

Chapter 2

Section 2.1 Practice Exercises

1. a. The numerical coefficient of t is 1, since t is $1t$.
 - b. The numerical coefficient of $-7x$ is -7 .
 - c. The numerical coefficient of $-\frac{w}{5}$ is $-\frac{1}{5}$,
since $-\frac{w}{5}$ means $-\frac{1}{5} \cdot w$.
 - d. The numerical coefficient of $43x^4$ is 43.
 - e. The numerical coefficient of $-b$ is -1 , since $-b$ is $-1b$.
2. a. $-4xy$ and $5yx$ are like terms, since $xy = yx$ by the commutative property.
 - b. $5q$ and $-3q^2$ are unlike terms, since the exponents on q are not the same.
 - c. $3ab^2$, $-2ab^2$, and $43ab^2$ are like terms, since each variable and its exponent match.
 - d. y^5 and $\frac{y^5}{2}$ are like terms, since the exponents on y are the same.
3. a. $-3y + 11y = (-3 + 11)y = 8y$
 - b. $4x^2 + x^2 = 4x^2 + 1x^2 = (4 + 1)x^2 = 5x^2$
 - c. $5x - 3x^2 + 8x^2 = 5x + (-3 + 8)x^2 = 5x + 5x^2$
 - d. $20y^2 + 2y^2 - y^2 = 20y^2 + 2y^2 - 1y^2$
 $= (20 + 2 - 1)y^2$
 $= 21y^2$

4. a. $3y + 8y - 7 + 2 = (3 + 8)y + (-7 + 2) = 11y - 5$
 - b. $6x - 3 - x - 3 = 6x - 1x + (-3 - 3)$
 $= (6 - 1)x + (-3 - 3)$
 $= 5x - 6$
 - c. $\frac{3}{4}t - t = \frac{3}{4}t - 1t = \left(\frac{3}{4} - 1\right)t = -\frac{1}{4}t$
 - d. $9y + 3.2y + 10 + 3 = (9 + 3.2)y + (10 + 3)$
 $= 12.2y + 13$
 - e. $5z - 3z^4$
These two terms cannot be combined because they are unlike terms.
5. a. $3(2x - 7) = 3(2x) + 3(-7) = 6x - 21$
 - b. $-5(x - 0.5z - 5)$
 $= -5(x) + (-5)(-0.5z) + (-5)(-5)$
 $= -5x + 2.5z + 25$
 - c. $-(2x - y + z - 2)$
 $= -1(2x - y + z - 2)$
 $= -1(2x) - 1(-y) - 1(z) - 1(-2)$
 $= -2x + y - z + 2$
6. a. $4(9x + 1) + 6 = 36x + 4 + 6 = 36x + 10$
 - b. $-7(2x - 1) - (6 - 3x) = -14x + 7 - 6 + 3x$
 $= -11x + 1$
 - c. $8 - 5(6x + 5) = 8 - 30x - 25 = -30x - 17$
7. "Subtract $7x - 1$ from $2x + 3$ " translates to
 $(2x + 3) - (7x - 1) = 2x + 3 - 7x + 1 = -5x + 4$
8. a.

Three	added to	double a number
↓	↓	↓
3	+	2x
or $2x + 3$		

b.

the sum of 5 and a number

subtract

six

↓ ↓ ↓

$$(5 + x) \quad - \quad 6 = 5 + x - 6$$

$$(5 + x) - 6 = 5 + x - 6 = x - 1$$

c.

two

times

the sum of 3 and a number

increased by

4

↓ ↓ ↓ ↓ ↓

$$2 \quad \cdot \quad (3 + x) \quad + \quad 4$$

$$2(3 + x) + 4 = 6 + 2x + 4 = 2x + 10$$

d.

a number

added to

half the number

added to

5 times the number

↓ ↓ ↓ ↓ ↓

$$x \quad + \quad \frac{1}{2}x \quad + \quad 5x$$

$$x + \frac{1}{2}x + 5x = \frac{13}{2}x$$
Vocabulary, Readiness & Video Check 2.1

1. $23y^2 + 10y - 6$ is called an expression while $23y^2$, $10y$, and -6 are each called a term.
2. To simplify $x + 4x$, we combine like terms.
3. The term y has an understood numerical coefficient of 1.
4. The terms $7z$ and $7y$ are unlike terms and the terms $7z$ and $-z$ are like terms.
5. For the term $-\frac{1}{2}xy^2$, the number $-\frac{1}{2}$ is the numerical coefficient.
6. $5(3x - y)$ equals $15x - 5y$ by the distributive property.
7. Although these terms have exactly the same variables, the exponents on each are not exactly the same—the exponents on x differ in each term.
8. distributive property
9. -1
10. The sum of 5 times a number and -2 , added to 7 times the number; $5x + (-2) + 7x$; because there are like terms.

Exercise Set 2.1

2. The numerical coefficient of $3x$ is 3.

4. The numerical coefficient of $-y$ is -1 , since $-y = -1y$.
6. The numerical coefficient of $1.2xyz$ is 1.2 .
8. $-2x^2y$ and $6xy$ are unlike terms, since the exponents on x are not the same.
10. ab^2 and $-7ab^2$ are like terms, since each variable and its exponent match.
12. $7.4p^3q^2$ and $6.2p^3q^2r$ are unlike terms, since the exponents on r are not the same.
14. $3x + 2x = (3 + 2)x = 5x$
16. $c - 7c + 2c = (1 - 7 + 2)c = -4c$
18. $6g + 5 - 3g - 7 = 6g - 3g + 5 - 7$
 $= (6 - 3)g - 2$
 $= 3g - 2$
20. $a + 3a - 2 - 7a = a + 3a - 7a - 2$
 $= (1 + 3 - 7)a - 2$
 $= -3a - 2$
22. $8p + 4 - 8p - 15 = (8p - 8p) + (4 - 15)$
 $= (8 - 8)p + (-11)$
 $= 0p - 11$
 $= -11$
24. $7.9y - 0.7 - y + 0.2 = 7.9y - y - 0.7 + 0.2$
 $= (7.9 - 1)y - 0.5$
 $= 6.9y - 0.5$
26. $8h + 13h - 6 + 7h - h = 8h + 13h + 7h - h - 6$
 $= (8 + 13 + 7 - 1)h - 6$
 $= 27h - 6$
28. $8x^3 + x^3 - 11x^3 = (8 + 1 - 11)x^3 = -2x^3$
30. $0.4y - 6.7 + y - 0.3 - 2.6y$
 $= 0.4y + y - 2.6y - 6.7 - 0.3$
 $= (0.4 + 1 - 2.6)y - 7.0$
 $= -1.2y - 7$
32. $7(r - 3) = 7(r) - 7(3) = 7r - 21$
34. $-4(y + 6) = -4(y) + (-4)(6) = -4y - 24$
36. $9(z + 7) - 15 = 9z + 63 - 15 = 9z + 48$
38. $-2(4x - 3z - 1) = -2(4x) - (-2)(3z) - (-2)(1)$
 $= -8x + 6z + 2$
40. $-(y + 5z - 7) = -y - 5z + 7$
42. $4(2x - 3) - 2(x + 1) = 8x - 12 - 2x - 2$
 $= 6x - 14$
44. $3y - 5$ added $y + 16$
 ↓ to ↓
 $(3y - 5) + (y + 16) = 3y + y - 5 + 16$
 $= 4y + 11$
46. $12 + x$ minus $4x - 7$
 ↓ ↓ ↓
 $(12 + x) - (4x - 7) = 12 + x - 4x + 7$
 $= 12 + 7 + x - 4x$
 $= 19 - 3x$
48. $2m - 6$ minus $m - 3$
 ↓ ↓ ↓
 $(2m - 6) - (m - 3) = 2m - 6 - m + 3$
 $= 2m - m - 6 + 3$
 $= m - 3$
50. $7c - 8 - c = 7c - c - 8 = (7 - 1)c - 8 = 6c - 8$
52. $5y - 14 + 7y - 20y = 5y + 7y - 20y - 14$
 $= (5 + 7 - 20)y - 14$
 $= -8y - 14$
54. $-3(2x + 5) - 6x = -3(2x) + (-3)(5) - 6x$
 $= -6x - 15 - 6x$
 $= -6x - 6x - 15$
 $= -12x - 15$
56. $2(6x - 1) - (x - 7) = 12x - 2 - x + 7$
 $= 11x + 5$
58. $8y - 2 - 3(y + 4) = 8y - 2 - 3y - 12 = 5y - 14$
60. $-11c - (4 - 2c) = -11c - 4 + 2c = -9c - 4$
62. $(8 - 5y) - (4 + 3y) = 8 - 5y - 4 - 3y = -8y + 4$
64. $2.8w - 0.9 - 0.5 - 2.8w = 2.8w - 2.8w - 0.9 - 0.5$
 $= -1.4$

$$\begin{aligned}
 66. \quad \frac{1}{5}(9y+2) + \frac{1}{10}(2y-1) &= \frac{9}{5}y + \frac{2}{5} + \frac{2}{10}y - \frac{1}{10} \\
 &= \frac{9}{5}y + \frac{1}{5}y + \frac{2}{5} - \frac{1}{10} \\
 &= \frac{10}{5}y + \frac{4}{10} - \frac{1}{10} \\
 &= 2y + \frac{3}{10}
 \end{aligned}$$

$$68. \quad 8 + 4(3x - 4) = 8 + 12x - 16 = -8 + 12x$$

$$70. \quad 0.2(k + 8) - 0.1k = 0.2k + 1.6 - 0.1k = 0.1k + 1.6$$

$$72. \quad 14 - 11(5m + 3n) = 14 - 55m - 33n$$

$$\begin{aligned}
 74. \quad 7(2x+5) - 4(x+2) - 20x &= 14x + 35 - 4x - 8 - 20x \\
 &= 14x - 4x - 20x + 35 - 8 \\
 &= -10x + 27
 \end{aligned}$$

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

78. The difference of a number and 2

$$\begin{array}{ccc}
 \downarrow & & \downarrow \\
 (x-2) & & \div
 \end{array}$$

divided by 5

$$\begin{array}{ccc}
 \downarrow & & \downarrow \\
 & & 5 = \frac{x-2}{5}
 \end{array}$$

80. 8 more than triple a number

$$\begin{array}{ccc}
 \downarrow & & \downarrow \\
 8 & + & 3x
 \end{array}$$

82. Eleven increased by two-thirds of a number

$$\begin{array}{ccc}
 \downarrow & & \downarrow \\
 11 & + & \frac{2}{3}x
 \end{array}$$

84. 9 times a number subtract 3 times the number and 10

$$\begin{array}{ccc}
 \downarrow & & \downarrow \\
 9x & - & (3x+10) \\
 9x - (3x + 10) & = & 9x - 3x - 10 = 6x - 10
 \end{array}$$

86. Six times the difference of a number and 5

$$\begin{array}{ccc} \downarrow & & \downarrow \\ 6 & \cdot & (x-5) \\ 6(x-5) & = & 6x-30 \end{array}$$

88. Half a number minus the product of the number and 8

$$\begin{array}{ccc} \downarrow & & \downarrow \\ \frac{1}{2}x & - & 8x \\ \frac{1}{2}x - 8x & = & -7.5x \end{array}$$

90. Twice a number added to -1 added to 5 times the number added to -12

$$\begin{array}{ccccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 2x & + & -1 & + & 5x & + & -12 \\ 2x + (-1) + 5x + (-12) & = & 7x - 13 \end{array}$$

92. $gh - h^2 = 0(-4) - (-4)^2 = 0 - 16 = -16$

94. $x^3 - x^2 + 4 = (-3)^3 - (-3)^2 + 4$
 $= -27 - 9 + 4$
 $= -32$

96. $x^3 - x^2 - x = (-2)^3 - (-2)^2 - (-2)$
 $= -8 - 4 + 2$
 $= -10$

98. $5 + (3x - 1) + (2x + 5) = 5 + 3x - 1 + 2x + 5$
 $= 5x + 9$

The perimeter is $(5x + 9)$ centimeters.

100. 2 cylinders $\stackrel{?}{\neq}$ 3 cubes
 2 cubes + 2 cubes $\stackrel{?}{\neq}$ 3 cubes
 4 cubes = 3 cubes: Not balanced

102. 1 cylinder $\stackrel{?}{\neq}$ 1 cone + 1 cube
 2 cubes $\stackrel{?}{\neq}$ 1 cube + 1 cube
 2 cubes = 2 cubes: Balanced

104. answers may vary

106. $5x + 10(3x) + 25(30x - 1) = 5x + 30x + 750x - 25$
 $= 785x - 25$

The total value is $(785x - 25)\$$.

108. no; answers may vary

$$110. \quad 4m^4 p^2 + m^4 p^2 - 5m^2 p^4 = 5m^4 p^2 - 5m^2 p^4$$

$$112. \quad 9y^2 - (6xy^2 - 5y^2) - 8xy^2 \\ = 9y^2 - 6xy^2 + 5y^2 - 8xy^2 \\ = 14y^2 - 14xy^2$$

$$114. \quad -(7c^3d - 8c) - 5c - 4c^3d \\ = -7c^3d + 8c - 5c - 4c^3d \\ = -11c^3d + 3c$$

Section 2.2 Practice Exercises

$$1. \quad x + 3 = -5 \\ x + 3 - 3 = -5 - 3 \\ x = -8$$

$$\text{Check: } x + 3 = -5 \\ -8 + 3 \stackrel{?}{=} -5 \\ -5 = -5$$

The solution is -8 .

$$2. \quad y - 0.3 = -2.1 \\ y - 0.3 + 0.3 = -2.1 + 0.3 \\ y = -1.8$$

$$\text{Check: } y - 0.3 = -2.1 \\ -1.8 - 0.3 \stackrel{?}{=} -2.1 \\ -2.1 = -2.1$$

The solution is -1.8 .

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

$$\text{Check: } \frac{2}{5} = x + \frac{3}{10} \\ \frac{2}{5} \stackrel{?}{=} \frac{1}{10} + \frac{3}{10} \\ \frac{2}{5} = \frac{2}{5}$$

The solution is $\frac{1}{10}$.

$$4. \quad 4t + 7 = 5t - 3 \\ 4t + 7 - 4t = 5t - 3 - 4t \\ 7 = t - 3 \\ 7 + 3 = t - 3 + 3 \\ 10 = t$$

$$\text{Check: } 4t + 7 = 5t - 3 \\ 4(10) + 7 \stackrel{?}{=} 5(10) - 3 \\ 40 + 7 \stackrel{?}{=} 50 - 3 \\ 47 = 47$$

The solution is 10 .

$$5. \quad 8x - 5x - 3 + 9 = x + x + 3 - 7 \\ 3x + 6 = 2x - 4 \\ 3x + 6 - 2x = 2x - 4 - 2x \\ x + 6 = -4 \\ x + 6 - 6 = -4 - 6 \\ x = -10$$

$$\text{Check: } 8x - 5x - 3 + 9 = x + x + 3 - 7 \\ 8(-10) - 5(-10) - 3 + 9 \stackrel{?}{=} -10 + (-10) + 3 - 7 \\ -80 + 50 - 3 + 9 \stackrel{?}{=} -10 + (-10) + 3 - 7 \\ -24 = -24$$

The solution is -10 .

$$6. \quad 4(2a - 3) - (7a + 4) = 2 \\ 4(2a) + 4(-3) - 7a - 4 = 2 \\ 8a - 12 - 7a - 4 = 2 \\ a - 16 = 2 \\ a - 16 + 16 = 2 + 16 \\ a = 18$$

Check by replacing a with 18 in the original equation.

$$7. \quad 12 - x = 20 \\ 12 - x - 12 = 20 - 12 \\ -x = 8 \\ x = -8$$

$$\text{Check: } 12 - x = 20 \\ 12 - (-8) \stackrel{?}{=} 20 \\ 20 = 20$$

The solution is -8 .

$$8. \quad \text{a. The other number is } 9 - 2 = 7.$$

$$\text{b. The other number is } 9 - x.$$

$$\text{c. The other piece has length } (9 - x) \text{ feet.}$$

$$9. \text{ The speed of the French TGV is } (s - 67.2) \text{ mph.}$$

Vocabulary, Readiness & Video Check 2.2

- The difference between an equation and an expression is that an equation contains an equal sign, whereas an expression does not.
- Equivalent equations are equations that have the same solution.
- A value of the variable that makes the equation a true statement is called a solution of the equation.
- The process of finding the solution of an equation is called solving the equation for the variable.
- By the addition property of equality, $x = -2$ and $x + 10 = -2 + 10$ are equivalent equations.
- The equations $x = \frac{1}{2}$ and $\frac{1}{2} = x$ are equivalent equations. The statement is true.
- The addition property of equality means that if we have an equation, we can add the same real number to both sides of the equation and have an equivalent equation.
- To confirm our solution, we replace the variable with the solution in the original equation to make sure we have a true statement.
- $\frac{1}{7}x$

Exercise Set 2.2

- $$x + 14 = 25$$

$$x + 14 - 14 = 25 - 14$$

$$x = 11$$
 Check: $x + 14 = 25$
 $11 + 14 \stackrel{?}{=} 25$
 $25 = 25$
 The solution is 11.
- $$y - 9 = 1$$

$$y - 9 + 9 = 1 + 9$$

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

- $$-17 = x + 3$$

$$-17 - 3 = x + 3 - 3$$

$$-20 = x$$
 Check: $-17 = x + 3$
 $-17 \stackrel{?}{=} -20 + 3$
 $-17 = -17$
 The solution is -20 .

- $$t - 9.2 = -6.8$$

$$5 - 9.2 + 9.2 = -6.8 + 9.2$$

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

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

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

$$\frac{9}{24} - \frac{4}{24} = c$$

$$\frac{5}{24} = c$$
 Check: $\frac{3}{8} = c + \frac{1}{6}$
 $\frac{3}{8} \stackrel{?}{=} \frac{5}{24} + \frac{1}{6}$
 $\frac{3}{8} \stackrel{?}{=} \frac{5}{24} + \frac{4}{24}$
 $\frac{3}{8} \stackrel{?}{=} \frac{9}{24}$
 $\frac{3}{8} = \frac{3}{8}$

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

- $$9x + 5.5 = 10x$$

$$9x - 9x + 5.5 = 10x - 9x$$

$$5.5 = x$$
 Check: $9x + 5.5 = 10x$
 $9(5.5) + 5.5 \stackrel{?}{=} 10(5.5)$
 $49.5 + 5.5 \stackrel{?}{=} 55$
 $55 = 55$
 The solution is 5.5.

14. $18x - 9 = 19x$
 $18x - 18x - 9 = 19x - 18x$
 $-9 = x$
 Check: $18x - 9 = 19x$
 $18(-9) - 9 \stackrel{?}{=} 19(-9)$
 $-162 - 9 \stackrel{?}{=} -171$
 $-171 = -171$
 The solution is -9 .

16. $z + \frac{9}{19} = -\frac{2}{19}$
 $z + \frac{9}{19} - \frac{9}{19} = -\frac{2}{19} - \frac{9}{19}$
 $z = -\frac{11}{19}$
 Check: $z + \frac{9}{19} = -\frac{2}{19}$
 $-\frac{11}{19} + \frac{9}{19} \stackrel{?}{=} -\frac{2}{19}$
 $-\frac{2}{19} = -\frac{2}{19}$
 The solution is $-\frac{11}{19}$.

18. $3n + 2n = 7 + 4n$
 $5n = 7 + 4n$
 $5n - 4n = 7 + 4n - 4n$
 $n = 7$
 Check: $3n + 2n = 7 + 4n$
 $3(7) + 2(7) \stackrel{?}{=} 7 + 4(7)$
 $21 + 14 \stackrel{?}{=} 7 + 28$
 $35 = 35$
 The solution is 7 .

20. $\frac{13}{11}y - \frac{2}{11}y = -3$
 $\frac{11}{11}y = -3$
 $y = -3$
 Check: $\frac{13}{11}y - \frac{2}{11}y = -3$
 $\frac{13}{11}(-3) - \frac{2}{11}(-3) \stackrel{?}{=} -3$
 $-\frac{39}{11} + \frac{6}{11} \stackrel{?}{=} -3$
 $-3 = -3$
 The solution is -3 .

22. $4x - 4 = 10x - 7x$
 $4x - 4 = 3x$
 $4x - 3x - 4 = 3x - 3x$
 $x - 4 = 0$
 $x - 4 + 4 = 0 + 4$
 $x = 4$
 Check: $4x - 4 = 10x - 7x$
 $4(4) - 4 \stackrel{?}{=} 10(4) - 7(4)$
 $16 - 4 \stackrel{?}{=} 40 - 28$
 $12 = 12$
 The solution is 4 .

24. $-4(z - 3) = 2 - 3z$
 $-4z + 12 = 2 - 3z$
 $-4z + 4z + 12 = 2 - 3z + 4z$
 $12 = 2 + z$
 $12 - 2 = 2 - 2 + z$
 $10 = z$
 Check: $-4(z - 3) = 2 - 3z$
 $-4(10 - 3) \stackrel{?}{=} 2 - 3(10)$
 $-4(7) \stackrel{?}{=} 2 - 30$
 $-28 = -28$
 The solution is 10 .

26. $\frac{1}{5}x - 1 = -\frac{4}{5}x - 13$
 $\frac{1}{5}x - 1 + \frac{4}{5}x = -\frac{4}{5}x - 13 + \frac{4}{5}x$
 $\frac{5}{5}x - 1 = -13$
 $x - 1 + 1 = -13 + 1$
 $x = -12$
 Check: $\frac{1}{5}x - 1 = -\frac{4}{5}x - 13$
 $\frac{1}{5}(-12) - 1 \stackrel{?}{=} -\frac{4}{5}(-12) - 13$
 $-\frac{12}{5} - 1 \stackrel{?}{=} \frac{48}{5} - 13$
 $-\frac{17}{5} = -\frac{17}{5}$
 The solution is -12 .

28. $2x + 7 = x - 10$
 $2x + 7 - x = x - 10 - x$
 $x + 7 = -10$
 $x + 7 - 7 = -10 - 7$
 $x = -17$

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

The solution is -17 .

30. $4p-11-p = 2+2p-20$
 $3p-11 = 2p-18$
 $3p-2p-11 = 2p-2p-18$
 $p-11 = -18$
 $p-11+11 = -18+11$
 $p = -7$

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

The solution is -7 .

32. $-2(x-1) = -3x$
 $-2x+2 = -3x$
 $-2x+2+2x = -3x+2x$
 $2 = -x$
 $x = -2$

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

The solution is -2 .

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

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

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

36. $3(y+7) = 2y-5$
 $3y+21 = 2y-5$
 $3y-2y+21 = 2y-2y-5$
 $y+21 = -5$
 $y+21-21 = -5-21$
 $y = -26$

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

The solution is -26 .

38. $5(3+z) - (8z+9) = -4z$
 $15+5z-8z-9 = -4z$
 $6-3z = -4z$
 $6-3z+4z = -4z+4z$
 $6+z = 0$
 $6-6+z = -6$
 $z = -6$

Check: $5(3+z) - (8z+9) = -4z$
 $5(3+(-6)) - (8(-6)+9) \stackrel{?}{=} -4(-6)$
 $5(-3) - (-48+9) \stackrel{?}{=} 24$
 $-15 - (-39) \stackrel{?}{=} 24$
 $24 = 24$

The solution is -6 .

40. $-5(x+1) + 4(2x-3) = 2(x+2) - 8$
 $-5x-5+8x-12 = 2x+4-8$
 $3x-17 = 2x-4$
 $3x-2x-17 = 2x-2x-4$
 $x-17 = -4$
 $x-17+17 = -4+17$
 $x = 13$

Check: $-5(x+1)+4(2x-3)=2(x+2)-8$
 $-5(13+1)+4(2(13)-3) \stackrel{?}{=} 2(13+2)-8$
 $-5(14)+4(26-3) \stackrel{?}{=} 2(15)-8$
 $-70+4(23) \stackrel{?}{=} 30-8$
 $-70+92 \stackrel{?}{=} 22$
 $22=22$

The solution is 13.

42. $-8=8+z$
 $-8-8=8+z-8$
 $-16=z$

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

46. $7y+2=6y+2$
 $7y-6y+2=6y-6y+2$
 $y+2=2$
 $y+2-2=2-2$
 $y=0$

48. $15x+20-10x-9=25x+8-21x-7$
 $5x+11=4x+1$
 $5x+11-4x=4x+1-4x$
 $x+11=1$
 $x+11-11=1-11$
 $x=-10$

50. $6(5+c)=5(c-4)$
 $30+6c=5c-20$
 $30+6c-5c=5c-5c-20$
 $30+c=20$
 $30-30+c=-20-30$
 $c=-50$

52. $m+2=7.1$
 $m+2-2=7.1-2$
 $m=5.1$

54. $15-(6-7k)=2+6k$
 $15-6+7k=2+6k$
 $9+7k=2+6k$
 $9+7k-6k=2+6k-6k$
 $9+k=2$
 $9-9+k=2-9$
 $k=-7$

56. $\frac{1}{11}=y+\frac{10}{11}$
 $\frac{1}{11}-\frac{10}{11}=y+\frac{10}{11}-\frac{10}{11}$
 $-\frac{9}{11}=y$

58. $-1.4-7x-3.6-2x=-8x+4.4$
 $-9x-5.0=-8x+4.4$
 $-9x+9x-5.0=-8x+9x+4.4$
 $-5.0=x+4.4$
 $-5.0-4.4=x+4.4-4.4$
 $-9.4=x$

60. $-2\left(x-\frac{1}{7}\right)=-3x$
 $-2x+\frac{2}{7}=-3x$
 $-2x+3x+\frac{2}{7}=-3x+3x$
 $x+\frac{2}{7}=0$
 $x+\frac{2}{7}-\frac{2}{7}=0-\frac{2}{7}$
 $x=-\frac{2}{7}$

62. $-4(x-1)-5(2-x)=-6$
 $-4x+4-10+5x=-6$
 $x-6=-6$
 $x-6+6=-6+6$
 $x=0$

64. $0.6v+0.4(0.3+v)=2.34$
 $0.6v+0.12+0.4v=2.34$
 $1v+0.12=2.34$
 $v+0.12-0.12=2.34-0.12$
 $v=2.22$

66. The other number is $13-y$.

68. The length of the other piece is $(5-x)$ feet.

70. The complement of the angle x° is $(90 - x)^\circ$.

72. 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 $m + 178.5$.

74. The weight of the Hoba West meteorite is $3y$ kilograms.

76. The reciprocal of $\frac{7}{6}$ is $\frac{6}{7}$ since $\frac{7}{6} \cdot \frac{6}{7} = 1$.

78. The reciprocal of 5 is $\frac{1}{5}$ since $5 \cdot \frac{1}{5} = 1$.

80. The reciprocal of $-\frac{3}{5}$ is $-\frac{5}{3}$ since $-\frac{3}{5} \cdot -\frac{5}{3} = 1$.

82. $\frac{-2y}{-2} = y$

84. $7\left(\frac{1}{7}r\right) = r$

86. $\frac{9}{2}\left(\frac{2}{9}x\right) = x$

88. $360 - (x + 3x + 5x) = 360 - (9x) = 360 - 9x$
The fourth angle is $(360 - 9x)^\circ$.

90. answers may vary

92. answers may vary

94. $100 + 250 + 500 + x = 1000$
 $850 + x = 1000$
 $850 + x - 850 = 1000 - 850$
 $x = 150$

The fluid needed by the patient is 150 ml.

96. answers may vary.

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

The answer is -9 .

100. answers may vary

102. Check $y = 1.2$: $8.13 + 5.85y = 20.05y - 8.91$
 $8.13 + 5.85(1.2) \stackrel{?}{=} 20.05(1.2) - 8.91$
 $8.13 + 7.02 \stackrel{?}{=} 24.06 - 8.91$
 $15.15 = 15.15$

Solution

104. Check $z = 4.8$:
 $7(z - 1.7) + 9.5 = 5(z + 3.2) - 9.2$
 $7(4.8 - 1.7) + 9.5 \stackrel{?}{=} 5(4.8 + 3.2) - 9.2$
 $7(3.1) + 9.55 \stackrel{?}{=} 5(8.0) - 9.2$
 $21.7 + 9.55 \stackrel{?}{=} 40.0 - 9.2$
 $31.2 \neq 30.8$

Not a solution

Section 2.3 Practice Exercises

1. $\frac{4}{5}x = 16$
 $\frac{5}{4} \cdot \frac{4}{5}x = \frac{5}{4} \cdot 16$
 $\left(\frac{5}{4} \cdot \frac{4}{5}\right)x = \frac{5}{4} \cdot 16$
 $1x = 20$
 $x = 20$

Check: $\frac{4}{5}x = 16$

$$\frac{4}{5} \cdot 20 \stackrel{?}{=} 16$$

$$16 = 16$$

The solution is 20.

2. $8x = -96$
 $\frac{8x}{8} = \frac{-96}{8}$
 $x = -12$
Check: $8x = -96$
 $8(-12) \stackrel{?}{=} -96$
 $-96 = -96$

The solution is -12 .

3. $\frac{x}{5} = 13$
 $5 \cdot \frac{x}{5} = 5 \cdot 13$
 $x = 65$

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

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

$$13 = 13$$

The solution is 65.

4. $2.7x = 4.05$

$$\frac{2.7x}{2.7} = \frac{4.05}{2.7}$$

$$x = 1.5$$

The solution is 1.5.

Check by replacing x with 1.5 in the original equation.

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

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

$$x = -\frac{12}{35}$$

Check by replacing x with $-\frac{12}{35}$ in the original equation. The solution is $-\frac{12}{35}$.

6. $-y + 3 = -8$

$$-y + 3 - 3 = -8 - 3$$

$$-y = -11$$

$$\frac{-y}{-1} = \frac{-11}{-1}$$

$$y = 11$$

To check, replace y with 11 in the original equation. The solution is 11.

7. $6b - 11b = 18 + 2b - 6 + 9$

$$-5b = 21 + 2b$$

$$-5b - 2b = 21 + 2b - 2b$$

$$-7b = 21$$

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

$$b = -3$$

Check by replacing b with -3 in the original equation. The solution is -3 .

8. $10x - 4 = 7x + 14$

$$10x - 4 - 7x = 7x + 14 - 7x$$

$$3x - 4 = 14$$

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

$$3x = 18$$

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

$$x = 6$$

To check, replace x with 6 in the original equation to see that a true statement results. The solution is 6.

9. $4(3x - 2) = -1 + 4$

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

$$12x - 8 = 3$$

$$12x - 8 + 8 = 3 + 8$$

$$12x = 11$$

$$\frac{12x}{12} = \frac{11}{12}$$

$$x = \frac{11}{12}$$

To check, replace x with $\frac{11}{12}$ in the original equation to see that a true statement results. The solution is $\frac{11}{12}$.

10. Let $x =$ first integer.

$$x + 2 = \text{second even integer.}$$

$$x + 4 = \text{third even integer.}$$

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

Vocabulary, Readiness & Video Check 2.3

1. By the multiplication property of equality,

$$y = \frac{1}{2} \text{ and } 5 \cdot y = 5 \cdot \frac{1}{2} \text{ are equivalent equations.}$$

2. The equations $\frac{z}{4} = 10$ and $4 \cdot \frac{z}{4} = 10$ are not equivalent equations. The statement is false.

3. The equations $-7x = 30$ and $\frac{-7x}{-7} = \frac{30}{7}$ are not equivalent equations. The statement is false.

4. By the multiplication property of equality,

$$9x = -63 \text{ and } \frac{9x}{9} = \frac{-63}{9} \text{ are equivalent equations.}$$

5. We can multiply both sides of an equation by the same nonzero number and have an equivalent equation.

6. addition property; multiplication property; answers may vary

$$7. (x + 1) + (x + 3) = 2x + 4$$

Exercise Set 2.3

2. $-7x = -49$

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

$$x = 7$$

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

The solution is 7.

4. $2x = 0$

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

$$x = 0$$

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

The solution is 0.

6. $-y = 8$

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

$$y = -8$$

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

The solution is -8.

8. $\frac{3}{4}n = -15$

$$\frac{4}{3}\left(\frac{3}{4}n\right) = \frac{4}{3}(-15)$$

$$n = -20$$

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

The solution is -20.

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

$$8\left(\frac{1}{4}\right) = 8\left(\frac{1}{8}v\right)$$

$$2 = v$$

Check: $\frac{1}{4} = \frac{1}{8}v$

$\frac{1}{4} \stackrel{?}{=} \frac{1}{8}(2)$

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

The solution is 2.

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

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

$d = 30$

Check: $\frac{d}{15} = 2$

$\frac{30}{15} \stackrel{?}{=} 2$

$2 = 2$

The solution is 30.

14. $\frac{f}{-5} = 0$

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

$f = 0$

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

$\frac{0}{-5} \stackrel{?}{=} 0$

$0 = 0$

The solution is 0.

16. $19.55 = 8.5y$

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

$2.3 = y$

Check: $19.55 = 8.5y$

$19.55 \stackrel{?}{=} 8.5(2.3)$

$19.55 = 19.55$

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: $3x - 1 = 26$

$$3(9) - 1 \stackrel{?}{=} 26$$

$$27 - 1 \stackrel{?}{=} 26$$

$$26 = 26$$

The solution is 9.

20. $-x + 4 = -24$

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

$$-x = -28$$

$$x = 28$$

Check: $-x + 4 = -24$

$$-(28) + 4 \stackrel{?}{=} -24$$

$$-28 + 4 \stackrel{?}{=} -24$$

$$-24 = -24$$

The solution is 28.

22. $8t + 5 = 5$

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

$$8t = 0$$

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

$$t = 0$$

Check: $8t + 5 = 5$

$$8(0) + 5 \stackrel{?}{=} 5$$

$$0 + 5 \stackrel{?}{=} 5$$

$$5 = 5$$

The solution is 0.

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

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

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

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

$$b = -24$$

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

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

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

$$-7 = -7$$

The solution is -24.

26. $4a + a = -1 + 3a - 1 - 2$

$$5a = 3a - 4$$

$$5a - 3a = 3a - 4 - 3a$$

$$2a = -4$$

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

$$a = -2$$

Check: $4a + a = -1 + 3a - 1 - 2$

$$4(-2) + (-2) \stackrel{?}{=} -1 + 3(-2) - 1 - 2$$

$$-8 - 2 \stackrel{?}{=} -1 - 6 - 1 - 2$$

$$-10 = -10$$

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

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

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

$$19 = 19$$

The solution is -50.

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

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

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

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

$$x = 10$$

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

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

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

$$-8 = -8$$

The solution is 10.

$$\begin{aligned}
 32. \quad \frac{2}{7}z - \frac{1}{5} &= \frac{1}{2} \\
 \frac{2}{7}z - \frac{1}{5} + \frac{1}{5} &= \frac{1}{2} + \frac{1}{5} \\
 \frac{2}{7}z &= \frac{7}{10} \\
 \frac{7}{2} \cdot \frac{2}{7}z &= \frac{7}{2} \cdot \frac{7}{10} \\
 z &= \frac{49}{20}
 \end{aligned}$$

$$\begin{aligned}
 \text{Check: } \quad \frac{2}{7}z - \frac{1}{5} &= \frac{1}{2} \\
 \frac{2}{7}\left(\frac{49}{20}\right) - \frac{1}{5} &\stackrel{?}{=} \frac{1}{2} \\
 \frac{7}{10} - \frac{1}{5} &\stackrel{?}{=} \frac{1}{2} \\
 \frac{5}{10} - \frac{2}{10} &\stackrel{?}{=} \frac{1}{2} \\
 \frac{1}{2} &= \frac{1}{2}
 \end{aligned}$$

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

$$\begin{aligned}
 34. \quad 11x + 13 &= 9x + 9 \\
 11x + 13 - 9x &= 9x + 9 - 9x \\
 2x + 13 &= 9 \\
 2x + 13 - 13 &= 9 - 13 \\
 2x &= -4 \\
 \frac{2x}{2} &= \frac{-4}{2} \\
 x &= -2
 \end{aligned}$$

$$\begin{aligned}
 36. \quad 2(4x + 1) &= -12 + 6 \\
 8x + 2 &= -6 \\
 8x + 2 - 2 &= -6 - 2 \\
 8x &= -8 \\
 \frac{8x}{8} &= \frac{-8}{8} \\
 x &= -1
 \end{aligned}$$

$$\begin{aligned}
 38. \quad 6x - 4 &= -2x - 10 \\
 6x - 4 + 2x &= -2x - 10 + 2x \\
 8x - 4 &= -10 \\
 8x - 4 + 4 &= -10 + 4 \\
 8x &= -6 \\
 \frac{8x}{8} &= \frac{-6}{8} \\
 x &= -\frac{3}{4}
 \end{aligned}$$

$$\begin{aligned}
 40. \quad 8 + 4 &= -6(5x - 2) \\
 12 &= -30x + 12 \\
 12 - 12 &= -30x + 12 - 12 \\
 0 &= -30x \\
 \frac{0}{-30} &= \frac{-30x}{-30} \\
 0 &= x
 \end{aligned}$$

$$\begin{aligned}
 42. \quad -17z - 4 &= -16z - 20 \\
 -17z - 4 + 17z &= -16z - 20 + 17z \\
 -4 &= z - 20 \\
 -4 + 20 &= z - 20 + 20 \\
 16 &= z
 \end{aligned}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\begin{aligned}
 78. \quad \text{Sum} &= \text{first integer} + \text{second integer} \\
 &\quad + \text{third integer} + \text{fourth integer.} \\
 \text{Sum} &= x + (x + 2) + (x + 4) + (x + 6) \\
 &= x + x + 2 + x + 4 + x + 6 \\
 &= 4x + 12
 \end{aligned}$$

$$\begin{aligned}
 80. \quad \text{Sum} &= 20 + \text{second integer.} \\
 \text{Sum} &= 20 + (x + 1) \\
 &= 20 + x + 1 \\
 &= x + 21
 \end{aligned}$$

$$\begin{aligned}
 82. \quad \text{Let } x &\text{ be an odd integer.} \\
 \text{Then } x + 2 &\text{ is the next odd integer.} \\
 x + (x + 2) + x + (x + 2) &= 4x + 4
 \end{aligned}$$

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

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

$$88. \quad -(x - 1) + x = -x + 1 + x = -x + x + 1 = 1$$

$$\begin{aligned}
 90. \quad (-2)^4 &= (-2)(-2)(-2)(-2) = 16 \\
 -2^4 &= -2 \cdot 2 \cdot 2 \cdot 2 = -16 \\
 (-2)^4 &> -2^4
 \end{aligned}$$

$$\begin{aligned}
 92. \quad (-4)^3 &= (-4)(-4)(-4) = -64 \\
 -4^3 &= -4 \cdot 4 \cdot 4 = -64 \\
 (-4)^3 &= -4^3
 \end{aligned}$$

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

96. answers may vary

98. answers may vary

$$\begin{aligned}
 100. \quad 9x &= 13.5 \\
 \frac{9x}{9} &= \frac{13.5}{9} \\
 x &= 1.5
 \end{aligned}$$

Each dose should be 1.5 milliliters.

$$\begin{aligned}
 102. \quad 4.95y &= -31.185 \\
 \frac{4.95y}{4.95} &= \frac{-31.185}{4.95} \\
 y &= -6.3
 \end{aligned}$$

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

Section 2.4 Practice Exercises

$$\begin{aligned}
 1. \quad 2(4a - 9) + 3 &= 5a - 6 \\
 8a - 18 + 3 &= 5a - 6 \\
 8a - 15 &= 5a - 6 \\
 8a - 15 - 5a &= 5a - 6 - 5a \\
 3a - 15 &= -6 \\
 3a - 15 + 15 &= -6 + 15 \\
 3a &= 9 \\
 \frac{3a}{3} &= \frac{9}{3} \\
 a &= 3
 \end{aligned}$$

$$\begin{aligned} \text{Check: } 2(4a-9)+3 &= 5a-6 \\ 2[4(3)-9]+3 &\stackrel{?}{=} 5(3)-6 \\ 2(12-9)+3 &\stackrel{?}{=} 15-6 \\ 2(3)+3 &\stackrel{?}{=} 9 \\ 6+3 &\stackrel{?}{=} 9 \\ 9 &= 9 \end{aligned}$$

The solution is 3 or the solution set is {3}.

$$\begin{aligned} 2. \quad 7(x-3) &= -6x \\ 7x-21 &= -6x \\ 7x-21-7x &= -6x-7x \\ -21 &= -13x \\ \frac{-21}{-13} &= \frac{-13x}{-13} \\ \frac{21}{13} &= x \end{aligned}$$

$$\begin{aligned} \text{Check: } 7(x-3) &= -6x \\ 7\left(\frac{21}{13}-3\right) &\stackrel{?}{=} -6\left(\frac{21}{13}\right) \\ 7\left(\frac{21}{13}-\frac{39}{13}\right) &\stackrel{?}{=} -\frac{126}{13} \\ 7\left(-\frac{18}{13}\right) &\stackrel{?}{=} -\frac{126}{13} \\ -\frac{126}{13} &= -\frac{126}{13} \end{aligned}$$

The solution is $\frac{21}{13}$.

$$\begin{aligned} 3. \quad \frac{3}{5}x-2 &= \frac{2}{3}x-1 \\ 15\left(\frac{3}{5}x-2\right) &= 15\left(\frac{2}{3}x-1\right) \\ 15\left(\frac{3}{5}x\right)-15(2) &= 15\left(\frac{2}{3}x\right)-15(1) \\ 9x-30 &= 10x-15 \\ 9x-30-9x &= 10x-15-9x \\ -30 &= x-15 \\ -30+15 &= x-15+15 \\ -15 &= x \end{aligned}$$

$$\begin{aligned} \text{Check: } \frac{3}{5}x-2 &= \frac{2}{3}x-1 \\ \frac{3}{5}\cdot-15-2 &\stackrel{?}{=} \frac{2}{3}\cdot-15-1 \\ -9-2 &\stackrel{?}{=} -10-1 \\ -11 &= -11 \end{aligned}$$

The solution is -15.

$$\begin{aligned} 4. \quad \frac{4(y+3)}{3} &= 5y-7 \\ 3\cdot\frac{4(y+3)}{3} &= 3\cdot(5y-7) \\ 4(y+3) &= 3(5y-7) \\ 4y+12 &= 15y-21 \\ 4y+12-4y &= 15y-21-4y \\ 12 &= 11y-21 \\ 12+21 &= 11y-21+21 \\ 33 &= 11y \\ \frac{33}{11} &= \frac{11y}{11} \\ 3 &= y \end{aligned}$$

To check, replace y with 3 in the original equation. The solution is 3.

$$\begin{aligned} 5. \quad 0.35x+0.09(x+4) &= 0.30(12) \\ 100[0.35x+0.09(x+4)] &= 100[0.30(12)] \\ 35x+9(x+4) &= 3(12) \\ 35x+9x+36 &= 36 \\ 44x+36 &= 36 \\ 44x+36-36 &= 36-36 \\ 44x &= 0 \\ \frac{44x}{44} &= \frac{0}{44} \\ x &= 0 \end{aligned}$$

To check, replace x with 0 in the original equation. The solution is 0.

$$\begin{aligned} 6. \quad 4(x+4)-x &= 2(x+11)+x \\ 4x+16-x &= 2x+22+x \\ 3x+16 &= 3x+22 \\ 3x+16-3x &= 3x+22-3x \\ 16 &= 22 \end{aligned}$$

There is no solution.

$$\begin{aligned} 7. \quad 12x-18 &= 9(x-2)+3x \\ 12x-18 &= 9x-18+3x \\ 12x-18 &= 12x-18 \\ 12x-18+18 &= 12x-18+18 \\ 12x &= 12x \\ 12x-12x &= 12x-12x \\ 0 &= 0 \end{aligned}$$

The solution is all real numbers.

Calculator Explorations

1. Solution ($-24 = -24$)
2. Solution ($-4 = -4$)
3. Not a solution ($19.4 \neq 10.4$)

4. Not a solution ($-11.9 \neq -60.1$)
5. Solution ($17,061 = 17,061$)
6. Solution ($-316 = -316$)

Vocabulary, Readiness & Video Check 2.4

1. $x = -7$ is an equation.
2. $x - 7$ is an expression.
3. $4y - 6 + 9y + 1$ is an expression.
4. $4y - 6 = 9y + 1$ is an equation.
5. $\frac{1}{x} - \frac{x-1}{8}$ is an expression.
6. $\frac{1}{x} - \frac{x-1}{8} = 6$ is an equation.
7. $0.1x + 9 = 0.2x$ is an equation.
8. $0.1x^2 + 9y - 0.2x^2$ is an expression.
9. 3; distributive property, addition property of equality, multiplication property of equality
10. Because both sides have more than one term, you need to apply the distributive property to make sure you multiply every single term in the equation by the LCD.
11. The number of decimal places in each number helps you determine what power of 10 you can multiply through by so you are no longer dealing with decimals.
12. When solving a linear equation and all variable terms, subtract out:
 - a. If you have a true statement, then the equation has all real numbers as a solution.
 - b. If you have a false statement, then the equation has no solution.

Exercise Set 2.4

2.
$$\begin{aligned} -3x+1 &= -2(4x+2) \\ -3x+1 &= -8x-4 \\ -3x+1-1 &= -8x-4-1 \\ -3x &= -8x-5 \\ -3x+8x &= -8x-5+8x \\ 5x &= -5 \\ \frac{5x}{5} &= \frac{-5}{5} \\ x &= -1 \end{aligned}$$
4.
$$\begin{aligned} 15x-5 &= 7+12x \\ 15x-5+5 &= 7+12x+5 \\ 15x &= 12+12x \\ 15x-12x &= 12+12x-12x \\ 3x &= 12 \\ \frac{3x}{3} &= \frac{12}{3} \\ x &= 4 \end{aligned}$$
6.
$$\begin{aligned} -(5x-10) &= 5x \\ -5x+10 &= 5x \\ -5x+10+5x &= 5x+5x \\ 10 &= 10x \\ \frac{10}{10} &= \frac{10x}{10} \\ 1 &= x \end{aligned}$$
8.
$$\begin{aligned} 3(2-5x)+4(6x) &= 12 \\ 6-15x+24x &= 12 \\ 6+9x &= 12 \\ 6-6+9x &= 12-6 \\ 9x &= 6 \\ \frac{9x}{9} &= \frac{6}{9} \\ x &= \frac{2}{3} \end{aligned}$$
10.
$$\begin{aligned} -4(n-4)-23 &= -7 \\ -4n+16-23 &= -7 \\ -4n-7 &= -7 \\ -4n-7+7 &= -7+7 \\ -4n &= 0 \\ \frac{-4n}{-4} &= \frac{0}{-4} \\ n &= 0 \end{aligned}$$

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

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

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

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

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

$$\begin{aligned}
 22. \quad & 0.40x + 0.06(30) = 9.8 \\
 & 100[0.40x + 0.06(30)] = 100(9.8) \\
 & 40x + 6(30) = 980 \\
 & 40x + 180 = 980 \\
 & 40x + 180 - 180 = 980 - 180 \\
 & 40x = 800 \\
 & \frac{40x}{40} = \frac{800}{40} \\
 & x = 20
 \end{aligned}$$

$$\begin{aligned}
 24. \quad & \frac{3(y+3)}{5} = 2y + 6 \\
 & 5\left[\frac{3(y+3)}{5}\right] = 5[2y + 6] \\
 & 3(y+3) = 10y + 30 \\
 & 3y + 9 = 10y + 30 \\
 & 3y - 10y + 9 = 10y - 10y + 30 \\
 & -7y + 9 = 30 \\
 & -7y + 9 - 9 = 30 - 9 \\
 & -7y = 21 \\
 & \frac{-7y}{-7} = \frac{21}{-7} \\
 & y = -3
 \end{aligned}$$

$$\begin{aligned}
 26. \quad & \frac{5}{2}x - 1 = x + \frac{1}{4} \\
 & 4\left(\frac{5}{2}x - 1\right) = 4\left(x + \frac{1}{4}\right) \\
 & 10x - 4 = 4x + 1 \\
 & 10x - 4x - 4 = 4x - 4x + 1 \\
 & 6x - 4 = 1 \\
 & 6x - 4 + 4 = 1 + 4 \\
 & 6x = 5 \\
 & \frac{6x}{6} = \frac{5}{6} \\
 & x = \frac{5}{6}
 \end{aligned}$$

$$\begin{aligned}
 28. \quad & 0.60(z - 300) + 0.05z = 0.70z - 205 \\
 & 100[0.60(z - 300) + 0.05z] = 100[0.70z - 205] \\
 & 60(z - 300) + 5z = 70z - 20,500 \\
 & 60z - 18,000 + 5z = 70z - 20,500 \\
 & 65z - 18,000 = 70z - 20,500 \\
 & 65z - 70z - 18,000 = 70z - 70z - 20,500 \\
 & -5z - 18,000 = -20,500 \\
 & -5z - 18,000 + 18,000 = -20,500 + 18,000 \\
 & -5z = -2500 \\
 & \frac{-5z}{-5} = \frac{-2500}{-5} \\
 & z = 500
 \end{aligned}$$

$$\begin{aligned}
 30. \quad & 14x + 7 = 7(2x + 1) \\
 & 14x + 7 = 14x + 7 \\
 & 14x + 7 - 14x = 14x + 7 - 14x \\
 & 7 = 7 \\
 & \text{All real numbers are solutions.}
 \end{aligned}$$

$$\begin{aligned}
 32. \quad & \frac{x}{3} - 2 = \frac{x}{3} \\
 & 3\left(\frac{x}{3} - 2\right) = 3\left(\frac{x}{3}\right) \\
 & x - 6 = x \\
 & x - x - 6 = x - x \\
 & -6 = 0 \\
 & \text{There is no solution.}
 \end{aligned}$$

$$\begin{aligned}
 34. \quad & 2(x - 5) = 2x + 10 \\
 & 2x - 10 = 2x + 10 \\
 & 2x - 2x - 10 = 2x - 2x + 10 \\
 & -10 = 10 \\
 & \text{There is no solution.}
 \end{aligned}$$

$$\begin{aligned}
 36. \quad & -5(4y - 3) + 2 = -20y + 17 \\
 & -20y + 15 + 2 = -20y + 17 \\
 & -20y + 17 = -20y + 17 \\
 & -20y + 17 + 20y = -20y + 17 + 20y \\
 & 17 = 17 \\
 & \text{All real numbers are solutions.}
 \end{aligned}$$

$$\begin{aligned}
 38. \quad & \frac{4(5 - w)}{3} = -w \\
 & 3\left[\frac{4(5 - w)}{3}\right] = 3(-w) \\
 & 4(5 - w) = -3w \\
 & 20 - 4w = -3w \\
 & 20 - 4w + 4w = -3w + 4w \\
 & 20 = w
 \end{aligned}$$

$$\begin{aligned}
 40. \quad & -(4a - 7) - 5a = 10 + a \\
 & -4a + 7 - 5a = 10 + a \\
 & -9a + 7 = 10 + a \\
 & -9a - a + 7 = 10 + a - a \\
 & -10a + 7 = 10 \\
 & -10a + 7 - 7 = 10 - 7 \\
 & -10a = 3 \\
 & \frac{-10a}{-10} = \frac{3}{-10} \\
 & a = -\frac{3}{10}
 \end{aligned}$$

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

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

$$\begin{aligned}
 46. \quad & 0.9x - 4.1 = 0.4 \\
 & 10(0.9x - 4.1) = 10(0.4) \\
 & 9x - 41 = 4 \\
 & 9x - 41 + 41 = 4 + 41 \\
 & 9x = 45 \\
 & \frac{9x}{9} = \frac{45}{9} \\
 & x = 5
 \end{aligned}$$

$$48. \quad 3(2x-1)+5=6x+2$$

$$6x-3+5=6x+2$$

$$6x+2=6x+2$$

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

$$2=2$$

All real numbers are solutions.

$$50. \quad 4(4y+2)=2(1+6y)+8$$

$$16y+8=2+12y+8$$

$$16y+8=10+12y$$

$$16y+8-8=10+12y-8$$

$$16y=2+12y$$

$$16y-12y=2+12y-12y$$

$$4y=2$$

$$\frac{4y}{4}=\frac{2}{4}$$

$$y=\frac{1}{2}$$

$$52. \quad \frac{7}{8}x+\frac{1}{4}=\frac{3}{4}x$$

$$8\left(\frac{7}{8}x+\frac{1}{4}\right)=8\left(\frac{3}{4}x\right)$$

$$7x+2=6x$$

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

$$2=-x$$

$$\frac{2}{-1}=\frac{-x}{-1}$$

$$-2=x$$

$$54. \quad \frac{x}{5}-7=\frac{x}{3}-5$$

$$15\left(\frac{x}{5}-7\right)=15\left(\frac{x}{3}-5\right)$$

$$3x-105=5x-75$$

$$3x-105-3x=5x-75-3x$$

$$-105=2x-75$$

$$-105+75=2x-75+75$$

$$-30=2x$$

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

$$-15=x$$

$$56. \quad 4(2+x)+1=7x-3(x-2)$$

$$8+4x+1=7x-3x+6$$

$$9+4x=4x+6$$

$$9+4x-4x=4x-4x+6$$

$$9=6$$

There is no solution.

$$58. \quad -0.01(5x+4)=0.04-0.01(x+4)$$

$$100[-0.01(5x+4)]=100[0.04-0.01(x+4)]$$

$$-(5x+4)=4-1(x+4)$$

$$-5x-4=4-x-4$$

$$-5x-4=-x$$

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

$$-4x-4=0$$

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

$$-4x=4$$

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

$$x=-1$$

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

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

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

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

$$6=11x-16$$

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

$$22=11x$$

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

$$2=x$$

$$62. \quad 7n+5=10n-10$$

$$7n+5-5=10n-10-5$$

$$7n=10n-15$$

$$7n-10n=10n-15-10n$$

$$-3n=-15$$

$$\frac{-3n}{-3}=\frac{-15}{-3}$$

$$n=5$$

$$64. \quad 0.2x-0.1=0.6x-2.1$$

$$10(0.2x-0.1)=10(0.6x-2.1)$$

$$2x-1=6x-21$$

$$2x-6x-1=6x-6x-21$$

$$-4x-1=-21$$

$$-4x-1+1=-21+1$$

$$-4x=-20$$

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

$$x=5$$

$$\begin{aligned}
 66. \quad & 0.03(2m+7) = 0.06(5+m) - 0.09 \\
 & 100[0.03(2m+7)] = 100[0.06(5+m) - 0.09] \\
 & 3(2m+7) = 6(5+m) - 9 \\
 & 6m+21 = 30+6m-9 \\
 & 6m+21 = 21+6m \\
 & 6m-6m+21 = 21+6m-6m \\
 & 21 = 21
 \end{aligned}$$

All real numbers are solutions.

$$\begin{array}{rcl}
 68. & 3 & \text{times} & \text{a number} \\
 & \downarrow & \downarrow & \downarrow \\
 & 3 & \cdot & x & = 3x
 \end{array}$$

$$\begin{array}{rcl}
 70. & 8 & \text{minus} & \text{twice} \\
 & \downarrow & \downarrow & \downarrow \\
 & 8 & - & 2x & \text{a number}
 \end{array}$$

$$\begin{array}{rcl}
 72. & \text{the quotient} & & \text{the difference} \\
 & \text{of } -12 & \text{and} & \text{of a number} \\
 & \downarrow & \downarrow & \downarrow \\
 & -12 & \div & (x-3) & = \frac{-12}{x-3}
 \end{array}$$

$$\begin{aligned}
 74. \quad & x + (7x - 9) = x + 7x - 9 = 8x - 9 \\
 & \text{The total length is } (8x - 9) \text{ feet.}
 \end{aligned}$$

$$\begin{aligned}
 76. \quad \text{a.} \quad & x+3 = x+5 \\
 & x+3-x = x+5-x \\
 & 3 = 5 \\
 & \text{There is no solution.}
 \end{aligned}$$

b. answers may vary

c. answers may vary

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

There is no solution. The answer is B.

$$\begin{aligned}
 80. \quad & x-11x-3 = -10x-1-2 \\
 & -10x-3 = -10x-3 \\
 & -10x-3+10x = -10x-3+10x \\
 & -3 = -3 \\
 & \text{All real numbers are solutions. The answer is A.}
 \end{aligned}$$

$$\begin{aligned}
 82. \quad & -x+15 = x+15 \\
 & -x+15+x = x+15+x \\
 & 15 = 2x+15 \\
 & 15-15 = 2x+15-15 \\
 & 0 = 2x \\
 & \frac{0}{2} = \frac{2x}{2} \\
 & 0 = x
 \end{aligned}$$

The answer is C.

84. answers may vary

86. a. Since the perimeter is the sum of the lengths of the sides, $x + (2x + 1) + (3x - 2) = 35$.

$$\begin{aligned}
 \text{b.} \quad & x + 2x + 1 + 3x - 2 = 35 \\
 & 6x - 1 = 35 \\
 & 6x - 1 + 1 = 35 + 1 \\
 & 6x = 36 \\
 & \frac{6x}{6} = \frac{36}{6} \\
 & x = 6
 \end{aligned}$$

$$\begin{aligned}
 \text{c.} \quad & 2x + 1 = 2(6) + 1 = 13 \\
 & 3x - 2 = 3(6) - 2 = 16 \\
 & \text{The lengths are } x = 6 \text{ meters,} \\
 & 2x + 1 = 13 \text{ meters and } 3x - 2 = 16 \text{ meters.}
 \end{aligned}$$

88. answers may vary

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

$$\begin{aligned}
 92. \quad & 0.127x - 2.685 = 0.027x - 2.38 \\
 & 1000(0.127x - 2.685) = 1000(0.027x - 2.38) \\
 & 127x - 2685 = 27x - 2380 \\
 & 127x - 27x - 2685 = 27x - 27x - 2380 \\
 & 100x - 2685 = -2380 \\
 & 100x - 2685 + 2685 = -2380 + 2685 \\
 & 100x = 305 \\
 & \frac{100x}{100} = \frac{305}{100} \\
 & x = 3.05
 \end{aligned}$$

$$\begin{aligned}
 94. \quad t^2 - 6t &= t(8+t) \\
 t^2 - 6t &= 8t + t^2 \\
 t^2 - t^2 - 6t &= 8t + t^2 - t^2 \\
 -6t &= 8t \\
 -6t + 6t &= 8t + 6t \\
 0 &= 14t \\
 \frac{0}{14} &= \frac{14t}{14} \\
 0 &= t
 \end{aligned}$$

$$\begin{aligned}
 96. \quad y^2 - 4y + 10 &= y(y-5) \\
 y^2 - 4y + 10 &= y^2 - 5y \\
 y^2 - y^2 - 4y + 10 &= y^2 - y^2 - 5y \\
 -4y + 10 &= -5y \\
 -4y + 5y + 10 &= -5y + 5y \\
 y + 10 &= 0 \\
 y + 10 - 10 &= -10 \\
 y &= -10
 \end{aligned}$$

Integrated Review

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

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

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

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

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

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

$$\begin{aligned}
 7. \quad \frac{2}{3}x &= 9 \\
 \frac{3}{2}\left(\frac{2}{3}x\right) &= \frac{3}{2}(9) \\
 x &= \frac{27}{2}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad \frac{4}{5}z &= 10 \\
 \frac{5}{4}\left(\frac{4}{5}z\right) &= \frac{5}{4}(10) \\
 z &= \frac{25}{2}
 \end{aligned}$$

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

$$\begin{aligned}
 10. \quad \frac{y}{-8} &= 8 \\
 -8\left(\frac{y}{-8}\right) &= -8(8) \\
 y &= -64
 \end{aligned}$$

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

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

$$\begin{aligned}
 13. \quad & 2x - 7 = 2x - 27 \\
 & 2x - 2x - 7 = 2x - 2x - 27 \\
 & \quad -7 = -27 \\
 & \text{There is no solution.}
 \end{aligned}$$

$$\begin{aligned}
 14. \quad & 3 + 8y = 8y - 2 \\
 & 3 + 8y - 8y = 8y - 8y - 2 \\
 & \quad 3 = -2 \\
 & \text{There is no solution.}
 \end{aligned}$$

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

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

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

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

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

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

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

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

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

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

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

All real numbers are solutions.

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

All real numbers are solutions.

$$\begin{aligned}
 27. \quad 0.02(6t-3) &= 0.04(t-2)+0.02 \\
 100[0.02(6t-3)] &= 100[0.04(t-2)+0.02] \\
 2(6t-3) &= 4(t-2)+2 \\
 12t-6 &= 4t-8+2 \\
 12t-6 &= 4t-6 \\
 12t-4t-6 &= 4t-4t-6 \\
 8t-6 &= -6 \\
 8t-6+6 &= -6+6 \\
 8t &= 0 \\
 \frac{8t}{8} &= \frac{0}{8} \\
 t &= 0
 \end{aligned}$$

$$\begin{aligned}
 28. \quad 0.03(m+7) &= 0.02(5-m)+0.03 \\
 100[0.03(m+7)] &= 100[0.02(5-m)+0.03] \\
 3(m+7) &= 2(5-m)+3 \\
 3m+21 &= 10-2m+3 \\
 3m+21 &= 13-2m \\
 3m+2m+21 &= 13-2m+2m \\
 5m+21 &= 13 \\
 5m+21-21 &= 13-21 \\
 5m &= -8 \\
 \frac{5m}{5} &= \frac{-8}{5} \\
 m &= -\frac{8}{5} = -1.6
 \end{aligned}$$

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

$$\begin{aligned}
 30. \quad -4x &= \frac{5(1-x)}{6} \\
 6(-4x) &= 6\left[\frac{5(1-x)}{6}\right] \\
 -24x &= 5-5x \\
 -24x+5x &= 5-5x+5x \\
 -19x &= 5 \\
 \frac{-19x}{-19} &= \frac{5}{-19} \\
 x &= -\frac{5}{19}
 \end{aligned}$$

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

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

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

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

$$\begin{aligned}
 35. \quad \frac{1}{10}(3x-7) &= \frac{3}{10}x+5 \\
 10\left[\frac{1}{10}(3x-7)\right] &= 10\left(\frac{3}{10}x+5\right) \\
 3x-7 &= 3x+50 \\
 3x-7-3x &= 3x+50-3x \\
 -7 &= 50
 \end{aligned}$$

There is no solution.

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

There is no solution.

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

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

Section 2.5 Practice Exercises

1. Let x = 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 = the number.

$$\begin{aligned}
 3x-4 &= 2(x-1) \\
 3x-4 &= 2x-2 \\
 3x-4-2x &= 2x-2-2x \\
 x-4 &= -2 \\
 x-4+4 &= -2+4 \\
 x &= 2
 \end{aligned}$$

The number is 2.

3. Let x = the length of short piece,
then $4x$ = the length of long piece.
 $x + 4x = 45$
 $5x = 45$
 $\frac{5x}{5} = \frac{45}{5}$
 $x = 9$
 $4x = 4(9) = 36$
 The short piece is 9 inches and the long piece is 36 inches.

4. Let x = number of Republican governors, then
 $x - 7$ = number of Democratic governors.
 $x + x - 7 = 49$
 $2x - 7 = 49$
 $2x - 7 + 7 = 49 + 7$
 $2x = 56$
 $\frac{2x}{2} = \frac{56}{2}$
 $x = 28$
 $x - 7 = 28 - 7 = 21$
 There were 28 Republican and 21 Democratic governors.

5. x = degree measure of first angle
 $3x$ = degree measure of second angle
 $x + 55$ = degree measure of third angle
 $x + 3x + (x + 55) = 180$
 $5x + 55 = 180$
 $5x + 55 - 55 = 180 - 55$
 $5x = 125$
 $\frac{5x}{5} = \frac{125}{5}$
 $x = 25$
 $3x = 3(25) = 75$
 $x + 55 = 25 + 55 = 80$
 The measures of the angles are 25° , 75° , and 80° .

6. Let x = the first even integer, then
 $x + 2$ = the second even integer, and
 $x + 4$ = the third even integer.
 $x + (x + 2) + (x + 4) = 144$
 $3x + 6 = 144$
 $3x + 6 - 6 = 144 - 6$
 $3x = 138$
 $\frac{3x}{3} = \frac{138}{3}$
 $x = 46$
 $x + 2 = 46 + 2 = 48$
 $x + 4 = 46 + 4 = 50$
 The integers are 46, 48, and 50.

Vocabulary, Readiness & Video Check 2.5

- $2x$; $2x - 31$
- $3x$; $3x + 17$
- $x + 5$; $2(x + 5)$
- $x - 11$; $7(x - 11)$
- $20 - y$; $\frac{20 - y}{3}$ or $(20 - y) \div 3$
- $-10 + y$; $\frac{-10 + y}{9}$ or $(-10 + y) \div 9$
- in the statement of the application
- The original application asks for the measure of two supplementary angles. The solution of $x = 43$ only gives us the measure of one of the angles.
- That the 3 angle measures are consecutive even integers and that they sum to 180° .

Exercise Set 2.5

2. Let x = the number.
 $3x - 1 = 2x$
 $3x - 1 - 3x = 2x - 3x$
 $3x - 1 - 3x = 2x - 3x$
 $-1 = -x$
 $\frac{-1}{-1} = \frac{-x}{-1}$
 $1 = x$
 The number is 1.
4. Let x = the number.
 $4x + (-2) = 5x + (-2)$
 $4x - 2 = 5x - 2$
 $4x - 2 + 2 = 5x - 2 + 2$
 $4x = 5x$
 $4x - 4x = 5x - 4x$
 $0 = x$
 The number is 0.

6. Let
- x
- = the number.

$$5[x + (-1)] = 6(x - 5)$$

$$5x + 5(-1) = 6x + 6(-5)$$

$$5x - 5 = 6x - 30$$

$$5x - 5x - 5 = 6x - 5x - 30$$

$$-5 = x - 30$$

$$-5 + 30 = x - 30 + 30$$

$$25 = x$$

The number is 25.

8. Let
- x
- = the number.

$$2(x - 4) = x - \frac{1}{4}$$

$$2x - 8 = x - \frac{1}{4}$$

$$4(2x - 8) = 4\left(x - \frac{1}{4}\right)$$

$$8x - 32 = 4x - 1$$

$$8x - 4x - 32 = 4x - 4x - 1$$

$$4x - 32 = -1$$

$$4x - 32 + 32 = -1 + 32$$

$$4x = 31$$

$$\frac{4x}{4} = \frac{31}{4}$$

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

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

$$x + 3x + 2 + 7x = 46$$

$$11x + 2 = 46$$

$$11x + 2 - 2 = 46 - 2$$

$$11x = 44$$

$$\frac{11x}{11} = \frac{44}{11}$$

$$x = 4$$

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

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

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

12. Let
- x
- be the length of the shorter piece. Then
- $3x$
- is the length of the 2nd piece and the 3rd piece. The sum of the lengths is 21 feet.

$$x + 3x + 3x = 21$$

$$7x = 21$$

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

$$x = 3$$

$$3x = 3(3) = 9$$

The shorter piece is 3 feet and the longer pieces are each 9 feet.

- 14.
- $x + x + 39,771 = 43,265$

$$2x + 39,771 = 43,265$$

$$2x + 39,771 - 39,771 = 43,265 - 39,771$$

$$2x = 3494$$

$$\frac{2x}{2} = \frac{3494}{2}$$

$$x = 1747$$

In 2014, 1747 screens were analog.

16. 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° .

18. Three consecutive integers:

Integer: x

Next integers: $x + 1, x + 2$

Sum of the second and third consecutive integers, simplified: $(x + 1) + (x + 2) = 2x + 3$

20. Three consecutive odd integers:

Odd integer: x

Next integers: $x + 2, x + 4$

Sum of the three consecutive odd integers, simplified: $x + (x + 2) + (x + 4) = 3x + 6$

22. Four consecutive integers:

Integer: x

Next integers: $x + 1, x + 2, x + 3$

Sum of the first and fourth consecutive integers, simplified: $x + (x + 3) = 2x + 3$

24. Three consecutive even integers:

Even integer: x

Next integers: $x + 2, x + 4$

Sum of the three consecutive even integers, simplified: $x + (x + 2) + (x + 4) = 3x + 6$

- 26.** Let x = the number of one room
and $x + 2$ = the number of the other.
 $x + x + 2 = 654$
 $2x + 2 = 654$
 $2x + 2 - 2 = 654 - 2$
 $2x = 652$
 $\frac{2x}{2} = \frac{652}{2}$
 $x = 326$
 $x + 2 = 326 + 2 = 328$
 The room numbers are 326 and 328.
- 28.** Let x = code for Mali Republic,
 $x + 2$ = code for Cote d'Ivoire,
 and $x + 4$ = code for Niger.
 $x + x + 2 + x + 4 = 675$
 $3x + 6 = 675$
 $3x + 6 - 6 = 675 - 6$
 $3x = 669$
 $\frac{3x}{3} = \frac{669}{3}$
 $x = 223$
 $x + 2 = 223 + 2 = 225$
 $x + 4 = 223 + 4 = 227$
 The codes are: 223 for Mali, 225 for Cote d'Ivoire, 227 for Niger.
- 30.** 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.
- 32.** 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.
 $x + 5x + 1 = 25$
 $6x + 1 = 25$
 $6x + 1 - 1 = 25 - 1$
 $6x = 24$
 $\frac{6x}{6} = \frac{24}{6}$
 $x = 4$
 $5x + 1 = 5(4) + 1 = 20 + 1 = 21$
 The pieces measure 4 feet and 21 feet.
- 34.** Let x = the number.
 $9 = 2x - 10$
 $9 + 10 = 2x - 10 + 10$
 $19 = 2x$
 $\frac{19}{2} = \frac{2x}{2}$
 $\frac{19}{2} = x$
 The number is $\frac{19}{2}$.
- 36.** Let x = species of grasshoppers,
 then $20x$ = species of beetles.
 $x + 20x = 420,000$
 $21x = 420,000$
 $\frac{21x}{21} = \frac{420,000}{21}$
 $x = 20,000$
 $20x = 20(20,000) = 400,000$
 There are 400,000 species of beetles and 20,000 species of grasshoppers.
- 38.** Let x = the measure of the smallest angle,
 $x + 2$ = the measure of the second,
 $x + 4$ = the measure of the third, and
 $x + 6$ = the measure of the fourth.
 $x + x + 2 + x + 4 + x + 6 = 360$
 $4x + 12 = 360$
 $4x + 12 - 12 = 360 - 12$
 $4x = 348$
 $\frac{4x}{4} = \frac{348}{4}$
 $x = 87$
 $x + 2 = 87 + 2 = 89$
 $x + 4 = 87 + 4 = 91$
 $x + 6 = 87 + 6 = 93$
 The angles are 87° , 89° , 91° , and 93° .
- 40.** Let x = first odd integer,
 then $x + 2$ = next odd integer,
 and $x + 4$ = third consecutive odd integer.
 $x + (x + 2) + (x + 4) = 51$
 $3x + 6 = 51$
 $3x + 6 - 6 = 51 - 6$
 $3x = 45$
 $\frac{3x}{3} = \frac{45}{3}$
 $x = 15$
 $x + 2 = 15 + 2 = 17$
 $x + 4 = 15 + 4 = 19$
 The code is 15, 17, 19.

42. Let
- $x =$
- the number.

$$\begin{aligned} 2(x+6) &= 3(x+4) \\ 2x+12 &= 3x+12 \\ 2x+12-12 &= 3x+12-12 \\ 2x &= 3x \\ 2x-2x &= 3x-2x \\ 0 &= x \end{aligned}$$

The number is 0.

44. Let
- $x =$
- the measure of the first angle then
- $2x - 3 =$
- the measure of the other.

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

$$2x - 3 = 2(31) - 3 = 59$$

The angles are 31° and 59° .

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

$$\begin{aligned} \frac{1}{5} + 2x - 2x &= 3x - \frac{4}{5} - 2x \\ \frac{1}{5} &= x - \frac{4}{5} \\ \frac{1}{5} + \frac{4}{5} &= x - \frac{4}{5} + \frac{4}{5} \\ \frac{5}{5} &= x \\ 1 &= x \end{aligned}$$

The number is 1.

48. Let
- $x =$
- the number.

$$\begin{aligned} \frac{3}{4} + 3x &= 2x - \frac{1}{2} \\ 4\left(\frac{3}{4} + 3x\right) &= 4\left(2x - \frac{1}{2}\right) \\ 3 + 12x &= 8x - 2 \\ 3 + 12x - 8x &= 8x - 2 - 8x \\ 3 + 4x &= -2 \\ 3 + 4x - 3 &= -2 - 3 \\ 4x &= -5 \\ \frac{4x}{4} &= \frac{-5}{4} \\ x &= -\frac{5}{4} \end{aligned}$$

The number is $-\frac{5}{4}$.

50. Let
- $x =$
- floor space of Empire State Building, then
- $3x =$
- floor space of the Pentagon.

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

$$3x = 3(2175) = 6525$$

The Empire State Building has

2175 thousand square feet and the Pentagon has 6525 thousand square feet.

52. Let
- $x =$
- the number.

$$\begin{aligned} \frac{7}{8} \cdot x &= \frac{1}{2} \\ \frac{8}{7} \cdot \frac{7}{8} \cdot x &= \frac{8}{7} \cdot \frac{1}{2} \\ x &= \frac{4}{7} \end{aligned}$$

The number is $\frac{4}{7}$.

54. Let
- $x =$
- first integer (smallest piece) then
- $x + 2 =$
- second integer (middle piece) and
- $x + 4 =$
- third integer (longest piece)

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

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

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

The pieces measure 14 inches, 16 inches, and 18 inches.

56. Let
- $x =$
- smallest angle, then
- $4x =$
- largest angles.

$$\begin{aligned} x+4x+4x &= 180 \\ 9x &= 180 \\ \frac{9x}{9} &= \frac{180}{9} \\ x &= 20 \end{aligned}$$

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

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

58. Let x = length of first piece,
then $5x$ = length of second piece,
and $6x$ = length of third piece.

$$x + 5x + 6x = 48$$

$$12x = 48$$

$$\frac{12x}{12} = \frac{48}{12}$$

$$x = 4$$

$$5x = 5(4) = 20$$

$$6x = 6(4) = 24$$

The first piece is 4 feet, the second piece is 20 feet, and the third piece is 24 feet.

60. The bars ending between 3 and 5 represent the games Destiny and Grand Theft Auto V, so those games sold between 3 and 5 million copies in 2014.

62. Let x represent the sales of Minecraft, in millions. Then $x + 0.6$ represents the sales of Grand Theft Auto V.

$$x + x + 0.6 = 6$$

$$2x + 0.6 = 6$$

$$2x + 0.6 - 0.6 = 6 - 0.6$$

$$2x = 5.4$$

$$\frac{2x}{2} = \frac{5.4}{2}$$

$$x = 2.7$$

$$x + 0.6 = 2.7 + 0.6 = 3.3$$

Minecraft sold 2.7 million copies and Grand Theft Auto V sold 3.3 million copies.

64. answers may vary

66. Replace B by 14 and h by 22.

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

68. Replace r by 15 and t by 2.

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

70. 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° .

72. 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.

74. answers may vary

76. answers may vary

78. Measurements may vary. Rectangle (b) best approximates the shape of a golden rectangle.

Section 2.6 Practice Exercises

1. Let $d = 580$ and $r = 5$.

$$d = r \cdot t$$

$$580 = 5t$$

$$\frac{580}{5} = \frac{5t}{5}$$

$$116 = t$$

It takes 116 seconds or 1 minute 56 seconds.

2. Let $l = 40$ and $P = 98$.

$$P = 2l + 2w$$

$$98 = 2 \cdot 40 + 2w$$

$$98 = 80 + 2w$$

$$98 - 80 = 80 + 2w - 80$$

$$18 = 2w$$

$$\frac{18}{2} = \frac{2w}{2}$$

$$9 = w$$

The dog run is 9 feet wide.

3. Let $C = 8$.

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

$$F = \frac{9}{5} \cdot 8 + 32$$

$$F = \frac{72}{5} + \frac{160}{5}$$

$$F = \frac{232}{5} = 46.4$$

The equivalent temperature is 46.4°F .

4. Let w = width of sign, then
 $5w + 3$ = length of sign.
 $P = 2l + 2w$
 $66 = 2(5w + 3) + 2w$
 $66 = 10w + 6 + 2w$
 $66 = 12w + 6$
 $66 - 6 = 12w + 6 - 6$
 $60 = 12w$
 $\frac{60}{12} = \frac{12w}{12}$
 $5 = w$
 $5w + 3 = 5(5) + 3 = 28$
 The sign has length 28 inches and width 5 inches.

5. $I = PRT$
 $\frac{I}{PT} = \frac{PRT}{PT}$
 $\frac{I}{PT} = R$ or $R = \frac{I}{PT}$

6. $H = 5as + 10a$
 $H - 10a = 5as + 10a - 10a$
 $H - 10a = 5as$
 $\frac{H - 10a}{5a} = \frac{5as}{5a}$
 $\frac{H - 10a}{5a} = s$ or $s = \frac{H - 10a}{5a}$

7. $N = F + d(n - 1)$
 $N - F = F + d(n - 1) - F$
 $N - F = d(n - 1)$
 $\frac{N - F}{n - 1} = \frac{d(n - 1)}{n - 1}$
 $\frac{N - F}{n - 1} = d$ or $d = \frac{N - F}{n - 1}$

8. $A = \frac{1}{2}a(b + B)$
 $2 \cdot A = 2 \cdot \frac{1}{2}a(b + B)$
 $2A = a(b + B)$
 $2A = ab + aB$
 $2A - ab = ab + aB - ab$
 $2A - ab = aB$
 $\frac{2A - ab}{a} = \frac{aB}{a}$
 $\frac{2A - ab}{a} = B$ or $B = \frac{2A - ab}{a}$

Vocabulary, Readiness & Video Check 2.6

1. A formula is an equation that describes known relationships among quantities.
2. This is a distance, rate, and time problem. The distance is given in miles and the time is given in hours, so the rate that we are finding must be in miles per hour (mph).
3. To show that the process of solving this equation for x —dividing both sides by 5, the coefficient of x —is the same process used to solve a formula for a specific variable. Treat whatever is multiplied by that specific variable as the coefficient—the coefficient is all the factors except that specific variable.

Exercise Set 2.6

2. Let $d = 195$ and $t = 3$.
 $d = rt$
 $195 = r(3)$
 $\frac{195}{3} = \frac{3r}{3}$
 $65 = r$
4. Let $l = 14$, $w = 8$, and $h = 3$.
 $V = lwh$
 $V = 14(8)(3)$
 $V = 336$
6. Let $A = 60$, $B = 7$, and $b = 3$.
 $A = \frac{1}{2}h(B + b)$
 $60 = \frac{1}{2}h(7 + 3)$
 $2(60) = 2 \left[\frac{1}{2}h(10) \right]$
 $120 = 10h$
 $\frac{120}{10} = \frac{10h}{10}$
 $12 = h$

8. Let
- $V = 45$
- , and
- $h = 5$
- .

$$V = \frac{1}{3}Ah$$

$$45 = \frac{1}{3}A(5)$$

$$3(45) = 3\left[\frac{1}{3}(5A)\right]$$

$$135 = 5A$$

$$\frac{135}{5} = \frac{5A}{5}$$

$$27 = A$$

10. Let
- $r = 4.5$
- , and
- $\pi \approx 3.14$
- .

$$A = \pi r^2$$

$$A \approx 3.14(4.5)^2$$

$$A \approx 3.14(20.25)$$

$$A \approx 63.6$$

12. Let
- $I = 1,056,000$
- ,
- $R = 0.055$
- , and
- $T = 6$
- .

$$I = PRT$$

$$1,056,000 = P(0.055)(6)$$

$$1,056,000 = 0.33P$$

$$\frac{1,056,000}{0.33} = \frac{0.33P}{0.33}$$

$$3,200,000 = P$$

14. Let
- $r = 3$
- and
- $\pi \approx 3.14$
- .

$$V = \frac{4}{3}\pi r^3$$

$$V \approx \frac{4}{3}(3.14)(3)^3$$

$$V \approx \frac{4}{3}(3.14)(27)$$

$$V \approx \frac{4}{3}(84.78)$$

$$V \approx 113.0$$

 $(V \approx 113.1$ using a calculator.)

$$16. \quad A = \pi ab$$

$$\frac{A}{\pi a} = \frac{\pi ab}{\pi a}$$

$$\frac{A}{\pi a} = b$$

$$18. \quad T = mnr$$

$$\frac{T}{mr} = \frac{mnr}{mr}$$

$$\frac{T}{mr} = n$$

20. $-x + y = 13$

$$-x + x + y = 13 + x$$

$$y = 13 + x$$

22. $A = P + PRT$

$$A - P = P - P + PRT$$

$$A - P = PRT$$

$$\frac{A - P}{PR} = \frac{PRT}{PR}$$

$$\frac{A - P}{PR} = T$$

24. $D = \frac{1}{4}fk$

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

$$4D = fk$$

$$\frac{4D}{f} = \frac{fk}{f}$$

$$\frac{4D}{f} = k$$

26. $PR = x + y + z + w$

$$PR - (x + y + w) = x + y + z + w - (x + y + w)$$

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

$$PR - x - y - w = z$$

28. $S = 4lw + 2wh$

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

$$S - 4lw = 2wh$$

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

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

30. 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.

32. a. $A = \frac{1}{2}bh$

$$A = \frac{1}{2} \cdot 36 \cdot 27$$

$$A = 486$$

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

$P = l_1 + l_2 + l_3$

$P = 27 + 36 + 45$

$P = 108$

- b. The fence has to do with perimeter because it is located around the edge of the property. The grass seed has to do with area because it is located in the middle of the property.

$$\begin{array}{ll}
 \text{34. a. } A = bh & P = 2l_1 + 2l_2 \\
 A = 9.3(7) & P = 2(11.7) + 2(9.3) \\
 A = 65.1 & P = 23.4 + 18.6 \\
 & P = 42
 \end{array}$$

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

- b. The border has to do with the perimeter because it surrounds the edge. The paint has to do with the area because it covers the wall.

36. Let $C = -5$.

$$F = \frac{9}{5}(-5) + 32 = -9 + 32 = 23$$

The equivalent temperature is 23°F.

38. Let $P = 400$ and $l = 2w - 10$.

$$P = 2l + 2w$$

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

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

$$400 = 6w - 20$$

$$400 + 20 = 6w - 20 + 20$$

$$420 = 6w$$

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

$$70 = w$$

$$l = 2w - 10 = 2(70) - 10 = 140 - 10 = 130$$

The length is 130 meters.

40. Let x = the measure of each of the two equal sides, and $x - 2$ = the measure of the third.

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

$$3x - 2 = 22$$

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

$$3x = 24$$

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

$$x = 8$$

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

The shortest side is 6 feet.

42. Let $d = 700$ and $r = 55$.

$$d = rt$$

$$700 = 55t$$

$$\frac{700}{55} = \frac{55t}{55}$$

$$\frac{700}{55} = t$$

$$t = \frac{700}{55} = \frac{140}{11} = 12\frac{8}{11}$$

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

44. Let $r = 4$ and $h = 3$. Use $\pi \approx 3.14$.

$$V = \pi r^2 h$$

$$V \approx (3.14)(4)^2(3)$$

$$\approx (3.14)(16)(3)$$

$$\approx 150.72$$

Let x = number of goldfish and volume per fish = 2.

$$150.72 = 2x$$

$$\frac{150.72}{2} = \frac{2x}{2}$$

$$75.36 = x$$

75 goldfish can be placed in the tank.

46. Use $N = 94$.

$$T = 50 + \frac{N - 40}{4}$$

$$T = 50 + \frac{94 - 40}{4}$$

$$T = 50 + \frac{54}{4}$$

$$T = 50 + 13.5$$

$$T = 63.5$$

The temperature is 63.5° Fahrenheit.

48. Use $T = 65$.

$$T = 50 + \frac{N - 40}{4}$$

$$65 = 50 + \frac{N - 40}{4}$$

$$65 - 50 = 50 + \frac{N - 40}{4} - 50$$

$$15 = \frac{N - 40}{4}$$

$$4 \cdot 15 = 4 \cdot \frac{N - 40}{4}$$

$$60 = N - 40$$

$$60 + 40 = N - 40 + 40$$

$$100 = N$$

There are 100 chirps per minute.

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

52. Let $A = 20$, and $b = 5$.

$$A = \frac{1}{2}bh$$

$$20 = \frac{1}{2}(5)h$$

$$2(20) = 2\left(\frac{5}{2}h\right)$$

$$40 = 5h$$

$$\frac{40}{5} = \frac{5h}{5}$$

$$8 = h$$

The height is 8 feet.

54. Let $r = 4000$. Use $\pi \approx 3.14$.

$$C = 2\pi r \approx 2(3.14)(4000)$$

$$C \approx 25,120$$

The length of rope is 25,120 miles.

56. $x + (2x - 8) + (3x - 12) = 82$

$$6x - 20 = 82$$

$$6x - 20 + 20 = 82 + 20$$

$$6x = 102$$

$$\frac{6x}{6} = \frac{102}{6}$$

$$x = 17$$

$$2x - 8 = 2(17) - 8 = 26$$

$$3x - 12 = 3(17) - 12 = 39$$

The lengths are 17 feet, 26 feet, and 39 feet.

58. $A = 3990$ and $w = 57$.

$$A = lw$$

$$3990 = l \cdot 57$$

$$\frac{3990}{57} = \frac{57l}{57}$$

$$70 = l$$

The length is 70 feet.

60. Let x = the length of a side of the square and $2x - 15$ = the length of a side of the triangle.

$$P(\text{triangle}) = P(\text{square})$$

$$3(2x - 15) = 4x$$

$$6x - 45 = 4x$$

$$6x - 4x - 45 = 4x - 4x$$

$$2x - 45 = 0$$

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

$$2x = 45$$

$$\frac{2x}{2} = \frac{45}{2}$$

$$x = 22.5$$

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

The side of the triangle is 30 units and the side of the square is 22.5 units.

62. Let $d = 150$ and $r = 45$.

$$d = rt$$

$$150 = 45t$$

$$\frac{150}{45} = \frac{45t}{45}$$

$$\frac{150}{45} = t$$

$$t = \frac{150}{45} = \frac{10}{3}$$

The trip will take $\frac{10}{3} = 3\frac{1}{3}$ hours or 3 hours

20 minutes.

He should arrive at 7:20 A.M.

64. Let $F = 78$.

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

$$78 = \frac{9}{5}C + 32$$

$$5(78) = 5\left(\frac{9}{5}C + 32\right)$$

$$390 = 9C + 160$$

$$390 - 160 = 9C + 160 - 160$$

$$230 = 9C$$

$$\frac{230}{9} = \frac{9C}{9}$$

$$\frac{230}{9} = C$$

$$C = \frac{230}{9} = 25\frac{5}{9}$$

The equivalent temperature is $25\frac{5}{9}^{\circ}\text{C}$.

66. Let $C = -10$.

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

The equivalent temperature is 14°F

68. Let $F = -227$.

$$\begin{aligned} C &= \frac{5}{9}(F - 32) \\ C &= \frac{5}{9}(-227 - 32) \approx -144 \end{aligned}$$

The equivalent temperature is -144°C .

70. 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.

72. $8\% = 0.08$

74. $0.5\% = 0.005$

76. $0.03 = 0.03(100\%) = 3\%$

78. $5 = 5(100\%) = 500\%$

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° .

- 84.

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

86. $\diamond \cdot \square + \triangle = \circ$

$$\diamond \cdot \square = \circ - \triangle$$

$$\square = \frac{\circ - \triangle}{\diamond}$$

88. Let $d = 238,860$ and $r = 186,000$.

$$\begin{aligned} d &= rt \\ 238,860 &= 186,000t \\ \frac{238,860}{186,000} &= \frac{186,000t}{186,000} \end{aligned}$$

$$1.3 \approx t$$

It will take 1.3 seconds.

$$\begin{aligned}
 90. \quad & 20 \frac{\text{miles}}{\text{hour}} \\
 & = 20 \frac{\text{miles}}{\text{hour}} \left(\frac{5280 \text{ feet}}{1 \text{ mile}} \right) \left(\frac{1 \text{ hour}}{3600 \text{ seconds}} \right) \\
 & = \frac{88}{3} \text{ feet/second}
 \end{aligned}$$

$$\text{Let } d = 1300 \text{ and } r = \frac{88}{3}.$$

$$\begin{aligned}
 d & = rt \\
 1300 & = \frac{88}{3}t \\
 \frac{3}{88}(1300) & = \frac{3}{88} \left(\frac{88}{3} \right) t \\
 44.3 & \approx t
 \end{aligned}$$

It will take about 44.3 seconds.

$$92. \text{ Use } d = rt \text{ when } d = 25,000 \text{ and } r = 3800.$$

$$\begin{aligned}
 d & = rt \\
 25,000 & = 3800 \cdot t \\
 \frac{25,000}{3800} & = \frac{3800t}{3800} \\
 6.58 & \approx t
 \end{aligned}$$

6 hr and $0.58(60) \approx 35$ min

It would take the Boeing X-51 6 hours 35 minutes to travel around Earth.

$$94. \text{ Let } d = 2 \text{ then } r = 1.$$

$$15 \text{ feet} = \frac{15 \text{ feet}}{1} \cdot \frac{12 \text{ inches}}{1 \text{ foot}} = 180 \text{ inches, so}$$

$$h = 180.$$

$$V = \pi r^2 h$$

$$V = (\pi)(1)^2(180) = 180\pi \approx 565.5$$

The volume of the column is 565.5 cubic inches.

Section 2.7 Practice Exercises

1. Let x = the unknown percent.

$$35 = x \cdot 56$$

$$\frac{35}{56} = \frac{56x}{56}$$

$$0.625 = x$$

The number 35 is 62.5% of 56.

2. Let x = the unknown number.

$$198 = 55\% \cdot x$$

$$198 = 0.55x$$

$$\frac{198}{0.55} = \frac{0.55x}{0.55}$$

$$360 = x$$

The number 198 is 55% of 360.

3. a. From the circle graph, we see that 41% of pets owned are freshwater fish and 3% are saltwater fish; thus $41\% + 3\% = 44\%$ of pets owned are freshwater fish or saltwater fish.

- b. The circle graph percents have a sum of 100%; thus the percent of pets that are not equines is $100\% - 3\% = 97\%$.

- c. To find the number of dogs owned, we find 19% of 396.12
 $= (0.19)(396.12)$
 $= 75.2628$
 ≈ 75.3
 Thus, about 75.3 million dogs are owned in the United States.

4. Let x = discount.

$$x = 85\% \cdot 480$$

$$x = 0.85 \cdot 480$$

$$x = 408$$

The discount is \$408.

$$\text{New price} = \$480 - \$408 = \$72$$

5. Increase = $2710 - 1900 = 810$

Let x = percent of increase.

$$810 = x \cdot 1900$$

$$\frac{810}{1900} = \frac{1900x}{1900}$$

$$0.426 \approx x$$

The percent of increase is 42.6%.

6. Let x = number of digital 3D screens in 2012.

$$x + 0.07x = 15,782$$

$$1.07x = 15,782$$

$$\frac{1.07x}{1.07} = \frac{15,782}{1.07}$$

$$x \approx 14,750$$

There were 14,750 digital 3D screens in 2012.

7. Let x = number of liters of 2% solution.

Eyewash	No. of gallons	Acid Strength	= Amt. of Acid
2%	x	2%	$0.02x$
5%	$6 - x$	5%	$0.05(6 - x)$
Mix: 3%	6	3%	$0.03(6)$

$$0.02x + 0.05(6 - x) = 0.03(6)$$

$$0.02x + 0.3 - 0.05x = 0.18$$

$$-0.03x + 0.3 = 0.18$$

$$-0.03x + 0.3 - 0.3 = 0.18 - 0.3$$

$$-0.03x = -0.12$$

$$\frac{-0.03x}{-0.03} = \frac{-0.12}{-0.03}$$

$$x = 4$$

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

She should mix 4 liters of 2% eyewash with 2 liters of 5% eyewash.

Vocabulary, Readiness & Video Check 2.7

- No, $25\% + 25\% + 40\% = 90\% \neq 100\%$.
- No, $30\% + 30\% + 30\% = 90\% \neq 100\%$.
- Yes, $25\% + 25\% + 25\% + 25\% = 100\%$.
- Yes, $40\% + 50\% + 10\% = 100\%$.
- equals; =
 - multiplication; \cdot
 - Drop the percent symbol and move the decimal point two places to the left.
- You also find a discount amount by multiplying the (discount) percent by the original price.
 - For discount, the new price is the original price minus the discount amount, so you *subtract* from the original price rather than *add* as with mark-up.
- You must first find the actual amount of increase in price by subtracting the original price from the new price.

8.

Alloy	Ounces	Copper Strength	Amount of Copper
10%	x	0.10	$0.10x$
30%	400	0.30	$0.30(400)$
20%	$x + 400$	0.20	$0.20(x + 400)$

$$0.10x + 0.30(400) = 0.20(x + 400)$$

Exercise Set 2.7

2. Let
- x
- be the unknown number.

$$x = 88\% \cdot 1000$$

$$x = 0.88 \cdot 1000$$

$$x = 880$$

880 is 88% of 1000.

4. Let
- x
- be the unknown percent.

$$87.2 = x \cdot 436$$

$$\frac{87.2}{436} = \frac{436x}{436}$$

$$0.2 = x$$

$$20\% = x$$

The number 87.2 is 20% of 436.

6. Let
- x
- be the unknown number.

$$126 = 35\% \cdot x$$

$$126 = 0.35 \cdot x$$

$$\frac{126}{0.35} = \frac{0.35x}{0.35}$$

$$360 = x$$

126 is 35% of 360.

- 8.
- $21\% + 10\% + 20\% = 51\%$

51% of Earth's land area is in Asia, Antarctica, or Africa.

10. The land area of Africa is 20% of Earth's land area.

$$20\% \text{ of } 56.4 = 20\% \cdot 56.4 = 0.20 \cdot 56.4 = 11.28$$

The land area of Africa is 11.28 million square areas.

12. Let
- x
- = amount of discount.

$$x = 25\% \cdot 12.50$$

$$x = 0.25 \cdot 12.50$$

$$x = 3.125 \approx 3.13$$

$$\text{New price} = 12.50 - 3.13 = 9.37$$

The discount was \$3.13 and the new price is \$9.37.

14. Let
- x
- = tip.

$$x = 20\% \cdot 65.40$$

$$x = 0.2 \cdot 65.4$$

$$x = 13.08$$

$$\text{Total} = 65.40 + 13.08 = 78.48$$

The total cost is \$78.48.

16. Decrease =
- $314 - 290 = 24$

Let x = percent.

$$24 = x \cdot 314$$

$$\frac{24}{314} = \frac{314x}{314}$$

$$0.076 \approx x$$

The percent of decrease is 7.6%.

18. Decrease =
- $100 - 81 = 11$

Let x = percent.

$$11 = x \cdot 100$$

$$\frac{11}{100} = \frac{100x}{100}$$

$$0.11 = x$$

The percent of decrease is 11%.

20. Let
- x
- = original price and
- $0.25x$
- = increase.

$$x + 0.25x = 80$$

$$1.25x = 80$$

$$\frac{1.25x}{1.25} = \frac{80}{1.25}$$

$$x = 64$$

The original price was \$64.

22. Let
- x
- = last year's salary, and
- $0.03x$
- = increase.

$$x + 0.03x = 55,620$$

$$1.03x = 55,620$$

$$\frac{1.03x}{1.03} = \frac{55,620}{1.03}$$

$$x = 54,000$$

Last year's salary was \$54,000.

24. Let
- x
- = the amount of 25% solution.

No. of cu cm · Strength = Amt. of Antibiotic

Strength	No. of cu cm	Amt. of Antibiotic
25%	x	$0.25x$
60%	10	$10(0.6)$
30%	$x + 10$	$0.3(x + 10)$

$$0.25x + 10(0.6) = 0.3(x + 10)$$

$$0.25x + 6 = 0.3x + 3$$

$$0.25x - 0.25x + 6 = 0.3x - 0.25x + 3$$

$$6 = 0.05x + 3$$

$$6 - 3 = 0.05x + 3 - 3$$

$$3 = 0.05x$$

$$\frac{3}{0.05} = \frac{0.05x}{0.05}$$

$$60 = x$$

Add 60 cc of 25% solution.

26. Let x = the pounds of cashew nuts.

No. of lb · Cost/lb =			Value
Peanuts	20	3	3(20)
Cashews	x	5	$5x$
Mix	$x + 20$	3.50	$3.50(x + 20)$

$$\begin{aligned}
 3(20) + 5x &= 3.50(x + 20) \\
 60 + 5x &= 3.5x + 70 \\
 60 + 5x - 3.5x &= 3.5x - 3.5x + 70 \\
 60 + 1.5x &= 70 \\
 60 - 60 + 1.5x &= 70 - 60 \\
 1.5x &= 10 \\
 \frac{1.5x}{1.5} &= \frac{10}{1.5} \\
 x &= 6\frac{2}{3}
 \end{aligned}$$

Add $6\frac{2}{3}$ pounds of cashews.

28. Let x = the number.

$$\begin{aligned}
 x &= 140\% \cdot 86 \\
 x &= 1.4 \cdot 86 \\
 x &= 120.4 \\
 140\% \text{ of } 86 &\text{ is } 120.4.
 \end{aligned}$$

30. Let x = the number.

$$\begin{aligned}
 56.25 &= 45\% \cdot x \\
 56.25 &= 0.45x \\
 \frac{56.25}{0.45} &= \frac{0.45x}{0.45} \\
 125 &= x \\
 56.25 &\text{ is } 45\% \text{ of } 125.
 \end{aligned}$$

32. Let x = the percent.

$$\begin{aligned}
 42 &= x \cdot 35 \\
 \frac{42}{35} &= \frac{35x}{35} \\
 1.2 &= x \\
 42 &\text{ is } 120\% \text{ of } 35.
 \end{aligned}$$

34. From the graph, the height of the bar is about 23. Therefore, the average American spends about 23 minutes on Internet browsers.

36. 17 is what percent of 162?

$$\begin{aligned}
 17 &= x \cdot 162 \\
 \frac{17}{162} &= \frac{162x}{162} \\
 0.105 &\approx x \\
 10.5\% &\text{ of online time is spent following news.}
 \end{aligned}$$

38. **Unit Case Volume for Coca-Cola
(in billions of cases)**

<i>World Region</i>	<i>Case Volume</i>	<i>Percent of Total (rounded to nearest percent)</i>
North America	5.9	$\frac{5.9}{28.2} \approx 21\%$
Latin America	8.2	$\frac{8.2}{28.2} \approx 29\%$
Europe	3.9	$\frac{3.9}{28.2} \approx 14\%$
Eurasia and Africa	4.3	$\frac{4.3}{28.2} \approx 15\%$
Pacific	5.9	$\frac{5.9}{28.2} \approx 21\%$
Total	28.2	100%

40. Let x = the decrease in price.
 $x = 0.15(0.95) = 0.1425 \approx 0.14$
 The decrease in price is \$0.14.
 The new price is $0.95 - 0.14 = \$0.81$.

42. Increase = $1.49 - 1.19 = 0.30$
 Let x = the percent.
 $0.3 = x \cdot 1.19$
 $\frac{0.3}{1.19} = \frac{1.19x}{1.19}$
 $0.252 \approx x$
 The percent of increase was 25.2%.

44. Let x represent the amount Charles paid for the car.
 $x + 20\% \cdot x = 4680$
 $x + 0.20x = 4680$
 $1.2x = 4680$
 $\frac{1.2x}{1.2} = \frac{4680}{1.2}$
 $x = 3900$
 Charles paid \$3900 for the car.

46. percent of increase = $\frac{\text{amount of increase}}{\text{original amount}}$
 $= \frac{24 - 6}{6}$
 $= \frac{18}{6}$
 $= 3$
 The area increased by 300%.

48. Let x be the gallons of water.

	gallons	concentration	amount
water	x	0%	$0x = 0$
70% antifreeze	30	70%	$0.7(30)$
60% antifreeze	$x + 30$	60%	$0.6(x + 30)$

The amount of antifreeze being combined must be the same as that in the mixture.

$$0 + 0.7(30) = 0.6(x + 30)$$

$$21 = 0.6x + 18$$

$$21 - 18 = 0.6x + 18 - 18$$

$$3 = 0.6x$$

$$\frac{3}{0.6} = \frac{0.6x}{0.6}$$

$$5 = x$$

Thus, 5 gallons of water should be used.

50. percent of increase = $\frac{\text{amount of increase}}{\text{original amount}}$
- $$= \frac{88 - 72}{72}$$
- $$= \frac{16}{72}$$
- $$\approx 0.222$$

The number of decisions by the Supreme Court increased 22.2%.

52. Let x be the average number of children per woman in 1920.

$$x - 0.44x = 1.9$$

$$0.56x = 1.9$$

$$\frac{0.56x}{0.56} = \frac{1.9}{0.56}$$

$$x \approx 3.4$$

There were 3.4 children per woman in 1920.

54. $64\% \cdot 9800 = 0.64 \cdot 9800 = 6272$
You would expect 6272 post-secondary institutions to have Internet access in their classrooms.

56. Let x be the pounds of chocolate-covered peanuts.

	pounds	cost (\$)	value
chocolate-covered	x	5	$5x$
granola bites	10	2	$2(10)$
trail mix	$x + 10$	3	$3(x + 10)$

The value of those being combined must be the same as the value as the mixture.

$$\begin{aligned}
 5x + 2(10) &= 3(x + 10) \\
 5x + 20 &= 3x + 30 \\
 5x + 20 - 3x &= 3x + 30 - 3x \\
 2x + 20 &= 30 \\
 2x + 20 - 20 &= 30 - 20 \\
 2x &= 10 \\
 \frac{2x}{2} &= \frac{10}{2} \\
 x &= 5
 \end{aligned}$$

Therefore, 5 pounds of chocolate-covered peanuts should be used.

58. Let x be the length of Christian's throw.

$$\begin{aligned}
 x &= 148.00 + 0.689(148.00) \\
 &= 148.00 + 101.972 \\
 &= 249.972 \\
 &\approx 250
 \end{aligned}$$

Christian Sandstrom's world record throw was 250 meters.

60. $\frac{12}{3} = 2^2$

62. $-3^3 = (-3)^3$

64. $|-2| = 2$; $-|-2| = -2$
 $|-2| > -|-2|$

66. answers may vary

68. a. yes; answers may vary

b. no; answers may vary

70. 23 g is what percent of 300 g? Let y represent the unknown percent.

$$\begin{aligned}
 y \cdot 300 &= 23 \\
 \frac{300y}{300} &= \frac{23}{300} \\
 y &= 0.07\bar{6}
 \end{aligned}$$

This food contains 7.7% of the daily value of total carbohydrate in one serving.

72. $6\text{ g} \cdot 9\text{ calories/gram} = 54\text{ calories}$
 54 of the 280 calories come from fat.

$$\frac{54}{280} \approx 0.193$$

19.3% of the calories in this food come from fat.

74. answers may vary

Section 2.8 Practice Exercises

1. Let x = time down, then $x + 1$ = time up.

$$\text{Rate} \cdot \text{Time} = \text{Distance}$$

Up	1.5	$x + 1$	$1.5(x + 1)$
Down	4	x	$4x$

$$d = d$$

$$1.5(x + 1) = 4x$$

$$1.5x + 1.5 = 4x$$

$$1.5 = 2.5x$$

$$\frac{1.5}{2.5} = \frac{2.5x}{2.5}$$

$$0.6 = x$$

$$\text{Total Time} = x + 1 + x = 0.6 + 1 + 0.6 = 2.2$$

The entire hike took 2.2 hours.

2. Let x = speed of eastbound train, then
 $x - 10$ = speed of westbound train.

$$r \cdot t = d$$

East	x	1.5	$1.5x$
West	$x - 10$	1.5	$1.5(x - 10)$

$$1.5x + 1.5(x - 10) = 171$$

$$1.5x + 1.5x - 15 = 171$$

$$3x - 15 = 171$$

$$3x = 186$$

$$\frac{3x}{3} = \frac{186}{3}$$

$$x = 62$$

$$x - 10 = 62 - 10 = 52$$

The eastbound train is traveling at 62 mph and the westbound train is traveling at 52 mph.

3. Let x = the number of \$20 bills, then
 $x + 47$ = number of \$5 bills.

Denomination	Number	Value
\$5 bills	$x + 47$	$5(x + 47)$
\$20 bills	x	$20x$

$$5(x + 47) + 20x = 1710$$

$$5x + 235 + 20x = 1710$$

$$235 + 25x = 1710$$

$$25x = 1475$$

$$x = 59$$

$$x + 47 = 59 + 47 = 106$$

There are 106 \$5 bills and 59 \$20 bills.

4. Let x = amount invested at 11.5%, then
 $30,000 - x$ = amount invested at 6%.

Principal · Rate · Time =				Interest
11.5%	x	0.115	1	$x(0.115)(1)$
6%	$30,000 - x$	0.06	1	$0.06(30,000 - x)(1)$
Total	30,000			2790

$$0.115x + 0.06(30,000 - x) = 2790$$

$$0.115x + 1800 - 0.06x = 2790$$

$$1800 + 0.055x = 2790$$

$$0.055x = 990$$

$$\frac{0.055x}{0.055} = \frac{990}{0.055}$$

$$x = 18,000$$

$$30,000 - x = 30,000 - 18,000 = 12,000$$

She invested \$18,000 at 11.5% and \$12,000 at 6%.

Vocabulary, Readiness & Video Check 2.8

1. $r \cdot t = d$

bus	55	x	$55x$
car	50	$x + 3$	$50(x + 3)$

$$55x = 50(x + 3)$$

2. The important thing is to remember the difference between the *number* of bills you have and the *value* of the bills.

3. $P \cdot R \cdot T = I$

x	0.06	1	$0.06x$
$36,000 - x$	0.04	1	$0.04(36,000 - x)$

$$0.06x = 0.04(36,000 - x)$$

Exercise Set 2.8

2. Let x = the time traveled by the bus.

$$\text{Rate} \cdot \text{Time} = \text{Distance}$$

Bus	60	x	$60x$
Car	40	$x + 1.5$	$40(x + 1.5)$

$$\begin{aligned}
 d &= d \\
 60x &= 40(x + 1.5) \\
 60x &= 40x + 60 \\
 20x &= 60 \\
 \frac{20x}{20} &= \frac{60}{20} \\
 x &= 3
 \end{aligned}$$

It will take the bus 3 hours to overtake the car.

4. Let x = the time to get to Disneyland and $7.2 - x$ = the time to return

$$\text{Rate} \cdot \text{Time} = \text{Distance}$$

	Rate	Time	Distance
Going	50	x	$50x$
Returning	40	$7.2 - x$	$40(7.2 - x)$

$$\begin{aligned}
 d &= d \\
 50x &= 40(7.2 - x) \\
 50x &= 288 - 40x \\
 90x &= 288 \\
 \frac{90x}{90} &= \frac{288}{90} \\
 x &= 3.2
 \end{aligned}$$

It took 3.2 hours to get to Disneyland.

$$d = rt$$

$$d = 50(3.2) = 160$$

The distance to Disneyland is 160 miles.

6. The value of z quarters is $0.25z$.
8. The value of $(20 - z)$ half-dollars is $0.50(20 - z)$.
10. The value of $97z$ \$100 bills is $100(97z)$ or $9700z$.
12. The value of $(15 - y)$ \$10 bills is $10(15 - y)$.
14. Let x = number of \$50 bills, then
 $6x$ = number of \$20 bills.

$$\text{Number of Bills} \quad \text{Value of Bills}$$

	Number of Bills	Value of Bills
\$20 bills	$6x$	$20(6x)$
\$50 bills	x	$50x$
Total		3910

$$\begin{aligned}
 20(6x) + 50x &= 3910 \\
 120x + 50x &= 3910 \\
 170x &= 3910 \\
 x &= 23
 \end{aligned}$$

$$6x = 6(23) = 138$$

There are 138 \$20 bills and 23 \$50 bills.

16. Let x = the amount invested at 9% for one year.

$$\text{Principal} \cdot \text{Rate} = \text{Interest}$$

	Principal	Rate	Interest
9%	x	0.09	$0.09x$
10%	$x + 250$	0.10	$0.10(x + 250)$
Total			101

$$0.09x + 0.10(x + 250) = 101$$

$$0.09x + 0.10x + 25 = 101$$

$$0.19x + 25 = 101$$

$$0.19x = 76$$

$$\frac{0.19x}{0.19} = \frac{76}{0.19}$$

$$x = 400$$

$$x + 250 = 400 + 250 = 650$$

She invested \$650 at 10% and \$400 at 9%.

18. Let x = the amount invested at 10% for one year.

$$\text{Principal} \cdot \text{Rate} = \text{Interest}$$

	Principal	Rate	Interest
10%	x	0.10	$0.10x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$0.10x + 0.12(2x) = 2890$$

$$0.10x + 0.24x = 2890$$

$$0.34x = 2890$$

$$\frac{0.34x}{0.34} = \frac{2890}{0.34}$$

$$x = 8500$$

$$2x = 2(8500) = 17,000$$

He invested \$17,000 at 12% and \$8500 at 10%.

20. Let x = number of adult tickets, then

$$732 - x = \text{number of child tickets.}$$

$$\text{Number} \cdot \text{Rate} = \text{Cost}$$

	Number	Rate	Cost
Adult	x	22	$22x$
Child	$732 - x$	15	$15(732 - x)$
Total	732		12,912

$$\begin{aligned}
 22x + 15(732 - x) &= 12,912 \\
 22x + 10,980 - 15x &= 12,912 \\
 10,980 + 7x &= 12,912 \\
 7x &= 1932 \\
 x &= 276 \\
 732 - x &= 732 - 276 = 456 \\
 \text{Sales included 276 adult tickets and 456 child tickets.}
 \end{aligned}$$

22. Let x = the time traveled

Rate · Time = Distance

Car A	65	x	$65x$
Car B	41	x	$41x$

The total distance is 530 miles.

$$\begin{aligned}
 65x + 41x &= 530 \\
 106x &= 530 \\
 \frac{106x}{106} &= \frac{530}{106} \\
 x &= 5
 \end{aligned}$$

The two cars will be 530 miles apart in 5 hours.

24. Let x = the amount invested at 12% for one year.

Principal · Rate = Interest

12%	x	0.12	$0.12x$
4%	$20,000 - x$	-0.04	$-0.04(20,000 - x)$

$$\begin{aligned}
 0.12x - 0.04(20,000 - x) &= 0 \\
 0.12x - 800 + 0.04x &= 0 \\
 0.16x - 800 &= 0 \\
 0.16x &= 800 \\
 \frac{0.16x}{0.16} &= \frac{800}{0.16} \\
 x &= 5000
 \end{aligned}$$

$20,000 - x = 20,000 - 5000 = 15,000$
 She invested \$15,000 at 4% and \$5000 at 12%.

26. Let x = the time they are able to talk.

Rate · Time = Distance

Cade	5	x	$5x$
Kathleen	4	x	$4x$
Total			20

$$\begin{aligned}
 5x + 4x &= 2 \\
 9x &= 20 \\
 \frac{9x}{9} &= \frac{20}{9} \\
 x &= 2\frac{2}{9}
 \end{aligned}$$

They can talk for $2\frac{2}{9}$ hours.

28. Let x = the speed of the slower train.

Rate · Time = Distance

Train A	x	1.5	$1.5x$
Train B	$x + 8$	1.5	$1.5(x + 8)$

The total distance is 162 miles.

$$\begin{aligned}
 1.5x + 1.5(x + 8) &= 162 \\
 1.5x + 1.5x + 12 &= 162 \\
 3x + 12 &= 162 \\
 3x &= 150 \\
 \frac{3x}{3} &= \frac{150}{3} \\
 x &= 50
 \end{aligned}$$

$$x + 8 = 58$$

The speeds of the trains are 50 mph and 58 mph.

30. Let x = number of quarters, then
 $5x$ = number of dimes.

Number Value

Quarters	x	$0.25x$
Dimes	$5x$	$0.10(5x)$
Total		27.75

$$\begin{aligned}
 0.25x + 0.10(5x) &= 27.75 \\
 0.25x + 0.5x &= 27.75 \\
 0.75x &= 27.75 \\
 x &= 37
 \end{aligned}$$

$$5x = 5(37) = 185$$

The collection has 37 quarters and 185 dimes.

32. Let x = the time traveled.

Rate · Time = Distance

Car A	65	x	$65x$
Car B	45	x	$45x$

The total distance is 330.

$$65x + 45x = 330$$

$$110x = 330$$

$$\frac{110x}{110} = \frac{330}{110}$$

$$x = 3$$

They will be 330 miles apart in 3 hours.

34. Let x = the time traveled.

Rate · Time = Distance

Car A	40	x	$40x$
Car B	50	x	$50x$

If two cars are traveling in the same direction, so find the difference in their distances traveled.

$$50x - 40x = 20$$

$$10x = 20$$

$$\frac{10x}{10} = \frac{20}{10}$$

$$x = 2$$

They will be 20 miles apart in 2 hours.

36. Let x = the amount invested at 9% for one year.

Principal · Rate = Interest

9%	x	0.09	$0.09x$
10%	$2x$	0.10	$0.1(2x)$
11%	$3x$	0.11	$0.11(3x)$
Total			2790

$$0.09x + 0.1(2x) + 0.11(3x) = 2790$$

$$0.09x + 0.2x + 0.33x = 2790$$

$$0.62x = 2790$$

$$\frac{0.62x}{0.62} = \frac{2790}{0.62}$$

$$x = 4500$$

$$2x = 2(4500) = 9000$$

$$3x = 3(4500) = 13,500$$

She invested \$4500 at 9%, \$9000 at 10% and \$13,500 at 11%.

38. Let x = the time it takes them to meet.

Rate · Time = Distance

Nedra	3	x	$3x$
Latonya	4	x	$4x$
Total			12

$$3x + 4x = 12$$

$$7x = 12$$

$$\frac{7x}{7} = \frac{12}{7}$$

$$x = 1\frac{5}{7}$$

They meet in $1\frac{5}{7}$ hours.

40. Let x = the time before getting stopped.

Rate · Time = Distance

Before	70	x	$70x$
After	60	$4 - x$	$60(4 - x)$
Total			255

$$70x + 60(4 - x) = 255$$

$$70x + 240 - 60x = 255$$

$$10x + 240 = 255$$

$$10x = 15$$

$$\frac{10x}{10} = \frac{15}{10}$$

$$x = 1.5$$

He drove 1.5 hours before getting stopped.

42. $(-2) + (-8) = -10$

44. $-11 + 2.9 = -8.1$

46. $-12 - 3 = -12 + (-3) = -15$

48. Let x = number of quarters, then
 $136 + x$ = number of dimes,
 $8x$ = number of nickels,
 $16x + 32$ = number of pennies.

	Number	Value
Quarters	x	$0.25x$
Dimes	$136 + x$	$0.10(136 + x)$
Nickels	$8x$	$0.05(8x)$
Pennies	$16x + 32$	$0.01(16x + 32)$
Total		44.86

$$0.25x + 0.10(136 + x) + 0.05(8x) + 0.01(16x + 32) = 44.86$$

$$0.25x + 13.6 + 0.1x + 0.4x + 0.16x + 0.32 = 44.86$$

$$0.91x + 13.92 = 44.86$$

$$0.91x = 30.94$$

$$x = 34$$

$$136 + x = 136 + 34 = 170$$

$$8x = 8(34) = 272$$

$$16x + 32 = 16(34) + 32 = 576$$

There were 34 quarters, 170 dimes, 272 nickels, and 576 pennies.

50. $R = C$

$$60x = 50x + 5000$$

$$10x = 5000$$

$$\frac{10x}{10} = \frac{5000}{10}$$

$$x = 500$$

Should sell 500 boards to break even.

$$C = R = 60x = 60(500) = 30,000$$

It costs \$30,000 to produce the break-even number of boards.

52. $R = C$

$$105x = 875 + 70x$$

$$105x - 70x = 875 + 70x - 70x$$

$$35x = 875$$

$$\frac{35x}{35} = \frac{875}{35}$$

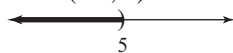
$$x = 25$$

They should sell 25 monitors to break even.

Section 2.9 Practice Exercises

1. $x < 5$

Place a parenthesis at 5 since the inequality symbol is $<$. Shade to the left of 5. The solution set is $(-\infty, 5)$.

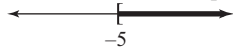


2. $x + 11 \geq 6$

$$x + 11 - 11 \geq 6 - 11$$

$$x \geq -5$$

The solution set is $[-5, \infty)$.

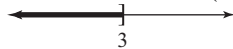


3. $-5x \geq -15$

$$\frac{-5x}{-5} \leq \frac{-15}{-5}$$

$$x \leq 3$$

The solution set is $(-\infty, 3]$.



4. $3x > -9$

$$\frac{3x}{3} > \frac{-9}{3}$$

$$x > -3$$

The solution set is $(-3, \infty)$.



5. $45 - 7x \leq -4$

$$45 - 7x - 45 \leq -4 - 45$$

$$-7x \leq -49$$

$$\frac{-7x}{-7} \geq \frac{-49}{-7}$$

$$x \geq 7$$

The solution set is $[7, \infty)$.



6. $3x + 20 \leq 2x + 13$

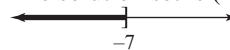
$$3x + 20 - 2x \leq 2x + 13 - 2x$$

$$x + 20 \leq 13$$

$$x + 20 - 20 \leq 13 - 20$$

$$x \leq -7$$

The solution set is $(-\infty, -7]$.



7. $6 - 5x > 3(x - 4)$

$$6 - 5x > 3x - 12$$

$$6 - 5x - 3x > 3x - 12 - 3x$$

$$6 - 8x > -12$$

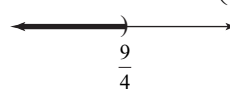
$$6 - 8x - 6 > -12 - 6$$

$$-8x > -18$$

$$\frac{-8x}{-8} < \frac{-18}{-8}$$

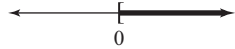
$$x < \frac{9}{4}$$

The solution set is $(-\infty, \frac{9}{4})$.



$$\begin{aligned}
 8. \quad & 3(x-4) - 5 \leq 5(x-1) - 12 \\
 & 3x - 12 - 5 \leq 5x - 5 - 12 \\
 & 3x - 17 \leq 5x - 17 \\
 & 3x - 17 - 5x \leq 5x - 17 - 5x \\
 & -2x - 17 \leq -17 \\
 & -2x - 17 + 17 \leq -17 + 17 \\
 & -2x \leq 0 \\
 & \frac{-2x}{-2} \geq \frac{0}{-2} \\
 & x \geq 0
 \end{aligned}$$

The solution set is $[0, \infty)$.



$$9. \quad -3 \leq x < 1$$

Graph all numbers greater than or equal to -3 and less than 1 . Place a bracket at -3 and a parenthesis at 1 .
The solution set is $[-3, 1)$.



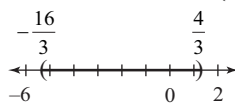
$$\begin{aligned}
 10. \quad & -4 < 3x + 2 \leq 8 \\
 & -4 - 2 < 3x + 2 - 2 \leq 8 - 2 \\
 & -6 < 3x \leq 6 \\
 & \frac{-6}{3} < \frac{3x}{3} \leq \frac{6}{3} \\
 & -2 < x \leq 2
 \end{aligned}$$

The solution set is $(-2, 2]$.



$$\begin{aligned}
 11. \quad & 1 < \frac{3}{4}x + 5 < 6 \\
 & 4(1) < 4\left(\frac{3}{4}x + 5\right) < 4(6) \\
 & 4 < 3x + 20 < 24 \\
 & 4 - 20 < 3x + 20 - 20 < 24 - 20 \\
 & -16 < 3x < 4 \\
 & \frac{-16}{3} < \frac{3x}{3} < \frac{4}{3} \\
 & -\frac{16}{3} < x < \frac{4}{3}
 \end{aligned}$$

The solution set is $\left(-\frac{16}{3}, \frac{4}{3}\right)$.



$$\begin{aligned}
 12. \quad & \text{Let } x = \text{the number.} \\
 & 35 - 2x > 15 \\
 & 35 - 2x - 35 > 15 - 35 \\
 & -2x > -20 \\
 & \frac{-2x}{-2} < \frac{-20}{-2} \\
 & x < 10
 \end{aligned}$$

All numbers less than 10 .

$$\begin{aligned}
 13. \quad & \text{Let } x = \text{number of classes.} \\
 & 300 + 375x \leq 1500 \\
 & 300 + 375x - 300 \leq 1500 - 300 \\
 & 375x \leq 1200 \\
 & \frac{375x}{375} \leq \frac{1200}{375} \\
 & x \leq 3.2
 \end{aligned}$$

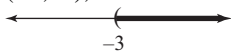
Kasonga can afford at most 3 community college classes this semester.

Vocabulary, Readiness & Video Check 2.9

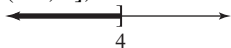
- $6x - 7(x + 9)$ is an expression.
- $6x = 7(x + 9)$ is an equation.
- $6x < 7(x + 9)$ is an inequality.
- $5y - 2 \geq -38$ is an inequality.
- -5 is not a solution to $x \geq -3$.
- $|-6| = 6$ is not a solution to $x < 6$.
- The graph of Example 1 is shaded from $-\infty$ to and including -1 , as indicated by a bracket. To write interval notation, you write down what is shaded for the inequality from left to right. A parenthesis is always used with $-\infty$, so from the graph, the interval notation is $(-\infty, -1]$.
- Step 5 is where you apply the multiplication property of inequality. If a negative number is multiplied or divided when applying this property, you need to make sure you remember to reverse the direction of the inequality symbol.
- You would divide the left, middle, and right by -3 instead of 3 , which would reverse the directions of both inequality symbols.
- no greater than; \leq

Exercise Set 2.9

2. $(-3, \infty), x > -3$



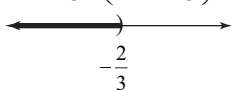
4. $(-\infty, 4], x \leq 4$



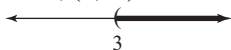
6. $y < 0, (-\infty, 0)$



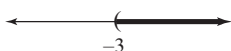
8. $z < -\frac{2}{3}, \left(-\infty, -\frac{2}{3}\right)$



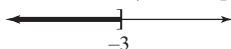
10. $x > 3, (3, \infty)$



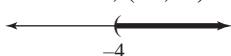
12. $3x > -9$
 $x > -3, (-3, \infty)$



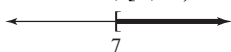
14. $x + 4 \leq 1$
 $x \leq -3, (-\infty, -3]$



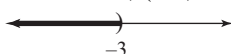
16. $-5x < 20$
 $\frac{-5x}{-5} > \frac{20}{-5}$
 $x > -4, (-4, \infty)$



18. $3 - 7x \geq 10 - 8x$
 $3 + x \geq 10$
 $x \geq 7, [7, \infty)$



20. $7x + 3 < 9x - 3x$
 $7x + 3 < 6x$
 $x + 3 < 0$
 $x < -3, (-\infty, -3)$



22. $3x + 9 \leq 5(x - 1)$

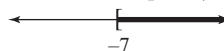
$3x + 9 \leq 5x - 5$

$-2x + 9 \leq -5$

$-2x \leq -14$

$\frac{-2x}{-2} \geq \frac{-14}{-2}$

$x \geq 7, [7, \infty)$



24. $-7x + 4 > 3(4 - x)$

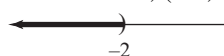
$-7x + 4 > 12 - 3x$

$-4x + 4 > 12$

$-4x > 8$

$\frac{-4x}{-4} < \frac{8}{-4}$

$x < -2, (-\infty, -2)$



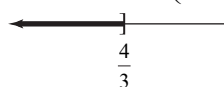
26. $3(5x - 4) \leq 4(3x - 2)$

$15x - 12 \leq 12x - 8$

$3x - 12 \leq -8$

$3x \leq 4$

$x \leq \frac{4}{3}, \left(-\infty, \frac{4}{3}\right]$



28. $7(x - 2) + x \leq -4(5 - x) - 12$

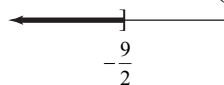
$7x - 14 + x \leq -20 + 4x - 12$

$8x - 14 \leq -32 + 4x$

$4x - 14 \leq -32$

$4x \leq -18$

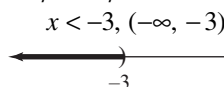
$x \leq -\frac{9}{2}, \left(-\infty, -\frac{9}{2}\right]$



30. $-7x > 21$

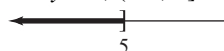
$\frac{-7x}{-7} < \frac{21}{-7}$

$x < -3, (-\infty, -3)$



32. $y - 4 \leq 1$

$y \leq 5, (-\infty, 5]$



34. $2x - 1 \geq 4x - 5$
 $-2x - 1 \geq -5$
 $-2x \geq -4$
 $\frac{-2x}{-2} \leq \frac{-4}{-2}$
 $x \leq 2, (-\infty, 2]$

36. $4 - x < 8x + 2x$
 $4 - x < 10x$
 $4 - 11x < 0$
 $-11x < -4$
 $\frac{-11x}{-11} > \frac{-4}{-11}$
 $x > \frac{4}{11}, \left(\frac{4}{11}, \infty\right)$

38. $\frac{5}{6}x \geq -8$
 $x \geq -\frac{48}{5}, \left[-\frac{48}{5}, \infty\right)$

40. $5(x + 4) < 4(2x + 3)$
 $5x + 20 < 8x + 12$
 $-3x + 20 < 12$
 $-3x < -8$
 $\frac{-3x}{-3} > \frac{-8}{-3}$
 $x > \frac{8}{3}, \left(\frac{8}{3}, \infty\right)$

42. $6(2 - x) \geq 12$
 $12 - 6x \geq 12$
 $-6x \geq 0$
 $\frac{-6x}{-6} \leq \frac{0}{-6}$
 $x \leq 0, (-\infty, 0]$

44. $-6x + 2 < -3(x + 4)$
 $-6x + 2 < -3x - 12$
 $-3x + 2 < -12$
 $-3x < -14$
 $\frac{-3x}{-3} > \frac{-14}{-3}$
 $x > \frac{14}{3}, \left(\frac{14}{3}, \infty\right)$

46. $-5(1 - x) + x \leq -(6 - 2x) + 6$
 $-5 + 5x + x \leq -6 + 2x + 6$
 $-5 + 6x \leq 2x$
 $-5 + 4x \leq 0$
 $4x \leq 5$
 $x \leq \frac{5}{4}, \left(-\infty, \frac{5}{4}\right]$

48. $\frac{1}{3}(3x - 1) < \frac{1}{2}(x + 4)$
 $6\left[\frac{1}{3}(3x - 1)\right] < 6\left[\frac{1}{2}(x + 4)\right]$
 $2(3x - 1) < 3(x + 4)$
 $6x - 2 < 3x + 12$
 $6x - 2 + 2 < 3x + 12 + 2$
 $6x < 3x + 14$
 $6x - 3x < 3x - 3x + 14$
 $3x < 14$
 $\frac{3x}{3} < \frac{14}{3}$
 $x < \frac{14}{3}, \left(-\infty, \frac{14}{3}\right)$

50. $2 \leq y \leq 3, [2, 3]$

52. $-1 \leq x \leq 4, [-1, 4]$

54. $-5 < 2x < -2$

$$-\frac{5}{2} < x < -1, \left(-\frac{5}{2}, -1\right)$$

56. $4 \leq 5x - 6 \leq 19$

$10 \leq 5x \leq 25$

$2 \leq x \leq 5, [2, 5]$



58. $0 < 4(x+5) \leq 8$

$0 < 4x + 20 \leq 8$

$-20 < 4x \leq -12$

$-5 < x \leq -3, (-5, -3]$



60. $1 < 4 + 2x \leq 7$

$-3 < 2x \leq 3$

$$-\frac{3}{2} < x \leq \frac{3}{2}, \left(-\frac{3}{2}, \frac{3}{2}\right]$$

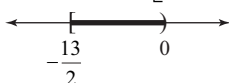


62. $-5 \leq 2(x+4) < 8$

$-5 \leq 2x + 8 < 8$

$-13 \leq 2x < 0$

$$-\frac{13}{2} \leq x < 0, \left[-\frac{13}{2}, 0\right)$$



64. Let x be the number.

$5x + 1 \leq 10$

$5x + 1 - 1 \leq 10 - 1$

$5x \leq 9$

$\frac{5x}{5} \leq \frac{9}{5}$

$x \leq \frac{9}{5}$

All numbers less than or equal to $\frac{9}{5}$ make this statement true.

66. Use $P = a + b + c$ when $a = x$, $b = 3x$, $c = 12$, and $P \leq 32$.

$x + 3x + 12 \leq 32$

$4x + 12 \leq 32$

$4x + 12 - 12 \leq 32 - 12$

$4x \leq 20$

$\frac{4x}{4} \leq \frac{20}{4}$

$x \leq 5$

$3x \leq 3(5) = 15$

The maximum lengths of the other two sides are 5 inches and 15 inches.

68. Convert heights to inches.

$6'8" = 6 \cdot 12 + 8 = 80$

$6'6" = 6 \cdot 12 + 6 = 78$

$6'0" = 6 \cdot 12 + 0 = 72$

$5'9" = 5 \cdot 12 + 9 = 69$

$6'5" = 6 \cdot 12 + 5 = 77$

Let x be the height of the center.

$$\frac{x + 80 + 78 + 72 + 69}{5} \geq 77$$

$$\frac{x + 299}{5} \geq 77$$

$$5 \cdot \frac{x + 299}{5} \geq 5 \cdot 77$$

$x + 299 \geq 385$

$x + 299 - 299 \geq 385 - 299$

$x \geq 86$

$86" = 7'2"$

The center should be at least 7'2".

70. Let x represent the number of people. Then the cost is $40 + 15x$.

$40 + 15x \leq 860$

$40 + 15x - 40 \leq 860 - 40$

$15x \leq 820$

$\frac{15x}{15} \leq \frac{820}{15}$

$x \leq \frac{820}{15}$

$x \leq \frac{820}{15} \approx 54.7$

They can invite at most 54 people.

72. Let x represent the number of minutes.

$5.3x \geq 200$

$\frac{5.3x}{5.3} \geq \frac{200}{5.3}$

$x \geq \frac{200}{5.3}$

$x \geq \frac{200}{5.3} \approx 38$

The person must bicycle at least 38 minutes.

74. Let
- $x =$
- the unknown number.

$$2 < \frac{1}{2}x - 4 < 3$$

$$6 < \frac{1}{2}x < 7$$

$$12 < x < 14$$

All numbers between 12 and 14

76. $(3)^3 = (3)(3)(3) = 27$

78. $0^5 = (0)(0)(0)(0)(0) = 0$

80. $\left(\frac{2}{3}\right)^3 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) = \frac{8}{27}$

82. Since
- $m \leq n$
- , then
- $2m \leq 2n$
- .

84. If
- $-x < y$
- , then
- $x > -y$
- .

86. Yes; answers may vary

88. Let
- x
- be the score on her final exam. Since the final counts as two tests, her final course average

is $\frac{85 + 95 + 92 + 3x}{6}$.

$$\frac{85 + 95 + 92 + 3x}{6} \geq 90$$

$$\frac{272 + 3x}{6} \geq 90$$

$$6\left(\frac{272 + 3x}{6}\right) \geq 6(90)$$

$$272 + 3x \geq 540$$

$$272 + 2x - 272 \geq 540 - 272$$

$$3x \geq 268$$

$$\frac{3x}{3} \geq \frac{268}{3}$$

$$x \geq 89.\bar{3}$$

Her final exam score must be at least 89.3 for her to get an A.

90. answers may vary

92. answers may vary

94. $C = 3.14d$

$$118 \leq 3.14d \leq 122$$

$$37.58 \leq d \leq 38.85$$

The diameter must be between 37.58 mm and 38.85 mm.

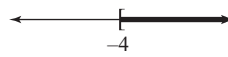
96. $x(x - 3) \geq x^2 - 5x - 8$

$$x^2 - 3x \geq x^2 - 5x - 8$$

$$-3x \geq -5x - 8$$

$$2x \geq -8$$

$$x \geq -4, [-4, \infty)$$



98. $x^2 - 4x + 8 < x(x + 8)$

$$x^2 - 4x + 8 < x^2 + 8x$$

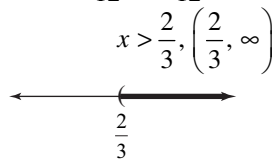
$$-4x + 8 < 8x$$

$$-12x + 8 < 0$$

$$-12x < -8$$

$$\frac{-12x}{-12} > \frac{-8}{-12}$$

$$x > \frac{2}{3}, \left(\frac{2}{3}, \infty\right)$$



Chapter 2 Vocabulary Check

- Terms with the same variables raised to exactly the same powers are called like terms.
- If terms are not like terms, they are unlike terms.
- A linear equation in one variable can be written in the form $ax + b = c$.
- A linear inequality in one variable can be written in the form $ax + b < c$, (or $>$, \leq , \geq).
- Inequalities containing two inequality symbols are called compound inequalities.
- An equation that describes a known relationship among quantities is called a formula.
- The numerical coefficient of a term is its numerical factor.
- Equations that have the same solution are called equivalent equations.
- The solutions to the equation $x + 5 = x + 5$ are all real numbers.
- The solution to the equation $x + 5 = x + 4$ is no solution.

11. If both sides of an inequality are multiplied or divided by the same positive number, the direction of the inequality symbol is the same.
12. If both sides of an inequality are multiplied by the same negative number, the direction of the inequality symbol is reversed.

Chapter 2 Review

1. $5x - x + 2x = 6x$
2. $0.2z - 4.6x - 7.4z = -4.6x - 7.2z$
3. $\frac{1}{2}x + 3 + \frac{7}{2}x - 5 = \frac{8}{2}x - 2 = 4x - 2$
4. $\frac{4}{5}y + 1 + \frac{6}{5}y + 2 = \frac{10}{5}y + 3 = 2y + 3$
5. $2(n - 4) + n - 10 = 2n - 8 + n - 10 = 3n - 18$
6. $3(w + 2) - (12 - w) = 3w + 6 - 12 + w = 4w - 6$
7. $(x + 5) - (7x - 2) = x + 5 - 7x + 2 = -6x + 7$
8. $(y - 0.7) - (1.4y - 3) = y - 0.7 - 1.4y + 3 = -0.4y + 2.3$
9. Three times a number decreased by 7 is $3x - 7$.
10. Twice the sum of a number and 2.8 added to 3 times the number is $2(x + 2.8) + 3x$.
11. $8x + 4 = 9x$
 $8x + 4 - 8x = 9x - 8x$
 $4 = x$
12. $5y - 3 = 6y$
 $5y - 3 - 5y = 6y - 5y$
 $-3 = y$
13. $\frac{2}{7}x + \frac{5}{7}x = 6$
 $\frac{7}{7}x = 6$
 $x = 6$
14. $3x - 5 = 4x + 1$
 $-5 = x + 1$
 $-6 = x$
15. $2x - 6 = x - 6$
 $x - 6 = -6$
 $x = 0$
16. $4(x + 3) = 3(1 + x)$
 $4x + 12 = 3 + 3x$
 $x + 12 = 3$
 $x = -9$
17. $6(3 + n) = 5(n - 1)$
 $18 + 6n = 5n - 5$
 $18 + n = -5$
 $n = -23$
18. $5(2 + x) - 3(3x + 2) = -5(x - 6) + 2$
 $10 + 5x - 9x - 6 = -5x + 30 + 2$
 $-4x + 4 = -5x + 32$
 $x + 4 = 32$
 $x = 28$
19. $x - 5 = 3$
 $x - 5 + \underline{5} = 3 + \underline{5}$
 $x = 8$
20. $x + 9 = -2$
 $x + 9 - \underline{9} = -2 - \underline{9}$
 $x = -11$
21. $10 - x$; choice b.
22. $x - 5$; choice a.
23. Complementary angles sum to 90° .
 $(90 - x)^\circ$; choice b.
24. Supplementary angles sum to 180° .
 $180 - (x + 5) = 180 - x - 5 = 175 - x$
 $(175 - x)^\circ$; choice c.
25. $\frac{3}{4}x = -9$
 $\frac{4}{3}\left(\frac{3}{4}x\right) = \frac{4}{3}(-9)$
 $x = -12$
26. $\frac{x}{6} = \frac{2}{3}$
 $6 \cdot \frac{x}{6} = 6 \cdot \frac{2}{3}$
 $x = 4$

$$27. \quad -5x = 0$$

$$\frac{-5x}{-5} = \frac{0}{-5}$$

$$x = 0$$

$$28. \quad -y = 7$$

$$\frac{-y}{-1} = \frac{7}{-1}$$

$$y = -7$$

$$29. \quad 0.2x = 0.15$$

$$\frac{0.2x}{0.2} = \frac{0.15}{0.2}$$

$$x = 0.75$$

$$30. \quad \frac{-x}{3} = 1$$

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

$$x = -3$$

$$31. \quad -3x + 1 = 19$$

$$-3x = 18$$

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

$$x = -6$$

$$32. \quad 5x + 25 = 20$$

$$5x = -5$$

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

$$x = -1$$

$$33. \quad 7(x-1) + 9 = 5x$$

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

$$7x + 2 = 5x$$

$$2 = -2x$$

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

$$-1 = x$$

$$34. \quad 7x - 6 = 5x - 3$$

$$2x - 6 = -3$$

$$2x = 3$$

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

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

$$35. \quad -5x + \frac{3}{7} = \frac{10}{7}$$

$$7\left(-5x + \frac{3}{7}\right) = 7 \cdot \frac{10}{7}$$

$$-35x + 3 = 10$$

$$-35x = 7$$

$$x = -\frac{7}{35}$$

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

$$36. \quad 5x + x = 9 + 4x - 1 + 6$$

$$6x = 4x + 14$$

$$2x = 14$$

$$x = 7$$

37. Let x = the first integer, then
 $x + 1$ = the second integer, and
 $x + 2$ = the third integer.
 sum = $x + (x + 1) + (x + 2) = 3x + 3$

38. Let x = the first integer, then
 $x + 2$ = the second integer
 $x + 4$ = the third integer
 $x + 6$ = the fourth integer.
 sum = $x + (x + 6) = 2x + 6$

$$39. \quad \frac{5}{3}x + 4 = \frac{2}{3}x$$

$$3\left(\frac{5}{3}x + 4\right) = 3\left(\frac{2}{3}x\right)$$

$$5x + 12 = 2x$$

$$12 = -3x$$

$$-4 = x$$

$$40. \quad \frac{7}{8}x + 1 = \frac{5}{8}x$$

$$8\left(\frac{7}{8}x + 1\right) = 8\left(\frac{5}{8}x\right)$$

$$7x + 8 = 5x$$

$$8 = -2x$$

$$-4 = x$$

$$41. \quad -(5x + 1) = -7x + 3$$

$$-5x - 1 = -7x + 3$$

$$2x - 1 = 3$$

$$2x = 4$$

$$x = 2$$

$$\begin{aligned}
 42. \quad & -4(2x+1) = -5x+5 \\
 & -8x-4 = -5x+5 \\
 & -3x-4 = 5 \\
 & -3x = 9 \\
 & x = -3
 \end{aligned}$$

$$\begin{aligned}
 43. \quad & -6(2x-5) = -3(9+4x) \\
 & -12x+30 = -27-12x \\
 & 30 = -27
 \end{aligned}$$

There is no solution.

$$\begin{aligned}
 44. \quad & 3(8y-1) = 6(5+4y) \\
 & 24y-3 = 30+24y \\
 & -3 = 30
 \end{aligned}$$

There is no solution.

$$\begin{aligned}
 45. \quad & \frac{3(2-z)}{5} = z \\
 & 3(2-z) = 5z \\
 & 6-3z = 5z \\
 & 6 = 8z \\
 & \frac{6}{8} = z \\
 & \frac{3}{4} = z
 \end{aligned}$$

$$\begin{aligned}
 46. \quad & \frac{4(n+2)}{5} = -n \\
 & 4(n+2) = -5n \\
 & 4n+8 = -5n \\
 & 8 = -9n \\
 & -\frac{8}{9} = n
 \end{aligned}$$

$$\begin{aligned}
 47. \quad & 0.5(2n-3) - 0.1 = 0.4(6+2n) \\
 & 10[0.5(2n-3) - 0.1] = 10[0.4(6+2n)] \\
 & 5(2n-3) - 1 = 4(6+2n) \\
 & 10n-15-1 = 24+8n \\
 & 10n-16 = 24+8n \\
 & 2n-16 = 24 \\
 & 2n = 40 \\
 & n = 20
 \end{aligned}$$

$$\begin{aligned}
 48. \quad & -9-5a = 3(6a-1) \\
 & -9-5a = 18a-3 \\
 & -9 = 23a-3 \\
 & -6 = 23a \\
 & -\frac{6}{23} = a
 \end{aligned}$$

$$\begin{aligned}
 49. \quad & \frac{5(c+1)}{6} = 2c-3 \\
 & 5(c+1) = 6(2c-3) \\
 & 5c+5 = 12c-18 \\
 & -7c+5 = -18 \\
 & -7c = -23 \\
 & c = \frac{23}{7}
 \end{aligned}$$

$$\begin{aligned}
 50. \quad & \frac{2(8-a)}{3} = 4-4a \\
 & 2(8-a) = 3(4-4a) \\
 & 16-2a = 12-12a \\
 & 10a+16 = 12 \\
 & 10a = -4 \\
 & a = \frac{-4}{10} \\
 & a = -\frac{2}{5}
 \end{aligned}$$

$$\begin{aligned}
 51. \quad & 200(70x-3560) = -179(150x-19,300) \\
 & 14,000x-712,000 = -26,850x+3,454,700 \\
 & 40,850x-712,000 = 3,454,700 \\
 & 40,850x = 4,166,700 \\
 & x = 102
 \end{aligned}$$

$$\begin{aligned}
 52. \quad & 1.72y-0.04y = 0.42 \\
 & 1.68y = 0.42 \\
 & y = 0.25
 \end{aligned}$$

$$\begin{aligned}
 53. \quad & \text{Let } x = \text{length of a side of the square, then} \\
 & 50.5 + 10x = \text{the height.} \\
 & x + (50.5 + 10x) = 7327 \\
 & 11x + 50.5 = 7327 \\
 & 11x = 7276.5 \\
 & x = 661.5 \\
 & 50.5 + 10x = 50.5 + 10(661.5) = 6665.5 \\
 & \text{The height is 6665.5 inches.}
 \end{aligned}$$

$$\begin{aligned}
 54. \quad & \text{Let } x = \text{the length of the shorter piece and} \\
 & 2x = \text{the length of the other.} \\
 & x + 2x = 12 \\
 & 3x = 12 \\
 & x = 4 \\
 & 2x = 2(4) = 8 \\
 & \text{The lengths are 4 feet and 8 feet.}
 \end{aligned}$$

55. Let x = the number of Target Canada stores, then
 $14x - 69$ = the number of Target US stores.

$$x + (14x - 69) = 1926$$

$$15x - 69 = 1926$$

$$15x = 1995$$

$$x = 133$$

$$14x - 69 = 14(133) - 69 = 1862 - 69 = 1793$$

There were 133 Target Canada stores and 1793 Target US stores.

56. Let x = first integer, then
 $x + 1$ = second integer, and
 $x + 2$ = third integer.

$$x + (x + 1) + (x + 2) = -114$$

$$3x + 3 = -114$$

$$3x = -117$$

$$x = -39$$

$$x + 1 = -39 + 1 = -38$$

$$x + 2 = -39 + 2 = -37$$

The integers are $-39, -38, -37$.

57. Let x = the unknown number.

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

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

$$x = 3x - 6$$

$$-2x = -6$$

$$x = 3$$

The number is 3.

58. Let x = the unknown number.

$$2(x + 6) = -x$$

$$2x + 12 = -x$$

$$12 = -3x$$

$$-4 = x$$

The number is -4 .

59. Let $P = 46$ and $l = 14$.

$$P = 2l + 2w$$

$$46 = 2(14) + 2w$$

$$46 = 28 + 2w$$

$$18 = 2w$$

$$9 = w$$

60. Let $V = 192$, $l = 8$, and $w = 6$.

$$V = lwh$$

$$192 = 8(6)h$$

$$192 = 48h$$

$$4 = h$$

61. $y = mx + b$

$$y - b = mx$$

$$\frac{y - b}{x} = m$$

62. $r = vst - 5$

$$r + 5 = vst$$

$$\frac{r + 5}{vt} = s$$

63. $2y - 5x = 7$

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

$$x = \frac{-2y + 7}{-5}$$

$$x = \frac{2y - 7}{5}$$

64. $3x - 6y = -2$

$$-6y = -3x - 2$$

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

$$y = \frac{3x + 2}{6}$$

65. $C = \pi D$

$$\frac{C}{D} = \pi$$

66. $C = 2\pi r$

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

67. Let $V = 900$, $l = 20$, and $h = 3$.

$$V = lwh$$

$$900 = 20w(3)$$

$$900 = 60w$$

$$15 = w$$

The width is 15 meters.

68. Let x = width, then $x + 6$ = length.

$$60 = 2x + 2(x + 6)$$

$$60 = 2x + 2x + 12$$

$$60 = 4x + 12$$

$$48 = 4x$$

$$12 = x$$

$$x + 6 = 12 + 6 = 18$$

The dimensions are 18 feet by 12 feet.

69. Let $d = 10,000$ and $r = 125$.

$$d = rt$$

$$10,000 = 125t$$

$$80 = t$$

It will take 80 minutes or 1 hour and 20 minutes.

70. Let $F = 104$.

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

$$= \frac{5}{9}(104 - 32)$$

$$= \frac{5}{9}(72)$$

$$= 40$$

The temperature was 40°C .

71. Let $x =$ the percent.

$$9 = x \cdot 45$$

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

$$0.2 = x$$

9 is 20% of 45.

72. Let $x =$ the percent.

$$59.5 = x \cdot 85$$

$$\frac{59.5}{85} = \frac{85x}{85}$$

$$0.7 = x$$

59.5 is 70% of 85.

73. Let $x =$ the number.

$$137.5 = 125\% \cdot x$$

$$137.5 = 1.25x$$

$$\frac{137.5}{1.25} = \frac{1.25x}{1.25}$$

$$110 = x$$

137.5 is 125% of 110.

74. Let $x =$ the number.

$$768 = 60\% \cdot x$$

$$768 = 0.6x$$

$$\frac{768}{0.6} = \frac{0.6x}{0.6}$$

$$1280 = x$$

768 is 60% of 1280.

75. Let $x =$ mark-up.

$$x = 11\% \cdot 1900$$

$$x = 0.11 \cdot 1900$$

$$x = 209$$

$$\text{New price} = 1900 + 209 = 2109$$

The mark-up is \$209 and the new price is \$2109.

76. Find 79% of 76,000.
 $0.79 \cdot 76,000 = 60,040$
 We would expect 60,040 people in that city to use the Internet.
77. Let x = gallons of 40% solution.

Strength	gallons	Concentration	
40%	x	0.4	$0.4x$
10%	$30 - x$	0.1	$0.1(30 - x)$
20%	30	0.2	$0.2(30)$

$$\begin{aligned}
 0.4x + 0.1(30 - x) &= 0.2(30) \\
 0.4x + 3 - 0.1x &= 6 \\
 0.3x + 3 &= 6 \\
 0.3x &= 3 \\
 x &= 10 \\
 30 - x &= 30 - 10 = 20 \\
 \text{Mix 10 gallons of 40\% acid solution with 20 gallons of 10\% acid solution.}
 \end{aligned}$$

78. Increase = $21.0 - 20.7 = 0.3$
 Let x = percent.
 $0.3 = x \cdot 20.7$
 $\frac{0.3}{20.7} = \frac{20.7x}{20.7}$
 $0.0145 \approx x$
 The percent of increase is 1.45%.
79. From the graph, the height of 'Almost hit a car' is 18%.
80. Choose the tallest bar. The most common effect is swerving into another lane.
81. Find 21% of 4600.
 $0.21 \cdot 4600 = 966$
 We would expect 966 customers to have cut someone off.
82. Find 41% of 4600.
 $0.41 \cdot 4600 = 1886$
 We would expect 1886 customers to have sped up.
83. percent of decrease = $\frac{\text{amount of decrease}}{\text{original amount}}$
 $= \frac{250 - 170}{250}$
 $= \frac{80}{250}$
 $= 0.32$
 The percent of decrease is 32%.

84. Let
- x
- = original price.

$$x - 0.20x = 19.20$$

$$0.80x = 19.20$$

$$\frac{0.80x}{0.80} = \frac{19.20}{0.80}$$

$$x = 24$$

The original price was \$24.

85. Let
- x
- = time up, then
- $3 - x$
- = time down.

Rate · Time = Distance

Up	10	x	$10x$
Down	50	$3 - x$	$50(3 - x)$

$$d = d$$

$$10x = 50(3 - x)$$

$$10x = 150 - 50x$$

$$60x = 150$$

$$x = 2.5$$

$$\text{Total distance} = 10x + 50(3 - x)$$

$$= 10(2.5) + 50(3 - 2.5)$$

$$= 25 + 50(0.5)$$

$$= 25 + 25$$

$$= 50$$

The distance traveled was 50 km.

86. Let
- x
- = the amount invested at 10.5% for one year.

Principal · Rate = Interest

10.5%	x	0.105	0.105
8.5%	$50,000 - x$	0.085	$0.085(50,000 - x)$
Total	50,000		4550

$$0.105x + 0.085(50,000 - x) = 4550$$

$$0.105x + 4250 - 0.085x = 4550$$

$$0.02x + 4250 = 4550$$

$$0.02x = 300$$

$$x = 15,000$$

$$50,000 - x = 50,000 - 15,000 = 35,000$$

Invest \$35,000 at 8.5% and \$15,000 at 10.5%.

87. Let x = the number of dimes,
 $2x$ = the number of quarters, and
 $500 - x - 2x$ the number of nickels.

	No. of Coins	Value	= Amt. of Money
Dimes	x	0.1	$0.1x$
Quarters	$2x$	0.25	$0.25(2x)$
Nickels	$500 - 3x$	0.05	$0.05(500 - 3x)$
Total	500		88

$$0.1x + 0.25(2x) + 0.05(500 - 3x) = 88$$

$$0.1x + 0.5x + 25 - 0.15x = 88$$

$$0.45x + 25 = 88$$

$$0.45x = 63$$

$$x = 140$$

$$500 - 3x = 500 - 3(140) = 500 - 420 = 80$$

There were 80 nickels in the pay phone.

88. Let x = the time traveled by the Amtrak train.

	Rate	Time	= Distance
Amtrak	60	x	$60x$
Freight	45	$x + 1.5$	$45(x + 1.5)$

$$d = d$$

$$60x = 45(x + 1.5)$$

$$60x = 45x + 67.5$$

$$15x = 67.5$$

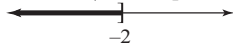
$$x = 4.5$$

It will take 4.5 hours.

89. $x > 0, (0, \infty)$



90. $x \leq -2, (-\infty, -2]$



91. $0.5 \leq y < 1.5, [0.5, 1.5)$



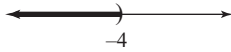
92. $-1 < x < 1, (-1, 1)$



93. $-3x > 12$

$$\frac{-3x}{-3} < \frac{12}{-3}$$

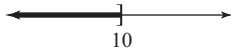
$$x < -4, (-\infty, -4)$$



94. $-2x \geq -20$

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

$$x \leq 10, (-\infty, 10]$$



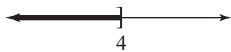
95. $x + 4 \geq 6x - 16$

$$-5x + 4 \geq -16$$

$$-5x \geq -20$$

$$\frac{-5x}{-5} \leq \frac{-20}{-5}$$

$$x \leq 4, (-\infty, 4]$$



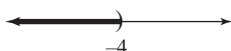
96. $5x - 7 > 8x + 5$

$$-3x - 7 > 5$$

$$-3x > 12$$

$$\frac{-3x}{-3} < \frac{12}{-3}$$

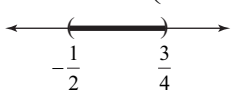
$$x < -4, (-\infty, -4)$$



97. $-3 < 4x - 1 < 2$

$$-2 < 4x < 3$$

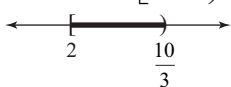
$$-\frac{1}{2} < x < \frac{3}{4}, \left(-\frac{1}{2}, \frac{3}{4}\right)$$



98. $2 \leq 3x - 4 < 6$

$$6 \leq 3x < 10$$

$$2 \leq x < \frac{10}{3}, \left[2, \frac{10}{3}\right)$$



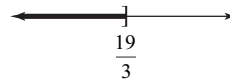
99. $4(2x - 5) \leq 5x - 1$

$$8x - 20 \leq 5x - 1$$

$$3x - 20 \leq -1$$

$$3x \leq 19$$

$$x \leq \frac{19}{3}, \left(-\infty, \frac{19}{3}\right]$$



100. $-2(x - 5) > 2(3x - 2)$

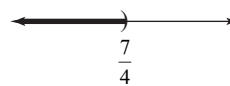
$$-2x + 10 > 6x - 4$$

$$-8x + 10 > -4$$

$$-8x > -14$$

$$\frac{-8x}{-8} < \frac{-14}{-8}$$

$$x < \frac{7}{4}, \left(-\infty, \frac{7}{4}\right)$$



101. Let x = the amount of sales then

$$0.05x = \text{her commission.}$$

$$175 + 0.05x \geq 300$$

$$0.05x \geq 125$$

$$x \geq 2500$$

Sales must be at least \$2500.

102. Let x = her score on the fourth round.

$$\frac{76 + 82 + 79 + x}{4} < 80$$

$$237 + x < 320$$

$$x < 83$$

Her score must be less than 83.

103. $6x + 2x - 1 = 5x + 11$

$$8x - 1 = 5x + 11$$

$$3x - 1 = 11$$

$$3x = 12$$

$$x = 4$$

104. $2(3y - 4) = 6 + 7y$

$$6y - 8 = 6 + 7y$$

$$-8 = 6 + y$$

$$-14 = y$$

$$\begin{aligned}
 105. \quad & 4(3-a) - (6a+9) = -12a \\
 & 12 - 4a - 6a - 9 = -12a \\
 & 3 - 10a = -12a \\
 & 3 = -2a \\
 & -\frac{3}{2} = a
 \end{aligned}$$

$$\begin{aligned}
 106. \quad & \frac{x}{3} - 2 = 5 \\
 & \frac{x}{3} = 7 \\
 & 3 \cdot \frac{x}{3} = 3 \cdot 7 \\
 & x = 21
 \end{aligned}$$

$$\begin{aligned}
 107. \quad & 2(y+5) = 2y+10 \\
 & 2y+10 = 2y+10 \\
 & 10 = 10
 \end{aligned}$$

All real numbers are solutions.

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

There is no solution.

$$\begin{aligned}
 109. \quad & \text{Let } x = \text{the number.} \\
 & 6 + 2x = x - 7 \\
 & 6 + x = -7 \\
 & x = -13
 \end{aligned}$$

The number is -13 .

$$\begin{aligned}
 110. \quad & \text{Let } x = \text{length of shorter piece, then} \\
 & 4x + 3 = \text{length of longer piece.} \\
 & x + (4x + 3) = 23 \\
 & 5x + 3 = 23 \\
 & 5x = 20 \\
 & x = 4 \\
 & 4x + 3 = 4(4) + 3 = 19
 \end{aligned}$$


The shorter piece is 4 inches and the longer piece is 19 inches.

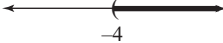
$$\begin{aligned}
 111. \quad & V = \frac{1}{3}Ah \\
 & 3 \cdot V = 3 \cdot \frac{1}{3}Ah \\
 & 3V = Ah \\
 & \frac{3V}{A} = \frac{Ah}{A} \\
 & \frac{3V}{A} = h
 \end{aligned}$$


$$\begin{aligned}
 112. \quad & \text{Let } x = \text{the number.} \\
 & x = 26\% \cdot 85 \\
 & x = 0.26 \cdot 85 \\
 & x = 22.1 \\
 & 22.1 \text{ is } 26\% \text{ of } 85.
 \end{aligned}$$

$$\begin{aligned}
 113. \quad & \text{Let } x = \text{the number.} \\
 & 72 = 45\% \cdot x \\
 & 72 = 0.45x \\
 & \frac{72}{0.45} = \frac{0.45x}{0.45} \\
 & 160 = x \\
 & 72 \text{ is } 45\% \text{ of } 160.
 \end{aligned}$$

$$\begin{aligned}
 114. \quad & \text{Increase} = 282 - 235 = 47 \\
 & \text{Let } x = \text{percent.} \\
 & 47 = x \cdot 235 \\
 & \frac{47}{235} = \frac{235x}{235} \\
 & 0.2 = x \\
 & \text{The percent of increase is } 20\%.
 \end{aligned}$$

$$\begin{aligned}
 115. \quad & 4x - 7 > 3x + 2 \\
 & x - 7 > 2 \\
 & x > 9, (9, \infty)
 \end{aligned}$$


$$\begin{aligned}
 116. \quad & -5x < 20 \\
 & \frac{-5x}{-5} > \frac{20}{-5} \\
 & x > -4, (-4, \infty)
 \end{aligned}$$


$$\begin{aligned}
 117. \quad & -3(1+2x) + x \geq -(3-x) \\
 & -3 - 6x + x \geq -3 + x \\
 & -3 - 5x \geq -3 + x \\
 & -5x \geq x \\
 & -6x \geq 0 \\
 & \frac{-6x}{-6} \leq \frac{0}{-6} \\
 & x \leq 0, (-\infty, 0]
 \end{aligned}$$


Chapter 2 Getting Ready for the Test

1. There is no equal sign, so this is not an equation that can be solved. Also, there is only one term that cannot be further simplified. Thus the best direction is to identify the numerical coefficient; C.

2. This is an equation that can be solved; A.
3. Two terms are given, so the best direction is to determine whether the given terms are like or unlike terms; D.
4. There is no equal sign, so this is not an equation that can be solved—it is an expression that can be simplified; B.
5. Subtracting $100z$ from $8m$ translates to $8m - 100z$; B.
6. Subtracting $7x - 1$ from $9y$ translates to $9y - (7x - 1)$; C.
7. $7x + 6 = 7x + 9$
 $7x - 7x + 6 = 7x - 7x + 9$
 $6 = 9$ False
 The equation has no solution; B.
8. $2y - 5 = 2y - 5$
 $2y - 2y - 5 = 2y - 2y - 5$
 $-5 = -5$ True
 The equation has all real numbers as solutions; A.
9. $11x - 13 = 10x - 13$
 $11x - 10x - 13 = 10x - 10x - 13$
 $x - 13 = -13$
 $x - 13 + 13 = -13 + 13$
 $x = 0$
 The solution is 0; C.
10. $x + 15 = -x + 15$
 $x + x + 15 = -x + x + 15$
 $2x + 15 = 15$
 $2x + 15 - 15 = 15 - 15$
 $2x = 0$
 $\frac{2x}{2} = \frac{0}{2}$
 $x = 0$
 The solution is 0; C.
11. $5(3x - 2) = 5 \cdot 3x - 5 \cdot 2 = 15x - 10$
 $-(x + 20) = -1(x + 20)$
 $= -1 \cdot x + (-1) \cdot 20$
 $= -x - 20$
 The resulting equation is $15x - 10 = -x - 20$; B.

$$12. \quad 30\left(\frac{8x}{3} + 1\right) = 30 \cdot \frac{8x}{3} + 30 \cdot 1$$

$$= 10 \cdot 8x + 30$$

$$= 80x + 30$$

$$30\left(\frac{x-2}{10}\right) = 3(x-2) = 3 \cdot x - 3 \cdot 2 = 3x - 6$$

The simplified equation is $80x + 30 = 3x - 6$; D.

Chapter 2 Test

1. $2y - 6 - y - 4 = y - 10$
2. $2.7x + 6.1 + 3.2x - 4.9 = 5.9x + 1.2$
3. $4(x - 2) - 3(2x - 6) = 4x - 8 - 6x + 18$
 $= -2x + 10$
4. $7 + 2(5y - 3) = 7 + 10y - 6 = 10y + 1$
5. $-\frac{4}{5}x = 4$
 $-\frac{5}{4} \cdot \left(-\frac{4}{5}x\right) = -\frac{5}{4} \cdot 4$
 $x = -5$
6. $4(n - 5) = -(4 - 2n)$
 $4n - 20 = -4 + 2n$
 $2n - 20 = -4$
 $2n = 16$
 $n = 8$
7. $5y - 7 + y = -(y + 3y)$
 $6y - 7 = -4y$
 $-7 = -10y$
 $\frac{7}{10} = y$
8. $4z + 1 - z = 1 + z$
 $3z + 1 = 1 + z$
 $2z + 1 = 1$
 $2z = 0$
 $z = 0$
9. $\frac{2(x+6)}{3} = x - 5$
 $2(x+6) = 3(x-5)$
 $2x + 12 = 3x - 15$
 $12 = x - 15$
 $27 = x$

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

$$\begin{aligned}
 11. \quad -0.3(x - 4) + x &= 0.5(3 - x) \\
 10[-0.3(x - 4) + x] &= 10[0.5(3 - x)] \\
 -3(x - 4) + 10x &= 5(3 - x) \\
 -3x + 12 + 10x &= 15 - 5x \\
 7x + 12 &= 15 - 5x \\
 12x + 12 &= 15 \\
 12x &= 3 \\
 x &= \frac{3}{12} = \frac{1}{4} = 0.25
 \end{aligned}$$

$$\begin{aligned}
 12. \quad -4(a + 1) - 3a &= -7(2a - 3) \\
 -4a - 4 - 3a &= -14a + 21 \\
 -7a - 4 &= -14a + 21 \\
 7a - 4 &= 21 \\
 7a &= 25 \\
 a &= \frac{25}{7}
 \end{aligned}$$

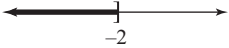
$$\begin{aligned}
 13. \quad -2(x - 3) &= x + 5 - 3x \\
 -2x + 6 &= -2x + 5 \\
 6 &= 5
 \end{aligned}$$


There is no solution.


$$\begin{aligned}
 14. \quad \text{Let } y &= -14, m = -2, \text{ and } b = -2. \\
 y &= mx + b \\
 -14 &= -2x - 2 \\
 -12 &= -2x \\
 6 &= x
 \end{aligned}$$

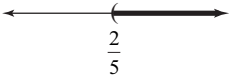
$$\begin{aligned}
 15. \quad V &= \pi r^2 h \\
 \frac{V}{\pi r^2} &= \frac{\pi r^2 h}{\pi r^2} \\
 \frac{V}{\pi r^2} &= h
 \end{aligned}$$

$$\begin{aligned}
 16. \quad 3x - 4y &= 10 \\
 -4y &= -3x + 10 \\
 y &= \frac{-3x + 10}{-4} \\
 y &= \frac{3x - 10}{4}
 \end{aligned}$$

$$\begin{aligned}
 17. \quad 3x - 5 &\geq 7x + 3 \\
 -4x - 5 &\geq 3 \\
 -4x &\geq 8 \\
 \frac{-4x}{-4} &\leq \frac{8}{-4} \\
 x &\leq -2, (-\infty, -2]
 \end{aligned}$$


$$\begin{aligned}
 18. \quad x + 6 &> 4x - 6 \\
 -3x + 6 &> -6 \\
 -3x &> -12 \\
 \frac{-3x}{-3} &< \frac{-12}{-3} \\
 x &< 4, (-\infty, 4)
 \end{aligned}$$


$$\begin{aligned}
 19. \quad -2 < 3x + 1 < 8 \\
 -3 < 3x < 7 \\
 -1 < x < \frac{7}{3}, \left(-1, \frac{7}{3}\right)
 \end{aligned}$$


$$\begin{aligned}
 20. \quad \frac{2(5x + 1)}{3} &> 2 \\
 2(5x + 1) &> 6 \\
 10x + 2 &> 6 \\
 10x &> 4 \\
 x &> \frac{4}{10} = \frac{2}{5}, \left(\frac{2}{5}, \infty\right)
 \end{aligned}$$


21. Let
- $x =$
- the number.

$$x + \frac{2}{3}x = 35$$

$$3\left(x + \frac{2}{3}x\right) = 3(35)$$

$$3x + 2x = 105$$

$$5x = 105$$

$$x = 21$$

The number is 21.

22. Let
- $x =$
- width, then
- $x + 2 =$
- length.

$$P = 2w + 2l$$

$$252 = 2x + 2(x + 2)$$

$$252 = 2x + 2x + 4$$

$$252 = 4x + 4$$

$$252 - 4 = 4x + 4 - 4$$

$$248 = 4x$$

$$\frac{248}{4} = \frac{4x}{4}$$

$$62 = x$$

$$64 = x + 2$$

The dimensions of the deck are 62 feet by 64 feet.

23. Let
- $x =$
- one area code, then

$$2x = \text{other area code.}$$

$$x + 2x = 1203$$

$$3x = 1203$$

$$\frac{3x}{3} = \frac{1203}{3}$$

$$x = 401$$

$$2x = 2(401) = 802$$

The area codes are 401 and 802.

24. Let
- $x =$
- the amount invested at 10% for one year.

Principal \cdot Rate = Interest

10%	x	0.10	$0.1x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$0.1x + 0.12(2x) = 2890$$

$$0.1x + 0.24x = 2890$$

$$0.34x = 2890$$

$$x = 8500$$

$$2x = 2(8500) = 17,000$$

He invested \$8500 at 10% and \$17,000 at 12%.

25. Let
- $x =$
- the time they travel.

Rate \cdot Time = Distance

Train 1	50	x	$50x$
Train 2	64	x	$64x$
Total			285

$$50x + 64x = 285$$

$$114x = 285$$

$$x = 2\frac{1}{2}$$

They must travel for $2\frac{1}{2}$ hours.

26. From the graph, 69% are classified as weak. Find 69% of 800.

$$69\% \cdot 800 = 0.69 \cdot 800 = 552$$

You would expect 552 of the 800 to be classified as weak.

27. Let
- x
- be the unknown percent.

$$72 = x \cdot 180$$

$$\frac{72}{180} = \frac{180x}{180}$$

$$0.4 = x$$

72 is 40% of 180.

28. percent of decrease =
- $\frac{\text{amount of decrease}}{\text{original amount}}$

$$= \frac{225 - 189}{225}$$

$$= \frac{36}{225}$$

$$= 0.16$$

The percent of decrease is 16%.

Chapter 2 Cumulative Review

- The natural numbers are 11 and 112.
- The whole numbers are 0, 11, and 112.
- The integers are -3 , -2 , 0, 11, and 112.
- The rational numbers are -3 , -2 , -1.5 , 0, $\frac{1}{4}$, 11, and 112.
- The irrational number is $\sqrt{2}$.
- All the numbers in the given set are real numbers.

2. a. The natural numbers are 2, 7, and 8.
 b. The whole numbers are 0, 2, 7, and 8.
 c. The integers are -185 , 0, 2, 7, and 8.
 d. The rational numbers are -185 , $-\frac{1}{5}$, 0, 2, 7, and 8.
 e. The irrational number is $\sqrt{3}$.
 f. All the numbers in the given set are real numbers.
3. a. $|4| = 4$
 b. $|-5| = 5$
 c. $|0| = 0$
 d. $\left|-\frac{1}{2}\right| = \frac{1}{2}$
 e. $|5.6| = 5.6$
4. a. $|5| = 5$
 b. $|-8| = 8$
 c. $\left|-\frac{2}{3}\right| = \frac{2}{3}$
5. a. $40 = 2 \cdot 2 \cdot 2 \cdot 5$
 b. $63 = 3 \cdot 3 \cdot 7$
6. a. $44 = 2 \cdot 2 \cdot 11$
 b. $90 = 2 \cdot 3 \cdot 3 \cdot 5$
7. $\frac{2}{5} = \frac{2}{5} \cdot \frac{4}{4} = \frac{8}{20}$
8. $\frac{2}{3} = \frac{2}{3} \cdot \frac{8}{8} = \frac{16}{24}$
9. $3[4 + 2(10 - 1)] = 3[4 + 2(9)]$
 $= 3[4 + 18]$
 $= 3[22]$
 $= 66$
10. $5[16 - 4(2 + 1)] = 5[16 - 4(3)]$
 $= 5[16 - 12]$
 $= 5[4]$
 $= 20$
11. Let $x = 2$.
 $3x + 10 = 8x$
 $3(2) + 10 \stackrel{?}{=} 8(2)$
 $6 + 10 \stackrel{?}{=} 16$
 $16 = 16$
 2 is a solution of the equation.
12. Let $x = 3$.
 $5x - 2 = 4x$
 $5(3) - 2 \stackrel{?}{=} 4(3)$
 $15 - 2 \stackrel{?}{=} 12$
 $13 \neq 12$
 3 is not a solution of the equation.
13. $-1 + (-2) = -3$
14. $(-2) + (-8) = -10$
15. $-4 + 6 = 2$
16. $-3 + 10 = 7$
17. a. $-(-10) = 10$
 b. $-\left(-\frac{1}{2}\right) = \frac{1}{2}$
 c. $-(-2x) = 2x$
 d. $-|-6| = -(6) = -6$
18. a. $-(-5) = 5$
 b. $-\left(-\frac{2}{3}\right) = \frac{2}{3}$
 c. $-(-a) = a$
 d. $-|-3| = -(3) = -3$
19. a. $5.3 - (-4.6) = 5.3 + 4.6 = 9.9$

- b.
$$\begin{aligned} -\frac{3}{10} - \frac{5}{10} &= -\frac{3}{10} + \left(-\frac{5}{10}\right) \\ &= \frac{-3-5}{10} \\ &= -\frac{8}{10} \\ &= -\frac{4}{5} \end{aligned}$$
- c.
$$\begin{aligned} -\frac{2}{3} - \left(-\frac{4}{5}\right) &= -\frac{2}{3} \cdot \frac{5}{5} + \frac{4}{5} \cdot \frac{3}{3} \\ &= -\frac{10}{15} + \frac{12}{15} \\ &= \frac{2}{15} \end{aligned}$$
20. a. $-2.7 - 8.4 = -2.7 + (-8.4) = -11.1$
- b.
$$-\frac{4}{5} - \left(-\frac{3}{5}\right) = -\frac{4}{5} + \frac{3}{5} = \frac{-4+3}{5} = -\frac{1}{5}$$
- c.
$$\frac{1}{4} - \left(-\frac{1}{2}\right) = \frac{1}{4} + \frac{1}{2} \cdot \frac{2}{2} = \frac{1}{4} + \frac{2}{4} = \frac{3}{4}$$
21. a. $x = 90 - 38 = 90 + (-38) = 52$
The complementary angle is 52° .
- b. $y = 180 - 62 = 180 + (-62) = 118$
The supplementary angle is 118° .
22. a. $x = 90 - 72 = 90 + (-72) = 18$
The complementary angle is 18° .
- b. $y = 180 - 47 = 180 + (-47) = 133$
The supplementary angle is 133° .
23. a. $(-1.2)(0.05) = -0.06$
- b.
$$\frac{2}{3} \cdot \left(-\frac{7}{10}\right) = \frac{2 \cdot 7}{3 \cdot 10} = -\frac{14}{30} = -\frac{7}{15}$$
- c.
$$\left(-\frac{4}{5}\right)(-20) = \frac{4 \cdot 20}{5} = \frac{80}{5} = 16$$
24. a. $(4.5)(-0.08) = -0.36$
- b.
$$-\frac{3}{4} \cdot \left(-\frac{8}{17}\right) = \frac{3 \cdot 8}{4 \cdot 17} = \frac{24}{68} = \frac{6}{17}$$
25. a. $\frac{-24}{-4} = 6$
- b. $\frac{-36}{3} = -12$
- c.
$$\frac{2}{3} \div \left(-\frac{5}{4}\right) = \frac{2}{3} \cdot \left(-\frac{4}{5}\right) = -\frac{8}{15}$$
- d.
$$-\frac{3}{2} \div 9 = -\frac{3}{2} \div \frac{9}{1} = -\frac{3}{2} \cdot \frac{1}{9} = -\frac{3}{18} = -\frac{1}{6}$$
26. a. $\frac{-32}{8} = -4$
- b. $\frac{-108}{-12} = 9$
- c.
$$-\frac{5}{7} \div \left(\frac{-9}{2}\right) = -\frac{5}{7} \cdot \left(-\frac{2}{9}\right) = \frac{10}{63}$$
27. a. $x + 5 = 5 + x$
- b. $3 \cdot x = x \cdot 3$
28. a. $y + 1 = 1 + y$
- b. $y \cdot 4 = 4 \cdot y$
29. a. $8 \cdot 2 + 8 \cdot x = 8(2 + x)$
- b. $7s + 7t = 7(s + t)$
30. a. $4 \cdot y + 4 \cdot \frac{1}{3} = 4\left(y + \frac{1}{3}\right)$
- b. $0.10x + 0.10y = 0.10(x + y)$
31. $(2x - 3) - (4x - 2) = 2x - 3 - 4x + 2 = -2x - 1$
32.
$$\begin{aligned} (-5x + 1) - (10x + 3) &= -5x + 1 - 10x - 3 \\ &= -15x - 2 \end{aligned}$$
33.
$$\begin{aligned} \frac{1}{2} &= x - \frac{3}{4} \\ 4\left(\frac{1}{2}\right) &= 4(x) - 4\left(\frac{3}{4}\right) \\ 2 &= 4x - 3 \\ 5 &= 4x \\ \frac{5}{4} &= x \end{aligned}$$

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

$$\begin{aligned}
 35. \quad 6(2a-1) - (11a+6) &= 7 \\
 12a-6-11a-6 &= 7 \\
 a-12 &= 7 \\
 a &= 19
 \end{aligned}$$

$$\begin{aligned}
 36. \quad -3x+1 - (-4x-6) &= 10 \\
 -3x+1+4x+6 &= 10 \\
 x+7 &= 10 \\
 x &= 3
 \end{aligned}$$

$$\begin{aligned}
 37. \quad \frac{y}{7} &= 20 \\
 y &= 140
 \end{aligned}$$

$$\begin{aligned}
 38. \quad \frac{x}{4} &= 18 \\
 x &= 72
 \end{aligned}$$

$$\begin{aligned}
 39. \quad 4(2x-3)+7 &= 3x+5 \\
 8x-12+7 &= 3x+5 \\
 8x-5 &= 3x+5 \\
 5x-5 &= 5 \\
 5x &= 10 \\
 x &= 2
 \end{aligned}$$

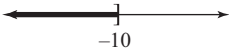
$$\begin{aligned}
 40. \quad 6x+5 &= 4(x+4)-1 \\
 6x+5 &= 4x+16-1 \\
 6x+5 &= 4x+15 \\
 2x+5 &= 15 \\
 2x &= 10 \\
 x &= 5
 \end{aligned}$$

$$\begin{aligned}
 41. \quad \text{Let } x &= \text{ a number.} \\
 2(x+4) &= 4x-12 \\
 2x+8 &= 4x-12 \\
 8 &= 2x-12 \\
 20 &= 2x \\
 10 &= x \\
 \text{The number is } &10.
 \end{aligned}$$

$$\begin{aligned}
 42. \quad \text{Let } x &= \text{ a number.} \\
 x+4 &= 3x-8 \\
 4 &= 2x-8 \\
 12 &= 2x \\
 6 &= x \\
 \text{The number is } &6.
 \end{aligned}$$

$$\begin{aligned}
 43. \quad V &= lwh \\
 \frac{V}{wh} &= \frac{lwh}{wh} \\
 \frac{V}{wh} &= l
 \end{aligned}$$

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

$$\begin{aligned}
 45. \quad x+4 &\leq -6 \\
 x &\leq -10, (-\infty, -10]
 \end{aligned}$$


$$\begin{aligned}
 46. \quad x-3 &> 2 \\
 x &> 5, (5, \infty)
 \end{aligned}$$
