

Chapter 1

Section 1.2 Practice Exercises

1. Let $b = 3.5$ and $h = 8$.

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

$$A = \frac{1}{2}(3.5)(8) = 14$$

The area is 14 square centimeters.

2. Let $p = 17$ and $q = 3$.

$$2p - q = 2(17) - 3 = 34 - 3 = 31$$

3. a. $\{6, 7, 8, 9\}$

b. $\{41, 42, 43, \dots\}$

4. a. True, since 7 is a natural number and therefore an element of the set.

- b. True, since 6 is not an element of the set $\{1, 3, 5, 7\}$.

5. a. True; every integer is a real number.

- b. False; $\sqrt{8}$ is an irrational number.

- c. True; every whole number is a rational number.

- d. False; since the element 2 in the first set is not an element of the second set.

6. a. $|4| = 4$ since 4 is located 4 units from 0 on the number line.

- b. $\left|-\frac{1}{2}\right| = \frac{1}{2}$ since $-\frac{1}{2}$ is $\frac{1}{2}$ unit from 0 on the number line.

- c. $|1| = 1$ since 1 is 1 unit from 0 on the number line.

- d. $-|6.8| = -6.8$
The negative sign outside the absolute value bars means to take the opposite of the absolute value of 6.8.

- e. $-|-4| = -4$
Since $|-4| = 4$, $-|-4| = -4$.

7. a. The opposite of 5.4 is -5.4 .

- b. The opposite of $-\frac{3}{5}$ is $\frac{3}{5}$.

- c. The opposite of 18 is -18 .

8. a. $3 \cdot x$ or $3x$

- b. $2x - 5$

- c. $3\frac{5}{8} + x$

- d. $x \div 2$ or $\frac{x}{2}$

- e. $x - 14$

- f. $5(x + 10)$

Vocabulary, Readiness & Video Check 1.2

1. Letters that represent numbers are called variables.

2. Finding the value of an expression means evaluating the expression.

3. The absolute value of a number is that number's distance from 0 on the number line.

4. An expression is formed by numbers and variables connected by operations such as addition, subtraction, multiplication, division, raising to powers, and/or taking roots.

5. The natural numbers are $\{1, 2, 3, \dots\}$.

6. The whole numbers are $\{0, 1, 2, 3, \dots\}$.

7. The integers are $\{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$.

8. The number $\sqrt{5}$ is an irrational number.

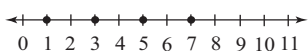
9. The number $\frac{5}{7}$ is a rational number.

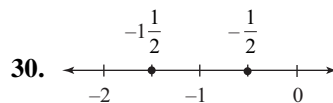
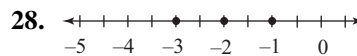
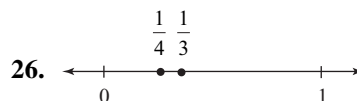
10. The opposite of a is $-a$.

11. This is an application, so the answer needs to be put in context. The decimal actually represents money.

12. Every real number is either a rational number or an irrational number. There are no numbers that are both rational and irrational.
13. The absolute value of a number is that number's distance from zero on a number line. Or, more formally, $|a| = a$ if a is 0 or a positive number. Also, $|a| = -a$ if a is a negative number.
14. The absolute value of a number is its *distance* from 0 on the number line, regardless of direction—distance must be positive or zero. The opposite of a number is the *number* that lies the same distance from 0 on the number line as the original number, but on the other side of 0—the opposite of a number can be negative.
15. Order is important in subtraction so you must read the phrase carefully to determine the order of subtraction in your algebraic expression.

Exercise Set 1.2

2. $3y = 3(45) = 135$
4. $7.1a = 7.1(1.5) = 10.65$
6. $yz = \frac{2}{3} \cdot \frac{1}{5} = \frac{2}{15}$
8. $2a - b = 2(12) - 7 = 24 - 7 = 17$
10. $1.5x = 1.5(30) = 45$
30 encyclopedias need 45 inches of shelf space.
12. $\frac{x}{5} = \frac{2}{5}$
You are $\frac{2}{5}$ of a mile away from the lightning.
14. $2193.16t = 2193.16 \cdot 1.7 = 3728.372$
The distance flown in 1.7 hours is 3728.372 miles.
16. $\{7, 8, 9, \dots\}$
18. $\{1, 3, 5, \dots\}$
20. \emptyset
22. $\{1, 3, 5, 7\}$
24. 



32. $\{3, 0, \sqrt{36}, -134\}$

34. $\left\{3, 0, \sqrt{36}, \frac{2}{5}, -134\right\}$

36. $\left\{3, 0, \sqrt{7}, \sqrt{36}, \frac{2}{5}, -134\right\}$

38. $0 \notin \{x | x \text{ is a positive integer}\}$

40. $12 \in \{1, 2, 3, \dots\}$

42. $0 \notin \{1, 2, 3, \dots\}$

44. $0 \notin \{x | x \text{ is a natural number}\}$

46. False; the number $\sqrt{2}$, for example, is not a natural number.

48. True; $\frac{1}{2}$ is a ratio of the two integers 1 and 2.

50. True; every integer is a rational number.

52. False; π is a real number.

54. False; the number $\sqrt{2}$, for example, is an irrational number, but it is not a natural number.

56. True; every natural number is a rational number.

58. $|8| = 8$ since 8 is located 8 units from 0 on the number line.

60. $|-6| = 6$ since -6 is located 6 units from 0 on the number line.

62. $|-1| = 1$ since -1 is located 1 unit from 0 on the number line.

64. Since $|-11|$ is 11, $-|-11| = -11$.

66. The opposite of -7.8 is $-(-7.8) = 7.8$.

68. The opposite of $\frac{9}{5}$ is $-\frac{9}{5}$.

70. The opposite of $-\frac{14}{3}$ is $-\left(-\frac{14}{3}\right) = \frac{14}{3}$.

72. The opposite of 10.3 is -10.3 .

74. $6x$

76. $6x + 1$

78. $x - 7$

80. $25 - x$

82. $\frac{x}{13}$

84. $3x - 4$

86. $15.7 + x$ or $15\frac{7}{10} + x$

88. $x - 2\frac{3}{4}$

90. $\frac{4}{x+1}$

92. $8(x - 9)$

94. The height of the bar representing France is about 91. Therefore, 91 million tourists are predicted for France.

96. The height of the bar representing Hong Kong is about 56. Therefore, 56 million tourists are predicted for Hong Kong.

98. answers may vary

100. answers may vary

102. answers may vary

104. answers may vary

Section 1.3 Practice Exercises

1. a. $-6 + (-2) = -(6 + 2) = -8$

b. $5 + (-8) = -3$

c. $-4 + 9 = 5$

d. $(-3.2) + (-4.9) = -8.1$

e. $-\frac{3}{5} + \frac{2}{3} = -\frac{3}{5} \cdot \frac{3}{3} + \frac{2}{3} \cdot \frac{5}{5} = -\frac{9}{15} + \frac{10}{15} = \frac{1}{15}$

f. $-\frac{5}{11} + \frac{3}{22} = -\frac{5}{11} \cdot \frac{2}{2} + \frac{3}{22} = -\frac{10}{22} + \frac{3}{22} = -\frac{7}{22}$

2. a. $3 - 11 = 3 + (-11) = -8$

b. $-6 - (-3) = -6 + (3) = -3$

c. $-7 - 5 = -7 + (-5) = -12$

d. $4.2 - (-3.5) = 4.2 + 3.5 = 7.7$

e. $-\frac{5}{7} - \frac{1}{3} = -\frac{5 \cdot 3}{7 \cdot 3} - \frac{1 \cdot 7}{3 \cdot 7}$
 $= -\frac{15}{21} + \left(-\frac{7}{21}\right)$
 $= -\frac{22}{21}$

f. $3 - 1.2 = 3 + (-1.2) = 1.8$

g. $2 - 9 = 2 + (-9) = -7$

3. a. $13 + 5 - 6 = 18 - 6 = 12$

b. $-6 - 2 + 4 = -8 + 4 = -4$

4. a. Since the signs of the two numbers are different or unlike, the product is negative.
 $(-5)(3) = -15$

b. Since the signs of the two numbers are the same, the product is positive.
 $(-7)\left(-\frac{1}{14}\right) = \frac{7}{14} = \frac{1}{2}$

c. $5.1(-2) = -10.2$

d. $14(0) = 0$

e. $\left(-\frac{1}{4}\right)\left(\frac{8}{13}\right) = -\frac{8}{52} = -\frac{2}{13}$

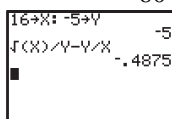
f. $6(-1)(-2)(3) = -6(-2)(3) = 12(3) = 36$

- g. $5(-2.3) = -11.5$
5. a. Since the signs are different or unlike, the quotient is negative.

$$\frac{-16}{8} = -2$$
- b. Since the signs are the same, the quotient is positive.

$$\frac{-15}{-3} = 5$$
- c. $-\frac{2}{3} \div 4 = -\frac{2}{3} \cdot \frac{1}{4} = -\frac{1}{6}$
- d. $\frac{54}{-9} = -6$
- e. $-\frac{1}{12} \div \left(-\frac{3}{4}\right) = -\frac{1}{12} \cdot -\frac{4}{3} = \frac{1}{9}$
- f. $\frac{0}{-7} = 0$
6. a. $2^3 = 2 \cdot 2 \cdot 2 = 8$
- b. $\left(\frac{1}{3}\right)^2 = \left(\frac{1}{3}\right)\left(\frac{1}{3}\right) = \frac{1}{9}$
- c. $-12^2 = -(12 \cdot 12) = -144$
- d. $(-12)^2 = (-12)(-12) = 144$
- e. $-4^3 = -(4 \cdot 4 \cdot 4) = -64$
- f. $(-4)^3 = (-4)(-4)(-4) = -64$
7. a. $\sqrt{49} = 7$ since 7 is positive and $7^2 = 49$.
- b. $\sqrt{\frac{1}{16}} = \frac{1}{4}$ since $\left(\frac{1}{4}\right)^2 = \frac{1}{16}$.
- c. $-\sqrt{64} = -8$
- d. $\sqrt{-64}$ is not a real number.
- e. $\sqrt{100} = 10$ since $10^2 = 100$.
8. a. $\sqrt[3]{64} = 4$ since $4^3 = 64$.
- b. $\sqrt[5]{-1} = -1$ since $(-1)^5 = -1$.
- c. $\sqrt[4]{10,000} = 10$ since $10^4 = 10,000$.
9. a. $14 - 3 \cdot 4 = 14 - 12 = 2$
- b. $3(5 - 8)^2 = 3(-3)^2 = 3(9) = 27$
- c. $\frac{|-5|^2 + 4}{\sqrt{4} - 3} = \frac{5^2 + 4}{2 - 3} = \frac{25 + 4}{-1} = \frac{29}{-1} = -29$
10. $5 - [(3 - 5) + 6(2 - 4)] = 5 - [-2 + 6(-2)]$
 $= 5 - [-2 + (-12)]$
 $= 5 - [-14]$
 $= 5 + 14$
 $= 19$
11. $\frac{-2\sqrt{12+4} - (-3)^2}{6^2 + |1-9|} = \frac{-2\sqrt{16} - (-3)^2}{6^2 + |-8|}$
 $= \frac{-2(4) - 9}{36 + 8}$
 $= \frac{-8 - 9}{44}$
 $= -\frac{17}{44}$
12. For each expression, replace x with 16 and y with -5 .
- a. $2x - 7y = 2(16) - 7(-5) = 32 + 35 = 67$
- b. $-4y^2 = -4(-5)^2 = -4(25) = -100$

$$\begin{aligned}
 \text{c. } \frac{\sqrt{x}}{y} - \frac{y}{x} &= \frac{\sqrt{16}}{-5} - \frac{-5}{16} \\
 &= -\frac{4}{5} + \frac{5}{16} \\
 &= -\frac{4}{5} \cdot \frac{16}{16} + \frac{5}{16} \cdot \frac{5}{5} \\
 &= -\frac{64}{80} + \frac{25}{80} \\
 &= -\frac{39}{80}
 \end{aligned}$$



13. a. $5x^2 + 1$; $x = 3$

$$3^2 = 9$$

$$5 \cdot 9 = 45$$

$$45 + 1 = 46$$

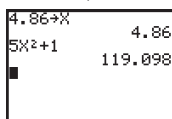
b. $5x^2 + 1$; $x = 11$

$$11^2 = 121$$

$$5 \cdot 121 = 605$$

$$605 + 1 = 606$$

c. $5x^2 + 1$; $x = 4.86$



The value of $5x^2 + 1$ when $x = 4.86$ is 119.098.

14. When $x = -5$,

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

When $x = 10$,

$$\frac{9}{5}x + 32 = \frac{9}{5}(10) + 32 = 18 + 32 = 50.$$

When $x = 25$,

$$\frac{9}{5}x + 32 = \frac{9}{5}(25) + 32 = 45 + 32 = 77.$$

The completed table is

Degrees Celsius	x	-5	10	25
Degrees Fahrenheit	$\frac{9}{5}x + 32$	23	50	77

Vocabulary, Readiness & Video Check 1.3

1. $0 \cdot a = \underline{0}$

2. $\frac{0}{4}$ simplifies to 0 while $\frac{4}{0}$ is undefined.

3. The reciprocal of the nonzero number b is $\frac{1}{b}$.

4. The fraction $-\frac{a}{b} = \frac{-a}{b} = \frac{a}{-b}$.

5. An exponent is a shorthand notation for repeated multiplication of the same number.

6. In $(-5)^2$, the 2 is the exponent and the -5 is the base.

7. The opposite of squaring a number is taking the square root of a number.

8. Using order of operations, $9 \div 3 \cdot 3 = \underline{9}$.

9. addition

10. The signs of the numbers determine the sign of the product or quotient. Same signs mean a positive product or quotient and different signs mean a negative product or quotient.

11. The parentheses, or lack of them, determine the base of the expression. In Example 7, -7^2 , the base is 7 and only 7 is squared. In Example 8, $(-7)^2$, the base is -7 and all of -7 is squared.

12. the positive or principal square root

13. It allows each expression to evaluate to a single number.

14. The 2 is part of a multiplication which must happen before addition in the order of operations.

Exercise Set 1.3

2. $12 + (-7) = 5$

4. $-5 + (-9) = -14$

6. $-8.2 - (-6.6) = -8.2 + 6.6 = -1.6$

8. $15 - (-1) = 15 + 1 = 16$

$$10. \frac{7}{10} - \frac{4}{5} = \frac{7}{10} + \left(-\frac{8}{10}\right) = -\frac{1}{10}$$

$$12. -13 - 4 + 9 = -17 + 9 = -8$$

$$14. -\frac{5}{2} - \left(-\frac{2}{3}\right) = -\frac{5}{2} + \frac{2}{3} = -\frac{15}{6} + \frac{4}{6} = -\frac{11}{6}$$

$$16. -3 - 9 = -12$$

$$18. -3 \cdot 8 = -24$$

$$20. -5 \cdot 0 = 0$$

$$22. \frac{-2}{0} \text{ is undefined.}$$

$$24. \frac{-20}{5} = -4$$

$$26. \frac{-36}{-6} = 6$$

$$28. 5\left(-\frac{1}{50}\right) = -\frac{5}{50} = -\frac{1}{10}$$

$$30. (-0.9)(-0.5) = 0.45$$

$$32. 22.5 \div (-2.5) = \frac{22.5}{1} \cdot \frac{1}{-2.5} = -9$$

$$34. \text{ Multiplying from left to right gives } -5(-3)(-2) = 15(-2) = -30.$$

$$36. (-7)^2 = (-7) \cdot (-7) = 49$$

$$38. -6^2 = -(6 \cdot 6) = -36$$

$$40. -2^3 = -(2 \cdot 2 \cdot 2) = -8$$

$$42. \left(-\frac{1}{2}\right)^4 = \left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right) = \frac{1}{16}$$

$$44. \sqrt{81} = 9 \text{ since } 9 \text{ is positive and } 9^2 = 81.$$

$$46. -\sqrt{\frac{4}{25}} = -\frac{2}{5} \text{ since } \left(\frac{2}{5}\right)^2 = \frac{4}{25}.$$

$$48. \sqrt[5]{32} = 2 \text{ since } 2^5 = 32.$$

$$50. \sqrt[3]{1} = 1 \text{ since } 1^3 = 1.$$

$$52. \text{ not a real number}$$

$$54. 7(3-8)^2 = 7(-5)^2 = 7(25) = 175$$

$$56. -5^2 - 2^4 = -25 - 16 = -25 + (-16) = -41$$

$$58. \frac{4.2 - (-8.2)}{-0.4} = \frac{4.2 + 8.2}{-0.4} = \frac{12.4}{-0.4} = -31$$

$$60. (-15)^2 - 2^4 = 225 - 16 = 209$$

$$62. -20 \div 5 \cdot 4 = -4 \cdot 4 = -16$$

$$64. -10\left(-\frac{2}{5}\right) - 10 = 4 - 10 = -6$$

$$66. 8 - [(4-7) + (8-1)] = 8 - [-3 + 7] = 8 - (4) = 4$$

$$68. \frac{(-1-2)(-3^2)}{-6-3} = \frac{(-3)(-9)}{-9} = -3$$

$$70. \begin{aligned} \left(\sqrt[3]{27}\right)(-5) - \left(\sqrt{25}\right)(-3) &= 3(-5) - (5)(-3) \\ &= -15 - (-15) \\ &= -15 + 15 \\ &= 0 \end{aligned}$$

$$72. \begin{aligned} 10 - [(4-5)^2 + (12-14)]^4 &= 10 - [(-1)^2 + (-2)]^4 \\ &= 10 - [1-2]^4 \\ &= 10 - [-1]^4 \\ &= 10 - 1 \\ &= 9 \end{aligned}$$

$$74. \begin{aligned} \frac{-\sqrt{16} - (6-2.4)}{-2} &= \frac{-4 - (6-2.4)}{-2} \\ &= \frac{-4 - 3.6}{-2} \\ &= \frac{-7.6}{-2} \\ &= 3.8 \end{aligned}$$

$$76. \frac{|-14| - |2-7|}{-15} = \frac{14 - |2-7|}{-15} = \frac{14-5}{-15} = \frac{9}{-15} = -\frac{3}{5}$$

$$\begin{aligned}
 78. \quad \frac{-1-2}{2(-3)+10} - \frac{2(-5)}{-1(8)+1} &= \frac{-1-2}{-6+10} - \frac{2(-5)}{-8+1} \\
 &= \frac{-3}{4} - \frac{-10}{-7} \\
 &= -\frac{3}{4} - \frac{10}{7} \\
 &= -\frac{21}{28} - \frac{40}{28} \\
 &= -\frac{61}{28}
 \end{aligned}$$

$$80. \quad \frac{\frac{1}{5} \cdot 20 - 6}{10 + \frac{1}{4} \cdot 12} = \frac{4 - 6}{10 + 3} = \frac{-2}{13} = -\frac{2}{13}$$

$$\begin{aligned}
 82. \quad 2\{-1 + 3[7 - 4(-10 + 12)]\} &= 2\{-1 + 3[7 - 4(2)]\} \\
 &= 2\{-1 + 3[7 - 8]\} \\
 &= 2\{-1 + 3[-1]\} \\
 &= 2\{-1 + [-3]\} \\
 &= 2\{-4\} \\
 &= -8
 \end{aligned}$$

$$\begin{aligned}
 84. \quad \frac{(-2)^4 + 3\sqrt{120 - 20}}{4^3 + |5(-1)|} &= \frac{(-2)^4 + 3\sqrt{100}}{4^3 + |-5|} \\
 &= \frac{16 + 3(10)}{64 + 5} \\
 &= \frac{16 + 30}{64 + 5} \\
 &= \frac{46}{69} \\
 &= \frac{2}{3}
 \end{aligned}$$

$$86. \quad \text{Let } x = 9, y = -2. \\ 4x - 10y = 4(9) - 10(-2) = 36 + 20 = 56$$

$$88. \quad \text{Let } y = -2. \\ -7y^2 = -7(-2)^2 = -7(4) = -28$$

$$90. \quad \text{Let } x = 9, y = -2.$$

$$\begin{aligned}
 \frac{y}{2x} - \frac{\sqrt{x}}{3y} &= \frac{-2}{2(9)} - \frac{\sqrt{9}}{3(-2)} \\
 &= \frac{-2}{18} - \frac{3}{-6} \\
 &= -\frac{1}{9} + \frac{1}{2} \\
 &= -\frac{2}{18} + \frac{9}{18} \\
 &= \frac{7}{18}
 \end{aligned}$$

$$92. \quad \text{Let } x = 9, y = -2.$$

$$\begin{aligned}
 \frac{5 + 2|y - x|}{x + 6y} &= \frac{5 + 2|-2 - 9|}{9 + 6(-2)} \\
 &= \frac{5 + 2|-11|}{9 + (-12)} \\
 &= \frac{5 + 2(11)}{-3} \\
 &= \frac{5 + 22}{-3} \\
 &= \frac{27}{-3} \\
 &= -9
 \end{aligned}$$

$$94. \quad \text{Let } x = 9, y = -2.$$

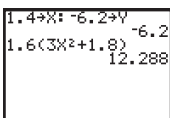
$$\begin{aligned}
 \frac{y^2 + \sqrt{x + 7}}{|3x - y|} &= \frac{(-2)^2 + \sqrt{9 + 7}}{|3(9) - (-2)|} \\
 &= \frac{4 + \sqrt{16}}{|27 + 2|} \\
 &= \frac{4 + 4}{|29|} \\
 &= \frac{8}{29}
 \end{aligned}$$

$$96. \quad \begin{array}{|l} 1.4 \div \times: -6.2 \div y \\ 5y^2 + x \\ \hline 193.6 \end{array}$$

When $x = 1.4$ and $y = -6.2$, $5y^2 + x = 193.6$.

$$98. \quad \begin{array}{|l} 1.4 \div \times: -6.2 \div y \\ \sqrt{(x - y) \cdot (2x)} \\ \hline .9845749109 \end{array}$$

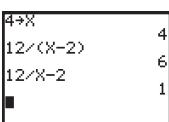
When $x = 1.4$ and $y = -6.2$, $\frac{\sqrt{x - y}}{2x} \approx 0.98$.

100. 

When $x = 1.4$ and $y = -6.2$,
 $1.6(3x^2 + 1.8) = 12.29$.

102. When $2x - y^2$ is evaluated for $x = 5.1$ and $y = -3$, the result is 1.2.

104. When $\frac{1}{2}BH$ or $(1/2)BH$ is evaluated for $B = 8$ and $H = 4.5$, the result is 18.

106. a. 

b. They are different; answers may vary

108. a. $r = 2$: $\pi r^2 = \pi(2^2) = \pi(4) \approx 12.56$
 $r = 3$: $\pi r^2 = \pi(3^2) = \pi(9) \approx 28.26$
 $r = 7$: $\pi r^2 = \pi(7^2) = \pi(49) \approx 153.86$
 $r = 10$: $\pi r^2 = \pi(10^2) = \pi(100) \approx 314$
 The completed table is:

Radius	r	2	3	7	10
Area	πr^2	12.56	28.26	153.86	314

b. Area increases as radius increases; answers may vary.

110. a. $c = -10$:
 $1.8c + 32 = 1.8(-10) + 32 = -18 + 32 = 14$
 $c = 0$: $1.8c + 32 = 1.8(0) + 32 = 0 + 32 = 32$
 $c = 50$:
 $1.8c + 32 = 1.8(50) + 32 = 90 + 32 = 122$
 The completed table is:

Degrees Celsius	c	-10	0	50
Degrees Fahrenheit	$1.8c + 32$	14	32	122

b. Degrees Fahrenheit increase as degrees Celsius increase; answers may vary.

112. $\frac{-x}{y} = \frac{x}{-y} = -\frac{x}{y}$; a, b

114. $-\frac{(y+z)}{3y} = \frac{-(y+z)}{3y} = \frac{(y+z)}{-3y}$; a, d

116. $\frac{-a}{-b} = \frac{a}{b}$; a

118. Let $x_1 = 2$, $x_2 = 4$, $y_1 = -3$, $y_2 = 2$.

$$\begin{aligned} & \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(4 - 2)^2 + (2 - (-3))^2} \\ &= \sqrt{2^2 + (2 + 3)^2} \\ &= \sqrt{2^2 + 5^2} \\ &= \sqrt{4 + 25} \\ &= \sqrt{29} \end{aligned}$$

120. $1 - \left(\frac{2}{9} + \frac{1}{6} + \frac{1}{4}\right) = 1 - \left(\frac{8}{36} + \frac{6}{36} + \frac{9}{36}\right)$
 $= 1 - \left(\frac{14}{36} + \frac{9}{36}\right)$
 $= 1 - \frac{23}{36}$
 $= \frac{13}{36}$

122. The difference in heights is
 $29,028 - (-1319) = 30,347$ feet. (We must use -1319 because the Dead Sea is 1319 feet below sea level.)

124. $6 - (5 \cdot 2 + 2) = 6 - (10 + 2) = 6 - 12 = -6$

126. answers may vary

128. $\sqrt{273} \approx 16.5227$

130. $\sqrt{19.6} \approx 4.4272$

132. $\frac{(-5.161)(3.222)}{7.955 - 19.676} = \frac{-16.628742}{-11.721} \approx 1.4187$

Section 1.4 Practice Exercises

1. $\underbrace{\text{The product of } -4 \text{ and } x}_{-4x} \text{ is } \underbrace{20}_{= 20}$

2. $\underbrace{\text{Three times}}_3 \underbrace{\text{the difference of } z \text{ and } 3}_{(z-3)} \text{ equals } \underbrace{9}_{\downarrow 9}.$

$$3(z-3) = 9$$

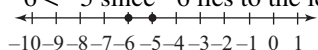
3. $\underbrace{\text{The sum of } x \text{ and } 5}_{x+5} \text{ is the same as } \underbrace{3 \text{ less than twice } x}_{2x-3}.$

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

4. $\underbrace{\text{The sum of } y \text{ and } 2}_{y+2} \text{ is } \underbrace{4 \text{ more than the quotient of } z \text{ and } 8}_{4+\frac{z}{8}}.$

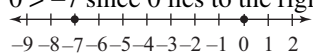
$$y+2 = 4+\frac{z}{8}$$

5. a. $-6 < -5$ since -6 lies to the left of -5 on the number line.

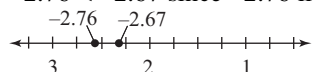


b. $\frac{24}{3} = 8$

c. $0 > -7$ since 0 lies to the right of -7 on the number line.



d. $-2.76 < -2.67$ since -2.76 lies to the left of -2.67 on the number line.



e. $\frac{9}{10} > \frac{7}{10}$

The denominators are the same, so $\frac{9}{10} > \frac{7}{10}$ since $9 > 7$.

f. $\frac{2}{3} < \frac{7}{9}$

By dividing, we see that $\frac{2}{3} = 0.666\dots$ and $\frac{7}{9} = 0.777\dots$. Thus, $\frac{2}{3} < \frac{7}{9}$ since $0.666\dots < 0.777\dots$

6. a. $x - 3 \leq 5$

b. $y \neq -4$

c. $2 < 4 + \frac{1}{2}z$

7. a. The opposite of -7 is $-(-7) = 7$.

b. The opposite of 4.7 is -4.7 .

c. The opposite of $-\frac{3}{8}$ is $-(-\frac{3}{8}) = \frac{3}{8}$.

8. a. The reciprocal of $-\frac{5}{3}$ is $-\frac{3}{5}$ because $-\frac{5}{3}\left(-\frac{3}{5}\right) = 1$.

b. The reciprocal of 14 is $\frac{1}{14}$.

c. The reciprocal of -2 is $-\frac{1}{2}$.

9. $8 + 13x = 13x + 8$

10. $3 \cdot (11b) = (3 \cdot 11)b = 33b$

11. a. $4(x + 5y) = 4 \cdot x + 4 \cdot 5y = 4x + 20y$

b. $-(3 - 2z) = -1(3 - 2z)$
 $= -1 \cdot 3 + (-1)(-2z)$
 $= -3 + 2z$

c. $0.3x(y - 3) = 0.3x \cdot y - 0.3x \cdot 3$
 $= 0.3xy - 0.9x$

12. a. $-(-11.7) = 11.7$ illustrates the double negative property.

b. $7(y + 5) = 7 \cdot y + 7 \cdot 5$ illustrates the distributive property.

c. $2 + (a + b) = (2 + a) + b$ illustrates the associative property of addition.

13. a. In words: Value of a dime \cdot number of dimes

	↓	↓	
Translate:	0.10	x	, or $0.10x$

b. In words: number of grams of carbohydrates in one cookie \cdot number of cookies

	↓	↓	
Translate:	26	y	, or $26y$

c. In words: cost of one birthday card \cdot number of cards

	↓	↓	
Translate:	1.75	z	, or $1.75z$

d. In words: Discount \cdot purchase price

	↓	↓	
Translate:	0.15	t	, or $0.15t$

- 14. a.** If two numbers have a sum of 16 and one number is x , the other number is the rest of 16.

In words:	Sixteen	minus	x
	↓	↓	↓
Translate:	16	−	x

- b.** In words: One hundred eighty minus one angle, x
- | | | | |
|------------|-----|---|-----|
| | ↓ | ↓ | ↓ |
| Translate: | 180 | − | x |

- c.** The next consecutive even integer is always two more than the previous even integer.

In words:	first integer	plus	two
	↓	↓	↓
Translate:	x	+	2

- d.** In words: younger brother's age plus nine
- | | | | |
|------------|-----|---|---|
| | ↓ | ↓ | ↓ |
| Translate: | x | + | 9 |

15. a. $6ab - ab = 6ab - 1ab = (6 - 1)ab = 5ab$

b. $4x - 5 + 6x = 4x + 6x - 5$
 $= (4 + 6)x - 5$
 $= 10x - 5$

- c.** $17p - 9$ cannot be simplified further since $17p$ and -9 are not like terms.

16. a. $5pq - 2pq - 11 - 4pq + 18$
 $= 5pq - 2pq - 4pq - 11 + 18$
 $= (5 - 2 - 4)pq + (-11 + 18)$
 $= -1pq + (7)$
 $= -pq + 7$

b. $3x^2 + 7 - 2(x^2 - 6) = 3x^2 + 7 - 2x^2 + 12$
 $= 3x^2 - 2x^2 + 7 + 12$
 $= x^2 + 19$

c. $(3.7x + 2.5) - (-2.1x - 1.3)$
 $= 3.7x + 2.5 + 2.1x + 1.3$
 $= 3.7x + 2.1x + 2.5 + 1.3$
 $= 5.8x + 3.8$

$$\begin{aligned}
 \text{d. } & \frac{1}{5}(15c - 25d) - \frac{1}{2}(8c + 6d + 1) + \frac{3}{4} \\
 &= 3c - 5d - 4c - 3d - \frac{1}{2} + \frac{3}{4} \\
 &= -c - 8d + \frac{1}{4}
 \end{aligned}$$

Vocabulary, Readiness & Video Check 1.4

	Symbol	Meaning
1.	<	is less than
2.	>	is greater than
3.	≠	is not equal to
4.	=	is equal to
5.	≥	is greater than or equal to
6.	≤	is less than or equal to

7. The opposite or additive inverse of nonzero number a is $-a$.
8. The reciprocal or multiplicative inverse of nonzero number a is $\frac{1}{a}$.
9. The commutative property has to do with “order.”
10. The associative property has to do with “grouping.”
11. $a(b + c) = ab + ac$ illustrates the distributive property.
12. The terms of an expression are the addends of the expression.
13. The x^{-1} key on a calculator is used to find the multiplicative inverse of a number.
14. =, ≠, <, ≤, >, ≥
15. *Reciprocal* is the same as multiplicative inverse and *opposite* is the same as additive inverse.
16. order; grouping
17. Understand the difference between the *number* of coins you have and the value the coins represent.
18. by combining like terms; distributive property

Exercise Set 1.4

$$\begin{array}{rcl}
 \text{2. } \underbrace{\text{The difference of } y \text{ and } 3}_{y-3} & \underbrace{\text{amounts to}}_{=}& \underbrace{12}_{12} \\
 \text{or } y - 3 & = & 12
 \end{array}$$

4. $\underbrace{\text{Three more than the product of 4 and } c}_{4c+3}$ is $\downarrow \downarrow$ 7.
 $= 7$

or $4c + 3 = 7$

6. $\underbrace{\text{The quotient of 8 and } y}_{\frac{8}{y}}$ is \downarrow 3 more than y .
 $= y + 3$

or $\frac{8}{y} = y + 3$

8. $\underbrace{\text{Five added to one-fourth } q}_{5+\frac{1}{4}q}$ is the same as $\underbrace{\text{4 more than } q}_{q+4}$.
 $=$

or $5 + \frac{1}{4}q = q + 4$

10. $\underbrace{\text{10 subtracted from the reciprocal of } x}_{\frac{1}{x}-10}$ is greater than \downarrow 0.
 > 0

or $\frac{1}{x} - 10 > 0$

12. $\underbrace{\text{Four times the sum of 5 and } x}_{4(5+x)}$ is not equal to $\underbrace{\text{the opposite of 15}}_{-15}$.
 \neq

or $4(5 + x) \neq -15$

14. $\underbrace{\text{5 times the sum of 6 and } y}_{5(6+y)}$ is $\downarrow \downarrow$ -35.
 $= -35$

or $5(6 + y) = -35$

16. $-14 > -24$ since -14 is to the right of -24 on the number line.

18. $\frac{7}{2} = \frac{35}{10}$ since $\frac{7 \cdot 5}{2 \cdot 5} = \frac{35}{10}$.

20. $\frac{9}{20} > \frac{3}{20}$ since $9 > 3$.

22. $\frac{3}{4} < \frac{7}{8}$ since $\frac{3}{4}$ is to the left of $\frac{7}{8}$ on the number line.

24. $-13.07 > -13.7$ since -13.07 is to the right of -13.7 on the number line.

	Number	Opposite	Reciprocal
26.	7	-7	$\frac{1}{7}$
28.	-4	4	$-\frac{1}{4}$
30.	$\frac{1}{11}$	$-\frac{1}{11}$	11
32.	1	-1	1
34.	$-\frac{23}{5}$	$\frac{23}{5}$	$-\frac{5}{23}$

36. $3a + 2b = 2b + 3a$

38. $r \cdot s = s \cdot r$

40. $\frac{x}{2} \cdot \frac{9}{10} = \frac{9}{10} \cdot \frac{x}{2}$

42. $3 \cdot (10z) = (3 \cdot 10)z$

44. $5q + (2r + s) = (5q + 2r) + s$

46. $(9 \cdot 2x) \cdot y = 9 \cdot 2(x \cdot y)$

48. $7(y + 2) = 7 \cdot y + 7 \cdot 2 = 7y + 14$

50. $-(c + 7d) = -1(c + 7d) = -c - 7d$

52. $5(3a + b + 9c) = 5 \cdot 3a + 5 \cdot b + 5 \cdot 9c$
 $= 15a + 5b + 45c$

54. $-10(2a - 3b - 4) = -10 \cdot 2a - 10(-3b) - 10(-4)$
 $= -20a + 30b + 40$

56. $1.2m(9n - 4) = 1.2m \cdot 9n - 1.2m \cdot 4$
 $= 10.8mn - 4.8m$

58. $8 + 0 = 8$

60. $4(x + 3) = 4x + 12$

62. $0 \cdot (-5.4) = 0$

64. $9y + (x + 3z) = (9y + x) + 3z$

66. The screen illustrates the distributive property.

68. The screen illustrates the associative property of multiplication.

70. In words: $\boxed{\text{Value of a nickel}} \cdot \boxed{\text{Number of nickels}}$
 Translate: $0.05 \cdot n$ or $0.05n$

72. If two numbers have a sum of 25 and one number is x , then the other number is the "rest of 25." So, in other words, we have
 $\boxed{\text{Twenty-five}} - \boxed{x}$
 Translate: $25 - x$

74. In words: $\boxed{\text{Ninety}} - \boxed{5x}$
 Translate: $90 - 5x$

76. In words: $\boxed{\text{Cost of a book}} \cdot \boxed{\text{Number of books}}$
 Translate: $\$35.61y$

78. The next even integer would be 2 more than the given even integer. In words:
 $\boxed{\text{Even integer}} + \boxed{\text{Two}}$
 Translate: $2x + 2$

80. $5y - 14 + 7y - 20y = 5y + 7y - 20y - 14$
 $= (5 + 7 - 20)y - 14$
 $= -8y - 14$

82. $-11c - (4 - 2c) = -11c - 4 + 2c$
 $= -11c + 2c - 4$
 $= (-11 + 2)c - 4$
 $= -9c - 4$

84. $(8 - 5y) - (4 + 3y) = 8 - 5y - 4 - 3y$
 $= -5y - 3y + 8 - 4$
 $= (-5 - 3)y + 4$
 $= -8y + 4$ or $4 - 8y$

86. $-4(yz + 3) - 7yz + 1 + y^2$
 $= -4yz - 12 - 7yz + 1 + y^2$
 $= y^2 - 4yz - 7yz - 11$
 $= y^2 + (-4 - 7)yz - 11$
 $= y^2 - 11yz - 11$

88. $-(8 - t) + (2t - 6) = -8 + t + 2t - 6$
 $= t + 2t - 8 - 6$
 $= (1 + 2)t - 14$
 $= 3t - 14$

90. $5(2z^3 - 6) + 10(3 - z^3) = 10z^3 - 30 + 30 - 10z^3$
 $= 10z^3 - 10z^3 - 30 + 30$
 $= (10 - 10)z^3 + 0$
 $= 0$

$$\begin{aligned}
 92. \quad 7n + 3(2n - 6) - 2 &= 7n + 6n - 18 - 2 \\
 &= (7 + 6)n - 20 \\
 &= 13n - 20
 \end{aligned}$$

$$\begin{aligned}
 94. \quad 6.3y - 9.7 + 2.2y - 11.1 &= 6.3y + 2.2y - 9.7 - 11.1 \\
 &= (6.3 + 2.2)y - 20.8 \\
 &= 8.5y - 20.8
 \end{aligned}$$

$$\begin{aligned}
 96. \quad \frac{7}{8}a - \frac{11}{12} - \frac{1}{2}a + \frac{5}{6} &= \frac{7}{8}a - \frac{1}{2}a - \frac{11}{12} + \frac{5}{6} \\
 &= \left(\frac{7}{8} - \frac{1}{2}\right)a - \frac{11}{12} + \frac{10}{12} \\
 &= \left(\frac{7}{8} - \frac{4}{8}\right)a - \frac{1}{12} \\
 &= \frac{3}{8}a - \frac{1}{12}
 \end{aligned}$$

$$98. \quad 4(5y + 12) = 20y + 48$$

$$\begin{aligned}
 100. \quad \frac{1}{4}(8x - 4) - \frac{1}{5}(20x - 6y) &= 2x - 1 - 4x + \frac{6}{5}y \\
 &= 2x - 4x - 1 + \frac{6}{5}y \\
 &= (2 - 4)x - 1 + \frac{6}{5}y \\
 &= -2x - 1 + \frac{6}{5}y \\
 &= -2x + \frac{6}{5}y - 1
 \end{aligned}$$

$$\begin{aligned}
 102. \quad \frac{1}{3}(6x - 33y) - \frac{1}{8}(24x - 40y + 1) - \frac{1}{3} \\
 &= 2x - 11y - 3x + 5y - \frac{1}{8} - \frac{1}{3} \\
 &= 2x - 3x - 11y + 5y - \frac{3}{24} - \frac{8}{24} \\
 &= (2 - 3)x + (-11 + 5)y - \frac{11}{24} \\
 &= -x - 6y - \frac{11}{24}
 \end{aligned}$$

$$104. \quad 4 + 8y = 8y + 4$$

$$106. \quad 5(3a)(7b) = 5(21ab) = 105ab$$

$$108. \quad a(b + c) = ab + ac$$

$$110. \quad \text{zero; answers may vary}$$

$$112. \quad \text{no; answers may vary}$$

$$114. \quad \text{answers may vary}$$

$$\begin{aligned}
 116. \quad 6.5y - 4.4(1.8x - 3.3) + 10.95 \\
 &= 6.5y - 7.92x + 14.52 + 10.95 \\
 &= 6.5y - 7.92x + 25.47
 \end{aligned}$$

Integrated Review

$$1. \quad \text{Let } z = -4.$$

$$z^2 = (-4)^2 = (-4)(-4) = 16$$

$$2. \quad \text{Let } z = -4.$$

$$-z^2 = -(-4)^2 = -(-4)(-4) = -16$$

$$3. \quad \text{Let } x = -1, y = 3, z = -4.$$

$$\frac{4x - z}{2y} = \frac{4(-1) - (-4)}{2(3)} = \frac{-4 + 4}{6} = \frac{0}{6} = 0$$

$$4. \quad \text{Let } x = -1, y = 3, z = -4.$$

$$\begin{aligned}
 x(y - 2z) &= -1[3 - 2(-4)] \\
 &= -1[3 + 8] \\
 &= -1[11] \\
 &= -11
 \end{aligned}$$

$$5. \quad -7 - (-2) = -7 + 2 = -5$$

$$6. \quad \frac{9}{10} - \frac{11}{12} = \frac{9}{10} \cdot \frac{6}{6} - \frac{11}{12} \cdot \frac{5}{5} = \frac{54}{60} - \frac{55}{60} = -\frac{1}{60}$$

$$7. \quad \frac{-13}{2-2} = \frac{-13}{0} \text{ is undefined.}$$

$$8. \quad (1.2)^2 - (2.1)^2 = 1.44 - 4.41 = -2.97$$

$$9. \quad \sqrt{64} - \sqrt[3]{64} = 8 - 4 = 4$$

$$10. \quad -5^2 - (-5)^2 = -25 - 25 = -50$$

$$\begin{aligned}
 11. \quad 9 + 2[(8 - 10)^2 + (-3)^2] &= 9 + 2[(-2)^2 + (-3)^2] \\
 &= 9 + 2(4 + 9) \\
 &= 9 + 2(13) \\
 &= 9 + 26 \\
 &= 35
 \end{aligned}$$

$$\begin{aligned}
 12. \quad 8 - 6\left[\sqrt[3]{8}(-2) + \sqrt{4}(-5)\right] &= 8 - 6[2(-2) + 2(-5)] \\
 &= 8 - 6[(-4) + (-10)] \\
 &= 8 - 6(-14) \\
 &= 8 + 84 \\
 &= 92
 \end{aligned}$$

$$13. \quad -15 - 2x$$

14. $3x + 5$

15. 0 is a whole number that is not a natural number.

16. True

17. $-5(9x) = (-5 \cdot 9)x = -45x$

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

$$\begin{aligned}
 19. \quad 8.6a + 2.3b - a + 4.9b &= 8.6a - a + 2.3b + 4.9b \\
 &= (8.6 - 1)a + (2.3 + 4.9)b \\
 &= 7.6a + 7.2b
 \end{aligned}$$

$$\begin{aligned}
 20. \quad \frac{2}{3}y - \frac{2}{3} + y - \frac{1}{9}y + \frac{9}{10} \\
 &= \frac{2}{3}y + y - \frac{1}{9}y - \frac{2}{3} + \frac{9}{10} \\
 &= \left(\frac{2}{3} + 1 - \frac{1}{9}\right)y + \left(-\frac{2}{3} + \frac{9}{10}\right) \\
 &= \left(\frac{6}{9} + \frac{9}{9} - \frac{1}{9}\right)y + \left(-\frac{20}{30} + \frac{27}{30}\right) \\
 &= \frac{6+9-1}{9}y + \frac{-20+27}{30} \\
 &= \frac{14}{9}y + \frac{7}{30}
 \end{aligned}$$

Section 1.5 Practice Exercises

$$\begin{aligned}
 1. \quad 3x + 7 &= 22 \\
 3x + 7 - 7 &= 22 - 7 \\
 3x &= 15 \\
 \frac{3x}{3} &= \frac{15}{3} \\
 x &= 5
 \end{aligned}$$

$$\begin{aligned}
 2. \quad 2.5 &= 3 - 2.5t \\
 2.5 - 3 &= 3 - 2.5t - 3 \\
 -0.5 &= -2.5t \\
 \frac{-0.5}{-2.5} &= \frac{-2.5t}{-2.5} \\
 0.2 &= t
 \end{aligned}$$

$$\begin{aligned}
 3. \quad -8x - 4 + 6x &= 5x + 11 - 4x \\
 -2x - 4 &= x + 11 \\
 -2x - 4 - x &= x + 11 - x \\
 -3x - 4 &= 11 \\
 -3x - 4 + 4 &= 11 + 4 \\
 -3x &= 15 \\
 \frac{-3x}{-3} &= \frac{15}{-3} \\
 x &= -5
 \end{aligned}$$

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

$$\begin{aligned}
 5. \quad \frac{y}{2} - \frac{y}{5} &= \frac{1}{4} \\
 20\left(\frac{y}{2} - \frac{y}{5}\right) &= 20\left(\frac{1}{4}\right) \\
 20\left(\frac{y}{2}\right) - 20\left(\frac{y}{5}\right) &= 5 \\
 10y - 4y &= 5 \\
 6y &= 5 \\
 \frac{6y}{6} &= \frac{5}{6} \\
 y &= \frac{5}{6}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad x - \frac{x-2}{12} &= \frac{x+3}{4} + \frac{1}{4} \\
 12\left(x - \frac{x-2}{12}\right) &= 12\left(\frac{x+3}{4} + \frac{1}{4}\right) \\
 12 \cdot x - 12\left(\frac{x-2}{12}\right) &= 12\left(\frac{x+3}{4}\right) + 12 \cdot \frac{1}{4} \\
 12x - (x-2) &= 3(x+3) + 3 \\
 12x - x + 2 &= 3x + 9 + 3 \\
 11x + 2 &= 3x + 12 \\
 11x + 2 - 3x &= 3x + 12 - 3x \\
 8x + 2 &= 12 \\
 8x + 2 - 2 &= 12 - 2 \\
 8x &= 10 \\
 \frac{8x}{8} &= \frac{10}{8} \\
 x &= \frac{5}{4}
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & 0.15x - 0.03 = 0.2x + 0.12 \\
 & 100(0.15x - 0.03) = 100(0.2x + 0.12) \\
 & 100(0.15x) - 100(0.03) = 100(0.2x) + 100(0.12) \\
 & 15x - 3 = 20x + 12 \\
 & 15x - 20x = 12 + 3 \\
 & -5x = 15 \\
 & \frac{-5x}{-5} = \frac{15}{-5} \\
 & x = -3
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & 4x - 3 = 4(x + 5) \\
 & 4x - 3 = 4x + 20 \\
 & 4x - 3 - 4x = 4x + 20 - 4x \\
 & -3 = 20
 \end{aligned}$$

This equation is false no matter what value the variable x might have. Thus, there is no solution. The solution set is $\{ \}$ or \emptyset .

$$\begin{aligned}
 9. \quad & 5x - 2 = 3 + 5(x - 1) \\
 & 5x - 2 = 3 + 5x - 5 \\
 & 5x - 2 = -2 + 5x \\
 & 5x - 2 + 2 = -2 + 5x + 2 \\
 & 5x = 5x \\
 & 5x - 5x = 5x - 5x \\
 & 0 = 0
 \end{aligned}$$

Since $0 = 0$ is a true statement for every value of x , all real numbers are solutions. The solution set is $\{x|x \text{ is a real number}\}$.

Vocabulary, Readiness & Video Check 1.5

- Equations with the same solution set are called equivalent equations.
- A value for the variable in an equation that makes the equation a true statement is called a solution of the equation.
- By the addition property of equality, $y = -3$ and $y - 7 = -3 - 7$ are equivalent equations.
- By the multiplication property of equality, $2y = -3$ and $\frac{2y}{2} = \frac{-3}{2}$ are equivalent equations.
- $\frac{1}{3}x - 5$ expression
- $2(x - 3) = 7$ equation
- $\frac{5}{9}x + \frac{1}{3} = \frac{2}{9} - x$ equation

$$8. \quad \frac{5}{9}x + \frac{1}{3} - \frac{2}{9} - x \text{ expression}$$

- The addition property of equality allows us to add the same number to (or subtract the same number from) both sides of an equation and have an equivalent equation. The multiplication property of equality allows us to multiply (or divide) both sides of an equation by the same nonzero number and have an equivalent equation.

10. distributive property

11. to make the calculations less tedious

12. When solving a linear equation and all variable terms subtract out and:

- you have a true statement, then the equation has all real numbers for which the equation is defined as solutions.
- you have a false statement, then the equation has no solution.

Exercise Set 1.5

$$\begin{aligned}
 2. \quad & -2x = 18 \\
 & \frac{-2x}{-2} = \frac{18}{-2} \\
 & x = -9
 \end{aligned}$$

$-9 \div x$	-9
$-2x$	18

The solution is -9 .

$$\begin{aligned}
 4. \quad & -25 = y + 30 \\
 & -25 - 30 = y + 30 - 30 \\
 & -55 = y
 \end{aligned}$$

$-55 \div y$	-55
$y + 30$	-25

The solution is -55 .

$$\begin{aligned}
 6. \quad & y - 8.6 = -6.3 \\
 & y - 8.6 + 8.6 = -6.3 + 8.6 \\
 & y = 2.3
 \end{aligned}$$

$2.3 \div y$	2.3
$y - 8.6$	-6.3

The solution is 2.3 .

8. $5y - 3 = 11 + 3y$

$5y - 3y = 11 + 3$

$2y = 14$

$\frac{2y}{2} = \frac{14}{2}$

$y = 7$

$5y - 3$	7
$11 + 3y$	32
	32

The solution is 7.

10. $10.3 - 6x = -2.3$

$10.3 - 6x - 10.3 = -2.3 - 10.3$

$-6x = -12.6$

$\frac{-6x}{-6} = \frac{-12.6}{-6}$

$x = 2.1$

$10.3 - 6x$	2.1
	-2.3

The solution is 2.1.

12. $4x + 14 = 6x + 8$

$4x - 6x = 8 - 14$

$-2x = -6$

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

$x = 3$

$4x + 14$	3
$6x + 8$	26
	26

The solution is 3.

14. $13x - 15x + 8 = 4x + 2 - 24$

$-2x + 8 = 4x - 22$

$-2x - 4x = -22 - 8$

$-6x = -30$

$x = 5$

$13x - 15x + 8$	5
$4x + 2 - 24$	-2
	-2

The solution is 5.

16. $6 + 3x + x = -x + 8 - 26 + 24$

$6 + 4x = -x + 6$

$5x = 0$

$x = 0$

$6 + 3x + x$	0
$-x + 8 - 26 + 24$	6
	6

The solution is 0.

18. $2(4x + 3) = 7x + 5$

$8x + 6 = 7x + 5$

$x + 6 = 5$

$x = -1$

$2(4x + 3)$	-1
$7x + 5$	-2
	-2

The solution is -1.

20. $6x = 4(x - 5)$

$6x = 4x - 20$

$2x = -20$

$x = -10$

$6x$	-10
$4(x - 5)$	-60
	-60

The solution is -10.

22. $-4(3n - 2) - n = -11(n - 1)$

$-12n + 8 - n = -11n + 11$

$-13n + 8 = -11n + 11$

$-13n + 11n = 11 - 8$

$-2n = 3$

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

$-4(3n - 2) - n$	-1.5
$-11(n - 1)$	27.5
	27.5

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

24. $\frac{x}{2} + \frac{x}{5} = \frac{5}{4}$

$20\left(\frac{x}{2} + \frac{x}{5}\right) = 20\left(\frac{5}{4}\right)$

$10x + 4x = 25$

$14x = 25$

$x = \frac{25}{14}$

The solution is $\frac{25}{14}$.

$$\begin{aligned}
 26. \quad & \frac{4r}{5} - \frac{r}{10} = 7 \\
 & 10\left(\frac{4r}{5} - \frac{r}{10}\right) = 10(7) \\
 & 2(4r) - r = 70 \\
 & 8r - r = 70 \\
 & 7r = 70 \\
 & r = 10
 \end{aligned}$$

The solution is 10.

$$\begin{aligned}
 28. \quad & \frac{2+h}{9} + \frac{h-1}{3} = \frac{1}{3} \\
 & 9\left(\frac{2+h}{9} + \frac{h-1}{3}\right) = 9\left(\frac{1}{3}\right) \\
 & 2+h+3(h-1) = 3 \\
 & 2+h+3h-3 = 3 \\
 & 4h-1 = 3 \\
 & 4h = 4 \\
 & h = 1
 \end{aligned}$$

The solution is 1.

$$\begin{aligned}
 30. \quad & 0.3x + 2.4 = 0.1x + 4 \\
 & 10(0.3x + 2.4) = 10(0.1x + 4) \\
 & 3x + 24 = 1x + 40 \\
 & 2x = 16 \\
 & x = 8
 \end{aligned}$$

The solution is 8.

$$\begin{aligned}
 32. \quad & \frac{2z+7}{8} - 2 = z + \frac{z-1}{2} \\
 & 8\left(\frac{2z+7}{8} - 2\right) = 8\left(z + \frac{z-1}{2}\right) \\
 & 2z+7-16 = 8z+4(z-1) \\
 & 2z+7-16 = 8z+4z-4 \\
 & 2z-9 = 12z-4 \\
 & -10z = 5 \\
 & z = -\frac{1}{2}
 \end{aligned}$$

The solution is $-\frac{1}{2}$.

$$\begin{aligned}
 34. \quad & 2.4(2x+3) = -0.1(2x+3) \\
 & 10[2.4(2x+3)] = 10[-0.1(2x+3)] \\
 & 48x+72 = -2x-3 \\
 & 50x = -75 \\
 & x = -1.5
 \end{aligned}$$

The solution is -1.5.

$$\begin{aligned}
 36. \quad & 6(4n+4) = 8(3+3n) \\
 & 24n+24 = 24+24n \\
 & 24n+24-24n = 24+24n-24n \\
 & 24 = 24 \\
 & 0 = 0
 \end{aligned}$$

Therefore, all real numbers are solutions.

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

This is false for any x . Therefore, no solution exists, \emptyset .

$$\begin{aligned}
 40. \quad & 5(x-4)+x = 6(x-2)-8 \\
 & 5x-20+x = 6x-12-8 \\
 & 6x-20 = 6x-20 \\
 & -20 = -20
 \end{aligned}$$

This is true for all x . Therefore, all real numbers are solutions.

$$\begin{aligned}
 42. \quad & 9(x-2) = 8(x-3) + x \\
 & 9x - 18 = 8x - 24 + x \\
 & 9x - 18 = 9x - 24 \\
 & -18 = -24
 \end{aligned}$$

This is false for any x . Therefore, no solution exists, \emptyset .

$$44. \text{ The screen shows that the solution of } 7x - 2 = 5x \text{ is } x = 1.$$

$$46. \text{ The screen shows that the solution of } 7(C + 2) = 5C + 4 \text{ is } C = -5.$$

$$\begin{aligned}
 48. \quad & \frac{a}{2} + \frac{7}{4} = 5 \\
 & 4\left(\frac{a}{2} + \frac{7}{4}\right) = 4 \cdot 5 \\
 & 2a + 7 = 20 \\
 & 2a = 13 \\
 & a = \frac{13}{2}
 \end{aligned}$$

$$\begin{aligned}
 50. \quad & 4x - 7 = 2x - 7 \\
 & 4x - 2x = -7 + 7 \\
 & 2x = 0 \\
 & x = 0
 \end{aligned}$$

$$\begin{aligned}
 52. \quad & 3x + 2(x+4) = 5(x+1) + 3 \\
 & 3x + 2x + 8 = 5x + 5 + 3 \\
 & 5x + 8 = 5x + 8 \\
 & 0 = 0
 \end{aligned}$$

Therefore, all real numbers are solutions.

$$\begin{aligned}
 54. \quad & -(w + 0.2) = 0.3(4 - w) \\
 & -w - 0.2 = 1.2 - 0.3w \\
 & -w + 0.3w = 1.2 + 0.2 \\
 & -0.7w = 1.4 \\
 & w = -2
 \end{aligned}$$

$$\begin{aligned}
 56. \quad & \frac{1}{3}(8 + 2c) = \frac{1}{5}(3c - 5) \\
 & \frac{8}{3} + \frac{2}{3}c = \frac{3}{5}c - 1 \\
 & \frac{8}{3} + 1 = \frac{3}{5}c - \frac{2}{3}c \\
 & \frac{8}{3} + \frac{3}{3} = \frac{9}{15}c - \frac{10}{15}c \\
 & \frac{11}{3} = -\frac{1}{15}c \\
 & -\frac{15}{1} \cdot \frac{11}{3} = c \\
 & -55 = c
 \end{aligned}$$

$$58. \quad 9c - 3(6 - 5c) = c - 2(3c + 9)$$

$$9c - 18 + 15c = c - 6c - 18$$

$$24c - 18 = -5c - 18$$

$$24c + 5c = -18 + 18$$

$$29c = 0$$

$$c = 0$$

$$60. \quad 10x - 2(x + 4) = 8(x - 2) + 6$$

$$10x - 2x - 8 = 8x - 16 + 6$$

$$8x - 8 = 8x - 10$$

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

$$0 = -2$$

This is false for any x . Therefore, the solution set is \emptyset .

$$62. \quad \frac{n+1}{8} - \frac{2-n}{3} = \frac{5}{6}$$

$$24\left(\frac{n+1}{8} - \frac{2-n}{3}\right) = 24\left(\frac{5}{6}\right)$$

$$3(n+1) - 8(2-n) = 4(5)$$

$$3n + 3 - 16 + 8n = 20$$

$$11n - 13 = 20$$

$$11n = 33$$

$$n = 3$$

$$64. \quad 10y - 18 - 4y = 12y - 13$$

$$6y - 18 = 12y - 13$$

$$6y - 12y = -13 + 18$$

$$-6y = 5$$

$$y = -\frac{5}{6}$$

$$66. \quad -4(2x - 3) - (10x + 7) - 2 = -(12x - 5) - (4x + 9) - 1$$

$$-8x + 12 - 10x - 7 - 2 = -12x + 5 - 4x - 9 - 1$$

$$-18x + 3 = -16x - 5$$

$$-2x = -8$$

$$x = 4$$

$$68. \quad \frac{1}{5}(2y - 1) - 2 = \frac{1}{2}(3y - 5) + 3$$

$$10 \cdot \left(\frac{1}{5}(2y - 1) - 2\right) = 10 \cdot \left(\frac{1}{2}(3y - 5) + 3\right)$$

$$2(2y - 1) - 20 = 5(3y - 5) + 30$$

$$4y - 22 = 15y + 5$$

$$-11y = 27$$

$$y = -\frac{27}{11}$$

$$\begin{aligned}
 70. \quad & 3[8 - 4(n - 2)] + 5n = -20 + 2[5(1 - n) - 6n] \\
 & 3[8 - 4n + 8] + 5n = -20 + 2[5 - 5n - 6n] \\
 & 3(16 - 4n) + 5n = -20 + 2(5 - 11n) \\
 & 48 - 12n + 5n = -20 + 10 - 22n \\
 & 48 - 7n = -10 - 22n \\
 & 15n = -58 \\
 & n = -\frac{58}{15}
 \end{aligned}$$

$$\begin{aligned}
 72. \quad & -3(-4) = 12 \text{ not } -12; \\
 & -3(x - 4) = 10 \\
 & -3x + 12 = 10 \\
 & -3x = -2 \\
 & \frac{-3x}{-3} = \frac{-2}{-3} \\
 & x = \frac{2}{3}
 \end{aligned}$$

$$\begin{aligned}
 74. \quad & 3\left(\frac{x}{3} + 7\right) = x + 21, \text{ not } x + 7; \\
 & \frac{x}{3} + 7 = \frac{5x}{3} \\
 & 3\left(\frac{x}{3} + 7\right) = 3\left(\frac{5x}{3}\right) \\
 & x + 21 = 5x \\
 & 21 = 4x \\
 & \frac{21}{4} = \frac{4x}{4} \\
 & \frac{21}{4} = x
 \end{aligned}$$

$$\begin{aligned}
 76. \quad & 5x - 3 = 5x - 3 \\
 & \text{Since the two sides of the equation are identical,} \\
 & \text{the equation is true for any value of } x. \text{ All real} \\
 & \text{numbers are solutions.}
 \end{aligned}$$

$$\begin{aligned}
 78. \quad & 5x - 2 = 5x - 7 \\
 & \text{Subtracting 2 from a number and subtracting 7} \\
 & \text{from the same number will not result in equal} \\
 & \text{numbers for any value of } x. \text{ There is no solution.}
 \end{aligned}$$

$$80. \text{ answers may vary}$$

$$82. \text{ answers may vary}$$

$$\begin{aligned}
 84. \quad & -7.6y - 10 = -1.1y + 12 \\
 & -7.6y = -1.1y + 22 \\
 & \text{From this we see that } K = 22.
 \end{aligned}$$

$$\begin{aligned}
 86. \quad & \frac{x}{6} + 4 = \frac{x}{3} \\
 & 6\left(\frac{x}{6} + 4\right) = 6\left(\frac{x}{3}\right) \\
 & x + 24 = 2x \\
 & \text{From this we see that } K = 24.
 \end{aligned}$$

$$88. \text{ answers may vary}$$

$$\begin{aligned}
 90. \quad & 7x^2 + 2x - 3 = 6x(x + 4) + x^2 \\
 & 7x^2 + 2x - 3 = 6x^2 + 24x + x^2 \\
 & 7x^2 + 2x - 3 = 7x^2 + 24x \\
 & 2x - 3 = 24x \\
 & -3 = 22x \\
 & x = -\frac{3}{22}
 \end{aligned}$$

$$\begin{aligned}
 92. \quad & x(x + 1) + 16 = x(x + 5) \\
 & x^2 + x + 16 = x^2 + 5x \\
 & x + 16 = 5x \\
 & 16 = 4x \\
 & x = 4
 \end{aligned}$$

$$\begin{aligned}
 94. \quad & -9.112y = -47.537304 \\
 & y = 5.217
 \end{aligned}$$

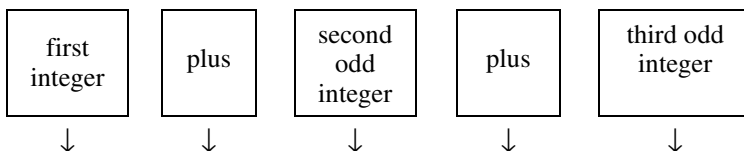
$$\begin{array}{r}
 5.217 \div \cancel{y} \quad 5.217 \\
 -9.112 \cancel{y} \quad -47.537304 \\
 \hline
 \end{array}$$

$$\begin{aligned}
 96. \quad & 1.25x - 20.175 = -8.15 \\
 & 1.25x = -8.15 + 20.175 \\
 & 1.25x = 12.025 \\
 & x = 9.62
 \end{aligned}$$

$$\begin{array}{r}
 9.62 \times \cancel{x} \quad 9.62 \\
 1.25 \cancel{x} - 20.175 \quad -8.15 \\
 \hline
 \end{array}$$

Section 1.6 Practice Exercises

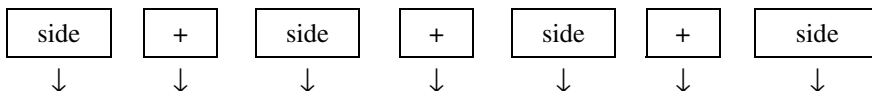
1. a. In words:



Translate: x $+$ $(x + 2)$ $+$ $(x + 4)$

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

- b. In words:

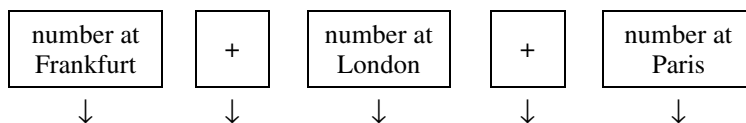


Translate: x $+$ $2x$ $+$ $(x + 2)$ $+$ $(2x - 3)$

Then $x + 2x + (x + 2) + (2x - 3) = x + 2x + x + 2 + 2x - 3 = 6x - 1$

2. If x = number of arrivals and departures at Frankfurt airport,
then $x + 12.9$ = number at London, and $x + 5.2$ = number at Paris.

In words:



Translate: x $+$ $(x + 12.9)$ $+$ $(x + 5.2)$

Then $x + (x + 12.9) + (x + 5.2) = x + x + 12.9 + x + 5.2 = 3x + 18.1$

3. Let x = the first number, then $3x - 8$ = the second number, and $5x$ = the third number.
The sum of the three numbers is 118.

$$x + (3x - 8) + 5x = 118$$

$$x + 3x + 5x - 8 = 118$$

$$9x - 8 = 118$$

$$9x = 126$$

$$x = 14$$

The numbers are 14, $3x - 8 = 3(14) - 8 = 34$, and $5x = 5(14) = 70$.

4. Let x = the original price. Then $0.4x$ = the discount. The original price, minus the discount, is equal to \$270.

$$x - 0.4x = 270$$

$$0.6x = 270$$

$$x = \frac{270}{0.6} = 450$$

The original price was \$450.

5. Let x = width, then $2x - 16$ = length.

The perimeter is 160 inches.

$$2(x) + 2(2x - 16) = 160$$

$$2x + 4x - 32 = 160$$

$$6x - 32 = 160$$

$$6x = 192$$

$$x = 32$$

$$2x - 16 = 2(32) - 16 = 48$$

The width is 32 inches and the length is 48 inches.

6. Let x = first odd integer, then $x + 2$ = second odd integer, and $x + 4$ = third odd integer.
The sum of the integers is 81.

$$x + (x + 2) + (x + 4) = 81$$

$$3x + 6 = 81$$

$$3x = 75$$

$$x = 25$$

$$x + 2 = 27$$

$$x + 4 = 29$$

The integers are 25, 27, and 29.

Vocabulary, Readiness & Video Check 1.6

- 130% of a number \geq the number.
- 70% of a number \leq the number.
- 100% of a number \equiv the number.
- 200% of a number \geq the number.

	First Integer	All Described Integers
5. Four consecutive integers	31	31, 32, 33, 34
6. Three consecutive odd integers	31	31, 33, 35
7. Three consecutive even integers	18	18, 20, 22
8. Four consecutive even integers	92	92, 94, 96, 98
9. Three consecutive integers	y	$y, y + 1, y + 2$
10. Three consecutive even integers	z (z is even)	$z, z + 2, z + 4$
11. Four consecutive integers	p	$p, p + 1, p + 2, p + 3$
12. Three consecutive odd integers	s (s is odd)	$s, s + 2, s + 4$

13. distributive property
14. The original application asks you to find three numbers. The solution $x = 45$ only gives you the first number. You need to INTERPRET this result.

Exercise Set 1.6

- The perimeter is the sum of the lengths of the four sides.

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

$$= 4x - 10$$

4. Let x = first odd integer, then
 $x + 2$ = second odd integer, and
 $x + 4$ = third odd integer.
 $x + (x + 2) + (x + 4) = x + x + x + 2 + 4 = 3x + 6$
6. Find the sum of y quarters worth 25¢ each,
 $7y$ dimes worth 10¢ each, and $(2y - 1)$ nickels
worth 5¢ each.
 $25y + 10(7y) + 5(2y - 1) = 25y + 70y + 10y - 5$
 $= 105y - 5$
The total amount is $(105y - 5)$ cents.
8. $4x + 5(3x - 15) = 4x + 15x - 75 = 19x - 75$
10. The length of the side denoted by ? is
 $18 - 10 = 8$. Similarly, the length of the
unmarked side is
 $(x + 14) - (x + 8) = x + 14 - x - 8 = 6$.
The perimeter of the floor plan is
 $18 + (x + 8) + 10 + 6 + 8 + (x + 14) = 2x + 64$
12. Let x = the number.
 $2(x + 3) = 5x - 1 - 4x$
 $2x + 6 = x - 1$
 $x = -7$
The number is -7 .
14. Let x = the first number, then
 $x - 6$ = the second number, and
 $2x$ = the third number.
 $x + (x - 6) + 2x = 306$
 $4x - 6 = 306$
 $4x = 312$
 $x = 78$
 $x - 6 = 72$
 $2x = 156$
The numbers are 78, 72, and 156.
16. $90\% \cdot 70 = 0.90 \cdot 70 = 63$
 $70 - 63 = 7$
7 million acres are not federally owned.
18. 27.7% of 1543 = $0.277 \cdot 1543 \approx 427$
Approximately 427 tornadoes occurred in the
United States during June 2010.
20. Let x be the number of people employed in the
restaurant industry. Then x is 9% of 141 million.
 $x = 0.09(141 \text{ million}) \approx 12.7 \text{ million}$
There were 12.7 million people employed in the
restaurant industry in the U.S. in 2010.
22. From the circle graph, the most common time
spent on email per day is 15 minutes to
60 minutes.
24. Let x be the number of employees who use
email between 2 and 3 hours per day. Then x is
10% of 250.
 $x = 0.10(250) = 25$
25 employees would be expected to use email
between 2 and 3 hours per day.
26. $3x + x + (x + 10) = 180$
 $5x + 10 = 180$
 $5x = 170$
 $x = 34$
 $3x = 3(34) = 102$
 $x + 10 = 34 + 10 = 44$
The angles measure 34° , 44° , and 102° .
28. $(2x) + (3.5x) + (3x + 7) = 75$
 $8.5x + 7 = 75$
 $8.5x = 68$
 $x = 8$
 $2x = 2(8) = 16$
 $3.5x = 3.5(8) = 28$
 $3x + 7 = 3(8) + 7 = 31$
The sides measure 16 centimeters,
28 centimeters, and 31 centimeters.
30. $7.3x + (9.2x - 3) + 7.3x + (9.2x - 3) = 324$
 $33x - 6 = 324$
 $33x = 330$
 $x = 10$
 $7.3x = 7.3(10) = 73$
 $9.2x - 3 = 9.2(10) - 3 = 89$
The sides measure 73 feet, 73 feet, 89 feet, and
89 feet.
32. Let x = the first odd integer, then
 $x + 2$ = the second odd integer and
 $x + 4$ = the third odd integer.
 $x + x + 2 + x + 4 = 327$
 $3x + 6 = 327$
 $3x = 321$
 $x = 107$
The numbers are 107, 109, 111.
34. Let x = first integer, then
 $x + 1$ = second integer, and
 $x + 2$ = third integer.

$$x + (x + 1) + 3(x + 2) = 2637$$

$$x + x + 1 + 3x + 6 = 2637$$

$$5x + 7 = 2637$$

$$5x = 2630$$

$$x = 526$$

$$x + 1 = 527$$

$$x + 2 = 528$$

The score for Alabama was 526, for Louisiana was 527, and for Michigan was 528.

36. $x + (2x + 10) + (4x - 25) = 300$

$$x + 2x + 4x + 10 - 25 = 300$$

$$7x - 15 = 300$$

$$7x = 315$$

$$x = 45$$

$$2x + 10 = 2(45) + 10 = 100$$

$$4x - 25 = 4(45) - 25 = 155$$

Year	Percent Increase in Wi-Fi-Enabled Cell Phones since 2009	Predicted Percent Increase
2010	x	45%
2011	$2x + 10$	100%
2012	$4x - 25$	155%
Total	300%	

38. Let x be the decline in the number of telemarketer jobs (in thousands). Then $x + 11$ is the decline in the number of file clerk jobs, and $2x + 3$ is the decline in the number of farmer or rancher jobs.

$$x + (x + 11) + (2x + 3) = 166$$

$$x + x + 2x + 11 + 3 = 166$$

$$4x + 14 = 166$$

$$4x = 152$$

$$x = 38$$

$$x + 11 = 38 + 11 = 49$$

$$2x + 3 = 2(38) + 3 = 79$$

The predicted declines in the number of jobs are as follows: farmer or rancher: 79 thousand, telemarketer: 38 thousand, file clerk: 49 thousand

40. Let x be the number of seats in Candlestick Park. Then $x + 9800$ is the number of seats in Cowboy Stadium, and

$x - 8700$ is the number of seats in Soldier Field.

$$x + (x + 9800) + (x - 8700) = 211,700$$

$$3x + 1100 = 211,700$$

$$3x = 210,600$$

$$x = 70,200$$

$$x + 9800 = 70,200 + 9800 = 80,000$$

$$x - 8700 = 70,200 - 8700 = 61,500$$

The number of seats in each stadium is as follows:

Cowboy: 80,000

Candlestick: 70,200

Soldier Field: 61,500

42. Let x be the price of the textbook before tax.

$$x + 0.09x = 158.60$$

$$1.09x = 158.60$$

$$x \approx 145.50$$

The human anatomy book cost \$145.50 before tax.

44. Let x be the population in 2000. This population is decreased by 3.7% to the 2009 population of 191.5 million.

$$x - 0.037x = 191.5$$

$$0.963x = 191.5$$

$$x \approx 198.9$$

The population in Brazil in 2000 was 198.9 million.

46. Let x be the size of the workforce prior to layoffs.

$$0.15x = 11,000$$

$$x \approx 73,333$$

Prior to layoffs, Dana's workforce was 73,333 people.

48. Let x = measure of complement; then

$2x + 30$ = measure of angle.

$$x + 2x + 30 = 90$$

$$3x = 60$$

$$x = 20$$

$$2x + 30 = 2(20) + 30 = 70$$

The angles measure 20° and 70° .

50. Let x = base angle; then $3x - 10$ = third angle.

$$2x + 3x - 10 = 180$$

$$5x - 10 = 180$$

$$5x = 190$$

$$x = 38$$

$$3x - 10 = 3 \cdot 38 - 10 = 104$$

The angles measure 38° , 38° , and 104° .

52. Let x = length of side of pentagon, then

$x + 7$ = length of side of square.

$$5x = 4(x + 7)$$

$$5x = 4x + 28$$

$$x = 28$$

$$x + 7 = 28 + 7 = 35$$

The pentagon has a side length of 28 inches and the square has a side length of 35 inches.

54. Let x = first integer, then
 $x + 1$ = second integer, and
 $x + 2$ = third integer, and
 $x + 3$ = fourth integer.

$$(x + 1) + (x + 3) = 110$$

$$2x + 4 = 110$$

$$2x = 106$$

$$x = 53$$

$$x + 1 = 54$$

$$x + 2 = 55$$

$$x + 3 = 56$$

The integers are 53, 54, 55, and 56.

56. Let x be the payroll for the Montreal Canadiens. Then $x + 5,986,667$ is the payroll for the San Jose Sharks.

$$x + (x + 5,986,667) = 113,103,333$$

$$2x + 5,986,667 = 113,103,333$$

$$2x = 107,116,666$$

$$x = 53,558,333$$

$$x + 5,986,667 = 53,558,333 + 5,986,667 \\ = 59,545,000$$

The payroll for the Canadiens was \$53,558,333 and the payroll for the Sharks was \$59,545,000.

58. Let x = number of arrivals and departures at Frankfurt airport, then $x + 12.9$ = number at London, and $x + 5.2$ = number at Paris.

$$x + (x + 12.9) + (x + 5.2) = 177.1$$

$$3x + 18.1 = 177.1$$

$$3x = 159$$

$$x = 53$$

$$x + 12.9 = 65.9$$

$$x + 5.2 = 58.2$$

The arrivals and departures are:

Frankfurt: 53 million

London = 65.9 million

Paris = 58.2 million

60. $(x + 2) + 2x + x + (2x - 3) = 110$
 $6x - 1 = 110$
 $6x = 111$
 $x = 18.5$

$$x + 2 = 18.5 + 2 = 20.5$$

$$2x = 2(18.5) = 37$$

$$2x - 3 = 2(18.5) - 3 = 34$$

The bases measure 18.5 meters and 37 meters, and the sides measure 20.5 meters and 34 meters.

62. Let x = Internet penetration of Iceland. Then $x + 6.8$ = Internet penetration of Falkland Islands, and $x - 2.3$ = Internet penetration of Norway.

$$x + (x + 6.8) + (x - 2.3) = 284.1$$

$$3x + 4.5 = 284.1$$

$$3x = 279.6$$

$$x = 93.2$$

$$x + 6.8 = 100$$

$$x - 2.3 = 90.9$$

The Internet penetration is as follows:

Iceland: 93.2%

Falkland Islands: 100%

Norway 90.9%

64. Let x be the number of medals won by South Korea. Then, the Russian Federation won $(x + 1)$ medals and Austria won $(x + 2)$ medals.

$$x + (x + 1) + (x + 2) = 45$$

$$3x + 3 = 45$$

$$3x = 42$$

$$x = 14$$

$$x + 1 = 14 + 1 = 15$$

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

In the 2010 Winter Olympics, South Korea won 14 medals, the Russian Federation won 15 medals, and Austria won 16 medals.

66. Let x = height, then $2x + 12$ = length.

$$2(x) + 2(2x + 12) = 312$$

$$2x + 4x + 24 = 312$$

$$6x + 24 = 312$$

$$6x = 288$$

$$x = 48$$

$$2x + 12 = 2(48) + 12 = 108$$

The height is 48 inches and the length is 108 inches.

68. answers may vary

70. Let x° be the measure of an angle. Then its complement measures $(90 - x)^\circ$ and its supplement measures $(180 - x)^\circ$.

$$180 - x = 2(90 - x) + 50$$

$$180 - x = 180 - 2x + 50$$

$$180 - x = 230 - 2x$$

$$180 + x = 230$$

$$x = 50$$

The angle measures 50° .

72. $y = -94.8x + 2049$

$$y = -94.8(15) + 2049$$

$$y = -1422 + 2049$$

$$y = 627$$

The average number of cigarettes smoked by an American adult is predicted to be 627 in 2015.

74. The average number of cigarettes smoked daily in 2015 is predicted to be $\frac{627}{365} \approx 2$.

This does not represent the average number of cigarettes smoked by an American smoker, because it is the average for *all* Americans, both smokers and non-smokers.

76. Let x be the first odd integer. Then $x + 2$ is the next consecutive odd integer.

$$7x = 5(x + 2) + 54$$

$$7x = 5x + 10 + 54$$

$$7x = 5x + 64$$

$$2x = 64$$

$$x = 32$$

No such odd integers exist.

78. $R = C$

$$60x = 50x + 5000$$

$$10x = 5000$$

$$x = 500$$

$$50x + 5000 = 50(500) + 5000$$

$$= 25,000 + 5000$$

$$= 30,000$$

500 computer boards must be sold to break even. It costs \$30,000 to produce the 500 boards.

80. The company makes a profit if it makes and sells more products than the break-even number.

Section 1.7 Practice Exercises

1. In words: \$2000 plus 6% of sales

Translate: $2000 + 0.06x$

X	y_1
1000	2060
2000	2120
3000	2180
4000	2240
5000	2300
6000	2360
7000	2420
8000	2480
9000	2540
10000	2600
11000	2660
12000	2720

The completed table is:

Sales, x	1000	3000	5000	7000
Gross pay	2060	2180	2300	2420

Find the 2540 entry in the y_1 (gross pay) column. The corresponding x -value (sales) figure is 9000. She must average \$9000 in sales per month to earn a gross pay of \$2540 per month.

2. Let x be the number of hours. The charge for the first plumber is $60 + 35x$, while the charge for the second plumber is $45x$.

X	y_1	y_2
5	235	225
6	270	270
7	305	315

The first plumber charges \$235 for 5 hours and the second plumber charges \$225, so the second plumber charges \$10 less for 5 hours.

3. First, find the discounted price, which is 40% off the original price.

In words: Discounted price is 60% of original price

Translate: Discounted price = $0.60 \cdot x$

Thus $y_1 = 0.60x$ is the discounted price.

The sales tax rate is 6.5%.

In words: Sales tax is 6.5% of discounted price

Translate: Sales tax = $0.065 \cdot (0.60x)$

X	y_1	y_2
47.99	47.99	47.99
16.45	16.45	16.45
32.78	32.78	32.78
15.25	15.25	15.25

47.99+16.45+32.78+15.25	87.67
87.67*0.065	5.655
87.67+5.655	92.66

The total price for the discounted items was \$87.00. Including tax, she paid \$92.66 for the items.

4. Let x be the number of items produced and sold. The cost is $5600 + 4x$ and the revenue is $11x$.

No. of items	600	700	800	900	1000
Cost (x items)	8000	8400	8800	9200	9600
Revenue (x items)	6600	7700	8800	9900	11,000

Since the table entries for 800 items are the same for cost and revenue, the sale and production of 800 items produces the break-even point.

5. $y = -16x^2 + 112x$

X	Y1	
0	0	
1	96	
2	192	
3	192	
4	160	
5	96	
6	0	
Y1 = -16X^2 + 112X		

- Since the window height is 160 feet, the rocket first passes the window 2 seconds after it is shot off.
- The rocket passes the window again at 5 seconds.
- At 7 seconds, the height is 0, indicating that the rocket has hit the ground.
- The rocket appears to reach its maximum height between 3 and 4 seconds.

X	Y1	
3	192	
3.5	195.44	
4	192	
4.5	184.56	
5	160	
5.5	120.56	
6	80	
6.5	39.56	
7	0	
X=3		

The maximum height, 196 feet, occurs 3.5 seconds after the rocket is launched.

Vocabulary, Readiness & Video Check 1.7

- Each y_1 -value is -2 times the x -value, so $y = -2x$; f.
- Each y_1 -value is 5 times the x -value, so $y = 5x$; a.
- Each y_1 -value is 1 more than 3 times the x -value, so $y = 3x + 1$; b.
- Each y_1 -value is 5 more than -1 times the x -value, so $y = -x + 5$; e.
- Each y_1 -value is 1 more than the square of the x -value, so $y = x^2 + 1$; d.
- Each y_1 -value is the square of the x -value, so $y = x^2$; c.
- To use the table feature of a calculator, give the table a specific value to start with, tell the table by what increment to increase, and give the expression you want evaluated.

Exercise Set 1.7

2.

X	Y1	
0	0	
1	3.14159	
2	12.56637	
3	28.27433	
4	50.26548	
5	78.53982	
6	113.09734	
7	153.93804	
8	200.9688	
9	254.16874	
10	313.5267	
Y1 = 3.14X^2		

Radius of Cylinder	x	2	3	4	5	6
Volume (If height is 3 Units)	$3\pi x^2$	37.70	84.82	150.80	235.62	339.29

- The volume of a cylinder with height 3 inches and radius 5 inches is about 235.62 cubic inches.
- The volume of a cylinder with height 3 meters and radius 4 meters is about 150.80 cubic meters.
- A cylinder with height 3 kilometers and volume 150.8 cubic kilometers has a radius of about 4 kilometers.

4.

x	V_1	V_2
7	2.35	
7.5	2.43	
8	2.5	
8.5	2.58	
9	2.65	
9.5	2.725	
10	2.8	
$V_1 = 1.30 + 0.15x$		

Minutes on Phone	x	7	7.5	8	8.5
Total Charge (Dollars)	$1.30 + 0.15x$	2.35	2.43	2.5	2.58

a.

x	V_1	V_2
12	3.1	
12.5	3.175	
13	3.25	
13.5	3.325	
14	3.4	
14.5	3.475	
15	3.55	
$V_1 = 1.30 + 0.15x$		

A person with \$3.25 can talk for 13 minutes on a pay phone.

b.

x	V_1	V_2
16.5	3.775	
17	3.85	
17.5	3.925	
18	4	
18.5	4.075	
19	4.15	
19.5	4.225	
$V_1 = 1.30 + 0.15x$		

To spend no more than \$4 on a single phone call, the call must be less than 18 minutes long.

- $y_1 = 69.75x$
 - $y_2 = 263.25x$

c.

x	V_1	V_2
2	139.5	526.5
3	209.25	789.75
4	279	1053
5	348.75	1316.25
6	418.5	1579.5
7	488.25	1842.75
8	558	2106
$V_1 = 69.75x$		

Credit Hours	2	3	4	5	6
In-State Cost (Dollars)	139.50	209.25	279.00	348.75	418.50
Out-of-State Cost (Dollars)	526.50	789.75	1053.00	1316.25	1579.50

- Her total tuition will be \$1061.25.

8.

x	V_1	V_2
3	113.1	113.1
3.1	1189.2	623.47
4.5	2203.8	2223.5
5.0	2359.5	2446
1.7	20.58	36.217
2.5	65.450	78.54
$V_1 = 4/3\pi x^3$		

Radius of Sphere	x	3	7.1	43	50
Volume	$\frac{4}{3}\pi x^3$	113.1	1499.2	333,038.14	523,598.78
Surface Area	$4\pi x^2$	113.1	633.47	23,235.22	31,415.93

- a. A sphere with radius 1.7 centimeters has volume 20.58 cubic centimeters and surface area 36.32 square centimeters.
- b. A sphere with radius 25 feet has volume 64,449.85 cubic feet and surface area 7853.98 square feet.
10. a. Use $y_1 = 23,500 + 1000(x-1)$ for Company A and $y_2 = 25,000 + 475(x-1)$ for Company B.

X	Y1	Y2
1	23500	25000
2	24500	25475
3	25500	25950
4	26500	26425
5	27500	26900

Years	1	2	3	4	5
Gross Pay A	23,500	24,500	25,500	26,500	27,500
Gross Pay B	25,000	25,475	25,950	26,425	26,900

- b. She makes more money in 5 years with Company B (\$129,750) than with Company A (\$127,500).
12. a. $y_1 = 6.00 + 1.72x$

b.

X	Y1
0	6.00
1	7.72
2	9.44
3	11.16
4	12.88
5	14.60
6	16.32

Gallons of Water Used (Thousands)	0	1	2	3	4	5	6
Monthly Cost (Dollars)	6	7.72	9.44	11.16	12.88	14.6	16.32

14. a. $y_1 = 850 - 25x$

b.

X	Y1
0	850
10	600
15	475
20	350
25	225
30	100

Days Elapsed	0	10	15	20	25	30
Cars Remaining	850	600	475	350	225	100

c.

X	Y1
0	850
10	600
20	350
30	100
34	0

His lot will be empty of cars after 34 days.

16. a. Use $y_1 = 35,000 + 650(x - 1)$ for Plan A and $y_2 = 32,000 + 1000(x - 1)$ for Plan B.

Year	1	2	3	4	5	6
Plan A	35,000	35,650	36,300	36,950	37,600	38,250
Plan B	32,000	33,000	34,000	35,000	36,000	37,000

- b. answers may vary

18. a. $y_1 = 10 + 0.09850x$

b.

X	V1
0	10
500	59.25
1000	108.5
1500	157.75
2000	207
2500	256.25
3000	305.5

V1=10+.09850X

Kilowatt-Hours	0	500	1000	1500	2000
Monthly Cost (Dollars)	10	59.25	108.5	157.75	207

20. a. $y_1 = 1000 - 1.5x$

b.

X	V1
0	1000
60	910
120	820
180	730
240	640
300	550
360	460

V1=1000-1.5X

Minutes	0	60	120	180	240	300	360
ml Solution Remaining	1000	910	820	730	640	550	460

c.

X	V1	V2
360	460	14
420	370	11.3333
480	280	8.6667
540	190	5.9999
600	100	3.3333
660	10	0.6667
720	-80	

V1=1000-1.5X

She should return in 660 minutes, which is 11 hours. She should return at 12 midnight.

22. a. A rate of 24 miles per gallon corresponds to $\frac{1}{24}$ gallon per mile.

$$y_1 = 14 - \frac{x}{24}$$

- b. A rate of 30 miles per gallon corresponds to $\frac{1}{30}$ gallon per mile.

$$y_2 = 14 - \frac{x}{30}$$

c.

X	V1	V2
0	14	14
50	11.917	12.3333
100	9.8333	10.6667
150	7.75	8.9999
200	5.6667	7.3333
250	3.5833	5.6667
300	1.5	4

V1=14-X/24

X	V1	V2
100	9.8333	10.6667
150	7.75	8.9999
200	5.6667	7.3333
250	3.5833	5.6667
300	1.5	4
350	-0.6667	2.3333
400	-2.6667	0.6667

V2=14-X/30

Miles	0	50	100	150	200	250	300	350	400
City	14	11.9	9.8	7.8	5.7	3.6	1.5	-0.6	-2.7
Highway	14	12.3	10.7	9	7.3	5.7	4	2.3	0.7

- d. After 300 miles of city driving, there are 1.5 gallons left in the tank.
 e. After 300 miles of highway driving, there are 4 gallons left in the tank.

f.

X	Y ₁	Y ₂
400	-2.667	.66667
410	-3.083	.33333
420	-3.5	0
430	-3.917	-.33333
440	-4.333	-.66667
450	-4.75	-1
460	-5.167	-1.333

X=400

He can drive 420 miles on the highway before his tank is empty.

g.

X	Y ₁	Y ₂
320	.25	3
324	.20833	2.66667
328	.16667	2.33333
332	.125	2
336	.08333	1.66667
340	.04167	1.33333
344	0	1

X=330

He can drive 336 miles in the city before his tank is empty.

- h. answers may vary

24. a. If the regular price is x dollars, the sale price is $x - 0.30x = 0.70x$ dollars.
 $y_1 = 0.70x$

b.

X	Y ₁
9.95	6.965
29.95	20.965
49.75	34.825
19.95	13.965
27.95	19.565
79.95	55.965

Y₁=.70X

Item	Hammer	Drill	Sander	Glue Gun	Screwdriver Set	Socket Wrench Set
Price Tag	\$9.95	\$29.95	\$49.75	\$19.95	\$27.95	\$79.95
Sale Price	\$6.97	\$20.97	\$34.83	\$13.97	\$19.57	\$55.97

c.

6.97+20.97+34.83
+13.97+19.57+55.97
152.28

His total bill before taxes is \$152.28 if he purchases all the items on sale.

d.

152.28*.07
10.6596
152.28+10.6596
162.94

His total after taxes is \$162.94.

e.

9.95+29.95+49.75
+19.95+27.95+79.95
217.5
217.5-152.28
65.22

He saves \$65.22 by waiting for the sale.

26. Let $y_1 = 1750 + 21x$ for the cost equation and $y_2 = 35x$ for the revenue equation.

X	Y1	Y2
25	2275	875
50	2800	1750
75	3325	2625
100	3850	3500
125	4375	4375
150	4900	5250
175	5425	6125

$$Y1 = 1750 + 21X$$

x Books	25	50	75	100	125
Cost	2275	2800	3325	3850	4375
Revenue	875	1750	2625	3500	4375

The break-even point is when 125 books are produced and sold.

28. When 100 books are produced and sold, there is a loss of $\$3850 - \$3500 = \$350$.

30. Let x be the diameter of the pizza. Use $y_1 = \pi\left(\frac{x}{2}\right)^2$ for the area, $y_2 = \pi x$ for the circumference, $y_3 = 0.05y_1$ for the cost based on area, and $y_4 = 0.25y_2$ for the cost based on circumference.

X	Y1	Y2
6	28.274	18.85
12	113.1	37.699
18	254.47	56.549
24	452.39	75.398
30	706.86	94.248
36	1017.9	113.1
42	1385.4	131.95

$$Y1 = \pi(X/2)^2$$

X	Y3	Y4
6	1.4127	4.7124
12	5.6509	9.4248
18	12.7223	14.1372
24	22.618	18.85
30	35.343	23.562
36	50.884	28.274
42	69.672	32.987

$$Y4 = .25Y2$$

Diameter (Inches)	Area	Circumference	Cost (Area)	Cost (Circumference)
6	28.274	18.85	\$1.41	\$4.71
12	113.1	37.699	\$5.65	\$9.42
18	254.17	56.549	\$12.72	\$14.14
24	452.39	75.398	\$22.62	\$18.85
30	706.86	94.248	\$35.34	\$23.56
36	1017.9	113.1	\$50.89	\$28.27

answers may vary

32. a.

X	Y1	Y2
1	84	
2	136	
3	156	
4	144	
5	100	
6	24	
7	-84	

$$Y1 = -16X^2 + 100X$$

Seconds	1	2	3	4	5
Height (Feet)	84	136	156	144	100

- b. The rocket rises, peaks, then falls.

- c.

X	Y1	Y2
6.05	24	
6.1	19.36	
6.15	14.64	
6.2	9.84	
6.25	5	
6.3	0	
6.35	-5.04	

$$X = 6$$

If the rocket doesn't explode in the air, it hits the ground after 6.3 seconds.

34. a. $C = 35 + 25x$

b.

X	Y1
1.5	72.5
2	85
2.5	97.5
3	110

$Y1 = 35 + 25X$

Hours on Job	1.5	2	2.5	3
Cost (Dollars)	72.5	85	97.5	110

36. a. Since the object is dropped, the maximum height is where it starts, at 1050 feet.

b.

X	Y1
8	26
8.05	13.16
8.1	2.4
8.15	-12.76
8.2	-25.84
8.25	-38.24

$Y1 = -16X^2 + 256X$

The object hits the ground after approximately 8.1 seconds.

38. Let x be the length of the sides perpendicular to the patio. Then $52 - 2x$ is the length of the side parallel to the patio and the area is $x(52 - 2x)$.

X	Y1
10	320
11	330
12	336
13	338
14	336
15	330
16	320

$Y1 = X(52 - 2X)$

The largest area, 338 square feet, occurs when $x = 13$. Then

$52 - 2x = 52 - 2(13) = 52 - 26 = 26$ and the dimensions are 13 feet by 26 feet.

40.

X	Y1
4	72.7
5	76.87
6	79.74
7	81.25
8	81.5
9	80.5

$Y1 = 1.05X^2 - 8.38X + 81.25$

- a. The lowest high temperature occurs when $x = 4$, which corresponds to Wednesday.
- b. The lowest high temperature is 72.7°F .
- c. No; answers may vary

Section 1.8 Practice Exercises

1. $I = PRT$

$$\frac{I}{PR} = \frac{PRT}{PR}$$

$$\frac{I}{PR} = T \text{ or } T = \frac{I}{PR}$$

2. $7x - 2y = 5$

$$7x - 2y - 7x = 5 - 7x$$

$$-2y = 5 - 7x$$

$$\frac{-2y}{-2} = \frac{5 - 7x}{-2}$$

$$y = \frac{7}{2}x - \frac{5}{2}$$

3. $A = P + Prt$

$$A - P = P + Prt - P$$

$$A - P = Prt$$

$$\frac{A - P}{Prt} = \frac{Prt}{Prt}$$

$$\frac{A - P}{Prt} = r \text{ or } r = \frac{A - P}{Prt}$$

4. Let $P = 8000$, $r = 6\% = 0.06$, $t = 4$, $n = 2$.

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

$$A = 8000 \left(1 + \frac{0.06}{2} \right)^{2 \cdot 4}$$

$$A = 8000(1.03)^8$$

$$A \approx 8000(1.266770081)$$

$$A \approx 10,134.16$$

Russ will have \$10,134.16 in his account.

5. Let $d = 192$ and $r = 7.5$.

$$d = rt$$

$$192 = 7.5t$$

$$\frac{192}{7.5} = \frac{7.5t}{7.5}$$

$$25.6t = t$$

They spent 25.6 hours cycling, or 25 hours 36 minutes.

6. $C = \frac{5}{9}(F - 32)$

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

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

Use $y_1 = \frac{9}{5}x + 32$.

X	Y1
-40	-22
-30	8
10	50
30	88

$Y1 = 9/5X + 32$

Celsius	-40	-30	10	30
Fahrenheit	-40	-22	50	86

7. Let x be the width of the pen. Then the length of the pen along the shed is $(88 - 2x)$ feet, and the area is $x(88 - 2x)$.

x	W	A
18	52	936
20	48	960
22	44	968
24	40	960
26	36	936
$V = x(88 - 2x)$		

The largest area is 968 square feet when the width is 22 feet and the length is $88 - 2 \cdot 22 = 44$ feet.

Vocabulary, Readiness & Video Check 1.8

- $2x + y = 5$
 $y = 5 - 2x$
- $7x - y = 3$
 $-y = 3 - 7x$
 $y = -3 + 7x$ or $y = 7x - 3$
- $a - 5b = 8$
 $a = 5b + 8$
- $7r + s = 10$
 $s = 10 - 7r$
- $5j + k - h = 6$
 $5j + k = h + 6$
 $k = h - 5j + 6$
- $w - 4y + z = 0$
 $w + z = 4y$
 $z = 4y - w$
- That the specified variable will equal some expression and that this expression should not contain the specified variable.
- The only way to check the solution is in the formula used, because if the wrong formula is used, a wrong answer may seem to check correctly.

Exercise Set 1.8

- $W = gh$
 $\frac{W}{h} = \frac{gh}{h}$
 $\frac{W}{h} = g$
 $g = \frac{W}{h}$
- $V = lwh$
 $\frac{V}{wh} = \frac{lwh}{wh}$
 $\frac{V}{wh} = l$
 $l = \frac{V}{wh}$
- $2x + 3y = 17$
 $2x + 3y - 2x = 17 - 2x$
 $3y = 17 - 2x$
 $\frac{3y}{3} = \frac{17 - 2x}{3}$
 $y = \frac{17 - 2x}{3}$
- $A = 3M - 2N$
 $A + 2N = 3M$
 $2N = 3M - A$
 $\frac{2N}{2} = \frac{3M - A}{2}$
 $N = \frac{3M - A}{2}$
- $y = mx + b$
 $y - b = mx$
 $\frac{y - b}{m} = \frac{mx}{m}$
 $x = \frac{y - b}{m}$
- $A = Prt + P$
 $A = P(rt + 1)$
 $\frac{A}{rt + 1} = \frac{P(rt + 1)}{rt + 1}$
 $P = \frac{A}{rt + 1}$

$$\begin{aligned}
 14. \quad & A = 5H(b + B) \\
 & A = 5Hb + 5HB \\
 & A - 5HB = 5Hb \\
 & \frac{A - 5HB}{5H} = \frac{5Hb}{5H} \\
 & \frac{A - 5HB}{5H} = b \\
 & b = \frac{A - 5HB}{5H}
 \end{aligned}$$

$$\begin{aligned}
 16. \quad & S = 2\pi r^2 + 2\pi rh \\
 & S - 2\pi r^2 = 2\pi rh \\
 & \frac{S - 2\pi r^2}{2\pi r} = \frac{2\pi rh}{2\pi r} \\
 & \frac{S - 2\pi r^2}{2\pi r} = h \\
 & h = \frac{S - 2\pi r^2}{2\pi r}
 \end{aligned}$$

$$\begin{aligned}
 18. \quad & A = P(1 + rt) \\
 & A = P + Prt \\
 & A - P = Prt \\
 & \frac{A - P}{Pr} = \frac{Prt}{Pr} \\
 & \frac{A - P}{Pr} = t \\
 & t = \frac{A - P}{Pr}
 \end{aligned}$$

$$\begin{aligned}
 20. \quad & C = \frac{5}{9}(F - 32) \\
 & 9C = 5(F - 32) \\
 & 9C = 5F - 160 \\
 & 9C + 160 = 5F \\
 & \frac{9C + 160}{5} = \frac{5F}{5} \\
 & \frac{9C + 160}{5} = F \\
 & F = \frac{9}{5}C + 32
 \end{aligned}$$

$$\begin{aligned}
 22. \quad & L = a + (n - 1)d \\
 & L - a = (n - 1)d \\
 & \frac{L - a}{n - 1} = \frac{(n - 1)d}{n - 1} \\
 & \frac{L - a}{n - 1} = d \\
 & d = \frac{L - a}{n - 1}
 \end{aligned}$$

24. $T = 3vs - 4ws + 5vw$

$$T + 4ws = 3vs + 5vw$$

$$T + 4ws = v(3s + 5w)$$

$$\frac{T + 4ws}{3s + 5w} = \frac{v(3s + 5w)}{3s + 5w}$$

$$\frac{T + 4ws}{3s + 5w} = v$$

$$v = \frac{T + 4ws}{3s + 5w}$$

26. $A = P\left(1 + \frac{r}{n}\right)^{nt} = 5000\left(1 + \frac{0.06}{n}\right)^{15n}$

n	1	2	4	12	365
A	\$11,982.79	\$12,136.31	\$12,216.10	\$12,270.47	\$12,297.11

28. a. Using the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, we have

$$A = 25,000\left(1 + \frac{0.05}{2}\right)^{2 \cdot 2}$$

$$= 25,000(1.025)^4$$

$$\approx 25,000(1.103812891)$$

$$\approx 27,595.32$$

The amount in the account is \$27,595.32.

b. $A = 25,000\left(1 + \frac{0.05}{4}\right)^{4 \cdot 2}$

$$= 25,000(1.0125)^8$$

$$\approx 25,000(1.104486101)$$

$$\approx 27,612.15$$

The amount in the account is \$27,612.15.

c. $A = 25,000\left(1 + \frac{0.05}{12}\right)^{12 \cdot 2}$

$$\approx 25,000(1.00416666)^{24}$$

$$\approx 25,000(1.104941335)$$

$$\approx 27,623.53$$

The amount in the account is \$27,623.53.

30. Roundtrip distance = $154 + 154 = 308$ miles

$$d = r \cdot t$$

$$308 = r\left(5\frac{1}{2}\right)$$

$$\frac{308}{5\frac{1}{2}} = r$$

$$r = 56$$

Their average speed was 56 mph.

32. Using the formula $F = \frac{9}{5}C + 32$, we have

$$F = \frac{9}{5}C + 32 = \frac{9}{5}(-15) + 32 = -27 + 32 = 5$$

The temperature was 5°F.

34. The total area of the ceiling is $18(12) = 216$ square feet. Each package can cover up to 50 square feet. Thus, the number of packages needed is $\frac{216}{50} = 4.32$. Therefore, 5 packages must be purchased.

36. Using the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, we have

$$A = 4000\left(1 + \frac{0.055}{2}\right)^{2 \cdot 3}$$

$$A = 4000(1.0275)^6$$

$$A \approx 4000(1.176768361)$$

$$A \approx 4707.07$$

Yes, the amount is enough.

38. Note that the wall covers $21 \cdot 8 = 168$ square feet. Because we wish to paint three coats, we actually must cover a total of $168 \cdot 3 = 504$ square feet. Since each gallon covers 300 square feet, we need $\frac{504}{300} = 1.68$ gallons of paint. 2 gallons should be purchased.

40. $V = \pi r^2 h$
 $825\pi = \pi(5)^2 h$
 $825\pi = 25\pi h$
 $825 = 25h$
 $33 = h$

The height is 33 mm.

42. a. $V = \frac{4}{3}\pi r^3$; $r = \frac{d}{2} = \frac{18}{2} = 9$

$$V = \frac{4}{3}\pi(9)^3$$

$$V = \frac{4}{3}\pi(729)$$

$$V = 972\pi$$

The volume is 972π cubic cm.

- b. $V = 972\pi \approx 3053.63$ cubic cm

44. a. $V = \pi r^2 h$

$$V = \pi(4)^2(15)$$

$$V \approx 753.98$$

The volume of the cylinder is 753.98 cubic millimeters.

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

$$V = \frac{4}{3}\pi(4)^3$$

$$V \approx 268.08$$

The volume of the sphere is 268.08 cubic millimeters.

- c. $V = 753.98 + 268.08 = 1022.06$

The volume of the vitamin is 1022.06 cubic millimeters.

46. Note that the radius of the circle is equal to $22,248 + 4000 = 26,248$.

$$C = 2\pi r$$

$$C = 2\pi(26,248)$$

$$C = 52,496\pi$$

$$C \approx 164,921.0479$$

The "length" of the Clarke belt is approximately 164,921 miles.

48. $8 \text{ miles} \times \frac{5280 \text{ ft}}{1 \text{ mile}} = 42,240 \text{ ft}$

$$7.5 \text{ hours} \times \frac{60 \text{ min}}{1 \text{ hour}} \times \frac{60 \text{ sec}}{1 \text{ min}} = 27,000 \text{ sec}$$

Using $d = rt$ we have:

$$42,240 = r(27,000)$$

$$r = \frac{42,240}{27,000} \approx 1.6$$

The drill can be removed at a rate of 1.6 ft/sec.

50. Using the formula $V = \frac{4}{3}\pi r^3$, we have

$$V = \frac{4}{3}\pi(20.6)^3$$

$$V \approx 36,618$$

The volume of Eartha is about 36,618 cu ft.

52. Let x be the width of the garden. Then the length of the garden along the patio is $(92 - 2x)$ feet, and the area is $x(92 - 2x)$ square feet.

x	$V = x(92 - 2x)$
20	4000
21	4050
22	4088
23	4108
24	4116
25	4110
26	4090
27	4040

The largest area is 1058 square feet when the width is 23 feet and the length is $92 - 2 \cdot 23 = 46$ feet.

$$\begin{aligned}
 54. \quad C &= 4h + 9f + 4p \\
 4h &= C - 9f - 4p \\
 h &= \frac{C - 9f - 4p}{4}
 \end{aligned}$$

$$\begin{aligned}
 56. \quad C &= 4h + 9f + 4p \\
 C &= 4(30) + 9(9) + 4(2) \\
 C &= 209 \\
 \text{There are 209 calories in this serving.}
 \end{aligned}$$

$$\begin{aligned}
 58. \quad f &= \frac{C - 4h - 4p}{9} \\
 f &= \frac{120 - 4(21) - 4(5)}{9} \\
 f &\approx 1.8 \\
 \text{There are 1.8 grams of fat per serving.}
 \end{aligned}$$

	Planet	AU from Sun
60.	Earth	$\frac{92.9}{92.9} = 1.000$
62.	Jupiter	$\frac{483.3}{92.9} \approx 5.202$
64.	Uranus	$\frac{1783}{92.9} \approx 30.065$
66.	Pluto (dwarf planet)	$\frac{3670}{92.9} = 39.505$

68. answers may vary

70. answers may vary

72. Two of the 8 sectors are yellow.

$$P(\text{yellow}) = \frac{2}{8} = \frac{1}{4}$$

74. Three of the 8 sectors are blue.

$$P(\text{blue}) = \frac{3}{8}$$

76. Three of the sectors are black or yellow.

$$P(\text{black or yellow}) = \frac{3}{8}$$

78. Six of the sectors are yellow, blue, or black.

$$P(\text{yellow, blue, or black}) = \frac{6}{8} = \frac{3}{4}$$

$$\begin{aligned}
 80. \quad P(\text{red, yellow, green, blue, or black}) \\
 &= P(\text{red}) + P(\text{yellow}) + P(\text{green}) + P(\text{blue}) \\
 &\quad + P(\text{black}) \\
 &= \frac{1}{8} + \frac{2}{8} + \frac{1}{8} + \frac{3}{8} + \frac{1}{8} \\
 &= 1
 \end{aligned}$$

$$82. P(\text{event sure to occur}) = 1$$

Chapter 1 Vocabulary Check

1. An algebraic expression is formed by numbers and variables connected by the operations of addition, subtraction, multiplication, division, raising to powers, and/or taking roots.
2. The opposite of a number a is $-a$.
3. $3(x - 6) = 3x - 18$ by the distributive property.
4. The absolute value of a number is the distance between the number and 0 on the number line.
5. An exponent is a shorthand notation for repeated multiplication of the same factor.
6. A letter that represents a number is called a variable.
7. The symbols $<$ and $>$ are called inequality symbols.
8. If a is not 0, then a and $\frac{1}{a}$ are called reciprocals.
9. $A + B = B + A$ by the commutative property.
10. $(A + B) + C = A + (B + C)$ by the associative property.
11. The numbers 0, 1, 2, 3, ... are called whole numbers.
12. If a number corresponds to a point on the number line, we know that number is a real number.
13. An equation in one variable that has no solution is called a contradiction.
14. An equation in one variable that has every number (for which the equation is defined) as a solution is called an identity.
15. The equation $d = rt$ is also called a formula.

16. When a variable in an equation is replaced by a number and the resulting equation is true, then that number is called a solution of the equation.
17. The integers 17, 18, 19 are examples of consecutive integers.
18. The statement $5x - 0.2 = 7$ is an example of a linear equation in one variable.

Chapter 1 Review

1. $7x = 7(3) = 21$
2. $st = (1.6)(5) = 8$
3. One minute = 60 seconds.
 $70t = 70(60) = 4200$
4200 wingbeats per minute.
4. One hour is $60(60) = 3600$ seconds.
 $70t = 70(3600) = 252,000$
252,000 wingbeats per hour.
5. $\{x|x \text{ is an odd integer between } -2 \text{ and } 4\}$
 $= \{-1, 1, 3\}$
6. $\{x|x \text{ is an even integer between } -3 \text{ and } 7\}$
 $= \{-2, 0, 2, 4, 6\}$
7. There are no whole numbers that are negative.
 \emptyset
8. All natural numbers are rational numbers.
 \emptyset
9. $\{x|x \text{ is a whole number greater than } 5\}$
 $= \{6, 7, 8, \dots\}$
10. $\{x|x \text{ is an integer less than } 3\} = \{\dots, -1, 0, 1, 2\}$
11. Since $D = \{2, 4, 6, 8, 10, \dots, 16\}$, $10 \in D$ is true.
12. Since $B = \{5, 9, 11\}$, $B \in 9$ is false.
13. $\sqrt{169} = 13$, which is a rational number. So
 $\sqrt{169} \notin G$ is true.
14. Since $F = \{ \}$ and 0 is not an element of the empty set, then $0 \notin F$ is true.
15. Since $E = \{x|x \text{ is a rational number}\}$ and π is irrational, then $\pi \in E$ is false.
16. Since $H = \{x|x \text{ is a real number}\}$ and π is a real number, then $\pi \in H$ is true.
17. Since $\sqrt{4} = 2$ and $G = \{x|x \text{ is an irrational number}\}$, and 2 is a rational number, then $\sqrt{4} \in G$ is false.
18. Since $E = \{x|x \text{ is a rational number}\}$ and -9 is a rational number, then $-9 \in E$ is true.
19. Since $A = \{6, 10, 12\}$ and
 $D = \{2, 4, 6, 8, 10, 12, 14, 16\}$, then $A \subseteq D$ is true.
20. Since $C = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$ and
 $B = \{5, 9, 11\}$, then $C \not\subseteq B$ is true.
21. Since $C = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$ and
 $E = \{x|x \text{ is a rational number}\}$, and all integers are rational numbers, then $C \not\subseteq E$ is false.
22. Since $F = \{ \}$ and $H = \{x|x \text{ is a real number}\}$, and the empty set is a subset of all sets, then $F \subseteq H$ is true.
23. Whole numbers: $\left\{5, \frac{8}{2}, \sqrt{9}\right\}$
24. Natural numbers: $\left\{5, \frac{8}{2}, \sqrt{9}\right\}$
25. Rational numbers: $\left\{5, -\frac{2}{3}, \frac{8}{2}, \sqrt{9}, 0.3, 1\frac{5}{8}, -1\right\}$
26. Irrational numbers: $\{\sqrt{7}, \pi\}$
27. Real numbers:
 $\left\{5, -\frac{2}{3}, \frac{8}{2}, \sqrt{9}, 0.3, \sqrt{7}, 1\frac{5}{8}, -1, \pi\right\}$
28. Integers: $\left\{5, \frac{8}{2}, \sqrt{9}, -1\right\}$
29. The opposite of $-\frac{3}{4}$ is $-\left(-\frac{3}{4}\right) = \frac{3}{4}$.
30. The opposite of 0.6 is -0.6 .
31. The opposite of 0 is $-0 = 0$.
32. The opposite of 1 is -1 .

33. The reciprocal of $-\frac{3}{4}$ is $\frac{1}{(-\frac{3}{4})} = -\frac{4}{3}$.

34. The reciprocal of 0.6 is $\frac{1}{0.6}$.

35. The reciprocal of 0 is $\frac{1}{0}$ which is undefined.

36. The reciprocal of 1 is $\frac{1}{1} = 1$.

37. $-7 + 3 = -4$

38. $-10 + (-25) = -35$

39. $5(-0.4) = -2$

40. $(-3.1)(-0.1) = 0.31$

41. $-7 - (-15) = -7 + 15 = 8$

42. $9 - (-4.3) = 9 + 4.3 = 13.3$

43. $(-6)(-4)(0)(-3) = 0$

44. $(-12)(0)(-1)(-5) = 0$

45. $(-24) \div 0$ is undefined.

46. $0 \div (-45) = 0$

47. $(-36) \div (-9) = 4$

48. $60 \div (-12) = -5$

49. $\left(-\frac{4}{5}\right) - \left(-\frac{2}{3}\right) = -\frac{4}{5} + \frac{2}{3} = -\frac{12}{15} + \frac{10}{15} = -\frac{2}{15}$

50. $\left(\frac{5}{4}\right) - \left(-2\frac{3}{4}\right) = \frac{5}{4} + \frac{11}{4} = \frac{16}{4} = 4$

51. $1 - \frac{1}{4} - \frac{1}{3} = \frac{12}{12} - \frac{3}{12} - \frac{4}{12} = \frac{5}{12}$

52. $31,441 - 1589 = 29,852$
The elevation relative to sea level is 29,852 feet below sea level.

53. $-5 + 7 - 3 - (-10) = 2 - 3 + 10 = -1 + 10 = 9$

54. $8 - (-3) + (-4) + 6 = 8 + 3 - 4 + 6$
 $= 11 - 4 + 6$
 $= 7 + 6$
 $= 13$

55. $3(4 - 5)^4 = 3(-1)^4 = 3(1) = 3$

56. $6(7 - 10)^2 = 6(-3)^2 = 6(9) = 54$

57. $\left(-\frac{8}{15}\right) \cdot \left(-\frac{2}{3}\right)^2 = -\frac{8}{15} \cdot \frac{4}{9} = -\frac{32}{135}$

58. $\left(-\frac{3}{4}\right)^2 \cdot \left(-\frac{10}{21}\right) = \left(\frac{9}{16}\right) \cdot \left(-\frac{10}{21}\right) = -\frac{15}{56}$

59. $-\frac{6}{15} \div \frac{8}{25} = -\frac{6}{15} \cdot \frac{25}{8} = -\frac{150}{120} = -\frac{5}{4}$

60. $\frac{4}{9} \div \left(-\frac{8}{45}\right) = \frac{4}{9} \cdot \left(-\frac{45}{8}\right) = -\frac{180}{72} = -\frac{5}{2}$

61. $-\frac{3}{8} + 3(2) \div 6 = -\frac{3}{8} + 6 \div 6 = -\frac{3}{8} + 1 = -\frac{3}{8} + \frac{8}{8} = \frac{5}{8}$

62. $5(-2) - (-3) - \frac{1}{6} + \frac{2}{3} = -10 + 3 - \frac{1}{6} + \frac{2}{3}$
 $= -7 - \frac{1}{6} + \frac{2}{3}$
 $= -\frac{42}{6} - \frac{1}{6} + \frac{4}{6}$
 $= -\frac{39}{6}$
 $= -6\frac{1}{2}$

63. $|2^3 - 3^2| - |5 - 7| = |8 - 9| - |-2|$
 $= |-1| - 2$
 $= 1 - 2$
 $= -1$

64. $|5^2 - 2^2| + |9 \div (-3)| = |25 - 4| + |-3|$
 $= |21| + 3$
 $= 21 + 3$
 $= 24$

65. $(2^3 - 3^2) - (5 - 7) = (8 - 9) - (-2) = -1 + 2 = 1$

$$\begin{aligned}
 66. \quad (5^2 - 2^4) + [9 \div (-3)] &= (25 - 16) + (-3) \\
 &= 9 + (-3) \\
 &= 6
 \end{aligned}$$

$$\begin{aligned}
 67. \quad \frac{(8-10)^3 - (-4)^2}{2+8(2) \div 4} &= \frac{(-2)^3 - 16}{2+16 \div 4} \\
 &= \frac{-8-16}{2+4} \\
 &= \frac{-24}{6} \\
 &= -4
 \end{aligned}$$

$$\begin{aligned}
 68. \quad \frac{(2+4)^2 + (-1)^5}{12 \div 2 \cdot 3 - 3} &= \frac{(6)^2 + (-1)}{6 \cdot 3 - 3} \\
 &= \frac{36-1}{18-3} \\
 &= \frac{35}{15} \\
 &= \frac{7}{3}
 \end{aligned}$$

$$\begin{aligned}
 69. \quad \frac{(4-9)+4-9}{10-12 \div 4 \cdot 8} &= \frac{(-5)+4-9}{10-3 \cdot 8} \\
 &= \frac{-1-9}{10-24} \\
 &= \frac{-10}{-14} \\
 &= \frac{5}{7}
 \end{aligned}$$

$$70. \quad \frac{3-7-(7-3)}{15+30 \div 6 \cdot 2} = \frac{-4-(4)}{15+5 \cdot 2} = \frac{-8}{15+10} = \frac{-8}{25} = -\frac{8}{25}$$

$$71. \quad \frac{\sqrt{25}}{4+3 \cdot 7} = \frac{5}{4+21} = \frac{5}{25} = \frac{1}{5}$$

$$72. \quad \frac{\sqrt{64}}{24-8 \cdot 2} = \frac{8}{24-16} = \frac{8}{8} = 1$$

$$\begin{aligned}
 73. \quad \text{Let } x = 0, y = 3, z = -2. \\
 x^2 - y^2 + z^2 &= (0)^2 - (3)^2 + (-2)^2 \\
 &= 0 - 9 + 4 \\
 &= -5
 \end{aligned}$$

$$\begin{aligned}
 74. \quad \text{Let } x = 0, y = 3, z = -2. \\
 \frac{5x+z}{2y} &= \frac{5(0)+(-2)}{2(3)} = \frac{0-2}{6} = \frac{-2}{6} = -\frac{1}{3}
 \end{aligned}$$

$$\begin{aligned}
 75. \quad \text{Let } y = 3, z = -2. \\
 \frac{-7y-3z}{-3} &= \frac{-7(3)-3(-2)}{-3} = \frac{-21+6}{-3} = \frac{-15}{-3} = 5
 \end{aligned}$$

$$\begin{aligned}
 76. \quad \text{Let } x = 0, y = 3, z = -2. \\
 (x-y+z)^2 &= (0-3+(-2))^2 \\
 &= (-3-2)^2 \\
 &= (-5)^2 \\
 &= 25
 \end{aligned}$$

$$\begin{aligned}
 77. \quad \text{When } r = 1, 2\pi r &= 2\pi(1) = 2(3.14) = 6.28. \\
 \text{When } r = 10, \\
 2\pi r &= 2\pi(10) = 20(3.14) = 62.8. \\
 \text{When } r = 100, \\
 2\pi r &= 2\pi(100) = 200(3.14) = 628.
 \end{aligned}$$

r	1	10	100
$2\pi r$	6.28	62.8	628

78. As the radius increases, the circumference increases.

$$\begin{aligned}
 79. \quad 5xy - 7xy + 3 - 2 + xy &= 5xy - 7xy + xy + 3 - 2 \\
 &= (5-7+1)xy + (3-2) \\
 &= (-1)xy + 1 \\
 &= -xy + 1
 \end{aligned}$$

$$\begin{aligned}
 80. \quad 4x + 10x - 19x + 10 - 19 \\
 &= (4+10-19)x + (10-19) \\
 &= -5x + (-9) \\
 &= -5x - 9
 \end{aligned}$$

$$\begin{aligned}
 81. \quad 6x^2 + 2 - 4(x^2 + 1) &= 6x^2 + 2 - 4x^2 - 4 \\
 &= 6x^2 - 4x^2 + 2 - 4 \\
 &= (6-4)x^2 + (2-4) \\
 &= 2x^2 + (-2) \\
 &= 2x^2 - 2
 \end{aligned}$$

$$\begin{aligned}
 82. \quad -7(2x^2 - 1) - x^2 - 1 &= -14x^2 + 7 - x^2 - 1 \\
 &= -14x^2 - x^2 + 7 - 1 \\
 &= (-14-1)x^2 + (7-1) \\
 &= -15x^2 + 6
 \end{aligned}$$

$$\begin{aligned}
 83. \quad (3.2x - 1.5) - (4.3x - 1.2) \\
 &= 3.2x - 1.5 - 4.3x + 1.2 \\
 &= 3.2x - 4.3x - 1.5 + 1.2 \\
 &= (3.2-4.3)x - 0.3 \\
 &= -1.1x - 0.3
 \end{aligned}$$

$$\begin{aligned}
 84. \quad (7.6x + 4.7) - (1.9x + 3.6) &= 7.6x + 4.7 - 1.9x - 3.6 \\
 &= 7.6x - 1.9x + 4.7 - 3.6 \\
 &= (7.6 - 1.9)x + 4.7 - 3.6 \\
 &= 5.7x + 1.1
 \end{aligned}$$

$$85. \quad \underbrace{\text{Twelve}}_{\downarrow} \text{ is } \underbrace{\text{the product of } x \text{ and negative } 4.}_{\downarrow}$$

$$\begin{aligned}
 12 &= -4x \\
 \text{or } 12 &= -4x
 \end{aligned}$$

$$86. \quad \underbrace{\text{The sum of } n \text{ and twice } n}_{\downarrow} \text{ is } \underbrace{\text{negative fifteen.}}_{\downarrow}$$

$$n + 2n = -15$$

$$87. \quad \underbrace{\text{Four times}}_{\downarrow} \underbrace{\text{the sum of } y \text{ and three}}_{\downarrow} \text{ is } \underbrace{-1}_{\downarrow}.$$

$$\begin{aligned}
 4 \cdot (y + 3) &= -1 \\
 \text{or } 4(y + 3) &= -1
 \end{aligned}$$

$$88. \quad \underbrace{\text{The difference of } t \text{ and } 5}_{\downarrow}, \underbrace{\text{multiplied by six}}_{\downarrow} \text{ is } \underbrace{\text{four.}}_{\downarrow}$$

$$\begin{aligned}
 (t - 5) \cdot 6 &= 4 \\
 \text{or } 6(t - 5) &= 4
 \end{aligned}$$

$$89. \quad \underbrace{\text{Seven subtracted from } z}_{\downarrow} \text{ is } \underbrace{\text{six.}}_{\downarrow}$$

$$\begin{aligned}
 z - 7 &= 6 \\
 \text{or } z - 7 &= 6
 \end{aligned}$$

$$90. \quad \underbrace{\text{Ten less than the product of } x \text{ and nine}}_{\downarrow} \text{ is } \underbrace{\text{five.}}_{\downarrow}$$

$$\begin{aligned}
 9x - 10 &= 5 \\
 \text{or } 9x - 10 &= 5
 \end{aligned}$$

$$91. \quad \underbrace{\text{The difference of } x \text{ and } 5}_{\downarrow} \text{ is at least } \underbrace{12}_{\downarrow}.$$

$$\begin{aligned}
 x - 5 &\geq 12 \\
 \text{or } x - 5 &\geq 12
 \end{aligned}$$

$$92. \quad \underbrace{\text{The opposite of four}}_{\downarrow} \text{ is less than } \underbrace{\text{the product of } y \text{ and seven.}}_{\downarrow}$$

$$\begin{aligned}
 -4 &< 7y \\
 \text{or } -4 &< 7y
 \end{aligned}$$

$$93. \quad \underbrace{\text{Two-thirds}}_{\downarrow} \text{ is not equal to } \underbrace{\text{twice the sum of } n \text{ and one-fourth.}}_{\downarrow}$$

$$\begin{aligned}
 \frac{2}{3} &\neq 2 \cdot \left(n + \frac{1}{4} \right) \\
 \text{or } \frac{2}{3} &\neq 2 \left(n + \frac{1}{4} \right)
 \end{aligned}$$

94. The sum of t and six is not more than negative twelve.

$$\begin{array}{ccc} t+6 & \leq & -12 \\ \text{or } t+6 \leq -12 \end{array}$$

95. $(M + 5) + P = M + (5 + P)$: Associative Property of Addition

96. $5(3x - 4) = 15x - 20$: Distributive Property

97. $(-4) + 4 = 0$: Additive Inverse Property

98. $(3 + x) + 7 = 7 + (3 + x)$: Commutative Property of Addition

99. Associative and Commutative Properties of Multiplication
To see this: $(XY)Z = X(YZ) = (YZ)X$

100. $\left(-\frac{3}{5}\right) \cdot \left(-\frac{5}{3}\right) = 1$: Multiplicative Inverse Property

101. $T \cdot 0 = 0$: Multiplication Property of Zero

102. $(ab)c = a(bc)$: Associative Property of Multiplication

103. $A + 0 = A$: Additive Identity Property

104. $8 \cdot 1 = 8$: Multiplicative Identity Property

105. $5x - 15z = 5(x - 3z)$

106. $(7 + y) + (3 + x) = (3 + x) + (7 + y)$

107. $0 = 2 + (-2)$, for example

108. $1 = 2 \cdot \frac{1}{2}$, for example

109. $[(3.4)(0.7)]5 = (3.4)[(0.7)(5)]$

110. $7 = 7 + 0$

111. $-9 > -12$, since -9 is to the right of -12 on the number line.

112. $0 > -6$, since 0 is to the right of -6 on the number line.

113. $-3 < -1$, since -3 is to the left of -1 on the number line.

114. $7 = |-7|$

115. $-5 < -(-5)$, since $-(-5) = 5$.

116. $-(-2) > -2$, since $-(-2) = 2$.

$$\begin{aligned}
 117. \quad & 4(x-5) = 2x-14 \\
 & 4x-20 = 2x-14 \\
 & 2x = 6 \\
 & x = 3
 \end{aligned}$$

$$\begin{aligned}
 118. \quad & x+7 = -2(x+8) \\
 & x+7 = -2x-16 \\
 & 3x = -23 \\
 & x = -\frac{23}{3}
 \end{aligned}$$

$$\begin{aligned}
 119. \quad & 3(2y-1) = -8(6+y) \\
 & 6y-3 = -48-8y \\
 & 14y = -45 \\
 & y = -\frac{45}{14}
 \end{aligned}$$

$$\begin{aligned}
 120. \quad & -(z+12) = 5(2z-1) \\
 & -z-12 = 10z-5 \\
 & -11z = 7 \\
 & z = -\frac{7}{11}
 \end{aligned}$$

$$\begin{aligned}
 121. \quad & n-(8+4n) = 2(3n-4) \\
 & n-8-4n = 6n-8 \\
 & -3n = 6n \\
 & -9n = 0 \\
 & n = 0
 \end{aligned}$$

$$\begin{aligned}
 122. \quad & 4(9v+2) = 6(1+6v)-10 \\
 & 36v+8 = 6+36v-10 \\
 & 36v+8 = 36v-4 \\
 & 8 = -4 \\
 & \text{No solution, or } \emptyset
 \end{aligned}$$

$$\begin{aligned}
 123. \quad & 0.3(x-2) = 1.2 \\
 & 10[0.3(x-2)] = 10(1.2) \\
 & 3(x-2) = 12 \\
 & 3x-6 = 12 \\
 & 3x = 18 \\
 & x = 6
 \end{aligned}$$

$$\begin{aligned}
 124. \quad & 1.5 = 0.2(c-0.3) \\
 & 1.5 = 0.2c-0.06 \\
 & 100(1.5) = 100(0.2c-0.06) \\
 & 150 = 20c-6 \\
 & 156 = 20c \\
 & 7.8 = c
 \end{aligned}$$

$$\begin{aligned}
 125. \quad & -4(2-3x) = 2(3x-4)+6x \\
 & -8+12x = 6x-8+6x \\
 & -8+12x = 12x-8 \\
 & -8 = -8
 \end{aligned}$$

All real numbers

$$\begin{aligned}
 126. \quad & 6(m-1)+3(2-m)=0 \\
 & 6m-6+6-3m=0 \\
 & 3m=0 \\
 & m=0
 \end{aligned}$$

$$\begin{aligned}
 127. \quad & 6-3(2g+4)-4g=5(1-2g) \\
 & 6-6g-12-4g=5-10g \\
 & -6-10g=5-10g \\
 & -6=5
 \end{aligned}$$

No solution, \emptyset

$$\begin{aligned}
 128. \quad & 20-5(p+1)+3p=-(2p-15) \\
 & 20-5p-5+3p=-2p+15 \\
 & 15-2p=-2p+15 \\
 & 15=15
 \end{aligned}$$

All real numbers

$$\begin{aligned}
 129. \quad & \frac{x}{3}-4=x-2 \\
 & 3\left(\frac{x}{3}-4\right)=3(x-2) \\
 & x-12=3x-6 \\
 & -2x=6 \\
 & x=-3
 \end{aligned}$$

$$\begin{aligned}
 130. \quad & \frac{9}{4}y = \frac{2}{3}y \\
 & 12\left(\frac{9}{4}y\right) = 12\left(\frac{2}{3}y\right) \\
 & 27y = 8y \\
 & 19y = 0 \\
 & y = 0
 \end{aligned}$$

$$\begin{aligned}
 131. \quad & \frac{3n}{8}-1=3+\frac{n}{6} \\
 & 24\left(\frac{3n}{8}-1\right)=24\left(3+\frac{n}{6}\right) \\
 & 9n-24=72+4n \\
 & 5n=96 \\
 & n=\frac{96}{5}
 \end{aligned}$$

$$132. \quad \frac{z}{6} + 1 = \frac{z}{2} + 2$$

$$6\left(\frac{z}{6} + 1\right) = 6\left(\frac{z}{2} + 2\right)$$

$$z + 6 = 3z + 12$$

$$-2z = 6$$

$$z = -3$$

$$133. \quad \frac{y}{4} - \frac{y}{2} = -8$$

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

$$y - 2y = -32$$

$$-y = -32$$

$$y = 32$$

$$134. \quad \frac{2x}{3} - \frac{8}{3} = x$$

$$2x - 8 = 3x$$

$$-8 = x$$

$$135. \quad \frac{b-2}{3} = \frac{b+2}{5}$$

$$5(b-2) = 3(b+2)$$

$$5b - 10 = 3b + 6$$

$$2b = 16$$

$$b = 8$$

$$136. \quad \frac{2t-1}{3} = \frac{3t+2}{15}$$

$$15\left(\frac{2t-1}{3}\right) = 15\left(\frac{3t+2}{15}\right)$$

$$5(2t-1) = 3t+2$$

$$10t-5 = 3t+2$$

$$7t = 7$$

$$t = 1$$

$$137. \quad \frac{2(t+1)}{3} = \frac{2(t-1)}{3}$$

$$3\left[\frac{2(t+1)}{3}\right] = 3\left[\frac{2(t-1)}{3}\right]$$

$$2(t+1) = 2(t-1)$$

$$2t+2 = 2t-2$$

$$2 = -2$$

No solution, \emptyset

$$138. \quad \frac{3a-3}{6} = \frac{4a+1}{15} + 2$$

$$30\left(\frac{3a-3}{6}\right) = 30\left(\frac{4a+1}{15} + 2\right)$$

$$5(3a-3) = 2(4a+1) + 30(2)$$

$$15a-15 = 8a+2+60$$

$$15a-15 = 8a+62$$

$$7a = 77$$

$$a = 11$$

139. Let x = the number.

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

$$2x-6 = 3x+1$$

$$-7 = x$$

The number is -7 .

140. Let x = smaller number, then
 $x+5$ = larger number.

$$x+x+5 = 285$$

$$2x = 280$$

$$x = 140$$

$$x+5 = 145$$

The numbers are 140 and 145.

141. Let n = the first integer, then
 $n+1$ = the second integer,
 $n+2$ = the third integer, and
 $n+3$ = the fourth integer.

$$(n+1) + (n+2) + (n+3) - 2n = 16$$

$$n+6 = 16$$

$$n = 10$$

Therefore, the integers are 10, 11, 12, and 13.

142. Let x = smaller odd integer, then
 $x+2$ = larger odd integer.

$$5x = 3(x+2) + 54$$

$$5x = 3x+6+54$$

$$2x = 60$$

$$x = 30$$

Since this is not odd, no such consecutive odd integers exist.

143. Let x = width of the playing field, then
 $2x-5$ = length of the playing field.

$$2x+2(2x-5) = 230$$

$$2x+4x-10 = 230$$

$$6x = 240$$

$$x = 40$$

Then $2x-5 = 2(40)-5 = 75$. The field is 75 meters long and 40 meters wide.

144. Let
- m
- = number of miles of driven.

$$2(19.95) + 0.12(m - 200) = 46.86$$

$$39.90 + 0.12m - 24 = 46.86$$

$$0.12m + 15.90 = 46.86$$

$$0.12m = 30.96$$

$$m = 258$$

- 145.

x	V_1
1	10.472
1.5	23.562
2	41.89
2.5	65.45
3	94.25

$$V_1 = \frac{10}{3}\pi x^2$$

Radius of Cone	x	1	1.5	2	2.5	3
Volume (If Height is 10 Inches)	$\frac{10}{3}\pi x^2$	10.47	23.56	41.89	65.45	94.25

- 146.

x	V_1
2	34
4.68	39.36
9.5	49
12.68	55.36

$$V_1 = 30 + 2x$$

Width of Rectangle	x	2	4.68	9.5	12.68
Perimeter (If Length is 15 Units)	$30 + 2x$	34	39.36	49	55.36

147. a.

x	V_1
0	500
1	524
2	516
3	476
4	404
5	300
6	164

$$V_1 = -16x^2 + 40x + 500$$

Seconds	0	1	2	3	4	5
Height in Feet	500	524	516	476	404	300

- b.

x	V_1
1.1	524.64
1.2	524.96
1.3	524.96
1.4	524.64
1.5	524
1.6	523.04
1.7	521.76

$$x = 1.1$$

The maximum height of the rock is 525 feet.

- c.

x	V_1
6.5	84
6.6	67.04
6.7	48.76
6.8	29.16
6.9	8.24
7.0	-22.56

$$x = 6.5$$

The rock strikes the ground after 7.0 seconds.

148. Use
- $y_1 = 8 + 1.10(x - 4)$
- for Coast Waterworks and
- $y_2 = 12 + 1.50(x - 5)$
- for Cross Gates Water Company.

x	y_1	y_2
5	9.1	12
6	10.2	13.5
7	11.3	15
8	12.4	16.5
9	13.5	18
10	14.6	19.5
11	15.7	21

$$y_1 = 8 + 1.10(x - 4)$$

Gallons (In Thousands Used)	5	6	7	8
Coast Charge (Dollars)	9.1	10.2	11.3	12.4
Cross Gates Charge (Dollars)	12	13.5	15	16.5

149. $V = lwh$

$$w = \frac{V}{lh}$$

150. $C = 2\pi r$

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

151. $5x - 4y = -12$

$$5x + 12 = 4y$$

$$y = \frac{5x + 12}{4}$$

152. $5x - 4y = -12$

$$5x = 4y - 12$$

$$x = \frac{4y - 12}{5}$$

153. $y - y_1 = m(x - x_1)$

$$m = \frac{y - y_1}{x - x_1}$$

154. $y - y_1 = m(x - x_1)$

$$y - y_1 = mx - mx_1$$

$$y - y_1 + mx_1 = mx$$

$$\frac{y - y_1 + mx_1}{m} = x$$

155. $E = I(R + r)$

$$E = IR + Ir$$

$$I - IR = Ir$$

$$\frac{E - IR}{I} = r$$

156. $S = vt + gt^2$

$$S - vt = gt^2$$

$$\frac{S - vt}{t^2} = g$$

157. $T = gr + gvt$

$$T = g(r + vt)$$

$$g = \frac{T}{r + vt}$$

$$\begin{aligned}
 158. \quad I &= Prt + P \\
 I &= P(rt + 1) \\
 \frac{I}{rt + 1} &= P
 \end{aligned}$$

$$\begin{aligned}
 159. \quad A &= \frac{h}{2}(B + b) \\
 2A &= hB + hb \\
 2A - hb &= hB \\
 \frac{2A - hb}{h} &= B
 \end{aligned}$$

$$\begin{aligned}
 160. \quad V &= \frac{1}{3}\pi r^2 h \\
 3V &= \pi r^2 h \\
 \frac{3V}{\pi r^2} &= h
 \end{aligned}$$

$$\begin{aligned}
 161. \quad R &= \frac{r_1 + r_2}{2} \\
 2R &= r_1 + r_2 \\
 2R - r_2 &= r_1
 \end{aligned}$$

$$\begin{aligned}
 162. \quad \frac{V_1}{T_1} &= \frac{V_2}{T_2} \\
 V_1 T_2 &= V_2 T_1 \\
 T_2 &= \frac{V_2 T_1}{V_1}
 \end{aligned}$$

$$163. \quad A = P \left(1 + \frac{r}{n} \right)^{nt} = 3000 \left(1 + \frac{0.03}{n} \right)^{7n}$$

$$\text{a.} \quad A = 3000 \left(1 + \frac{0.03}{2} \right)^{14} \approx \$3695.27$$

$$\text{b.} \quad A = 3000 \left(1 + \frac{0.03}{52} \right)^{364} \approx \$3700.81$$

$$\begin{aligned}
 164. \quad &\text{Let } x = \text{original width, then} \\
 &x + 2 = \text{original length.} \\
 &(x + 4)(x + 2 + 4) = x(x + 2) + 88 \\
 &(x + 4)(x + 6) = x^2 + 2x + 88 \\
 &x^2 + 10x + 24 = x^2 + 2x + 88 \\
 &8x = 64 \\
 &x = 8
 \end{aligned}$$

$$x + 2 = 10$$

The original width is 8 in. and the original length is 10 in.

165.

C	F
-40	-40
-15	5
10	50
60	140
0	32
100	212

$V1 \text{ B } (9X + 160) / 5$

a.

Celsius	-40	-15	10	60
Fahrenheit	-40	5	50	140

b. 100 degrees Celsius is 212 degrees Fahrenheit.

c. 0 degrees Celsius is 32 degrees Fahrenheit.

166. a.

Hours	Miles
0	0
0.25	13.75
0.50	27.5
0.75	41.25
1	55
1.25	68.75
1.5	82.5

$V1 \text{ B } 55X$

Hours	0	0.25	0.50	0.75	1	1.25	1.5
Miles	0	13.75	27.5	41.25	55	68.75	82.5

b.

Hours	Miles
0	0
0.25	13.75
0.50	27.5
0.75	41.25
1	55
1.25	68.75
1.5	82.5

$V1 \text{ B } 55X$

It takes 3.5 hours to travel 192.5 miles at 55 mph.

167. $8 \cdot 21 = 378$

The area of the floor is 378 square feet.

$$\frac{378}{24} = 15.75$$

It takes 16 packages to tile the floor.

168. $V_{\text{box}} = lwh = 8 \cdot 5 \cdot 3 = 120 \text{ in}^3$, while $V_{\text{cyl}} = \pi r^2 h = \pi \cdot 3^2 \cdot 6 = 54\pi \approx 170 \text{ in}^3$

Therefore, the cylinder holds more ice cream.

169. The opposite of $-\frac{3}{4}$ is $\frac{3}{4}$.

The reciprocal of $-\frac{3}{4}$ is $-\frac{4}{3}$.

170. If the opposite of the number is -5 , then the number is $-(-5) = 5$. The reciprocal of 5 is $\frac{1}{5}$.

171. $-2\left(5x + \frac{1}{2}\right) + 7.1 = -2 \cdot 5x + (-2) \cdot \frac{1}{2} + 7.1$
 $= -10x - 1 + 7.1$
 $= -10x + 6.1$

172. $\sqrt{36} \div 2 \cdot 3 = 6 \div 2 \cdot 3 = 3 \cdot 3 = 9$

$$173. -\frac{7}{11} - \left(-\frac{1}{11}\right) = -\frac{7}{11} + \frac{1}{11} = -\frac{6}{11}$$

$$174. \begin{aligned} 10 - (-1) + (-2) + 6 &= 10 + 1 + (-2) + 6 \\ &= 11 + (-2) + 6 \\ &= 9 + 6 \\ &= 15 \end{aligned}$$

$$175. \begin{aligned} \left(-\frac{2}{3}\right)^3 \div \frac{10}{9} &= -\frac{8}{27} \div \frac{10}{9} \\ &= -\frac{8}{27} \cdot \frac{9}{10} \\ &= -\frac{2 \cdot 4 \cdot 9}{3 \cdot 9 \cdot 2 \cdot 5} \\ &= -\frac{4}{15} \end{aligned}$$

$$176. \begin{aligned} \frac{(3-5)^2 + (-1)^3}{1+2(3-(-1))^2} &= \frac{(-2)^2 + (-1)^3}{1+2(3+1)^2} \\ &= \frac{4+(-1)}{1+2(4)^2} \\ &= \frac{3}{1+2(16)} \\ &= \frac{3}{1+32} \\ &= \frac{3}{33} \\ &= \frac{1}{11} \end{aligned}$$

$$177. \begin{aligned} \frac{x-2}{5} + \frac{x+2}{2} &= \frac{x+4}{3} \\ 30\left(\frac{x-2}{5} + \frac{x+2}{2}\right) &= 30\left(\frac{x+4}{3}\right) \\ 6(x-2) + 15(x+2) &= 10(x+4) \\ 6x-12+15x+30 &= 10x+40 \\ 21x+18 &= 10x+40 \\ 11x &= 22 \\ x &= 2 \end{aligned}$$

$$178. \begin{aligned} \frac{2z-3}{4} - \frac{4-z}{2} &= \frac{z+1}{3} \\ 12\left(\frac{2z-3}{4} - \frac{4-z}{2}\right) &= 12\left(\frac{z+1}{3}\right) \\ 3(2z-3) - 6(4-z) &= 4(z+1) \\ 6z-9-24+6z &= 4z+4 \\ 12z-33 &= 4z+4 \\ 8z &= 37 \\ z &= \frac{37}{8} \end{aligned}$$

$$179. \begin{aligned} A &= \frac{h}{2}(B+b) \\ 2A &= hB + hb \\ 2A - hb &= hB \\ \frac{2A - hb}{h} &= B \end{aligned}$$

$$180. \begin{aligned} V &= \frac{1}{3}\pi r^2 h \\ 3V &= \pi r^2 h \\ \frac{3V}{\pi r^2} &= h \end{aligned}$$

$$181. \begin{aligned} \text{Let } x &= \text{number of tourists for France, then} \\ x+9 &= \text{number of tourists for United States, and} \\ x+44 &= \text{number of tourists for China.} \\ x+(x+9)+(x+44) &= 332 \\ 3x+53 &= 332 \\ 3x &= 279 \\ x &= 93 \end{aligned}$$

$$x+9=102$$

$$x+44=137$$

China is predicted to have 137 million tourists, whereas the United States is predicted to have 102 million and France, 93 million.

182. Since $h = 10$, use $y_1 = \frac{1}{3}\pi x^2 \cdot 10 = \frac{10}{3}\pi x^2$.

X	Y1
1.5	23.562
2.1	46.181
2.75	79.184
3	94.248
3.5	128.28

Height h	10	10	10	10	10
Radius x	1.5	2.1	2.75	3	3.5
Volume	23.56	46.18	79.19	94.25	128.28

183. Since $h = 6$, use $y_1 = \frac{1}{3}\pi x^2 \cdot 6 = 2\pi x^2$.

X	Y1
1	6.2832
1.5	14.137
2	25.133
2.25	31.809
3	56.549

Height h	6	6	6	6	6
Radius x	1	1.5	2	2.25	3
Volume	6.28	14.14	25.13	31.81	56.55

Chapter 1 Test

- True; -2.3 lies to the right of -2.33 on the number line.
- False; $-6^2 = -36$, while $(-6)^2 = 36$.
- False; $-5 - 8 = -13$, while $-(5 - 8) = -(-3) = 3$.
- False; $(-2)(-3)(0) = 0$, while $\frac{(-4)}{0}$ is undefined.
- True
- False; for example, $\frac{1}{2}$ is a rational number that is not an integer.
- $5 - 12 \div 3(2) = 5 - 4(2) = 5 - 8 = -3$
- $5^2 - 3^4 = 25 - 81 = -56$
- $(4 - 9)^3 - |-4 - 6|^2 = (-5)^3 - |-10|^2$
 $= -125 - 10^2$
 $= -125 - 100$
 $= -225$

$$\begin{aligned}
 10. \quad 12 + \{6 - [5 - 2(-5)]\} &= 12 + \{6 - [5 + 10]\} \\
 &= 12 + (6 - 15) \\
 &= 12 + (-9) \\
 &= 12 - 9 \\
 &= 3
 \end{aligned}$$

$$\begin{aligned}
 11. \quad \frac{6(7-9)^3 + (-2)}{(-2)(-5)(-5)} &= \frac{6(-2)^3 - 2}{10(-5)} \\
 &= \frac{6(-8) - 2}{-50} \\
 &= \frac{-48 - 2}{-50} \\
 &= \frac{-50}{-50} \\
 &= 1
 \end{aligned}$$

$$\begin{aligned}
 12. \quad \frac{(4 - \sqrt{16}) - (-7 - 20)}{-2(1 - 4)^2} &= \frac{(4 - 4) - (-27)}{-2(-3)^2} \\
 &= \frac{0 + 27}{-2(9)} \\
 &= \frac{27}{-18} \\
 &= -\frac{3}{2}
 \end{aligned}$$

$$\begin{aligned}
 13. \quad &\text{Let } q = 4 \text{ and } r = -2. \\
 &q^2 - r^2 = (4)^2 - (-2)^2 = 16 - 4 = 12
 \end{aligned}$$

$$\begin{aligned}
 14. \quad &\text{Let } q = 4, r = -2, \text{ and } t = 1. \\
 &\frac{5t - 3q}{3r - 1} = \frac{5(1) - 3(4)}{3(-2) - 1} = \frac{5 - 12}{-6 - 1} = \frac{-7}{-7} = 1
 \end{aligned}$$

15. a. When $x = 1$, $8.75x = 8.75(1) = 8.75$.
 When $x = 3$, $8.75x = 8.75(3) = 26.25$.
 When $x = 10$, $8.75x = 8.75(10) = 87.50$.
 When $x = 20$, $8.75x = 8.75(20) = 175.00$.

x	1	3	10	20
$8.75x$	8.75	26.25	87.50	175.00

- b. As the number of adults increases the total cost increases.

$$\begin{aligned}
 16. \quad &\underbrace{\text{Twice}} \underbrace{\text{the sum of } x \text{ and five}} \text{ is } 30. \\
 &\quad \quad \quad \downarrow \quad \downarrow \\
 &2 \cdot \quad (x + 5) \quad = 30 \\
 &\text{or } 2(x + 5) = 30
 \end{aligned}$$

17. The square of the difference of six and y divided by seven is not equal to 10.

$$(6 - y)^2 \div 7 \neq 10$$

$$\text{or } \frac{(6 - y)^2}{7} \neq 10$$

18. The product of nine and z, divided by the absolute value of -12 is not equal to 10.

$$9z \div |-12| \neq 10$$

$$\text{or } \frac{9z}{|-12|} \neq 10$$

19. Three times the quotient of n and five is the opposite of n.

$$3 \cdot \frac{n}{5} = -n$$

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

20. Twenty is equal to 6 subtracted from twice x.

$$20 = 2x - 6$$

$$\text{or } 20 = 2x - 6$$

21. Negative two is equal to x divided by the sum of x and five.

$$-2 = x \div (x + 5)$$

$$\text{or } -2 = \frac{x}{x + 5}$$

22. $6(x - 4) = 6x - 24$: Distributive Property

23. $(4 + x) + z = 4 + (x + z)$: Associative Property of Addition

24. $(-7) + 7 = 0$: Additive Inverse Property

25. $(-18)(0) = 0$: Multiplication Property of Zero

26. Let 0.05 be the value of each nickel and 0.1 be the value of each dime. If there are n nickels, and d dimes, then the total amount of money is $0.05n + 0.1d$.

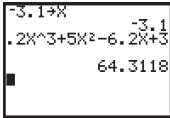
27. The reciprocal of $-\frac{7}{11}$ is $-\frac{11}{7}$.

$$\text{The opposite of } -\frac{7}{11} \text{ is } \frac{7}{11}.$$

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

$$\begin{aligned}
 29. \quad 4y + 10 - 2(y + 10) &= 4y + 10 - 2y - 20 \\
 &= 4y - 2y + 10 - 20 \\
 &= (4 - 2)y - 10 \\
 &= 2y - 10
 \end{aligned}$$

$$\begin{aligned}
 30. \quad (8.3x - 2.9) - (9.6x - 4.8) \\
 &= 8.3x - 2.9 - 9.6x + 4.8 \\
 &= 8.3x - 9.6x - 2.9 + 4.8 \\
 &= (8.3 - 9.6)x + 1.9 \\
 &= -1.3x + 1.9
 \end{aligned}$$

31. 

The value is 64.3118.

32. Let x be the diameter. Use $y_1 = \frac{1}{2}x$ for the radius, $y_2 = \pi x$ for the circumference, and $y_3 = \pi(y_1)^2$ for the area.

X	Y1	Y2
2	1	6.2832
3.8	1.9	11.938
10	5	31.416
14.9	7.45	46.81

$Y_2 = \pi X$

X	Y2	Y3
2	6.2832	3.1416
3.8	11.938	11.341
10	31.416	78.54
14.9	46.81	174.37

$Y_3 = \pi Y_1^2$

Diameter	d	2	3.8	10	14.9
Radius	r	1	1.9	5	7.45
Circumference	πd	6.28	11.94	31.42	46.81
Area	πr^2	3.14	11.34	78.54	174.37

$$\begin{aligned}
 33. \quad 8x + 14 &= 5x + 44 \\
 3x &= 30 \\
 x &= 10
 \end{aligned}$$

$$\begin{aligned}
 34. \quad 3(x + 2) &= 11 - 2(2 - x) \\
 3x + 6 &= 11 - 4 + 2x \\
 3x + 6 &= 7 + 2x \\
 x + 6 &= 7 \\
 x &= 1
 \end{aligned}$$

35. $3(y - 4) + y = 2(6 + 2y)$

$$3y - 12 + y = 12 + 4y$$

$$4y - 12 = 12 + 4y$$

$$-12 = 12$$

No solution, \emptyset

36. $7n - 6 + n = 2(4n - 3)$

$$8n - 6 = 8n - 6$$

$$-6 = -6$$

All real numbers

37. $\frac{7w}{4} + 5 = \frac{3w}{10} + 1$

$$20\left(\frac{7w}{4} + 5\right) = 20\left(\frac{3w}{10} + 1\right)$$

$$35w + 100 = 6w + 20$$

$$29w = -80$$

$$w = -\frac{80}{29}$$

38. $3x - 4y = 8$

$$3x - 8 = 4y$$

$$y = \frac{3x - 8}{4}$$

39. $S = gt^2 + gvt$

$$S = g(t^2 + vt)$$

$$g = \frac{S}{t^2 + vt}$$

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

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

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

41. Let x be the number of people employed as registered nurses in 2008. The number of people employed in this field in 2018 is x increased by 22%.

$$x + 0.22x = 3,200,000$$

$$1.22x = 3,200,000$$

$$x \approx 2,623,000$$

In 2008, there were 2,623,000 registered nurses employed.

42. $C = 2\pi r$

$$78.5 = 2(3.14)r$$

$$\frac{78.5}{6.28} = r$$

$$12.5 = r$$

$$A = \pi r^2 = 3.14(12.5)^2 = 490.625$$

$$\frac{490.625}{60} \approx 8.2$$

Approximately 8 dogs can be kept in the pen.

43. $A = P\left(1 + \frac{r}{n}\right)^{nt}$

$$= 2500\left(1 + \frac{0.035}{4}\right)^{4(10)}$$

$$= 2500(1.00875)^{40}$$

$$\approx 3542.27$$

There will be \$3542.27 in the account.

44. Let x be the amount of money international travelers spend in New York. Then $x + 4$ is the amount of money international travelers spend in California and $2x - 1$ is the amount of money international travelers spend in Florida.

$$x + (x + 4) + (2x - 1) = 39$$

$$4x + 3 = 39$$

$$4x = 36$$

$$x = 9$$

$$x + 4 = 9 + 4 = 13$$

$$2x - 1 = 2(9) - 1 = 18 - 1 = 17$$

International travelers spend \$9 billion in New York, \$13 billion in California, and \$17 billion in Florida.

45. a. Use $y_1 = 1500 + 0.05x_0$

x_0	y_1
8000	1900
9000	1950
10000	2000
11000	2050
12000	2100
13000	2150
14000	2200

Sales (Dollars)	8000	9000	10,000	11,000	12,000
Gross Monthly Pay (Dollars)	1900	1950	2000	2050	2100

b. $12(2050) = 24,600$

If her sales are \$11,000 per month, her gross annual income is \$24,600.

- c. To achieve a monthly pay of \$2200, her sales must be \$14,000.

46.

x	V_1
0	20
0.5	56
1	84
1.5	104
2	116
2.5	120
3	116
$x=0$	

- a. The height of the rocket is 116 feet at 2 seconds and 3 seconds.
- b. The rocket's maximum height is 120 feet.
- c. The rocket reaches its maximum height after 2.5 seconds.
- d. The rocket explodes $2.5 + 0.5 = 3.0$ seconds after being launched.