

Chapter 2

Section 2.1 Practice

1. $x - 5 = 8$

$$x - 5 + 5 = 8 + 5$$

$$x = 13$$

Check: $x - 5 = 8$

$$13 - 5 \stackrel{?}{=} 8$$

$$8 = 8 \quad \text{True}$$

The solution is 13.

2. $y + 1.7 = 0.3$

$$y + 1.7 - 1.7 = 0.3 - 1.7$$

$$y = -1.4$$

Check: $y + 1.7 = 0.3$

$$-1.4 + 1.7 \stackrel{?}{=} 0.3$$

$$0.3 = 0.3 \quad \text{True}$$

The solution is -1.4 .

3. $\frac{7}{8} = y - \frac{1}{3}$

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

$$\frac{7}{8} \cdot \frac{3}{3} + \frac{1}{3} \cdot \frac{8}{8} = y$$

$$\frac{21}{24} + \frac{8}{24} = y$$

$$\frac{29}{24} = y$$

Check: $\frac{7}{8} = y - \frac{1}{3}$

$$\frac{7}{8} \stackrel{?}{=} \frac{29}{24} - \frac{1}{3}$$

$$\frac{7}{8} \stackrel{?}{=} \frac{29}{24} - \frac{8}{24}$$

$$\frac{7}{8} \stackrel{?}{=} \frac{21}{24}$$

$$\frac{7}{8} = \frac{7}{8} \quad \text{True}$$

The solution is $\frac{29}{24}$.

4. $3x + 10 = 4x$

$$3x + 10 - 3x = 4x - 3x$$

$$10 = x$$

Check: $3x + 10 = 4x$

$$3(10) + 10 \stackrel{?}{=} 4(10)$$

$$30 + 10 \stackrel{?}{=} 40$$

$$40 = 40 \quad \text{True}$$

The solution is 10.

5. $10w + 3 - 4w + 4 = -2w + 3 + 7w$

$$6w + 7 = 5w + 3$$

$$-5w + 6w + 7 = -5w + 5w + 3$$

$$w + 7 = 3$$

$$w + 7 - 7 = 3 - 7$$

$$w = -4$$

Check:

$$10w + 3 - 4w + 4 = -2w + 3 + 7w$$

$$10(-4) + 3 - 4(-4) + 4 \stackrel{?}{=} -2(-4) + 3 + 7(-4)$$

$$-40 + 3 + 16 + 4 \stackrel{?}{=} 8 + 3 - 28$$

$$-17 = -17 \quad \text{True}$$

The solution is -4 .

6. $3(2w - 5) - (5w + 1) = -3$

$$3(2w) - 3(5) - 1(5w) - 1(1) = -3$$

$$6w - 15 - 5w - 1 = -3$$

$$w - 16 = -3$$

$$w - 16 + 16 = -3 + 16$$

$$w = 13$$

Check: $3(2w - 5) - (5w + 1) = -3$

$$3(2 \cdot 13 - 5) - (5 \cdot 13 + 1) \stackrel{?}{=} -3$$

$$3(26 - 5) - (65 + 1) \stackrel{?}{=} -3$$

$$3(21) - 66 \stackrel{?}{=} -3$$

$$63 - 66 \stackrel{?}{=} -3$$

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

The solution is 13.

7. $12 - y = 9$

$$12 - y - 12 = 9 - 12$$

$$-y = -3$$

$$y = 3$$

Check: $12 - y = 9$

$$12 - 3 \stackrel{?}{=} 9$$

$$9 = 9 \quad \text{True}$$

The solution is 3.

8. a. If the sum of two numbers is 11 and one number is 4, find the other number by subtracting 4 from 11. The other number is $11 - 4$, or 7.

- b. If the sum of two numbers is 11 and one number is x , find the other number by subtracting x from 11. The other number is $11 - x$.
- c. If the sum of two numbers is 56 and one number is a , find the other number by subtracting a from 56. The other number is $56 - a$.
9. Mike received 100,445 more votes than Zane, who received n votes. So, Mike received $(n + 100,445)$ votes.

Vocabulary and Readiness Check

- A combination of operations on variables and numbers is called an expression.
 - A statement of the form "expression = expression" is called an equation.
 - An equation contains an equal sign (=).
 - An expression does not contain an equal sign (=).
 - An expression may be simplified and evaluated while an equation may be solved.
 - A solution of an equation is a number that when substituted for a variable makes the equation a true statement.
 - Equivalent equations have the same solution.
 - By the addition property of equality, the same number may be added to or subtracted from both sides of an equation without changing the solution of the equation.
9. $x + 4 = 6$
 $x = 2$
10. $x + 7 = 17$
 $x = 10$
11. $n + 18 = 30$
 $n = 12$
12. $z + 22 = 40$
 $z = 18$
13. $b - 11 = 6$
 $b = 17$

14. $d - 16 = 5$
 $d = 21$

Exercise Set 2.1

2. $x + 14 = 25$
 $x + 14 - 14 = 25 - 14$
 $x = 11$
Check: $x + 14 = 25$
 $11 + 14 \stackrel{?}{=} 25$
 $25 = 25$ True
The solution is 11.

4. $y - 9 = 1$
 $y - 9 + 9 = 1 + 9$
 $y = 10$
Check: $y - 9 = 1$
 $10 - 9 \stackrel{?}{=} 1$
 $1 = 1$ True
The solution is 10.

6. $-8 = 8 + z$
 $-8 - 8 = -8 + 8 + z$
 $-16 = z$
Check: $-8 = 8 + z$
 $-8 \stackrel{?}{=} 8 + (-16)$
 $-8 = -8$ True
The solution is -16 .

8. $t - 9.2 = -6.8$
 $9.2 + t - 9.2 = 9.2 - 6.8$
 $t = 2.4$
Check: $t - 9.2 = -6.8$
 $2.4 - 9.2 \stackrel{?}{=} -6.8$
 $-6.8 = -6.8$ True
The solution is 2.4.

10. $y - \frac{4}{7} = -\frac{3}{14}$
 $y - \frac{4}{7} + \frac{4}{7} = -\frac{3}{14} + \frac{4}{7}$
 $y = -\frac{3}{14} + \frac{8}{14}$
 $y = \frac{5}{14}$

$$\begin{aligned}\text{Check: } y - \frac{4}{7} &= -\frac{3}{14} \\ \frac{5}{14} - \frac{4}{7} &\stackrel{?}{=} -\frac{3}{14} \\ \frac{5}{14} - \frac{8}{14} &\stackrel{?}{=} -\frac{3}{14} \\ -\frac{3}{14} &= -\frac{3}{14} \quad \text{True}\end{aligned}$$

The solution is $\frac{5}{14}$.

$$\begin{aligned}12. \quad c + \frac{1}{6} &= \frac{3}{8} \\ c + \frac{1}{6} - \frac{1}{6} &= \frac{3}{8} - \frac{1}{6} \\ c &= \frac{9}{24} - \frac{4}{24} \\ c &= \frac{5}{24}\end{aligned}$$

$$\begin{aligned}\text{Check: } c + \frac{1}{6} &= \frac{3}{8} \\ \frac{5}{24} + \frac{1}{6} &\stackrel{?}{=} \frac{3}{8} \\ \frac{5}{24} + \frac{4}{24} &\stackrel{?}{=} \frac{3}{8} \\ \frac{9}{24} &\stackrel{?}{=} \frac{3}{8} \\ \frac{3}{8} &= \frac{3}{8} \quad \text{True}\end{aligned}$$

The solution is $\frac{5}{24}$.

$$\begin{aligned}14. \quad 3n + 2n &= 7 + 4n \\ 5n &= 7 + 4n \\ 5n - 4n &= 7 + 4n - 4n \\ n &= 7 \\ \text{Check: } 3n + 2n &= 7 + 4n \\ 3(7) + 2(7) &\stackrel{?}{=} 7 + 4(7) \\ 21 + 14 &\stackrel{?}{=} 7 + 28 \\ 35 &= 35 \quad \text{True}\end{aligned}$$

The solution is 7.

$$\begin{aligned}16. \quad \frac{13}{11}y - \frac{2}{11}y &= -3 \\ \frac{11}{11}y &= -3 \\ y &= -3\end{aligned}$$

$$\begin{aligned}\text{Check: } \frac{13}{11}y - \frac{2}{11}y &= -3 \\ \frac{13}{11}(-3) - \frac{2}{11}(-3) &\stackrel{?}{=} -3 \\ -\frac{39}{11} + \frac{6}{11} &\stackrel{?}{=} -3 \\ -\frac{33}{11} &\stackrel{?}{=} -3 \\ -3 &= -3 \quad \text{True}\end{aligned}$$

The solution is -3.

$$\begin{aligned}18. \quad 4x - 4 &= 10x - 7x \\ 4x - 4 &= 3x \\ 4x - 4 - 4x &= 3x - 4x \\ -4 &= -x \\ 4 &= x \\ \text{Check: } 4x - 4 &= 10x - 7x \\ 4(4) - 4 &\stackrel{?}{=} 10(4) - 7(4) \\ 16 - 4 &\stackrel{?}{=} 40 - 28 \\ 12 &= 12 \quad \text{True}\end{aligned}$$

The solution is 4.

$$\begin{aligned}20. \quad -4(z - 3) &= 2 - 3z \\ -4z + 12 &= 2 - 3z \\ -4z + 12 + 3z &= 2 - 3z + 3z \\ -z + 12 &= 2 \\ -z + 12 - 12 &= 2 - 12 \\ -z &= -10 \\ z &= 10 \\ \text{Check: } -4(z - 3) &= 2 - 3z \\ -4(10 - 3) &\stackrel{?}{=} 2 - 3(10) \\ -4(7) &\stackrel{?}{=} 2 - 30 \\ -28 &= -28 \quad \text{True}\end{aligned}$$

The solution is 10.

$$\begin{aligned}22. \quad \frac{1}{5}x - 1 &= -\frac{4}{5}x - 13 \\ \frac{4}{5}x + \frac{1}{5}x - 1 &= \frac{4}{5}x - \frac{4}{5}x - 13 \\ \frac{5}{5}x - 1 &= -13 \\ x - 1 &= -13 \\ x - 1 + 1 &= -13 + 1 \\ x &= -12\end{aligned}$$

Check: $\frac{1}{5}x - 1 = -\frac{4}{5}x - 13$
 $\frac{1}{5}(-12) - 1 \stackrel{?}{=} -\frac{4}{5}(-12) - 13$
 $-\frac{12}{5} - \frac{5}{5} \stackrel{?}{=} \frac{48}{5} - \frac{65}{5}$
 $-\frac{17}{5} = -\frac{17}{5} \quad \text{True}$

The solution is -12 .

24. $2x + 7 = x - 10$
 $-x + 2x + 7 = -x + x - 10$
 $x + 7 = -10$
 $x + 7 - 7 = -10 - 7$
 $x = -17$

Check: $2x + 7 = x - 10$
 $2(-17) + 7 \stackrel{?}{=} -17 - 10$
 $-34 + 7 \stackrel{?}{=} -27$
 $-27 = -27 \quad \text{True}$

The solution is -17 .

26. $4p - 11 - p = 2 + 2p - 20$
 $3p - 11 = 2p - 18$
 $-2p + 3p - 11 = -2p + 2p - 18$
 $p - 11 = -18$
 $p - 11 + 11 = -18 + 11$
 $p = -7$

Check: $4p - 11 - p = 2 + 2p - 20$
 $4(-7) - 11 - (-7) \stackrel{?}{=} 2 + 2(-7) - 20$
 $-28 - 11 + 7 \stackrel{?}{=} 2 - 14 - 20$
 $-32 = -32 \quad \text{True}$

The solution is -7 .

28. $-2(x - 1) = -3x$
 $-2x + 2 = -3x$
 $2x - 2x + 2 = 2x - 3x$
 $2 = -x$
 $-2 = x$

Check: $-2(x - 1) = -3x$
 $-2(-2 - 1) \stackrel{?}{=} -3(-2)$
 $-2(-3) \stackrel{?}{=} 6$
 $6 = 6 \quad \text{True}$

The solution is -2 .

30. $\frac{2}{5}x - \frac{1}{12} = -\frac{3}{5}x - \frac{3}{4}$
 $\frac{2}{5}x - \frac{1}{12} + \frac{3}{5}x = -\frac{3}{5}x - \frac{3}{4} + \frac{3}{5}x$
 $\frac{5}{5}x - \frac{1}{12} = -\frac{3}{4}$
 $x - \frac{1}{12} = -\frac{3}{4}$
 $x - \frac{1}{12} + \frac{1}{12} = -\frac{3}{4} + \frac{1}{12}$
 $x = -\frac{9}{12} + \frac{1}{12}$
 $x = -\frac{8}{12}$
 $x = -\frac{2}{3}$

Check: $\frac{2}{5}x - \frac{1}{12} = -\frac{3}{5}x - \frac{3}{4}$
 $\frac{2}{5}\left(-\frac{2}{3}\right) - \frac{1}{12} \stackrel{?}{=} -\frac{3}{5}\left(-\frac{2}{3}\right) - \frac{3}{4}$
 $-\frac{4}{15} - \frac{1}{12} \stackrel{?}{=} \frac{6}{15} - \frac{3}{4}$
 $-\frac{16}{60} - \frac{5}{60} \stackrel{?}{=} \frac{24}{60} - \frac{45}{60}$
 $-\frac{21}{60} = -\frac{21}{60} \quad \text{True}$

The solution is $-\frac{2}{3}$.

32. $3(y + 7) = 2y - 5$
 $3y + 21 = 2y - 5$
 $-2y + 3y + 21 = -2y + 2y - 5$
 $y + 21 = -5$
 $y + 21 - 21 = -5 - 21$
 $y = -26$

Check: $3(y + 7) = 2y - 5$
 $3(-26 + 7) \stackrel{?}{=} 2(-26) - 5$
 $3(-19) \stackrel{?}{=} -52 - 5$
 $-57 = -57 \quad \text{True}$

The solution is -26 .

34. $5(3 + z) - (8z + 9) = -4z$
 $15 + 5z - 8z - 9 = -4z$
 $-3z + 6 = -4z$
 $3z - 3z + 6 = 3z - 4z$
 $6 = -z$
 $-6 = z$

$$\begin{aligned}
 \text{Check: } & 5(3+z) - (8z+9) = -4z \\
 & 5(3+(-6)) - (8(-6)+9) \stackrel{?}{=} -4(-6) \\
 & 5(-3) - (-48+9) \stackrel{?}{=} 24 \\
 & -15 - (-39) \stackrel{?}{=} 24 \\
 & -15 + 39 \stackrel{?}{=} 24 \\
 & 24 = 24 \quad \text{True}
 \end{aligned}$$

The solution is -6 .

$$\begin{aligned}
 36. \quad & -5(x+1) + 4(2x-3) = 2(x+2) - 8 \\
 & -5x - 5 + 8x - 12 = 2x + 4 - 8 \\
 & 3x - 17 = 2x - 4 \\
 & 3x - 17 - 2x = 2x - 4 - 2x \\
 & x - 17 = -4 \\
 & x - 17 + 17 = -4 + 17 \\
 & x = 13
 \end{aligned}$$

$$\begin{aligned}
 \text{Check: } & -5(x+1) + 4(2x-3) = 2(x+2) - 8 \\
 & -5(13+1) + 4(2 \cdot 13 - 3) \stackrel{?}{=} 2(13+2) - 8 \\
 & -5(14) + 4(26-3) \stackrel{?}{=} 2(15) - 8 \\
 & -70 + 4(23) \stackrel{?}{=} 30 - 8 \\
 & -70 + 92 \stackrel{?}{=} 22 \\
 & 22 = 22 \quad \text{True}
 \end{aligned}$$

The solution is 13 .

$$\begin{aligned}
 38. \quad & 18x - 9 = 19x \\
 & 18x - 9 - 18x = 19x - 18x \\
 & -9 = x
 \end{aligned}$$

$$\begin{aligned}
 40. \quad & 9x + 5.5 = 10x \\
 & 9x + 5.5 - 9x = 10x - 9x \\
 & 5.5 = x
 \end{aligned}$$

$$\begin{aligned}
 42. \quad & 7y + 2 = 6y + 2 \\
 & 7y + 2 - 6y = 6y + 2 - 6y \\
 & y + 2 = 2 \\
 & y + 2 - 2 = 2 - 2 \\
 & y = 0
 \end{aligned}$$

$$\begin{aligned}
 44. \quad & 15x + 20 - 10x - 9 = 25x + 8 - 21x - 7 \\
 & 5x + 11 = 4x + 1 \\
 & -4x + 5x + 11 = -4x + 4x + 1 \\
 & x + 11 = 1 \\
 & x + 11 - 11 = 1 - 11 \\
 & x = -10
 \end{aligned}$$

$$\begin{aligned}
 46. \quad & 6(5+c) = 5(c-4) \\
 & 30 + 6c = 5c - 20 \\
 & 30 + 6c - 5c = 5c - 20 - 5c \\
 & 30 + c = -20 \\
 & -30 + 30 + c = -30 - 20 \\
 & c = -50
 \end{aligned}$$

$$\begin{aligned}
 48. \quad & m + 2 = 7.1 \\
 & m + 2 - 2 = 7.1 - 2 \\
 & m = 5.1
 \end{aligned}$$

$$\begin{aligned}
 50. \quad & 15 - (6 - 7k) = 2 + 6k \\
 & 15 - 6 + 7k = 2 + 6k \\
 & 9 + 7k = 2 + 6k \\
 & 9 + 7k - 6k = 2 + 6k - 6k \\
 & 9 + k = 2 \\
 & -9 + 9 + k = -9 + 2 \\
 & k = -7
 \end{aligned}$$

$$\begin{aligned}
 52. \quad & \frac{1}{11} = y + \frac{10}{11} \\
 & \frac{1}{11} - \frac{10}{11} = y + \frac{10}{11} - \frac{10}{11} \\
 & -\frac{9}{11} = y
 \end{aligned}$$

$$\begin{aligned}
 54. \quad & -1.4 - 7x - 3.6 - 2x = -8x + 4.4 \\
 & -9x - 5 = -8x + 4.4 \\
 & 8x - 9x - 5 = 8x - 8x + 4.4 \\
 & -x - 5 = 4.4 \\
 & -x - 5 + 5 = 4.4 + 5 \\
 & -x = 9.4 \\
 & x = -9.4
 \end{aligned}$$

56. If the sum of the lengths of the two pieces is 5 feet and one piece is x feet, then the other piece has a length of $(5 - x)$ feet.

58. If the sum of the measures of two angles is 90° and one angle measures x° , then the other angle measures $(90 - x)^\circ$.

60. If the length of I-80 is m miles and the length of I-90 is 178.5 miles longer than I-80, the length of I-90 is $m + 178.5$.

62. If the weight of the Armanty meteorite is y kilograms and the weight of the Hoba West meteorite is 3 times the weight of the Armanty meteorite, then the weight of the Hoba West meteorite is $3y$ kilograms.

$$\begin{aligned}
 64. \quad & \text{The multiplicative inverse of } \frac{7}{6} \text{ is } \frac{6}{7}, \text{ since} \\
 & \frac{7}{6} \cdot \frac{6}{7} = 1.
 \end{aligned}$$

66. The multiplicative inverse of 5 is $\frac{1}{5}$, since

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

68. The multiplicative inverse of $-\frac{3}{5}$ is $-\frac{5}{3}$ since

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

70. $\frac{-2y}{-2} = \frac{-2 \cdot y}{-2 \cdot 1} = \frac{y}{1} = y$

72. $7\left(\frac{1}{7}r\right) = \left(7 \cdot \frac{1}{7}\right)r = 1r = r$

74. $\frac{9}{2}\left(\frac{2}{9}x\right) = \left(\frac{9}{2} \cdot \frac{2}{9}\right)x = 1x = x$

76. answers may vary

78. $a + 9 = 15$
 $a + 9 + (-9) = 15 + (-9)$
 $a = 6$

80. answers may vary

82. $360 - x - 3x - 5x = 360 - 9x$
 The measure of the fourth angle is $(360 - 9x)^\circ$.

84. answers may vary

86. $-85.325 = x - 97.985$
 $-85.325 + 97.985 = x - 97.985 + 97.985$
 $12.66 = x$

Section 2.2 Practice

1. $\frac{3}{7}x = 9$
 $\frac{7}{3} \cdot \left(\frac{3}{7}x\right) = \frac{7}{3} \cdot 9$
 $\left(\frac{7}{3} \cdot \frac{3}{7}\right)x = \frac{7}{3} \cdot 9$
 $1x = 21$
 $x = 21$

Check: $\frac{3}{7}x = 9$

$$\frac{3}{7}(21) \stackrel{?}{=} 9$$

$$9 = 9 \quad \text{True}$$

The solution is 21.

2. $7x = 42$

$$\frac{7x}{7} = \frac{42}{7}$$

$$1 \cdot x = 6$$

$$x = 6$$

Check: $7x = 42$

$$7 \cdot 6 \stackrel{?}{=} 42$$

$$42 = 42 \quad \text{True}$$

The solution is 6.

3. $-4x = 52$

$$\frac{-4x}{-4} = \frac{52}{-4}$$

$$1x = -13$$

$$x = -13$$

Check: $-4x = 52$

$$-4(-13) \stackrel{?}{=} 52$$

$$52 = 52 \quad \text{True}$$

The solution is -13 .

4. $\frac{y}{5} = 13$

$$\frac{1}{5}y = 13$$

$$5 \cdot \frac{1}{5}y = 5 \cdot 13$$

$$1y = 65$$

$$y = 65$$

Check: $\frac{y}{5} = 13$

$$\frac{65}{5} \stackrel{?}{=} 13$$

$$13 = 13 \quad \text{True}$$

The solution is 65.

5. $2.6x = 13.52$

$$\frac{2.6x}{2.6} = \frac{13.52}{2.6}$$

$$x = 5.2$$

Check: $2.6x = 13.52$

$$2.6(5.2) \stackrel{?}{=} 13.52$$

$$13.52 = 13.52 \quad \text{True}$$

The solution is 5.2.

$$\begin{aligned}
 6. \quad & -\frac{5}{6}y = -\frac{3}{5} \\
 & -\frac{6}{5} \cdot -\frac{5}{6}y = -\frac{6}{5} \cdot -\frac{3}{5} \\
 & y = \frac{18}{25}
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \quad & -\frac{5}{6}y = -\frac{3}{5} \\
 & -\frac{5}{6}\left(\frac{18}{25}\right) \stackrel{?}{=} -\frac{3}{5} \\
 & -\frac{3}{5} = -\frac{3}{5} \quad \text{True}
 \end{aligned}$$

The solution is $\frac{18}{25}$.

$$\begin{aligned}
 7. \quad & -x + 7 = -12 \\
 & -x + 7 - 7 = -12 - 7 \\
 & -x = -19 \\
 & \frac{-x}{-1} = \frac{-19}{-1} \\
 & 1x = 19 \\
 & x = 19
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \quad & -x + 7 = -12 \\
 & -19 + 7 \stackrel{?}{=} -12 \\
 & -12 = -12 \quad \text{True}
 \end{aligned}$$

The solution is 19.

$$\begin{aligned}
 8. \quad & -7x + 2x + 3 - 20 = -2 \\
 & -5x - 17 = -2 \\
 & -5x - 17 + 17 = -2 + 17 \\
 & -5x = 15 \\
 & \frac{-5x}{-5} = \frac{15}{-5} \\
 & x = -3
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \quad & -7x + 2x + 3 - 20 = -2 \\
 & -7(-3) + 2(-3) + 3 - 20 \stackrel{?}{=} -2 \\
 & 21 - 6 + 3 - 20 \stackrel{?}{=} -2 \\
 & -2 = -2 \quad \text{True}
 \end{aligned}$$

The solution is -3.

$$\begin{aligned}
 9. \quad & 10x - 4 = 7x + 14 \\
 & 10x - 4 - 7x = 7x + 14 - 7x \\
 & 3x - 4 = 14 \\
 & 3x - 4 + 4 = 14 + 4 \\
 & 3x = 18 \\
 & \frac{3x}{3} = \frac{18}{3} \\
 & x = 6
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \quad & 10x - 4 = 7x + 14 \\
 & 10(6) - 4 \stackrel{?}{=} 7(6) + 14 \\
 & 60 - 4 \stackrel{?}{=} 42 + 14 \\
 & 56 = 56 \quad \text{True}
 \end{aligned}$$

The solution is 6.

$$\begin{aligned}
 10. \quad & 4(3x - 2) = -1 + 4 \\
 & 4(3x) - 4(2) = -1 + 4 \\
 & 12x - 8 = 3 \\
 & 12x - 8 + 8 = 3 + 8 \\
 & 12x = 11 \\
 & \frac{12x}{12} = \frac{11}{12} \\
 & x = \frac{11}{12}
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \quad & 4(3x - 2) = -1 + 4 \\
 & 4\left(3 \cdot \frac{11}{12} - 2\right) \stackrel{?}{=} -1 + 4 \\
 & 4\left(\frac{11}{4} - 2\right) \stackrel{?}{=} -1 + 4 \\
 & 11 - 8 \stackrel{?}{=} 3 \\
 & 3 = 3 \quad \text{True}
 \end{aligned}$$

The solution is $\frac{11}{12}$.

11. a. If x is the first integer, then $x + 1$ is the second integer.
 Their sum is $x + (x + 1) = x + x + 1 = 2x + 1$.
- b. If x is the first odd integer, then $x + 2$ is the second consecutive odd integer.
 Their sum is $x + (x + 2) = x + x + 2 = 2x + 2$.

Vocabulary and Readiness Check

- By the multiplication property of equality, both sides of an equation may be multiplied or divided by the same nonzero number without changing the solution of the equation.
- By the addition property of equality, the same number may be added to or subtracted from both sides of an equation without changing the solution of the equation.
- An equation may be solved while an expression may be simplified and evaluated.
- An equation contains an equal sign ($=$) while an expression does not.
- Equivalent equations have the same solution.

6. A solution of an equation is a number that when substituted for a variable makes the equation a true statement.

7. $3a = 27$
 $a = 9$

8. $9c = 54$
 $c = 6$

9. $5b = 10$
 $b = 2$

10. $7t = 14$
 $t = 2$

11. $6x = -30$
 $x = -5$

12. $8r = -64$
 $r = -8$

Exercise Set 2.2

2. $-7x = -49$
 $\frac{-7x}{-7} = \frac{-49}{-7}$
 $x = 7$

Check: $-7x = -49$
 $-7(7) \stackrel{?}{=} -49$
 $-49 = -49$ True

The solution is 7.

4. $2x = 0$
 $\frac{2x}{2} = \frac{0}{2}$
 $x = 0$

Check: $2x = 0$
 $2(0) \stackrel{?}{=} 0$
 $0 = 0$ True

The solution is 0.

6. $-y = 8$
 $\frac{-y}{-1} = \frac{8}{-1}$
 $y = -8$

Check: $-y = 8$
 $-(-8) \stackrel{?}{=} 8$
 $8 = 8$ True

The solution is -8.

8. $\frac{3}{4}n = -15$
 $\frac{4}{3} \cdot \frac{3}{4}n = \frac{4}{3} \cdot (-15)$
 $n = -20$

Check: $\frac{3}{4}n = -15$
 $\frac{3}{4}(-20) \stackrel{?}{=} -15$
 $-15 = -15$ True

The solution is -20.

10. $\frac{1}{8}v = \frac{1}{4}$
 $8 \cdot \frac{1}{8}v = 8 \cdot \frac{1}{4}$
 $v = 2$

Check: $\frac{1}{8}v = \frac{1}{4}$
 $\frac{1}{8} \cdot 2 \stackrel{?}{=} \frac{1}{4}$
 $\frac{1}{4} = \frac{1}{4}$ True

The solution is 2.

12. $\frac{d}{15} = 2$
 $15 \cdot \frac{d}{15} = 15 \cdot 2$
 $d = 30$

Check: $\frac{d}{15} = 2$
 $\frac{30}{15} \stackrel{?}{=} 2$
 $2 = 2$ True

The solution is 30.

14. $\frac{f}{-5} = 0$
 $-5 \cdot \left(\frac{f}{-5}\right) = -5 \cdot 0$
 $f = 0$

Check: $\frac{f}{-5} = 0$
 $\frac{0}{-5} \stackrel{?}{=} 0$
 $0 = 0$ True

The solution is 0.

16. $8.5y = 19.55$

$$\frac{8.5y}{8.5} = \frac{19.55}{8.5}$$

$$y = 2.3$$

Check: $8.5y = 19.55$
 $8.5(2.3) \stackrel{?}{=} 19.55$
 $19.55 = 19.55$ True

The solution is 2.3.

18. $3x - 1 = 26$

$$3x - 1 + 1 = 26 + 1$$

$$3x = 27$$

$$\frac{3x}{3} = \frac{27}{3}$$

$$x = 9$$

Check: $3x - 1 = 26$
 $3 \cdot 9 - 1 \stackrel{?}{=} 26$
 $27 - 1 \stackrel{?}{=} 26$
 $26 = 26$ True

The solution is 9.

20. $-x + 4 = -24$

$$-x + 4 - 4 = -24 - 4$$

$$-x = -28$$

$$\frac{-x}{-1} = \frac{-28}{-1}$$

$$x = 28$$

Check: $-x + 4 = -24$
 $-28 + 4 \stackrel{?}{=} -24$
 $-24 = -24$ True

The solution is 28.

22. $8t + 5 = 5$

$$8t + 5 - 5 = 5 - 5$$

$$8t = 0$$

$$\frac{8t}{8} = \frac{0}{8}$$

$$t = 0$$

Check: $8t + 5 = 5$
 $8 \cdot 0 + 5 \stackrel{?}{=} 5$
 $0 + 5 \stackrel{?}{=} 5$
 $5 = 5$ True

The solution is 0.

24. $\frac{b}{4} - 1 = -7$

$$\frac{b}{4} - 1 + 1 = -7 + 1$$

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

$$4 \cdot \frac{b}{4} = 4 \cdot (-6)$$

$$b = -24$$

Check: $\frac{b}{4} - 1 = -7$

$$\frac{-24}{4} - 1 \stackrel{?}{=} -7$$

$$-6 - 1 \stackrel{?}{=} -7$$

$$-7 = -7$$
 True

The solution is -24.

26. $4a + 1 + a - 11 = 0$

$$5a - 10 = 0$$

$$5a - 10 + 10 = 0 + 10$$

$$5a = 10$$

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

$$a = 2$$

Check: $4a + 1 + a - 11 = 0$

$$4 \cdot 2 + 1 + 2 - 11 \stackrel{?}{=} 0$$

$$8 + 1 + 2 - 11 \stackrel{?}{=} 0$$

$$0 = 0$$
 True

The solution is 2.

28. $19 = 0.4x - 0.9x - 6$

$$19 = -0.5x - 6$$

$$19 + 6 = -0.5x - 6 + 6$$

$$25 = -0.5x$$

$$\frac{25}{-0.5} = \frac{-0.5x}{-0.5}$$

$$-50 = x$$

Check: $19 = 0.4x - 0.9x - 6$

$$19 \stackrel{?}{=} 0.4(-50) - 0.9(-50) - 6$$

$$19 \stackrel{?}{=} -20 + 45 - 6$$

$$19 = 19$$
 True

The solution is -50.

$$30. \quad \frac{3}{5}x - 14 = -8$$

$$\frac{3}{5}x - 14 + 14 = -8 + 14$$

$$\frac{3}{5}x = 6$$

$$\frac{5}{3} \cdot \frac{3}{5}x = \frac{5}{3} \cdot 6$$

$$x = 10$$

$$\text{Check: } \frac{3}{5}x - 14 = -8$$

$$\frac{3}{5} \cdot 10 - 14 \stackrel{?}{=} -8$$

$$6 - 14 \stackrel{?}{=} -8$$

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

The solution is 10.

$$32. \quad \frac{2}{7}z - \frac{1}{5} = \frac{1}{2}$$

$$\frac{2}{7}z - \frac{1}{5} + \frac{1}{5} = \frac{1}{2} + \frac{1}{5}$$

$$\frac{2}{7}z = \frac{5}{10} + \frac{2}{10}$$

$$\frac{2}{7}z = \frac{7}{10}$$

$$\frac{7}{2} \cdot \frac{2}{7}z = \frac{7}{2} \cdot \frac{7}{10}$$

$$z = \frac{49}{20}$$

$$\text{Check: } \frac{2}{7}z - \frac{1}{5} = \frac{1}{2}$$

$$\frac{2}{7} \left(\frac{49}{20} \right) - \frac{1}{5} \stackrel{?}{=} \frac{1}{2}$$

$$\frac{7}{10} - \frac{1}{5} \stackrel{?}{=} \frac{1}{2}$$

$$\frac{7}{10} - \frac{2}{10} \stackrel{?}{=} \frac{1}{2}$$

$$\frac{5}{10} \stackrel{?}{=} \frac{1}{2}$$

$$\frac{1}{2} = \frac{1}{2} \quad \text{True}$$

The solution is $\frac{49}{20}$.

$$34. \quad 11x + 13 = 9x + 9$$

$$11x + 13 - 9x = 9x + 9 - 9x$$

$$2x + 13 = 9$$

$$2x + 13 - 13 = 9 - 13$$

$$2x = -4$$

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

$$x = -2$$

$$36. \quad 2(4x + 1) = -12 + 6$$

$$8x + 2 = -12 + 6$$

$$8x + 2 = -6$$

$$8x + 2 - 2 = -6 - 2$$

$$8x = -8$$

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

$$x = -1$$

$$38. \quad 6x - 4 = -2x - 10$$

$$6x - 4 + 2x = -2x - 10 + 2x$$

$$8x - 4 = -10$$

$$8x - 4 + 4 = -10 + 4$$

$$8x = -6$$

$$\frac{8x}{8} = \frac{-6}{8}$$

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

$$40. \quad 8 + 4 = -6(5x - 2)$$

$$8 + 4 = -30x + 12$$

$$12 = -30x + 12$$

$$12 - 12 = -30x + 12 - 12$$

$$0 = -30x$$

$$\frac{0}{-30} = \frac{-30x}{-30}$$

$$0 = x$$

$$42. \quad -17z - 4 = -16z - 20$$

$$17z - 17z - 4 = 17z - 16z - 20$$

$$-4 = z - 20$$

$$-4 + 20 = z - 20 + 20$$

$$16 = z$$

$$\begin{aligned}
 44. \quad \frac{1}{3}(3x-1) &= -\frac{1}{10} - \frac{2}{10} \\
 x - \frac{1}{3} &= -\frac{3}{10} \\
 x - \frac{1}{3} + \frac{1}{3} &= -\frac{3}{10} + \frac{1}{3} \\
 x &= -\frac{9}{30} + \frac{10}{30} \\
 x &= \frac{1}{30}
 \end{aligned}$$

$$\begin{aligned}
 46. \quad -14y - 1.8 &= -24y + 3.9 \\
 -14y - 1.8 + 14y &= -24y + 3.9 + 14y \\
 -1.8 &= -10y + 3.9 \\
 -1.8 - 3.9 &= -10y + 3.9 - 3.9 \\
 -5.7 &= -10y \\
 \frac{-5.7}{-10} &= \frac{-10y}{-10} \\
 0.57 &= y
 \end{aligned}$$

$$\begin{aligned}
 48. \quad -3x + 15 &= 3x - 15 \\
 -3x - 3x + 15 &= -3x + 3x - 15 \\
 -6x + 15 &= -15 \\
 -6x + 15 - 15 &= -15 - 15 \\
 -6x &= -30 \\
 \frac{-6x}{-6} &= \frac{-30}{-6} \\
 x &= 5
 \end{aligned}$$

$$\begin{aligned}
 50. \quad 81 &= 3x \\
 \frac{81}{3} &= \frac{3x}{3} \\
 27 &= x
 \end{aligned}$$

$$\begin{aligned}
 52. \quad 6.3 &= -0.6x \\
 \frac{6.3}{-0.6} &= \frac{-0.6x}{-0.6} \\
 -10.5 &= x
 \end{aligned}$$

$$\begin{aligned}
 54. \quad 10y + 15 &= -5 \\
 10y + 15 - 15 &= -5 - 15 \\
 10y &= -20 \\
 \frac{10y}{10} &= \frac{-20}{10} \\
 y &= -2
 \end{aligned}$$

$$\begin{aligned}
 56. \quad 2 - 0.4p &= 2 \\
 -2 + 2 - 0.4p &= -2 + 2 \\
 -0.4p &= 0 \\
 \frac{-0.4p}{-0.4} &= \frac{0}{-0.4} \\
 p &= 0
 \end{aligned}$$

$$\begin{aligned}
 58. \quad 20x - 20 &= 16x - 40 \\
 20x - 20 + 20 &= 16x - 40 + 20 \\
 20x &= 16x - 20 \\
 20x - 16x &= 16x - 20 - 16x \\
 4x &= -20 \\
 \frac{4x}{4} &= \frac{-20}{4} \\
 x &= -5
 \end{aligned}$$

$$\begin{aligned}
 60. \quad 7(2x+1) &= 18x - 19x \\
 14x + 7 &= -x \\
 -14x + 14x + 7 &= -14x - x \\
 7 &= -15x \\
 \frac{7}{-15} &= \frac{-15x}{-15} \\
 -\frac{7}{15} &= x
 \end{aligned}$$

$$\begin{aligned}
 62. \quad -\frac{4}{5}r &= -5 \\
 -\frac{5}{4} \cdot \left(-\frac{4}{5}r\right) &= -\frac{5}{4} \cdot (-5) \\
 r &= \frac{25}{4}
 \end{aligned}$$

$$\begin{aligned}
 64. \quad -\frac{10}{3}x &= 30 \\
 -\frac{3}{10} \cdot \left(-\frac{10}{3}x\right) &= -\frac{3}{10} \cdot 30 \\
 x &= -9
 \end{aligned}$$

$$\begin{aligned}
 66. \quad -3n - \frac{1}{3} &= \frac{8}{3} \\
 -3n - \frac{1}{3} + \frac{1}{3} &= \frac{8}{3} + \frac{1}{3} \\
 -3n &= \frac{9}{3} \\
 -3n &= 3 \\
 \frac{-3n}{-3} &= \frac{3}{-3} \\
 n &= -1
 \end{aligned}$$

$$\begin{aligned}
 68. \quad & 12 = 3j - 4 \\
 & 12 + 4 = 3j - 4 + 4 \\
 & 16 = 3j \\
 & \frac{16}{3} = \frac{3j}{3} \\
 & \frac{16}{3} = j
 \end{aligned}$$

$$\begin{aligned}
 70. \quad & 12x + 30 + 8x - 6 = 10 \\
 & 20x + 24 = 10 \\
 & 20x + 24 - 24 = 10 - 24 \\
 & 20x = -14 \\
 & \frac{20x}{20} = \frac{-14}{20} \\
 & x = -\frac{14}{20} \\
 & x = -\frac{7}{10}
 \end{aligned}$$

$$\begin{aligned}
 72. \quad & t - 6t = -13 + t - 3t \\
 & -5t = -13 - 2t \\
 & -5t + 2t = -13 - 2t + 2t \\
 & -3t = -13 \\
 & \frac{-3t}{-3} = \frac{-13}{-3} \\
 & t = \frac{13}{3}
 \end{aligned}$$

$$\begin{aligned}
 74. \quad & x + \frac{3}{7} = -x + \frac{1}{3} + \frac{4}{7} \\
 & x + \frac{3}{7} = -x + \frac{7}{21} + \frac{12}{21} \\
 & x + \frac{3}{7} = -x + \frac{19}{21} \\
 & x + \frac{3}{7} - \frac{3}{7} = -x + \frac{19}{21} - \frac{3}{7} \\
 & x = -x + \frac{19}{21} - \frac{9}{21} \\
 & x = -x + \frac{10}{21} \\
 & x + x = -x + \frac{10}{21} + x \\
 & 2x = \frac{10}{21} \\
 & \frac{1}{2} \cdot 2x = \frac{1}{2} \cdot \frac{10}{21} \\
 & x = \frac{5}{21}
 \end{aligned}$$

$$\begin{aligned}
 76. \quad & -19 + 74 = -5(x + 3) \\
 & 55 = -5x - 15 \\
 & 55 + 15 = -5x - 15 + 15 \\
 & 70 = -5x \\
 & \frac{70}{-5} = \frac{-5x}{-5} \\
 & -14 = x
 \end{aligned}$$

78. If x represents the first of three consecutive even integers, then $x + 2$ and $x + 4$ represent the second and third even integers, respectively. Thus, the sum is represented by $x + x + 2 + x + 4 = 3x + 6$.

80. If x represents the first integer, then $x + 1$ represents the second consecutive integer. The sum of 20 and the second integer is represented by $20 + x + 1 = x + 21$.

82. If x represents the first odd integer, then $x + 2$ represents the next consecutive odd integer. The sum of the lengths is $x + x + 2 + x + x + 2 = 4x + 4$.

$$\begin{aligned}
 84. \quad & -7y + 2y - 3(y + 1) = -7y + 2y - 3 \cdot y - 3 \cdot 1 \\
 & = -7y + 2y - 3y - 3 \\
 & = -8y - 3
 \end{aligned}$$

$$\begin{aligned}
 86. \quad & -(3a - 3) + 2a - 6 = -3a + 3 + 2a - 6 \\
 & = -3a + 2a + 3 - 6 \\
 & = -a - 3
 \end{aligned}$$

$$\begin{aligned}
 88. \quad & 8(z - 6) + 7z - 1 = 8z - 48 + 7z - 1 \\
 & = 8z + 7z - 48 - 1 \\
 & = 15z - 49
 \end{aligned}$$

90. If the solution is $\frac{1}{2}$, then replacing x by $\frac{1}{2}$ results in a true statement.

$$\begin{aligned}
 & \frac{\quad}{\quad} \cdot \frac{1}{2} = 10 \\
 & \frac{\quad}{\quad} \cdot \frac{1}{2} \cdot 2 = 10 \cdot 2 \\
 & \frac{\quad}{\quad} = 20
 \end{aligned}$$

The missing number is 20.

92. answers may vary

94. answers may vary

$$\begin{aligned}
 96. \quad & 0.06y + 2.63 = 2.5562 \\
 & 0.06y + 2.63 - 2.63 = 2.5562 - 2.63 \\
 & 0.06y = -0.0738 \\
 & \frac{0.06y}{0.06} = \frac{-0.0738}{0.06} \\
 & y = -1.23
 \end{aligned}$$

Section 2.3 Practice

$$\begin{aligned}
 1. \quad & 5(3x-1) + 2 = 12x + 6 \\
 & 15x - 5 + 2 = 12x + 6 \\
 & 15x - 3 = 12x + 6 \\
 & 15x - 3 - 12x = 12x + 6 - 12x \\
 & 3x - 3 = 6 \\
 & 3x - 3 + 3 = 6 + 3 \\
 & 3x = 9 \\
 & \frac{3x}{3} = \frac{9}{3} \\
 & x = 3 \\
 \text{Check: } & 5(3x-1) + 2 = 12x + 6 \\
 & 5[3(3)-1] + 2 \stackrel{?}{=} 12(3) + 6 \\
 & 5(9-1) + 2 \stackrel{?}{=} 36 + 6 \\
 & 5(8) + 2 \stackrel{?}{=} 42 \\
 & 40 + 2 \stackrel{?}{=} 42 \\
 & 42 = 42 \quad \text{True}
 \end{aligned}$$

The solution is 3.

$$\begin{aligned}
 2. \quad & 9(5-x) = -3x \\
 & 45 - 9x = -3x \\
 & 45 - 9x + 9x = -3x + 9x \\
 & 45 = 6x \\
 & \frac{45}{6} = \frac{6x}{6} \\
 & \frac{15}{2} = x \\
 \text{Check: } & 9(5-x) = -3x \\
 & 9\left(5 - \frac{15}{2}\right) \stackrel{?}{=} -3\left(\frac{15}{2}\right) \\
 & 9\left(\frac{10}{2} - \frac{15}{2}\right) \stackrel{?}{=} -\frac{45}{2} \\
 & 9\left(-\frac{5}{2}\right) \stackrel{?}{=} -\frac{45}{2} \\
 & -\frac{45}{2} = -\frac{45}{2} \quad \text{True}
 \end{aligned}$$

The solution is $\frac{15}{2}$.

$$\begin{aligned}
 3. \quad & \frac{5}{2}x - 1 = \frac{3}{2}x - 4 \\
 & 2\left(\frac{5}{2}x - 1\right) = 2\left(\frac{3}{2}x - 4\right) \\
 & 5x - 2 = 3x - 8 \\
 & 5x - 2 - 3x = 3x - 8 - 3x \\
 & 2x - 2 = -8 \\
 & 2x - 2 + 2 = -8 + 2 \\
 & 2x = -6 \\
 & \frac{2x}{2} = \frac{-6}{2} \\
 & x = -3 \\
 \text{Check: } & \frac{5}{2}x - 1 = \frac{3}{2}x - 4 \\
 & \frac{5}{2}(-3) - 1 \stackrel{?}{=} \frac{3}{2}(-3) - 4 \\
 & -\frac{15}{2} - 1 \stackrel{?}{=} -\frac{9}{2} - 4 \\
 & -\frac{15}{2} - \frac{2}{2} \stackrel{?}{=} -\frac{9}{2} - \frac{8}{2} \\
 & -\frac{17}{2} = -\frac{17}{2} \quad \text{True}
 \end{aligned}$$

The solution is -3.

$$\begin{aligned}
 4. \quad & \frac{3(x-2)}{5} = 3x + 6 \\
 & 5 \cdot \frac{3(x-2)}{5} = 5(3x + 6) \\
 & 3(x-2) = 5(3x + 6) \\
 & 3x - 6 = 15x + 30 \\
 & 3x - 6 - 3x = 15x + 30 - 3x \\
 & -6 = 12x + 30 \\
 & -6 - 30 = 12x + 30 - 30 \\
 & -36 = 12x \\
 & \frac{-36}{12} = \frac{12x}{12} \\
 & -3 = x \\
 \text{Check: } & \frac{3(x-2)}{5} = 3x + 6 \\
 & \frac{3(-3-2)}{5} \stackrel{?}{=} 3(-3) + 6 \\
 & \frac{3(-5)}{5} \stackrel{?}{=} -9 + 6 \\
 & \frac{-15}{5} \stackrel{?}{=} -3 \\
 & -3 = -3
 \end{aligned}$$

The solution is -3.

$$\begin{aligned}
 5. \quad & 0.06x - 0.10(x - 2) = -0.16 \\
 & 100[0.06x - 0.10(x - 2)] = 100[-0.16] \\
 & 6x - 10(x - 2) = -16 \\
 & 6x - 10x + 20 = -16 \\
 & -4x + 20 = -16 \\
 & -4x + 20 - 20 = -16 - 20 \\
 & -4x = -36 \\
 & \frac{-4x}{-4} = \frac{-36}{-4} \\
 & x = 9
 \end{aligned}$$

To check, replace x with 9 in the original equation. The solution is 9.

$$\begin{aligned}
 6. \quad & 5(2 - x) + 8x = 3(x - 6) \\
 & 10 - 5x + 8x = 3x - 18 \\
 & 10 + 3x = 3x - 18 \\
 & 10 + 3x - 3x = 3x - 18 - 3x \\
 & 10 = -18
 \end{aligned}$$

Since the statement $10 = -18$ is false, the equation has no solution.

$$\begin{aligned}
 7. \quad & -6(2x + 1) - 14 = -10(x + 2) - 2x \\
 & -12x - 6 - 14 = -10x - 20 - 2x \\
 & -12x - 20 = -12x - 20 \\
 & 12x - 12x - 20 = 12x - 12x - 20 \\
 & -20 = -20
 \end{aligned}$$

Since $-20 = -20$ is a true statement, every real number is a solution.

Calculator Explorations

$$\begin{aligned}
 1. \quad & 2x = 48 + 6x \\
 & \boxed{2} \boxed{\times} \boxed{-12} \boxed{=} \quad \text{Display: } \boxed{-24} \\
 & \boxed{48} \boxed{+} \boxed{6} \boxed{\times} \boxed{-12} \boxed{=} \quad \text{Display: } \boxed{-24} \\
 & \text{Since the left side equals the right side, } x = -12 \text{ is a solution.}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & -3x - 7 = 3x - 1 \\
 & \boxed{-3} \boxed{\times} \boxed{-1} \boxed{-7} \boxed{=} \quad \text{Display: } \boxed{-4} \\
 & \boxed{3} \boxed{\times} \boxed{-1} \boxed{-1} \boxed{=} \quad \text{Display: } \boxed{-4} \\
 & \text{Since the left side equals the right side, } x = -1 \text{ is a solution.}
 \end{aligned}$$

$$\begin{aligned}
 3. \quad & 5x - 2.6 = 2(x + 0.8) \\
 & \boxed{5} \boxed{\times} \boxed{4.4} \boxed{-2.6} \boxed{=} \quad \text{Display: } \boxed{19.4} \\
 & \boxed{2} \boxed{\times} \boxed{4.4} \boxed{+} \boxed{0.8} \boxed{=} \quad \text{Display: } \boxed{10.4} \\
 & \text{Since the left side does not equal the right side, } x = 4.4 \text{ is not a solution.}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & -1.6x - 3.9 = -6.9x - 25.6 \\
 & \boxed{-1.6} \boxed{\times} \boxed{5} \boxed{-3.9} \boxed{=} \quad \text{Display: } \boxed{-11.9} \\
 & \boxed{-6.9} \boxed{\times} \boxed{5} \boxed{-25.6} \boxed{=} \quad \text{Display: } \boxed{-60.1} \\
 & \text{Since the left side does not equal the right side, } x = 5 \text{ is not a solution.}
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & \frac{564x}{4} = 200x - 11(649) \\
 & \boxed{564} \boxed{\times} \boxed{121} \boxed{\div} \boxed{4} \boxed{=} \quad \text{Display: } \boxed{17061} \\
 & \boxed{200} \boxed{\times} \boxed{121} \boxed{-} \boxed{11} \boxed{\times} \boxed{649} \boxed{=} \quad \text{Display: } \boxed{17061} \\
 & \text{Since the left side equals the right side, } x = 121 \text{ is a solution.}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & 20(x - 39) = 5x - 432 \\
 & \boxed{20} \boxed{\times} \boxed{23.2} \boxed{-} \boxed{39} \boxed{=} \quad \text{Display: } \boxed{-316} \\
 & \boxed{5} \boxed{\times} \boxed{23.2} \boxed{-} \boxed{432} \boxed{=} \quad \text{Display: } \boxed{-316} \\
 & \text{Since the left side equals the right side, } x = 23.2 \text{ is a solution.}
 \end{aligned}$$

Vocabulary and Readiness Check

- $x = -7$ is an equation.
- $x - 7$ is an expression.
- $4y - 6 + 9y + 1$ is an expression.
- $4y - 6 = 9y + 1$ is an equation.
- $\frac{1}{x} - \frac{x-1}{8}$ is an expression.
- $\frac{1}{x} - \frac{x-1}{8} = 6$ is an equation.
- $0.1x + 9 = 0.2x$ is an equation.
- $0.1x^2 + 9y - 0.2x^2$ is an expression.

Exercise Set 2.3

$$\begin{aligned}
 2. \quad & -3x + 1 = -2(4x + 2) \\
 & -3x + 1 = -8x - 4 \\
 & -3x + 1 + 8x = -8x - 4 + 8x \\
 & 5x + 1 = -4 \\
 & 5x + 1 - 1 = -4 - 1 \\
 & 5x = -5 \\
 & \frac{5x}{5} = \frac{-5}{5} \\
 & x = -1
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & 15x - 5 = 7 + 12x \\
 & 15x - 5 - 12x = 7 + 12x - 12x \\
 & 3x - 5 = 7 \\
 & 3x - 5 + 5 = 7 + 5 \\
 & 3x = 12 \\
 & \frac{3x}{3} = \frac{12}{3} \\
 & x = 4
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & -(5x - 10) = 5x \\
 & -5x + 10 = 5x \\
 & 5x - 5x + 10 = 5x + 5x \\
 & 10 = 10x \\
 & \frac{10}{10} = \frac{10x}{10} \\
 & 1 = x
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & 3(2 - 5x) + 4(6x) = 12 \\
 & 6 - 15x + 24x = 12 \\
 & 6 + 9x = 12 \\
 & 6 + 9x - 6 = 12 - 6 \\
 & 9x = 6 \\
 & \frac{9x}{9} = \frac{6}{9} \\
 & x = \frac{2}{3}
 \end{aligned}$$

$$\begin{aligned}
 10. \quad & -4(n - 4) - 23 = -7 \\
 & -4n + 16 - 23 = -7 \\
 & -4n - 7 = -7 \\
 & -4n - 7 + 7 = -7 + 7 \\
 & -4n = 0 \\
 & \frac{-4n}{-4} = \frac{0}{-4} \\
 & n = 0
 \end{aligned}$$

$$\begin{aligned}
 12. \quad & 5 - 6(2 + b) = b - 14 \\
 & 5 - 12 - 6b = b - 14 \\
 & -7 - 6b = b - 14 \\
 & -7 - 6b + 6b = b - 14 + 6b \\
 & -7 = 7b - 14 \\
 & -7 + 14 = 7b - 14 + 14 \\
 & 7 = 7b \\
 & \frac{7}{7} = \frac{7b}{7} \\
 & 1 = b
 \end{aligned}$$

$$\begin{aligned}
 14. \quad & 6y - 8 = -6 + 3y + 13 \\
 & 6y - 8 = 7 + 3y \\
 & 6y - 8 - 3y = 7 + 3y - 3y \\
 & 3y - 8 = 7 \\
 & 3y - 8 + 8 = 7 + 8 \\
 & 3y = 15 \\
 & \frac{3y}{3} = \frac{15}{3} \\
 & y = 5
 \end{aligned}$$

$$\begin{aligned}
 16. \quad & -7n + 5 = 8n - 10 \\
 & -7n + 5 + 7n = 8n - 10 + 7n \\
 & 5 = 15n - 10 \\
 & 5 + 10 = 15n - 10 + 10 \\
 & 15 = 15n \\
 & \frac{15}{15} = \frac{15n}{15} \\
 & 1 = n
 \end{aligned}$$

$$\begin{aligned}
 18. \quad & \frac{4}{5}x - \frac{8}{5} = -\frac{16}{5} \\
 & 5\left(\frac{4}{5}x - \frac{8}{5}\right) = 5\left(-\frac{16}{5}\right) \\
 & 4x - 8 = -16 \\
 & 4x - 8 + 8 = -16 + 8 \\
 & 4x = -8 \\
 & \frac{4x}{4} = \frac{-8}{4} \\
 & x = -2
 \end{aligned}$$

$$\begin{aligned}
 20. \quad & \frac{2}{9}x - \frac{1}{3} = 1 \\
 & 9\left(\frac{2}{9}x - \frac{1}{3}\right) = 9(1) \\
 & 2x - 3 = 9 \\
 & 2x - 3 + 3 = 9 + 3 \\
 & 2x = 12 \\
 & \frac{2x}{2} = \frac{12}{2} \\
 & x = 6
 \end{aligned}$$

$$\begin{aligned}
 22. \quad & 0.40x + 0.06(30) = 9.8 \\
 & 40x + 6(30) = 980 \\
 & 40x + 180 = 980 \\
 & 40x + 180 - 180 = 980 - 180 \\
 & 40x = 800 \\
 & \frac{40x}{40} = \frac{800}{40} \\
 & x = 20
 \end{aligned}$$

$$24. \quad \frac{3(y+3)}{5} = 2y + 6$$

$$5 \left[\frac{3(y+3)}{5} \right] = 5(2y+6)$$

$$3(y+3) = 5(2y+6)$$

$$3y+9 = 10y+30$$

$$3y+9-30 = 10y+30-30$$

$$3y-21 = 10y$$

$$3y-21-3y = 10y-3y$$

$$-21 = 7y$$

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

$$-3 = y$$

$$26. \quad \frac{5}{2}x - 1 = x + \frac{1}{4}$$

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

$$10x - 4 = 4x + 1$$

$$10x - 4 - 4x = 4x + 1 - 4x$$

$$6x - 4 = 1$$

$$6x - 4 + 4 = 1 + 4$$

$$6x = 5$$

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

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

$$28. \quad 0.60(z-300) + 0.05z = 0.70z - 205$$

$$60(z-300) + 5z = 70z - 20,500$$

$$60z - 18,000 + 5z = 70z - 20,500$$

$$65z - 18,000 = 70z - 20,500$$

$$65z - 18,000 - 65z = 70z - 20,500 - 65z$$

$$-18,000 = 5z - 20,500$$

$$-18,000 + 20,500 = 5z - 20,500 + 20,500$$

$$2500 = 5z$$

$$\frac{2500}{5} = \frac{5z}{5}$$

$$500 = z$$

$$30. \quad 14x + 7 = 7(2x + 1)$$

$$14x + 7 = 14x + 7$$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

$$32. \quad \frac{x}{3} - 2 = \frac{x}{3}$$

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

$$-2 = 0$$

Since the statement $-2 = 0$ is false, the equation has no solution.

$$34. \quad 2(x-5) = 2x+10$$

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

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

$$-10 = 10$$

Since the statement $-10 = 10$ is false, the equation has no solution.

$$36. \quad -5(4y-3) + 2 = -20y + 17$$

$$-20y + 15 + 2 = -20y + 17$$

$$-20y + 17 = -20y + 17$$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

$$38. \quad \frac{4(5-w)}{3} = -w$$

$$3 \cdot \frac{4(5-w)}{3} = 3(-w)$$

$$4(5-w) = -3w$$

$$20 - 4w = -3w$$

$$20 - 4w + 4w = -3w + 4w$$

$$20 = w$$

$$40. \quad -(4a-7) - 5a = 10 + a$$

$$-4a + 7 - 5a = 10 + a$$

$$-9a + 7 = 10 + a$$

$$-9a + 7 + 9a = 10 + a + 9a$$

$$7 = 10 + 10a$$

$$7 - 10 = 10 + 10a - 10$$

$$-3 = 10a$$

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

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

$$\begin{aligned}
 42. \quad & 9x + 3(x - 4) = 10(x - 5) + 7 \\
 & 9x + 3x - 12 = 10x - 50 + 7 \\
 & 12x - 12 = 10x - 43 \\
 & 12x - 12 - 10x = 10x - 43 - 10x \\
 & 2x - 12 = -43 \\
 & 2x - 12 + 12 = -43 + 12 \\
 & 2x = -31 \\
 & \frac{2x}{2} = \frac{-31}{2} \\
 & x = -\frac{31}{2}
 \end{aligned}$$

$$\begin{aligned}
 44. \quad & \frac{5(x-1)}{4} = \frac{3(x+1)}{2} \\
 & 4 \left[\frac{5(x-1)}{4} \right] = 4 \left[\frac{3(x+1)}{2} \right] \\
 & 5(x-1) = 6(x+1) \\
 & 5x - 5 = 6x + 6 \\
 & 5x - 5 - 5x = 6x + 6 - 5x \\
 & -5 = x + 6 \\
 & -5 - 6 = x + 6 - 6 \\
 & -11 = x
 \end{aligned}$$

$$\begin{aligned}
 46. \quad & 0.9x - 4.1 = 0.4 \\
 & 9x - 41 = 4 \\
 & 9x - 41 + 41 = 4 + 41 \\
 & 9x = 45 \\
 & \frac{9x}{9} = \frac{45}{9} \\
 & x = 5
 \end{aligned}$$

$$\begin{aligned}
 48. \quad & 3(2x - 1) + 5 = 6x + 2 \\
 & 6x - 3 + 5 = 6x + 2 \\
 & 6x + 2 = 6x + 2
 \end{aligned}$$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

$$\begin{aligned}
 50. \quad & 4(4y + 2) = 2(1 + 6y) + 8 \\
 & 16y + 8 = 2 + 12y + 8 \\
 & 16y + 8 = 10 + 12y \\
 & 16y + 8 - 16y = 10 + 12y - 16y \\
 & 8 = 10 - 4y \\
 & 8 - 10 = 10 - 4y - 10 \\
 & -2 = -4y \\
 & \frac{-2}{-4} = \frac{-4y}{-4} \\
 & \frac{1}{2} = y
 \end{aligned}$$

$$\begin{aligned}
 52. \quad & \frac{7}{8}x + \frac{1}{4} = \frac{3}{4}x \\
 & 8 \left(\frac{7}{8}x + \frac{1}{4} \right) = 8 \left(\frac{3}{4}x \right) \\
 & 7x + 2 = 6x \\
 & 7x + 2 - 7x = 6x - 7x \\
 & 2 = -x \\
 & \frac{2}{-1} = \frac{-x}{-1} \\
 & -2 = x
 \end{aligned}$$

$$\begin{aligned}
 54. \quad & \frac{x}{5} - 7 = \frac{x}{3} - 5 \\
 & 15 \left(\frac{x}{5} - 7 \right) = 15 \left(\frac{x}{3} - 5 \right) \\
 & 3x - 105 = 5x - 75 \\
 & 3x - 105 - 3x = 5x - 75 - 3x \\
 & -105 = -75 + 2x \\
 & 75 - 105 = 75 - 75 + 2x \\
 & -30 = 2x \\
 & \frac{-30}{2} = \frac{2x}{2} \\
 & -15 = x
 \end{aligned}$$

$$\begin{aligned}
 56. \quad & 4(2 + x) + 1 = 7x - 3(x - 2) \\
 & 8 + 4x + 1 = 7x - 3x + 6 \\
 & 9 + 4x = 4x + 6 \\
 & 9 + 4x - 4x = 4x + 6 - 4x \\
 & 9 = 6
 \end{aligned}$$

Since the statement $9 = 6$ is false, the equation has no solution.

$$\begin{aligned}
 58. \quad & -0.01(5x + 4) = 0.04 - 0.01(x + 4) \\
 & -1(5x + 4) = 4 - 1(x + 4) \\
 & -5x - 4 = 4 - x - 4 \\
 & -5x - 4 = -x \\
 & -5x - 4 + 5x = -x + 5x \\
 & -4 = 4x \\
 & \frac{-4}{4} = \frac{4x}{4} \\
 & -1 = x
 \end{aligned}$$

60. $3 - \frac{1}{2}x = 5x - 8$

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

$$6 - x = 10x - 16$$

$$6 - x + x = 10x - 16 + x$$

$$6 = 11x - 16$$

$$6 + 16 = 11x - 16 + 16$$

$$22 = 11x$$

$$\frac{22}{11} = \frac{11x}{11}$$

$$2 = x$$

62. $\frac{5}{9}x + 2 - \frac{1}{6}x = \frac{11}{18}x + \frac{1}{3}$

$$18\left(\frac{5}{9}x + 2 - \frac{1}{6}x\right) = 18\left(\frac{11}{18}x + \frac{1}{3}\right)$$

$$10x + 36 - 3x = 11x + 6$$

$$7x + 36 = 11x + 6$$

$$7x + 36 - 7x = 11x + 6 - 7x$$

$$36 = 4x + 6$$

$$36 - 6 = 4x + 6 - 6$$

$$30 = 4x$$

$$\frac{30}{4} = \frac{4x}{4}$$

$$\frac{15}{2} = x$$

64. $2x - \frac{1}{10} = \frac{2}{5} - \frac{1}{4}x - \frac{17}{20}$

$$20\left(2x - \frac{1}{10}\right) = 20\left(\frac{2}{5} - \frac{1}{4}x - \frac{17}{20}\right)$$

$$40x - 2 = 8 - 5x - 17$$

$$40x - 2 = -9 - 5x$$

$$40x - 2 + 5x = -9 - 5x + 5x$$

$$45x - 2 = -9$$

$$45x - 2 + 2 = -9 + 2$$

$$45x = -7$$

$$\frac{45x}{45} = \frac{-7}{45}$$

$$x = -\frac{7}{45}$$

66. The total length is the sum of the two lengths.

$$x + (7x - 9) = x + 7x - 9$$

$$= 8x - 9$$

The total length is $(8x - 9)$ feet.

68. Three times a number is $3x$.

70. The difference of 8 and twice a number is $8 - 2x$.

72. The quotient of -12 and the difference of a number and 3 is $\frac{-12}{x-3}$.

74. a. $x + 3 = x + 5$

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

$$3 = 5$$

Since the statement $3 = 5$ is false, the equation has no solution.

b. answers may vary

c. answers may vary

76. $3x + 1 = 3x + 2$

$$3x + 1 - 3x = 3x + 2 - 3x$$

$$1 = 2$$

Since the statement $1 = 2$ is false, the equation has no solution. The choice is b.

78. $x - 11x - 3 = -10x - 1 - 2$

$$-10x - 3 = -10x - 3$$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution. The choice is a.

80. $-x + 15 = x + 15$

$$-x + 15 - 15 = x + 15 - 15$$

$$-x = x$$

$$-x - x = x - x$$

$$-2x = 0$$

$$\frac{-2x}{-2} = \frac{0}{-2}$$

$$x = 0$$

The choice is c.

82. answers may vary

84. a. The perimeter is the sum of the lengths of the sides.

$$x + (2x + 1) + (3x - 2) = 35$$

b. $x + 2x + 1 + 3x - 2 = 35$

$$6x - 1 = 35$$

$$6x - 1 + 1 = 35 + 1$$

$$6x = 36$$

$$\frac{6x}{6} = \frac{36}{6}$$

$$x = 6$$

c. The lengths of the sides are:

$$x = 6 \text{ meters}$$

$$2x + 1 = 2(6) + 1 = 12 + 1 = 13 \text{ meters}$$

$$3x - 2 = 3(6) - 2 = 18 - 2 = 16 \text{ meters}$$

86. answers may vary

$$\begin{aligned}
 88. \quad & 1000(x+40) = 100(16+7x) \\
 & 1000x + 40,000 = 1600 + 700x \\
 & 1000x + 40,000 - 700x = 1600 + 700x - 700x \\
 & 40,000 + 300x = 1600 \\
 & 40,000 + 300x - 40,000 = 1600 - 40,000 \\
 & 300x = -38,400 \\
 & \frac{300x}{300} = \frac{-38,400}{300} \\
 & x = -128
 \end{aligned}$$

$$\begin{aligned}
 90. \quad & 0.127x - 2.685 = 0.027x - 2.38 \\
 & 127x - 2685 = 27x - 2380 \\
 & 127x - 2685 - 27x = 27x - 2380 - 27x \\
 & 100x - 2685 = -2380 \\
 & 100x - 2685 + 2685 = -2380 + 2685 \\
 & 100x = 305 \\
 & \frac{100x}{100} = \frac{305}{100} \\
 & x = 3.05
 \end{aligned}$$

Integrated Review

$$\begin{aligned}
 1. \quad & x - 10 = -4 \\
 & x - 10 + 10 = -4 + 10 \\
 & x = 6
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & y + 14 = -3 \\
 & y + 14 - 14 = -3 - 14 \\
 & y = -17
 \end{aligned}$$

$$\begin{aligned}
 3. \quad & 9y = 108 \\
 & \frac{9y}{9} = \frac{108}{9} \\
 & y = 12
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & -3x = 78 \\
 & \frac{-3x}{-3} = \frac{78}{-3} \\
 & x = -26
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & -6x + 7 = 25 \\
 & -6x + 7 - 7 = 25 - 7 \\
 & -6x = 18 \\
 & \frac{-6x}{-6} = \frac{18}{-6} \\
 & x = -3
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & 5y - 42 = -47 \\
 & 5y - 42 + 42 = -47 + 42 \\
 & 5y = -5 \\
 & \frac{5y}{5} = \frac{-5}{5} \\
 & y = -1
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & \frac{2}{3}x = 9 \\
 & \frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot 9 \\
 & x = \frac{27}{2}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & \frac{4}{5}z = 10 \\
 & \frac{5}{4} \cdot \frac{4}{5}z = \frac{5}{4} \cdot 10 \\
 & z = \frac{50}{4} \\
 & z = \frac{25}{2}
 \end{aligned}$$

$$\begin{aligned}
 9. \quad & \frac{r}{-4} = -2 \\
 & -4 \cdot \frac{r}{-4} = -4 \cdot (-2) \\
 & r = 8
 \end{aligned}$$

$$\begin{aligned}
 10. \quad & \frac{y}{-8} = 8 \\
 & -8 \cdot \frac{y}{-8} = -8 \cdot 8 \\
 & y = -64
 \end{aligned}$$

$$\begin{aligned}
 11. \quad & 6 - 2x + 8 = 10 \\
 & -2x + 14 = 10 \\
 & -2x + 14 - 14 = 10 - 14 \\
 & -2x = -4 \\
 & \frac{-2x}{-2} = \frac{-4}{-2} \\
 & x = 2
 \end{aligned}$$

$$\begin{aligned}
 12. \quad & -5 - 6y + 6 = 19 \\
 & -6y + 1 = 19 \\
 & -6y + 1 - 1 = 19 - 1 \\
 & -6y = 18 \\
 & \frac{-6y}{-6} = \frac{18}{-6} \\
 & y = -3
 \end{aligned}$$

$$\begin{aligned}
 13. \quad & 2x - 7 = 6x - 27 \\
 & 2x - 7 + 7 = 6x - 27 + 7 \\
 & 2x = 6x - 20 \\
 & 2x - 6x = 6x - 20 - 6x \\
 & -4x = -20 \\
 & \frac{-4x}{-4} = \frac{-20}{-4} \\
 & x = 5
 \end{aligned}$$

$$\begin{aligned}
 14. \quad & 3 + 8y = 3y - 2 \\
 & 3 + 8y - 3y = 3y - 2 - 3y \\
 & 3 + 5y = -2 \\
 & -3 + 3 + 5y = -3 - 2 \\
 & 5y = -5 \\
 & \frac{5y}{5} = \frac{-5}{5} \\
 & y = -1
 \end{aligned}$$

$$\begin{aligned}
 15. \quad & 9(3x - 1) = -4 + 49 \\
 & 27x - 9 = 45 \\
 & 27x - 9 + 9 = 45 + 9 \\
 & 27x = 54 \\
 & \frac{27x}{27} = \frac{54}{27} \\
 & x = 2
 \end{aligned}$$

$$\begin{aligned}
 16. \quad & 12(2x + 1) = -6 + 66 \\
 & 24x + 12 = 60 \\
 & 24x + 12 - 12 = 60 - 12 \\
 & 24x = 48 \\
 & \frac{24x}{24} = \frac{48}{24} \\
 & x = 2
 \end{aligned}$$

$$\begin{aligned}
 17. \quad & -3a + 6 + 5a = 7a - 8a \\
 & 6 + 2a = -a \\
 & 6 + 2a - 2a = -a - 2a \\
 & 6 = -3a \\
 & \frac{6}{-3} = \frac{-3a}{-3} \\
 & -2 = a
 \end{aligned}$$

$$\begin{aligned}
 18. \quad & 4b - 8 - b = 10b - 3b \\
 & 3b - 8 = 7b \\
 & -3b + 3b - 8 = -3b + 7b \\
 & -8 = 4b \\
 & \frac{-8}{4} = \frac{4b}{4} \\
 & -2 = b
 \end{aligned}$$

$$\begin{aligned}
 19. \quad & -\frac{2}{3}x = \frac{5}{9} \\
 & -\frac{3}{2} \cdot \left(-\frac{2}{3}x\right) = -\frac{3}{2} \cdot \frac{5}{9} \\
 & x = -\frac{15}{18} \\
 & x = -\frac{5}{6}
 \end{aligned}$$

$$\begin{aligned}
 20. \quad & -\frac{3}{8}y = -\frac{1}{16} \\
 & -\frac{8}{3} \cdot \left(-\frac{3}{8}y\right) = -\frac{8}{3} \cdot \left(-\frac{1}{16}\right) \\
 & y = \frac{1}{6}
 \end{aligned}$$

$$\begin{aligned}
 21. \quad & 10 = -6n + 16 \\
 & 10 - 16 = -6n + 16 - 16 \\
 & -6 = -6n \\
 & \frac{-6}{-6} = \frac{-6n}{-6} \\
 & 1 = n
 \end{aligned}$$

$$\begin{aligned}
 22. \quad & -5 = -2m + 7 \\
 & -5 - 7 = -2m + 7 - 7 \\
 & -12 = -2m \\
 & \frac{-12}{-2} = \frac{-2m}{-2} \\
 & 6 = m
 \end{aligned}$$

$$\begin{aligned}
 23. \quad & 3(5c - 1) - 2 = 13c + 3 \\
 & 15c - 3 - 2 = 13c + 3 \\
 & 15c - 5 = 13c + 3 \\
 & 15c - 5 + 5 = 13c + 3 + 5 \\
 & 15c = 13c + 8 \\
 & 15c - 13c = 13c + 8 - 13c \\
 & 2c = 8 \\
 & \frac{2c}{2} = \frac{8}{2} \\
 & c = 4
 \end{aligned}$$

$$\begin{aligned}
 24. \quad & 4(3t+4) - 20 = 3 + 5t \\
 & 12t + 16 - 20 = 3 + 5t \\
 & 12t - 4 = 3 + 5t \\
 & 12t - 4 - 5t = 3 + 5t - 5t \\
 & 7t - 4 = 3 \\
 & 7t - 4 + 4 = 3 + 4 \\
 & 7t = 7 \\
 & \frac{7t}{7} = \frac{7}{7} \\
 & t = 1
 \end{aligned}$$

$$\begin{aligned}
 25. \quad & \frac{2(z+3)}{3} = 5 - z \\
 & 3 \left[\frac{2(z+3)}{3} \right] = 3(5 - z) \\
 & 2(z+3) = 3(5 - z) \\
 & 2z + 6 = 15 - 3z \\
 & 2z + 6 + 3z = 15 - 3z + 3z \\
 & 6 + 5z = 15 \\
 & 6 + 5z - 6 = 15 - 6 \\
 & 5z = 9 \\
 & \frac{5z}{5} = \frac{9}{5} \\
 & z = \frac{9}{5}
 \end{aligned}$$

$$\begin{aligned}
 26. \quad & \frac{3(w+2)}{4} = 2w + 3 \\
 & 4 \left[\frac{3(w+2)}{4} \right] = 4(2w + 3) \\
 & 3(w+2) = 4(2w + 3) \\
 & 3w + 6 = 8w + 12 \\
 & 3w + 6 - 6 = 8w + 12 - 6 \\
 & 3w = 8w + 6 \\
 & 3w - 8w = 8w + 6 - 8w \\
 & -5w = 6 \\
 & \frac{-5w}{-5} = \frac{6}{-5} \\
 & w = -\frac{6}{5}
 \end{aligned}$$

$$\begin{aligned}
 27. \quad & -2(2x-5) = -3x+7-x+3 \\
 & -4x+10 = -4x+10
 \end{aligned}$$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

$$\begin{aligned}
 28. \quad & -4(5x-2) = -12x+4-8x+4 \\
 & -20x+8 = -20x+8
 \end{aligned}$$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

$$\begin{aligned}
 29. \quad & 0.02(6t-3) = 0.04(t-2) + 0.02 \\
 & 2(6t-3) = 4(t-2) + 2 \\
 & 12t-6 = 4t-8+2 \\
 & 12t-6 = 4t-6 \\
 & 12t-6-4t = 4t-6-4t \\
 & 8t-6 = -6 \\
 & 8t-6+6 = -6+6 \\
 & 8t = 0 \\
 & \frac{8t}{8} = \frac{0}{8} \\
 & t = 0
 \end{aligned}$$

$$\begin{aligned}
 30. \quad & 0.03(m+7) = 0.02(5-m) + 0.03 \\
 & 3(m+7) = 2(5-m) + 3 \\
 & 3m+21 = 10-2m+3 \\
 & 3m+21 = 13-2m \\
 & 3m+21+2m = 13-2m+2m \\
 & 5m+21 = 13 \\
 & 5m+21-21 = 13-21 \\
 & 5m = -8 \\
 & \frac{5m}{5} = \frac{-8}{5} \\
 & m = -1.6
 \end{aligned}$$

$$\begin{aligned}
 31. \quad & -3y = \frac{4(y-1)}{5} \\
 & 5(-3y) = 5 \left[\frac{4(y-1)}{5} \right] \\
 & -15y = 4(y-1) \\
 & -15y = 4y-4 \\
 & -15y-4y = 4y-4-4y \\
 & -19y = -4 \\
 & \frac{-19y}{-19} = \frac{-4}{-19} \\
 & y = \frac{4}{19}
 \end{aligned}$$

$$\begin{aligned}
 32. \quad -4x &= \frac{5(1-x)}{6} \\
 6(-4x) &= 6 \cdot \frac{5(1-x)}{6} \\
 -24x &= 5(1-x) \\
 -24x &= 5-5x \\
 -24x+5x &= 5-5x+5x \\
 -19x &= 5 \\
 \frac{-19x}{-19} &= \frac{5}{-19} \\
 x &= -\frac{5}{19}
 \end{aligned}$$

$$\begin{aligned}
 33. \quad \frac{5}{3}x - \frac{7}{3} &= x \\
 3\left(\frac{5}{3}x - \frac{7}{3}\right) &= 3x \\
 5x - 7 &= 3x \\
 -5x + 5x - 7 &= -5x + 3x \\
 -7 &= -2x \\
 \frac{-7}{-2} &= \frac{-2x}{-2} \\
 \frac{7}{2} &= x
 \end{aligned}$$

$$\begin{aligned}
 34. \quad \frac{7}{5}n + \frac{3}{5} &= -n \\
 5\left(\frac{7}{5}n + \frac{3}{5}\right) &= 5(-n) \\
 7n + 3 &= -5n \\
 -7n + 7n + 3 &= -7n - 5n \\
 3 &= -12n \\
 \frac{3}{-12} &= \frac{-12n}{-12} \\
 -\frac{1}{4} &= n
 \end{aligned}$$

$$\begin{aligned}
 35. \quad \frac{1}{10}(3x-7) &= \frac{3}{10}x + 5 \\
 \frac{3}{10}x - \frac{7}{10} &= \frac{3}{10}x + 5 \\
 -\frac{3}{10}x + \frac{3}{10}x - \frac{7}{10} &= -\frac{3}{10}x + \frac{3}{10}x + 5 \\
 -\frac{7}{10} &= 5
 \end{aligned}$$

Since the statement $-\frac{7}{10} = 5$ is false, the equation has no solution.

$$\begin{aligned}
 36. \quad \frac{1}{7}(2x-5) &= \frac{2}{7}x + 1 \\
 7 \cdot \frac{1}{7}(2x-5) &= 7\left(\frac{2}{7}x + 1\right) \\
 2x - 5 &= 2x + 7 \\
 2x - 5 - 2x &= 2x + 7 - 2x \\
 -5 &= 7
 \end{aligned}$$

Since the statement $-5 = 7$ is false, the equation has no solution.

$$\begin{aligned}
 37. \quad 5 + 2(3x-6) &= -4(6x-7) \\
 5 + 6x - 12 &= -24x + 28 \\
 6x - 7 &= -24x + 28 \\
 24x + 6x - 7 &= 24x - 24x + 28 \\
 30x - 7 &= 28 \\
 30x - 7 + 7 &= 28 + 7 \\
 30x &= 35 \\
 \frac{30x}{30} &= \frac{35}{30} \\
 x &= \frac{7}{6}
 \end{aligned}$$

$$\begin{aligned}
 38. \quad 3 + 5(2x-4) &= -7(5x+2) \\
 3 + 10x - 20 &= -35x - 14 \\
 10x - 17 &= -35x - 14 \\
 10x - 17 + 35x &= -35x - 14 + 35x \\
 45x - 17 &= -14 \\
 45x - 17 + 17 &= -14 + 17 \\
 45x &= 3 \\
 \frac{45x}{45} &= \frac{3}{45} \\
 x &= \frac{1}{15}
 \end{aligned}$$

Section 2.4 Practice

1. Let x represent the number.

$$\begin{aligned}
 3x - 6 &= 2x + 3 \\
 3x - 6 - 2x &= 2x + 3 - 2x \\
 x - 6 &= 3 \\
 x - 6 + 6 &= 3 + 6 \\
 x &= 9
 \end{aligned}$$

The number is 9.

2. Let x represent the number.

$$3(x-5) = 2x-3$$

$$3x-15 = 2x-3$$

$$3x-15-2x = 2x-3-2x$$

$$x-15 = -3$$

$$x-15+15 = -3+15$$

$$x = 12$$

The number is 12.

3. Let x represent the length of the shorter piece. Then $5x$ represents the length of the longer piece. Their sum is 18 feet.

$$x+5x = 18$$

$$6x = 18$$

$$\frac{6x}{6} = \frac{18}{6}$$

$$x = 3$$

The shorter piece is 3 feet and the longer piece is $5(3) = 15$ feet.

4. Let x represent the number of votes for Texas. Then $x+21$ represents the number of votes for California. Their sum is 89.

$$x+x+21 = 89$$

$$2x+21 = 89$$

$$2x+21-21 = 89-21$$

$$2x = 68$$

$$\frac{2x}{2} = \frac{68}{2}$$

$$x = 34$$

Texas has 34 electoral votes and California has $34+21 = 55$ electoral votes.

5. Let x represent the number of miles driven. The cost for x miles is $0.15x$. The daily cost is \$28.

$$0.15x+28 = 52$$

$$0.15x+28-28 = 52-28$$

$$0.15x = 24$$

$$\frac{0.15x}{0.15} = \frac{24}{0.15}$$

$$x = 160$$

You drove 160 miles.

6. Let x represent the measure of the smallest angle. Then $2x$ represents the measure of the second angle and $3x$ represents the measure of the third angle. The sum of the measures of the angles of a triangle equals 180.

$$x+2x+3x = 180$$

$$6x = 180$$

$$\frac{6x}{6} = \frac{180}{6}$$

$$x = 30$$

If $x = 30$, then $2x = 2(30) = 60$ and

$$3x = 3(30) = 90.$$

The smallest is 30° , second is 60° , and third is 90° .

7. If x is the first even integer, then $x+2$ and $x+4$ are the next two even integers.

$$x+x+2+x+4 = 144$$

$$3x+6 = 144$$

$$3x+6-6 = 144-6$$

$$3x = 138$$

$$\frac{3x}{3} = \frac{138}{3}$$

$$x = 46$$

If $x = 46$, then $x+2 = 48$ and $x+4 = 50$. The integers are 46, 48, 50.

Vocabulary and Readiness Check

- If x is the number, then “double the number” is $2x$, and “double the number, decreased by 31” is $2x-31$.
- If x is the number, then “three times the number” is $3x$, and “three times the number, increased by 17” is $3x+17$.
- If x is the number, then “the sum of the number and 5” is $x+5$, and “twice the sum of the number and 5” is $2(x+5)$.
- If x is the number, then “the difference of the number and 11” is $x-11$, and “seven times the difference of the number and 11” is $7(x-11)$.
- If y is the number, then “the difference of 20 and the number” is $20-y$, and “the difference of 20 and the number, divided by 3” is $\frac{20-y}{3}$ or $(20-y) \div 3$.
- If y is the number, then “the sum of -10 and the number” is $-10+y$, and “the sum of -10 and the number, divided by 9” is $\frac{-10+y}{9}$ or $(-10+y) \div 9$.

Exercise Set 2.4

$$\begin{aligned}
 2. \quad & 3x - 1 = 2x \\
 & 3x - 1 - 3x = 2x - 3x \\
 & -1 = -x \\
 & \frac{-1}{-1} = \frac{-x}{-1} \\
 & 1 = x
 \end{aligned}$$

The number is 1.

$$\begin{aligned}
 4. \quad & 4x - 2 = 5x - 2 \\
 & 4x - 2 - 4x = 5x - 2 - 4x \\
 & -2 = x - 2 \\
 & -2 + 2 = x - 2 + 2 \\
 & 0 = x
 \end{aligned}$$

The number is 0.

$$\begin{aligned}
 6. \quad & 5[x + (-1)] = 6x \\
 & 5(x - 1) = 6x \\
 & 5x - 5 = 6x \\
 & 5x - 5 - 5x = 6x - 5x \\
 & -5 = x
 \end{aligned}$$

The number is -5.

$$\begin{aligned}
 8. \quad & 2(x - 4) = x - \frac{1}{4} \\
 & 2x - 8 = x - \frac{1}{4} \\
 & 2x - 8 - x = x - \frac{1}{4} - x \\
 & x - 8 = -\frac{1}{4} \\
 & x - 8 + 8 = -\frac{1}{4} + 8 \\
 & x = -\frac{1}{4} + \frac{32}{4} \\
 & x = \frac{31}{4}
 \end{aligned}$$

The number is $\frac{31}{4}$.

10. The sum of the three lengths is 46 feet.

$$\begin{aligned}
 & x + 3x + 2 + 7x = 46 \\
 & 11x + 2 = 46 \\
 & 11x + 2 - 2 = 46 - 2 \\
 & 11x = 44 \\
 & \frac{11x}{11} = \frac{44}{11} \\
 & x = 4
 \end{aligned}$$

$$3x = 3(4) = 12$$

$$2 + 7x = 2 + 7(4) = 2 + 28 = 30$$

The lengths are 4 feet, 12 feet, and 30 feet.

12. Let x be the length of the shorter piece. Then $3x + 1$ is the length of the longer piece. The sum of the lengths is 21 feet.

$$\begin{aligned}
 & x + 3x + 1 = 21 \\
 & 4x + 1 = 21 \\
 & 4x + 1 - 1 = 21 - 1 \\
 & 4x = 20 \\
 & \frac{4x}{4} = \frac{20}{4} \\
 & x = 5
 \end{aligned}$$

$$3x + 1 = 3(5) + 1 = 15 + 1 = 16$$

The shorter piece is 5 feet and the longer piece is 16 feet.

14. Let x represent the number of gold medals won by the Russian team. Then $x + 13$ represents the number of gold medals won by the U.S. team.

$$\begin{aligned}
 & x + x + 13 = 59 \\
 & 2x + 13 = 59 \\
 & 2x + 13 - 13 = 59 - 13 \\
 & 2x = 46 \\
 & \frac{2x}{2} = \frac{46}{2} \\
 & x = 23
 \end{aligned}$$

$$x + 13 = 23 + 13 = 36$$

The Russian team won 23 gold medals and the U.S. team won 36 gold medals.

16. Let x be the number of hours. Then the total cost is $27x + 80$.

$$\begin{aligned}
 & 27x + 80 = 404 \\
 & 27x + 80 - 80 = 404 - 80 \\
 & 27x = 324 \\
 & \frac{27x}{27} = \frac{324}{27} \\
 & x = 12
 \end{aligned}$$

She expects the job to take 12 hours.

18. Let x be the number of hours. Then the total cost is $25.50x + 30$.

$$\begin{aligned}
 & 25.5x + 30 = 119.25 \\
 & 25.5x + 30 - 30 = 119.25 - 30 \\
 & 25.5x = 89.25 \\
 & \frac{25.5x}{25.5} = \frac{89.25}{25.5} \\
 & x = 3.5
 \end{aligned}$$

You were charged for 3.5 hours.

20. Let x be the measure of the smaller angle. Then $2x - 15$ is the measure of the larger angle. The sum of the four angles is 360° .

$$2x + 2(2x - 15) = 360$$

$$2x + 4x - 30 = 360$$

$$6x - 30 = 360$$

$$6x - 30 + 30 = 360 + 30$$

$$6x = 390$$

$$\frac{6x}{6} = \frac{390}{6}$$

$$x = 65$$

$$2x - 15 = 2(65) - 15 = 130 - 15 = 115$$

Two angles measure 65° and two angles measure 115° .

22. Let angles B and C have measure x . Then angle A has measure $x - 42$. The sum of the measures is 180° .

$$x + x + x - 42 = 180$$

$$3x - 42 = 180$$

$$3x - 42 + 42 = 180 + 42$$

$$3x = 222$$

$$\frac{3x}{3} = \frac{222}{3}$$

$$x = 74$$

$$x - 42 = 74 - 42 = 32$$

Angles B and C measure 74° and angle A measures 32° .

	First Integer	Next Integers			Indicated Sum
24.	x	$x + 1$	$x + 2$		$(x + 1) + (x + 2) = 2x + 3$
26.	x	$x + 2$	$x + 4$		$x + (x + 2) + (x + 4) = 3x + 6$
28.	x	$x + 1$	$x + 2$	$x + 3$	$x + (x + 3) = 2x + 3$
30.	x	$x + 2$	$x + 4$		$x + (x + 2) + (x + 4) = 3x + 6$

32. If x is the first even integer, the next consecutive even integer is $x + 2$.

$$x + x + 2 = 654$$

$$2x + 2 = 654$$

$$2x + 2 - 2 = 654 - 2$$

$$2x = 652$$

$$\frac{2x}{2} = \frac{652}{2}$$

$$x = 326$$

The room numbers are 326 and $326 + 2 = 328$.

34. If x is the first odd integer, the next two odd integers are $x + 2$ and $x + 4$.

$$x + x + 2 + x + 4 = 51$$

$$3x + 6 = 51$$

$$3x + 6 - 6 = 51 - 6$$

$$3x = 45$$

$$\frac{3x}{3} = \frac{45}{3}$$

$$x = 15$$

The code is 15, $15 + 2 = 17$, $15 + 4 = 19$.

36. Let x be the measure of the shorter piece. Then $5x + 1$ is the measure of the longer piece. The measures sum to 25 feet.

$$\begin{aligned}x + 5x + 1 &= 25 \\6x + 1 &= 25 \\6x + 1 - 1 &= 25 - 1 \\6x &= 24 \\\frac{6x}{6} &= \frac{24}{6} \\x &= 4\end{aligned}$$

$5x + 1 = 5(4) + 1 = 20 + 1 = 21$
The pieces measure 4 feet and 21 feet.

38. Let x represent the floor space of the Empire State Building in thousands of square feet. Then the floor space of the Pentagon is $3x$.

$$\begin{aligned}x + 3x &= 8700 \\4x &= 8700 \\\frac{4x}{4} &= \frac{8700}{4} \\x &= 2175\end{aligned}$$

$3x = 3(2175) = 6525$
The Empire State Building has 2175 thousand square feet of floor space and the Pentagon has 6525 thousand square feet of floor space.

40. The sum of the measures is 90° .

$$\begin{aligned}x + (2x - 3) &= 90 \\x + 2x - 3 &= 90 \\3x - 3 &= 90 \\3x - 3 + 3 &= 90 + 3 \\3x &= 93 \\\frac{3x}{3} &= \frac{93}{3} \\x &= 31\end{aligned}$$

$2x - 3 = 2(31) - 3 = 62 - 3 = 59$
The angles measure 31° and 59° .

42. Let x be the first odd integer. Then the next three consecutive odd integers are $x + 2$, $x + 4$, and $x + 6$. The sum of the measures is 360° .

$$\begin{aligned}x + x + 2 + x + 4 + x + 6 &= 360 \\4x + 12 &= 360 \\4x + 12 - 12 &= 360 - 12 \\4x &= 348 \\\frac{4x}{4} &= \frac{348}{4} \\x &= 87\end{aligned}$$

$x + 2 = 87 + 2 = 89$
 $x + 4 = 87 + 4 = 91$
 $x + 6 = 87 + 6 = 93$
The angles measure 87° , 89° , 91° , and 93° .

44.
$$\begin{aligned}\frac{2}{3} + 4x &= 5x - \frac{5}{6} \\6 \cdot \left(\frac{2}{3} + 4x \right) &= 6 \cdot \left(5x - \frac{5}{6} \right) \\4 + 24x &= 30x - 5 \\4 + 24x - 24x &= 30x - 5 - 24x \\4 &= 6x - 5 \\4 + 5 &= 6x - 5 + 5 \\9 &= 6x \\\frac{9}{6} &= \frac{6x}{6} \\\frac{3}{2} &= x\end{aligned}$$

The number is $\frac{3}{2}$.

46. Let x be the amount the son receives. Then $2x$ is the amount the husband receives. The sum of the amounts is \$15,000.

$$\begin{aligned}x + 2x &= 15,000 \\3x &= 15,000 \\\frac{3x}{3} &= \frac{15,000}{3} \\x &= 5,000\end{aligned}$$

$2x = 2(5,000) = 10,000$
The son receives \$5000 and the husband receives \$10,000.

48. Let x represent the number of Republican governors. Then the number of Democrat governors is $x + 8$. The total number of governors is 50.

$$\begin{aligned}x + x + 8 &= 50 \\2x + 8 &= 50 \\2x + 8 - 8 &= 50 - 8 \\2x &= 42 \\\frac{2x}{2} &= \frac{42}{2} \\x &= 21\end{aligned}$$

$x + 8 = 21 + 8 = 29$
There were 21 Republican governors and 29 Democrat governors.

50. Let x be the first even integer. The next two consecutive even integers are $x + 2$ and $x + 4$. The three integers total 48.

$$\begin{aligned}x + x + 2 + x + 4 &= 48 \\3x + 6 &= 48 \\3x + 6 - 6 &= 48 - 6 \\3x &= 42 \\\frac{3x}{3} &= \frac{42}{3} \\x &= 14\end{aligned}$$

$$x + 2 = 14 + 2 = 16$$

$$x + 4 = 14 + 4 = 18$$

The boards have lengths 14 inches, 16 inches, and 18 inches.

52. Let x represent the diameter. Then $5x + 8$ represents the height.

$$x + 5x + 8 = 14$$

$$6x + 8 = 14$$

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

$$6x = 6$$

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

$$x = 1$$

$$5x + 8 = 5(1) + 8 = 5 + 8 = 13$$

The diameter is 1 meter and the height is 13 meters.

54. $2(x + 6) = 3(x + 4)$

$$2x + 12 = 3x + 12$$

$$2x + 12 - 2x = 3x + 12 - 2x$$

$$12 = x + 12$$

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

$$0 = x$$

The number is 0.

56. Let x represent the weight of the Armanty meteorite. Then $3x$ represents the weight of the Hoba West meteorite.

$$x + 3x = 88$$

$$4x = 88$$

$$\frac{4x}{4} = \frac{88}{4}$$

$$x = 22$$

$$3x = 3(22) = 66$$

The Armanty meteorite weighs 22 tons and the Hoba West meteorite weighs 66 tons.

58. Let x represent the first odd integer. Then $x + 2$ and $x + 4$ represent the next two consecutive odd integers.

$$x + x + 2 + x + 4 = 675$$

$$3x + 6 = 675$$

$$3x + 6 - 6 = 675 - 6$$

$$3x = 669$$

$$\frac{3x}{3} = \frac{669}{3}$$

$$x = 223$$

$$x + 2 = 223 + 2 = 225$$

$$x + 4 = 223 + 4 = 227$$

Mali Republic's code is 223, Côte d'Ivoire's code is 225, and Niger's code is 227.

60. Let x be the number of votes, in millions for David Archuleta. Then $x + 11.7$ is the number of votes for David Cook.

$$x + x + 11.7 = 97.5$$

$$2x + 11.7 = 97.5$$

$$2x + 11.7 - 11.7 = 97.5 - 11.7$$

$$2x = 85.8$$

$$\frac{2x}{2} = \frac{85.8}{2}$$

$$x = 42.9$$

$$x + 11.7 = 42.9 + 11.7 = 54.6$$

Archuleta received 42.9 million votes and Cook received 54.6 votes.

62. Let x be the measure of the smallest angle. Then the two larger angles both measure $4x$.

$$x + 4x + 4x = 180$$

$$9x = 180$$

$$\frac{9x}{9} = \frac{180}{9}$$

$$x = 20$$

$$4x = 4(20) = 80$$

The angles measure 20° , 80° , and 80° .

64. The bars ending between 20 and 25 represent the albums Led Zeppelin: *Led Zeppelin IV*, Pink Floyd: *The Wall*, and AC/DC: *Back in Black*, so these albums sold between \$20 and \$25 million.

66. Let x represent the sales of AC/DC. Then $x + 7$ is the sales of Eagles.

$$x + x + 7 = 51$$

$$2x + 7 = 51$$

$$2x + 7 - 7 = 51 - 7$$

$$2x = 44$$

$$\frac{2x}{2} = \frac{44}{2}$$

$$x = 22$$

$$x + 7 = 29$$

Eagles: *Their Greatest Hits* had sales of \$29 million and AC/DC: *Back in Black* had sales of \$22 million.

68. answers may vary

70. Replace B by 14 and h by 22.

$$\frac{1}{2}Bh = \frac{1}{2}(14)(22) = 7(22) = 154$$

72. Replace r by 15 and t by 2.

$$r \cdot t = 15 \cdot 2 = 30$$

74. Let x be the measure of the first angle. Then $2x$ is the measure of the second angle and $5x$ is the measure of the third angle. The measures sum to 180° .

$$x + 2x + 5x = 180$$

$$8x = 180$$

$$\frac{8x}{8} = \frac{180}{8}$$

$$x = 22.5$$

$$2x = 2(22.5) = 45$$

$$5x = 5(22.5) = 112.5$$

Yes, the triangle exists and has angles that measure 22.5° , 45° , and 112.5° .

76. One blink every 5 seconds is $\frac{1 \text{ blink}}{5 \text{ sec}}$.

There are $60 \cdot 60 = 3600$ seconds in one hour.

$$\frac{1 \text{ blink}}{5 \text{ sec}} \cdot 3600 \text{ sec} = 720 \text{ blinks}$$

The average eye blinks 720 times each hour.

$$16 \cdot 720 = 11,520$$

The average eye blinks 11,520 times while awake for a 16-hour day.

$$11,520 \cdot 365 = 4,204,800$$

The average eye blinks 4,204,800 times in one year.

78. answers may vary

80. answers may vary

82. Measurements may vary.

Rectangle (b) best approximates the shape of the golden rectangle.

Section 2.5 Practice

1. Use $d = rt$ when $d = 1180$ and $r = 50$.

$$d = rt$$

$$1180 = 50t$$

$$\frac{1180}{50} = \frac{50t}{50}$$

$$23.6 = t$$

They will spend 23.6 hours driving.

2. Use $A = lw$ when $w = 18$.

$$A = lw$$

$$450 = l \cdot 18$$

$$\frac{450}{18} = \frac{18l}{18}$$

$$25 = l$$

The length of the deck is 25 feet.

3. Use $F = \frac{9}{5}C + 32$ with $C = 5$.

$$F = \frac{9}{5}C + 32$$

$$F = \frac{9}{5} \cdot 5 + 32$$

$$F = 9 + 32$$

$$F = 41$$

Thus, 5°C is equivalent to 41°F .

4. Let x be the width. Then $4x + 1$ is the length. The perimeter is 52 meters.

$$P = 2l + 2w$$

$$52 = 2(4x + 1) + 2x$$

$$52 = 8x + 2 + 2x$$

$$52 = 10x + 2$$

$$52 - 2 = 10x + 2 - 2$$

$$50 = 10x$$

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

$$5 = x$$

$$4x + 1 = 4(5) + 1 = 20 + 1 = 21$$

The width is 5 meters and the length is 21 meters.

5. $C = 2\pi r$

$$\frac{C}{2\pi} = \frac{2\pi r}{2\pi}$$

$$\frac{C}{2\pi} = r \text{ or } r = \frac{C}{2\pi}$$

6. $P = 2l + 2w$

$$P - 2w = 2l + 2w - 2w$$

$$P - 2w = 2l$$

$$\frac{P - 2w}{2} = \frac{2l}{2}$$

$$\frac{P - 2w}{2} = l \text{ or } l = \frac{P - 2w}{2}$$

7. $P = 2a + b - c$

$$P + c = 2a + b - c + c$$

$$P + c = 2a + b$$

$$P + c - b = 2a + b - b$$

$$P + c - b = 2a$$

$$\frac{P + c - b}{2} = a \text{ or } a = \frac{P + c - b}{2}$$

$$\begin{aligned}
 8. \quad A &= \frac{a+b}{2} \\
 2A &= 2 \cdot \frac{a+b}{2} \\
 2A &= a+b \\
 2A-a &= a+b-a \\
 2A-a &= b \text{ or } b = 2A-a
 \end{aligned}$$

Exercise Set 2.5

2. Use
- $d = rt$
- when
- $d = 195$
- and
- $t = 3$
- .

$$\begin{aligned}
 d &= rt \\
 195 &= r \cdot 3 \\
 \frac{195}{3} &= \frac{3r}{3} \\
 65 &= r
 \end{aligned}$$

4. Use
- $V = lwh$
- when
- $l = 14$
- ,
- $w = 8$
- , and
- $h = 3$
- .

$$\begin{aligned}
 V &= lwh \\
 V &= 14 \cdot 8 \cdot 3 \\
 V &= 336
 \end{aligned}$$

6. Use
- $A = \frac{1}{2}h(B+b)$
- when
- $A = 60$
- ,
- $B = 7$
- , and
- $b = 3$
- .

$$\begin{aligned}
 A &= \frac{1}{2}h(B+b) \\
 60 &= \frac{1}{2}h(7+3) \\
 60 &= \frac{1}{2}h(10) \\
 60 &= 5h \\
 \frac{60}{5} &= \frac{5h}{5} \\
 12 &= h
 \end{aligned}$$

8. Use
- $V = \frac{1}{3}Ah$
- when
- $V = 45$
- and
- $h = 5$
- .

$$\begin{aligned}
 V &= \frac{1}{3}Ah \\
 45 &= \frac{1}{3}A \cdot 5 \\
 45 &= \frac{5}{3}A \\
 \frac{3}{5} \cdot 45 &= \frac{3}{5} \cdot \frac{5}{3}A \\
 27 &= A
 \end{aligned}$$

10. Use
- $A = \pi r^2$
- when
- $r = 4$
- and 3.14 is used as an approximation for
- π
- .

$$\begin{aligned}
 A &= \pi r^2 \\
 A &= 3.14 \cdot 4^2 \\
 A &= 3.14 \cdot 16 \\
 A &= 50.24
 \end{aligned}$$

- 12.
- $C = 2\pi r$

$$\begin{aligned}
 \frac{C}{2\pi} &= \frac{2\pi r}{2\pi} \\
 \frac{C}{2\pi} &= r
 \end{aligned}$$

- 14.
- $T = mn r$

$$\begin{aligned}
 \frac{T}{mr} &= \frac{mn r}{mr} \\
 \frac{T}{mr} &= n
 \end{aligned}$$

- 16.
- $-x + y = 13$

$$\begin{aligned}
 x - x + y &= x + 13 \\
 y &= x + 13
 \end{aligned}$$

- 18.
- $A = P + PRT$

$$\begin{aligned}
 A - P &= P + PRT - P \\
 A - P &= PRT \\
 \frac{A - P}{PR} &= \frac{PRT}{PR} \\
 \frac{A - P}{PR} &= T
 \end{aligned}$$

- 20.
- $D = \frac{1}{4}fk$

$$\begin{aligned}
 4D &= 4 \cdot \frac{1}{4}fk \\
 4D &= fk \\
 \frac{4D}{f} &= \frac{fk}{f} \\
 \frac{4D}{f} &= k
 \end{aligned}$$

- 22.
- $PR = x + y + z + w$

$$\begin{aligned}
 PR - x - y - w &= x + y + z + w - x - y - w \\
 PR - x - y - w &= z
 \end{aligned}$$

24. $S = 4lw + 2wh$

$$S - 4lw = 4lw + 2wh - 4lw$$

$$S - 4lw = 2wh$$

$$\frac{S - 4lw}{2w} = \frac{2wh}{2w}$$

$$\frac{S - 4lw}{2w} = h$$

26. Use $A = lw$ when $A = 52,400$ and $l = 400$.

$$A = lw$$

$$52,400 = 400 \cdot w$$

$$\frac{52,400}{400} = \frac{400w}{400}$$

$$131 = w$$

The width of the sign is 131 feet.

28. a. Area = $bh = 9.3(7) = 65.1$

$$\text{Perimeter} = 2(11.7) + 2(9.3)$$

$$= 23.4 + 18.6$$

$$= 42$$

The area is 65.1 square feet and the perimeter is 42 feet.

b. The border goes around the edges, so it involves perimeter. The paint covers the wall, so it involves area.

30. a. Area = $\frac{1}{2}bh = \frac{1}{2}(36)(27) = 486$

$$\text{Perimeter} = 27 + 36 + 45 = 108$$

The area is 486 square feet and the perimeter is 108 feet.

b. The fence goes around the edges of the yard, so it involves perimeter. The grass seed covers the yard, so it involves area.

32. Use $F = \frac{9}{5}C + 32$ when $C = -5$.

$$F = \frac{9}{5}C + 32$$

$$F = \frac{9}{5}(-5) + 32$$

$$F = \frac{9}{5}(-5) + 32$$

$$F = -9 + 32$$

$$F = 23$$

Thus, -5°C is equivalent to 23°F .

34. Use $d = rt$ when $d = 303$ and $t = 8\frac{1}{2}$.

$$d = rt$$

$$303 = r \cdot 8\frac{1}{2}$$

$$303 = \frac{17}{2}r$$

$$\frac{2}{17} \cdot 303 = \frac{2}{17} \cdot \frac{17}{2}r$$

$$\frac{606}{17} = r$$

$$35\frac{11}{17} = r$$

The average rate during the flight was

$$35\frac{11}{17} \text{ mph.}$$

36. Let x be the width. Then $2x - 10$ is the length.

Use $P = 2 \cdot \text{length} + 2 \cdot \text{width}$ when $P = 400$.

$$P = 2 \cdot \text{length} + 2 \cdot \text{width}$$

$$400 = 2(2x - 10) + 2x$$

$$400 = 4x - 20 + 2x$$

$$400 = 6x - 20$$

$$400 + 20 = 6x - 20 + 20$$

$$420 = 6x$$

$$\frac{420}{6} = \frac{6x}{6}$$

$$70 = x$$

The width is 70 meters and the length is

$$2(70) - 10 = 140 - 10 = 130 \text{ meters.}$$

38. Let x represent the length of each of the equal sides. Then the shortest side is $x - 2$. The perimeter is the sum of the lengths of the sides.

$$x + x + x - 2 = 22$$

$$3x - 2 = 22$$

$$3x - 2 + 2 = 22 + 2$$

$$3x = 24$$

$$\frac{3x}{3} = \frac{24}{3}$$

$$x = 8$$

The shortest side is 6 feet.

40. Use
- $d = rt$
- when
- $d = 700$
- and
- $r = 55$
- .

$$\begin{aligned}d &= rt \\700 &= 55t \\ \frac{700}{55} &= \frac{55t}{55} \\ 12\frac{8}{11} &= t\end{aligned}$$

The trip will take $12\frac{8}{11}$ hours.

42. Use
- $N = 94$
- .

$$\begin{aligned}T &= 50 + \frac{N - 40}{4} \\ T &= 50 + \frac{94 - 40}{4} \\ T &= 50 + \frac{54}{4} \\ T &= 50 + 13.5 \\ T &= 63.5\end{aligned}$$

The temperature is 63.5° Fahrenheit.

44. Use
- $T = 65$
- .

$$\begin{aligned}T &= 50 + \frac{N - 40}{4} \\ 65 &= 50 + \frac{N - 40}{4} \\ 65 - 50 &= 50 + \frac{N - 40}{4} - 50 \\ 15 &= \frac{N - 40}{4} \\ 4 \cdot 15 &= 4 \cdot \frac{N - 40}{4} \\ 60 &= N - 40 \\ 60 + 40 &= N - 40 + 40 \\ 100 &= N\end{aligned}$$

There are 100 chirps per minute.

46. As the air temperature of their environment decreases, the number of cricket chirps per minute
- decreases
- .

48. To find the amount of water in the tank, use

$$\begin{aligned}V &= \pi r^2 h \text{ with } r = \frac{8}{2} = 4, h = 3, \text{ and } \pi \approx 3.14. \\ V &= \pi r^2 h = 3.14(4)^2 \cdot 3 = 3.14(16) \cdot 3 = 150.72 \\ \text{The tank holds } 150.72 \text{ cubic meters of water. Let } x &\text{ represent the number of goldfish the tank could hold. Then } 2x = 150.72.\end{aligned}$$

$$2x = 150.72$$

$$\begin{aligned}\frac{2x}{2} &= \frac{150.72}{2} \\ x &= 75.36\end{aligned}$$

The tank could hold 75 goldfish.

50. Use
- $A = \frac{1}{2}bh$
- when
- $A = 20$
- and
- $b = 5$
- .

$$\begin{aligned}A &= \frac{1}{2}bh \\ 20 &= \frac{1}{2} \cdot 5 \cdot h \\ \frac{2}{5} \cdot 20 &= \frac{2}{5} \cdot \frac{5}{2} \cdot h \\ 8 &= h\end{aligned}$$

The height of the sail is 8 feet.

52. Use
- $C = 2\pi r$
- when
- $r = 4000$
- and
- $\pi \approx 3.14$
- .

$$\begin{aligned}C &= 2\pi r \\ C &= 2 \cdot 3.14 \cdot 4000 \\ C &= 25,120\end{aligned}$$

Thus, 25,120 miles of rope is needed to wrap around the Earth.

54. Use
- $d = rt$
- when
- $r = 0.5$
- and
- $d = 6$
- .

$$\begin{aligned}d &= rt \\ 6 &= 0.5t \\ \frac{6}{0.5} &= \frac{0.5t}{0.5} \\ 12 &= t\end{aligned}$$

It took roughly 12 hours.

56. Let
- x
- be the length of the sides of the square pen. Then
- $2x - 15$
- is the length of the sides of the triangular pen. The perimeters are equal.

$$\begin{aligned}4x &= 3(2x - 15) \\ 4x &= 6x - 45 \\ 4x - 6x &= 6x - 45 - 6x \\ -2x &= -45 \\ \frac{-2x}{-2} &= \frac{-45}{-2} \\ x &= 22.5\end{aligned}$$

$$2x - 15 = 2(22.5) - 15 = 45 - 15 = 30$$

The square's side length is 22.5 units and the triangle's side length is 30 units.

58. Use
- $d = rt$
- when
- $d = 150$
- and
- $r = 45$
- .

$$\begin{aligned}d &= rt \\150 &= 45t \\ \frac{150}{45} &= \frac{45t}{45} \\ 3\frac{1}{3} &= t \text{ or } t = 3 \text{ hr } 20 \text{ min}\end{aligned}$$

If he left at 4 A.M., then he will arrive at
4 A.M. + 3 hr 20 min = 7:20 A.M.

60. Let
- x
- be the number of times the bolt can travel around the world in one second.

$$\begin{aligned}25,120x &= 270,000 \\ \frac{25,120x}{25,120} &= \frac{270,000}{25,120} \\ x &= 10.7\end{aligned}$$

The bolt can travel 10.7 times around the world.

62. Use
- $F = \frac{9}{5}C + 32$
- when
- $C = -10$
- .

$$F = \frac{9}{5}C + 32 = \frac{9}{5}(-10) + 32 = -18 + 32 = 14$$

Thus, -10°C is equivalent to 14°F .

64. Use
- $d = rt$
- when
- $d = 2810$
- and
- $r = 105$
- .

$$\begin{aligned}2810 &= 105t \\ \frac{2810}{105} &= \frac{105t}{105} \\ 26.8 &\approx t\end{aligned}$$

It would take about 26.8 hours.

66. Use
- $V = \frac{4}{3}\pi r^3$
- when
- $r = \frac{30}{2} = 15$
- and
- $\pi = 3.14$
- .

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(15)^3 = 14,130$$

The volume of the sphere is 14,130 cubic inches.

68. Use
- $F = \frac{9}{5}C + 32$
- when
- $F = -227$
- .

$$\begin{aligned}F &= \frac{9}{5}C + 32 \\ -227 &= \frac{9}{5}C + 32 \\ -227 - 32 &= \frac{9}{5}C + 32 - 32 \\ -259 &= \frac{9}{5}C \\ -259 \cdot \frac{5}{9} &= \frac{5}{9} \cdot \frac{9}{5}C \\ -144 &\approx C\end{aligned}$$

The average temperature on Jupiter is -144°C .

- 70.
- $8\% = 0.08$

- 72.
- $0.5\% = 0.005$

- 74.
- $0.03 = 0.03(100\%) = 3\%$

- 76.
- $5 = 5(100\%) = 500\%$

$$\begin{aligned}78. \quad B &= \frac{F}{P-V} \\ B(P-V) &= \frac{F}{P-V}(P-V) \\ B(P-V) &= F \\ BP - BV &= F \\ BP - BV - BP &= F - BP \\ -BV &= F - BP \\ \frac{-BV}{-B} &= \frac{F - BP}{-B} \\ V &= \frac{BP - F}{B} \\ V &= \frac{BP}{B} - \frac{F}{B} \\ V &= P - \frac{F}{B}\end{aligned}$$

80. Use
- $A = bh$
- . If the base is doubled, the new base is
- $2b$
- . If the height is doubled, the new height is
- $2h$
- .

$$A = (2b)(2h) = 2 \cdot 2 \cdot b \cdot h = 4bh$$

The area is multiplied by 4.

82. Let
- x
- be the temperature. Use
- $F = \frac{9}{5}C + 32$

when $F = C = x$.

$$\begin{aligned}F &= \frac{9}{5}C + 32 \\ x &= \frac{9}{5}x + 32 \\ x - \frac{9}{5}x &= \frac{9}{5}x + 32 - \frac{9}{5}x \\ \frac{5}{5}x - \frac{9}{5}x &= 32 \\ -\frac{4}{5}x &= 32 \\ -\frac{5}{4} \cdot \left(-\frac{4}{5}x\right) &= -\frac{5}{4} \cdot 32 \\ x &= -40\end{aligned}$$

They are the same when the temperature is -40° .