

Student Journal Answers

Chapter 1

Review & Refresh

1. $14x$
2. $-11b - 4$
3. $90 - 15g$
4. $2y - 42$
5. $5m + 48$
6. $13a - 2$
7. $1.5p + 3p + 2.5p; 7p$
8. -4
9. -12
10. -8
11. -8
12. 7
13. -7
14. 6
15. -12
16. 58°F

1.1 Exploration

Exploration 1

- a.** Addition Property of Equality: Adding the same number to each side of an equation produces an equivalent equation.
Subtraction Property of Equality: Subtracting the same number from each side of an equation produces an equivalent equation.
Multiplication Property of Equality: Multiplying each side of an equation by the same number produces an equivalent equation.
Division Property of Equality: Dividing each side of an equation by the same number produces an equivalent equation.
- b.** Subtraction Property of Equality; $x = -10$;
Subtract 8 from each side of the equation
 $x + 8 = -2$.
Addition Property of Equality; $x = 5$; Add 11 to each side of the equation $x - 11 = -6$.
Division Property of Equality; $x = -8$; Divide each side of the equation $-2x = 16$ by -2 .
- c.** Check students' work.

1.1 Practice

1. $h = 26\pi$
2. $p = -\frac{1}{4}$
3. $c = -2.8$
4. $p - 9.75 = 64$; \$73.75
5. $j = 10$
6. $t = -4$
7. $q = -3$
8. $4.5\ell = 55.8$; 12.4 in.
9. $r = 22$
10. $n = \frac{49}{12}$

11. *Sample answer:* $x + 15 = 10$; $3x = -15$
12. 40 pieces of fruit
13. **a.** \$4, \$12, \$24
b. *Sample answer:* Each person bought a different number of tickets.
14. \$16

1.2 Exploration

Exploration 1

- a.** $36^\circ, 36^\circ, 108^\circ$; $q + q + 3q = 180$, $q = 36$
- b.** $42.5^\circ, 85^\circ, 52.5^\circ$; $m + 2m + (m + 10) = 180$,
 $m = 42.5$
- c.** $55^\circ, 65^\circ, 60^\circ$; $x + (x + 10) + (x + 5) = 180$,
 $x = 55$
- d.** $60^\circ, 30^\circ, 90^\circ$; $y + (y - 30) + 90 = 180$, $y = 60$
- e.** Triangle with angles t, x, x : $45^\circ, 45^\circ, 90^\circ$;
 $t = 90$; $x + x + t = 180$; $x = 45$
Triangle with angles n, n, n : $60^\circ, 60^\circ, 60^\circ$;
 $n + n + n = 180$; $n = 60$
Triangle with angles p, p, m : $75^\circ, 75^\circ, 30^\circ$;
 $x + n + p = 180$; $p = 75$; $p + p + m = 180$; $m = 30$
Triangle with angles s, k, m : $15^\circ, 135^\circ, 30^\circ$;
 $p + s = 90$; $s = 15$; $s + k + m = 180$; $k = 135$
Triangle with angles $(t + 5), n, w$: $25^\circ, 60^\circ, 95^\circ$;
 $w + n + (t + 5) = 180$; $w = 25$
Triangle with angles p, y, f : $75^\circ, 65^\circ, 40^\circ$;
 $w + f = 90$; $f = 65$; $p + f + y = 180$; $y = 40$

1.2 Practice

1. $p = -14$
2. $x = 2$
3. $h = 9$
4. $x = -3$
5. $44 + (x + 20) + 3x = 180$; $x = 29$
6. **a.** 42 ft
b. $x + 3x + 2x = 42$; $x = 7$
c. 50 ft by 7 ft, 50 ft by 21 ft, 50 ft by 14 ft
7. \$58.40
8. $18 + x + (4x - 1) = 42$; 19 in.
9. $4x + 2.5 = 14.30$; \$2.95
10. 120 samples

1.3 Exploration

Exploration 1

- a. blue figure: $x = 6$; $2x + 6 = 3x$, $x = 6$
 yellow figure: not possible; $2x + 4 = 2x$, $4 \neq 0$
 orange figure: $x = 6$; $2x + 8 = 3x + 2$, $x = 6$
- b. green prism: $y = 8$; $24y + 64 = 32y$, $y = 8$
 blue prism: not possible; $16y + 32 = 16y$, $32 \neq 0$
- c. *Sample answer:* The equations have variables on both sides of the equal sign; To solve, collect the variable terms on one side of the equation and the constant terms on the other side.

1.3 Practice

- $x = 15$
- $x = 8$
- $m = 21$
- $s = 3$
- $15 + 0.25t = 20 + 0.05t$; 25 texts
- The solver did not distribute 0.2 to both terms.
 $0.4x = 0.2(x - 8)$
 $0.4x = 0.2x - 1.6$
 $0.2x = -1.6$
 $x = -8$
- no solution
- infinitely many solutions
- $0.6p = 0.8(p - 40)$; \$160
- 10 months

1.4 Exploration

Exploration 1

- a. parallelogram: $h = \frac{A}{b}$; Divide each side of the equation $A = bh$ by b .
 rectangular prism: $h = \frac{V}{\ell w}$; Divide each side of the equation $V = \ell wh$ by ℓw .
 triangle: $h = \frac{2A}{b}$; Multiply each side of the equation $A = \frac{1}{2}bh$ by $\frac{2}{b}$.
- b. rectangle: $\ell = \frac{P - 2w}{2}$; Subtract $2w$ from each side of the equation $P = 2\ell + 2w$. Then divide each side by 2. rectangular prism: $\ell = \frac{S - 2wh}{2w + 2h}$;
 Subtract $2wh$ from each side of the equation $S = 2\ell w + 2\ell h + 2wh$. Factor out ℓ from each term on the right side. Divide each side of the equation by $(2w + 2h)$.

- c. parallelogram: $h = 7$ m; rectangle: $\ell = 5.5$ in.; triangle: $h = 8$ in.; orange rectangular prism: $\ell = 6$ m; yellow rectangular prism: $h = 5$ in.

1.4 Practice

- $y = 8 + 12x$
- $y = -3.6 + 3x$
- a. $w = \frac{v}{\ell h}$
- $h = \frac{S}{2\pi r} - \frac{r}{2}$
- a. $C = \frac{5}{9}(F - 32)$
- a. $m = \frac{360A}{\pi r^2}$
- a. $P = \frac{I}{rt}$

b.

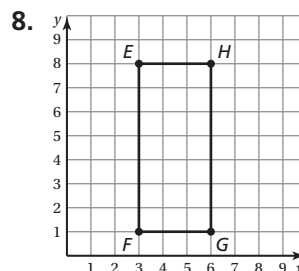
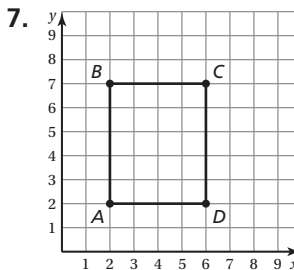
I	\$135
P	\$750
r	6%
t	3 years

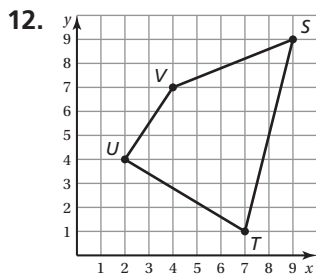
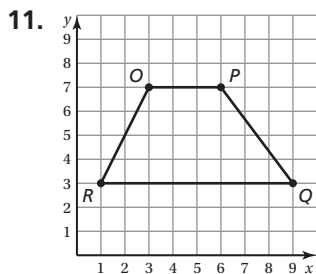
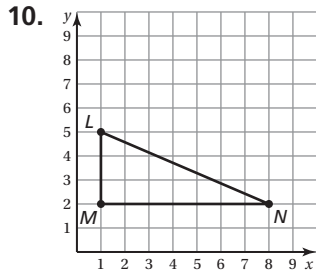
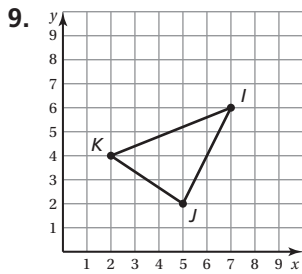
- b. 7 ft
- b. $P = \frac{2A}{a}$
- b. 100°C
- b. 143.2°
- c. greater than; The numerator will be larger.

Chapter 2

Review & Refresh

- a. $(1, -1)$
- a. $(-2, 4)$
- a. $(-3, -3)$
- a. $(4, 3)$
- a. $(-1, -2)$
- a. $(3, -2)$





2.1 Exploration

Exploration 1

- Answers will vary.
- The sides have the same length in the copy as in the original figure, the angle measures are the same in the figures, and parallel lines are still parallel.
- Point B: 1 unit right and 2 units up;
Point C: 3 units left and 4 units up;
Point D: 2 units left and 3 units up;
Point E: 4 units right and 1 unit down
- $(x + a, y + b)$

2.1 Practice

- no
- yes
- $T'(1, 3), U'(4, 4), V'(4, -1), W'(1, -1)$
- 2 units left and 4 units down
- 7 units up

- 1 unit right and 7 units down
 - 1 unit left and 7 units up
- yes; *Sample answer:* The bed slides and is not turned.
 - no; *Sample answer:* In order for the desk to be usable, you must rotate it.
 - yes; *Sample answer:* You can slide the bed stand around the bed.

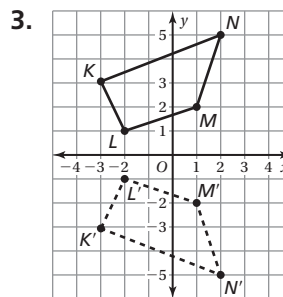
2.2 Exploration

Exploration 1

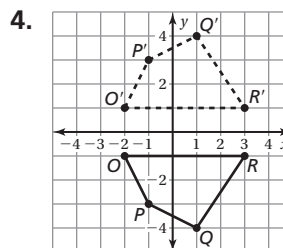
- Answers will vary.
- The sides have the same length in the image as in the original figure, the angle measures are the same in the figures, and parallel lines are still parallel.
- Point B: reflection in y -axis;
Point C: reflection in x -axis;
Point D: reflection in the x -axis and in the y -axis
- $(x, -y)$
- $(-x, y)$

2.2 Practice

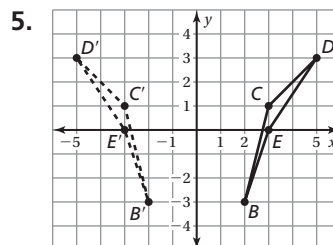
- no
- yes



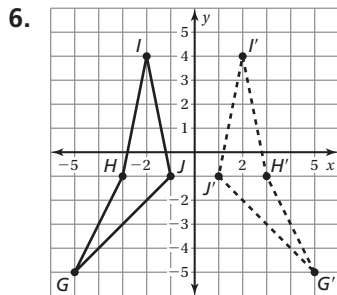
$K'(-3, -3), L'(-2, -1), M'(1, -2), N'(2, -5)$



$O'(-2, 1), P'(-1, 3), Q'(1, 4), R'(3, 1)$



$B'(-2, -3), C'(-3, 1), D'(-5, 3), E'(-3, 0)$

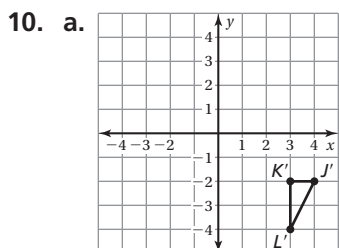


$G'(5, -5), H'(3, -1), I'(2, 4), J'(1, -1)$

7. bob

8. x -axis; The y -coordinate switched signs.

9. y -axis; The x -coordinate switched signs.



b. There is no change in the resulting triangle; In both approaches, each coordinate in the resulting triangle is the opposite of its corresponding coordinate in $\triangle JKL$.

11. a. $A''(2, 1), B''(-4, -2), C''(-2, 2)$

b. Each coordinate in the resulting triangle is the opposite of its corresponding coordinate in $\triangle ABC$.

2.3 Exploration

Exploration 1

a. Answers will vary.

b. The sides have the same length in the image as in the original figure, the angle measures are the same in the figures, and parallel lines are still parallel.

c. Point B : rotation of 180° counterclockwise about the origin;
Point C : rotation of 270° counterclockwise about the origin;
Point D : rotation of 90° counterclockwise about the origin

d. $P'(-y, x); P'(-x, -y); P'(y, -x)$

2.3 Practice

1. no

2. yes; 90° counterclockwise

3. $A'(1, -1), B'(2, -2), C'(2, -4), D'(1, -5)$

4. $A'(1, -1), B'(2, -2), C'(2, -4), D'(1, -5)$

5. $A'(1, 1), B'(2, 0), C'(2, -2), D'(1, -3)$

6. $A'(9, 1), B'(8, 0), C'(6, 0), D'(5, 1)$

7. no; The longer side of the oval shapes will be vertical when rotated.

8. yes; The figure is identical when rotated.

9. $(-3, -2), (0, 6), (1, 3)$

2.4 Exploration

Exploration 1

a. Answers will vary.

b. Triangle ABC and Triangle DEF , Triangle GHI and Triangle LMN ; Figure $ABCD$ and Figure $FGHJ$; *Sample answer*: In each pair of figures, one figure can be obtained from the other using transformations.

c. yes; Translations, reflections, and rotations each produce identical figures, so a sequence of these transformations will do the same.

2.4 Practice

1. $\angle A$ and $\angle J, \angle B$ and $\angle K, \angle C$ and $\angle L, \angle D$ and $\angle M; \overline{AB}$ and $\overline{JK}, \overline{BC}$ and $\overline{KL}, \overline{CD}$ and $\overline{LM}, \overline{DA}$ and \overline{MJ}

2. $\angle P$ and $\angle V, \angle Q$ and $\angle W, \angle R$ and $\angle X, \angle S$ and $\angle Y, \angle T$ and $\angle Z; \overline{PQ}$ and $\overline{VW}, \overline{QR}$ and $\overline{WX}, \overline{RS}$ and $\overline{XY}, \overline{ST}$ and $\overline{YZ}, \overline{TP}$ and \overline{ZV}

3. a. 10 in. b. $\angle L$ c. 24 in.

4. a. true; They have the same mark.

b. false; Side MN is congruent to side ED .

c. false; $\angle B$ corresponds to $\angle P$.

d. true; $\angle B$ corresponds to $\angle P$ and $\angle C$ corresponds to $\angle O$. So, side BC is congruent to side PO .

e. true; $m\angle A = 90^\circ$.

$m\angle B = m\angle C = m\angle O = 130^\circ$.

$m\angle D = m\angle N = 120^\circ$. So, the sum is $90^\circ + 130^\circ + 130^\circ + 70^\circ + 120^\circ = 540^\circ$.

f. false; $\angle B \cong \angle C$ and $m\angle C = 130^\circ$. So, $m\angle B = 130^\circ$.

5. $\triangle JKL$ is translated 3 units right and 2 units down, and then rotated 180° about the origin.

2.5 Exploration

Exploration 1

a. Answers will vary.

b. Corresponding side lengths of the figures are proportional; Corresponding angles of the figures are congruent.

2.7 Exploration

Exploration 1

a. *Sample answer:*

Original Side Lengths	$k = 2$	$k = 3$
$P = 6$	$P = 12$	$P = 18$

$k = 4$	$k = 5$	$k = 6$
$P = 24$	$P = 30$	$P = 36$

The perimeter of each dilated rectangle is k times the perimeter of the original rectangle.

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

c. *Sample answer:*

Original Side Lengths	$k = 2$	$k = 3$
$A = 2$	$A = 8$	$A = 18$

$k = 4$	$k = 5$	$k = 6$
$A = 32$	$A = 50$	$A = 72$

The area of each dilated rectangle is k^2 times the area of the original rectangle.

d. The value of the ratio of the areas is equal to the square of the value of the ratio of the corresponding side lengths.

e. To find the perimeter of the blue rectangle, write and solve the proportion

$$\frac{\text{perimeter of red rectangle}}{\text{perimeter of blue rectangle}} = \frac{\text{side length of red rectangle}}{\text{side length of blue rectangle}}$$

To find the area of the blue rectangle, write and solve the proportion

$$\frac{\text{Area of red rectangle}}{\text{Area of blue rectangle}} = \left(\frac{\text{side length of red rectangle}}{\text{side length of blue rectangle}} \right)^2$$

2.7 Practice

- Perimeter: 5 : 13; Area: 25 : 169
- $x = 10.5$
- 9 : 14; The ratio of the perimeters is equal to the ratio of the corresponding sides.
 - 81 : 196; The ratio of the areas is equal to the square of the ratio of the corresponding sides.
 - 70 ft
- 2.56 times greater
 - 12.5 ft²
 - 15 ft

5. a. 4 : 25

b. 2 : 5; Area of a circle equals πr^2 .

c. 5π

Chapter 3

Review & Refresh

- vertical; 128
- adjacent; 55
- vertical; 37
- adjacent; 15
- 76°
- supplementary; 63
- complementary; 21
- complementary; 49
- supplementary; 14
- 53

3.1 Exploration

Exploration 1

- no; If you extend line A and line B , they will intersect.
- The vertical angles are congruent.
- Line A and line B are parallel.
- yes
- When a line intersects two parallel lines, the angles created by the intersection of the line and the first parallel line are congruent to the corresponding angles created by the intersection of the line and the second parallel line.

3.1 Practice

- $m\angle 6 = m\angle 7 = 32^\circ$; supplementary angles
 $m\angle 5 = 148^\circ$; vertical angles
 $m\angle 1 = m\angle 3 = 148^\circ$; corresponding angles
 $m\angle 2 = m\angle 4 = 32^\circ$; corresponding angles
- $m\angle 1 = 90^\circ$; vertical angles
 $m\angle 2 = m\angle 3 = 90^\circ$; supplementary angles
 $m\angle 6 = m\angle 4 = 90^\circ$; corresponding angles
 $m\angle 5 = m\angle 7 = 90^\circ$; corresponding angles
- 130°; $\angle 1$ and $\angle 8$ are corresponding angles.
- 127°; *Sample answer:* $\angle 5$ and $\angle 4$ are corresponding angles, and $\angle 4$ and $\angle 3$ are supplementary angles.
- 109°; $\angle 7$ and $\angle 3$ are supplementary angles.
- 115°; *Sample answer:* $\angle 4$ and $\angle 5$ are corresponding angles, and $\angle 5$ and $\angle 6$ are supplementary angles.
- always; The angles are vertical angles.
- sometimes; The angles are supplementary if they are right angles.

9. never; The angles are supplementary.
10. never; The angles are adjacent angles.
11. always; Angles 2 and 6 are congruent because they are corresponding angles. Angles 6 and 8 are congruent because they are vertical angles. So, angles 2 and 8 are congruent.
12. no; Any two adjacent angles will be supplementary and two acute angles cannot be supplementary.

3.2 Exploration

Exploration 1

- a. The sum of the interior angle measures of a triangle is 180° .
- b. The measure of an exterior angle of a triangle is equal to the sum of the measures of the two nonadjacent interior angles.

Exploration 2

The figure shows a triangle formed by two parallel lines and two transversals;

Sample answer: $\angle D + \angle B + \angle E = 180^\circ$ because they make up a straight angle, and $\angle F = \angle B + \angle E$. Using alternate interior angles, $\angle D \cong \angle A$, $\angle E \cong \angle C$, and $\angle F \cong \angle G$. By substitution, $\angle A + \angle B + \angle C = 180^\circ$, and $\angle G = \angle B + \angle C$.

3.2 Practice

1. $37^\circ, 41^\circ, 102^\circ$
2. $60^\circ, 60^\circ, 60^\circ$
3. 118°
4. 155°
5. $18^\circ, 72^\circ, 90^\circ$
6. yes; $20^\circ, 70^\circ, 90^\circ$; *Sample answer:* The sum of the measures of the two nonadjacent interior angles is 160° and one of the measures is 90° , so the other nonadjacent angle measures 70° . The sum of the interior angle measures is 180° , so the adjacent interior angle measures 20° .
7. 155°
8. always; *Sample answer:* All the interior angles of an equilateral triangle have the same measure.
9. always; *Sample answer:* All the exterior angles of equilateral triangles have the same measure of 120° .
10. always; *Sample answer:* A triangle will always have at least two vertices with an obtuse exterior angle.

3.3 Exploration

Exploration 1

- a. 360°
- b. 540°
- c. 720°
- d. 900°
- e. 1080°
- f. 1260°

9. Number of Sides, n	3	4	5	6
Number of Triangles	1	2	3	4
Interior Angle Sum, S	180°	360°	540°	720°

Number of Sides, n	7	8	9
Number of Triangles	5	6	7
Interior Angle Sum, S	900°	1080°	1260°

$$S = (n - 2) \cdot 180^\circ$$

3.3 Practice

1. 900°
2. 1080°
3. 1440°
4. 1260°
5. $x = 105$
6. $x = 99$
7. 8 sides
8. $90^\circ, 90^\circ, 90^\circ, 135^\circ, 135^\circ$
9. a. 1800°
- b. 150°

3.4 Exploration

Exploration 1

- a–b. no; yes; The triangles are not congruent because they are not the same size. The triangles are similar because the second triangle is a dilation of the first triangle.
- c. Two triangles that have two pairs of congruent angles are similar.

Exploration 2

Because the Sun's rays are parallel and $\angle B$ and $\angle E$ are corresponding angles, $\angle B \cong \angle E$. Because $\angle A$ and $\angle D$ are right angles, $\angle A \cong \angle D$. Because two angles of $\triangle ABC$ are congruent to two angles of $\triangle DEF$, $\angle C \cong \angle F$ and the triangles are similar. So, corresponding side lengths are proportional, and you can write and solve the proportion $\frac{x}{5} = \frac{36}{3}$ to find x .

3.4 Practice

1. not similar; Corresponding angles are not congruent.
2. similar; Corresponding angles are congruent.
3. $x = 76$

4. a. *Sample answer:* $\angle B$ is congruent to itself. $\angle A$ and $\angle D$ have the same line of sight, so they are congruent. Because two angles are congruent, the third angles are congruent and the triangles are similar.

b. 17.7 feet

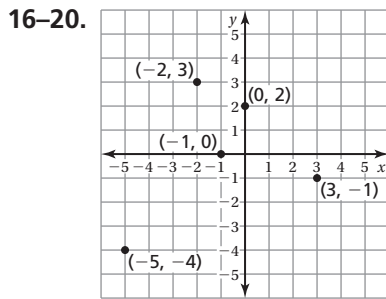
5. a. *Sample answer:* $\angle B$ and $\angle E$ are right angles, and are congruent. $\angle BCA$ and $\angle ECD$ are vertical angles, so they are congruent. Because two angles are congruent, the third angles are congruent and the triangles are similar.

b. 0.6 mi

Chapter 4

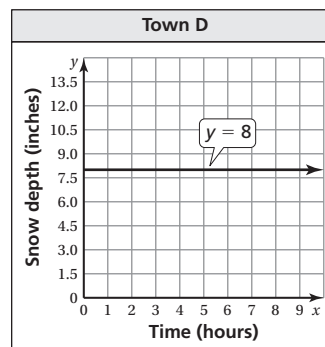
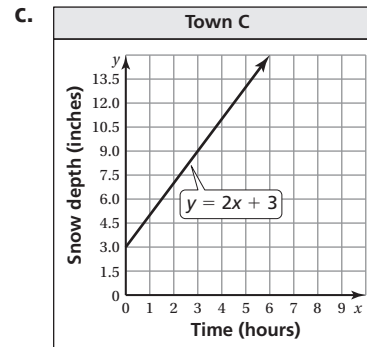
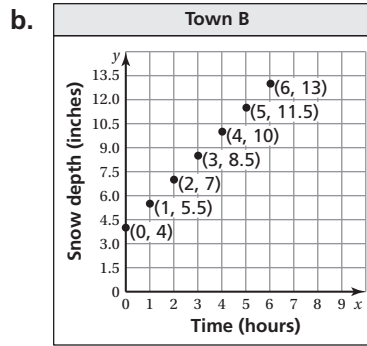
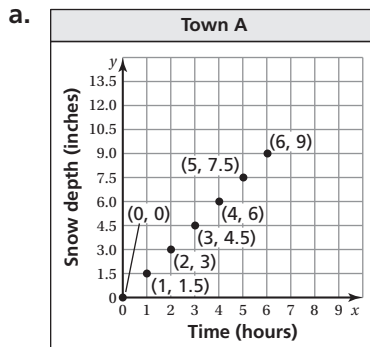
Review & Refresh

- | | |
|---------------------------|---------------------------|
| 1. 5 | 2. 16 |
| 3. -5 | 4. $-38\frac{1}{2}$ |
| 5. 108 | 6. 65 |
| 7. $-3\frac{7}{19}$ | 8. 262 |
| 9. \$50.00 | 10. $(-5, 0)$ |
| 11. $(3, -5)$ | 12. Point F |
| 13. Point G | 14. Point B , Point H |
| 15. Point C , Point E | |



4.1 Exploration

Exploration 1

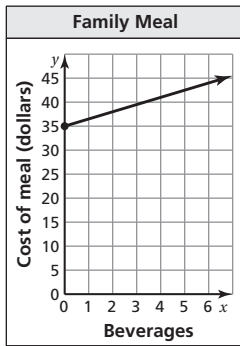


d. *Sample answer:* The depth of the snow in Town D remains constant over time. The snow depth in Town C increases at a greater rate than the snow depth in Town A and Town B.

4.1 Practice

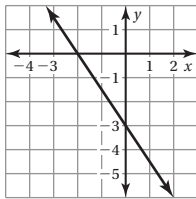
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5. a.

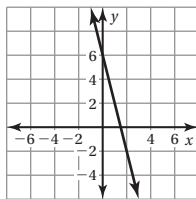


b. *Sample answer:* about \$42
c. \$42.50

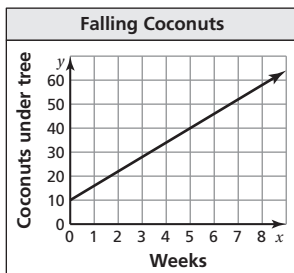
6. $y = -\frac{3}{2}x - 3$



7. $y = -4x + 6$

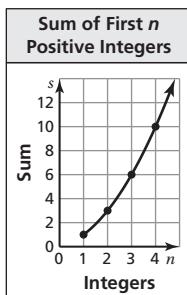


8. a. $y = 10 + 6x$



b. after 7 weeks

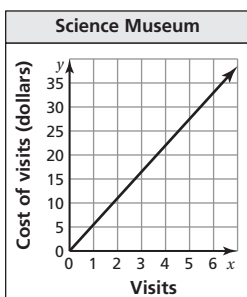
9. a.



not a linear equation; The graph is not a line.

b. no; 4.2 is not a positive integer.

10.



With each additional visit, the cost goes up \$5.50.

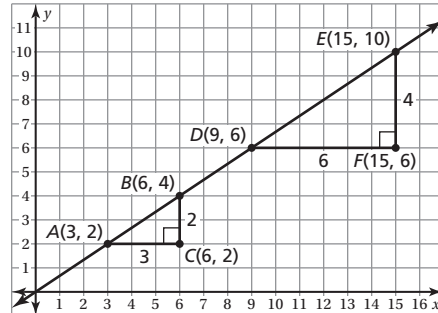
4.2 Exploration

Exploration 1

- Answers will vary.
- Answers will vary. Because the two lines are a constant distance apart from each other, the steepness of each line is the same.

Exploration 2

a. *Sample answer:*



- They are similar; *Sample answer:* \overline{BC} and \overline{EF} are both vertical and are parallel. The line that contains the points A , B , D , and E is a transversal. So, $\angle ABC$ is congruent to $\angle DEF$ because corresponding angles are congruent. \overline{AC} and \overline{DF} are both horizontal and are parallel. The line that contains the points A , B , D , and E is a transversal. So, $\angle BAC$ is congruent to $\angle EDF$ because corresponding angles are congruent. Both are right triangles. So, you can conclude that $\triangle ABC$ and $\triangle DEF$ are similar because their angles are congruent.
- They are both equal to $\frac{2}{3}$. *Sample answer:* Because the triangles are similar, $\frac{BC}{EF} = \frac{AC}{DF}$ and this can be rewritten as $\frac{BC}{AC} = \frac{EF}{DF}$; The line rises 2 units for each 3 unit increase horizontally.

4.2 Practice

- $\frac{1}{5}$
- 0
- $\frac{3}{2}$
- 1
- 10 feet
- a. 1
b. The data usage costs \$1.00 per gigabyte.
c. \$5.00
d. 30 gigabytes
- $k = 11$
- $k = 0$

4.3 Exploration

Exploration 1

a.

Vinegar (fl oz), x	3	6	9
Water (fl oz), y	2	4	6

For every increase of 2 fluid ounces of water in the cleaning product, there is a 3 fluid ounce increase of vinegar. The slope is $\frac{2}{3}$.

b. *Sample answer:*

Vinegar (fl oz), x	2	4	6
Water (fl oz), y	5	10	15

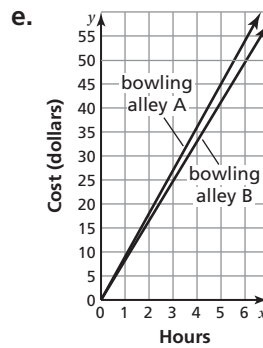
For every increase of 5 fluid ounces of water in the cleaning product, there is a 2 fluid ounce increase of vinegar. The slope is $\frac{5}{2}$.

Exploration 2

- a. corresponding side lengths are proportional; *Sample answer:* The corresponding angles of the triangles are congruent, so the triangles are similar.
- b. $\frac{y-0}{x-0} = \frac{m}{1}$; $y = mx$
- c. $y = mx$ is the general equation for two quantities x and y that are in a proportional relationship; m represents the slope of the line, constant of proportionality, or unit rate.

4.3 Practice

- no; The graph does not pass through the origin.
- yes; $y = 12x$; The graph is a line that passes through the origin.
- yes; $y = 4x$; The rate of change in the table is constant.
- yes; $y = \frac{2}{3}x$; The rate of change in the table is constant.
- a. $y = 9x$
b. It costs \$9 to rent the lane for 1 hour.
c. \$27
d. $y = 8.25x$



The graph of bowling alley A is steeper than the graph of bowling alley B. It will cost more to bowl at bowling alley A.

- a. yes; The graph is a line that passes through the origin.
b. $y = \frac{1}{20}x$; The height of the water in the tank rises $\frac{1}{20}$ inch per gallon of water.
c. 12.5 in.

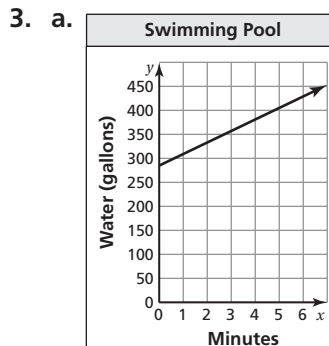
4.4 Exploration

Exploration 1

- a. *Sample answer:* Because the y -value of each point on the line increases by 3 units, you can add 3 to the right side of the equation $y = mx$ to obtain $y = mx + 3$.
- b. corresponding side lengths are proportional; *Sample answer:* The corresponding angles of the triangles are congruent, so the triangles are similar.
- c. $\frac{y-3}{x-0} = \frac{m}{1}$; yes; *Sample answer:* By translating the graph of a proportional relationship up 3 units, the $y - 0$ side of the triangle became $y - 3$. Solving the equation for y produces $y = mx + 3$.
- d. $y = mx + b$;
 $\frac{y-b}{x-0} = \frac{m}{1}$
 $y - b = mx$
 $y = mx + b$

4.4 Practice

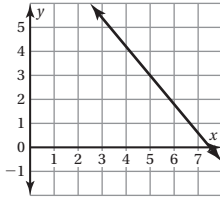
- $m = -\frac{3}{8}$; $b = 10$
- $m = -\frac{4}{5}$; $b = -\frac{1}{5}$



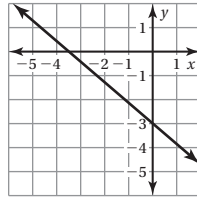
b. The slope is 24. So, the number of gallons of water in the swimming pool increases by 24 gallons every minute. The y -intercept is 285. So, when the faucet was turned on, there were 285 gallons of water in the swimming pool.

c. no; The x -intercept has a negative x -coordinate. The number of minutes cannot be negative.

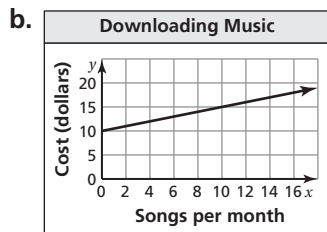
4. 7.5



5. $-\frac{7}{2}$

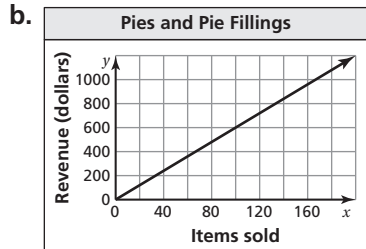


6. a. $y = 0.50x + 10$



c. \$17.50, $y = 0.50(15) + 10$; $y = 17.5$

7. a. $y = 6x$



c. 184 items per month; $1100 = 6x$; $x = 183\frac{1}{3}$; The business will approximately break even when 183 items are sold.

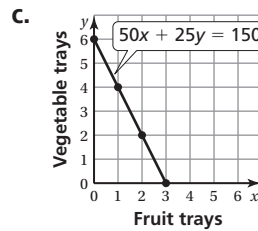
d. 46 items per week

4.5 Exploration

Exploration 1

a. \$50; \$25; \$150; $50x + 25y = 150$

b. 3 fruit trays; 6 vegetable trays; yes;
Sample answer: These values can be used as the x - and y -intercepts. Draw a line through the intercepts, (3, 0) and (0, 6).



0 fruit trays and 6 vegetable trays, 1 fruit tray and 4 vegetable trays, 2 fruit trays and 2 vegetable trays, 3 fruit trays and 0 vegetable trays

(0, 6): $50(0) + 25(6) = 150$

(1, 4): $50(1) + 25(4) = 150$

(2, 2): $50(2) + 25(2) = 150$

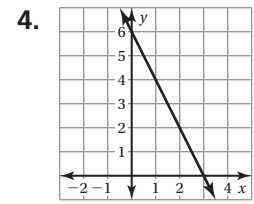
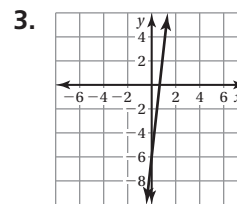
(3, 0): $50(3) + 25(0) = 150$

d. the intercepts increase; The equation now becomes $50x + 25y = 200$. The x -intercept shifts right 1 unit to the point (4, 0), and the y -intercept shifts up 2 units to (8, 0).

4.5 Practice

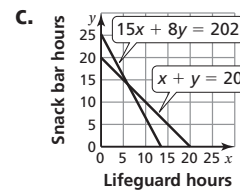
1. $y = -\frac{2}{3}x + 4$

2. $y = 2x - 5$

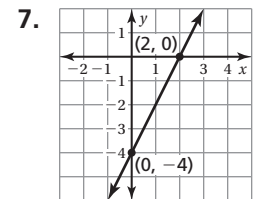
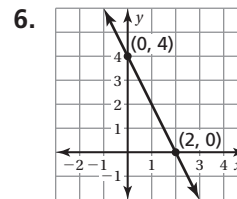


5. a. $x + y = 20$

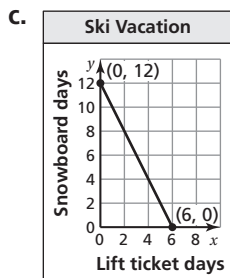
b. $15x + 8y = 202$



d. 6 hours as a lifeguard and 14 hours in the snack bar; The lines intersect at the point (6, 14).

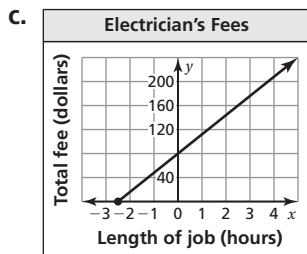


8. a. $80x + 40y = 480$ b. 6; 12



d. 5 days

9. a. $y = 80 + 32x$ b. -2.5; 80



d. no; The visit cannot last a negative number of hours.

4.6 Exploration

Exploration 1

a. black line: slope: $\frac{1}{2}$, y-intercept: 4, $y = \frac{1}{2}x + 4$

gray line: slope: $\frac{1}{2}$, y-intercept: 1, $y = \frac{1}{2}x + 1$

dashed line: slope: $\frac{1}{2}$, y-intercept: -2, $y = \frac{1}{2}x - 2$

The lines are parallel.

b. black line: slope: $-\frac{1}{3}$, y-intercept: 3, $y = -\frac{1}{3}x + 3$

gray line: slope: $\frac{4}{3}$, y-intercept: 3, $y = \frac{4}{3}x + 3$

dashed line: slope: $\frac{1}{6}$, y-intercept: 3, $y = \frac{1}{6}x + 3$

The lines have the same y-intercept.

Exploration 2

a. slope: 50, y-intercept: 100; The car travels 50 miles per hour and starts 100 miles from Phoenix.

b. $y = 50t + 100$

c. *Sample answer:* Use the equation found in part (b) and substitute 11 for the variable t .

4.6 Practice

1. $y = 1, y = 3x - 5, y = -2, y = -3x - 5$

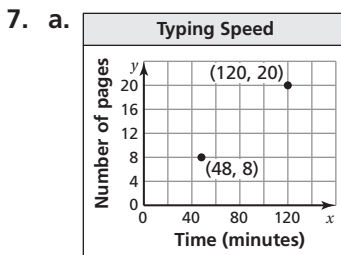
2. $y = -\frac{1}{4}x - 1$ 3. $y = \frac{7}{5}x + 4$

4. a. 5.7 inches per year

b. $y = 5.7x + 6$ c. 28.8 inches

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

6. $y = -2x - 3$



b. $\frac{1 \text{ page}}{6 \text{ minutes}}$ or $\frac{1}{6}$ page per minute; The rate of typing is the slope of the line.

$$m = \frac{20 - 8}{120 - 48} = \frac{12}{72} = \frac{1}{6}$$

c. $y = \frac{1}{6}x$

4.7 Exploration

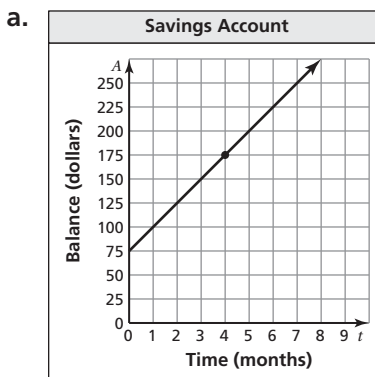
Exploration 1

a. $m = \frac{y - y_1}{x - x_1}$; *Sample answer:* To find the slope

of the line, divide the vertical distance of the coordinates by the horizontal distance of the coordinates.

b. $y - y_1 = m(x - x_1)$; This result represents the equation of a line with slope m that passes through the point (x_1, y_1) .

Exploration 2



b. $A - 175 = 25(t - 4)$
 $A = 25t + 75$

4.7 Practice

1. $y = \frac{5}{4}x - 2$

2. $y = -4x + 3$

3. $y - 3 = \frac{1}{3}(x + 6)$

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

5. $y = 4x - 5$ 6. $y = \frac{4}{5}x - 4$
7. $y = 6.75x + 50$
8. a. $y = -2x + 24$ b. 24 feet
c. after 12 seconds
9. $y = -\frac{1}{6}x + 4$; Parallel lines have the same slope, so both lines have a slope of $-\frac{1}{6}$.

Chapter 5

Review & Refresh

1. $x + 5$ 2. $-2d + 4$
3. $13y - 11$ 4. $7z + 2$
5. $5s + 1$ 6. $24x - 8$
7. $(12x - 2)$ feet 8. $y = 2$
9. $a = -3$ 10. $k = \frac{13}{36}$
11. $m = -43$ 12. $t = -4$
13. $h = 9$ 13. 12 calculators

5.1 Exploration

Exploration 1

a.

x (minutes)	10	20	30	40
p (headphones)	$16\frac{2}{3}$	$33\frac{1}{3}$	50	$66\frac{2}{3}$
p (phone)	35	45	55	65

x (minutes)	50	60
p (headphones)	$83\frac{1}{3}$	100
p (phone)	75	85

Sample answer: Initially, the battery power of the headphones is less than the battery power of the phone, but it increases faster and reaches 100% sooner than the battery power of the phone.

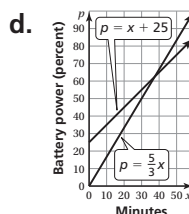
- b. 37.5 min; 62.5%;

Sample answer: $\frac{5}{3}x = x + 25$
 $x = 37.5$

Headphones: $p = \frac{5}{3}(37.5) = 62.5$

Phone: $p = 37.5 + 25 = 62.5$

- c. one, none, or infinitely many; The graphs of two linear equations either intersect at one point (one solution), are parallel and never intersect (no solution), or are the same (infinitely many solutions).



Sample answer: The intersection point of the graphs is where the devices have the same battery power at the same time.

- e. *Sample answer:* Enter the equations into a graphing calculator. Then graph the equations and use the *intersect* feature to find the point of intersection.

5.1 Practice

1. (3, 15) 2. (-2, -13)
3. (8, -2)
4. a. $R = 16x$ b. 250 tickets
5. (4, 7) 6. (1, -2)
7. (-3, 0)
8. $x + y = 60$
 $x = 2y$

40 one-bedroom apartments; 20 two-bedroom apartments

9. yes; The two lines could be parallel.
10. a. 25 min b. 50 min c. the tortoise

5.2 Exploration

Exploration 1

- a. System 1: $\text{☾} = 2$, $\text{★} = 3$;
System 2: $\text{☀} = 2$, $\text{✱} = -1$;
Answers will vary.

- b. (-1, 4); Solve one of the equations for one variable. Substitute the expression for this variable into the other equation and solve for the other variable. Then, substitute this value into one of the original equations and solve for the remaining variable.

Exploration 2

- a-b. Answers will vary.

5.2 Practice

1. (-5, 1) 2. (3, -2) 3. $(4, \frac{1}{2})$
4. a. $208x + 52y = 5460$
 $y = x + 10$
b. \$19 c. \$29

5. $(7, 8)$; *Sample answer:* Solve for x . The second equation was already solved for x .
6. $(-6, 2)$; *Sample answer:* Solve for x . The second equation has an x -term with a coefficient of 1.
7. $(\frac{3}{2}, 1)$; *Sample answer:* Solve for y . The smallest coefficient is in the first equation and it is the coefficient of y .
8. 83
9. a. $x + y = 98$
 $5x = 9y$
- b. 63 food tents c. 35 retail tents
10. a. 9 two-year-olds b. 18 three-year-olds
c. 18 four-year-olds

5.3 Exploration

Exploration 1

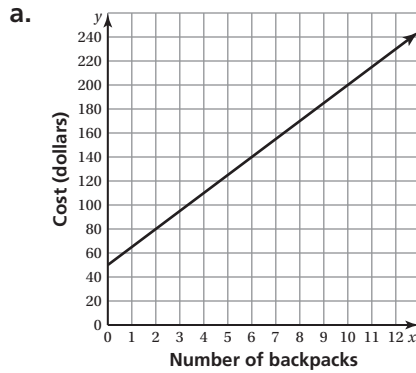
- a. Add the equations; no; Adding the equations will only produce an equation in one variable when the equations in the system have one pair of like terms with opposite coefficients.
- b. System 1: yes, $(1, -2)$; System 2: no; *Sample answer:* Replace Equation 2 with $6x - 4y = 26$; $(3, -2)$
- c. Answers will vary.

5.3 Practice

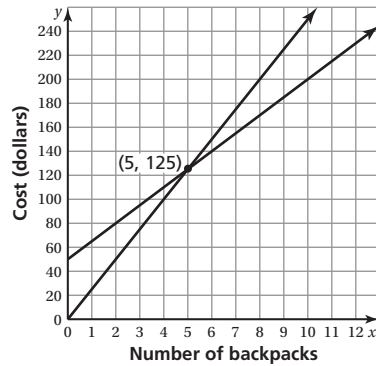
1. $(0, 0)$ 2. $(-5, -2)$
3. $(8, 3)$
4. a. $x + y = 42$
 $x = y - 8$
- b. 17 magazine subscriptions
- c. 25 magazine subscriptions
5. $(6, -3)$; *Sample answer:* Eliminate y . The y -term in the second equation has a coefficient of -1 .
6. $(-1, 1)$; *Sample answer:* Eliminate y . The y -terms are multiples of each other.
7. $(-3, -3)$; *Sample answer:* Eliminate y . The y -terms are the same in both equations.
8. a. *Sample answer:* $a = -5$
b. *Sample answer:* $b = 4$
9. \$390
10. a. $a = -3$ b. $b = -1$ c. $c = 1$
11. *Sample answer:* $3x - y = 0$
 $-2x + y = -2$

5.4 Exploration

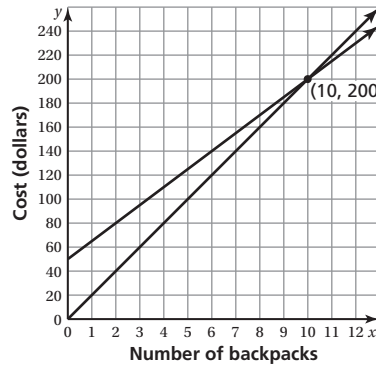
Exploration 1



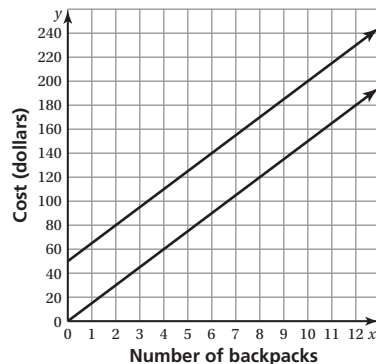
b. 5 backpacks



c. yes



no



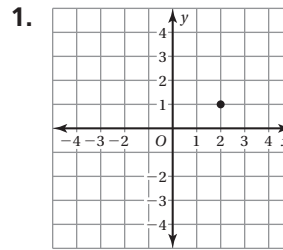
- d. no solution: yes, the lines can be parallel; exactly one solution: yes, the lines can have different slopes; exactly two solutions: no, two lines cannot intersect at exactly two points; infinitely many solutions: yes, the lines can be the same

5.4 Practice

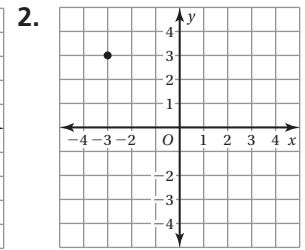
- no solution; *Sample answer:* elimination; The equations have the same form and the coefficients of x and y are the same.
- $(-3, 5)$; *Sample answer:* substitution; The first equation is solved for y .
- no solution; *Sample answer:* substitution; $2y$ is isolated in the second equation.
- infinitely many solutions; *Sample answer:* substitution; The second equation is solved for y .
- $(0, 0)$; *Sample answer:* substitution; The first equation is solved for x .
- infinitely many solutions; *Sample answer:* elimination; The equations have the same form and the coefficients of x are multiples of each other.
- infinitely many solutions
- Yes, if the y -intercepts are the same. If the y -intercepts are different, then the system has no solution.
- a. $y = 4x + 13$
 $y = 4x$
b. no; The system has no solution.
- Sample answer:* $x + y = 3$
 $2x + 2y = 6$
- Sample answer:* $2x - y = 3$
 $x + y = 3$
- Sample answer:* $y = 3x + 2$
 $y = 3x - 5$
- $a = 15$, b is any number except 3.
- a. one solution; The x -terms do not have the same coefficient.
b. perpendicular; The product of their slope is -1 .

Chapter 6

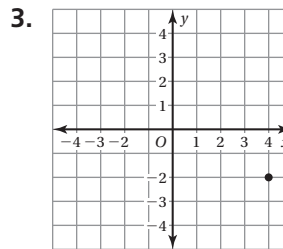
Review & Refresh



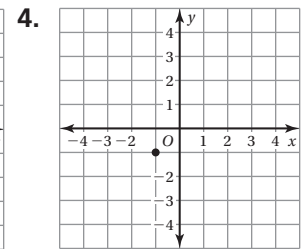
Quadrant I



Quadrant II



Quadrant IV



Quadrant III

5. Point A: Quadrant II; Point B: Quadrant I; Point C: Quadrant IV

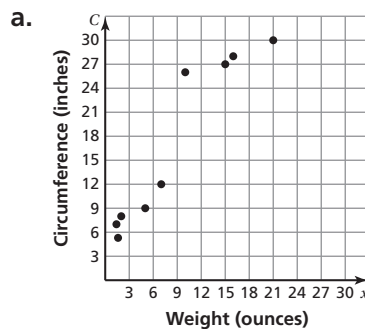
6. $y = 3x + 4$ 7. $y = -\frac{6}{5}x + 5$

8. $y = \frac{4}{5}x + 8$ 9. $y = -\frac{4}{3}x - 3$

10. $y = 3x$ 11. $y = -2x$

6.1 Exploration

Exploration 1

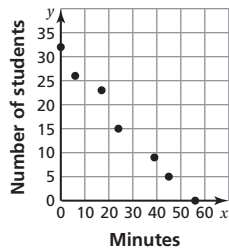


Write the weight and the circumference of each ball as an ordered pair, where the weight is x and the circumference is y . Then plot the ordered pairs in the coordinate plane.

- yes; As weight increases, the circumference increases.
- kickball: yes; *Sample answer:* An ordered pair representing the kickball would fit in with the other points on the graph; bowling ball: no; *Sample answer:* An ordered pair representing the bowling ball would not fit in with the other points on the graph.

6.1 Practice

1. a. (56, 0), (45, 5), (39, 9), (24, 15), (17, 23), (6, 26), (0, 32);

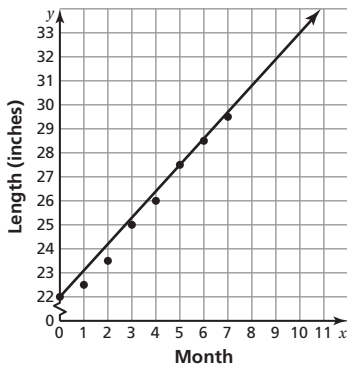


- b. negative linear relationship
2. a. about 16 bushels b. about 175 apples
- c. positive linear relationship
3. *Sample answer:* the number of items in a cart and the total cost
4. a. 0 yard sales; 18 yard sales
- b. January, February, and December
- c. nonlinear relationship
- d. *Sample answer:* a snowy climate
- e. gap between y -values of 4 to 12

6.2 Exploration

Exploration 1

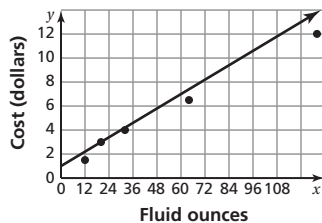
- a. *Sample answer:*



- b. *Sample answer:* $y = 1.1x + 22$
- c. *Sample answer:* 35.2 in.

6.2 Practice

1. a.



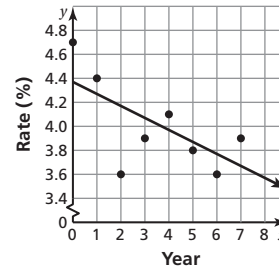
- b. $y = 0.086x + 1.065$

- c. The slope is 0.086 and the y -intercept is 1.065. So, the base price for a bottle of juice is \$1.065, and the price increases by \$0.086 for every fluid ounce.

d. \$23.08, $y = 0.086(256) + 1.065$; $y = 23.081$

- e. $r = 0.9984$; The correlation coefficient is positive and close to 1, so there is a strong positive linear relationship and the points are close to the line.

2. a–b.



c. $y = -0.10x + 4.37$

- d. The slope is -0.10 . Mortgage interest rates are dropping about 0.1% per year.

e. 3.37; $y = -0.10(10) + 4.37$; $y = 3.37$

- f. $r = -0.6658$; The correlation coefficient is negative and closer to -1 than 0, so there is a moderate negative linear relationship and the points are somewhat close to the line.

3. 0.127; It is closer to zero.

6.3 Exploration

Exploration 1

- a. Bottom row: 20, 18, 14, 5, 8
Right column: 12, 16, 14, 11, 12
- b. no; The cell where the black and gold row meets the XL column T-shirts has a 0.
- c. Bottom row: 25, 30, 35, 30, 25
Right column: 29, 29, 29, 29, 29
Bottom right cell: 145
- d. *Sample answer:* For every category of shirt, order the number of shirts sold last year minus the number remaining. If the result is a negative number, then do not order any shirts in that category. Also, order a couple extra of the shirts that were all sold. For example, order $6 - 1 = 5$ large blue and white shirts, order $1 - 4 = -3$, or 0, small red-and-white shirts, and order extra of the extra-large black-and-gold shirts.

6.3 Practice

1. 91 cars have 2 doors; 109 cars have 4 doors; 79 cars have 4 cylinders; 121 cars have 6 cylinders.

2. a. 26
- b. 87 students chose watching television;
84 students chose playing video games;
58 students chose going online; 75 students
are in 10th grade; 74 students are in 11th grade;
80 students are in 12th grade.
- c. $\frac{30}{229} \approx 13.1\%$

3. a.

		Hair Color			
		Red	Blonde	Brunette	Black
Gender	Female	3	15	41	33
	Male	4	21	30	27

- b. 7 classmates have red hair; 36 classmates have
blonde hair; 71 classmates have brunette hair;
60 classmates have black hair; 92 students are
female; 82 students are male.

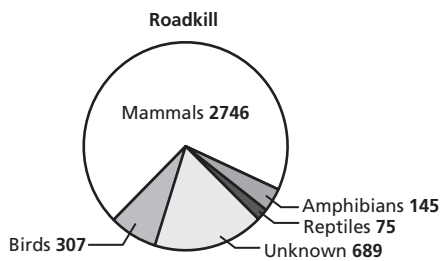
c.

		Hair Color			
		Red	Blonde	Brunette	Black
Gender	Female	43%	42%	58%	55%
	Male	57%	58%	42%	45%

6.4 Exploration

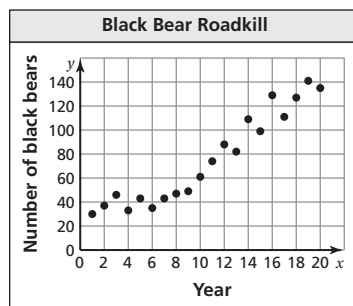
Exploration 1

- a. *Sample answer:*



The circle graph shows the kinds of animals as parts of a whole.

- b. *Sample answer:*



The scatter plot shows the relationship over time.

- c. *Sample answer:*

Raccoon Roadkill Weights

Stem	Leaf
9	4 5
10	
11	0
12	4 9
13	4 6 9
14	0 5 8 8
15	2 7
16	8
17	0 2 3 5
18	5 5 6 7
19	0 1 4
20	4
21	3 5 5 5
22	
23	
24	
25	4

Key: 9|4 = 9.4 pounds

The stem-and-leaf plot shows how the raccoon weights are distributed.

- d. *Sample answer:* Reduce the speed limit on some roads.

6.4 Practice

- Sample answer:* bar graph; shows data in categories
- Sample answer:* histogram; shows frequency in intervals of same size
- Sample answer:* scatter plot; shows the relationship between the two data sets
- Sample answer:* circle graph; shows data as parts of a whole
- It looks like equal amounts of fruit were consumed, until you look at the key.
- Unequal spacing on the vertical axis does not show the larger number of occurrences in the older age groups.
- Sample answer:* dot plot; shows the number of times each value occurs
- stem-and-leaf plot
- Sample answer:* scatter plot; shows the relationship between two data sets
- Sample answer:* circle graph; shows data as parts of a whole

11. a. A pictograph does not show the kind of precise data a Board of Directors would need.

b. *Sample answer:* line graph

Chapter 7

Review & Refresh

- | | |
|---------|---------|
| 1. 11 | 2. 36 |
| 3. 46 | 4. 19 |
| 5. 19.5 | 6. 31.2 |
| 7. 4 | 8. -12 |
| 9. 32 | 10. 21 |
| 11. 3 | 12. -3 |

7.1 Exploration

Exploration 1

- a. The output is the square of the input; output: 64;
Sample answer: input: 9; yes; The input 8 only has one possible output, but the output 81 has two possible inputs.
- b. The output is a possible color of the input (fruit);
Sample answer: input: lime; output: green; yes; The missing input could be any fruit that is green.

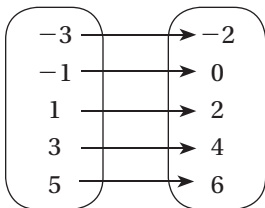
Exploration 2

- a. Play A: one output; Play B: There are different numbers of outputs.
- b. Play A: each ticket costs \$8; Play B: Each ticket costs \$4 or \$8.
- c. no; *Sample answer:* The price of a ticket for Play B varies.

7.1 Practice

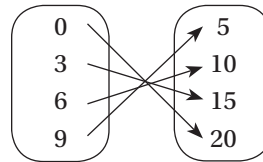
1. (1, 2), (5, 6), (9, 4), (1, 8)
2. (3, 1), (4, -1), (5, 1), (6, -1)

3. **Input** **Output**



The relation is a function. Each input has exactly one output.

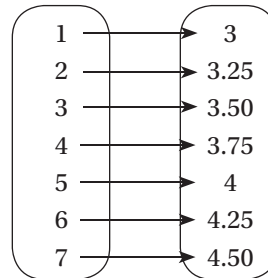
4. **Input** **Output**



The relation is a function. Each input has exactly one output.

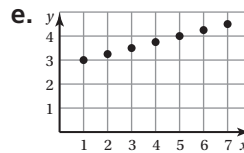
5. a. \$3.75, \$4, \$4.25, \$4.50

b. **Input** **Output**



c. Every input has exactly one output. So, the relation is a function.

d. (1, 3), (2, 3.25), (3, 3.50), (4, 3.75), (5, 4), (6, 4.25), (7, 4.50)



f. The cost is \$3 for the first hour and \$0.25 for every additional hour.

7.2 Exploration

Exploration 1

a.

Input, x	1	2	3	4
Output, A	1	3	5	7

Figure 41

b.

Input, x	1	2	3	4
Output, A	1	4	9	16

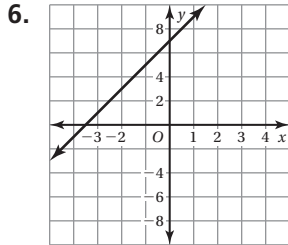
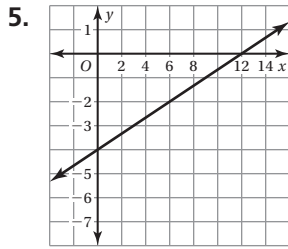
Figure 9

Exploration 2

- a. false
- b. true; $y = 16.4x$

7.2 Practice

- | | |
|-------------|----------------|
| 1. $y = 5x$ | 2. $y = x - 2$ |
| 3. $y = 2$ | 4. $y = -3$ |



7. a. $d = 70h$

b. $d = 245$ miles

8. $x = 4$

9. $x = -4$

10. a. $P = 1.50b - 90$

b. b is the independent variable and P is the dependent variable; The profit depends on the number of bags of popcorn sold.

c. 60 bags

11. a. $P = 4s$

b. $A = \left(\frac{P}{4}\right)^2$

12. $y = 17$

7.3 Exploration

Exploration 1

a. x is the width of the rectangle; y is the perimeter; $y = 2x + 8$; yes; *Sample answer:* The function is in slope-intercept form.

b. x is the radius of the circle; y is the area; $y = \pi x^2$; no; *Sample answer:* The function cannot be written in slope-intercept form.

c. x is the length of one of the bases of the trapezoid; y is the area; $y = x + 4$; yes; *Sample answer:* The function is in slope-intercept form.

d. x is the width of the prism; y is the surface area; $y = 12x + 16$; yes; *Sample answer:* The function is in slope-intercept form.

7.3 Practice

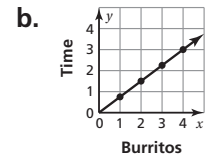
1. $y = -\frac{1}{4}x - 1$

2. $y = -1$

3. $y = -2x$

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

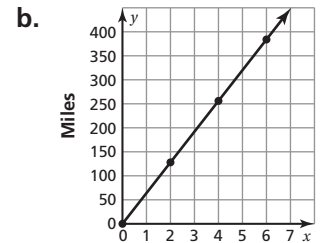
5. a. $y = 0.75x$



c. The slope is 0.75. It takes 0.75 minutes to make 1 burrito. Both the x - and y -intercepts are 0. It takes 0 minutes to make 0 burritos.

d. 5.25 min; $y = 0.75(7)$; $y = 5.25$

6. a. $y = 64x$



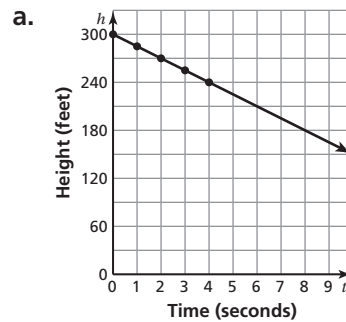
c. 320 mi

d. $r = 64$ mi/h

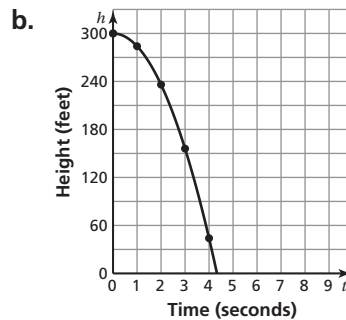
e. $6\frac{1}{4}$ h; $400 = 64x$; $x = \frac{400}{64}$; $x = 6\frac{1}{4}$

7.4 Exploration

Exploration 1



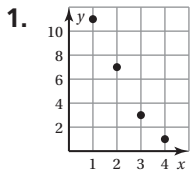
Sample answer: Plot points and connect them with a line; linear



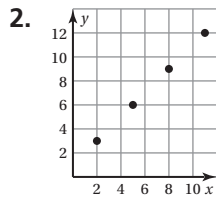
Sample answer: Plot points and connect them with a curve; nonlinear

Sample answer: Both objects fall from an initial height of 300 feet. The skydiver has a constant speed, and the bowling ball has an increasing speed. The bowling ball reaches the ground first.

7.4 Practice



nonlinear



linear

- linear; The graph is a line.
- nonlinear; The graph is not a line.
- linear; The equation is in slope-intercept form.
- linear; The equation can be written in slope-intercept form.
- a. 8
b. $y = 4x$; A \$4 profit is made for each pair of flip flops sold.
- a. nonlinear; Commission does not show a constant change.
b. \$600
- nonlinear; The equation cannot be written in slope-intercept form.

7.5 Exploration

Exploration 1

- C; *Sample answer:* The graph increases when your speed increases, is horizontal when your speed is constant, and decreases when you slow down.
- A; *Sample answer:* The graph increases when your speed increases, and then gets steeper when you go faster down a hill. When you come to a quick stop, the speed decreases to zero.
- D; *Sample answer:* The graph increases when your speed increases, decreases when you come to a stop, and is zero when you are in the store. When you continue to ride, increasing your speed, the graph increases.
- B; *Sample answer:* The graph is horizontal when your speed is constant and decreases when you go up a hill. When you are at the top of the hill and your speed increases, the graph increases.

Exploration 2

The height increases and decreases in a cyclical pattern over time. *Sample answer:* your height above the ground over time as you ride a Ferris wheel

7.5 Practice

- Sample answer:* The number of customers increases at a constant rate and then decreases at a constant rate.
- Sample answer:* The altitude increases at an increasing rate, then increases at a decreasing rate, and then increases at an increasing rate again.
- Sample answer:* The cost of the postage remains constant, then jumps, remains constant, then jumps, and repeats this pattern.
- Sample answer:* The height of the water decreases at a constant rate, remains the same, decreases at a constant rate, remains the same, and then decreases at a constant rate.
- a. *Sample answer:* The Demand curve remains constant. The Supply curve decreases at an increasing rate.
b. The left side represents a surplus. The right side represents a shortage. *Sample answer:* On the left side, supply is greater than the demand. On the right side, demand is greater than the supply.
c. *Sample answer:* The equilibrium point moves up and left, so a shortage occurs sooner.

Chapter 8

Review & Refresh

- | | |
|----------------------------------------------------------|-----------|
| 1. 14 | 2. 3 |
| 3. 394 | 4. 86 |
| 5. 76 | 6. 16 |
| 7. a. 386
b. $2(4) + 2(5^2) + 3(3)(6^2) + 2(2) = 386$ | |
| 8. 2.352 | 9. 0.1014 |
| 10. 6.0048 | 11. 9 |
| 12. 1.5 | 13. 2700 |
| 14. \$6.93 | |

8.1 Exploration

Exploration 1

a.

Power	Repeated Multiplication Form	Value
$(-3)^1$	(-3)	-3
$(-3)^2$	$(-3) \cdot (-3)$	9
$(-3)^3$	$(-3) \cdot (-3) \cdot (-3)$	-27
$(-3)^4$	$(-3) \cdot (-3) \cdot (-3) \cdot (-3)$	81
$(-3)^5$	$(-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3)$	-243
$(-3)^6$	$(-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3)$	729
$(-3)^7$	$(-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3)$	-2187

- b. -3 is used as a factor n times; Write -3 as a factor n times and multiply.

Exploration 2

$3 \cdot 3 \cdot 3 \cdot 3 = 3^4 = \81 ; The large cube is made up of $3 \cdot 3 \cdot 3$ small cubes. Because each small cube is worth \$3, the total value of the large cube is $3 \cdot 3 \cdot 3 \cdot 3 = 3^4 = \81 .

8.1 Practice

- $-\left(\frac{3}{7}\right)^3$
- $\left(-\frac{3}{7}\right)^3$
- $25^4(-p)^5$
- $(-2)^2x^3y^4$
- 343
- 256
- 256
- $\frac{8}{125}$
- $3^3 \cdot 7^2$
- 95
- 83
- 22
- 0
- a. $7 \cdot \left(\frac{7}{8}\right)^3$ b. $\frac{2401}{512} \approx 4.7$ ft

15.

h	1	2	3	4	5
$3^h - 2$	1	7	25	79	241
3^{h-1}	1	3	9	27	81

The values of $3^h - 2$ are greater than the values of 3^{h-1} for $h > 1$. The values are the same when $h = 1$.

16. a. $\frac{1}{2} \left[\frac{1}{2} \left(\frac{1}{2} (8) \right) \right]$ b. 1 mi

8.2 Exploration

Exploration 1

a.

Product	Repeated Multiplication Form	Power
$2^2 \cdot 2^4$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^6
$(-3)^2 \cdot (-3)^4$	$(-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3) \cdot (-3)$	$(-3)^6$
$7^3 \cdot 7^2$	$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$	7^5
$5.1^1 \cdot 5.1^6$	$(5.1) \cdot (5.1) \cdot (5.1) \cdot (5.1) \cdot (5.1) \cdot (5.1) \cdot (5.1)$	5.1^7
$(-4)^2 \cdot (-4)^2$	$(-4) \cdot (-4) \cdot (-4) \cdot (-4)$	$(-4)^4$
$10^3 \cdot 10^5$	$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$	10^8
$\left(\frac{1}{2}\right)^5 \cdot \left(\frac{1}{2}\right)^5$	$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$	$\left(\frac{1}{2}\right)^{10}$

$$a^m \cdot a^n = a^{m+n}$$

- b. $(7^3)^2 = 7^3 \cdot 7^3 = 7^{3+3} = 7^6$;
 $(6^2)^2 = 6^2 \cdot 6^2 = 6^{2+2} = 6^4$;
 $(3^2)^3 = 3^2 \cdot 3^2 \cdot 3^2 = 3^{2+2+2} = 3^6$;
 $(2^2)^4 = 2^2 \cdot 2^2 \cdot 2^2 \cdot 2^2 = 2^{2+2+2+2} = 2^8$;
- $$\left(\left(\frac{1}{2}\right)^2\right)^5 = \left(\frac{1}{2}\right)^2 \cdot \left(\frac{1}{2}\right)^2 \cdot \left(\frac{1}{2}\right)^2 \cdot \left(\frac{1}{2}\right)^2 \cdot \left(\frac{1}{2}\right)^2$$
- $$= \left(\frac{1}{2}\right)^{2+2+2+2+2}$$
- $$= \left(\frac{1}{2}\right)^{10};$$
- $$(a^m)^n = a^{mn}$$

Exploration 2

Power	Repeated Multiplication Form	Product of Powers
$(2 \cdot 3)^3$	$(2 \cdot 3) \cdot (2 \cdot 3) \cdot (2 \cdot 3)$	$2^3 \cdot 3^3$
$(2 \cdot 5)^2$	$(2 \cdot 5) \cdot (2 \cdot 5)$	$2^2 \cdot 5^2$
$(5 \cdot 4)^3$	$(5 \cdot 4) \cdot (5 \cdot 4) \cdot (5 \cdot 4)$	$5^3 \cdot 4^3$
$(-2 \cdot 4)^2$	$(-2 \cdot 4) \cdot (-2 \cdot 4)$	$(-2)^2 \cdot 4^2$
$(-3 \cdot 2)^4$	$(-3 \cdot 2) \cdot (-3 \cdot 2) \cdot (-3 \cdot 2) \cdot (-3 \cdot 2)$	$(-3)^4 \cdot 2^4$

$$(ab)^m = a^m b^m$$

8.2 Practice

- $(-16)^{26}$
- $\left(\frac{1}{15}\right)^{13}$
- q^{16}
- $(-7.4)^{21}$
- $\left(\frac{5}{8}\right)^6$
- $\left(-\frac{2}{9}\right)^{15}$
- $16p^4$
- $\frac{1}{125}k^3$
- 5832
- $\frac{2}{25}v^3$
- $2^{11} \cdot 3^5 \cdot 5^6$
- $V = \pi\left(\frac{2}{3}h\right)^2 h; V = \frac{4}{9}\pi h^3$
 - $V = \frac{3}{16}\pi \text{ in.}^3$
 - $V = \frac{3}{2}\pi r^3$
- $(5 \cdot 27 \cdot y)^6 = (5 \cdot 3 \cdot 9 \cdot y)^6$
 $= (15 \cdot 9 \cdot y)^6$
 $= 15^6 \cdot 9^6 \cdot y^6$
- $x = 10$
- $x = 6$
- 2^x cents per day; You will be paid a total of \$5,368,709.10 for the month.

8.3 Exploration

Exploration 1

a.

Quotient	Repeated Multiplication Form	Power
$\frac{2^4}{2^2}$	$\frac{2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2}$	2^2
$\frac{(-4)^5}{(-4)^2}$	$\frac{(-4) \cdot (-4) \cdot (-4) \cdot (-4) \cdot (-4)}{(-4) \cdot (-4)}$	$(-4)^3$
$\frac{7^7}{7^3}$	$\frac{7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7}{7 \cdot 7 \cdot 7}$	7^4
$\frac{8.5^9}{8.5^6}$	$\frac{(8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5)}{(8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5) \cdot (8.5)}$	8.5^3
$\frac{10^8}{10^5}$	$\frac{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}$	10^3
$\frac{3^{12}}{3^4}$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3 \cdot 3}$	3^8
$\frac{(-5)^7}{(-5)^5}$	$\frac{(-5) \cdot (-5) \cdot (-5) \cdot (-5) \cdot (-5) \cdot (-5) \cdot (-5)}{(-5) \cdot (-5) \cdot (-5) \cdot (-5) \cdot (-5)}$	$(-5)^2$
$\frac{11^4}{11^1}$	$\frac{11 \cdot 11 \cdot 11 \cdot 11}{11}$	11^3
$\frac{x^6}{x^2}$	$\frac{x \cdot x \cdot x \cdot x \cdot x \cdot x}{x \cdot x}$	x^4

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\text{b. } \frac{2^4}{2^2} = 2^{4-2} = 2^2; \frac{(-4)^5}{(-4)^2} = (-4)^{5-2} = (-4)^3;$$

$$\frac{7^7}{7^3} = 7^{7-3} = 7^4; \frac{8.5^9}{8.5^6} = 8.5^{9-6} = 8.5^3;$$

$$\frac{10^8}{10^5} = 10^{8-5} = 10^3; \frac{3^{12}}{3^4} = 3^{12-4} = 3^8;$$

$$\frac{(-5)^7}{(-5)^5} = (-5)^{7-5} = (-5)^2; \frac{11^4}{11^1} = 11^{4-1} = 11^3;$$

$$\frac{x^6}{x^2} = x^{6-2} = x^4;$$

yes

8.3 Practice

1. 7.6^{10}
2. u^{22}
3. a. $\frac{10^{12}}{10^3} = 10^9$
- b. $(10^3)^2 = 10^6 \text{ m}^2$
- c. $(10^{12})^2 = 10^{24} \text{ m}^2$
- d. $\frac{10^{24}}{10^6} = 10^{18}$
- e. $(10^3)^3 = 10^9 \text{ m}^3$
- f. $(10^{12})^3 = 10^{36} \text{ m}^3$
- g. $\frac{10^{36}}{10^9} = 10^{27}$
4. $(-7.9)^5$
5. b^{20}
6. always true; $\frac{5^{x+3}}{5^x} = 5^{(x+3)-x} = 5^3$
7. sometimes true; $\frac{5^x}{5^y} = 5^{x-y}$; So, $5^{x-y} = 5^3$ when $x-y=3$.
8. never true; $\frac{5^{x+1}}{5^x} = 5^{(x+1)-x} = 5^1 = 5$; $5 \neq 5^3$
9. $x=4$
10. $x=3$

8.4 Exploration

Exploration 1

a.

Quotient	Quotient of Powers Property	Power
$\frac{5^3}{5^3}$	5^{3-3}	5^0
$\frac{6^2}{6^2}$	6^{2-2}	6^0
$\frac{(-3)^4}{(-3)^4}$	$(-3)^{4-4}$	$(-3)^0$
$\frac{(-4)^5}{(-4)^5}$	$(-4)^{5-5}$	$(-4)^0$

- b. Each expression equals 1; You can equate the powers in the last column of the table in part (a) to 1. So, based on these results, you can conclude that $a^0 = 1$, where $a \neq 0$.

Exploration 2

a.

Product	Product of Powers Property	Power	Value
$5^{-3} \cdot 5^3$	5^{-3+3}	5^0	1
$6^2 \cdot 6^{-2}$	$6^{2+(-2)}$	6^0	1
$(-3)^4 \cdot (-3)^{-4}$	$(-3)^{4+(-4)}$	$(-3)^0$	1
$(-4)^{-5} \cdot (-4)^5$	$(-4)^{-5+5}$	$(-4)^0$	1

- b. From the Multiplicative Inverse Property, you know that the product of a nonzero number and its reciprocal is 1. So, because each product in the table is 1, you can rewrite each power containing a negative exponent as the reciprocal of the power containing a positive exponent.

c. $a^{-n} = \frac{1}{a^n}$

8.4 Practice

1. $\frac{1}{1000}$
2. $\frac{1}{9}$
3. 1
4. $\frac{1}{256}$
5. $8^{-2}; 4^{-3}; 2^{-6}$
6. a. $\frac{1}{10^{15}}$
- b. $\frac{1}{10^9}$
- c. $\frac{1}{10^{18}}$
- d. $\frac{1}{10^3}$
- e. 10^3
- f. 10^{12}
- g. $\frac{1}{10^{27}}$
7. $\frac{2}{u^{12}}$
8. $\frac{b^9}{8}$
9. $22\frac{2}{3}$ hours

8.5 Exploration

Exploration 1

- a. $6 \times 10^{-2} \text{ m}$
- b. $6 \times 10^3 \text{ m}$
- c. $2 \times 10^{-1} \text{ m}$
- d. $1 \times 10^1 \text{ m}$

Sample answer: Start with the picture that is the most zoomed out and match it with the largest distance. Then, each successive zoom in can be matched with the next largest distance.

Exploration 2

- a. C
- b. F
- c. A
- d. E
- e. B
- f. H
- g. D
- h. G

Sample answer: Write each number in List 2 in standard form. Then match it with the closest number in List 1.

8.5 Practice

1. $6 \cdot 10^{10}$
2. $5 \cdot 10^7$
3. $\$(7 \cdot 10^5)$
4. $5 \cdot 10^{-7}$
5. $7 \cdot 10^{-11}$
6. $2.5 \cdot (4 \cdot 10^6) = 10 \cdot 10^6 = 10^7$ words
7. a. 300,000 m b. 50,000 m c. $5 \cdot 10^4 \text{ m}$

8. 0.00006973; 0.00006973 is closer to 7×10^{-5} .
 9. 4.5 times 10. $1 \cdot 10^{11}$
 11. less than; 784,392 is approximately $8 \cdot 10^5$, which is less than 10^6 .

8.6 Exploration

Exploration 1

- a. *Answer should include, but is not limited to:* The student realizes that the number to the right of E is the exponent of a power of 10, and that the number to the left of E is multiplied by the power of 10.
 b. *Sample answer:* yes; $y = 10^6$ gives a result of 1E6, which is 1×10^6 , or 1,000,000.
 c. *Answer should include, but is not limited to:* The student realizes that the number to the right of E is the exponent of a power of 10, and that the number to the left of E is multiplied by the power of 10.
 d. *Sample answer:* yes; $y = \left(\frac{1}{10}\right)^6$ gives a result of 1E-6, which is 1×10^{-6} , or 0.000001.

8.6 Practice

1. 8.5×10^{-5} 2. 4.1×10^8
 3. $7 \cdot 10^{15}$ 4. 1.99×10^{-12}
 5. 0.0005 6. 154,000
 7. 0.00000178 8. 355,500,000
 9. a. Sun b. Moon
 c. 6,380,000 m d. 1,740,000 m
 e. 700,000,000 m
 10. a. 157,800,000 sec b. 2,630,000 sec
 11. 400 moons
 12. a. 1.07×10^3 b. 1.89×10^{11} dimples

8.7 Exploration

Exploration 1

a.

Expression 1	Expression 2	Sum	Difference
3×10^4	1×10^4	4×10^4	2×10^4
4×10^{-3}	2×10^{-3}	6×10^{-3}	2×10^{-3}
4.1×10^{-7}	1.5×10^{-7}	5.6×10^{-7}	2.6×10^{-7}
8.3×10^6	1.5×10^6	9.8×10^6	6.8×10^6

Sample answer: Write each expression in standard form. Then add or subtract the numbers and write the result in scientific notation.

- b. Use the Distributive Property to group the factors a and b . Then add or subtract a and b .

Exploration 2

a.

Expression 1	Expression 2	Product	Quotient
3×10^4	1×10^4	3×10^8	3×10^0
4×10^3	2×10^2	8×10^5	2×10^1
7.7×10^{-2}	1.1×10^{-3}	8.47×10^{-5}	7×10^1
4.5×10^5	3×10^{-1}	1.35×10^5	1.5×10^6

Sample answer: Write each expression in standard form. Then multiply or divide the numbers and write the result in scientific notation.

- b. To multiply, use the Commutative and Associative Properties of Multiplication to group the factors a and b and the powers of 10. Then multiply a and b , and multiply the powers of 10 using the Product of Powers Property. To divide, rewrite the expression as $\frac{a}{b} \times \frac{10^n}{10^m}$. Then divide a by b , and divide 10^n by 10^m using the Quotient of Powers Property.

8.7 Practice

1. 3×10^1 2. 6.2×10^{-5}
 3. 6.87×10^{-2} 4. 5.89×10^{14}
 5. 2.5×10^{-2} 6. $1.83 \cdot 10^{-6}$
 7. 8×10^{-25} 8. 1.86×10^5
 9. $7.02 \times 10^{12} \text{ m}^2$ 10. $2.652 \times 10^{-9} \text{ ft}^2$
 11. about 50 times greater
 12. 5.7×10^4 13. -1.628×10^9
 14. 0.00000006712

Chapter 9

Review & Refresh

1. < 2. >
 3. = 4. >
 5. *Sample answer:* $-5.2, -5.3, -6.5$
 6. *Sample answer:* 2.56, 2.3, -3.2
 7. *Sample answer:* $-3.18, -3.1, -2.05$
 8. *Sample answer:* 0.05, 0.3, 1.55
 9. C, E, B, A, D
 10. 167 11. 3

12. 63

13. 116

14. -51

15. 1

16. $\frac{24 + 32 + 30 + 28}{2}; 57$

9.1 Exploration

Exploration 1

9 yd; 18 cm; 19 mi; 15 mi; 1.7 in.; $\frac{2}{3}$ ft;

Find a number whose square is the area.

Exploration 2

$x^2 = 0$: $x = 0$; one solution

$x^2 = 1$: $x = -1$ and $x = 1$; two solutions

$x^2 = 4$: $x = -2$ and $x = 2$; two solutions

$x^2 = 9$: $x = -3$ and $x = 3$; two solutions

$x^2 = 16$: $x = -4$ and $x = 4$; two solutions

$x^2 = 25$: $x = -5$ and $x = 5$; two solutions

$x^2 = 0$ only has one solution because there is only one number, 0, whose square is 0. The other five equations have two solutions because there are two numbers whose square is the number on the right side of the equation.

9.1 Practice

1. $s = \frac{13}{15}$ cm

2. $r = 11$ yd

3. 113.04 ft²

4. -22

5. $\frac{5}{8}$ and $-\frac{5}{8}$

6. $r = 5$ ft

7. 4.8

8. 6

9. $\sqrt{\frac{49}{9}} > 2$

10. $\frac{2}{5} = \sqrt{\frac{12}{75}}$

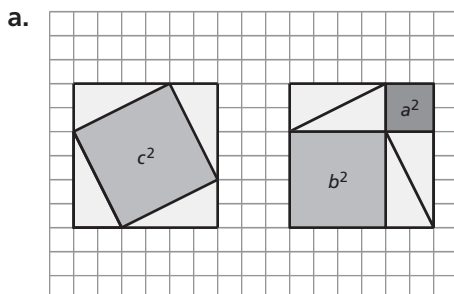
11. $r = 12$ m

12. $s = 24$ m

13. 11 DVD players

9.2 Exploration

Exploration 1



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

b. Answer should include, but is not limited to: The two values should be close to each other.

9.2 Practice

1. $c = 37$ mm

2. $a = 3$ ft

3. 26 in.

4. 9 in.

5. $x = 6$ cm

6. 8 fewer blocks

7. Sample answer: $x = 2, x = 8$

8. $x = 3$

9. yes; The pencil is 17 centimeters long and the diagonal from the top corner to the opposite bottom corner is $10\sqrt{3} \approx 17.3$ centimeters long.

9.3 Exploration

Exploration 1

2 cm; 3 ft; 5 m; 7 in.; 0.1 cm; $\frac{1}{2}$ yd; Find a number whose cube is the volume.

Exploration 2

$x^3 = -27$: $x = -3$; one solution

$x^3 = -8$: $x = -2$; one solution

$x^3 = -1$: $x = -1$; one solution

$x^3 = 1$: $x = 1$; one solution

$x^3 = 8$: $x = 2$; one solution

$x^3 = 27$: $x = 3$; one solution

Each equation has one solution because there is only one number whose cube is the number on the right side of the equation.

9.3 Practice

1. 7

2. -11

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

4. 138

5. $2\frac{17}{27}$

6. -976

7. 168

8. $-\frac{25}{2}$

9. a. 12 ft

b. 864 ft²

c. 144 ft²

10. >

11. >

12. Sample answer: 8 and -8; 27 and -27

13. 3 m

14. $x = 2$

15. $x = 1$

16. $x = 6$

9.4 Exploration

Exploration 1

a. $10x = 6.666\dots$; $10x = 1.111\dots$; $10x = 2.444\dots$

b. $9x = 3, x = \frac{1}{3}, 0.333\dots$ written as a fraction;

$9x = 6, x = \frac{2}{3}, 0.666\dots$ written as a fraction;

$9x = 1, x = \frac{1}{9}, 0.111\dots$ written as a fraction;

$9x = 2.2, x = \frac{2.2}{9} = \frac{11}{45}, 0.2444\dots$ written as a fraction

- c. $\frac{4}{33}, \frac{5}{11}, \frac{3}{11}, \frac{931}{990}$; The procedure involves writing and solving an equation that does not have a repeating decimal; The procedure involves multiplying each side of the original equation by 100 instead of 10.
- d. Let x equal the repeating decimal d . Subtract the equation $x = d$ from the equation $10^n x = 10^n d$, where n is the number of repeating digits. Then solve for x .

9.4 Practice

- $0.19\overline{44}$
- $-7.05\overline{33}$
- $3.\overline{18}$
- 4.4375 in.
- $8\frac{7}{9}$
- $24\frac{8}{9}$
- $-1\frac{41}{90}$
- $-\frac{32}{99}$
- $6\frac{13}{99}$
- $7\frac{10}{11}$
- $\frac{1}{6}$
- a. $5\frac{13}{15} = 5.8\overline{66}$ c b. $\frac{4}{3}c$ c. $1.8958\overline{33}c$
- $0.5\overline{46}$
- $-0.8\overline{409}$
- $-0.\overline{04}$
- Sample answer: $0.\overline{33}$; $\frac{3}{11} = 0.\overline{27}$ and $\frac{4}{11} = 0.\overline{36}$
- Sample answer: $0.\overline{55}$ and $0.\overline{66}$; $\frac{17}{30} = 0.5\overline{6}$
- not equal; $\frac{7}{33} = 0.\overline{21}$, $0.\overline{21} \neq 0.21$
- equal; $\frac{5}{44} = 0.11\overline{36}$ 20. equal; $\frac{6}{55} = 0.10\overline{9}$

9.5 Exploration

Exploration 1

- $\sqrt{2}$; irrational number; $\sqrt{2}$ cannot be written as $\frac{a}{b}$, where a and b are integers and $b \neq 0$.
- 1 and 2; $\sqrt{1} = 1$ and $\sqrt{4} = 2$. $\sqrt{1} < \sqrt{2} < \sqrt{4}$, so $1 < \sqrt{2} < 2$.
- 1.4; Sample answer: Use tracing paper to trace the length of the diagonal and compare it to a distance on the number line.
- 1.414;
 $(1.412)^2 = 1.993744$
 $(1.413)^2 = 1.996569$
 $(1.414)^2 = 1.999396$
 $(1.415)^2 = 2.002225$
 So, $(1.414)^2$ is closest to 2, which means that 1.414 is closest to $\sqrt{2}$.

9.5 Practice

- rational
- rational
- rational
- irrational
- irrational; The circumference is 10π meters and π is irrational.
- a. -5 b. -5.3
- a. 20 b. 19.9
- a. -4 b. -3.7
- a. 1 b. 0.9
- a. 1 b. 1.2
- a. 7 b. 6.6
- a. $c = \sqrt{2450}$
b. 49, 64
c. 49.5 ft
- $\sqrt{220}$; $\sqrt{220}$ is to the right of $\sqrt[3]{1260}$ on a number line.
- $-\sqrt{135}$; $-\sqrt{135}$ is to the right of $-\sqrt{145}$ on a number line.
- $\sqrt{\frac{7}{64}}$; $\sqrt{\frac{7}{64}}$ is to the right of $\sqrt[3]{\frac{1}{28}}$ on a number line.
- $\sqrt[3]{250}$; $\sqrt[3]{250}$ is to the right of 2π on a number line.
- Sample answer: $a = 50$, $b = 60$
- yes; $(0.25)^2 = 0.0625$, so $\sqrt{0.0625} = 0.25$.
- a. $s = 4$ cm b. $s = 4.4$ cm

9.6 Exploration

Exploration 1

- If I live in the United States, then I live in California; statement: true; California is in the United States; converse: false; A person can live in one of the other 49 states and still live in the United States.
If I am alive, then my heart is beating; statement: true; A beating heart means you are alive; converse: true; Being alive means your heart is beating.
If two figures are congruent, then one figure is a translation of the other figure; statement: true; Translations produce congruent images; converse: false; Sample answer: One figure can be a rotation of the other figure.
- Answers will vary.

Exploration 2

- 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; *Sample answer*: true
- Because $\triangle JKL$ is a right triangle, $a^2 + b^2 = x^2$. Because $a^2 + b^2 = c^2$, you can substitute c^2 for $a^2 + b^2$ in $a^2 + b^2 = x^2$. So, $c^2 = x^2$ and $c = x$. Two triangles with the same side lengths are the same size and shape. There is a sequence of rigid motions that takes one triangle to the other, which means that $\triangle DEF \cong \triangle JKL$. So, $\angle E$ is a right angle and $\triangle DEF$ is a right triangle.

9.6 Practice

- If you live in New York, then you live in New York City; statement: true; New York City is located in New York; converse: false; A person can live in another city and still live in New York.
- If \sqrt{a} is an integer, then a is a perfect square; statement: true; A perfect square is a number with integers as its square roots. converse: true; Because \sqrt{a} is a solution of $x^2 = a$ and x is an integer, a is a perfect square.
- right triangle 4. not a right triangle
- no; $8.1^2 + 8.1^2 \neq 11.5^2$
- no 7. yes
- no 9. \$159
- a. no b. 9.6 min
- no; The distance between A and B is $\sqrt{288}$. The distance between A and C is $\sqrt{464}$. The distance between B and C is $\sqrt{464}$; $(\sqrt{288})^2 + (\sqrt{464})^2 \neq (\sqrt{464})^2$
- (0, 0), (7, 5), (10, -4)
- no; The distance between A and B is $\sqrt{74}$. The distance between A and C is $\sqrt{116}$. The distance between B and C is $\sqrt{90}$; $(\sqrt{74})^2 + (\sqrt{90})^2 \neq (\sqrt{116})^2$

Chapter 10

Review & Refresh

- 51 m^2
- about 146.93 m^2
- 74 in.^2
- 171 in.^2
- 81 ft^2
- 88 in.^2
- \$444
- about 314 in.^2
- about 113.04 m^2
- about 452.16 cm^2
- about 153.86 ft^2
- about 490.625 yd^2
- about 706.5 mm^2
- about 502.4 cm^2

10.1 Exploration

Exploration 1

- $V = Bh$ for each prism.
- Multiply the area of the base by the height of the prism.
- Multiply the area of the base by the height of the cylinder; As the number of sides of the bases of a prism increases, the prism begins to look like a cylinder. So, the volume of a cylinder is found in the same way as the volume of a prism.

Exploration 2

a–b. Check students' work.

10.1 Practice

- $243\pi \approx 763.4 \text{ mm}^3$
- $126\pi \approx 395.8 \text{ ft}^3$
- 1540 cm^3
- a. $50\pi \text{ m}^3$; $V = \pi r^2 \left(\frac{1}{2}h\right) = \frac{1}{2}\pi r^2 h$
b. $25\pi \text{ m}^3$; If the diameter is halved, then the radius is halved;
 $V = \pi \left(\frac{r}{2}\right)^2 h = \pi \left(\frac{1}{4}r^2\right) h = \frac{1}{4}\pi r^2 h$
- 7 in.
- 47 ft
- a. 1000 ft^3 b. 5 ft c. 754 gal

10.2 Exploration

Exploration 1

- Check students' work.
- 3
- $V = \frac{1}{3}Bh = \frac{1}{3}\pi r^2 h$
- Check students' work; The volume of the cone is $\frac{1}{3}$ of the volume of the cylinder.
- Sample answer*: yes; Volumes of oblique solids are calculated in the same way as volumes of right solids.

10.2 Practice

- $\frac{640}{3}\pi \approx 670.2 \text{ mm}^3$
- $84\pi \approx 263.9 \text{ ft}^3$
- 7.5 m
- 13.3 containers
- 6.0 in.
- 5.0 m
- a. $\frac{5}{3}\pi \approx 5.2 \text{ cm}^3$ b. 3.5 sec
- 1 : 2

10.3 Exploration

Exploration 1

a. The height of the cylinder is twice the radius.

b. $\frac{2}{3}$

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

$V = \pi r^2 h$ Write the formula for volume of a cylinder.

$= \frac{2}{3}\pi r^2 h$ Multiply by $\frac{2}{3}$ because the volume of a sphere is $\frac{2}{3}$ of the volume of the cylinder.

$= \frac{2}{3}\pi r^2(2r)$ Substitute $2r$ for h .

$= \frac{4}{3}\pi r^3$ Simplify.

10.3 Practice

- $\frac{10,976}{3}\pi \approx 11,494.0 \text{ m}^3$
- $\frac{243}{2}\pi \approx 381.7 \text{ mi}^3$
- $972\pi \approx 3052 \text{ cm}^3$
- 511.8 in.^3
- 12 yd
- 10.5 mm
- 14.1 in.^3
- 65.4 ft^3
- 572.6 m^3
- 42.9 cm^3

10.4 Exploration

Exploration 1

a.

Radius	1	2	3	4	5
Height	1	2	3	4	5
Surface Area	4π	16π	36π	64π	100π
Volume	π	8π	27π	64π	125π

When the radius and height are x times the smallest cylinder, the surface area is x^2 times the surface area of the smallest cylinder and the volume is x^3 times the volume of the smallest cylinder.

b.

Base Side	6	12	18	24	30
Height	4	8	12	16	20
Slant Height	5	10	15	20	25
Surface Area	96	384	864	1536	2400
Volume	48	384	1296	3072	6000

When the base side, height, and slant height are x times the smallest square pyramid, the surface area is x^2 times the surface area of the smallest square pyramid and the volume is x^3 times the volume of the smallest square pyramid.

10.4 Practice

- $r = \frac{4}{3} \text{ ft}$
- $h = 37.5 \text{ cm}; w = 8 \text{ cm}$
- 150.4 m^2
- 227.6 cm^3
- 25.0 in.^3
- 1559.3 cm^3
 - 7219.0 cm^3
 - $\ell \approx 18.3 \text{ cm}; w = 17.5 \text{ cm}; h = 22.5 \text{ cm}$