2\pi r}{2\pi}$

$3.00 \approx r$

The radius of the tabletop is about 3.00 feet.

The diameter is twice the radius, so
$d = 2(3.00) = 6.00$
The diameter of the tabletop is about 6.00 feet.

97. Total area = Area of top triangle + area of bottom triangle
Total Area = $0.5b_1h_1 + 0.5b_2h_2$
Total Area = $0.5(2)(1) + 0.5(2)(2)$
Total Area = $1 + 2 = 3$
The area of the kite is 3 square feet.

98. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(36)(31) = 558$

The area is 558 in.^{2}.

99. $V = lwh$

$V = (60)(30)(1.5)$

$V = 2700$

The volume of sand is 2700 cubic feet.

100. $V = lwh$

$V = (17)(14)(6)$

$V = 1428$

The volume of the carrying case is 1428 in.^{3}.

101. $V = \pi r^2 h$
$= \pi(4)^2(3)$
$= \pi(16)(3)$
$= 48\pi \approx 150.80$
The volume of water in the hot tub is about 150.80 ft^3.

102. $V = \pi r^2 h$

The radius is $\frac{1}{2}$ the diameter or

$\frac{1}{2}(24 \text{ in.}) = 12 \text{ in.} = 1 \text{ foot.}$

$V = \pi(1)^2(4) = 4\pi \approx 12.57$

The volume of the drum is about 12.57 ft^3.

103. $A = \frac{1}{2}h(b+d)$

$A = \frac{1}{2}(2)(4+3)$

$= \frac{1}{2}(2)(7)$

$= (1)7$

$= 7$

The area of the sign is 7 ft^2.

104. $A = \frac{1}{2}h(b+d)$

$A = \frac{1}{2}(100)(80+200)$

$= \frac{1}{2}(100)(280)$

$= (50)(280)$

$= 14{,}000$

The seating area is 14,000 ft^2.

105. The radius is half the diameter.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi\left(\frac{9}{2}\right)^3$

$V \approx 381.7$

The volume of the basketball is about 381.7 in.^{3}.

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106. The radius is half the diameter.

$$V = \frac{4}{3}\pi r^3$$
$$V = \frac{4}{3}\pi\left(\frac{12}{2}\right)^3$$
$$V = \frac{4}{3}\pi(6)^3$$
$$V = \frac{4}{3}\pi(216)$$
$$V = 288\pi$$
$$V \approx 904.78$$

The volume of the ball is about 904.78 ft^3.

107. The radius is half the diameter.

$$V = \frac{1}{3}\pi r^2 h$$
$$V = \frac{1}{3}\pi\left(\frac{3}{2}\right)^2(8)$$
$$V = \frac{1}{3}\pi\left(\frac{9}{4}\right)(8)$$
$$V = \frac{1}{3}\pi(18)$$
$$V = 6\pi$$
$$V \approx 18.85$$

The volume of the cone is about 18.85 cubic feet.

108. $V = \frac{1}{3}\pi r^2 h$

$$V = \frac{1}{3}\pi(8)^2(15) \approx 1005.31$$

The volume of the bin is about 1005.31 cubic feet.

109. a. $B = \frac{703w}{h^2}$

b. 5 feet 3 inches $= 5(12) + 3$
$= 60 + 3$
$= 63$ inches

$$B = \frac{703(135)}{(63)^2} = \frac{94{,}905}{3969} \approx 23.91$$

110. $B = \frac{703(162)}{(67)^2} = \frac{113{,}886}{4489} \approx 25.37$

111. a. $V = lwh$
$V = (3x)(x)(6x-1)$
$= 3x^2(6x-1)$
$= 18x^3 - 3x^2$

b. $V = 18x^3 - 3x^2$
$V = 18(7)^3 - 3(7)^2$
$= 6174 - 147$
$= 6027$

Volume is 6027 cm^3.

c. $S = 2lw + 2lh + 2wh$
$S = 2(3x)(x) + 2(3x)(6x-1)$
$+ 2(x)(6x-1)$
$= 6x^2 + 36x^2 - 6x + 12x^2 - 2x$
$= 54x^2 - 8x$

d. $S = 54x^2 - 8x$
$S = 54(7)^2 - 8(7)$
$= 2646 - 56$
$= 2590$

Surface area is 2590 cm^2.

112. When using the distance formula, if the rate is doubled and the time is halved, the distance stays the same. To double the rate, multiply r by 2. To halve the time, divide t by 2.

$d = rt$

$$d = 2r \cdot \frac{t}{2} = \frac{2rt}{2} = rt$$

113. When using the simple interest formula, if the principal and rate are doubled and the time is halved, simple interest doubles. To double the principal, multiply p by 2. To double the rate, multiply r by 2. To halve the time, divide t by 2.

$I = prt$

$$I = 2p \cdot 2r \cdot \frac{t}{2} = \frac{4prt}{2} = 2prt$$

114 When using the formula for area of a square, if the side of the square is doubled, then the area becomes 4 times as large. To double the side length, multiply s by 2.

$A = s^2$

$$A = (2s)^2 = 2^2 s^2 = 4s^2$$

115. When using the formula for volume of a cube, if the side of the cube is doubled, then the volume becomes 8 times as large. To double the side length, multiply s by 2.

$V = s^3$

$$V = (2s)^3 = 2^3 s^3 = 8s^3$$

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116. 

Square: $A = s^2$

Circle: $A = \pi\left(\frac{s}{2}\right)^2 = \frac{\pi s^2}{4} = \frac{\pi}{4}s^2$

$\frac{\pi}{4} < 1$, so $s^2 > \frac{\pi s^2}{4}$

Therefore, a square with side length s inches has a greater area than a circle with diameter s inches.

117. 

First find the side length x of the square in terms of s. Use the Pythagorean theorem to solve. Then compare the areas of the square and circle.

$x^2 + x^2 = s^2$

$2x^2 = s^2$

$x^2 = \frac{s^2}{2}$

$x = \sqrt{\frac{s^2}{2}}$

Square: $A = x^2 = \frac{s^2}{2} = \frac{1}{2}s^2$

Circle: $A = \pi\left(\frac{s}{2}\right)^2 = \frac{\pi s^2}{4} = \frac{\pi}{4}s^2$

$\frac{\pi}{4} > \frac{1}{2}$, so $\frac{s^2}{2} < \frac{\pi s^2}{4}$

Therefore, a circle with diameter s inches has a greater area than a square with diagonal length s inches.

118. **a.** B^2 **b.** A^2 **c.** $A^2 - B^2$

d. A^2C **e.** $V = lwh$

$V = (1.5)(1.5)(0.8)$

$V = 1.8 \text{ ft}^3$

119. $-\frac{4}{15} + \frac{3}{5} = -\frac{4}{15} + \frac{3}{5} \cdot \frac{3}{3}$

$= -\frac{4}{15} + \frac{9}{15}$

$= \frac{5}{15}$

$= \frac{1}{3}$

120. $-6 + 7 - 4 - 3 = -6 + 7 + (-4) + (-3) = -6$

121. $\left[4\left(12 \div 2^2 - 3\right)^2\right]^2 = \left[4\left(12 \div 4 - 3\right)^2\right]^2$

$= \left[4(3-3)^2\right]^2$

$= \left[4(0)^2\right]^2$

$= \left[4(0)\right]^2$

$= (0)^2$

$= 0$

122. $\frac{r}{2} + 2r = 20$

$2\left(\frac{r}{2} + 2r\right) = 2(20)$

$r + 4r = 40$

$5r = 40$

$\frac{5r}{5} = \frac{40}{5}$

$r = 8$

Exercise Set 2.7

1. A proportion is a statement of equality of two ratios.

2. In the proportion $\frac{a}{b} = \frac{p}{q}$, a and q are called extremes.

3. In the proportion $\frac{a}{b} = \frac{p}{q}$, b and p are called means.

4. A method for solving proportions is cross multiplying.

5. Two figures that have equal corresponding angles and have their corresponding sides in proportion are called similar figures.

6. Another way of expressing the ratio $\frac{c}{d}$ is $c : d$.

7. When solving an applied problem involving proportions, it is crucial that the two ratios have the same units.

8. The quotient of two quantities is called a ratio.

9. 6:9 = 2:3

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10. 6:4 = 3:2

11. 6:24 = 1:4

12. 9:24 = 3:8

13. Grades better than C = 6 + 4 = 10
Ratio of grades better than C to total grades = 10:24 = 5:12

14. Grades better than C $= 6+4=10$
Grades less than C = 3 + 2 = 5
Ratio of grades better than C to grades less than C = 10:5 = 2:1

15. 7:4

16. 3:47

17. 5:15 = 1:3

18. 18:24 = 3:4

19. 3 hours $=3\times60=180$ minutes
Ratio is $\frac{180}{30}=\frac{6}{1}$ or 6:1.

20. 7 minutes $=7\times60=420$ seconds
Ratio is $\frac{420}{15}=\frac{28}{1}$ or 28:1.

21. 3 feet $=3\times12=36$ inches
Ratio is $\frac{36}{8}=\frac{9}{2}$ or 9:2.

22. 4 yards is $4\times3=12$ feet
Ratio is $\frac{6}{12}=\frac{1}{2}$ or 1:2.

23. 12 quarters is $12\cdot\left(\frac{5}{2}\right)=30$ dimes
Ratio is 7:30.

24. 5 quarters $=5\times5=25$ nickels
Ratio is $\frac{27}{25}$ or 27:25.

25. $\text{Gear ratio}=\frac{\text{number of teeth on driving gear}}{\text{number of teeth on driven gear}}$
$=\frac{40}{5}=\frac{8}{1}$
Gear ratio is 8:1.

26. $\text{Gear ratio}=\frac{\text{number of teeth on driving gear}}{\text{number of teeth on driven gear}}$
$=\frac{30}{8}=\frac{15}{4}$
Thus the gear ratio is 15:4.
Dividing both parts of the ratio by 4, ratio can also be expressed as 3.75:1.

27. $\text{Gear ratio}=\frac{\text{number of teeth on driving gear}}{\text{number of teeth on driven gear}}$
$=\frac{45}{18}=\frac{5}{2}$
Thus the gear ratio is 5:2.
Dividing both parts of the ratio by 2, ratio can also be expressed as 2.5:1.

28. $\text{Gear ratio}=\frac{\text{number of teeth on driving gear}}{\text{number of teeth on driven gear}}$
$=\frac{56}{16}=\frac{7}{2}$
Thus the gear ratio is 7:2.
Dividing both parts of the ratio by 2, ratio can also be expressed as 3.5:1.

29. a) 663,000:1200 = 1105:2

b) Dividing both parts of the ratio by 2, ratio can also be expressed as 552.5:1.

30. a. 270:75 = 18:5

b. Dividing both parts of the ratio by 5, ratio can also be expressed as 3.6:1.

31. a. 2320:1450 = 8:5

b. Dividing both parts of the ratio by 5, ratio can also be expressed as 1.6:1.

32. a. 19,320:7850 = 1932:785

b. Since $1932 \div 785 \approx 2.46$, $1932:785 \approx 2.46:1$.

33. a. 35:17

b. 25:19

34. a. 2500:2200 = 25:22

b. 3500:2500 = 7:5

35. a. 40:32 or 5:4

b. 15:11

36. a. 80:11

b. 1:5

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37. $\frac{x}{3}=\frac{20}{5}$

$x\cdot 5=3\cdot 20$

$5x=60$

$\frac{5x}{5}=\frac{60}{5}$

$x=12$

38. $\frac{x}{8}=\frac{24}{48}$

$x\cdot 48=8\cdot 24$

$48x=192$

$\frac{48x}{48}=\frac{192}{48}$

$x=4$

39. $\frac{5}{3}=\frac{75}{a}$

$5\cdot a=3\cdot 75$

$5a=225$

$\frac{5a}{5}=\frac{225}{5}$

$a=45$

40. $\frac{7}{2}=\frac{63}{b}$

$7\cdot b=2\cdot 63$

$7b=126$

$\frac{7b}{7}=\frac{126}{7}$

$b=18$

41. $\frac{-7}{3}=\frac{21}{p}$

$-7\cdot p=3\cdot 21$

$-7p=63$

$\frac{-7p}{-7}=\frac{63}{-7}$

$p=-9$

42. $\frac{-12}{13}=\frac{36}{x}$

$-12\cdot x=13\cdot 36$

$-12x=468$

$\frac{-12x}{-12}=\frac{468}{-12}$

$x=-39$

43. $\frac{15}{45}=\frac{x}{-6}$

$15\cdot -6=45\cdot x$

$-90=45x$

$\frac{-90}{45}=\frac{45x}{45}$

$-2=x$

44. $\frac{18}{24}=\frac{y}{-16}$

$18\cdot(-16)=24\cdot y$

$-288=24y$

$\frac{288}{24}=\frac{24y}{24}$

$12=y$

45. $\frac{-1.3}{y}=\frac{3}{15}$

$-1.3\cdot 15=y\cdot 3$

$-19.5=3y$

$\frac{-19.5}{3}=\frac{3y}{3}$

$-6.5=y$

46. $\frac{3}{12}=\frac{-1.4}{z}$

$3\cdot z=12\cdot -1.4$

$3z=-16.8$

$\frac{3z}{3}=\frac{-16.8}{3}$

$z=-5.6$

47. $\frac{9}{12}=\frac{x}{8}$

$9\cdot 8=12\cdot x$

$72=12x$

$\frac{72}{12}=\frac{12x}{12}$

$6=x$

48. $\frac{2}{20}=\frac{x}{200}$

$2\cdot 200=20\cdot x$

$400=20x$

$\frac{400}{20}=\frac{20x}{20}$

$20=x$

49. $\frac{3}{12}=\frac{8}{x}$

$3x=12\cdot 8$

$3x=96$

$\frac{3x}{3}=\frac{96}{3}$

$x=32$

Thus the side is 32 inches in length.

50. $\frac{2}{1.8}=\frac{0.8}{x}$

$2x=(1.8)(0.8)$

$2x=1.44$

$\frac{2x}{2}=\frac{1.44}{2}$

$x=0.72$

Thus the side is 0.72 feet in length.

51. $\frac{4}{7}=\frac{9}{x}$

$4x=7\cdot 9$

$4x=63$

$\frac{4x}{4}=\frac{63}{4}$

$x=15.75$

Thus the side is 15.75 inches in length.

52. $\frac{5}{7}=\frac{8}{x}$

$5x=7\cdot 8$

$5x=56$

$\frac{5x}{5}=\frac{56}{5}$

$x=11.2$

Thus the side is 11.2 feet in length.

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53. $\frac{16}{12}=\frac{26}{x}$

$16x=(12)(26)$

$16x=312$

$\frac{16x}{16}=\frac{312}{16}$

$x=19.5$

Thus the side is 19.5 inches in length.

54. $\frac{20}{8}=\frac{14}{x}$

$20x=(8)(14)$

$20x=112$

$\frac{20x}{20}=\frac{112}{20}$

$x=5.6$

Thus the side is 5.6 inches in length.

55. Let x = number of loads one bottle can do.

$\frac{4 \text{ fl ounces}}{1 \text{ load}}=\frac{100 \text{ fl ounces}}{x \text{ loads}}$

$\frac{4}{1}=\frac{100}{x}$

$4x=100$

$x=25$

One bottle can do 25 loads.

56. Let x = amount of time it takes to lay cable in hours.

$\frac{42 \text{ feet}}{1 \text{ hour}}=\frac{252 \text{ feet}}{x \text{ hours}}$

$\frac{42}{1}=\frac{252}{x}$

$42x=1\cdot 252$

$42x=252$

$x=6$

It will take them 6 hours.

57. Let x = number of miles that can be driven with a full tank.

$\frac{25 \text{ miles}}{1 \text{ gallon}}=\frac{x}{21.1 \text{ gallons}}$

$\frac{25}{1}=\frac{x}{21.1}$

$x=25(21.1)$

$x=527.5$

It can travel 527.5 miles on a full tank.

58. Let x = number of shares that can be purchased.

$\frac{2 \text{ shares}}{\$38.25}=\frac{x \text{ shares}}{\$344.25}$

$\frac{2}{38.25}=\frac{x}{344.25}$

$2(344.25)=38.25\cdot x$

$688.5=38.25x$

$18=x$

18 shares can be purchased.

59. Let x = length of model in feet.

$\frac{1 \text{ foot model}}{20 \text{ foot train}}=\frac{x \text{ foot model}}{30 \text{ foot train}}$

$\frac{1}{20}=\frac{x}{30}$

$20x=30$

$x=1.5$

The model should be 1.5 feet long.

60. Let x = Jane's property tax.

$\frac{\$1000 \text{ assessed value}}{\$15.9933 \text{ tax}}=\frac{\$333,716 \text{ assessed value}}{x \text{ dollars tax}}$

$\frac{1000}{15.9933}=\frac{333,716}{x}$

$1000x=(15.9933)(333,716)$

$1000x=5,337,220.103$

$x\approx 5337.22$

Thus Jane's property tax is \$5337.22.

61. Let x = number of teaspoons needed for sprayer.

$\frac{3 \text{ teaspoons}}{1 \text{ gallon water}}=\frac{x \text{ teaspoons}}{8 \text{ gallons water}}$

$\frac{3}{1}=\frac{x}{8}$

$3\cdot 8=1\cdot x$

$24=x$

Thus 24 teaspoons are needed for the sprayer.

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62. Let x = number of pounds of fertilizer needed.

$$\frac{5000 \text{ square feet}}{40 \text{ pounds fertilizer}} = \frac{26{,}000 \text{ square feet}}{x \text{ pounds fertilizer}}$$

$$\frac{5000}{40} = \frac{26{,}000}{x}$$

$$5000x = (40)(26{,}000)$$

$$5000x = 1{,}040{,}000$$

$$x = 208$$

Thus 208 pounds of fertilizer are needed for 26,000 square feet.

63. Let x = actual distance in miles.

$$\frac{1 \text{ inch}}{4 \text{ miles}} = \frac{3.75 \text{ inches}}{x \text{ miles}}$$

$$\frac{1}{4} = \frac{3.75}{x}$$

$$1 \cdot x = 4 \cdot 3.75$$

$$x = 15$$

The actual distance is 15 miles.

64. Let x = length on a map in inches.

$$\frac{0.5 \text{ inches}}{22 \text{ miles}} = \frac{x \text{ inches}}{55 \text{ miles}}$$

$$\frac{0.5}{22} = \frac{x}{55}$$

$$0.5 \cdot 55 = 22 \cdot x$$

$$27.5 = 22x$$

$$1.25 = x$$

The length on the map will be 1.25 inches.

65. Let x = number of cups needed.

$$\frac{1\frac{1}{2} \text{ cups}}{6 \text{ servings}} = \frac{x \text{ cups}}{15 \text{ servings}}$$

$$\frac{\frac{3}{2}}{6} = \frac{x}{15}$$

$$6x = 15 \cdot \frac{3}{2}$$

$$6x = 22.5$$

$$x = 3.75$$

3.75 cups of onions are needed.

66. Let x = time in hours it will take Karen to read the entire novel.

$$\frac{72 \text{ pages}}{1.3 \text{ hours}} = \frac{656 \text{ pages}}{x \text{ hours}}$$

$$\frac{72}{1.3} = \frac{656}{x}$$

$$72 \cdot x = 0.3 \cdot 656$$

$$72x = 852.8$$

$$x \approx 11.84$$

It will take her about 11.84 hours.

67. Let x = length of the model bull in feet.

$$\frac{2.95 \text{ feet metal bull}}{1 \text{ feet real bull}} = \frac{28 \text{ feet metal bull}}{\text{x feet real bull}}$$

$$\frac{2.95}{1} = \frac{28}{x}$$

$$2.95 \cdot x = 1 \cdot 28$$

$$2.95x = 28$$

$$x \approx 9.49$$

The model bull is about 9.49 feet long.

68. Let x = time, in minutes, it will take to remove the water.

$$\frac{3 \text{ inches}}{30 \text{ minutes}} = \frac{12 \text{ inches}}{x \text{ minutes}}$$

$$\frac{3}{30} = \frac{12}{x}$$

$$3x = 30 \cdot 12$$

$$3x = 360$$

$$x = \frac{360}{3} = 120$$

It will take 120 minutes or 2 hours.

69. Let x = number of milliliters to be given.

$$\frac{1 \text{ milliliter}}{400 \text{ micrograms}} = \frac{x \text{ milliliter}}{220 \text{ micrograms}}$$

$$\frac{1}{400} = \frac{x}{220}$$

$$1 \cdot 220 = 400 \cdot x$$

$$220 = 400x$$

$$\frac{220}{400} = x$$

$$0.55 = x$$

Thus 0.55 milliliter should be given.

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70. Let x = number of grams of meprobanate to be given.

$$\frac{1 \text{ sq m body surface}}{0.7 \text{ grams}} = \frac{0.6 \text{ sq m body surface}}{x \text{ grams}}$$

$$\frac{1}{0.7} = \frac{0.6}{x}$$

$$x = (0.6)(0.7)$$

$$x = 0.42$$

Thus 0.42 g meprobamate should be given.

71. Let x = number of minutes to read entire book.

$$\frac{40 \text{ pages}}{30 \text{ minutes}} = \frac{760 \text{ pages}}{x \text{ minutes}}$$

$$\frac{40}{30} = \frac{760}{x}$$

$$40x = (30)(760)$$

$$40x = 22{,}800$$

$$x = \frac{22{,}800}{40} = 570$$

Thus it will take her 570 minutes or 9 hours 30 minutes to read the entire book.

72. Let x = time, in minutes, it takes Jason to swim 30 laps.

$$\frac{3 \text{ laps}}{2.3 \text{ minutes}} = \frac{30 \text{ laps}}{x \text{ minutes}}$$

$$\frac{3}{2.3} = \frac{30}{x}$$

$$3 \cdot x = 2.3 \cdot 30$$

$$3x = 69$$

$$x = 23$$

It will take him 23 minutes.

73. Let x = number of children born with Prader-Willi Syndrome.

$$\frac{12{,}000 \text{ births}}{1 \text{ baby with syndrome}} = \frac{4{,}315{,}000 \text{ births}}{x \text{ babies with syndrome}}$$

$$\frac{12{,}000}{1} = \frac{4{,}315{,}000}{x}$$

$$12{,}000x = 4{,}315{,}000$$

$$x = \frac{4{,}315{,}000}{12{,}000} \approx 360$$

Thus, about 360 children were born with Prader-Willi Syndrome.

74. Let x = time it takes her to complete the scrapbook.

$$\frac{4 \text{ pages}}{20.5 \text{ minutes}} = \frac{36 \text{ pages}}{x \text{ minutes}}$$

$$\frac{4}{20.5} = \frac{36}{x}$$

$$4 \cdot x = 20.5 \cdot 36$$

$$4x = 738$$

$$x = \frac{738}{4} = 184.5$$

It will take her 184.5 minutes or 3 hr. 4 min. 30 sec. to complete the scrapbook.

75. $$\frac{12 \text{ inches}}{1 \text{ foot}} = \frac{78 \text{ inches}}{x \text{ feet}}$$

$$\frac{12}{1} = \frac{78}{x}$$

$$12x = 78$$

$$x = \frac{78}{12} = 6.5$$

Thus 78 inches equals 6.5 feet.

76. $$\frac{1 \text{ mile}}{5280 \text{ feet}} = \frac{x \text{ miles}}{22{,}704 \text{ feet}}$$

$$\frac{1}{5280} = \frac{x}{22{,}704}$$

$$22{,}704 = 5280x$$

$$\frac{22{,}704}{5280} = x$$

$$4.3 = x$$

Thus 22,704 feet equals 4.3 miles.

77. $$\frac{9 \text{ square feet}}{1 \text{ square yard}} = \frac{26.1 \text{ square feet}}{x \text{ square yards}}$$

$$\frac{9}{1} = \frac{26.1}{x}$$

$$9x = 26.1$$

$$x = \frac{26.1}{9} = 2.9$$

Thus 26.1 square feet equals 2.9 square yards.

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78. $\dfrac{1 \text{ pound}}{16 \text{ ounces}} = \dfrac{x \text{ pounds}}{146.4 \text{ ounces}}$

$$\frac{1}{16} = \frac{x}{146.4}$$
$$146.4 = 16x$$
$$\frac{146.4}{16} = x$$
$$9.15 = x$$

Thus 146.4 ounces equals 9.15 pounds.

79. $\dfrac{2.54 \text{ cm}}{1 \text{ inch}} = \dfrac{50.8 \text{ cm}}{x \text{ inches}}$

$$\frac{2.54}{1} = \frac{50.8}{x}$$
$$2.54x = 50.8$$
$$x = \frac{50.8}{2.54} = 20$$

Thus the length of the newborn is 20 inches.

80. $\dfrac{1 \text{ mile}}{1.6 \text{ kilometers}} = \dfrac{520 \text{ miles}}{x \text{ kilometers}}$

$$\frac{1}{1.6} = \frac{520}{x}$$
$$x = (1.6)(520)$$
$$x = 832$$

Thus the distance from San Diego to San Francisco is 832 kilometers.

81. $\dfrac{\$41.08}{1 \text{ gram}} = \dfrac{\$513.50}{x \text{ grams}}$

$$\frac{41.08}{1} = \frac{513.5}{x}$$
$$41.08 \cdot x = 1 \cdot 513.5$$
$$41.08x = 513.5$$
$$x = \frac{513.5}{41.08} = 12.5$$

Brie can purchase 12.5 grams of gold.

82. $\dfrac{\$31.08}{1 \text{ gram}} = \dfrac{\$1359.75}{x \text{ grams}}$

$$\frac{31.08}{1} = \frac{1359.75}{x}$$
$$31.08 \cdot x = 1 \cdot 1359.75$$
$$31.08x = 1359.75$$
$$x = \frac{1359.75}{31.08} = 43.75$$

Jacque can purchase 43.75 grams of platinum.

83. $\dfrac{\frac{3}{4} \text{ cup of sugar}}{2 \text{ gallons of punch}} = \dfrac{x \text{ cups of sugar}}{5 \text{ gallons of punch}}$

$$\frac{\frac{3}{4}}{2} = \frac{x}{5}$$
$$\frac{3}{4} \cdot 5 = 2x$$
$$\frac{15}{4} = 2x$$
$$\frac{15}{4}\left(\frac{1}{2}\right) = 2x\left(\frac{1}{2}\right)$$
$$\frac{15}{8} \text{ or } 1\frac{7}{8} = x$$

Tim needs $1\frac{7}{8}$ cups of sugar.

84. $\dfrac{\frac{1}{2} \text{ teaspoon of cayenne}}{3 \text{ avocados}} = \dfrac{x \text{ teaspoons of cayenne}}{8 \text{ avocados}}$

$$\frac{\frac{1}{2}}{3} = \frac{x}{8}$$
$$\frac{1}{2} \cdot 8 = 3x$$
$$4 = 3x$$
$$\frac{4}{3} = \frac{3x}{3}$$
$$\frac{4}{3} \text{ or } 1\frac{1}{3} = x$$

Anthony needs $1\frac{1}{3}$ teaspoons of cayenne pepper.

85. $\dfrac{\$1.00 \text{ U.S.}}{\$1.33 \text{ Canadian}} = \dfrac{\$x \text{ U.S.}}{\$1995 \text{ Canadian}}$

$$\frac{1}{1.33} = \frac{x}{1995}$$
$$1995 = 1.33x$$
$$\frac{1995}{1.33} = \frac{1.33x}{1.33}$$
$$1500 = x$$

Willy will need $1500 U.S. dollars.

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86. $\frac{\$1.00 \text{ U.S.}}{0.92 \text{ euros}} = \frac{\$400 \text{ U.S.}}{x \text{ euros}}$

$$\frac{1}{0.92} = \frac{400}{x}$$
$$1 \cdot x = 0.92 \cdot 400$$
$$x = 368$$

Andrew will receive 368 euros.

87. The ratio of Javier's total cholesterol to high density cholesterol is $\frac{175}{56}$. If we divide 175 by 56 we obtain 3.125. Thus Javier's ratio is equivalent to 3.125:1. Therefore his ratio is less than the desired 3.5:1 ratio.

88. a. The ratio of Cameron's total cholesterol to high density cholesterol is $\frac{216}{48}$. If we divide 216 by 48 we obtain 4.5. Thus Cameron's ratio is equivalent to 4.5:1. Therefore his ratio is not less than or equal to the desired 3.5:1 ratio.

89. In $\frac{a}{b} = \frac{c}{d}$, if b and d remain the same while a increases, then c increases because $ad = bc$. If a increases, then ad increases so bc must increase by increasing c.

90. In $\frac{a}{b} = \frac{c}{d}$, if a and c remain the same while d decreases, then b decreases because $ad = bc$. If d decreases, then ad decreases so bc must decrease by decreasing b.

91. Let x = number of miles remaining on the life of each tire.
Inches remaining on the life of each tire:
$0.31 - 0.06 = 0.25$

$$\frac{0.03 \text{ inches}}{5000 \text{ miles}} = \frac{0.25 \text{ miles}}{x \text{ miles}}$$
$$\frac{0.03}{5000} = \frac{0.25}{x}$$
$$0.03x = 5000 \cdot 0.25$$
$$0.03x = 1250$$
$$x = \frac{1250}{0.03}$$
$$x \approx 41{,}667$$

The tires will last about 41,667 more miles.

92. Let x represent the amount of the ingredient that should be used.

flour: $\frac{12}{8} = \frac{\frac{1}{2}}{x}$

$$12x = \left(\frac{1}{2}\right)8$$
$$12x = 4$$
$$x = \frac{1}{3}$$

$\frac{1}{3}$ cup of flour should be used.

nutmeg: $\frac{12}{8} = \frac{1}{x}$

$$12x = 8$$
$$x = \frac{2}{3}$$

$\frac{2}{3}$ teaspoon of nutmeg should be used.

cinnamon: $\frac{12}{8} = \frac{1}{x}$

$$12x = 8$$
$$x = \frac{2}{3}$$

$\frac{2}{3}$ teaspoon of cinnamon should be used.

salt: $\frac{12}{8} = \frac{\frac{1}{4}}{x}$

$$12x = \left(\frac{1}{4}\right)8$$
$$12x = 2$$
$$x = \frac{1}{6}$$

$\frac{1}{6}$ teaspoon of salt should be used.

butter: $\frac{12}{8} = \frac{2}{x}$

$$12x = 82$$
$$12x = 16$$
$$x = \frac{4}{3} \text{ or } 1\frac{1}{3}$$

$\frac{4}{3}$ or $1\frac{1}{3}$ tablespoons of butter should be used.

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sugar: $\frac{12}{8}=\frac{\frac{3}{2}}{x}$

$$12x=8\left(\frac{3}{2}\right)$$
$$12x=12$$
$$x=1$$

1 cup of sugar should be used.

93. Let x = number of cubic centimeters of fluid needed.

$$\frac{1}{40}=\frac{x}{25}$$
$$40x=25$$
$$x=\frac{25}{40}$$
$$x=0.625$$

0.625 cubic centimeters of fluid should be drawn up into a syringe.

94. a. – d. Answers will vary.

95. Answers will vary.

96. commutative property of addition

97. associative property of multiplication

98. distributive property

99.
$$3(4x-3)=6(2x+1)-15$$
$$12x-9=12x+6-15$$
$$12x-9=12x-9$$
$$12x-12x-9=12x-12x-9$$
$$-9=-9 \quad \text{True}$$

Since a true statement is obtained, the solution is all real numbers.

100.
$$y=mx+b$$
$$y-b=mx+b-b$$
$$y-b=mx$$
$$\frac{y-b}{x}=\frac{mx}{x}$$
$$\frac{y-b}{x}=m$$

Exercise Set 2.8

1. A mathematical statement that includes the symbols $<$, $>$, $\le$, or $\ge$ is called an inequality.

2. Whenever we multiply or divide both sides of an inequality by a negative number we must change the direction of the inequality symbol.

3. When representing a solution on a number line, an open circle, $\circ$, indicates that the endpoint is not included in the solution.

4. When representing a solution on a number line a closed circle, $\bullet$, indicates that the endpoint is included in the solution.

5. When we are solving an inequality and we obtain an inequality that is *always* true then we state that the solution is all real numbers.

6. When we are solving an inequality and we obtain an inequality that is *never* true then we state that there is no solution.

7. a.
$$-8<4$$
$$-4(-8)>-4(4)$$
$$32>-16$$

b.
$$-8<4$$
$$\frac{-8}{-4}>\frac{4}{-4}$$
$$2>-1$$

8. a.
$$12>-6$$
$$-3(12)<-3(-6)$$
$$-36<18$$

b.
$$12>-6$$
$$\frac{12}{-3}<\frac{-6}{-3}$$
$$-4<2$$

9. a.
$$5x\ge 15$$
$$\frac{5x}{5}\ge\frac{15}{5}$$
$$x\ge 3$$

b.
$$5x\ge -15$$
$$\frac{5x}{5}\ge\frac{-15}{5}$$
$$x\ge -3$$

c.
$$-5x\ge 15$$
$$\frac{-5x}{-5}\le\frac{15}{-5}$$
$$x\le -3$$

d.
$$-5x\ge -15$$
$$\frac{-5x}{-5}\le\frac{-15}{-5}$$
$$x\le 3$$

10. a.
$$6x\le 24$$
$$\frac{6x}{6}\le\frac{24}{6}$$
$$x\le 4$$

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b. $6x \le -24$

$$\frac{6x}{6} \le \frac{-24}{6}$$

$$x \le -4$$

c. $-6x \le 24$

$$\frac{-6x}{-6} \ge \frac{24}{-6}$$

$$x \ge -4$$

d. $-6x \le -24$

$$\frac{-6x}{-6} \ge \frac{-24}{-6}$$

$$x \ge 4$$

11. $x + 2 > 6$

$x + 2 - 2 > 6 - 2$

$x > 4$



$(4, \infty)$

12. $y + 6 > 2$

$y + 6 - 6 > 2 - 6$

$y > -4$



$(-4, \infty)$

13. $x - 3 \ge -9$

$x - 3 + 3 \ge -9 + 3$

$x \ge -6$



$[-6, \infty)$

14. $x - 7 > -3$

$x - 7 + 7 > -3 + 7$

$x > 4$



$(4, \infty)$

15. $-x + 3 < 8$

$-x + 3 - 3 < 8 - 3$

$-x < 5$

$(-1)(-x) > (-1)(5)$

$x > -5$



$(-5, \infty)$

16. $-x - 4 \ge 2$

$-x - 4 + 4 \ge 2 + 4$

$-x \ge 6$

$(-1)(-x) \le (-1)(6)$

$x \le -6$



$(-\infty, -6]$

17. $8 \le 2 - r$

$8 - 2 \le 2 - r - 2$

$6 \le -r$

$(-1)(6) \ge (-1)(-r)$

$-6 \ge r$

$r \le -6$



$(-\infty, -6]$

18. $15 < 12 - s$

$15 - 12 < -s$

$3 < -s$

$-1(3) > -1(-s)$

$-3 > s$

$s < -3$



$(-\infty, -3)$

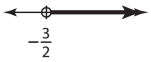
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19. $-2x < 3$

$$\frac{-2x}{-2} > \frac{3}{-2}$$

$$x > -\frac{3}{2}$$



$$\left(-\frac{3}{2}, \infty\right)$$

20. $-5x > -3$

$$\frac{-5x}{-5} < \frac{-3}{-5}$$

$$x < \frac{3}{5}$$



$$\left(-\infty, \frac{3}{5}\right)$$

21. $2t + 3 \le 5$

$$2t + 3 - 3 \le 5 - 3$$

$$2t \le 2$$

$$\frac{2t}{2} \le \frac{2}{2}$$

$$t \le 1$$



$$(-\infty, 1]$$

22. $7u + 5 \le 33$

$$7u + 5 - 5 \le 33 - 5$$

$$7u \le 28$$

$$\frac{7u}{7} \le \frac{28}{7}$$

$$u \le 4$$



$$(-\infty, 4]$$

23. $-4x - 3 > 5$

$$-4x - 3 + 3 > 5 + 3$$

$$-4x > 8$$

$$\frac{-4x}{-4} < \frac{8}{-4}$$

$$x < -2$$



$$(-\infty, -2)$$

24. $-7x + 9 \ge -12$

$$-7x + 9 - 9 \ge -12 - 9$$

$$-7x \ge -21$$

$$\frac{-7x}{-7} \le \frac{-21}{-7}$$

$$x \le 3$$



$$(-\infty, 3]$$

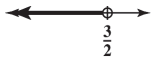
25. $4 - 6x > -5$

$$4 - 4 - 6x > -5 - 4$$

$$-6x > -9$$

$$\frac{-6x}{-6} < \frac{-9}{-6}$$

$$x < \frac{3}{2}$$



$$\left(-\infty, \frac{3}{2}\right)$$

26. $-3 - 8x < 7$

$$-3 + 3 - 8x < 7 + 3$$

$$-8x < 10$$

$$\frac{-8x}{-8} > \frac{10}{-8}$$

$$x > -\frac{5}{4}$$

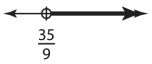


$$\left(-\frac{5}{4}, \infty\right)$$

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27.
$$\begin{aligned} 15 &> -9x + 50 \\ 9x + 15 &> -9x + 9x + 50 \\ 9x + 15 &> 50 \\ 9x + 15 - 15 &> 50 - 15 \\ 9x &> 35 \\ \frac{9x}{9} &> \frac{35}{9} \\ x &> \frac{35}{9} \end{aligned}$$



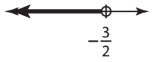
$\left(\frac{35}{9}, \infty\right)$

28.
$$\begin{aligned} 8 &< 4 - 2q \\ 8 - 4 &< 4 - 4 - 2q \\ 4 &< -2q \\ \frac{4}{-2} &> \frac{-2q}{-2} \\ -2 &> q \\ q &< -2 \end{aligned}$$



$(-\infty, -2)$

29.
$$\begin{aligned} 7 &> 2x + 10 \\ 7 - 10 &> 2x + 10 - 10 \\ -3 &> 2x \\ \frac{-3}{2} &> \frac{2x}{2} \\ -\frac{3}{2} &> x \\ x &< -\frac{3}{2} \end{aligned}$$



$\left(-\infty, -\frac{3}{2}\right)$

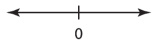
30.
$$\begin{aligned} -15 &\le 3x - 10 \\ -15 + 10 &\le 3x - 10 + 10 \\ -5 &\le 3x \\ \frac{-5}{3} &\le \frac{3x}{3} \\ -\frac{5}{3} &\le x \\ x &\ge -\frac{5}{3} \end{aligned}$$



$\left[-\frac{5}{3}, \infty\right)$

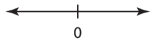
31.
$$\begin{aligned} 16s + 2 &\le 16s - 9 \\ 16s + 2 - 2 &\le 16s - 9 - 2 \\ 16s &\le 16s - 11 \\ 16s - 16s &\le 16s - 16s - 11 \\ 0 &\le -11 \quad \text{False} \end{aligned}$$

Since a false statement is obtained, there is no solution.



32.
$$\begin{aligned} -5t + 3 &< -5t - 7 \\ -5t + 3 + 7 &< -5t - 7 + 7 \\ -5t + 10 &< -5t \\ -5t + 5t + 10 &< -5t + 5t \\ 10 &< 0 \quad \text{False} \end{aligned}$$

Since a false statement is obtained, there is no solution.



33.
$$\begin{aligned} x - 4 &\le 3x + 8 \\ x - 4 - 8 &\le 3x + 8 - 8 \\ x - 12 &\le 3x \\ x - x - 12 &\le 3x - x \\ -12 &\le 2x \\ \frac{-12}{2} &\le \frac{2x}{2} \\ -6 &\le x \\ x &\ge -6 \end{aligned}$$



$[-6, \infty)$

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34.
$$-4n-6>4n-20$$
$$-4n+4n-6+>4n+4n-20$$
$$-6>8n-20$$
$$-6+20>8n-20+20$$
$$14>8n$$
$$\frac{14}{8}>n$$
$$\frac{7}{4}>n$$
$$n<\frac{7}{4}$$



$$\left(-\infty,\ \frac{7}{4}\right)$$

35.
$$-x+4<-3x+6$$
$$-x+4-4\le-3x+6-4$$
$$-x<-3x+2$$
$$-x+3x<-3x+3x+2$$
$$2x<2$$
$$\frac{2x}{2}<\frac{2}{2}$$
$$x<1$$



$$(-\infty,\ 1)$$

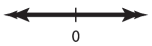
36.
$$-3x+5>-5x+13$$
$$-3x+5-5>-5x+13-5$$
$$-3x>-5x+8$$
$$-3x+5x>-5x+5x+8$$
$$2x>8$$
$$\frac{2x}{2}>\frac{8}{2}$$
$$x>4$$



$$(4,\ \infty)$$

37.
$$6(2m-4)\ge2(6m-12)$$
$$12m-24\ge12m-24$$
$$12m-12m-24\ge12m-12m-24$$
$$-24\ge-24 \quad \text{True}$$

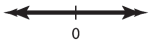
Since a true statement is obtained, the solution is all real numbers.



$$(-\infty,\ \infty)$$

38.
$$-3(8x+3)<4(-6x+1)$$
$$-24x-9<-24x+4$$
$$-24x-9+9<-24x+4+9$$
$$-24x<-24x+13$$
$$-24x+24x<-24x+24x+13$$
$$0<13$$

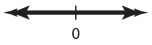
Since 0 is always less than 13, the solution is all real numbers



$$(-\infty,\ \infty)$$

39.
$$x+3<x+4$$
$$x-x+3<x-x+4$$
$$3<4$$

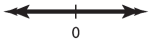
Since 3 is always less than 4, the solution is all real numbers.



$$(-\infty,\ \infty)$$

40.
$$y+4\ge y-3$$
$$y-y+4\ge y-y-3$$
$$4\ge-3 \quad \text{True}$$

Since 4 is always greater than or equal to –3, the solution is all real numbers.



$$(-\infty,\ \infty)$$

41.
$$6(3-x)<2x+15$$
$$18-6x<2x+15$$
$$18-15-6x<2x+15-15$$
$$3-6x<2x$$
$$3-6x+6x<2x+6x$$
$$3<8x$$
$$\frac{3}{8}<\frac{8x}{8}$$
$$\frac{3}{8}<x$$
$$x>\frac{3}{8}$$



$$\left(\frac{3}{8},\ \infty\right)$$

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42. $2(3-x)+4x<-6$

$6-2x+4x<-6$

$6+2x<-6$

$6-6+2x<-6-6$

$2x<-12$

$\frac{2x}{2}<\frac{-12}{2}$

$x<-6$



$(-\infty,\ -6)$

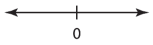
43. $4x-4<4(x-5)$

$4x-4<4x-20$

$4x-4x-4<4x-4x-20$

$-4<-20$

Since –4 is never less than –20, there is no solution.



44. $-2(-5-x)>3(x+2)+4-x$

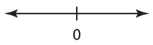
$10+2x>3x+6+4-x$

$10+2x>2x+10$

$10+2x-2x>2x-2x+10$

$10>10$

Since 10 is never greater than 10, there is no solution.



45. $5(2x+3)\ge 6+(x+2)-2x$

$10x+15\ge 6+x+2-2x$

$10x+15\ge 8-x$

$10x+15-15\ge 8-15-x$

$10x\ge -7-x$

$10x+x\ge -7-x+x$

$11x\ge -7$

$\frac{11x}{11}\ge\frac{-7}{11}$

$x\ge -\frac{7}{11}$



$\left[-\frac{7}{11},\infty\right)$

46. $-3(-2x+12)<-4(x+2)-6$

$6x-36<-4x-8-6$

$6x-36<-4x-14$

$6x+4x-36<-4x+4x-14$

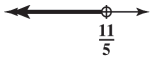
$10x-36<-14$

$10x-36+36<-14+36$

$10x<22$

$\frac{10x}{10}<\frac{22}{10}$

$x<\frac{11}{5}$



$\left(-\infty,\ \frac{11}{5}\right)$

47. $1.2x+3.1<3.5x-3.8$

$1.2x-1.2x+3.1<3.5x-1.2x-3.8$

$3.1<2.3x-3.8$

$3.1+3.8<2.3x-3.8+3.8$

$6.9<2.3x$

$\frac{6.9}{2.3}<\frac{2.3x}{2.3}$

$3<x$

$x>3$



$(3,\ \infty)$

48. $-5.3r-6.7\ge 2.3-6.5r$

$-5.3r+6.5r-6.7\ge 2.3-6.5r+6.5r$

$1.2r-6.7\ge 2.3$

$1.2r-6.7+6.7\ge 2.3+6.7$

$1.2r\ge 9.0$

$\frac{1.2r}{1.2}\ge\frac{9.0}{1.2}$

$r\ge 7.5$

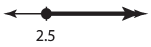


$(7.5,\ \infty)$

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49.
$$1.2(m-3) \geq 4.6(2-m)+1.7$$
$$1.2m-3.6 \geq 9.2-4.6m+1.7$$
$$1.2m-3.6 \geq 10.9-4.6m$$
$$1.2m+4.6m-3.6 \geq 10.9-4.6m+4.6m$$
$$5.8m-3.6 \geq 10.9$$
$$5.8m-3.6+3.6 \geq 10.9+3.6$$
$$5.8m \geq 14.5$$
$$\frac{5.8m}{5.8} \geq \frac{14.5}{5.8}$$
$$m \geq 2.5$$



$[2.5, \infty)$

50.
$$-4.6(4-x) < 2.4(x-3)-0.2$$
$$-18.4+4.6x < 2.4x-7.2-0.2$$
$$-18.4+4.6x < 2.4x-7.4$$
$$-18.4+4.6x-2.4x < 2.4x-2.4x-7.4$$
$$-18.4+2.2x < -7.4$$
$$-18.4+18.4+2.2x < -7.4+18.4$$
$$2.2x < 11.0$$
$$\frac{2.2x}{2.2} < \frac{11.0}{2.2}$$
$$x < 5$$



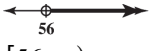
$(-\infty, 5)$

51.
$$\frac{x}{2} \geq \frac{x}{3}+5$$
$$6\left(\frac{x}{2}\right) \geq 6\left(\frac{x}{3}+5\right)$$
$$3x \geq 2x+30$$
$$3x-2x \geq 2x-2x+30$$
$$x \geq 30$$



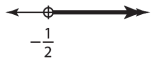
$[30, \infty)$

52.
$$\frac{x}{7}-1 \geq \frac{x}{8}$$
$$56\left(\frac{x}{7}-1\right) \geq 56\left(\frac{x}{8}\right)$$
$$8x-56 \geq 7x$$
$$8x-7x-56 \geq 7x-7x$$
$$x-56 \geq 0$$
$$x \geq 56$$



$[56, \infty)$

53.
$$t+\frac{1}{6} > \frac{2}{3}t$$
$$6\left(t+\frac{1}{6}\right) > 6\left(\frac{2}{3}t\right)$$
$$6t+1 > 4t$$
$$6t-6t+1 > 4t-6t$$
$$1 > -2t$$
$$\frac{1}{-2} < \frac{-2t}{-2}$$
$$-\frac{1}{2} < t$$
$$t > -\frac{1}{2}$$



$\left(-\frac{1}{2}, \infty\right)$

54.
$$\frac{3}{5}r-9 < \frac{3}{8}r$$
$$40\left(\frac{3}{5}r-9\right) < 40\left(\frac{3}{8}r\right)$$
$$24r-360 < 15r$$
$$24r-24r-360 < 15r-24r$$
$$-360 < -9r$$
$$\frac{-360}{-9} > \frac{-9r}{-9}$$
$$40 > r$$
$$r < 40$$



$(-\infty, 40)$

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55. $\frac{1}{8}(4-r)\le\frac{1}{4}$

$\frac{4}{8}-\frac{1}{8}r\le\frac{1}{4}$

$8\left(\frac{4}{8}-\frac{1}{8}r\right)\le 8\left(\frac{1}{4}\right)$

$4-r\le 2$

$4-4-r\le 2-4$

$-r\le -2$

$(-1)(-r)\ge(-1)(-2)$

$r\ge 2$



$[2,\infty)$

56. $\frac{1}{6}(5-a)\ge\frac{1}{3}$

$\frac{5}{6}-\frac{1}{6}a\ge\frac{1}{3}$

$\frac{5}{6}-\frac{5}{6}-\frac{1}{6}a\ge\frac{1}{3}-\frac{5}{6}$

$-\frac{1}{6}a\ge-\frac{3}{6}$

$-6\left(-\frac{1}{6}a\right)\le -6\left(-\frac{3}{6}\right)$

$a\le -3$



$(-\infty,\ 3]$

57. $\frac{2}{3}(t+2)\le\frac{1}{4}(2t-6)$

$\frac{2}{3}t+\frac{4}{3}\le\frac{1}{2}t-\frac{3}{2}$

$6\left(\frac{2}{3}t+\frac{4}{3}\right)\le 6\left(\frac{1}{2}t-\frac{3}{2}\right)$

$4t+8\le 3t-9$

$4t-3t+8\le 3t-3t-9$

$t+8\le -9$

$t+8-8\le -9-8$

$t\le -17$



$(-\infty,\ -17]$

58. $\frac{3}{4}(n-4)\ge\frac{2}{3}(n-4)$

$\frac{3}{4}n-3\ge\frac{2}{3}n-\frac{8}{3}$

$12\left(\frac{3}{4}n-3\right)\ge 12\left(\frac{2}{3}n-\frac{8}{3}\right)$

$9n-36\ge 8n-32$

$9n-8n-36\ge 8n-8n-32$

$n-36\ge -32$

$n-36+36\ge -32+36$

$n\ge 4$



$[4,\infty)$

59. a. The average high temperature was greater than 65°F in May, June, July, August, and September.

b. The average high temperature was less than or equal to 59°F in January, February, March, April, November, and December.

c. The average low temperature was less than 29°F in January, February, and December.

d. The average low temperature was greater than or equal to 58°F in June, July, and August.

60. a. Korea and Mexico

b. Mexico and the United States

c. United States and France

d. United States

61. $\neq$

62. The direction of the inequality symbol was not changed when both sides of the inequality were divided by –4.

63. We cannot divide both sides of an inequality by y because we do not know that y is positive. If y is negative, we must reverse the sign of the inequality.

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64. $3(2-x)-4(2x-3)\le 6+2x-4x$

$$6-3x-8x+12\le 6-2x$$
$$18-11x\le 6-2x$$
$$18-11x+11x\le 6-2x+11x$$
$$18\le 6+9x$$
$$18-6\le 6-6+9x$$
$$12\le 9x$$
$$\frac{12}{9}\le\frac{9x}{9}$$
$$\frac{4}{3}\le x \text{ or } x\ge\frac{4}{3}$$

65. $6x-6>-4(x+3)+5(x+6)-x$

$$6x-6>-4x-12+5x+30-x$$
$$6x-6>18$$
$$6x-6+6>18+6$$
$$6x>24$$
$$\frac{6x}{6}>\frac{24}{6}$$
$$x>4$$

66. Substitute 3 for x.

$$-x^2=-(3)^2$$
$$=-(3)(3)$$
$$=-9$$

67. Substitute -5 for x.

$$-x^2=-(-5)^2$$
$$=-(-5)(-5)$$
$$=-25$$

68. $4-3(2x-4)=5-(x+3)$

$$4-6x+12=5-x-3$$
$$-6x+16=2-x$$
$$-6x+6x+16=2-x+6x$$
$$16=2+5x$$
$$16-2=2-2+5x$$
$$14=5x$$
$$\frac{14}{5}=\frac{5x}{5}$$
$$\frac{14}{5}=x$$
$$x=\frac{14}{5} \text{ or } 2\frac{4}{5}$$

69. Let x = number of kilowatt-hours of electricity used.

$$\frac{\$0.174}{1 \text{ kilowatt-hour}}=\frac{\$87}{x \text{ kilowatt-hours}}$$
$$\frac{0.174}{1}=\frac{87}{x}$$
$$0.174x=87$$
$$x=\frac{87}{0.174}=500$$

Thus the Vega's used 500 kilowatt-hours of electricity in July.

Review Exercises

1. $3(x+8)=3x+3(8)$

$$=3x+24$$

2. $5(x-2)=5[x+(-2)]$

$$=5x+5(-2)$$
$$=5x+(-10)$$
$$=5x-10$$

3. $-2(x+4)=-2x+(-2)(4)$

$$=-2x+(-8)$$
$$=-2x-8$$

4. $-(x+2)=-1(x+2)$

$$=(-1)(x)+(-1)(2)$$
$$=-x+(-2)$$
$$=-x-2$$

5. $-(m+8)=-1(m+8)$

$$=(-1)(m)+(-1)(8)$$
$$=-m-8$$

6. $-4(4-x)=-4[4+(-x)]$

$$=(-4)(4)+(-4)(-x)$$
$$=-16+4x$$

7. $5(5-p)=5[5+(-p)]$

$$=5(5)+5(-p)$$
$$=25+(-5p)$$
$$=25-5p$$

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8. $6(4x-5)=6(4x)-6(5)$
$=24x-30$

9. $-5(5t-5)=-5[5t+(-5)]$
$=-5(5t)+(-5)(-5)$
$=-25t+25$

10. $4(-x+3)=4(-x)+4(3)$
$=-4x+12$

11. $\frac{1}{2}(2x+4)=\left(\frac{1}{2}\right)(2x)+\left(\frac{1}{2}\right)(4)$
$=x+2$

12. $-\frac{1}{3}(3+6y)=\left(-\frac{1}{3}\right)(3)+\left(-\frac{1}{3}\right)(6y)$
$=-1+(-2y)$
$=-1-2y$

13. $-(x+2y-z)=-1[x+2y+(-z)]$
$=-1(x)+(-1)(2y)+(-1)(-z)$
$=-x+(-2y)+z$
$=-x-2y+z$

14. $-3(2a-5b+7)=-3\left[2a+(-5b)+7\right]$
$=-3(2a)+(-3)(-5b)+(-3)(7)$
$=-6a+15b+(-21)$
$=-6a+15b-21$

15. $10m-6m=4m$

16. $5-3y+3=-3y+5+3$
$=-3y+8$

17. $1+3x+2x=1+5x$
$=5x+1$

18. $-2x-x+3y=-3x+3y$

19. $4m+2n+4m+6n=4m+4m+2n+6n$
$=8m+8n$

20. There are no like terms.
$9x+3y+2$ cannot be further simplified.

21. $6x-2x+3y+6=4x+3y+6$

22. $x+8x-9x+3=9x-9x+3$
$=3$

23. $-4x^2-8x^2+3=-12x^2+3$

24. $-2\left(3a^2-4\right)+6a^2-8=-6a^2+8+6a^2-8$
$=-6a^2+6a^2+8-8$
$=0$

25. $2x+3(x+4)-5=2x+3x+12-5$
$=5x+7$

26. $-4+2(3-2b)+b=-4+6-4b+b$
$=2-3b$
$=-3b+2$

27. $6-(-7x+6)-7x=6+7x-6-7x$
$=7x-7x+6-6$
$=0$

28. $2(2x+5)-10-4=4x+10-10-4$
$=4x-4$

29. $-6(4-3x)-18+4x=-24+18x-18+4x$
$=18x+4x-24-18$
$=22x-42$

30. $4.03x-2(x+1.6)+6x^2+1.09$
$=4.03x-2x-3.2+6x^2+1.09$
$=6x^2+4.03x-2x-3.2+1.09$
$=6x^2+2.03x-2.11$

31. $\frac{1}{4}d+2-\frac{3}{5}d+5=\frac{1}{4}d-\frac{3}{5}d+2+5$
$=\frac{5}{20}d-\frac{12}{20}d+7$
$=-\frac{7}{20}d+7$

32. $3-(a-b)+(a-b)=3-a+b+a-b$
$=-a+a+b-b+3$
$=3$

33. $\frac{5}{6}x-\frac{1}{3}(2x-6)=\frac{5}{6}x-\frac{2}{3}x+2$
$=\frac{5}{6}x-\frac{4}{6}x+2$
$=\frac{1}{6}x+2$

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34. $\frac{2}{3}-\frac{1}{4}n-\frac{1}{3}(n+2)=\frac{2}{3}-\frac{1}{4}n-\frac{1}{3}n-\frac{2}{3}$

$=-\frac{1}{4}n-\frac{1}{3}n+\frac{2}{3}-\frac{2}{3}$

$=-\frac{3}{12}n-\frac{4}{12}n+0$

$=-\frac{7}{12}n$

35. $-3x=-3$

$\frac{-3x}{-3}=\frac{-3}{-3}$

$x=1$

36. $t+6=-7$

$t+6-6=-7-6$

$t=-13$

37. $x-4=7$

$x-4+4=7+4$

$x=11$

38. $\frac{x}{3}=-9$

$3\left(\frac{x}{3}\right)=3(-9)$

$x=-27$

39. $-\frac{a}{5}=3$

$-5\left(-\frac{a}{5}\right)=-5(3)$

$a=-15$

40. $14=3+2x$

$14-3=3-3+2x$

$11=2x$

$\frac{11}{2}=\frac{2x}{2}$

$\frac{11}{2}=x$

41. $4c+11=-21$

$4c+11-11=-21-11$

$4c=-32$

$\frac{4c}{4}=\frac{-32}{4}$

$c=-8$

42. $9-2a=15$

$9-9-2a=15-9$

$-2a=6$

$\frac{-2a}{-2}=\frac{6}{-2}$

$a=-3$

43. $-x=-12$

$-1x=-12$

$(-1)(-1x)=(-1)(-12)$

$1x=12$

$x=12$

44. $3(x-2)=6$

$3x-6=6$

$3x-6+6=6+6$

$3x=12$

$\frac{3x}{3}=\frac{12}{3}$

$x=4$

45. $-12=3(2x-8)$

$-12=6x-24$

$-12+24=6x-24+24$

$12=6x$

$\frac{12}{6}=\frac{6x}{6}$

$2=x$

46. $4(6+2x)=0$

$24+8x=0$

$24-24+8x=0-24$

$8x=-24$

$\frac{8x}{8}=\frac{-24}{8}$

$x=-3$

47. $-6n+2n+6=0$

$-4n+6=0$

$-4n+6-6=0-6$

$-4n=-6$

$\frac{-4n}{-4}=\frac{-6}{-4}$

$n=\frac{6}{4}=\frac{3}{2}$

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48.
$$\begin{aligned}-3&=3w-(4w+6)\\-3&=3w-4w-6\\-3&=-1w-6\\-3+6&=-1w-6+6\\3&=-1w\\\frac{3}{-1}&=\frac{-1w}{-1}\\-3&=w\end{aligned}$$

49.
$$\begin{aligned}6-(2n+3)-4n&=6\\6-2n-3-4n&=6\\6-3-2n-4n&=6\\3-6n&=6\\3-3-6n&=6-3\\-6n&=3\\\frac{-6n}{-6}&=\frac{3}{-6}\\n&=-\frac{3}{6}=-\frac{1}{2}\end{aligned}$$

50.
$$\begin{aligned}6(2x-3)-4(3x-2)&=13\\12x-18-12x+8&=13\\12x-12x-18+8&=13\\-10&=13\quad\text{False}\end{aligned}$$
Since a false statement is obtained, there is no solution.

51.
$$\begin{aligned}5+3(x-1)&=3(x+1)-1\\5+3x-3&=3x+3-1\\3x+2&=3x+2\\3x-3x+2&=3x-3x+2\\2&=2\quad\text{True}\end{aligned}$$
The solution is all real numbers.

52.
$$\begin{aligned}8.4r-6.3&=6.3+2.1r\\8.4r-2.1r-6.3&=6.3+2.1r-2.1r\\6.3r-6.3&=6.3\\6.3r-6.3+6.3&=6.3+6.3\\6.3r&=12.6\\\frac{6.3r}{6.3}&=\frac{12.6}{6.3}\\r&=2\end{aligned}$$

53.
$$\begin{aligned}1.1x-2.34&=0.09x+1.7\\1.1x-0.09x-2.34&=0.09x-0.09x+1.7\\1.01x-2.34&=1.7\\1.01x-2.34+2.34&=1.7+2.34\\1.01x&=4.04\\\frac{1.01x}{1.01}&=\frac{4.04}{1.01}\\x&=4\end{aligned}$$

54.
$$\begin{aligned}0.35(c-5)&=0.45(c+4)\\0.35c-1.75&=0.45c+1.8\\0.35c-0.35c-1.75&=0.45c-0.35c+1.8\\-1.75&=0.10c+1.8\\-1.75-1.8&=0.10c+1.8-1.8\\-3.55&=0.10c\\\frac{-3.55}{0.10}&=\frac{0.10c}{0.10}\\-35.5&=c\end{aligned}$$

55.
$$\begin{aligned}0.2(x+6)&=-0.3(2x-1)\\0.2x+1.2&=-0.6x+0.3\\0.2x+0.6x+1.2&=-0.6x+0.6x+0.3\\0.8x+1.2&=0.3\\0.8x+1.2-1.2&=0.3-1.2\\0.8x&=-0.9\\\frac{0.8x}{0.8}&=\frac{-0.9}{0.8}\\x&=-1.125\end{aligned}$$

56.
$$\begin{aligned}-2.3(x-8)&=3.7(x+4)\\-2.3x+18.4&=3.7x+14.8\\-2.3x+2.3x+18.4&=3.7x+2.3x+14.8\\18.4&=6.0x+14.8\\18.4-14.8&=6.0x+14.8-14.8\\3.6&=6.0x\\\frac{3.6}{6.0}&=\frac{6.0x}{6.0}\\0.6&=x\end{aligned}$$

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57.
$$\frac{p}{3}+2=\frac{1}{4}$$
$$12\left(\frac{p}{3}+2\right)=12\left(\frac{1}{4}\right)$$
$$4p+24=3$$
$$4p+24-24=3-24$$
$$4p=-21$$
$$\frac{4p}{4}=\frac{-21}{4}$$
$$p=-\frac{21}{4}$$

58.
$$\frac{d}{6}+\frac{1}{7}=2$$
$$42\left(\frac{d}{6}+\frac{1}{7}\right)=42(2)$$
$$7d+6=84$$
$$7d+6-6=84-6$$
$$7d=78$$
$$\frac{7d}{7}=\frac{78}{7}$$
$$d=\frac{78}{7}$$

59.
$$\frac{3}{5}(r-6)=3r$$
$$\frac{3}{5}r-\frac{18}{5}=3r$$
$$5\left(\frac{3}{5}r-\frac{18}{5}\right)=5(3r)$$
$$3r-18=15r$$
$$3r-3r-18=15r-3r$$
$$-18=12r$$
$$\frac{-18}{12}=\frac{12r}{12}$$
$$-\frac{18}{12}=r$$
$$-\frac{3}{2}=r$$

60.
$$\frac{2}{3}w=\frac{1}{6}(w-2)$$
$$\frac{2}{3}w=\frac{1}{6}w-\frac{2}{6}$$
$$6\left(\frac{2}{3}w\right)=6\left(\frac{1}{6}w-\frac{2}{6}\right)$$
$$4w=w-2$$
$$4w-w=w-w-2$$
$$3w=-2$$
$$\frac{3w}{3}=\frac{-2}{3}$$
$$w=-\frac{2}{3}$$

61.
$$8x-5=-4x+19$$
$$8x+4x-5=-4x+4x+19$$
$$12x-5=19$$
$$12x-5+5=19+5$$
$$12x=24$$
$$\frac{12x}{12}=\frac{24}{12}$$
$$x=2$$

62.
$$-(w+2)=2(3w-6)$$
$$-w-2=6w-12$$
$$-w-2+12=6w-12+12$$
$$-w+10=6w$$
$$-w+w+10=6w+w$$
$$10=7w$$
$$\frac{10}{7}=\frac{7w}{7}$$
$$\frac{10}{7}=w$$

63.
$$2x+6=3x+9-3$$
$$2x+6=3x+6$$
$$2x-2x+6=3x-2x+6$$
$$6=x+6$$
$$6-6=x+6-6$$
$$0=x$$

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64.
$$\begin{aligned} -5a+3 &= 2a+10 \\ -5a+3-10 &= 2a+10-10 \\ -5a-7 &= 2a \\ -5a+5a-7 &= 2a+5a \\ -7 &= 7a \\ \frac{-7}{7} &= \frac{7a}{7} \\ -1 &= a \end{aligned}$$

65.
$$\begin{aligned} 5p-2 &= -2(-3p+6) \\ 5p-2 &= 6p-12 \\ 5p-5p-2 &= 6p-5p-12 \\ -2 &= p-12 \\ -2+12 &= p-12+12 \\ 10 &= p \end{aligned}$$

66.
$$\begin{aligned} 3x-12x &= 24-9x \\ -9x &= 24-9x \\ -9x+9x &= 24-9x+9x \\ 0 &= 24 \quad \text{False} \end{aligned}$$
Since a false statement is obtained, there is no solution.

67.
$$\begin{aligned} 4(2x-3)+4 &= 8x-8 \\ 8x-12+4 &= 8x-8 \\ 8x-8 &= 8x-8 \end{aligned}$$
Since the equation is true for all values of x, the solution is all real numbers.

68.
$$\begin{aligned} 4-c-2(4-3c) &= 3(c-4) \\ 4-c-8+6c &= 3c-12 \\ 5c-4 &= 3c-12 \\ 5c-3c-4 &= 3c-3c-12 \\ 2c-4 &= -12 \\ 2c-4+4 &= -12+4 \\ 2c &= -8 \\ \frac{2c}{2} &= \frac{-8}{2} \\ c &= -4 \end{aligned}$$

69.
$$\begin{aligned} 2(x+7) &= 6x+9-4x \\ 2x+14 &= 6x+9-4x \\ 2x+14 &= 2x+9 \\ 2x-2x+14 &= 2x-2x+9 \\ 14 &= 9 \quad \text{False} \end{aligned}$$
Since a false statement is obtained, there is no solution.

70.
$$\begin{aligned} -5(3-4x) &= -6+20x-9 \\ -15+20x &= -6+20x-9 \\ -15+20x &= -15+20x \end{aligned}$$
The statement is true for all values of x, thus the solution is all real numbers.

71.
$$\begin{aligned} 4(x-3)-(x+5) &= 0 \\ 4x-12-x-5 &= 0 \\ 3x-17 &= 0 \\ 3x-17+17 &= 0+17 \\ 3x &= 17 \\ \frac{3x}{3} &= \frac{17}{3} \\ x &= \frac{17}{3} \end{aligned}$$

72.
$$\begin{aligned} -2(4-x) &= 6(x+2)+3x \\ -8+2x &= 6x+12+3x \\ -8+2x &= 9x+12 \\ -8-12+2x &= 9x+12-12 \\ -20+2x &= 9x \\ -20+2x-2x &= 9x-2x \\ -20 &= 7x \\ \frac{-20}{7} &= \frac{7x}{7} \\ -\frac{20}{7} &= x \end{aligned}$$

73.
$$\begin{aligned} \frac{x+3}{2} &= \frac{x}{2} \\ 2(x+3) &= 2x \\ 2x+6 &= 2x \\ 2x-2x+6 &= 2x-2x \\ 6 &= 0 \quad \text{False} \end{aligned}$$
Since a false statement is obtained, there is no solution.

74.
$$\begin{aligned} \frac{y}{7} &= \frac{y-5}{2} \\ 2 \cdot y &= 7(y-5) \\ 2y &= 7y-35 \\ 2y-7y &= 7y-7y-35 \\ -5y &= -35 \\ \frac{-5y}{-5} &= \frac{-35}{-5} \\ y &= 7 \end{aligned}$$

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75. $\frac{1}{5}(3s+4)=\frac{1}{3}(2s-8)$

$\frac{3}{5}s+\frac{4}{5}=\frac{2}{3}s-\frac{8}{3}$

$15\left(\frac{3}{5}s+\frac{4}{5}\right)=15\left(\frac{2}{3}s-\frac{8}{3}\right)$

$9s+12=10s-40$

$9s-9s+12=10s-9s-40$

$12=s-40$

$12+40=s-40+40$

$52=s$

76. $\frac{2(2t-4)}{5}=\frac{3t+6}{4}-\frac{3}{2}$

$\frac{4t-8}{5}=\frac{3t+6}{4}-\frac{3}{2}$

$20\left(\frac{4t-8}{5}\right)=20\left(\frac{3t+6}{4}-\frac{3}{2}\right)$

$4(4t-8)=5(3t+6)-30$

$16t-32=15t+30-30$

$16t-32=15t+0$

$16t-16t-32=15t-16t$

$-32=-1t$

$\frac{-32}{-1}=\frac{-1t}{-1}$

$32=t$

77. $\frac{2}{5}(2-x)=\frac{1}{6}(-2x+2)$

$\frac{4}{5}-\frac{2}{5}x=-\frac{2}{6}x+\frac{2}{6}$

$\frac{4}{5}-\frac{2}{5}x=-\frac{1}{3}x+\frac{1}{3}$

$15\left(\frac{4}{5}-\frac{2}{5}x\right)=15\left(-\frac{1}{3}x+\frac{1}{3}\right)$

$12-6x=-5x+5$

$12-6x+6x=-5x+6x+5$

$12=x+5$

$12-5=x+5-5$

$7=x$

78. $\frac{x}{4}+\frac{x}{6}=\frac{1}{2}(x+3)$

$\frac{x}{4}+\frac{x}{6}=\frac{x}{2}+\frac{3}{2}$

$12\left(\frac{x}{4}+\frac{x}{6}\right)=12\left(\frac{x}{2}+\frac{3}{2}\right)$

$3x+2x=6x+18$

$5x=6x+18$

$5x-6x=6x-6x+18$

$-1x=18$

$\frac{-1x}{-1}=\frac{18}{-1}$

$x=-18$

79. Substitute 7 for y, 2 for x, and 1 for b. Then solve for m.

$y=mx+b$

$7=m(2)+1$

$7=2m+1$

$7-1=2m+1-1$

$6=2m$

$\frac{6}{2}=\frac{2m}{2}$

$3=m$

80. Substitute 12 for h, 3 for b, and 5 for d. Then solve for A.

$A=\frac{1}{2}h(b+d)$

$A=\frac{1}{2}(12)(3+5)$

$A=\frac{1}{2}(12)(8)$

$A=48$

81. $A=\frac{1}{2}bh$

$A=\frac{1}{2}(8)(3)$

$A=12\text{ cm}^2$

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82. $V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(2)^3$

$V = \frac{4}{3}\pi(8)$

$V = \frac{32}{3}\pi \approx 33.51 \text{ in.}^3$

83. $P = 2l + 2w$

$P - 2w = 2l + 2w - 2w$

$P - 2w = 2l$

$\frac{P-2w}{2} = \frac{2l}{2}$

$\frac{P-2w}{2} = l$

84. $y - y_1 = m(x - x_1)$

$\frac{y-y_1}{x-x_1} = \frac{m(x-x_1)}{(x-x_1)}$

$\frac{y-y_1}{x-x_1} = m$

85. $-x + 3y = 2$

$-x + x + 3y = 2 + x$

$3y = x + 2$

$\frac{3y}{3} = \frac{x+2}{3}$

$y = \frac{x}{3} + \frac{2}{3}$

$y = \frac{1}{3}x + \frac{2}{3}$

86. $d = rt$

$d = (61.7)(5)$

$d = 308.5$

He traveled 308.5 miles.

87. $A = lw$

$A = (20)(12)$

$A = 240$

The area of the flower garden is 240 ft^2.

88. $V = \pi r^2 h$

$V = \pi(2)^2(2)$

$V = 8\pi \approx 25.13 \text{ in.}^3$

89. 15: 20 = 3: 4

90. 80 ounces $= \frac{80}{16} = 5$ pounds

The ratio of 80 ounces to 12 pounds is thus 5:12.

91. 4 minutes = 240 seconds

The ratio of 4 minutes to 40 seconds is $\frac{240}{40} = \frac{6}{1}$.

The ratio is 6:1.

92. $\frac{x}{4} = \frac{8}{16}$

$16 \cdot x = 8 \cdot 4$

$16x = 32$

$x = \frac{32}{16} = 2$

93. $\frac{5}{20} = \frac{x}{80}$

$20 \cdot x = 80 \cdot 5$

$20x = 400$

$x = \frac{400}{20} = 20$

94. $\frac{3}{t} = \frac{15}{45}$

$3 \cdot 45 = 15 \cdot t$

$135 = 15t$

$\frac{135}{15} = t$

$9 = t$

95. $\frac{20}{45} = \frac{15}{q}$

$20 \cdot q = 15 \cdot 45$

$20q = 675$

$q = \frac{675}{20} = \frac{135}{4}$

96. $\frac{6}{5} = \frac{-12}{x}$

$6 \cdot x = -12 \cdot 5$

$6x = -60$

$x = \frac{-60}{6} = -10$

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97. $\frac{b}{6}=\frac{8}{-3}$

$-3\cdot b=6\cdot 8$

$-3b=48$

$x=\frac{48}{-3}=-16$

98. $\frac{-7}{9}=\frac{-12}{y}$

$-7\cdot y=-12\cdot 9$

$-7y=-108$

$y=\frac{-108}{-7}$

$y=\frac{108}{7}$

99. $\frac{x}{-15}=\frac{30}{-5}$

$-5\cdot x=-15\cdot 30$

$-5x=-450$

$x=\frac{-450}{-5}=90$

100. $\frac{6}{8}=\frac{30}{x}$

$6\cdot x=8\cdot 30$

$6x=240$

$x=\frac{240}{6}=40$

The length of the side is thus 40 in.

101. $\frac{7}{3.5}=\frac{2}{x}$

$7\cdot x=2\cdot 3.5$

$7x=7$

$x=\frac{7}{7}=1$

The length of the side is thus 1 ft.

102. $3x+4\ge 10$

$3x+4-4\ge 10-4$

$3x\ge 6$

$\frac{3x}{3}\ge\frac{6}{3}$

$x\ge 2$



$[2,\ \infty)$

103. $-4a+10>4a-14$

$-4a+4a+10>4a+4a-14$

$10>8a-14$

$10+14>8a-14+14$

$24>8a$

$\frac{24}{8}>\frac{8a}{8}$

$3>a$

$a<3$



$(-\infty,\ 3)$

104. $5-3r\le 2r+15$

$5-15-3r\le 2r+15-15$

$-10-3r\le 2r$

$-10-3r+3r\le 2r+3r$

$-10\le 5r$

$\frac{-10}{5}\le\frac{5r}{5}$

$-2\le r$

$r\ge -2$



$[-2,\ \infty)$

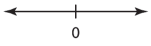
105. $2(x+4)\le 2x-5$

$2x+8\le 2x-5$

$2x-2x+8\le 2x-2x-5$

$8\le -5$

Since 8 is never less than or equal to –5, there is no solution.



106. $2(x+3)>6x-4x+4$

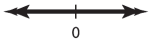
$2x+6>6x-4x+4$

$2x+6>2x+4$

$2x-2x+6>2x-2x+4$

$6>4$

Since 6 is always greater than 4, the answer is all real numbers.



$(-\infty,\ \infty)$

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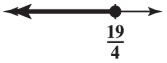
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107.
$$\begin{aligned} x+6 &> 9x+30 \\ x+6-30 &> 9x+30-30 \\ x-24 &> 9x \\ x-x-24 &> 9x-x \\ -24 &> 8x \\ \frac{-24}{8} &> \frac{8x}{8} \\ -3 &> x \\ x &< -3 \end{aligned}$$



$(-\infty, -3)$

108.
$$\begin{aligned} x-8 &\le -3x+11 \\ x+3x-8 &\le -3x+3x+11 \\ 4x-8 &\le 11 \\ 4x-8+8 &\le 11+8 \\ 4x &\le 19 \\ \frac{4x}{4} &\le \frac{19}{4} \\ x &\le \frac{19}{4} \end{aligned}$$



$\left(-\infty, \frac{19}{4}\right]$

109.
$$\begin{aligned} -(y+2) &< -2(-2y+5) \\ -y-2 &< 4y-10 \\ -y-2+10 &< 4y-10+10 \\ -y+8 &< 4y \\ -y+y+8 &< 4y+y \\ 8 &< 5y \\ \frac{8}{5} &< \frac{5y}{5} \\ \frac{8}{5} &< y \\ y &> \frac{8}{5} \end{aligned}$$



$\left(\frac{8}{5}, \infty\right)$

110.
$$\begin{aligned} \frac{x}{2} &< \frac{2}{3}(x+3) \\ \frac{x}{2} &< \frac{2}{3}x+2 \\ 6\left(\frac{x}{2}\right) &< 6\left(\frac{2}{3}x+2\right) \\ 3x &< 4x+12 \\ 3x-4x &< 4x-4x+12 \\ -1x &< 12 \\ \frac{-1x}{-1} &> \frac{12}{-1} \\ x &> -12 \end{aligned}$$



$(-12, \infty)$

111.
$$\begin{aligned} \frac{3}{10}(t-2) &\le \frac{3}{4}(4+2t) \\ \frac{3}{10}t-\frac{6}{10} &\le 3+\frac{6}{4}t \\ 20\left(\frac{3}{10}t-\frac{6}{10}\right) &\le 20\left(3+\frac{6}{4}t\right) \\ 6t-12 &\le 60+30t \\ 6t-6t-12 &\le 60+30t-6t \\ -12 &\le 60+24t \\ -12-60 &\le 60-60+24t \\ -72 &\le 24t \\ \frac{-72}{24} &\le \frac{24t}{24} \\ -3 &\le t \\ t &\ge -3 \end{aligned}$$



$[-3, \infty)$

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112. Let t = the time it will take in hours to make the boat trip.

$$\frac{40 \text{ miles}}{1.8 \text{ hours}} = \frac{140 \text{ miles}}{t \text{ hours}}$$
$$\frac{40}{1.8} = \frac{140}{t}$$
$$40 \cdot t = 1.8 \cdot 140$$
$$40t = 252$$
$$\frac{40t}{40} = \frac{252}{40}$$
$$t = 6.3$$

It will take the boat 6.3 hours to travel 140 miles.

113. Let x = number of dishes he can wash in 21 minutes.

$$\frac{12 \text{ dishes}}{3.5 \text{ minutes}} = \frac{x \text{ dishes}}{21 \text{ minutes}}$$
$$\frac{12}{3.5} = \frac{x}{21}$$
$$12 \cdot 21 = 3.5 \cdot x$$
$$252 = 3.5x$$
$$\frac{252}{3.5} = \frac{3.5x}{3.5}$$
$$72 = x$$

He can wash 72 dishes in 21 minutes.

114. Let x = number of pages that can be copied in 22 minutes.

$$\frac{1 \text{ minutes}}{20 \text{ pages}} = \frac{22 \text{ minutes}}{x \text{ pages}}$$
$$\frac{1}{20} = \frac{22}{x}$$
$$1 \cdot x = 22 \cdot 20$$
$$x = 440$$

440 pages can be copied in 22 minutes.

115. Let x = number of inches representing 380 miles.

$$\frac{60 \text{ miles}}{1 \text{ inch}} = \frac{380 \text{ miles}}{x \text{ inches}}$$
$$\frac{60}{1} = \frac{380}{x}$$
$$60 \cdot x = 380 \cdot 1$$
$$60x = 380$$
$$x = \frac{380}{60} = 6\frac{1}{3}$$

$6\frac{1}{3}$ inches on the map represent 380 miles.

116. Let x = size of actual car in feet

$$\frac{1 \text{ inch}}{1.5 \text{ feet}} = \frac{10.5 \text{ inches}}{x \text{ feet}}$$
$$\frac{1}{1.5} = \frac{10.5}{x}$$
$$1 \cdot x = 1.5 \cdot 10.5$$
$$x = 15.75$$

The size of the actual car is 15.75 ft.

117. Let x = the value of 1 peso in terms of U.S. dollars.

$$\frac{\$1 \text{ U.S.}}{20.52 \text{ pesos}} = \frac{x \text{ dollars}}{1 \text{ peso}}$$
$$\frac{1}{20.52} = \frac{x}{1}$$
$$20.52 \cdot x = 1 \cdot 1$$
$$20.52x = 1$$
$$x = \frac{1}{20.52} \approx 0.049$$

1 peso equals about \$0.049.

118. Let x = number of bottles the machine can fill and cap in 2 minutes.

2 minutes = 120 seconds

$$\frac{50 \text{ seconds}}{80 \text{ bottles}} = \frac{120 \text{ seconds}}{x \text{ bottles}}$$
$$\frac{50}{80} = \frac{120}{x}$$
$$50 \cdot x = 80 \cdot 120$$
$$50x = 9600$$
$$x = \frac{9600}{50} = 192$$

The machine can fill and cap 192 bottles in 2 minutes.

Practice Test

1. $-3(4-2x) = -3[4+(-2x)]$
$= -3(4)+(-3)(-2x)$
$= -12+6x$ or $6x-12$

2. $-(x+3y-4) = -[x+3y+(-4)]$
$= -1[x+3y+(-4)]$
$= (-1)(x)+(-1)(3y)+(-1)(-4)$
$= -x+(-3y)+4$
$= -x-3y+4$

3. $5x-8x+4 = -3x+4$

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4. $4+2x-3x+6=2x-3x+4+6$
$=-x+10$

5. $-y-x-4x-6=-x-4x-y-6$
$=-5x-y-6$

6. $a-2b+6a-6b-3=a+6a-2b-6b-3$
$=7a-8b-3$

7. $2x^2+3+2(3x-2)=2x^2+3+6x-4$
$=2x^2+6x+3-4$
$=2x^2+6x-1$

8. $2.4x-6.3=3.3$
$2.4x-6.3+6.3=3.3+6.3$
$2.4x=9.6$
$\frac{2.4x}{2.4}=\frac{9.6}{2.4}$
$x=4$

9. $\frac{5}{6}(x-2)=x-3$
$\frac{5}{6}x-\frac{10}{6}=x-3$
$6\left(\frac{5}{6}x-\frac{10}{6}\right)=6(x-3)$
$5x-10=6x-18$
$5x-5x-10=6x-5x-18$
$-10=x-18$
$-10+18=x-18+18$
$8=x$

10. $2x-3(-2x+4)=-13+x$
$2x+6x-12=-13+x$
$8x-12=-13+x$
$8x-12+12=-13+12+x$
$8x=-1+x$
$8x-x=-1+x-x$
$7x=-1$
$\frac{7x}{7}=\frac{-1}{7}$
$x=-\frac{1}{7}$

11. $3x-4-x=2(x+5)$
$3x-4-x=2x+10$
$2x-4=2x+10$
$2x-2x-4=2x-2x+10$
$-4=10$ False
Since a false statement is obtained, there is no solution.

12. $-3(2x+3)=-2(3x+1)-7$
$-6x-9=-6x-2-7$
$-6x-9=-6x-9$
Since the equation is true for all values of x, the solution is all real numbers.

13. $ax+by+c=0$
$ax+by-by+c=0-by$
$ax+c=-by$
$ax+c-c=-by-c$
$ax=-by-c$
$\frac{ax}{a}=\frac{-by-c}{a}$
$x=\frac{-by-c}{a}$

14. $-6x+5y=-2$
$-6x+6x+5y=-2+6x$
$5y=6x-2$
$\frac{5y}{5}=\frac{6x-2}{5}$
$y=\frac{6x}{5}-\frac{2}{5}$
$y=\frac{6}{5}x-\frac{2}{5}$

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15. $\frac{1}{7}(2x-5)=\frac{3}{8}x-\frac{5}{7}$

$$\frac{2}{7}x-\frac{5}{7}=\frac{3}{8}x-\frac{5}{7}$$
$$56\left(\frac{2}{7}x-\frac{5}{7}\right)=56\left(\frac{3}{8}x-\frac{5}{7}\right)$$
$$16x-40=21x-40$$
$$16x-16x-40=21x-16x-40$$
$$-40=5x-40$$
$$-40+40=5x-40+40$$
$$0=5x$$
$$\frac{0}{5}=\frac{5x}{5}$$
$$0=x$$

16. $\frac{9}{x}=\frac{3}{-15}$

$$9(-15)=3x$$
$$-135=3x$$
$$\frac{-135}{3}=x$$
$$-45=x$$

17. a. An equation that has exactly one solution is a conditional equation.

b. An equation that has no solution is a contradiction.

c. An equation that has all real numbers as its solution is an identity.

18. $2x-4<4x+10$

$$2x-4-10<4x+10-10$$
$$2x-14<4x$$
$$2x-2x-14<4x-2x$$
$$-14<2x$$
$$\frac{-14}{2}<\frac{2x}{2}$$
$$-7<x$$
$$x>-7$$



$(-7,\ \infty)$

19. $3(x+4)\geq 5x-12$

$$3x+12\geq 5x-12$$
$$3x+12+12\geq 5x-12+12$$
$$3x+24\geq 5x$$
$$3x-3x+24\geq 5x-3x$$
$$24\geq 2x$$
$$\frac{24}{2}\geq\frac{2x}{2}$$
$$12\geq x$$
$$x\leq 12$$

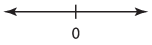


$(-\infty,\ 12]$

20. $4(x+3)+2x<6x-3$

$$4x+12+2x<6x-3$$
$$6x+12<6x-3$$
$$6x-6x+12<6x-6x-3$$
$$12<-3$$

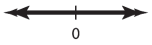
Since 12 is never less than –3, the answer is no solution.



21. $-(x-2)-3x=4(1-x)-2$

$$-x+2-3x=4-4x-2$$
$$-4x+2=-4x+2 \quad \text{True}$$

This equation is true for all real numbers.



$(-\infty,\ \infty)$

22. $\frac{3}{4}=\frac{8}{x}$

$$3x=4\cdot 8$$
$$3x=32$$
$$x=\frac{32}{3}$$

The length of side x is $\frac{32}{3}$ feet or $10\frac{2}{3}$ feet.

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23. Let r = the simple interest rate.

$$i = prt$$
$$80 = 2000 \cdot r \cdot 1$$
$$80 = 2000r$$
$$\frac{80}{2000} = \frac{2000r}{2000}$$
$$0.04 = r$$

The interest rate was 4%.

24. Let C= the circumference of the pie.

$$C = 2\pi r$$
$$C = 2\pi(4.5)$$
$$C = 9\pi \approx 28.27$$

The circumference of the pie is 28.27 in.

25. Let x = number of minutes it will take.

$$\frac{25 \text{ miles}}{35 \text{ minutes}} = \frac{125 \text{ miles}}{x \text{ minutes}}$$
$$\frac{25}{35} = \frac{125}{x}$$
$$25x = 35 \cdot 125$$
$$25x = 4375$$
$$x = \frac{4375}{25} = 175$$

It would take 175 minutes or 2 hours 55 minutes.

Cumulative Review Test

1. $\frac{52}{15} \cdot \frac{10}{13} = \frac{{}^{4}\cancel{52}}{{}_{3}\cancel{15}} \cdot \frac{\cancel{10}^{2}}{\cancel{13}_{1}}$

$$= \frac{4 \cdot 2}{3 \cdot 1}$$
$$= \frac{8}{3}$$

2. $\frac{5}{24} \div \frac{2}{9} = \frac{5}{24} \cdot \frac{9}{2}$

$$= \frac{5}{8} \cdot \frac{3}{2}$$
$$= \frac{5 \cdot 3}{8 \cdot 2}$$
$$= \frac{15}{16}$$

3. $|-2| > 1$ since $|-2| = 2$ and $2 > 1$.

4. $-5 - (-4) + 12 - 8 = -5 + 4 + 12 - 8$

$$= -1 + 12 - 8$$
$$= 11 - 8$$
$$= 3$$

5. $-7 - (-6) = -7 + 6$

$$= -1$$

6. $20 - 6 \div 3 \cdot 2 = 20 - 2 \cdot 2$

$$= 20 - 4$$
$$= 16$$

7. $3\left[6 - \left(4 - 8^2\right)\right] - 30 = 3\left[6 - (4 - 64)\right] - 30$

$$= 3\left[6 - (-60)\right] - 30$$
$$= 3[6 + 60] - 30$$
$$= 3(66) - 30$$
$$= 198 - 30$$
$$= 168$$

8. Substitute –2 for each x.

$$-2x^2 - 6x + 8 = -2(-2)^2 - 6(-2) + 8$$
$$= -2(4) - (-12) + 8$$
$$= -8 + 12 + 8$$
$$= 4 + 8$$
$$= 12$$

9. distributive property

10. $8x + 2y + 4x - y = 8x + 4x + 2y - y$

$$= 12x + y$$

11. $9 - \frac{2}{3}x + 16 + \frac{3}{4}x = \frac{3}{4}x - \frac{2}{3}x + 9 + 16$

$$= \frac{9}{12}x - \frac{8}{12}x + 25$$
$$= \frac{1}{12}x + 25$$

12. $7t + 3 = -4$

$$7t + 3 - 3 = -4 - 3$$
$$7t = -7$$
$$\frac{7t}{7} = \frac{-7}{7}$$
$$t = -1$$

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13.
$$4(x-2)=5(x-1)+3x+2$$
$$4x-8=5x-5+3x+2$$
$$4x-8=5x+3x-5+2$$
$$4x-8=8x-3$$
$$4x-4x-8=8x-4x-3$$
$$-8=4x-3$$
$$-8+3=4x-3+3$$
$$-5=4x$$
$$\frac{-5}{4}=\frac{4x}{4}$$
$$-\frac{5}{4}=x$$

14.
$$\frac{3}{4}n-\frac{1}{5}=\frac{2}{3}n$$
$$60\left(\frac{3}{4}n-\frac{1}{5}\right)=60\left(\frac{2}{3}n\right)$$
$$45n-12=40n$$
$$45n-45n-12=40n-45n$$
$$-12=-5n$$
$$\frac{-12}{-5}=\frac{-5n}{-5}$$
$$\frac{12}{5}=n$$

15.
$$A=\frac{a+b+c}{3}$$
$$3\cdot A=3\cdot\left(\frac{a+b+c}{3}\right)$$
$$3A=a+b+c$$
$$3A-a=a-a+b+c$$
$$3A-a=b+c$$
$$3A-a-c=b+c-c$$
$$3A-a-c=b$$

16.
$$\frac{40}{30}=\frac{3}{x}$$
$$40\cdot x=30\cdot 3$$
$$40x=90$$
$$\frac{40x}{40}=\frac{90}{40}$$
$$x=\frac{90}{40}=\frac{9}{4} \text{ or } 2.25$$

17.
$$x-3>7$$
$$x-3+3>7+3$$
$$x>10$$



$(10,\ \infty)$

18.
$$2x-7\le 3x+5$$
$$2x-7-5\le 3x+5-5$$
$$2x-12\le 3x$$
$$2x-2x-12\le 3x-2x$$
$$-12\le x$$
$$x\ge -12$$



$[-12,\ \infty)$

19. Let A = the area of the trampoline.
$$A=\pi r^2$$
$$A=\pi(11)^2$$
$$A=122\pi\approx 380.13$$
The area of the trampoline is 380.13 ft^2.

20. Let x = amount he earns after 8 hours.
$$\frac{2 \text{ hours}}{\$10.50}=\frac{8 \text{ hours}}{x \text{ dollars}}$$
$$\frac{2}{10.5}=\frac{8}{x}$$
$$2x=(10.5)(8)$$
$$2x=84$$
$$x=\frac{84}{2}=42$$
He earns \$42 after 8 hours.

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Name:_____

Date:_____

Chapter 2 Pretest Form A

Use the distributive property to simplify.

1. $8(7x-4y)$ **1.** _____

2. $-(3x+5y-9)$ **2.** _____

Simplify.

3. $4x-9x+3$ **3.** _____

4. $7x-9y-2x+y$ **4.** _____

5. $-6-(7+x)-9x$ **5.** _____

6. $\frac{2}{3}m \quad 2 \mid m \mid n \quad \left(\frac{3}{5}n\right) \mid \frac{1}{2}$ **6.** _____

Solve.

7. $x+3=18$ **7.** _____

8. $\frac{2}{3}x=36$ **8.** _____

9. $6x-1=47$ **9.** _____

10. $2x-5+3x=30$ **10.** _____

11. $9x-3=x-35$ **11.** _____

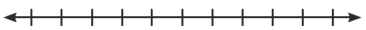
12. $3=4(x-1)+1-3x$ **12.** _____

13. $0.25(4x-5)=1.5x-0.1(5x+3)$ **13.** _____

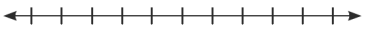
14. Solve the proportion: $\frac{6}{m}=\frac{3}{5}$ **14.** _____

Solve, graph the solution, and represent the solution in interval notation.

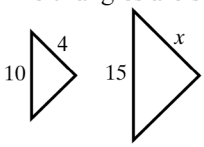
15. $x-10<-16$ **15.** _____



16. $5-3x\geq 26$ **16.** _____



17. The triangles are similar. Find the length of x. **17.** _____



18. A history class consists of 14 males and 11 females. Find the ratio of males to the entire class. **18.** _____

19. Convert 60 ounces to pounds. **19.** _____

20. A worker in an assembly line takes 9 hours to produce 24 parts. At that rate how many parts can she produce in 27 hours? **20.** _____

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Name:_____

Date:_____

Chapter 2 Pretest Form B

Use the distributive property to simplify.

1. $9(6-4x)$ **1.** _____

2. $-2(3a-2b+7)$ **2.** _____

Simplify.

3. $2x-9x+10$ **3.** _____

4. $\frac{3}{4}x+5-\frac{2}{3}x-\frac{3}{7}$ **4.** _____

5. $8-(5+x)+3x$ **5.** _____

6. $9x+7y+7x+y-8$ **6.** _____

Solve.

7. $20=m-3$ **7.** _____

8. $\frac{4}{5}x=100$ **8.** _____

9. $5y-4=6$ **9.** _____

10. $9x+6-3x=30$ **10.** _____

11. $3x-1=x+9$ **11.** _____

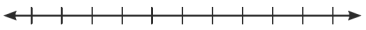
12. $0.7(2k-3)=1.3+0.4k$ **12.** _____

13. $6(x+6)=-1+6x$ **13.** _____

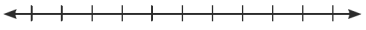
14. Solve the proportion: $\frac{15}{x}=\frac{25}{-40}$ **14.** _____

Solve, graph the solution, and represent the solution in interval notation.

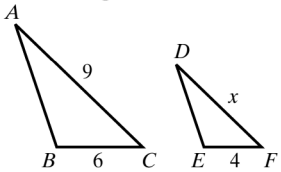
15. $x+6<2$ **15.** _____



16. $-5x\geq 25$ **16.** _____



17. The triangles are similar. Find the length of x. **17.** _____



18. Find the ratio of 10 dimes to 3 quarters. **18.** _____

19. Convert 20 inches to feet. **19.** _____

20. If 8 gallons of insecticide can treat 2 acres of land, how many gallons of insecticide are needed to treat 28 acres of land? **20.** _____

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Mini-Lecture 2.1
Combining Like Terms

Learning Objectives:

1. Identify terms.
2. Identify like terms.
3. Combine like terms.
4. Use the distributive property.
5. Remove parentheses when they are preceded by a plus or minus sign.
6. Simplify an expression.
7. Key vocabulary: *variable, algebraic expression, term, numerical coefficient, constant, combine like terms, simplifying an expression*

Examples:

1. Identify the terms.
   a) $3x+2-7y$ b) $-2m+5n+4$ c) $3a+b-8$
2. Identify any like terms.
   a) $2a-5+9-7a$ b) $3x^2+2x+4x^2$ c) $3+mn-5m+2$
3. Combine like terms.
   a) $\frac{2}{3}w+\frac{3}{4}w$ b) $-3x^2+5y-4x^2-12-3y+10$
4. Use the distributive property to remove parentheses.
   a) $3(m+7)$ b) $-5(s-4)$
5. Remove the parentheses.
   a) $(4x+2y-8)$ b) $-(3a-2b+7)$
6. Simplify.
   a) $-\left(\frac{3}{2}x-\frac{1}{4}\right)+5x$ b) $4(2x-3)-(5y+4)+8y$

Teaching Notes:

- When listing terms, students may need to be reminded to include the minus sign for terms with a negative coefficient.
- When using the distributive property, some students may forget to distribute minus signs across all terms inside the parentheses.
- Some students may not understand that terms can involve expressions (for example, 3(x + 1) is one term).

Answers: 1a) $3x$, 2, $-7y$; *1b)* $-2m$, $5n$, 4; *1c)* $3a$, b, -8; *2a)* $2a$ *and* $-7a$, -5 *and* 9; *2b)* $3x^2$ *and* $4x^2$; *2c)* 3 *and* 2; *3a)* $\frac{17}{12}w$; *3b)* $-7x^2+2y-2$; *4a)* $3m+21$; *4b)* $-5s+20$; *5a)* $4x+2y-8$; *5b)* $-3a+2b-7$; *6a)* $\frac{7}{2}x+\frac{1}{4}$; *6b)* $8x+3y-16$

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Mini-Lecture 2.2

The Addition Property of Equality

Learning Objectives:

1. Identify linear equations.
2. Check solutions to equations.
3. Identify equivalent equations.
4. Use the addition property to solve equations.
5. Solve equations by doing some steps mentally.
6. Key vocabulary: *equation, linear equation, solution to an equation, solve an equation, equivalent equations, addition property of equality*

Examples:

1. Identify whether each equation is linear.

   a) $3x+2=5x-1$ b) $2x+\frac{1}{x}=7$ c) $3\sqrt{x}+4=9$

2. Determine whether the given value is a solution to the equation $-3(1-x)-2x=7$.

   a) 5 b) 10 c) 15

3. Identify whether the pairs of equations are equivalent.

   a) $2x+5=-3$; $4x+5=-6$ b) $x+2=1$; $3x+6=3$ c) $4x-8=2$; $4x=10$

4. Solve each equation.

   a) $n-3=-15$ b) $w+5=9$ c) $h-\frac{2}{3}=\frac{1}{6}$

5. Solve each equation mentally.

   a) $-2=w-9$ b) $x+15=27$

Teaching Notes:

- Some students may need a short review on combining like terms.
- Emphasize that checking if a value is a solution is not the same as solving an equation.
- Remind students to check their solutions in the original equation.
- When obtaining equivalent equations, remind students that "*what you do to one side, you must do to the other.*"
- Explain to students that solving an equation for a variable just means to isolate the variable on one side of the equation.

Answers: 1a) linear; 1b) not linear; 1c) not linear; 2a) no; 2b) yes; 2c) no; 3a) not equivalent; 3b) equivalent; 3c) equivalent; 4a) $n=-12$; *4b)* $w=4$; *4c)* $h=\frac{5}{6}$; *5a)* $w=7$; *5b)* $x=12$

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Mini-Lecture 2.3

The Multiplication Property of Equality

Learning Objectives:

1. Identify reciprocals.
2. Use the multiplication property to solve equations.
3. Solve equations of the form $-x = a$.
4. Do some steps mentally when solving equations.
5. Key vocabulary: *reciprocal, multiplication property of equality*

Examples:

1. Identify which pairs of numbers are reciprocals.

   a) $\frac{2}{3}, -\frac{2}{3}$ b) $\frac{4}{5}, \frac{5}{4}$ c) $-\frac{4}{5}, -\frac{5}{4}$ d) $3, \frac{1}{3}$

2. Solve each equation.

   a) $3y = 27$ b) $\frac{t}{6} = 4$ c) $\frac{2}{7}w = 6$

   d) $2p = 16$ e) $0.15x = 6$ f) $-7x = -63$

3. Solve each equation.

   a) $-r = 17$ b) $-q = -10$

4. Solve each equation by doing at least one step mentally.

   a) $\frac{1}{7}h = 12$ b) $-5a = -80$

Teaching Notes:

- Remind students that the product of a number and its reciprocal is 1, and that 0 has no reciprocal.
- Point out that when the multiplication property is applied, like the addition property, an equivalent equation results.
- Remind students that multiplying both sides of an equation by the reciprocal of a is the same as dividing both sides of the equation by a.
- Emphasize that students should always check their solutions, and the check should be done with the original equation.

Answers: 1a) no; 1b) yes; 1c) yes; 1d) yes; 2a) $y = 9$; *2b)* $t = 24$; *2c)* $w = 21$; *2d)* $p = 8$; *2e)* $x = 40$; *2f)* $x = 9$; *3a)* $r = -17$; *3b)* $q = 10$; *4a)* $h = 84$; *4b)* $a = 16$

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Mini-Lecture 2.4

Solving Linear Equations with a Variable on Only One Side of the Equation

Learning Objectives:

1. Solve linear equations with a variable on only one side of the equation.
2. Solve equations containing decimal numbers or fractions.
3. Key vocabulary: *isolating a variable, addition property of equality, multiplication property of equality*

Examples:

1. Solve each equation.

   a) $4n-7=5$

   b) $2b+9=5$

   c) $3x+4=9$

   d) $-6k+2=7$

   e) $2x+2-3=5$

   f) $3x-5+2x=12$

   g) $-2(x+3)+4x=8$

   h) $10x-(5x+7)=1$

2. Solve each equation.

   a) $1.3x+4.2-0.5x=2.6$

   b) $4.7c-3.1-2.1c=3.4$

   c) $0.4w+1.4(w-3)=-5.1$

   d) $\frac{2}{3}(x-2)=5$

   e) $\frac{v}{4}-5v=11$

   f) $\frac{5}{4}p+\frac{3}{10}p=\frac{7}{5}$

Teaching Notes:

- Encourage students to review the addition property of equality and the multiplication property of equality.
- Common Error: When multiplying or dividing both sides of an equation by a number, some students do not distribute the number over each term on a side.
- When solving multi-step problems, remind students that they may first need to isolate the variable *terms* using the addition property. Then, they can isolate the variable using the multiplication property.
- Remind students that checks should always be made in the original equation.
- Point out that fractions can initially be cleared from an equation by multiplying both sides of the equation by the LCD.

Answers: *1a)* $n=3$; *1b)* $b=-2$; *1c)* $x=\frac{5}{3}$; *1d)* $k=-\frac{5}{6}$; *1e)* $x=3$; *1f)* $x=\frac{17}{5}$; *1g)* $x=7$; *1h)* $x=\frac{8}{5}$; *2a)* $x=-2$; *2b)* $c=2.5$; *2c)* $w=-0.5$; *2d)* $x=\frac{19}{2}$; *2e)* $v=-\frac{44}{19}$; *2f)* $p=\frac{28}{31}$

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Mini-Lecture 2.5

Solving Linear Equations with the Variable on Both Sides of the Equation

Learning Objectives:

1. Solve equations with the variable on both sides of the equation.
2. Solve equations containing decimal numbers or fractions.
3. Identify identities and contradictions.
4. Key vocabulary: *conditional equations, identity, contradiction*

Examples:

1. Solve each equation.

   a) $7x+5=2x-10$

   b) $4x-2x+9=3x+5x-15$

   c) $3-10a+5=2a+6-4a$

   d) $2(w+1)=3w+7$

   e) $16-3(2d+5)=4d-29$

   f) $3r-(6-r)=4+5(r-2)$

2. Solve each equation.

   a) $3.75+2.50p=5.50p+1.50$

   b) $\frac{5}{9}k=\frac{4}{3}k+\frac{7}{6}$

   c) $\frac{1}{5}x+\frac{2}{3}=\frac{3}{2}x-\frac{5}{6}$

   d) $\frac{2}{5}(10n+2)=\frac{1}{3}(9n+5)-1$

3. Solve each equation.

   a) $3x-8+2x=7x+5-2x$

   b) $3(x+1)-4=-2(2-x)+3+x$

   c) $0.25x-1.2(5x+22)=1.75x-2.50(3x+1)$

   d) $\frac{2}{3}x+\frac{1}{9}(3x+27)=4x-3(x-1)$

Teaching Notes:

- Encourage students to simplify both sides of the equation before using the addition property or multiplication property.
- Remind students that addition and subtraction are inverse operations, as are multiplication and division.
- Remind students to always check their solutions in the original equation. If the equation is an identity, have students check at least two different solutions.
- When isolating the variable, let students know that it does matter on which side the variable is isolated.

Answers: *1a)* $x=-3$; *1b)* $x=4$; *1c)* $a=\frac{1}{4}$; *1d)* $w=-5$; *1e)* $d=3$; *1f)* $r=0$; *2a)* $p=0.75$; *2b)* $k=-\frac{3}{2}$; *2c)* $x=\frac{15}{13}$; *2d)* $n=-\frac{2}{15}$; *3a) no solution; 3b) all real numbers; 3c) no solution; 3d) all real numbers*

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Mini-Lecture 2.6
Formulas

Learning Objectives:

1. Use the simple interest formula and the distance formula.
2. Use geometric formulas.
3. Solve for a variable in a formula.
4. Key vocabulary: *formula, evaluate a formula, simple interest, perimeter, area, circumference, radius, diameter, volume, distance formula*

Examples:

1. Solve.
   a) How much interest will be owed on a 5-year loan of $25,000 at 7.5% simple interest?
   b) What was the principal on a 4-year, 6% loan if the simple interest was $2040?
   c) Find the distance traveled if a van travels 4.5 hours at 65 miles per hour (mph).
   d) How fast is a car traveling if it travels 84 miles in 1.5 hours?

2. Solve.
   a) A rectangular tablecloth is 3 yards long and 2 yards wide. Find the perimeter and area.
   b) A rectangular pillowcase has an area of 600 square inches. If the length is 30 inches, what is the width?
   c) A swimming pool in the shape of a right circular cylinder is 4 feet deep and has a diameter of 12 feet. What is the volume of the pool?
   d) Find the circumference and area of a circular sign that has a radius of 70 centimeters.

3. Solve for the indicated variable.
   a) Solve $3x-2y=12$ for y.
   b) Solve $t=\dfrac{(2a+nd-d)n}{2}$ for a.

Teaching Notes:

- Remind students to pay attention to units. Sometimes a unit conversion will be necessary before using a formula. Encourage students to examine the variables in a formula to help determine what type of units will be in the final answer.
- When working with formulas, have students begin with the general form and then substitute in known quantities.
- Encourage students to draw a picture, when appropriate, labeling all known and unknown quantities.

Answers: 1a) $9375; 1b) $8500; 1c) 292.5 miles; 1d) 56 miles per hour; 2a) 10 yards, 6 square yards; 2b) 20 inches; 2c) $144\pi \approx 452.39$ *cubic feet; 2d)* 140π *cm,* $4900\pi \approx 15{,}393.804$ *square centimeters;*

3a) $y=\dfrac{3}{2}x-6$; *3b)* $a=\dfrac{2t-dn(n-1)}{2n}$

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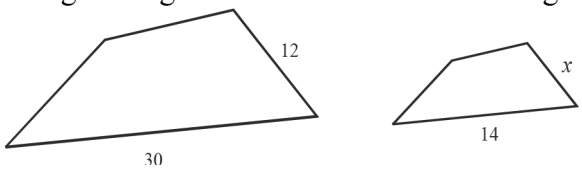
Mini-Lecture 2.7
Ratios and Proportions

Learning Objectives:

1. Understand ratios.
2. Solve proportions using cross-multiplication.
3. Solve applications.
4. Use proportions to change units.
5. Use proportions to solve problems involving similar figures.
6. Key vocabulary: *ratio, terms of the ratio, proportion, extremes, means, cross-multiplication, similar figures*

Examples:

1. In a survey of 25 algebra students, 11 said they were more visual learners, 8 said they were more auditory learners, and 6 were uncertain. Find the following ratios.
   a) the ratio of the number of visual learners to the number of auditory learners
   b) the ratio of the number of auditory learners to the total number surveyed
2. Solve the following by cross multiplying.
   a) $\frac{x}{3}=\frac{18}{27}$ b) $\frac{-4}{17}=\frac{28}{m}$
3. a) Shawn decides to mow lawns to earn some extra money. If it takes him 25 minutes to mow 3000 square feet, how long will it take him to mow 4200 square feet?
   b) A nutritionist recommends her patients consume 25 grams of dietary fiber each day. If 1 ounce of a bran cereal contains 8 grams of dietary fiber, how many ounces of the cereal must be eaten to meet the recommendation?
4. a) There are 2.54 centimeters in an inch. How many inches are in 635 centimeters?
   b) At a downtown bank, Payton is told that she can exchange 79 euros for $100 U.S. How much will she receive in euros if she converts $600 U.S.?
5. The given figures are similar. Find the length of the side indicated by the x.



Teaching Notes:

- Remind students that the two ratios in a proportion must have the same units.
- Some students have trouble distinguishing ratios and proportions. Emphasize that a ratio is a comparison of two numbers while a proportion is an equation with a ratio on each side.
- Point out that a *rate* is a ratio that tells how long it takes to perform a task.
- Some students may need to review Section 1.2 on problem solving.

Answers: 1a) 11:8; 1b) 8:25; 2a) $x=2$; 2b) $m=-119$; 3a) 35 minutes; 3b) 3.125 ounces; 4a) 250 inches; 4b) 474 euros; 5) $x=5.6$

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Mini-Lecture 2.8

Inequalities in One Variable

Learning Objectives:

1. Solve linear inequalities and graph the solution on a number line.
2. Write inequality solutions in interval notation.
3. Solve linear inequalities that have all real numbers as their solution, or have no solution.
4. Key vocabulary: *inequality, $\le$, $\ge$, $<$, $>$, sense or order of the inequality, properties for solving inequalities*

Examples:

1. Solve the inequality, graph the solution on a number line, and represent the solution in interval notation.

   a) $x-5>-3$

   b) $2x+6\le 4$

   c) $5m\ge 25$

   d) $-3n>18$

   e) $8<-7-x$

   f) $-a+4>-6a+19$

   g) $\frac{1}{4}x+\frac{2}{5}\ge\frac{2}{5}x+\frac{1}{2}$

   h) $0.2(3x+4)\ge 6.8-0.9x$

2. Solve the inequality, graph the solution on a number line, and represent the solution in interval notation when possible.

   a) $5(2x-3)+1>10x+23$

   b) $\frac{1}{2}(4x-5)<6x-2(2x-1)$

   c) $-6(3-x)+15\le 4x+2\left(x-\frac{3}{2}\right)$

   d) $2.4x+7.5\le 1.2(2x-7)$

Teaching Notes:

- Common Error: Many students forget to reverse the direction of the inequality symbol when multiplying or dividing both sides by a negative number.
- Remind students that, while it is common practice to isolate the variable on the left side, they can isolate the variable on either side of the inequality symbol (like they did with equations).
- Remind students to simplify both sides of the inequality before applying the properties for solving inequalities.

Answers: (Graph answers are in the answer pages.)
1a) $x>2$, (2, ∞); 1b) $x\le -1$, (–∞, –1]; 1c) $m\ge 5$, [5, ∞); 1d) $n<-6$, (–∞, –6); 1e) $x<-15$, (–∞, –15); 1f) $a>3$, (3, ∞); 1g) $x\le -\frac{2}{3}$, $\left(-\infty,-\frac{2}{3}\right]$; 1h) $x\ge 4$, [4, ∞); 2a) no solution; 2b) all real numbers, (–∞, ∞); 2c) all real numbers, (–∞, ∞); 2d) no solution

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Additional Exercises 2.1

1. List the terms in the expression $4x^3 - 8x^2 - 3x + 1$. **1.** _____

2. List the terms in the expression $-2w^5 + 3w^4 - w^3 - 1$. **2.** _____

3. Determine if x and $-6x^2$ are like terms. Answer yes or no. **3.** _____

Combine like terms when possible.

4. $7x + 2y - 3x + 4y$ **4.** _____

5. $3x - 7y + x - 4y - 4$ **5.** _____

6. $22p - 17 - 30p + 9$ **6.** _____

7. $-8y + (-4) + 5x + (-2y) - 6x$ **7.** _____

8. $-14.37 + 2.9x + 5.1x + 12.3$ **8.** _____

9. $3p^2 + 4p - 8p^2 + p - 7$ **9.** _____

Use the distributive property to remove parentheses.

10. $5(2x + 3y)$ **9.** _____

11. $0.4(6 - 1.2k)$ **10.** _____

12. $(3x + 3y - 2)$ **11.** _____

13. $3\left(\frac{1}{6}x - 2y + 4\right)$ **13.** _____

14. $2.5(4x - 1.2y - 3.8)$ **14.** _____

Simplify when possible.

15. $-2(3x + 4y - 1)$ **15.** _____

16. $-5(4x - y - 2)$ **16.** _____

17. $-4 - (4 + x) - 5x$ **17.** _____

18. $5(2a - b) + 4b - 2(3a + 2b)$ **18.** _____

19. $-0.4(8x - 3) + 5x$ **19.** _____

20. $\frac{1}{3}(x - 5) - \frac{1}{2}(x - 6)$ **20.** _____

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Additional Exercises 2.2

1. Is $3x-5=-7$ a linear equation? Answer yes or no. **1.** _____

2. Is $8x^2+9x+4=13$ a linear equation? Answer yes or no. **2.** _____

3. Is $-\frac{1}{6}$ a solution of thc cquation $6x+6=5$? **3.** _____

4. Is 3 a solution of the equation $3x+6=-3$? **4.** _____

5. Is -5 a solution of the equation $8=3-x$? **5.** _____

6. Does the number -8 satisfy the equation $1=9-x$? **6.** _____

Solve each equation.

7. $x+6=8$ **7.** _____

8. $28=m-7$ **8.** _____

9. $58=t+23$ **9.** _____

10. $x+5=2$ **10.** _____

11. $x-(-9)=-33$ **11.** _____

12. $x-22=-15$ **12.** _____

13. $-5=m-6$ **13.** _____

14. $-25=16+c$ **14.** _____

15. $x-9=-9$ **15.** _____

16. $-42.8+x=23.65$ **16.** _____

17. $18+x=-15$ **17.** _____

18. $3.14+x=2.5$ **18.** _____

19. $x-6.75=-4.25$ **19.** _____

20. $x+\frac{5}{8}=\frac{1}{3}$ **20.** _____

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Additional Exercises 2.3

Solve each equation.

1.	$-\frac{x}{4}=12$	**1.** _____
2.	$-x=-12$	**2.** _____
3.	$-24=-4m$	**3.** _____
4.	$2x=-14$	**4.** _____
5.	$\frac{1}{7}x=-8$	**5.** _____
6.	$\frac{1}{7}x=2$	**6.** _____
7.	$-\frac{x}{2}=4$	**7.** _____
8.	$3x=\frac{1}{3}$	**8.** _____
9.	$3w=15$	**9.** _____
10.	$4x=-32$	**10.** _____
11.	$\frac{1}{3}x=5$	**11.** _____
12.	$\frac{1}{9}x=5$	**12.** _____
13.	$-\frac{5}{3}x=-15$	**13.** _____
14.	$-\frac{6}{5}x=-30$	**14.** _____
15.	$\frac{4}{3}p=28$	**15.** _____
16.	$\frac{1}{3}x=4$	**16.** _____
17.	$\frac{7}{6}x=168$	**17.** _____
18.	$-2.1q=30.03$	**18.** _____
19.	$-\frac{9}{5}x=-45$	**19.** _____
20.	$-\frac{4}{9}x=-36$	**20.** _____

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Additional Exercises 2.4

Solve each equation.

1.	$4x-4=-40$	**1.** _____
2.	$9x-7=-34$	**2.** _____
3.	$\frac{7}{8}y-6=8$	**3.** _____
4.	$10-x=6$	**4.** _____
5.	$-2x-4x=1$	**5.** _____
6.	$-9x+12x=-9$	**6.** _____
7.	$\frac{x}{3}-\frac{x}{5}=2$	**7.** _____
8.	$\frac{x}{7}-\frac{x}{9}=2$	**8.** _____
9.	$\frac{3+z}{4}=-5$	**9.** _____
10.	$\frac{1}{4}=\frac{d-9}{2}$	**10.** _____
11.	$\frac{5}{9}y-4=6$	**11.** _____
12.	$x+0.4x=3.5$	**12.** _____
13.	$5(x-3)=45$	**13.** _____
14.	$-3(x+7)=9$	**14.** _____
15.	$-0.4(0.5x-8)=12$	**15.** _____
16.	$8=2(x-5)+6x$	**16.** _____
17.	$2=7(x+4)+9x$	**17.** _____
18.	$1=3(x-2)+3-2x$	**18.** _____
19.	$\frac{2}{3}n+\frac{1}{4}=\frac{2}{5}$	**19.** _____
20.	$3.65-7.4x+1.12=21.76$	**20.** _____

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Additional Exercises 2.5

Solve each equation.

1. $5x = 3x - 12$ **1.** _____

2. $-8x = 2x + 10$ **2.** _____

3. $3x + 1 = x - 4$ **3.** _____

4. $-2c - 4 = c + 11$ **4.** _____

5. $5x - 3 = x - 4$ **5.** _____

6. $4x - 5 = x - 17$ **6.** _____

7. $x + 9 = 2(5x - 4)$ **7.** _____

8. $2(x - 4) = -6 + 2x$ **8.** _____

9. $\frac{5}{4} = \frac{3m + 1}{8}$ **9.** _____

10. $4(x + 8) = 32 + 4x$ **10.** _____

11. $x + 3 = 3(4x - 3)$ **11.** _____

12. $2(x + 3) = -5 + 2x$ **12.** _____

13. $3(x - 6) = -10 + 3x$ **13.** _____

14. $\frac{m}{3} - 4 = 3m$ **14.** _____

15. $2x + 3 - 9x = 3x + 3 - 10x$ **15.** _____

16. $3x + 3 + 8x = 5x + 4 + 6x$ **16.** _____

17. $-8x + 3 - 2x = -6x + 3 - 4x$ **17.** _____

18. $10x + 3 + 10x = 13x - 3 + 7x$ **18.** _____

19. $6 + 3x = 5(x - 1) - 3(x - 2)$ **19.** _____

20. $\frac{1}{5}(30 - 10x) = \frac{2}{3}(4x + 2)$ **20.** _____

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Additional Exercises 2.6

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For problems 1–6, use the formula to find the value of the variable indicated. Round all answers to hundredths.

1. $C = 2\pi r$ (circumference of a circle); find C when $\pi = 3.14$ and $r = 9$ inches. **1.** _____

2. $A = \pi r^2$ (area of a circle); find A when $\pi = 3.14$ and $r = 2.5$ feet. **2.** _____

3. $P = 2l + 2w$ (perimeter of a rectangle); find P when $l = 5.9$ and $w = 4.1$. **3.** _____

4. $P = 2l + 2w$ (perimeter of a rectangle); find P when $l = 4.1$ and $w = 1.7$. **4.** _____

5. $A = \frac{1}{2}bh$ (area of a triangle); find h when $A = 20$ and $b = 5$. **5.** _____

6. $A = \frac{1}{2}bh$ (area of a triangle); find h when $A = 24$ and $b = 12$. **6.** _____

7. Solve for A in $B = \frac{2}{5}(A - 11)$. **7.** _____

8. Solve $5x - 2y = 4$, for y. Write the answer in $y = mx + b$ form. **8.** _____

9. Solve for F in $C = \frac{5}{9}(F - 32)$. **9.** _____

10. Solve $y - 4 = 2(x + 3)$, for y. Write the answer in $y = mx + b$ form. **10.** _____

11. Solve for t in $i = prt$. **11.** _____

12. Solve for t in the equation $A = 6s^2 t$. **12.** _____

13. Solve $C = 2\pi r$ for r. **13.** _____

14. A package in the shape of a rectangular solid is to be wrapped for shipping. If the length is 8 inches, the height is 5 inches, and the width is 4 inches, how much paper is needed to wrap the package? **14.** _____

15. A can of soup in the shape of a right circular cylinder is 5 inches tall and has a radius of 1.5 inches. How much soup will the can hold? **15.** _____

16. A circular swimming pool with a 16-foot diameter is surrounded by a concrete path that is 4 feet wide. What is the area of the path? **16.** _____

17. First State Bank charges 8% simple interest on personal loans. What is the total interest on a $2300 loan over 3 years? **17.** _____

18. Find the interest earned on $900 invested at 5.5% for 5 years. **18.** _____

19. The formula for finding the simple interest (i) on a loan is $i = prt$. How much interest will Bill pay on his car loan if he finances $17,000 ($p$) at a 13% simple interest rate (r) for 4 years. **19.** _____

20. Find the interest earned on $2000 invested at 8.5% for 3 months. **20.** _____

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Additional Exercises 2.7

Find the ratio. Write each ratio in lowest terms.

1. A history class consists of 17 males and 15 females. Find the ratio of males to the entire class. **1.** _____

2. Find the ratio of 3 quarters to 10 nickels. **2.** _____

3. Find the ratio of 5 days to 1 week. **3.** _____

4. A science class consists of 14 males and 13 females. Find the ratio of females to males. **4.** _____

5. Find the ratio of 4 hours to 40 minutes. **5.** _____

6. Find the ratio of 6 days to 1 week. **6.** _____

Solve for the variable by cross-multiplying.

7. $\frac{15}{j}=\frac{5}{4}$ **7.** _____

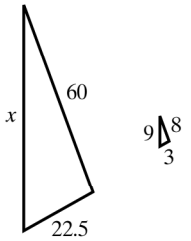
8. $\frac{10}{x}=\frac{10}{-24}$ **8.** _____

9. $\frac{12}{j}=\frac{2}{5}$ **9.** _____

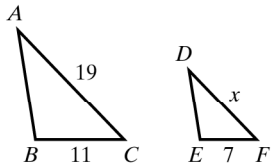
10. $\frac{-3}{5}=\frac{x}{15}$ **10.** _____

The figures below are similar. For each pair, find the length of the side indicated with an x.

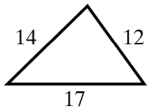
11. **11.** _____



12. **12.** _____

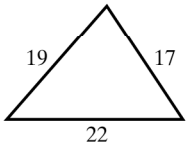


13. **13.** _____





14. **14.** _____





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Additional Exercises 2.7 *(cont.)*

Name:_____

15. A worker in an assembly line takes 6 hours to produce 26 parts. At that rate how many parts can she produce in 30 hours?

15. _____

16. If 20 gallons of insecticide can treat 5 acres of land, how many gallons of insecticide are needed to treat 24 acres of land?

16. _____

17. In 1967 the world population was 3.5 billion, and in 2006 it had climbed to 6.5 billion. What is the ratio of the world population in 1967 to the world population in 2006?

17. _____

18. The recommended daily allowance of protein for males is 64 grams per day. Three ounces of a certain product provide 4 grams of protein. How many ounces of the product are needed to provide 64 grams of protein?

18. _____

19. Convert 9 inches to feet.

19. _____

20. Convert 244 ounces to pounds.

20. _____

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Name:_____

Date:_____

Additional Exercises 2.8

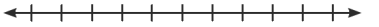
Solve each inequality, graph the solution on the real number line, and represent the solution in interval notation when possible.

1. $x+2 \geq -4$

1. _____

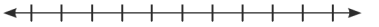
2. $x-4 > -4$

2. _____



3. $-x+5 > 6$

3. _____



4. $2x-7 \leq 15$

4. _____

5. $13 > 5-3x$

5. _____

6. $9 \geq 4x-19$

6. _____

7. $-5x \leq 2x+21$

7. _____

8. $4x < 5x-3$

8. _____

9. $5x-7 > 3x+11$

9. _____

10. $9-8x \geq 10-6x$

10. _____

11. $x+2-2(x-4) < 0$

11. _____

12. $2(x+3) > 4x+18$

12. _____

13. $-5(x+4) > 2-5x$

13. _____

14. $3(x+4) < -6+3x$

14. _____

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Additional Exercises 2.8 *(cont.)*

Name:_____

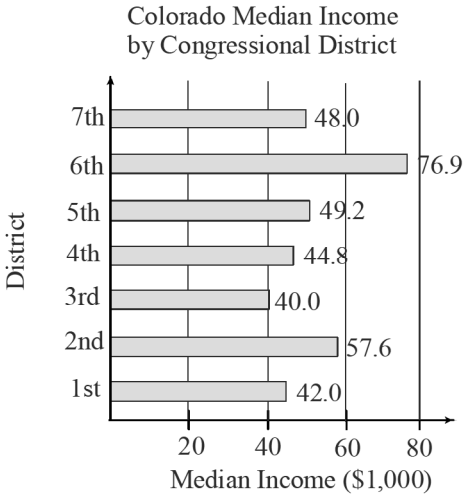
15. $-3x-3+3x>-x+6+x$

15. _____

16. $3x+1+3x>5x-5+x$

16. _____

The chart shows the 2006 median income for each of the congressional districts in Colorado. Use the chart for problems 17–20.



17. Find the districts where the median income was > $50,000.

17. _____

18. Find the districts where the median income was < $50,000.

18. _____

19. Find the districts where the median income was ≥ $60,000.

19. _____

20. Find the districts where the median income was ≤ $40,000.

20. _____

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Name:_____

Date:_____

Chapter 2 Test Form A

Use the distributive property to simplify.

1. $-3(4-8x)$ **1.** _____

2. $-(-2x-5y+4)$ **2.** _____

Simplify.

3. $-x+3-2x+3$ **3.** _____

4. $4+2x-7+x$ **4.** _____

5. $2(x-2)-4y+4$ **5.** _____

6. $\frac{2}{5}x+\frac{1}{3}-\left(x+\frac{3}{7}\right)$ **6.** _____

Solve.

7. $10x-6=14$ **7.** _____

8. $3+4x-x=12$ **8.** _____

9. $-2x-4=2(x-8)$ **9.** _____

10. $5x+4(3-2x)=3(1-x)$ **10.** _____

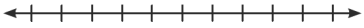
11. $\frac{2}{14}=\frac{1}{7x}$ **11.** _____

12. $-7(-x+3)-2x=5(x-4)-1$ **12.** _____

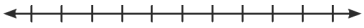
13. Solve $-12x+2y=-21$ for y. Write the answer in $y=mx+b$ form. **13.** _____

For problems 14–16, solve, graph the solution on the real number line, and represent the solution in interval notation when possible.

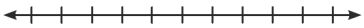
14. $-2x+4<3(1-3x)$ **14.** _____



15. $2(4x \quad 1)\geq 3x \quad 3(x \quad 2)$ **15.** _____



16. $3(2-x)-3x<10-6x$ **16.** _____



17. $V=\frac{1}{3}\pi r^2 h$; find V for $r=3$ inches and $h=10$ inches. **17.** _____

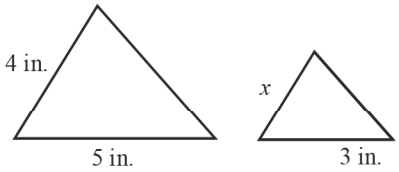
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Chapter 2 Test Form A *(cont.)*

Name:_____

18. The following figures are similar figures. Find the length of side x. **18.** _____



19. If a batch of 60 cookies requires 2 eggs, how many eggs are required to make 330 cookies? **19.** _____

20. If 10 pounds of seed can cover 3000 square feet, how much seed will a 5700-square-foot lawn require? **20.** _____

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Name:_____

Date:_____

Chapter 2 Test Form B

Use the distributive property to simplify.

1. $-5(-3x+16)$ **1.** _____

2. $-2(2x-5+3y)$ **2.** _____

Simplify.

3. $-(x-2y)+4y-3$ **3.** _____

4. $4-(y-x)+3x$ **4.** _____

5. $-8x-1+x+6$ **5.** _____

6. $7x+5-2x-2$ **6.** _____

Solve.

7. $4+2x=8$ **7.** _____

8. $-2\left(x+4\right)+5x=3x-8$ **8.** _____

9. $\frac{1}{2}x-2=\frac{3x}{2}$ **9.** _____

10. $-5+8x=3(x-1)$ **10.** _____

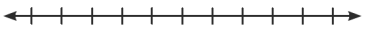
11. $\frac{1}{x}=\frac{5}{45}$ **11.** _____

12. $7x-8-4(2x-3)=5-x$ **12.** _____

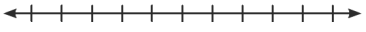
13. Solve $5x+4y=22$ for y. Write the answer in $y=mx+b$ form. **13.** _____

For problems 14–16, solve, graph the solution on the real number line, and represent the solution in interval notation when possible.

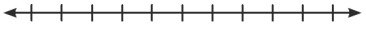
14. $-2x-4>2(x-8)$ **14.** _____



15. $8x-6<3(x-1)+5x$ **15.** _____



16. $2(4x-1)\le 5x+3(x-1)$ **16.** _____



17. $P=2l+2w$; find P for $l=2.5$ yards and $w=3.7$ yards. **17.** _____

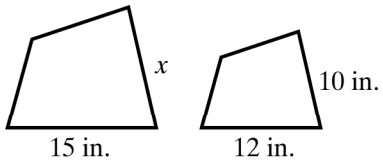
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Chapter 2 Test Form B *(cont.)*

Name:_____

18. The following figures are similar figures. Find the length of side x.



18. _____

19. If 12 pounds of seed can cover 3500 square feet, how much seed will an 8750-square-foot lawn require?

19. _____

20. If 2 gallons of paint covers 850 square feet, how many gallons of paint will Logan need to paint 3400 square feet of wall surface?

20. _____

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Name:_____

Date:_____

Chapter 2 Test Form C

Use the distributive property to simplify.

1. $-4(10-3x)$ **1.** _____

2. $-3(4+3x-3y)$ **2.** _____

For problems 3–5, simplify.

3. $5+8x-2x+1$ **3.** _____

4. $-1+3(x-y)+7x$ **4.** _____

5. $7\left(2x-y\right)+3x-2y$ **5.** _____

6. $i=prt$; find r when $i=\$234$, $p=\$1300$, and $t=4$ years. **6.** _____

Solve.

7. $3+3x=-6$ **7.** _____

8. $3+2x-x=5$ **8.** _____

9. $2(4x-1)=5x+1+3(x-1)$ **9.** _____

10. $-(1+2x)=4x-2(1-x)$ **10.** _____

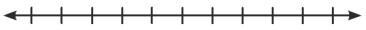
11. $-6+8x=3(x-1)+5x$ **11.** _____

12. $\frac{7}{9}=\frac{x}{27}$ **12.** _____

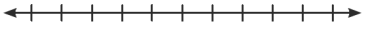
13. Solve $4x+16y=11$ for y. Write the answer in $y=mx+b$ form. **13.** _____

For problems 14–17, solve, graph the solution on the real number line, and represent the solution in interval notation when possible.

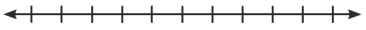
14. $4\left(5x+3\right)\le 6x+6\left(2x-3\right)$ **14.** _____



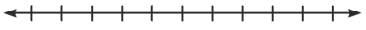
15. $-(3-2x)<4x-2(2+x)$ **15.** _____



16. $4(x+4)\ge 2x+8-(1-2x)$ **16.** _____



17. $4(x-1)>6-3(x+1)$ **17.** _____



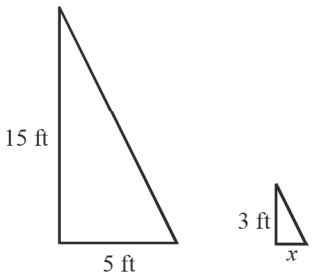
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Chapter 2 Test Form C *(cont.)*

Name:_____

18. The following figures are similar figures. Find the length of side x. **18.** _____



19. If 3 gallons of paint cover 950 square feet, how many gallons of paint will Jennifer need to paint 3800 square feet of wall surface? **19.** _____

20. If Shawn's car uses 4 gallons of gasoline to travel 90 miles, how many miles can he travel with 26 gallons of gasoline? **20.** _____

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Name:_____

Date:_____

Chapter 2 Test Form D

Use the distributive property to simplify.

1. $-(-2x-3)$ **1.** _____

2. $6(10x-7+2y)$ **2.** _____

For problems 3–5, simplify.

3. $-10x+2-x-13$ **3.** _____

4. $4-6x+2-3x$ **4.** _____

5. $-(2+y)-3x+4x$ **5.** _____

6. $A=\frac{1}{2}bh$; find b when $A=16.8$ cm^2 and $h=3$ cm. **6.** _____

Solve.

7. $2+x=-9$ **7.** _____

8. $4(x+4)=2x+17-(1-2x)$ **8.** _____

9. $x-1+3x=7$ **9.** _____

10. $-(3-2x)=4x-2(1+x)$ **10.** _____

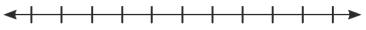
11. $2(1-3x)=3x-16$ **11.** _____

12. $\frac{x}{3}=\frac{4}{6}$ **12.** _____

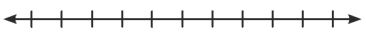
13. Solve $1.5x-3y=4.2$ for y. Write the answer in $y=mx+b$ form. **13.** _____

For problems 14–17, solve, graph the solution on the real number line, and represent the solution in interval notation when possible.

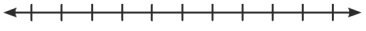
14. $-4(x+4)\le 2x+8$ **14.** _____



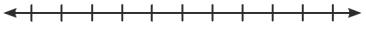
15. $2\left(1+2x\right)>5x-\left(1+x\right)$ **15.** _____



16. $4x-2<3(x+3)$ **16.** _____



17. $3(1-x)+1\ge 5(1-x)+2x$ **17.** _____



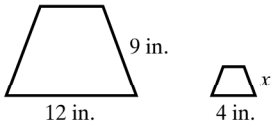
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Chapter 2 Test Form D *(cont.)*

Name:_____

18. The following figures are similar figures. Find the length of side x.



18. _____

19. If a car uses 4 gallons of gasoline to travel 106 miles, how many gallons of gasoline are needed to travel 400 miles?

19. _____

20. To make 2 cups of hot chocolate, you need 5 tablespoons of chocolate mix. How many cups of hot chocolate can you make with 15 tablespoons of chocolate mix?

20. _____

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Name:_____

Date:_____

Chapter 2 Test Form E

Use the distributive property to simplify.

1. $-2(3x+5)$ **1.** _____

2. $-4(x-7-3y)$ **2.** _____

For problems 3–5, simplify.

3. $-3+7x-x+5$ **3.** _____

4. $3+2(x-2y)+x$ **4.** _____

5. $4+2(x-y)-5y$ **5.** _____

6. $P=2l+2w$; find w if $P=20$ feet and $l=7$ feet. **6.** _____

Solve.

7. $1-3x=7$ **7.** _____

8. $1+4x-2x=9$ **8.** _____

9. $2(x-3)=x-3(x-1)$ **9.** _____

10. $4x-2=3(x+3)$ **10.** _____

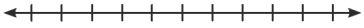
11. $2(x-3)=2+2(x-4)$ **11.** _____

12. $\frac{2}{9}=\frac{10}{x}$ **12.** _____

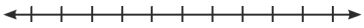
13. Solve $-5x-10y=28$ for y. Write the answer in $y=mx+b$ form. **13.** _____

For problems 14–17, solve, graph the solution on the real number line, and represent the solution in interval notation when possible.

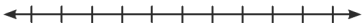
14. $2(1-3x)<3x-16$ **14.** _____



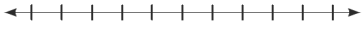
15. $2(x-3)\le -10+2(x-4)$ **15.** _____



16. $\frac{2}{3}(6-x)-1>-\frac{1}{6}x+4(3x-2)$ **16.** _____



17. $-2x-4\ge 2(x-8)$ **17.** _____



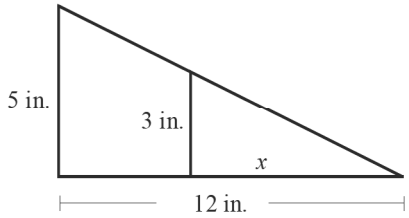
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Chapter 2 Test Form E *(cont.)*

Name:_____

18. The following figures are similar figures. Find the length of side x. **18.**_____



19. If a car uses 4 gallons of gasoline to travel 86 miles, how many gallons of gasoline are needed to travel 430 miles? **19.** _____

20. If 15 pounds of seed can cover 4300 square feet, how many square feet of lawn can 21 pounds of seed cover? **20.** _____

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Name:_____

Date:_____

Chapter 2 Test Form F

Use the distributive property to simplify.

1. $-(-3-2x)$ **1.** _____

2. $-(-5y-2x+4)$ **2.** _____

For problems 3–5, simplify.

3. $28-15x-16+3x$ **3.** _____

4. $-3+7x-x+5$ **4.** _____

5. $-4(2x-3)-8+7x$ **5.** _____

6. $d=rt$; find t if $r=25$ mph and $d=160$ miles. **6.** _____

Solve.

7. $10x-14=6$ **7.** _____

8. $5(x-4)-1=-7(-x+3)-2x$ **8.** _____

9. $-2(x+2)=2x-16$ **9.** _____

10. $\frac{7x}{14}=\frac{1}{2}$ **10.** _____

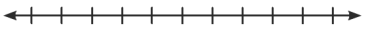
11. $4x-2(1+x)=2x-3$ **11.** _____

12. $\frac{1}{5}x-\frac{2}{3}=\frac{1}{3}(2-x)$ **12.** _____

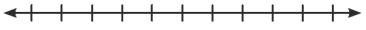
13. $2x-3(x-1)=-2(3-x)$ **13.** _____

For problems 14–16, solve, graph the solution on the real number line, and represent the solution in interval notation when possible.

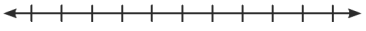
14. $3x-3(x-2)\geq 2(4x-1)$ **14.** _____



15. $2(x+4)-(1-2x)\leq 4(x+4)$ **15.** _____



16. $2(x+4)>-4(x+4)$ **16.** _____



17. Solve $y-3=2(x+1)$ for y. Write the answer in $y=mx+b$ form. **17.** _____

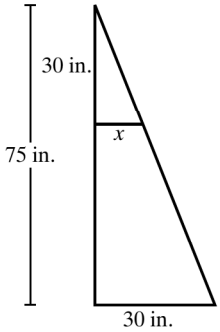
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Chapter 2 Test Form F *(cont.)*

Name:_____

18. The following figures are similar figures. Find the length of side x. **18.**_____



19. If Chef Luigi can make 4 large pizzas in 18 minutes, how long will it take him to make 10 pizzas? **19.** _____

20. If a steam machine uses 5 ounces of detergent to clean a 24-square-inch rug, how much detergent will it use for 552 square feet of office space? **20.** _____

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Name:_____

Date:_____

Chapter 2 Test Form G

Use the distributive property to simplify.

1. $-3(4-8x)$

(a) $-12-8x$ **(b)** $8x-24$ **(c)** $-12x+24$ **(d)** $24x-12$

2. $-(2x-5+3y)$

(a) $-2x-5y+3$ **(b)** $2x+5+3y$ **(c)** $-2x-3y+5$ **(d)** $2y+3x-5$

For problems 3–5, simplify.

3. $5+8x-2x+1$

(a) $6x+6$ **(b)** $4+10x$ **(c)** $4-10x$ **(d)** $6-6x$

4. $4-6x+2-3x$

(a) $-9x+6$ **(b)** $-9x+4$ **(c)** $9x-6$ **(d)** $-9x+2$

5. $2(1-y)+x+5x$

(a) $-y+6x+1$ **(b)** $6x-2y+2$ **(c)** $6x-y-1$ **(d)** $6x-2y-2$

6. $A=\frac{1}{2}h(b+d)$; find h if $A=60$, $b=5$, and $d=7$.

(a) $h-3$ **(b)** $h-21$ **(c)** $h-25$ **(d)** $h-10$

7. Solve $y+3=-2(x+5)$ for y. Write the answer in $y=mx+b$ form.

(a) $y=-2x-7$ **(b)** $y=-2x-13$ **(c)** $y=-2x+8$ **(d)** $y=-2x+2$

Solve.

8. $4x+1-2x=9$

(a) $x=4$ **(b)** $x=-2$ **(c)** $x=5$ **(d)** all real numbers

9. $-6+8x=5x+3(x-1)$

(a) $x=-1$ **(b)** all real numbers **(c)** no solution **(d)** $x=3$

10. $4x-2=3(x+3)$

(a) no solution **(b)** $x=5$ **(c)** $x=11$ **(d)** all real numbers

11. $2(4x-1)=5x+1+3(x-1)$

(a) $x=0$ **(b)** all real numbers **(c)** $x=-\frac{1}{4}$ **(d)** no solution

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Chapter 2 Test Form G *(cont.)*

Name:_____

12. $\frac{10}{x}=\frac{2}{9}$

(a) no solution **(b)** $x=18$ **(c)** $x=27$ **(d)** $x=45$

13. $4x-2(1-x)=-(1+2x)$

(a) $x=-\frac{1}{8}$ **(b)** $x=\frac{1}{8}$ **(c)** no solution **(d)** $x=\frac{1}{6}$

14. $4x-2(2+x)>-(3-2x)$

(a) $x<\frac{1}{3}$ **(b)** all real numbers **(c)** no solution **(d)** $x>0$

15. $\frac{3}{5}(x+2)>2-\frac{1}{5}(2x-1)$

(a) $x>1$ **(b)** all real numbers **(c)** $x<1$ **(d)** no solution

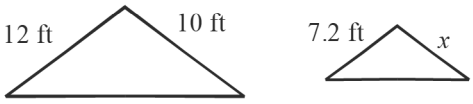
16. $3x+(1-x)<2(1+2x)$

(a) $x\le 2$ **(b)** $x>-\frac{1}{2}$ **(c)** $x<-\frac{1}{2}$ **(d)** $x<-2$

17. $2-4x>-3(x+3)$

(a) $x<11$ **(b)** no solution **(c)** $x<9$ **(d)** $x>-9$

18. The following figures are similar figures. Find the length of side x.



(a) 6 ft **(b)** 8.6 ft **(c)** 16.6 ft **(d)** 22 ft

19. If Peter can type 6 pages in 32 minutes, how long will it take him to type a 15-page report?

(a) 47 min **(b)** 1 hr **(c)** 64 min **(d)** 80 min

20. If a compactor reduces 30 cubic feet of recycling material to 4 cubic feet, how big will 140 cubic feet of material be after going through the same machine?

(a) 11.67 cubic ft **(b)** 105 cubic ft **(c)** 186.67 cubic ft **(d)** 18.67 cubic ft

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Name:_____

Date:_____

Chapter 2 Test Form H

Use the distributive property to simplify.

1. $-3(-2x+3)$

(a) $-3-2x+3$ **(b)** $6x-9$ **(c)** $3x+6$ **(d)** $9-6x$

2. $-(2x-5y+4)$

(a) $-2x-5y-4$ **(b)** $-2x+4$ **(c)** $-2x+5y-4$ **(d)** $-5y+2x+8$

For problems 3–5, simplify.

3. $-(x-2y)+4y-3$

(a) $-x+6y-3$ **(b)** $-x+2y-3$ **(c)** $x-8y-3$ **(d)** $-x+6y+3$

4. $4+2x-7+x$

(a) $x-11$ **(b)** $2x-4$ **(c)** $3x-3$ **(d)** $3x-4$

5. $7x-8-4(2x-3)$

(a) $15x-11$ **(b)** $x-4$ **(c)** $5x+4$ **(d)** $-x+4$

6. $V=\frac{4}{3}\pi r^3$; find V when $r=\frac{3}{2}$.

(a) 14.18 **(b)** 42.41 **(c)** 1.57 **(d)** 56.55

7. Solve $-3x+15y=-20$ for y. Write the answer in $y=mx+b$ form.

(a) $y=5x+\frac{20}{3}$ **(b)** $y=\frac{1}{5}x-\frac{4}{3}$ **(c)** $y=-5x+\frac{5}{3}$ **(d)** $y=-\frac{1}{3}x+20$

For problems 8–17, solve.

8. $3+4x-x=12$

(a) $x=-3$ **(b)** $x=\frac{1}{3}$ **(c)** no solution **(d)** $x=3$

9. $2x-3+x=-9$

(a) $x=2$ **(b)** all real numbers **(c)** $x=-2$ **(d)** $x=-\frac{1}{2}$

10. $-7(-x+3)-2x=5(x-4)-1$

(a) all real numbers **(b)** $x=\frac{1}{3}$ **(c)** $x=3$ **(d)** $x=-3$

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Chapter 2 Test Form H *(cont.)*

Name:_____

11. $\frac{1}{x}=\frac{5}{45}$

(a) $x=15$ **(b)** $x=9$ **(c)** $x=3$ **(d)** no solution

12. $3x-(6-5x)=-\frac{8}{3}\left(\frac{3}{2}-3x\right)$

(a) $x=2$ **(b)** $x=\frac{1}{2}$ **(c)** $x=-2$ **(d)** no solution

13. $-(1+2x)=4x-2(1-x)$

(a) $x=8$ **(b)** $x=-8$ **(c)** $x=\frac{1}{8}$ **(d)** all real numbers

14. $-2x-4>2(x-8)$

(a) $x<3$ **(b)** $x<2$ **(c)** $x\le 3$ **(d)** $x>3$

15. $8x-6<3(x-1)+5x$

(a) all real numbers **(b)** $x\ge 1$ **(c)** $x<-\frac{3}{2}$ **(d)** no solution

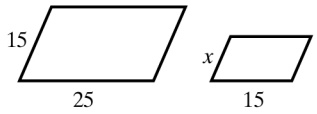
16. $\frac{1}{2}(x-2)-5\le 4x-\frac{1}{2}(x+3)$

(a) all real numbers **(b)** $x\ge\frac{10}{3}$ **(c)** $x\ge-\frac{3}{2}$ **(d)** $x\le-\frac{5}{2}$

17. $8x-1\le 3(x-1)+5x$

(a) $x<2$ **(b)** $x\ge 5$ **(c)** $x\le -2$ **(d)** no solution

18. The following figures are similar figures. Find the length of side x.



(a) 12 in. **(b)** 3 in. **(c)** 9 in. **(d)** 15 in.

19. If Jeff can travel 3 miles on his bicycle in 14 minutes, how many miles can he travel in 42 minutes?

(a) 7 **(b)** $10\frac{1}{3}$ **(c)** 12 **(d)** 9

20. If a compactor reduces 45 cubic feet of recycling material to 6 cubic feet, how big will 720 cubic feet of material be after going through the same machine?

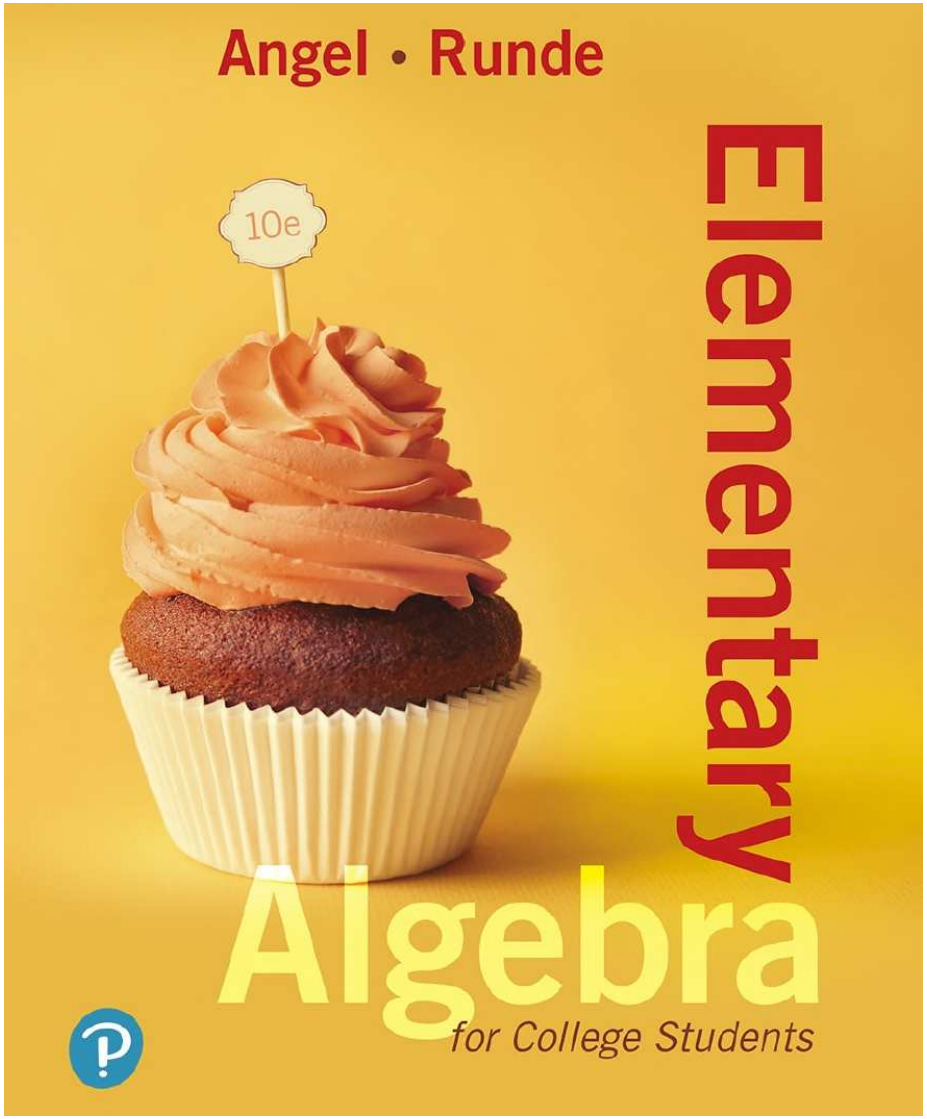
(a) 112 cubic ft **(b)** 96 cubic ft **(c)** 270 cubic ft **(d)** 16 cubic ft

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Chapter 1

Real Numbers



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1.2

Problem Solving

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Objectives

1. Learn the five-step problem-solving procedure.
2. Solve problems involving bar, line, and circle graphs.
3. Solve problems involving statistics.

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Guidelines for Problem Solving (1 of 3)

1. Understand the problem.

- Read the problem *carefully* at least twice. In the first reading, get a general overview of the problem. In the second reading, determine (a) exactly what you are being asked to find and (b) what information the problem provides.
- Make a list of the given facts. Determine which are pertinent to solving the problem.
- Determine whether you can substitute smaller or simpler numbers to make the problem more understandable.
- If it will help you organize the information, list the information in a table.
- If possible, make a sketch to illustrate the problem. Label the information given.

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Guidelines for Problem Solving (2 of 3)

2. Translate the problem to mathematical language.

- This will generally involve expressing the problem in terms of an algebraic expression or equation. (We will explain how to express application problems as equations in Chapter 3.)
- Determine whether there is a formula that can be used to solve the problem.

3. Carry out all necessary calculations.

4. Check the answer obtained in step 3.

- Ask yourself, “Does the answer make sense?” “Is the answer reasonable?” If the answer is not reasonable, recheck your method for solving the problem and your calculations.

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Guidelines for Problem Solving (3 of 3)

- Check the solution using the original wording of the problem if possible.

5. Make sure you have answered the question.

- State the answer clearly.

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Example 2 (1 of 3)

Larry Gilligan's iMac computer can perform 200 billion operations per second (200 billion OPS). How many operations can Larry's computer perform in 0.8 second?

Understand We are given the computer owner's name, the model of the computer, a speed of 200 billion (200,000,000,000) operations per second, and 0.8 second. To determine the answer to this problem, the owner's name, Larry Gilligan, and the model of the computer, iMac, are not needed.

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Example 2 (2 of 3)

Translate

Number of operations in 0.8 second = 0.8 × the number of operations per second

Carry Out

$= 0.8 \times 200{,}000{,}000{,}000$

$= 160{,}000{,}000{,}000$

Check

The answer 160,000,000,000 operations is less than the 200,000,000,000 operations per second, which makes sense because the computer is operating for less than a second.

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Example 2 (3 of 3)

Answer

In 0.8 second, the computer can perform 160,000,000,000 operations.

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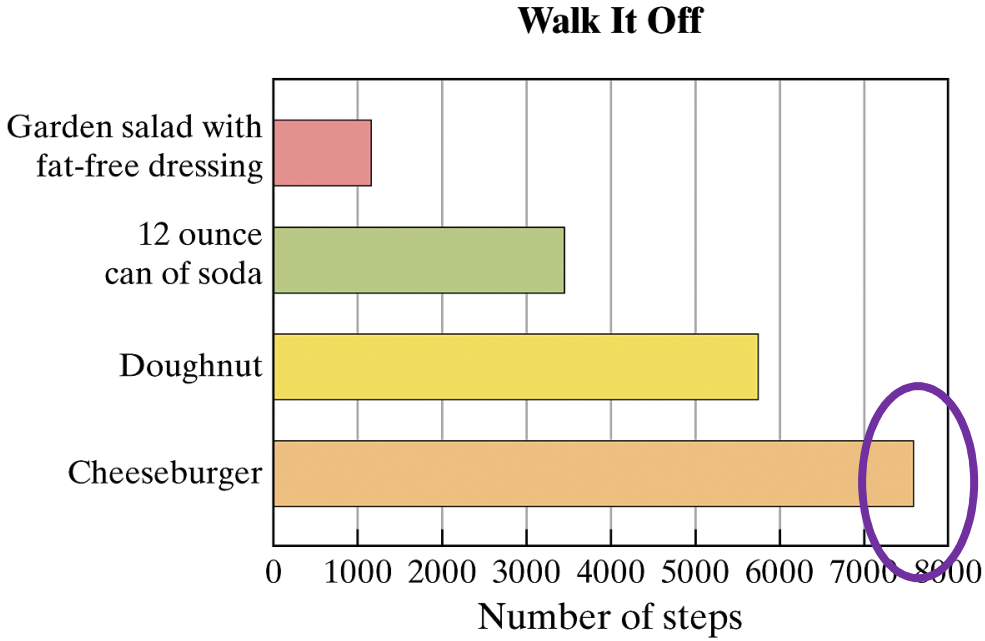
Example 4 (1 of 4)

Walking It Off Experts suggest that people walk 10,000 steps daily. Depending on stride length, each mile ranges between 2000 and 2500 steps. The figure on the next slide is a **bar graph** that shows the number of steps it takes to burn off calories from a garden salad with fat-free dressing, a 12-ounce can of soda, a doughnut, and a cheeseburger.

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Example 4 (2 of 4)

a) Using the bar graph, estimate the number of steps it takes to burn off calories from a cheeseburger.



We estimate that the number of steps it takes to burn off calories from a cheeseburger is about 7600 steps.

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Example 4 (3 of 4)

b) If Cliff can walk a mile in 2000 steps, how many miles will he have to walk in order to burn off the calories from the cheeseburger he ate for lunch?

Understand Since it takes Cliff 2000 steps to walk a mile, it follows that he would need to take 4000 steps to walk 2 miles, 6000 steps to walk 3 miles, and so on. To determine how many miles Cliff will have to walk in order to burn off the calories from the cheeseburger, we need to divide as follows.

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Example 4 (4 of 4)

Translate

$$\text{miles to walk} = \frac{\text{number of steps to burn off calories}}{2000}$$

Carry Out

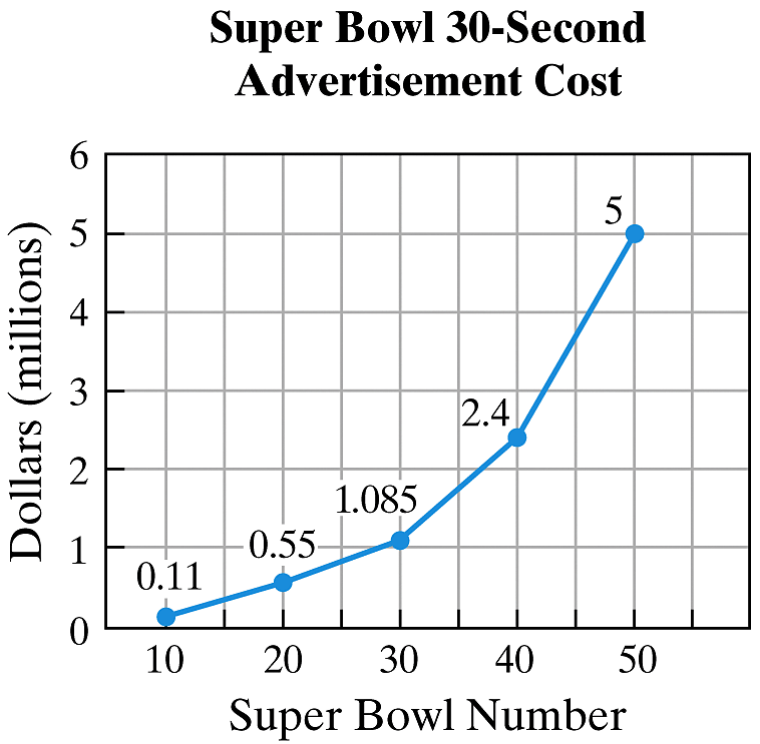
$$\text{miles to walk} = \frac{7600}{2000} = 3.8$$

Check and Answer The answer appears reasonable. Cliff will need to walk 3.8 miles in order to burn off the calories from the cheeseburger that he ate for lunch.

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Example 5 (1 of 5)

Super Bowl Ads The cost of advertising during the annual Super Bowl has generally risen every year since Super Bowl 1 was held in 1967. The *line graph* shows the cost of a 30-second advertisement during Super Bowls 10, 20, 30, 40, and 50.



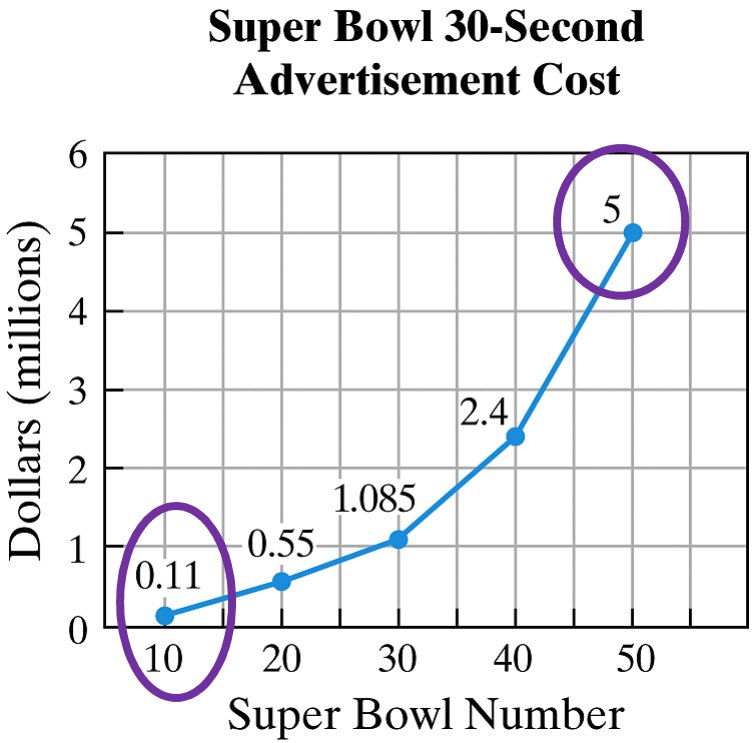
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Example 5 (2 of 5)

a. Determine the cost of a 30-second advertisement during Super Bowl 10 and during Super Bowl 50.

A 30-second ad during Super Bowl 10 cost \$0.11 million or \$0.11(1,000,000) = \$110,000.

A 30-second ad during Super Bowl 50 cost \$5 million or \$5(1,000,000) = \$5,000,000.



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Example 5 (3 of 5)

b. How much more was the cost of a 30-second advertisement during Super Bowl 50 than during Super Bowl 10?

Understand To determine how much more a 30-second advertisement cost during Super Bowl 50 than during Super Bowl 10, we need to subtract, as shown below.

Translate

Difference in the cost = SB 50 cost − SB 10 cost

Carry Out = $5,000,000 − $110,000 = $4,890,000

Check and Answer The answer appears reasonable. The cost of a 30-second advertisement was $4,890,000 more during Super Bowl 50 than during Super Bowl 10.

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Example 5 (4 of 5)

c. How many times greater was the cost of a 30-second advertisement during Super Bowl 50 than during Super Bowl 10? Round your answer to the nearest hundredth.

Understand To determine the answer, we will divide the cost during Super Bowl 50 by the cost during Super Bowl 10.

Translate

$$\text{number of times greater} = \frac{\text{cost during SB 50}}{\text{cost during SB 10}}$$

Carry Out

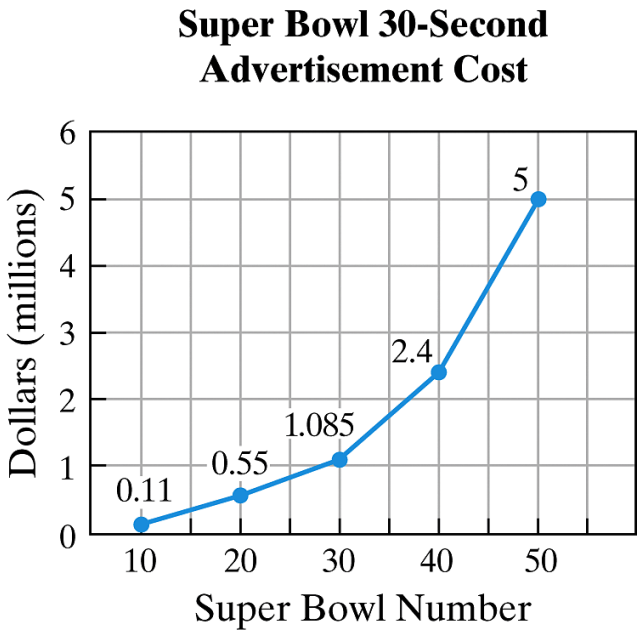
$$= \frac{\$5{,}000{,}000}{\$110{,}000} = 45.454545\ldots \approx 45.45$$

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Example 5 (5 of 5)

Check and Answer

By observing the graph, we see that the answer is reasonable. The cost of a 30-second advertisement during Super Bowl 50 was about 45.45 times greater than during Super Bowl 10.



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Solve Problems Involving Statistics

The *mean* and *median* are two **measures of central tendency**, which are also referred to as *averages*.

An average is a value that is representative of a set of data (or numbers). The **mean** of a set of data is determined by adding all the values and dividing the sum by the number of values.

The **median** is the value in the middle of a set of **ranked data**. The data may be ranked from smallest to largest or largest to smallest.

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Example 7 (1 of 4)

The Mean Grade Jose's first six exam grades are 90, 87, 76, 84, 78, and 62.

a. Determine the mean for Jose's six grades.

$$\text{mean} = \frac{90 + 87 + 76 + 84 + 78 + 62}{6}$$

$$= \frac{477}{6} = 79.5$$

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Example 7 (2 of 4)

b. If one more exam is to be given, what is the minimum grade that Jose can receive to obtain at least a B average (a mean average of 80 or better)?

Understand For the mean average of seven exams to be 80, the total points for the seven exams must be 7(80) or 560. The minimum grade needed can be determined by subtracting the sum of the first six grades from 560.

Translate

minimum grade = 560 – sum of first six exam grades

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Example 7 (3 of 4)

Carry Out

$= 560 - (90 + 87 + 76 + 84 + 78 + 62)$

$= 560 - 477$

$= 83$

Check We can check to see that a seventh grade of 83 gives a mean of 80 as follows:

$$\text{mean} = \frac{90 + 87 + 76 + 84 + 78 + 62 + 83}{7} = \frac{560}{7} = 80$$

Answer A seventh grade of 83 or higher will result in at least a B average.

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Example 7 (4 of 4)

c. If there is only one more exam, is it possible for Jose to obtain an A average (90 or better)? Explain.

We can use the same reasoning as in part **b)**. For a 90 average, the total points that Jose will need to attain is 90(7) = 630. Since his total points are 477, he will need 630 – 477 or 153 points to obtain an A average. Since the maximum number of points available on most exams is 100, Jose would not be able to obtain an A in the course.

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