# **Selected Answers**

## 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

Section 1.1

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

19.	n = -5	<b>21.</b> $m = 7.3\pi$	23.	$k = 1\frac{2}{3}$	25.	$p = -2\frac{1}{3}$
27.	They should have ad	ded 1.5 to each side.	29.	6.5 <i>x</i> = 42.25; \$6.50 pc	er hour	•
	-1.5 + k = 8.2		31.	$420 = \frac{7}{6}b, b = 360;$ \$6	60	
	k = 8.2 + 1.5			0		
	k = 9.7					
33.	h = -7	<b>35.</b> <i>q</i> = 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 1.2Solving Multi-Step Equations<br/>(pages 14 and 15)1. 2 + 3x = 17; x = 53. $k = 45; 45^{\circ}, 45^{\circ}, 90^{\circ}$ 5. $b = 90; 90^{\circ}, 135^{\circ}, 90^{\circ}, 90^{\circ}, 135^{\circ}$ 7. c = 0.59. h = -911. $x = -\frac{2}{9}$ 13. 20 watches15. 4(b + 3) = 24; 3 in.17. $\frac{2580 + 2920 + x}{3} = 3000; 3500$ people19. <</td>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 **17.** 15 + 0.5m = 25 + 0.25m; 40 mi right side. 3x - 4 = 2x + 13x - 2x - 4 = 2x + 1 - 2xx - 4 = 1x - 4 + 4 = 1 + 4x = 5**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:  $5x + 4(x + 1) \stackrel{?}{=} 40$ 2(white area) = black area 2[5(6x)] = 4[6(x+1)]Length of hallway is  $5\left(\frac{2}{3}\right) + 4\left(\frac{2}{3} + 1\right) \stackrel{?}{=} 40$ 60x = 24x + 24 $10 \neq 40$ 36x = 24 $x = \frac{2}{3}$ **45.**  $15.75 \text{ cm}^3$ **47.** C **Rewriting Equations and Formulas** Section 1.4 (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**13.** a.  $t = \frac{I}{Dr}$ **11.** The *y* should have a negative sign in front of it. 2x - y = 5**b.** t = 3 yr-y = -2x + 5y = 2x - 5**17.**  $\ell = \frac{A - \frac{1}{2}\pi w^2}{2w}$ **15.**  $m = \frac{e}{c^2}$ **19.** w = 6g - 40**21. a.**  $F = 32 + \frac{9}{5}(K - 273.15)$  **23.**  $r^3 = \frac{3V}{4\pi}$ ; r = 4.5 in. **25.**  $-5\frac{1}{3}$ **b.** 32°F **27.**  $1\frac{1}{4}$ c. liquid nitrogen

## 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.

	6	y I
	-5-	
	-4-	
	-3-	
	-2-	
	-1-	
-4-3-2	0	1 2 3 4 5 x
D	2	B
	12	

## Section 2.2

#### Translations (pages 52 and 53)

- **1.** A
- **5.** no
- **11.** A'(-3, 0), B'(0, -1), C'(1, -4), D'(-3, -5)
- **7.** yes



**9.** no

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



**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.
- **5.** yes

- **7.** no
- **11.** M'(-2, -1), N'(0, -3), P'(2, -2)



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



- **19.** *x*-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



**1.** (0, 0); (1, −3)

Quadrant IV
 translation

**Rotations** 

(pages 65-67)

- **7.** reflection
- **13.** *A*'(2, 2), *B*'(1, 4), *C*'(3, 4), *D*'(4, 2)
- **17.** W'(-2, 6), X'(-2, 2), Y'(-6, 2), Z'(-6, 5)

**3.** Quadrant IV

**9.** no

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

G'		y		
	-4-	F'		
	-3-			
D'		F'		
-2	0		. 2	$x = \frac{1}{x}$
	-2-	Ε		
+	-3-	-		
_	-4-			
	G' D' -2 D	G' 4 	G' Y 4 F' -2 D' E' D -2 -2 -2 D -2 -3	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$

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

**33.** B

					y				
	K'			-6- -4-				K	
		•••	• •	-	J	-	$\sim$	A	L
4			-6	0	2			8	<i>L</i> ,
Ľ			М	4-		M			L
				۲.	r				

**21.** *y*-axis





**11.** yes; 90° counterclockwise

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



## 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  $180^{\circ}$  about the origin and then rotate  $90^{\circ}$  clockwise about vertex (-1, 0); Rotate  $90^{\circ}$  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.

**11.** 14

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



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

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



## **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 <sup>1</sup>/<sub>2</sub>, the ratio of the areas is equal to (<sup>1</sup>/<sub>2</sub>)<sup>2</sup>. To find the area, solve the proportion <sup>30</sup>/<sub>x</sub> = <sup>1</sup>/<sub>4</sub> to get x = 120 square inches.
  5. <sup>5</sup>/<sub>8</sub>; <sup>25</sup>/<sub>64</sub>
  7. <sup>14</sup>/<sub>9</sub>; <sup>196</sup>/<sub>81</sub>
  9. The area is 9 times larger.
- **11.** 25.6

**13.** 39 in.; 93.5 in.<sup>2</sup> **15.** 108 yd

**23.** n = -4

- **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<sup>2</sup>

Section 2.7

Section 2.6

**19.** 15 m

Dilations (pages 87–89)

**21.** x = -2

- **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.



9. no
 11. yes

15.

**7.** yes

The triangles are similar.



enlargement

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



## Parallel Lines and Transversals (pages 107–109)

**1.** *Sample answer:* 



**9.**  $\angle 5 = 49^{\circ}, \angle 6 = 131^{\circ}$ 

- **3.** *m* and *n*
- 8
   ∠1 = 107°, ∠2 = 73°
- **11.** 60°; Corresponding angles are congruent.
- 13. Sample answer: rotate 180° and translate down
- **15.**  $\angle 6 = 61^\circ$ ;  $\angle 6$  and the given angle are vertical angles.
  - $\angle 5 = 119^{\circ}$  and  $\angle 7 = 119^{\circ}$ ;  $\angle 5$  and  $\angle 7$  are supplementary to the given angle.
  - $\angle 1 = 61^{\circ}$ ;  $\angle 1$  and the given angle are corresponding angles.
  - $\angle 3 = 61^{\circ}$ ;  $\angle 1$  and  $\angle 3$  are vertical angles.
  - $\angle 2 = 119^{\circ}$  and  $\angle 4 = 119^{\circ}$ ;  $\angle 2$  and  $\angle 4$  are supplementary to  $\angle 1$ .

- **17.**  $\angle 2 = 90^\circ$ ;  $\angle 2$  and the given angle are vertical angles.  $\angle 1 = 90^\circ$  and  $\angle 3 = 90^\circ$ ;  $\angle 1$  and  $\angle 3$  are supplementary to the given angle.  $\angle 4 = 90^\circ$ ;  $\angle 4$  and the given angle are corresponding angles.  $\angle 6 = 90^\circ$ ;  $\angle 4$  and  $\angle 6$  are vertical angles.
  - $\angle 5 = 90^{\circ}$  and  $\angle 7 = 90^{\circ}$ ;  $\angle 5$  and  $\angle 7$  are supplementary to  $\angle 4$ .
- **19.**  $132^\circ$ ; *Sample answer*:  $\angle 2$  and  $\angle 4$  are alternate interior angles and  $\angle 4$  and  $\angle 3$  are supplementary.
- **21.**  $120^\circ$ ; *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  $(2(42) - 12)^\circ = 72^\circ$ .

- **17.** 126°
- **19.** sometimes; The sum of the angle measures must equal  $180^{\circ}$ .
- **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°

## 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,  $20.3240^{\circ} \div 20 = 162^{\circ}$ ; The measure of each interior angle is  $162^{\circ}$ .
- **21.** 24 sides

**23.** 75°, 93°, 85°, 107°

- **25.**  $60^{\circ}$ ; 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  $720^{\circ} \div 6 = 120^{\circ}$  and each exterior angle is  $60^{\circ}$ .
- **27.** 120°, 120°, 120°
- **33. a.** *Sample answer:*



**b.** Sample answer:

**29.** interior:  $135^\circ$ ; exterior:  $45^\circ$ 

square, regular hexagon

**c.** *Sample answer:* 

**31.** 120°



interior and exterior angles of the polygons in the tessellation and how they combine to add up to 360° where the vertices meet.

d. Answer should include, but is not limited to: a discussion of the

**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,  $81^\circ$ ,  $51^\circ$ , and  $48^\circ$ .
- **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.** 
$$y = 8x - 4$$

EHmmm.

#### **Graphing Linear Equations** Section 4.1 (pages 146 and 147) **1.** a line **3.** *Sample answer:* y = 3x - 10 x 1 y = 3x - 1-12 3x3 - 2 - 12 5. y = -5x7. 9. (0 V =5 10 2 άí 15 11. 13. 15. $y = -\frac{1}{3}x + 4$ 0 5 (-0.5, 0) 3-2 2 3 r 0. -2-3-2-1 + 1 2 3 x **17.** The equation x = 4 is graphed, not y = 4. 19. a. **b.** about \$5 14 = 2x3 12 **c.** \$5.25 10 (0, 4) $y = \overline{4}$ -3-2-1 + 1 2 3 x 2 3 4 x **21.** $y = -\frac{5}{2}x + 2$ **23.** y = -2x + 3= -2x + 3

## Section 4.1

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

900 720 (5, 540) 540 360 (4, 360) 180 (2, 0) (3, 180)  $0 \frac{12}{0123456n}$ 

Yes; The graph of the equation is a line.

- 27. Begin this exercise by listing all of the given information.
- **29.** (-6, 6)
- **31.** (-4, -3)

## **Slope of a Line** (pages 153-155)

**1. a.** B and C

Section 4.2

- **b.** A
- c. no; None of the lines are vertical.
- **7.**  $\frac{3}{4}$ 5. **13.** 0 9.  $-\frac{3}{5}$ **15.** undefined **17.**  $-\frac{11}{6}$ **11.** 0

The lines are parallel.

- **19.** The denominator should be 2 4. **21.** 4 m = -1
- **23.**  $-\frac{3}{4}$ **25.**  $\frac{1}{3}$ **29.** k = -5
- **27.** *k* = 11
- **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.**  $x = 7.5$ 

Selected Answers A20



**Graphing Linear Equations (continued)** 



**3.** The line is horizontal.

## 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;  $y = \frac{1}{2}x$ ; *Sample answer*: The rate of change in the table is constant.



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.





## **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  $t = \frac{300}{r}$ , 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.



**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

**Selected Answers** 

3000 10x + 3000Height (feet) after 300 seconds. The slope of -10 means that the skydiver 2500 2000 falls to the ground at a rate of 10 feet per second. 1500 1000 500 0 L 0 100 200 300 Time (seconds) y = -1.4x - 121. 19. 23. Ż À. = 6x - 7x-intercept:  $\frac{20}{3}$ x-intercept:  $\frac{7}{6}$ x-intercept:  $-\frac{5}{7}$ **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. **29.**  $y = \frac{2}{3}x - 2$ **27.** y = 2x + 3

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

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

17. a.



b. The x-intercept of 300 means the skydiver lands on the ground

## **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





**5.** y = -2x + 17

![](_page_13_Figure_14.jpeg)

- 7.  $y = \frac{1}{2}x + 10$
- **11.** B **13.** C

## Section 4.5

# **15.** a. $\begin{bmatrix} y \\ 130 \\ 130 \\ 120 \\ 110 \\ 90 \\ 90 \\ 0 \\ 0 \\ 0 \\ 1 \\ 2 \\ 3 \\ x \end{bmatrix}$

- **b.** \$390
- **21. a.** 9.45x + 7.65y = 160.65

![](_page_14_Figure_4.jpeg)

![](_page_14_Figure_5.jpeg)

## Section 4.6

# 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

![](_page_14_Figure_12.jpeg)

(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.** 
$$y = -10x + 60$$

## (continued) (pages 176 and 177)

**Graphing Linear Equations in Standard Form** 

![](_page_14_Figure_16.jpeg)

**19.** *x*-intercept: 9 *y*-intercept: 7

![](_page_14_Figure_18.jpeg)

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

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

You cannot have a negative time.

![](_page_14_Figure_22.jpeg)

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

![](_page_15_Picture_1.jpeg)

21 and 23.

Writing Equations in Point-Slope Form

	-7- -6- -5- -4- -3- -2- -1-	x y (2, 7)
<u>-4-3-2</u> (−1, −2)	0	1 2 3 4 x

## Section 4.7

- **1.** m = -2; (-1, 3)
- 7.  $y-8=\frac{3}{4}(x-4)$
- **13.** y = 2x
- **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

![](_page_15_Figure_12.jpeg)

**3.**  $y - 0 = \frac{1}{2}(x + 2)$ **9.**  $y + 5 = -\frac{1}{7}(x - 7)$ **15.**  $y = \frac{1}{4}x$ 

27. D

(pages 188 and 189)

- **5.** y + 1 = -3(x 3)**11.** y + 4 = -2(x + 1)
- **17.** y = x + 1

![](_page_15_Picture_17.jpeg)

## 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)
- **13.** (12, 15) **15.** (8, 1)
- **21.** no; Two lines cannot intersect in exactly two points.

**9.** C; (3, −1)

- **11.** (-5, 1)
- **19.** (-6, 2)
- **23.** Make a table to compare your distance to your friend's distance.
- **27.** *x* = 11

**17.** (5, 1.5)

![](_page_15_Picture_33.jpeg)

## Solving Systems of Linear Equations by Substitution (pages 212 and 213)

- 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.
   sometimes; A solution obtained by graphing may not be exact.
   Sample answer: x + 2y = 6 x - y = 3
   2x + 10y = 14; Dividing by 2 to solve for x yields integers.
   (6, 17)
   (4, 1)
   (4, 1)
   (-2, 4) 64x + 132y = 1040 b. adult tickets: \$8; student tickets: \$4
- **21.** The expression for *y* was substituted back into the same equation; solution: (2, 1)
- **23.** 30 cats, 35 dogs

Section 5.2

- **27.** 2x 5y = -8
- Section 5.3

## Solving Systems of Linear Equations by Elimination (pages 221–223)

the problem.

29. B

25. Make a diagram to help visualize

25. yes; The lines are perpendicular.

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 **17.** (5, -1) **19.** (-2, -1) **21.** (4, 3) 

   2x + 3y = 22 b. 6 minutes
- **23.** a. ±4
  - **b.** ±7

![](_page_16_Picture_20.jpeg)

**27. a.** 23x + 10y = 8628x + 5y = 76

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

**35.** yes

**29.** \$95

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

37. D

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

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

Solving Linear Equations by Graphing

# 

## **Extension 5.4**

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

**3.** no solution

(pages 230 and 231)

- **5.** x = 2
- **7.** *Sample answer:* 6x 3 = 6x; Subtract 3 from the right side.

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

**11.** 6 mo

## **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.

![](_page_18_Figure_4.jpeg)

Section 6.1

![](_page_18_Figure_5.jpeg)

- **7.** (1, 8), (3, 8), (3, 4), (5, 6), (7, 2)
- **11.** yes

**13.** Input Output  $\begin{array}{c|c} -3 & -3 \\ \hline -1 & -1 \\ 1 & -1 \\ 3 & 3 \end{array}$ 

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

17. a. Input Output

**19.** *y*-axis

## Section 6.2

## **Representations of Functions** (pages 253–255)

**21.** *x*-axis

- 1. input variable: *x*; output variable: *y*
- **5.** y = x + 7
- **13.** 8

![](_page_18_Figure_18.jpeg)

**15.** –17

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

![](_page_18_Figure_20.jpeg)

**9.** y = x - 3

**11.** y = 6x

**3.** What output is twice the sum of the input 3 and 4?;

**17.** 54

2(3 + 4) = 14; 2(3) + 4 = 10

![](_page_18_Picture_25.jpeg)

**5.** As each input increases by 1,

the output increases by 5.

3

2

7

12

17

22

Input Output

1

2

3

4

5

6

![](_page_18_Figure_26.jpeg)

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

**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.

**b.** yes; Each input has exactly one output.

![](_page_18_Figure_31.jpeg)

- **25.** The order of the *x* and *y*-coordinates is reversed in each coordinate pair.
- **27.** B
- **29.** A
- **31.** -4
- **33.** *a*. *P* = 3.50*b* 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	Side Length	1	2	3	4	5
Perimeter	4	8	12	16	20	Area	1	4	9	16	25

![](_page_19_Figure_12.jpeg)

*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.

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

**39.** 1

## 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.

2 3 4 5 x

 $5\tau$ 

4π 3π 2π

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

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

- **11. a.** independent variable: *x*; dependent variable: *y* 
  - **b.** y = 3x; It costs \$3 to rent one movie.

![](_page_19_Figure_23.jpeg)

![](_page_19_Figure_24.jpeg)

![](_page_19_Figure_25.jpeg)

**5.**  $y = \frac{4}{3}x + 2$  **7.** 

**7.** y = 3

![](_page_20_Picture_0.jpeg)

#### 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

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

**b.** 67.5 calories

19. a	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. y16 12 8 4 0 0 1 2 3 4 x linear
- 7. linear; The graph is a line.

- 5.  $y_{15}$  nonlinear
- **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.

**21.** C

![](_page_20_Figure_25.jpeg)

# Analyzing and Sketching Graphs (pages 276 and 277)

5. D

**1.** F

Section 6.5

- 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.

3. A

- **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.

![](_page_21_Figure_7.jpeg)

#### **Finding Square Roots** (pages 292 and 293)

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

Section 7.1

- **3.**  $\sqrt{256}$  represents the positive square root because there is not a or a ± in front.
- 5. s = 1.3 km7. 3 and -39. 2 and -211. 2513.  $\frac{1}{31} \text{ and } -\frac{1}{31}$ 15. 2.2 and -2.217. -19
- **19.** The positive and negative square roots should have been given.  $\sqrt{1}$

$$\pm \sqrt{\frac{1}{4}} = \frac{1}{2}$$
 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.	<i>x</i> = 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.

5. 9 in.

**3.** 29 km

```
7. 24 cm
```

- 9. The length of the hypotenuse was substituted for the wrong variable.
  - $a^{2} + b^{2} = c^{2}$   $7^{2} + b^{2} = 25^{2}$   $49 + b^{2} = 625$   $b^{2} = 576$  b = 24

**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

![](_page_22_Figure_18.jpeg)

**19.** 6 and -6

**21.** 13

**23.** C

![](_page_22_Picture_22.jpeg)

#### **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, <sup>1</sup>/<sub>8</sub>, √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.

Section 7.4

- **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 **23. a.** −10 **b.** 26.2 **b.** −10.2
- **27.**  $\sqrt{15}$ ;  $\sqrt{15}$  is positive and -3.5 is negative.
- **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
  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 Repe

### Repeating Decimals (pages 316 and 317)

**3.**  $-1\frac{2}{9}$ 

- **1.**  $\frac{1}{9}$
- **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.

**47.** 30.1 m/sec

**25. a.** -13

**29.**  $\frac{2}{3}$ ;  $\frac{2}{3}$  is to the right of  $\sqrt{\frac{16}{81}}$ .

**b.** -12.9

## 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

Section 7.5

**21.** yes

**5.**  $245\pi \approx 769.7 \, \text{ft}^3$ 

**9.**  $252\pi \approx 791.7$  in.<sup>3</sup>

**13.**  $\frac{125}{8\pi} \approx 5 \text{ ft}$ 

**5.**  $9\pi \approx 28.3 \,\mathrm{m}^3$ 

21. yes

- **23.** no; The measures of the side lengths are  $\sqrt{5000}$ ,  $\sqrt{3700}$ , and  $\sqrt{8500}$  and  $(\sqrt{5000})^2 + (\sqrt{3700})^2 \neq (\sqrt{8500})^2$ .
- **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?;  $170\pi \approx 534.1 \text{ cm}^2$ ;  $300\pi \approx 942.5 \text{ cm}^3$
- **3.**  $486\pi \approx 1526.8 \text{ ft}^3$
- **7.**  $90\pi \approx 282.7 \text{ mm}^3$
- **11.**  $256\pi \approx 804.2 \text{ cm}^3$
- **15.**  $\sqrt{\frac{150,000}{19\pi}} \approx 50 \text{ cm}$
- 17. Divide the volume of one round bale by the volume of one square bale.
- **19.**  $8325 729\pi \approx 6035 \text{ m}^3$
- **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.

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

**13.** The diameter was used instead of the radius;

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

15.	1.5 ft	17.	$2\sqrt{\frac{10.8}{4.2\pi}} \approx 1.8 \text{ in}.$
19.	24.1 min	21.	3у
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 sph	nere	. <b>3.</b> $\frac{500\pi}{3} \approx 523.6$ in	3	
5.	$972\pi \approx 3053.6 \text{ mm}^3$	7.	$36\pi \approx 113.1 \mathrm{cm}^3$	9.	9 mm
11.	4.5 ft		<b>13.</b> 2.5 in.		
15.	$256\pi + 128\pi = 384\pi \approx 1206.4 \mathrm{ft}^3$		<b>17.</b> $r = \frac{3}{4}h$		
19.	5400 in. <sup>2</sup> ; 27,000 in. <sup>3</sup>	21.	enlargement; 2	23.	А

## Section 8.4

# Surface Areas and Volumes of Similar Solids (pages 359–361)

1. Similar solids are solids of the same type<br/>that have proportional corresponding<br/>linear measures.3. a.  $\frac{9}{4}$ ; because  $\left(\frac{3}{2}\right)^2 = \frac{9}{4}$ 5. nob.  $\frac{27}{8}$ ; because  $\left(\frac{3}{2}\right)^3 = \frac{27}{8}$ 5. no7. no9. b = 18 m; c = 19.5 m; h = 9 m11. 1012.5 in.<sup>2</sup>13. 13,564.8 ft<sup>3</sup>15. 673.75 cm<sup>2</sup>

- Selected Answers
- 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  $\left(\frac{8.4}{1}\right)^3$ .

- **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

![](_page_25_Figure_12.jpeg)

## 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)

![](_page_26_Figure_6.jpeg)

- **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

![](_page_26_Picture_16.jpeg)

## 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|)

![](_page_26_Figure_20.jpeg)

- **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.

Hmmm.

- 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; 5. 51 total of males surveyed: 59
- 7. 71 students are juniors.93 students are attending the school play.75 students are seniors.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%

		I			
		Green	Blue	Brown	Total
lder	Male	5	16	27	48
Gen	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.

11. a.

		Eye Color		
		Green	Blue	Brown
der	Male	63%	46%	60%
Gen	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.

![](_page_27_Picture_20.jpeg)

**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:

![](_page_28_Picture_4.jpeg)

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?23. A

![](_page_28_Picture_15.jpeg)

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

## 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.**  $\pi^3 x^4$  **9.**  $(6.4)^4 b^3$

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

- **11.** 25
- **17.** The negative sign is not part of the base;  $-6^2 = -(6 \cdot 6) = -36$ .

**13.** 1

- **19.**  $-\left(\frac{1}{4}\right)^4$  **21.** 29 **23.** 5 **25.** 66
- 27.  $2^{h} - 1$ ; The option  $2^{h} - 1$  pays you h 2 3 4 5 1 more money when h > 1.  $2^{h} - 1$ 3 7 15 31 1  $2^{h-1}$ 1 2 4 8 16
- **29.** Remember to add the black keys when finding how many notes you travel.

**31.** Associative Property of Multiplication

**33.** B

![](_page_28_Picture_29.jpeg)

## **Product of Powers Property** (pages 420 and 421)

Section 10.2

Section 10.3

1. when multiplying powers with the same base **3**. 3<sup>4</sup> 5.  $(-4)^{12}$ 7.  $h^7$ **9.**  $\left(-\frac{5}{7}\right)^{17}$ **11.** 5<sup>12</sup> **13.** 3.8<sup>12</sup> **15.** The bases should not be multiplied.  $5^2 \cdot 5^9 = 5^{2+9} = 5^{11}$ **19.**  $\frac{1}{25}k^2$ **17.** 216g<sup>3</sup> **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.<sup>3</sup> **b.**  $192\pi \approx 603.19$  in.<sup>3</sup> 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

![](_page_29_Picture_3.jpeg)

## **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<sup>6</sup> 5.  $(-3)^3$ **7**. 5<sup>6</sup> **11.**  $(-6.4)^2$ **9.**  $(-17)^3$ **13**. *b*<sup>13</sup> **15.** You should subtract the exponents instead of dividing them.  $\frac{6^{15}}{6^5} = 6^{15-5} = 6^{10}$ **21.**  $k^{14}$ **17.** 2<sup>9</sup> **19.**  $\pi^8$ **27.**  $x^7 y^6$ **25.**  $125a^3b^2$ **23.** 64*x* **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<sup>13</sup> galaxies **33.** -9 **37.** B **35.** 61

#### 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  $\frac{1}{36}$ **11.**  $\frac{1}{16}$ **13.**  $5\frac{1}{4}$ **15.**  $\frac{1}{125}$ 9. 17. The negative sign goes with the exponent, not the base.  $(4)^{-3} = \frac{1}{4^3} = \frac{1}{64}$ **21.**  $\frac{a^7}{64}$ **19.**  $2^0$ ;  $10^0$ **23.** 5*b* **25.** 12 **27.**  $\frac{w^6}{9}$ **29.** 100 mm **33. a.** 10<sup>-9</sup> m **31.** 1,000,000 nanometers **b.** equal to **35.** Write the power as 1 divided by the power and use a negative exponent. Justifications will vary.
- **37.** 10<sup>9</sup> **39.** 10<sup>4</sup>

## Section 10.5

Section 10.4

### **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
- **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.	<b>a.</b> 810,000,000 platelets	27.	a. Bellatrix
	<b>b.</b> 1,350,000,000,000 platelets		<b>b.</b> Betelgeuse
29.	1555.2 km <sup>2</sup>	31.	35,000,000 km <sup>3</sup>
33.	$4^{5}$	35.	$(-2)^3$

## 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.**  $2.1 \times 10^{-3}$ **5.**  $3.21 \times 10^{8}$ **7.**  $4 \times 10^{-5}$ **9.**  $4.56 \times 10^{10}$ **11.**  $8.4 \times 10^{5}$ **13.** 72.5 is not less than 10. The decimal point needs to move one more place to the left.<br/> $7.25 \times 10^{7}$ **17.**  $4.8 \times 10^{-8}, 4.8 \times 10^{-6}, 4.8 \times 10^{-5}$ **15.**  $6.09 \times 10^{-5}, 6.78 \times 10^{-5}, 6.8 \times 10^{-5}$ **17.**  $4.8 \times 10^{-8}, 4.8 \times 10^{-6}, 4.8 \times 10^{-5}$ **19.**  $6.88 \times 10^{-23}, 5.78 \times 10^{23}, 5.82 \times 10^{23}$ **21.**  $4.01 \times 10^{7}$  m**23.**  $680, 6.8 \times 10^{3}, \frac{68,500}{10}$ **25.**  $6.25 \times 10^{-3}, 6.3\%, 0.625, 6\frac{1}{4}$ **27.**  $1.99 \times 10^{9}$  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

Section 10.7

Section 10.6

**33.** irrational

## **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.	$8.34 imes10^7$	5.	$4.947\times10^{11}$
7.	$5.8 imes10^5$	9.	$5.2 imes10^8$
11.	$7.555  imes 10^7$	13.	$1.037  imes 10^7$

- **15.** You have to rewrite the numbers so they have the same power of 10 before adding;  $3.03 \times 10^9$
- **17.**  $2.9 \times 10^{-3}$ **19.**  $1.5 \times 10^{0}$ **21.**  $2.88 \times 10^{-7}$ **23.**  $1.12 \times 10^{-2}$
- **25.**  $4.006 \times 10^9$  **27.**  $1.962 \times 10^8$  cm
- **29.** First find the total length of the ridges and valleys.
- **31.**  $3 \times 10^8 \text{ m/sec}$
- **33.**  $\frac{1}{8}$
- **35.** C

![](_page_31_Picture_16.jpeg)

# **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*.

angle of rotation, 62 base, 412 center of dilation, 84 center of rotation, 62 concave polygon, 119 congruent figures, 44 convex polygon, 119 corresponding angles, 44 corresponding sides, 44 cube root, 296 dilation, 84 distance formula, 320 exponent, 412 exterior angles, 105 exterior angles of a polygon, 112 function, 245 function rule, 250 hemisphere, 351 hypotenuse, 302 image, 50 indirect measurement, 129 input, 244 interior angles, 105 interior angles of a polygon, 112 irrational number, 310 joint frequency, 388 legs, 302 line of best fit, 381 line of fit, 380 line of reflection, 56 linear equation, 144 linear function, 258 literal equation, 28 mapping diagram, 244 marginal frequency, 388 nonlinear function, 268

output, 244 perfect cube, 296 perfect square, 290 point-slope form, 186 power, 412 Pythagorean Theorem, 302 radical sign, 290 radicand, 290 real numbers, 310 reflection, 56 regular polygon, 121 relation, 244 rise, 150 rotation, 62 run. 150 scale factor, 84 scatter plot, 374 scientific notation, 438 similar figures, 72 similar solids, 356 slope, 150 slope-intercept form, 168 solution of a linear equation, 144 solution of a system of linear equations, 204 sphere, 348 square root, 290 standard form, 174 system of linear equations, 204 theorem, 300 transformation, 50 translation, 50 transversal, 104 two-way table, 388 x-intercept, 168 y-intercept, 168

# **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.

![](_page_34_Picture_2.jpeg)

Addition Property of Equality, 4 Algebra equations graphing linear, 142-147 literal. 28 multi-step, 10-15 rewriting, 26–31 simple, 2–9 with variables on both sides, 18 - 25formulas. See Formulas functions linear, 256-263 nonlinear, 266-271 relations and, 242-247 representing, 245-255 linear equations graphing, 142–147 lines of fit, 378-383 slope of a line, 148–157 slope-intercept form, 166-183 standard form, 172-177 systems of, 202-229 properties, See Properties Angle(s) alternate exterior, 106 alternate interior, 106 corresponding, 104-105 defined, 44 error analysis, 107 exterior defined, 105 error analysis, 115 interior, defined, 105 of polygons, 118–125 defined, 112 error analysis, 123, 124 reading, 120 real-life application, 121 similar, 126-131 of rotation, 62 of triangles, 110-115 exterior, 112 interior, 112 real-life application, 113 similar, 128 Angle of rotation, defined, 62 Area of similar figures, 76-81 formula, 78 writing, 80

### ₿

Bar graphs, 394 **Base,** defined, 412 Box-and-whisker plots, 394

## C

Center of dilation, defined, 84 Center of rotation, defined, 62 Choose Tools, Throughout. For example, see: graphing linear equations, 143 indirect measurement, 127 scientific notation, 447 slope, 154 systems of linear equations, 203 Circle graphs, 394 Common Error linear functions, 259 Pythagorean Theorem, 320 Quotient of Powers Property, 424 scientific notation, 445 transformations rotations, 63 similar figures, 72 Comparison chart, 264 Concave polygon, defined, 119 Cone(s) volume of, 340-345 error analysis, 344 formula, 342 real-life application, 343 writing, 344 **Congruent figures,** 42–47 corresponding angles, 44 corresponding sides, 44 defined, 44 error analysis, 47 identifying, 44 naming parts, 44 reading, 44 Connections to math strands, Throughout. For example, see: Algebra, 305 Geometry, 24, 25, 75, 81, 109, 125, 131, 147, 156, 157, 293, 299, 453 Convex polygon, defined, 119

Coordinate plane(s) transformations in the dilations, 82–89 reflections, 55-59 rotations, 61-67 translations, 49-53 **Corresponding angles** defined, 44 naming, 44 symbol, 44 **Corresponding sides** defined, 44 error analysis, 47 naming, 44 symbol, 44 Critical Thinking, Throughout. For *example*, *see*: angle measures, 109 cube roots, 299 equations multi-step, 15 simple, 9 exponents, 415 Product of Powers Property, 420, 421 Quotient of Powers Property, 427 zero, 432 linear equations, 170 graphing, 171, 177 in slope-intercept form, 171, 183 solving systems of, 207, 223 in standard form, 177 writing, 183 proportional relationships, 163 scientific notation, 441, 453 similar triangles, 131 slope, 153, 154, 155 slope-intercept form, 170 solids, 339 square roots, 292 transformations congruent figures, 47 dilations, 89 reflections, 59 rotations, 67 similar figures, 74, 75 volume of cones. 345 of cylinders, 339

Cube root(s) defined, 296 finding, 294–299 real-life application, 297 perfect cube, 296 Cylinder(s) volume of, 334–339 formula, 336 modeling, 339 real-life application, 337

## D

Data, See also Equations; Graphs analyzing line of best fit, 381 writing, 382 displaying bar graph, 394 box-and-whisker plot, 394 choosing a display, 392-399 circle graph, 394 dot plot, 394 histogram, 394 line graph, 394 pictograph, 394 project, 393 scatter plot, 372–377, 394 stem-and-leaf plot, 394 two-way table, 386–391 writing, 398 identifying relationships, 375 linear, 375 negative, 375 nonlinear, 375 positive, 375 joint frequencies, 388 marginal frequencies, 388 misleading displays, 396 Decimal(s) repeating, 316–317 Different Words, Same Question, Throughout. For example, see: angles of polygons, 123 exponents, 432 functions, 253 rotations. 65 solving equations, 30 triangles, 304 volume of cylinders, 338 **Dilation(s)**, 82–89 center of. 84 in the coordinate plane, 82-89 defined. 84 error analysis, 88 scale factor, 84

Direct variation, *See also* Proportional relationships **Distance formula**, 319–323 defined, 320 error analysis, 322 real-life application, 321 Distributive Property equations with variables on both sides, 20 multi-step equations, 13 Division Property of Equality, 5 Dot plots, 394

## Ε

Equality Addition Property of, 4 Division Property of, 5 Multiplication Property of, 5 Subtraction Property of, 4 Equation(s), *See also* Linear equations function rules, 250 literal, 28 multi-step, 10–15 error analysis, 14 real-life application, 13 rewriting, 26–31 error analysis, 30 real-life application, 29 simple, 2–9 error analysis, 8 modeling, 8 real-life application, 6 solving by addition, 4 by division, 5 by multiplication, 5 multi-step, 10–15 by rewriting, 26–31 simple, 2–9 by subtraction, 4 two-step, 12 with variables on both sides, 18 - 25with variables on both sides, 18 - 25error analysis, 23, 24 real-life application, 22 writing, 23 Error Analysis, Throughout. For *example*, *see*: angles corresponding, 107 exterior, 115 of polygons, 123, 124 congruent figures, 47

corresponding sides, 47 distance formula, 322 equations multi-step, 14 rewriting, 30 simple, 8 with variables on both sides, 23.24 exponents evaluating expressions, 414 negative, 432 functions graphing, 254 relations and, 246 linear equations graphing, 146 in slope-intercept form, 170, 182 solving systems of, 207, 213, 228 in standard form, 176 parallel lines, 107 powers Product of Powers Property, 420 Quotient of Powers Property, 426 Pythagorean Theorem, 304, 322 relations, 246 scientific notation operations in, 452 writing numbers in, 446 writing in standard form, 440 slope, 154 square roots, 313 finding, 292 systems of linear equations solving by elimination, 221, 222 solving by graphing, 207 solving special, 228 solving by substitution, 213 transformations dilations, 88 triangles exterior angles of, 115 Pythagorean Theorem, 304 volume of cones, 344 of similar solids, 360 Example and non-example chart, 116 Exponent(s) defined, 412 evaluating expressions, 410–415 error analysis, 414 real-life application, 413

negative, 428–433 defined, 430 error analysis, 432 real-life application, 431 writing, 432 powers and, 410-421 error analysis, 420, 426 real-life application, 425 writing, 426 properties of Power of a Power Property, 418 Power of a Product Property, 418 Product of Powers Property, 416-421 Quotient of Powers Property, 422-427 quotients and, 422-427 scientific notation defined, 438 error analysis, 440, 446, 452 operations in, 448–453 project, 453 reading numbers in, 436-441 real-life applications, 439, 445,451 writing numbers in, 442–447 zero, 428-433 defined, 430 Expressions evaluating exponential, 410-415 error analysis, 414 real-life application, 413 Exterior angle(s) alternate, 106 angle sum of, 122 real-life application, 121 defined, 105, 112 of triangles, 110-115 error analysis, 115 Exterior angles of a polygon, defined. 112

#### F

Formula(s) area of similar figures, 78 distance, 320 perimeter of similar figures, 78 Pythagorean Theorem, 302 rewriting, 26–31 slope, 148, 150 surface area of similar solids, 357 temperature conversion, 29

volume of a cone, 342 of a cylinder, 336 of a hemisphere, 351 of similar solids, 358 of a sphere, 350 Formula triangle, 346 Four square, 306 Fraction(s) repeating decimals written as, 316-317 Function(s) defined, 245 function rules defined, 250 real-life application, 252 writing, 250–255 linear, 256-263 compared to nonlinear, 266 - 271defined, 258 modeling, 271 real-life applications, 259, 269 writing, 261 nonlinear compared to linear, 266-271 defined, 268 real-life application, 269 relations and, 242-247 error analysis, 246 inputs, 244 mapping diagrams, 242–247 outputs, 244 research, 247 representing error analysis, 254 with graphs, 248–255 with input-output tables, 248-255 with mapping diagrams, 245-247, 252 real-life application, 252 writing, 253 Function rule(s) defined, 250 real-life application, 252 writing, 250-255

#### G

Geometry angles, 102–115, 118–131 corresponding, 44 exterior, 105, 112 interior, 105, 112 of polygons, 118–125 of rotation, 62

area of similar figures, 76-81 line of reflection, 56 parallel lines, 102-109 perimeter of similar figures, 76-81 polygons angles of, 118-125 concave, 119 convex, 119 Pythagorean Theorem, 300-305 converse of, 320 defined, 302 using, 318–323 sides, corresponding, 44 solids cones, 340–345 cylinders, 334-339 similar, 354–361 spheres, 348-353 surface area of, 354-361 volume of, 334–345, 348–361, 354-361 tessellation, 48-49 transformations congruent figures, 42-47 dilations, 82-89 reflections, 54-59 rotations, 60-67 similar figures, 70-81 translations, 48-53 transversals, 102-109 triangles angles of, 110–115 congruent, 42-44 hypotenuse, 302 legs, 302 right, 302 similar, 126–131 Graphic Organizers comparison chart, 264 example and non-example chart, 116 formula triangle, 346 four square, 306 information frame, 384 information wheel, 434 notetaking organizer, 214 process diagram, 164 summary triangle, 68 Y chart, 16 Graphs analyzing, 272-277 bar graphs, 394 box-and-whisker plots, 394 circle graphs, 394 dot plots, 394 of functions, 248-255 error analysis, 254

histograms, 394 line graphs, 394 linear, 142–147 defined, 144 error analysis, 146 of horizontal lines, 144 real-life application, 145 in slope-intercept form, 166 - 171solution of, 144 in standard form, 172-177 of vertical lines, 144 misleading, 396 pictographs, 394 proportional relationships, 158 - 163scatter plots, 372-377, 394 sketching, 272–277 slope, 148–157 defined, 148, 150 error analysis, 154 formula, 148, 150 reading, 150 stem-and-leaf plots, 394 used to solve linear equations, 230-231 real-life application, 231 used to solve systems of linear equations, 202-207 error analysis, 207 modeling, 207 real-life application, 205

## ß

Hemisphere(s) defined, 351 volume formula, 351 Histograms, 394 Hypotenuse, defined, 302

![](_page_37_Picture_3.jpeg)

Image(s) defined, 50 reading, 50 Indirect measurement, 127–129 defined, 129 modeling, 127 project, 127 Information frame, 384 Information wheel, 434 Input(s), defined, 244 Input-output tables using to represent functions, 248–255 Interior angle(s) alternate, 106 defined, 105, 112 of triangles, 110–115 real-life application, 113 Interior angles of a polygon, defined, 112 Irrational number(s), defined, 310

![](_page_37_Picture_6.jpeg)

Joint frequency, defined, 388

![](_page_37_Picture_8.jpeg)

Leg(s), defined, 302 Like terms, combining to solve equations, 12 Line(s) graphing horizontal, 144 vertical. 144 parallel, 102–109 defined, 104 error analysis, 107 project, 108 slope of, 156 symbol, 104 perpendicular defined, 104 slope of, 157 symbol, 104 of reflection, 56 slope of, 148–157 transversals, 102–109 x-intercept of, 168 *v*-intercept of, 168 Line of best fit, defined, 381 Line of fit, 378–383 defined. 380 line of best fit, 381 modeling, 378, 379, 383 writing, 382 Line graphs, 394 Line of reflection, defined, 56 Linear equation(s), See also Equations, Proportional relationships defined, 144 graphing, 142–147 error analysis, 146 horizontal lines, 144 real-life applications, 145, 175, 231 in slope-intercept form, 166 - 171to solve, 230-231

in standard form, 172–177 vertical lines, 144 lines of fit, 378–383 modeling, 378, 379, 383 point-slope form defined, 186 real-life application, 187 writing, 188 writing in, 184–189 slope of a line, 148–157 defined, 148, 150 error analysis, 154 formula, 148, 150 reading, 150 slope-intercept form defined, 168 error analysis, 170, 182 real-life applications, 169, 181 writing in, 178–183 x-intercept, 168 *v*-intercept, 168 solution of, 144 standard form, 172-177 defined, 174 error analysis, 176 modeling, 177 real-life application, 175 writing, 176 systems of defined, 202, 204 error analysis, 207, 213, 221, 222, 228 modeling, 207 reading, 204 real-life applications, 205, 211, 220 solution of a, 204 solving by elimination, 216-223 solving by graphing, 202–207 solving special, 224-229 solving by substitution, 208-213 writing, 206, 212, 221, 228 Linear function(s), 256–263 compared to nonlinear, 266-271 real-life application, 269 defined, 258 modeling, 271 real-life application, 259 writing, 261 Linear measures, 357 Literal equation(s), defined, 28 Logic, Throughout. For example, see: angles interior, 110 measures, 108

cube roots, 299 equations rewriting, 31 simple, 9 linear equations graphing, 142, 177 in slope-intercept form, 167 solving systems of, 217, 223, 229 scatter plots, 376 systems of linear equations, 217, 223, 229 transformations similar figures, 75

#### M

Mapping diagram(s), 242-247 defined. 244 Marginal frequency, defined, 388 Meaning of a Word dilate. 82 reflection, 54 rotate, 60 translate, 48 transverse, 102 Mental Math, Throughout. For example, see: rotations, 65 Modeling, Throughout. For example, see: equations, 8 indirect measurement, 127 linear equations lines of fit, 378, 379, 383 solving systems of, 207 in standard form, 177 linear functions, 271 Pythagorean Theorem, 300 volume of a cylinder, 339 Multiplication Property of Equality, 5

## N

Nonlinear function(s) compared to linear, 266–271 real-life application, 269 defined, 268 Notetaking organizer, 214 Number(s) irrational, 310–315 defined, 310 real, 310–315 classifying, 310 defined, 310 Number Sense, Throughout. For *example*, *see*: analyzing data, 382 angles exterior, 114 of a polygon, 123 cube roots, 299 exponents, 414, 427, 432 functions, 271 real numbers, 315 scientific notation, 441, 452 similar solids surface area of, 359 volume of, 359 square roots, 292 systems of linear equations solving by elimination, 221 solving by substitution, 212, 213 transformations reflections, 59 similar figures, 80

## 0

Open-Ended, Throughout. For example, see: data histograms, 397 misleading displays, 397 scatter plots, 377 two-way tables, 390 dilations, 89 equations linear, 170 multi-step, 14 simple, 9 with variables on both sides, 23, 24 exponents, 433 parallel lines, 107 similar solids, 359 similar triangles, 131 slope, 153 square roots, 315 Output(s), defined, 244

## P

Parallel line(s) defined, 104 slope of, 156 symbol, 104 and transversals, 102–109 error analysis, 107 project, 108 **Perfect cube,** defined, 296 Perfect square, defined, 290 Perimeter of similar figures, 76-81 formula, 78 writing, 80 Perpendicular line(s) defined, 104 slope of, 157 symbol, 104 Pictographs, 394 **Point-slope form** defined, 186 writing equations in, 184-189 real-life application, 187 writing, 188 Polygon(s) angles, 118-125 error analysis, 123, 124 exterior, 112 interior, 112 measures of interior, 120 real-life application, 121 sum of exterior, 122 concave, 119 convex, 119 defined, 120 reading, 120 regular, 121 triangles, 110–115 error analysis, 115 modeling, 127 project, 127 similar, 126–131 writing, 130 **Power(s)**, *See also* Exponents base of, 412 defined, 412 exponent of, 412 of a power, 418 of a product, 418 product of, 416–421 error analysis, 420 Product of Powers Property, 418 quotient of, 422-427 error analysis, 426 Quotient of Powers Property, 424 real-life application, 425 writing, 426 scientific notation defined, 438 error analysis, 440, 446, 452 operations in, 448-453 project, 453 reading numbers in, 436-441 real-life applications, 439, 445, 451 writing numbers in, 442-447

Power of a Power Property, 418 Power of a Product Property, 418 Precision, Throughout. For example, see: analyzing data, 391 angles of a triangle, 115 equations with variables on both sides, 24, 25 exponents, 433 functions, 246 indirect measurement, 127 linear equations graphing, 142, 146 in slope-intercept form, 182 Product of Powers Property, 420 Pythagorean Theorem, 305 relations, 246 similar solids, 361 square roots, 293 systems of linear equations, 229 transformations rotations, 61 translations, 49 Problem Solving, Throughout. For example, see: angles of a polygon, 124 area and perimeter, 81 data displays, 377 equations with variables on both sides, 25 linear equations graphing, 147 in point-slope form, 189 solving systems of, 223 linear functions, 263 proportional relationships, 163 Pythagorean Theorem, 301 scatter plots, 377 solids, 339 transformations dilations, 89 translations, 53 volume of a cylinder, 339 Process diagram, 164 Product of Powers Property, 416-421 defined, 418 error analysis, 420 Properties Addition Property of Equality, 4 **Division Property of Equality**, 5 Multiplication Property of Equality, 5 Power of a Power Property, 418 Power of a Product Property, 418 Product of Powers Property, 416-421

Quotient of Powers Property, 422-427 Subtraction Property of Equality, 4 Proportional relationships direct variation, 160 graphing, 158–163 Proportions similar figures, 70–81 Pythagorean Theorem, 300–305 converse of, 320 defined, 302 error analysis, 304 modeling, 300 project, 305 real-life applications, 303, 321 using, 318-323 distance formula, 320 error analysis, 322 writing, 322

## Q

Quotient of Powers Property, 422–427 defined, 424 error analysis, 426 real-life application, 425 writing, 426

## R

Radical sign, defined, 290 Radicand, defined, 290 Ratio similar figures areas of, 78 perimeters of, 78 Rational number(s), defined, 310 Reading images, 50 polygons, 120 slope, 150 symbol congruent, 44 prime, 50 similar, 72 systems of linear equations, 204 **Real number(s),** 310–315 classifying, 310 defined, 310 error analysis, 313 Real-Life Applications, *Throughout*. *For example, see:* angles of triangles, 113 cube roots, 297 distance formula, 321

equations multi-step, 13 rewriting, 29 simple, 6 with variables on both sides, 22 exponents evaluating expressions, 413 negative, 431 Quotient of Powers Property, 425 functions graphing, 252 linear, 259 interior angles of a polygon, 121 linear equations graphing, 145 in point-slope form, 187 in slope-intercept form, 169, 181 solving systems of, 205, 211, 220 solving using graphs, 231 in standard form, 175 writing, 181 linear functions, 269 nonlinear functions, 269 Pythagorean Theorem, 303, 321 scientific notation operations in, 451 reading numbers in, 439 writing numbers in, 445 similar figures, 73 square roots approximating, 312 finding, 291 systems of linear equations, 205 solving by elimination, 220 solving by substitution, 211 volume of cones, 343 of cylinders, 337 Reasoning, Throughout. For example, see: analyzing graphs, 277 angle measures, 108, 115, 124 congruent figures, 47 cube roots, 295, 298 data analyzing, 387 displaying, 397, 399 scatter plots, 376, 377 two-way tables, 387, 391 distance formula, 323 equations rewriting, 31 simple, 9

exponents, 433 exterior angles of polygons, 124 functions graphing, 255 linear, 263 indirect measurement, 130 linear equations in point-slope form, 189 in slope-intercept form, 171 lines of fit, 382, 383 perfect squares, 293 Product of Powers Property, 420 proportional relationships, 162, 163 Pythagorean Theorem, 323 scientific notation operations in, 448 reading numbers in, 441 writing numbers in, 446, 447 slope, 153, 155 square roots, 292 systems of linear equations solving by elimination, 222, 223 solving by graphing, 207 solving special, 228, 229 solving by substitution, 212 transformations congruent figures, 59 dilations, 87, 89 reflections, 58, 59 rotations, 67 similar figures, 75, 81 translations, 53 triangles exterior angles of, 115 similar, 126, 130, 131 volume of cones, 344, 345 of cylinders, 338, 353 of spheres, 353 Reflection(s), 54–59 in the coordinate plane, 55-59 defined, 56 line of, 56 writing, 58 Regular polygon(s), defined, 121 Relation(s) defined. 244 functions and, 242-247 error analysis, 246 research, 247 inputs, 244 mapping diagrams, 242-247 defined, 244 outputs, 244

Repeated Reasoning, Throughout. For example, see: cube roots, 314 equations, 31 exponents, 410 negative, 429 zero, 428 inputs and outputs, 247 polygons angles of, 111, 118, 119 repeating decimals, 316, 317 similar solids surface area of, 355 volume of, 355, 361 slope, 149 systems of linear equations, 213 **Repeating decimals** writing as fractions, 316-317 Rise, defined, 150 Rotation(s), 60-67 angle of, 62 center of, 62 in the coordinate plane, 61-67 defined. 62 rotational symmetry, 66 Run, defined, 150

S

Scale factor, defined, 84 Scatter plot(s), 372–379, 394 defined, 374 identifying relationships, 375 linear, 375 negative, 375 nonlinear, 375 positive, 375 interpreting, 374-375 line of best fit, 381 lines of fit, 378-383 defined, 380 modeling, 378, 379, 383 writing, 382 Scientific notation defined, 438 operations in, 448–453 error analysis, 452 real-life application, 451 writing, 452 project, 453 reading numbers in, 436-441 real-life application, 439 writing, 440 writing numbers in, 442-447 error analysis, 440, 446 real-life application, 445

standard form, 438-439 writing, 446 Side(s) corresponding, defined, 44 Similar figures, 70–81 areas of, 76-81 formula, 78 writing, 80 defined, 72 perimeters of, 76-81 formula, 78 writing, 80 reading, 72 real-life application, 73 Similar solids defined, 356 surface area of, 354-361 linear measures, 357 volume of, 354-361 error analysis, 360 formula, 358 Slope, 148–157 defined, 148, 150 error analysis, 154 formula, 148, 150 negative, 152 and parallel lines, 156 and perpendicular lines, 157 positive, 152 project, 154 reading, 150 rise, 150 run. 150 undefined, 152 zero, 152 Slope-intercept form, 166–171 defined. 168 graphing equations in, 166–171 error analysis, 170 real-life application, 169 writing equations in, 178–183 error analysis, 182 real-life application, 181 writing, 182 x-intercept, 168 y-intercept, 168 Solids cones real-life application, 343 volume of, 340-345 writing, 344 cylinders modeling, 339 real-life application, 337 volume of, 334–339 hemispheres, 351 volume of, 351

similar defined, 356 error analysis, 360 linear measures, 357 volume of, 354-361 spheres volume of, 348-353 surface area of, 354-361 formula, 357 volume of, 334-345, 348-361 error analysis, 344 real-life applications, 337, 343 Solution of a linear equation, defined, 144 Solution of a system of linear equations, defined, 204 Sphere(s) defined, 348 volume of, 348-353 formula, 350 Square root(s) approximating, 308–315 real-life application, 312 writing, 314 defined, 290 error analysis, 313 finding, 288–293 error analysis, 292 real-life application, 291 perfect square, 290 radical sign, 290 radicand, 290 Standard form of a linear equation defined, 174 graphing equations in, 172–177 error analysis, 176 modeling, 177 real-life application, 175 writing, 176 Standard form of a number scientific notation and, 438-439 Stem-and-leaf plots, 394 Structure, Throughout. For example, see: angles of a polygon, 110, 119 data displays, 399 distance formula, 323 equations, 3 exponents, 414, 429 linear equations solving using graphs, 230 linear functions, 261 Pythagorean Theorem, 323 real numbers, 315 repeating decimals, 316 scientific notation, 448 slope, 155

square roots, 308, 315 systems of linear equations, 213, 217 transformations dilations, 88, 89 similar figures, 81 volume of solids, 345 Study Tip analyzing graphs, 274 angles alternate exterior, 106 alternate interior, 106 corresponding, 104 exterior, 113 direct variation, 160 equations, 13 exponents, 418 Quotient of Powers Property, 425 linear equations, 168, 231, 268 line of best fit, 381 line of fit, 380 in point-slope form, 187 in slope-intercept form, 168 in standard form, 174 system of, 205 writing, 180, 187 powers, 412 proportional relationships, 160 Pythagorean triples, 320 real numbers, 310 right triangles, 302 scientific notation, 438, 444, 450 in standard form, 450 slope, 150, 151, 160 solids, 351 cones, 342 similar solids, 358 square roots approximating, 311 of zero, 290 systems of linear equations, 205, 211, 218, 219, 226 transformations dilations, 85 rotations, 62, 63 transversals, 104, 106 volume of cones, 342 of cylinders, 336 Substitution to solve systems of linear equations, 208-213 Subtraction Property of Equality, 4 Summary triangle, 68 Surface area of similar solids, 354-361 formula, 357 linear measures, 357

Symbols congruent, 44 parallel lines, 104 perpendicular lines, 104 prime, 50 similar, 72 square root, 290 Symmetry, rotational, 66 System of linear equations defined, 202, 204 reading, 204 solution of a defined, 204 solving by elimination, 216-223 error analysis, 221, 222 real-life application, 220 writing, 221 solving by graphing, 202–207 error analysis, 207 modeling, 207 real-life application, 205 writing, 206 solving special, 224-229 error analysis, 228 infinitely many solutions, 226 no solution, 226 one solution, 226 writing, 228 solving by substitution, 208-213 error analysis, 213 real-life application, 211 writing, 212

Т

Theorem, defined, 300 Transformation(s) congruent figures, 42-47 corresponding angles of, 44 corresponding sides of, 44 defined, 44 error analysis, 47 identifying, 44 reading, 44 defined, 50 dilations, 82-89 center of, 84 in the coordinate plane, 82-89 defined, 84 error analysis, 88 scale factor, 84 image, 50 reflections, 54-59 in the coordinate plane, 55-57 defined, 56 line of, 56 writing, 58

rotations, 60–67 angle of, 62 center of, 62 in the coordinate plane, 61-67 defined, 62 rotational symmetry, 66 similar figures, 70–81 areas of, 76-81 defined, 72 perimeters of, 76-81 reading, 72 real-life application, 73 writing, 80 tessellations, 48-49 translations, 48–53 in the coordinate plane, 50 defined, 50 writing, 52 Translation(s), 48–53 in the coordinate plane, 49-53 defined, 50 tessellations, 48-49 writing, 52 Transversal(s), 102-109 alternate exterior angles and, 106 alternate interior angles and, 106 corresponding angles and, 104 defined, 104 exterior angles and, 105 interior angles and, 105 Triangle(s) angles of, 110-115 error analysis, 115 exterior, 112 interior, 112 real-life application, 113 congruent, 42-44 Pythagorean Theorem, 300-305 defined, 302 error analysis, 304, 322 project, 305 real-life applications, 303, 321 using, 318–323 right hypotenuse, 302 legs, 302

similar, 126–131 angles of, 128 modeling, 127 project, 127 writing, 130 **Two-way table(s),** 386–391 defined, 388 joint frequencies, 388 marginal frequencies, 388

## V

Volume of composite solids, 351 of cones, 340–345 error analysis, 344 formula, 342 real-life application, 343 writing, 344 of cylinders, 334–339 modeling, 339 real-life application, 337 of similar solids, 354–361 error analysis, 360 formula, 358 of spheres, 348–353 formula, 350

## W

Which One Doesn't Belong?, *Throughout. For example, see:* angle measures, 107 corresponding angles, 46 equations linear, 146 simple, 7 exponents, 414 functions, 270 polygons, 123 powers, 426 Pythagorean Theorem, 322 scientific notation, 440 similar triangles, 130

square roots, 313 systems of linear equations, 221 transformations congruent figures, 46 reflections, 58 volume of solids, 352 Writing, Throughout. For example, displaying data, 398 equations multi-step, 14 with variables on both sides, 23 exponents, 432 functions linear, 261 representing, 253 linear equations in point-slope form, 188 in standard form, 176 lines of fit, 382 powers, 426 Pythagorean Theorem, 322 scientific notation, 440, 446, 452 similar triangles, 130 square roots, 313, 314 systems of linear equations, 206 solving by elimination, 221 solving by graphing, 206 solving special, 228 solving by substitution, 212 transformations reflections, 58 similar figures, 80 translations, 52 volume of solids, 344

![](_page_42_Picture_7.jpeg)

x-intercept, defined, 168

![](_page_42_Picture_9.jpeg)

Y chart, 16 *y*-intercept, defined, 168

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## **Common Core State Standards**

## Kindergarten

Counting and Cardinality	<ul> <li>Count to 100 by Ones and Tens; Compare Numbers</li> </ul>
Operations and Algebraic Thinking	<ul> <li>Understand and Model Addition and Subtraction</li> </ul>
Number and Operations in Base Ten	<ul> <li>Work with Numbers 11–19 to Gain Foundations for Place Value</li> </ul>
Measurement and Data	<ul> <li>Describe and Compare Measurable Attributes;</li> <li>Classify Objects into Categories</li> </ul>
Geometry	<ul> <li>Identify and Describe Shapes</li> </ul>
Grade 1	
Operations and Algebraic Thinking	<ul> <li>Represent and Solve Addition and Subtraction Problems</li> </ul>
Number and Operations in Base Ten	<ul> <li>Understand Place Value for Two-Digit Numbers;</li> <li>Use Place Value and Properties to Add and Subtract</li> </ul>
Measurement and Data	<ul> <li>Measure Lengths Indirectly; Write and Tell Time; Represent and Interpret Data</li> </ul>
Geometry	<ul> <li>Draw Shapes; Partition Circles and Rectangles into Two and Four Equal Shares</li> </ul>
Grade 2	
Operations and Algebraic Thinking	<ul> <li>Solve One- and Two-Step Problems Involving Addition and Subtraction; Build a Foundation for Multiplication</li> </ul>
Number and Operations in Base Ten	<ul> <li>Understand Place Value for Three-Digit Numbers;</li> <li>Use Place Value and Properties to Add and Subtract</li> </ul>
Measurement and Data	<ul> <li>Measure and Estimate Lengths in Standard Units;</li> <li>Work with Time and Money</li> </ul>
Geometry	<ul> <li>Draw and Identify Shapes; Partition Circles and Rectangles into Two, Three, and Four Equal Shares</li> </ul>

## Grade 3

Operations and Algebraic Thinking

Number and Operations in Base Ten

Number and Operations— Fractions

**Measurement and Data** 

- Represent and Solve Problems Involving Multiplication and Division; Solve Two-Step Problems Involving Four Operations
- Round Whole Numbers; Add, Subtract, and Multiply Multi-Digit Whole Numbers
- Understand Fractions as Numbers
- Solve Time, Liquid Volume, and Mass Problems; Understand Perimeter and Area
- Reason with Shapes and Their Attributes

Geometry

## Grade 4

Operations and Algebraic Thinking

Number and Operations in Base Ten

Number and Operations— Fractions

Measurement and Data

## Geometry

## Grade 5

Operations and Algebraic Thinking

Number and Operations in Base Ten

Number and Operations— Fractions

Measurement and Data

Geometry

- Use the Four Operations with Whole Numbers to Solve Problems; Understand Factors and Multiples
- Generalize Place Value Understanding; Perform Multi-Digit Arithmetic
- Build Fractions from Unit Fractions; Understand Decimal Notation for Fractions
- Convert Measurements; Understand and Measure Angles
- Draw and Identify Lines and Angles; Classify Shapes
- Write and Interpret Numerical Expressions
- Perform Operations with Multi-Digit Numbers and Decimals to Hundredths
- Add, Subtract, Multiply, and Divide Fractions
- Convert Measurements within a Measurement System; Understand Volume
- 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  $\approx$  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  $\approx$  7.5 gallons

#### Metric

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

## **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 + aca(b - c) = ab - ac

#### **U.S.** Customary to Metric

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

1 centimeter  $\approx 0.39$  inch 1 meter  $\approx 3.28$  feet 1 kilometer  $\approx 0.62$  mile 1 liter  $\approx 1.06$  quarts 1 liter  $\approx 0.26$  gallon 1 kilogram  $\approx 2.2$  pounds 1 gram  $\approx 0.035$  ounce 1 cubic meter  $\approx 264$  gallons

#### **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:  $\frac{a^m}{a^n} = a^{m-n}, a \neq 0$ Power of a Power Property:  $(a^m)^n = a^{mn}$ 

## Slope

![](_page_51_Figure_3.jpeg)

## **Equations of Lines**

Slope-intercept form y = mx + bStandard form  $ax + by = c, a, b \neq 0$ Point-slope form  $y - y_1 = m(x - x_1)$ 

#### Volume

![](_page_51_Figure_7.jpeg)

![](_page_51_Figure_8.jpeg)

![](_page_51_Figure_9.jpeg)

Cone

#### Sphere

![](_page_51_Figure_11.jpeg)

Power of a Product Property:  $(ab)^m = a^m b^m$ Zero Exponents:  $a^0 = 1, a \neq 0$ Negative Exponents:  $a^{-n} = \frac{1}{a^n}, a \neq 0$ 

## **Pythagorean Theorem**

![](_page_51_Figure_14.jpeg)

#### 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**

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

![](_page_51_Figure_19.jpeg)

Angles of Polygons Interior Angle Measures of a Triangle

![](_page_51_Figure_21.jpeg)

#### Interior Angle Measures of a Polygon

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

#### **Exterior Angle Measures of a Polygon**

![](_page_51_Figure_25.jpeg)