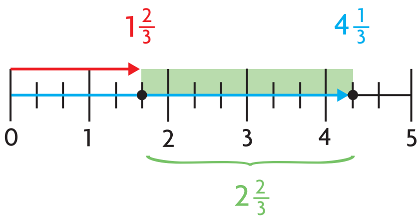
Answers

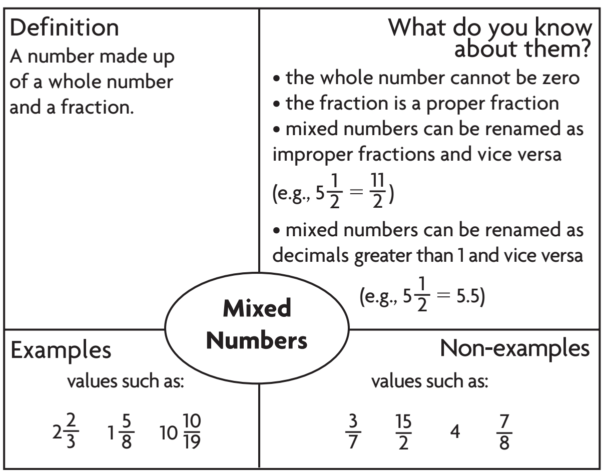
Chapter 1

Getting Started, page 4

1. a) iv) d) vii) g) viii)
   b) ix) e) ii) h) v)
   c) vi) f) i) i) iii)
2. a) $\frac{5}{6}$ b) $\frac{7}{8}$ c) $\frac{9}{10}$ d) $1\frac{1}{15}$
3. a) $\frac{1}{6}$ b) $\frac{5}{8}$ c) $\frac{3}{10}$ d) $\frac{5}{14}$
4. a) $\frac{1}{8}$ b) $\frac{1}{2}$ c) $\frac{3}{25}$ d) $\frac{2}{15}$
5. $5\frac{7}{4} = 6\frac{3}{4}$ 
6. $\frac{8}{12} + \frac{9}{12} = \frac{17}{12} = 1\frac{5}{12}$
7. a)

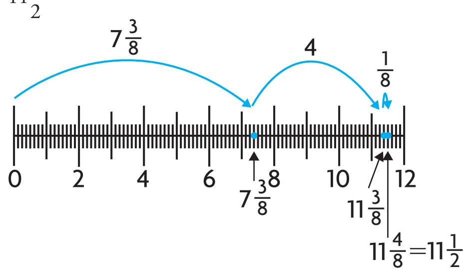


   b) $4\frac{1}{3} - 1\frac{2}{3} = 2\frac{2}{3}$
8. a) $\frac{9}{20}$ b) $\frac{5}{6}$
9. a) 4 b) -7 c) 15 d) 5
10. 7 shots
11. a) -24 b) 15 c) -20 d) 2
12. a) 4.22 b) 11.49 c) 0.66 d) 20
13. a) $8 \times 8 = 64$ b) $5.2 \times 5.2 \times 5.2 = 140.608$
14. a) -1 b) 65
15. Answers may vary, e.g.,

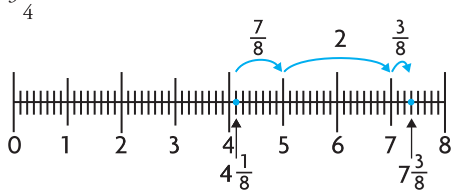


Lesson 1.1, page 16

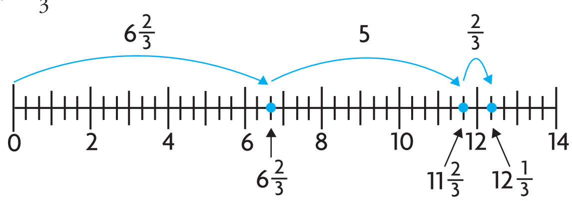
1. a) 4 b) $4\frac{1}{3}$
2. a) First, I would model each of the mixed numbers using whole strips and the appropriate fraction strips. Since the $\frac{1}{6}$ strips are not the same length as the $\frac{1}{2}$ strip, I would replace the $\frac{1}{2}$ strip with 3 of the $\frac{1}{6}$ strips since $\frac{1}{2} = \frac{3}{6}$. Then, I would have 10 whole strips and 8 $\frac{1}{6}$ strips. Since 6 of the $\frac{1}{6}$ strips make a whole, I would replace them with 1 whole strip to make 11 whole strips and 2 $\frac{1}{6}$ strips. But 2 $\frac{1}{6}$ strips are the same length as 1 $\frac{1}{3}$ strip. The value of the expression is $11\frac{1}{3}$.
   b) First, I would model $9\frac{1}{8}$ using 9 whole strips and 1 $\frac{1}{8}$ strip. Since I have to subtract $6\frac{3}{4}$, I would remove 6 whole strips. Then, I would have $3\frac{1}{8}$ left, but I still need to subtract $\frac{3}{4}$. If I take $\frac{3}{4}$ away from one of the whole strips, then that strip would still have $\frac{1}{4}$ left and I would also have 2 whole strips and the $\frac{1}{8}$ strip. I could replace the $\frac{1}{4}$ strip with 2 $\frac{1}{8}$ strips so my fraction parts are all the same length. The value of the expression is $2\frac{3}{8}$.
3. a) $11\frac{1}{2}$



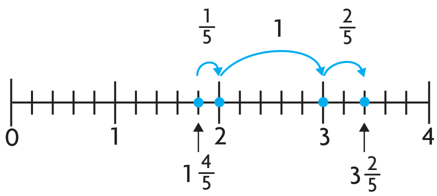
   b) $3\frac{1}{4}$



   c) $12\frac{1}{3}$



d) $1\frac{3}{5}$



4. **a)** 12 and 13 **b)** 9 and 10 **c)** 16 and 17 **d)** 8 and 9 **e)** 51 and 52 **f)** 53 and 54

5. **a)** $12\frac{2}{3}$ **b)** $9\frac{19}{20}$ **c)** $16\frac{23}{24}$ **d)** $8\frac{7}{15}$ **e)** $51\frac{9}{20}$ **f)** $53\frac{1}{10}$

6. **a)** between 2 and 3 **b)** between 1 and 2 **c)** between 5 and 6 **d)** between 0 and 1 **e)** between 6 and 7 **f)** between 25 and 26

7. **a)** $2\frac{3}{10}$ **b)** $1\frac{5}{12}$ **c)** $5\frac{3}{4}$ **d)** $\frac{71}{72}$ **e)** $6\frac{3}{16}$ **f)** $25\frac{5}{6}$

8. $6\frac{2}{15}$ h

9. **a)** $2\frac{3}{4}$ h **b)** $1\frac{1}{4}$ h

10. $7\frac{11}{12}$ cups

11. **a)** Answers may vary, e.g., $2\frac{3}{10} + 1\frac{1}{2} = 3\frac{4}{5}$. I chose $1\frac{1}{2}$ because it had a different denominator than $3\frac{4}{5}$. Since addition and subtraction are inverse operations, I subtracted $1\frac{1}{2}$ from $3\frac{4}{5}$. Since $2\frac{3}{10}$ did not have 2 as a denominator, I knew I had a valid answer.

OR

Answers may vary, e.g., $1\frac{3}{5} + 2\frac{2}{10}$. I selected whole numbers that add to 3, then split the fraction into two fractions with a sum of $\frac{4}{5}$. I chose $\frac{3}{5}$ and $\frac{1}{5}$. But the denominators had to be different, so I changed $\frac{1}{5}$ to $\frac{2}{10}$.

b) Answers may vary, e.g., $5\frac{3}{10} - 1\frac{1}{2} = 3\frac{4}{5}$. Once again I chose $1\frac{1}{2}$ because it had a different denominator than $3\frac{4}{5}$. This time I added $1\frac{1}{2}$ to $3\frac{4}{5}$ to get a valid answer of $5\frac{3}{10}$.

OR

Answers may vary, e.g, $5\frac{1}{20} - 1\frac{1}{4}$. I decided to start with a different denominator than 5. I chose $5\frac{1}{20}$, then subtracted $3\frac{4}{5}$ from $5\frac{1}{20}$ to get $1\frac{1}{4}$.

12. **a)** Substitute $1\frac{2}{5} + 2$ for $3\frac{2}{5}$. Since $2 - 1\frac{4}{7} = \frac{3}{7}$, the question now becomes $1\frac{2}{5} + \frac{3}{7}$ or $\frac{3}{7} + 1\frac{2}{5}$.

b) Subtracting 2 is like subtracting $1\frac{5}{6}$ and then subtracting another $\frac{1}{6}$. So, $3\frac{5}{6} - 2 = 3\frac{5}{6} - 1\frac{5}{6} - \frac{1}{6}$. By regrouping, the question is $3\frac{5}{6} - \frac{1}{6} - 1\frac{5}{6}$. This is equivalent to $3\frac{4}{6} - 1\frac{5}{6}$ or $3\frac{2}{3} - 1\frac{5}{6}$.

13. **a)** $13\frac{43}{60}$ laps **b)** $3\frac{1}{12}$ laps **c)** $10\frac{19}{30}$ laps **d)** 6720 m

14. 20' $5\frac{3}{8}$ "

15. **a)** Answers may vary, e.g., $63\frac{8}{13} + 27\frac{4}{7}$.

b) I think most people would calculate the answer to my question by creating equivalent fractions for the fraction parts. This method would be easier than renaming the mixed numbers as equivalent improper fractions because the numbers used in the calculation would be a lot smaller.

16. **a)** $1\frac{3}{4}$

b) **i)** 2; **ii)** $\frac{1}{2} - \frac{1}{4} = \frac{2}{4} - \frac{1}{4} = \frac{1}{4}$; **iii)** $2 - \frac{1}{4} = 1\frac{3}{4}$

c) $3\frac{7}{12}$; **i)** 4; **ii)** $\frac{3}{4} - \frac{1}{3} = \frac{9}{12} - \frac{4}{12} = \frac{5}{12}$; **iii)** $4 - \frac{5}{12} = 3\frac{7}{12}$

d) $1\frac{11}{15}$; **i)** 2; **ii)** $\frac{2}{3} - \frac{2}{5} = \frac{10}{15} - \frac{6}{15} = \frac{4}{15}$ **iii)** $2 - \frac{4}{15} = 1\frac{11}{15}$

e) The whole part for the second mixed number was always less than the whole part for the first mixed number. So, the difference can be found between the whole parts to see how many whole parts remain. The second mixed number's fraction part was always greater than the first mixed number's fraction part. So, you would have to subtract the fraction part in the first mixed number and then take a little more away. Finding the difference in part ii) meant finding how much greater the second fraction part was. This is what would still have to be taken away. Since there weren't enough fraction parts to take it away from, the remaining fraction is taken away from the whole parts.
Looking at the process algebraically:

$$
\begin{aligned}
3\frac{1}{4} - 1\frac{1}{2} &= 3 + \frac{1}{4} - \left(1 + \frac{1}{2}\right) \\
&= 3 + \frac{1}{4} - 1 - \frac{1}{2} \\
&= 3 - 1 - \frac{1}{2} + \frac{1}{4} \\
&= 3 - 1 - \left(\frac{1}{2} - \frac{1}{4}\right) \\
&= 2 - \frac{1}{4} \\
&= 1\frac{3}{4}.
\end{aligned}
$$

17. The smaller number is $1\frac{1}{4}$ and the larger number can be any mixed number.

Lesson 1.2, page 28

1. a) $6\frac{3}{4} \times 4\frac{2}{3}$ b) $31\frac{1}{2}$
2. $\frac{15}{2} \times \frac{12}{5} = 18$
3. $4\frac{1}{2} \div 1\frac{1}{4} = 3\frac{3}{5}$
4. $\frac{22}{15} \times \frac{25}{36} = 1\frac{1}{54}$
5. a) i) $3\frac{2}{5} \times 1\frac{2}{3}$ ii) $5\frac{1}{2} \times 2\frac{3}{4}$
   b) i) $5\frac{2}{3}$ ii) $15\frac{1}{8}$
6. a) about 6 c) about $5\frac{1}{2}$
   b) about 42 d) about 6
7. a) $10\frac{1}{9}$ c) $5\frac{3}{16}$ e) 22
   b) $4\frac{2}{3}$ d) $19\frac{1}{6}$ f) $6\frac{4}{7}$
8. a) 7 b) 4 c) 19
9. a) $\frac{27}{64}$ b) $\frac{125}{8}$ c) $\frac{4096}{125}$
10. a) 3 c) $3\frac{5}{8}$ e) $\frac{52}{63}$
    b) $\frac{25}{76}$ d) $\frac{3}{4}$ f) $1\frac{67}{108}$
11. a) i) $\frac{2}{3}$ ii) $2\frac{1}{3}$ iii) $1\frac{3}{4}$
    b) $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$
    $\frac{2}{3} \div \frac{1}{4} = \frac{8}{12} \div \frac{1}{4} = \frac{8 \div 1}{12 \div 4} = \frac{8}{3} = 2\frac{2}{3}$
12. a) $\frac{57}{2} = 28\frac{1}{2}$ b) $\frac{2}{7}$
13. a) 26 m b) $42\frac{1}{4}$ m^2
14. a) 9 feet b) 78 blocks
15. $5\frac{1}{2} = \frac{11}{2}$ and its reciprocal is $\frac{2}{11}$. Dividing by $\frac{11}{2}$ is the same as multiplying by its reciprocal, $\frac{2}{11}$.
16. Any whole number 8 or greater.
17. a) i) $19\frac{5}{6}; 3\frac{1}{2}$ ii) $4\frac{1}{14}; 4\frac{3}{4}$ iii) $15\frac{3}{10}; 6\frac{4}{5}$
    b) The triangles' values equal the first values in the first statements. The second statements deal with the inverse operation of the first statements. Multiplication and division are inverse operations.
    c) Answers may vary, e.g., $2\frac{2}{5} \div 3\frac{1}{8} = 7\frac{1}{2}; 7\frac{1}{2} \div 3\frac{1}{8} = 2\frac{2}{5}$.
18. 6 large bottles
19. $14.82
20. $5 \div 10 = \frac{1}{2}$, so a value *less than* 5 divided by 10 is less than $\frac{1}{2}$.
21. The first step is an extra step. This adds another chance of making a mistake. With this method, most of the numbers will get a lot bigger, making the multiplication step more difficult. It is easier to multiply smaller numbers than to multiply large numbers.
22. Answers may vary, e.g., $30\frac{1}{4}, 35\frac{3}{4}$.
23. $\frac{3}{4}$ units by $\frac{3}{4}$ units

Lesson 1.3, page 35

1. a) negative c) positive e) negative
   b) negative d) negative f) positive
2. a) -8 c) 8 e) -16
   b) -8 d) -16 f) 16
3. a) $-49 - 2(-27) = -49 - (-54) = -49 + 54 = 5$
   b) $-16 - (16) - 16 = -32 - 16 = -48$
4. a) 6 b) -2 c) -10
5. a) 3 c) 5 e) 2
   b) 3 d) 3 f) (-2) or -2
6. a) -125 c) -64 e) -81
   b) 36 d) -64 f) 27
7. 8, (-8)
8. a) -40 c) 64 e) 2
   b) 47 d) -23 f) -8
9. a) error in second line; in the square brackets, must multiply before subtract
   $-4[5 - 2(-3)]$
   $= -4[5 - (-6)]$
   $= -4(5 + 6)$
   $= -4(11)$
   $= -44$
   b) error in second line; evaluate the power before multiply
   $-2(3)^2$
   $= -2(9)$
   $= -18$
10. Robin reasoned that 5 groups of -2 tiles subtract 3 groups of -2 tiles makes 2 groups of -2 tiles, which is -4.
11. a) 3 c) -27 e) -2
    b) 80 d) -8 f) -1
12. 23
13. a) Negative. If n is odd, then both $-b^n$ and $(-b)^n$ would have negative values. When you add two negative values, the answer would be negative.
    b) Zero. If n is even, then $-b^n$ would be negative and $(-b)^n$ would be positive. The magnitudes of the numbers would be equal, so the values would be opposites. The sum of two opposite numbers is zero.
14. a) i) -128 ii) 256 iii) 64
    b) i) $(-2)^7$ ii) $(-2)^8$ iii) $(-2)^6$
    c) Keep the common base -2 and add the exponents.
15. a) i) 9 ii) 81 iii) 81
    b) i) $(-3)^2$ ii) $(-3)^4$ iii) $(-3)^4$
    c) Keep the common base -3 and subtract the exponents.
16. a) When the same value of n is substituted into both expressions, the expressions will always give the same answer.
    b) $3(2^n) - 2^n$ is the same as $(3 - 1)(2^n) = 2(2^n)$. This is 2^{n+1}.

Mid-Chapter Review, page 40

1. a) $9\frac{5}{6}$ b) $6\frac{3}{20}$ c) $\frac{1}{12}$ d) $4\frac{12}{35}$
2. a) Answers may vary, e.g., whole numbers add to 9 and the sum of the fraction parts are a little less than one whole. The answer is between 9 and 10, but closer to 10.

b) Answers may vary, e.g., $\frac{2}{5}$ is $\frac{1}{4}$ + a bit. So, the fraction parts add to 1 + a bit. The whole numbers add to 5. The answer is a bit more than 6.

c) Answers may vary, e.g., whole numbers subtract to zero. $\frac{3}{4} - \frac{2}{4} = \frac{1}{4}$. Since $\frac{2}{3}$ is larger than $\frac{2}{4}$, $\frac{3}{4} - \frac{2}{3}$ would be less than $\frac{1}{4}$. The answer is between 0 and $\frac{1}{4}$.

d) Answers may vary, e.g., $9 - 4 = 5$. Since $\frac{4}{5}$ is larger than $\frac{1}{7}$, the answer would have to be less than 5. The answer is between 4 and 5.

3. $9\frac{3}{4}$ h

4. $3\frac{1}{5} = 3 + \frac{1}{5}$. Now subtract $2\frac{1}{4}$ from 3. 3 is $2 + \frac{4}{4} - 2\frac{1}{4} = \frac{3}{4}$. Now you have $\frac{3}{4} + \frac{1}{5}$.

5. **a)** $\frac{21}{22}$ **b)** $2\frac{2}{35}$ **c)** $8\frac{2}{3}$ **d)** $34\frac{4}{5}$

6. **a)** $11\frac{1}{2}$ **b)** $\frac{2}{23}$ **c)** $3\frac{1}{13}$ **d)** $1\frac{127}{128}$

7. **a)** $2\frac{5}{6}$ **b)** $\frac{1}{2}$ **c)** $24\frac{8}{9}$ **d)** $1\frac{1}{2}$

8. $9\frac{5}{12}$"

9. $1\frac{3}{8} \div \frac{11}{64} = 8$ rows and $2 \div \frac{1}{8} = 16$ characters per row. $8 \times 16 = 128$ characters.

10. **a)** 121 **b)** −64 **c)** −49 **d)** −216

11. Answers may vary, e.g., $(-8)^2$, 2^6, $(-2)^6$, 4^3.

12. 253

13. **a)** 14 **b)** −28 **c)** 5 **d)** 1

Lesson 1.4, page 45

1. **a)** $\frac{-9}{4}$ **b)** $\frac{-41}{7}$

2. **a)** 0.2 **b)** $-0.\overline{571428}$ **c)** −0.75 **d)** $-7.8\overline{3}$

3. **a)** $-\frac{7}{20}$ **b)** $\frac{37}{8}$ **c)** $-\frac{573}{50}$

4. **a)** −2.25 **c)** −0.75 **e)** 1.75
b) −1.5 **d)** 0.5

5. **a)** $-\frac{11}{3}$ **c)** $-\frac{2}{3}$ **e)** $\frac{8}{3}$
b) $\frac{7}{3}$ **d)** $\frac{4}{3}$

6. Tammy is correct. Jasmine's error is when she added in this step: $\frac{(-2 \times 2 + 1)}{2}$. She should subtract $\frac{(-2 \times 2 - 1)}{2}$.

7. **a)** > ; zero is greater than every negative value.
b) < ; −4.3 is to the left of −3.4.
c) < ; all negative values are less than positive values.
d) = ; decimal values are equal.
e) = ; decimal values are equal.
f) > ; $-2\frac{3}{10}$ is further to the right on the number line.

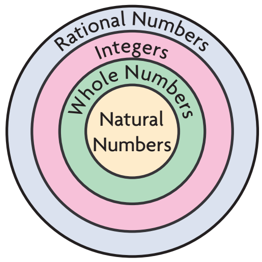
8. $-3\frac{1}{4} = -1 \times 3\frac{1}{4} = -\left(3 + \frac{1}{4}\right) = -3 - \frac{1}{4}$, whereas $-3 + \frac{1}{4} = -2\frac{3}{4}$.

9. **a)** Answers may vary, e.g., $\frac{5}{16}, \frac{7}{24}, \frac{8}{24}$ or $\frac{1}{3}$.
b) Use the opposites, e.g., $-\frac{5}{16}, -\frac{7}{24}, -\frac{1}{3}$.
c) Yes, since they are fractions. Any number that can be expressed as a fraction, without a denominator of zero, is a rational number.

10. **a)** True. Write the whole number followed by the decimal part, which is the numerator of the fraction part divided by the denominator. Put a bar over the digits that repeat.
b) False. Zero is an integer but cannot be a denominator.
c) False. They must also be the same distance from zero.
d) True. Any positive number is greater than any negative number.

11. **a)** $\frac{13}{30}$ **b)** $\frac{1}{6}$ **c)** $\frac{19}{75}$

12.



13. $-a > -b$; Suggestion: plot a, b, and their opposites on a number line to help explain.

Lesson 1.5, page 53

1. **a)** −5.0 **b)** −19.0 **c)** −7.0 **d)** −16.0

2. **a)** −1 **b)** $-\frac{1}{2}$ **c)** $\frac{24}{35}$ **d)** $-\frac{16}{25}$

3. all

4. **a)** 76 and 77 **c)** −16 and −15
b) 65 and 66 **d)** −1 and 0

5. **a)** 76.54 **c)** −15.3
b) 65.65 **d)** −0.3046

6. **a)** \$53.87 **b)** −\$0.87

7. $-18.9\overline{6}$ °C

8. **a)** $1\frac{3}{8}$ **c)** $-15\frac{17}{20}$ **e)** $-9\frac{2}{15}$
b) $-2\frac{5}{6}$ **d)** $-\frac{3}{10}$ **f)** $1\frac{1}{4}$

9. **a)** $\frac{2}{9}$ **c)** $-32\frac{1}{7}$ **e)** −8
b) 4 **d)** $-\frac{9}{10}$ **f)** $2\frac{8}{13}$

10. $\frac{7}{12}$ h, or 35 min

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

12. **a)** **i)** $2\frac{1}{6}$; $-3\frac{1}{2}$ **ii)** $15\frac{3}{10}$; $-6\frac{4}{5}$

b) The triangles' values are the same as the first values in the first statements. The second statements deal with the inverse operation of the first statements.

c) Answers may vary, e.g., $4\frac{2}{7} \div -1\frac{7}{8} = -2\frac{2}{7}$; $-2\frac{2}{7} \times -1\frac{7}{8} = 4\frac{2}{7}$.

13. **a)** +;18.56 **c)** −; −44.05 **e)** −; $-1.91\overline{6}$
b) −; −70.3 **d)** −; −123.008 **f)** −; −4.5

14. **a)** $-3\frac{49}{60}$ **b)** $1\frac{4}{5}$ **c)** $-\frac{23}{24}$ **d)** $8\frac{7}{16}$

15. **a)** $36\frac{2}{3}$ °C **b)** $-38\frac{8}{9}$ °C **c)** 32 °F

16. **a)** 212 °F **b)** 98.6 °F

17. **a)** −16.18 **c)** $-3\frac{1}{8}$
b) −54.59 **d)** $-2\frac{1}{6}$

18. **a)** $2\frac{9}{10}$ or −2.9 **b)** 16.781 25 or $16\frac{25}{32}$

19. 1:31:57.7 h; almost 1 h 32 min longer

20. **a)** $-1\frac{7}{20}$
b) $-1\frac{17}{42}$
c) −1.35; $-1.4\overline{047619}$
d) Answers may vary, e.g., for part a), I would prefer decimal form because the values were not so large to calculate and each was a terminating decimal. For part b), I would prefer fraction form because the fractions were easier to calculate than the repeating decimals.

21. **a)** −1.6875 or $-1\frac{11}{16}$ **b)** $-5\frac{7}{27}$ or $-5.\overline{259}$

22. **a)** $1 + \cfrac{1}{1 + \cfrac{1}{\left(\frac{3}{2}\right)}} = 1 + \cfrac{1}{\left(1 + \frac{2}{3}\right)} = 1 + \left(\cfrac{1}{\frac{5}{3}}\right)$

$= 1 + \frac{3}{5} = \frac{8}{5}$

b) $1\frac{4}{5} = 1 + \frac{4}{5} = 1 + \left(\cfrac{1}{\frac{5}{4}}\right) = 1 + \cfrac{1}{1 + \frac{1}{4}}$

23. length × width: $21\frac{1}{3}$ m × $5\frac{1}{3}$ m

Lesson 1.6, page 62

1. **a)** 20.25 **c)** −91.125
b) −20.25 **d)** −91.125

2. **a)** positive **c)** negative **e)** negative
b) negative **d)** positive **f)** positive

3. **a)** $\frac{4}{9}$ **c)** $-\frac{4}{9}$ **e)** $-\frac{8}{27}$
b) $-\frac{4}{9}$ **d)** $\frac{8}{27}$ **f)** $\frac{32}{243}$

4. **a)** subtract in the brackets, square the answer, multiply answer by 2, add result to −4.5
b) 85.28

5. **a)** −1.34 **c)** 0 **e)** $19.56\overline{7}$
b) 59.582 **d)** 3.96 **f)** $-0.75\overline{18}$

6. **a)** $\frac{2}{9}$ **c)** $\frac{369}{400}$ **e)** $\frac{13}{56}$
b) $-2\frac{1}{27}$ **d)** $689\frac{1}{16}$ **f)** $\frac{625}{16}$ or $39\frac{1}{16}$

7. **a)** 2; answers may vary, e.g., I multiplied 2.4 by itself until the answer was 5.76.
b) 2; answers may vary, e.g., I used the result from part a) to get the answer.
c) 3; answers may vary, e.g., I multiplied 3.5 by itself until the answer was 42.875.
d) −3.5; answers may vary, e.g., looking at part c), I knew the base would have to be the same but negative.

8. **a)** Rob earned more interest because the money he invested had more time to earn interest.
b) Rob: \$162.89; Sharon: \$161.05

9. **a)** Diego's investment earns interest twice a year, every year for 5 years. So, interest would be earned 10 times at the end of 5 years.
b) \$2687.83

10. **a)** Tanjay: \$148.02; Eda: \$148.59
b) Eda's investment earned interest more often.

11. **a)** 500 g; 250 g; $\frac{125}{128}$ g
b) 0; nothing of the sample remains after 1 year.

12. **a)** 19.25 **c)** −2.375
b) −12.75 **d)** −225.792

13. **a)** $-\frac{3}{16}$ **c)** $39\frac{4}{5}$
b) $\frac{17}{27}$ **d)** $19\frac{3}{4}$

14. Both sides of first equality yield $-\frac{27}{8}$ or $-3\frac{3}{8}$. The odd exponent keeps positive signs positive and negative signs negative. For $-\left(1\frac{1}{2}\right)^4$, the answer is negative but when the negative is in the brackets and raised to an even exponent, the answer is positive.

15. The sign of the numbers.

16. about \$530.83

17. $x = 2$ or $x = -2$

Chapter Review, page 66

1. **a)** $11\frac{1}{6}$ **b)** $\frac{1}{2}$ **c)** $6\frac{5}{8}$ **d)** $2\frac{1}{12}$

2. $36\frac{9}{16}$ in.

3. $-2\frac{5}{8}$

4. **a)** $6\frac{1}{8}$ **b)** 39 **c)** $\frac{10}{29}$ **d)** $\frac{1}{2}$

5. $5\frac{19}{25}$

6. $5\frac{23}{64}$ m^3

7. **a)** $14\frac{5}{6}$ in. **b)** $12\frac{2}{3}$ in.^{2}

8. For -8^2: multiply 8 by itself to get 64; then multiply 64 by −1 to get −64.
For $(-8)^2$: multiply −8 by itself to get 64.

9. **a)** 9 **b)** −2 **c)** 19 **d)** 3

10. **a)** 21 **b)** 60 **c)** 2 **d)** −1

Answers

11. a) Since $-2.6 = -2 - 0.6$, the number would be 2 units to the left of zero and then another 0.6 further to the left.
b) Since $-\frac{24}{5} = -4\frac{4}{5} = -4 - \frac{4}{5}$, the number would be 4 units to the left of zero and then another $\frac{4}{5}$ further to the left.

12. a) $-\frac{29}{3} = -9\frac{2}{3}$, because $-\frac{31}{3}$ is greater than -10.

13. Callander. $-4\frac{5}{6} = -4.8\overline{3}$, which is further to the left of zero along a number line than -4.8. So, it is a lower (colder) value.

14. a) $-1\frac{1}{3}, \frac{-3}{5}, \frac{1}{-3}$ c) $-0.\overline{3}, -0.3, 0.7$
b) $-2\frac{1}{5}, -\frac{2}{5}, \frac{4}{5}$ d) $-2, -1.5, 0$

15. a) $>$; compare placement of decimal equivalents on number line
b) $>$; compare second decimal digits (hundredths)
c) $=$; compare decimal equivalents
d) $<$; all negative values are less than positive values

16. about $-\$2.26$

17. a) $-3\frac{1}{12}$ c) $-34\frac{1}{2}$
b) $-2\frac{13}{20}$ d) $-2\frac{103}{120}$

18. Answers may vary, e.g., $-3\frac{1}{3} - 6$; $-28\left(\frac{1}{3}\right)$.

19. a) 0.1 c) -1
b) -8.4 d) 1.184

20. a) $-1\frac{1}{3}$ or $-\frac{4}{3}$ c) $-\frac{1}{2}$
b) $-1\frac{1}{3}$ or $-\frac{4}{3}$ d) $-\frac{2}{5}$

21. a) -370.146232 c) $-2\frac{2997}{8000}$
b) 708.681 d) $7\frac{27}{40}$

22. about \$136.86

23. a) $<$; negative values are always less than positive values.
b) $>$; positive values are always greater than negative values.
c) $=$; each equals $\frac{1}{4}$.
d) $<$; compare decimal equivalents.

24. a) 84.9 cm^2 c) 248.7 m^2
b) $21\frac{3}{5}$ $in.^2$ d) $68\frac{2}{5}$ $in.^2$

25. a) $\frac{4}{9}$ c) $2\frac{1}{4}$
b) 1.44 d) -456.533

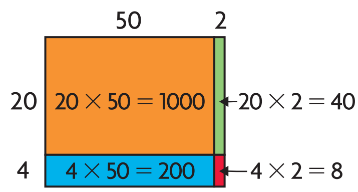
Chapter Self-Test, page 68

1. D. $\frac{4}{5}$
2. C. -10
3. C. $-2\frac{2}{5}, -\frac{11}{5}, \frac{-11}{-5}$
4. a) $9\frac{11}{14}$ b) $6\frac{1}{4}$
5. $19\frac{5}{12}$ in.
6. To calculate $(-2)^2$: multiply -2 by itself; answer $= 4$.
To calculate -2^4: multiply 2 by itself 4 times to get an answer of 16, and then multiply 16 by -1; answer $= -16$.
7. a) -56 b) -1.811
8. $-4\frac{1}{3} = -4.\overline{3}$ and its opposite, $4.\overline{3}$, would be farther to the right of zero along a number line than 4.3. Since $-4\frac{1}{3}$ is the same distance from zero as $4.\overline{3}$, $-4\frac{1}{3}$ is farther from zero than 4.3.
9. a) $1\frac{13}{14}$ b) $-3\frac{5}{9}$
10. -3.58 °C
11. $-5\frac{31}{100}$

Chapter 2

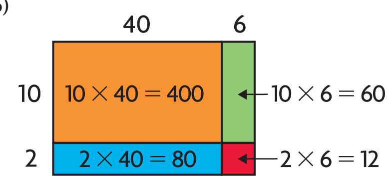
Getting Started, page 72

1. a) i c) iii e) ii
b) v d) iv f) vi
2. a)



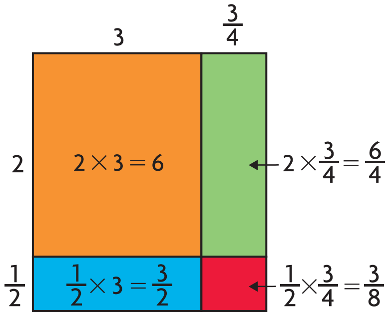
$$\begin{aligned} 24 \times 52 &= (20 + 4) \times (50 + 2) \\ &= 20 \times 50 + 20 \times 2 + 4 \times 50 + 4 \times 2 \\ &= 1000 + 40 + 200 + 8 = 1248 \end{aligned}$$

b)



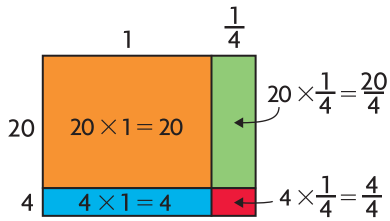
$$\begin{aligned} 12 \times 46 &= (10 + 2) \times (40 + 6) \\ &= 10 \times 40 + 10 \times 6 + 2 \times 40 + 2 \times 6 \\ &= 400 + 60 + 80 + 12 = 552 \end{aligned}$$

c)



$$2\frac{1}{2} \times 3\frac{3}{4} = \left(2 + \frac{1}{2}\right) \times \left(3 + \frac{3}{4}\right)$$
$$= 2 \times 3 + 2 \times \frac{3}{4} + \frac{1}{2} \times 3 + \frac{1}{2} \times \frac{3}{4}$$
$$= 6 + \frac{6}{4} + \frac{3}{2} + \frac{3}{8} = 6 + \frac{6}{2} + \frac{3}{8}$$
$$= 6 + 3 + \frac{3}{8} = 9\frac{3}{8}$$

d)



$$24 \times 1\frac{1}{4} = (20 + 4) \times \left(1 + \frac{1}{4}\right)$$
$$= 20 \times 1 + 20 \times \frac{1}{4} + 4 \times 1 + 4 \times \frac{1}{4}$$
$$= 20 + \frac{20}{4} + 4 + \frac{4}{4}$$
$$= 20 + 5 + 4 + 1 = 30$$

3. **a)** $b + 3c = 1 + 3(-1) = -2$
b) $3b + 2c - d = 3(1) + 2(-1) - 2 = -1$
c) $2a^2 + b - d = 2(0)^2 + 1 - 2 = -1$
d) $3(2b - 3c) = 3[2(1) - 3(-1)] = 15$
e) $-4(a + b + c) = -4(0 + 1 + -1) = 0$
f) $(5c - 6b)^2 = [5(-1) - 6(1)]^2 = (-5 - 6)^2 = 121$

4. **a)** $P = 2(3 + 5) = 16$ cm
b) $A = \frac{(5.5 \times 4)}{2} = 11$ m
c) $V = 12^3 = 1728$ cm
d) $c = \sqrt{a^2 + b^2} = \sqrt{5^2 + 12^2} = 13$ m

5. **a)** 13^4 **b)** $(-8)^6$ **c)** $7^2 \times 6^2$ or 42^2

6. **a)** $7 \times 7 \times 7 \times 7$ **b)** $(-7)(-7)(-7)(-7)$ **c)** $-7 \times 7 \times 7 \times 7$

7. 2×10^3 is 2×1000 or 2000.
6×10^2 is 6×100 or 600.
7×10^1 is 7×10 or 70.
When I add 2000 + 600 + 70 + 3, I get 2673.

8. $1 \times 10^3 + 2 \times 10^2 + 5 \times 10^1 + 4$

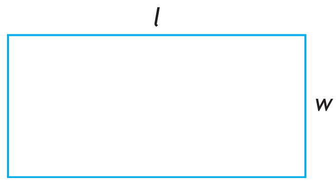
9. 16, 100, 25, 1; because 16 can be thought of as 4×4, 100 as 10×10, 25 as 5×5, and 1 as 1×1.

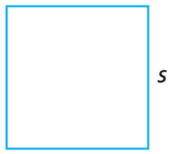
10. $T = 5A + 2.50C$, where T is the total cost.

11. $A = 4s^2 + 2\left(\frac{1}{2}\right)bh$ or $4s^2 + bh$, where A is the total area.

12. Answers may vary, e.g.,

Math term	**Drawing or description**
base of a power	4^3, x^2
My definition	**Reminds me of this**
A base of a power is the number that you multiply together, and the exponent tells you how many times to multiply it. For example, in the power x^2, x is the base.	This also reminds me of the numbers in scientific notation that we sometimes see in science class. In 2.1×10^{23}, for example, the number 10 is the base of the power 10^{23}.

Math term	**Drawing or description**
algebraic expression	$4x + 3y$
My definition	**Reminds me of this**
An algebraic expression has letters and numbers. Sometimes these are combined using addition, subtraction, multiplication and division, and exponents.	The formula for the perimeter of a rectangle $P = 2l + 2w$. 

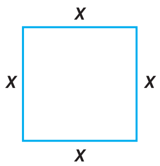
Math term	**Drawing or description**
variable	This square has side length s and area s^2. 
My definition	**Reminds me of this**
A variable is a value that can change. I use a letter like x to represent an amount if I don't have a number value for it.	x and y labels on the axes when I draw a graph.

Lesson 2.1, page 80

1. **a)** c^3 **b)** c **c)** d^2 **d)** d^3

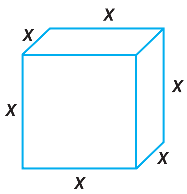
2. **a)** $\sqrt{49} = 7$; 7 cm
b) 10 and 11, because $10 \times 10 = 100$ and $11 \times 11 = 121$

3. a)

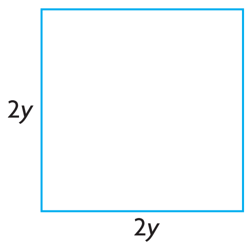


c)

b)



d)



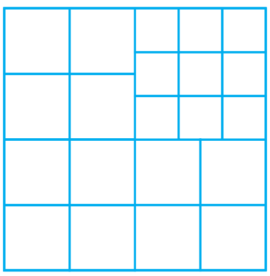
4. a) 12 km; 12 km $\times$ 12 km $=$ 144 km^2
b) Estimate 8.7 cm; 8.7 cm $\times$ 8.7 cm $=$ 75.7 cm^2
c) 0.1 m^2; (0.1 m)(0.1 m) $=$ 0.01 m^2

5. a) $(3y)^3$ c) $\sqrt{(2x^2)}$
b) $2x$ d) $(3y)^2$

6. The better estimate is 7.2 m, since 7 squared is 49 and 8 squared is 64. Since 50 is closer to 49 than to 64, the better estimate is closer to 7 than to 8. We need an area of 50 m^2, and 7.2 m gives an area closer to what is needed.

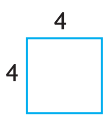
7. The area is 1000 cm^2. I can check by multiplying $\sqrt{1000}$ cm, which is about 31.62 cm, by itself to get the area. The result is 999.82 cm^2 so my answer is correct.

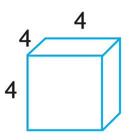
8. a)



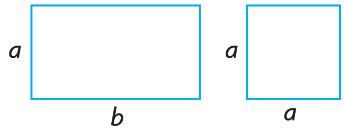
b) and c) The side length is 12 cm because the tiles must be arranged either 2 + 2 + 2 + 3 + 3 or 3 + 3 + 3 + 3 on a side in order to make a square.

9. The term 4^2 can represent the area of a square with side lengths of 4, and the term 4^3 can represent the volume of a cube with side lengths of 4.

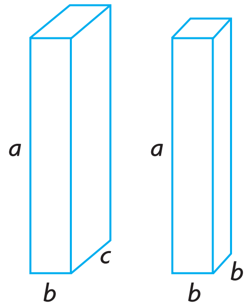




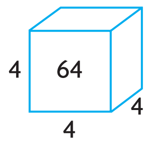
10. Answers may vary, e.g., the rectangle has area ab. The square has area a^2. They're the same because they're both models of two-dimensional area. They're different because the square has all sides the same length, and the rectangle has sides of different lengths. I can see the difference between them by looking at their shapes and the algebraic expressions for their areas.



11. Both are models of the volume of rectangular prisms, but the one at left has 3 different dimensions and its volume is abc. The one at right has 2 dimensions the same, and its volume is ab^2.



12. Answers may vary, e.g., the length of the side of a cube can be thought of as the cube root of its volume. If the volume of a cube is 64, the side of the cube is 4, and this is the cube root of 64. I can check by seeing if 4 $\times$ 4 $\times$ 4 is 64. It is.



Lesson 2.2, page 89

1. a) 2^5 b) x^7
2. a) 2^3 b) y^3
3. a) $2^2 = 4$ b) $(5)(3^2) = 45$
4. a) $\dfrac{x^7}{x^6} = x = 2$ b) $y^3(x) = 250$
5. a) (5^{10}) b) (m^6) c) $(7^4)(x^6)$ d) $\left(\dfrac{2}{5}\right)^9$
6. a) $(n^8)(w^{13})$ c) $2^7(p^{13})$ e) $(x^9)(-2)^4$
b) $(m^9)(r^{10})$ d) $3^6(b^{15})$ f) 3^3a^{10}
7. The bases in each problem are the same, and in each expression the exponents add to 11, so the results are all the same.
8. a) 5^5 b) m^2 c) $2x$ d) $(-5)^2y$
9. a) 7^5a^2 b) $10^2x^3y^4$ or $100x^3y^4$ c) xy^2 d) $\dfrac{y^3}{x}$
10. Answers may vary, e.g.,
$(7^2)(7^2)(7^2)(7^2) = 7^8$
$(7^3)(7)(7^4) = 7^8$
$\dfrac{7^{12}}{7^4} = 7^8$
$\dfrac{7^2 7^{12}}{7^6} = 7^8$

11. a) $2^3 = 8$ c) $(3^3)(7^2) = 1323$ e) $\left(\frac{2}{7}\right)^2 = \frac{4}{49}$

b) $4^4 = 256$ d) 4.2 f) $\left(\frac{4}{5}\right)^3 = \frac{64}{125}$

12. a) $x = 2$ c) $(x)(y^3) = 250$ e) $2(x)(y^3) = 500$

b) $y = 5$ d) $2y^3 = 250$ f) $\left(\frac{3}{4}\right)x^2y = 15$

13. Because the two numbers have the same base, I know that I add the powers to get 10. I also know that I subtract one power from the other to get 2. The powers could be 6 and 4. I can check by seeing that $7^6 \times 7^4 = 7^{10}$ and $\frac{7^6}{7^4} = 7^2$.

14. $(50 \times 10^{12})(6 \times 10^9) = 300 \times 10^{21}$ or 3×10^{23}

15. Answers may vary, e.g., exponents say how many times a base is to be multiplied by itself. If the bases are different, their exponents will say how many times to multiply different numbers. So, I won't be able to add or subtract these exponents and get correct results. For instance, when I work out $4^3 3^2$ I get $4 \times 4 \times 4 \times 3 \times 3 = 576$. However, if I add the exponents I get 4^5, 3^5, or 12^5. These are not the same and do not work out to 576. So to use the exponent principles the bases have to be the same.

16. a)

	Millimetres	Centimetres	Metres	Kilometres
Millimetres		10^{-1}	10^{-3}	10^{-6}
Centimetres	10^1		10^{-2}	10^{-5}
Metres	10^3	10^2		10^{-3}
Kilometres	10^6	10^5	10^3	

b) 500 000 cm c) 4000 mm

17. $40\,000 \text{ cm}^3 = 4 \times 10^4 = 4 \times 10\,000 = 40\,000 \text{ cm}^3$

18. 1.5×10^3 kg

19. a) $\frac{3^5}{3^5} = \frac{243}{243} = 1$

b) $\frac{3^5}{3^5} = 3^{5-5} = 3^0$

c) $\frac{3^5}{3^5} = \frac{\cancel{3 \times 3 \times 3 \times 3 \times 3}}{\cancel{3 \times 3 \times 3 \times 3 \times 3}}$ All of the 3's divide out to leave $\frac{1}{1}$, which is 1.

d) Answers may vary, e.g., based on my answers to a) and c), 3^0 must equal 1.

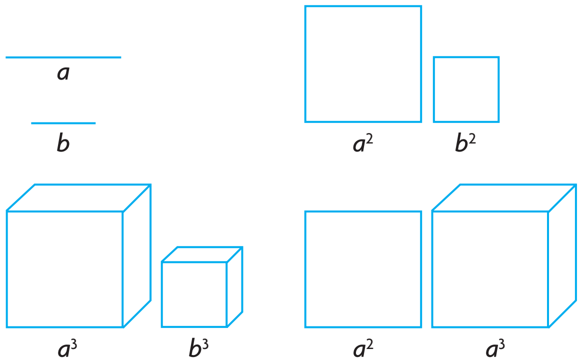
e) Answers may vary, e.g., the power a^0 should have a similar meaning for most values of a. As with a base of 3 above, the exponent 0 will make the expression equal to 1. The only exception would be if $a = 0$. In that case 0^0 is not 1. 0^0 is undefined.

Lesson 2.3, page 96

1. a) 7^{15} b) x^{24} c) c^6
2. a) 2^4 or 4^2 b) 2^6, 4^3, or 8^2 c) 3^8 or 81^2
3. a) 3^8 c) 2^{15} e) x^6
   b) 9^{12} d) 10^{36} f) 5^8
4. a) 4^4 b) 2^8 c) 5^6 d) 3^9
5. Answers may vary, e.g.,
   a) This principle shows that, to simplify a power of a power, you multiply the exponents. For example, $(2^3)^4 = 2^{12}$.
   b) This principle shows that when a power applies to more than one factor, you multiply the exponent of each factor by the exponent outside the brackets. For example, $(2^3 3^4)^2 = (2^3)^2(3^4)^2 = 2^6 3^8$.
   c) This principle shows that when you have the power of a quotient, the outer exponent refers to each term inside the brackets. For example, $\left(\frac{5^2}{4^3}\right)^2 = \left(\frac{5^4}{4^6}\right) = \frac{625}{4096}$.
6. a) 3^{13} c) 2^5 or 32 e) 5^4 or 625
   b) 5^{24} d) 10^2 or 100 f) 3^4 or 81
7. a) y^{12} b) m^6 c) c^9 d) n^{12}
8. a) v^5 c) k^{13} e) x^2
   b) n^{18} d) j^6 f) y^6
9. a) $27a^6$ c) $16m^8$ e) $100a^4b^6$
   b) $25x^{10}$ d) $4096p^8$ f) $27x^{12}y^6$
10. a) $4^{21}3^{10}$ c) $2^2 5^2$ or 100
    b) 2^9x^{22} d) $5^3\frac{a^5}{b^4}$ or $125\frac{a^5}{b^4}$
11. a) $16y^{12}$ c) $6561a^{16}b^4$ or $3^8a^{16}b^4$
    b) $9x^{10}$ d) 5^7a^{14}
12. Answers may vary, e.g.,
    a) The exponents 2×6 and 3×4 both equal 12, and $3^{12} - 3^{12}$ is zero.
    b) The exponents 2×8 and 4×4 both equal 16, and $10^{16} - 10^{16}$ is zero.
    c) The exponents are 2×3 and 3×2, which are equal. The numbers are equal. The first term has an even exponent, so it is positive. The second term has an odd exponent, so it is negative. Sum is 0.
13. $SA = 6(3^5)^2 = 6(3^{10})$; $V = (3^5)^3 = 3^{15}$
14. $25x^2$
15. a) 4 c) 12 e) $\frac{1}{25}$
    b) 125 d) 35 f) 2^{12} or 4096
16. a) $a^3 = 8$ b) $b^6 = 1$ c) $c = 4$ d) $a^2b^2 = 4$
17. $3^{10} = 3^{2 \times 5} = (3^2)^5 = 9^5$
18. a) $x^7 = 128$
    b) $m + n = 7$
    c) Answers may vary, e.g., by using exponent principles, I simplified the expressions a lot. The numbers left were much smaller, and I could work out the answers quickly in my head.
19. a) 6 b) 3 c) 4 d) 12
20. a) 2^{10} b) 3^{12} c) 3^{12} d) $(-5)^{21}$
21. Answers may vary, e.g., I can write 2^{30} as $(2^3)^{10}$, and 3^{20} as $(3^2)^{10}$. Since 2^3 is less than 3^2, I know that $(2^3)^{10}$ must be less than $(3^2)^{10}$.
22. Answers may vary, e.g., the principle for multiplying powers having the same base is to add their exponents. The principle for dividing powers having the same base is to subtract the exponent of the denominator (divisor) from the exponent of the numerator (dividend). The power of a power principle says that any factors inside brackets are multiplied by the exponents outside the brackets. For example, $(2^4)^3 = 2^{12}$ because $(2^4)^3$ is the same as $(2^4)(2^4)(2^4)$. When I expand the expression like this I can check by adding the exponents: $4 + 4 + 4 = 12$.
23. a) She can input 25^4 as $(5^2)^4$ or 5^8.
    b) She can input (16^2) as 4^4 or 2^8.
24. Answers may vary, e.g., you need an even number of 2's to group into pairs to get a new base of 4. You can not do this for 2^7 and have an integer as an exponent because you would have an extra 2 left over.

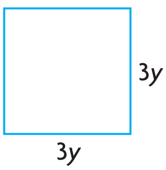
Mid-Chapter Review, page 101

1. Answers may vary, e.g., these are the models I created.



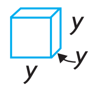
a) Models a and b are alike because they both have exponents of 1. This is why they are shown as lines. They are different because line a is twice as long as line b.
b) Models a^2 and b^2 are alike because they both have exponents of 2. This is why they are shown as squares. They are different because a^2 has twice the side length and four times the area of b^2.
c) Models a^3 and b^3 are alike because they both have exponents of 3. This is why they are shown as cubes. They are different because a^3 has twice the side length and eight times the volume of b^3.
d) These models are alike because their side lengths are the same. They are different because they have different dimensions, as a^2 is a square and a^3 is a cube.

2. **a)**



b)

c)



3. **a)** $8 \times 8 = 64$ and $9 \times 9 = 81$, so the length of x is about half-way between these two numbers. My estimate is 8.5.
b) $\sqrt{72}$
c) 8.49

4. **a)** 5^9 **b)** $(2)^{10}$ **c)** 5^4 **d)** 7^8 **e)** $(7^5)(2^{11})$ **f)** 7×2 or 14

5. **a)** $\left(\frac{5}{7}\right)^9$ **b)** $\left(\frac{-2}{5}\right)^6$ **c)** $(3.1)^{10}$ **d)** $(0.012)^2$

6. **a)** x^8 **b)** y^9 **c)** m **d)** n^4 **e)** a^4b^{11} **f)** x^2y^5

7. **a)** 2^5x^7 or $32x^7$ **b)** 5^6y^9 **c)** $64m^5$ **d)** $36q^3$

8. If the bases are different, their exponents will say how many times to multiply different numbers. For instance, 5^22^4 is $5 \times 5 \times 2 \times 2 \times 2 \times 2 = 400$. If I add the exponents I get 6, but I'm not multiplying 6 of the same thing, so I can't write 5^6 or 2^6. To use the exponent principle when multiplying powers, the bases have to be the same.

9. about 108 Earths

10. **a)** 5^{15} **b)** x^{12} **c)** 2^7x^{21} or $128x^{21}$ **d)** $\left(\frac{8}{5}\right)^{12}$ or $\frac{8^{12}}{5^{12}}$

11. **a)** 2^{15} **b)** 9^4 **c)** 3^8 **d)** 10^{30}

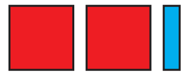
12. **a)** 5^{31} **b)** x^{32} **c)** $2^7m^{24}x^{42}$ or $128m^{24}x^{42}$ **d)** $2^2m^3x^8$ or $4m^3x^8$

13. In each case the base is the same and the exponents multiply to 36.

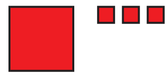
14. $SA = 6(2^5)^2 = 6(2^{10})$ cm; $V = (2^5)^3 = 2^{15}$ cm^3

Lesson 2.4, page 109

1. **a)**



b)



c)

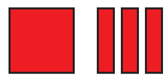
2. **a)** $3x$ and $-2x$
b) $6m$ and $-15m$

3. **a)** $3x^2 - 2x$ **b)** $-3y^2 + 2x + 4$

4. $5x^2 + 6x + 5$

5. **a)** $5x$ **b)** $5y^2$ **c)** $7x - 2y$ **d)** $7x - 1$ **e)** $x + 1$ **f)** $-2x$

6. **a)**



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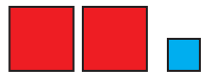
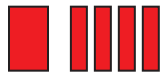
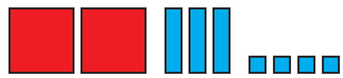


c)



d)



7. **a)** $-2g$ and $-5g$ **b)** $-\frac{1}{2}y$ and $2\frac{1}{2}y$ **c)** $-21g^3$ and $-0.8g^3$ **d)** $-3.75rs$ and $4.25rs$

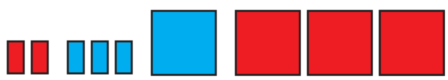
8. **a)** $2x^2 + 3x$ **b)** $3x^2 - 2y^2$ **c)** $-2xy + 2x$ **d)** $2x^2 + x - 3$ **e)** $2x^2 - 2x + 1$

9. **a)** $5h + 6$ **b)** $3x^2 + 4y$ **c)** $-w^2$ **d)** $\frac{1}{2}a + \frac{1}{5}b$

10. **a)** $5x - 2y$ **b)** $-3y^2 + 2y + 1$ **c)** $9x^2 - 12xy + 3y^2$

11. **a)** $2x - 6y$ **b)** $8y^2 - 4y + 4$ **c)** $-3x^2 + 4xy + 9y^2$

12. **a)** $-y + 2x^2$



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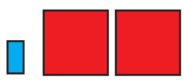


b) $-2y^2 - 1$
Check by adding: Does $-2y^2 - 1 + (3y^2 - 2y + 3) = y^2 - 2y + 2$? Yes, it does.

13.

	Initial Polynomial	Polynomial to Be Added	Final Polynomial
a)	$x^2 + 3x$	$-2x^2 + 2x$	$-x^2 + 5x$
b)	$2x^2y^2 - 4y^2$	$3x^2y^2 + y^2$	$5x^2y^2 - 3y^2$
c)	$-7xy + 4x$	$-x - 2$	$-7xy + 3x - 2$
d)	$2x^2 - 3x - 4$		$-2x^2 + 3x - 6$

14. The cost is $28(2x^2) + 2.25(6x)$ or $56x^2 + 13.5x$, where x is the width of the table in metres. When $x = 1.5$ m, the cost is $146.25.

15. **a)** $43.5x + 35$ **b)** $38.75x + 41$ **c)** $82.25x + 76$ **d)** $734.00

16. **a)** $220t - 160$ **c)** $380t - 285$
b) $160t - 125$ **d)** $1615.00
e) Answers may vary, e.g., no, because t is the number of tables they each work, the polynomial in c) is valid only if they work the same number of tables.

17. **a)** $1000 + 125c - 250w$ **b)** $3875

18. Answers may vary, e.g.,
a) $a + b + 1$ and $c + d + 1$ add to $a + b + c + d + 2$
b) $a + b + 1$ and $2a + 3b + 4$ add to $3a + 4b + 5$
c) $a + b + 1$ and $a - b - 1$ add to $2a$

19. Answers may vary, e.g., when simplifying polynomials, I have to combine the coefficients of like terms. This is done using the same principles as adding and subtracting integers. The zero principle means that I can combine any two equal values with opposite signs, like $+3$ and -3 or $+4.5$ and -4.5, and the result will be 0.

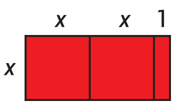
20. **a)** $-2x + 6y + 3z$ **b)** $-10abc - 7ab$ **c)** $-3xyz + 9xy + 5yz$

21. **a)** $9x - 2y$ **b)** $-8ab + 13a$ **c)** $3xy + 5y^2$

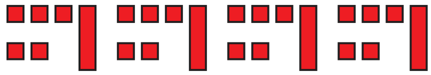
22. **a)** Answers may vary, e.g., this is never true. When I add two monomials, I can get a monomial, a binomial, or zero. Two monomials cannot be added to make a trinomial.
b) Answers may vary, e.g., this is sometimes true. One polynomial could include $+y$ and the other could include $-2y$, but it could also be that one polynomial has $-y$ and the other polynomial has no y term.
c) Answers may vary, e.g., this is always true. There is no x term in the sum, so if one polynomial has $+2x$, the other must have $-2x$ so they cancel out.
d) Answers may vary, e.g., this is sometimes true. They could both be binomials, like $3x^2 - 2y$ and $y + 4$. But they could also be a binomial and a monomial, like $3x^2 + 4$ and $-y$.

Lesson 2.5, page 116

1. **a)** $2x(x + 4) = 2x^2 + 8x$ **b)** $2x(2x + 3) = 4x^2 + 6x$
2. **a)** $8a^5 - 2a^4$ **b)** $-2y^2 + 2y + 2$
3. **a)** $6x + 8$ **b)** $3x^2 + 6x$
4. **a)** $2x^2 + x$; verifying using a diagram:



b) $20 + 4x$; verifying using algebra tiles:



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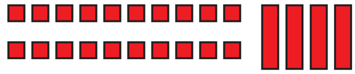


c) $6x^2 + 10x$; verifying using the distributive property:
$(3x + 5)(2x) = (3x)(2x) + (5)(2x) = 6x^2 + 10x$

5. **a)** $2(3x + 1) = 6x + 2$ **c)** $x(4x + 2) = 4x^2 + 2x$
b) $3x(3 + 2x) = 9x + 6x^2$

6. **a)** $-2y^2 - 2y - 2$ **d)** $-x^2 + 3x - 7$
b) $2b^5 - 4b^3 + b^2$ **e)** $-4x^3 + 12x^2$
c) $15m^5 + 18m^4 - 12m^3$ **f)** $-6n^3 + 10n^2 - 8n^5$

7. **a)** $3(2x - 10) = 6x - 30$
b) $2x^2(x^3 - 5x - 4) = 2x^5 - 10x^3 - 8x^2$
c) $-4a^3(3a^4 - a + 2) = -12a^7 + 4a^4 - 8a^3$

8. **a)** 68
b) 15
c) 1150
d) 295
e) Answers may vary, e.g., I know the answer should be the same before and after I expand each statement because both forms are just different ways of writing the same expression.
f) Answers may vary, e.g., in some cases it was easier to evaluate before using the distributive property, as in b). At other times it was easier for me to expand first, as in a).

9. **a)** $P = 14x - 4$, $A = 12x^2 - 8x$
b) $P = 12x + 6$, $A = 6x^2 + 9x$
c) $P = 18y + 4$, $A = 16y^2 + 8y$
d) $P = 52$ cm, $A = 160$ cm^2

10. Answers may vary, e.g., when I use the distributive property to simplify $x(2x + 7)$, I multiply both terms inside the brackets by x. When I multiply 20×47, I can rewrite this as $20(40 + 7)$, and then multiply both terms inside the brackets by 20 to get $20 \times 40 + 20 \times 7$.

11. **a)** $2xy - 6xz$ **b)** $-3x^2y - 3xyz$

12. **a)** $5(4x + 3)$ **b)** $5x(x + 5)$ **c)** $2x^2(2x^3 + 4x - 1)$
d) Answers may vary, e.g., I could multiply them out using the distributive property.

13. **a)** Answers may vary, e.g., $6x(2x - 1)$.
b) Answers may vary, e.g., $7y(3y^2 + y - 2)$.
c) Answers may vary, e.g., $5x(x - 2y + 6)$.

Lesson 2.6, page 125

1. **a)** $7x + 1$ **b)** -4
2. **a)** $7x^5 + 4x^3 - 3x^2$ **b)** $-3y^5 - y^2$
3. $12(20 + 95h) + 8(25 + 120h)$ or $2100h + 440$
4. **a)** $2(x - 1) + 3(2x + 2) = 8x + 4$
b) $3(y^2 - 1) - 2(y^2 + 1) = y^2 - 5$
c) $(x^2 + 1) + 2(x^2 - 1) = 3x^2 - 1$
5. **a)** $26c + 88$ **d)** $5y^3 - 8y^2 + 14y$
b) $-2x - 39$ **e)** $11y$
c) $-4x^2 + 6x + 15$ **f)** $6x^5 + 11x^3 - 18x + 12$
6. **a)** $9a + 24$, 51 **c)** $-2a^2 - 10a - 14$, -62
b) $-2a + 25$, 19 **d)** $a^3 - a^2 - 2a$, 12
7. **a)** $4x^2 + 17x - 21$ **c)** $4y^2 + 17y - 21$
b) $7x + 7$ **d)** $5p^2 + 13p + 5$
8. **a)** $8x^5 - 4x^4$ **c)** $2m^5 - 23m^4 + 13m^3$
b) $-6y^7 + 5y^5 - 3y^2$ **d)** $-3x^4 + 8x^3$

Answers

9. **a)** $\frac{3}{10}a - 3\frac{1}{3}$ **b)** $\frac{7}{10}a + \frac{1}{9}b - \frac{1}{6}$ **c)** $-6.455m + 4.13$

10. **a)** $(40x + 8)$ cm **b)** 208 cm **c)** $100x^2 - 80x + 12$ cm **d)** 2112 cm^2 **e)** $2000x^2 - 1600x + 240$ cm^2

11. **a)** $-38\,100x + 308\,700$

b)

	A	B	C	D
1	Number of Years	Value of One Sedan	Value of One Sport Utility	Total Value
2	0	$19 600	$24 500	$308 700
3	1	17 200	21 400	270 600
4	2	14 800	18 300	232 500
5	3	12 400	15 200	194 400
6	4	10 000	12 100	156 300
7	5	7600	9000	118 200
8	6	5200	5900	80 100

c) The company paid $73 500 for the SUVs and $235 200 for the sedans.

d) The sport utilities are depreciating at a faster rate.

12. **a)** $-13x + 52$

b) Answers may vary, e.g., order of operations must be considered when doing this problem. Multiplication must happen before addition or subtraction. The "10" in front of the brackets means each term inside the brackets must be multiplied by 10 before subtraction can be carried out.

13. **a)** sometimes true

b) Answers may vary, e.g., I can use algebra tiles to simplify algebraic expressions that require the distributive property as long as the degree is at most 3. This is because algebra tiles can only show up to 3 dimensions. The exponent of x is 1, for instance, so I can represent it using a long, narrow tile or line. For $-x$, I can use a tile or line of the same length but of a different colour or shade.

To represent x^2, I can use a square tile or draw a square of the same colour or shade of x. For $-x^2$, I can use a square tile or draw a square of the same area but with the same colour or shade as the $-x$ tile.

To represent x^3, I can use a cube of side x or draw a 3D cube having x side lengths. I can use the same size cube to represent $-x^3$ but change the colour or shade to that of the $-x$ tile. I cannot represent x^4 degree 4 or higher using algebra tiles.

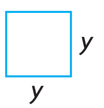
14. **a)** $-2x - 39y$ **b)** $3x^2 - xy$ **c)** $-4x^2 + 6xy + 15y$

15. **a)** $2x^2 + 10x + 12$ **b)** $y^2 + 3y + 2$ **c)** $2x^2 + 3xy + y^2$

16. **a)** $4x^2 - 2x - 6$ **b)** $x^2 - xy - 2y^2$ **c)** $8x^2 + 5x - 15$

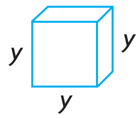
Chapter Review, page 131

1. **a)**

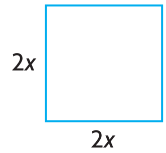


c)

b)



d)



2. Answers may vary, e.g., the side length must be between 20 cm and 25 cm, because $20 \times 20 = 4007$ and $25 \times 25 = 625$. My estimate is 20.5 cm. Using my calculator, I found that the side length to two decimal places is 20.30 cm.

3. The bases are all the same in each problem and when I add the exponents in the numerator and subtract the exponent in the denominator, I get 3 in each case. So the answer is always 5^3.

4. **a)** $x = -2$ **b)** $x^2y^2 = 36$ **c)** $-2x^3 = 16$

5. The numbers are 9^4 (or 6561) and 9^2 (or 81), because $(9^4)(9^2) = 9^6$ and $\frac{9^4}{9^2} = 9^2$.

6. Answers may vary, e.g., I can round 9.5×10^{16} km to 10×10^{16} km. When I divide this value by 10×10^8 km/h, I get 1×10^8 h, or about 100 000 000 h. That is close to 11 500 years.

7. **a)** a^6 **b)** $256x^{12}$ **c)** $2y^6$

8. **a)** Answers may vary, e.g., the bases are the same and the exponents in both cases multiply to 15; $10^{15} - 10^{15} = 0$.

b) Answers may vary, e.g., I can also represent 9^2 as 3^4. If I substitute 3^4 in the expression it becomes $(3^4)^2 - (3^4)^2$, which is zero.

9. **a)** 2^9 **b)** 5^8 **c)** 3^6

10. $SA = 6(5^3)^2 = 6(5^6) = 93\,750$; $V = (5^3)^3 = 5^9 = 1\,953\,125$

11. **a)** y; checking, e.g., using algebra tiles:

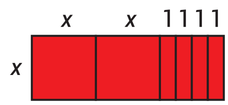
b) $6xy^2$ **c)** $7x^2 - 6x$ **d)** $2y^2 + 4xy$

12. **a)** $\frac{3}{5}a$ **b)** $3a + \frac{1}{3}b$ **c)** $-4.00m + 5.0$

13. **a)** $10h + 25$ **b)** $9h + 8$ **c)** $19h + 33$ **d)** $128.00

14. **a)** $3y - 6$

b) $2x^2 + 4x$; checking, e.g., using a diagram:



c) $15m^4 + 10mn$ **d)** $-3x^3 + 3x^2$ **e)** $2y^6 + 6y^5 - 2y^4$ **f)** $-4a^5 + 5a^4 - 2a^3$

15. **a)** $x + 4$ **b)** $\frac{1}{4}a + 4b$ **c)** $-4.2m^2 - 3.3m$

16. **a)** $P = 2[(x + 20) + x]$ **b)** $P = 4x + 40$ **c)** 220 cm **d)** $P = 2x + 2(x + 20)$

e) The expression in d) is what I get when I remove the square brackets from the expression in a), so the results will be the same.

17. **a)** $5x$; checking, e.g., using algebra tiles:

b) $2y^2 + y - 10$ **c)** $9x^2 - 4x + 6$ **d)** $13x^3 - 16x^2$

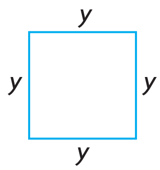
18. **a)** $26x^2 + 200x$ **b)** 14 400 cm^2 or 1.44 m^2

19. **a)** $9x - 6$ **b)** $19x - 19y$ **c)** $-13.4x^2 - 33.72x$

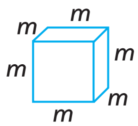
20. **a)** $22(3y + 15) + 18(2y + 12) = 102y + 546$

b) $1158.00

Chapter Self-Test, page 133

1. a) 

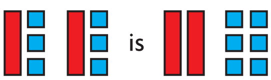
b) 

c) 

Answers may vary, e.g., my sketches are the same in that they are all geometric shapes: a square, a line, and a cube. However, the line has only one dimension, the square two, and the cube three. The cube has the same side length as the line, but the side length of the square is different.

2. a) $\sqrt{310}$
   b) Answers may vary, e.g., I know that 15^2 is 225 and 20^2 is 400. 310 is slightly closer to 225 than to 400, so my guess is 17.4 cm.
   c) 17.61 cm
3. 57.4 m
4. a) 3^{10} b) $\frac{4}{5}$ c) x^8 d) $(6.1^{12})(5^2)$
5. C.
6. Answers may vary, e.g., suppose I have the expression $(x^5)^3$. This means x gets multiplied by itself 5 times and that the result gets multiplied by itself another 3 times. All together that is the same as x multiplied by itself 15 times. Expanded, the expression would look like $(xxxxx)(xxxxx)(xxxxx)$, which is the same as x^{15}.
7. Simplify
   a) 6^6 c) 5^5x^{20} or $3125x^{20}$ e) y^{16}
   b) x^{10} d) $\left(\frac{2}{5}\right)^{20}$ f) $\frac{25}{x^4}$
8. Answers may vary, e.g., "like terms" means that the variable and exponent parts of terms are the same. I can represent terms with exponents up to 3 using algebra tiles or diagrams. When I use algebra tiles, I know that tiles of the same shape and size are like terms. I can also represent like terms having one dimension as lines, with two dimensions as squares, and with three dimensions as cubes. The tiles or diagrams do not have to be the same colour, since positive and negative terms can still be alike. In this way I can quickly identify like terms.
9. a) $3x$; checking, e.g., using algebra tiles:

   b) $9xy$
   c) $7x^2 - 6a$
10. A.
11. a) $2x - 6$; checking, e.g., using algebra tiles:

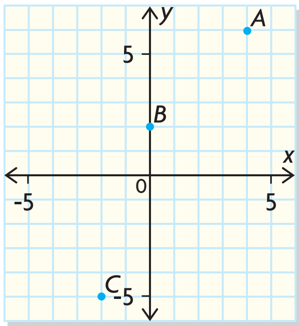


   b) $12x^3 - 15x^2$
   c) $5y^9 + 3y^8 - y^7$
12. a) $5x$; checking, e.g., using algebra tiles:

   b) $2y^2 + y - 10$
   c) $7.2x^2 - 4x + 0.6$
13. a) $114h + 430$ b) $4078.00
14. Answers may vary, e.g., $x(2x + 1) + (x^2 - x)$.

Chapter 3

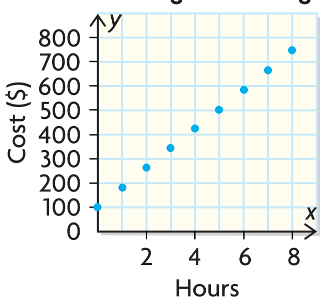
Getting Started, page 138

1. a) v) c) iv) e) iii)
   b) ii) d) i) f) vi)
2. 

3.

Number of Hours	Charge ($)
0	100
1	180
2	260
3	340
4	420
5	500
6	580
7	660
8	740

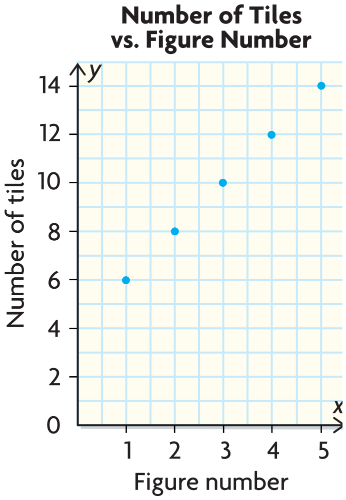
Plumbing Elite Charges



4. a) 17 b) 7 c) $\frac{9}{4}$
5. a) $3x - 6$ b) $x - 3$ c) $4\frac{9x}{4}$
6. a) $t = 2n + 4$
   b) The orange tiles are represented by $2n$. The blue tiles are represented by the constant 4.
   c) 38

d)

Figure	Number of Squares
1	6
2	8
3	10
4	12
5	14

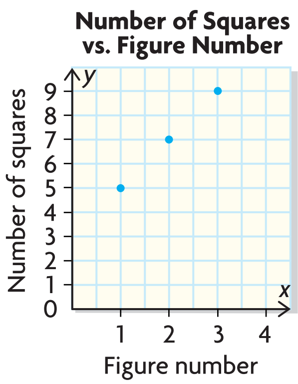


7. Answers may vary, e.g., the Cartesian coordinate system is made of the intersection of two axes. An ordered pair is plotted on the Cartesian coordinate system. A scatter plot is made by plotting the values in a table of values. A table of values is made of ordered pairs. The values of variables are used to make a table of values. An algebraic expression is made of variables and constants. An algebraic expression can be plotted on axes. The relation between two variables results in an ordered pair.

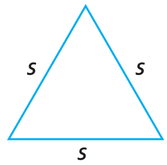
Lesson 3.1, page 146

1. $s = 2f + 3$

Figure	1	2	3
Number of Squares	5	7	9



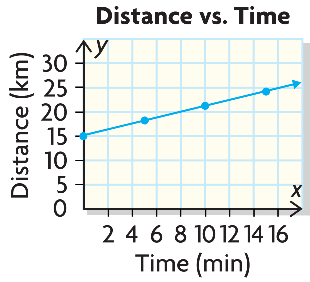
2. **a)** Answers may vary, e.g., $p = 3s$.



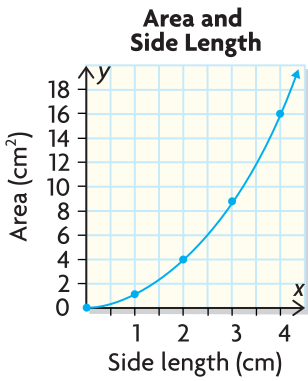
b) Answers may vary, e.g., $c = 0.5k + 2.5$.

Distance (km)	2	3	4	5
Fare ($)	3.50	4.00	4.50	5.00

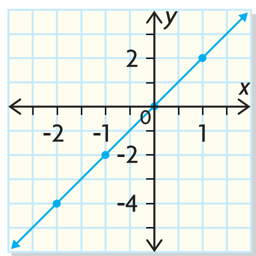
3. **a)**



b)



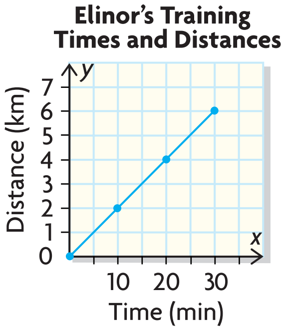
c)



4. **a)** $d = \frac{3}{5}t + 15$ **b)** $a = s^2$ **c)** $y = 2x$

5. **a)** time is independent, distance is dependent
b) Answers may vary, e.g., 4.4 km.

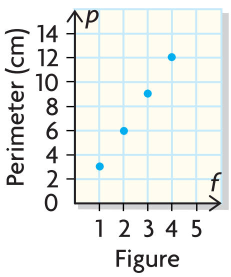
c) and **d)**



d) From the graph, if $x = 22$ km, then $y = 4.4$ min.

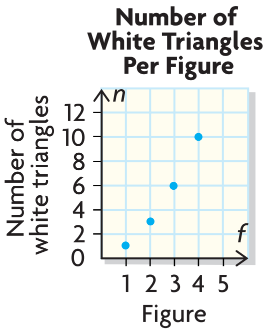
6. **a)** $y = x$ **b)** $y = 0.5x + 3$

7. **a)**



b) 30, because $p = 3f$

c)



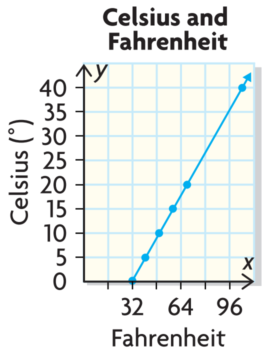
d) There are 55 white triangles. For example, the number goes up by one more than the figure number each time; 1, 3, 6, 10, 15, 21, 28, 36, 45, 55 or $n = \frac{1}{2}f(f + 1)$.

8. **a)** Answers may vary, e.g., F, because the equation is $C =$.

b)

Fahrenheit (°)	32	41	50	59	68
Celsius (°)	0	5	10	15	20

c)



d) continuous

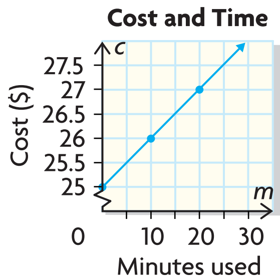
e) Answers may vary, e.g., 38 °C.

f) $37.\overline{7}$ °C

g) Answers may vary, e.g., because a graph or table gives an estimate, while an equation gives a more exact value.

9. **a)** Answers may vary, e.g., cost depends on time. There is a $25 charge to start with, before any minutes are used.

b)



c) continuous

d) $c = \frac{m}{10} + 25$

e) Answers may vary, e.g., an equation, since it will give exact value.

f) $35

10. **a)** Answers may vary, e.g., $e = 5h + 8$.

b) Antwan's earnings depend on time, so e is the dependent variable and t is the independent variable.

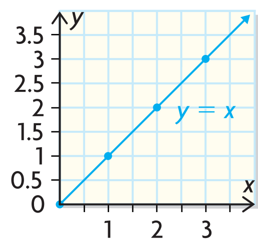
11. **a)** Answers may vary, e.g., $d = 75 - 0.125l$, $l = 75 - 0.125d$.

b) 600 km

12. **a)** A, B, D **b)** A, B, C

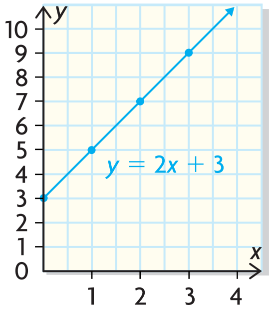
13. **a)**

x	0	1	2	3
y	0	1	2	3



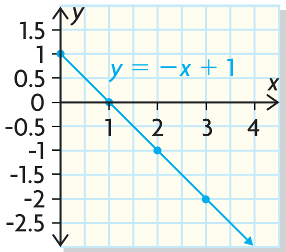
b)

x	0	1	2	3
y	3	5	7	9



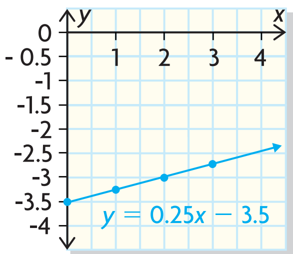
c)

x	0	1	2	3
y	1	0	-1	-2



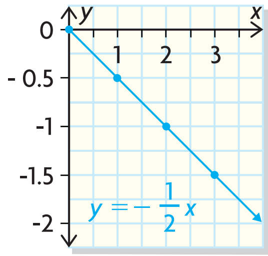
d)

x	0	1	2	3
y	-3.5	-3.25	-3.0	-2.75



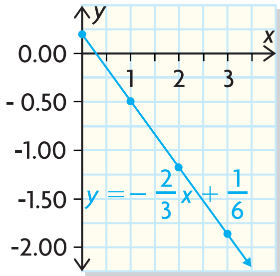
e)

x	0	1	2	3
y	0	$-\frac{1}{2}$	-1	



f)

x	0	1	2	3
y	$\frac{1}{6}$	$-\frac{3}{6}$	$-\frac{7}{6}$	$-\frac{11}{6}$



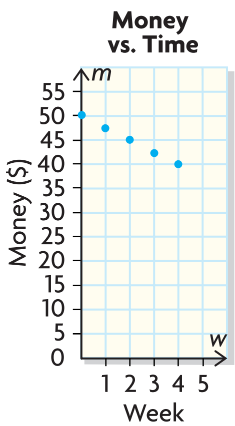
14. **a)** C, ii); values in table match the points on the graph and are solutions of the equation.

b) A, iii); values in table match the points on the graph and are solutions of the equation.

c) B, i); values in table match the points on the graph and are solutions of the equation.

15. $m = -2.50w + 50$

Week	Money in Bank ($)
0	50.00
1	47.50
2	45.00
3	42.50
4	40.00



16. Group 2

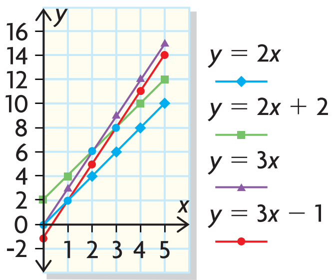
17. **a)** One inch is the same length as 2.54 centimetres.

b) The Fahrenheit temperature is the same as 32 degrees more than $\frac{9}{5}$ of the temperature in Celsius.

c) One kilogram is the same weight as 2.2 pounds.

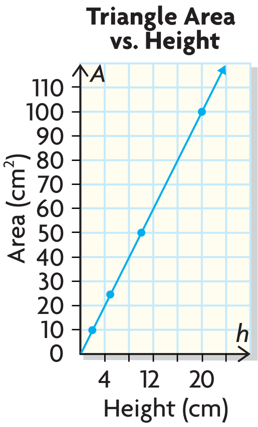
d) The temperature in Kelvin is 273 degrees more than the temperature in Celsius.

18. **a)**



b) If there is no constant, the graph will pass through the origin. If there is a constant, it will not.

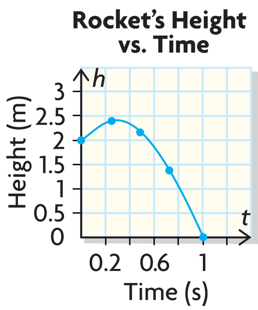
19. **a)**



b) $A = 5h$

20.

t	0	0.25	0.50	0.75	1
h	2	2.44	2.25	1.44	0



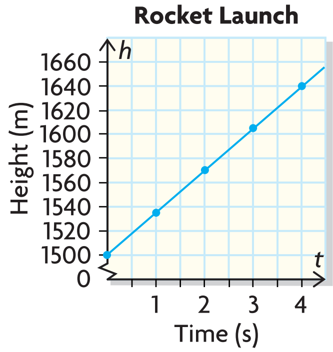
Lesson 3.2, page 151

1. **a)** direct **b)** partial **c)** partial **d)** partial **e)** direct **f)** partial

2. **a)** $h = 35t + 1500$

b)

Time (s)	0	1	2	3	4
Height (m)	1500	1535	1570	1605	1640



c) partial variation; graph does not go through (0, 0)

3. **a)** Plan A: $C = 0.75g$; Plan B: $C = 0.25g + 10.00$

b) Plan A, $15; Plan B, $15

c) Plan A, $22.50; Plan B, $17.50

d) For less than 20 glasses of milk choose Plan A, for more than 20 glasses choose Plan B, and for 20 glasses choose either.

e) Plan A is a direct variation, Plan B is a partial variation.

f) For example, in a partial variation there is a flat cost and a cost per glass, so you have to pay even if you do not buy any milk. In a direct variation, there is no flat cost.

Lesson 3.3, page 156

1. **a)** linear; first differences constant

b) linear; graph is straight line

c) nonlinear; first differences not constant

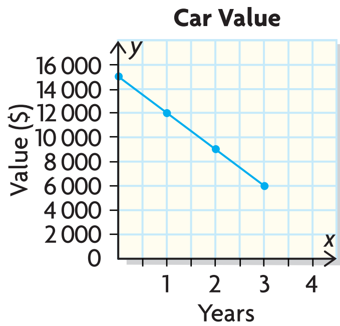
d) nonlinear; graph not a straight line

2. **a)** 3 **b)** −2

3. **a)** 3 **b)** −2 **c)** 8 **d)** −2

4. **a)** x-values are out of order

b)



c) −3000. This is the change in the value of the car each year.

d) $x = 5$. This does not seem realistic because usually many years must pass for a car to be worth $0.

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

6. **a)** 18 cm **b)** 100 cm **c)** $\frac{18}{25}$

Answers

7. **a)** 1 **c)** -34 **e)** 3

b) $\frac{1}{5}$ **d)** 9 **f)** -1

8. **a)** The y-intercept is the flat charge for a luncheon, \$150, and the slope is the extra cost per person attending the luncheon, \$8.

b) The y-intercept is the value of the copier before any time has elapsed, \$7000, and the slope is how much the value of the copier decreases for each passing year, $-\$1000$.

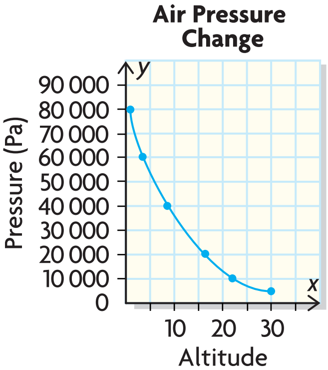
9. **a)** Answers may vary, e.g., $(-1, 3)$ if the run is -3 the rise is -2; $(2 - 3, 5 - 2)$, $(5, 7)$ if the run is 3 the rise is 2; $(2 + 3, 5 + 2)$.

b) Answers may vary, e.g., $(-4, 1)$ if the run is -4 the rise is 3; $(0 - 4, -2 + 3)$, $(4, -5)$ if the run is 4 the rise is -3; $(0 + 4, -2 - 3)$.

c) Answers may vary, e.g., $(0, -11)$ if the run is -1 the rise is -5; $(1 - 1, -6 - 5)$, $(2, -1)$ if the run is 1 the rise is 5; $(1 + 1, -6 + 5)$.

d) Answers may vary, e.g., $(-3, -1)$ if the run is -1 the rise is 2; $(-2 - 1, -3 + 2)$, $(-1, -5)$ if the run is 1 the rise is -2; $(-2 + 1, -3 - 2)$.

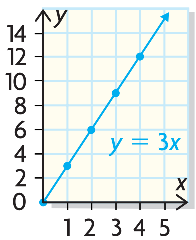
10. **a)**



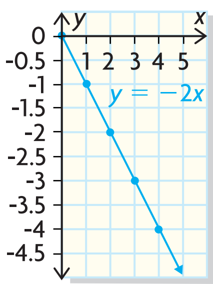
b) The graph shows that the air pressure has a large negative rate of change at low altitudes but changes as the altitude increases to become a small negative rate of change at high altitudes.

c) approximately 12 500 Pa using the curved graph

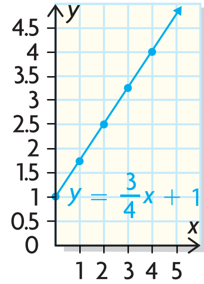
11. **a)** slope is 3



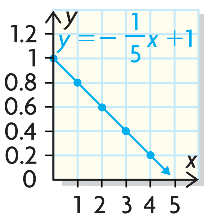
b) slope is -2



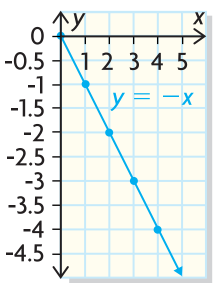
c) slope is $\frac{3}{4}$



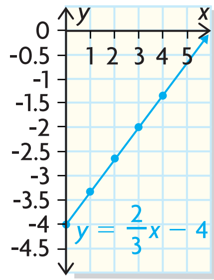
d) slope is $-\frac{1}{5}$



e) slope is -1



f) slope is $\frac{2}{3}$



12. **a)** \$125 000 **c)** \$177 500

b) \$140 000 **d)** \$7500 increase each year

13. **a)** x, the number of weeks is independent; y, the amount of money in account is dependent.

b) Answers may vary, e.g., the amount he takes out each week does not change, or the degree of the equation is 1.

c) $-\$70$/week

d) the amount of money taken out of account each week

e) It is the same as the number in front of the x term the slope.

f) 58 weeks

14. **a)** the maximum safe heart rate for a 20-year-old person

b) the rate at which the maximum heart rate decreases per year of age of the person

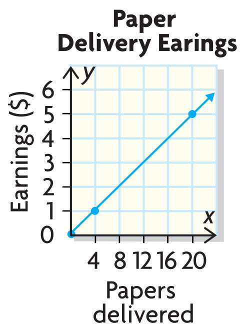
c) $b = -(a - 20) + 220$, where b is maximum beats per minute and a is age in years.

d) 162 beats per minute

15. No, if he sold \$1000 at 5% commission, his earnings would be $0.05(1000) + 300 = \$350$. If he sold \$1000 at 10% commission, they would be $0.1(1000) + 300 = \$400$, which is not twice \$350.

16. **a)**

x	y	First Differences
0	0	
		0.25
1	0.25	
		0.25
2	0.50	
		0.25
3	0.75	
		0.25
4	1.00	



b) The first differences are the amount she earns per paper.

c) \$0.25/paper

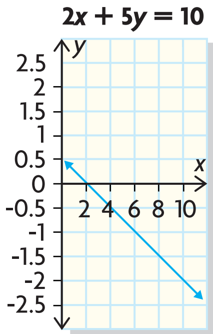
d) $y = 0.25x$, where y is her total earnings and x is the number of papers delivered, \$68.75.

17. **a)** $y = \frac{3}{5}x + 2$ **c)** $y = \frac{1}{3}x + 5$ **e)** $y = -\frac{1}{2}x + 1.5$

b) $y = -4x$ **d)** $y = 2x - 7$ **f)** $y = \frac{4}{7}x - 2$

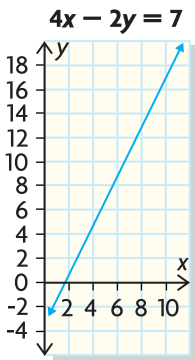
18. **a)** $2x + 5y = 10$

x	0	1	2	3	4
y	2	$\frac{8}{5}$	$\frac{6}{5}$	$\frac{4}{5}$	$\frac{2}{5}$



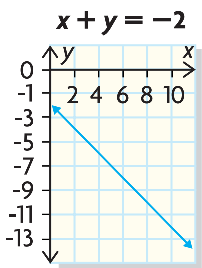
$4x - 2y = 7$

x	0	1	2	3	4
y	$-\frac{7}{2}$	$-\frac{3}{2}$	$-\frac{1}{2}$	$-\frac{5}{2}$	$-\frac{9}{2}$



$x + y = -2$

x	0	1	2	3	4
y	−2	−3	−4	−5	−6



b)

Equation	Slope	y-intercept	x-intercept
$2x + 5y = 10$	$-\frac{2}{5}$	2	5
$4x - 2y = 7$	2	$-\frac{7}{2}$	$\frac{7}{4}$
$x + y = -2$	−1	−2	−2

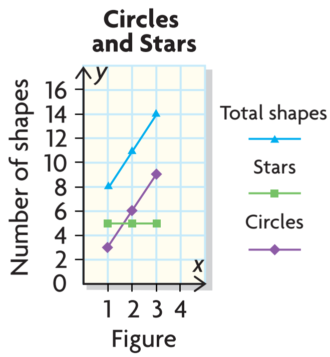
c) The equations are in the form $ax + by = c$. Notice that the slope is $-\frac{a}{b}$, the x-intercept is $\frac{c}{a}$, and the y-intercept is $\frac{c}{b}$.

Mid-Chapter Review, page 163

1. **a)**

Figure	Circles	Stars
1	3	5
2	6	5
3	9	5

$c = 3f$, where f is figure number and c is number of circles; $s = 5$, where s is number of stars; or $t = 3f + 5$, where f is the figure number and t is the total number of shapes



b) 225 **c)** 5

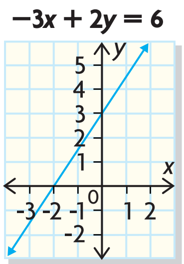
2. **a)** partial variation; does not pass through (0, 0)
b) partial variation; does not pass through (0, 0)
c) direct variation; passes through (0, 0)

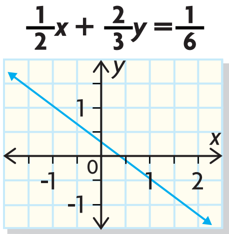
3. **a)** $\frac{10}{3}$ **b)** 40 words/min **c)** 3

4. **a)** linear, graph is a straight line
b) linear, degree of the equation is 1
c) nonlinear, graph is not a straight line
d) linear, when graphed all points lie on a straight line

5. **a)** −50, means that she withdraws $50 for each passing week
b) y-intercept = 1250, this is her original amount of money
c) after 25 weeks

Lesson 3.4, page 169

1. a)


b)


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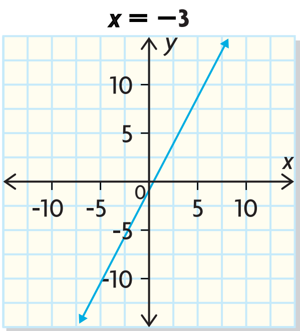
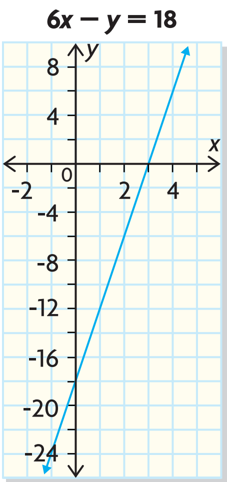
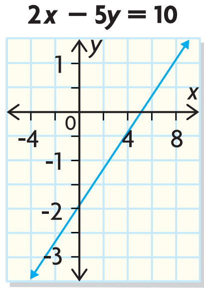
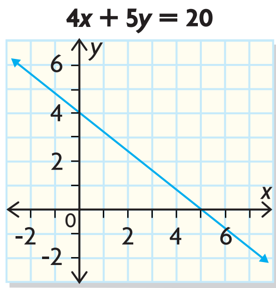
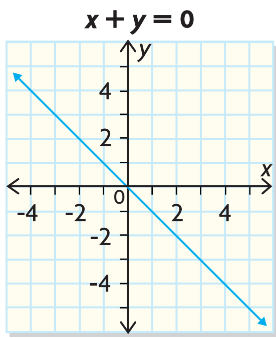


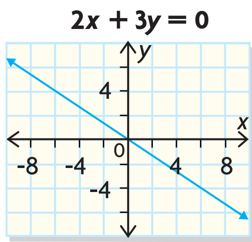
2. a) $x + y = 38$
   b) The maximum amount she can work at each particular job.
3. Answers may vary, e.g., $(0, -18)$, $(1, -12)$, $(2, -6)$.



4. a)


b)


c)


d)


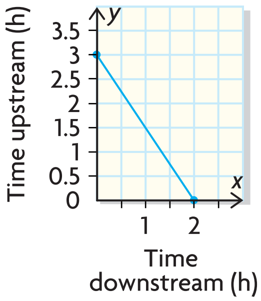
5. a) Answers may vary, e.g., x is the number of dimes and y is the number of quarters he has. They multiply by their respective worth and add to give \$14.50.
   b) yes, equation is of degree 1
   c) x-intercept is 145; y-intercept is 58; they are the maximum values of dimes or quarters if he only has one or the other.
   d) discrete, because he cannot have partial dimes or quarters
6. a) x is the hours worked at the coffee shop and y is the hours worked at the grocery store. They multiply by their respective wages and add to give his total earnings, \$288.
   b) yes, equation is of degree 1
   c) 32; 25.6; They are the maximum amount of hours he could have worked at either job.
   d) Answers may vary, e.g., 17 h at coffee shop and 12 h at grocery store.

7. **a)** x is the amount of time spent going downstream and y is the amount of time going upstream, they multiply by their respective speeds and add to give the total distance travelled, 60 km.

b) x-intercept, 20: the mooring point of the boat; y-intercept, 30: the starting point of boat

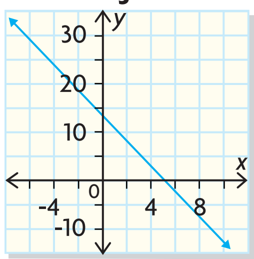
c)

St. Lawrence Boat Tour



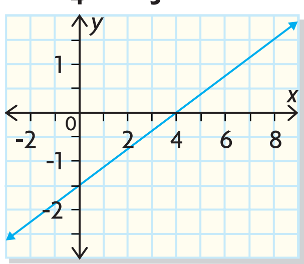
8. **a)**

$$2x + \frac{4}{5}y = 11$$



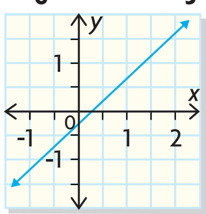
b)

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



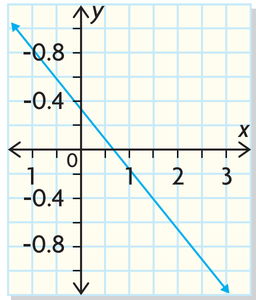
c)

$$-\frac{5}{6}x + y = -\frac{1}{3}$$



d)

$$-\frac{2}{7}x - \frac{1}{3}y = -\frac{5}{42}$$



9. The paths do not cross.

10. **a)** Answers may vary, e.g., 40 figure skates and 48 hockey skates, or 20 figure skates and 72 hockey skates.

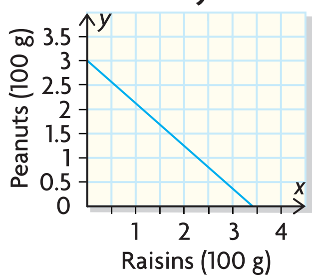
b) 10 figure skates and 84 hockey skates

11. **a)** x is the mass of raisins and y is the mass of peanuts. Multiply by their respective costs and add to give the total cost, \$3.00.

b) x-intercept 3.4, y-intercept 3. These are the maximum amounts of each type of nuts and raisins she can include.

c)

$$0.88x - 1y = 3.00$$



12. Answers may vary, e.g., 172 of the \$3.50 shares and 104 of the \$5.75 shares, or 80 of the \$3.50 shares and 160 of the \$5.75 shares.

13.

	x-intercept	y-intercept	Slope
a)	3	2	$-\frac{2}{3}$
b)	9	$\frac{9}{4}$	$-\frac{1}{4}$
c)	5	-2	$\frac{2}{5}$
d)	2	$-\frac{4}{3}$	$\frac{2}{3}$

14. The slope is equal to the negative of the y-intercept divided by the x-intercept, which for an equation in the form $Ax + By = C$ is the same as $-\frac{A}{B}$.

15. **a)** $y = -2x + 4$ **b)** $y = -x + 2$ **c)** $y = \frac{3}{4}x + \frac{1}{4}$

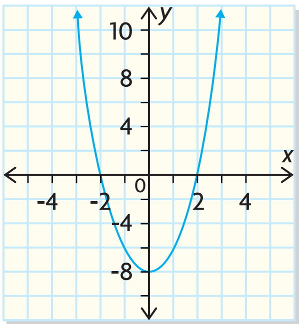
16. **a)** $x - 2y = 4$ **c)** $-3x + y = -3$
b) $6x + 4y = 3$ **d)** $9x + 2y = 6$

17. **a)** 0 **b)** 2, −2 **c)** −8

d)

x	−2	−2	−1	0	1	2	3
y	10	0	−6	−8	−6	0	10

$y = 2x^2 - 8$



Lesson 3.5, page 179

1. **a)** linear; graph is straight line
b) nonlinear; points lie on curve

2. nonlinear; equation is degree 2, not degree 1

3. **a)** nonlinear **b)** linear **c)** linear

4. **a)** time, since distance depends on time
b) linear, first differences are constant

5. **a)**

Figure Number	1	2	3	4
Perimeter	4	16	28	40

b) 136 units, because Perimeter $= 4(3f - 2)$ where f is the figure number.
c) linear, first differences are constant
d)

Figure Number	1	2	3	4
Blue Squares	1	5	11	19

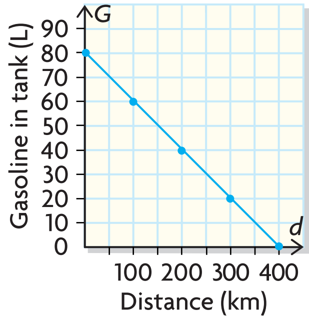
e) The number of blue squares in the figure increases by a number two more than the last; e.g., the blue squares increase by 4, 6, 8… Figure 12 will have 155 blue squares.
f) nonlinear; first differences not constant

6. **a)** linear, one shape is added for each new figure
b) nonlinear; different number of shapes are added for each new figure

7. **a)** linear, equation is of degree 1
b)

d	0	100	200	300	400
G	80	60	40	20	0

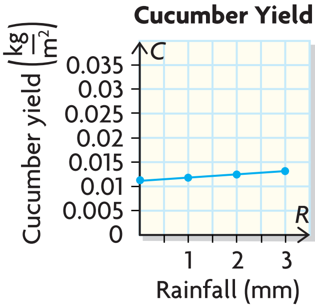
Hybrid Mileage



8. **a)** linear; equation is of degree 1
b) using a table to show the first differences are constant

R	$C = 0.006(R + 20)$	First Differences
0	0.12	
		0.006
1	0.126	
		0.006
2	0.132	
		0.006
3	0.138	

Cucumber Yield



9. nonlinear; number of sections doubles for each paper fold

10. At approximately 30 s. The first differences decrease by −250 for each time.

11. **a)** The relation in Pattern 1 is linear, while the number of shapes in Pattern 2 and Pattern 3 are nonlinear.
b) The differences between each figure in Pattern 1 is constant, and the ones in Pattern 2 and Pattern 3 are not.

12. **a)** 1st differences: 1, 3, 5, 7; 2nd differences: 2, 2, 2; 3rd differences: 0, 0
b) 1st differences: 1, 7, 19, 37; 2nd differences: 6, 12, 18; 3rd differences: 6, 6
c) 1st differences: −2, −6, −10, −14; 2nd differences: −4, −4, −4; 3rd differences: 0, 0
d) 1st differences: 4, 28, 76, 148; 2nd differences: 24, 48, 72; 3rd differences: 24, 24
e) 1st differences: $\frac{7}{3}, \frac{9}{3}, \frac{11}{3}, \frac{13}{3}$; 2nd differences: $\frac{2}{3}, \frac{2}{3}, \frac{2}{3}$; 3rd differences: 0, 0
f) 1st differences: −1, −13, −37, −73, −121; 2nd differences: −12, −24, −36, −48; 3rd differences: −12, −12, −12
In an equation with degree 2, the 2nd differences are constant and the 3rd differences are zero. In an equation with degree 3, the 2nd differences are linear and the 3rd differences are constant.

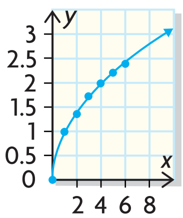
13. a) nonlinear; first differences not constant

x	$y = (x + 1)(x - 2)$	First Differences
-1	0	
0	-2	-2
1	-2	0
2	0	2
3	4	4

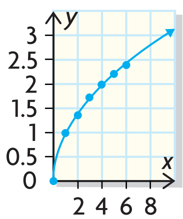
b) nonlinear; first differences not constant

x	$y = 2(x - 1)(x + 3)$	First Differences
-1	-8	
0	-6	2
1	0	6
2	10	10
3	24	14

c) nonlinear



d) nonlinear



Chapter Review, page 183

1. a) Answers may vary, e.g., $y = x - 1$.
b) Answers may vary, e.g., $y = -x$.
c) Answers may vary, e.g.,

x	0	1	2	3
y	4	6	8	10

d) Answers may vary, e.g., $y = -x + 1$.
e) Answers may vary, e.g., $y = -\frac{2x}{3}$.

f)

x	0	1	2	3
y	-6	$-\frac{9}{2}$	-3	$-\frac{3}{2}$

2. a) a) partial variation; graph does not cross point (0, 0)
b) direct variation; graph crosses point (0, 0)
c) partial variation; (0, 0) is not a solution
d) partial variation; graph does not cross point (0, 0)
e) direct variation; graph crosses point (0, 0)
f) partial variation; (0, 0) is not a solution

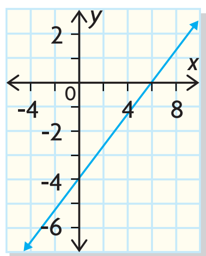
b) a) $y = 6$ c) $y = 18$ e) $y = -\frac{14}{3}$
b) $y = -7$ d) $y = -6$ f) $y = \frac{9}{2}$

3. a) $\frac{4}{5}$ **c)** $\frac{5}{3}$ **e)** -5
b) 4 **d)** -2

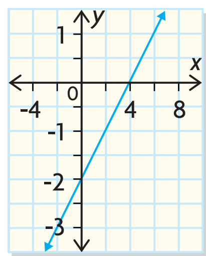
4. a) section DE, since the slope is a larger negative number than the other sections' slopes
b) section EF, since the slope is flat
c) For part a), the slope is -2 since the rise is down 2 and the run is 1. For part b), the y values of the points E and F are equal, so Δy will be 0 regardless of their x values and so the slope is 0.

5. a) (6, -2), (10, 1) **c)** (-2, 3), (8, -3)
b) (-3, 3), (3, 7) **d)** (1, 4), (3, 9)

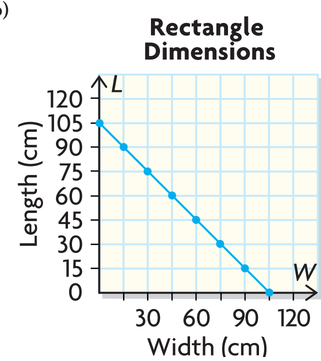
6. a)



b)



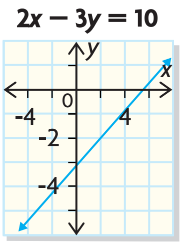
7. a) L is length and W is width, the equation is correct since the perimeter of the figure is the sum of the lengths of its sides. Using this definition and a perimeter of 210, we arrive at this equation.
b)



c) continuous, a side of a rectangle can have any length, one that is not necessarily a whole number
d) Answers may vary, e.g., $L = 50$ cm and $W = 55$ cm, or $L = 100$ cm and $W = 5$ cm.

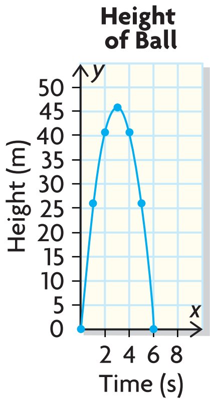
Answers

8. Yes, as shown in the graph, when $x = 5$, $y = 0$.



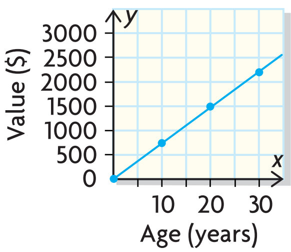
9. **a)** linear; graph is straight line
b) linear; equation is of degree 1
c) linear; first differences constant
d) nonlinear; graph not a straight line
e) nonlinear; equation is of degree 2
f) nonlinear; first differences not constant

10. **a)** nonlinear
b)



c) approximately 35 m
d) at 2.4 s and 3.6 s
e) at 6.0 s
f) 46 m

11. **a)** linear
b)



c) $y = 75x + 0.25$
d) $1125.25

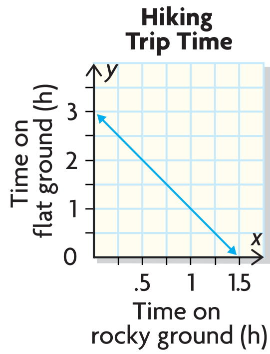
Chapter Self-Test, page 185

1. **a)** $C = 0.25a$, where C is cost and a is number of apples
b) total cost is dependent, apples bought is independent
c) discrete
d) $37.50

2. linear; first differences constant

Distance (km)	Total Cost ($)
0	45.00
100	60.00
200	75.00
300	90.00
400	105.00

3. A.
4. C.
5. A.
6. **a)** x is the time spent running and y is the time spent walking. This makes sense because they multiply by their respective speeds and add to give the total distance travelled, 6 km.
b) 1.5 h, 3 h
c)

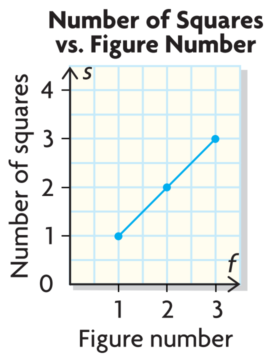


d) Answers may vary, e.g., $x = 1$ and $y = 1$, or $x = 0.5$ and $y = 2$, or $x = 0.25$ and $y = 2.5$.

7. **a)** linear; first differences are constant

Figure Number	1	2	3
Number of Squares	1	2	3

linear; graph is a straight line

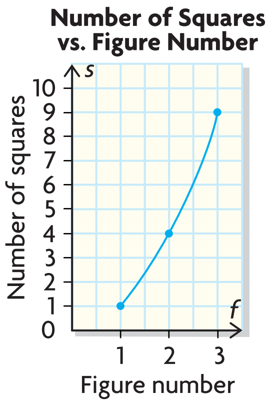


linear; equation is of degree 1: $s = f$

b) nonlinear; first differences are not constant

Figure Number	1	2	3
Number of Squares	1	4	9

nonlinear; graph is not a straight line



nonlinear; equation is of degree 2: $s = f^2$

Chapters 1–3 Cumulative Review, page 187

1. A.
2. A.
3. B.
4. D.
5. C.
6. D.
7. D.
8. A.
9. A.
10. A.
11. A.
12. B.
13. C.
14. D.
15. D.
16. D.
17. B.
18. A.
19. B.
20. C.
21. D.
22. C.
23. **a)** Answers may vary, e.g., representing the relation as a balance helps because you can see that if you remove a certain amount from one side of the balance, you must remove the same amount from the other side to keep the balance even.
    b) The relation is linear. e.g., make a table of values:

First Number	1	2	3	4	5
Second Number	2	−1	−4	−7	−10

The second number decreases by a constant, 3, each time, so the relation is linear.

Or write the equations out, where x is the first number and y is the second number:

$3x + y = 5$

$y = -3x + 5$

It is in the form $y = mx + b$, so the relation is linear.

c) **i)** 11 **ii)** $\frac{1}{2}$ **iii)** $-\frac{5}{8}$ **iv)** $6\frac{4}{5}$

d) **i)** Answers may vary, e.g., write out the equation for the new game, where x is the first number and y is the second number:

$\frac{4}{9}x + \frac{1}{3}y = \frac{1}{2}$, $y = -\frac{4}{3}x + \frac{3}{2}$

Both games' equations are in the form $y = mx + b$, m is negative in both games, and b is positive in both games. However, both m and b are fractions in this game while in the first game they were integers.

ii) Both graphs have negative slopes, both graphs have positive y-intercepts, and both graphs are linear. However, the graph for the second game has a shallower slope than the graph in the first game, and the graph for the first game has a higher y-intercept.

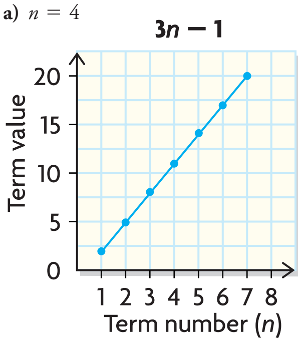
e) Answers may vary, e.g.,

- Your partner tells you a number.
- Your partner multiplies this first number by 2.
- Your partner adds the product to 5 times a second number, so that the sum is −3.
- You guess what the second number is.

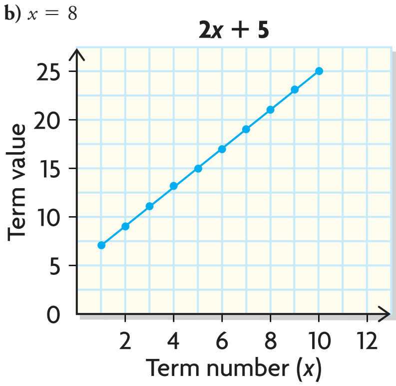
Chapter 4

Getting Started, page 192

1. **a)** i **b)** vi **c)** ii **d)** iii **e)** v **f)** iv
2. **a)** $n = 4$



b) $x = 8$



3. **a)** $a = 1$ **b)** $m = 2$ **c)** $x = 5$
4. **a)** \$19.95 **b)** 21 **c)** 18 **d)** 240 km
5. $n = 8$

6. **a)** $x = \frac{2}{3}$ **b)** $x = 8$ **c)** $n = \frac{54}{7}$

7. **a)** $x = 13$ **b)** $m = 8.5$ **c)** $n = 4.4$

8. **a)** $\frac{-32}{5}$, or $-6\frac{2}{5}$ **b)** $3\frac{7}{40}$

9. **a)** $-11x - 14$ **b)** $-2.5x + 3.5$

10. **a)** initial value: 13, rate of change: -3

b) Plot one coordinate at (0,13). The rest of the points on the line go down 3, right 1.

11. **a)** \$200 **c)** 32 h, \$1000; 53 h, \$1525

b) $y = 200 + 25x$

12. Answers may vary, e.g., related math terms: solution, inverse operations, linear.

Definition: a mathematical statement in which two expressions are equated

Non-examples: $3x - 4$; $2 + \frac{5}{6}$; $x(x - 4) < 8$

Examples: $3x + 2 = 8$; $x = 4$; $2x^2 + 7x - 8 = 0$

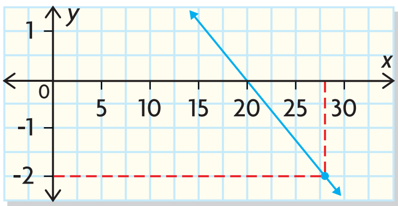
Lesson 4.1, page 201

1. $y = 4.25x - 3$

x	$y = 4.25x - 3$
1	1.25
2	5.5
3	9.75

From the table of values, the solution to the equation is between 2 and 3, but closer to 3. So, a reasonable estimate is about 2.8.
Check: $4.25(2.8) - 3 = 8.9$

2.



Answers may vary, e.g., $x = 28$.

Check: $5 - \frac{1}{4}(28) = -2$

3. question 1: $x = 2\frac{16}{17}$, question 2: $x = 28$

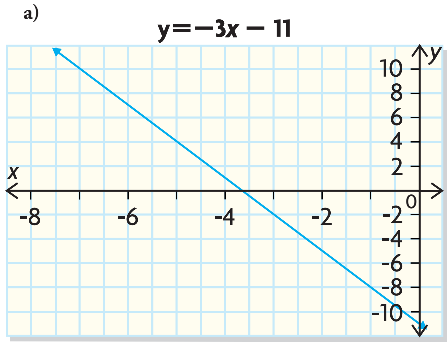
4. **a)** Answers may vary, e.g.,

Amount of Fencing (lin. ft)	50	100	150
Cost	262.5	525	787.5

Justin can purchase between 100 and 150 linear feet of fencing for \$600.

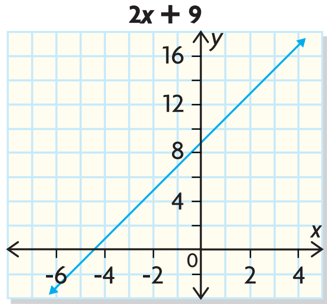
b) $114\frac{2}{7}$ linear feet **c)** $114\frac{2}{7} \times \$5.25 = \$600$

5. **a)**



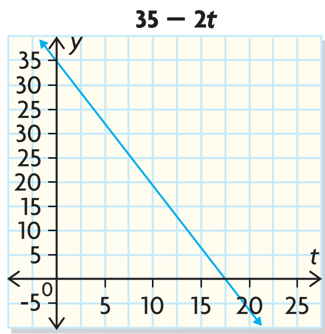
Answers may vary, e.g., $x = -6$.

b)



Answers may vary, e.g., $x = -2.5$.

c)



Answers may vary, e.g., $t = 11$.

6. **a)** $x = -6$ **b)** $x = -2.5$ **c)** $t = 11$

7. **a)**

x	1	0	-1
$2x - 8$	-6	-8	-10

x is between 0 and -1

b)

x	-5	-4	-3
$7 - 3x$	22	19	16

$x = -3$

c)

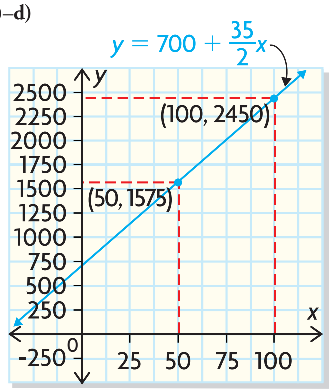
x	-2	-1	0
$2.75x + 3.8$	-1.7	1.05	3.8

$x = 0$

8. **a)** $x = -\frac{1}{2}$ **b)** $x = -3$ **c)** $x = 0$

9. **a)** $y = 700 + \frac{35}{2}x$

b)–d)



c) $y = 700 + \left(\frac{35}{2}\right)(50), y = 700 + \left(\frac{35}{2}\right)(100)$

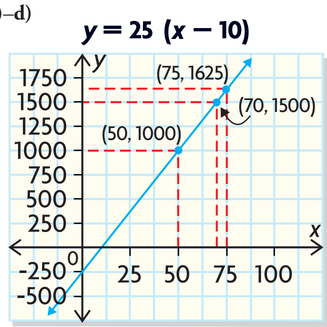
At 50 s, the rocket would be about 1575 m high.
At 100 s, the rocket would be about 2450 m high.

d) $1000 = 700 + \left(\frac{35}{2}\right)x$

The rocket reaches a height of 1000 m at 17 s.

10. a) $y = 25(x - 10)$

b)–d)



c) $y = 25(50 - 10)$; $y = 25(75 - 10)$
For 50 guests, the cost would be about \$1000.
For 75 guests, the cost would be about \$1625.

d) $1500 = 25(x - 10)$
For \$1500, you could invite 70 guests.

11. using tables and verifying

a)

x	0	1	2	3	4
$2x + 3$	3	5	7	9	11

b)

n	1	2	3	4	5
$3 - 4n$	−1	−5	−9	−13	−17

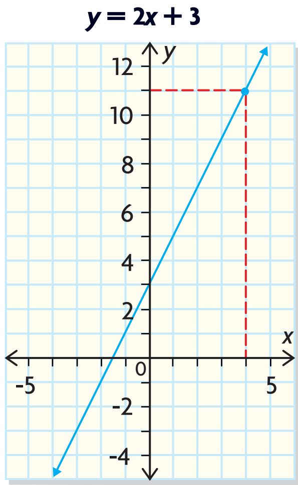
$n = 5$

c)

n	−8	−6	−4	−2	0
$-2 + \frac{1}{2}n$	−6	−5	−4	−3	−2

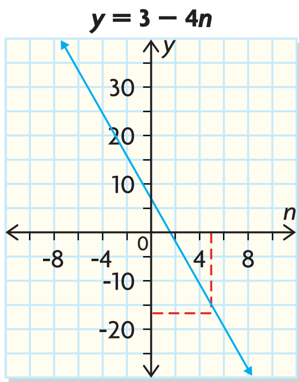
11. using graphs

a)



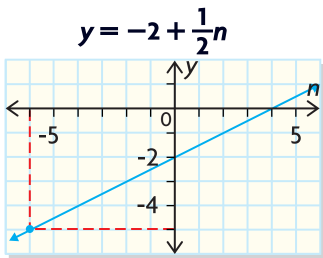
$x = 4$

b)



$n = 5$

c)



$n = -6$

12. a) $x = 4$; $2(4) + 3 = 8 + 3 = 11$

b) $n = 5$; $3 - 4(5) = 3 - 20 = -17$

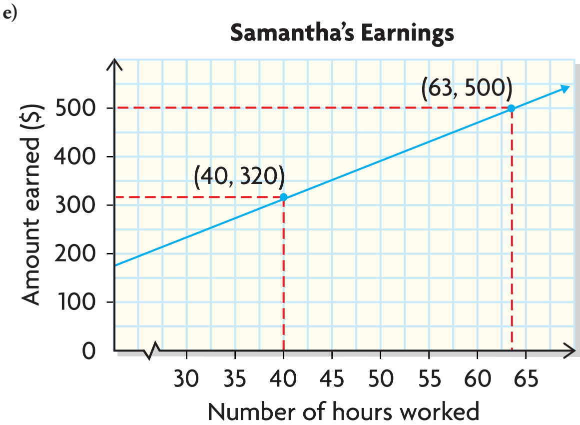
c) $n = -6$; $-2 + \frac{1}{2}(-6) = -2 + -3 = -5$

13. a) $y = 8x$ **b)** $500 = 8x$ **c)** $y = 8(40)$

d) The y-intercepts are the same. One solves for the independent variable while the other solves for the dependent variable.

Answers

e)

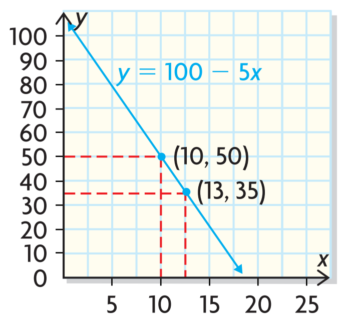


63 hours is the estimated solution to $500 = 8x$. \$320 is the estimated solution to $y = 8(40)$.

f) $x = 62.5$; $y = 320$

14. **a)** $x = -2$ **c)** $x = 0$
b) $x = 10$ **d)** $0 = -1$; no solution

15. **a)** $y = 100 - 5x$ **b)** $y = 100 - 5(13)$ **c)** $50 = 100 - 5x$
d) Answers may vary, e.g., both are equations, but the relation in part b) is easier to calculate since the variable is already isolated.
e)

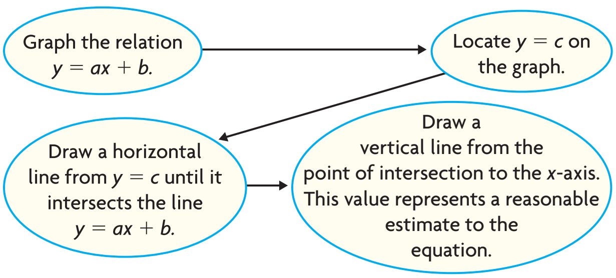


f) $y = 35$, $y = 5(13) = 35$
$x = 10$, $50 = 5(10)$

16. **a)** $2(100) + 2w = 500$ Perimeter is $2l + 2w = 500$ with $l = 100$
b) $w \doteq 150$
c) $w = 150$
d) 150 m

17. **a)** $C = 3n + 3$; C represents the number of counters, n represents the figure number
b) Figure 19 would have 60 counters.
c) The solution to the equation $100 = 3n + 3$, is $n = 32.33333\ldots$ Since you cannot have a partial number of figures, there is no figure that has 100 counters.

18. Answers may vary, e.g.,



19. using tables and verifying

a)

x	-3	-2	-1	0
$\frac{(x+2)}{5} - 3x$	8.8	6	3.2	0.4

$x \doteq -2.5$; $\frac{(-2.5 + 2)}{5} - 3(-2.5) = 7.4$

b)

x	$\frac{1}{2}(x+2) - \frac{1}{3}(x-1)$
0	1.333
5	2.167
10	3
15	3.833
20	4.667

$x \doteq 16$; $\frac{1}{2}(16 + 2) - \frac{1}{3}(16 - 1) = 4$

c)

x	0	1	2	3	4
$x^2 + 7$	7	8	11	16	23

$x = 3$; $3^2 + 7 = 16$

x	0	-1	-2	-3	-4
$x^2 + 7$	7	8	11	16	23

$x = -3$; $(-3)^2 + 7 = 16$

d)

x	0	1	2	3	4
$2x^2 - 3$	-3	-1	5	15	29

$x \doteq 2.6$; $2(2.6)^2 - 3 = 10.52$

x	0	-1	-2	-3	-4
$2x^2 - 3$	-3	-1	5	15	29

$x = -2.6$; $2(-2.6)^2 - 3 = 10.52$

e)

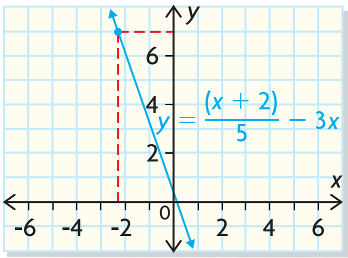
x	0	1	2	3	4
$3x^3 - 9$	-9	-6	15	72	183

$x = 3$; $3(3^3) - 9 = 72$

19. using graphs

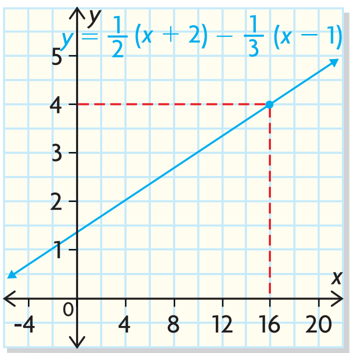
a) $x = -2.3$

Answers may vary, e.g.,



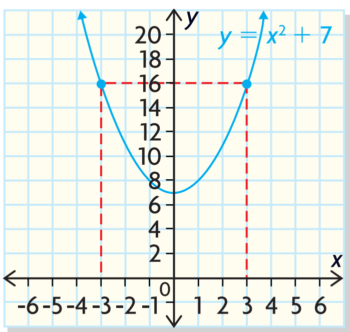
b) $x = 16$

Answers may vary, e.g.,



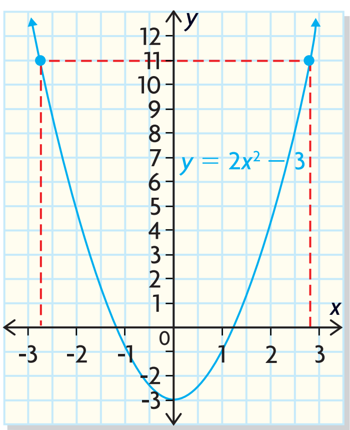
c) $x = +3; x = -3$

Answers may vary, e.g.,



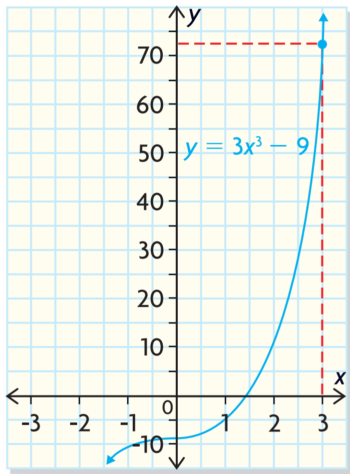
d) $x = +2.6; x = -2.6$

Answers may vary, e.g.,



e) $x = +3$

Answers may vary, e.g.,



20. **a)** $x = -2\frac{5}{14}$

b) $x = 16$

c) $x = +3$ or $x = -3$

d) $x = \sqrt{7}, x = -\sqrt{7}$

e) $x = +3$

21. $0 = mx + b$. Since the y-value on the x-axis is zero, I would substitute this value in for y and solve the equation.

Lesson 4.2, page 210

1. **a)** subtract 2, divide by -3

b) add 3.2, divide by 12.4

c) subtract 5, multiply by 2

2. **a)** $x = -\frac{13}{3}$ **b)** $x \doteq 2$ **c)** $x = 12$

3. **a)** $10\,000 = 1.25x + 5000$

b) $x = 4000$

c) $1.25(4000) + 5000 = 10\,000$

4. **a)** add 10, divide by 6

b) subtract 1, divide by 2.5

c) add 4, divide by 3

d) subtract 6, divide by -2

e) subtract 6, divide by -2

f) add 3, divide by -1

5. **a)** $6b = -2 + 10, 6b = 8, b = \frac{4}{3}; 6\left(\frac{4}{3}\right) - 10 = -2$

b) $2.5c = 1.5 - 1.0, 2.5c = 0.5, c = \frac{1}{5}; 2.5\left(\frac{1}{5}\right) + 1.0 = 1.5$

c) $3f = 10 + 4, 3f = 14, f = \frac{14}{3}; 3\left(\frac{14}{3}\right) - 4 = 10$

d) $2d = 4 - 6, -2d = -2, d = 1; 6 - 2(1) = 4$

e) $-2e = 6 - 6, -2e = 0, e = 0; 6 - 2(0) = 6$

f) $-h = -2 + 3, -h = -1, h = -1; -3 - (-1) = -2$

6. **a)** $10 = 8.00 + 0.50T$

b) $20 = 16 + T, 20 - 16 = T, 4 = T$

7. **a)** $D = -600 + 4t$

b) $-486 = -600 + 4t$

c) add 600, divide by 4

d) $t = 28.5$

e) $-600 + 4(28.5) = -486$

8. No. The process of balancing and using inverse operations is the same. Balancing is performing the same operation to each side of an equation with the goal of isolating the variable. Using inverse operations means using operations that are the reverse of those operating on the variable to isolate it and solve the equation.

Answers

9. $H = 500 - 60t$
$20 = 500 - 60t$
$t = 8$

10. **a)** $x = 8$ **c)** $y = 6$ **e)** $w = -12$
b) $x = 26$ **d)** $b = -55$ **f)** $d = 24$

11. $\frac{x}{7} + 13 = 32; x = 133$

12. **a)** $x = 3$ **c)** $w = 5$ **e)** $a = 6$
b) $x = 6$ **d)** $y = 23$ **f)** $c = \frac{15}{2}$

13. **a)** The number of people at each table is represented by x. $22.95(x - 1)$ represents the charge of 22.95 multiplied by the number of people at a table, subtract the one free person. T represents the total cost; $x =$ the number of people per table; $T =$ bill total
b) Table 1: $22.95(x - 1) = 137.70, x = 7$
Table 2: $22.95(x - 1) = 68.85, x = 4$
Table 3: $22.95(x - 1) = 160.65, x = 8$
Table 4: $22.95(x - 1) = 91.80, x = 5$
Table 5: $22.95(x - 1) = 91.80, x = 5$
c) 29 people

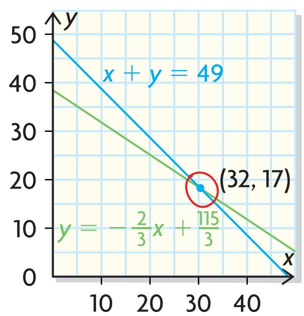
14. **a)** $14\frac{4}{9}$ °C or about 14.4 °C
b) subtract 32, multiply by 5, divide by 9
c) multiply by 9, divide by 5, add 32
d) 77 °F

15. Balancing: You do the same inverse operations to both sides.

16. **a)** $x = 1$ **b)** $x = \frac{5}{2}$

17. **a)** subtract $3x$, divide by 5
b) $y = -\frac{3}{5}x + 3$
c) subtract $5y$, divide by 3
d) $x = -\frac{5}{3}y + 5$
e) You can plot the x- and y-intercepts and that will allow you to draw a straight line.

18. **a)** $x + y = 49$; x represents the number of cars and y represents the number of trucks
b) $4x + 6y = 230$
c)



32 cars and 17 trucks were washed.

Lesson 4.3, page 220

1. $x = 3$

2. **a)** The width is 3 less than the length L
b) $44 = 2(L + L - 3); L = 12.5$
c) 12.5 cm by 9.5 cm

3. **a)** A: subtract $2x$ to isolate the variable term
B: add 18 to isolate the variable term
C: divide by 2 to isolate the variable
b) A: multiply both sides by 6 (LCD of 3 and 2) to remove the fractions
B: distribute the 6 through the bracket on the left; multiply 5×6 to simplify
C: subtract 4 from both sides to isolate the variable term
D: divide both sides by 3 to isolate the variable
E. simplify $\frac{26}{3}$ and express as a mixed number

4. **a)** Each equation is the same because if you use the distributive property on the right side of the first equation, it simplifies to the second equation; if you collect the like terms from the second equation so that the variables are on the left and the numbers on the right, you arrive at the third equation. Each equation has the same solution, $x = -14$.
b) Each equation is the same because if you multiply the equations containing fractions by the lowest common denominator and simplify, you will arrive at the equation without any fractions. Each equation has the same solution, $x = -\frac{56}{3}$.
c) Each equation is the same because if you multiply the equations containing fractions by the lowest common denominator and simplify, you will arrive at the equation without any fractions. Each equation has the same solution, $x = 4$.

5. **a)** $x = -8; 5(-8) + 24 = 2(-8)$
b) $k = \frac{15}{2}; 2\left(\frac{15}{2}\right) = 4\left(\frac{15}{2}\right) - 15$
c) $x = -6; -4(-6) - 1 = -3(-6) + 5$
d) no solution
e) $b = 2; 3(2) - 4 - 5(2) = -3(2) - 2$
f) $a = 0; 0 + 2(0) + 3(0) - 6 = 7(0) - 6$

6. $n = 17$

7. **a)** $x = 7; 3(7 - 5) = 6$
b) $d = -2; -5 = 5(3 + 2(-2))$
c) $m = 3; -3(5 - 6(3)) = 39$
d) $x = 10; 2(10 - 2) = 3(10) - 14$
e) $c = -1; 3(-1 + 5) = 4(1 - 2(-1))$
f) $x = -1; 4(-1 - 2) = -3(2(-1) + 6)$

8. $n - 5 = 3n + 1; n = -3$

9. 11.5 cm by 6.5 cm

10. **a)** $(x + 5) + (3x + 5) = 46$
b) George is 27 years old; Sam is 9 years old.

11.

	Equation	Common Denominator of All Terms	Equation with Denominators Eliminated
a)	$\frac{3x}{4}+\frac{2}{3}=2$	12	$9x+8=24$
b)	$\frac{1}{2}-\frac{x}{3}=\frac{1}{3}$	6	$3-2x=2$
c)	$\frac{2}{3}=5+x$	3	$2=15+3x$
d)	$\frac{x-5}{4}+1=\frac{1}{2}$	4	$(x-5)+4=2$
e)	$-16=\frac{x}{5}+\frac{x}{3}$	15	$-240=3x+5x$
f)	$\frac{-2}{5}(x-8)=4$	5	$-2(x-8)=20$
g)	$\frac{y+2}{3}=\frac{1}{5}(2y+3)$	15	$5(y+2)=3(2y+3)$

12. **a)** $x=6; \frac{6}{3}=2$

b) $d=-4; \frac{-4}{4}+3=2$

c) $x=12; \frac{12}{2}+\frac{12}{3}=10$

d) $c=36; \frac{36}{3}-\frac{36}{4}=3$

e) $k=22.5; \frac{3}{5}(22.5)-6=\frac{22.5}{3}$

f) $x=7; \frac{2(7)+1}{3}=5$

13. $\frac{1}{2}q+\frac{3}{5}=\frac{2}{3}q; q=\frac{18}{5}$, or $3\frac{3}{5}$

14. **a)** $\frac{1}{4}x+\frac{1}{3}x=1, x=\frac{12}{7}$ or $1\frac{5}{7}$

b) $\frac{1}{30}x+\frac{1}{60}x=1, x=20$ min

c) x represents the number of hours time the jets have been in the air; $600x=3500-800x; x=2.5$.

15. $k=2$

16. The equation simplifies to $0x=7$. Since no value of x will multiply by zero and make 7, there is no solution to the equation.

17. The equation simplifies to $0x=0$. Any value of x will make this equation true. Therefore, there is an infinite number of solutions. This happens because the expressions on the left and right hand of the equation are equivalent.

18. Step A: The LCD of 4 and 5 is 20. She multiplied by 20 to remove the fractions.
Step B: Jennifer eliminated the fractions by dividing 20 by 4 to get 5 and 20 by 5 to get 4. She multiplied the 20 and 2 on the right side of the equation.
Step C: Jennifer used the distributive property to simplify the left side of the equation.
Step D: Jennifer combined like terms.
Step E: Jennifer used inverse operations to group the numbers on the right side of the equation.
Step F: Jennifer added the numbers on the both sides of the equation.
Step G: Jennifer divided both sides of the equation by 28 because the operation between 28 and x is multiplication. Division is the inverse operation of multiplication.
Step H: Jennifer expressed the solution as an improper fraction in lowest terms and as a mixed number.

19. Agree: Solving an equation with variables on both sides of the equation involves using inverse operations to collect the variables on one side.

$$
\begin{aligned}
3x+2 &= 5x-8\\
3x+2-3x &= 5x-8-3x\\
2 &= 2x-8\\
2+8 &= 2x-8+8\\
10 &= 2x\\
5 &= x
\end{aligned}
$$

20.

	David	Colin
Number of Quarters	q	$\frac{q}{3}$
Number of Dimes	$16-q$	$2(16-q)$
Value of Quarters (¢)	$25q$	$25\left(\frac{q}{3}\right)$
Value of Dimes (¢)	$10(16-q)$	$10\times 2(16-q)$

David has 6 quarters and 10 dimes; Colin has 2 quarters and 20 dimes. They each have $2.50.

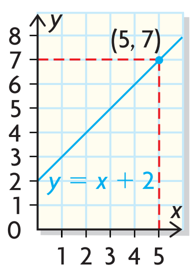
21. **a)** $x=25$ **b)** $x=30$ **c)** $x=42.5$

22. **a)** $x=+3, x=-3$ **b)** $x=5$ or $x=-7$ **c)** no solution

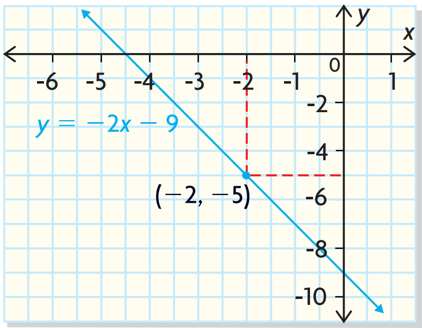
23. One large candy costs $0.14 or 14 cents and one small candy costs $0.08 or 8 cents.

Mid-Chapter Review, page 228

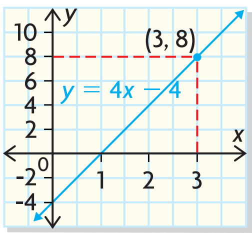
1. **a)**



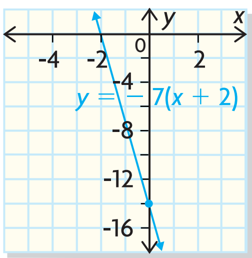
$x=5$

b) 

$x = -2$

c) 

$x = 3$

d) 

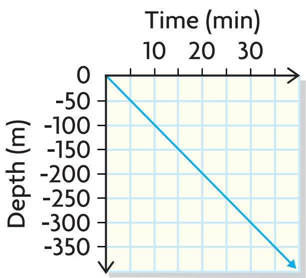
$x = 0$

2. a)

Time (min)	5	10	15	20	25	30
Depth (m)	50	100	150	200	250	300

b) Answers may vary, e.g.,

Depth of a Submarine

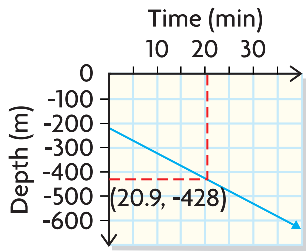


c) For every 5 min increase in time, there is a 50 m decrease in depth.

d) Answers may vary, e.g., $y = -219 - 10x$

e)

Depth of a Submarine



$-428 = -219 - 10x$,
$x = 20.9$

3. a) $x = 6$ b) $x = 2$ c) $x = -3$ d) $k \doteq -6.95$ e) $z = 0$ f) $a = 5$

4. a) $8.98(b - 6)$ b) \$17.96 c) $53.88 = 8.98(b - 6)$; $b = 12$

5. a) $x = 6$; $-(6) + 6 = 0$ and $2(6) - 12 = 12 - 12 = 0$

b) $x = -1$; $\frac{2}{3}(-1) - 2 = -\frac{2}{3} - 2 = -2\frac{2}{3}$ and

$4(-1) + \frac{4}{3} = -4 + \frac{4}{3} = -\frac{12}{3} + \frac{4}{3} = -\frac{8}{3} = -2\frac{2}{3}$

c) $x = 7$; $4[(7) - 8] = 4(-1) = -4$ and
$-2[(7) - 5] = -2(2) = -4$

d) $x = 0$; $\frac{2}{3}(0) - \frac{1}{2} = -\frac{1}{2}$ and $-\frac{1}{2} + \frac{1}{4}(0) = -\frac{1}{2}$

e) $a = \frac{18}{7}$ or $2\frac{4}{7}$; $\frac{1}{5}\left[\left(\frac{18}{7}\right) + 1\right] = \frac{1}{5} \times \frac{25}{7} = \frac{5}{7}$ and

$\frac{1}{3}\left[2\left(\frac{18}{7}\right) - 3\right] = \frac{1}{3}\left(\frac{36}{7} - 3\right) = \frac{1}{3} \times \frac{15}{7} = \frac{5}{7}$

f) $a = -\frac{24}{7}$ or $-3\frac{3}{7}$;

$$\frac{4\left(-\frac{24}{7}\right) - 2}{5} + \frac{1}{2} = \frac{-\frac{96}{7} - 2}{5} + \frac{1}{2} =$$

$$\frac{-\frac{110}{7}}{5} + \frac{1}{2} - \frac{22}{7} + \frac{1}{2} = -\frac{37}{14} \text{ and}$$

$$\frac{3\left(-\frac{24}{7}\right) + 7}{2} - 1 = \frac{-\frac{72}{7} + 7}{2} - 1 =$$

$$\frac{-\frac{23}{7}}{2} - 1 = -\frac{23}{14} - 1 = -\frac{37}{14}$$

6. a) $k + 3 = 12$, $k = 9$

b) $3x - 18 = 7$, $x = \frac{25}{3}$ or $8\frac{1}{3}$

c) $-15g + 7 = 0$, $g = \frac{7}{15}$

d) $8h + 3 = 42$, $h = \frac{39}{8}$ or $4\frac{7}{8}$

7. a) $2(2x + 7) = 210$; the dimensions are 49 m by 56 m.

b) $3x + 100 = 5x + 100$, $x = 0$; the angles are each 100 degrees.

c) $0.25q + 0.10(117 - q) = 15.75$; 27 quarters and 90 dimes

d) $\frac{1}{10}t + \frac{1}{12}t = 1$, $t = 5\frac{5}{11}$ h or about 5.45 h

Lesson 4.4, page 235

1. a) $x = \frac{(5 - y)}{3}$ b) $y = \frac{(-10 - 2x)}{5}$

2. **a)** $3x + 2.5y = 240$, where x is the number of pairs of figure skates and y is the number of pairs of hockey skates

b) $y = -\frac{3}{2.5}x + 96$ or $-\frac{6}{5}x + 96$

c) $x = -\frac{2.5}{3}y + 80$ or $-\frac{5}{6}y + 80$

3. **a)** $b = 2a + 4$ **c)** $4m - 3n + 2 = 4$

b) $x + 2y = -6$

4. **a)** $y = 4 - 2x$

b) $y = -4 - \frac{2}{3}x$

c) $y = \frac{(5.3 - 2.8x)}{1.1}$

d) $y = \frac{-10}{21}x + \frac{55}{91}$

e) $y = \frac{-4}{9}x + \frac{8}{15}$

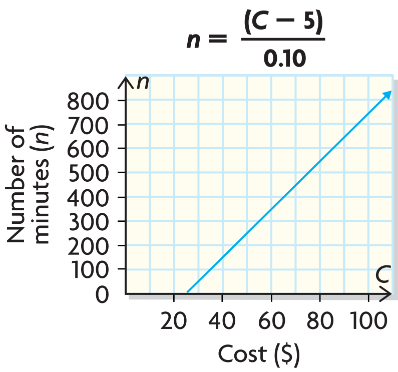
f) $y = -\frac{2}{3}x + \frac{14}{3}$

5. **a)** $n = \frac{(C - 25)}{0.10}$ or $n = 10C - 250$

b)

Cost C	25	50	100
Number of Minutes (n)	0	250	750

c)

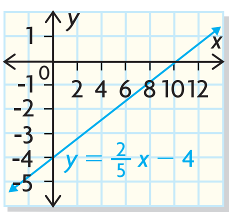


d) The independent variable in this relation is the number of minutes and the dependent variable is the cost.

e) Answers may vary, e.g., someone might want to use the cost as the independent variable if they are trying to determine how many minutes they could afford each month.

6. **a)** $y = -4 + \frac{2}{5}x$

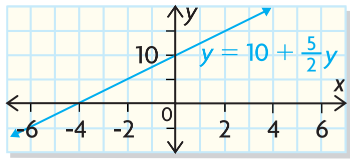
b)



c) slope $= \frac{2}{5}$; x-intercept $= 10$; y-intercept $= -4$

d) $x = 10 + \frac{5}{2}y$

e)



f) slope $= \frac{5}{2}$; x-intercept $= -4$; y-intercept $= 10$

g) The slopes are the inverse of each other. $\frac{5}{2}$ is the inverse of $\frac{2}{5}$.

7. **a)** $a = \frac{(12 + 5b)}{2}$ or $a = 6 + \frac{5}{2}b$

b) $n = \frac{(9 - 0.35m)}{2.4}$ or $n = \frac{15}{4} - \frac{7}{48}m$

c) $p = \left(\frac{1}{4} + \frac{2}{3}q\right) \div \left(\frac{1}{2}\right)$ or $p = \frac{1}{2} + \frac{4}{3}x$

d) $r = \frac{I}{pt}$

e) $L = (P - 2W) \div 2$ or $L = \frac{1}{2}P - W$

f) $r = \frac{C}{2\pi}$

8. **a)** $\frac{2A}{b} = h$ **b)** 27.5 cm

9. **a)** $0.10x + 0.25y = 42.50$

b) $y = \frac{42.50 - 0.10x}{0.25} = 170 - 0.4x$

c) $x = \frac{42.50 - 0.25y}{0.10} = 425 - 2.5y$

d) Answers may vary, e.g., (0, 170), (5, 168), (10, 166).

10. **a)** $30a + 8r = 150$

b) $a = 5 - \frac{4}{15}r$

c) $r = \frac{75 - 15a}{4} = 18.75 - 3.75a$

d) Answers may vary, e.g.,

Mass of Almonds (kg)	0.5	1	1.5	2
Mass of Raisins (kg)	16.875	15	13.125	11.25

11. Answers may vary, e.g., at least 708 digital watches and 472 analog watches should be produced.

12. **a)** $\frac{(xk + n)}{r} = w$

b) operations acting on x: multiply by k, add n, divide by r
inverse operations to isolate x: multiply by r, subtract n, divide by k

c) $x = \frac{(wr - n)}{k}$

d) The process is the same since rearranging an equation or formula or linear relation provides an equivalent version. But, the end result is quite different. When solving a linear equation, the result is a number. The result when rearranging for a variable is an equivalent equation, relationship or rule.

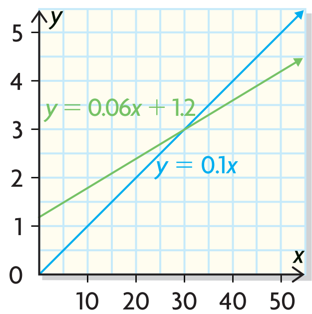
13. a) $x = \dfrac{5}{(9 - 2y)}$
b) $x = 7$ or $x = -7$
c) $x = 10$ or $x = -2$
d) $x = \dfrac{(3 + y)}{-4}$ or $x = \dfrac{-3 - y}{4}$
e) $x = 80$
f) $x = -\dfrac{1}{2}$

14. a) $h = \dfrac{SA}{2\pi r} - r$
b) 4.55 cm
c) The radius has two different exponents in the original equation, so it cannot be isolated.

Lesson 4.5, page 245

1. a) (2, 2) c) $\left(\frac{4}{3}, \frac{5}{3}\right)$
b) (2, 3) d) (0, 0)

2. a) $y = 1.20 + 0.06x$
b) $y = 0.10x$
c)



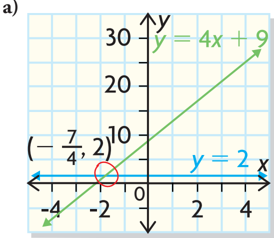
d) the break-even point
e) i) loss ii) profit iii) profit

3. a) $x = -\dfrac{11}{7}; y = \dfrac{19}{7}$ c) $x = \dfrac{122}{21}; y = \dfrac{19}{21}$
b) $x = -\dfrac{59}{22}; y = \dfrac{34}{11}$ d) no solution; the lines are parallel

4. a) $x + y = 42; x - y = 17$
b) Answers may vary, e.g., because the answers are not integers there is no solution.

5. 31 dimes and 27 quarters
6. a) yes b) no c) no d) no

7. a)



$\left(-\frac{7}{4}, 2\right)$

b) $2 = 4x + 9$
c) $\left(-1\frac{3}{4}, 2\right)$

8. a) (1, 10)
b) no point of intersection; the lines are parallel
c) no point of intersection; the lines are parallel
d) (1, −4)

9. a) $y = \dfrac{3}{4}x; y = 250 + 0.25x$; x represents the number of bottles of water purchased/sold; y represents the total amount of money either spent or made.
b) 500 bottles

10. a) Uplink: $y = 19$; Blueline: $y = 10 + 0.59(x - 30) = 0.59x - 7.7$
b) Answers may vary, e.g., (45, 19).
c) $19 = 10 + 0.59(x - 30)$. This equation is reasonable because both y values are the same at this point.
d) Answers may vary, e.g., I would tell Mr. Smith that if he plans to use less than 45 h per month, Blueline is cheaper. If he plans to use more than 45 h per month, Uplink is cheaper.

11. Answers may vary, e.g., while these companies might be initially cheaper, their cost per hour is very expensive. As the number of hours increases, the costs rise more quickly. Downlink exceeds the monthly cost of Uplink after about 12 hours of use and Redline after about 9 hours. Blueline also gives more free hours, which is a factor that should be considered.

12. a) (0.8, 1) c) at about (−0.22, 0.44)
b) intersects everywhere on the line d) (2, 0)

13. Answers may vary, e.g.,
a) $2x + y = 7$ or $y = -2x + 7$
b) $y = -x + 2$. These equations have the same slope, so they are parallel and therefore do not intersect.

14. The point of intersection is (20, 50). If the customer intends to rent more than 20 movies, the customer should use Films 'R' Us. If the customer plans to rent fewer than 20 movies, the customer should use Movies to Go.

15. The solution is the point of intersection of the two lines. Two lines can intersect at most once unless they are the same line.

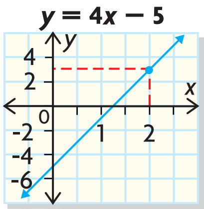
16. The points of intersection have the same y-value, which makes the $mx + b$ parts equal, too.

17. When solving using inverse operations, you are able to determine the exact value of the point of intersection. Graphing sometimes can only give an approximation.

18. a) (2, 8) and (−2, 8)
b) $2x^2 = 8; x = 2, x = -2$
c) Yes. There are two points of intersection on the graph and so there must be two values that solve the equation.

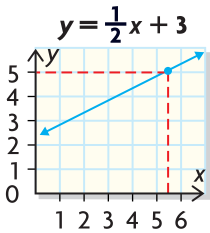
Chapter Review, page 250

1. **a)** $y = 4x - 5$



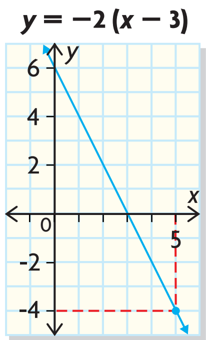
Answers may vary, e.g., $x = 2$.

b) $y = \frac{1}{2}x + 3$



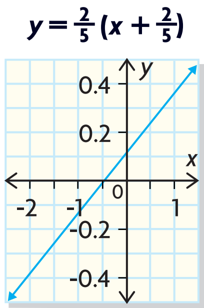
Answers may vary, e.g., $x = 4$.

c) $y = -2(x - 3)$



Answers may vary, e.g., $x = 5$.

d) $y = \frac{1}{4}\left(x + \frac{2}{5}\right)$



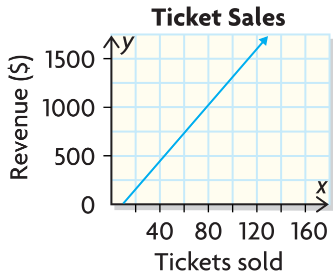
Answers may vary, e.g., $x = -\frac{2}{5}$.

2. **a)** $x = 2$ **b)** $x = -3$ **c)** $x = 5$ **d)** $x = 3$

3. **a)** $x = 4$ **b)** $x = 5$

4. **a)** $y = 15(x - 10)$

b)



c) $y = 15(100 - 10)$; $y \doteq 1350$
d) $600 = 15(x - 10)$; $x \doteq 50$

5. **a)** $x = 2$ **b)** $x = 4$ **c)** $x = 5$ **d)** $x = -\frac{2}{5}$

6. **a)** $y = 15.95(x - 10)$
b) \$79.75
c) $\frac{y}{15.95} + 10 = x$; $x = 12$; Erynn ordered 12 CDs

7. **a)** $x = 6$ **b)** $x = -\frac{80}{153}$ **c)** $x = -10$ **d)** $x = 86$

8. $x = 2$; 2 units and 5 units, 6 units and 8 units

9. No. I substituted $x = 3$ into both sides of the equation and got different values.

10. **a)** $l = \frac{(P - 2w)}{2}$ **c)** $\frac{V}{\pi r^2 = h}$
b) $\frac{(A - P)}{(Pr)} = t$ **d)** $y = \frac{(C - Ax)}{B}$

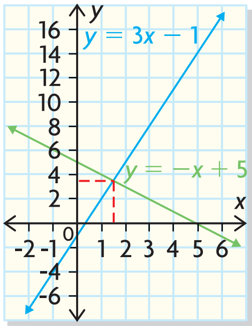
11. **a)** $32\frac{2}{9}$ °C or about 32.2 °C **c)** 77 °F
b) $F = \frac{9C}{5} + 32$

12. **a)** $y = -3 + 2x$ **c)** $x - 3 = y$
b) $\frac{1}{2}x + 2 = y$ **d)** $y = 16 - 2x$

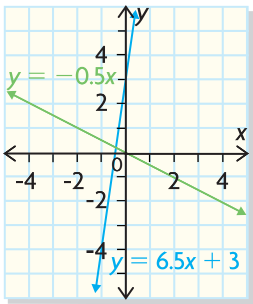
13. **a)** $x + 2y = 32$; x represents the number loonies, y represents the number of toonies
b) $y = \frac{32 - x}{2}$
c) Answers may vary. e.g., 0 loonies and 16 toonies, 2 loonies and 15 toonies, 16 loonies and 8 toonies, 10 loonies and 11 toonies
d) No. Answers may vary, e.g., the total value of the toonies is always an even number, so the number of loonies has to be an even number.

14. **a)** -3.5
b) $-2(-3.5) - 3 = 4$; the solution is correct.
c) $y = 4$ is a straight horizontal line, so it will have to intersect the other relation at some point. There can only be one point of intersection.
d) You could graph the lines $y = 3x - 4$ and $y = 2x + 3$. They will intersect because their slopes are not equal. Then use the graph to determine the point of intersection.

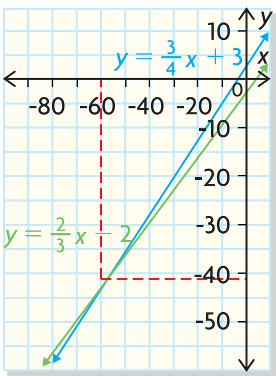
Answers

15. a) 

(1.5, 3.5)

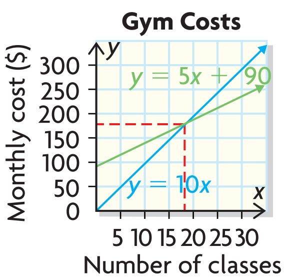
b) 

$\left(-\frac{3}{7}, \frac{3}{14}\right)$

c) 

(−60, −41)

16. a) $y = 90 + 5x$; $y = 10x$

b) 

c) The point of intersection is (18, 180).

d) The cost for 18 classes is \$180 regardless of which gym you join.

e) If you are going to take more than 18 classes a month, you should choose Faster Fitness. Any less and Drop-in Fitness is cheaper.

17. a) Video Vault: $C = 3v$
Videorenters: $C = 15 + 2v$

b) (15, 45)

c) In this case, the point of intersection represents the number of DVDs that have to be rented (15) to yield the same price (\$45) at both video stores.

d) If a customer is going to rent more than 15 DVDs in a year, then the customer should use Videorenters. If the customer is going to rent less than 15 DVDs in a year, then the customer should use Video Vault.

Chapter Self-Test, page 252

1. a)
- The table of values is valid because it shows the exact value of the expression for various values of the variable.
- The graph is valid because it shows the exact value of the expression for all values of the variable.
- The algebraic model is valid because each equation is equivalent.

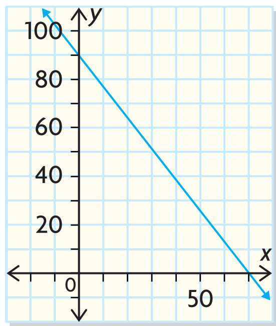
b) algebraic model

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

3. a) $y = \frac{(6 + 3x)}{2}$ or $y = \frac{3}{2}x + 3$

b) $\frac{(y - 2)}{3} = x$

4. a) Answers may vary. e.g., 7 h at the \$14/h job and 82 h at the \$11/h job; 18 h at the \$14/h job and 68 h at the \$11/h job.

b) 

5. a) (1, −2) **b)** (−1.4, 2.2)

6. 2000 linear feet

Chapter 5

Getting Started, page 256

1. a) viii **b)** vii **c)** i **d)** iii **e)** ii **f)** iv **g)** v **h)** vi

2. a) $\frac{5}{-3} = \frac{-5}{3}$ **b)** $\frac{4}{11}$ **c)** $\frac{-3}{10}$ **d)** $\frac{2}{3}$

3. a) $b = \frac{V}{h}$ **b)** $y = \frac{-3}{5}x + 3$ **c)** $w = \frac{P}{2} - l$ **d)** $d = vt$ **e)** $r = \frac{I}{Pt}$ **f)** $x = \frac{-2}{5}y + 4$

4. Line PT is parallel to line RU ($PT \parallel RU$).
Line QV is perpendicular to line PT ($QV \perp PT$).
Line QV is perpendicular to line RU ($QV \perp RU$).

5. a) $x = 7$ **b)** $m = -15$ **c)** $p = 4$ **d)** $t = 1$

6. a) linear; for each unit increase in x, there is an increase of 7.5 in y or the degree of the variables is 1

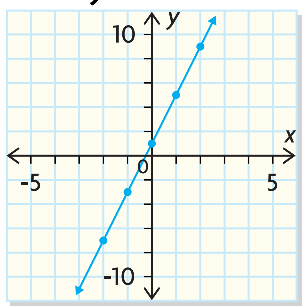
b) nonlinear; first differences in table of values are not constant or the degree of the variables is not 1

c) linear; first difference in table of values are constant ($= -2$) or the degree of the variables is 1

7. a)

x	y
-2	-7
-1	-3
0	1
1	5
2	9

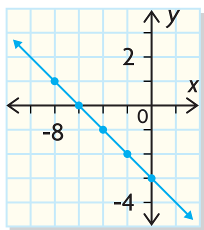
$y = 4x + 1$



b)

x	y
-8	1
-6	0
-4	-1
-2	-2
0	-3

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



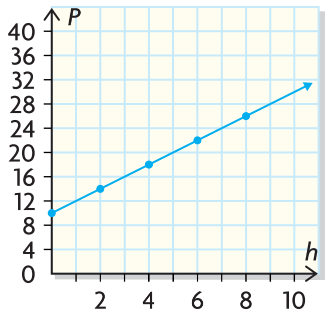
8. a) $x = \frac{4}{5}; y = 4$ b) $x = -7; y = -2$

9. a) \$55 b) \$0.04 c) equal d) \$0.04/flyer

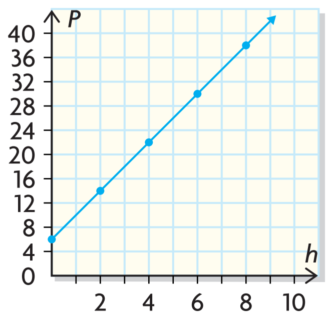
10. a) Herteises: $P = 10 + 2h$; Farids: $P = 6 + 4h$

b)

$P = 10 + 2h$



$P = 6 + 4h$



c) earns more money if babysits for Farids longer than 2 hours, else select Herteises

11. a) disagree; could look for first differences in a table of values without graphing

b) agree, the line is extended to both ends so it passes through 2 or more quadrants

c) agree, vertical lines have an equation $x = a$, where a is a number. Therefore all points (x, y) have $x = a$.

d) disagree, consider two lines passing through the origin. One line can have a large negative slope and the other can have a small negative slope and be 45° apart.

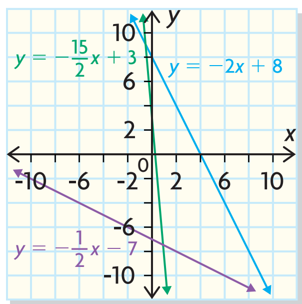
Lesson 5.1, page 263

1. a) iii c) iv e) i
b) vi d) ii f) v

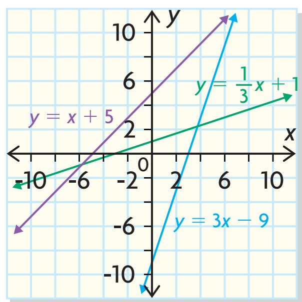
2. i) a) steepest: $y = -\frac{15}{2}x + 3$ b) steepest: $y = 3x - 9$

least steep: $y = -\frac{1}{2}x - 7$ least steep: $y = \frac{1}{3}x + 1$

ii) a)



b)



3. a) $y = 0$ b) $x = 0$

Lesson 5.2, page 269

1. $y = -\frac{5}{6}x - \frac{5}{2}$

2. a) $3s + 4c = 48$ b) 16, 12, 8, 4, or 0 stools.

3. a) $y = \frac{4}{3}x - 8$; slope $= \frac{4}{3}$; y-intercept $= -8$

b) $y = -\frac{2}{5}x + 3$; slope $= -\frac{2}{5}$; y-intercept $= 3$

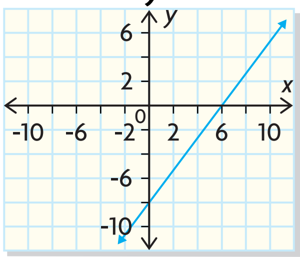
c) $y = \frac{1}{2}x - \frac{7}{3}$; slope $= \frac{1}{2}$; y-intercept $= -\frac{7}{3}$

d) $y = -\frac{8}{5}x$; slope $= -\frac{8}{5}$; y-intercept $= 0$

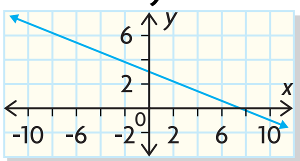
e) $y = -\frac{4}{7}x + \frac{11}{7}$; slope $= -\frac{4}{7}$; y-intercept $= \frac{11}{7}$

f) $y = -\frac{8}{5}x - 2$; slope $= -\frac{8}{5}$; y-intercept $= -2$

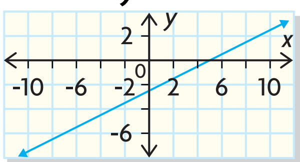
4. a) $4x - 3y = 24$



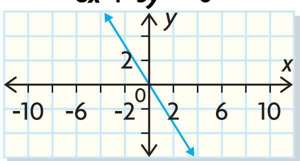
b) $2x + 5y = 15$



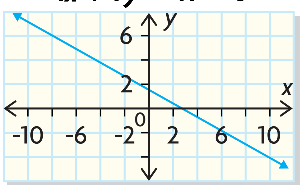
c) $3x - 6y - 14 = 0$



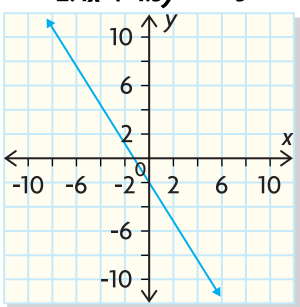
d) $8x + 5y = 0$



e) $4x + 7y - 11 = 0$



f) $2.4x + 1.5y = -3$



5. a) i) fall (slope is negative)

ii) rise (slope is positive)

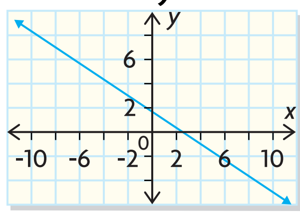
iii) fall (slope is negative)

iv) fall (slope is negative)

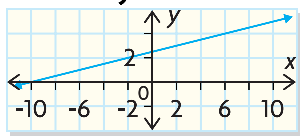
v) rise (slope is positive)

vi) rise (slope is positive)

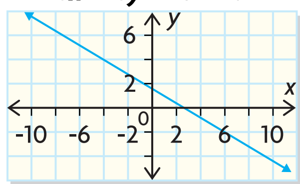
b) i) $2x + 3y = 5$



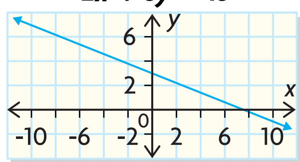
ii) $x - 4y + 10 = 0$



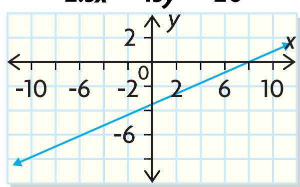
iii) $3x + 5y - 8 = 0$



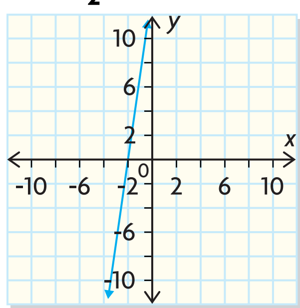
iv) $2x + 5y = 15$



v) $2.5x - 15y = 20$



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



6. a) $d = \frac{-4}{3}t + 3$; d-intercept $= 3$; slope $= \frac{-4}{3}$

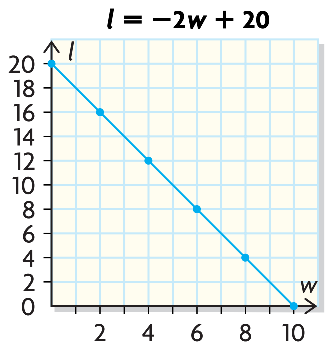
b) $d = \frac{1}{4}h - 2$; d-intercept $= -2$; slope $= \frac{1}{4}$

c) $d = \frac{5}{6}k + \frac{5}{2}$; d-intercept $= \frac{5}{2}$; slope $= \frac{5}{6}$

7. a) $2l + 4w = 40$

b) Answers may vary, e.g., $l = -2w + 20$ or $w = 10 - \frac{1}{2}l$.

c)



d) Answers may vary, e.g.,

w	2	4	5
l	16	12	10

8. a) $12j + 21a = 18$

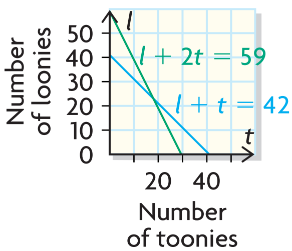
b) $j = \frac{-7a + 6}{4} = \frac{-7a}{4} + \frac{3}{2}$

c) 1062.5 g

d) 1325 g

9. a) total number of coins: $l + t = 41$; total value: $l + 2t = 59$

b)



c) $(t, l) = (18, 23)$

d) The intersection is the one point that satisfies both equations.

10.

Chocolate Chip Batches	Oatmeal Batches
0	12
2	9
4	6
6	3
8	0

11. a) $0.9t + 0.6n = 6$, where t is the number of textbooks and n is the number of notebooks.

b) $t = \frac{-2}{3}n + \frac{20}{3}$ or $n = \frac{-3}{2}t + 10$

c)

Textbooks (*t*)	0	2	4	6
Notebooks (*n*)	10	7	4	1

12. a) $3x - 8y + 5 = 0$ can be solved for y and gives $y = \frac{3}{8}x + \frac{5}{8}$, so they must be the same line.

b) No. $2x + 3y + 1 = 0$ equals $y = \frac{-2}{3}x - \frac{1}{3}$.

13. a) Answers may vary, e.g., as Punitha's tutor, I would ensure Punitha was comfortable manipulating an equation (isolating variables and knowing what each component of the equation represented).

b) You can find all characteristics of a line from any linear equation form; the intercepts, the slope, and so on.

14. both are equivalent to $2x - 3y + 7 = 0$

15. a) i) slope $= \frac{-3}{4}$ ii) slope $= \frac{-2}{5}$ iii) slope $= \frac{4}{3}$

y-intercept $= 2$ y-intercept $= \frac{9}{5}$ y-intercept $= 4$

b) i) $-\frac{A}{B}$ ii) $-\frac{C}{B}$

Lesson 5.3, page 278

1. a) 1 b) -6

2. $y = 7$

3. a) $-\frac{13}{6}$ b) 1 c) undefined d) 0 e) $-\frac{2}{3}$ f) 15

4. a) Answers may vary, e.g., (6, 4).

b) Answers may vary, e.g., (5, 13).

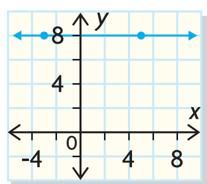
c) Answers may vary, e.g., (3, 1).

d) Answers may vary, e.g., (10, 5).

5. Slopes are not equal.

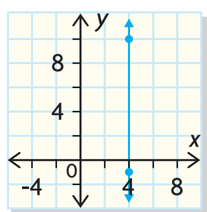
6. a) yes b) no c) no d) yes

7. a)



b) $m = 0$ c) The slope of a horizontal line is 0.

8. a)



b) slope is undefined

c) The slope of a vertical line is undefined.

9. a) horizontal; a horizontal line does not "rise"

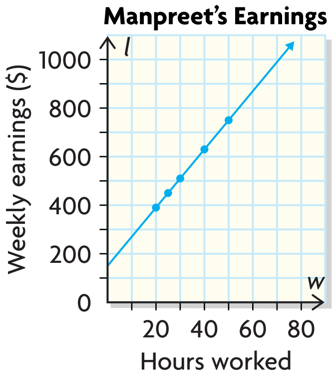
b) vertical; a vertical line does not "run"

10. If the x-coordinates are the same, the line is vertical. If the y-coordinates are the same, the line is horizontal. If no coordinates are the same, the line is slanted.

11. Answer may vary, e.g., slopes close to -1 are reasonable.

12. 15 km/h

13. a)



b) \$12/h

c) 62.5 h without overtime. 55 h at time and one half above 40 h

d) Answers may vary, e.g., unlikely since the average work week is 40 h.

14. \$13 125/year

15. a) No b) 1080 cm or 10.8 m

16. a) Snowbowl: 852 ft; Bear Claw: 4800 ft; The Vortex: 3400 ft

b) Bear Claw, The Vortex, Snowbowl

17. \$15/person

18. $k = 5$

19. From the top, clockwise: undefined; between 1 and positive infinity, 1; between 0 and 1; 0; between 0 and -1; -1; between -1 and negative infinity

20. a) $k = -2$

b) A(7, -2); C(13, 7)

c) Any other value of k will make the three points non-collinear. Answers may vary, e.g., $k = 0$

21. a) $y = 5x + 2$ c) $y = \frac{2}{3}x$ e) $y = -2$

b) $y = -4x + 13$ d) $x = 2$

Mid-Chapter Review, page 283

1.

	Slope	y-intercept
a)	4	-5
b)	-2	3
c)	$\frac{3}{7}$	$-\frac{2}{3}$

2. a) falling to the right c) horizontal e) rising to the right

b) horizontal d) vertical f) rising to the right

3. a) $y = 7$ b) $y = \frac{2}{3}x - 7$ c) $y = -\frac{1}{5}x + 8$

$y = x$ $y = 2.5x - 3.7$ $y = -2x + 4$

$x = 2$ $y = \frac{9}{2}x + 4$ $y = -6x - \frac{5}{8}$

4. a) $y = 7$ is horizontal, which is flat; $x = 2$ is vertical, which represents a cliff.

b) Bunny Hills

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

$y = -\frac{1}{5}x + 8$

Intermediate Hills

$y = x$

Double Black Diamond Hills

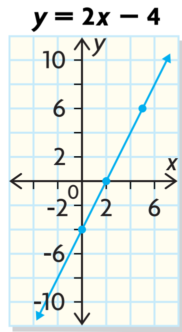
$y = -2x + 4$

$y = 2.5x - 3.7$

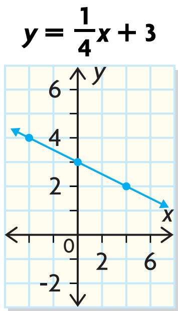
$y = \frac{9}{2}x + 4$

$y = -6x - \frac{5}{8}$

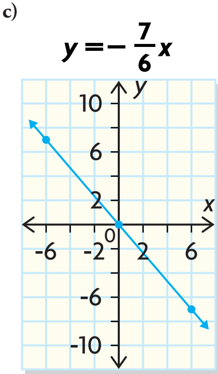
5. a)



b)



c)



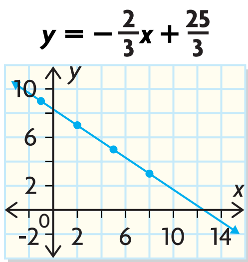
6. a) $y = 2x - 5$ c) $y = \frac{1}{4}x - \frac{5}{4}$ e) $y = -4x + 9$

b) $y = \frac{-1}{2}x - 2$ d) $y = 0x + 10$ f) $y = \frac{2}{3}x + \frac{1}{3}$

7. a) $8x + 12y = 100$, where x is the number of movie tickets and y is the number of concert tickets.

b) $y = \frac{-2}{3}x + \frac{25}{3}$

c)



d)

Movie	2	5	8	11
Concert	7	5	3	1

8. a) 2 c) $\frac{2}{3}$ e) $-\frac{3}{4}$

b) -3 d) $\frac{1}{5}$ f) 0

9. a) $-\frac{1}{2}$ c) -1 e) 0
b) $\frac{11}{10}$ d) $\frac{5}{3}$ f) undefined

10. a) no b) no c) yes d) no

11. a) $k = -\frac{18}{5}$ or -3.6 c) $k = 4$
b) $k = 1$ d) $k = \frac{38}{5}$ or 7.6

12. \$15 per person

13. 89 km/h

Lesson 5.4, page 290

1. a) $y = 3x + 5$ b) 5; 1

2. a) iii b) iv c) i d) ii

3. a) $y = -2x + 12$ b) $y = 3x - 6$

4. a) $y = -5x + 3$ b) $\frac{4}{3}; -2$ c) $y = 2$ d) $\frac{1}{2}; 0$

5. a) $y = 3x + 5$ c) $y = -\frac{5}{3}x$ e) $y = \frac{1}{4}x - 2$
b) $y = 5$ d) $y = -\frac{5}{2}x + 3$ f) $y = \frac{2}{3}x + \frac{1}{3}$

6. a) -11 b) 11 c) -6

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

8. a) $y = \frac{-8}{9}x + 4$ c) $y = \frac{3}{4}x - 3$
b) $y = \frac{1}{5}x - \frac{28}{5}$ d) $x = 6$

9. a) $x = 1$ c) $y = 7$ e) $x = 0$
b) $y = \frac{15}{8}x + 12$ d) $y = \frac{5}{6}x + 13$ f) $y = \frac{1}{10}x - \frac{1}{2}$

10. $y = \frac{3}{10}x + 3$

11. a) $y = -110x + 680$, where x is the time in hours and y is the distance from home in kilometres.
b) The slope of -110 means that the distance is decreasing at a rate of 110 km/h. The y-intercept of 680 means they began their trip 680 km away from home.

12. a) maximum heart rate in a stress test for a newborn baby
b) the rate of decline of maximum heart rate in a stress test over the years
c) $y = \frac{-4}{5}x + 184$
d) about 173 beats/min

13. a) $C = 0.50t + 12$, where C is the total cost, in dollars, and t is the number of ride tickets purchased.
b) $C = 21$, where C is the total cost, in dollars.
c) Answers may vary, e.g., since 25 tickets cost \$24.50, she should buy the ride pass.
d) \$4

14. a) $B = 0.1d + 21.50$, where B is the total bill and d is the number of songs downloaded.
b) $B = 0.1(21) + 21.50 = \$23.60$, so the third point also satisfies the equation.
c) Answers may vary, e.g., if she downloads more than 25 songs per month on average she should not change companies.
d) Answers may vary, e.g., if she averages 35 downloads or more per month then she should consider changing to Digital Beats.

15. Barb is correct. The slope and y-intercept can be determined from any two pieces of information, such as two points, or the x- and y-intercepts.

16. $y = 2x - 4$

17. a) Substitute the coordinates into the slope formula $\frac{y - q}{x - p} = m$ then isolate y.
b) $y = 3(x - 1) + 2$, which simplifies to $y = 3x - 1$
c) $y = 3x - 1$
d) i) $y = 5(x - 4) - 6$ or $y = 5(x - 5) - 1$; both simplify to $y = 5x - 26$
ii) $y = \frac{2}{3}(x - 3) - 1$ or $y = \frac{2}{3}(x - 9) + 3$; both simplify to $y = \frac{2}{3}x - 3$
iii) $y = -4(x - 4) + 5$ or $y = -4(x - 3) + 9$; both simplify to $y = -4x + 21$

Lesson 5.5, page 302

1. a) Answers may vary, e.g., $y = -\frac{3}{2}x - 9$.
b) Answers may vary, e.g., $y = \frac{2}{3}x + 9$.

2. a, g, and f are parallel; perpendicular pairs: b and e, c and h

3. a) perpendicular c) neither e) parallel
b) perpendicular d) parallel f) neither

4. PQ is parallel to KL; AB ⊥ PQ; AB ⊥ KL; GH ⊥ UV.

5. Perpendicular; one line is horizontal and one line is vertical, so they are perpendicular lines.

6. a) $y = 4$
b) $y = -8$
c) horizontal line equation has the form: y = y-coordinate of point through which it passes

7. a) $x = -9$
b) $x = 6$
c) vertical line equation has the form: x = x-coordinate of point through which it passes

8. a) $y = 3x - 14$ c) $y = \frac{-3}{2}x + 3$
b) $y = \frac{-1}{3}x - 4$ d) $y = \frac{-3}{2}x + 6$

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

10. $y = \frac{-5}{2}x + \frac{25}{2}$

11. a) yes b) no

12. $m_{AB} = -\frac{4}{7}$ $m_{AC} = \frac{7}{4}$ $m_{CD} = -\frac{4}{7}$ $m_{DB} = \frac{7}{4}$
AB is perpendicular to AC and to DB.
CD is perpendicular to AC and to DB.
The quadrilateral ABDC has four right angles, so it must be a rectangle.

13. $m_{EF} = -\frac{7}{4}$ $m_{FG} = -\frac{1}{6}$ $m_{GH} = -\frac{7}{4}$ $m_{HE} = -\frac{1}{6}$
EF and GH are parallel.
FG and HE are parallel.
No sides are perpendicular.
The quadrilateral EFGH is a parallelogram but not a rectangle.

14. 795 cm

15. a) -4.5 b) 1.5

16. A line perpendicular to $y = \frac{3}{4}x + 2$ has a slope of $\frac{-4}{3}$ and a line parallel to $y = \frac{4}{5}x - 8$ has a slope of $\frac{4}{5}$. A single line cannot have both of these slopes.

17. a) Answers may vary, e.g., C(2, 5) and D(−1, −1).
b) Answers may vary, e.g., C(6, 0) and D(3, −6).
c) Answers may vary, e.g., C(−2, 4) and D(−5, −2).

18. $m_{AM} = -3$ and $m_{BC} = \frac{1}{3}$ and $m_{AM} \times m_{BC} = -1$

19. $m_{AC} = -2$ and $m_{BC} = \frac{1}{2}$ and $m_{AC} \times m_{BC} = -1$

Chapter Review, page 309

1. a) 3; 4 b) $\frac{-2}{5}$; −6.8 c) 9.7; −1.11 d) 0; 3

2. a) $y = \frac{1}{3}x - 2$; $y = x + 8$; $y = 2x - 4$
b) $y = -\frac{1}{3}x + 5$; $y = -\frac{5}{2}x + 3$; $y = -8x - 2$

3.

	Equation	Rises to the Right	Falls to the Right
a)	$y = 4x + 5$	✓	
b)	$y = -\frac{2}{3}x - 8$		✓
c)	$y = -2.8x + 4$		✓
d)	$y = \frac{21}{8}x$	✓	
e)	$y = 1.5x + 4.5$	✓	

4. a) $\frac{3}{4}$; $\frac{9}{4}$ b) 5; −12 c) $\frac{-1}{3}$; $\frac{16}{3}$ d) −4; 2

5. a) Evan: $10d + 5s = 255$; Sara: $10d + 5s = 230$, where d is the number of double driveways and s is the number of single driveways.
b) Evan: $s = -2d + 51$; Sara: $s = -2d + 46$
c) Evan: 31; Sara: 26

6. a) $\frac{9}{8}$ c) −3 e) $-\frac{2}{3}$
b) 0 d) undefined f) $\frac{4}{3}$

7. a) −1 b) $-\frac{3}{4}$ c) $-\frac{5}{2}$ d) $\frac{13}{6}$

8. 2

9. 21 km/h

10. a) $y = 12$ c) $y = \frac{2}{3}x + 8$ e) $y = \frac{1}{5}x - 8$
b) $y = \frac{-5}{2}x + 4$ d) $x = 4$

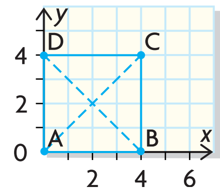
11. a) $y = \frac{-3}{4}x + \frac{27}{2}$ c) $y = -4x + 17$ e) $y = \frac{1}{3}x + \frac{7}{3}$
b) $y = \frac{-16}{3}x + 5$ d) $x = 5$

12. A is on the line, B is not on the line.

13. a) neither c) perpendicular e) perpendicular
b) parallel d) neither f) perpendicular

14. a) $y = \frac{7}{2}x + 2$ b) $y = 4x + 2$ c) $y = \frac{-9}{4}x + 6$

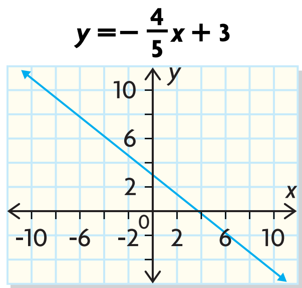
15. a) yes
b) Answers may vary, e.g.,



c) $m_{AC} = 1$, $m_{BD} = -1$. $1 \times -1 = -1$, so the diagonals are perpendicular.
d) Using A(1, 0), B(0, 1), C(−1, 0), and D(0, −1), one diagonal is horizontal and one is vertical, so they are perpendicular. The diagonals of a square are perpendicular.

Chapter Self-Test, page 311

1. B.
2. D.
3. C.
4. A.
5. B.
6.



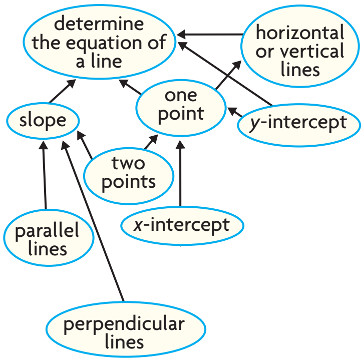
7. No, since $m_{AB} \neq m_{BC}$
8. −3
9. a) $8a + 6s = 2200$, where a is the number of adult tickets and s is the number of student tickets.
b) $a = \frac{-3}{4}s + 275$ c) 275 d) 164

10. $y = \frac{4}{5}x + 11$

11. a) $C = 0.92d + 67$, where C is the total cost and d is the number of CDs produced.
b) \$435

12. $y = \frac{5}{3}x + 1$

13. Answers may vary, e.g.,



Chapter 6

Getting Started, page 316

1. **a)** v **b)** i **c)** ii **d)** vi **e)** iii **f)** iv

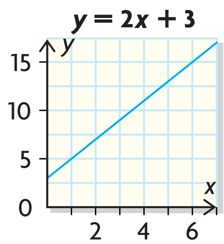
2. **a)** $y = \frac{2}{3}x + 4$ **b)** $y = -2x - 2.5$

3. **a)** $y = -\frac{3}{5}x + 5$ **b)** $y = 1.8x - 19$

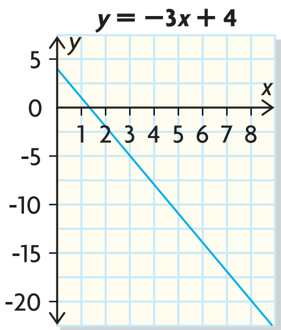
4. **a)** $y = -\frac{3}{4}x + \frac{7}{4}$
b) $y = -2x + 18$

5. **a)** $y = \frac{1}{3}x - 2$ **b)** $y = -x - 2$

6. **a)**



b)



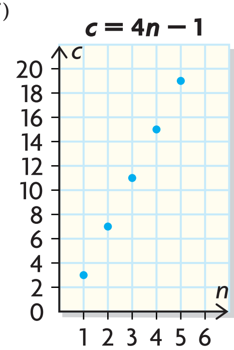
7. **a)** $y = \frac{1}{2}x - 1$
b) the depth or height of the seed at time $t = 0$
c) 1 cm every 2 days
d) the time when the seedling reaches the surface of the ground
e) depths below ground level; heights above ground level

8. **a)** Vintage car: The value increases with age. Newer car: The value decreases with age.
b) about $5000
c) around 1985

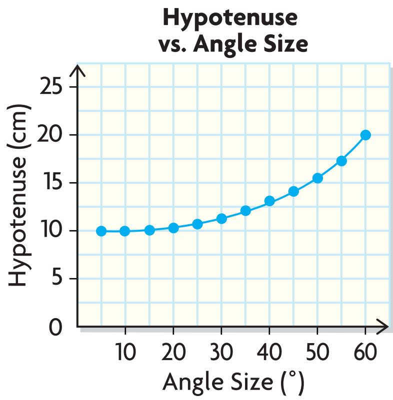
9. **a)** Each figure has four more shapes than the previous figure.
b)

Figure Number (n)	1	2	3	4	5
Number of Circles (c)	3	7	11	15	19

c) $c = 4n - 1$
d) 4
e) Yes. The number of shapes increases by the same amount for each figure and the first difference is a constant 4.
f)



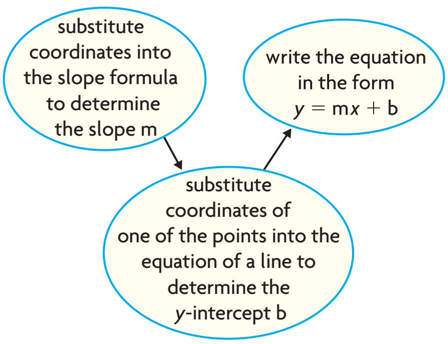
10. Calculating the length of the hypotenuse for each case produces a set of data in which first differences are not constant. The resulting graph is nonlinear.



Answers

Angle (°)	Height (cm)	Hypotenuse (cm)
5	0.9	10.0
10	1.8	10.2
15	2.7	10.4
20	3.6	10.6
25	4.8	11.1
30	5.8	11.6
35	7.0	12.2
40	8.4	13.1
45	10	14.1
50	11.9	15.5
55	14.3	17.4
60	17.3	20.0

11. Answers may vary, e.g.,



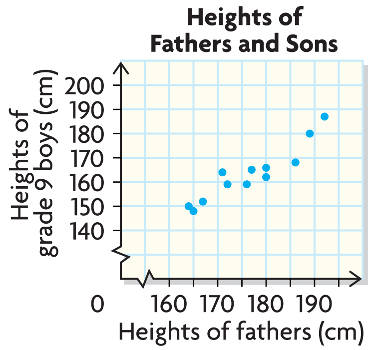
Lesson 6.1, page 326

1. **a)** Hours Spent Watching TV; Math Mark
b) Time, e.g., time is usually the independent variable.
c) A student watches TV for 2 hours and has a mark of 65.

2. **a)** A: On a day when the temperature was 30 °C, 376 bottles of water were sold. B: On a day when the temperature was 23 °C, 32 bottles of water were sold.
b) Sales of bottled water tend to increase when the temperature increases.

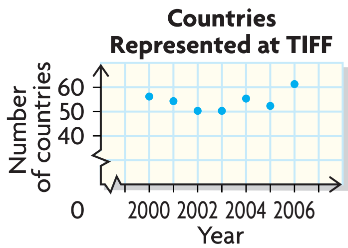
3. **a)** independent variable: age of tractor; dependent variable: value of tractor
b) continuous; solid line
c) Yes. Newer tractors tend to be worth more than older tractors.

4. **a)** independent variable: Height of Father; dependent variable: Height of Grade 9 Boy
b) continuous
c) solid line
d)

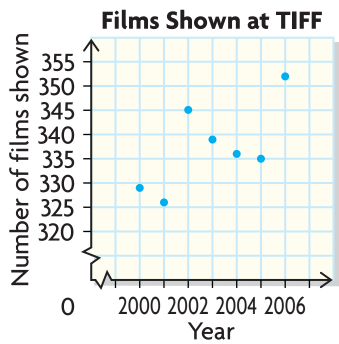


e) Yes. Taller fathers tend to have taller sons.
f) Yes. Answers may vary, e.g., maybe the tendency to be taller or shorter is inherited.

5. **a)**

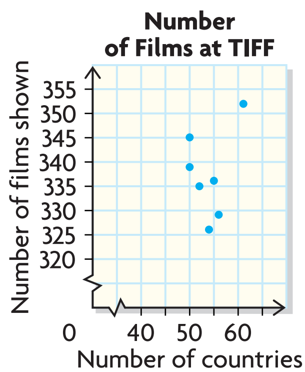


b) Answers may vary, e.g., the number of countries represented has been fairly constant.
c)



d) Answers may vary, e.g., overall there has been an increase in the number of films screened, although there have been years when the number has decreased.
e) discrete; dashed

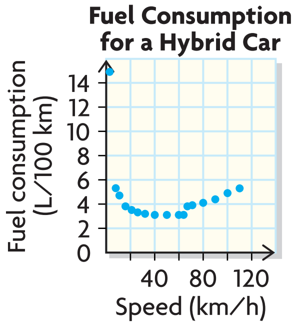
6. **a)**



b) Answers may vary, e.g., I couldn't decide which to choose but I remembered that x was usually in the left-hand column of a data table, so I chose Number of countries as the independent variable and Number of films shown as the dependent variable.

c) There are no clear trends in the scatter plot.

7. **a)**



b) The car's fuel consumption decreases rapidly until about 20 km/h, is fairly constant until about 70 km/h, then increases steadily as speed increases.

c) Yes. Answers may vary, e.g., it makes sense that a car uses more fuel at higher speeds.

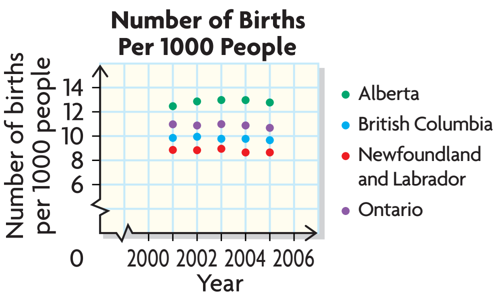
d) Yes. Drive at moderate speeds to save fuel.

e) Answers may vary, e.g., people who own a hybrid car could determine what speed consumes less fuel.

f) continuous

g) Speed. Answers may vary, e.g., I thought that the amount of fuel used would depend on the speed at which you were driving.

8. **a)**



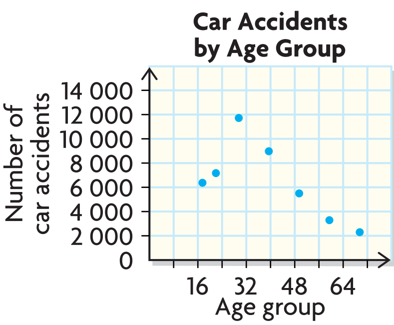
b) Yes. The birthrate is approximately constant.

9. **a)** The data generally go in one direction or another.

b) Use a solid line for continuous variables; use a dashed line for discrete variables.

10. **a)** I chose Age group to be the independent variable because times and ages aren't affected by other variables.

b)



c) Answers may vary, e.g., the number of accidents peaks in the 25–34 age group.

d) Yes. A dashed line because the data is discrete.

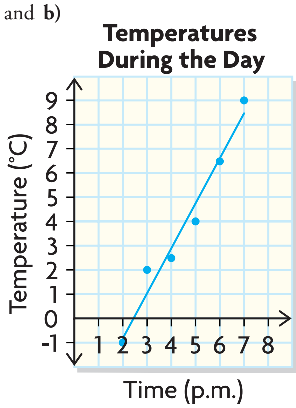
e) No. Answers may vary, e.g., we don't know the total number of younger drivers and the total number of older drivers. It is possible that there are more younger drivers than older drivers. If we knew the total numbers, we could calculate the percentage of younger drivers and the percentage of older people who have had accidents.

Lesson 6.2, page 337

1. **a)** about \$56 000

b) about 28

2. **a)** and **b)**

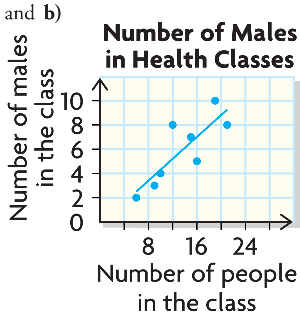


c) $y = 1.9x - 4.5$

d) about 6 °C

e) about 6:45 p.m.

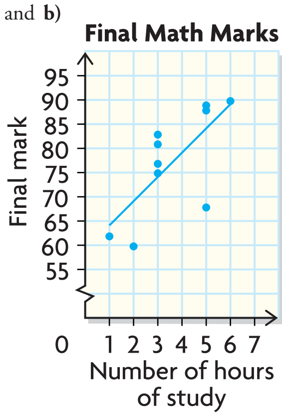
3. **a)** and **b)**



c) about 6

d) about 12

4. **a)** and **b)**



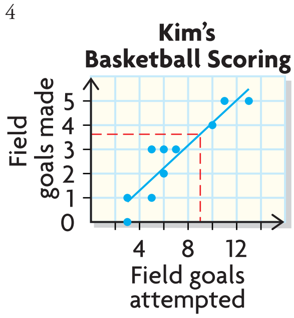
Answers

c) $y = 5x + 59$
d) about 79
e) about 2.4 h
f) Yes. Students who study more tend to achieve higher marks.

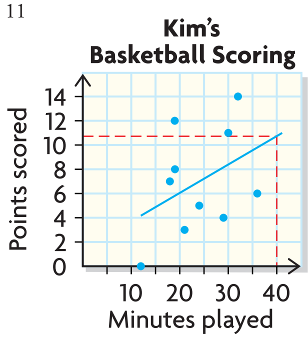
5. a) 1013; 610
b) about 11 days
c) no

6. a) $y = 0.13x - 0.66$ with distance as the independent variable
b) about 22 s
c) No. For such a long race, a runner cannot keep the same pace as in the shorter races for which we have data.
d) Answers may vary, e.g., the slope of the line of best fit is related to Tomas's average speed.

7. a) 4

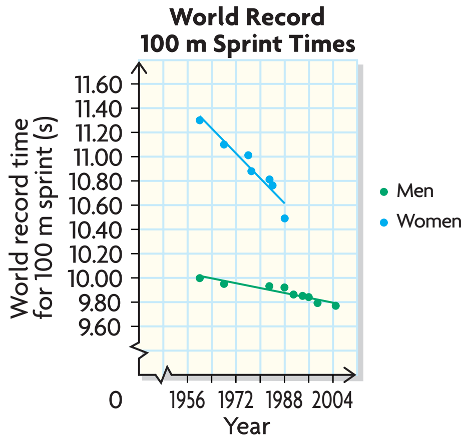


b) 11



8. a) Use a transparent ruler. Choose the slope of the ruler so that it follows the pattern of the data. Balance the plotted points on each side of the ruler.
b) Choose two points on the line, read off the coordinates, find the slope and the y-intercept.
c) Answers may vary, e.g., I could extend the line (if necessary) and then construct vertical and horizontal lines in the right places in order to read the value at the point of intersection.

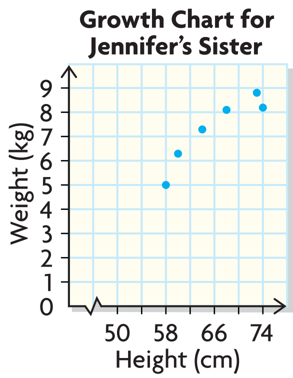
9. a) and c)



b) For both sets of data, the world record time is decreasing. However, the record time for women seems to be decreasing slightly more rapidly.
d) Yes. Maybe around the year 2025.
e) No. First, the women's world record has not changed for many years, so future changes may not follow the same line of best fit. Second, it could be that changes for both men and women will become much more gradual because of human limitations. If the trends continued forever, the record times would eventually be negative, which is impossible.

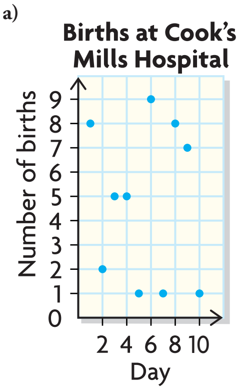
Mid-Chapter Review, page 343

1. a)



b) The points can be connected by a solid line because Jennifer's sister always has a height and a weight.
c) Yes. The general trend is that as the height increases, so does the weight.

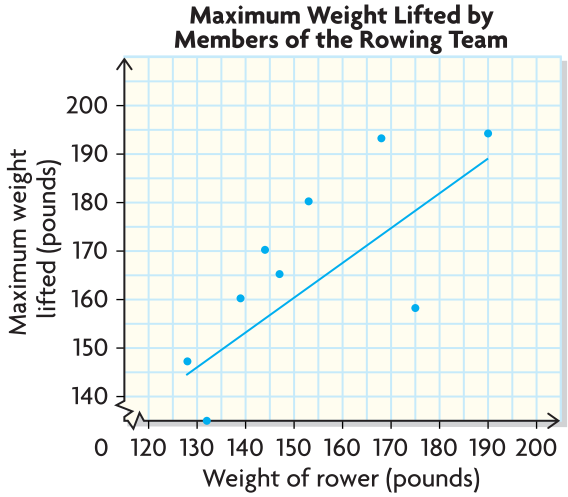
2. a)



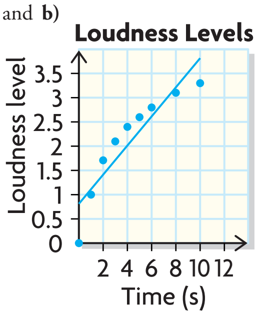
b) There is no clear pattern.

c) Possibly. This data set is probably too small to draw any solid conclusions from.

3. No. The points are not balanced on either side of the line.



4. a) and **b)**



c) $y = 0.3x + 0.8$

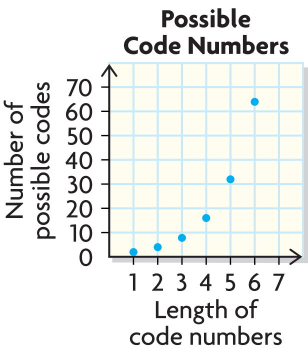
d) 1.9 using the line of best fit

e) 11 s

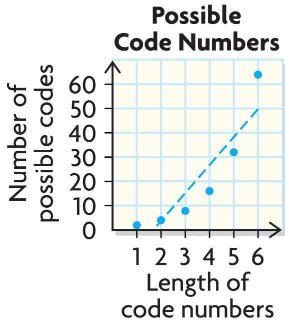
5. No. If they drew their lines by eye, they most likely ended up with different lines. The equations of the different lines would be different, but they would be close in value.

Lesson 6.3, page 349

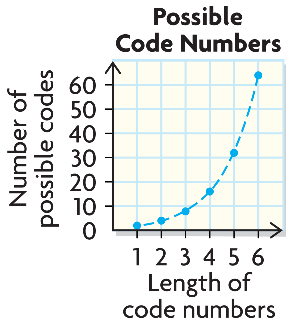
1. a)



b)



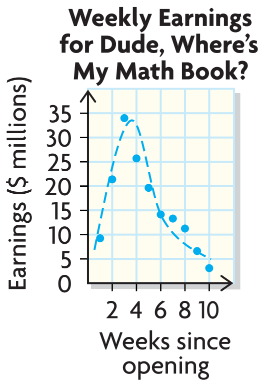
c)



d) curve

e) Neither, since code numbers have a whole number of digits.

2. a) and **b)** Answers may vary, e.g.,

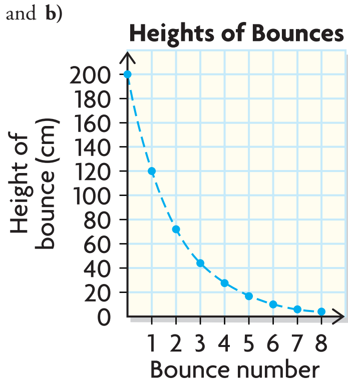


A dashed curve, because the data is discrete.

c) No. The figures are only released on a weekly basis.

d) No. Answers may vary, e.g., there's a good chance that the movie will not be playing after 20 weeks.

3. a) and **b)**

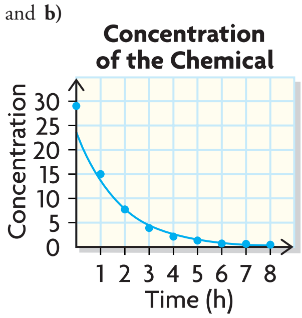


Dashed curve. The data represents the peak height after each bounce, not any in-between heights.

c) No. The data are discrete.

d) Yes. You could extrapolate up to a certain point. But eventually, the ball will stop moving.

4. a) and b)



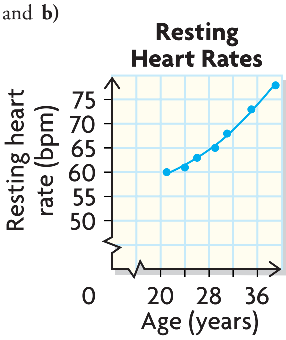
Solid, since you could measure the concentration at any moment.

c) The concentration decreases quickly at first, then decreases more gradually.

d) about 2.3 h

e) about 0.2 mg/L

5. a) and b)



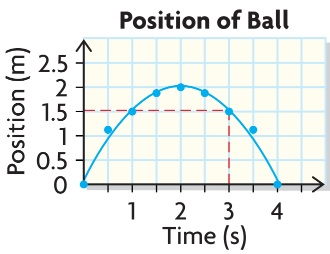
Solid, because the variables are continuous.

c) Resting heart rate increases as age increases.

d) Yes. The variables are continuous.

e) No. It's not wise to extrapolate far outside the range of the data.

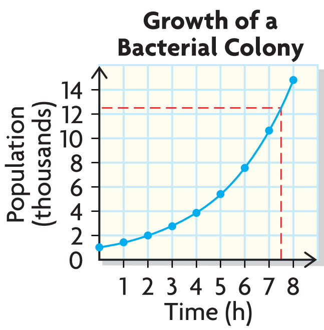
6.



a) about 0.6 m

b) about 4 s

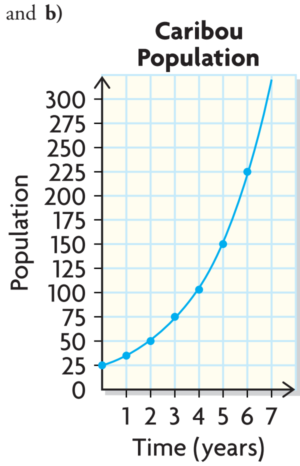
7.



a) The colony grows more and more rapidly as time passes.

b) about 12 600

8. a) and b)

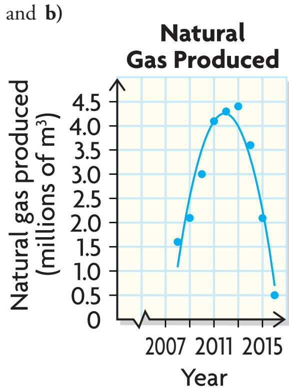


The data points seem to follow a curve.

c) The herd's population grew gradually at first, then at an increasing pace.

d) about 325

9. a) and b)

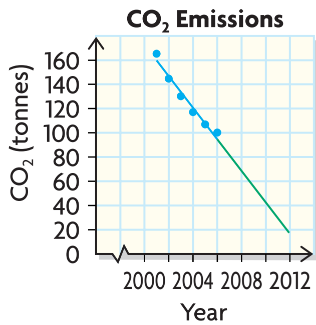


The plotted points seem to fall on a curve.

c) Production increases for the first 5 years or so, reaches a peak for a couple of years, then falls to near zero.

d) around 2017

10. a)



About 18 tonnes

b) The estimate using a line is much lower. The curve seems more reliable, since the plotted points seem to lie on a curve rather than on a line.

11. a) If the plotted points seem to lie on a simple curve, then a curve of best fit may be more appropriate. Otherwise, a line of best fit may be better.

b) Use horizontal and vertical guidelines to help you read values off the axes.

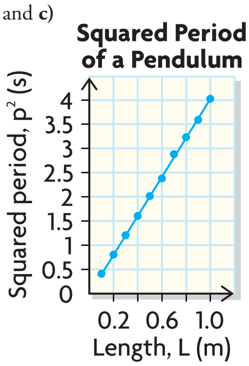
c) Use your judgement. It's not wise to extrapolate too far outside the range of the data.

12. **a)** yes **b)** no **c)** about 5.8%

13. **a)**

Length, L (m)	Squared Period, P^2 (s)
0.1	0.41
0.2	0.81
0.3	1.21
0.4	1.61
0.5	2.02
0.6	2.40
0.7	2.89
0.8	3.24
0.9	3.61
1.0	4.04

b) and **c)**

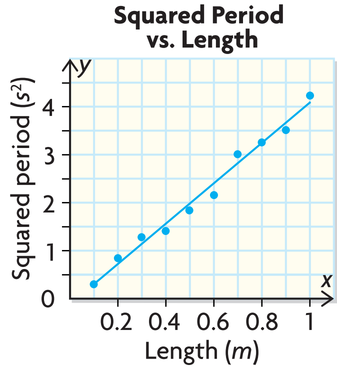


d) m = 4

e) about 9.87

f) Answers may vary, e.g.,

Length, L (m)	Period, P (s)	Squared Period, P^2 (s^2)
0.1	0.60	0.36
0.2	0.93	0.86
0.3	1.14	1.30
0.4	1.20	1.44
0.5	1.35	1.82
0.6	1.45	2.10
0.7	1.74	3.03
0.8	1.80	3.24
0.9	1.87	3.50
1.0	2.06	4.24

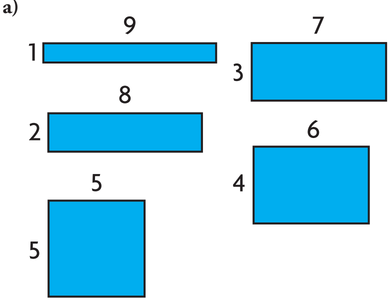


Slope = 4.13

Since slope $= \dfrac{4\pi^2}{g}$, $g = \dfrac{4\pi^2}{slope}$

$$g \doteq \frac{4(3.14)^2}{4.13} \doteq 9.6m/s^2$$

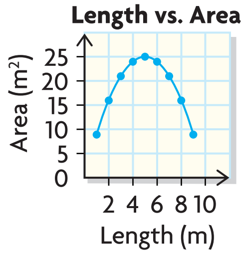
14. **a)**



b)

Length (m)	1	2	3	4	5
Width (m)	9	8	7	6	5
Area (m²)	9	16	21	24	25

c)



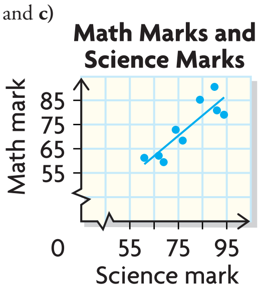
d) 5 m by 5 m

e) $A = l(10 - w)$

Lesson 6.4, page 361

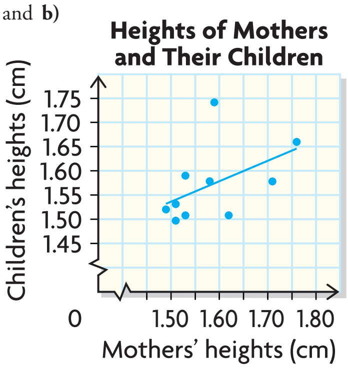
1. **a)** People who tend to do well in math also do well in science, so math marks increase as science marks increase.

b) and **c)**



On my scatter plot, science marks increase as math marks increase, so the graph supports my conjecture.

2. **a)** and **b)**

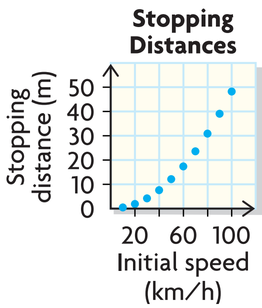


c) Yes. Although there are a few outliers, it seems that there is a slight increase in daughter height as mother height increases.

3. If the data were plotted, the line of best fit would have a positive slope. The positive slope means that as age increases, so vocabulary size increases.

4. **a)** Answers may vary, e.g., the greater the initial speed, the longer the stopping distance.

b)



c) Yes. My scatter plot shows that the greater the initial speed of the car, the greater the stopping distance.

5. **a)** If it is possible to draw a line of best fit, and the interpretation of the line of best fit matches the hypothesis, then the data supports the hypothesis.

b) If it is not possible to draw a line of best fit, or if the line of best fit contradicts the hypothesis, then the data does not support the hypothesis.

c) Yes. They may draw different lines of best fit, or one person may judge that it is not possible to draw a line of best fit.

6. **a)** upward sloping

b) Not necessarily. It is possible that one variable influences the other. It's also possible that neither influences the other.

Lesson 6.5, page 368

1. **a)** iii **b)** i **c)** iv **d)** ii

2. **a)** The ATV is stopped from 20 s–26 s. Its slowest speed while actually moving is from 8 s–16 s. Its fastest speed is from 26 s–32 s.

b) The ATV begins to return to its starting point at the 26 s mark, and reaches its starting point at the 32 s mark.

c) The slope of the graph between 20 s and 26 s is 0 m/s.

d) A zero slope (0 m/s) means that the object is not moving during a particular time interval.

3. Answers may vary, e.g., Jim ran to the library to return some overdue books. He then started to walk home. On his way home he called on his friend and he stayed at his house for a while playing video games. He left and ran home so he wouldn't be late for dinner.

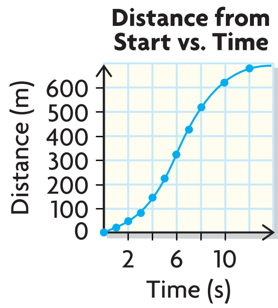
4. **a)** nonlinear relationship

b) Answers may vary, e.g.,

Time (s)	Distance (m)	First Differences
0	0	
1	9	9
2	37	28
3	84	47
4	150	66
5	235	85
6	335	100
7	455	120

c) Since the first differences are increasing, the dragster is speeding up or accelerating down the track.

d) Assuming that the parachute slows the drag racer to a complete stop.



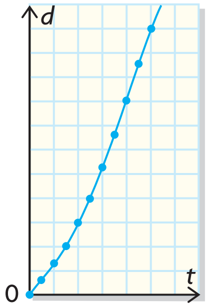
5. **a)** Answers may vary, e.g., Martina started to walk to school from home. She turned around and went back to her home because she felt ill. She rested at home while her mom called the doctor. She went to the doctor's office, was examined, and then returned home.

b) Answers may vary, e.g., Joe kicks his soccer ball. Its height increases and then it begins to fall. The ball comes to rest in a tree.

c) Answers may vary, e.g., Sarit walks to Amy's house. They are then driven to Jane's house by Amy's mom. Jane's dad drives all three girls to the library so they can get some books for their science project. They remain at the library for a while. Jane's dad then drives all three girls to Sarit's house so they can work on their project.

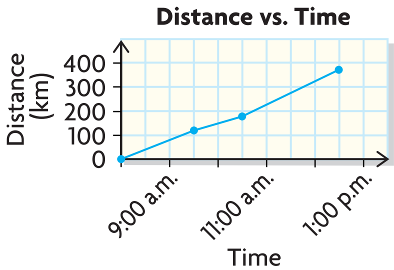
d) Answers may vary, e.g., a sky diver jumps out of a plane and free falls for some time, opens the parachute, and descends to the ground at a constant rate.

6.



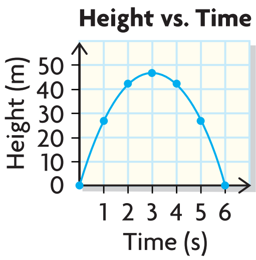
7. **i)** **a)** linear, **b)** constant velocity
ii) **a)** nonlinear, **b)** decelerating
iii) **a)** nonlinear, **b)** accelerating

8. **a)**



b) The car travels fastest from 10:30 a.m. to 12:30 p.m. The car travels slowest from 9:30 a.m. to 10:30 a.m.
c) nonlinear
d) about 82 km/h

9. **a)** nonlinear
b)

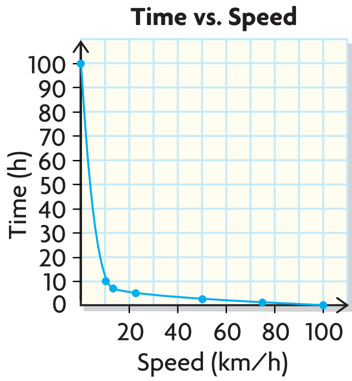


c) 34.75 m
d) at the 2.37 s mark or the 3.63 s mark
e) in the time interval from 3 s to 6 s; in the time interval from 0 s to 3 s
f) at 3 s
g) 46 m
h) Gravity accelerates the ball downward.

10. **a)**

Speed (km/h)	100	75	50	25	12.5	10	1
Time (h)	1	$1\frac{1}{3}$	2	4	8	10	100

b)



Speed is the independent variable, while time is the dependent variable.

c) Answers may vary, e.g., (25, 4), (50, 2), and $\left(75, 1\frac{1}{3}\right)$.

Rate triangle 1: Slope $= \frac{2-4}{50-25} = -\frac{2}{25}$

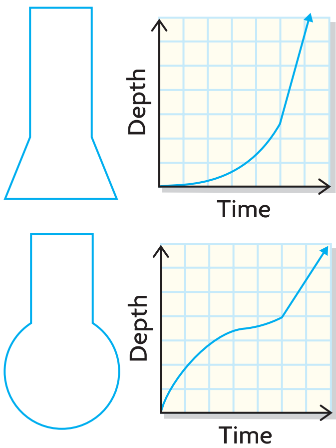
Rate triangle 2: Slope $= \frac{1\frac{1}{3} - 2}{75-50} = \frac{-\frac{2}{3}}{25} = -\frac{2}{75}$

The values are different.

d) The relationship is nonlinear.

11. **a)** The increasing parts represent time intervals when the race car is accelerating.
The decreasing parts represent time intervals when the race car is decelerating.
b) The horizontal parts of the graph represent time intervals when the race car is at a constant speed.
c) Answers may vary, e.g., the car starts from rest and accelerates until it approaches the first corner, then it decelerates as it travels through this corner. As it leaves the corner, it accelerates then decelerates as it travels through the second corner. It accelerates again and reaches a constant speed before it decelerates through the final corner.

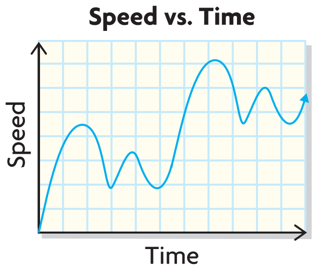
12. Answers may vary, e.g.,



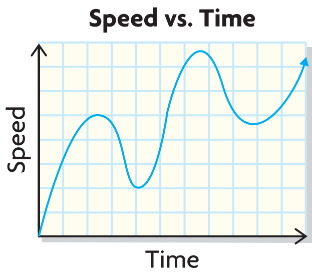
Answers

13. Answers may vary, e.g.,

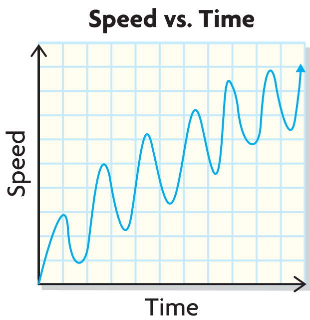
a)



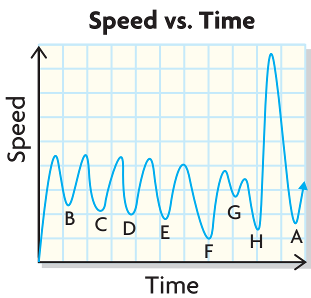
b)



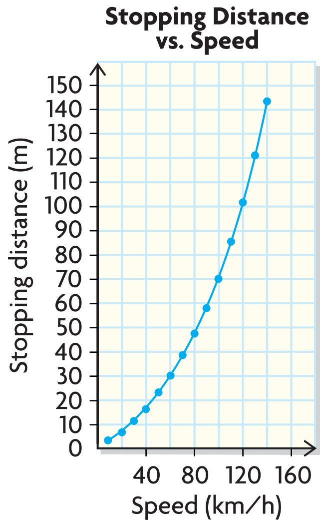
c)



d)



14. a)



b) rate triangle 1: slope $= \dfrac{37.9 - 29.8}{70 - 6} = \dfrac{8.1}{10} = 0.81$

rate triangle 2: slope $= \dfrac{47.5 - 37.9}{70 - 60} = \dfrac{9.6}{10} = 0.96$

c) The rate of change in stopping distance also increases as the speed increases.

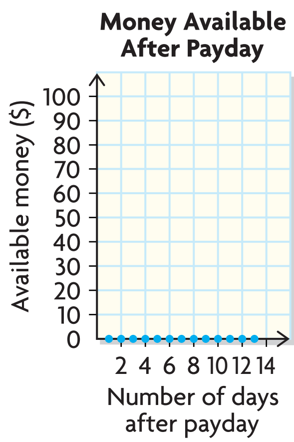
d) This is not an accurate observation on Sheila's part, as the relationship is nonlinear. She will need to leave more than twice the distance if she drives twice as fast.

Chapter Review, page 374

1. Answers may vary, e.g., we might expect the number of people with allergies to increase when the air becomes dirtier.

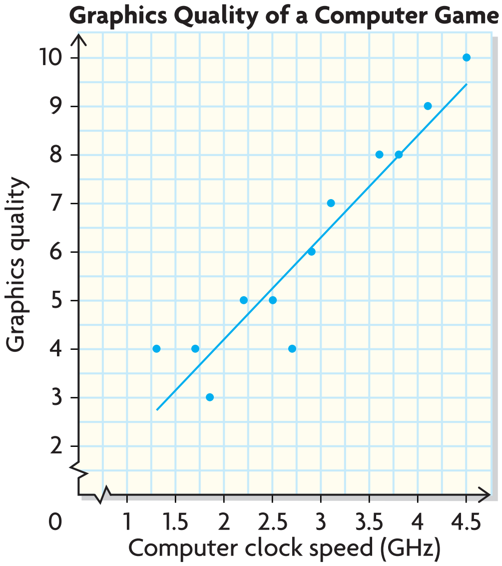
2. **a)** I would choose Number of days after payday for the independent variable, since I have no control over that, and Available money as the dependent variable.

b) Answers may vary, e.g.,



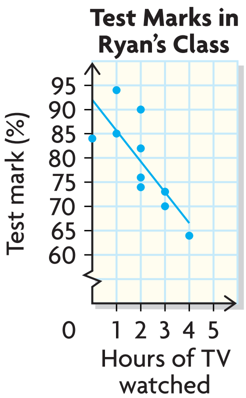
c) Answers may vary, e.g., the person seems to have spent all of his or her money on payday, and has none left for the next two weeks.

3. **a)** no



b) $y = 2.1x$

4. **a)** and **c)**



b) Yes. Marks tend to decrease as the amount of TV watched increases.

d) $y = -6.3x + 91.9$

e) about 75

f) No. Each of us may use a different line of best fit, but our answers will be close in value.

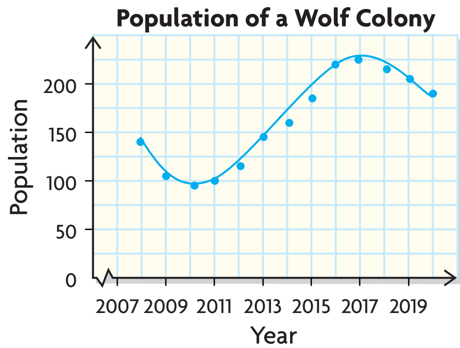
5. **a)** A solid line indicates that the data is continouous. Every point on the line of best fit represents an ordered pair that belongs to the linear relationship. A dashed line indicates the data is discrete. Only points with whole number coordinates that lie on the line of best fit belong to the linear relationship.

b) Answers may vary, e.g., independent variable: time, dependent variable: student's height

c) Answers may vary, e.g., independent variable: day number of the month, dependent variable: number of students in class that day.

6. **a)** Answers may vary, e.g., yes, it might give a good estimate for a long-term trend.

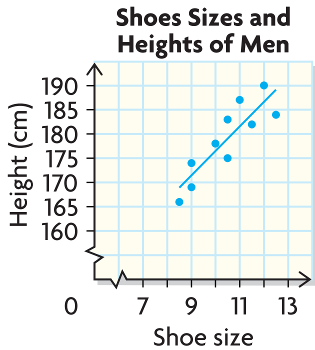
b) Answers may vary, e.g., yes, it might give a good estimate for short-term variation.



c) Yes. A line of best fit might be a good estimate of a long-term trend and a curve of best fit might be a good estimate of a short-term trend.

7. No. The plotted points just need to be "balanced" on either side of the line or curve of best fit.

8. **a)** and **c)**



b) Yes. Height tends to increase as shoe size increases.

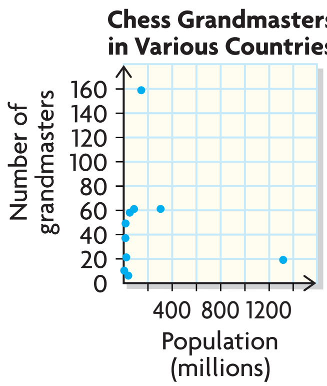
d) $y = 5.1x + 125.7$

e) 10.5 or 11

f) about 215 cm

9. **a)** Answers may vary, e.g., the bigger the population of a country, the more chess grandmasters there are in the country.

b)



c) No line or curve of best fit is helpful.

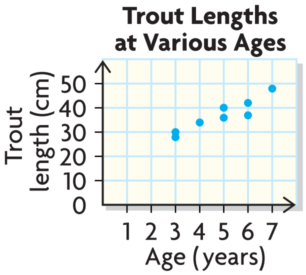
d) no

e) Answers may vary, e.g., culture, history, leadership.

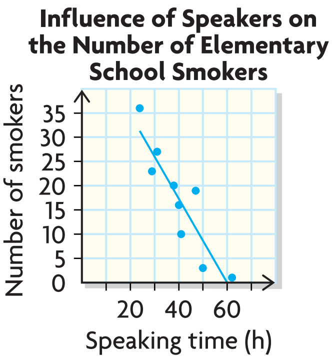
10. It took the bus 22 minutes to get to David's hotel from the airport. The bus travelled for 1 minute then made a stop for over a minute to probably pick up passengers at a different pickup location. It travelled for about 2 minutes before it made another pickup. It traveled for over 4 minutes and stopped again. At this stop the bus was at its furthest distance from the airport. The bus then started to travel back toward the airport for 6 minutes and made one final 2 minute stop. The bus then travelled at its greatest speed for 2 minutes before stopping at David's hotel.

Chapter Self-Test, page 376

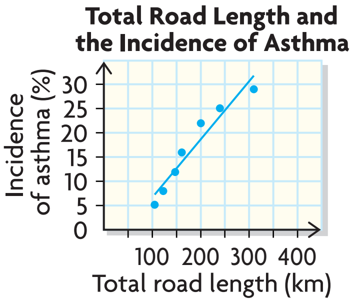
1. The slope of the line of best fit is about right, but the line needs to be shifted. As drawn, too many points are above the line. The points should be "balanced" on both sides of the line.
2. **a)** Age, since we have no control over it.
   b) continuous
   c) Older fish tend to be longer.
   d)



   e) Yes. As age increases, so does length.
3. **C.**
4. **a)** and **c)**



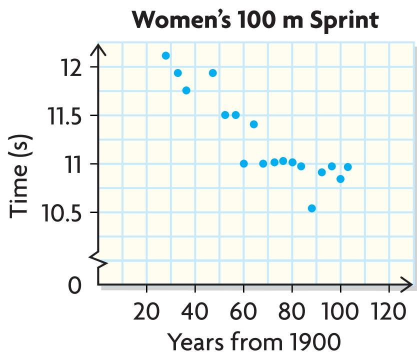
   b) Elementary schools at which peer leaders speak for longer times have fewer smokers.
   d) Not necessarily. Answers may vary, e.g., we don't know how many students smoked before the speaking program, and we don't know how many students go to each school.
5. **D.**
6. **a)** and **b)**



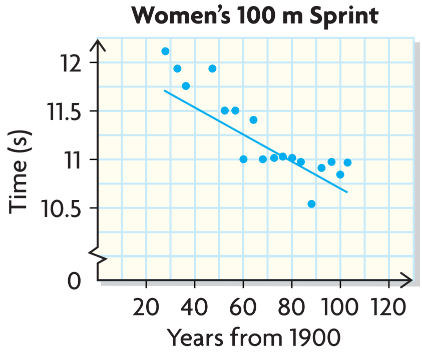
   c) $y = 0.12x - 5.4$
   d) 42.6 %
   e) No. The two variables may not be related, or their increase may be influenced by a third variable.
7. **a)** between D and E
   b) Shasta is resting.
   c) after 10 min
   d) 4 min
   e) Shasta ran 125 m/min on her way home.

Chapters 4–6 Cumulative Review, page 379

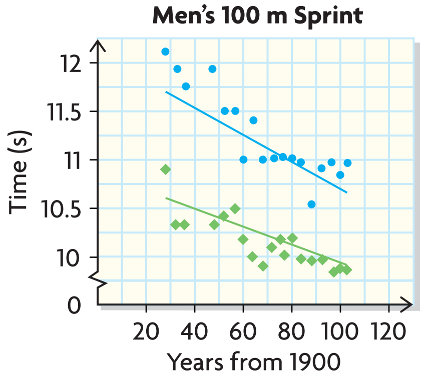
1. **C.**
2. **B.**
3. **D.**
4. **A.**
5. **B.**
6. **D.**
7. **B.**
8. **B.**
9. **B.**
10. **A.**
11. **B.**
12. **A.**
13. **C.**
14. **C.**
15. **B.**
16. **C.**
17. **D.**
18. **a)** Answers may vary, e.g.,



b)



c)



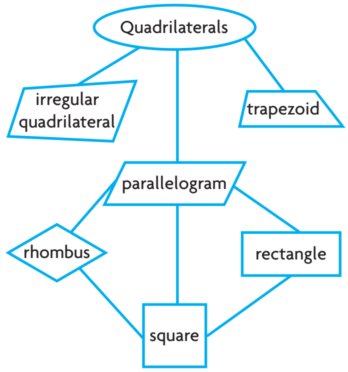
d) Answers may vary, e.g., 2150.
e) Answers may vary, e.g., 2151.

Chapter 7

Getting Started, page 384

1. **a)** iv) **b)** vi) **c)** i) **d)** v) **e)** iii) **f)** vii) **g)** ii) **h)** viii)
2. **a)** $x = 130°$ **b)** $x = 79°$
3. **a)** $x = 62°$ **b)** $x = 102°, y = 113°, z = 145°$
4. **a)** $y = 19°, z = 161°$
b) $x = 115°, y = 65°, z = 50°$
5. **a)** iv) perpendicular
b) vi) adjacent
c) i) parallel
d) v) congruent
e) viii) supplementary
f) iii) transversal
g) vii) straight angle
h) ii) regular
6. **a)** similarity: Answers may vary, e.g., both have 4 equal sides.
difference: Answers may vary, e.g., square's sides meet at 90°, rhombus's sides meet at varying angles.
b) similarity: Answers may vary, e.g., both have 2 pairs of equal sides.
difference: Answers may vary, e.g., rectangle's sides meet at 90°, parallelogram's sides meet at varying angles.
c) similarity: Answers may vary, e.g., both have opposite sides that are parallel.
difference: Answers may vary, e.g., rhombus has 4 equal sides, parallelogram has 2 pairs of equal sides, which are not always equal to each other.
d) similarity: Answers may vary, e.g., both have interior angles that sum to 180°.
difference: Answers may vary, e.g., equilateral triangle has 3 equal sides and 3 equal angles, isosceles triangle has 2 equal sides and the 2 equal angles, the third angle and side can be different.

7. **a)** $x = 30°$ **b)** $x = 19°$ **c)** $x = 15°$ **d)** $x = 42.5°$
8. **a)**



b) Answers may vary, e.g., a trapezoid and a parallelogram are quadrilaterals because they have four sides. A rectangle, square, and rhombus are parallelograms because they have two pairs of parallel opposite sides. A square is a rhombus because it has four congruent sides.
9. **a)** Answers may vary, e.g., square or rhombus.
b) Answers may vary, e.g., irregular quadrilateral.
c) Answers may vary, e.g., rectangle or parallelogram.
d) Answers may vary, e.g., rhombus or parallelogram.
e) Answers may vary, e.g., trapezoid.
f) Answers may vary, e.g., parallelogram or rhombus.

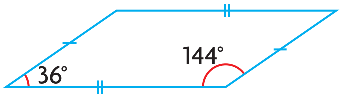
Lesson 7.1, page 390

1. **a)** 360° **b)** 720° **c)** 540° **d)** 1260°
2. **a)** 1080° **b)** 540° **c)** 1980° **d)** 1620°
3. Yes. Answers may vary, e.g., because polygons with the same number of sides will always divide into the same number of non-overlapping triangles.
4. 154.3°, to one decimal place
5. 10

Lesson 7.2, page 394

1. They are supplementary angles.
2. **a)** $a = 150°$
b) $b = 108°$
c) $c = 84°; d = 121°$
d) $e = 145°; f = 114°; g = 66°; h = 107°$
3. **a)** $a = 104°; b = 51°; c = 115°$
b) $d = 78°; e = 38°; f = 75°; g = 94°, h = 57°, i = 105°$
4. 270°
5. 70°
6. **a)** They are supplementary angles.
b) The angles are always supplementary.
c) $\angle 1 + \angle 2 = 180°$
7. **a)** $x = 150°$ **b)** $x = 20°$ **c)** $x = 45°$ **d)** $x = 135°; y = 45°$
8. **a)** $360° = x + 80° + 100° + 130°; x = 50°$
b) $180° = x + (180° - 135°) + (180° - 85°); x = 40°$
c) $180° = x + (x - 15)° + (180° - 150°); x = 82.5°$
d) $360° = x + x + (x - 30)° + (x - 40)°; x = 107.5°$

9. Interior angle measures are 36°, 144°, 36°, and 144°.



10. Vertex A interior angle: 20°, exterior angle: 160°;
Vertex B interior angle: 59°, exterior angle: 121°;
Vertex C interior angle: 101°, exterior angle: 79°

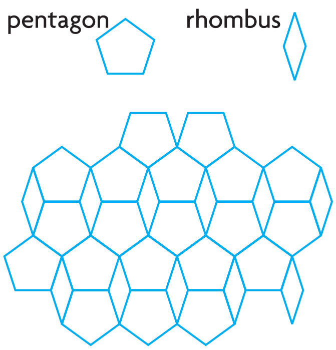
11. 10

12. $180° \times (n - 2) \div n$

13. Answers may vary, e.g., the sum of the exterior angles is always 360°, but the sum of the interior angles for a polygon with more than four sides is greater than 360°. An example is the hexagon. Its interior angles add to 720°. Its exterior angles add to 360°.

14. Answers may vary, e.g., the set of pattern blocks include equilateral triangles, squares and regular hexagons. The blocks fit together because the interior angles of the shapes add easily to 360°. The interior angles are 60° for the triangle, 90° for the square, and 120° for the hexagon. You can tile a floor with these shapes because their interior angles all divide into 360° evenly. The interior angle of a regular pentagon is 108°. This does not divide evenly into 360°. So, it cannot tile a floor. Also, it does not add well with the angles of the other three shapes.

15. **a)** You can tile a floor using octagons with a square at each side.
b) Answers may vary, e.g., you can tile a floor with a regular pentagon and a rhombus:



Mid-Chapter Review, page 398

1. **a)** 36° **b)** 98° **c)** 117° **d)** 98° **e)** 80° **f)** 69°

2. **a)** 150° **b)** 156° **c)** 162°

3. 3 or 6 sides

4. **a)** $a = 115°$, $b = 65°$ **b)** $c = 60°$ **c)** $d = 29°$ **d)** $e = 87°$

5. 5 sides

6.

Figure	Measure of each Interior Angle	Measure of each Exterior Angle	Sum of Interior Angles	Sum of Exterior Angles
square	90°	90°	360°	360°
pentagon	108°	72°	540°	360°
hexagon	120°	60°	720°	360°
octagon	135°	45°	1080°	360°

Lesson 7.3, page 401

1. **a)** (5, 0): The diagonals had to be perpendicular and bisecting.
b) (11, 0): The diagonals had to be congruent and intersect to form two pairs of equal line segments.
c) Answers may vary, e.g., (6, −2); the diagonals had to be perpendicular and one had to bisect the other.

2. **a)** iii); perpendicular, congruent, bisecting
b) v); perpendicular, bisecting
c) i); congruent, divided congruently
d) ii); bisecting
e) vi); perpendicular, one bisects the other
f) iv); congruent, bisecting

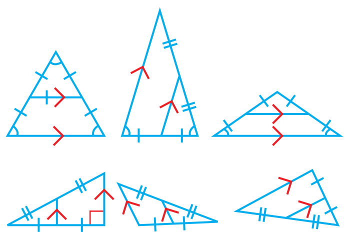
3. Answers may vary, e.g., a quadrilateral has 2 diagonals; a kite has perpendicular diagonals; a parallelogram has diagonals that bisect each other; a rhombus has perpendicular diagonals that bisect each other; a rectangle has congruent diagonals that bisect each other; a square has congruent, perpendicular diagonals that bisect each other; a trapezoid has one pair of opposite parallel sides; an isosceles trapezoid has one pair of opposite parallel sides and equal length diagonals that intersect to form two pairs of equal line segments (not the midpoint).

4.

Quadrilateral	Number of Congruent Triangles
square	4 congruent triangles
rhombus	4 congruent triangles
rectangle	4 congruent triangles
parallelogram	2 pairs of congruent triangles
isosceles trapezoid	1 pair of congruent triangles
kite	2 pairs of congruent triangles

Lesson 7.4, page 407

1. The conjecture is most likely true. I tested an equilateral triangle, two isosceles triangles, a right triangle, and two scalene triangles. The midsegments were parallel to the opposite side in each one.



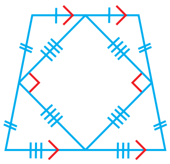
2. The conjecture is false. A rhombus is a counterexample.

3. Answers may vary, e.g., I predict it will not always have all sides equal. A counterexample is a rectangle. All the angles are 90°, but the sides are not all equal.

4. Answers may vary, e.g., I predict it will not always have all angles equal. A counterexample is a rhombus. All the sides are equal length, but the angles are not all equal.

5. Answers may vary, e.g., I predict there are $n - 3$ diagonals from each vertex in an n-sided polygon. I think my conjecture is true. All my examples support it. A triangle has 0 diagonals, a square has 1 diagonal, a pentagon has 2 diagonals, and a hexagon has 3 diagonals.

6. The conjecture is false. For a counterexample, I constructed an isosceles trapezoid with bimedians forming a square.

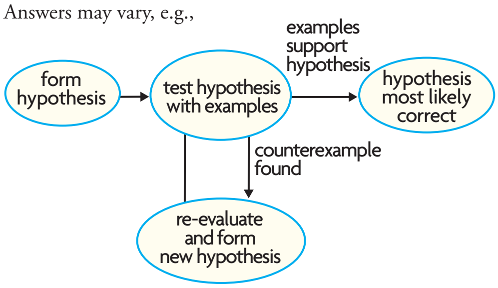


7. The conjecture is true. Answers may vary, e.g., I drew several triangles using *The Geometer's Sketchpad* and then drew their medians. The medians for each triangle always intersected in one point. All my examples—an equilateral triangle, an isosceles triangle, a right triangle, and two scalene triangles—supported the conjecture.

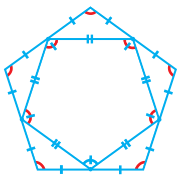
8. Answers may vary, e.g., I predict the area of the shape formed by a triangle's midsegments is $\frac{1}{4}$ the area of the triangle's area. I drew several triangles using *The Geometer's Sketchpad* and then drew their midsegments. For each one, I calculated the area of shape formed by the midsegments. It was always $\frac{1}{4}$ of the area of the triangle. The conjecture is true.

9. The conjecture is true. Answers may vary, e.g., I drew different rectangles using *The Geometer's Sketchpad*. Then I looked for possible circles. The centre of the circle was always at the intersection of the diagonals of the rectangle. I intersected the diagonals of every rectangle and then drew a circle with a centre at the intersection point. I always found one that intersected each vertex.

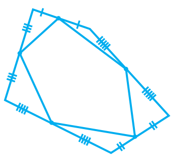
10. Answers may vary, e.g.,



11. I predict that only regular pentagons have midsegments that form regular pentagons. All my examples support my conjecture.



These midsegments of this regular pentagon form a regular pentagon.



The midsegments of this irregular pentagon do not form a regular pentagon.

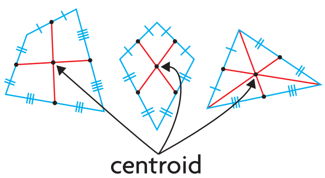
12. Answers may vary, e.g., I predict that the inner quadrilaterals will alternate back and forth between two types of quadrilaterals. I tested with several examples. My conjecture was wrong. Only some quadrilaterals alternate. My results are:

Initial Quadrilateral	Quadrilateral Formed by Midsegments of Initial Quadrilateral
square	square
rhombus	rectangle
rectangle	rhombus
parallelogram	parallelogram
kite	rectangle
trapezoid	parallelogram
isosceles trapezoid	rhombus

13. Answers may vary, e.g., I predict that each new quadrilateral formed will be a parallelogram. I drew several different quadrilaterals using *The Geometer's Sketchpad*. Each one supported my conjecture. However, I cannot be fully sure. There might be a counterexample that I have not found.

Lesson 7.5, page 413

1.

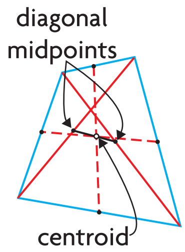


2. **a)** a rhombus
b) the intersection of the diagonals
c) a parallelogram
d) the midsegments

3.

Quadrilateral	Centroid Construction Method	Bimedian Geometric Properties
square	intersection of bimedians or diagonals	bisect each other, equal length, intersect at right angles, split square into 4 smaller congruent squares
rhombus	intersection of bimedians or diagonals	bisect each other, intersect at right angles, split rhombus into 4 smaller congruent rhombuses
rectangle	intersection of bimedians or diagonals	bisect each other, equal length, split rectangle into 4 smaller congruent rectangles
parallelogram	intersection of bimedians or diagonals	bisect each other, split parallelogram into 4 smaller congruent parallelograms
kite	intersection of bimedians	bisect each other, equal length, split kite into 4 quadrilaterals, 2 of which are smaller kites
isosceles trapezoid	intersection of bimedians	bisect each other, intersect at right angles, split isosceles trapezoid into 2 pairs of smaller congruent trapezoids, bimedian between 2 non-base sides parallel to base sides
non-isosceles trapezoid	intersection of bimedians	bisect each other, bimedian between 2 non-base sides parallel to base sides
irregular quadrilateral	intersection of bimedians	bisect each other

4. 15 cm
5. **a)** 97.5 cm **b)** the bimedian is 4 cm from each side
6. **a)** 10 cm **b)** 13 cm
7. **a)** 40 cm **b)** 9 cm
8. Answers may vary, e.g., construct the bimedians in the new quadrilaterals. One is already drawn so you just need one. The bimedians intersect at the centroid.
9. Answers may vary, e.g., the intersection of the diagonals determines the centroid for squares, rhombuses, rectangles, and parallelograms. It does not determine the centroid for any other quadrilateral.
10. **a)** the centroid of the quadrilateral
b) Answers may vary, e.g., I determined the midpoint of the segment joining the diagonal midpoints. Then I drew the bimedians. They intersected at the point. I realized the point I had constructed was the centroid of the quadrilateral.



11. Answers may vary, e.g., draw one of the diagonals and then divide it into 4 equal sections by drawing three points on it. Draw lines from the points on the diagonal to the other two vertices and then erase the diagonal. There quadrilateral is now divided into 4 equal parts.

Chapter Review, page 418

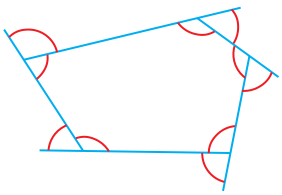
1. **a)** 132° **b)** 51°
2. He is incorrect. Answers may vary, e.g., I know the sum of the interior angles of an n-gon is $180 \times (n - 2)$ degrees. This works out to 1080° for an octagon.
3. **a)** 2 is subtracted from n to give the number of triangles that are formed by the diagonals of the n-gon.
b) $(n - 2)$ is multiplied by 180°, because there are 180° in each of the triangles that are formed by the diagonals of the n-gon.
4. **a)** Interior angle: 165.6°
b) Exterior angle: 14.4°
5. **a)** $x = 155°$ **c)** $x = 128.6°$ to one decimal place
b) $x = 97°$ **d)** $x = 40°$
6. **a)** $x = 85°$ **b)** $x = 94°$
7. **a)** always **d)** sometimes **g)** always
b) sometimes **e)** sometimes **h)** sometimes
c) never **f)** sometimes
8. **a)** irregular quadrilateral. One of the diagonals has to be bisected for the quadrilateral to be a kite.
b) kite. The diagonals have to bisect each other for the quadrilateral to be a parallelogram.
c) irregular quadrilateral. The diagonals have to intersect so that they have equal distances on either side for the quadrilateral to be an isosceles trapezoid.
d) parallelogram. Bisecting diagonals means two pairs of congruent sides.
9. Answers may vary, e.g., I predicted that only squares, kites, and rhombuses have midsegments forming a square or a rectangle. I tested my conjecture with several examples. Each one supported it. However, I could not be fully sure, as there still might be a counterexample.
10. The conjecture is false. Answers may vary, e.g., a scalene triangle with interior angles of 76°, 53°, and 51° is a counterexample.
11. The conjecture is true. Answers may vary, e.g., I tested several isosceles triangles by drawing the median from the vertex joining the two equal sides in *The Geometer's Sketchpad*. The median bisected the angle between the two equal sides each time.
12. The conjecture is true. Answers may vary, e.g., I tested several triangles by drawing a median. I calculated the area on either side of the median using *The Geometer's Sketchpad*. Each time, the areas were equal.
13. If a polygon with n sides is used, then the new shape formed by the midsegments is another polygon with n sides. This is because there are n midpoints, which are the n vertices for the new polygon. The polygon might be regular or it might be irregular.

14. **a)** They are equal.
b) They are not equal.
c) Answers may vary, e.g., Conjecture: Every quadrilateral whose vertices lie on a circle has supplementary opposite angles, and these are the only quadrilaterals that do. I could test this conjecture by drawing many quadrilaterals. I would divide them into 2 groups. One group would have quadrilaterals whose vertices lie on a circle. The other group would have all the other quadrilaterals. Then I could measure the angles for each quadrilateral.

15. **a)** 26 cm **b)** 6 cm

Chapter Self-Test, page 420

1. Answers may vary, e.g., if n is the number of sides, the number of diagonals drawn from one vertex is $n - 3$.
2. **A.**
3. **a)** $a = 35°, b = 75°$
b) $c = 127°, d = 88°, e = 92°$
4. Answers may vary, e.g., each pair of opposite interior and exterior angles adds to 180°, so in total, the sum of both the exterior and interior angles of the pentagon is $5 \times 180°$, or 900°. The sum of the interior angles of a pentagon is 540°. I know this from the formula for the sum of the interior angles of a polygon. $900° - 540° = 360°$, so the sum of the exterior angles must be 360°.



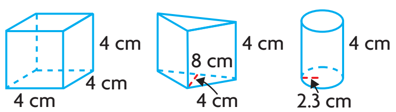
5. **D.**
6. **a)** iii **b)** i **c)** ii **d)** iv
7. 8 km, everything in ΔABC is twice that of ΔDEC.
8. I tested the conjecture for several triangles and it was true each time. It is true.

Chapter 8

Note: Answers are given to the same number of decimal points as the numbers in each question.

Getting Started, page 424

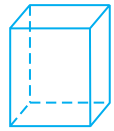
1. **a)** v **e)** ii **h)** iv
b) vii **f)** ix **i)** vi
c) x **g)** viii **j)** i
d) iii
2. **a)** 600 cm^2 **b)** 158 cm^2 **c)** 700 cm^2
3. **a)** about 471 cm^2 **b)** about 302 cm^2 **c)** about 565 cm^2
4. **a)** about 9 cm **b)** about 14 cm **c)** 13 cm
5. **a)** about 3421 cm^2 **b)** 1 080 000 km^2 **c)** 5940 cm^2
6. **a)** surface area 432 cm^2, volume 400 cm^3
b) about surface area 262 cm^2, about volume 225 cm^3
c) about surface area 230 m^2, about volume 265 m^3
7. **a)** Answers may vary, e.g.,



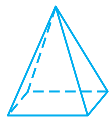
b) Answers may vary, e.g., cube 96 cm^2, triangular prism 109 cm^2, cylinder 91 cm^2.

8. **a)** 20 m **b)** 15 cm **c)** 25 cm
9. **a)** agree **c)** disagree
b) agree **d)** agree
10. Answers may vary, e.g.,

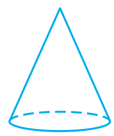
Prism:

Definition	Properties	Diagram
a shape with two opposite faces that are the same and with the sides joining them all rectangles	The two opposite faces have the same shape and area and are parallel. The sides joining the two equal opposite faces might be different rectangles.	

Pyramid:

Definition	Properties	Diagram
a shape with a base in the form of a regular polygon, and with triangles connecting the sides of the base to a common vertex	The triangular faces have the same shape and area. A pyramid is like a prism but with one end face shrunk to a point.	

Cone:

Definition	Properties	Diagram
a shape with a circle for a base, and one curved surface that goes from the circumference of the circle to a single vertex	The single vertex should be directly above the centre of the base when the cone is placed upright. A cone is like a prism with circles as the opposite faces but with one circle shrunk to a point.	

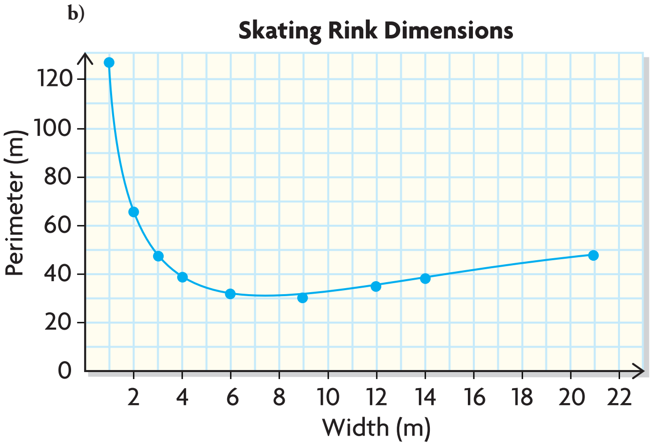
Lesson 8.1, page 431

1. **B.**
2. a square 6-by-6 units
3. **a) i)** 625.0 cm^2 **b) i)** 4.0 m
ii) 324.0 m^2 **ii)** 33.5 cm
iii) 1785.1 km^2 **iii)** 15.7 cm
iv) 1278.1 mm^2 **iv)** 21.2 cm
4. 1.62 m by 1.62 m
5. **a)** Answers may vary, e.g.,

W	1	2	3	4	6	9	12	14	21
L	126	63	42	31.5	21	12	10.5	9	6
P	128	67	48	39.5	33	30	34.5	37	48

Answers

b)

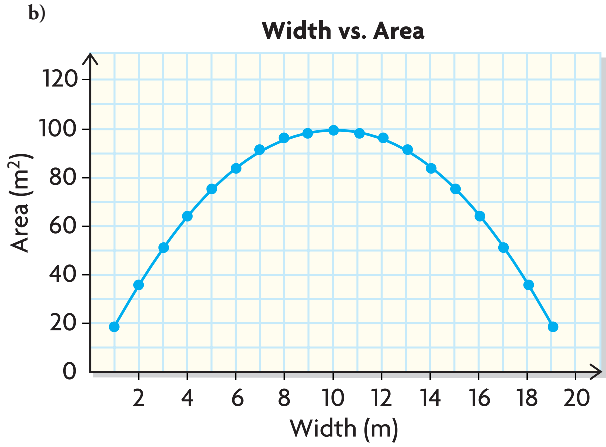


c) width about 9 m and length about 14 m

6. C, since it is a square.
7. 9 m by 9 m, e.g., this is a square.
8. 10 cm by 10 cm
9. a)

Length (m)	Width (m)	Perimeter (m)	Area (m^2)
19	1	20	19
18	2	20	36
17	3	20	51
16	4	20	64
15	5	20	75
14	6	20	84
13	7	20	91
12	8	20	96
11	9	20	99
10	10	20	100
9	11	20	99
8	12	20	96
7	13	20	91
6	14	20	84
5	15	20	75
4	16	20	64
3	17	20	51
2	18	20	36
1	19	20	19

b)

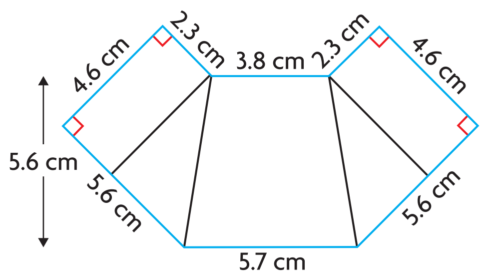


c) Answers may vary, e.g., the largest rectangular area is when the length and width are both 10 m. This is because this forms a square, which is the optimum rectangle for maximising area for a given perimeter.

10. 30 m by 60 m, with the 60 m section parallel to the barn wall
11. 10 368 m^2
12. Answers may vary, e.g., a rectangle in the shape of a square has the least perimeter, which is often the optimum perimeter. A rectangle in the shape of a square has the greatest area, which is often the optimum area.
13. 14.99 cm by 14.99 cm and 0.01 cm by 0.01 cm
14. 10.0 m by 13.3 m uses 79.9 m of wood.

Lesson 8.2, page 440

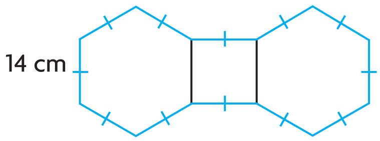
1. a) 15.5 cm^2 b) 9.9 m^2 c) 20.5 cm^2
2. a) perimeter 17.4 m, area 8.6 m^2
   b) perimeter 19.0 m, area 11.9 m^2
3. a) 72 cm^2 c) 45 cm^2
   b) 6.6 m^2 d) 31.2 cm^2
4. perimeter 26.2 cm, area 42.0 cm
5. a) perimeter 272 mm, area 5576 mm^2
   b) perimeter 50.4 cm, area 181.4 cm^2
   c) perimeter 102.0 cm, area 734.4 cm^2
6. a) Answers may vary, e.g.,



   b) The area of each rectangle is 10.6 cm^2, the area of each triangle is 7.6 cm^2, and the area of the trapezoid is 26.6 cm^2. E.g., I multiplied the area of the rectangles by 2 and I multiplied the area of the triangles by 2, then I added the new numbers to the area of the trapezoid. That's because there are 2 each of the triangles and rectangles. The total area is about 63.0 cm.
7. a) about 1.7 cm b) about 17 mm

8. **a)** Answers may vary, e.g., I would divide the shape into a square, a pentagon, and a hexagon. I would then divide the hexagon and pentagon into six and five triangles, respectively, so I would need height measurements to determine the areas of the triangles.
b) 693 cm

9. Answers may vary, e.g., I created the following shape:



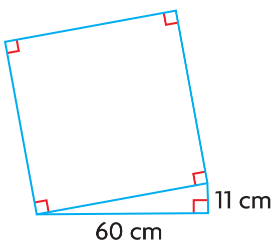
- Divide the compound shape into smaller shapes with areas that are easier to determine.
- Add the areas of the smaller shapes together.
- Determine the length of each section of the perimeter and add them together. The perimeter of the shape is 168 cm and the area is about 1214 cm^2.

10. **a)** $A = \pi R^2 - \pi r^2$ **b)** $A = 4r^2 - \pi r^2$ **c)** $A = 4r^2 - \pi r^2$

11. $A_{\text{regular polygon}} = \dfrac{Pa}{2}$, where P is the perimeter and a is the distance from the centre to the midpoint of each side.

Lesson 8.3, page 445

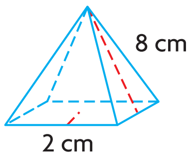
1. **a)** 10 m **b)** about 14 cm **c)** about 20 cm **d)** about 14 cm
2. about 91 km
3. **a)** 10 m **b)** 37 cm **c)** 69 m
4. 60 m
5. **a)** 40 m **b)** about 29 m **c)** about 46 m
6. boom 8.0 m, forestay 15.5 m
7. A: 1764 cm^2; B: 1600 cm^2; C: 3364 cm^2
8. If the corners meet at a right angle, the diagonal will measure about 12.1 m.
9. **a)** yes **b)** no **c)** no **d)** no
10. Answers may vary, e.g., determine the perimeter of the square on the hypotenuse in the diagram.



Solution: 244 cm
11. 13 cm long by 12 cm high
12. Answers may vary, e.g., height of 80 cm and side length of 120 cm. Or height of 60 cm and side length of 160 cm.
13. Answers may vary, e.g., because the triangle is not a right triangle. I know this because if the triangle were right angled, squares A and B would be smaller and the Pythagorean theorem would work and give an answer for the area of C. Since A and B are bigger than they would be in a right triangle, the Pythagorean theorem could not work, because it would give a different answer for the area of C.

Lesson 8.4, page 454

1. **a)** 35.6 cm^2 **b)** 85.4 cm^2
2. **a)** 139 cm **b)** 283 cm^2
3. **a)** 600 m^2 **b)** 66.6 cm^2 **c)** 678.2 cm^2
4. 172.8 cm^2
5. **a)** 8.9 cm **b)** 162.0 cm^2
6. cup B
7. **a)** 1977 mm^2 **b)** 18.4 cm^2 **c)** 118 m^2
8. **a)** 452.2 cm^2 **b)** 942 cm^2 **c)** 1685.1 cm^2
9. The pyramid with the octagon base. I calculated the surface area of each pyramid and the one with the octagon base has a greater surface area. The surface area of the pyramid with the square base is 289 cm^2, and the surface area of the pyramid with the octagon base is 320 cm^2.
10. 211.4 cm^2
11. 66.3 cm^2
12. 20.6 m^2
13. 43.2 m^2
14. **a)** 139 144.1 m^2 **b)** about 20 788 blocks
15. about 1590 cm^2
16. Answers may vary, e.g.,



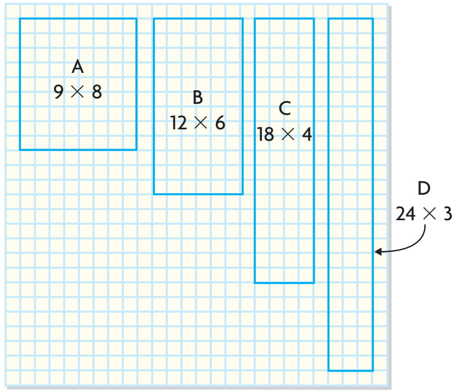
To determine the surface area, I can find the area of the square base by doubling and squaring the distance from the centre to the middle of a side, and then calculate the area of one of the triangular sides by multiplying the slant height by the base side length and dividing by two. I would then multiply the area of one triangle by four and add the area of the base to determine the surface area. Or, I could use the formula for the surface area of a pyramid.

17. Answers may vary, e.g., I think the 20-sided container has the greatest surface area. I looked at the equation for the surface area of a pyramid. The variables in the equation are P for perimeter, a for the distance between the centre of the base and the midpoint of each side, and L for slant height. Since the distance between the centre of the base and the midpoint of each side and height are given to be the same, then I can determine the slant height for each pyramid and it will be the same, too. I know that the distance between the centre of the base and the midpoint of each side and slant height are the same for each pyramid. So the equation tells me that the pyramid with the greatest perimeter will have the greatest surface area. The perimeters seem to get bigger as the number of sides increases, so the 20-sided container should have the greatest surface area.

18. **a)** 226 cm^2
b) 318 cm^2
c) $49n + (7n + 7) \times \sqrt{37.25}$

Mid-Chapter Review, page 460

1. C; Answers may vary, e.g., C is a square and I know that a square will maximize the area for a given perimeter.

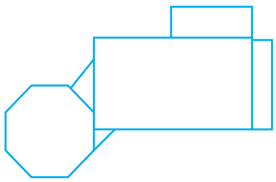


2. Rectangle A has the least perimeter. It has a perimeter of 34 units.

3. **a)** 625 cm^2 **b)** 25 m^2 **c)** 36 km^2

4. 28 m

5. Answers may vary, e.g.,



I would need the length of one side of the hexagon, the side lengths of the two triangles, and the length and width of the three rectangles.

6. The square on the left edge is 900 cm^2, the square on the bottom edge is 256 cm^2, the square on the hypotenuse is 1156 cm^2, and the triangle is 240 cm^2.

7. 10.6 m

8. **a)** 340.2 cm^2 **b)** 422.9 cm^2

9. **a)** 48 bundles of shingles **b)** \$1727.52

Lesson 8.5, page 464

1. 149 cm^3

2. 45.0 m^3

3. 530.9 cm^3

4. 79.8 cm^3

5. 11.3 m^3

6. **a)** 4399.2 m^3
b) 637 sanders, leaving some sand left over

7. 7.5 cm

8. 9 cm, 18 cm, 21 cm

9. The volume of the pyramid is $\frac{1}{3}$ the volume of the prism.

10. 26 719 mL

11. Answers may vary, e.g., I would measure the base side length of the pyramid and the base radius of the cone. Then, I would calculate the base area for each figure. I would use the formula s^2 for the base of the pyramid, where s is the base side length. I would use the formula πr^2 for the base of the cone, where r is the base radius. Then, I would multiply the base area of each figure by the height and divide by three. I would compare the volumes to determine which was greater.

12. **a)** $V = \frac{1}{6} nhsa$, where V is the volume of an n-sided pyramid, s is its side length, and a is the distance from the centre of the base to the midpoint of an edge.
b) $V = \frac{10}{3}\pi a^2$

Lesson 8.6, page 470

1. 113.1 cm^2

2. 697 cm^3

3. Answers may vary, e.g., $4\pi \times 12 \text{ cm} \times 12 \text{ cm} = 1810 \text{ cm}^2$.

4. 524 mL

5. **a)** 17 269 ball bearings
b) 16 405.55 g
c) 670 boxes
d) Answers may vary, e.g., the shape, size, and mass of each box.

6. **a)** 170 scoops **b)** \$146.20

7. **a)** radius 6366.2 km, surface area 509 296 200 km^2
b) 21 300 km

8. **a)** 29 322 cm^3 of modelling clay **b)** 5027 cm^2 of foil

9. **a)** 247.0 cm^3 **b)** 82.9 cm^2

10. between 168.4 cm^2 and 175.8 cm^2

11. the cylinder: Its surface area is 471 cm^2, while the cube's is 600 cm^2.

12. **a)**

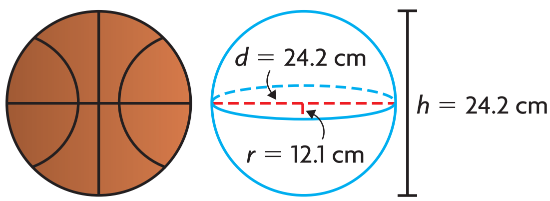
Shape	Surface Area (cm^2)	Dimensions (cm)	Volume (cm^3)
square-based prism	1000	$s = 10$, $h = 20$	2000
cylinder	1000	$r = 10$, $h \doteq 5.92$	1858.88
sphere	1000	$r \doteq 9$	2974

b) sphere

13. 17.27 cm^2

14. 1.5 cm^3

15. Answers may vary, e.g., the formula for the volume of a sphere with radius r is $\frac{4}{3}\pi r^3$. The volume is a fraction of the volume of the cylinder with base radius r and height $2r$. You can see this by placing an orange in a cylindrical glass of the same height full of water, then measuring how much water spills when you put the orange inside. The formula for the surface area of a sphere with radius r is $4\pi r^2$. The surface area is equal to the area of 4 circles with radius r. You can see this by taking the peel of an orange and placing it on 4 circles that have radius equal to the orange's radius.



One sphere from my experience is a basketball, which has a radius of 12.1 cm:
volume of basketball 7420.7 cm^3
surface area of basketball 1839.8 cm^2

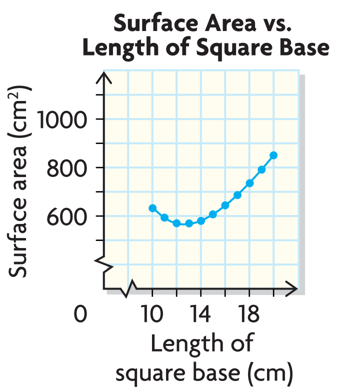
16. The cube has a greater volume and surface area.
17. by 0.7 cm

Lesson 8.7, page 475

1. Answers may vary, e.g., I chose a square-based prism with a fixed volume of 1000 cm^3.
2. **a)** Answers may vary, e.g., what is the minimum amount of cellophane packaging needed to wrap a piece of chocolate in the shape of a prism if its volume is 1000 cm^3?

   b)

Volume (cm^3)	Length of Square Base (cm)	Height (cm)	Surface Area (cm^2)
1000	10	30.00	632.46
1000	11	24.79	596.73
1000	12	20.83	577.01
1000	13	17.75	572.07
1000	14	15.31	580.81
1000	15	13.33	602.08
1000	16	11.72	634.64
1000	17	10.38	677.24
1000	18	9.26	728.71
1000	19	8.31	788.04
1000	20	7.50	854.40



The minimum amount of cellophane needed is about 572 square centimetres when the base of the piece of chocolate is a 13 cm × 13 cm square.

Lesson 8.8, page 480

1. **a)** about 7 cm by 7 cm by 8 cm
   b) radius of about 4 cm and height about 9 cm
2. **a)** 30 cm by 30 cm by 30 cm
   b) 22 scoopfuls
3. **a)** 5 m by 5 m by 5 m
   b) 15 cm by 15 cm by 15 cm
   c) 2.800 cm by 2.800 cm by 2.800 cm
   d) 14.600 cm by 14.600 cm by 14.600 cm
4. **a)** 1.5 cm by 1.5 cm by 1.5 cm
   b) 216 cm^3
   c) 6 cm by 6 cm by 6 cm
5. **a)** 3217.0 cm^2 with radius 8.0 cm and height 16.0 cm
   b) 1837.1 cm^2 as a cube with side length 12.2 cm
6. A cylinder with radius 10.9 cm and height 21.9 cm. It would have a surface area of 2251.1 cm^2.
7. **a)** 5 m by 5 m by 5 m, volume 125 m^3
   b) 12 cm by 12 cm by 12 cm, volume 1728 cm^3
   c) 9.5 cm by 9.5 cm by 9.5 cm, volume 857.4 cm^3
   d) 28.5 cm by 28.5 cm by 28.5 cm, volume 23 149.1 cm^3
8. The cylinder with radius of 5 cm and height of 13 cm uses the least material, 556 cm^2.

Radius (cm)	Height (cm)	Surface Area (cm^2)
1	318	2006
2	80	1025
3	35	724
4	20	601
5	13	556
6	9	558
7	7	594
8	5	653
9	4	729
10	3	829

9. side length 3.6 cm, height 1.8 cm
10. radius 4.6 cm, height 4.7 cm, surface area 203 cm^2
11. Answers may vary, e.g., a cube with side length 24 cm.
12. 13 cm^3
13. Answers may vary, e.g., the cue cards read:
   - "Case 1: You know the surface area or volume."
   - "For cylinders, create a chart of different heights and radii satisfying the surface area or volume, then determine the dimensions that minimize surface area *and* maximize volume."
   - "The height should be twice the radius." With visual of cylinder with height twice the radius.
   - "For prisms, create a chart of different heights and base lengths satisfying the surface area or volume, then determine the dimensions that minimize surface area *and* maximize volume."
   - "The height should equal the base length, so the prism should be a cube." With visual of a cube.
   - "Case 2: You know one dimension of the cylinder or prism."
   - "For cylinders, if you know the radius, set the height equal to twice the radius."
   - "If you know the height, set the radius to half the height."
   - "For prisms, if you know the base side length, set the height equal to it. The prism is a cube."
   - "If you know the height, set the base side length equal to it. The prism is a cube."

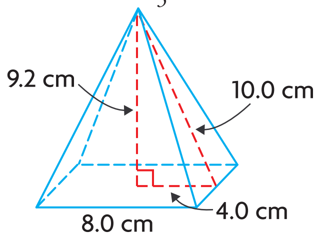
14. a) 20 cm by 20 cm by 30 cm
b) No, packaging them 8 cans per box would be more economical because it would create a perfect cube.

Chapter Review, page 484

1. 2.4 m by 2.4 m
2. 89 cm
3. 5 m × 5 m
4. 20 m × 40 m with longer side parallel to the beach
5. 60 cm^2
6. area 83.2 cm^2, perimeter 33.2 cm
7. a) 170 m b) 3.7 laps c) 1530 m^2
8. a) area: 99 cm^2, perimeter 33 cm
b) area 120 cm^2, perimeter 40 cm
9. 38.7 m
10. 9.6 cm
11. 99 m
12. 2704 cm^2
13. 874 cm^2
14. a) 34 bundles b) 3 cans of paint c) \$1313.51
15. 224 cm^2
16. 23.2 cm
17. a) V = 324 cm^3, SA = 312 cm^2
b) V = 1963 cm^3, SA = 1171 cm^2
18. a) 466 cm^2 b) 576 cm^3
19. 148 cm^3
20. Volume: 92 cm^3
Surface Area: 99 m^2
21. a) 268 cm^3 b) 244 cm^3
22. 2422 cm^3 of rubber
23. Answers may vary, e.g., radius of 6 cm and height of 8 cm.
24. a) The square-based prism with the greatest volume for a given surface area is a cube. 210 cm^2 ÷ 6 = 35 cm^2, so each side has an area of 35 cm^2. That means that the side length of one side is $\sqrt{35}$, which is about 6. So the square-based prism with the greatest volume and a surface area of 210 cm^2 is a cube with side length 6 cm.
b) Using the same process as part a), the answer is a cube of side length 8 cm.
25. 98 cm^3

Chapter Self-Test, page 486

1. 180 cm
2. a) area 59.6 cm^2, perimeter 30.5 cm
b) area 864 cm^2, perimeter 168 cm
3. The volume is 195.5 cm^3. To determine the volume, I needed to know the area of the base and the height. I knew the side length was 8.0 cm, so the area of the base is 64.0 cm^2. To determine the height, I used the Pythagorean theorem with the distance from the centre of the base to the midpoint of an edge and slant height. The distance from the centre of the base to the midpoint of an edge is half of the side length, so 4.0 cm. I had one leg and the hypotenuse of the right triangle. I used the Pythagorean theorem to solve for the height. I solved $h^2 + 4.0^2 = 10.0^2$ to get 9.165 cm for the height. I didn't round off yet so that the answer would be accurate.
The volume is $\frac{1}{3}$ multiplied by the height multiplied by the area of the base, which is $\frac{1}{3} \times 9.165 \times 64.0 = 195.5$ cm^3.



4. C
5. a) V = 353.3 cm^3, SA = 184.1 cm^2
b) V = 229.5 cm^3, SA = 254.1 cm^2
6. a) 132.7 cm^2 b) 143.8 cm^3
7. A
8. 11 cm by 11 cm by 10 cm

Chapters 7–8 Cumulative Review, page 488

1. **C.**
2. **D.**
3. **D.**
4. **D.**
5. **B.**
6. **C.**
7. **B.**
8. **A.**
9. **A.**
10. **D.**
11. **C.**
12. **A.**
13. **B.**
14. **D.**
15. **A.**
16. **D.**
17. **B.**
18. **C.**
19. **B.**
20. **C.**
21. **B.** and **C.**
22. a) $\frac{2000}{3}$ cm^3 c) $\frac{1}{8}$
b) $\frac{250}{3}$ cm^3 d) yes

Appendix A

A–1, page 492

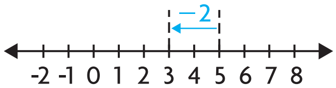
1. a) 4 d) 9 g) 16 j) 3125
b) 8 e) 1000 h) 64
c) 16 f) 10 000 i) 125

A–2, page 492

1. a) 25 c) 25 e) 100
b) 8 d) 4 f) 0

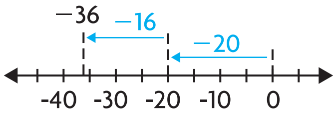
A–3, page 493

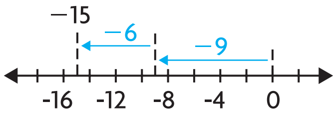
1. a) 

b) 

c) 

d) 

e) 

f) 

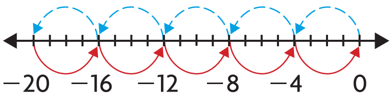
2. a) −5 b) −1 c) −10 d) −2 e) −55 f) −14

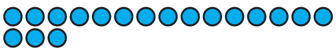
3. a) 7 b) −3 c) 18 d) −7 e) 12 f) −47

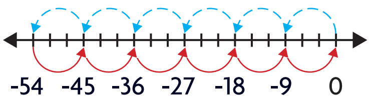
4. a) 17 b) −4 c) 2 d) −58

A–4, page 494

1. a) 

b) 

c) 

d) 

2. a) −6 b) 36 c) −12 d) 21 e) 20 f) −14

3. a) 3 b) −4 c) −3 d) 3 f) 2 e) −5

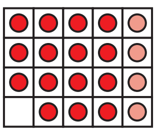
4. a) 25 b) −7 c) 40 d) −16 e) 24 f) −1

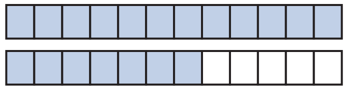
A–5, page 495

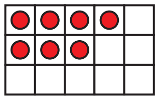
1. a) 6 b) −1 c) 14 d) −2 e) 8 f) 3

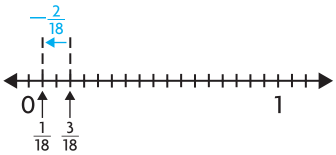
2. a) 26 b) −16 c) −11 d) 6 e) 16 f) 101

A–6, page 497

1. a) 

b) 

c) 

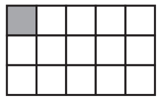
d) 

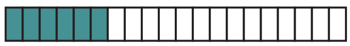
2. a) $\frac{4}{7}$ b) $\frac{7}{9}$ c) $\frac{1}{2}$ d) $\frac{4}{9}$ e) $\frac{1}{2}$ f) $\frac{3}{4}$

3. a) $\frac{4}{9}$ b) $\frac{7}{15}$ c) $\frac{1}{15}$ d) $\frac{11}{24}$ e) $\frac{7}{12}$ f) $\frac{1}{6}$

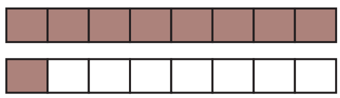
4. a) $\frac{21}{20}$ or $1\frac{1}{20}$ b) $\frac{38}{33}$ or $1\frac{5}{33}$ c) $\frac{44}{35}$ or $1\frac{9}{35}$ d) $\frac{113}{240}$ e) $\frac{41}{10}$ or $1\frac{1}{10}$ f) $\frac{73}{35}$ or $2\frac{3}{35}$

A–7, page 498

1. a) 

b) 

c) 

d) 

2. a) $\frac{3}{10}$ b) $\frac{21}{40}$ c) $\frac{2}{5}$ d) $\frac{6}{11}$

3. a) $\frac{15}{28}$ b) $\frac{10}{33}$ c) $\frac{6}{7}$ d) $\frac{10}{13}$

4. a) $\frac{16}{39}$ b) $\frac{9}{25}$ c) $\frac{5}{2}$ or $2\frac{1}{2}$ d) $\frac{1}{3}$

A–8, page 499

1. a) $\frac{97}{60}$ or $1\frac{37}{60}$ b) $\frac{29}{120}$ c) $\frac{37}{10}$ or $3\frac{7}{10}$ d) $\frac{1471}{1080}$ or $1\frac{391}{1080}$ e) $\frac{19}{24}$ f) $\frac{25}{36}$

A–9, page 500

1. a) 3.5 b) 1.5 c) 4.55 d) 11.25 e) 8.09 f) 5.87
2. a) 2.7 b) 4.95 c) 2.5 d) 1.5 e) 3 f) 9.65

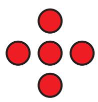
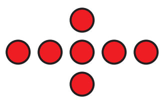
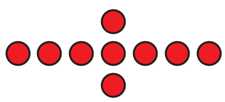
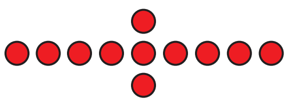
A–10, page 501

1. a) $1 \times 10^3 + 2 \times 10^2 + 3 \times 10 + 4 \times 10^0$
   b) $1 \times 10^4 + 1 \times 10^3 + 1 \times 10^2 + 2 \times 10 + 5 \times 10^0$
   c) $1 \times 10^4 + 5 \times 10^0$
   d) $1 \times 10^6 + 4 \times 10^4 + 5 \times 10^3 + 3 \times 10^2 + 1 \times 10^0$
2. a) 1.234×10^3 b) 1.1125×10^4 c) 1.0005×10^4 d) $1.045\,301 \times 10^6$

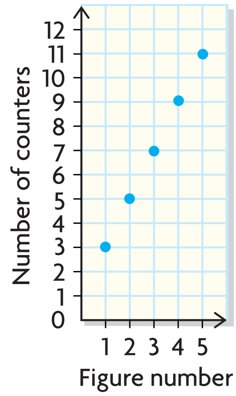
Standard Form	Expanded Form	Scientific Notation
451	$4 \times 10^2 + 5 \times 10 + 1 \times 10^0$	4.51×10^2
1026	$1 \times 10^3 + 2 \times 10 + 6 \times 10^0$	1.026×10^3
2050	$2 \times 10^3 + 5 \times 10$	2.050×10^3
472 000	$4 \times 10^5 + 7 \times 10^4 + 2 \times 10^3$	4.72×10^5

A–11, page 502

1. a)

Figure Number	Figure	Number of Counters
1		3
2		5
3		7
4		9
5		11

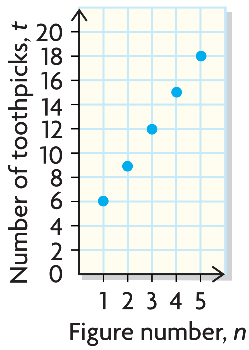
b)



2. a) $t = 3n + 3$
   b)

Figure Number, n	Number of Toothpicks, t
1	6
2	9
3	12
4	15
5	18

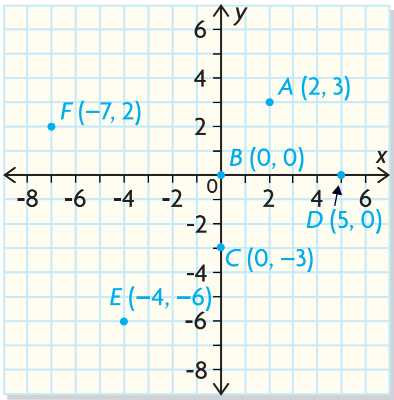
c)



A–12, page 503

1. A: (2, 6)
   B: (−4, −2)
   C: (5, 0)
   D: (−2, 1)
   E: (4, −3)
   F: (0, 0)

2.



3. **a)** b) and d) on the x-axis, b) and c) on the y-axis
b) a) I, e) III, f) II

4. **a)** Answers may vary, e.g., (3, 2).
b) Answers may vary, e.g., $(-4, 0)$.
c) Answers may vary, e.g., $(-1, -1)$.
d) Answers may vary, e.g., $(-2, 4)$.

A–13, page 505

1. **a)** $n = 4$ **c)** $x = 6$ **e)** $n = 11$
b) $f = -3$ **d)** $g = -6$ **f)** $z = 15$

2. **a)** $x = 3$ **c)** $c = -4$ **e)** $h = -5$
b) $n = 6$ **d)** $m = -5$ **f)** $a = 5$

3. **a)** $k = 3$ **c)** $a = 5$ **e)** $p = 3$ **g)** $h = 0$
b) $k = 7$ **d)** $y = -3$ **f)** $v = 2$ **h)** $y = 1$

4. **a)** $m = 12$ **c)** $h = -8$ **e)** $y = 48$
b) $e = 20$ **d)** $a = -32$ **f)** $c = 0$

A–14, page 506

1. **a)** 1 : 2 **c)** 2 : 5 **e)** $\frac{3}{5}$
b) 1 : 3 **d)** 2 : 7 **f)** $\frac{5}{7}$

2. **a)** 7 : 30 **c)** 25: 0.05 or 2500 : 5 or 500 : 1
b) 17 : 60 **d)** 15 : 60 or 1 : 4

3. **a)** 4 **b)** 9 **c)** 14 **d)** 24

4. **a)** 2 tins/dollar **d)** $\frac{79}{4}$ km/h
b) $\frac{75}{87}$ dollars/h **e)** $\frac{3}{4}$ goals/shot
c) $\frac{4}{3}$ dollars/novel **f)** $\frac{17}{23}$ min/paper

A–15, page 506

1. **a)** $\frac{49}{100}$ **c)** $\frac{1}{100}$ **e)** $\frac{1}{3}$
b) $\frac{3}{4}$ **d)** $\frac{1}{200}$ **f)** $\frac{3}{40}$

2. **a)** 73% **c)** 14% **e)** 62.5%
b) 30% **d)** 25% **f)** 100%

3. **a)** 11.3 **c)** 90 **e)** 20.6
b) 51 **d)** 1.2

A–16, page 508

1. **a)** $a = 65°$, $b = 115°$, $c = 115°$
b) $w = 60°$, $x = 40°$, $y = 80°$, $z = 40°$
c) $x = 50°$, $y = 62°$
d) $a = 70°$
e) $a = 80°$, $b = 80°$, $c = 100°$
f) $a = 65°$, $b = 50°$, $c = 65°$
g) $a = 50°$, $b = 50°$, $c = 50°$, $d = 75°$
h) $x = 60°$, $y = 120°$, $z = 120°$

2. **a)** $a = 80°$, $b = 100°$, $c = 100°$, $d = 100°$
b) $x = 37°$, $y = 71°$, $z = 71°$
c) $w = 131°$, $x = 49°$, $y = 74°$, $z = 57°$
d) $a = 48°$, $b = 106°$, $c = 26°$, $d = 106°$

A–17, page 510

1. **a)** 598 m **b)** 260 m **c)** 24 cm **d)** 24 mm

2. **a)** 70.4 cm^2 **c)** 12.7 m^2 **e)** 80 cm^2
b) 642.1 cm^2 **d)** 1009.2 cm^2 **f)** 37.5 m^2

3. **a)** 50 cm^2 **c)** 48 cm^2
b) 96 cm^2 **d)** 6775 cm^2

A–18, page 512

1. **a)** $A = 12.57$ cm^2, $C = 12.57$ cm
b) $A = 3.14$ cm^2, $C = 6.28$ cm
c) $A = 1256.64$ cm^2, $C = 125.66$ cm
d) $A = 314.16$ cm^2, $C = 62.83$ cm

2. **a)** 17.59 cm^2 **b)** 8.59 cm

3. **a)** 21.46 m^2 **c)** 1.72 cm^2
b) 14.13 cm^2 **d)** 89.27 cm^2

A–19, page 513

1. **a)** $6^2 + 8^2 = x^2$ **c)** $5^2 + y^2 = 9^2$
b) $13^2 + 6^2 = c^2$ **d)** $3.2^2 + a^2 = 8.5^2$

2. **a)** $x = 10$ cm **c)** $y = 7.5$ cm
b) $c = 14.3$ cm **d)** $a = 7.9$ cm

3. 100 m

4. **a)** 11.2 m **b)** 6.7 cm **c)** 7.4 cm **d)** 4.9 m

5. 69.4 m

6. 631.5 m

A–20, page 515

1. **a)** $SA = 127.4$ cm^2, $V = 66.4$ cm^3
b) $SA = 398.3$ cm^2, $V = 482.4$ cm^3
c) $SA = 596.9$ cm^2, $V = 1099.6$ cm^3
d) $SA = 747.7$ cm^2, $V = 1539.4$ cm^3

2. **a)** 283.5 cm^3 **b)** 173 cm^3

3. **a)** 469.1 m^3 **b)** 472.4 cm^3

4. 3.2 cm

5. **a)** 211.6 m^3 **b)** 245.1 m^2 **c)** 4 cans