Selected Answers

Section 1.1 Solving Simple Equations
(pages 7–9)

1. $+$ and $-$ are inverses. $\times$ and $\div$ are inverses.

3. $x - 3 = 6$; It is the only equation that does not have $x = 6$ as a solution.

5. $x = 57$

7. $x = -5$

9. $p = 21$

11. $x = 9\pi$

13. $d = \frac{1}{2}$

15. $n = -4.9$

17. a. $105 = x + 14$; $x = 91$

    b. no; Because $82 + 9 = 91$, you did not knock down the last pin with the second ball of the frame.

19. $n = -5$

21. $m = 7.3\pi$

23. $k = 1\frac{2}{3}$

25. $p = -2\frac{1}{3}$

27. They should have added 1.5 to each side.

$$-1.5 + k = 8.2$$
$$k = 8.2 + 1.5$$
$$k = 9.7$$

29. $6.5x = 42.25$; \$6.50 per hour

31. $420 = \frac{7}{6}b$, $b = 360$; \$60

33. $h = -7$

35. $q = 3.2$

37. $x = -1\frac{4}{9}$

39. greater than; Because a negative number divided by a negative number is a positive number.

41. 3 mg

43. 12 in.

45. $7x - 4$

47. $\frac{25}{4}g - \frac{2}{3}$

Section 1.2 Solving Multi-Step Equations
(pages 14 and 15)

1. $2 + 3x = 17$; $x = 5$

3. $k = 45$; $45°, 45°, 90°$

5. $b = 90$; $90°, 135°, 90°, 90°, 135°$

7. $c = 0.5$

9. $h = -9$

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

13. 20 watches

15. $4(b + 3) = 24$; 3 in.

17. $\frac{2580 + 2920 + x}{3} = 3000$; 3500 people

19. $<$

21. $>$

Section 1.3 Solving Equations with Variables on Both Sides
(pages 23–25)

1. no; When 3 is substituted for x, the left side simplifies to 4 and the right side simplifies to 3.

3. $x = 13.2$ in.

5. $x = 7.5$ in.

7. $k = -0.75$

9. $p = -48$

11. $n = -3.5$

13. $x = -4$

15. The 4 should have been added to the right side.

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

17. $15 + 0.5m = 25 + 0.25m$; 40 mi

19. $x = \frac{1}{3}$

21. no solution

23. infinitely many solutions

25. $x = 2$

27. no solution

29. infinitely many solutions

31. *Sample answer:* $8x + 2 = 8x$; The number $8x$ cannot be equal to 2 more than itself.

33. It's never the same. Your neighbor's total cost will always be \$75 more than your total cost.

35. no; $2x + 5.2$ can never equal $2x + 6.2$.

37. 7.5 units

39. Remember that the box is with priority mail and the envelope is with express mail.

41. 10 mL

43. **a.** 40 ft

b. no;

$$\begin{aligned} 2(\text{white area}) &= \text{black area} \\ 2[5(6x)] &= 4[6(x + 1)] \\ 60x &= 24x + 24 \\ 36x &= 24 \\ x &= \frac{2}{3} \end{aligned}$$

$$\begin{aligned} 5x + 4(x + 1) &\stackrel{?}{=} 40 \\ \text{Length of hallway is } 5\left(\frac{2}{3}\right) + 4\left(\frac{2}{3} + 1\right) &\stackrel{?}{=} 40 \\ 10 &\neq 40 \end{aligned}$$

45. 15.75 cm^3

47. C

Section 1.4 Rewriting Equations and Formulas
(pages 30 and 31)

1. no; The equation only contains one variable.

3. **a.** $A = \frac{1}{2}bh$ **b.** $b = \frac{2A}{h}$ **c.** $b = 12$ mm

5. $y = 4 - \frac{1}{3}x$

7. $y = \frac{2}{3} - \frac{4}{9}x$

9. $y = 3x - 1.5$

11. The y should have a negative sign in front of it.

$$\begin{aligned} 2x - y &= 5 \\ -y &= -2x + 5 \\ y &= 2x - 5 \end{aligned}$$

13. **a.** $t = \frac{I}{Pr}$

b. $t = 3$ yr

15. $m = \frac{e}{c^2}$

17. $\ell = \dfrac{A - \frac{1}{2}\pi w^2}{2w}$

19. $w = 6g - 40$

21. **a.** $F = 32 + \frac{9}{5}(K - 273.15)$

b. 32°F

c. liquid nitrogen

23. $r^3 = \frac{3V}{4\pi}$; $r = 4.5$ in.

25. $-5\frac{1}{3}$

27. $1\frac{1}{4}$

Section 2.1 Congruent Figures
(pages 46 and 47)

1. **a.** $\angle A$ and $\angle D$, $\angle B$ and $\angle E$, $\angle C$ and $\angle F$

   b. Side AB and Side DE, Side BC and Side EF, Side AC and Side DF

3. $\angle V$ does not belong. The other three angles are congruent to each other, but not to $\angle V$.

5. congruent

7. $\angle P$ and $\angle W$, $\angle Q$ and $\angle V$, $\angle R$ and $\angle Z$, $\angle S$ and $\angle Y$, $\angle T$ and $\angle X$;
   Side PQ and Side WV, Side QR and Side VZ, Side RS and Side ZY,
   Side ST and Side YX, Side TP and Side XW

9. not congruent; Corresponding side lengths are not congruent.

11. The corresponding angles are not congruent, so the two figures are not congruent.

13. What figures have you seen in this section that have at least one right angle?

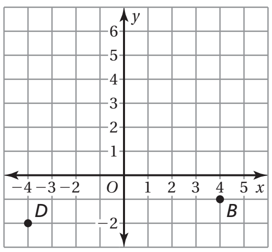
15. **a.** true; Side AB corresponds to Side YZ.

    b. true; $\angle A$ and $\angle X$ have the same measure.

    c. false; $\angle A$ corresponds to $\angle Y$.

    d. true; The measure of $\angle A$ is 90°, the measure of $\angle B$ is 140°, the measure of $\angle C$ is 40°, and the measure of $\angle D$ is 90°. So, the sum of the angle measures of $ABCD$ is $90° + 140° + 40° + 90° = 360°$.

17 and 19.



Section 2.2 Translations
(pages 52 and 53)

1. A

3. yes; Translate the letters T and O to the end.

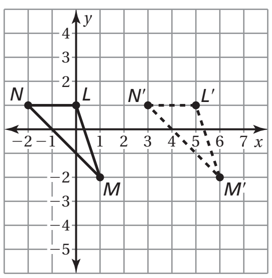
5. no

7. yes

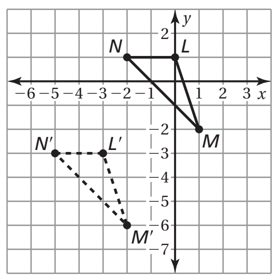
9. no

11. $A'(-3, 0)$, $B'(0, -1)$, $C'(1, -4)$, $D'(-3, -5)$

13.



15.



17. 2 units left and 2 units up

19. 6 units right and 3 units down

21. **a.** 5 units right and 1 unit up

b. no; It would hit the island.

c. 4 units up and 4 units right

23. If you are doing more than 10 moves and have not moved the knight to g5, you might want to start over.

25. no

27. yes

Section 2.3 Reflections
(pages 58 and 59)

1. The third one because it is not a reflection.

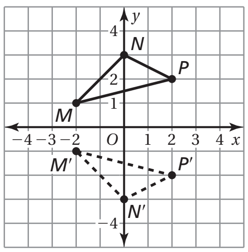
3. Quadrant IV

5. yes

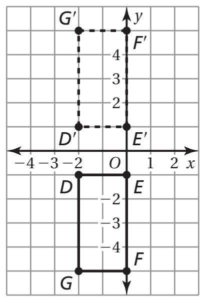
7. no

9. no

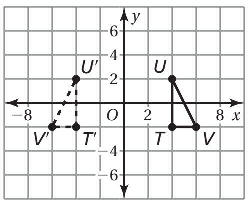
11. $M'(-2, -1)$, $N'(0, -3)$, $P'(2, -2)$



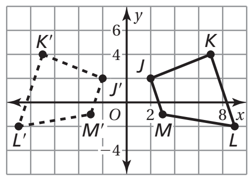
13. $D'(-2, 1)$, $E'(0, 1)$, $F'(0, 5)$, $G'(-2, 5)$



15. $T'(-4, -2)$, $U'(-4, 2)$, $V'(-6, -2)$



17. $J'(-2, 2)$, $K'(-7, 4)$, $L'(-9, -2)$, $M'(-3, -1)$



19. x-axis

21. y-axis

23. $R'(3, -4)$, $S'(3, -1)$, $T'(1, -4)$

25. yes; Translations and reflections produce images that are congruent to the original figure.

27. If you are driving a vehicle and want to see who is following you, where would you look?

29. obtuse

31. right

33. B

Section 2.4 Rotations
(pages 65–67)

1. (0, 0); (1, −3)

3. Quadrant IV

5. Quadrant II

7. reflection

9. translation

11. yes; 90° counterclockwise

13. $A'(2, 2)$, $B'(1, 4)$, $C'(3, 4)$, $D'(4, 2)$

15. $J'(0, -3)$, $K'(0, -5)$, $L'(-4, -3)$

17. $W'(-2, 6)$, $X'(-2, 2)$, $Y'(-6, 2)$, $Z'(-6, 5)$

Section 2.4 Rotations *(continued)*
(pages 65–67)

19. It only needs to rotate 120° to produce an identical image.

21. It only needs to rotate 180° to produce an identical image.

23. $J''(4, 4)$, $K''(3, 4)$, $L''(1, 1)$, $M''(4, 1)$

25. *Sample answer:* Rotate 180° about the origin and then rotate 90° clockwise about vertex $(-1, 0)$; Rotate 90° counterclockwise about the origin and then translate 1 unit left and 1 unit down.

27. Use Guess, Check, and Revise to solve this problem.

29. (2, 4), (4, 1), (1, 1)

31. yes

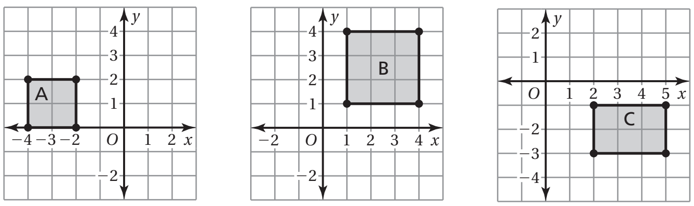
33. no

Section 2.5 Similar Figures
(pages 74 and 75)

1. They are congruent.

3. Yes, because the angles are congruent and the side lengths are proportional.

5. not similar; Corresponding side lengths are not proportional.

7. 

A and B; Corresponding side lengths are proportional and corresponding angles are congruent.

9. $6\frac{2}{3}$

11. 14

13. 30 in.

15. What types of quadrilaterals can have the given angle measures?

17. 3 times

19. **a.** yes

b. yes; It represents the fact that the sides are proportional because you can split the isosceles triangles into smaller right triangles that will be similar.

21. $\frac{16}{81}$

23. $\frac{49}{16}$

25. C

Section 2.6

Perimeters and Areas of Similar Figures
(pages 80 and 81)

1. The ratio of the perimeters is equal to the ratio of the corresponding side lengths.

3. Because the ratio of the corresponding side lengths is $\frac{1}{2}$, the ratio of the areas is equal to $\left(\frac{1}{2}\right)^2$. To find the area, solve the proportion $\frac{30}{x} = \frac{1}{4}$ to get $x = 120$ square inches.

5. $\frac{5}{8}$; $\frac{25}{64}$

7. $\frac{14}{9}$; $\frac{196}{81}$

9. The area is 9 times larger.

11. 25.6

13. 39 in.; 93.5 in.^{2}

15. 108 yd

17. **a.** 400 times greater; The ratio of the corresponding lengths is $\frac{120 \text{ in.}}{6 \text{ in.}} = \frac{20}{1}$. So, the ratio of the areas is $\left(\frac{20}{1}\right)^2 = \frac{400}{1}$.

b. 1250 ft^2

19. 15 m

21. $x = -2$

23. $n = -4$

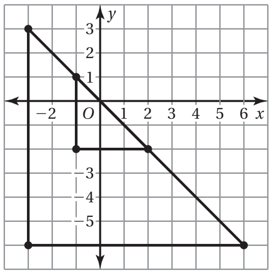
Section 2.7

Dilations
(pages 87–89)

1. A dilation changes the size of a figure. The image is similar, not congruent, to the original figure.

3. The middle red figure is not a dilation of the blue figure because the height is half of the blue figure and the base is the same. The left red figure is a reduction of the blue figure and the right red figure is an enlargement of the blue figure.

5.



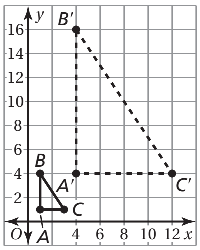
The triangles are similar.

7. yes

9. no

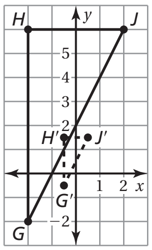
11. yes

13.



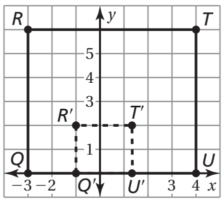
enlargement

15.



reduction

17.



reduction

19. Each coordinate was multiplied by 2 instead of divided by 2. The coordinates should be $A'(1, 2.5)$, $B'(1, 0)$, and $C'(2, 0)$.

Section 2.7 Dilations *(continued)* *(pages 87–89)*

21. reduction; $\frac{1}{4}$

23. $A''(10, 6)$, $B''(4, 6)$, $C''(4, 2)$, $D''(10, 2)$

25. $J''(3, -3)$, $K''(12, -9)$, $L''(3, -15)$

27. *Sample answer:* Rotate 90° counterclockwise about the origin and then dilate with respect to the origin using a scale factor of 2

29. Exercise 27: yes; Exercise 28: no; Explanations will vary based on sequences chosen in Exercises 27 and 28.

31. **a.** enlargement

b. center of dilation

c. $\frac{4}{3}$

d. The shadow on the wall becomes larger. The scale factor will become larger.

33. The transformations are a dilation using a scale factor of 2 and then a translation of 4 units right and 3 units down; similar; A dilation produces a similar figure and a translation produces a congruent figure, so the final image is similar.

35. The transformations are a dilation using a scale factor of $\frac{1}{3}$ and then a reflection in the x-axis; similar; A dilation produces a similar figure and a reflection produces a congruent figure, so the final image is similar.

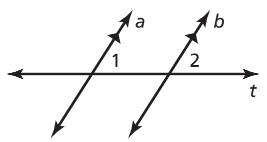
37. $A'(-2, 3)$, $B'(6, 3)$, $C'(12, -7)$, $D'(-2, -7)$; Methods will vary.

39. supplementary; $x = 16$

41. B

Section 3.1 Parallel Lines and Transversals *(pages 107–109)*

1. *Sample answer:*



3. m and n

5. 8

7. $\angle 1 = 107°$, $\angle 2 = 73°$

9. $\angle 5 = 49°$, $\angle 6 = 131°$

11. 60°; Corresponding angles are congruent.

13. *Sample answer:* rotate 180° and translate down

15. $\angle 6 = 61°$; $\angle 6$ and the given angle are vertical angles.
$\angle 5 = 119°$ and $\angle 7 = 119°$; $\angle 5$ and $\angle 7$ are supplementary to the given angle.
$\angle 1 = 61°$; $\angle 1$ and the given angle are corresponding angles.
$\angle 3 = 61°$; $\angle 1$ and $\angle 3$ are vertical angles.
$\angle 2 = 119°$ and $\angle 4 = 119°$; $\angle 2$ and $\angle 4$ are supplementary to $\angle 1$.

17. $\angle 2 = 90°$; $\angle 2$ and the given angle are vertical angles.
$\angle 1 = 90°$ and $\angle 3 = 90°$; $\angle 1$ and $\angle 3$ are supplementary to the given angle.
$\angle 4 = 90°$; $\angle 4$ and the given angle are corresponding angles.
$\angle 6 = 90°$; $\angle 4$ and $\angle 6$ are vertical angles.
$\angle 5 = 90°$ and $\angle 7 = 90°$; $\angle 5$ and $\angle 7$ are supplementary to $\angle 4$.

19. 132°; *Sample answer:* $\angle 2$ and $\angle 4$ are alternate interior angles and $\angle 4$ and $\angle 3$ are supplementary.

21. 120°; *Sample answer:* $\angle 6$ and $\angle 8$ are alternate exterior angles.

23. 61.3°; *Sample answer:* $\angle 3$ and $\angle 1$ are alternate interior angles and $\angle 1$ and $\angle 2$ are supplementary.

25. They are all right angles because perpendicular lines form 90° angles.

27. 130

29. **a.** no; They look like they are spreading apart. **b.** Check students' work.

31. 13
33. 51
35. B

Section 3.2 Angles of Triangles
(pages 114 and 115)

1. Subtract the sum of the given measures from 180°.

3. 115°, 120°, 125°
5. 40°, 65°, 75°
7. 25°, 45°, 110°
9. 48°, 59°, 73°
11. 45
13. 140°

15. The measure of the exterior angle is equal to the sum of the measures of the two nonadjacent interior angles. The sum of all three angles is not 180°;

$$(2x - 12) = x + 30$$

$$x = 42$$

The exterior angle is $(2(42) - 12)° = 72°$.

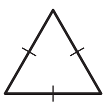
17. 126°

19. sometimes; The sum of the angle measures must equal 180°.

21. never; If a triangle had more than one vertex with an acute exterior angle, then it would have to have more than one obtuse interior angle which is impossible.

23. $x = -4$
25. $n = -3$

Section 3.3 Angles of Polygons
(pages 123–125)

1. *Sample answer:* 

3. What is the measure of an interior angle of a regular pentagon?; 108°; 540°

5. 1260°
7. 360°
9. 1260°

Selected Answers

Section 3.3 Angles of Polygons *(continued)*

(pages 123–125)

11. no; The interior angle measures given add up to 535°, but the sum of the interior angle measures of a pentagon is 540°.

13. 90°, 135°, 135°, 135°, 135°, 90°

15. 140°

17. 140°

19. The sum of the interior angle measures should have been divided by the number of angles, 20. $3240° \div 20 = 162°$; The measure of each interior angle is 162°.

21. 24 sides

23. 75°, 93°, 85°, 107°

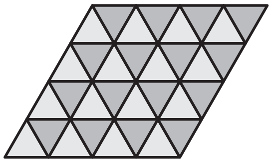
25. 60°; The sum of the interior angle measures of a hexagon is 720°. Because it is regular, each angle has the same measure. So, each interior angle is $720° \div 6 = 120°$ and each exterior angle is 60°.

27. 120°, 120°, 120°

29. interior: 135°; exterior: 45°

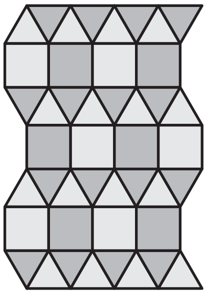
31. 120°

33. **a.** *Sample answer:*



b. *Sample answer:* square, regular hexagon

c. *Sample answer:*



d. *Answer should include, but is not limited to:* a discussion of the interior and exterior angles of the polygons in the tessellation and how they combine to add up to 360° where the vertices meet.

35. 2

37. 6

Section 3.4 Using Similar Triangles

(pages 130 and 131)

1. Write a proportion that uses the missing measurement because the ratios of corresponding side lengths are equal.

3. *Sample answer:* Two of the angles are congruent, so they have the same sum. When you subtract this from 180°, you will get the same third angle.

5. Student should draw a triangle with the same angle measures as the ones given in the textbook.

If the student's triangle is larger than the one given, then the ratio of the corresponding side lengths, $\frac{\text{student's triangle length}}{\text{book's triangle length}}$, should be greater than 1. If the student's triangle is smaller than the one given, then the ratio of the corresponding side lengths, $\frac{\text{student's triangle length}}{\text{book's triangle length}}$, should be less than 1.

7. no; The triangles do not have two pairs of congruent angles.

9. yes; The triangles have the same angle measures, 81°, 51°, and 48°.

11. yes; The triangles have two pairs of congruent angles.

13. Think of the different ways that you can show that two triangles are similar.

15. 30 ft

17. maybe; They are similar when both have measures of 30°, 60°, 90° or both have measures of 45°, 45°, 90°. They are not similar when one has measures of 30°, 60°, 90° and the other has measures of 45°, 45°, 90°.

19. $y = 5x + 3$

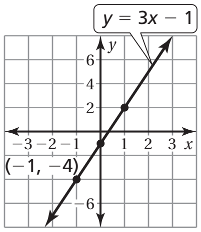
21. $y = 8x - 4$

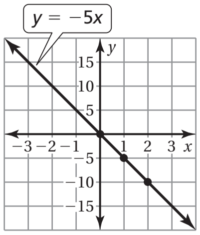
Section 4.1 Graphing Linear Equations
(pages 146 and 147)

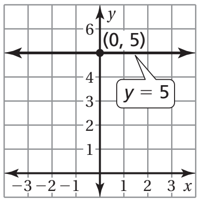
1. a line

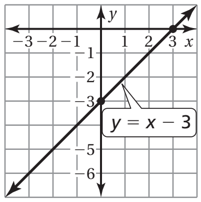
3. *Sample answer:*

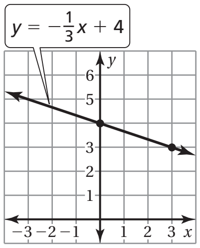
x	0	1
$y = 3x - 1$	-1	2

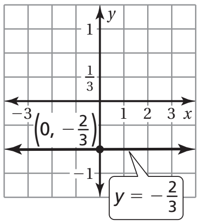


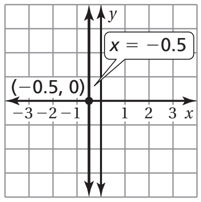
5. 

7. 

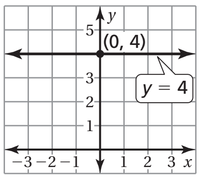
9. 

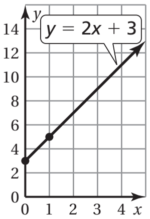
11. 

13. 

15. 

17. The equation $x = 4$ is graphed, not $y = 4$.

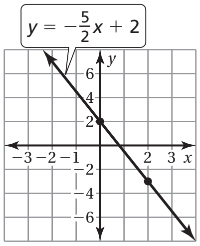


19. a. 

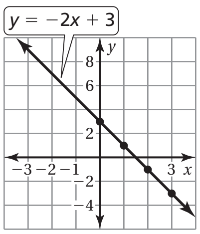
b. about \$5

c. \$5.25

21. $y = -\frac{5}{2}x + 2$



23. $y = -2x + 3$

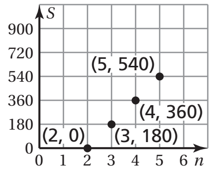


Selected Answers

Section 4.1 Graphing Linear Equations *(continued)*

(pages 146 and 147)

25. **a.** *Sample answer:*



Yes; The graph of the equation is a line.

b. No, $n = 3.5$ does not make sense because a polygon cannot have half a side.

27. Begin this exercise by listing all of the given information.

29. $(-6, 6)$

31. $(-4, -3)$

Section 4.2 Slope of a Line

(pages 153–155)

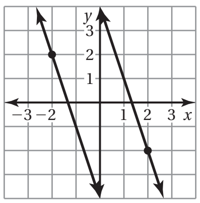
1. **a.** B and C

b. A

c. no; None of the lines are vertical.

3. The line is horizontal.

5.



The lines are parallel.

7. $\frac{3}{4}$

9. $-\frac{3}{5}$

11. 0

13. 0

15. undefined

17. $-\frac{11}{6}$

19. The denominator should be $2 - 4$.
$m = -1$

21. 4

23. $-\frac{3}{4}$

25. $\frac{1}{3}$

27. $k = 11$

29. $k = -5$

31. **a.** $\frac{3}{40}$

b. The cost increases by \$3 for every 40 miles you drive, or the cost increases by \$0.075 for every mile you drive.

33. yes; The slopes are the same between the points.

35. When you switch the coordinates, the differences in the numerator and denominator are the opposite of the numbers when using the slope formula. You still get the same slope.

37. $b = 25$

39. $x = 7.5$

Extension 4.2 Slopes of Parallel and Perpendicular Lines
(pages 156 and 157)

1. blue and red; They both have a slope of -3.

3. yes; Both lines are horizontal and have a slope of 0.

5. yes; Both lines are vertical and have an undefined slope.

7. blue and green; The blue line has a slope of 6. The green line has a slope of $-\frac{1}{6}$. The product of their slopes is $6 \cdot \left(-\frac{1}{6}\right) = -1$.

9. yes; The line $x = -2$ is vertical. The line $y = 8$ is horizontal. A vertical line is perpendicular to a horizontal line.

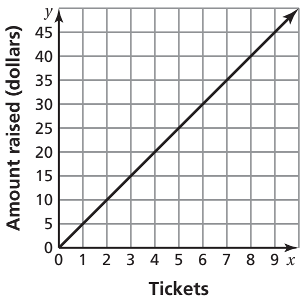
11. yes; The line $x = 0$ is vertical. The line $y = 0$ is horizontal. A vertical line is perpendicular to a horizontal line.

Section 4.3 Graphing Proportional Relationships
(pages 162 and 163)

1. (0, 0)

3. no; *Sample answer:* The graph of the equation does not pass through the origin.

5. yes; $y = \frac{1}{3}x$; *Sample answer:* The rate of change in the table is constant.

7. 

Each ticket costs \$5.

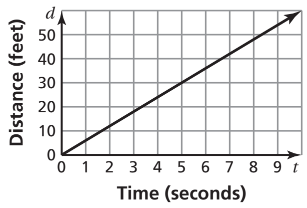
9. **a.** the car; *Sample answer:* The equation for the car is $y = 25x$. Because 25 is greater than 18, the car gets better gas mileage.

   b. 56 miles

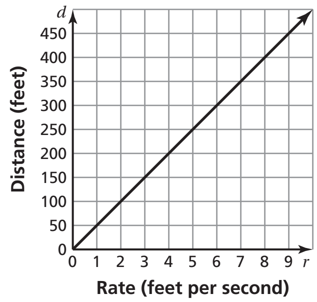
11. Consider the direct variation equation and that the graph passes through the origin.

Section 4.3 Graphing Proportional Relationships *(continued)* *(pages 162 and 163)*

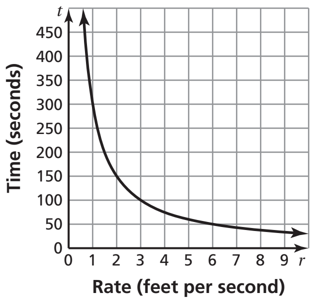
13. **a.** yes; The equation is $d = 6t$, which represents a proportional relationship.



b. yes; The equation is $d = 50r$, which represents a proportional relationship.

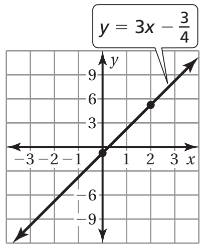


c. no; The equation is $t = \dfrac{300}{r}$, which does not represent a proportional relationship.



d. part c; It is called inverse variation because when the rate increases, the time decreases, and when the rate decreases, the time increases.

15.



17. B

Section 4.4 Graphing Linear Equations in Slope-Intercept Form *(pages 170 and 171)*

1. Find the x-coordinate of the point where the graph crosses the x-axis.

3. *Sample answer:* The amount of gasoline y (in gallons) left in your tank after you travel x miles is $y = -\frac{1}{20}x + 20$. The slope of $-\frac{1}{20}$ means the car uses 1 gallon of gas for every 20 miles driven. The y-intercept of 20 means there is originally 20 gallons of gas in the tank.

5. A; slope: $\frac{1}{3}$; y-intercept: -2

7. slope: 4; y-intercept: -5

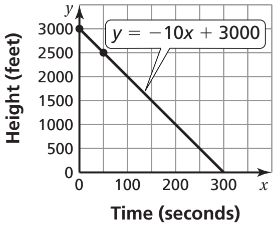
9. slope: $-\frac{4}{5}$; y-intercept: -2

11. slope: $\frac{4}{3}$; y-intercept: -1

13. slope: -2; y-intercept: 3.5

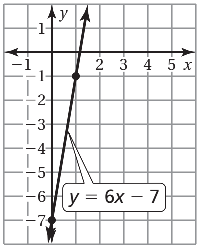
15. slope: 1.5; y-intercept: 11

17. a.



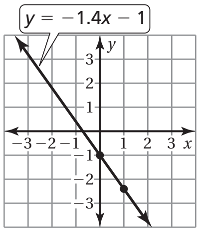
b. The x-intercept of 300 means the skydiver lands on the ground after 300 seconds. The slope of -10 means that the skydiver falls to the ground at a rate of 10 feet per second.

19.



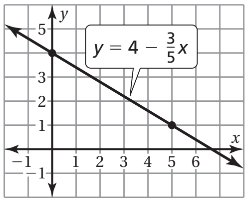
x-intercept: $\frac{7}{6}$

21.



x-intercept: $-\frac{5}{7}$

23.



x-intercept: $\frac{20}{3}$

25. a. $y = 2x + 4$ and $y = 2x - 3$ are parallel because the slope of each line is 2; $y = -3x - 2$ and $y = -3x + 5$ are parallel because the slope of each line is -3.

b. $y = 2x + 4$ and $y = -\frac{1}{2}x + 2$ are perpendicular because the product of their slopes is -1;

$y = 2x - 3$ and $y = -\frac{1}{2}x + 2$ are perpendicular because the product of their slopes is -1;

$y = -\frac{1}{3}x - 1$ and $y = 3x + 3$ are perpendicular because the product of their slopes is -1.

27. $y = 2x + 3$

29. $y = \frac{2}{3}x - 2$

31. B

Section 4.5 Graphing Linear Equations in Standard Form

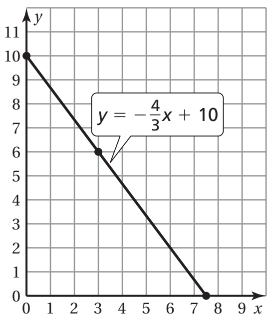
(pages 176 and 177)

1. no; The equation is in slope-intercept form.

3. x = pounds of peaches

y = pounds of apples

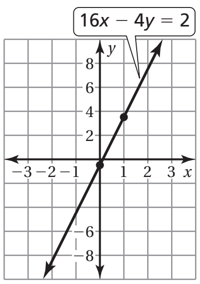
$y = -\frac{4}{3}x + 10$



5. $y = -2x + 17$

7. $y = \frac{1}{2}x + 10$

9.



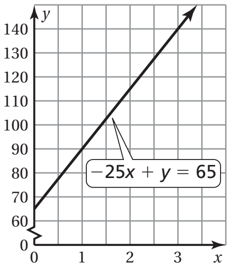
11. B

13. C

Graphing Linear Equations in Standard Form

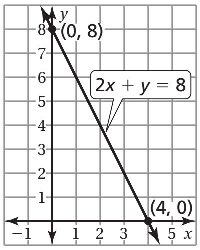
(continued) (pages 176 and 177)

15. a.



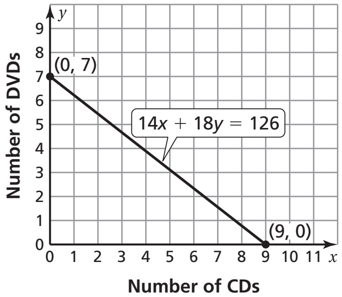
b. \$390

17.



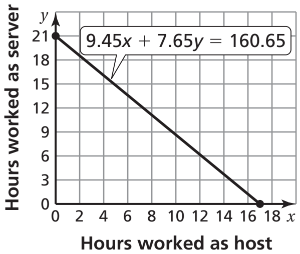
19. x-intercept: 9

y-intercept: 7



21. a. $9.45x + 7.65y = 160.65$

b.

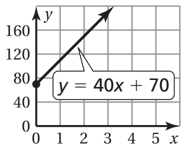


23. a. $y = 40x + 70$

b. x-intercept: $-\frac{7}{4}$; no;

You cannot have a negative time.

c.



25. $\frac{1}{2}$

Writing Equations in Slope-Intercept Form

(pages 182 and 183)

1. *Sample answer:* Find the ratio of the rise to the run between the intercepts.

3. $y = 3x + 2;\ y = 3x - 10;\ y = 5;\ y = -1$

5. $y = x + 4$

7. $y = \frac{1}{4}x + 1$

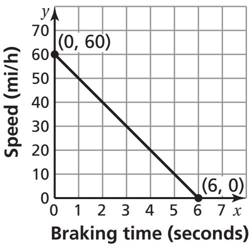
9. $y = \frac{1}{3}x - 3$

11. The x-intercept was used instead of the y-intercept. $y = \frac{1}{2}x - 2$

13. $y = 5$

15. $y = -2$

17. a–b.

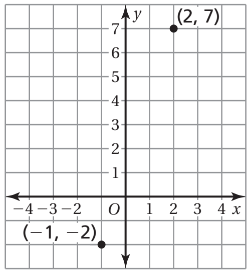


(0, 60) represents the speed of the automobile before braking. (6, 0) represents the amount of time it takes to stop. The line represents the speed y of the automobile after x seconds of braking.

c. $y = -10x + 60$

19. Be sure to check that your rate of growth will not lead to a 0-year-old tree with a negative height.

21 and 23.



Section 4.7 Writing Equations in Point-Slope Form *(pages 188 and 189)*

1. $m = -2$; $(-1, 3)$

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

5. $y + 1 = -3(x - 3)$

7. $y - 8 = \frac{3}{4}(x - 4)$

9. $y + 5 = -\frac{1}{7}(x - 7)$

11. $y + 4 = -2(x + 1)$

13. $y = 2x$

15. $y = \frac{1}{4}x$

17. $y = x + 1$

19. **a.** $V = -4000x + 30{,}000$

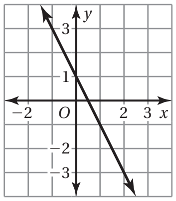
b. $30,000

21. The rate of change is 0.25 degree per chirp.

23. **a.** $y = 14x - 108.5$

b. 4 meters

25.



27. D

Section 5.1 Solving Systems of Linear Equations by Graphing *(pages 206 and 207)*

1. yes; The equations are linear and in the same variables.

3. Check whether (3, 4) is a solution of each equation.

5. (4, 176)

7. B; (6, 7)

9. C; (3, −1)

11. (−5, 1)

13. (12, 15)

15. (8, 1)

17. (5, 1.5)

19. (−6, 2)

21. no; Two lines cannot intersect in exactly two points.

23. Make a table to compare your distance to your friend's distance.

25. $c = 8$

27. $x = 11$

Section 5.2 Solving Systems of Linear Equations by Substitution *(pages 212 and 213)*

1. **Step 1:** Solve one of the equations for one of the variables.
   Step 2: Substitute the expression from Step 1 into the other equation and solve.
   Step 3: Substitute the value from Step 2 into one of the original equations and solve.

3. sometimes; A solution obtained by graphing may not be exact.

5. *Sample answer:* $x + 2y = 6$
   $x - y = 3$

7. $4x - y = 3$; The coefficient of y is -1.

9. $2x + 10y = 14$; Dividing by 2 to solve for x yields integers.

11. (6, 17)

13. (4, 1)

15. $\left(\frac{1}{4}, 6\right)$

17. **a.** $x = 2y$
    $64x + 132y = 1040$
    b. adult tickets: \$8; student tickets: \$4

19. $(-2, 4)$

21. The expression for y was substituted back into the same equation; solution: (2, 1)

23. 30 cats, 35 dogs

25. Make a diagram to help visualize the problem.

27. $2x - 5y = -8$

29. B

Section 5.3 Solving Systems of Linear Equations by Elimination *(pages 221–223)*

1. **Step 1:** Multiply, if necessary, one or both equations by a constant so at least one pair of like terms has the same or opposite coefficients.
   Step 2: Add or subtract the equations to eliminate one of the variables.
   Step 3: Solve the resulting equation for the remaining variable.
   Step 4: Substitute the value from Step 3 into one of the original equations and solve.

3. $2x + 3y = 11$
   $3x - 2y = 10$;
   You have to use multiplication to solve the system by elimination.

5. (6, 2)

7. (2, 1)

9. $(1, -3)$

11. (3, 2)

13. The student added y-terms, but subtracted x-terms and constants; solution (1, 2)

15. **a.** $2x + y = 10$
    $2x + 3y = 22$
    b. 6 minutes

17. $(5, -1)$

19. $(-2, -1)$

21. (4, 3)

23. **a.** ± 4
    b. ± 7

25. yes; The lines are perpendicular.

27. **a.** $23x + 10y = 86$

$28x + 5y = 76$

b. Multiple choice: 2 points each Short response: 4 points each

29. \$95

31. 5 grams of 90% gold alloy, 3 grams of 50% gold alloy

33. $(-1, 2, 1)$

35. yes

37. D

Section 5.4 Solving Special Systems of Linear Equations
(pages 228 and 229)

1. The graph of a system with no solution is two parallel lines, and the graph of a system with infinitely many solutions is one line.

3. infinitely many solutions; all points on the line $y = 4x + \frac{1}{3}$

5. no solution; The lines have the same slope and different y-intercepts.

7. infinitely many solutions; The lines are identical.

9. $(-1, -2)$

11. infinitely many solutions; all points on the line $y = -\frac{1}{6}x + 5$

13. $(-2.4, -3.5)$

15. no; because they are running at the same speed and your pig had a head start

17. When the slopes are different, there is one solution. When the slopes are the same, there is no solution if the y-intercepts are different and infinitely many solutions if the y-intercepts are the same.

19. $y = 0.99x + 10$

$y = 0.99x$

no; Because you paid \$10 before buying the same number of songs at the same price, you spend \$10 more.

21. Try using the Guess, Test, and Revise method to help you answer this question.

23. $y = 3x$

25. $y = -\frac{1}{2}x + 2$

Extension 5.4 Solving Linear Equations by Graphing
(pages 230 and 231)

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

3. no solution

5. $x = 2$

7. *Sample answer:* $6x - 3 = 6x$; Subtract 3 from the right side.

9. $x = \frac{21}{2}$

11. 6 mo

Selected Answers

Section 6.1 Relations and Functions
(pages 246 and 247)

1. the first number; the second number

3. As each input increases by 1, the output increases by 4.

Input	Output
1	4
2	8
3	12
4	16
5	20
6	24

5. As each input increases by 1, the output increases by 5.

Input	Output
1	−3
2	2
3	7
4	12
5	17
6	22

7. (1, 8), (3, 8), (3, 4), (5, 6), (7, 2)

9. no

11. yes

13.

Input	Output
−3	−3
−1	−1
1	1
3	3

As each input increases by 2, the output increases by 2.

15.

Input	Output
0	35
3	25
6	15
9	5

As each input increases by 3, the output decreases by 10.

17. a.

Input	Output
1	10
2	18
3	24
4	28

b. yes; Each input has exactly one output.

c. The pattern is that for each input increase of 1, the output increases by \$2 less than the previous increase. For each additional movie you buy, your cost per movie decreases by \$1.

19. y-axis

21. x-axis

Section 6.2 Representations of Functions
(pages 253–255)

1. input variable: x; output variable: y

3. What output is twice the sum of the input 3 and 4?; $2(3 + 4) = 14$; $2(3) + 4 = 10$

5. $y = x + 7$

7. $y = \frac{1}{2}x$

9. $y = x - 3$

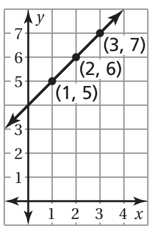
11. $y = 6x$

13. 8

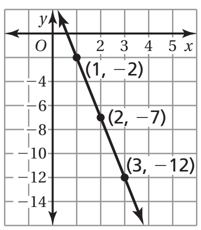
15. −17

17. 54

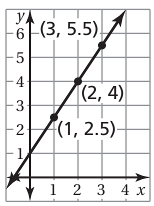
19.



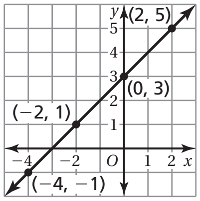
21.



23.



25. The order of the x- and y-coordinates is reversed in each coordinate pair.



27. B

29. A

31. -4

33. **a.** $P = 3.50b - 84$

b. independent variable: b; dependent variable: P; The profit depends on the number of bracelets sold.

c. 24 bracelets

35. **a.** $G = 35 + 10h$

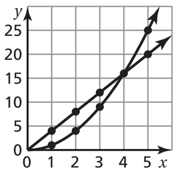
b. $S = 25h$

c. Snake Tours; For 2 hours, Gator Tours cost \$55 and Snake Tours cost \$50.

37. *Sample answer:*

Side Length	1	2	3	4	5
Perimeter	4	8	12	16	20

Side Length	1	2	3	4	5
Area	1	4	9	16	25



Sample answer: The perimeter function appears to form a line, and the area function appears to form a curve. When the side length is less than 4, the perimeter function is greater. When the side length is greater than 4, the area function is greater. When the side length is 4, the two functions are equal.

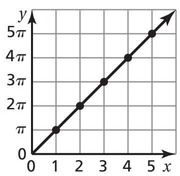
39. 1

41. $\frac{1}{3}$

Section 6.3 Linear Functions
(pages 261–263)

1. yes; The graph of $y = mx$ is a nonvertical line, so it is a linear function.

3. $y = \pi x$; x is the diameter; y is the circumference.



5. $y = \frac{4}{3}x + 2$

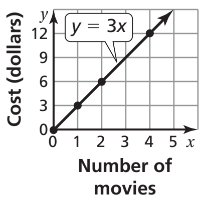
7. $y = 3$

9. $y = -\frac{1}{4}x$

11. **a.** independent variable: x; dependent variable: y

b. $y = 3x$; It costs \$3 to rent one movie.

c.



d. \$9

Section 6.3 Linear Functions *(continued)*
(pages 261–263)

13. **a.** $y = -0.2x + 1$

b. The slope indicates that the power decreases by 20% per hour. The x-intercept indicates that the battery lasts 5 hours. The y-intercept indicates that the battery power is at 100% when you turn on the laptop.

c. 1.25 hours

15. **a.** hiking

b. 67.5 calories

17. yes; A horizontal line is a nonvertical line.

19. **a.**

Temperature (°F), t	94	95	96	97	98
Heat Index (°F), H	122	126	130	134	138

b. independent variable: t; dependent variable: H

c. $H = 4t - 254$

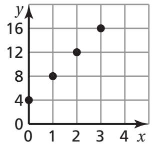
d. 146°F

21. $w = 1.5$

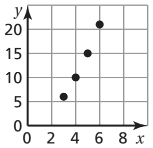
23. C

Section 6.4 Comparing Linear and Nonlinear Functions
(pages 270 and 271)

1. A linear function has a constant rate of change. A nonlinear function does not have a constant rate of change.

3. 

linear

5. 

nonlinear

7. linear; The graph is a line.

9. linear; As x increases by 6, y increases by 4.

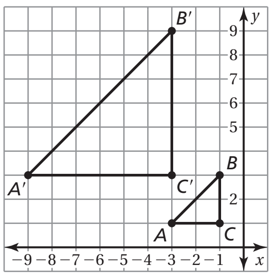
11. nonlinear; As x increases by 1, V increases by different amounts.

13. linear; You can rewrite the equation in slope-intercept form.

15. nonlinear; As x decreases by 65, y increases by different amounts.

17. **a.** nonlinear; When graphing the points, they do not lie on a line.

b. Tree B; After ten years, the height of Tree A is 20 feet and the height of Tree B is at least 23 feet.

19. **a.** 

enlargement

21. C

Section 6.5 Analyzing and Sketching Graphs
(pages 276 and 277)

1. F **3.** A **5.** D

7. The volume of the balloon increases at a constant rate, then stays constant, then increases at a constant rate, then stays constant, and then increases at a constant rate.

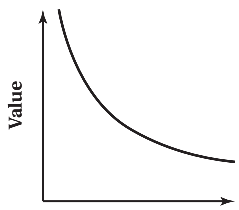
9. Horsepower increases at an increasing rate and then increases at a decreasing rate.

11. The hair length increases at a constant rate, then decreases instantly, then increases at a constant rate, then decreases instantly, and then increases at a constant rate.

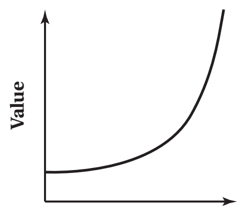
13. **a.** The usage decreases at an increasing rate.

b. The usage decreases at a decreasing rate.

15.



17.



19. Think about the real-life meanings of the words "surplus" and "shortage."

21. $(2, -1)$ **23.** C

Section 7.1 Finding Square Roots
(pages 292 and 293)

1. no; There is no integer whose square is 26.

3. $\sqrt{256}$ represents the positive square root because there is not a – or a ± in front.

5. $s = 1.3$ km **7.** 3 and -3 **9.** 2 and -2 **11.** 25

13. $\frac{1}{31}$ and $-\frac{1}{31}$ **15.** 2.2 and -2.2 **17.** -19

19. The positive and negative square roots should have been given.

$\pm\sqrt{\frac{1}{4}} = \frac{1}{2}$ and $-\frac{1}{2}$

21. -116 **23.** 9 **25.** 25 **27.** 40

29. because a negative radius does not make sense

31. $=$ **33.** 9 ft **35.** 8 m/sec **37.** 2.5 ft

39. $y = 3x - 2$ **41.** $y = \frac{3}{5}x + 1$

Section 7.2 Finding Cube Roots
(pages 298 and 299)

1. no; There is no integer that equals 25 when cubed.

3. 50 in.
5. 0.4 m
7. -5
9. 12
11. $\frac{7}{4}$
13. $3\frac{5}{8}$
15. $\frac{7}{12}$
17. 74
19. -276
21. 30 cm
23. $>$
25. $<$
27. $-1, 0, 1$
29. The side length of the square base is 18 inches and the height of the pyramid is 9 inches.
31. $x = 3$
33. $x = 4$
35. 289
37. 49

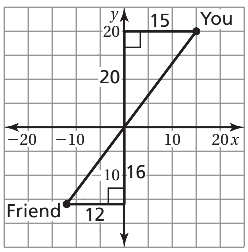
Section 7.3 The Pythagorean Theorem
(pages 304 and 305)

1. The hypotenuse is the longest side and the legs are the other two sides.
3. 29 km
5. 9 in.
7. 24 cm
9. The length of the hypotenuse was substituted for the wrong variable.

$$\begin{aligned} a^2 + b^2 &= c^2 \\ 7^2 + b^2 &= 25^2 \\ 49 + b^2 &= 625 \\ b^2 &= 576 \\ b &= 24 \end{aligned}$$

11. 16 cm
13. Use a right triangle to find the distance.

15. *Sample answer:* length $= 20$ ft, width $= 48$ ft, height $= 10$ ft; $BC = 52$ ft, $AB = \sqrt{2804}$ ft
17. **a.** *Sample answer:*



b. 45 ft

19. 6 and -6
21. 13
23. C

Section 7.4 Approximating Square Roots
(pages 313–315)

1. A rational number can be written as the ratio of two integers. An irrational number cannot be written as the ratio of two integers.

3. all rational and irrational numbers; *Sample answer:* $-2, \frac{1}{8}, \sqrt{7}$

5. yes
7. no
9. whole, integer, rational
11. irrational
13. rational
15. irrational
17. 144 is a perfect square. So, $\sqrt{144}$ is rational.
19. **a.** If the last digit is 0, it is a whole number. Otherwise, it is a natural number.
    b. irrational number **c.** irrational number
21. **a.** 26 **b.** 26.2
23. **a.** -10 **b.** -10.2
25. **a.** -13 **b.** -12.9
27. $\sqrt{15}$; $\sqrt{15}$ is positive and -3.5 is negative.
29. $\frac{2}{3}$; $\frac{2}{3}$ is to the right of $\sqrt{\frac{16}{81}}$.
31. $-\sqrt{182}$; $-\sqrt{182}$ is to the right of $-\sqrt{192}$.
33. true
35. 8.1 ft
37. 8.5 ft
39. 20.6 in.
41. Create a table of integers whose cubes are close to the radicand. Determine which two integers the cube root is between. Then create another table of numbers between those two integers whose cubes are close to the radicand. Determine which cube is closest to the radicand; 2.4
43. *Sample answer:* $a = 82$, $b = 97$
45. 1.1
47. 30.1 m/sec
49. Falling objects do not fall at a linear rate. Their speed increases with each second they are falling.

51. 40 m
53. 9 cm

Extension 7.4 Repeating Decimals
(pages 316 and 317)

1. $\frac{1}{9}$
3. $-1\frac{2}{9}$
5. Because the solution does not change when adding/subtracting two equivalent equations; Multiply by 10 so that when you subtract the original equation, the repeating part is removed.
7. $-\frac{13}{30}$
9. $\frac{3}{11}$
11. Pattern: Digits that repeat are in the numerator and 99 is in the denominator; Use 9 as the integer part, 4 as the numerator, and 99 as the denominator of the fractional part.

Section 7.5 Using the Pythagorean Theorem
(pages 322 and 323)

1. the Pythagorean Theorem and the distance formula

3. If a^2 is odd, then a is an odd number; true when a is an integer; A product of two integers is odd only when each integer is odd.

5. yes **7.** no **9.** yes **11.** $\sqrt{52}$ **13.** $\sqrt{29}$ **15.** $\sqrt{85}$

17. The squared quantities under the radical should be added not subtracted; $\sqrt{136}$

19. yes **21.** yes

23. no; The measures of the side lengths are $\sqrt{5000}$, $\sqrt{3700}$, and $\sqrt{8500}$ and $\left(\sqrt{5000}\right)^2 + \left(\sqrt{3700}\right)^2 \neq \left(\sqrt{8500}\right)^2$.

25. Notice that the picture is not drawn to scale. Use right triangles.

27. mean: 13; median: 12.5; mode: 12

29. mean: 58; median: 59; mode: 59

Section 8.1 Volumes of Cylinders
(pages 338 and 339)

1. How much does it take to cover the cylinder?; $170\pi \approx 534.1$ cm^2; $300\pi \approx 942.5$ cm^3

3. $486\pi \approx 1526.8$ ft^3 **5.** $245\pi \approx 769.7$ ft^3

7. $90\pi \approx 282.7$ mm^3 **9.** $252\pi \approx 791.7$ in.^{3}

11. $256\pi \approx 804.2$ cm^3 **13.** $\frac{125}{8\pi} \approx 5$ ft

15. $\sqrt{\frac{150{,}000}{19\pi}} \approx 50$ cm

17. Divide the volume of one round bale by the volume of one square bale.

19. $8325 - 729\pi \approx 6035$ m^3 **21.** yes

23. no

Section 8.2 Volumes of Cones
(pages 344 and 345)

1. The height of a cone is the perpendicular distance from the base to the vertex.

3. Divide by 3. **5.** $9\pi \approx 28.3$ m^3

7. $\frac{2\pi}{3} \approx 2.1$ ft^3 **9.** $\frac{147\pi}{4} \approx 115.5$ yd^3 **11.** $\frac{125\pi}{6} \approx 65.4$ in.^{3}

13. The diameter was used instead of the radius;

$V = \frac{1}{3}(\pi)(1)^2(3) = \pi$ m^3

15. 1.5 ft

17. $2\sqrt{\dfrac{10.8}{4.2\pi}} \approx 1.8$ in.

19. 24.1 min

21. $3y$

23. $A'(-1, 1), B'(-3, 4), C'(-1, 4)$

25. D

Section 8.3 Volumes of Spheres

(pages 352 and 353)

1. A hemisphere is one-half of a sphere.

3. $\dfrac{500\pi}{3} \approx 523.6 \text{ in.}^3$

5. $972\pi \approx 3053.6 \text{ mm}^3$

7. $36\pi \approx 113.1 \text{ cm}^3$

9. 9 mm

11. 4.5 ft

13. 2.5 in.

15. $256\pi + 128\pi = 384\pi \approx 1206.4 \text{ ft}^3$

17. $r = \dfrac{3}{4}h$

19. 5400 in.^2; $27{,}000 \text{ in.}^3$

21. enlargement; 2

23. A

Section 8.4 Surface Areas and Volumes of Similar Solids

(pages 359–361)

1. Similar solids are solids of the same type that have proportional corresponding linear measures.

3. a. $\dfrac{9}{4}$; because $\left(\dfrac{3}{2}\right)^2 = \dfrac{9}{4}$

   b. $\dfrac{27}{8}$; because $\left(\dfrac{3}{2}\right)^3 = \dfrac{27}{8}$

5. no

7. no

9. $b = 18$ m; $c = 19.5$ m; $h = 9$ m

11. 1012.5 in.^2

13. $13{,}564.8 \text{ ft}^3$

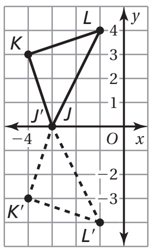
15. 673.75 cm^2

17. a. 9483 pounds; The ratio of the height of the original statue to the height of the small statue is 8.4 : 1. So, the ratio of the weights, or volumes is $\left(\dfrac{8.4}{1}\right)^3$.

    b. 221,184 lb

19. a. yes; Because all circles are similar, the slant height and the circumference of the base of the cones are proportional.

    b. no; because the ratio of the volumes of similar solids is equal to the cube of the ratio of their corresponding linear measures

21. 

$J'(-3, 0), K'(-4, -3), L'(-1, -4)$

Selected Answers

Section 9.1 Scatter Plots

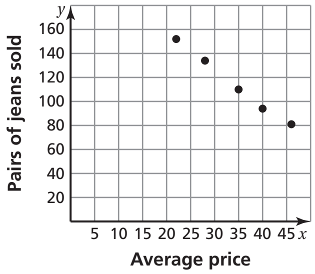
(pages 376 and 377)

1. They must be ordered pairs so there are equal amounts of x- and y-values.

3. no relationship; A student's shoe size is not related to his or her IQ.

5. nonlinear relationship; On each successive bounce, the ball rebounds to a height less than its previous bounce.

7. **a.** (22, 152), (40, 94), (28, 134), (35, 110), (46, 81)



b. As the average price of jeans increases, the number of pairs of jeans sold decreases.

9. **a.** 3.5 h **b.** $85

c. There is a positive relationship between hours worked and earnings.

11. nonlinear relationship; no outliers, gaps, or clusters

13. positive relationship

15. *Sample answer:* bank account balance during a shopping spree

17. Could there be another event that is causing the sales of both items to increase?

19. 8

21. B

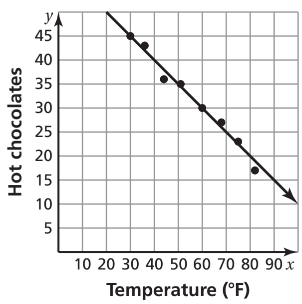
Section 9.2 Lines of Fit

(pages 382 and 383)

1. You can estimate and predict values.

3. -0.98, because it is closer to -1 than 0.91 is to 1. $(|-0.98| > |0.91|)$

5. **a.**



b. *Sample answer:* $y = -0.5x + 60$

c. *Sample answer:* The slope is -0.5 and the y-intercept is 60. So, you could predict that 60 hot chocolates are sold when the temperature is 0°F, and the sales decrease by about 1 hot chocolate for every 2°F increase in temperature.

d. 50 hot chocolates

7. no; There is no line that lies close to most of the points.

9. $y = 0.9x + 4$; $r \approx 0.999$; The relationship between x and y is a strong positive correlation and the equation closely models the data; 4 in.

11. **a.** $y = 48x + 11$; $r \approx 0.98$; The relationship between x and y is a strong positive correlation and the equation closely models the data.

    b. 251 ft

    c. The height of a hit baseball is not linear. The best fit line from part (a) only models a small part of the data.

13. $-2\frac{7}{9}$

15. $\frac{9}{11}$

Section 9.3 Two-Way Tables
(pages 390 and 391)

1. The joint frequencies are the entries in the two-way table that differentiate the two categories of data collected. The marginal frequencies are the sums of the rows and columns of the two-way table.

3. total of females surveyed: 73;
   total of males surveyed: 59

5. 51

7. 71 students are juniors.
   75 students are seniors.
   93 students are attending the school play.
   53 students are not attending the school play.

9. **a.** 19; 42

   b. 72 6th-graders were surveyed.
   74 7th-graders were surveyed.
   65 8th-graders were surveyed.
   112 students chose grades.
   40 students chose popularity.
   59 students chose sports.

   c. about 8.5%

11. **a.**

		Eye Color			
		Green	Blue	Brown	Total
Gender	Male	5	16	27	48
	Female	3	19	18	40
	Total	8	35	45	88

b. 48 males were surveyed.
40 females were surveyed.
8 students have green eyes.
35 students have blue eyes.
45 students have brown eyes.

c.

		Eye Color		
		Green	Blue	Brown
Gender	Male	63%	46%	60%
	Female	38%	54%	40%

Sample answer: About 63% of the students with green eyes are male. 40% of the students with brown eyes are female.

13. Be careful not to count the females with green eyes twice.

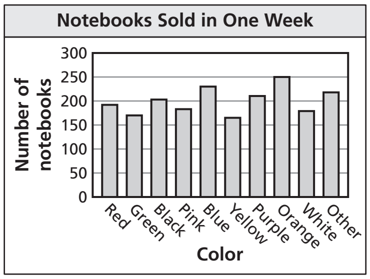
15. $y = 5x - 2$

17. B

Section 9.4 Choosing a Data Display
(pages 397–399)

1. yes; Different displays may show different aspects of the data.

3. *Sample answer:*



A bar graph shows the data in different color categories.

5. *Sample answer:* line graph; shows changes over time

7. *Sample answer:* line graph; shows changes over time

9. **a.** yes; The circle graph shows the data as parts of the whole.
   b. no; The bar graph shows the number of students, not the portion of students.

11. The pictures of the bikes are the largest on Monday and the smallest on Wednesday, which makes it seem like the distance is the same each day.

13. The intervals are not the same size.

15. *Sample answer:* bar graph; Each bar can represent a different vegetable.

17. *Sample answer:* dot plot

19. Does one display better show the differences in digits?

21. **a.** -9
    b. -8.6

23. A

Section 10.1 Exponents
(pages 414 and 415)

1. -3^4 is the negative of 3^4, so the base is 3, the exponent is 4, and its value is -81. $(-3)^4$ has a base of -3, an exponent of 4, and a value of 81.

3. 3^4

5. $\left(-\frac{1}{2}\right)^3$

7. π^3x^4

9. $(6.4)^4b^3$

11. 25

13. 1

15. $\frac{1}{144}$

17. The negative sign is not part of the base; $-6^2 = -(6 \cdot 6) = -36$.

19. $-\left(\frac{1}{4}\right)^4$

21. 29

23. 5

25. 66

27.

h	1	2	3	4	5
$2^h - 1$	1	3	7	15	31
2^{h-1}	1	2	4	8	16

$2^h - 1$; The option $2^h - 1$ pays you more money when $h > 1$.

29. Remember to add the black keys when finding how many notes you travel.

31. Associative Property of Multiplication

33. B

Section 10.2 Product of Powers Property
(pages 420 and 421)

1. when multiplying powers with the same base

3. 3^4 **5.** $(-4)^{12}$ **7.** h^7

9. $\left(-\frac{5}{7}\right)^{17}$ **11.** 5^{12} **13.** 3.8^{12}

15. The bases should not be multiplied. $5^2 \cdot 5^9 = 5^{2+9} = 5^{11}$

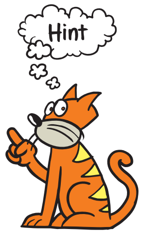
17. $216g^3$ **19.** $\frac{1}{25}k^2$ **21.** $r^{12}t^{12}$

23. no; $3^2 + 3^3 = 9 + 27 = 36$ and $3^5 = 243$

25. 496 **27.** 78,125

29. **a.** $16\pi \approx 50.27$ in.^{3}

b. $192\pi \approx 603.19$ in.^{3} Squaring each of the dimensions causes the volume to be 12 times larger.



31. Use the Commutative and Associative Properties of Multiplication to group the powers.

33. 4 **35.** 3

37. B

Section 10.3 Quotient of Powers Property
(pages 426 and 427)

1. To divide powers means to divide out the common factors of the numerator and denominator. To divide powers with the same base, write the power with the common base and an exponent found by subtracting the exponent in the denominator from the exponent in the numerator.

3. 6^6 **5.** $(-3)^3$ **7.** 5^6

9. $(-17)^3$ **11.** $(-6.4)^2$ **13.** b^{13}

15. You should subtract the exponents instead of dividing them. $\frac{6^{15}}{6^5} = 6^{15-5} = 6^{10}$

17. 2^9 **19.** π^8 **21.** k^{14}

23. $64x$ **25.** $125a^3b^2$ **27.** x^7y^6

29. You are checking to see if there is a linear relationship between memory and price, not if the change in price is constant for consecutive sizes of MP3 players.

31. 10^{13} galaxies **33.** -9

35. 61 **37.** B

Section 10.4 Zero and Negative Exponents
(pages 432 and 433)

1. no; Any nonzero base raised to a zero exponent is always 1.

3. $5^{-5}, 5^0, 5^4$

5. 1

7. 1

9. $\frac{1}{36}$

11. $\frac{1}{16}$

13. $5\frac{1}{4}$

15. $\frac{1}{125}$

17. The negative sign goes with the exponent, not the base. $(4)^{-3} = \frac{1}{4^3} = \frac{1}{64}$

19. 2^0; 10^0

21. $\frac{a^7}{64}$

23. $5b$

25. 12

27. $\frac{w^6}{9}$

29. 100 mm

31. 1,000,000 nanometers

33. **a.** 10^{-9} m **b.** equal to

35. Write the power as 1 divided by the power and use a negative exponent. Justifications will vary.

37. 10^9

39. 10^4

Section 10.5 Reading Scientific Notation
(pages 440 and 441)

1. Scientific notation uses a factor greater than or equal to 1 but less than 10 multiplied by a power of 10. A number in standard form is written out with all the zeros and place values included.

3. 5,600,000,000,000

5. 87,300,000,000,000,000

7. yes; The factor is greater than or equal to 1 and less than 10. The power of 10 has an integer exponent.

9. no; The factor is greater than 10.

11. yes; The factor is greater than or equal to 1 and less than 10. The power of 10 has an integer exponent.

13. no; The factor is less than 1.

15. 70,000,000

17. 500

19. 0.000044

21. 1,660,000,000

23. 9,725,000

25. **a.** 810,000,000 platelets
b. 1,350,000,000,000 platelets

27. **a.** Bellatrix
b. Betelgeuse

29. 1555.2 km^2

31. 35,000,000 km^3

33. 4^5

35. $(-2)^3$

Section 10.6 Writing Scientific Notation
(pages 446 and 447)

1. If the number is greater than or equal to 10, the exponent will be positive. If the number is less than 1 and greater than 0, the exponent will be negative.

3. 2.1×10^{-3}

5. 3.21×10^{8}

7. 4×10^{-5}

9. 4.56×10^{10}

11. 8.4×10^{5}

13. 72.5 is not less than 10. The decimal point needs to move one more place to the left. 7.25×10^{7}

15. 6.09×10^{-5}, 6.78×10^{-5}, 6.8×10^{-5}

17. 4.8×10^{-8}, 4.8×10^{-6}, 4.8×10^{-5}

19. 6.88×10^{-23}, 5.78×10^{23}, 5.82×10^{23}

21. 4.01×10^{7} m

23. 680, 6.8×10^{3}, $\frac{68{,}500}{10}$

25. 6.25×10^{-3}, 6.3%, 0.625, $6\frac{1}{4}$

27. 1.99×10^{9} watts

29. carat; Because 1 carat $= 1.2 \times 10^{23}$ atomic mass units and 1 milligram $= 6.02 \times 10^{20}$ atomic mass units, and $1.2 \times 10^{23} > 6.02 \times 10^{20}$.

31. natural, whole, integer, rational

33. irrational

Section 10.7 Operations in Scientific Notation
(pages 452 and 453)

1. Use the Distributive Property to group the factors together. Then subtract the factors and write it with the power of 10. The number may need to be rewritten so that it is still in scientific notation.

3. 8.34×10^{7}

5. 4.947×10^{11}

7. 5.8×10^{5}

9. 5.2×10^{8}

11. 7.555×10^{7}

13. 1.037×10^{7}

15. You have to rewrite the numbers so they have the same power of 10 before adding; 3.03×10^{9}

17. 2.9×10^{-3}

19. 1.5×10^{0}

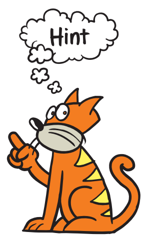
21. 2.88×10^{-7}

23. 1.12×10^{-2}

25. 4.006×10^{9}

27. 1.962×10^{8} cm

29. First find the total length of the ridges and valleys.



31. 3×10^{8} m/sec

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

35. C

Selected Answers

Key Vocabulary Index

Mathematical terms are best understood when you see them used and defined *in context*. This index lists where you will find key vocabulary. A full glossary is available in your Record and Practice Journal and at *BigIdeasMath.com*.

Student Index

This student-friendly index will help you find vocabulary, key ideas, and concepts. It is easily accessible and designed to be a reference for you whether you are looking for a definition, real-life application, or help with avoiding common errors.

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Common Core State Standards

Kindergarten

Counting and Cardinality	– Count to 100 by Ones and Tens; Compare Numbers
Operations and Algebraic Thinking	– Understand and Model Addition and Subtraction
Number and Operations in Base Ten	– Work with Numbers 11–19 to Gain Foundations for Place Value
Measurement and Data	– Describe and Compare Measurable Attributes; Classify Objects into Categories
Geometry	– Identify and Describe Shapes

Grade 1

Operations and Algebraic Thinking	– Represent and Solve Addition and Subtraction Problems
Number and Operations in Base Ten	– Understand Place Value for Two-Digit Numbers; Use Place Value and Properties to Add and Subtract
Measurement and Data	– Measure Lengths Indirectly; Write and Tell Time; Represent and Interpret Data
Geometry	– Draw Shapes; Partition Circles and Rectangles into Two and Four Equal Shares

Grade 2

Operations and Algebraic Thinking	– Solve One- and Two-Step Problems Involving Addition and Subtraction; Build a Foundation for Multiplication
Number and Operations in Base Ten	– Understand Place Value for Three-Digit Numbers; Use Place Value and Properties to Add and Subtract
Measurement and Data	– Measure and Estimate Lengths in Standard Units; Work with Time and Money
Geometry	– Draw and Identify Shapes; Partition Circles and Rectangles into Two, Three, and Four Equal Shares

Grade 3

Operations and Algebraic Thinking	–	Represent and Solve Problems Involving Multiplication and Division; Solve Two-Step Problems Involving Four Operations
Number and Operations in Base Ten	–	Round Whole Numbers; Add, Subtract, and Multiply Multi-Digit Whole Numbers
Number and Operations—Fractions	–	Understand Fractions as Numbers
Measurement and Data	–	Solve Time, Liquid Volume, and Mass Problems; Understand Perimeter and Area
Geometry	–	Reason with Shapes and Their Attributes

Grade 4

Operations and Algebraic Thinking	–	Use the Four Operations with Whole Numbers to Solve Problems; Understand Factors and Multiples
Number and Operations in Base Ten	–	Generalize Place Value Understanding; Perform Multi-Digit Arithmetic
Number and Operations—Fractions	–	Build Fractions from Unit Fractions; Understand Decimal Notation for Fractions
Measurement and Data	–	Convert Measurements; Understand and Measure Angles
Geometry	–	Draw and Identify Lines and Angles; Classify Shapes

Grade 5

Operations and Algebraic Thinking	–	Write and Interpret Numerical Expressions
Number and Operations in Base Ten	–	Perform Operations with Multi-Digit Numbers and Decimals to Hundredths
Number and Operations—Fractions	–	Add, Subtract, Multiply, and Divide Fractions
Measurement and Data	–	Convert Measurements within a Measurement System; Understand Volume
Geometry	–	Graph Points in the First Quadrant of the Coordinate Plane; Classify Two-Dimensional Figures

Mathematics Reference Sheet

Conversions

U.S. Customary
1 foot = 12 inches
1 yard = 3 feet
1 mile = 5280 feet
1 acre ≈ 43,560 square feet
1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 231 cubic inches
1 pound = 16 ounces
1 ton = 2000 pounds
1 cubic foot ≈ 7.5 gallons

U.S. Customary to Metric
1 inch = 2.54 centimeters
1 foot ≈ 0.3 meter
1 mile ≈ 1.61 kilometers
1 quart ≈ 0.95 liter
1 gallon ≈ 3.79 liters
1 cup ≈ 237 milliliters
1 pound ≈ 0.45 kilogram
1 ounce ≈ 28.3 grams
1 gallon ≈ 3785 cubic centimeters

Time
1 minute = 60 seconds
1 hour = 60 minutes
1 hour = 3600 seconds
1 year = 52 weeks

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

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

Metric
1 centimeter = 10 millimeters
1 meter = 100 centimeters
1 kilometer = 1000 meters
1 liter = 1000 milliliters
1 kiloliter = 1000 liters
1 milliliter = 1 cubic centimeter
1 liter = 1000 cubic centimeters
1 cubic millimeter = 0.001 milliliter
1 gram = 1000 milligrams
1 kilogram = 1000 grams

Metric to U.S. Customary
1 centimeter ≈ 0.39 inch
1 meter ≈ 3.28 feet
1 kilometer ≈ 0.62 mile
1 liter ≈ 1.06 quarts
1 liter ≈ 0.26 gallon
1 kilogram ≈ 2.2 pounds
1 gram ≈ 0.035 ounce
1 cubic meter ≈ 264 gallons

Number Properties

Commutative Properties of Addition and Multiplication

$a + b = b + a$

$a \cdot b = b \cdot a$

Associative Properties of Addition and Multiplication

$(a + b) + c = a + (b + c)$

$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Addition Property of Zero

$a + 0 = a$

Multiplication Properties of Zero and One

$a \cdot 0 = 0$

$a \cdot 1 = a$

Distributive Property:

$a(b + c) = ab + ac$

$a(b - c) = ab - ac$

Properties of Equality

Addition Property of Equality

If $a = b$, then $a + c = b + c$.

Subtraction Property of Equality

If $a = b$, then $a - c = b - c$.

Multiplication Property of Equality

If $a = b$, then $a \cdot c = b \cdot c$.

Multiplicative Inverse Property

$n \cdot \frac{1}{n} = \frac{1}{n} \cdot n = 1, n \neq 0$

Division Property of Equality

If $a = b$, then $a \div c = b \div c, c \neq 0$.

Squaring both sides of an equation

If $a = b$, then $a^2 = b^2$.

Cubing both sides of an equation

If $a = b$, then $a^3 = b^3$.

Properties of Exponents

Product of Powers Property: $a^m \cdot a^n = a^{m+n}$

Quotient of Powers Property: $\dfrac{a^m}{a^n} = a^{m-n}, a \neq 0$

Power of a Power Property: $(a^m)^n = a^{mn}$

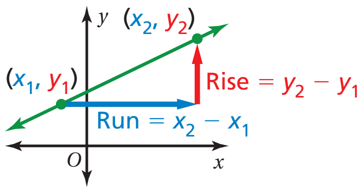
Power of a Product Property: $(ab)^m = a^m b^m$

Zero Exponents: $a^0 = 1, a \neq 0$

Negative Exponents: $a^{-n} = \dfrac{1}{a^n}, a \neq 0$

Slope

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$



Equations of Lines

Slope-intercept form

$y = mx + b$

Standard form

$ax + by = c, a, b \neq 0$

Point-slope form

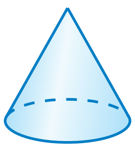
$y - y_1 = m(x - x_1)$

Volume

Cylinder

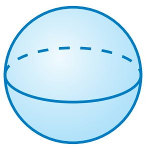
$V = Bh = \pi r^2 h$

Cone



$V = \dfrac{1}{3}Bh = \dfrac{1}{3}\pi r^2 h$

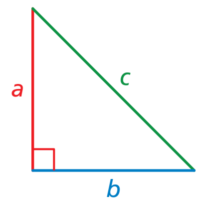
Sphere



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

Pythagorean Theorem

$a^2 + b^2 = c^2$

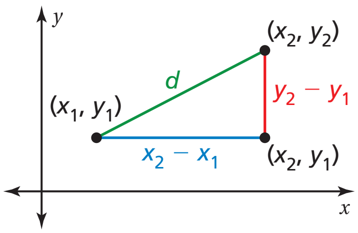


Converse of the Pythagorean Theorem

If the equation $a^2 + b^2 = c^2$ is true for the side lengths of a triangle, then the triangle is a right triangle.

Distance Formula

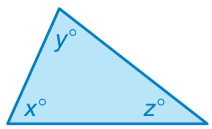
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



Angles of Polygons

Interior Angle Measures of a Triangle

$x + y + z = 180$



Interior Angle Measures of a Polygon

The sum S of the interior angle measures of a polygon with n sides is $S = (n - 2) \cdot 180°$.

Exterior Angle Measures of a Polygon

$w + x + y + z = 360$