Answers

Unit 1 Square Roots and the Pythagorean Theorem, page 4

1.1 Square Numbers and Area Models, page 8
4.a) ii) b) i) c) iii) 5.a) 64 square units b) 100 square units c) 9 square units 6. Yes; 36 = 6²

7. No; 28 cannot be modelled using a square.

8. 25 = 5²
9. 12 cannot be modelled using a square.
10.a) b) c) d)

11.a) 10 m b) 8 cm c) 9 m d) 20 cm 12.c) 81 = 9²

13. Answers may vary. For example:

<table>
<thead>
<tr>
<th>Base (cm)</th>
<th>Height (cm)</th>
<th>Perimeter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>32</td>
<td>2</td>
<td>68</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>32</td>
</tr>
</tbody>
</table>

A square with side length 8 cm has the smallest perimeter.

   For example: 9, 36, 81, 144, 225, 324
15.a) 9 and 16 b) 36 and 49 c) 64 and 81 d) 196 and 225
16.a) 12 m b) 48 m c) 20 pieces; Assumptions may vary. For example: You must buy whole pieces.
17. 5 m 18. 64 = 8², 81 = 9², 100 = 10², 121 = 11², 144 = 12², 169 = 13², 196 = 14²
19.b) 49 m² c) 7 m d) 28 m e) $280; Assumptions may vary. For example: There is no tax on fencing.
20.a) 30 cm b) 2 cuts
21.a) 1, 4, 9, 7, 9, 4, 1, 9, 1, 4, 9, 7, 7, 9 b) The digital root of a square number is either 1, 4, 7, or 9.
   c) 2809, 4225, 625

1.2 Squares and Square Roots, page 15
5.a) 16 b) 36 c) 4 d) 81 6.a) 64 b) 9 c) 1 d) 49 7.a) 5 b) 9 c) 8 d) 13
8.a) i) 1 ii) 100 iii) 10 000 iv) 1 000 000 b) i) 100 000 000 ii) 1 000 000 000 000
9.a) 100 = 10², 144 = 12²
10.a) 1, 2, 4, 8, 16, 32, 64, 128, 256; 16 b) 1, 5, 25, 125, 625; 25 c) 1, 11, 121; 11
11. 225 and 324; Each has an odd number of factors.
12.a) i) 1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96 ii) 1, 2, 4, 11, 22, 44, 121, 242, 484 iii) 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 40, 48, 60, 80, 120, 240 iv) 1, 2, 4, 8, 19, 38, 76, 152 v) 1, 3, 7, 9, 21, 49, 63, 147, 441 vi) 1, 2, 3, 6, 9, 18, 27, 54 b) 484 and 441; Each has an odd number of factors.
13.a) 1 b) 7 c) 12 d) 3
11. Line segment b is shorter. If you draw a square on each segment, the area of the square in part b is smaller, so its side length is also smaller.

12. a) \(\sqrt{20}\) units  b) \(\sqrt{41}\) units  
   c) \(\sqrt{10}\) units  d) \(\sqrt{8}\) units

13. Divide the square into 4 congruent triangles. The area of each triangle is \(\frac{1}{4}\) square units. So, the area of the square is 2 square units.

14. The area must be 25 cm². Draw 4 triangles each with area 6 cm² and place a small square with area 1 cm² in middle.

1.4 Estimating Square Roots, page 25

4. a) 15  b) 3  c) 22  d) 1

5. a) 2 and 3  b) 3 and 4  c) 7 and 8  
   d) 6 and 7  e) 13 and 14  f) 10 and 11

6. 2.6

7. a) \(\sqrt{30}\); 30 is about halfway between 25 and 36. \(\sqrt{64}\); 64 is exactly 8. \(\sqrt{72}\); 72 is about halfway between 64 and 81.

   b) \(\sqrt{23}\) is about 4.8. \(\sqrt{50}\) is about 7.1.

8.

9. a) Greater than  
    b) Greater than  
    c) Equal to  
    d) Less than

10. a) 8  b) 8  c) 9  d) 12

11. a) False  b) False  c) True

12. a) 4.80  b) 3.61  c) 8.83  
   d) 11.62  e) 7.87  f) 6.71

13. a) 9.6 cm  b) 20.7 m  c) 12.2 cm  d) 5.4 m

14. a) Bad estimate  b) Good estimate  
    c) Good estimate  d) Good estimate

15. a) 2.24 m by 2.24 m  b) 10 m since perimeter is about 8.96 m

16. a) 12.33 m by 12.33 m  b) 49.32 m

17. 7.35

18. Answers will vary. For example:  
   My classroom is 10 m by 7 m. The area is 70 m². If my classroom were a square: \(s = 8.37\) m

19. a) 6.93 m by 6.93 m  b) 16 m²

20. Always a perfect square

21. Since 7.67 is closer to 8 than 7, the whole number is closer to 64.

22. 9² = 81 and 10² = 100  
   Any number between 81 and 100 has a square root between 9 and 10.

23. a) 13  b) 9.85  c) 5  d) 9.22  e) 3.61
Unit 1 Technology: Investigating Square Roots with a Calculator, page 29
1.a) 21  b) 4.36; Approximation  
    c) 7.94; Approximation  d) 23

Unit 1 Mid-Unit Review, page 30
1. 100  
2.a) 4  b) 7  c) 14  d) 20  
3.a) 121  b) 8  c) 13  d) 15  
4.a) i) $A = 16 \text{ cm}^2$  ii) $s = \sqrt{16} \text{ cm}$  
   b) i) $A = 36 \text{ cm}^2$  ii) $s = \sqrt{36} \text{ cm}$  
5.a) 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 27, 36, 54, 72, 108, 216; Not a square number since even number of factors.  
   b) 1, 2, 4, 7, 13, 14, 26, 28, 52, 91, 182, 364; Not a square number since even number of factors  
   c) 1, 3, 9, 27, 81, 243, 729; Square number since odd number of factors; $\sqrt{729} = 27$  
6. Let the square number represent the area of a square, then its square root is the side length.  
7.a) $\sqrt{24}$; 24 is not a square number.  
   b) 81 cm$^2$  
8.a) 72 cm$^2$  b) $\sqrt{72} \text{ cm}$  c) 8.5 cm  
9.a) 12  
10.a) 1 and 2  b) 8 and 9  
   c) 8 and 9  d) 7 and 8  
11.a) 4.12  b) 10.39  c) 5.74  d) 8.89  

1.5 The Pythagorean Theorem, page 34  
3.a) 50 cm$^2$  
4.a) 64 cm$^2$  
5.a) 10 cm  b) 13 cm  c) 4.5 cm  d) 5.8 cm  
6.a) 9 cm  b) 24 cm  c) 9.8 cm  d) 6.7 cm  
7.a) 7.6 cm  b) 20 cm  c) 20 cm  
8.a) 8.06 cm  b) 11.66 cm  c) 25 cm  
9.a) 5 cm  b) 10 cm  c) 15 cm  
   Compared to rectangle a, the lengths are two times greater in rectangle b and three times greater in rectangle c. The next rectangle has dimensions 12 cm by 16 cm and diagonal 20 cm.  
10. The longest side is the hypotenuse.  
11. The two right triangles formed by the diagonals both have legs 12 cm and 16 cm. So the diagonals must be the same length.  
12. 1 and $\sqrt{17}$, $\sqrt{22}$ and 4, $\sqrt{3}$ and $\sqrt{15}$, 2 and $\sqrt{14}$, $\sqrt{5}$ and $\sqrt{13}$, $\sqrt{6}$ and $\sqrt{12}$, $\sqrt{7}$ and $\sqrt{11}$, $\sqrt{8}$ and $\sqrt{10}$, 3 and 3  
   For each answer, the sum of the squares is 18.  
13.a) 6 units  b) 8 units  c) 4 units  
14.a)  

15. $15^2 = 12^2 + 9^2$; Length of legs: 12 cm and 9 cm  
16. 3.535 cm$^2$, 6.283 cm$^2$, 9.817 cm$^2$  
   The sum of the areas of the semicircles on the legs is equal to the area of the semicircle on the hypotenuse.  
17.a)  

18.a) $\sqrt{2}$ cm, $\sqrt{3}$ cm, $\sqrt{4}$ cm, $\sqrt{5}$ cm, $\sqrt{6}$ cm, $\sqrt{7}$ cm  
   b) 1.4, 1.7, 2.0, 2.2, 2.4, 2.6  
   c) 1.4 cm, 1.7 cm, 2.0 cm, 2.2 cm, 2.4 cm, 2.6 cm  
   d) The lengths of the hypotenuses are the square roots of consecutive whole numbers.  

1.6 Exploring the Pythagorean Theorem, page 43  
3.a) Yes; $38 + 25 = 63$  
4.a) No; $10^2 + 1^2 \neq 13^2$  
5. No, since it is not a right triangle  
6.a) Yes  b) No  c) Yes  d) Yes  
7.a, c, d, f  
8. Yes, it is a right angle since $9^2 + 12^2 = 15^2$.  
9. Yes, the triangle is a right triangle;  
   $7^2 = 6^2 + \sqrt{13}^2$  
   No, the side lengths do not form a Pythagorean triple since $\sqrt{13}$ is not a whole number.  
10. $3^2 + 5^2 \neq 7^2$; Not a right triangle  
11.a) Legs: 3, 4; 6, 8; 9, 12; 10, 15; 16, 20  
   Hypotenuse: 5; 10; 15; 20; 25  
   b) All triples are multiples of first triple 3, 4, 5.  
   c) 10, 24, 26; 15, 36, 39; 20, 48, 52; 25, 60, 65  
12.a) 50, since $14^2 + 48^2 = 50^2$
b) 40, since $32^2 + 24^2 = 40^2$

c) 35, since $12^2 + 35^2 = 37^2$

d) 99, since $20^2 + 99^2 = 101^2$

13. Hold the 1st, 4th, and 8th knots to form a right triangle with side lengths 3 units, 4 units, and 5 units.

14. Yes; Since $48^2 + 55^2 = 73^2$; all angles are right angles.

15. $40 \text{ m}$ and $9 \text{ m}$, since $9 + 40 + 41 = 90$ and $9^2 + 40^2 = 41^2$

16. a) For obtuse triangles, the area of the square on the longest side is greater than the sum of the areas of the squares on the two smaller sides.

b) For acute triangles, the area of the square on the longest side is less than the sum of the areas of the squares on the two smaller sides.

c) In question 6, • the acute triangle is: b • the right triangles are: a, c, d, h • the obtuse triangles are: e, f, g

17. Answers will vary. For example:
Lesser number: 8; Greater number: 14
Triple: 224, 132, 260

1.7 Applying the Pythagorean Theorem, page 49

4.a) 29 cm b) 12.2 cm c) 15.8 cm

5.a) 24 cm b) 15 cm c) 5.7 cm

6. 4 m

7.a) 26 cm or 21.8 cm

b) The unknown side could be a leg or the hypotenuse of the right triangle.

8.a) 6.7 units b) 7.8 units

9. 65 cm

10. 91 m

11. 38.18 m

12.a) The area of the square on the hypotenuse is equal to the sum of the areas of the squares on the legs.

b) The square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.

13. 57.4 cm

14. F; I drew two right triangles with hypotenuses AB and AF. The legs of both triangles were 4 units and 3 units.

15. 5.8 units 16. 216.9 m

17. Yes; $650^2 + 720^2 = 970^2$

18. 403.1 km 19. 7.6 cm 20. 17 cm

21. 37.3 m 22. 291.2 km

Unit 1 Unit Review, page 54

1. Rectangles: 1 unit by 24 units, 2 units by 12 units, 3 units by 8 units, 4 units by 6 units

Not a perfect square since 24 cannot be modelled by a square

2. 25

3. Answers may vary. For example: 16, 25, 1024, 1600, 2401, 2500

4.a) 25 b) 49 c) 81 d) 169

5.a) 7 b) 17 c) 20

6.a) i) 1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108

ii) 1, 9, 36

iii) 1, 2, 3, 5, 6, 10, 15, 25, 30, 50, 75, 150

iv) 2, 11, 13, 22, 26, 143, 286

v) 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 81, 108, 162, 324

vi) 2, 4, 7, 8, 14, 28, 56

b) 361 and 324; Both have an odd number of factors.

7. 44 cm

8. $A = 17$ square units; $s = \sqrt{17}$ units

9.a) $\sqrt{75}$ cm b) $\sqrt{96}$ cm c) 9 cm

10. b; I drew a square on each line segment and found the area. Square b has a greater area.

11.a) 26 b) 5 c) 50 d) 13

12.a) 6 and 7 b) 9 and 10 c) 10 and 11 d) 34 and 35

13.a) 2 b) 3 c) 5 d) 6 e) 8 f) 9

14.a) 7.4 b) 8.7 c) 9.7 d) 10.2 e) 6.8 f) 10.7

15. 8.49, since $8.48^2 = 71.9104$ and $8.49^2 = 72.0801$

16. 130 cm

17.a) False b) True c) True

18.a) 34 cm b) 28 cm c) 16.2 cm

19.a) 8.5 cm b) 7.8 cm

20. Yes, since $24 + 57 = 81$

21. No; $7^2 + 12^2 \neq 15^2$

22. a and c

23. 21; One solution, because in a Pythagorean triple all three numbers must be whole numbers

24. 40 km

25. 42 cm

26. The distance from each possible position to x is the hypotenuse of a right triangle with legs lengths 2 units and 3 units.

27. 31.2 km

Unit 1 Practice Test, page 58

1.a) 11 b) 196 c) 6.32 d) 81

2. $\sqrt{1} = \sqrt{1 \times 1} = 1$

3. $s = 8 \text{ cm}, A = 64 \text{ cm}^2$

4.a) 25 square units b) 5 units

5.a) Yes; $15 + 9 = 24$ b) No; $11 + 7 \neq 20$

6.a) 14.2 cm b) 16 cm

7.a) No; $20^2 + 48^2 \neq 54^2$ b) Yes; $18^2 + 24^2 = 30^2$

8.a) 16.2 m b) 81 m

9.a) 3.6 cm, 2.2 cm, 2.0 cm
b) The line segments could form a triangle because $2.0 + 2.2 > 3.6$.
They could not form a right triangle because $2.0^2 + 2.2^2 \neq 3.6^2$.

10. 19 times

Unit 1 Unit Problem: The Locker Problem, page 61
2. 1, 4, 9, 16, and 25; All numbers are perfect squares.
3. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100
4. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400
5. Open lockers have perfect squares as numbers. The number of students that change the locker corresponds to the number of factors for that locker number. All perfect squares have an odd number of factors, so those lockers are open.
6. The numbers in the third column are the consecutive odd numbers beginning at 3.
7.a) Every odd square number will appear in the third column if you continue the table far enough.
b) No, the difference between 2 consecutive odd numbers is always an odd number.
   c) 25
d) 12, 13, 5 and 24, 25, 7
   e) 9, 40, 41

Unit 2 Integers, page 62

2.1 Using Models to Multiply Integers, page 68
5.a) (+3) × (–1) = –3  b) (+5) × (–2) = –10
c) (+4) × (+11) = +44
6.a) (–4) + (–4) + (–4) + (–4) + (–4) + (–4) = –28
   b) (+3) + (+3) + (+3) + (+3) + (+3) + (+3) = +18
   c) (+6) + (+6) + (+6) + (+6) = +24
   d) (–6) + (–6) + (–6) + (–6) = –24
7.a) (–3) + (–3) = –6  b) (+4) × (–2) = –8
8.a) –6  b) +27  c) +12  d) –20
9.a) (+5) × (–2) = –10  b) (+5) × (+2) = +10
   c) (–7) × (–3) = +21  d) (–9) × (–4) = +36
   e) (+11) × (+3) = +33  f) (–10) × (–5) = +50
10.a) +5  b) +24  c) –14  d) –24  e) –30  f) +32
11.a) +8  b) +8  c) +16  d) –30  e) –24  f) +21
12.a) (+2) × (+9) = +18; The temperature rose 18°C.
13.(–3) × (+11) = –33; The water level dropped 33 cm.
14.a) Answers will vary. For example:
    Olinga withdraws $6 from his bank account every day for 8 days. (+8) × (–6) = –48
    +5
15.a) Use tiles: withdraw 7 sets of 8 red tiles.
    Use a number line: Face the negative end and take 7 steps backward each of size 8.
    (–7) × (–8) = +56
16.a) (–4) × (+4) = –16
17.a) (–8) × (–5) = +40; He will have $40 less.
   b) (–2) × (–5) = +10; He had $10 more.
18.a) –40 or 40 cm to the left
   b) +12 or 12 cm to the right
   c) (–4) × (+10) = –40
      (–3) × (–4) = +12
19. Answers may vary. For example:
    Hugh threw out 7 cartons each with half a dozen eggs. How many eggs did he throw out?
    (–7) × (–6) = 42
20.a) –24  b) +15  c) –30  d) +36

2.2 Developing Rules to Multiply Integers, page 73
3.a) Negative  b) Positive
c) Negative  d) Positive
4.a) –24  b) +20  c) –27  d) –42  e) –30
   f) +42  g) 0  h) –10  i) +56  j) –81
5.a) i) –21, –21  ii) +32, +32
     iii) +45, +45  iv) –60, –60
   b) No
6.a) +300  b) +780  c) –1600  d) –840
    e) –780  f) –2640  g) +3290  h) +4680
7.a) –300  b) –945  c) +544  d) –666
    e) +221  f) –3024  g) +1275  h) +667
8.a) +4  b) –3  c) +6  d) –6
    e) –4  f) –12  g) –30  h) –6
9.a) +16, +32, +64; Multiply by +2 each time.
    b) +1296, –7776, +46 656; Multiply by –6 each time.
    c) –81, +243, –729; Multiply by –3 each time.
    d) –4, +4, –4; Multiply by –1 each time.
10. (–17) × (–26) = +442; Gaston withdrew $442.
11.a) –8 and –5  b) +9 and –8
12.a) i) +6  ii) –24  iii) +120
    iv) –720  v) +5040  vi) –40 320
    vii) +362 880  viii) –3 628 800
   b) i) Positive ii) Negative
   c) Yes
13.a) (+60) × (–20) = –1200; Amelie wrote +1200 instead of –1200.
   b) –1080
14. Answers will vary. For example:
    Gavin ate 15 handfuls of 8 jelly beans. How many jelly beans did he eat?
    (+15) × (–8) = –120; Gavin ate 120 jelly beans.
15. When you multiply an integer by itself, you multiply two integers with the same sign. This always gives a positive product.
16. Answers may vary. For example:
   Bridget’s van uses 12 L of gas every day. How much gas does Bridget use in 7 days?
   \((-12) \times (-7) = 84\); Bridget uses 84 L of gas.

17. For example:
   Two factors: \((+2) \times (-18); (-2) \times (+18)\)
   Three factors: \((-2) \times (-2) \times (-9);\)
   \((-2) \times (+2) \times (+9)\)
   Four factors: \((-2) \times (-2) \times (+3) \times (+3)\)

18. Answers will vary. For example:
   \((+4) \times (+5) = +20; 20\degree C\)
   \((-2) \times (+7) = -14; 14\text{ m}\)
   \((-12) \div (+6) = -2; 2\text{ m}\)

19. No, the product of the positive integer and a negative integer is always less than or equal to each of the integers.

20. a) -5      b) -9

21. Multiply the integers from left to right.
   The product is positive when there is an even number of negative factors.
   The product is negative when there is an odd number of negative factors.
   For example: \((-1) \times (+2) \times (-4)\) has 2 negative factors, so the answer is +8.

2.3 Using Models to Divide Integers,
page 80

3. a) \((+5) \times (+5) = +25\)
   b) \((-12) \times (-2) = +24\)
   c) \((-2) \times (-7) = +14\)
   d) \((-3) \times (+6) = -18\)

4. a) \((-20) \div (-4) = +5\)
   b) \((+21) \div (+3) = +7\)
   c) \((-26) \div (-13) = +2\)
   d) \((-24) \div (+4) = -6\)

5. a) +8
   b) +3
   c) -2
   d) +3
   e) +5
   f) -10

6. a) i) 2
    b) i) 4
    c) i) 3
   d) i) 4
   e) i) 3
   f) i) 3

8. a) +3
   b) -2
   c) +4
   d) -3
   e) -3
   f) +2

9. a) +2
   b) +2
   c) -2
   d) -2
   e) -2
   f) -2

10. a) +3
    b) +4
    c) -4
    d) -5
    e) -7
    f) -2

11. (12) ÷ (+3) = +4; 4 hours
   (r) ÷ (-4) = -5; 5 hours
   (148) ÷ (+4) = -37; 37 m

12. Answers will vary. For example:
    Heather returned 5 towels to a store and received $45. How much had each towel cost?
    \((+45) \div (-5) = -9\); Each towel cost $9.

15. Answers will vary. For example:
    A scuba diver descends a total of 12 m over the course of 6 equal descents. How far did he descend each time?
    \((-12) \div (+6) = -2; 2\text{ m}\)

16. a) \((-36) \div (-6) = +6; After 6 minutes\)
   b) \((+18) \div (-6) = -3; 3 minutes ago\)

17. a) -4°C
   b) +3°C

18. a) 6 weeks
   b) $8

Unit 2 Mid-Unit Review, page 83

1. a) -36  b) +35  c) +32  d) -15
2. \((-2) \times (+7) = -14; 14 \text{ m}\)
3. \((+4) \times (+5) = +20; 20\degree C\)

4. a) Negative  b) Positive
   c) Negative  d) Positive
5. a) -40  b) +15  c) -48  d) +72
6. a) -280  b) +456  c) +1080  d) -403
7. \((-35) \times (+30) = -1050; 1050 \text{ L}\)
8. a) -8  b) -9  c) +7  d) -12
9. a) (+9) ÷ (+3) = +3; (3) ÷ (+9) = +27
   b) (-2) ÷ (-7) = +14; (-7) ÷ (-2) = -14
   c) (+7) ÷ (-3) = -21; (-3) ÷ (+7) = -21
   d) (-13) ÷ (+2) = -26; (+2) ÷ (-13) = -26

10. a) +5  b) +4  c) -4  d) -9

11. \((-30) \div (-5) = +6; 6 \text{ hours}\)

12. Answers will vary. For example:
    A stock dropped 18 points steadily over 3 days. How much did it drop each day?
    \((-18) \div (+3) = -6; 6 \text{ points}\)

13. To go from 0 to +64 take steps backwards of size 8. It will take 8 steps and you will face the negative direction. \((+64) \div (-8) = -8\)

2.4 Developing Rule to Divide Integers,
page 87

4. a) Negative  b) Positive
   c) Negative  d) Positive
5. a) +3  b) +5  c) -2  d) -9  e) -9
6. a) (0) ÷ (+3) = 0; (+3) ÷ (+3) = +1;
   b) (+6) ÷ (+3) = +2; (+9) ÷ (+3) = +3
   c) (0) ÷ (+3) = 0; (+3) ÷ (+3) = +1;
   d) (0) ÷ (+3) = 0; (+3) ÷ (+3) = +1;
   e) (0) ÷ (+3) = 0; (+3) ÷ (+3) = +1;
   f) (0) ÷ (+3) = 0; (+3) ÷ (+3) = +1;

8. It will take 8 steps and you will face the negative direction. \((+64) \div (-8) = -8\)

ANSWERS 501
7.a) i) +8 ii) −5 iii) −7
b) i) (+24) ÷ (+8) = +3 ii) (+45) ÷ (−5) = −9
iii) (−28) ÷ (−7) = +4
8.a) (−30) ÷ (−6) = +5 and (−30) ÷ (+5) = −6
b) (+42) ÷ (+7) = +6 and (+42) ÷ (+6) = +7
c) (−36) ÷ (+9) = −4 and (−36) ÷ (−4) = +9
d) (−32) ÷ (−4) = −8 and (−32) ÷ (−8) = −4
9.a) +4 b) −3 c) +9 d) 0
10.a) +5 b) −90 c) +9 d) −21
e) −60 f) +49 g) −48 h) +44
11.a) (−56) ÷ (−7) b) +8; 8 days
12.a) (−15) ÷ (+5) b) −3; Dropped 3°C per day

13. S11
14.a) (−24) ÷ (−6) b) +4; 4 performances
15.a) +81, −243, +729; Multiply by 3.
b) +30, −36, +42; Add +6 and multiply by −1.
c) −40, −160, +80; Alternately multiply by +4, divide by −2.
d) +8, −4, +2; Divide by −2.
e) −100, +10, −1; Divide by −10.
16.a) When the dividend is positive and the divisor is greater than the quotient; (+8) ÷ (+4) = +2
b) When the dividend and divisor are equal and non-zero; (+8) ÷ (+8) = +1
c) When the dividend and divisor are opposite integers; (+8) ÷ (−8) = −1
f) When the dividend is 0 and the divisor is non-zero; 0 ÷ (−4) = 0
17. (−32) ÷ (−1) = +32; (−32) ÷ (+1) = −32
(−32) ÷ (−2) = −16; (−32) ÷ (+2) = +16
(−32) ÷ (−4) = +8; (−32) ÷ (+4) = −8
(−32) ÷ (+8) = +4; (−32) ÷ (−8) = −4
(−32) ÷ (−16) = +2; (−32) ÷ (+16) = −2
(−32) ÷ (−32) = +1; (−32) ÷ (+32) = −1
18.a) −5 b) +6 c) −7 d) +4 e) +4 f) −5
19. +$9$
20. Answers may vary. For example:
A squirrel had 78 acorns and ate 13 each week. How many weeks ago did the squirrel have 78 acorns? (+78) ÷ (−13) = −6; 6 weeks ago
21.a) 2°C/hour
b) The temperature must have been less than −20°C.
22. −2, +2, +4; −6, +6, +4; −8, +8, +4; −4, +2, +6; −6, +2, +8
23. (−36) ÷ (+1) = −36; (−36) ÷ (−1) = +36
(−36) ÷ (−2) = +18; (−36) ÷ (+2) = −18
(−36) ÷ (−3) = 12; (−36) ÷ (−3) = +12
(−36) ÷ (+4) = −9; (−36) ÷ (−4) = +9
(−36) ÷ (+6) = −6; (−36) ÷ (−6) = +6
(−36) ÷ (+9) = −4; (−36) ÷ (−9) = +4
(−36) ÷ (−12) = +3; (−36) ÷ (−12) = +3

(−36) ÷ (+18) = −2; (−36) ÷ (−18) = +2
(−36) ÷ (+36) = −1; (−36) ÷ (−36) = +1
−36 is not a square number; Each pair of factors has opposite signs.

24. Represent the mean with the division equation: (−140) ÷ (+7) = −20
Find 7 numbers whose sum is −140. Use guess and check.

2.5 Order of Operations with Integers, page 92
3.a) Multiply b) Divide c) Add
d) Add e) Multiply f) Divide
4.a) 10 b) 7 c) 4 d) +4 e) −12 f) 9
5. No; Elijah added before subtracting
Correct answer: −24
6.a) i) 0 ii) 6
b) The brackets are in different positions.
7.a) Multiply; 23 b) Add; −18
c) Multiply; 25 d) Multiply; −14
e) Divide numbers in brackets; −3
f) Divide; −54
8.a) −15 b) 10 c) 2 d) 14 e) 10 f) 14
9.a) −5 b) 1 c) −2 d) −1
10.a) 8 b) 2 c) −4 d) −2
11.a) Robert
b) Christian calculated (−8) ÷ 2 to be +4 instead of −4. Brenna subtracted (−40) − 2 first.
12.a) −8; −20 ÷ [2 − (−2)]
b) −19; [(−21) + 6] + 3
c) 9; 10 + 3 × [2 − 7]
13. 405 + 4(−45); $225
14. Answers may vary. For example:
a) (−4) + (−4) + (−4) b) (−4) − (−4) + (−4)
c) (−4)(−4) − (−4) d) (−4) + (−4) + (−4)
e) (−4) + (−4) − (−4) f) (−4) + (−4)

15. −5°C
16.a) [(−24) + 4] ÷ (−5) = 4
b) [(−4) + 10] × (−2) = −12
c) [(−10) − 4] ÷ (−2) = 7
17.a) (−10) × (−2) + 1 = 21
b) (−5) − (−2) + 4 = 1 c) 6 × (−7) − 2 = −44
d) (−2)(−2) − 8 = −4

Unit 2 Strategies for Success: Understanding the Problem, page 95
1. Answers may vary. For example:
1 − 5 = −4; 2 − 6 = −4; 3 − 7 = −4; 4 − 8 = −4
2. (−5) + [(−4) − (−2) − (−1)] × (−3) = −11
3. 10°C

Unit 2 Unit Review, page 97
1.a) (−1) + (−1) = −2 b) (9) + (9) = +18
c) (−3) + (−3) + (−3) = −9
d) (7) + (7) + (7) = +21
Unit 2 Practice Test, page 99

1.a) +90 b) –66 c) –6 d) +13
e) –48 f) –4 g) +11 h) +5
2.a) +98 b) –3 c) –4 d) +21
3. –20°C
4.a) Receive $90 b) Spend $105
c) Receive $63
da) +3 and +4 c) –2 and –1 d) +4 and –1
e) Answers may vary. For example: Find all pairs of integers with a difference of –2.
   +2 and +4, 0 and +2, –2 and 0, +1 and +3, –1 and +1

Unit 2 Unit Problem: Charity Golf Tournament, page 100

1.a) 3(0) + 2(+1) + (–1) + 2(–2) + (+2)
b) –1 or 1 under par
2.a) 4, 4, 4, 3, 3 b) 31 c) –1 or 1 under par
3.a) Kyle: 35 b) Delaney: 28
c) Hamid: 26
4.a) Hamid, Hanna, Delaney, Chai Kim, Kyle, Weng Kwong
b) Hamid: –6
c) Hanna and Delaney; –5 and –4

Unit 3 Operations with Fractions, page 102

3.1 Using Models to Multiply Fractions and Whole Numbers, page 108

5.a) \( \frac{5}{9} \times 45; 45 \times \frac{5}{9} \) b) \( \frac{3}{8} \times 32; 32 \times \frac{3}{8} \)
c) \( \frac{1}{12} \times 36; 36 \times \frac{1}{12} \) d) \( \frac{4}{5} \times 25; 25 \times \frac{4}{5} \)
6.a) \( 3 \times \frac{1}{4}; \frac{1}{4} \times 3 \) b) \( 7 \times \frac{2}{3}; \frac{2}{3} \times 7 \)
c) \( 4 \times \frac{3}{10}; \frac{3}{10} \times 4 \)
7.a) \( \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} \) b) 4
c) \( \frac{2}{3} \times 6 = 4 \)
8.a) \( 4 \times \frac{4}{5} = 3 \frac{1}{5} \) b) \( 9 \times \frac{1}{2} = 4 \frac{1}{2} \)
c) \( 3 \times \frac{5}{6} = 2 \frac{1}{2} \)
9.a) \( 5 \times \frac{1}{2} = \frac{5}{2} \) b) \( 4 \times \frac{3}{4} = 3 \)
10.a) \( 4 \times \frac{1}{2} = 2 \) b) \( 5 \times \frac{2}{3} = 3 \frac{1}{3} \)
11.a) \( 5 \times \frac{1}{8} = \frac{5}{8} \) b) \( \frac{2}{5} \times 3 = 1 \frac{1}{5} \)
c) \( 4 \times \frac{5}{12} = 2 \frac{2}{3} \)

12.a) 12 b) 8 c) 6 d) 4 e) 3 f) 2
13.a) 24 b) 16 c) 18 d) 20 e) 9 f) 10

ANSWERS 503
14. a) \( \frac{5}{7} \)  
   b) \( 1 \frac{1}{3} \)  
   c) 9  
   d) \( 2 \frac{4}{5} \)  

15. a) 4  
   b) 3  
   c) 9  
   d) 6  

16. a) \( 2 \frac{2}{5} \)  
   b) \( 3 \frac{8}{9} \)  
   c) 10  
   d) \( 2 \frac{1}{2} \)  
   e) \( 10 \frac{1}{2} \)  
   f) \( 4 \frac{1}{2} \)  

17. \( 24 \times \frac{2}{3} = 16; \) 16 hours  

18. a) For example: Jerry ordered 5 pizzas for his birthday party. \( \frac{3}{8} \) of each pizza is left over. How much pizza is left over in total? \( 5 \times \frac{3}{8} = \frac{15}{8} \)  
   b) \( \frac{15}{8} \)  
   c) \( \frac{3}{8} \times \frac{1}{2} = \frac{3}{16} \)  

19. For example: Parri only likes black jelly beans. At Halloween she receives 16 packets of jelly beans, each containing 3 black jelly beans and 5 jelly beans of other colours. How many packets of jelly beans will she eat? \( \frac{3}{8} \times 16 = 6 \)  

20. \( \frac{4}{7} \times 28 = 16 \); She spent $16 on rides.  

21. a) i) 1  
   ii) 1  
   iii) 1  
   iv) 1  

b) The product of a number and its reciprocal is 1.  
   c) For example: \( 6 \times \frac{1}{6} = 1; \) \( 37 \times \frac{1}{37} = 1 \)  

22. \( 4 \frac{1}{2} \) hours  

3.2 Using Models to Multiply Fractions, page 113  

5. a) 1  
   b) 3  
   c) 20  
   d) 3  
   e) \( \frac{3}{20} \)  

6. a) \( \frac{3}{8} \)  
   b) \( \frac{1}{2} \)  
   c) \( \frac{1}{5} \)  
   d) \( \frac{5}{12} \)  
   e) \( \frac{21}{40} \)  
   f) \( \frac{3}{5} \)  

7. a) \( \frac{3}{5} \)  
   b) \( \frac{4}{9} \)  
   c) \( \frac{1}{6} \)  
   d) \( \frac{2}{9} \)  
   e) \( \frac{5}{12} \)  
   f) \( \frac{1}{2} \)  

8. a) \( \frac{16}{32} \)  
   b) \( \frac{8}{45} \)  
   c) \( \frac{1}{6} \)  
   d) \( \frac{4}{7} \)  
   e) \( \frac{2}{9} \)  
   f) \( \frac{16}{25} \)  

9. For example: \( \frac{1}{7} \times \frac{2}{3} = \frac{2}{21}; \) \( \frac{3}{5} \times \frac{1}{2} = \frac{3}{10} \)  

10. a) \( \frac{3}{5} \times \frac{1}{2} = \frac{3}{10} \)  
    b) \( \frac{6}{8} \times \frac{1}{3} = \frac{1}{4} \)  
    c) \( \frac{1}{3} \times \frac{3}{4} = \frac{1}{4} \)  
    d) \( \frac{4}{5} \times \frac{3}{5} = \frac{8}{25} \)  

11. \( \frac{1}{4} \)  

12. a) i) \( \frac{3}{10} \)  
    ii) \( \frac{3}{10} \)  
    iii) \( \frac{3}{32} \)  
    iv) \( \frac{3}{32} \)  
    v) \( \frac{2}{5} \)  
    vi) \( \frac{2}{5} \)  

b) Switching the numerators of 2 fractions does not change the product.  
   c) For example: \( \frac{1}{7} \times \frac{5}{8} = \frac{5}{56}; \) \( \frac{3}{11} \times \frac{2}{1} = \frac{3}{22} \)  

13. a) \( \frac{1}{6} \)  
    b) \( \frac{1}{2} \times \frac{1}{6} \)  
    c) \( \frac{3}{10} \)  

14. For example: Gwen conducted an experiment involving \( \frac{4}{9} \) of the lab rats at her school. Of the rats she used, \( \frac{1}{5} \) were female. What fraction of the rats used were female? \( \frac{4}{9} \times \frac{1}{5} = \frac{4}{45} \)  

15. \( \frac{2}{7} \times \frac{1}{8} = \frac{1}{4} \)  

16. \( \frac{5}{8} \times \frac{3}{12} = \frac{5}{32} \)  
    \( \frac{3}{8} \times \frac{5}{12} = \frac{5}{32} \)  

17. a) 3 of 5 parts making up the whole are shaded.
b) To show \( \frac{5}{3} \) of \( \frac{3}{5} \) you need to shade \( \frac{5}{5} \) of the \( \frac{3}{5} \) already shaded. Since \( \frac{5}{3} \) is all 5 parts of the whole, one whole is \( \frac{5}{3} \) of \( \frac{3}{5} \).

3.3 Multiplying Fractions, page 118

4. a) 2, 4 b) 7  c) 2, 4, 8
d) 3 e) 5  f) 2, 3, 6

5. a) \( \frac{1}{8} \)

b) \( \frac{5}{6} \) is about 1, \( \frac{3}{20} \) is about 0; so \( \frac{5}{6} \times \frac{3}{20} \) is close to 0.

c) Yes; \( \frac{1}{8} \) is close to 0.

6. \( \frac{3}{16} \)

7. a) \( \frac{5}{8} \)  b) \( \frac{3}{10} \)  c) 1  d) \( \frac{1}{3} \)  e) \( \frac{5}{6} \)  f) \( \frac{3}{2} \)

8. a) \( \frac{2}{3} \)  b) \( \frac{1}{4} \)  c) \( \frac{1}{24} \)  d) \( \frac{39}{16} \)  e) \( \frac{11}{8} \)  f) \( \frac{49}{24} \)

9. a) \( \frac{3}{32} \)  b) \( \frac{1}{6} \)

10. For example: Amanda ate \( \frac{1}{8} \) of a pizza. Her clumsy friend Cody dropped \( \frac{1}{2} \) of the remaining pizza on the floor. How much pizza is left?

\[ \frac{7}{8} \times \frac{1}{2} = \frac{7}{16} \]

11. \( \frac{3}{8} \)

12. a) i) 1  ii) 1  iii) 1  iv) 1

b) For example: \( \frac{3}{8} \times \frac{8}{3} = 1, \frac{8}{9} \times \frac{9}{8} = 1, \frac{12}{6} \times \frac{6}{13} = 1 \)

The product of a fraction and its reciprocal is 1.

13. Answers may vary. For example:

a) i) \( \frac{3}{2} \times \frac{4}{3} = \frac{2}{1} \) ii) \( \frac{12}{5} \times \frac{5}{4} = \frac{3}{1} \)

iii) \( \frac{3}{5} \times \frac{16}{5} = \frac{4}{1} \) iv) \( \frac{15}{2} \times \frac{2}{3} = \frac{5}{1} \)

b) \( \frac{7}{20} \times \frac{20}{7} = 1 \)

i) \( \frac{7}{10} \times \frac{20}{7} = 2 \) ii) \( \frac{7}{20} \times \frac{60}{7} = 3 \)

iii) \( \frac{7}{20} \times \frac{20}{7} = 4 \) iv) \( \frac{35}{20} \times \frac{20}{7} = 5 \)

14. \( \frac{1}{3} \) and \( \frac{1}{4} \)

15. a) \( \frac{9}{40} \)  b) \( \frac{6}{13} \)  c) \( \frac{3}{8} \)  d) \( \frac{4}{13} \)

16. a) i) \( \frac{24}{25} \times \frac{85}{96} = \frac{1 \times 17}{5 \times 4} = \frac{17}{20} \)

b) \( \frac{24}{25} \times \frac{85}{96} = \frac{1 \times 17}{5 \times 4} = \frac{17}{20} \)

17. For example: \( \frac{1}{2} \times \frac{3}{2} \)

18. \( \frac{1}{3} \)

19. \( \frac{10}{3} \)

20. b) \( \frac{4}{7} \times \frac{3}{5} = \frac{12}{35} \)

21. a) \( \frac{2}{3} \)  b) \( \frac{4}{5} \)  c) \( \frac{3}{5} \)  d) \( \frac{7}{13} \)

3.4 Multiplying Mixed Numbers, page 125

4. a) \( \frac{3}{2} \), \( \frac{7}{2} \)  b) \( \frac{2}{3} \), \( \frac{11}{5} \)  c) \( \frac{6}{7} \), \( \frac{13}{7} \)

5. a) \( \frac{23}{10} \)  b) \( \frac{33}{8} \)  c) \( \frac{23}{6} \)  d) \( \frac{5}{3} \)  e) \( \frac{17}{5} \)

f) \( \frac{11}{2} \)  g) \( \frac{18}{7} \)  h) \( \frac{32}{9} \)  i) \( \frac{20}{3} \)

6. a) \( \frac{3}{2} \)  b) \( \frac{3}{4} \)  c) \( \frac{4}{5} \)  d) \( \frac{13}{8} \)  e) \( \frac{3}{6} \)

7. a) \( \frac{8}{3} \)  b) \( \frac{8}{3} \)  c) \( \frac{21}{5} \)  d) \( \frac{15}{10} \)  e) \( \frac{5}{6} \)

8. a) \( \frac{8}{3} \)  b) \( \frac{18}{5} \)  c) \( \frac{8}{9} \)  d) \( \frac{8}{9} \)

9. a) \( \frac{3}{4} \)  b) \( \frac{8}{1} \)  c) \( \frac{3}{1} \)  d) \( \frac{9}{3} \)  e) \( \frac{3}{1} \)

10. a) \( \frac{1}{2} \)  b) \( \frac{7}{5} \)  c) \( \frac{4}{5} \)  d) \( \frac{3}{5} \)

11. a) \( \frac{5}{5} \)  b) \( \frac{14}{2} \)  c) \( \frac{7}{9} \)  d) \( \frac{8}{6} \)  e) \( \frac{6}{5} \)  f) \( \frac{4}{5} \)

12. a) \( \frac{3}{4} \)  b) \( \frac{8}{5} \)  c) \( \frac{5}{15} \)  d) \( \frac{14}{16} \)  e) \( \frac{3}{13} \)  f) \( \frac{11}{40} \)

13. a) \( \frac{35}{4} \)  b) \( $35.25 \)

14. \( 6 \frac{5}{12} \) h or 6 h 25 min

15. For example: Josh spends \( \frac{3}{7} \) hours on his phone every week. Mark spends \( \frac{2}{8} \) as much time on the phone as Josh. How much time does Mark spend on the phone in a week? \( 7 \frac{7}{16} \) hours

16. 7 innings

17. a) Layton: 5; Meghan and Josh: \( \frac{12}{2} \)

b) \( \frac{5}{12} \)  c) \( \frac{13}{3} \)  d) \( \frac{21}{4} \)  e) \( 255 \)

18. Least product: a; Greatest product: d

19. a) \( \frac{16}{27} \)  b) \( \frac{12}{5} \)  c) \( \frac{11}{13} \)  d) \( \frac{11}{16} \)
Unit 3 Mid-Unit Review, page 128

1.a) \( \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \frac{1}{2} \)
   b) \( \frac{2}{3} + \frac{3}{5} + \frac{3}{3} + \frac{3}{5} + \frac{3}{3} + \frac{3}{5} = 4 \frac{1}{2} \)
   c) \( \frac{5}{6} + \frac{5}{6} + \frac{2}{9} = 2 \frac{1}{2} \)
   d) \( \frac{2}{9} + \frac{2}{9} + \frac{2}{9} + \frac{2}{9} + \frac{2}{9} = 1 \frac{1}{3} \)

2.a) \( 3 \frac{3}{4} \)  b) \( 3 \)  c) \( 4 \frac{1}{8} \)  d) \( 1 \frac{1}{4} \)

3.a) \( 14 \)  b) \( 2 \)  c) \( \frac{1}{8} \)

4.a) \( \frac{5}{16} \)  b) \( \frac{1}{2} \)  c) \( \frac{2}{5} \)  d) \( \frac{1}{4} \)

5.a) \( \frac{2}{9} \)  b) \( \frac{4}{15} \)  c) \( \frac{6}{11} \)  d) \( \frac{1}{3} \)

6.a) \( \frac{1}{3} \)  b) \( \frac{1}{5} \)  c) \( \frac{9}{32} \)  d) \( \frac{10}{27} \)

7. \( \frac{2}{15} \)

8.a) \( 5 \)  b) \( 8 \frac{1}{3} \)  c) \( 25 \frac{25}{32} \)  d) \( 8 \frac{1}{4} \)

9.a) \( 8 \frac{1}{8} \)  b) \( 1 \frac{1}{16} \)  c) \( 2 \frac{4}{5} \)  d) \( 14 \frac{7}{16} \)

10. \( \frac{1}{2} \)

3.5 Dividing Whole Numbers with Fractions, page 132

3.a) \( 4 \times \frac{1}{3} = 12 \)  b) \( 3 \times \frac{1}{6} = 18 \)
   c) \( 4 \times \frac{2}{3} = 6 \)  d) \( 3 \times \frac{3}{5} = 5 \)

4.a) 
   b) \( 4 \times \frac{1}{6} \)  c) \( 4 \frac{1}{5} \)  d) \( 4 \times \frac{5}{6} = 4 \frac{5}{3} \)

5. 5 subjects

6.a) \( 4 \)  b) \( 9 \)  c) \( 16 \)  d) \( 12 \)  e) \( 6 \)  f) \( 8 \)

7. Answers may vary. For example:
   a) \( 3 + \frac{1}{4} = 12; 3 + \frac{3}{4} = 4; 3 + \frac{1}{2} = 2 \)
   b) \( 2 + \frac{1}{3} = 10; 2 + \frac{2}{5} = 5; 2 + \frac{10}{5} = 1 \)
   c) \( 4 + \frac{1}{6} = 24; 4 + \frac{1}{3} = 12; 4 + \frac{3}{4} = 3 \)

8.a) i) \( 6 \)  ii) \( 3 \)  iii) \( 4 \)
   b) i) \( 12 \)  ii) \( 6 \)  iii) \( 4 \)
   c) i) \( \frac{1}{4} \)  ii) \( \frac{1}{8} \)  iii) \( \frac{1}{16} \)

9.a) \( 7 \frac{1}{2} \)  b) \( 5 \frac{1}{3} \)  c) \( 1 \frac{1}{10} \)  d) \( \frac{5}{16} \)

3.6 Dividing Fractions, page 139

4.a) \( \frac{9}{5} \)  b) \( \frac{7}{3} \)  c) \( \frac{8}{7} \)  d) \( \frac{15}{14} \)

5.a) \( \frac{2}{3} \)

6.a) \( \frac{10}{9} \)  b) \( \frac{3}{5} \times \frac{10}{9} = \frac{1}{3} \times \frac{2}{3} = \frac{2}{3} \)

7.a) \( 2 \frac{1}{2} \)  b) \( \frac{2}{3} \)

10.a) \( 20 \)  b) \( 9 \)  c) \( 15 \)

11.a) \( \frac{3}{20} \)  b) \( 12 \)  c) \( \frac{11}{60} \)

12.a) \( 2 \times \frac{4}{3} = 3; 2 \times \frac{6}{4} = \frac{11}{3} \)

13. No
   \( \frac{2}{3} + 4 = \frac{1}{6} \)
   \( 4 \div \frac{2}{3} = 6 \)

14.a) \( 24 \)  b) \( \frac{1}{24} \)

15. \( \frac{25}{4} - 5 = \frac{25}{4} + 5 = 1 \frac{1}{4} \)

   \( \frac{49}{6} - 7 = \frac{49}{6} + 7 = 1 \frac{1}{6} \)

   The numerator is the square of the whole number.
   The denominator is one less than the whole number.

3.7 Dividing Fractions, page 140
For example: Tahoe has $\frac{7}{8}$ of a bag of chips he wants to share with his friends. Each serving of chips should be $\frac{1}{4}$ of a bag. How many servings are there? $3\frac{1}{2}$.

19.a) $\frac{3}{4}$, b) $\frac{5}{4}$, c) $\frac{5}{9}$, d) $\frac{9}{7}$

20. Answers will vary. For example:

$$3 \div \frac{5}{4} ; 6 \div \frac{5}{9} ; \frac{1}{2} \div \frac{3}{4}$$

### 3.7 Dividing Mixed Numbers, page 145

4.a) $\frac{35}{8}$, b) $\frac{23}{7}$, c) $\frac{37}{6}$, d) $\frac{9}{4}$

e) $\frac{17}{10}$, f) $\frac{23}{7}$, g) $\frac{37}{6}$, h) $\frac{27}{5}$

5.a) $1\frac{5}{9}$, b) $2\frac{2}{7}$, c) $4\frac{4}{5}$, d) $2\frac{1}{10}$

e) $2\frac{1}{2}$, f) $3\frac{2}{7}$, g) $5\frac{2}{3}$, h) $2\frac{1}{12}$

6.a) 2, b) 4, c) 1, d) 5

7.a) $\frac{2}{3}$, b) $\frac{9}{5} + \frac{27}{10}$, c) $\frac{2}{3}$

d) Yes; The quotient and estimate are both $\frac{2}{3}$.

### Answers

8.a) $3\frac{1}{3}$, b) $\frac{7}{26}$, c) $\frac{1}{2}$, d) $\frac{3}{5}$

9.a) $1\frac{2}{5}$

b) $1\frac{1}{2}$

10.a) $\frac{44}{63}$, b) $3\frac{1}{3}$, c) $\frac{13}{36}$, d) 1

11.a) $\frac{57}{80}$, b) $1\frac{5}{28}$, c) $\frac{18}{35}$, d) 1

12. 10

13. $3\frac{1}{2}$ min

14.a) 7, c) $10\frac{3}{8} + 1\frac{1}{2} = 7\frac{1}{12}$

d) Amelia can fill 7 planters and $\frac{1}{12}$ of another planter.

15. For example: Sharon has $4\frac{2}{3}$ pounds of cherries with which to make cherry tarts. Each tart requires $\frac{3}{5}$ of a pound of cherries. How many tarts can she make? $7\frac{7}{9}$ tarts
16. Greatest quotient: c; Least quotient: d
17.a) \(\frac{3}{8} + \frac{2}{5}\) is a mixed number since the divisor is smaller than the dividend.
   b) \(\frac{175}{136} ; \frac{136}{175}\) The quotients are reciprocals.
18. Parts a, b, and d have values less than \(\frac{3}{5}\). Parts c, e, and f have values greater than \(\frac{3}{5}\). Part f has a greater value than part e since \(\frac{3}{2} > \frac{2}{3}\).
   Calculate c and f:
   c) \(\frac{4}{5}\)
   f) \(\frac{7}{10}\)
   So, c has the greatest value.
19.a) Instead of multiplying, divide by the reciprocal of the second fraction.
   b) Answers may vary. For example: No, since drawing number lines to divide takes too long.

3.8 Solving Problems with Fractions, page 151
3.a) Addition b) Multiplication c) Subtraction d) Multiplication
4. \(\frac{11}{12}\) cans; Addition
5. 40 goals; Division
6.a) \(\frac{1}{2}\); Subtraction b) 15; Multiplication
7. \(7 \frac{1}{12}\); Subtraction
8. $960; Multiplication
9. 72 cm; Division
10. \(\frac{5}{24}\); Subtraction
11.a) \(\frac{1}{2}\); Subtraction b) \(\frac{1}{8}\) cups; Multiplication c) \(\frac{23}{24}\) cups; Addition d) \(\frac{13}{24}\) cup; Subtraction
12. \(\frac{1}{12}\); Multiplication
13. \(\frac{3}{5}\); Subtraction, then multiplication
14. \(\frac{17}{24}\); Division
15. The official was puzzled because the sum of \(\frac{3}{8}\) and \(\frac{3}{5}\) is greater than 1.

3.9 Order of Operations with Fractions, page 155
4.a) Subtraction b) Multiplication c) Division d) Addition
5. Raj; Rena added before she multiplied.

6.a) \(\frac{11}{20}\); Multiplication b) \(\frac{1}{3}\); Division
   c) \(1 \frac{10}{21}\); Division d) \(\frac{1}{48}\); Subtraction
   e) \(1 \frac{1}{3}\); Division f) \(\frac{8}{7}\); Addition
7.a) \(\frac{3}{16}\) b) \(\frac{5}{8}\) c) \(\frac{1}{3}\) d) \(\frac{3}{8}\)
8. No; In the first equation you divide first, and in the second equation you multiply first.
9.a) \(\frac{2}{5}\) b) \(\frac{1}{5}\) c) \(\frac{1}{2}\)
10.a) 4 b) \(\frac{1}{18}\)
11.a) Myra
   b) Robert solved \(\left(\frac{3}{4} - \frac{1}{2}\right) + \frac{13}{6} \times \frac{1}{2}\) then multiplied by 4. Joe solved \(\left(\frac{3}{4} - \frac{1}{2}\right) + \frac{13}{6}\) before multiplying.
12.a) \(2 \frac{7}{8}\) b) \(\frac{5}{8}\) c) \(5 \frac{11}{15}\)

Unit 3 Strategies for Success: Checking and Reflecting, page 157
1.a) 3 b) \(\frac{2}{5}\) c) \(\frac{11}{12}\) d) \(\frac{3}{4}\)
2. 12 glasses
3. \(\frac{5}{6}\) h

Unit 3 Unit Review, page 159
1.a) \(6 \times \frac{2}{3} = \frac{2}{5}\) b) \(3 \times \frac{6}{5} = \frac{2}{7}\)
2.a) 1 b) \(3 \frac{1}{2}\) c) \(\frac{3}{5}\)
3.a) 18 b) 4 c) 50 d) \(\frac{1}{2}\)
4.a) \(\frac{1}{4}\) b) \(\frac{6}{25}\) c) \(\frac{21}{40}\) d) \(\frac{1}{7}\)
5. \(\frac{3}{20}\)
6.a) \(\frac{3}{20}\) b) \(\frac{3}{40}\) c) \(\frac{7}{20}\) d) \(\frac{4}{21}\)
7. \(\frac{3}{10}\)
8. For example: \(\frac{5}{7}\) of a litter of mice are grey with white patches. The other \(\frac{2}{7}\) are black. Of the grey and white mice, \(\frac{3}{8}\) are female. What fraction of the litter is grey, white, and female? \(\frac{15}{36}\)
9.a) \( \frac{15}{2} \)  b) \( \frac{23}{8} \)  c) \( \frac{107}{10} \)

10.a) \( \frac{3}{5} \)  b) \( \frac{7}{5} \)  c) \( \frac{3}{5} \)  d) \( \frac{2}{5} \)

11.a) \( \frac{3}{6} \)  b) \( \frac{13}{16} \)  c) \( \frac{3}{20} \)  d) \( \frac{2}{3} \)

12. \( \frac{11}{12} \) h assuming that he mows at the same rate

13.a) \( \frac{1}{10} \)  b) \( 12 \)

14.a) \( \frac{3}{4} \)  b) \( \frac{4}{5} \)  c) \( \frac{3}{20} \)  d) \( \frac{7}{8} \)

15. 16 glasses

16. \( 13 \frac{1}{2} \) loads

17. For example: \( \frac{3}{4} + \frac{5}{3} = \frac{9}{12} < 1 \)

18.a) \( \frac{11}{2} \)  b) \( \frac{1}{2} \)

19.a) \( 2 \)  b) \( \frac{2}{7} \)  c) \( \frac{1}{4} \)  d) \( \frac{5}{6} \)

20. \( \frac{1}{4} \)

21. For example: \( \frac{3}{5} + \frac{5}{3} = \frac{9}{15} < 1 \)

22.a) \( \frac{40}{11} \)  b) \( \frac{31}{6} \)  c) \( \frac{44}{9} \)  d) \( \frac{29}{12} \)

23.a) \( \frac{14}{17} \)  b) \( \frac{149}{6} \)  c) \( \frac{2}{11} \)  d) \( \frac{1}{2} \)

24. \( \frac{3}{5} \)

25. \( \frac{1}{8} \)

26. 882 tickets

27.a) \( \frac{3}{10} \)  b) 9 students

28.a) \( \frac{3}{4} \); Multiplication  b) \( \frac{2}{7} \); Subtraction  c) \( \frac{2}{3} \); Multiplication  d) \( \frac{3}{5} \); Division

29.a) \( \frac{3}{4} \)  b) \( \frac{3}{4} \)  c) \( \frac{1}{2} \)  d) \( \frac{5}{36} \)

30. Carlton should have written \( \frac{14}{5} + \frac{9}{12} = \frac{14}{5} \times \frac{12}{9} \).

Correct answer: \( \frac{31}{15} \)

Unit 3 Practice Test, page 162

1. 6

3.a) 7  b) \( \frac{3}{16} \)  c) \( \frac{5}{12} \)  d) \( \frac{3}{10} \)

4.a) \( \frac{1}{3} \)  b) \( \frac{7}{3} \)  c) \( \frac{2}{4} \)  d) \( \frac{14}{15} \)

5.a) \( \frac{1}{5} \)  b) \( \frac{2}{1} \) since \( \frac{3}{5} \) of 30 is 18 and \( \frac{1}{3} \) of 30 is 10, which are both whole numbers

6.a) \( \frac{3}{4} \)  b) \( \frac{7}{12} \)  c) \( \frac{1}{9} \)  d) \( \frac{3}{12} \)

7. The product of a fraction and its reciprocal is 1.

For example: \( \frac{7}{8} \times \frac{8}{7} = \frac{56}{56} = 1 \)

8.a) \( \frac{2}{5} \)  b) \( \frac{1}{8} \)

9.a) About \( \frac{41}{2} \)

b) About 5

d) Each poodle takes the same amount of time to groom.

10.a) \( \frac{7}{15} \)  b) \( \frac{1}{4} \)

11.a) Yes  ii) No; \( \frac{1}{6} \)

Cumulative Review Units 1–3, page 167

1.a) i) 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 34, 84  
ii) 1, 3, 7, 9, 21, 49, 63, 147, 441  
iii) 1, 2, 4, 59, 118, 236  
iv) 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 25, 30, 36, 45, 50, 60, 75, 90, 100, 150, 180, 225, 300, 450, 900  
b) 441 and 900; Both have an odd number of factors.

2.a) \( \frac{7}{2} \)  b) \( \frac{7}{9} \)  c) \( \frac{9}{5} \)  d) \( \frac{8}{7} \)

3.a) 32.5 cm  b) 27.5 cm

4.a) No; \( 16 + 8 \neq 30 \)  b) Yes; \( 16 + 8 = 24 \)

5.a) No; \( 2^2 + 5^2 \neq 6^2 \)  b) Yes; \( 6^2 + 8^2 = 10^2 \)  
c) No; \( 9^2 + 7^2 \neq 12^2 \)  d) Yes; \( 18^2 + 24^2 = 30^2 \)

6. 5 cm

7. 31.1 m

8.a) \( -72 \)  b) \( +112 \)  c) \( +18 \)  d) \( -126 \)

9.a) \( (+4) \times (-5) \)  b) \( -20 \)

10. For example: Paul withdraws $5 from his account for 8 days. How much has he withdrawn in total? \( (+8) \times (-5) = -40; \$40 \)

11.a) \( -11 \)  b) \( +2 \)  c) \( +30 \)  d) \( -4 \)  e) \( -17 \)  f) \( 0 \)

12.a) \( -7 \)  b) \( +5 \)  c) \( -6 \)  d) \( +7 \)

13.a) \( -52 \)  b) \( +4 \)  c) \( -13 \)  d) \( $13 \)

14. Answers will vary. For example:

a) i) \( -(10) + (+2) = -8 \)  ii) \( +(2) - (+10) = -8 \)  
iii) \( -(4) \times (+2) = -8 \)  iv) \( (-16) + (+2) = -8 \)

b) i) \( -(4) + (+2) = -2 \)  ii) \( +(1) - (+3) = -2 \)
\[
\begin{align*}
\text{i)} (-1) \times (+2) &= -2 \quad \text{iv)} (-4) \div (+2) &= -2 \\
\text{ii)} (-10) + (-2) &= -12 \quad \text{ii)} (+2) - (+14) &= -12 \\
\text{iii)} (-4) \times (+3) &= -12 \quad \text{iv)} (+24) \div (-2) &= -12 \\
\text{d)} \text{i)} (-7) + (+4) &= -3 \quad \text{ii)} (+7) - (+10) &= -3 \\
\text{iii)} (-1) \times (+3) &= -3 \quad \text{iv)} (+15) + (-5) &= -3
\end{align*}
\]

15. a) 24  \quad b) -32  \quad c) -3

16. a) \(\frac{2}{3}\)  \quad b) \(\frac{7}{2}\)  \quad c) \(\frac{5}{8}\)  \quad d) \(\frac{4}{5}\)

17. a) 28  \quad b) 17\frac{1}{2}  \quad c) \(\frac{25}{36}\)

18. a) \(\frac{15}{2}\)  \quad b) \(\frac{5}{18}\)  \quad c) \(\frac{5}{9}\)

19. \(\frac{8}{9}\) or about 5 bottles

20. a) \(\frac{9}{16}\)  \quad b) \(\frac{27}{34}\)  \quad c) \(\frac{13}{7}\)  \quad d) \(\frac{3}{5}\)

21. a) \(\frac{4}{5}\); subtraction  \quad b) \(\frac{8}{5}\); multiplication

**Unit 4 Measuring Prisms and Cylinders, page 168**

4.1 Exploring Nets, page 174

4. 6 rectangular faces

5. 6 square faces

6. Net a; Net b cannot be folded into a rectangular prism.
b) For example:

14.a) Square pyramid  b) Square prism
c) Rectangular pyramid
d) Pentagonal pyramid  e) Triangular pyramid

15. Like a net, wrapping paper is folded into the shape of various objects.
Unlike a net, wrapping paper is not folded to make an object.

16.a)

b)

17.b)

c) Both nets of a cube with different colour arrangements
d) Same net, different colour labels

4.2 Creating Objects from Nets, page 180

3. b

4.a) Right triangular prism
c) 2 congruent triangular bases and 3 rectangular faces

5.a) C: Triangular pyramid
   D: Right triangular prism
   E: Right hexagonal prism
   F: Cube with pyramid on top

6.a) Right prism with 2 congruent L-shaped bases
c) Yes; 2 congruent L-shaped bases and 6 rectangular faces
d) Parallel faces: 1 and 2;
   3 and 5; 3 and 7;
   4 and 6; 4 and 8;
   5 and 7; 6 and 8
   Perpendicular faces:
   1 and 4; 1 and 3; 1 and 5;
   1 and 6; 1 and 7; 1 and 8;

2 and 3; 2 and 4; 2 and 5; 2 and 6; 2 and 7;
2 and 8; 3 and 4; 3 and 6; 3 and 8; 4 and 5;
4 and 7; 5 and 6; 5 and 8; 6 and 7; 7 and 8

7.a) No
b) There are several ways to correct the diagram.
   For example:
   Move squares A and B to:
   1 and 2; 3 and 4; 1 and 3;
or 2 and 4.

8. A soccer ball is made of pentagons and hexagons.
   Each pentagon is joined to 5 hexagons.

9.a) Net of a right rectangular pyramid
   b) Net of a right triangular prism
c) Not a net
d) Not a net

10. a


12.a) 8 congruent faces
   b) 8 congruent triangular faces, each with equal angles and side lengths

13.a) Square pyramid  b)

4.3 Surface Area of a Right Rectangular Prism, page 186

4. 174 cm$^2$; Add the areas of all faces.
5. 92 cm$^2$

6.a) 160 cm$^2$  b) 216 cm$^2$  c) 82 cm$^2$

7.a) 164 m$^2$  b) 158 cm$^2$

9. For example:
a) 4 cans
b) The height of the room is 3 m. The ceiling and floor are not being painted.

10.a) 9 cm$^2$  b) 3 cm

11. 12 000 m$^2$; Assuming the windows cover one-quarter of 4 sides

12. 2 700 000 Euros

13. Greatest surface area: R; Least surface area: Q

14.i) Increases but doesn’t double
   ii) Decreases but is not halved

15.a) 1580 cm$^2$  b) 436 cm$^2$

16. 2 m by 2 m by 5 m

17. 3 cm by 4 cm by 6 cm
4.4 Surface Area of a Right Triangular Prism, page 191

4. 81 cm²; Add the areas of all faces.
5. Triangular bases and rectangular faces on the sides
6. 2100 cm²
7.a) i) 50 cm² ii) 48 m²
   b) The surface area of the prism is the same as the area of the net.
8. Prism D: 528.0 cm²; Prism A: 147.7 cm²; Prism C: 117.0 cm²; Prism B: 102.4 cm²
9.a) 336 cm² b) 334.4 m² c) 481.2 mm²
10.
11.b
12. No; The surface area will increase by a factor of 4.
13. 14 400 cm²
14. 1872.7 cm²; Assuming the triangular bases are not covered
15. No, since the surface area of the rectangular prism does not include the side along which the cut was made
16. Between 7.33 cm and 11.5 cm
17.a) About 7.4 cm   b) 374 cm²

Unit 4 Mid-Unit Review, page 194
1.a) A and C are nets
   b) A forms a regular triangular pyramid.
      C forms a pentagonal pyramid.
3.a) 88 cm²   b) 447 cm²
4. 59 318 m²; Assuming the top and bottom are not glass
5.a) 10 752 cm²
   b) About 10 800 cm²; Wrapping paper must overlap a bit

4.5 Volume of a Rectangular Prism, page 198

4.a) 120 cm³ b) 729 cm³ c) 6000 cm³
5.b) 11 200 cm³
6.a) A: 120 cm³; B: 120 cm³; C: 120 cm³
   b) They are the same.  c) No
7.a) 67.5 cm³ b) 96 cm³ c) 25.2 cm³
9.a) 420 462 cm³, 626 859 cm³
   b) About 1.5 times
10. 10 cm
11.a) 40.6 m³ b) 3 trailers
12.a) 2000 m³ b) 1800 m³ c) 1000 m³
13.a) Possible dimensions: 1 cm by 2 cm by 18 cm; 1 cm by 1 cm by 36 cm; 1 cm by 3 cm by 12 cm; 1 cm by 4 cm by 9 cm; 2 cm by 2 cm by 9 cm; 1 cm by 6 cm by 6 cm; 3 cm by 3 cm by 4 cm; 2 cm by 3 cm by 6 cm
   b) i) Prism with dimensions 1 cm by 1 cm by 36 cm
      ii) Prism with dimensions 3 cm by 3 cm by 4 cm
14.a) 1260 cm³ b) 42 cm³
   c) For example: Philip could cut the fudge into 3 columns and 10 rows.
15.a) Doubles   b) Increases by a factor of 4
      c) Increases by a factor of 8
   True for all rectangular prisms
16. To double volume, double any one dimension.
   Surface area will increase but not double.
17.a) 8640 cm³ b) 60 cm by 36 cm by 32 cm
   c) A box with dimensions 60 cm by 36 cm by 32 cm has the least surface area. So, the least amount of material is needed to make it.
18.a) Sketches may vary. Possible dimensions: 1 cm by 1 cm by 24 cm; 2 cm by 1 cm by 12 cm; 3 cm by 1 cm by 8 cm

4.6 Volume of a Right Triangular Prism, page 205

3.a) 225 cm³ b) 312 cm³
4.a) 21.16 cm³ b) 217.5 cm³ c) 45 m³
5.a) 955.5 cm³ b) 240 m³ c) 3.83 m³
6.a) 532 cm³ b) 108 cm³
7. 18 cm³
8. 7.5 cm
9.a) i) A = 5 cm², l = 1 cm; A = 1 cm², l = 5 cm
    ii) A = 9 m², l = 1 m; A = 1 m², l = 9 m;
       A = 3 m², l = 3 m
    iii) A = 8 m², l = 1 m; A = 4 m², l = 2 m;
        A = 2 m², l = 4 m; A = 1 m², l = 8 m
    iv) A = 18 cm², l = 1 cm; A = 9 cm², l = 2 cm;
       A = 6 cm², l = 3 cm; A = 3 cm², l = 6 cm;
       A = 2 cm², l = 9 cm; A = 1 cm², l = 18 cm

512 ANSWERS
b) i) 2 ii) 3 iii) 4 iv) 6
10.a) 120 cm³  b) 6
11. 10 m²
12.a) 1.125 m³  b) 3.375 m³
13.b) A: 180 cm³; B: 126 cm³
c) Change the length of 7 cm to 10 cm
14.a) 2250 cm²  b) 18 cm  c) 60%
15. l = 11 cm
   Possible b and h values: 1 cm, 36 cm; 36 cm, 1 cm; 2 cm, 18 cm; 18 cm, 2 cm;
   3 cm, 12 cm; 12 cm, 3 cm; 4 cm, 9 cm; 9 cm, 4 cm; 6 cm, 6 cm
16.a) 231.4 cm²; 113.9 cm³
    b) i) b = 7 cm, h = 6.2 cm, l = 21 cm
       b = 7 cm, h = 3.1 cm, l = 42 cm
       b = 3.5 cm, h = 6.2 cm, l = 42 cm
       b = 14 cm, h = 3.1 cm, l = 21 cm
       b = 3.5 cm, h = 12.4 cm, l = 21 cm
       b = 3.5 cm, h = 3.1 cm, l = 84 cm
       ii) Either two of the dimensions are doubled or one is increased by a factor of 4.
17.a) 36 m²; 12 m³  b) 60 m³; 24 m³
    c) 96 m²; 48 m³  d) 144 m³; 96 m³

4.7 Surface Area of a Right Cylinder, page 212
4.a) 88 cm²  b) 25 cm²  c) 101 cm²
5.a) A cylinder with radius 2 cm and height 5 cm
    b) A cylinder with radius 1 cm and height 3 cm
    c) A cylinder with radius 2 cm and height 6 cm
6.a) 50 cm²  b) 94 cm²  c) 251 m²
8.a) 214 cm²  b) 19 046 mm²  c) 4 m²
9. 174 m²  10. 12 m²
11.a) 94 cm²  b) 4255
12. 191 cm²  13. 37 267 cm² or 4 m²
14.a) 14 137 cm²
    b) 14 141 cm²; Assuming the heads do not go over the edge of the shell
15. Cylindrical tubes
16.a) 66 cm  b) 10.5 cm
    c) 346 cm²  d) 1352 cm²
17. 488 cm²

4.8 Volume of a Right Cylinder, page 218
4.a) 785 cm³  b) 63 cm³  c) 1609 cm³
5.a) 503 cm³  b) 8836 mm³  c) 328 m³
6. 1571 cm³  8. 196 cm³
9. The cylinders have the same volume because they have the same radius and height.
10. Bottle C; It has the greatest radius and height, and so the greatest volume.
11.a) 462 cm³  b) 1583 cm³
12. 5301 cm³  13. 441 786 cm³
14. 9 521 684 cm³ or about 9.5 m³
15. 404 mL
16. A cylinder with radius 2 m and height 1 m

17.a) 96 m³  b) 12 219 m³
    c) 4.58 m by 4.58 m by 4.58 m
18. 28 cm

Unit 4 Strategies for Success: Choosing the Correct Answer, page 220
1.c) 108 m²  2.b) 99 cm³

Unit 4 Unit Review, page 223
1. The net of a rectangular prism must have 3 pairs of congruent rectangles.
2.a) Right hexagonal prism  b) Cube
    c) Right cylinder  d) Pentagonal pyramid
3. Net A; To correct net B, move the rectangle from the top right to the bottom right.
4.a) Pentagonal pyramid  b) Triangular pyramid
    c) To form a triangular prism:

5.a) 96 cm²
    b) Find the area of one face and multiply by 6.
6.a) 72 m²; 36 m²  b) 15 000 cm²; 125 000 cm³
    c) 114 cm³; 72 cm³
7.a) 10 rolls and 1 can
    b) Assuming you must buy whole rolls and cans
8.a) A: 1 m by 1 m by 28 m; B: 1 m by 2 m by 14 m
    C: 1 m by 4 m by 7 m; D: 2 m by 2 m by 7 m
    b) A: 114 m²; B: 88 m²; C: 78 m²; D: 64 m²
9.a) 24 m³  b) 45 cm³
10.a) 7.2 cm²  b) 0.96 cm³
11.a) 14.2 m²  b) 2.3 m³
    c) Rotating an object will not change its volume.
12. 6 m³
13.a) Double the height or base of the triangle.
    c) The volume doubles.
14.a) 428 mL
    b) A pocket of air is left in the soup can.
15. 49 m³
16. 12 174 m³

Unit 4 Practice Test, page 226
1.a) A square prism with a square pyramid on top
2. a) 3 rectangular faces, b) 2 circles and 2 triangular bases, c) 1 rectangle

3. a) 632 cm², b) 200 cm², c) 88 cm²

4. a) 632 cm², b) 199 m², c) 17.99 cm²

5. a) 166.95 cm³, b) 126 m³

8. a) The volume increases by a factor of 9.
   b) 27.5625 m³

9. a) 8.5 m², b) 1.5 m³

10. A piece of paper rolled into a cylinder lengthwise

Unit 5 Percent, Ratio, and Rate, page 232
5.1 Relating Fractions, Decimals, and Percents, page 239

6.a) \[ \frac{50}{100} \text{ or } 0.50; 50\% \]  b) \[ \frac{36}{100} \text{ or } 0.36; 36\% \]  c) \[ \frac{87}{100} \text{ or } 0.87; 87\% \]  d) \[ \frac{4}{100} \text{ or } 0.04; 4\% \]

7.a) \[ \frac{3}{100} \text{ or } 0.03 \]  b) \[ \frac{51}{100} \text{ or } 0.51 \]
   c) \[ \frac{98}{100} \text{ or } 0.98 \]  d) \[ \frac{29}{100} \text{ or } 0.29 \]

8.a) \[ \frac{1}{8} \text{ or } 0.125; 12.5\% \]  b) \[ \frac{341}{400} \text{ or } 0.8525; 85.25\% \]
   c) \[ \frac{139}{400} \text{ or } 0.3475; 34.75\% \]

9.a) \[ \frac{147}{200} \text{ or } 0.735 \]  b) \[ \frac{17}{80} \text{ or } 0.2125 \]
   c) \[ \frac{7}{80} \text{ or } 0.0875 \]  d) \[ \frac{3}{250} \text{ or } 0.012 \]

12.a) \[ \frac{1}{400} \text{ or } 0.0025 \]  b) \[ \frac{3}{500} \text{ or } 0.006 \]
   c) \[ \frac{1}{200} \text{ or } 0.005 \]  d) \[ \frac{19}{5000} \text{ or } 0.0038 \]

13.a) 0.006; 0.6\%  b) 0.045; 4.5\%  c) 0.014; 1.4\%  d) 0.032; 3.2\%

14.a) \[ \frac{69}{200} \text{ or } 34.5\% \]  b) \[ \frac{23}{10000} \text{ or } 0.23\% \]
   c) \[ \frac{73}{400} \text{ or } 18.25\% \]  d) \[ \frac{7}{1000} \text{ or } 0.7\% \]

15. Fiona is correct.

16. Junita; 83.3\% is greater than 82.5\%.

17. Answers may vary. For example:
   a) i) \[ \frac{5}{8} \text{ means one whole divided into 8 equal parts, with 5 parts shaded} \]
      ii) A cherry rhubarb pie is divided into 8 equal slices. Laura and her friends eat 3 slices. \[ \frac{5}{8} \text{ of the pie is left.} \]
   b) i) \[ \frac{5}{8} \text{ means 5 objects divided into 8 equal groups.} \]
      ii) 5 watermelons are shared among 8 people.

18.a) 16 red squares, 12 green squares, and 18 blue squares

Shadings may vary.

For example:
   b) \[ \frac{1}{25}, \text{ or } 0.0416; 4.16\% \]
   c) In a 6-cm by 9-cm rectangle, 18 squares will be red, 13.5 squares will be green, and 20.25 squares will be blue.

Answers will vary. For example: Yes, but it would have been more complicated because it would involve part squares;

In a 7-cm by 7-cm square, 16\(\frac{3}{4}\) squares will be red, 12.25 squares will be green, and 18.375 squares will be blue.

19. Kyle; 78.6\% is greater than 76\(\frac{2}{3}\)\%.

20.a) No
   b) \[ \frac{1}{16}, \text{ the student made an error when he converted } 6.25\% \text{ to a fraction.} \]

21.a) =  b) >  c) >  d) <  e) =  f) =

5.2 Calculating Percents, page 246

4.a)
8. Answers may vary. It is not possible for one individual to give 110% or to put in more than 100% of their effort.

9.a) Answers may vary. For example:
   A charity has a goal for the amount of money they wish to receive in donations. It receives more than 100% of its goal.
   A baker has a recipe for 6 dozen cookies. He wants to make 8 dozen, so he must use more than 100% of the ingredients in the original recipe.
   b) 5000 tickets were sold in a raffle for a new boat. The chance of winning written as a percent is between 0% and 1%.
   If you guess every answer on a 100 question multiple-choice test, your chances of getting 100% are between 0% and 1%.

10.a) i) 33\% \frac{1}{3} \quad ii) 66\% \frac{2}{3} \quad iii) 100\% \frac{5}{5}
   iv) 133\% \frac{4}{3} \quad v) 166\% \frac{5}{3} \quad vi) 200\% \frac{4}{2}
   b) Each time the numerator increases by 1, the percent increases by \frac{1}{3}.
   c) i) 233\% \frac{7}{3} \quad ii) 266\% \frac{8}{3} \quad iii) 300\% \frac{10}{3}
   iv) 333\% \frac{10}{3} \quad v) 366\% \frac{12}{3} \quad vi) 400\% \frac{15}{3}

11.a) i) 720 符号 72 符号 7.2 符号 0.72
   b) The digits move one place to the right each time.
   c) i) 7200 符号 ii) 0.072

12.a) 5 runners

13.a) Shapes may vary. For example:

14. About 3140
   a) 3139.5 or about 3140
   b) 3120
   c) No, the answers are different. Juan’s answer is correct.

15.a) 168 people
16.a) About 20 people  b) 15 people  c) 1985
17. 66.\% 18. $110\ 000
19. 58 cm

5.3 Solving Percent Problems, page 252

3.a) 30  b) 16  c) 200  d) 150
4.a) 20  b) 24  c) 800  d) 40
5.a) 100\%  b) 50\%  c) 833 \text{g}  d) 500 \text{cm}  e) 1500 \text{g}
6.a) 20\%  b) 25\%  c) 833 \text{g}  d) 500 \text{cm}  e) 1500 \text{g}
7.a) 833 \text{g}  b) 500 \text{cm}  c) 1500 \text{g}
8.a) 7.5\%  b) About 138\%  c) About 4.55\%  d) About 41.2\%
9. a) 169 840 miners  b) 1985
10. About 78.2\%

12.a) Jemma: about 1.98 kg; George: 1.95 kg
   b) Explanations may vary. Jenna’s mass after Week 2 is calculated on her mass after Week 1, which is greater than her birth mass.
13.a) 859 320 people  b) About 953 845 people
   c) About 37.64\%  d) No; the overall increase in population is greater than 35%.
14.a) About 13 711 crimes per 100 000 population
   b) No; the total decrease from 2004 to 2006 is less than 10%.
15.a) About 167 cm  b) About 180 cm
   Assumptions may vary. For example:
   The girls’ height increases at the given average rate.
16. Answers will vary, based on gender and current height.
17. No. The original price is $20. It is greater than 120% of the sale price ($19.20).
18.a) 5.6 cm  b) 44\%  c) 31.36 \text{cm}²  d) 68.64\%
19. 200 marbles

5.4 Sales Tax and Discount, page 260

4.a) $1.05  b) $0.63  c) $1.54
5.a) $5.40  b) $1.50  c) $1.08
6.a) $0.97  b) $4.29  c) $3.64
7.a) i) PST: $1.30; GST: $1.56
   ii) PST: $7.62; GST: $9.15
   b) i) $28.85  ii) $169.22
8.a) i) $18.00  ii) $54.00
   b) i) $71.99  ii) $66.00
   c) i) $76.31  ii) $69.96
9. $389 120
10. Choice A; $35 for 2 DVDs is a better deal than $40 for 2 DVDs.

11.a) About 40\%  b) $12.07
12. No; the total reduction in price was less than 50%.
13. $44.95
14. No; the sale price including taxes is $127.79.
15.a) $42.36  
2)  
16. It makes no difference whether the discount is calculated before or after the tax is added. Anika will pay $59.33.
17. Strictly Sports offers the better deal. $41.44 is $0.95 cheaper than $42.39.
18.a) $87.72  
19.a) Yes; the total cost is $22.20.
19.b) $17.80
20. The sale price of the skateboard including taxes is $32.47. $39.99 – 14% means a price of $34.39, which is more than the actual sale price of the skateboard.

Unit 5 Mid-Unit Review, page 263
1.a) \( \frac{3}{5} : 0.6 \)  
2.a) 
3.a) \( \frac{9}{50} : 18\% \)  
4.a) 1.45  
5. Answers may vary. For example: No, a mark of 112% is not possible. If Jon answered correctly all the questions on the test, he would score 100%.
6. $45.50
7.a) 20  
8.700 tickets  
9. 16%  
10. $28.93
11.a) $39.99  
12. $43.52

5.5 Exploring Ratios, page 266
4.a) \( \frac{5}{8} \)  
5.a) 95%  
6.a) red candies to green candies  
b) blue candies to green candies  
c) green candies to the total number of candies  
d) red candies to green candies to blue candies  
e) red candies to green and blue candies

7. Answers may vary. For example:
   a) 3 : 15; 20%; \( \frac{1}{5} \)  
b) 1 : 15; 6.66%; \( \frac{1}{15} \)  
c) 7 : 4; 7 to 4  
d) 7 : 1 : 3; 7 to 1 to 3
8.a) 5 : 7  
b) 5 : 7
9.a) i) 9 : 7  
ii) 8 : 3  
iii) 3 : 1 : 2
b) i) 9 : 16; \( \frac{9}{16} \); 56.25%; 7 : 16; \( \frac{7}{16} \); 43.75%  
ii) 8 : 11; \( \frac{8}{11} \); 72.72%; 3 : 11; \( \frac{3}{11} \); 27.27%  
iii) 3 : 6; \( \frac{1}{2} \); 50%; 1 : 6; \( \frac{1}{6} \); 16.6%; 2 : 6; \( \frac{1}{3} \); 33.3%
11.a) i) 8 : 3  
ii) 5 : 1  
iii) 3 : 1 : 5  
iv) 8 : 25
b) i) 5 : 3  
ii) 3 : 1  
iii) 3 : 1 : 3  
iv) 4 : 16
12. Answers may vary. For example:
   a) \( \frac{2}{7} \) as a ratio compares 2 out of 7 parts of a group to the total number of parts of the group. It can also be written as 2 : 7.
   b) There are 7 students in the student council: 2 boys and 5 girls. The ratio of boys to the total number of students is 2 : 7 or \( \frac{2}{7} \) or about 28.57%.

13. Answers may vary. For example:
   a)  
   b)  
   c)  
   d) The ratio in part a may be a part-to-part or a part-to-whole ratio. The ratios in parts b and c are part-to-part ratios.
14.a) 11 cups
   b) i) 3 : 2  
   ii) 2 : 3  
   iii) 2 : 2 : 1
   c) 5 : 11; \( \frac{5}{11} \); 45.45%
   d) i) 2 : 2  
   ii) 2 : 3  
   iii) 2 : 2 : 1
   i) 4 : 10; \( \frac{2}{5} \); 40%
   e) Answers will vary. For example: Patrick decides to add 1 extra cup of raisins to the recipe. Write the ratio of raisins to the total amount of ingredients.
   \( \text{Answer: } 1 : 12; \frac{1}{12}; 8.3\% \)
15. Answers may vary. For example: ratio, problem, percent, taxes
16. No. Jeff got \( \frac{2}{3} \) of the cranberries.
17. Answers may vary. For example:
   a) i) Squares to triangles: 3 : 5
ii) Green shapes to blue triangles: 2 : 1
iii) Red squares to red triangles: 2 : 3
iv) Green squares to all shapes: 1 : 11
b) Replace a red circle with a green square. The ratio of all red shapes to red triangles is 7 : 3; the ratio of green squares to triangles is 2 : 5.

18. Answers will vary. For example: 3 : 5
squirrel; cinnamon; mushroom

5.6 Equivalent Ratios, page 274
5. Answers may vary. For example:

\[
\begin{array}{ccc}
\text{1st term} & 2 & 3 \\
\text{2nd term} & 4 & 6 & 38 \\
\end{array}
\]

b)

\[
\begin{array}{ccc}
\text{1st term} & 4 & 14 \\
\text{2nd term} & 6 & 21 & 36 \\
\end{array}
\]

c)

\[
\begin{array}{ccc}
\text{1st term} & 5 & 6 \\
\text{2nd term} & 20 & 24 & 18 \\
\end{array}
\]

6. Answers may vary. For example:

\[
\begin{array}{ccc}
\text{1st term} & 6 & 9 \\
\text{2nd term} & 8 & 12 & 20 \\
\end{array}
\]

b)

\[
\begin{array}{ccc}
\text{1st term} & 28 & 98 \\
\text{2nd term} & 8 & 28 & 364 \\
\end{array}
\]

c)

\[
\begin{array}{ccc}
\text{1st term} & 216 & 144 \\
\text{2nd term} & 225 & 160 & 312 \\
\end{array}
\]

7. Answers may vary. For example:

\[
\begin{array}{ccc}
\text{1st term} & 2 & 4 \\
\text{2nd term} & 6 & 12 & 48 \\
\text{3rd term} & 12 & 24 & 96 \\
\end{array}
\]

b)

\[
\begin{array}{ccc}
\text{1st term} & 24 & 84 \\
\text{2nd term} & 10 & 35 & 50 \\
\text{3rd term} & 14 & 49 & 70 \\
\end{array}
\]

c)

\[
\begin{array}{ccc}
\text{1st term} & 12 & 168 \\
\text{2nd term} & 2 & 28 & 44 \\
\text{3rd term} & 4 & 56 & 88 \\
\end{array}
\]

8.a) 1 : 3  b) 2 : 3  c) 1 : 4 : 6  d) 22 : 14 : 3
9.a) 4 : 1  b) 1 : 3  c) 6 : 2 : 1  d) 4 : 8 : 3
10.a) 8  b) 60  c) 40  d) 7
11.a) 2 : 3 ; 4 and 6 : 9 ; 12 ; 8 : 5 : 4 and 16 : 10 : 8 ; 3 : 6 : 9 and 1 : 2 : 3 ; 3 : 4 : 5 and 9 : 12 : 15
b) Explanations may vary. For example:
In each pair, the first ratio is in simplest form. The second ratio is formed by multiplying the terms of the first ratio by the same number.

12. Answers may vary. For example:

\[
\begin{array}{ccc}
\text{Fiction} & 3 & 21 \\
\text{Non-fiction} & 1 & 7 & 17 \\
\end{array}
\]

b) There is an infinite number of different answers for part a. The ratio in simplest form can be multiplied by any number.

13. 30 cm by 15 cm
14. Drawings may vary. For example:

a) i)

\[
\begin{array}{ccc}
\text{ } & & \\
\text{ } & & \\
\text{ } & & \\
\end{array}
\]

ii)

\[
\begin{array}{ccc}
\text{ } & & \\
\text{ } & & \\
\text{ } & & \\
\end{array}
\]

iii)

\[
\begin{array}{ccc}
\text{ } & & \\
\text{ } & & \\
\text{ } & & \\
\end{array}
\]

iv)

\[
\begin{array}{ccc}
\text{ } & & \\
\text{ } & & \\
\text{ } & & \\
\end{array}
\]

15.a) No  b) No  c) Yes  d) Yes
16.a) 12  b) 20
17.a) 12  b) 84  c) 12  d) 21
18.a) i) 8 : 1  ii) 8 : 9  iii) 1 : 9
b) i) 17 : 1  ii) 17 : 18  iii) 1 : 18

Unit 5 Strategies for Success: Explaining Your Thinking, page 277
1. Yes; There are 365 (or 366) days in a year, so only the first 366 students can have a unique birthday. The remaining students will share a birthday with someone else.
2. \(\frac{2}{3}\) cup sugar, 500 mL milk, \(\frac{3}{3}\) mL vanilla
3. \(0.35 \times 12 = 4.20\)
No; A dozen donuts will cost $4.20 with the coupon. $4.20 is more expensive than the sale price of $3.99.

5.7 Comparing Ratios, page 284
4.a) 1 : 4  b) 1 : 8  c) 1 : 7
d) 1 : 9  e) 1 : 3  f) 1 : 6
5.a) 4 : 1  b) 5 : 1  c) 12 : 1
d) 5 : 1  e) 7 : 1  f) 12 : 1
6.a) 5 cans of white paint and 7 cans of blue paint
b) 3 cans of white paint and 4 cans of blue paint
7. Tara’s
a) \(\frac{21}{35}\) \(\frac{25}{35}\)
b) When the denominators are the same, look at the numerators to compare two fractions.
8. Henhouse B; Assumptions may vary. For example: I assume that the ratio of eggs produced daily by each henhouse is consistent.
9. Mixture A
10. Nadhu; 65 out of 117 is better than 54 out of 117, or \(\frac{65}{117} > \frac{54}{117}\). 
11.a) Calgary Cougars  b) No
12. Recipe A
13.a) Ms. Arbuckle’s; 2 more fiction books than Mr. Albright’s class
b) Ms. Arbuckle: 41.6%
Mr. Albright: 42.9%
14.a) 2 : 1 and 3 : 2
b) Add 1 more can of concentrate to B.
15.a) A : 4 : 12; B : 3 : 15; C : 2 : 3
b) A : 1 : 3; B : 1 : 5; C : 1 : 1.5
c) Shade C  d) Shade B
16. Marcel’s reasoning is incorrect.
17. Glider A
18.a) 70  b) The second box, with a ratio of 3 : 2
19. a) No. The ratios are not equivalent.
   b) 3 scoops for 2 cups of water

5.8 Solving Ratio Problems, page 291
4. a) 36  b) 18  c) 10  d) 63  e) 33  f) 26
5. a) 12  b) 8  c) 7  d) 3  e) 3  f) 10
6. a) 9  b) 15  c) 10  d) 7  e) 70  f) 5
7. a) 27  b) 28  c) 12  d) 16  e) 33  f) 56
8. 225 shots
9. 148 dentists
10. 0.3 m or 30 cm
11. a) No. There are no measures given.
    b) 15 cm
12. 10 500 000 cm or 105 km
13. 5.14 cm
14. a) 0.15 m or 15 cm
    b) 7.2 m
15. 8 cm
16. a) 10 trees
    b) 26 tickets

5.9 Exploring Rates, page 298
4. a) 60 words/min  b) 25 m/min
    c) 20 pages/h
5. a) 15 km/h  b) 24 km/h  c) 10 km/min
6. a) 55 flyers/h  b) 60 cupcakes/h
    c) 4.5°C/h
7. a) rate  b) rate  c) ratio  d) ratio
    e) $1.13/L  b) $0.25/cob  c) $0.42/can
8. a) 1.5 goals/game
    b) 53 goals; assuming she continues to score at the same rate
9. a) 120 beats/min; when you run, your heart rate increases.
    11. a) $0.48  b) $2.40  c) 25 m
    12. a) $10.50/h  b) $367.50
    13. a) $1.20  b) $3.00  c) $12.00  d) 1.5 kg
    14. a) 30.3 m/s  b) 13.9 m/s
    15. a) 144 km/h  b) 5.4 km/h
    16. a) 25 km  b) 25 km/h
    17. a) $50.00  b) £12
    18. a) About 56
    b) About 2
    Assumptions may vary. For example:
    Petra takes no breaks and works at an even rate.
19. 8 min/km
20. a) i) 7 min/km  ii) 8 min/km  iii) 8.5 min/km
    b) Answers may vary. For example: 6 h 36 min

5.10 Comparing Rates, page 303
5. a) $133/week  b) 85 km/h
    c) $0.29/bottle  d) $0.33/can
6. a) $36.00 in 4 h  b) $4.50 for 6 muffins
    c) $0.99 for 250 mL
7. a) The 500-mL can is the better buy.
    b) Answers may vary. For example: Delaney may have only needed 110 mL.
    c) The customer may have needed 500 mL of mushroom soup, so she could go with the better deal.
8. a) 8 for $2.99  b) 2 L for $4.49
    c) 150 mL for $2.19  d) 125 g for $0.79
9. a) 87.5 km
    b) The average speed is the mean distance travelled each hour, or 87.5 km/h.
    c) 8 h
10. a) $36.00 in 4 h  b) $4.50 for 6 muffins
    c) $0.99 for 250 mL
11. a) Petra’s job; $9.25/h is better than $9/h.
    b) Answers may vary. For example: Yes, I would choose to work as a lifeguard. It pays more, and you get to work more hours per week.
12. a) $10.50/h  b) 304 points
13. About 4.92 cm
14. a) Brand B
    b) Brand A: $3.61/kg; Brand B: $2.21/kg
    c) Brand B is the better buy.
    d) Becky may not have enough money or room to store it.
15. a) i) 16 2/3 min  ii) About 31 min
    b) i) Swimming; 52 min
    ii) Cycling and walking
16. 520.83 kg
17. Answers may vary. For example:
    a) A rate compares 2 quantities with different units: a bike travelled 40 m in 5 s.
    b) A unit rate compares a quantity to a unit: a snail crawls 1.75 km in 100 h or 0.0175 km/h.
18. a) Toyota Echo
    b) 14 L
19. $8.73
20. a) i) About 3 people/km²
    ii) About 137 people/km²
    iii) About 338 people/km²
21. a) 8 km
    b) 12 km/h faster
Unit 5 Unit Review, page 308

1.a) \( \frac{13}{20} \) \( \text{65\%} \)

b) \( \frac{69}{10000} \) \( 0.69\% \)

c) \( \frac{3}{80} \) \( 3.75\% \)

d) \( \frac{393}{400} \) \( 98.25\% \)

2. Conner: 87.5\% > 83.3\%

3.a) \( \frac{19}{50} \) \( 0.38 \)

b) \( \frac{15}{16} \) \( 0.9375 \)

c) \( \frac{79}{10000} \) \( 0.0079 \)

d) \( \frac{1}{500} \) \( 0.002 \)

4.a) 1.6

c) 0.0027

d) 0.009

5.a) 44 800 people

6.25 cards 7. 65

8.a) Both mandrills had the same mass at the end of month 2.

b) No; by the end of month 2, Amy gained more than 45\% of her original mass.

9. 112.5 cm or 1.125 m

10.a) 205.8 cm by 235.2 cm

b) 3.96\%

11.a) $69.99

b) 28.6\%

12. $76.27

13. $36.11; the cost would be the same.

14.a) i) 2 : 3

ii) 5 : 3

iii) 5 : 10 = \frac{1}{2} = 50\%

iv) 5 : 2 : 3

b) i) 1 : 2

ii) 4 : 2

iii) 4 : 7 = \frac{4}{7} = 57.1\%

iv) 4 : 1 : 2

15.a) 7 : 4

b) 3 : 4

c) 3 : 11

16.a) or

c) 3 : 2

17.a) i) 1 : 3

ii) 3 : 1

iii) 3 : 8

iv) 1 : 6 : 3

b) i) Purple to blue

ii) Yellow to red or purple to green

iii) Yellow to blue to red

18.a) 12 girls

b) 3 : 2

19. Explanations may vary. For example: Divide terms by a common factor, such as 5 (5 : 2 : 6) or, multiply terms by the same number, such as 3

(75 : 30 : 90)

20.a) 30

b) 40

c) 35

d) 108

21.a) 8 : 1

b) \( \frac{11}{12} \) : 1

c) \( \frac{1}{2} \) : 1
d) \( \frac{23}{4} \) : 1

22.a) Stronger

b) Weaker

23.a) Ms. Beveridge’s class

b) Answers will vary. For example: No; I used equivalent ratios. The ratios given are part-to-part ratios and I need part-to-whole ratios to use percents.

24. 180 pike

25. About 14

26.a) 400 mL

b) 15 people: about 2.14 L pop; 857.14 mL orange juice

20 people: about 2.86 L pop; 1.14 L orange juice

27.a) 40 km/h

b) 250 m/min

c) $8.00/h

28.a) The cougar is faster, 936 m/min; 800 m/min

b) Cougar to wild horse: 117 : 100

29.a) 16.6 m/s

b) 11.1 m/s

30.a) $9.50/h

b) $237.50

31.a) i) $1.07/L

ii) $4.46/kg

iii) $0.44/100 g

32.a) 8.5 L for $7.31

b) 12 candles for $5.99

c) 5 kg of grass seed for $2.79

33. Jevon

34. Aaron’s job as a ticket seller pays more.

Unit 5 Practice Test, page 312

1.a) 132

b) 14

c) 2

d) 17.85

2.a) 39

b) 7

c) 28

d) 18

3.a) $5.16/h

b) 12 min/puzzle

c) \( \frac{1}{3} \) km/min

4. 350 boxes

5.a) $57.37

b) $63.68

6. No; the house is less expensive at the end of 2006.

7.a) 24 batteries for $9.29

b) 100 g of iced tea mix for $0.29

8.a) The Tigers

b) The Leos

9. No; the medium size of orange juice is the best buy. It costs $2.17/L, compared to $2.79/L and $2.26/L.

10. Answers may vary. For example:

a) The Jessup family ate 6 of 8 slices of the sugar pie, or \( \frac{3}{4} \) of it.

b) Carly has 6 yellow gumballs and 2 purple ones. The ratio of yellow gumballs to all gumballs is 6 : 8 or 3 : 4 or \( \frac{3}{4} \).

c) 4 sisters split 3 brownies and got \( \frac{3}{4} \) of a brownie each.

d) The ladybug flew 3 km in 4 h.

Unit 6 Linear Equations and Graphing, page 316

6.1 Solving Equations Using Models, page 324

5.a) \( s = 4 \)

b) \( t = -3 \)

c) \( a = 3 \)

d) \( b = -6 \)

6.a) \( x = 2 \)

b) \( s = 3 \)

c) \( c = 1 \)

d) \( m = -2 \)

7.a) \( 6n + 3 = 21; \ n = 3 \)

8.a) \( 6n - 3 = 21; \ n = 4 \)

9.a) \( 3n + 4 = 22; \ n = 6 \)
10.a) No; Curtis’ model should subtract 2 unit tiles.
   b) Change the two yellow unit tiles on the left side of the model to red; \( x = 5 \)

11.a) \( x = 3 \)  \( b) \ x = -5 \)  \( c) \ x = 6 \)  \( d) \ x = -3 \)

12.a) Breanna added an extra \( a \)-mass on the left side of the scale.
   b) The balance scales should show 3 identical \( a \) masses in one pan and three 8-g masses in the other pan; \( a = 8 \)

13.a) \( x = -5 \)  \( b) \ x = 5 \)  \( c) \ x = -5 \)  \( d) \ x = -8 \)

14.a) \( 4a + 2 = 34 \); \( a = 8 \)

15.a) \( n = 1 \)  \( b) \ n = 5 \)  \( c) \ n = 20 \)

16. Answers will vary. For example:
   a) All equations that have positive values and an integer solution; for example: \( 3b + 2 = 11 \); \( b = 3 \)
   b) All equations that have at least one negative value but an integer solution. For example:
      \( 4f = -2 \); \( f = 3 \)
   c) All equations that can be solved with balance scales can be solved with algebra tiles.

17.a) One heart, one star, and two smiley faces equal one heart, one smiley face, and three stars.
   b) 22 g; it is not possible to determine the mass of a heart.

6.2 Solving Equations Using Algebra, page 331

5.a) \( x = 4 \)  \( b) \ a = 3 \)  \( c) \ m = 2 \)
   d) \( x = 3 \)  \( e) \ x = 4 \)  \( f) \ x = 6 \)

6.a) \( x = -4 \)  \( b) \ x = -4 \)  \( c) \ x = -3 \)  \( d) \ x = -5 \)

7.a) \( x = -5 \)  \( b) \ n = 3 \)  \( c) \ n = 5 \)  \( d) \ x = -4 \)
   d) There are no mistakes.

8.a) \( x = -6 \)  \( b) \ x = 3 \)  \( c) \ x = -2 \)  \( d) \ x = -4 \)

9.a) \( 72 + 24w = 288 \)  \( b) \ w = 9 \)

10.a) \( 85 + 2x = 197 \)  \( b) \ s = 56 \)

11.a) \( x = -6 \)  \( b) \ c = -5 \)  \( c) \ b = -4 \)
   d) \( a = -5 \)  \( e) \ f = -3 \)  \( f) \ d = 11 \)

12.a) \( n = \frac{1}{3} \)  \( b) \ x = \frac{3}{2} \)  \( c) \ p = \frac{4}{5} \)
   d) \( p = \frac{1}{3} \)  \( e) \ e = \frac{3}{4} \)  \( f) \ g = \frac{4}{5} \)

13.a) \( 2n + 7 = -3 \)  \( b) \ n = -5 \); -5°C

14. Answers may vary. For example:
   a) A family wants to spend a day fishing. They rent 2 fishing boats, and some rods for $720.
      How many rods did they rent?
      \( 2 \times 300 + 20r = 720 \); \( r = 6 \)
   c) Use guess and test.

15. Answers may vary. For example:
   a) A basement is flooded with 316 L of water.
      After how many minutes of pumping is there 1 L of water left?
      \( 316 = 15m + 1 \); \( m = 21 \); 21 min

6.3 Solving Equations Involving Fractions, page 336

3.a) \( t = 30 \)  \( b) \ a = 56 \)  \( c) \ b = 18 \)  \( d) \ c = 27 \)

4.a) \( d = -20 \)  \( b) \ f = -40 \)  \( c) \ k = -36 \)  \( d) \ m = 35 \)

5.a) \( \frac{b}{4} = 8 \)  \( b) \ b = 32 \); 32 golf balls

6.a) \( \frac{n}{6} = 9 \); \( n = 54 \)  \( b) \ \frac{n}{4} = -3 \); \( n = 12 \)

7.a) \( n = 28 \)  \( b) \ m = 33 \)  \( c) \ x = 24 \)  \( d) \ s = 22 \)

8.a) \( f = 18 \)  \( b) \ t = -36 \)  \( c) \ w = -25 \)  \( d) \ e = -63 \)

9.a) \( \frac{n}{3} + 1 = 6 \); \( n = -15 \)  \( b) \ 3 - \frac{n}{5} = 0 \); \( n = 27 \)
   c) \( \frac{n}{2} + 4 = -3 \); \( n = 14 \)

10.a) \( \frac{s}{2} - 11 = 12 \)  \( b) \ s = 46 \); 46 baseballs

11.a) Yes; each student gets \( \frac{n}{5} \) of the bag, then gives 1 treat to the teacher, and is left with 9 treats.
       \( b) \ n = 50 \); 50 treats

12.a) \( \frac{s}{3} + 5 = 41 \)  \( b) \ s = 108 \); 108 students

13.a) Correct  \( b) \ t = 48 \)  \( c) \ r = -40 \)

14.b) \( n = 105 \)

6.4 The Distributive Property, page 342

4.a) i) 77  ii) 77  b) i) 25 ii) 25  c) i) -10 ii) -10

       The expressions in each pair are equivalent.

5. Five groups of 1 positive \( x \)-tile and 2 positive unit tiles are equivalent to 5 \( x \)-tiles and 10 unit tiles.
   Both use the same tiles, only the tiles are grouped differently.

6.

7.a) \( 2x + 20 \)  \( b) \ 5a + 5 \)  \( c) \ 10f + 20 \)
   d) \( 72 + 6g \)  \( e) \ 64 + 8y \)  \( f) \ 5s + 30 \)  \( g) \ 27 + 3p \)
   h) \( 44 + 4r \)  \( i) \ 7g + 105 \)  \( j) \ 63 + 9h \)

8.a) \( 3x - 21 \)  \( b) \ 4a - 12 \)  \( c) \ 9h - 45 \)  \( d) \ 56 - 7f \)
   e) \( 5 - 5s \)  \( f) \ 6p - 12 \)  \( g) \ 88 - 8r \)  \( h) \ 30 - 2v \)
   i) \( 10b - 80 \)  \( j) \ 11c - 44 \)

9. \( P = 2(b + h) \); \( P = 2 \times b + 2 \times h \)

10. Answers will vary. For example: In multiplication, the order of the terms does not matter. The area of a rectangle with \( b = 2 \) cm and \( h = 1 \) cm is \( b \times h = h \times b = 2 \) cm².

11. The expression in Part a:
      \( 54 - 9t \) is equal to \( 9(6 - t) \).

12.a) \( -6c - 24 \)  \( b) \ -8a + 40 \)  \( c) \ 10f - 70 \)
   d) \( -24 - 3g \)  \( e) \ -64 + 8y \)  \( f) \ 2x - 10 \)
   g) \( 5t + 40 \)  \( h) \ -81 + 9w \)

13. Expressions in parts c and d are equivalent.
14.a) $15(25 + 14)$ or $15 \times 25 + 15 \times 14$

b) $\$585$; Answers may vary. For example: I prefer the unexpanded expression. It is easier to solve.

15.a) $5(9 + 8)$ or $5 \times 9 + 5 \times 8$

b) $\$85$; Answers may vary. For example: I prefer the unexpanded expression. It is easier to solve.

16.a) iv

b) i

c) iii

d) i

17.2$(3(m + 2)) = 6(m + 2) = 6m + 12$

18.a) i $7y + 21$

ii $3t - 15$

iii $32 - 8s$

iv $-12p - 36$

19.a) $14 + 2b + 2c$

b) $-66 + 11e - 11f$

c) $r - s + 8$

d) $60 + 10v + 10w$

e) $S - 75 - 5k$

f) $4g - 48 + 4h$

6.5 Solving Equations Involving the Distributive Property, page 347

4.a) $x = 7$

b) $p = 15$

c) $y = 3$

d) $a = -5$

5.a) $a = -13$

b) $r = 14$

c) $y = -2$

d) $c = 16$

6.a) $2(c + 3) = 20$

b) $c = 7$

7. The equation doubles the cards Marc had before he was given 3 more cards.

8.a) $2(w + 8) = 26$

b) $w = 5$; 5 cm

9.a) $6(x - 5) = 90$

b) $x = 20$; $\$20$

10.a) $8(6 + m) = 264$

b) $m = 27$; $\$27$

11.a) $-5(n + 9) = 15$

b) $n = -12$

12.a) $-4(n - 7) = 36$

b) $n = -2$

13.a) No

b) Kirsten divided the right side of the equation by $+8$ instead of $-8$. The correct solution is $x = 2$.  

c) $r = \frac{3}{4}$, or 0.75

d) $s = -12$

14.a) $t = 0$

b) $p = \frac{13}{2}$, or 6.5

c) $r = \frac{3}{4}$, or 0.75

d) $s = -12$

15.a) $1500 = 25(n + 40)$

b) $n = 20$; 20 guests

16. Answers may vary. For example:

a) Glenn and Lisa won a radio contest for a free roller-skating party for themselves and five other friends. The cost per person includes a $2.00 skate rental deposit that is returned to the renter when the skates are returned.

If the total value of the roller-skating party works out to be $42, what is the cost per person, before and after the skates are returned?

b) $n = 8$; The cost per person is $8 before the skates are returned and $6 after.

17.a) $p = 5$

b) $x = \frac{3}{8}$, or 0.375

c) $s = \frac{1}{2}$, or 0.5

Unit 6 Mid-Unit Review, page 350

1.a) $x = -9$

b) $x = -9$

c) $x = 3$

d) $x = -4$

2.a) $3g + 4 = 13$

b) $g = 3$; 3 granola bars

3.a) $x = -9$

b) $x = -3$

c) $x = \frac{1}{3}$

d) $x = \frac{5}{6}$

4.a) $125 + 12p = 545$

b) $p = 35$

5.a) $n = -32$

b) $m = 15$

c) $b = -18$

d) $f = -32$

6.a) $\frac{n}{7} = 4$; $n = -28$

b) $\frac{k}{9} = -3$; $k = 27$

c) $\frac{m}{2} + 5 = 0$; $m = 10$

6.6 Creating a Table of Values, page 356

4.a) $x$

<table>
<thead>
<tr>
<th>$y$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

5.a) $x$

<table>
<thead>
<tr>
<th>$y$</th>
<th>1</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

6. (2, 11), (4, 29), (5, 38)

7.a) $h$

<table>
<thead>
<tr>
<th>$w$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

8.a) $x$

<table>
<thead>
<tr>
<th>$y$</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

ANSWERS 521
9. a) | x  | y  |
   | -3 |  9 |
   | -2 |  7 |
   | -1 |  5 |
   |  0 |  3 |
   |  1 |  1 |
   |  2 | -1 |
   |  3 | -3 |
  b) | x  | y  |
   | -3 | 11 |
   | -2 |  6 |
   | -1 |  1 |
   |  0 | -4 |
   |  1 | -9 |
   |  2 | -14|
   |  3 | -19|
  c) | x  | y  |
   | -3 | -27|
   | -2 | -19|
   | -1 | -11|
   |  0 |  -3|
   |  1 |  5 |
   |  2 |  13|
   |  3 |  21|
10. (1, 2), (5, -10), (7, -16)
11. a) (-8, 23) b) (12, -17) c) (-12, 31) d) (15, -23)
12. a) | n  | m  |
     |  0 | 100|
     |  1 |  98|
     |  2 |  96|
     |  3 |  94|
     |  4 |  92|
     |  5 |  90|
13. a) m represents the product, t represents the number 9 is being multiplied by.
       b) | t  | m  |
       |  0 |  0 |
       |  1 |  9 |
       |  2 | 18 |
       |  3 | 27 |
       |  4 | 36 |
       |  5 | 45 |
       c) Patterns may vary. For example: The tens digit in the product increases by 1 each time and the ones digit decreases by 1 each time. The value of m starts at 9 and increases by 9 each time. The sum of the digits of m is equal to 9.
       d) Yes; 126 is divisible by 9 because its digits add up to 9.
14. a) (-4, -14) b) (-7, -26) c) (3, 14) d) (-1, -2)
15. a) (-2, -18) b) (-8, -48) c) (6, 22) d) (1, -3)

6.7 Graphing Linear Relations, page 363
4. a) When x increases by 1, y increases by 4.
      The points lie on a line that goes up to the right.
      b) When x increases by 1, y decreases by 3.
      The points lie on a line that goes down to the right.
5. a) Graph of y = 2x
      b) Graph of y = 3x
      c) Graph of y = 4x
      d) Graph of y = 5x
6. a) Graph of y = x + 1
      b) Graph of y = x - 1
      c) Graph of y = -x + 3
      d) Graph of y = -x - 3
7. (2, 19), (3, 27), (5, 43)
   To find a missing number, substitute the given number into the equation and then solve for the unknown.
8. (-3, 13), (-2, 7), (2, -17), (3, -23)
   To find the missing numbers, substitute the given numbers into the equation and then solve for the remaining unknown.
9.a) b) The points go up and to the right. As the $x$ value increases by 1, the $y$ value increases by 2.
c) (6, 23)

10.a) b) The points go down and to the right. As the $x$ value increases by 2, the $y$ value decreases by 4.
c) (7, 86)

11.a) b) The points lie on a line that goes up and to the right. As the $x$ value increases by 1, the $y$ value increases by 8.
c) Yes

12.a) b) The points go up and to the right. As the $x$ value increases by 1, the $y$ value increases by 2.
c) (6, 23)

13.a) | $n$ | $p$ |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>-12000</td>
</tr>
<tr>
<td>20</td>
<td>-9000</td>
</tr>
<tr>
<td>30</td>
<td>-6000</td>
</tr>
<tr>
<td>40</td>
<td>-3000</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>3000</td>
</tr>
<tr>
<td>70</td>
<td>6000</td>
</tr>
<tr>
<td>80</td>
<td>9000</td>
</tr>
</tbody>
</table>

The negative values of $p$ represent a loss of money.
c) As the value of $n$ increases by 10, the value of $p$ increases by 3000. The points lie on a line that goes up and to the right.
d) $7500; I used the graph.

14.a) b) When $n$ increases by 1, $C$ increases by 40. The points lie on a line that goes up and to the right.
c) No; answers may vary. For example: You cannot work –1 h.
15.a) i) ii) iii) iv) v) vi) vii) viii)

b) Graphs ii, iv, v, and vi go up and to the right. Graphs i, iii, vii, and viii go down and to the right.

c) If the x term is positive, the graph goes up to the right; if it is negative, the graph goes down to the right.

**Unit 6 Technology: Using Spreadsheets to Graph Linear Relations, page 367**

1. When the input increases by 1, the output increases by 2.

2. If Chris is planning on using the ATV for under 5 h, using the “Rambler” is cheaper. For more than 5 h, the “Northern” is cheaper; for exactly 5 h, the price is the same.

**Unit 6 Strategies for Success: Choosing a Strategy, page 369**

1. 152 fence posts
2. 16 teams
3. Ivan has $25.00 and Marsh has $35.00.
4.a) $7.95  b) $22.95
5. The order of the beads on a necklace is reversed when a necklace is flipped over.
   a) There are 3 different necklaces which can be made: Green, Yellow, Red; Yellow, Red, Green; Red, Green, Yellow
   b) There are 6 different necklaces which can be made: Green, Yellow, Red, Red; Yellow, Green, Red, Red; Yellow, Red, Green, Red; Green, Red, Yellow, Red; Red, Green, Yellow, Red; Green, Red, Red, Yellow

**Unit 6 Unit Review, page 371**

1.a) 7c = 56  b) c = 8; 8 coins
2.a) x = 5  b) x = –2  c) x = 4
d) x = –4  e) x = 6  f) x = –6
3.a) 8 + 3g = 29  b) g = 7; 7 gardens
4.a) x = 4  b) x = 3  c) x = \( \frac{2}{3} \)
d) x = –7  e) x = \( \frac{1}{3} \)  f) x = 2
5.a) 3h + 6 = 3  b) h = –1; –1°C
c) w = –54  d) e = –88
6.a) p = 12  b) t = –90
c) w = –54  d) e = –88
7. h = 14
8.a) \( \frac{f}{5} = 52 \)  b) f = 260; 260 fish
9.

10.a) 6x + 54  b) 33 – 12c
c) –35s + 25  d) –12a + 8
11.b) 5t – 20
12.a) x = 3  b) b = 12  c) p = 17
d) $s = \frac{24}{5}$, or 4.8

13.a) $-4(x - 7) = 36$  
   b) $x = -2$

14.a) No  
   b) $c = -9$; Chas should have written +10 after multiplying -2 and -5.

15.a)  

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-11</td>
</tr>
<tr>
<td>-2</td>
<td>-10</td>
</tr>
<tr>
<td>-1</td>
<td>-9</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
</tr>
<tr>
<td>2</td>
<td>-6</td>
</tr>
<tr>
<td>3</td>
<td>-5</td>
</tr>
</tbody>
</table>

b)  

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>8</td>
</tr>
<tr>
<td>-2</td>
<td>7</td>
</tr>
<tr>
<td>-1</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

16.a)  

<table>
<thead>
<tr>
<th>$n$</th>
<th>$s$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>42</td>
</tr>
<tr>
<td>8</td>
<td>48</td>
</tr>
</tbody>
</table>

b) When $n$ increases by 1, $s$ increases by 6.

c) (9, 54)

17.a)  

18.a)  

<table>
<thead>
<tr>
<th>$n$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>1</td>
<td>240</td>
</tr>
<tr>
<td>2</td>
<td>280</td>
</tr>
<tr>
<td>3</td>
<td>320</td>
</tr>
<tr>
<td>4</td>
<td>360</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>440</td>
</tr>
<tr>
<td>7</td>
<td>480</td>
</tr>
</tbody>
</table>

b) When $n$ increases by 1, $p$ increases by 40.

c) (5, 400)

19.a)  

<table>
<thead>
<tr>
<th>$n$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>1</td>
<td>240</td>
</tr>
<tr>
<td>2</td>
<td>280</td>
</tr>
<tr>
<td>3</td>
<td>320</td>
</tr>
<tr>
<td>4</td>
<td>360</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>440</td>
</tr>
<tr>
<td>7</td>
<td>480</td>
</tr>
</tbody>
</table>

20.a)  

21.a)  

$(-2, 9), (-1, 8), (0, 7), (3, 4)$

22.

Unit 6 Practice Test, page 374

1. $s = 2$

2.a) $3 - 3r = -6$; $3 - 3r + 3r = -6 + 3r$; $3 + 6 = -6 + 6 + 3r$; $9 = 3r$; $3 = r$

3.a)  

b) No, you could not draw a picture to show that $-4(x + 3)$ and $-4x - 12$ are the same, because it is not possible to draw a rectangle with negative side lengths and areas.

4.a) $x = 12$  
   b) $n = -21$  
   c) $p = 42$  
   d) $x = 8$

5.a) $14p + 200 = 424$  
   b) $p = 16$; 16 people

6.a)  

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>19</td>
</tr>
<tr>
<td>-2</td>
<td>13</td>
</tr>
<tr>
<td>-1</td>
<td>7</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
</tr>
<tr>
<td>2</td>
<td>-11</td>
</tr>
<tr>
<td>3</td>
<td>-17</td>
</tr>
</tbody>
</table>

b)  

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-25</td>
</tr>
<tr>
<td>-2</td>
<td>-18</td>
</tr>
<tr>
<td>-1</td>
<td>-11</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>-10</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

ANSWERS 525
7.a)  
<table>
<thead>
<tr>
<th>a</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

b)  
When \( a \) decreases by 1, \( g \) increases by 1.  
(5, 5) because both boys get an equal share

c)  
When \( p \) increases by 10, \( h \) increases by 300.

d)  
\( (5, 5) \) because both boys get an equal share

8.a)  
<table>
<thead>
<tr>
<th>n</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>20</td>
<td>110</td>
</tr>
<tr>
<td>30</td>
<td>140</td>
</tr>
</tbody>
</table>

b) \$185  
c) 70

Unit 6 Unit Problem: Planning a Ski Trip, page 376

1. You should choose company A: Company A charges \$5525; company B charges \$7225.
2. \( 851 = 23p; p = 37 \); 37 students
3.a) \( T = -15 \); \(-15^\circ C\)  
b) \( c = -8 \); \(-8^\circ C\)

4.a)  
<table>
<thead>
<tr>
<th>p</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1500</td>
</tr>
<tr>
<td>10</td>
<td>1800</td>
</tr>
<tr>
<td>20</td>
<td>2100</td>
</tr>
<tr>
<td>30</td>
<td>2400</td>
</tr>
<tr>
<td>40</td>
<td>2700</td>
</tr>
<tr>
<td>50</td>
<td>3000</td>
</tr>
<tr>
<td>60</td>
<td>3300</td>
</tr>
<tr>
<td>70</td>
<td>3600</td>
</tr>
<tr>
<td>80</td>
<td>3900</td>
</tr>
<tr>
<td>90</td>
<td>4200</td>
</tr>
<tr>
<td>100</td>
<td>4500</td>
</tr>
</tbody>
</table>

b)  
When \( p \) increases by 10, \( h \) increases by 300.

c) \$4350; \$45.79/person

Cumulative Review Units 1–6, page 378

1.a) \( l \)  
b) \( 256 \)  
c) \( 6.6 \)  
d) \( 121 \)
2.a) \( 20 \text{ cm}^2; \sqrt{20} \text{ cm} \)  
b) \( 45 \text{ cm}^2; \sqrt{45} \text{ cm} \)
3. \((+24) \times (-3) = -72; 72 \text{ s}\)
4.a) \(-60 \)  
b) \(+80 \)  
c) \(-19 \)  
d) \(-19 \)
5.a) \(\frac{5}{12} \)  
b) \(\frac{1}{3} \)  
c) \(\frac{5}{3} \)  
d) \(\frac{419}{24} \)
6.a) \( 5 \)  
b) \( 4 \)

c) The hygienist sees 4 patients and has \( \frac{1}{2} \) of \( \frac{1}{6} \) h free time.
7.c) A box with base 2 units by 4 units.
8. \( 832 \text{ cm}^2 \)
9.a) \( 600 \text{ cm}^3 \)  
b)  
c) \( 660 \text{ cm}^2 \)

10. 12%
11.a) i) \( 9 : 1 \)  
b) \( 1 : 2 \)  
c) \( 5 : 6 \)  
d) \( 2 : 1 : 9 \)
12.a) 12 rolls of paper towels for \$5.59  
b) \( 500 \text{ mL} \) of mouthwash for \$3.99
13.a) \$46.65  
b) \$38.84
14.a) \( x = -5 \)  
b) \( s = -7 \)  
c) \( t = 96 \)  
d) \( f = -40 \)
15. \( A = 8(6 + x); A = 48 + 8x \)
16.a) \(-2(x + 11) = -4 \)  
b) \( x = -9 \)
17.a) \( (2, -13) \)  
b) \( (0, 5) \)  
c) \( (3, -2) \)  
d) \( (4, -31) \)
18.a) Answers may vary.

For example:

<table>
<thead>
<tr>
<th>n</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>20</td>
<td>110</td>
</tr>
<tr>
<td>30</td>
<td>140</td>
</tr>
</tbody>
</table>

Unit 7 Data Analysis and Probability, page 380

7.1 Choosing an Appropriate Graph, page 387

3.a) Answers will vary. For example:

- Adult women watch TV 4 h more than adult men.
- Children watch 15 h of TV a week.
- Teens watch 2 h less of TV than children.

b) Answers will vary. For example:

- Adult women watch more TV than adult men.
- Teens watch the least amount of TV.
- Adult women watch more TV than any other age group.

c) The bar graph; It is easier to determine the number of hours of television each group watches.

4.a), b)

<table>
<thead>
<tr>
<th></th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Graph</td>
<td>The heights of the bars can be used to compare the responses. It is easy to read.</td>
<td>The percent of students who chose each response cannot be read from the graph.</td>
</tr>
<tr>
<td>Pictograph</td>
<td>The key is one symbol equals 3 students. The key can be used to calculate the total number of students who littered.</td>
<td>Some people may find this graph difficult to read accurately because not all of the symbols are complete.</td>
</tr>
</tbody>
</table>

c) Answers may vary. For example: the bar graph; it is easier to read than the pictograph with partial pictures.
d) A line graph would not be appropriate because the data were not collected over time. A circle graph would be appropriate if you wanted to know percents.

5. a) Answers will vary. For example:
   - 7 people got an A.
   - 1 more person got a B than a C.
   - 3 people got a D.

b) Answers will vary. For example:
   - More people got a B than any other grade.
   - More than half the class got an A or B.
   - About 75% did not get an A.

c) The bar graph; you can see the exact number of students.

d) Bar graphs, since they show the actual number of students, and his class has more students who got As and Bs.

e) Ms. Taylor’s class; it had a higher percent of students who got As and Bs.

6. a) Both compare the winning times of the men’s and women’s 400-m hurdles at six Olympic games.

b) The line graph makes it easier to compare women’s or men’s times from one Olympic game to the next.

   The bar graph makes it easier to compare women’s and men’s times for a particular year.

c) The line graph makes it difficult to accurately read the times.

   The double bar graph makes it difficult to compare from one year to the next.

d) i) The double line graph; it clearly shows the change from one year to the next.

   ii) The bar graph; the difference in bar heights for any year is easy to see.

7. Answers will vary. For example:

   a) Practice run times for 2 months
   b) Student shoe sizes
   c) Average heights of boys and girls for several grades
   d) Number of apples eaten in a week
   e) How a student spends her time during summer vacation

8. a) Yearly sales; it shows a trend over time.

b) Answers may vary. For example: Bar graph; it would break down the number of pairs by size.

9. a) The line graph shows better the general decrease in attendance. The bar graph shows better the actual mean attendance numbers.

b) For both graphs, it is difficult to accurately read the numbers that are not directly on a grid line.

c) Answers may vary. For example: The line graph; it shows best the change over time.

d) No; we are not interested in mean attendance numbers as parts of a whole.

10. a)

b) Allows you to see a trend in data which are collected over a period of time

Difficult to read accurately because none of the points are on a grid line

11. a)

b) Allows for direct comparison of populations in different regions

   Difficult to read accurately the exact populations

   Does not show populations as percents

12. Answers may vary. For example:

   i) A line graph to show the trend over time
   ii) A double bar graph to compare her parents
   iii) A circle graph to show the percent of time her brother spent on each activity
   iv) A line graph to show the change in height over time

13. a)

b) Allows you to see a trend in data collected over a long period of time

   Difficult to read accurately the data because not all of the points are on grid lines

c) 8 months: about 290 g; 30 months: about 525 g
1. a) Answers may vary.

2. a) Circle graph; since each piece of data is independent and should not be represented as part of a whole.

   Line graph since data are not collected over time.

3. a) The line graph; the data are collected over a period of time.

   b) A circle graph, because the data do not represent parts of a whole.

4. a) Graph A gives the impression that half the students want to go to Stanley Park.

   Graph B gives the impression that the votes are roughly equal.

   b) Graph A is misleading because its horizontal axis doesn’t start at zero.

   Graph B is misleading because the scale on its horizontal axis is too large.

   c) The creator of Graph A would most likely like to go to Stanley Park.

   d) Answers may vary. For example: The creator of Graph B probably doesn’t want to go anywhere.

   e) Start the horizontal axis at 0, and let 1 grid square represent 1 student.

5. Conclusions a and b are incorrect.

   Both conclusions were based on Graph A, whose vertical axis doesn’t start at 0.

6. a) No; Nick thought the larger symbols represented a greater number of animals.

   b) All the fish symbols should be drawn the same size.

   c) Bird; The symbols for birds are so large it looks like most students have birds.

7. a) No; the drop is only 5% from 3rd to 4th term.
b) The vertical axis should start at zero.
8.a) Manufacturer A has a lot more trucks still on the road.
     b) 97.5, 96.5, and 95.5
     c) Manufacturer A’s trucks are about as dependable as those of the other three manufacturers; the four companies have nearly the same number of trucks on the road after 10 years.
     d) Start the vertical axis at zero.
9.a) Kathy’s plant
     b) The symbols are drawn in different sizes; it looks like Arlene’s plant is the tallest.
     c) Make all symbols the same size.
     d) No; Arlene probably drew it to make her plant look the tallest.
10.a) More girls participate in sports than boys.
     b), c) The girls’ bars are thicker and the boys’ scale larger.
     d) Use the same scale and the same bar width for both.
     e) A double bar graph
11.a) The graph is misleading because the angle it is drawn on makes the closest bars appear taller.
     b) Do not draw the graph on an angle.
13. By making the symbols of a pictograph different sizes
     By altering where an axis begins its numbering
     By slightly removing a sector from a circle graph
14.a) No, because you don’t know how much money either of them has to spend, only the percent they spend on each activity
     b) A double bar graph
15.a) Draw a bar graph with a large scale that starts at $50 000.
     b) Draw a bar graph with a small scale.
     c) Draw a bar graph. Start the vertical axis at 0 and let 1 grid square represent $25 000.
16. Answers may vary. For example:
     a) Draw a 3-D bar graph on an angle to make the Pizza bar appear larger.
     b) Draw a bar graph with a large scale.
     c) Draw a bar graph and start the vertical scale at 195.

Unit 7 Technology: Using Spreadsheets to Investigate Formatting, page 405
1.a) This graph makes it appear that Thornton made 3 times as many points as some of the players.
Unit 7 Mid-Unit Review, page 406

1.a) The bar graph shows the number of endangered species of each type of animal. The circle graph shows the percent of endangered species of each type of animal.

b) The bar graph allows for comparison of numbers. The circle graph shows percents or parts of a whole.

c) In the circle graph, the original numbers are lost. The bar graph does not show percents.

d) The bar graph; Percents of endangered species are less relevant than actual numbers.

e) No; The data were not collected over a period of time.

2.a) No; The Hawks have scored more points per game and are improving faster.

b) The smaller scale on the Ravens’ graph and the fact that their vertical axis doesn’t start at 0.

c) Have the same scales and start both vertical axes at the same number.

7.3 Probability of Independent Events, page 411

3.a) \( \frac{1}{4} \)  
   b) \( \frac{1}{2} \)

4.a) \( \frac{4}{9} \)  
   b) \( \frac{2}{9} \)  
   c) \( \frac{4}{9} \)  
   d) \( \frac{2}{3} \)

5.a) \( \frac{1}{10} \)  
   b) \( \frac{1}{5} \)  
   c) \( \frac{3}{10} \)

6.a) i) \( \frac{3}{100} \)  
   ii) \( \frac{3}{20} \)  
   iii) \( \frac{3}{100} \)  
   iv) \( \frac{6}{25} \)

7.a) \( \frac{1}{36} \)  
   b) \( \frac{1}{36} \)  
   c) \( \frac{5}{12} \)  
   d) \( \frac{1}{4} \)  
   e) \( \frac{1}{4} \)

8.a) i) \( \frac{1}{24} \)  
   ii) \( \frac{5}{78} \)

   c) \( \frac{1}{312} \): The rule is much faster than using a tree diagram.

9. The probability of rolling the same colour twice is \( \frac{1}{16} \). However, Marcus forgets that there are 4 different colours. So, a person actually has a \( \frac{1}{4} \) chance of winning.

10.a) \( \frac{1}{5} \)

   b), c) Answers may vary depending on assumptions. For example: \( \frac{1}{25} \):

   I assumed he places the first pair of socks back in the drawer before trying again.

11.a) \( \frac{1}{4} \)  

   b) For example:

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>B</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>B</td>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>

12.a) i) \( \frac{1}{12} \)  
   ii) \( \frac{1}{9} \)  
   iii) \( \frac{1}{9} \)

   b) No; the colour of the first marble will affect which marbles are left and their probabilities for being drawn.

13.a) \( \frac{1}{5} \)  
   b) \( \frac{9}{10} \)  
   c) \( \frac{1}{10} \)  
   d) 0

14. \( \frac{1}{16} \)

15. Answers will vary. For example:

   a) Rolling a number less than 7 and tossing heads
   b) Rolling a 2 or 5 and tossing tails
   c) Rolling a 1, 3, 4, or 6 and tossing heads

7.4 Solving Problems Involving Independent Events, page 420

4.a) \( \frac{1}{8} \)  
   b) \( \frac{1}{8} \)  
   c) \( \frac{1}{8} \)
5.a) \( \frac{1}{216} \)  
b) \( \frac{1}{36} \)

6.a) \( \frac{1}{32} \)  
b) \( \frac{3}{16} \)  
c) \( \frac{1}{8} \)

7. \( \frac{1}{10,000} \)

8.a) \( \frac{1}{1000} \)  
b) \( \frac{1}{10} \)  
c) \( \frac{6561}{10,000} \)

9.a) \( \frac{1}{64} \)  
b) \( \frac{1}{32} \)  
c) \( \frac{3}{104} \)

10.a) \( \frac{1}{1024} \)  
b) \( \frac{9}{1024} \)  
c) \( \frac{243}{1024} \)

11. \( \frac{1}{17,576} \)

12.a) \( \frac{27}{512} \)  
b) \( \frac{9}{1024} \)  
c) \( \frac{5}{512} \)

13.a) About 0.013%  
b) \( \frac{1}{10} \); The events are independent.  
c) No; the probability of drawing the white marble 6 times in a row looks at 6 events and their outcomes altogether, so it is much less likely to happen.

14.a) \( \frac{5}{64} \)  
b) \( \frac{7}{192} \)  
c) 0

15.a) 30%  
b) 21%  
c) 49%

16.a) \( \frac{1}{216} \)  
b) \( \frac{215}{216} \)  
c) The sum is 1 because rolling 6s and not rolling 6s account for all possibilities.

Unit 7 Technology: Using Technology to Investigate Probability, page 423

1.b) i) \( \frac{1}{8} \) or 12.5%  
ii) \( \frac{1}{4} \) or 25%  

c) The results are very similar.

Unit 7 Unit Review, page 424

1.a) Line graph:  
The number of barrels of oil produced increased every year except for 1999 and 2005. The lowest production year was 1999. The highest production year was 2004.  
Bar graph:  
The amount of oil produced never exceeded 2.5 million barrels. The amount of oil produced never dropped below 1.5 million barrels. Oil production was fairly steady from 1998 to 2001.  
b) The line graph is more appropriate to display the data because it clearly shows the change from year to year.

2.a) A circle graph shows the percent of students who chose each response. A pictograph is more visually appealing and makes it very easy to compare how many students chose each response.  
b) For example, a company who produces snack food might want to know which products are most popular.  
c) For example, Sarah is throwing a birthday party and she’s inviting the entire class. She wants to know how many people prefer each kind of snack food.

3.a) The number of awards each group of dogs won.  
b) Answers may vary. For example: The bar graph; it isn’t important what percent of the awards each type of dog won, but how many awards each group won.  
c) No; the data do not change over time  
d) Yes; however, you would have to use symbols or divide a symbol into many smaller pieces.

4.a)  
b) Allows for immediate comparison between the different responses 
Does not show each number of pizzas sold as a percent of the total number of pizzas sold. May be difficult to read the value of the bars that do not end on grid lines.

5.a) Yes; she drew the same number of symbols next to each category  
b) Carrots  
c) The symbols for carrots are enlarged to make them appear more popular.

6. The “Not Ready” sections are not drawn to scale; they are drawn shorter to make the percents appear smaller.

7. The second graph; because it does not start the scale on the horizontal axis at 0, but rather at 10; it appears that Party Pizza has at least 10 times as many wrong orders as Pizza Place

8. No; the graph is misleading because its vertical axis does not start at 0. This shortens the bar for the 11-year-olds to look as though very few of them have cell phones
9. a) [Bicycle Demon's Profit graph]

I created the impression of a large growth in profit by not starting the vertical axis scale at 0.

b) [Bicycle Demon's Profit graph]

I created the impression of very little growth in profit by using a very large scale on the vertical axis.

10. a) $\frac{1}{6}$

11. a) $\frac{1}{3}$ b) $\frac{1}{3}$ c) $\frac{1}{9}$ d) $\frac{1}{9}$ e) 0

12. a) $\frac{1}{3}$ b) $\frac{1}{27}$ c) $\frac{8}{27}$

13. a) $\frac{1}{2197}$ b) $\frac{1}{140608}$ c) $\frac{9}{676}$

14. $\frac{1}{1024}$

15. a) $\frac{1}{64}$ b) $\frac{1}{64}$ c) $\frac{1}{64}$ d) $\frac{3}{64}$

Unit 7 Practice Test, page 428

1. a) Answers may vary. For example:
   i) A bar graph does not allow data to be displayed as percents or parts of a whole.
   ii) In a circle graph, the original data are lost, only the percents are shown.

b) A pictograph would likely be a bad choice; the data would require a large number of symbols. A line graph could not be used because the data were not collected over a period of time.

c) A bar graph; the actual number of students would be shown

2. a), b) The first graph gives the impression that sales have not increased substantially by using a large scale that goes far beyond the data. The second graph gives the impression that sales have increased dramatically because the vertical axis does not start at 0 and the scale is very small.

c) Use an appropriate scale that starts at 0.

3. a) $\frac{4}{5}$ b) $\frac{6}{18}$ c) $\frac{1}{12}$ d) $\frac{1}{6}$

4. a) $\frac{3}{4}$ b) $\frac{9}{64}$ c) $\frac{7}{64}$

Unit 8 Geometry, page 432

8. 1 Sketching Views of Objects, page 437

4. a) [Graphs]

8. 5. A: N, P; B: L, N, Q; C: L, Q; D: J, L, Q; E: K, M, Q

16. 7 possible objects

17. a) No

b) Answers may vary. For example: Front, back, and side views the same

c) Answers may vary. For example: Front and side views the same
d) Answers may vary. For example: No views the same

8.2 Drawing Views of Rotated Objects, page 444
3. a) Horizontally 90° counterclockwise
   b) Horizontally 180°
   c) Horizontally 90° clockwise
4. a) Front view: B; top view: E; left side view: A; right side view: A
   b) Front view: G; top view: C; left side view: F; right side view: D
5. Part a
6. Students’ answers should show the rectangle representing the vertical side piece.
7. i), iii)
8. a) b)
9. i)
10.
11. Answers will vary.
   For example:
12.
13. a) b) 112 cm²; 56 cm³
14. a) b)
15.
16. a) 9 b) 7 c) 4

8.3 Building Objects from Their Views, page 450
4. Object C
5. 6.
4. Same views as when rotated 90° clockwise

6.a) 

8.4 Identifying Transformations, page 460

5.a) Reflection  
   b) Rotation of 180° or reflection  
   c) Translation 1 unit left  
   d) Translation 1 unit right

6.a) B  
   b) D  
   c) A  
   d) C  
   e) F

7.a) Rotation of 90° counterclockwise
   b) Translation 2 units up
   c) Rotation of 90° counterclockwise
   d) Rotation of 180°

8.

9. A could be a translation image of D or E, or a rotation image of C.  
   B could be a reflection image of D, or a rotation image of D.  
   C could be a rotation image of A, D, or E.  
   D could be a reflection image of B, a translation image of A or E, or a rotation image of C.  
   E could be a translation image of A or D, or a rotation image of C.

10.a) The shape should have at least 2 axes of symmetry.  
     b) The shape should have 1 axis of symmetry.  
     c) The shape should not have any axes of symmetry.

12. Translation: 3 units up along the diagonal  
     Rotation: 120° counterclockwise or 240° clockwise  
     Reflection

8.5 Constructing Tessellations, page 467

6.a) Designs i and iii are tessellations since there are no gaps between shapes.  
     b) Designs ii and iv are not tessellations since there are gaps between shapes.

7.a) Yes  
     b) Yes  
     c) No  
     d) No  
     e) Yes  
     f) No

8.a) 90° + 90° + 90° + 90° = 360°  
     60° + 60° + 60° + 60° + 60° + 60° = 360°  
     108° + 108° + 108° = 324° < 360°  
     150° + 150° = 300° < 360°  
     120° + 120° + 120° = 360°  
     144° + 144° = 288° < 360°  
     b) Triangle, square, hexagon

9. Answers will vary. For example:

10. No; multiples of 90° and 120° do not add up to 360°.

11.a) Yes; 45° + 45° + 90° + 90° + 45° + 45° = 360°  
     b) Yes; 120° + 120° + 60° + 60° = 360°  
     c) No; Even though the sum of some angle measures may be 360°, gaps remain among shapes.
     d) Yes; 60° + 60° + 60° + 60° + 60° + 60° = 360°  
     and 120° + 120° + 120° = 360°  
     e) No; Even though the sum of some angle measures may be 360°, gaps remain among shapes.
     f) No; Even though the sum of some angle measures may be 360°, gaps remain among shapes.

12.a) Answers will vary. For example:  
     Shapes e and f combine to form a hexagon that tessellates.

13. No; 135° + 135° = 270° < 360°

14. Regular octagon and square; The shape tessellates because the sum of the angles at each point is 90° + 135° + 135° = 360°.

16. For example:

17.a) No  
     c) For example:

18.a) No  
     c) For example:

8.6 Identifying Transformations in Tessellations, page 476

3. Answers will vary. For example:
   i) a) Shape C; translation to the right  
       b) Shape F; line of reflection is the shared side.  
       c) Shape E; rotation 120° counterclockwise about shared vertex
   ii) a) Shape B; translation to the right  
       b) Shape B; line of reflection is the shared side.  
       c) Shape D; rotation 180° about shared vertex
   iii) a) Shape H; translation down  
       b) Shape E; line of reflection is the shared side.  
       c) Shape J; rotation 180° about shared vertex

4. Answers will vary. For example:
   i) a) Shape E; Translation down and to the right  
       b) Shape D; Line of reflection is the shared side.
c) Shape D: Rotation 60° counterclockwise about shared vertex
ii) a) Shape C; Translation to the right
b) Shape B; Line of reflection is the shared side.
c) Shape E; Rotation 180°
5. Answers will vary. For example:
a) Translate 1 unit down, then rotate 180° about top right vertex. Repeat.
b) Reflect across shared side, then reflect across shared vertex. Repeat.
c) Rotate 90° clockwise about centre vertex. Repeat.
6.a) Answers will vary. For example:
Translate A 4 units to the right to get C.
Translate B 4 units to the right to get D.
Translate E and F down and to the left to get G and H.
Translate E and F down and to the right to get I and J.
b) Answers will vary. For example:
Reflect A across right side to get B.
Reflect B across right side to get C.
Reflect C across right side to get D.
Reflect E across right side to get F.
Reflect G across right side to get H.
Reflect I across right side to get J.
7. Translations, reflections followed by rotations
8. Answers will vary. For example:
A tessellation can be created by translating the shape 2 units up and 1 unit to the right, then repeating with the new shape.
9. Translations, reflections, rotations of 90°, 180°, and 270°
12. Answers will vary. Students’ answers should describe translations, rotations, and reflections.
13. Divide each square into 4 identical squares.
Rotate the smaller square in the top left corner 90°, 180°, and 270° to get the other three smaller squares.
14.c) Label the shapes A, B, C, D, and E starting from the top left and going clockwise.
Translate A 8 units right to get C.
Translate A 4 units down and 4 units right to get D.
Translate B 4 units down and 4 units left to get E.

Unit 8 Strategies for Success: Explaining Your Answer, page 481
1. $39.96
2. 4 tables of 8 people and 9 tables of 10 people;
   9 tables of 8 people and 5 tables of 10 people;
   14 tables of 8 people and 1 table of 10 people

Unit 8 Unit Review, page 483
1.a) b)
3.b)
4.a) 90° clockwise
b) 90° clockwise or 90° counterclockwise
c) 180° rotation
5.
6. Object c
7.a) b)
8.a) D b) C c) A d) B
9. Each image is the same.
10.a) Answers may vary. For example:
   b) Translate A and D to the right to obtain the other shapes.
11.a) No b) Yes c) Yes
12. Answers will vary. For example:
13. a) A and B
15. Translations and rotations

Unit 8 Practice Test, page 486

1. [Diagram]

2. a) [Diagram]
   b) [Diagram]
   c) [Diagram]

3. [Diagram]

4. A: Reflection across the red line
   B: 180° rotation about P
   C, D: Reflection across the blue line then the red line

5. a) No; 108° + 108° + 108° = 324° < 360°
   b) Yes; 135° + 45° + 90° + 90° = 360°
   c) Yes; 120° + 120° + 120° = 360°

6. Answers will vary. For example:
   A and D can either be translated 2 units to the right or reflected across their right sides to obtain B and C. Since all shapes are congruent, area is conserved.

7. Answers may vary. For example:

8. Answers may vary.
   For example:
   Start from the shaded shape and rotate 60° clockwise to obtain the next shape. Rotate the new shape 60° clockwise.

Cumulative Review Units 1–8, page 492

1. a) Logan  b) 7.3 m

2. a) False; \( \sqrt{5} + \sqrt{2} \neq 3.65 > 2.65 = \sqrt{7} \\ b) True; \( \sqrt{46} \approx 6.78 \\ c) True; \( \sqrt{36} + \sqrt{64} = 6 + 8 = 14 

3. $20
4. a) –6 b) 2 c) 2 d) –1
5. \( \frac{3}{4} \)
6. a) \( \frac{7}{12} \) h b) 7 batches

7. Cube
8. a) Triangular prism  b) Cylinder
   c) Hexagonal prism

9. a) 1 unit by 1 unit by 60 units; least like cube, 242 square units
   b) 3 units by 4 units by 5 units; most like cube, 94 square units

10. a) \( \frac{253}{400} \cdot 0.6325 \)
    b) \( \frac{9}{800}, 0.01125 \)
    c) \( \frac{7}{2500}, 0.0028 \)
    d) \( \frac{7}{1000}, 0.007 \)

11. a) 7\( \frac{1}{2} \)% of $2.00 is $0.15; cost in 2007: $2.15
    b) 12% of $2.15 is $0.26; cost in 2008: $2.41
    b) No; 119\( \frac{1}{2} \)% of $2.00 is $2.39

12. a) i) \( \frac{3}{8} \) ii) \( \frac{5}{12} \)
    b) i) \( \frac{3}{8} \) ii) \( \frac{5}{12} \)
    c) 2 : 5

13. a) 36  b) About 36 min

14. a) 8 apples/min  b) 12 fence posts/h
    c) 12 km/h

15. a) \( 52 + 12d \)
    b) \(-35 + 42c \)
    c) \(-72d + 56 \)
    d) 48e – 6

16. a) Adding 7 to both sides of the equation, instead of subtracting 5 from both sides
    b) Yes; Substitute –4 for \( x \) into the original equation.
    c) It did not affect the solution because Felix always did the same operations on both sides of the equations.

17. a) \begin{tabular}{|c|c|}
<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>–2</td>
<td>6</td>
</tr>
<tr>
<td>–1</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>–3</td>
</tr>
<tr>
<td>2</td>
<td>–6</td>
</tr>
</tbody>
</table>
\end{tabular}

b) \begin{tabular}{|c|c|}
<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>–2</td>
<td>5</td>
</tr>
<tr>
<td>–1</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
\end{tabular}
18. a) Answers may vary. For example:

<table>
<thead>
<tr>
<th>n</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>9</td>
<td>72</td>
</tr>
</tbody>
</table>

b) 96  c) 18
d) Answers may vary. For example:

e) Linear  f) (6, 48)

19. a) Answers may vary. For example:
The bar graph allows you to determine easily the difference in percents among various uses of water.
The circle graph shows the different water uses as parts of a whole.
b) Answers may vary. For example: In both graphs, we cannot tell how many people were surveyed.
c) Circle graph; because various water uses are parts of a whole
d) No; because the data was not collected over a period of time

20. a) The first graph gives the impression that government funding has not increased much.
The second graph gives the impression that government funding has increased dramatically.
b) The first graph uses a large scale on the vertical axis. The second graph starts its vertical axis at 155,000.
c) Groups advocating for more government funding would use the first graph to show the government is not giving enough money. The government would use the second graph to show it is providing a lot more money.

21. a) \( \frac{49}{400} \)  b) \( \frac{3}{100} \)  c) \( \frac{21}{200} \)  d) \( \frac{39}{400} \)

22. \( \frac{77}{1000} \) or 7.7%

23. a) \( \frac{1}{64} \)

24.

25.

26. Answers will vary. For example:
From A to B, translate 4 units right.
From A to C, translate 8 units right.
From A to D, translate 2 units right and 2 units up.
From A to E, translate 6 units right and 2 units up.
Since all shapes are congruent, area is conserved.

27. Yes
acute angle: an angle measuring less than 90°

acute triangle: a triangle with three acute angles

algebraic expression: a mathematical expression containing a variable: for example, $6x - 4$ is an algebraic expression

approximate: a number close to the exact value of an expression; the symbol $\approx$ means “is approximately equal to”

area: the number of square units needed to cover a region

array: an arrangement in rows and columns

average: a single number that represents a set of numbers (see mean, median, and mode)

axis of rotation: the straight line around which an object is turned

bar graph: a graph that displays data by using horizontal or vertical bars

bar notation: the use of a horizontal bar over a decimal digit to indicate that it repeats; for example, $1.\overline{3}$ means $1.333\ldots$

base: the side of a polygon or the face of an object from which the height is measured

bisector: a line that divides a line segment or an angle into two equal parts

capacity: the amount a container can hold

Cartesian Plane: another name for a coordinate grid (see coordinate grid)

central angle: the angle between the two radii that form a sector of a circle; also called sector angle

certain event: an event with probability 1, or 100%

chance: a description of a probability expressed as a percent

circle graph: a diagram that uses sectors of a circle to display data

circumference: the distance around a circle, also known as the perimeter of the circle

common denominator: a number that is a multiple of each of the given denominators; for example, 12 is a common denominator for the fractions $\frac{1}{3}, \frac{5}{4}, \frac{7}{12}$

common factor: a number that is a factor of each of the given numbers; for example, 3 is a common factor of 15, 9, and 21

commutative property: the property of addition and multiplication that states that numbers can be added or multiplied in any order; for example, $3 + 5 = 5 + 3; 3 \times 5 = 5 \times 3$

composite number: a number with three or more factors; for example, 8 is a composite number because its factors are 1, 2, 4, and 8

composite shape: the result of combining one or more shapes to make a new shape

concave polygon: has at least one angle greater than 180°

congruent: shapes that match exactly, but do not necessarily have the same orientation

consecutive numbers: integers that come one after the other without any integers missing; for example, 34, 35, 36 are consecutive numbers, so are $-2, -1, 0,$ and 1

conservation of area: under a transformation, the area of a shape does not change

constant term: the number in an expression or equation that does not change; for example, in the expression $4x + 3$, 3 is the constant term

convex polygon: has all angles less than 180°

coordinate axes: the horizontal and vertical axes on a grid
coordinate grid: a two-dimensional surface on which a coordinate system has been set up
coordinates: the numbers in an ordered pair that locate a point on the grid (see ordered pair)
cube: an object with six congruent square faces
cubic units: units that measure volume
cylinder: an object with two parallel, congruent, circular bases
database: an organized collection of facts or information, often stored on a computer
denominator: the term below the line in a fraction
diagonal: a line segment that joins two vertices of a shape, but is not a side
diameter: the distance across a circle, measured through its centre
digit: any of the symbols used to write numerals; for example, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9
dimensions: measurements, such as length, width, and height
discount: the amount by which a price is reduced
discrete data: data that can be counted
distributive property: the property stating that a product can be written as a sum or difference of two products; for example, \( a(b + c) = ab + ac \), \( a(b - c) = ab - ac \)
dividend: the number that is divided
divisor: the number that divides into another number
double bar graph: a bar graph that shows two sets of data
equation: a mathematical statement that two expressions are equal
equilaterial triangle: a triangle with three equal sides
equivalent: having the same value; for example, \( \frac{2}{3} \) and \( \frac{6}{9} \); 3:4 and 9:12
estimate: a reasoned guess that is close to the actual value, without calculating it exactly
evaluate: to substitute a value for each variable in an expression
even number: a number that has 2 as a factor; for example, 2, 4, 6
event: any set of outcomes of an experiment
experimental probability: the probability of an event calculated from experimental results
expression: a mathematical phrase made up of numbers and/or variables connected by operations
factor: to factor means to write as a product; for example, \( 20 = 2 \times 2 \times 5 \)
formula: a rule that is expressed as an equation
fraction: an indicated quotient of two quantities
frequency: the number of times a particular number occurs in a set of data
greatest common factor (GCF): the greatest number that divides into each number in a set; for example, 5 is the greatest common factor of 10 and 15
height: the perpendicular distance from the base of a shape to the opposite side or vertex; the perpendicular distance from the base of an object to the opposite face or vertex
hexagon: a six-sided polygon
horizontal axis: the horizontal number line on a coordinate grid
hypotenuse: the side opposite the right angle in a right triangle
image: the shape that results from a transformation
impossible event: an event that will never occur; an event with probability 0, or 0%
improper fraction: a fraction with the numerator greater than the denominator; for example, both \( \frac{6}{5} \) and \( \frac{3}{2} \) are improper fractions
**independent events**: two events in which the result of one event does not depend on the result of the other event

**inspection**: solving an equation by finding the value of the variable by using addition, subtraction, multiplication, and division facts

**integers**: the set of numbers
\[ \ldots -3, -2, -1, 0, +1, +2, +3, \ldots \]

**inverse operation**: an operation that reverses the result of another operation; for example, subtraction is the inverse of addition, and division is the inverse of multiplication

**irregular polygon**: a polygon that does not have all sides equal or all angles equal

**isometric**: equal measure; on isometric dot paper, the line segments joining 2 adjacent dots in any direction are equal

**isometric drawing**: a representation of an object as it would appear in three dimensions

**isosceles triangle**: a triangle with two equal sides

**legend**: part of a circle graph that shows what category each sector represents

**legs**: the sides of a right triangle that form the right angle; (see hypotenuse)

**linear relation**: a relation that has a straight-line graph

**line graph**: a graph that displays data by using points joined by line segments

**line segment**: the part of a line between two points on the line

**line symmetry**: a shape that can be divided into 2 congruent parts, so that the parts coincide when the shape is folded along a line of symmetry

**lowest common multiple (LCM)**: the lowest multiple that is the same for two numbers; for example, the lowest common multiple of 12 and 21 is 84

**mass**: the amount of matter in an object

**mean**: the sum of a set of numbers divided by the number of numbers in the set

**measure of central tendency**: a single number that represents a set of numbers (see mean, median, and mode)

**median**: the middle number when data are arranged in numerical order; if there is an even number of data, the median is the mean of the two middle numbers

**midpoint**: the point that divides a line segment into two equal parts

**mixed number**: a number consisting of a whole number and a fraction; for example, \( \frac{1}{3} \) is a mixed number

**mode**: the number that occurs most often in a set of numbers

**multiple**: the product of a given number and a natural number; for example, some multiples of 8 are 8, 16, 24, …

**natural numbers**: the set of numbers 1, 2, 3, 4, 5, …

**negative number**: a number less than 0

**net**: a pattern that can be folded to make an object

**numerator**: the term above the line in a fraction

**numerical coefficient**: the number by which a variable is multiplied; for example, in the expression \( 4x + 3 \), 4 is the numerical coefficient

**obtuse angle**: an angle whose measure is greater than 90˚ and less than 180˚

**obtuse triangle**: a triangle with one angle greater than 90˚

**octagon**: an eight-sided polygon

**odd number**: a number that does not have 2 as a factor; for example, 1, 3, 7

**operation**: a mathematical process or action such as addition, subtraction, multiplication, or division
opposite integers: two integers with a sum of 0; for example, \(+3\) and \(-3\) are opposite integers

ordered pair: two numbers in order, for example, \((2, 4)\); on a coordinate grid, the first number is the horizontal coordinate of a point, and the second number is the vertical coordinate of the point

order of operations: the rules that are followed when simplifying or evaluating an expression

origin: the point where the \(x\)-axis and the \(y\)-axis intersect

outcome: a possible result of an experiment or a possible answer to a survey question

parallel lines: lines on the same flat surface that do not intersect

parallelogram: a quadrilateral with both pairs of opposite sides parallel

part-to-part ratio: a ratio that compares a part of the whole to another part of the whole

part-to-whole ratio: a ratio that compares a part of the whole to the whole

pentagon: a five-sided polygon

percent: the number of parts per 100; the numerator of a fraction with denominator 100

percent decrease: to calculate a percent decrease, divide the decrease by the original amount, then write the quotient as a percent
Percent decrease (%) = \(\frac{\text{Decrease}}{\text{Original amount}} \times 100\)

percent increase: to calculate a percent increase, divide the increase by the original amount, then write the quotient as a percent
Percent increase (%) = \(\frac{\text{Increase}}{\text{Original amount}} \times 100\)

perfect square: a number that is the square of a whole number; for example, 16 is a perfect square because \(16 = 4^2\)

perimeter: the distance around a closed shape

perpendicular lines: intersect at 90°

pictograph: a graph that uses a symbol to represent a certain number, and repetitions of the symbol illustrate the data (see page 384)

plane: a flat surface with the property that a line segment joining any two points lies completely on its surface

polygon: a closed shape that consists of line segments; for example, triangles and quadrilaterals are polygons

polyhedron (plural, polyhedra): an object with faces that are polygons

population: the set of all things or people being considered

prediction: a statement of what you think will happen

prime number: a whole number with exactly two factors, itself and 1; for example, 2, 3, 5, 7, 11, 29, 31, and 43

prism: an object that has two congruent and parallel faces (the bases), and other faces that are parallelograms

probability: the likelihood of a particular outcome; the number of times a particular outcome occurs, written as a fraction of the total number of outcomes

product: the result when two or more numbers are multiplied

proper fraction: a fraction with the numerator less than the denominator; for example, \(\frac{5}{6}\)

proportion: a statement that two ratios are equal; for example, \(r.24 = 3:4\)

pyramid: an object that has one face that is a polygon (the base), and other faces that are triangles with a common vertex

Pythagorean Theorem: the rule that states that, for any right triangle, the area of the square on the hypotenuse is equal to the sum of the areas of the squares on the legs

Pythagorean triple: three whole-number side lengths of a right triangle

quadrant: one of four regions into which coordinate axes divide a plane
**quadrilateral**: a four-sided polygon

**quotient**: the result when one number is divided by another

**radius** (*plural, radii*): the distance from the centre of a circle to any point on the circle

**range**: the difference between the greatest and least numbers in a set of data

**rate**: a comparison of two quantities measured in different units

**ratio**: a comparison of two or more quantities with the same unit

**reciprocals**: two numbers whose product is 1; for example, $\frac{2}{3}$ and $\frac{3}{2}$

**rectangle**: a quadrilateral that has four right angles

**rectangular prism**: a prism that has rectangular faces

**rectangular pyramid**: a pyramid with a rectangular base

**reflection**: a transformation that is illustrated by a shape and its image in a line of reflection

**reflex angle**: an angle between 180˚ and 360˚

**regular polygon**: a polygon that has all sides equal and all angles equal

**regular prism**: a prism with regular polygons as bases; for example, a cube

**regular pyramid**: a pyramid with a regular polygon as its base; for example, a tetrahedron

**related denominators**: two fractions where the denominator of one fraction is a factor of the other

**relation**: a rule that associates two terms

**repeating decimal**: a decimal with a repeating pattern in the digits to the right of the decimal point; it is written with a bar above the repeating digits; for example, $\frac{1}{15} = 0.0\overline{6}$

**rhombus**: a parallelogram with four equal sides

**right angle**: a 90˚ angle

**right triangle**: a triangle that has one right angle

**rotation**: a transformation in which a shape is turned about a fixed point

**scale**: the numbers on the axes of a graph

**scalene triangle**: a triangle with all sides different

**sector**: part of a circle between two radii and the included arc

**sector angle**: see central angle

**simplest form**: a ratio with terms that have no common factors, other than 1; a fraction with numerator and denominator that have no common factors, other than 1

**spreadsheet**: a computer-generated arrangement of data in rows and columns, where a change in one value results in appropriate calculated changes in the other values

**square**: a rectangle with four equal sides

**square number**: the product of a number multiplied by itself; for example, 25 is the square of 5

**square root**: a number which, when multiplied by itself, results in a given number; for example, 5 is a square root of 25

**statistics**: the branch of mathematics that deals with the collection, organization, and interpretation of data

**straight angle**: an angle measuring 180˚
surface area: the total area of the surface of an object

symmetrical: possessing symmetry (see line symmetry)

systematic trial: solving an equation by choosing a value for the variable, then checking by substituting

term: (of a fraction) the numerator or the denominator of the fraction
(of a ratio) each of the quantities constituting a ratio; for example, in the ratio 4:5, 4 and 5 are both terms

terminating decimal: a decimal with a certain number of digits after the decimal point; for example, \(\frac{1}{8} = 0.125\)

tessellate: to use congruent copies of a shape to cover a plane with no overlaps or gaps

tetrahedron: an object with four equal triangular faces; a regular triangular pyramid

theoretical probability: the number of favourable outcomes written as a fraction of the total number of possible outcomes

three-dimensional: having length, width, and depth or height

three-term ratio: a comparison of three quantities with the same unit

transformation: a translation, rotation, or reflection

translation: a transformation that moves a point or a shape in a straight line to another position on the same flat surface

trapezoid: a quadrilateral that has one pair of parallel sides

triangle: a three-sided polygon

two-dimensional: having length and width, but no thickness, height, or depth

two-term ratio: a comparison of two quantities with the same unit

unit fraction: a fraction that has a numerator of 1

unit price: the price of one item, or the price of a particular mass or volume of an item

unit rate: a quantity associated with a single unit of another quantity; for example, 6 m in 1 s is a unit rate; it is written as 6 m/s

variable: a letter or symbol representing a quantity that can vary

vertex (plural, vertices): the point where 2 sides of a shape meet, or the point where 3 or more edges of an object meet

vertical axis: the vertical number line on a coordinate grid

volume: the amount of space occupied by an object

whole numbers: the set of numbers 0, 1, 2, 3, …

x-axis: the horizontal number line on a coordinate grid

y-axis: the vertical number line on a coordinate grid

zero pair: two opposite numbers whose sum is equal to zero

zero property: the property of addition that states adding 0 to a number does not change the number; for example, 3 + 0 = 3; for multiplication, multiplying a number by 0 results in the product 0; for example, 3 × 0 = 0
acute triangle, 39, 40, 464
algebra,
  solving equations involving fractions with, 334, 335
  solving equations with, 327–330
algebra tiles,
  modelling the distributive property with, 340
  solving equations with, 320–323, 328, 329
area,
  of a circle, 209
  of a rectangle, 6, 105
  of a square, 7, 17–19, 22–24, 40, 41, 47, 48
  of a triangle, 18
area model,
  multiplying fractions with, 115, 116
  multiplying mixed numbers with, 122, 123
ascending order, 14
average speed, 296, 297
axis of rotation, 441–444
balance-scales model,
  solving equations with, 319, 320, 327
“bank” model,
  for dividing integers, 77, 80
  for multiplying integers, 65, 66
bar graph, 382, 384, 385
  constructing with spreadsheet software, 391
  formatting on spreadsheet software, 403
  misrepresented data on, 395, 396
base of a net, 171
base of a prism vs. base of a polygon, 184
brackets, 85, 90, 91, 154
calculators,
  investigating square roots with, 29
circle,
  area of, 209
  circumference of, 209
circle graph, 382, 384–386
  constructing with spreadsheet software, 392
  misrepresented data on, 396
clockwise rotation, 441–444, 457, 459, 474
coloured tiles,
  dividing integers with, 80
  multiplying integers with, 65, 66
  solving equations with, 318
common denominators, 123
  dividing fractions with, 136–138
  dividing mixed numbers with, 142
subtraction fractions with, 154
common factors, 124
  in multiplying fractions, 115–117
collective property, 71
circle graph, 382, 384–386
  constructing with spreadsheet software, 392
  misrepresented data on, 396
circumference, 209
clockwise rotation, 441–444, 457, 459, 474
coloured tiles,
  dividing integers with, 80
  multiplying integers with, 65, 66
  solving equations with, 318
common denominators, 123
  dividing fractions with, 136–138
  dividing mixed numbers with, 142
subtraction fractions with, 154
common factors, 124
  in multiplying fractions, 115–117
collective property, 71
circle graph, 382, 384–386
  constructing with spreadsheet software, 392
  misrepresented data on, 396
circumference, 209
clockwise rotation, 441–444, 457, 459, 474
coloured tiles,
  dividing integers with, 80
  multiplying integers with, 65, 66
  solving equations with, 318
common denominators, 123
  dividing fractions with, 136–138
  dividing mixed numbers with, 142
subtraction fractions with, 154
common factors, 124
  in multiplying fractions, 115–117
collective property, 71
circle graph, 382, 384–386
  constructing with spreadsheet software, 392
  misrepresented data on, 396
circumference, 209
clockwise rotation, 441–444, 457, 459, 474
coloured tiles,
  dividing integers with, 80
  multiplying integers with, 65, 66
  solving equations with, 318
common denominators, 123
  dividing fractions with, 136–138
  dividing mixed numbers with, 142
subtraction fractions with, 154
common factors, 124
  in multiplying fractions, 115–117
collective property, 71
circle graph, 382, 384–386
  constructing with spreadsheet software, 392
  misrepresented data on, 396
circumference, 209
clockwise rotation, 441–444, 457, 459, 474
coloured tiles,
  dividing integers with, 80
  multiplying integers with, 65, 66
  solving equations with, 318
common denominators, 123
  dividing fractions with, 136–138
  dividing mixed numbers with, 142
subtraction fractions with, 154
common factors, 124
  in multiplying fractions, 115–117
collective property, 71
Target Tessellations, 470
Triple Play, 278
What’s My Product?, 76
goods and services tax (GST), 256–259
graphs, 382–386
constructing with spreadsheet software, 366, 367
finding unit rates with, 296
for linear relations, 352, 359–362
formatting on spreadsheet software, 403, 404
harmonized sales tax (HST) (see sales tax)
hexagon, 463
hexagonal pyramid, 171
horizontal rotation, 441–444
hundredths chart for representing percents with, 235, 244
hypotenuse, 31–33, 46–48
hypothesis, 314
improper fractions, 122, 143, 144
independent events, probability of, 408–410
solving problems with, 417–419
integers, division models of, 77–80
division rules for, 84–86
multiplication models of, 64–67
multiplication rules for, 70–72
order of operations with, 90, 91
interactive isometric drawing tool, 454
inverse operations, 12, 129
isometric, 435
isometric drawing, 435, 436
isosceles right triangle, 31
legs, 31–33, 46–48
length of a line segment, 17–19
line graph, 383
constructing with spreadsheet software, 391
formatting on spreadsheet software, 404
misrepresented data on, 397, 398
line segment measurements, 17–19
linear relations, creating tables of values for, 352–355
graphing, 359–362
graphing with spreadsheet software, 366, 367
linking cubes, building objects from their views, 447–449
viewing objects with, 435, 436, 440
viewing rotated objects with, 442–444
viewing with an interactive isometric drawing tool, 454
obtuse triangle, 39, 40, 464
octagonal pyramid, 179
order of operations, 90, 91
for expressions as a fraction, 91
with fractions, 153, 154
ordered pair, 353, 355
outcomes, 407–410, 417–419
palindromic number, 16 Practice
part-to-part ratio, 265, 266, 281
part-to-whole ratio, 265, 266, 282, 283
Pattern Blocks, multiplying fractions with, 111
pentagonal prism, 171
percent decrease, 251, 252
percent increase, 251
percents, as ratios, 265, 266
calculating sales taxes in, 256–259
comparing ratios with, 282, 283
relating to decimals and fractions, 234–238, 242–245, 248–252, 282, 283
perfect square (see square numbers)
perimeter, of a square, 7, 24
phonograph cylinder, 214
Math Link
pictograph, 384, 385
comparing ratios with, 280
finding unit rates with, 295
misrepresented data on, 396
multiplying fractions by whole numbers with, 105, 106
pie charts, 392
plane, 462–467
plus/minus statistics, 67
Math Link
polygons, 171, 179
tessellations of, 463
Acknowledgments

Pearson Education would like to thank the Bank of Canada and the Royal Canadian Mint for the illustrative use of Canadian bills and coins in this textbook. In addition, the publisher wishes to thank the following sources for photographs, illustrations, and other materials used in this book. Care has been taken to determine and locate ownership of copyright material in this text. We will gladly receive information enabling us to rectify any errors or omissions in credits.

Photography

Cover: John Guistina/Imagestate/firstlight.ca
Acknowledgments


Illustrations

Steve Attoe, Pierre Berthiaume, Philippe Germain, Brian Hughes, Paul McCusker, Dusan Petrič, Michel Rabagliati, Neil Stewart/NSV Productions, Craig Terlson