Answers

Chapter 1 Pythagorean Relationship

Get Ready, pages 4–5

1. a) $80 = 2 \times 2 \times 2 \times 2 \times 5$
b) (1, 80), (2, 40), (4, 20), (5, 16), (8, 10)
2. (1, 18), (2, 9), (3, 6)
3. 6
4. 24
5. a) 1, 2, 3, 6, 9, 18, 27, 54; $54 = 2 \times 3 \times 3 \times 3$
b) Answers may vary. For example: Except for 1, each number in both sets is a multiple of 2 and/or 3. The list of factors of 54 include both prime and composite numbers, as well as 1.
6. a) 26 cm, 36 cm^2 **b)** 36 m, 81 m^2
7. Yes. For example: 1 cm by 8 cm.
8. a) 17, 18, 19, 20, 21, 22, 23, 24
b) 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49
9. 20.5 is halfway between 16 and 25; 42.5 is halfway between 36 and 49
10. When both numbers are even or both numbers are odd.
11. a) 13 **b)** 8
12. Answers may vary. For example: Ask yourself what number when multiplied by 4 equals 32. The answer is 8.

13. a)
$\frac{2x}{2} = \frac{18}{2}$ Divide both sides by 2.
$x = 9$

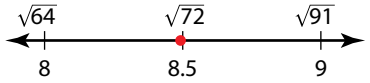
b)
$15 + 4x - 15 = 35 - 15$ Subtract 15 to start isolating x.
$4x = 20$
$\frac{4x}{4} = \frac{20}{4}$ Divide by 4 to isolate x.
$x = 5$

c)
$3x + 2 - 2 = 11 - 2$ Subtract 2 to start isolating x.
$3x = 9$
$\frac{3x}{3} = \frac{9}{3}$ Divide by 3 to isolate x.
$x = 3$

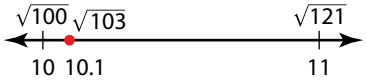
d)
$7 + 6x - 7 = 31 - 7$ Subtract 7 to start isolating x.
$6x = 24$
$\frac{6x}{6} = \frac{24}{6}$ Divide by 6 to isolate x.
$x = 4$

1.1 Squares and Square Roots, pages 6–13

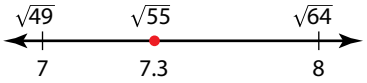
1. a) 400 cm^2 **b)** $400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$
c) Answers may vary. For example: Yes, both prime factors are represented an even number of times in the prime factorization.
d) Answers may vary. For example: 5 cm by 80 cm
2. Answers may vary. For example: You could count the number of times each prime different prime factor occurs. Since the factor 3 occurs three times, which is not even, 72 is not a perfect square.
3. a) $42 = 2 \times 3 \times 7$; not a perfect square
b) $169 = 13 \times 13$; a perfect square
c) $256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$; a perfect square
4. a) $144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$; both prime factors occur an even number of times in the prime factorization so 144 is a perfect square.
b) $60 = 2 \times 2 \times 3 \times 5$; not a perfect square because the prime factors 3 and 5 occur an odd number of times.
c) $40 = 2 \times 2 \times 2 \times 5$; not a perfect square because the prime factors 2 and 5 occur an odd number of times.
5. 8 mm
6. 30 cm
7. a) 7 **b)** 11 **c)** 18
8. a) 3 **b)** 5 **c)** 40
9. a)



b)



c)

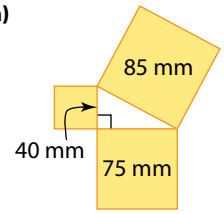


10. Answers may vary.
a) For example: 3.9 **b)** For example: 9.2 **c)** For example: 11.6
12. No, the squares of odd numbers will be odd. For example: $5^2 = 25$.
13. 20 m
14. 15
15. Answers may vary. For example: No, the approximate square root of 18 is 4.24. Therefore, the side length of the rug, 4.24 m is longer than the shorter dimension of the room, 4 m.
16. a) 56 m^2
b) Answers may vary. For example: 7 m by 8 m is one set of dimensions for the patio.
c) No, it is not possible to make a patio with the same area that is a square since 56 is not a perfect square.
17. 1360 m
18. a) Answers may vary. For example: 4.4 cm **b)** 4.5 cm
19. Answers may vary. For example: 5.2 m
20. 17, 18, 19, 20, 21, 22, 23, 24
21. a) $\frac{1}{4}$ **b)** $\frac{5}{6}$ **c)** $\frac{1}{4}$ **d)** $\frac{9}{49}$
22. a) 60
b) No, there is only one answer. The number must be between 49 and 64. The only multiple of 12 in this range is 60.
23. a) \$40 000 **b)** 5 people
24. $\sqrt{26}$, 5.8, $\sqrt{46}$, 7
25. 1806
26. a) perfect squares: 100 and 10 000
b) $\sqrt{100} = 10$ and $\sqrt{10000} = 100$
c) Answers may vary. For example: The number 1000 is not a perfect square. The prime factorization of 1000 is $2 \times 2 \times 2 \times 5 \times 5 \times 5$. There is an odd number of factors of 2 and 5.

d) Any power of 10 with an even number of trailing zeros will be a perfect square.
e) No, 1 000 000 000 is not a perfect square because it has an odd number of trailing zeros.
27. 106 500 and 106 800
28. 14

1.2 Exploring the Pythagorean Relationship, pages 14–21

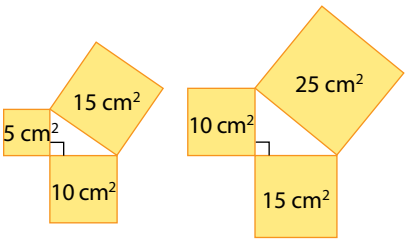
1. $e^2 = 900$ mm^2; $f^2 = 1600$ mm^2; $g^2 = 2500$ mm^2
2. a)



b) 1600 mm^2, 5625 mm^2, 7225 mm^2
c) $1600 + 5625 = 7225$
3. a) $25 + 144 = 169$
b) 5 cm, 12 cm, 13 cm
c) The sum of the areas of the two smaller squares is equal to the area of the largest square: $5^2 + 12^2 = 13^2$.
4. a) 81 cm^2, 144 cm^2, 225 cm^2
b) $81 + 144 = 225$
c) The sum of the areas of the two smaller squares is equal to the area of the largest square: $9^2 + 12^2 = 15^2$.
5. No. The sum of the areas of the smaller squares is not equal to the area of the largest square: $20 + 40 \neq 50$.
6. a) 4 cm^2, 9 cm^2, 16 cm^2
b) No. The sum of the areas of the smaller squares is not equal to the area of the largest square: $2^2 + 3^2 \neq 4^2$.
7. Answers may vary. For example: The triangle is not a right triangle because the sum of areas of the squares of the two shorter sides does not equal the area of the square of the hypotenuse. $5^2 = 25$, $6^2 = 36$, and $8^2 = 64$; $25 + 36 \neq 64$.
8. The sum of the areas of the smaller squares is equal to the area of the largest square: $64 + 225 = 289$.
9. a) 52 cm^2 **b)** 676 mm^2 **c)** 65 cm^2 **d)** 24 cm^2
10. No, the correct relationship is $p^2 = r^2 + q^2$. The sum of the squares of the two legs, r and q, will be equal to the square of the hypotenuse, p.
11. a) 9 square units **b)** 12 units
c) Answers may vary. For example: Although the yellow square was rearranged, the sum of the area of the green and yellow squares is equal to the area of the pink square.
12. No, the garden is not a right triangle. The sum of the areas of the smaller squares is not equal to the area of the largest square: $4800 + 4800 \neq 9800$.
14. No, the angle is not a right angle. The diagonal would have to be 10 m for the angle to be right angled. $62 + 8^2 = 100$; $\sqrt{100} = 10$ not 9.5
15. a) $3^2 + 4^2 = 5^2$, $6^2 + 8^2 = 10^2$, $0.6^2 + 0.8^2 = 1.0^2$
b) Each set is a multiple of each other. For example, if you multiply each number in the set 0.6, 0.8 and 1.0 by a factor of 10 you get the second set: 6, 8 and 10.
c) Answers may vary. For example: 0.8 mm, 1.5 mm and 1.7 mm; 16 mm, 30 mm, 34 mm
16. No, the walls are not at right angles to each other since $30^2 + 30^2 \neq 43^2$.
17. a) 1225 cm^2 **b)** 144 mm^2
18.

Triangle	Side Lengths	Check
A	9, 12, 15	$9^2 + 12^2 = 15^2$
B	7, 8, 11	$7^2 + 8^2 \neq 11^2$
C	7, 24, 25	$7^2 + 24^2 = 25^2$
D	16, 30, 34	$16^2 + 30^2 = 34^2$
E	10, 11, 14	$10^2 + 11^2 \neq 14^2$

19. a) 28 m^2 **b)** 16 m^2
20. 5 cm^2 and 25 cm^2



21. Answers may vary. For example: The sum of the areas of the two smaller semicircles is equal to the area of the semicircle attached to the hypotenuse of the triangle.

1.3 Applying the Pythagorean Relationship, pages 22–30

1. a) 20 cm **b)** 34 m
2. a) 9.2 cm **b)** 13.6 cm
3. a) 24 cm **b)** 10 cm
4. a) 7.5 mm **b)** 10.2 mm
5. $\sqrt{13} \approx 3.6$
6. 7.2 cm
7. 13
8. a) 420 m **b)** 323 m **c)** Maria walked further by 97 m.
9. a) 1700 m **b)** 600 m
10. 9.8 m
11. No, Kira is incorrect. The length of side y is 12 cm. The hypotenuse is side x so the correct relationship between the sides is $x^2 = w^2 + y^2$ which corresponds to $13^2 = 5^2 + y^2$.
12. 8.6 cm
13. 120 cm
14. $b = 4$ m; $c = 7.2$ m

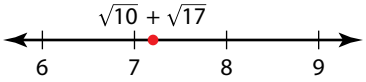
15. 12.6 cm
16. Answers may vary. For example: Shahriar is correct. The diagonal is 39.1 inches when calculated with the Pythagorean relationship, which is smaller than the advertised 42-inch diagonal.
17. maximum of 291.7 cm, minimum of 279.1 cm
18. 52 cm
20. 51 km
21. 1764 mm^2
22. a) 14.8 mm
b) Answers may vary. For example: First, find the hypotenuse of the right triangle of 12 mm and 7 mm. Then use that as a side length with 5 mm to find the length of the red diagonal with the Pythagorean relationship.
23. 16.1 mm

Rich Problems, pages 31

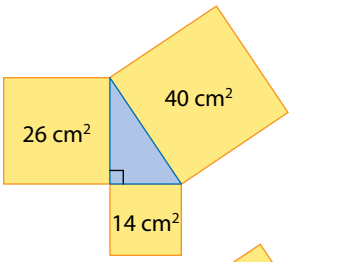
1. 16 cm^2
2. a) $A = \frac{p^2}{16}$ **b)** $A = \frac{d^2}{2}$
3. 90 cm^2
4. 3.46 m

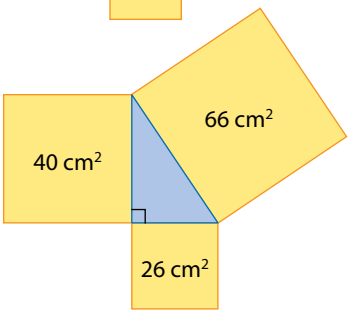
Chapter 1 Review, pages 32–33

1. C
2. A
3. 9 mm
4. $196 = 2 \times 2 \times 7 \times 7$; group the factors into two identical groups that each contain one factor of 2 and 7; this product, 14, is the square root of 196.
5. Since $\sqrt{10}$ is slightly bigger than 3 and $\sqrt{17}$ is slightly bigger than 4, the sum of these expressions will be a little larger than 7.



6. C
7. 14 cm^2 or 66 cm^2





8. A: $9^2 + 12^2 = 15^2$, C: $12^2 + 35^2 = 37^2$, D: $30\,000^2 + 40\,000^2 = 50\,000^2$
9. v
10. 8 m
11. a) AC = 5.4 cm^2, EF = 6.7 cm^2 **b)** 15.7 cm
12. 10.0 m
13. 400 mm^2
14. a) 15.7 m
b) It is 0.7 m shorter than the actual distance traveled.
c) Since the car has actually traveled further than the radar gun is measuring, the radar gun will underestimate the car's actual speed.

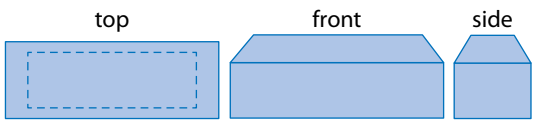
Chapter 2 Surface Area

Get Ready, pages 36–37

1. a) 1, 3, 5
b) The top is 4, the front is 6 and the side is a 2.
c) Answers will vary. For example: I can see three sides of the die so it looks 3-D.
2. a) 3
b) The faces are rectangles.
c) front: 320 cm^2, side: 128 cm^2, top: 160 cm^2
d) 1216 cm^2
3. I know $b = 12$, but I don't know the height. Use the Pythagorean relationship to determine h. Then, substitute the value for h into Area $= (b \times h) \div 2$.
4. a) Answers will vary. For example: triangles.
b) Answers will vary. For example: diamonds, hexagons, trapezoids.
c) Answers will vary. For example: Count the number of triangles and multiply the area of one triangle by the number of triangles.
5. Answers will vary.
6. a) 6 mm **b)** 10 cm
7. a) 9.42 cm **b)** 113.04 mm^2 **c)** 38.47 cm^2

2.1 Views of Three-Dimensional Objects, pages 38–43

1. top: D, front: A, side: B
2. a)



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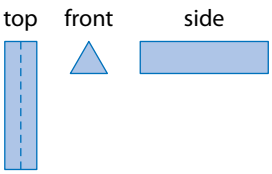

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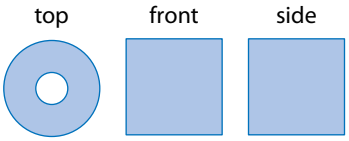
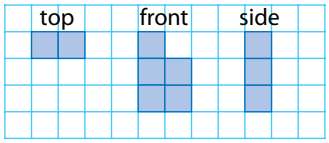


3. a)



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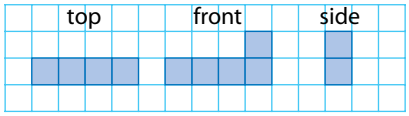
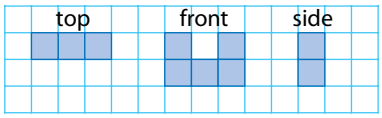
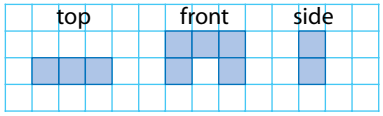


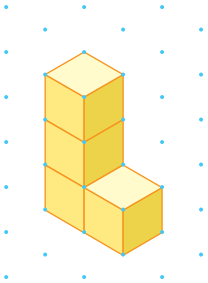
c)



d)



4. a)



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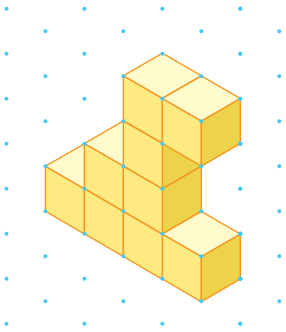

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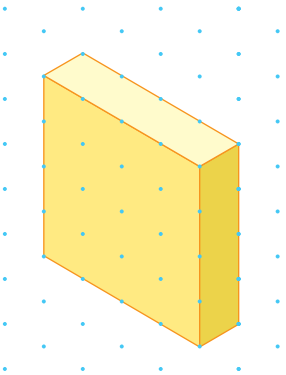
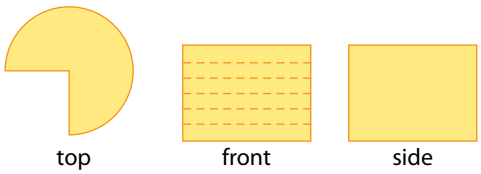


6. No. You need at least three views to sketch an object: the top, front, and side views. If the object is complicated, you may need more views. For example, if the front and back are different, you would need both of those views, plus the top and side.

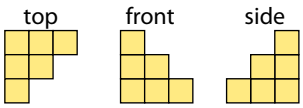
7. Answers will vary.

8. a)

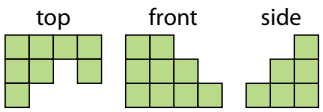
b)



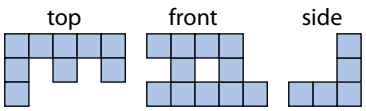
9. a)



b)

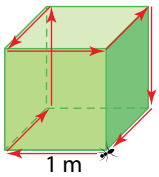


c)



10. Answers may vary. For example: a cube and a rectangular prism.

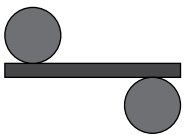
11. a) Answers may vary. For example:



b) 8 m

2.2 Nets of Three-Dimensional Objects, pages 44–49

1. a)



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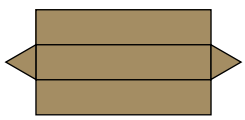

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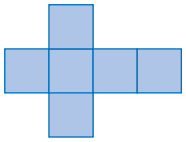
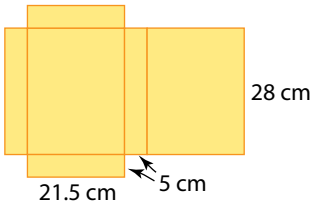


2. a)



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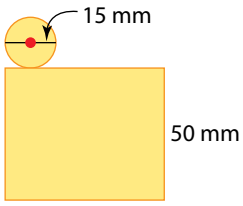
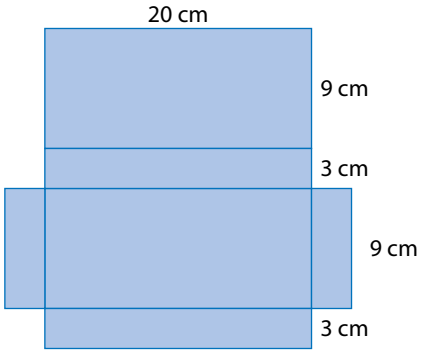


3. a)



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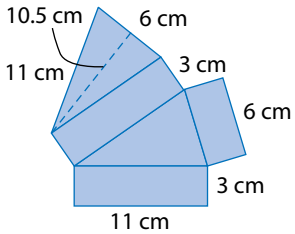

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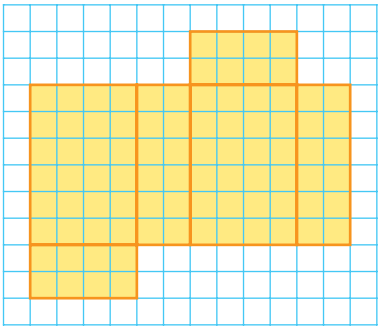
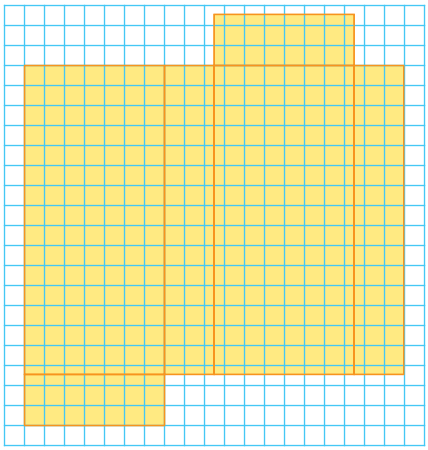


5. b) triangular prism

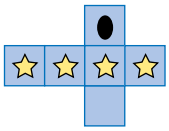
6. rectangular prism: E; triangular prism: D; cylinder: B

7. No, only Net A will form a cube. Net B is too many sides attached to one another. If you try to fold it into a cube, the sides can't all connect.

8.

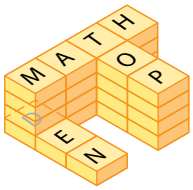


10.



11. b) triangular prisms

12. a)

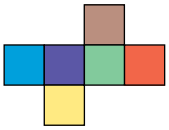


b)

M	A	T	H
E		O	
N		P	

13. a) yellow, green, brown

b)



2.3 Surface Area of a Prism, pages 50–57

1. 819.5 cm^2

2. 501.7 m^2

3. 7.7 cm^2

4. Answers may vary. For example: Measure the dimensions of the prism. Use the appropriate formula for each face. Add the areas of the faces.

5. 106.7 cm^2

7. 94 mm^2

8. a) 4 **b)** 6.36 m^2

c) $349.80; Answers will vary. For example: Paco does not need extra glass to account for waste. Paco can buy the exact amount of glass he wants.

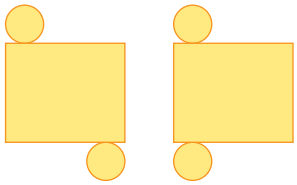
9. 1131 cm^2

10. 9.96 m^2

11. The triangular prism would require less wrapping paper because its surface area of 770 cm^2 is less than the surface area of 1000 cm^2 of the rectangular prism.
13. 266 pans
15. a) 1 : 4
b) The ratio of the old surface area to the new surface area is 1 : 9. Yes, there is a pattern. The surface area is increased by a factor equal to the square of the multiplier of the edge length.
16. a) one 4-L can and two 1-L cans of wall paint plus one 4-L can of ceiling paint
b) $73.88

2.4 Surface Area of a Cylinder, pages 58–63

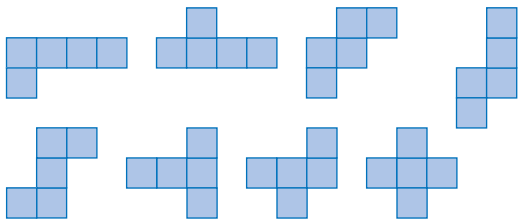
1.



2. a) 736.3 cm^2 **b)** 2009.6 cm^2
3. a) 135.4 cm^2 **b)** 0.2 m^2
4. a) 88.31 cm^2 **b)** 149.15 cm^2
5. Answers may vary. For example: Use a formula. It is quicker, and you are less likely to miss part of the calculation.
7. 5604.9 cm^2
8. The 85-cm long container required more plastic. Its surface area of 3125.87 cm^2 is greater than the surface area of 2758.49 cm^2 of the other container.
9. 345.4 cm^2
10. 538.51 cm^2
11. 3228.31 mm^2
12. a) length: 251.2 cm; width: 21 cm
b) 5275.2 cm^2
c) $131.52

Rich Problems, page 64

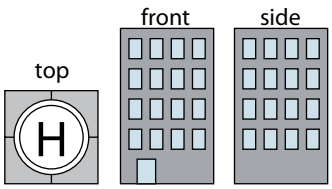
1. 1202 mm^2
2.



3. a) Answers will vary. For example: Each new figure has one more row on the bottom. The new row is always two cubes more than the previous row. The surface area increase by 4 $units^2$ each time.
b) Figure 6
4. 340 cm^2
5. 2 hours and 13 minutes.

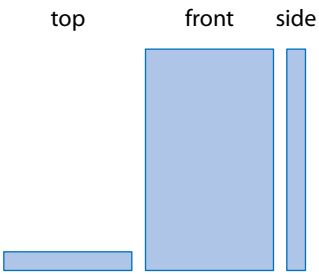
Chapter 2 Review, pages 65–67

1. a)

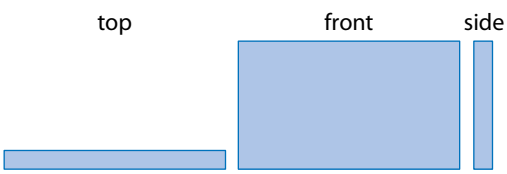


b)

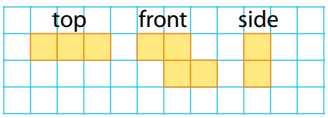
2. a) A:



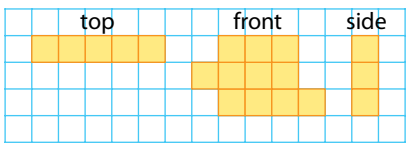
B:



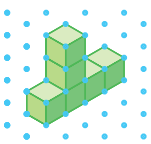
b) Answers may vary. The objects are the same. The only difference from A to B is it is turned onto its side.
3. a)



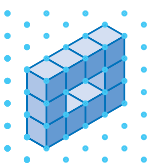
b)



4. a)

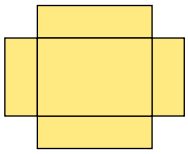


b)

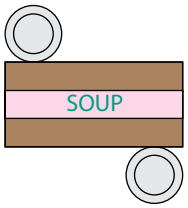


5. a) cylinder **b)** triangular prism **c)** rectangular prism

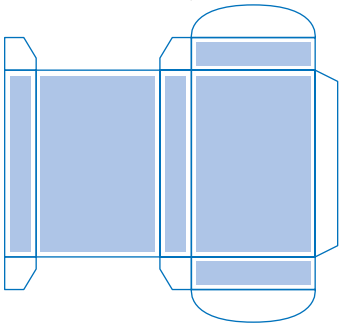
6. a)



b)



7. Answers will vary. For example:



8. a) 864 cm^2 **b)** 10.5 m^2
9. 3648 mm^2
10. a) 144 cm^2 **b)** 3865 cm^2
11. Answers may vary. For example: Liza needs 5309 cm^2 more paper, not including overlap. Estimate another 2 cm per side for overlap. So, Liza needs 6241 cm^2 of wrapping paper.
12. a) 20 in. **b)** 314 in.^{2} **c)** 285.74 in.^{2}
d) Answers may vary. For example: calculating the area of a circular piece of hide large enough to cover the sides includes more hide than is necessary to cover the side of the drum.
13. 19 939 cm^2
14. \$1907.48
15. 558.02 mm^2
16. a) 6 cm^2
b) Answers may vary. For example: Cutting the diamond increases the surface area because there are so many facets cut into it.
17. a) 800.7 cm^2
b) 109.9 cm^2
c) Answers may vary. For example: Adding a layer results in another 109.9 cm^2 of cake that needs to be iced.
d) Answers may vary. For example: You know each layer results in approximately 110 cm^2 of surface area along the side. If you estimate the top area as about 150 cm^2, you can add 110 cm^2 for each layer of cake.

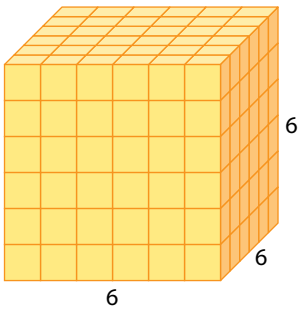
Chapter 3 Volume

Get Ready, pages 70–71

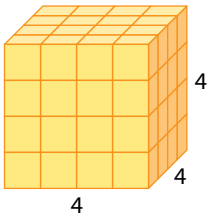
1. a) 416 cm^2 **b)** 20 m^2
2. a) 122 cm^2 **b)** approximately 164.9 cm^2 **c)** 159.5 cm^2
3. a) 60 cm^3 **b)** 189 cm^3 **c)** 135 cm^3 **d)** 216 cm^3
4. The volume does not depend on which face is used as the base. Answers will vary. For example: A rectangular prism has sides 5 cm, 6 cm, and 7 cm. If the area of the base is 30 cm^2 (5 cm × 6 cm), the volume is 210 cm^3 (30 cm^2 × 7 cm). If the area of the base is 35 cm^2 (5 cm × 7 cm), the volume is 210 cm^3 (35 cm^2 × 6 cm). If the area of the base is 42 cm^2 (7 cm × 6 cm), the volume is 210 cm^3 (42 cm^2 × 5 cm).
5. a) 27 cm^3 **b)** 28 cm^3
c) approximately 502.4 cm^3
d) approximately 4710 cm^3
6. a) approximately 12.8 cm
b) approximately 6.4 cm
7. a) approximately 20.9 cm
b) approximately 7.9 cm

3.1 Cubes and Cube Roots, pages 72–77

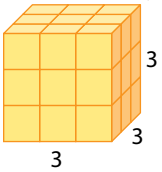
1.



$6^3 = 216$
2. a) side length = 8 units; volume = 512 cubic units
b) side length = 10 units; volume = 1000 cubic units
3. Answers may vary. For example: draw or build a cube with side lengths of 7. Count all the cubes.
4.



$\sqrt[3]{64} = 4$
5. Answers may vary.



The model shows a cube with side lengths of 3 units. It is built from 27 unit cubes, so, $\sqrt[3]{27} = 3$.

6. a) 9
b) Answers may vary. For example: build a cube using 729 cubes. The side lengths are 9 so the cube root of 729 is 9.
7. 343
8. a) 13
b) Answers may vary. For example: Prime factorization may be preferred because it doesn't require building a model with so many unit cubes.
9. 125 000 cm^3; $50 \times 50 \times 50 = 125\,000$
10. 1 mm; $1 \times 1 \times 1 = 1$
12. Answers may vary. For example: A squared number is when a number is multiplied by itself once. A cubed number is when a number is multiplied by itself twice.
13. 9 cm^2
14. Use prime factorization to see that 1728 is a perfect cube.
15. Answers may vary. For example: Yes. An odd number multiplied by an odd number gives an odd result.
16. 512 oranges
17. 3375 cm^3
18. $\frac{27}{64}$
19. 7 cm; Answers will vary. For example: The cardboard can be cut to create a cube with no wasted cardboard.
20. Answers will vary. **a)** 2.1 **b)** 4.5 **c)** 10 **d)** 20
21. Answers will vary. **a)** 2.1 **b)** 2.3 **c)** 2.8 **d)** 4.5
22. 12
23. Yes. There are 2 arrangements possible. $35^3 = 42\,875$ and $38^3 = 54\,872$

3.2 Volume of Prisms, pages 78–87

1. a) 294 cm^3 **b)** 133.65 m^3 **c)** 13 440 000 mm^3
2. a) 144 m^3 **b)** 84 m^3 **c)** 1200 cm^3 **d)** 514.15 mm^3
3. 4800 cm^3
4. a) Yes, he needs all 6 prisms.
b) approximately 8.3 m^3
5. a) approximately 7385.28 cm^3
b) approximately 0.785 m^3
6. a) approximately 628 cm^3
b) approximately 1589.625 cm^3
c) approximately 602.88 cm^3
7. 46.9cm
8. 1309.38 cm^3
9. Answers will vary. For example: Find the volume of the outside cylinder as if it were solid. Then, subtract the volume of the inner empty cylinder.
10. approximately 2.8 m^3
11.

Base (cm)	Height of Triangle (cm)	Height of Prism (cm^2)	Volume (cm^3)
7	2	10	70
18	12	10	1080
20	14	5	700

13. 27 prisms
14. a) approximately 372 875 cm^3
b) approximately 1 864 375 cm^3
c) approximately half a garbage can.
15. 13 pails
16. a) the cylinder
b) Answers will vary. For example: If the manager charges 1 cent per cm^3, then the cube should cost approximately $3.50 and the cylinder should cost approximately $4.50.
17. 26 cones
18. a) approximately 763.02 $in.^3$ **b)** 1728 $in.^3$ **c)** 624 drums
19. approximately 25 m^3
20. No. She will need 1.45 m^3 more.
21. 1300 cm^3
22. There is no difference in volume.
23. a) 0.8 m **b)** 810 m^3 remaining; 0.675 m **c)** 12 h
24. approximately 6280 m^3
25. a) approximately 149 250 m^3 **b)** approximately 4 h 9 min
26. 540 672 cm^3

3.3 The Relationship Between Surface Area and Volume, pages 88–93

1. a) 3 : 5 **b)** approximately 1.8 : 1
2. a) approximately 1 : 2 **b)** approximately 1 : 2
3. a) 2.25 **b)** approximately 0.5644
4. Answers may vary. For example: The surface areas are 15 000 cm^2, 21 600 cm^2, and 29 400 cm^2. The volumes are 125 000 cm^3, 216 000 cm^3, and 343 000 cm^3. The volume increases more quickly than the surface area.
5.

Height (cm)	Surface Area (cm^2)	Volume (cm^3)	Surface Area to Volume Ratio
0.5	9.42	1.57	6
2.5	21.98	7.85	2.8

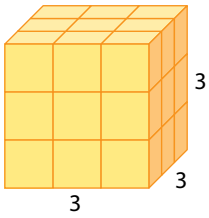
Answers may vary. For example: Smaller pieces of carrot will cook more quickly. The surface area to volume ratio is larger for a smaller piece of carrot, so there is proportionally more surface area in contact with the hot water compared to the volume of carrot to cook.
6. Answers may vary. For example: The small diameter greatly increases the area available for the transfer of waste and nutrients compared to the amount of blood inside the capillary.
8. a) Answers may vary. For example: A squirrel would lose heat much faster because it has a higher surface area to volume ratio. This means there is proportionally more surface area to lose heat from, compared to the volume of the animal.
b) Answers may vary. For example: Small mammals have to pump blood more quickly to keep themselves warm.
9. Answers will vary. The animal should be large and could have fur or some other way of keeping warm.
10. Answers will vary. For example: Since the slice opens up an area that looks larger than the top and bottom, the surface would be doubled while the volume remains the same.
11. Three rows of 4 has less surface area and so it uses less packaging. A company may want to use less packaging material because it costs less and reduces waste.
12. a) $3 \times 3 \times 4$ prism = 66 $units^2$
b) $1 \times 1 \times 36$ prism = 146 $units^2$
13. The sphere has a smaller surface area.

Rich Problems, page 94

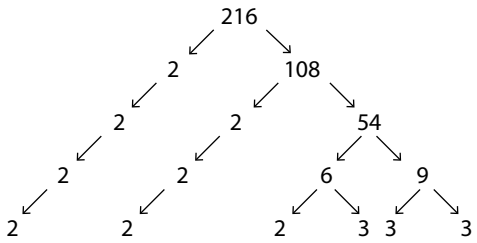
1. approximately 2.9 cm
2. 6
3. Answers will vary.
4. Answers will vary.
5. Answers may vary. For example: cylinder where $r = 2$, $h = 9$, V = approximately 113.04, $S.A.$ = approximately 138.16; cylinder where $r = 3$, $h = 4$, V = approximately 113.04, $S.A.$ = approximately 131.88
6. Cylinder: Has a round face. Rectangular prism: Orientation is taller than it is wide. Cube: Has all equal sides. Triangular prism: Volume does not equal approximately 27 cm^3.

Chapter Review, pages 95–97

1. 512
2. 64 cubes; The volume of a cube is the side length cubed.
3. a)



b)

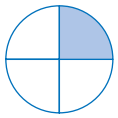


$2 \times 3 = 6$
c) Answers may vary. For example: $13^3 = 2197$, $15^3 = 3375$, so $\sqrt[3]{3375} = 15$
4. a) 100 cm^3 **b)** 14 400 mm^3
5. a) approximately 125 600 cm^3
b) approximately 327 910.2 m^3
6. 301.3 mm^3
7. a) 55 080 m^3 **b)** 1312 loads **c)** 11 days
8. 2009.6 cm^3
9. 8.78 m
10. Answers will vary. For example: Estimate of volume when the top of the cylinder is 28 cm (the circumference of the opening): 1300 cm^3. Estimate of volume when the top of the cylinder is 22 cm (the circumference of the opening): 1000 cm^3. The way that produces the largest volume is when the 28 cm side forms the top of the cylinder (the circumference of the opening).
11. a) 0.9375 m^3 **b)** 1 min 34 s
12. a) 0.049 m^3
b) outside: 0.003 54 m^3; inside: 0.001 68 m^3
13. approximately 1.14 m^3
14. a) approximately 1.5303
b) approximately 0.0952
c) approximately 1.19
15. Answers will vary. For example: When cells are small, the surface are to volume ratio is relatively large. As cells get bigger, this ratio gets smaller, so it is more difficult for the cell to absorb enough food quickly enough to maintain the cell.
16. Answers will vary. For example: Huge leaves on tropical plants increase their surface area so that the plants can absorb as many nutrients as possible. Cacti have no leaves, so their surface area to volume ratio is much smaller. They are better able to retain their water in dry climates, instead of losing the water to evaporation.
17. Answers will vary.
18. Answers will vary.
19. a) Answers will vary. For example: Box A has dimensions 2 cm × 4 cm × 6 cm, box B has dimensions 1 cm × 4 cm × 12 cm, and box C has dimensions 1 cm × 6 cm × 8 cm.
b) $S.A._{\text{box A}} = 88$ cm^2, $S.A._{\text{box B}} = 128$ cm^2, $S.A._{\text{box C}} = 124$ cm^2
c) Box A: \$4.40, box B: \$6.40, box C: \$6.20

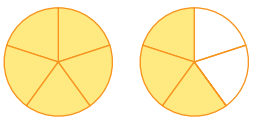
Chapter 4 Adding and Subtracting Fractions

Get Ready, pages 100–101

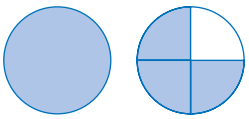
1. a) 2, 4, 6, 8, 10 **b)** 4, 8, 12, 16, 20 **c)** 5, 10, 15, 20, 25
2. 40
3. a) $1\frac{1}{2}, \frac{3}{2}$ **b)** $1\frac{3}{4}, \frac{7}{4}$ **c)** $2\frac{4}{6}, \frac{16}{6}$
4. a) Three quarters; Answers may vary. For example: part of a dollar
b) One eighth; Answers may vary. For example: part of a pizza
c) Seven tenths; Answers may vary. For example: money
5. a)



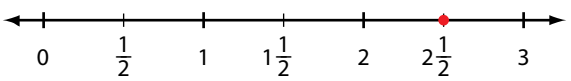
b)



c)



d)



6. a) $\frac{1}{4}$ **b)** $\frac{1}{2}$ **c)** $\frac{1}{6}$ **d)** $\frac{1}{8}$ **e)** $\frac{1}{3}$ **f)** $\frac{1}{5}$
7. $\frac{1}{8}, \frac{1}{6}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}$

8. a) The value gets smaller.
b) Yes, if the numerator was the same in all of the fractions.
9. Fraction strips can be used to compare the fractions.
a) equivalent **b)** not equivalent
c) not equivalent **d)** equivalent
10. a) equivalent **b)** not equivalent
c) not equivalent **d)** equivalent
Examples will vary but could include: number of people in a class, pieces of a set, or slices of a pizza. Reduce each fraction to its lowest terms to determine if the fractions are equivalent.
11. If there is no common factor for the numerator or denominator the fraction is in lowest terms.
12.

Representation Type	Advantages	Disadvantages
Circle	• Easy to draw • Can be cut into multiples of half easily	• Hard to cut into equal size pieces
Rectangle	• Easier to cut into equal size pieces • Can be cut into rows and columns • Can be folded • Quick to draw	
Set of Objects	• Represent real world situations	• Takes longer to draw

4.1 Common Denominators, pages 102–107

1. a) 15, $\frac{5}{15}$, $\frac{9}{15}$ **b)** 24, $\frac{20}{24}$, $\frac{6}{24}$

2. a) 12, $\frac{3}{12}$, $\frac{8}{12}$ **b)** 8, $\frac{4}{8}$, $\frac{6}{8}$

3. a) Denominator 6; divide each side into 3 and 2 pieces respectively for 6 in the whole.
b) Denominator 15; divide each side into 5 and 3 pieces respectively for 15 in the whole.
c) Denominator 30; divide each side into 5 and 6 pieces respectively for 30 in the whole.

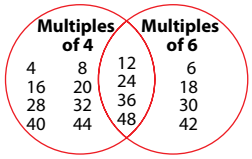
4. a) 10, $\frac{5}{10}$, $\frac{4}{10}$ **b)** 12, $\frac{4}{12}$, $\frac{3}{12}$ **c)** 24, $\frac{15}{24}$, $\frac{4}{24}$, $\frac{10}{24}$

5. a) 8, $\frac{3}{8}$, $\frac{2}{8}$ **b)** 12, $\frac{2}{12}$, $\frac{3}{12}$ **c)** 30, $\frac{6}{30}$, $\frac{20}{30}$, $\frac{21}{30}$

7. Ian is correct. Meko likely added the denominators.
8. Multiples of 2 = 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, …
Multiples of 5 = 5, 10, 15, 20, 25, …
Multiples of 4 = 4, 8, 12, 16, 20, 24, …
Common denominator = 20

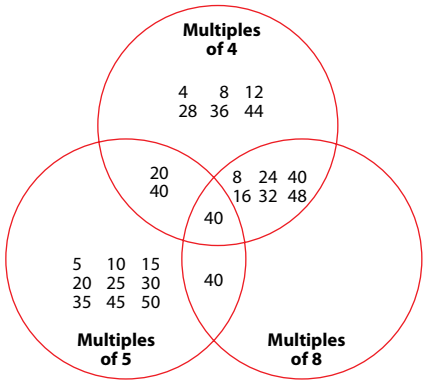
9. a) $\frac{12}{16} > \frac{11}{16}$ **b)** $\frac{35}{49} > \frac{34}{49}$ **c)** $\frac{11}{30} > \frac{9}{30}$ **d)** $\frac{12}{27} = \frac{12}{27}$

10.

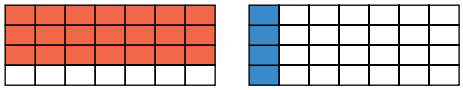


Least common multiple = 12

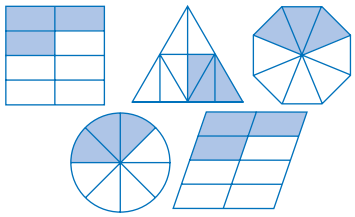
11. a)



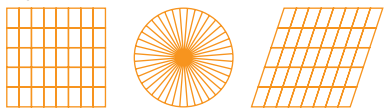
b) The numbers in the common spaces are multiples of each other.
12. Common multiples can be used to determine the number of each type of cell. There should be one white blood cell, 34 platelets $\left(\frac{17}{350} = \frac{34}{700}\right)$, and 660 red blood cells $\left(\frac{165}{175} = \frac{660}{700}\right)$.
13. Answers will vary. All of the examples are factors of 60 so all could work. Tenths could also work.
14. a) 1 **b)** 3 or 4 **c)** 5, 6, or 7
15. Answers will vary. Use equivalent fractions with denominator of 12. $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$
16. a) The rectangle shows the multiples of 2 and 3. Six, the number of spaces, is the common denominator.
b)



The common denominator is 28.
17. $\frac{5}{12} = \frac{15}{36} > \frac{14}{36} = \frac{7}{18}$; the grass takes up more space.
18. a)



b) Answers will vary. For example: The rectangle, circle, and octagon are easier to divide into 8 pieces.
c)



Answers will vary. For example: A rectangle may be easier to fold because it can be folded into rows and columns.
19. a) C; Answers will vary. For example: Use a common denominator of 200 and find equivalent fractions.
b) Answers will vary. For example: Any fraction between $\frac{101}{400}$ and $\frac{139}{400}$
20. a) Kindergarten **b)** Grade 5
c) Grade 4 and Grade 6 **d)** 360 students
21. a) *ab* **b)** *abc*

4.2 Add and Subtract Fractions with Unlike Denominators, pages 108–115

1. a) $\frac{1}{4}+\frac{1}{2}=\frac{3}{4}$ **b)** $\frac{2}{5}+\frac{3}{10}=\frac{7}{10}$

2. a) $\frac{3}{8}+\frac{1}{4}=\frac{5}{8}$ **b)** $\frac{1}{7}+\frac{1}{2}=\frac{9}{14}$

3. a) $\frac{1}{2}$ **b)** $\frac{7}{8}$ **c)** $\frac{3}{4}$ **d)** $\frac{17}{20}$ **e)** $\frac{7}{10}$ **f)** $\frac{13}{24}$

4. a) $\frac{7}{8}$ **b)** $\frac{11}{12}$ **c)** $\frac{11}{12}$ **d)** $\frac{5}{9}$

5. a) $\frac{1}{2}+\frac{1}{3}=\frac{5}{6}$ **b)** $\frac{1}{6}+\frac{1}{3}=\frac{1}{2}$

6. a) $\frac{3}{4}-\frac{3}{8}=\frac{3}{8}$ **b)** $\frac{7}{10}-\frac{1}{5}=\frac{1}{2}$

7. a) $\frac{5}{6}-\frac{2}{3}=\frac{1}{6}$ **b)** $\frac{9}{12}-\frac{3}{4}=0$

8. a) $\frac{3}{10}$ **b)** $\frac{1}{3}$ **c)** $\frac{2}{5}$ **d)** $\frac{3}{8}$ **e)** $\frac{4}{15}$ **f)** $\frac{5}{24}$

9. a) $\frac{1}{6}$ **b)** $\frac{3}{4}$ **c)** $\frac{3}{20}$ **d)** $\frac{1}{18}$

10. a) $\frac{1}{2}-\frac{1}{6}=\frac{1}{3}$ **b)** $\frac{2}{3}-\frac{1}{6}=\frac{1}{2}$

12. You cannot subtract the numerators because the denominators are not the same.

13. a) $\frac{3}{8}$ **b)** $\frac{5}{8}$ **c)** $\frac{1}{8}$ **d)** 0

14. $\frac{1}{8}$ of a length

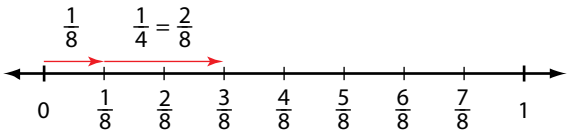
15. a) The numerators and denominators were added. **b)** $\frac{7}{12}$

16. $\frac{1}{2}$ roll

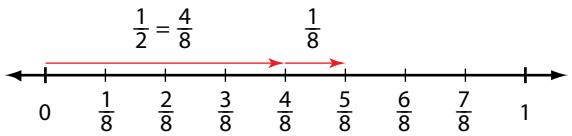
17. The outer and inner cores combined are $\frac{19}{200}$ larger than the crust and mantle combined.

18. Answers will vary. For example: $\frac{3}{4}=\frac{45}{60}$ and $\frac{1}{12}=\frac{5}{60}$, so Gosha is correct.

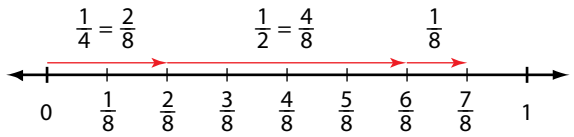
19. a)



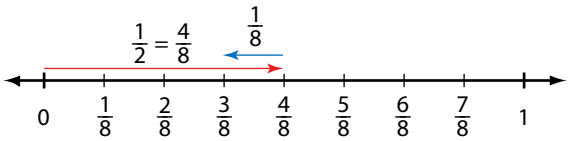
b)



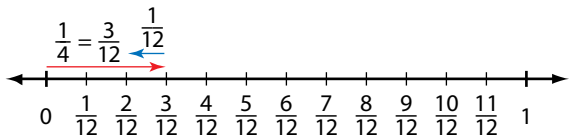
c)



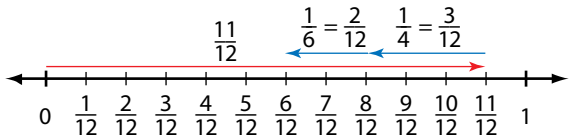
20. a)



b)



c)



21. No. The sum is $\frac{63}{64}$.

22.

$\frac{1}{6}$	$\frac{5}{12}$	$\frac{5}{12}$
$\frac{7}{12}$	$\frac{1}{3}$	$\frac{1}{12}$
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$

23. a) A $=\frac{1}{4}$, B $=\frac{1}{4}$, C $=\frac{1}{8}$, D $=\frac{1}{16}$, E $=\frac{1}{8}$, F $=\frac{1}{16}$, G $=\frac{1}{8}$

b) $\frac{1}{2}$ **c)** $\frac{15}{16}$ **d)** D and F **e)** Answers will vary.

24. Yes. $\frac{a}{b}+\frac{c}{d}=\frac{ad}{bd}+\frac{bc}{bd}=\frac{ad+bc}{bd}$

4.3 Add and Subtract Mixed Numbers, pages 116–123

1. a) $1\frac{2}{6}+1\frac{3}{6}=2\frac{5}{6}$ **b)** $2\frac{5}{8}+2\frac{4}{8}=5\frac{1}{8}$ **c)** $\frac{3}{4}+1\frac{1}{6}=1\frac{11}{12}$

d) $3\frac{5}{12}+2\frac{3}{4}=6\frac{1}{6}$

2. a) $8\frac{3}{4}$ **b)** $4\frac{1}{5}$ **c)** $3\frac{4}{35}$ **d)** $6\frac{9}{10}$ **e)** $5\frac{7}{12}$ **f)** $4\frac{11}{15}$

3. a) $6\frac{1}{6}$ **b)** $3\frac{5}{12}$ **c)** $6\frac{3}{7}$ **d)** $11\frac{4}{5}$

4. a) $3\frac{2}{3}-2\frac{1}{3}=1\frac{1}{3}$ **b)** $3\frac{1}{8}-2\frac{2}{8}=\frac{7}{8}$ **c)** $4\frac{6}{8}-2\frac{2}{4}=2\frac{1}{4}$

d) $4\frac{7}{12}-2\frac{3}{4}=1\frac{5}{6}$

5. a) $1\frac{1}{3}$ **b)** 2 **c)** $3\frac{4}{7}$ **d)** $3\frac{3}{10}$ **e)** $2\frac{8}{9}$ **f)** $1\frac{2}{15}$

6. a) $1\frac{1}{5}$ **b)** $2\frac{5}{12}$ **c)** $1\frac{1}{2}$ **d)** $2\frac{13}{35}$

7. 4 rooms

8. $3\frac{11}{12}$ h or 3 h 55 min

9. $1\frac{17}{20}$ or 1 h 51 min

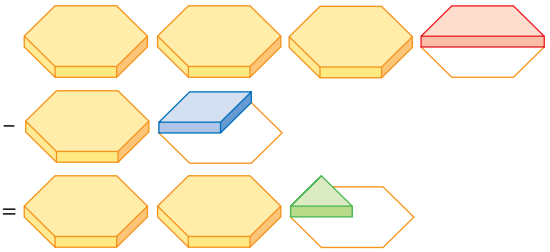
10. $1\frac{5}{12}<1\frac{6}{12}$, Mei ran $\frac{1}{12}$ of a lap further.

12. $\frac{2}{3}$ h

13. Yes. Jack will have $\frac{1}{2}$ of a bottle left for his hike. $2\frac{3}{4}-2\frac{1}{4}=\frac{1}{2}$ or $2\frac{1}{4}+\frac{1}{2}=2\frac{3}{4}$.

14. They have consumed exactly half of the sports drink. There are $4\frac{7}{8}$ bottles left. If they drink the same amount during the second half, there is enough.

15. a) $2\frac{1}{6}$ sheets



b) Julia should by 3 sheets of plywood to allow for wasted material.

16. No. He needs $\frac{1}{12}$ more. $1\frac{1}{4} + 2\frac{2}{3} = 3\frac{11}{12}$

17. He uses $4\frac{5}{6}$ dozen eggs. There are 2 eggs left.

18. a) She has practiced for 9 h, not counting the partial hours. The partial hours total more than 1 h, so she has surpassed her goal.

b) 2 h

19. $\frac{1}{2}$ h

20. Answers will vary. Fractions should total 1.

21. a) i) $8\frac{1}{6}$ **ii)** $9\frac{1}{3}$ **iii)** $7\frac{4}{5}$ **iv)** $12\frac{1}{5}$

b) $1\frac{3}{60}$ p.m. **c)** $7\frac{6}{60}$ p.m. **d)** $9\frac{35}{60}$ a.m.

e) $2\frac{35}{60}$ h, $3\frac{35}{60}$ h **f)** 11:20 a.m.

22. a) $16\frac{11}{12}$ **b)** \$203

23. a) $\frac{5}{6}$ **b)** 10 balls **c)** 68.75%

Rich Problems, page 124

1. Answers will vary.

2. Answers will vary. For example: In the format shown, when the first two denominators are consecutive numbers, and the third denominator is their product, the equations are correct.

a) Multiple solutions include

$\frac{1}{8} = \frac{1}{9} + \frac{1}{72}, \frac{1}{24} = \frac{1}{25} + \frac{1}{600}, \frac{1}{35} = \frac{1}{36} + \frac{1}{1260}$

b) $\frac{1}{10} + \frac{1}{15}$

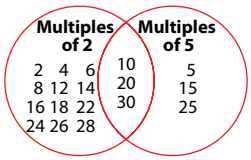
c) Yes. The formula is $\frac{1}{n} = \frac{1}{(n+1)} + \frac{1}{(n \times (n+1))}$.

3. a) $\frac{2}{5} = \frac{1}{3} + \frac{1}{15}; \frac{2}{7} = \frac{1}{4} + \frac{1}{28}; \frac{2}{9} = \frac{1}{5} + \frac{1}{45}$

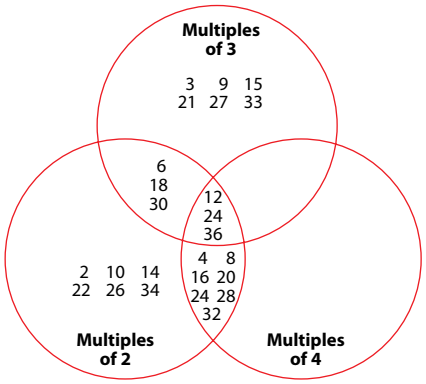
b) Yes.

Chapter 4 Review, pages 125–127

1. a)



b)



2. a) $\frac{12}{20}$ and $\frac{5}{20}$ **b)** $\frac{48}{28}$ and $\frac{7}{28}$ **c)** $\frac{25}{30}$, $\frac{12}{30}$, and $\frac{9}{30}$

3. Arrange the wrenches and fractions from smallest to largest $\frac{1}{4}, \frac{3}{8}, \frac{1}{2}, \frac{9}{16}, \frac{5}{8}, \frac{21}{32}, \frac{11}{16}, \frac{3}{4}$ and then match them.

4. a) $\frac{2}{3} + \frac{1}{4} = \frac{11}{12}$ **b)** $\frac{7}{9} - \frac{4}{6} = \frac{1}{9}$ **c)** $\frac{1}{2} + \frac{1}{6} = \frac{2}{3}$

d) $\frac{8}{8} - \frac{1}{2} = \frac{1}{2}$

5. a) $\frac{5}{6}$ **b)** $\frac{3}{20}$ **c)** $\frac{1}{3}$ **d)** $\frac{41}{42}$ **e)** $\frac{3}{4}$ **f)** $\frac{17}{24}$

6. Yesterday, she biked for $\frac{1}{6}$ h more.

7. a) $\frac{5}{12}$ of the bag **b)** $\frac{1}{4}$ of the bag is left.

8. a) $2\frac{3}{10} + 2\frac{6}{10} = 4\frac{9}{10}$ **b)** $2\frac{3}{5} - 1\frac{3}{5} = 1$ **c)** $3\frac{3}{4} + 2\frac{1}{2} = 6\frac{1}{4}$

d) $2\frac{1}{4} - \frac{2}{3} = 1\frac{7}{12}$

9. a) $3\frac{7}{8}$ **b)** $4\frac{11}{12}$ **c)** $6\frac{1}{14}$ **d)** $\frac{34}{45}$ **e)** $9\frac{3}{20}$ **f)** $\frac{3}{4}$

10. a) $1\frac{7}{12}$ h **b)** $3\frac{11}{12}$ h

11. a) $\frac{7}{12}$ cup **b)** $3\frac{1}{2}$ cups

12. a) Answers will vary. For example: This bowl may not be big enough because the ingredients total $5\frac{7}{24}$ cups, and she may need more room in the bowl to mix properly.

b) $\frac{17}{24}$ cup

13.

$1\frac{7}{9}$	$1\frac{1}{3}$	$3\frac{5}{9}$
4	$2\frac{2}{9}$	$\frac{4}{9}$
$\frac{8}{9}$	$3\frac{1}{9}$	$2\frac{2}{3}$

14. a)

Area of Focus	Fraction of the Two Rooms Used
Aboriginal Peoples	$\frac{1}{4}$
Settlement in British Columbia	$\frac{9}{16}$
Town History	$\frac{3}{16}$

b) Answers will vary. For example: The school does not appear to want to encourage local residents to come to the exhibit. More space could be allocated to the town's history and to Canadian Aboriginal Peoples to help encourage more people to come. More than half of the allocated amount is currently going to settlement in British Columbia.

Chapter 5 Multiplying and Dividing Fractions

Get Ready, pages 130–131

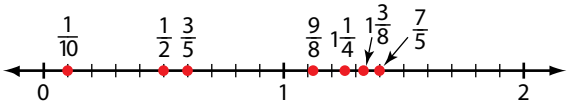
1. a) $4 + 4$
b) $3 + 3 + 3 + 3 + 3$
c) $4 + 4 + 4 + 4$
d) $12 + 12 + 12$

2. a) 1unit × 12 units or 2 units × 6 units or 3 units × 4 units
b) 1 unit × 9 units or 3 units × 3 units
c) 1 unit × 20 units or 2 units × 10 unit or 4 units × 5 units

3. a) $3\frac{2}{3}$ **b)** $2\frac{5}{6}$ **c)** $12\frac{1}{2}$ **d)** $1\frac{3}{5}$

4. a) $\frac{14}{3}$ **b)** $\frac{23}{8}$ **c)** $\frac{19}{3}$ **d)** $\frac{25}{7}$

5.



6. a) $\frac{2}{9}$ **b)** $\frac{1}{5}$ **c)** $\frac{1}{2}$ **d)** $\frac{4}{5}$

7. a) $\frac{11}{12}$ **b)** $\frac{5}{7}$ **c)** $\frac{11}{12}$ **d)** $\frac{1}{2}$

8. a) $\frac{1}{6}$ **b)** $\frac{5}{9}$ **c)** $\frac{7}{12}$ **d)** $\frac{7}{10}$

9. a) $1\frac{1}{2}$ **b)** $1\frac{1}{6}$ **c)** $\frac{5}{6}$ **d)** $9\frac{19}{20}$ **e)** $4\frac{1}{6}$ **f)** $\frac{7}{12}$

10. a) $\frac{3}{4}$; Answers will vary. For example: $\frac{1}{4} + \frac{1}{2} = \frac{3}{4}$ and $\frac{1}{3} < \frac{1}{2}$

b) $\frac{3}{4} + 1\frac{1}{2}$; Answers will vary. For example: $1\frac{1}{2} + \frac{3}{4} = 2\frac{1}{4}$ and $2\frac{1}{2} - \frac{3}{4} < 2$

c) $1 + \frac{1}{2}$; Answers will vary. For example: $\frac{19}{20} < 1$ and $\frac{3}{8} < \frac{1}{2}$

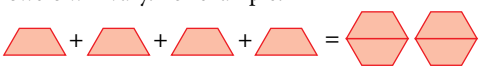
$\frac{1}{2}$; $\frac{9}{10} + \frac{11}{12} + \frac{11}{14}$ Answers will vary. For example: $\frac{9}{10} > \frac{4}{5}$, $\frac{11}{12} > \frac{5}{6}$, and although $\frac{6}{7} > \frac{11}{14}$, $\frac{1}{7} < \left(\frac{1}{5} + \frac{1}{6}\right)$

5.1 Multiplying a Fraction and a Whole Number, pages 132–137

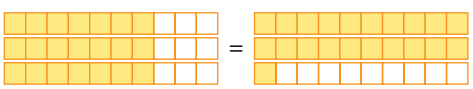
1. a) $4 \times \frac{1}{3} = 1\frac{1}{3}$ **b)** $3 \times \frac{2}{5} = \frac{6}{5}$ **c)** $4 \times \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$

2. Answers will vary. For example:

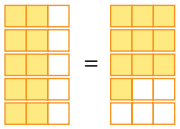
a) 2;



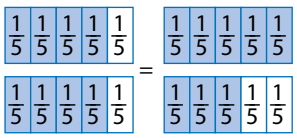
b) $\frac{21}{10}$;



c) $\frac{10}{3}$;



d) $\frac{8}{5}$;



3. a) There are 5 parts in the whole.
b) There are four groups.
c) The product is two wholes plus an additional 2 out of 5 parts.

4. a) 2 m **b)** $2\frac{2}{3}$ m

c) The French flag is larger because $2\frac{2}{3} > 2$.

5. 9

6. a) $\frac{1}{6}$ **b)** 3 cm^2

7. 10 L

8. approximately 31 491 km^2.

10. The families will receive 8, 4, 10 and 2 baskets, respectively.

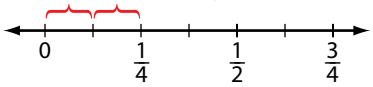
11. 6 students

12. The shortest side measures 3 cm, and the other sides are 6 cm each.

13. >; =; <

5.2 Dividing a Fraction by a Whole Number, pages 138–143

1. a) Answers will vary. For example:

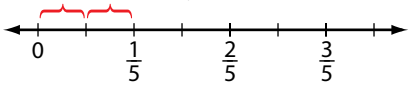


$\frac{1}{8}$

b) Answers will vary. For example:

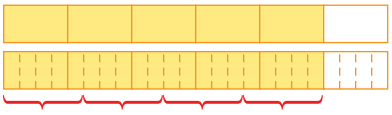
$\frac{1}{9}$

c) Answers will vary. For example:



$\frac{1}{10}$

d) Answers will vary. For example:



$\frac{5}{24}$

2. a) $\frac{3}{10}$ **b)** $\frac{1}{15}$ **c)** $\frac{1}{8}$ **d)** $\frac{1}{9}$

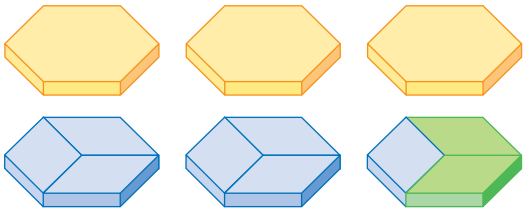
3. Answers will vary. For example: how many groups of 2 wholes are there in $\frac{2}{3}$ or how can $\frac{2}{3}$ be cut in half? Example: two thirds of a chocolate bar is shared between two people.

4. a) $\frac{1}{4}$ of a coconut **b)** $\frac{1}{8}$ of a coconut

5. $\frac{1}{6}$

6. Four sixths cannot be divided into three equal parts. When breaking to three equal groups there would be 1 and $\frac{1}{3}$ in each group so the strips would need to be in ninths.

7. Using 3 hexagons as one whole there are 9 parts in the whole. $\frac{2}{3}$ would be 2 out of 9 or $\frac{2}{9}$;



8. a) $\frac{1}{12}$ h **b)** 5 min

9. He averages $\frac{3}{10}$ of a charge per hour. He would use $\frac{9}{10}$ of a charge in 3 h, so he would have enough battery power.

10. a) $\frac{3}{20}$ **b)** Answers will vary. For example: December, January, and February are the coldest months, so they are more likely to have frost.

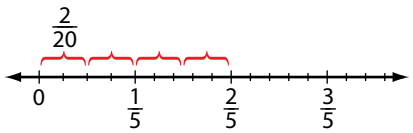
11. $\frac{2}{5}$

12. $\frac{1}{20}$

14. D

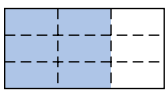
15. $\frac{8}{15}, \frac{2}{3}$

16. a)



b) A number line can be used to show that $\frac{2}{5} = \frac{8}{20}$. When divided into 4 equal parts, one of those parts is $\frac{2}{20} = \frac{1}{10}$ as shown by the red arrow.

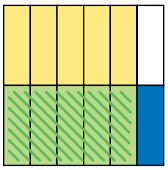
17. Each person would receive $\frac{1}{9}$.



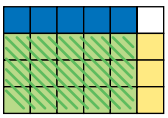
Answers will vary. For example: cut the leftover brownie into half and then cut each half into thirds.

5.3 Multiplying Proper Fractions, pages 144–149

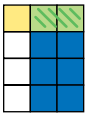
1. a) $\frac{5}{12}$



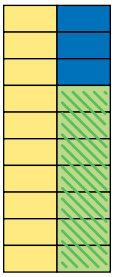
b) $\frac{15}{24} = \frac{5}{8}$



2. a) $\frac{2}{12} = \frac{1}{6}$



b) $\frac{7}{20}$



3. a) $\frac{1}{4}$ **b)** $\frac{1}{14}$ **c)** $\frac{9}{16}$ **d)** $\frac{11}{1000}$

4. a) $\frac{8}{25}$ **b)** $\frac{7}{10}$ **c)** $\frac{1}{3}$ **d)** $\frac{3}{32}$

5. a) Answers will vary. For example: $\frac{2}{3}$ of a group of $\frac{3}{5}$ is less than one but Brendan has an answer greater than one, so his answer is incorrect.

b) $\frac{6}{25}$

6. a) $\frac{1}{12}$ **b)** 2 h per day

7. Approximately $\frac{1}{200}$

8. $\frac{3}{10}$

9. a) $\frac{1}{3}$ **b)** 28

10. $\frac{13}{15}$

12. $\frac{1}{50}$

13. $\frac{3}{26}$

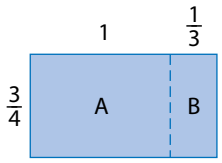
14. a) $\frac{1}{8}$ **b)** $\frac{1}{15}$ **c)** $\frac{1}{8}$ **d)** $\frac{1}{8}$

15. a) $\frac{5}{8}$ **b)** $\frac{7}{9}$ **c)** $\frac{3}{4}$ **d)** $\frac{5}{6}$

16. a) $\frac{1}{4}$ and $\frac{1}{4}$ **b)** $\frac{1}{3}$ and $\frac{1}{2}$ **c)** $\frac{1}{6}$ and $\frac{1}{2}$

5.4 Multiplying Improper Fractions and Mixed Numbers, pages 150–155

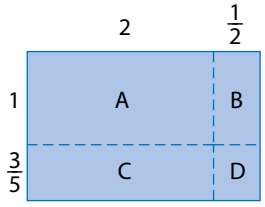
1. a)



Area of A: $\frac{3}{4}$
Area of B: $\frac{3}{12}$
Total: 1

Total area = 1

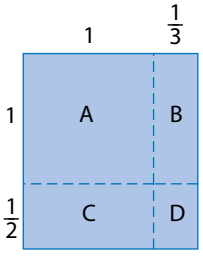
b)



Area of A: 2
Area of B: $\frac{1}{2}$
Total: 4
Area of C: $\frac{6}{5}$
Area of D: $\frac{3}{10}$

Total area = 4

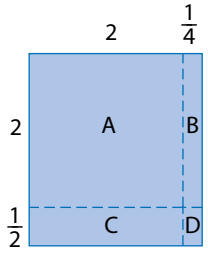
c)



Area of A: 1
Area of B: $\frac{1}{3}$
Total: 2
Area of C: $\frac{1}{2}$
Area of D: $\frac{1}{6}$

Total area = 2

d)



Area of A: 4
Area of B: $\frac{1}{2}$
Total: $5\frac{5}{8}$
Area of C: 1
Area of D: $\frac{1}{8}$

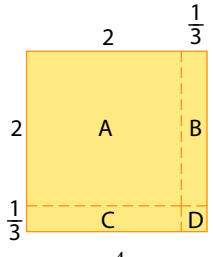
Total area = $5\frac{5}{8}$

2. a)

Area of A: 1
Area of B: $\frac{1}{4}$
Total: $1\frac{1}{4}$

Total area = $1\frac{1}{4}$

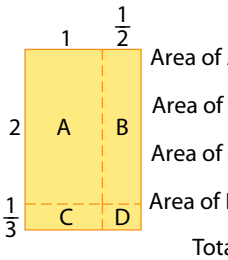
b)



Area of A: 4
Area of B: $\frac{2}{3}$
Total: $5\frac{4}{9}$
Area of C: $\frac{2}{3}$
Area of D: $\frac{1}{9}$

Total area = $5\frac{4}{9}$

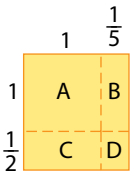
c)



Area of A: 2
Area of B: 1
Area of C: $\frac{1}{3}$
Area of D: $\frac{1}{6}$
Total: $3\frac{1}{2}$

Total area = $3\frac{1}{2}$

d)



Area of A: 1
Area of B: $\frac{1}{5}$
Area of C: $\frac{1}{2}$
Area of D: $\frac{1}{10}$
Total: $1\frac{4}{5}$

Total area = $1\frac{4}{5}$

3. a) $18\frac{3}{4}$ **b)** $1\frac{1}{7}$ **c)** $3\frac{2}{3}$ **d)** $1\frac{7}{8}$

4. a) $4\frac{8}{9}$ **b)** $11\frac{1}{3}$ **c)** $22\frac{3}{4}$

5. It is possible. The whole number in the first term must be multiplied by the whole number and the fraction in the second term and the fraction in the first term must be multiplied by the whole number and the fraction in the second term. The resulting four products are then added. This is the same process as used with an area model, but without using a diagram.

6. a) Henri did not multiply the whole numbers by the fractions.

b) $8\frac{1}{8}$

7. a) There are three parts in each whole and with four wholes there are twelve parts plus two additional parts of the whole for fourteen in total.

b) Multiply the whole number by the denominator in the fraction and add the numerator to determine the numerator in the improper fraction. The denominator stays the same.

c) Divide the numerator by the denominator. The number of times the denominator divides to the numerator is the number of wholes and the remainder is the numerator in the fraction.

8. $2\frac{1}{2} \times 3 = 7\frac{1}{2}$

9. 54 h

10. $3\frac{1}{2}$ h

11. a) $\frac{5}{8}$ h **b)** $37\frac{1}{2}$ min

13. Argon: 18 protons; Zinc: 30 protons; Cadmium: 48 protons; Total: 96 protons

14. $1.75

15. The product will be more than the proper fraction but less than the mixed number.

16. Answers will vary. For example: It took McKenna $3\frac{1}{3}$ h to finish her project. Logan spent $1\frac{1}{2}$ times as long as McKenna to complete his project. How many hours did it take Logan to complete his project? Answer: 5 h

17. a) Two and a half groups of two is around five. Another half group is between one and two so the number seems reasonable. This is the correct solution.

b) Answers will vary. For example: in the second line, Moira found a common denominator, but this step is not necessary in multiplication.

18. a) If each fraction is changed to its improper fraction form, the numerator is 13, and the denominator is twice the denominator of the previous term; $\frac{13}{48}, \frac{13}{96}, \frac{13}{192}$

b) Each term is multiplied by $\frac{3}{2}$ to get the next term; $20\frac{1}{4}$, $30\frac{3}{8}$, $45\frac{9}{16}$

19. a) Answers will vary. For example: cooking more than one batch of a recipe.

b) Answers will vary. For example: calculating the volume of a rectangular prism.

20. a) 15 **b)** 10 **c)** $12\frac{5}{6}$ **d)** $3\frac{11}{15}$

21. a) $1\frac{1}{2}$ **b)** $1\frac{1}{5}$ **c)** $2\frac{1}{2}$ **d)** $2\frac{1}{2}$

5.5 Dividing Fractions and Mixed Numbers, pages 156–163

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

$\frac{5}{8} \div \frac{1}{4} = 2\frac{1}{2}$

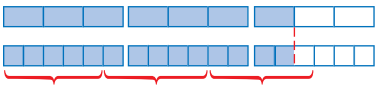
b) $\frac{3}{4}$

$\frac{1}{4} \div \frac{1}{3} = \frac{3}{4}$

c) $2\frac{1}{4}$

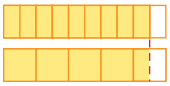
$1\frac{1}{2} \div \frac{2}{3} = 2\frac{1}{4}$

d) $2\frac{4}{5}$



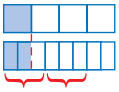
$2\frac{1}{3} \div \frac{5}{6} = 2\frac{4}{5}$

2. a) $4\frac{1}{2}$



$\frac{9}{10} \div \frac{1}{5} = 4\frac{1}{2}$

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

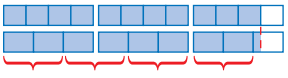


$\frac{1}{4} \div \frac{3}{8} = \frac{2}{3}$

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

$1\frac{2}{3} \div \frac{1}{2} = 3\frac{1}{3}$

d) $4\frac{1}{8}$



$2\frac{3}{4} \div \frac{2}{3} = 4\frac{1}{8}$

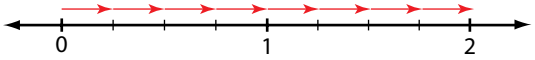
3. a) $\frac{2}{3}$ **b)** $1\frac{4}{5}$ **c)** $1\frac{9}{11}$ **d)** $\frac{1}{2}$

4. a) $\frac{5}{9}$ **b)** $3\frac{3}{5}$ **c)** 4 **d)** $\frac{10}{11}$

5. a) $\frac{15}{16}$ **b)** $\frac{10}{17}$ **c)** $4\frac{4}{11}$ **d)** $\frac{13}{30}$

6. a) Divide two by a quarter. Answer: 8

b) Draw a number line and count the number of quarters in two.



7. a) Divide two thirds by one sixth.

b) The answer should be greater than one since $\frac{2}{3} > \frac{1}{6}$. Answer: 4

8. a) 8 **b)** Answers will vary. For example: There are 8 quarter-hours in two hours.

9. You can make 60 servings.

10. a) $\frac{2}{9}$ as much energy **b)** $\frac{8}{9}$ less energy

11. Divide the amount of land in South America by the amount in Asia; $\frac{3}{10} \div \frac{3}{25}$. Answer: $2\frac{1}{2}$

13. a) approximately 4200 km

b) approximately 2000 km

14. a) 8; The quotient is doubled each time the divisor is halved.

b) $9 \div 9 = 1, 9 \div 3 = 3, 9 \div 1 = 9, 9 \div \frac{1}{3} = 27$

15. Answers will vary. For example: Sebi can ride his scooter to his grandmother's house in $3\frac{3}{4}$ h. If he takes the bus, he can make the trip in $2\frac{1}{4}$ h. How many times longer does it take him to ride the scooter than it takes him to ride the bus? Answer: It takes Sebi $1\frac{2}{3}$ times longer to ride his scooter.

16. $4\frac{1}{3}$

17. $\frac{35}{39}$

5.6 Order of Operations with Fractions, pages 164–169

1. a) $\frac{5}{12}$ **b)** 4 **c)** $4\frac{3}{4}$

2. a) $\frac{9}{14}$ **b)** $2\frac{1}{2}$ **c)** $7\frac{7}{11}$

3. a) \$584 **b)** \$656 **c)** \$728 **d)** \$620

4. $\frac{1}{6}$

5. a) $\frac{3}{16}$ **b)** $\frac{1}{8}$

6. $\left(1 - \frac{5}{7}\right) \times 28 = 8$; $\frac{5}{7} \times 28 = 20, 28 - 20 = 8$; Eight students did not go.

7. a) 105 g **b)** 150 g **c)** 125 g

8. a) $4\frac{1}{4}$ pages **b)** \$1050 **c)** approximately \$247.06

9. a) $\frac{5}{2} \times \left(\frac{3}{5} - \frac{2}{5}\right) + \frac{1}{2} = 1$

b) $1\frac{1}{2} + 2\frac{1}{2} \div \left(\frac{3}{4} - \frac{1}{8}\right) = 5\frac{1}{2}$

c) $\left(\frac{2}{3} - \frac{1}{6} + \frac{5}{6}\right) \div \frac{16}{9} = \frac{3}{4}$

11. a) Ranjeet subtracted 2 from 10 and then multiplied by one-half.
b) Ranjeet multiplied 2 by one-half and then subtracted the result from ten.
c) The correct answer is 9 because you must multiply before subtracting.

12. Manuel is correct. Dave cannot be correct since $\frac{3}{4} \times 6 = 4\frac{1}{2}$ which is less than 6. $6 \div \frac{3}{4} = 8$ which is larger than 6 and $\frac{3}{4} \times 8 = 6$.

13. a) She multiplied $\frac{1}{4} \times \frac{5}{3}$ and then added $\frac{1}{2}$. **b)** $\frac{5}{4}$

14. $\frac{13}{12}$

15. There are 36 black keys and 52 white keys.

16. The shelves hold 128, 64, and 32 books.

Rich Problems, page 170

1. 80 cm

2. You can show this by using letters for numbers. Let a be a whole number and $\frac{b}{c}$ be a fraction.

$$a \div \frac{b}{c} = \frac{a}{\frac{b}{c}}$$
$$= \frac{a \times \frac{c}{b}}{\frac{b}{c} \times \frac{c}{b}}$$
$$= a \times \frac{c}{b}$$

3. Each successive term is found by dividing the previous term into the term prior to it.
6th term
= 4th term divided by 5th term
$= \frac{243}{3125}$
7th term
= 5th term divided by 6th term
$= 59\frac{3526}{6561}$

4. a) $\frac{8}{1} + \frac{7}{2} - \frac{3}{6} - \frac{4}{5} = 10\frac{1}{5}$

b) $\frac{7}{8} + \frac{2}{3} - \frac{1}{5} - \frac{4}{6} = \frac{27}{40}$

5. 721 buttons

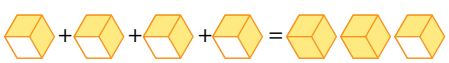
6. $\frac{1}{2} + \frac{1}{4} + \frac{1}{4}$; this is the only other set of three unit fractions that sum to one.

Chapter 5 Review, pages 171–173

1. a) $\frac{5}{4}$

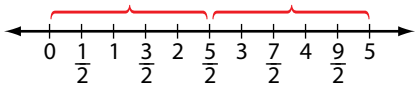
$5 \times \frac{1}{4} = \frac{5}{4}$ or $1\frac{1}{4}$

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



$4 \times \frac{2}{3} = \frac{8}{3}$ or $2\frac{2}{3}$

c) 5

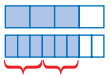


$2 \times \frac{5}{2} = \frac{10}{2}$ or 5

2. $3\frac{3}{5}$ kg

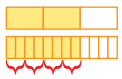
3. 1280 km

4. a) $\frac{3}{8}$



$\frac{3}{4} \div 2 = \frac{3}{8}$

b) $\frac{1}{6}$

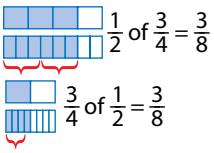


$\frac{2}{3} \div 4 = \frac{2}{12}$ or $\frac{1}{6}$

5. $\frac{1}{12}$ of an onion

6. 40 m

7. $\frac{1}{2}$ of $\frac{3}{4} = \frac{3}{8}$
$\frac{3}{4}$ of $\frac{1}{2} = \frac{3}{8}$



8. a) $\frac{9}{25}$ **b)** $\frac{1}{3}$ **c)** $\frac{1}{14}$

9. $\frac{1}{5}$

10. a) $3\frac{1}{5}$ **b)** $\frac{49}{12}$ **c)** $9\frac{1}{2}$

11. 675 km

12. 84 h

13. $C \approx 44$ cm; $d \approx 0.3\overline{18}$ m

14. a) No, she multiplied the two numbers instead of dividing them.

b) $\frac{2}{9}$

15. a) $\frac{4}{5}$ **b)** $1\frac{5}{9}$ **c)** $7\frac{5}{7}$

16. 30 days

17. $7\frac{1}{2}$ h

18. a) $\frac{7}{8}$ **b)** $1\frac{4}{5}$

19. $3\frac{1}{2} \div \frac{1}{4} = 14$; $16 \times \frac{1}{4} = 4$; He only has enough pasta to cook 14 dinners. He would need four full packages of pasta to cook 16 dinners.

20. $\frac{1}{2}$ of a charge

21. 6 m

22. 352 256 bits

23. 14 weeks

24. $V = \frac{21}{80}$ m^3; $SA = 2\frac{21}{40}$ m^2

25. a) 45 carousels **b)** 25 carousels **c)** $\frac{3}{2}$ times

d) 250 carousels; $75 \div \frac{3}{10} = 250$

Chapter 6

Get Ready, pages 176–177

1. a)

Figure Number	Number of Blocks
1	4
2	6
3	8

Answers will vary. For example: The number of blocks increases by two. $2x + 2$

b)

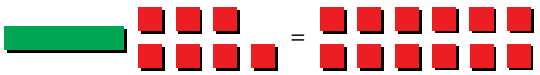
Figure Number	Number of Blocks
1	10
2	7
3	4

Answers will vary. For example: The number of blocks decreases by three. $13 - 3x$

2. a) 19 **b)** 23 **c)** 53

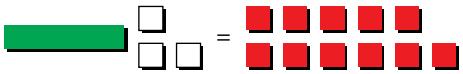
3. a) 494 cm^2 **b)** 408 cm^2

4. a)



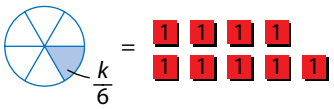
$p + 7 = 12$

b)



$x - 3 = 11$

c)



$\frac{k}{6} = 9$

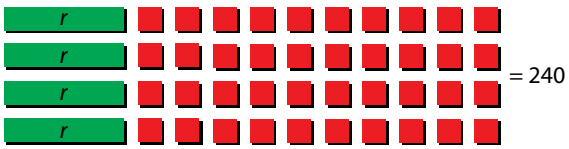
5. a) $x = \frac{20}{4}$, $x = 5$ **b)** $h + 13 = 152$; $h = 139$ **c)** $2t = 50$; $t = 25$

6. a) Subtract 4 from both sides of the equation, then divide both sides by 2.

b) Subtract 6 from both sides of the equation, then divide both sides by 7.

7. a) $j = 8$ **b)** $x = 3$

8. t represents the length of trim and r represents the length of ribbon.



Equations: $4r + 40 = t$

When $t = 240$, $r = 50$. Jan uses 50 cm of ribbon.

6.1 Representing Patterns, pages 178–187

1. a) 17 **b)** −3 **c)** −2 **d)** 11

2. a) For each octagon added the number of sides increases by 6.

b)

Number of Octagons	# of Sides
1	8
2	14
3	20
4	26

c) Expression: $6n + 2$. Equation: $s = 6n + 2$, where s represents the number of sides and n represents the number of octagons. The 2 represents the starting number of sides, and 6 represents the number of sides added multiplied by the number of octagons, n.

d) 104 sides

e) 120 octagons

3. a)

Figure	# of Yellow Tiles
1	8
2	12
3	16

b) Four yellow tiles are added to each subsequent figure.

c) Expression: $4f + 4$. Equation: $t = 4f + 4$, where t represents the number of yellow tiles and f represents the figure number. The 4 represents the starting number of tiles, and 4 represents the number of sides added multiplied by the figure number, f.

d) 100 tiles

e) Figure 43

f) No, when $t = 54$ is substituted into the equation the results if $f = 12.5$. There cannot be half of a figure.

4. a)

Figure	# of Circles
1	11
2	8
3	5

b) The number of circles decreases by 3 for each subsequent figure.

c) Expression: $14 - 3f$. Equation: $c = 14 - 3f$, where c represents the number of circles and f represents the figure number. The 14 represents the starting number of circles, and −3 represents the number of circles subtracted multiplied by the figure number, f.

d) There is no Figure 17 as that would have to have −37 circles.

e) −32

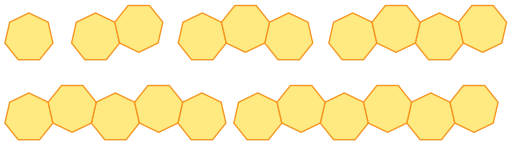
f) Pictorial models do not work when they are comprised of negative numbers of objects or when the number of objects result in a negative figure number.

5. a)

Term	Value
1	−14
2	−8
3	−2
4	4
5	10

b) $v = 6t - 20$ **c)** 718 **d)** 45

6. a)



For each heptagon added, the number of sides increases by 5.

b)

Figure	Perimeter
1	7
2	12
3	17
4	22
5	27
6	32

c) $p = 5f + 2$; p represents the perimeter in centimetres, and f represents the figure number. **d)** 62 cm **e)** 23 heptagons

f) No, it cannot. A figure with perimeter of 74 cm require 14.4 heptagons. A fraction of a heptagon is not possible.

7. a)

Term	Number
1	−5
2	−8
3	−11
4	−14
5	−17

b) $n = -3t - 2$ **c)** −149 **d)** 39

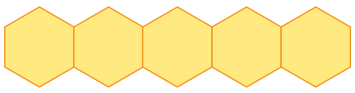
8. a) $y = 13 + 3x$ **b)** $p = 17 + 7r$ **c)** $t = 3k - 5$ **d)** $w = -2f + 1$

10. Christina is correct. The situation is modeled by the equation $w = 6p + 35$ where the wage, w, is equal to the flat rate of $35 plus $6 for every pair of shoes sold. Liam's mistake was that he did not include the flat rate in his calculation.

11. Answers will vary. For example: Observe in the number pattern that each value decreases by 3. The resulting equation is $y = 7 - 3x$. Substitute $x = 59$ into the equation and evaluate the result. $y = 7 - 3(59) = -170$. The value of the 59th term is −170.

12. a) $p = 4t + 2$, where p is the number of people and t is the number of tables. **b)** 22

c)



Count the sides of the figure = 22

d) 7

13. a)

Number of T-Shirts	Cost ($)
0	125
5	200
10	275
15	350
35	650
55	950

b) $c = 15n + 125$, where c is the cost in dollars and n is the number of t-shirts. The 15 represents the $15 charge for each t-shirt printed. **c)** $5795 **d)** 148

e) They can order 111 t-shirts. They will have money left over because 111 t-shirts costs $1790, with $10 left over.

14. a) $t = 2s - 4$, where t is the number of tiles and s is the side length of the frame.

b) 96 **c)** 100 cm by 100 cm

15. a)

Number of Intervals	Year
1	1834
2	1910
3	1986
4	2062
5	2138
6	2214

b) 2062. Answers will vary: Assuming the year is 2016 and the student is 15 years old, the student will be 61 years old the next time Halley's comet is seen.

c) $y = 1758 + 76n$, where y is the year and n is the number of 76 year intervals since 1758.

d) No it will not appear. If 2370 is substituted into the equation, the result is not a whole number (~8.05). It will appear in 2366.

16. a) $v = 3t + 1$, where t represents the term number and v represents that term's value.

b) 127

c) Subtract 1 from 45 678. Divide the resulting number, 45 677, by 3. If the result is a whole number, then 45 678 is one more than a multiple of 3. It is not.

17. a) $r = 2.2n - 2.2$, where r is the row length and n is the number of trees.

b) 92 trees. The trees will not be evenly spaced because a whole number of trees will not create a length of 100 m.

18. a)

Term	Number
1	−27
2	−18
3	−7
4	6
5	21

b) No, the pattern is not linear. The difference between each subsequent pair of numbers is not the same.

c) $n = t^2 + 6t - 34$ **d)** 11 193 **e)** 18

19. a)

Number of Bounces	Height (m)
1	$\frac{4}{3}$
2	$\frac{8}{9}$
3	$\frac{16}{27}$
4	$\frac{32}{81}$
5	$\frac{64}{243}$

b) No, the pattern is not linear. The difference between each subsequent pair of heights is not the same.

c) $h = 2\left(\frac{2}{3}\right)^b$, where h is the bounce height and b is the bounce number.

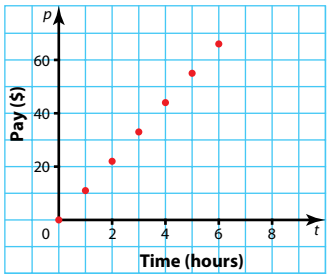
d) $\frac{32}{81} \approx 0.395$ m

e) bounce 7

6.2 Graphing Linear Relations, pages 188–199

1. a) B **b)** A **c)** C

2. a)

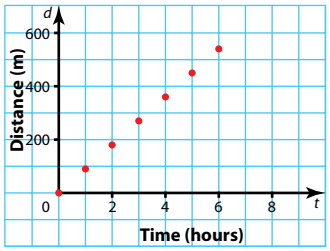


b) The graph shows that for each additional hour worked, the pay increases by $11.

c) Method 1: Use the equation by substituting $t = 8$ and evaluating. $88.

Method 2: Extrapolate from the graph by extending the points past $t = 8$.

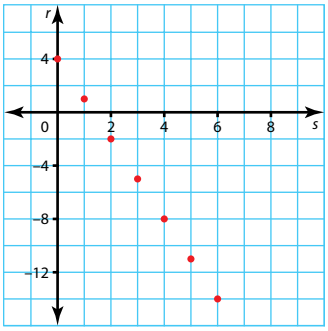
3. a)



b) approximately 3.5 hours

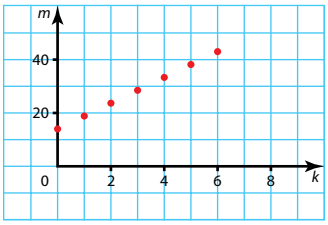
4. a)

s	r
0	4
1	1
2	−2
3	−5
4	−8
5	−11
6	−14



b)

k	m
0	13
1	18
2	23
3	28
4	33
5	38
6	43



5. a) $C = 2m$, where C is the cost in dollars and m is the mass in kilograms.

b) 2.5 kg

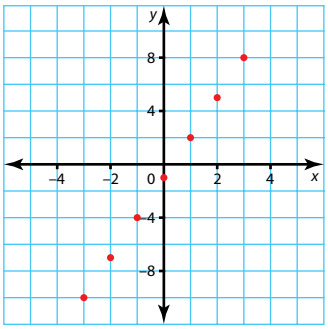
c) Yes, because you can purchase a mass that is a fraction of a kilogram or spend part of a dollar (limited to $0.01)

6. a) $h = 6t$, where h is the height in centimetres and t is the time in hours.

b) 30 m

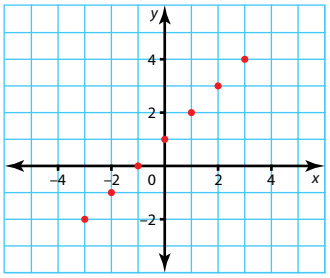
c) Yes, as long as the depth and time are not less than 0 and the water height is not beyond what the pool can hold.

7. a)



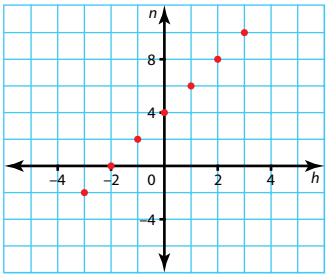
$y = 3x - 1$

b)



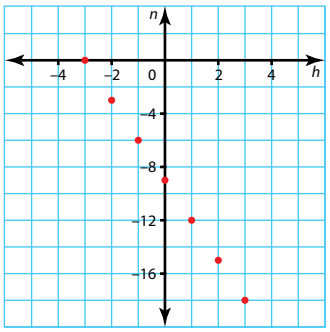
$y = x + 1$

c)



$n = 2h + 4$

d)



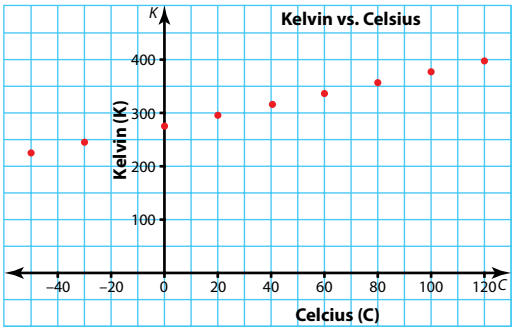
$n = -3h - 9$

8. a) $y = -4x$ **b)** $y = 2x + 2$

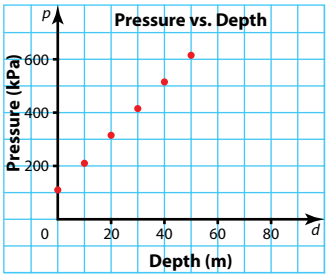
9. a) $y = x - 2$ **b)** $y = -x + 4$

10. Create a table of values by first selecting at least 3 x-values. Substitute the values into the linear equation to calculate the corresponding y-values. Plot the three coordinate pairs.

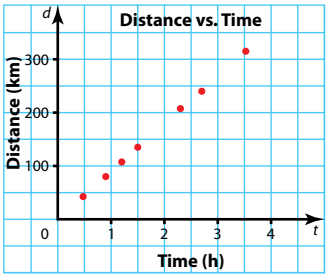
12. a) approximately 1200 m
b) approximately 12.5 min
c) $a = 80t$, where a is the altitude, in metres, and t is the time, in minutes.
d) The balloon is rising at a rate of 80 m per minute.
13. a) 20 min. Join the coordinate points and extended the resulting line until it reaches the 100 °C line of the graph. From there, draw a line straight down to the x-axis (time) where the value is approximately 20 min.
b) 50 °C
c) $\frac{100\ °C}{20\ min} = 5\ °C/min$
14. a)



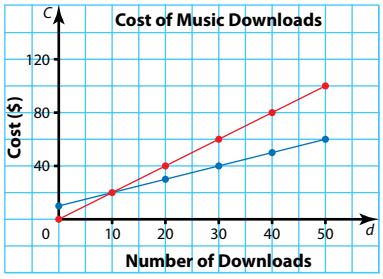
b) 373 K
c) It's the point on the y-axis of the graph.
15. a)



b) approximately 250 kPa. Verification: $P = 10(15) + 102 = 252$
c) approximately 40 m. Verification: $500 = 10d + 102$; $d = 39.8$
d) "+ 120" represents the air pressure at sea level. It's represented on the graph as the point on the y-axis.
16. a)



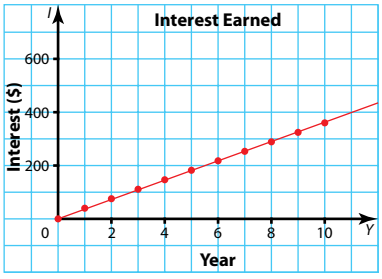
b) approximately 180 km
c) approximately 2.4 h
d) $d = 90t$ **e)** 90 km/h
17. a) Girls' growth appears to be linear at greater than 24 months of age.
b) Girls' growth appears to be non-linear prior to 24 months of age.
18. a) 3:00 pm **b)** 3:30 pm
19. a)



b) If you purchase fewer than 10 songs per month, Plan B is a better deal. If you purchase more than 10 songs per month, Plan A is a better deal.
20. a)

Year, y	Interest, I($)
0	0
1	35
2	70
3	105
4	140
5	175
6	210
7	245
8	280
9	315
10	350

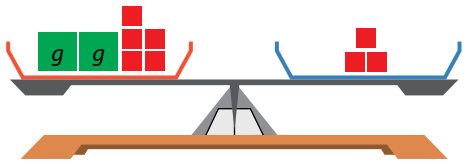
b)



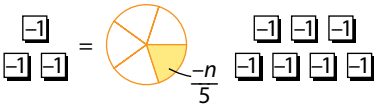
c) approximately 2.85 years, approximately 5.71 years
d) approximately 14 years

6.3 Modelling and Solving Equations: $ax + b = c$ or $\frac{x}{a} + b = c$, pages 200–207

1. a) $x = 1$ **b)** $g = 2$
2. a) $x = 21$ **b)** $b = -18$
3. a)



$g = -4$
b)

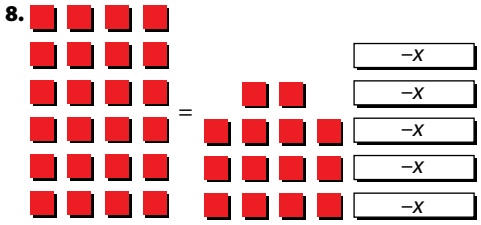


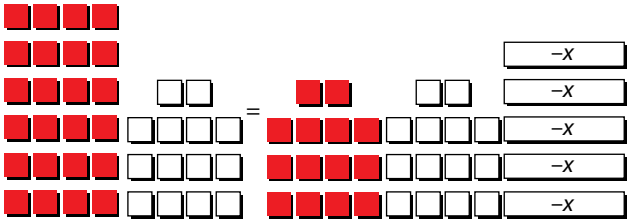
$n = -20$
4. a) $x = 3$ **b)** $t = -7$ **c)** $z = 4$
5. a) $r = 2$ **b)** $m = 1$ **c)** $g = 4$ **d)** $f = -17$

6. a) $k = -7$ **b)** $n = -2$ **c)** $x = -3$ **d)** $n = 2$

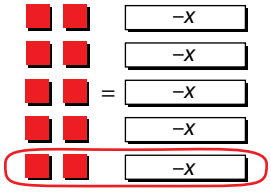
7. a) $t = 15$ **b)** $p = -13$ **c)** $k = -108$ **d)** $x = -9$

8.





$24 - 14 = 14 - 14 - 5x$



$10 = -5x$

$x = -2$

9. a) subtract 10 from both sides, then divide each side by 5.

b) Yes, but I would add 10 to both sides, then divide by 5.

10. a)

Left side:
$= -8(-3) - 1$
$= 24 - 1$
$= 23$

Right side:
$= 25$

not a solution

b)

Left side:
$= 30$

Right side:
$= 6(-3) + 12$
$= -18 + 12$
$= -6$

not a solution

11. a)

Left side:
$= 6 + \frac{(-72)}{9}$
$= 6 - 8$
$= -2$

Right Side:
$= 14$

not a solution

b)

Left side:
$= \frac{(-72)}{-3} + 6$
$= 24 + 6$
$= 30$

Right side:
$= -18$

not a solution

14. a) 3 extras **b)** 3 extras.

$30 = 2e + 24$
$6 = 2e$
$e = 3$

15. \$174.50

$2m - 50 = 299$
$2m = 349$
$m = 174.50$

16. a) The value of 6 represents the number of metres that the eagle drops every second. **b)** 12 s

17. a) −25 °C **b)** 9000 m

18. The first step is the same, to subtract the value, b, from both sides of the equation. The second step is different to solve for x as the answer is either $(c - b)a$ or $\frac{c - b}{a}$.

19. The deck width is 5.75 m.

$30 + 8x = 76$
$8x = 46$
$x = 5.75$

20. There are 3 possible values for m: 667, 668, and 669

21. 3.7 km/h

22. a) Mara hears each sound first.

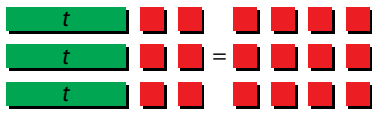
b) approximately 4.7 m

6.4 Modelling and Solving Two-Step Equations $a(x + b) = c$, pages 208–213

1. a) $x = 6$ **b)** $s = -5$

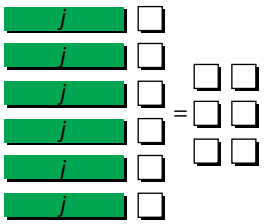
2. a) $x = 4$ **b)** $x = 8$

3. a)



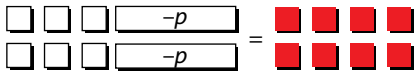
$t = -2$

b)



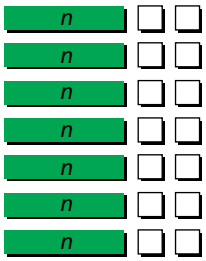
$j = 0$

4. a)



$p = -7$

b)



$n = 2$

5. a) $r = -9$ **b)** $m = 6$ **c)** $g = -26$ **d)** $f = -7$
6. a) $k = -10$ **b)** $n = 8$ **c)** $x = 3$ **d)** $n = -11$
7. Answers may vary. For example: You lent a friend some money. She pays back $3, but then borrows the amount that she currently owes again. The amount she now owes you is $6. How much did your friend borrow in the first place?
9. Julia's strategy will not work, but Chris' first step is correct.
10. a)

Left Side:	Right Side:
$= -8(-4 - 1)$	$= 24$
$= -8(-5)$	
$= 40$	

not a solution

b)

Left Side:	Right Side:
$= 3(-8 - (-4))$	$= -24$
$= 3(-4)$	
$= -12$	

not a solution

c)

Left Side:	Right Side:
$= 25$	$= -5(-4 - 1)$
	$= -5(-5)$
	$= 25$

is a solution

d)

Left Side:	Right Side:
$= 66$	$= 6(-4 + 7)$
	$= 6(3)$
	$= 18$

not a solution

11. a) $3(s + 7) = 99$ **b)** 26 cm
12. a) $5(x + 22) = 500$ **b)** 78 kg
13. a) 17 750 kJ **b)** −30 °C
14. a) $4(x + 10) = 96$
b) 14 cm by 14 cm
15. 4 h
16. $17
17. a) 12 km/h
b) 9 km/h
c) Answers may vary. For example: Andrew would not be able to get to his grandfather's apartment in two hours if he was riding his bicycle through a city with several traffic lights and several steep hills. It would also depend on the types of roads, the terrain that he would have to bicycle over, and on his athletic ability.
18. a) $h = 7.8$ cm **b)** $a = 1.3$ m

Rich Problems, page 214

1. 36 tiles

2. Answers may vary. For example: $10\left(x - \frac{5}{4}\right) + 20 = 0$

3. a) The x-term is repeated 1 time and increases by 1, + and − is repeated, and the last digit on the left hand side is 1, 2, 3, ….
b) BE FREE
c) Answers will vary.
d) Answers may vary. For example: To create the statement "LAUGH OUT LOUD", I know that each letter is a value of x. Using the Eqtnsolv encryption, the cipher for this statement is 13 −1 45 10 29 Z 39 91 72 Z 69 65 137 12.
e) Answers may vary. For example: Yes, you may use 1, 1, 2, 3, 5, 8, … as the x term's coefficient, or as the b value for the expression $ax + b = y$.
4. Answers will vary.

Chapter 6 Review, pages 215–217

1. a)

Figure #	Number of Toothpicks
1	4
2	7
3	10
4	13

Starting with figure 1, which has 4 toothpicks, each figure has 3 toothpicks more than the previous figure.
b) $3f + 1$
c) 31
d) 3 represents the number of toothpicks added to each subsequent figure, and the +1 represents the additional toothpick for the starting figure.
2. a)

Week	Bank Balance ($)
1	1560
2	1545
3	1530
4	1515
5	1500

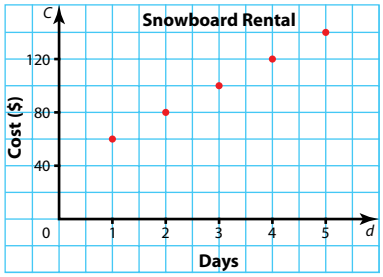
b) $b = 1575 - 15w$, where b is the bank balance and w is the week number.
c) $1050
d) 47 weeks
3. a)

Pairs of Shoes Sold	Earnings ($)
0	75
1	77
2	79
3	81
4	83
5	85
6	87
7	89
8	91
9	93
10	95

b) $w = 2p + 75$, where w represents her wage and p represents the number of pairs of shoes sold.
c) $99

4. a) the base rental cost

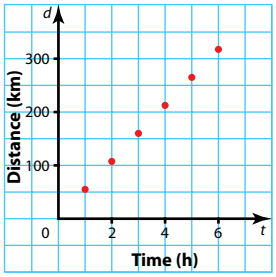
b)



c) $60, $180

d) You could rent up to 12 days. On the 13th day the cost is the same.

5.



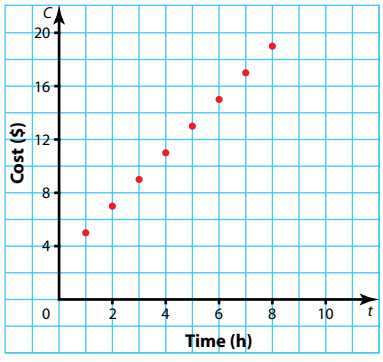
a) Answers may vary. For example: the distance a family travels over a period of 6 hours while on vacation.

b) $d = 52t$, where d is the distance in kilometres and t is the time in hours **c)** The value 52 is the average speed of the car. There is no constant (equals 0)

6. a)

Hours (h)	Cost ($)
1	5
2	7
3	9
4	11
5	13
6	15
7	17
8	19

b)



c) $11 **d)** 6 h **e)** $c = 2h + 3$

7. a) $-4x + 7 = -1, x = 2$

b) $\frac{v}{5} + 7 = -3, v = -50$

c) $-2 = -\frac{j}{4} - 3, j = -4$

8. a) $t = -4$ **b)** $j = -24$ **c)** $p = 4$ **d)** $n = 13$

9. a) $a = 4m - 3$, where a is the number of albums and m is the number of movies.

b) 7 movies

10. a) $v = 12$ **b)** $d = 15$ **c)** $x = -42$ **d)** $n = 36$

11. $s = \frac{b}{5} - 135$, where s is the number of Saskatchewan players and b is the number of British Columbia players. British Columbia has 119 750 players.

12. a) $6 = 3(x + 4), x = -2$

b) $-8 = 2(-w + 3), w = 7$

13. a) $q = 9$ **b)** $g = -11$ **c)** $k = -14$ **d)** $x = 1$

14. $4(x + 6) = 660$, where x is the side length of the quilt before the border is added. The dimensions of the quilt are 159 cm by 159 cm.

15. 9 cm

16. $p = 36c - 20$, where p is the profit and c is the price of 1 fruit bar. $p = \$16$

17. Answers will vary. From the table the total cost of the products is $310. In order to make a profit of $150, the prices per item would have to be increased an average of approximately 48.4%. Round this to 50%
granola bars = $0.54 × 1.5 = $0.81
chips = $0.56 × 1.5 = $0.84
juice boxes = $0.49 × 1.5 = $0.74
frozen milk treats = $1.00 × 1.5 = $1.50

Chapter 7 Ratios, Rates, and Proportional Reasoning

Get Ready, pages 220–221

1. a) 4 to 6, or 4:6 **b)** 6 to 4, or 6:4

c) 6 to 10, or 6:10, or $\frac{6}{10}$

2. a) white balls to black balls

b) white balls to total balls

c) total balls to black balls (in lowest terms)

3. a) Answers will vary. For example, the number of days of the week that start with the letter 'S' to the total number of days of the week.

b) 2 to 7, or 2:7, or $\frac{2}{7}$

4. a) Yes **b)** Yes **c)** No **d)** Yes

5. a) Answers will vary. For example: $\frac{2}{8}, \frac{3}{12}, \frac{4}{16}$, or $\frac{5}{20}$

b) Answers will vary. For example: $\frac{3}{8}, \frac{9}{24}, \frac{12}{32}$, or $\frac{18}{48}$

c) Answers will vary. For example: $\frac{1}{3}, \frac{2}{6}, \frac{3}{9}$, or $\frac{8}{24}$

d) Answers will vary. For example: $\frac{4}{22}, \frac{6}{33}, \frac{8}{44}$, or $\frac{10}{55}$

6. a) 15 **b)** 6 **c)** 15 **d)** 4

7. a) Answers will vary. For example: $\frac{14}{28}, \frac{1}{2}$, or $\frac{7}{14}$

b) Answers will vary. For example: $\frac{4}{5}, \frac{20}{25}$, or $\frac{40}{50}$

c) Answers will vary. For example: $\frac{36}{12}$, $\frac{3}{1}$, or $\frac{18}{6}$

8. a) 3 **b)** 2 **c)** 0.75 or $\frac{3}{4}$

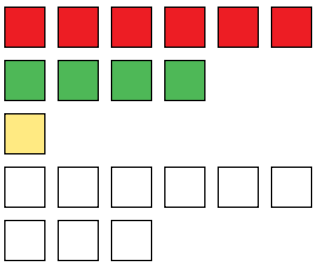
9. a) $\frac{31}{50}$ **b)** $\frac{2}{5}$ **c)** $\frac{3}{20}$ **d)** $\frac{6}{25}$

10. a) 34% **b)** 32% **c)** 90% **d)** 35%

7.1 Ratios, pages 222–231

1. a) 3:4 **b)** 8:4:3 **c)** white to red **d)** 1:5 or $\frac{1}{5}$

2. a)



b) 9 **c)** 1:4:6 **d)** $\frac{6}{20}$ or 30%

3. a) 2:8, 1:4 **b)** 21:26 **c)** 16:14:30, 8:7:15

4. a) $\frac{4}{10}$, 40% **b)** $\frac{3}{9}$, $33.\overline{3}\%$ **c)** $\frac{3}{15}$, 20%

5. a) 1:4 **b)** She is correct because raspberry juice concentrate to the total amount of punch is 1:16 or 6.25%.
c) 200mL of orange juice concentrate, 100mL of raspberry juice concentrate, 100mL of lemon juice, 1200mL of soda water

6. a) 50mL
b) She is incorrect. The mixed cleaner is 350mL water to 400mL mixed cleaner or 86% water.
c) 5 full spray bottles

7. a) soccer and basketball since wins to losses for soccer is 9:6 or 3:2 and for basketball is 12:8 or 3:2.
b) $\frac{6}{15}$ or 0.6 or 60% **c)** 15
d) Prediction was incorrect since the overall winning percent is under 60%. Total games won to total game played is $\frac{27}{51}$ or about 53%.

8. a) She wants oranges:apples, so it is 4:3 since there are 4 oranges and 3 apples.
b) No, it does not make sense to write this ratio as a fraction since it is a part-to-part ratio and not a part-to-whole ratio.

10. a) yellow to red, 30:20, or red to yellow, 20:30
b) yellow to total, 30:50, or red to total, 20:50
c) The part-to-whole ratios in part b) can be written as fractions. 60% of the liquid is yellow, 40% is red.

11. a) 12 **b)** 16:12, or 4:3 **c)** 15

12. a) It's a part-to-whole ratio because is compares the part of the group younger than 16 to the whole group.
b) Answers will vary. For example: The ratio of people younger than 16 to the total number of people is 3 to 8.
c) 30

13. a) Romano to mozzarella to ricotta is 2:6:5
b) 300 g of Romano and 750 g of ricotta

14. a) 16:48, or 1:3
b) 12:44, or 3:11
c) Both ratios from are appropriate to write as percents, because they are both part-to-whole ratios. Approximately 33% of passengers got off the bus at the stop, and approximately 27% of the passengers on the bus after the stop were new.

15. a) 25 kg of cement powder, 100 kg of gravel
b) 600 kg of sand, 1200 kg of gravel

16. a) 8.5 m
b) Canadian flag is longer
c) Mexico. Its ratio of height to length is higher than that of Canada or the United States. If equivalent ratios with a common second term are used, Canada's flag can be expressed as 133:266, Mexico's as 152:266, and the United States' as 140:266. A square is 1:1, or 266:266, so Mexico's flag is closest.

17. 4.5 kg of nitrogen, 6 kg of phosphorus, 3 kg of potassium

18. a) 3200 mL of gas
b) Approximately 2.4% of the mixture needs to be oil, 97.6% needs to be gas.
c) Approximately 4.9 mL

19. a) 24 m × 38.9 m and 348 mm × 565 mm are both approximately golden rectangles, but 52 cm × 120.5 cm is not.
b) approximately 10.4 m

20. a) 1:4 **b)** $\frac{1}{4}$, 0.25, or 25%
c) i) the slope will increase **ii)** the slope will decrease
iii) the slope will decrease **iv)** the slope will increase

7.2 Rates, pages 232–239

1. a) 55 km/h **b)** 19.3 km/h **c)** 16 m/s **d)** 8 mm/min

2. a) 11 kg/week **b)** 1.5 daffodils/min (or 90 daffodils/hour)
c) 26 customers/hour
d) 14.5 L/day

3. a) hummingbird speed: approximately 40 km/h; butterfly speed: approximately 20 km/h
b) hummingbird: 43.2 km/h; butterfly: 19.2 km/h

4. Asad's rate of pay ($13.75/h) is greater than Gina's ($13/h)

5. a) 2-L carton is $0.2095/100 mL, 1-L carton is $0.299/100 mL, 250-mL carton is $0.316/100 mL
b) 2-L carton is $2.095/L, 1-L carton is $2.99/L, 250-mL carton is $3.16/L
c) The 2-L carton is the best buy because is has the lowest unit price.
d) Answers will vary. For example: Fraser might consider things like how much milk he actually wants to buy, how much money he has, and whether he wants to drink it all now or have some to save for later.

6. a) By estimation the larger jar appears to be the better buy, because its size is four times more than the small jar but the price is not even twice as much.
b) The large jar is the better buy. The small jar is $2.196/100 g while the large jar is $0.799/100 g.
c) Answers will vary. For example: most people would be more likely to use estimation to determine the better buy, especially in cases like this where the sizes are easy to work with mentally.

7. Yes, the data support the statement that bear cubs grow faster immediately after birth compared to later on. The cub's growth rate for the first 8 weeks is 0.7 kg/week, while its growth rate for the next 12 weeks is 0.5 kg/week.
8. A rate compares quantities with different units, such as time worked in hours/week or water flow in L/min. A ratio compares quantities with the same units, such as the ratio of red to yellow flowers in a garden of 3 to 2 or a ratio of girls to boys in a class of 13 : 17.
11. a) Joe: 14.29 km/L, Sarah: 14 km/L, Martin: 12.25 km/L
b) Joe: 7 L/100 km, Sarah: 7.14 L/100 km, Martin: 8.16 L/100 km
c) Joe's vehicle had the best rate. A higher rate is better for fuel economy (km/L) in part a), but a lower rate is better for fuel consumption (L/100 km) in part b).
12. a) Approximately 200 British pounds or 280 U.S. dollars.
b) 260.12 euros
c) 21357.96 Russian rubles
d) Answers will vary. If a conversion rate are higher than those listed here, then it is more favourable for a Canadian travelling there.
13. Anywhere between $6.48 and $7.50
15. Daniel will take 100 min to mow the area; Grace will take 16 min.
16. Venus: 13.54 km/h; Earth: 1669.76 km/h; Saturn: 37.01 km/h
17. 0.2 mL/cm^2

7.3 Proportional Reasoning, pages 240–247

1. a) 2 h **b)** 60 goals **c)** 72 beats
2. a) $4.95 **b)** 200 kg
3. a) $9.87 **b)** 50 blocks
4. $23.20
5. a) 120 seconds
b) Assuming that she continues to run at the same speed
6. a) 10 **b)** 11 **c)** 14 **d)** 18
7. 33 home runs
8. 12 times
9. a) Yes. The ratios are equivalent.
b) No. The rates are not equivalent.
10. a) Yes **b)** No **c)** Yes
11. a) Wendy is correct that a proportion cannot be used in this case. The number of laps is not proportional—6 laps to 4 laps is only because Richie started first. After one more lap it will be 7 to 5, then 8 to 6, and so on. These ratios are not proportional.
b) 13 laps
12. $60
13. a) first missing value is 9.6; second value is 12.5
b) first missing value is 367.5; second value is 102.4
14. 150 g of rice
15. a) No, the relationship is not exactly proportional (but it is close). The speeds are slightly different.
b) Approximately 49 minutes.
17. 13.75 mL
18. 17.5 min
19. a) 144 fish
b) The biologist assumes that the fish that are tagged and released mix with the rest of the fish in the lake before the biologist returns to recapture fish.
20. a) Frogs eat 96 insects/day and dragonflies eat 99 insects/day. Dragonflies eat more insects per day.
b) 693 **c)** 2976
21. a) 1 : 2 **b)** 1 : 4

Rich Problems, page 248

1. The tomatoes grow by 0.5 inches each day, so this is a proportional relationship. The carrots grow by 0.6 cm each day, so this is proportional. The onions grow by varying amounts each day, so this is not proportional. The zucchini grow by 2.25 cm each day, so this is proportional.
2. Caleb should pay $102.94, Jamal should pay $80.88, and Mina should pay $66.18. This is each persons proportional share of the $250 total cost.
3. Crust: 0.1137 cm, Upper mantle: 2.7288 cm, Lower mantle: 8.2282 cm, Outer core: 8.5617 cm, Inner core: 4.6276 cm
4. Eight years

Chapter 7 Review, page 249-251

1. a) 6 : 6 **b)** 6 : 12 **c)** 1 : 2, 2 : 4, or 3 : 6 **d)** 50%
2. a) 6 : 16 **b)** $\frac{3}{8}$ **c)** 8 : 4
3. a) 8 : 32 (or 1 : 4) **b)** 24 : 8 (or 3 : 1)
4. a) silver to total
b) 40% of the cars are silver. She is not correct.
c) 30
5. a) 5 : 2 : 3
b) 350 mL of oil, 140 mL of lemon juice, 210 mL of vinegar
6. a) 50 steps/min **b)** $0.90/L **c)** 624 km/h **d)** 50 kg/year
7. Television
8. a) $0.83 or 83¢
b) It is a rate because the quantities being divided have different units. The units are dollars per bar or cents per bar.
9. a) Shelly **b)** 2.5 km
10. a) 16 kg **b)** $10.50 **c)** 18 min
11. a) $7.84 **b)** $5.\overline{3}$ cm
12. No, this does not represent a proportional relationship. Minji's rate was 4.8 jars/hour the first day and 5 jars/hour the next.
13. No, this does not represent a proportional relationship. The snow fell at a rate of 5 cm/h the first night and 5.25 cm/h the next day.
14. $18.96
15. $50

16. Ratio and rates are a comparisons of quantities. For example, a ratio might be used to compare the number of Physics to Biology classes in a school as 3:8, and a rate might be used to express that the average class size in a school is 25 students/class. A proportion is a comparison of equivalent ratios or rates For example, $3:8 = 6:16$ is a proportion comparing two ratios, or $\frac{100 \text{ students}}{4 \text{ classes}} = \frac{25 \text{ students}}{1 \text{ class}}$ is a proportion comparing two rates.

17. a) It represents a rate, because the units are different (dollars and shirts).

b) \$14/shirt

c) No, this is not a proportional relationship. The cost per shirt is different for each row of the table—the unit price decreases for larger orders.

18. a) They have won 62.5% of their games, so slightly more than 60%.

b) 16.875 points/game

c) 304 points

d) No, it does not represent a proportional relationship because the win:loss ratios are not equal. 11 to 7 is not equivalent to 5 to 3.

e) The team won 61% of its games, so the coach's prediction was quite accurate. With only 18 games in total, the value could not have come out to be exactly 60%. 11 out of 18 games is as close to 60% as the team's winning record could have been.

Chapter 8 Understanding Percent

Get Ready, pages 254–255

1. a) 15% **b)** 89% **c)** 64% **d)** 47%

2. a) 3 squares of one row shaded

b) 4 rows and 6 squares (46 squares total) shaded

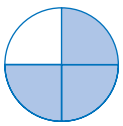
c) 9 rows and 7 squares (97 squares total) shaded

d) 1 rows and 5 squares (15 squares total) shaded

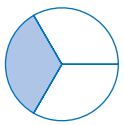
3. a) $\frac{1}{4}$; 0.25; 25% **b)** $\frac{1}{2}$; 0.5; 50% **c)** $\frac{3}{8}$; 0.375; 37.5%

d) $\frac{4}{5}$; 0.8; 80%

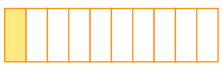
4. a)



b)

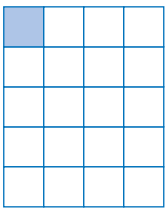


c)



d)

e)



f)

5. a) $0.\overline{3}$ **b)** $0.\overline{45}$ **c)** $0.13\overline{27}$

6. a) $0.\overline{81}$ **b)** $0.\overline{7}$ **c)** $0.8\overline{3}$ **d)** $0.\overline{36}$

7. a) tens **b)** tenths **c)** units **d)** hundredths **e)** thousandths **f)** ten thousandths

8. Answers will vary. For example:

a) 17; 22% of 100 is 22, but 85 is less than 100, so 22% of 85 will be less than 22.

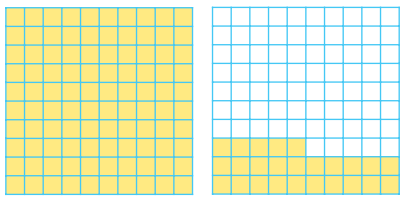
b) 50; 48% of 100 is 48, but 102 is more than 100, so 48% of 102 will be more than 48.

c) 50; 75% of 100 is 75 and 75% of 50 is 37.5, so 75% of 70 will be between 37.5 and 75.

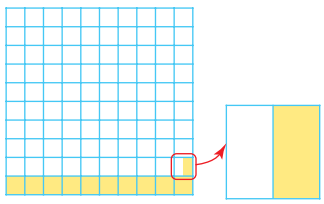
d) 72; 82% of 100 is 82, but 91 is less than 100, so 82% of 91 will be less than 82.

8.1 Understanding Large and Small Percents, pages 256–265

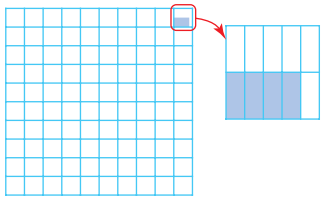
1. a)



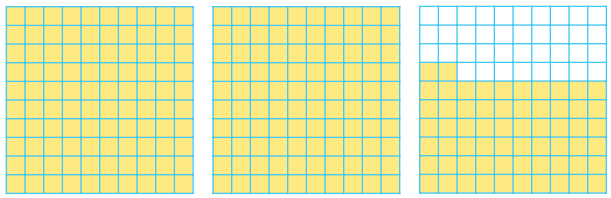
b)



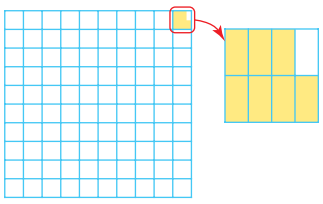
c)



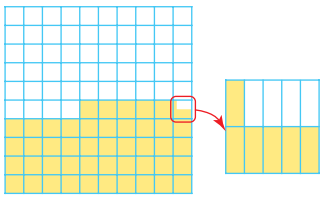
d)



e)



f)



2. a) 3 **b)** 5 **c)** 12

3. a) 112% **b)** 0.2% **c)** $85\frac{1}{3}\%$ **d)** $\frac{3}{8}\%$ **e)** 125.5% **f)** 282%

4. a) Answers will vary. For example: approximately 133%
b) Assume that the increased size of the box reflects the increased amount of product.
c) The package could say "33% bonus."

5. a) $41.\overline{6}\%$ **b)** $141.\overline{6}\%$

6. a) 1% of 229 373 is 2293.73, so dairy farms represent more than 1% of all farms in Canada, and greenhouse vegetable farms represent less than 1% of all farms in Canada.
b) dairy farms: approximately 6.4%; greenhouse vegetable farms: approximately 0.3%

7. 0.13%; the shaded area represents 13% of 1%.

8. maximum: $0.\overline{3}\%$; minimum: 0.25%

9. Answers will vary. For example: "give an effort today that is 110% of your effort last game,"or 10% more than the effort put forth in the last game.

10. a) The ratio would be less than one percent if there were more than 100 children for each adult.
b) The ratio would be a fractional percent if there were 3 adults and 8 children.
c) The ratio would be more than 100% if there were more adults than there were children.

11. a) 800 **b)** Answers will vary. For example: 47

13. Answers will vary. For example: chemicals that cause pollution in water might need to be present in very, very small percents to be considered pollution.

14. Yes, the original is 8 mm long and the enlargement is 20 mm long. 20 is 250% of 8.

16. Divide the area of each other mattress size by the area of the single mattress, and convert to percent format; double: approximately 138%; queen: approximately 163%; king: approximately 213%

17. You could do a sequence of four hundreds grids, with each grid being a 'zoom in' of one square of the previous grid—one shaded square of the fourth grid would represent 0.000 001%. A percent this small might be encountered when talking about substances that are found in very small trace amounts in water or air.

18. Answers will vary. For example: a situation where a population of animals has grown to be more than ten times the original population.

19. Shade 7 of the 8 pieces to represent $87\frac{1}{2}\%$; shade 4 of the 8 pieces and $\frac{1}{2}$ of another to represent $56\frac{1}{4}\%$.

8.2 Fractions, Decimals, and Percents, pages 266–273

1. a) 2.48; $\frac{62}{25}$ **b)** 0.0056; $\frac{7}{1250}$ **c)** 0.755; $\frac{151}{200}$

d) 0.0593; $\frac{593}{10\,000}$ **e)** 5.5; $\frac{11}{2}$ **f)** 0.008; $\frac{1}{125}$

2. a) 0.72%; $\frac{9}{1250}$ **b)** 54.8%; $\frac{137}{250}$ **c)** 345%; $\frac{69}{20}$

d) 25.6%; $\frac{32}{125}$ **e)** 0.05%; $\frac{1}{2000}$ **f)** 650%; $\frac{13}{2}$

3. a) 0.004; 0.4% **b)** 0.405; 40.5% **c)** 1.4; 140% **d)** 1.7; 170%
e) 0.3075; 30.75% **f)** 0.006; 0.6%

4. a) 0.0575; $\frac{23}{400}$ **b)** 0.027; $\frac{27}{1000}$ **c)** 0.214; $\frac{107}{500}$

d) $0.12\overline{6}$; $\frac{19}{150}$

5. a) $\frac{23}{10}$; 2.3 **b)** $\frac{19}{5000}$; 0.0038 **c)** $\frac{199}{1000}$; 0.199

6. a) $\frac{17}{25}$; 0.68; 68% **b)** $\frac{9}{24}$ or $\frac{3}{8}$; 0.375; 37.5%

7. a) $\frac{33}{25}$; 1.32; 132% **b)** $\frac{47}{20}$; 2.35; 235%

8. 2.4, $\frac{12}{5}$, and $\frac{60}{25}$; all three equal 240%.

9. a) The numerator is greater than the denominator.
b) The value is more than 1.
c) The percent is greater than 100%.

11. 0.6%, $\frac{5}{8}\%$, 33.5%, 0.65, 1.32, 145%

13. $\frac{12}{2700}$ or $\frac{1}{225}$; $0.00\overline{4}$; approximately 0.4%

14. Answers will vary. For example:
a) Decimal format may be preferred because 1.3 sounds like more than $\frac{13}{10}$.
b) Decimal format may be preferred because 0.605 sounds like more than $\frac{121}{200}$.
c) Fraction format may be preferred because $\frac{3}{400}$ sounds like more than 0.0075.

15. (percents and decimals are approximate)

Species	Number	Percent of Total	Fraction of Total	Decimal Equivalent
Chinook	143	53.6%	$\frac{143}{267}$	0.536
Coho	122	45.7%	$\frac{122}{267}$	0.457
Steelhead	2	0.75%	$\frac{2}{267}$	0.0075

16. $\frac{150\,000}{25\,000}$ or $\frac{6}{1}$; 6.0; 600%

17. $\frac{90}{75}$ or $\frac{6}{5} = 1.2 = 120\%$; $\frac{125}{75}$ or $\frac{5}{3} = 1.\overline{6} = 166.\overline{6}\%$; $\frac{150}{75}$ or $\frac{2}{1} = 2.0 = 200\%$

18. Answers will vary. For example: $\frac{74}{10\,000}$ or $\frac{37}{5000}$; 0.0074; 0.74%

19. Answers will vary. For example: $\frac{3}{4} = 0.75 = 75\%$; $\frac{4}{5} = 0.8 = 80\%$; $\frac{11}{14}$ = approximately 0.7857 = approximately 78.57%

8.3 Percent of a Number, pages 274–279

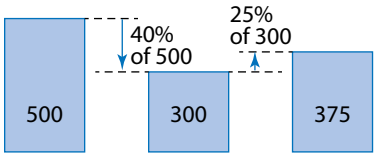
1. a) 6000 **b)** 1.35 **c)** 0.04

2. a) \$0.12 **b)** \$1000 **c)** \$325.50

3. Oxygen: 39 kg
Carbon: 11.1 kg
Hydrogen: 5.7 kg
Calcium: 0.9 kg
Phosphorus: 0.6 kg
Potassium: 0.24 kg
Sulfur: 0.18 kg
Sodium: 0.12 kg
Chlorine: 0.12 kg
Magnesium: 0.06 kg
Other elements: less than 0.6 kg
4. a) 1.95 **b)** approximately 144.88 **c)** $219.63
5. a) 3.25 **b)** 150.8 **c)** $185.90
6. 1300
7. a) 0.5% **b)** 5 tickets
8. $32.25
9. 5957.73 m
10. 825 mL
11. 1100 km
13. a) earnings that are calculated as a percent of sale price
b) $32 575
14. 250; 12.5% of 500 = 62.5; 25% of 250 = 62.5
15. $7680
16. approximately 28.6%
17. 61 baskets

8.4 Combined Percents and Percent of a Percent, pages 280–285

1. a) 18% **b)** 98.4% **c)** 19.25% **d)** 0.32%
2. 1.75%
3. 6.25%
4. a) 652.8 **b)** 1311.31 **c)** 101.76 **d)** 4032
5. a) 132 caribou **b)** The increase the first year was 10% of the original amount, but the increase the second year was 20% of the amount after the first year.
6. Answers will vary. For example:



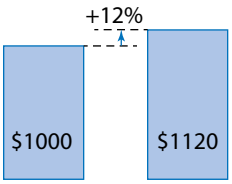
8. No, Kyle is not correct. A 15% increase followed by a 10% increase is an increase of 26.5% compared to the initial amount.
10. a) a decrease of 34% **b)** an increase of 23.5%
c) a decrease of 21.6% **d)** an increase of 48.75%
11. 50% of 50% of 50% is greater; 0.6 × 0.5 × 0.4 = 0.12; 0.5 × 0.5 × 0.5 = 0.125
12. 171.6%
13. approximately 38.3%
14. a) approximately 0.012 m (or 12 mm)
b) In theory, she will never reach the door. If she continually cuts the distance in half there will always be some space left between the marker and the door. In practice, when the distance to the door is less than the width of the marker, she will reach the door.

8.5 Percent and Financial Literacy, pages 286–293

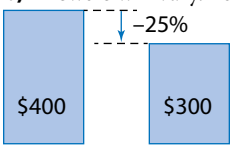
1. a) $11.18 **b)** $4.47 **c)** $22.39
2.

Item Purchased	Price	Total Tax	Total Cost
Boots	$119.99	$14.40	$134.39
Pants	$89.99	$10.80	$100.79
Gloves	$39.99	$4.80	$44.79
Helmet	$189.99	$22.80	$212.79

3. $67.17
4. $24.19
5. $1092
6. a) $38.25 **b)** 55%
7. a) $63 **b)** 47.5%
8. a) Answers will vary. For example: for a total tax rate of 12%:



b) Answers will vary. For example: for a discount of 25%:



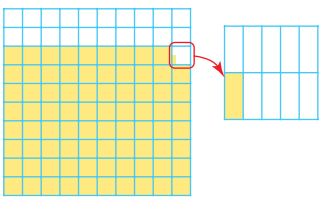
9. a) $23 736 **b)** $26 584.32
10. No, it is not free. These are percents of different values and cannot be combined.
11. $539.68
12. a) $107.10 **b)** One person pays $37.48 (or $37.49), one person pays $26.78 (or $26.77), and two people each pay $21.42.
14. 70%
15. approximately 71.43%
16. 8% increase on the store's cost
17. $572.15
18. a) i) $1090 **ii)** $1092.73
b) Answers will vary. For example: simple interest is more simple to calculate. It is the same amount each year, whereas the amount earned for compound interest increases each year.
19. a) $335.99 **b)** $180.61

Rich Problems, page 294

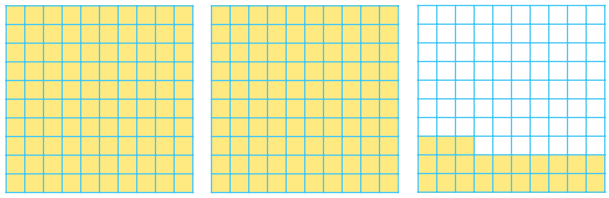
1. Answers will vary.
2. Answers will vary.
3. 22 games
4. Answers will vary.

Chapter 8 Review, pages 295–297

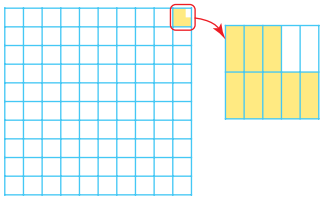
1. a) 0.7% **b)** 0.6% **c)** 50.25% **d)** 145%
2. a)



b)



c)



3. a) approximately 171% **b)** 0.000 004 41%

4. a) 0.955; $\frac{191}{200}$ **b)** 1.4; $\frac{7}{5}$ **c)** 0.009; $\frac{9}{1000}$

5. a) to **d)**

Fraction	Decimal	Percent
$\frac{23}{200}$	0.115	11.5%
$\frac{19}{80}$	0.2375	$23\frac{3}{4}$%
$\frac{3}{200}$	0.015	1.5%
$\frac{77}{20}$	3.85	385%

6. a) swim: $\frac{3}{103}$; approximately 0.029; approximately 2.9%;
bike: $\frac{80}{103}$; approximately 0.777; approximately 77.7%;
run: $\frac{20}{103}$; approximately 0.194; approximately 19.4%

b) swim: $\frac{1125}{6538}$; approximately 0.172; approximately 17.2%;
bike: $\frac{3565}{6538}$; approximately 0.545; approximately 54.5%;
run: $\frac{1848}{6538}$; approximately 0.283; approximately 28.3%

c) No, they are not the same. He travels at different speeds for each portion of the race.

7. a) 264.5 **b)** $40\frac{3}{8}$ **c)** 0.1 **d)** 0.8

8. a) approximately 38.7
b) 287.1
c) approximately 4.5
d) 108

9. $377.20

10. 23.75%

11. a) 221 **b)** 10.5%

12. $771.23

13. $258.94

14. The final sale price will be 50% of the regular price at store A and 56.25% of the regular price at Store B. Store A is the better buy.

15. a) approximately 127%
b) Yes, bathroom #2 makes up less than 1% of the total floor area.
c) after; the kitchen/great room is approximately 31.1% of the total floor area before the renovation, and approximately 32.7% of the total floor area after the renovation.
d) approximately 14.7%
e) $38 150
f) approximately 8.3%

16. a) $\frac{26}{80}$ or $\frac{13}{40}$; 0.325; 32.5%

b) Answers will vary. For example: a fraction has the advantage of showing the actual number of hits and at bats (if it is not reduced to lower terms), a decimal has the advantage that is it simple, and percents are very easy to relate to mentally.
c) 3.9%
d) 81 hits total, or 55 more hits this season
e) part-to-whole; batting average relates the number of hits to the total number of times at bat.
f) i) No, a batter cannot have more hits than the number of times at bat.
ii) Yes, if a batter had only one hit, and was at bat more than 100 times.
iii) Yes. For example: if a batter was to get 3 hits out of 77 times at bat, the batting average will be a fractional percent.

Chapter 9 Statistics and Probability

Get Ready, pages 300–301

1.

Fraction	Decimal	Percent
$\frac{1}{2}$	0.5	50%
$\frac{2}{3}$	$0.\overline{6}$	$66.\overline{6}$%
$\frac{2}{10}$ or $\frac{1}{5}$	0.2	20%
$\frac{37}{100}$	0.37	37%
$\frac{80}{100}$ or $\frac{8}{10}$ or $\frac{4}{5}$	0.8	80%
$\frac{125}{100}$ or $\frac{5}{4}$	1.25	125%

2. a) 75¢, $0.75 **b)** $\frac{75}{100}$ or $\frac{3}{4}$ **c)** 75%

3. a) equivalent **b)** not equivalent **c)** not equivalent **d)** equivalent

4. a) $\frac{3}{8}$ **b)** $\frac{1}{2}$ **c)** $\frac{7}{10}$

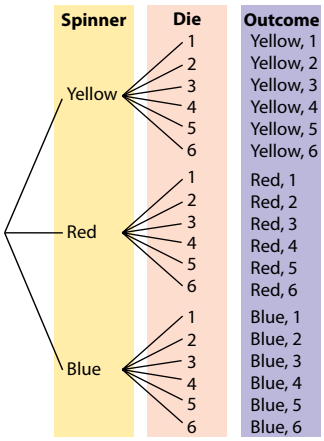
5. $\frac{1}{6}, \frac{3}{5}, \frac{2}{3}, \frac{7}{10}, \frac{11}{15}$

6. a) yellow $= \frac{4}{8}$, blue $= \frac{3}{8}$, red $= \frac{1}{8}$

b) yellow: $\frac{4}{8}$ or $\frac{1}{2}$, 0.5, 50%, blue: $\frac{3}{8}$, 0.375, 37.5%, red: $\frac{1}{8}$, 0.125, 12.5%

7. a)

		Die					
		1	2	3	4	5	6
Spinner	Yellow	Y1	Y2	Y3	Y4	Y5	Y6
	Blue	B1	B2	B3	B4	B5	B6
	Red	R1	R2	R3	R4	R5	R6



b) (Y, 1), (Y, 2), (Y, 3), (Y, 4), (Y, 5), (Y, 6), (B, 1), (B, 2), (B, 3), (B, 4), (B, 5), (B, 6), (R, 1), (R, 2), (R, 3), (R, 4), (R, 5), (R, 6)

c) $\frac{3}{18}$ or $\frac{1}{6}$

9.1 Mean, Median, and Mode, pages 302–307

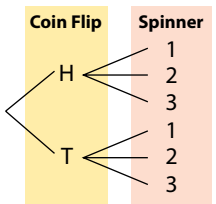
1. a) 6 **b)** 2 **c)** 60
2. a) 3 **b)** 18 and 21 **c)** 8
3. a) median = 6, mode = 6
b) median = 10, no mode
c) median = 18, mode = 18
4. a) mean = 7.5, median = 7.5, no mode
b) mean = 2.3, median = 1.9, modes = 1.4, 1.6, and 2.2
c) mean = 100, median = 100, no mode
d) mean = 9, median = 10, mode = 11
e) mean = 10, median = 10, modes = 6, 10, and 14
5. Mean and average have the same meaning, so the mean would be more useful than the median.
6. Answers and explanations will vary. For example: 2, 3, 3, 3, 5.
7. Yes. The numbers must be reordered to determine the median.
8. a) 6
b) Redistribute the cubes so that all towers are the same height.
9. 8.5
10. mode = 3. Explanations will vary. For example: if they can increase the number of goals in each game by one, they are more likely to win.
11. 42,000
13. a) 11 **b)** \$15 per hour **c)** \$16 per hour
d) The modes would now be \$15 per hour, \$16 per hour, and \$18 per hour, but the median would not change.
14. a) 100 g and 110 g **b)** 102.5 g
c) median = 100 g, modes = 100 g and 110 g
15. Answers will vary. For example: 7, 7, 15, 16
16. a) 4 **b)** any number except 5 or 6
17. a) 4 **b)** anything 4 or greater

9.2 Choosing Measures of Central Tendency, pages 308–313

1. a) mean = $17.\overline{4}$; median = 13; mode = 11
b) Answers will vary. For example: because one value is significantly higher than the others, median may be preferred.
2. Mode may be preferred to reflect a group's favorite movie.
3. Answers will vary. For example: because one value is significantly higher than the others, median may be preferred.
4. a) mean = $7.91\overline{6}$; modes = 7 and 8
b) mode; the number of each size that have sold is important for knowing which sizes need to be restocked.
6. Explanations will vary.
a) mean **b)** mode **c)** median **d)** mean **e)** mode
7. a) median = 21.5 min, mean = 21.5 min
b) modes = 19 and 24; Answers will vary. For example: the mean of the two modes is the same as the mean and median for the entire data set.
c) Mean may be preferred because all of the times are very close to each other. She averages 21.5 min per game.
9. a) approximately 7.5 **b)** 7.3 **c)** 6.8
d) Mean may be preferred because there are no obvious outliers.
10. a) Answers will vary. For example: this practice can help reduce bias, so one judge cannot influence the outcomes by giving an unfairly high or low score.
b) The mean is slightly altered, the median is not altered, and the mode is eliminated.
11. Answers will vary. For example: the grade 4s averaged 6 cans per student, which is more than any other grade, so they should win the prize.
13. a) median = 7, modes = 4 and 8, mean = 6.4
b) Answers will vary. For example: the mean may be preferred because it is the average.
c) Answers will vary. For example: Min should likely make between 7 and 9 free throws, based on her most recent performance.
d) Answers will vary. For example: none of the measures of central tendency account for improvement over time.
14. Answers will vary. One example is 1, 1, 28, 82.
15. a) 39.25
b) 43; 80% of 250 total marks available is 200. He already has 157, so he needs 43 more.
16. 2, 7, 7, 8

9.3 Determine Probabilities Using Tree Diagrams and Tables, pages 314–321

1. a)



b) (H, 1), (H, 2), (H, 3), (T, 1), (T, 2), (T, 3)

c) $\frac{1}{6}$ or $0.1\overline{6}$ or $16.\overline{6}\%$

2. a)

		Spin 2		
		T	W	O
Spin 1	T	T,T	T,W	T,O
	W	W,T	W,W	W,O
	O	O,T	O,W	O,O

b) $\frac{1}{9}$ or $0.\overline{1}$ or $11.\overline{1}\%$ **c)** $\frac{1}{3}$ or $0.\overline{3}$ or $33.\overline{3}\%$

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

b) $\frac{6}{16}$ or $\frac{3}{8}$ or 0.375 or 37.5%

c) $\frac{4}{16}$ or $\frac{1}{4}$ or 0.25 or 25%

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

b) $\frac{4}{30}$ or $\frac{2}{5}$ or $0.1\overline{3}$ or $13.\overline{3}\%$ **c)** $\frac{15}{30}$ or $\frac{1}{2}$ or 0.5 or 50%

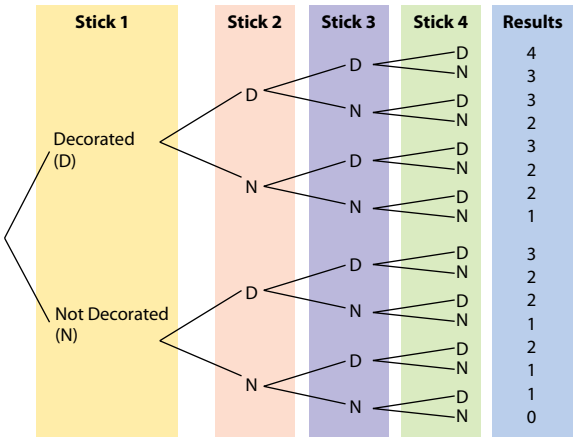
d) $\frac{10}{30}$ or $\frac{1}{3}$ or $0.\overline{3}$ or $33.\overline{3}\%$

5. a) the probability of flipping heads and rolling a 3

b) Only one branch leads from H to 3, so the probability is 1 out of the total number of branches.

6. Determine the number of branches that include HHT in any order, and divide that number by the total number of branches.

7. a) and **b)**



c) $\frac{4}{16}$ or $\frac{1}{4}$ or 0.25 or 25%

9. a)

		Second Baby	
		B	G
First Baby	B	B,B	B,G
	G	G,B	G,G

b) $\frac{2}{4}$ or $\frac{1}{2}$ or 0.5 or 50%

c) Answers will vary. For example: that the probability of a boy is the same as the probability of a girl.

d) $\frac{1}{8}$ or 0.125 or 12.5%

10. He is not correct. There are four possible outcomes; (H, H), (H, T), (T, H), (T, T)

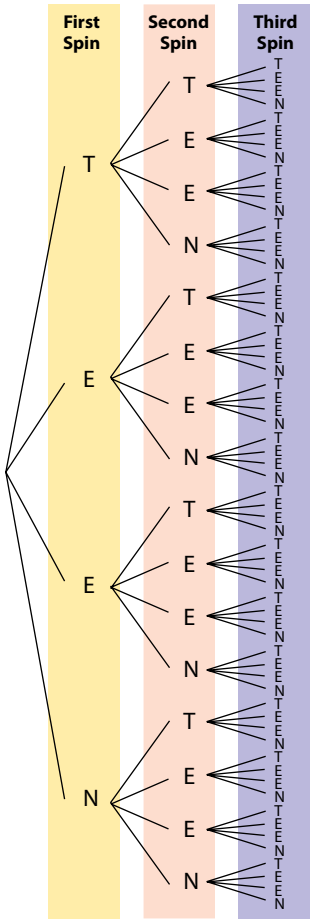
11. a) (T, T), (T, N), (T, E1), (T, E2), (N, T), (N, N), (N, E1), (N, E2), (E1, T), (E1, N), (E1, E1), (E1, E2), (E2, T), (E2, N), (E2, E1), (E2, E2)

b) $\frac{2}{16}$ or $\frac{1}{8}$ or 0.125 or 12.5%

c) $\frac{4}{16}$ or $\frac{1}{4}$ or 0.25 or 25%

d) $\frac{6}{16}$ or $\frac{3}{8}$ or 0.375 or 37.5%

13. a)



b) $\frac{8}{64}$ or $\frac{1}{8}$ or 0.125 or 12.5%

c) $\frac{2}{64}$ or $\frac{1}{32}$ or 0.031 25 or 3.125%

d) $\frac{42}{64}$ or $\frac{21}{32}$ or 0.656 25 or 65.625%

14. a) $\frac{8}{36}$ or $\frac{2}{9}$ or $0.\overline{2}$ or $22.\overline{2}\%$

b) $\frac{18}{36}$ or $\frac{1}{2}$ or 0.5 or 50%

c) $\frac{15}{36}$ or $\frac{5}{12}$ or $0.41\overline{6}$ or $41.\overline{6}\%$

d) $\frac{8}{36}$ or $\frac{2}{9}$ or $0.\overline{2}$ or $22.\overline{2}\%$

9.4 Determining Probabilities Using Fractions, pages 322–331

1. a)

		Die					
		1	2	3	4	5	6
Spinner	A	A,1	A,2	A,3	A,4	A,5	A,6
	B	B,1	B,2	B,3	B,4	B,5	B,6

b) $\frac{1}{2}$ **c)** $\frac{1}{6}$ **d)** $\frac{1}{12}$

2. a)

		Die					
		1	2	3	4	5	6
Coin	Heads	H,1	H,2	H,3	H,4	H,5	H,6
	Tails	T,1	T,2	T,3	T,4	T,5	T,6

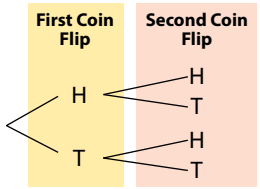
There are 12 possible outcomes.

b) $\frac{1}{12}$ **c)** $\frac{1}{4}$

3. a) $\frac{3}{4}$ **b)** $\frac{3}{5}$ **c)** $\frac{9}{20}$

4. a) $\frac{1}{2}$ **b)** $\frac{1}{4}$

c)



5. a) $\frac{1}{24}$ **b)** $\frac{3}{8}$

6. First, calculate the probability of getting a red marble: $\frac{3}{5}$. Calculate the probability of getting a nickel: $\frac{2}{6}$. Multiply them together to get the probability of getting a red marble and a nickel: $\frac{1}{5}$.

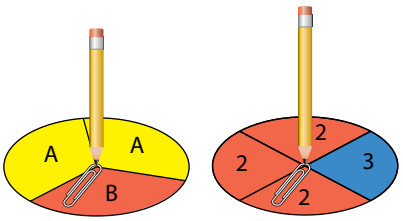
7. 15%

8. a) There are only 2 types of marbles, but there is not the same number of each, therefore, P(black) is not $\frac{1}{2}$. The same argument follows for the coins.

b) $\frac{4}{15}$

10. $\frac{3}{7}$; approximately 0.429; approximately 42.9%

11. a)



b) $\frac{1}{2}$ **c)** $\frac{1}{12}$

12. a) $\frac{3}{8}$ **b)** $\frac{3}{24}$

c) The situations in parts a) and b) do not take into account the probabilities that Jeremy is happy with either his appetizer or his main course.

13. a) $\frac{2}{5}$ **b)** $\frac{3}{8}$

14. $\frac{7}{30}$ or $0.2\overline{3}$ or $23.\overline{3}\%$

15. a) $\frac{1}{169}$ **b)** $\frac{12}{169}$ **c)** $\frac{3}{169}$

16. $P(\text{C}) = \frac{3}{5}$; the numerator must be 3 because $1 \times 3 \times 3 = 9$, and the denominator must be 5 because $2 \times 7 \times 5 = 70$.

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

19. $\frac{19}{27}$

Rich Problems, page 332

1. a) Answers will vary. For example: a coin works; heads can represent one team scoring, and tails can represent the other team scoring.
b) Results will vary.
c) Results will vary.
d) Results will vary.
e) Soccer is not random, so the better team will eventually score more times and win more games.

2. The probability of selecting the special coin is $\frac{1}{2}$. If the regular coin is selected, the probability of getting H, H, H is $\frac{1}{8}$. If the 2-headed coin is selected, the probability of getting H, H, H is 1. The probability of selecting the 2-headed coin is still $\frac{1}{2}$.

3. a) Answers will vary. For example: once one goat has been revealed, the probability of winning the car is $\frac{1}{2}$, so there is no advantage either way.
b) Results will vary.
c) The probability of winning is $\frac{1}{2}$ either way.
d) The probability that the car is behind any one of the remaining doors is equal, however the likelihood of winning, decreases as the number of doors increases.
e) Answers may vary.

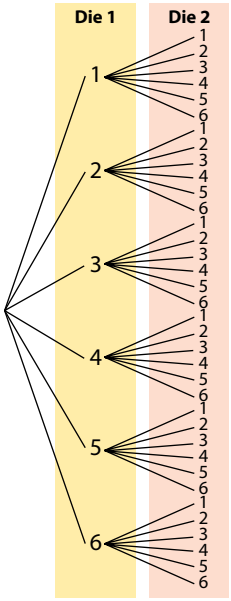
4. Not returning the ball each time increases the probability of you guessing correctly as you are guessing from a smaller number of balls with each successive try.

Chapter 9 Review, pages 333–335

1. approximately 2.7 days
2. mode = 21, median = 20
3. mode = 5, median = 5
4. a) 7 **b)** 24 **c)** 11
5. a) Class A: 1; Class B: 3 **b)** Class A: 3; Class B: approximately 2.53 **c)** Answers will vary. For example: Class B might be selected because every student contributed.
6. a) The mode would be selected because 99% of germs were killed in more than one trial.

b) Answers will vary. For example: the mean might be selected because there are no obvious outliers.

7. a) Answers will vary. For example:

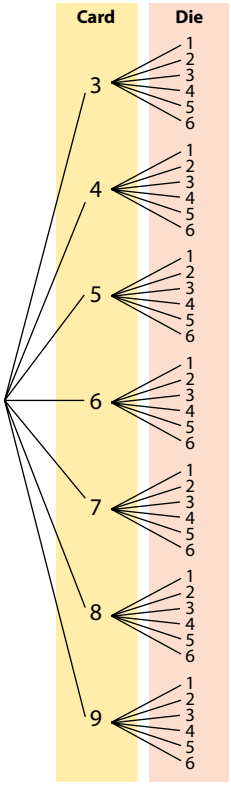


b) $\frac{3}{36}$ or $\frac{1}{12}$ or $0.08\overline{3}$ or $8.\overline{3}$

c) $\frac{6}{36}$ or $\frac{1}{6}$

d) $\frac{6}{36}$ or $\frac{1}{6}$

8. a) Answers will vary. For example:

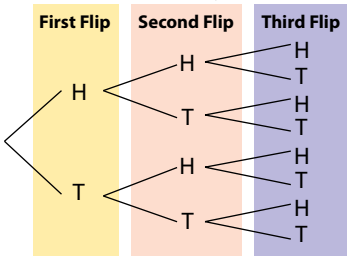


b) $\frac{4}{42}$ or $\frac{2}{21}$

c) $\frac{32}{42}$ or $\frac{16}{21}$

d) $\frac{9}{42}$ or $\frac{3}{14}$

9. a) Answers will vary. For example:



b) $\frac{1}{8}$

c) $\frac{3}{8}$

10. a) (H,1), (H,2), (H,3), (T,1), (T,2), (T,3)

b) 6

c) There are two possible outcomes from the coin, and three from the spinner; $2 \times 3 = 6$

11. a) $\frac{3}{5}$ **b)** $\frac{4}{5}$ **c)** $\frac{12}{25}$

12. a) 0.05 **b)** 0.02 **c)** The answer to part b) reflects the probability of it snowing in Nanaimo, Chilliwack, and Whistler on that day.

13. a) 25% **b)** 15%

c) Answers will vary. For example: the number of trials is quite low.

d) Answers will vary. For example: the experimental probability should be closer to 25%. As the sample size increases, the experimental probability tends to approach the theoretical probability.

14. 62%

15. a) $\frac{6}{216}$ or $\frac{1}{36}$ **b)** $\frac{108}{216}$ or $\frac{1}{2}$

16. a) \$18.25 **b)** approximately 91.5%

c) Answers will vary. For example: \$38.20

d) Answers will vary. For example: his current mean bill is \$38.20 per month, so he should not switch plans. If, however, he wants the ability to send more texts, for an additional \$1.75 per month, he could have unlimited texting.