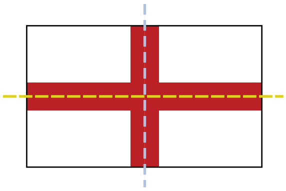
Answers

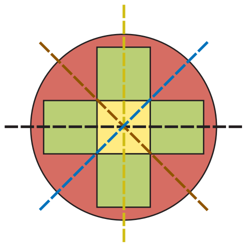
Chapter 1

1.1 Line Symmetry, pages 12–15

4. a)



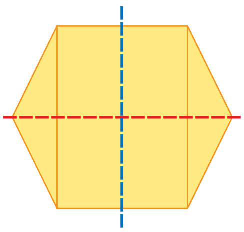
b)



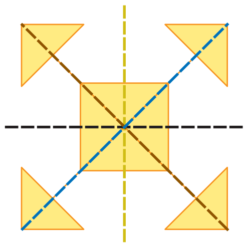
c)

Digital rights not available.

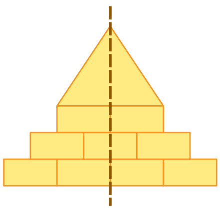
5. a)



b)

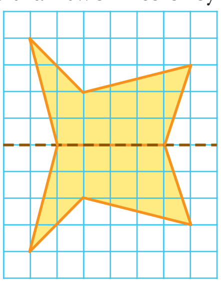


c)

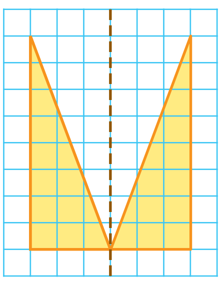


6. B, D, and E. They can be folded in two different ways so that they overlap exactly. Each of the other figures has more than two lines of symmetry.

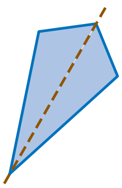
7. a)



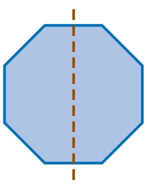
b)



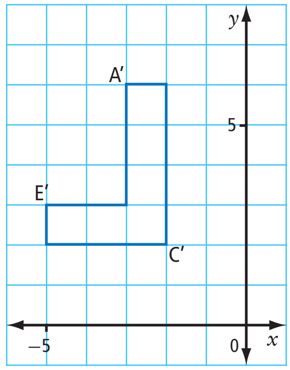
8. a)



b)

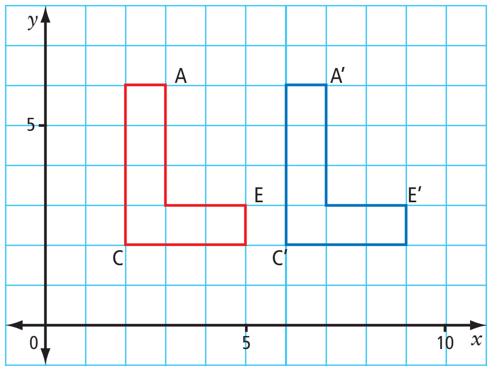


9. a)

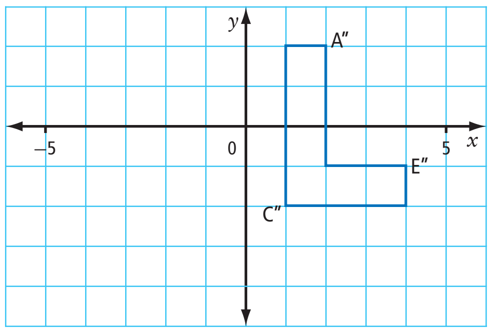


b) A′(−3, 6), C′(−2, 2), E′(−5, 3) **c)** Yes, the original image and the reflected image show line symmetry. However, each individual figure does not show line symmetry within itself.

10. Example: **a)**

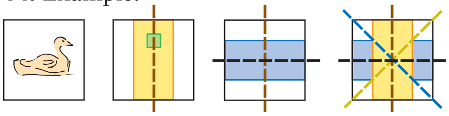


b) A′(7, 6), C′(6, 2), E′(9, 3) **c)** No. The image was not reflected and does not contain line symmetry within itself. **d)** No. See explanation in 10c).



11. Example: I agree because these shapes show horizontal and/or vertical line symmetry within themselves, a horizontal or vertical translation of the shape results in line symmetry between the original and new images. A figure with only vertical line symmetry within itself will show line symmetry after a horizontal translation only.

12. a) Yes, the flag has horizontal line symmetry. If folded from bottom to top through the middle of the horizontal blue stripe, the upper and lower halves will overlap.
b) Moving the vertical blue and white stripes to the centre of the flag would give it two lines of symmetry.
13. a) one horizontal **b)** one vertical **c)** two: one horizontal and one vertical **d)** four: one horizontal, one vertical, and two oblique
14. Example:

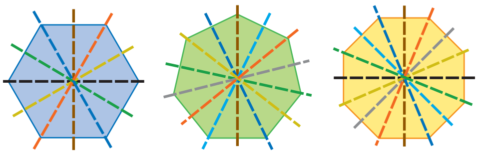


0 lines 1 line 2 lines 4 lines

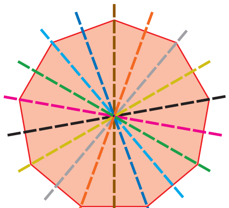
15. a) B, C, D, E, H, I, K, O, X
b) A, H, I, M, O, T, U, V, W, X, Y **c)** H, I, O, X
16. a) Example: **WOW** **W O W** **HAH** **H A H**

b) Example: **HI** **H I** **c)** Example: **WHO** **W H O**

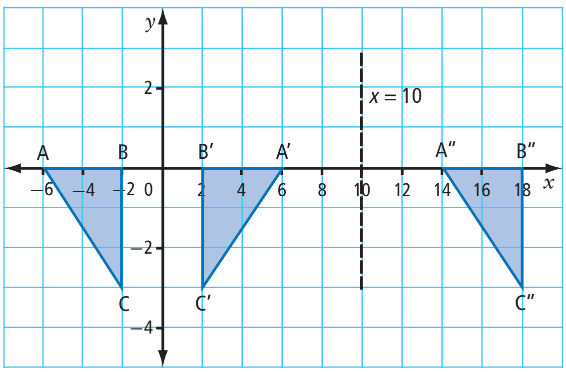
17. a) 0, I, 3, 8 **b)** Example: I00I **c)** Example: 80I08
18. a)



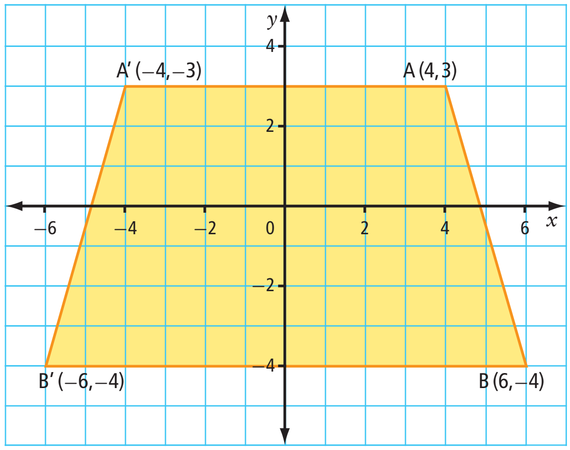
b) The number of equal, interior angles equals the number of lines of symmetry. **c)** Yes. As the number of interior angles increases, you approach a circle shape, which is symmetrical from all angles.



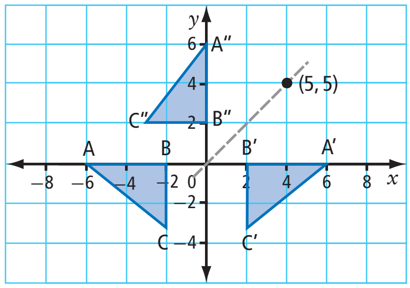
19. a) A **b)** Different colours mean that figure B becomes a non-symmetric figure. **c)** Figure A has five lines of symmetry.
20.



Triangle A″B″C″ is the result of a horizontal translation 20 units to the right.
21. a) If the two-dot separator in the digital clock is ignored, then both clocks show line symmetry at some time.
b) The digital clock can show horizontal line symmetry at 8:08, 8:38, 3:03 (not 1:01 or 10:10, etc., because of the shape of the number 1); the analogue clock can show line symmetry at any time when the line of symmetry bisects the angle between the hands and bisects the squares representing the numbers or when the time is 6:00 or 12:00.
22.



70 square units
23.



Triangle A″B″C″ is the image created by rotating the original triangle 90° about the origin.
24. Example: Yes, a three-dimensional object such as a cube is symmetric because all faces and edges are of equal size. A plane cutting the cube parallel to a face and through the centre will create two identical rectangular prisms.

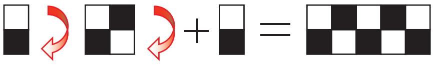
1.2 Rotation Symmetry and Transformations, pages 21–25

4. a) order of rotation = 4, angle of rotation = 90°, fraction of a turn = $\frac{1}{4}$, centre of rotation is at centre of figure. **b)** order of rotation = 2, angle of rotation = 180°, fraction of a turn = $\frac{1}{2}$, centre of rotation is at centre of figure. **c)** order of rotation = 2, angle of rotation = 180°, fraction of a turn = $\frac{1}{2}$, centre of rotation is between 9 and 6.
5. a) Yes; angle of rotation = 90° **b)** Yes; angle of rotation = 120° **c)** Yes; angle of rotation = 180°
6. a) number of lines of symmetry = 6, order of rotation = 6
b) number of lines of symmetry = 2, order of rotation = 2
c) number of lines of symmetry = 2, order of rotation = 2

7. a) number of lines of symmetry = 3, angle of rotation = 120° **b)** number of lines of symmetry = 5, angle of rotation = 72°

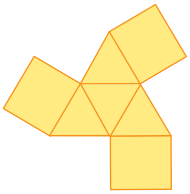
8. a) 

b) Rotate the original figure 180° and join the two figures. Translate the new figure to the right so it does not overlap. Join the two figures. Now join this new figure with the original one on the right.



9. a) 3

b)



c) No, because the image does not show line symmetry.

10. a) Example: line symmetry: pu, pa; rotation symmetry: ki, ku;

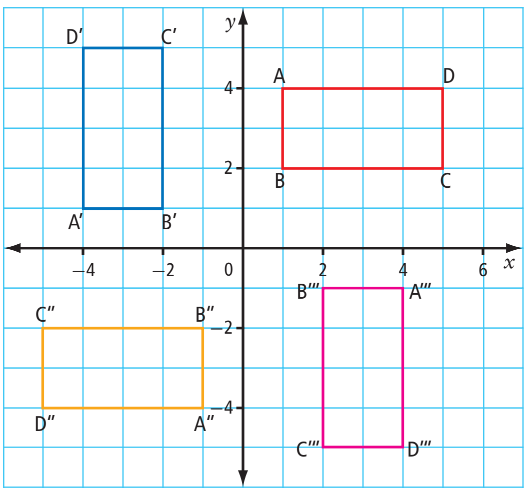
11. a) Both. Lines of symmetry: the vertical black line with three red squares to its left and to its right in each row; the horizontal black line with two red squares above it and below it in each column. The centre of rotation is located where the two lines of symmetry intersect.

b) Neither. There would be a vertical line of symmetry through the noses of the centre column of faces if the face colours on each side of the line matched each other.

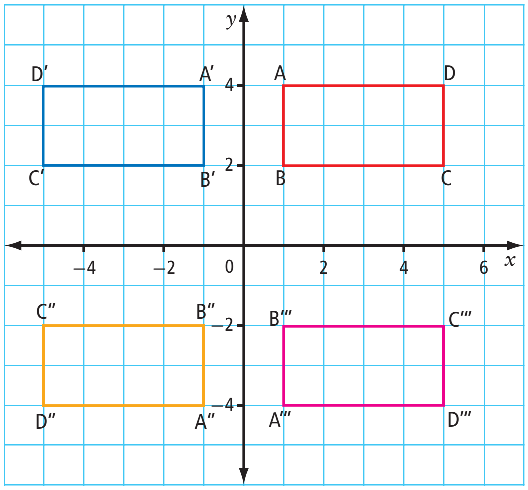
c) Neither. There would be 180° rotation symmetry if the pink and blue dolphins were the same colour.

d) Rotation symmetry only of order 4. The centre of rotation is at the centre of the figure.

12. a) The vertices of the images are:
A′(−4, 1), B′(−2, 1), C′(−2, 5), D′(−4, 5);
A″(−1, −4), B″(−1, −2), C″(−5, −2), D″(−5, −4);
A‴(4, −1), B‴(2, −1), C‴(2, −5), D‴(4, −5).



b) Each image is oriented with the longer dimension along the horizontal and the order of labelling switches between clockwise and counter-clockwise.



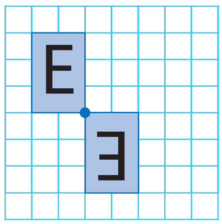
13. a) order of rotation = 4, angle of rotation = 90°

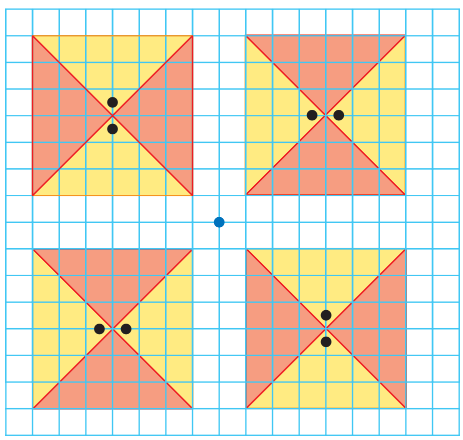
b) No; the rotation of the design makes line symmetry impossible.

14. a) There are eight lines of symmetry; the angle between the lines is 22.5°

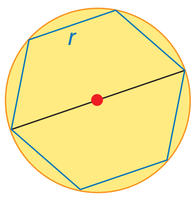
b) order of rotation = 8, angle of rotation = 45°

15. Example:

16. a) 

b) 

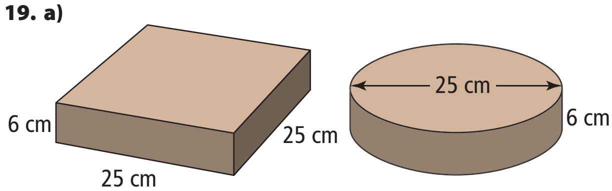
17. a) order of rotation = 5, angle of rotation = 72°
b) order of rotation = 7, angle of rotation = 51.4°
c) order of rotation = 6, angle of rotation = 60°
d) order of rotation = 12, angle of rotation = 30°
18. a) Example: Some parts of the diagram appear to be rotated and projected five times, whereas others (such as the interior bolts) appear four times. Depending on which part is chosen, the order of rotation may seem different.
b) Adding another bolt so that the total on the inside rim is five would give this diagram rotation symmetry.
19. a) The top half of the card, along with the K symbol, is rotated 180° (rotation order 2). **b)** Cards are designed so they can be read while being held from either end.
c) No; attempting to fold the card along any line does not result in an overlap.
20. Rachelle is correct. Although there are 20 wedges on the board, the alternating red and green colours must be grouped together and then rotated to reproduce the image.
21. a) H, I, N, O, S, X, Z **b)** 0, I, 8 **c)** Example: X08OI
22. Example: A hexagon-shaped sign, a six-sided snowflake, or other object.
23. a) A: no symmetry because of the variation in overlap of green and blue circles in pairs of opposite rays;
B: rotational symmetry of order 4 and line symmetry
b) Example: The logo of Sun Microsystems shows rotational symmetry, and UNESCO shows vertical line symmetry.
24. a) $m = 12$. The letter m represents the number of teeth in the gear. **b)** $n = 16$ **c)** 4.5 turns **d)** 6 turns
e) $\frac{(x)(m)}{y} = \text{number of turns}_B$
25. a) All of the objects have at least one example of line symmetry. All of Group A show multiple lines of symmetry. Only the left object in Group B does not show rotation symmetry.
b) Example: A cube has many lines of symmetry because the edges are all of equal length.
26.



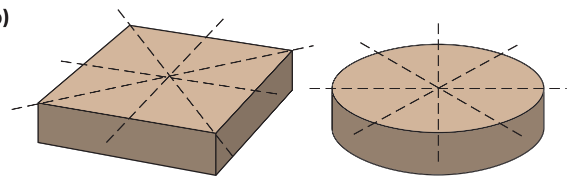
The shape made would be a hexagon. The order of rotation for the shape is 6.

1.3 Surface Area, pages 32–35

4. a) Estimate the total surface area of a solid,
2 × 4 × 5 rectangular prism. The total surface area of the object is 72 cm^2. **b)** Estimate the total surface area of a solid,
4 × 4 × 6 prism. The total surface area of the object is 112 cm^2.
5. a) 216 cm^2 **b)** 256 cm^2
6. a) 12 cm^2 **b)** 214 cm^2
7. a) 17 cm by 9 cm by 11 cm **b)** The surface area with the cutout is the same as the surface area without the cutout (4750 cm^2).
8. a) For one box: width = 2 cm, height = 1 cm, depth = 3 cm **b)** 96 cm^2 **c)** one box: 22 cm^2; six boxes: 132 cm^2. The ratio of the surface area for the six combined boxes to the surface area for six separate boxes is 8 : 11.
9. a) 4320 cm^2 **b)** 54 720 cm^2 **c)** Only three surface areas need to be calculated (shelf, side, back).
10. a) 36 cm^2 **b)** Example: A 1 cm × 2 cm × 5 cm rectangular prism has a surface area of 34 cm^2, while a 1 cm × 1 cm × 10 cm rectangular prism has a surface area of 42 cm^2.
11. Example: Surface area is important to consider when painting a building, icing a cake, and packaging items.
12. a) 0.06 m. This allows rainwater to flow away from the house, off the roof to the ground below.
b) 57.89 m^2; You must assume that there is no bottom included in this calculation, all angles are 90°, the garage door is to be included, and an average height of 2.4 m.
13. a) left mug: 286.5 cm^2; right mug: 298.6 cm^2
b) The left mug has better heat-retaining properties. It has less surface area exposed to the air resulting in lower heat loss.
14. 1.92 m^2
15. a) The object's top and bottom faces, left and right faces, and front and back faces are symmetrical.
b) 324.57 cm^2
16. a) You must use the Pythagorean theorem three times.
b) 51.7 m^2 **c)** 33 bundles of shingles for a cost of $889.35
17. a) The two flues are each 24 cm wide and 20 cm tall.
b) 4672 cm^2
18. 392 cm^2; To calculate the surface area of the inside of the box, you must assume the metal has zero thickness.
19. a)



b)

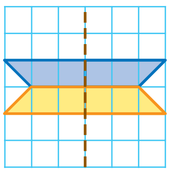


c) square cake: 1850 cm^2; 8 square-cake slices: 3270.8 cm^2; round cake: 1452.3 cm^2; 8 round-cake slices: 2651.9 cm^2; surface area increase of square cake: 1448.6 cm^2; surface area increase of round cake: 1200 cm^2; For both cakes, the eight equal slices increase the total surface area by almost double compared to the unsliced cakes.

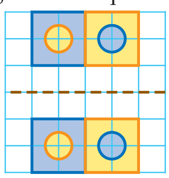
20. The rice with the small grains has a smaller surface area per grain than the rice with larger grains. This means that more rice per cup can come into contact with the hot water with the smaller grains, meaning it can cook faster.
21. Example: Elephants' ears are very thin, but large, giving them a large surface area. This allows more skin to be exposed to air, and allows more skin to be cooled or warmed by the air, regulating the elephant's body temperature.
22. 12 201.95 cm^2
23. 391 m^2

Chapter 1 Review, pages 36–37

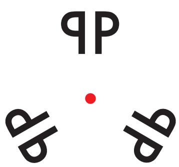
1. E
2. A
3. D
4. B
5. F
6. C
7. a) 4; vertical, horizontal, two oblique
b) 6; vertical, horizontal, four oblique
8. a)



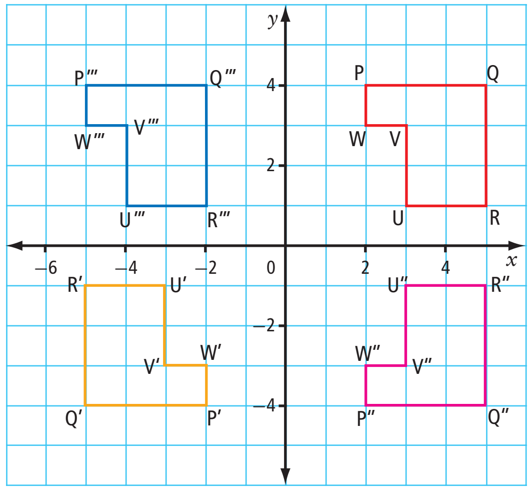
b)



9. a) A′(5, 3), B′(5, 2), C′(1, 2), D′(1, 4), E′(3, 4), F′(3, 3). This shows a vertical line of symmetry with the original image. **b)** A″(1, 0), B″(1, −1), C″(5, −1), D″(5, 1), E″(3, 1), F″(3, 0). This does not show symmetry with the original image.
10. a) order of rotation = 4; angle of rotation = 90°, one quarter turn **b)** order of rotation = 8; angle of rotation = 45°, one eighth turn
11. There is an oblique line of symmetry from the top left corner to the bottom right corner.
12. a)



b) Example: The letter H in the image would make both line symmetry and rotation symmetry. Other possible answers include A, I, M, O, T, V, W, X, and Y.
13. The design has rotation symmetry only with an order of rotation of 3. Because of the colouring and overlapping, there is no line symmetry.
14. a) P′(−2, −4), Q′(−5, −4), R′(−5, −1), U′(−3, −1), V′(−3, −3), W′(−2, −3). Yes, the two images are related by rotation symmetry. **b)** P″(2, −4), Q″(5, −4), R″(5, −1), U″(3, −1), V″(3, −3), W″(2, −3). Yes, the two images are related by horizontal line symmetry.
c) P‴(−5, 4), Q‴(−2, 4), R‴(−2, 1), U‴(−4, 1), V‴(−4, 3), W‴(−5, 3). No, the images are not related by symmetry.

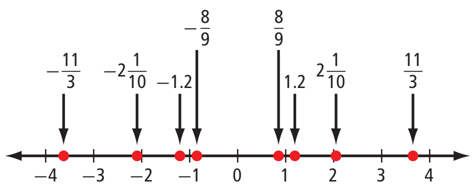


15. 35.1 cm^2
16. a) top: 444 cm^2; bottom: 1088 cm^2 **b)** 1244 cm^2
17. a) 38 cm^2 **b)** 42 cm^2 **c)** 72 cm^2

Chapter 2

2.1 Comparing and Ordering Rational Numbers, pages 51–54

4. a) D **b)** C **c)** A **d)** E **e)** B
5. a) W **b)** Y **c)** Z **d)** V **e)** X
6.



7. a) $4.\overline{1}$ **b)** $-\frac{4}{5}$ **c)** $5\frac{3}{4}$ **d)** $-\frac{9}{8}$
8. $-1\frac{2}{3}, -\frac{1}{5}, -0.1, 1\frac{5}{6}, 1.9$
9. $1.\overline{8}, \frac{9}{5}, -\frac{3}{8}, -\frac{1}{2}, -1$
10. Example: **a)** $\frac{-4}{10}$ **b)** $\frac{5}{3}$ **c)** $\frac{-3}{4}$ **d)** $\frac{8}{-6}$
11. Example: **a)** $\frac{-2}{6}$ **b)** $\frac{4}{5}$ **c)** $-\frac{5}{4}$ **d)** $\frac{-7}{2}$
12. a) $\frac{1}{3}$ **b)** $\frac{7}{10}$ **c)** $-\frac{1}{2}$ **d)** $-2\frac{1}{8}$
13. a) $\frac{4}{7}$ **b)** $-\frac{5}{3}$ **c)** $-\frac{7}{10}$ **d)** $-1\frac{4}{5}$
14. Example: **a)** 0.7 **b)** −0.5625 **c)** 0.1 **d)** −0.825
15. Example: **a)** 1.6 **b)** −2.4 **c)** 0.6 **d)** −3.015
16. Example: **a)** $\frac{1}{4}$ **b)** $\frac{-1}{20}$ **c)** $-\frac{3}{4}$ **d)** $\frac{-21}{40}$
17. Example: **a)** $1\frac{4}{5}$ **b)** $1\frac{1}{4}$ **c)** $-3\frac{7}{20}$ **d)** $-2\frac{1}{50}$

18. a) +8.2; Example: An increase suggests a positive value. **b)** +2.9; Example: A growth suggests a positive value. **c)** −3.5; Example: Below sea level suggests a negative value. **d)** +32.5; Example: Earnings suggest a positive value. **e)** −14.2; Example: Below freezing suggests a negative value.
19. a) helium and neon **b)** radon and xenon
c) helium (−272.2), neon (−248.67), argon (−189.2), krypton (−156.6), xenon (−111.9), radon (−71.0)
d) radon (−61.8), xenon (−107.1), krypton (−152.3), argon (−185.7), neon (−245.92), helium (−268.6)
20. a) Example: −2 is to the left of −1 on the number line, so $-2\frac{1}{5}$ is to the left of $-1\frac{9}{10}$ and therefore, it is smaller. **b)** Example: Since both mixed numbers are between −1 and −2 on the number line, Naomi needed to examine the positions of $-\frac{1}{4}$ and $-\frac{2}{7}$. Since $-\frac{2}{7}$ is to the left of $-\frac{1}{4}$, $-1\frac{1}{4}$ is greater.
21. a) 6.1 (Penticton), 5.4 (Edmonton), 3.9 (Regina), 0.6 (Whitehorse), −0.1 (Yellowknife), −5.1 (Churchill), −14.1 (Resolute) **b)** Yellowknife
22. a) = **b)** > **c)** = **d)** < **e)** > **f)** >
23. Yes. Example: Zero can be expressed as the quotient of two integers as long as the dividend is zero, and the divisor is any number except zero.
24. Example: **a)** $\frac{2}{5}$ **b)** $\frac{3}{-4}$ **c)** $\frac{-10}{3}$ **d)** $\frac{5}{-4}$
25. −3, −2, −1, 0, 1, and 2
26. a) 0.44 **b)** $0.\overline{3}$ **c)** −0.7 **d)** −0.66; Example: To determine which pair is greater, write each pair of fractions in an equivalent form with the same positive denominator and compare the numerators.
27. $\frac{-1}{3}$, $\frac{-2}{3}$, $\frac{-3}{3}$, $\frac{-4}{3}$, and $\frac{-5}{3}$
28. None. Example: $\frac{2}{3}$ and $0.\overline{6}$ are equivalent numbers.
29. a) −2; Yes, any integer less than −2 also makes the statement true. **b)** +9; No **c)** −1; No **d)** 0; No
e) 4; Yes, 0, 1, 2, and 3 will also make the statement true.
f) −1; No **g)** −26; No **h)** −1; Yes, −2, −3, −4, −5, −6, −7, −8, −9, −10, and −11 also make the statement true.
30. a) 8 **b)** −2 **c)** −3 **d)** 25

2.2 Problem Solving With Rational Numbers in Decimal Form, pages 60–62

4. a) −2, −1.93 **b)** 2, 2.3 **c)** −10, −9.98 **d)** 6, 5.34
5. a) −2.25 **b)** 1.873 **c)** 0.736 **d)** −12.94
6. a) −9, −8.64 **b)** −1, −1.3 **c)** 36, 30.25 **d)** 4, 4.6
7. a) 3.6 **b)** 9.556 **c)** −22.26 **d)** −1.204 **e)** 0.762
f) −0.833
8. a) −13.17 **b)** 2.8 **c)** −3.08
9. a) 1.134 **b)** −1.4 **c)** −5.2
10. 38.7 °C
11. a) +7.7 °C **b)** +1.54 °C/h
12. a) 3.8 − (−2.3) **b)** 6.1 m
13. a) 85.5 m **b)** 19 min
14. a loss of $16.25
15. a) −8.2 °C **b)** 1.9 °C
16. a) 2.2 **b)** Example: Use hundredths instead of tenths.
17. 2.06 m
18. a) −2.37 **b)** 1.75
19. a) loss of $1.2 million per year
b) profit of $3.6 million
20. Example: If the cost of gasoline is $1.30/L, then the difference would be $13.65.
21. 11 min
22. 2080 m
23. −0.6 °C
24. a) −5.3 **b)** −4.4 **c)** 2.1 **d)** −2.5
25. Example: At 16:00 the temperature in Calling Lake, Alberta, started decreasing at the constant rate of −1.1 °C/h. At 23:00 the temperature was −19.7 °C. What was the temperature at 16:00? The answer is −12 °C.
26. 2.88
27. a) −25.8 **b)** −3.3
28. a) 2.6 **b)** −0.35 **c)** −0.45
29. a) 3.5 × (4.1 − 3.5) − 2.8 = −0.7
b) [2.5 + (−4.1) + (−2.3)] × (−1.1) = 4.29
c) −5.5 − (−6.5) ÷ [2.4 + (−1.1)] = −0.5

2.3 Problem Solving With Rational Numbers in Fraction Form, pages 68–71

5. a) 0, $\frac{1}{2}$ **b)** 1, $1\frac{1}{12}$ **c)** −1, $\frac{-5}{6}$ **d)** 0, $\frac{5}{6}$
e) $-\frac{1}{2}$, $-\frac{1}{2}$ **f)** $\frac{1}{2}$, $\frac{5}{8}$
6. a) 0, $\frac{-1}{12}$ **b)** $\frac{-2}{3}$, $\frac{-5}{9}$ **c)** −1, $\frac{-17}{20}$ **d)** $-\frac{1}{2}$, $\frac{-1}{8}$
e) −1, $\frac{-3}{4}$ **f)** $\frac{-1}{2}$, $\frac{-7}{20}$
7. a) 1, $\frac{24}{25}$ **b)** 6, $5\frac{5}{6}$ **c)** 0, $\frac{-1}{20}$ **d)** 1, $1\frac{1}{8}$
e) $-2\frac{1}{2}$, −2 **f)** 0, $\frac{-4}{15}$
8. a) 0, $\frac{1}{12}$ **b)** 1, $1\frac{1}{15}$ **c)** $-\frac{1}{2}$, $-\frac{15}{28}$ **d)** −2, $-1\frac{7}{10}$
e) $\frac{-1}{2}$, $\frac{-14}{33}$ **f)** $\frac{2}{3}$, $\frac{3}{5}$
9. $19.50
10. He is short 6.4 m.
11. 120 jiffies
12. a) $2\frac{1}{2}$ h **b)** $13\frac{1}{2}$ h
c) Tokyo is $3\frac{1}{4}$ h ahead of Kathmandu.
d) Chatham Islands are $16\frac{1}{4}$ h ahead of St. John's.
e) Kathmandu, Nepal
13. a) $\frac{1}{50}$ **b)** 2400 km
14. a) Ray **b)** $\frac{1}{24}$ of a pizza **c)** $1\frac{1}{8}$ of a pizza

15. a) $1\frac{5}{8}, 2\frac{1}{4}, 2\frac{7}{8}$ **b)** $-\frac{1}{24}, \frac{1}{48}, -\frac{1}{96}$
16. a) \$108.80 **b)** \$44.80
17. a) Example: $-\frac{2}{3}$ is a repeating decimal, so she would need to round before adding. **b)** Example: Find a common denominator, change each fraction to an equivalent form with a common denominator, and then add the numerators.
18. 9.5 m
19. a) $\frac{-5}{4}$ **b)** $1\frac{1}{10}$ **c)** $\frac{8}{13}$ **d)** $-1\frac{1}{2}$
20.

$-\frac{1}{2}$	$-2\frac{1}{6}$	$\frac{1}{6}$
$-\frac{1}{6}$	$-\frac{5}{6}$	$-1\frac{1}{2}$
$-1\frac{5}{6}$	$\frac{1}{2}$	$-1\frac{1}{6}$

21. a) $\frac{4}{15}$ **b)** $\frac{9}{20}$ **c)** $-2\frac{1}{4}$
22. a) 1 large scoop + 1 medium scoop − 1 small scoop or 2 large scoops − 1 medium scoop **b)** 1 large scoop − 2 small scoops or 2 medium scoops − 3 small scoops
23. Example: $-2\frac{1}{6} - \blacksquare = -\frac{4}{3}$. Find the rational number to replace $\blacksquare$. The answer is $\frac{-5}{6}$.
24. Yes. Example: If the two rational numbers are both negative, the sum would be less.
Example: $\frac{-1}{4} + \frac{-5}{6} = \frac{-13}{12}$
25. Example: **a)** $\left[-\frac{1}{2} + \left(-\frac{1}{2}\right)\right] + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = -1$
b) $\left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = 0$
c) $\left[\left(-\frac{1}{2}\right) \times \left(-\frac{1}{2}\right)\right] + \left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\right] = \frac{1}{4}$
d) $\left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) = 4$
e) $\left[-\frac{1}{2} + \left(-\frac{1}{2}\right)\right] + \left[\left(-\frac{1}{2}\right) \times \left(-\frac{1}{2}\right)\right] = -\frac{3}{4}$
f) $\left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) \div \left(-\frac{1}{2}\right) - \left(-\frac{1}{2}\right) = -1\frac{1}{2}$
26. $\frac{-3}{8}$
27. $-\frac{1}{2}$ and 2

History Link, page 71

1. Example: **a)** $\frac{1}{5} + \frac{1}{10}$ **b)** $\frac{1}{2} + \frac{1}{7}$ **c)** $\frac{1}{4} + \frac{1}{5}$ **d)** $\frac{1}{2} + \frac{1}{9}$
2. Example: A strategy is to work with factors of the denominator.
3. Example: **a)** $\frac{1}{28} + \frac{1}{4}$ **b)** $\frac{1}{18} + \frac{1}{6}$ **c)** $\frac{1}{66} + \frac{1}{6}$
4. Example: **a)** $\frac{1}{8} + \frac{1}{4} + \frac{1}{2}$ **b)** $\frac{1}{24} + \frac{1}{12} + \frac{1}{3}$
c) $\frac{1}{12} + \frac{1}{6} + \frac{1}{2}$

2.4 Determining Square Roots of Rational Numbers, pages 78–81

5. Example: 12
6. Example: 0.55
7. a) 9, 9.61 **b)** 144, 156.25 **c)** 0.36, 0.3844
d) 0.09, 0.0841
8. a) 16 cm², 18.49 cm² **b)** 0.0016 km², 0.001 225 km²
9. a) Yes, 1 and 16 are perfect squares. **b)** No, 5 is not a perfect square. **c)** Yes, 36 and 100 are perfect squares.
d) No, 10 is not a perfect square.
10. a) No **b)** Yes **c)** No **d)** Yes
11. a) 18 **b)** 1.7 **c)** 0.15 **d)** 45
12. a) 13 m **b)** 0.4 mm
13. a) 6, 6.2 **b)** 2, 2.12 **c)** 0.9, 0.933 **d)** 0.15, 0.148
14. a) 0.92 m **b)** 7.75 cm
15. 1.3 m
16. a) 3.16 m **b)** 6.16 m **c)** 4.2 L
17. a) \$3504 **b)** The cost will not be the same.
c) The cost of fencing two squares each having an area of 60 m² is \$4960.
18. No. Example: Each side of the picture is 22.36 cm. This is too large for the frame that is 30 cm by 20 cm.
19. 2.9 cm
20. 3.8 m
21. 27.4 m
22. 14.1 cm
23. 12.5 cm; Assume the 384 square tiles are all the same size.
24. a) 7.2 km **b)** 4.6 km **c)** 252.4 km
25. 35.3 cm
26. 12.2 m
27. 4.1 cm
28. a) 2.53 s **b)** 3.16 s **c)** 1.41 s
29. 30 m/s greater
30. 12.3 s
31. a) 59.8 cm² **b)** 34.7 cm²
32. 36 cm
33. 25.1 cm²
34. 3.6 m
35. 1.8 cm by 5.4 cm
36. 4

Chapter 2 Review, pages 82–83

1. OPPOSITES
2. RATIONAL NUMBER
3. PERFECT SQUARE
4. NON-PERFECT SQUARE
5. $\frac{3}{24}, \frac{-10}{-6}, \frac{-6}{4}, \frac{82}{-12}$
6. a) = **b)** < **c)** > **d)** = **e)** > **f)** >

7. a) Example: Axel wrote each fraction in an equivalent form so both fractions had a common denominator of 4. He then compared the numerators to find that $-6 < -5$, so $-1\frac{1}{2} < -1\frac{1}{4}$. **b)** Example: Bree wrote $-1\frac{1}{2}$ as -1.5 and $-1\frac{1}{4}$ as -1.25. She compared the decimal portions to find that $-1.5 < -1.25$. **c)** Example: Caitlin compared $-\frac{2}{4}$ and $-\frac{1}{4}$ and found that $-\frac{2}{4} < -\frac{1}{4}$. **d)** Example: Caitlin's method is preferred because it involves fewer computations.

8. Example: $-\frac{5}{6}$ and $\frac{5}{-7}$

9. a) -0.95 **b)** 1.49 **c)** -8.1 **d)** 1.3

10. a) -0.6 **b)** 8.1 **c)** -6.5 **d)** 5.3

11. 1.6 °C/h

12. \$1.3 million profit

13. a) $-\frac{2}{15}$ **b)** $-1\frac{1}{8}$ **c)** $-1\frac{9}{10}$ **d)** $4\frac{7}{12}$

14. a) $\frac{4}{9}$ **b)** $-\frac{20}{21}$ **c)** $-12\frac{5}{6}$ **d)** $1\frac{17}{22}$

15. The quotients are the same. Example: The quotient of two rational numbers with the same sign is positive.

16. 420 h

17. $\frac{9}{10}$

18. a) Yes, both 64 and 121 are perfect squares.
b) No, 7 is not a perfect square.
c) Yes, 49 and 100 are perfect squares.
d) No, 10 is not a perfect square.

19. Example: The estimate is 14.8.
220 is between the perfect square numbers 196 and 225. The square roots of 196 and 225 are 14 and 15. Since 220 is closer to 225, the value in the tenths place should be close to 8 or 9.

20. 0.0225

21. a) 3.6 **b)** 0.224

22. a) Example: When the number is greater than 1. The square root of 49 is 7.
b) Example: When the number is smaller than 1. The square root of 0.16 is 0.4.

23. a) 1.5 cm; Example: One method is to find the square root of 225, and divide by 10. A second method is to divide 225 by 100, then find the square root of the quotient. **b)** 21.2 cm

24. a) 2.5 cans **b)** 6.6 m by 6.6 m

25. 15.7 s

Chapter 3

3.1 Using Exponents to Describe Numbers, pages 97–98

4. a) $7^2 = 49$ **b)** $3^3 = 27$ **c)** $8^5 = 32\ 768$
d) $10^7 = 10\ 000\ 000$

5. a) 1^4; 1 is the base and 4 is the exponent
b) 2^5; 2 is the base and 5 is the exponent
c) 9^7; 9 is the base and 7 is the exponent
d) 13^1; 13 is the base and 1 is the exponent

6. a) 25 **b)** 27 **c)** 1024

7. a) 512 **b)** 64 **c)** 1

8.

Repeated Multiplication	Exponential Form	Value
a) $6 \times 6 \times 6$	6^3	216
b) $3 \times 3 \times 3 \times 3$	3^4	81
c) 7×7	7^2	49
d) 11×11	11^2	121
e) $5 \times 5 \times 5$	5^3	125

9. No, because $4^3 = 64$ and $3^4 = 81$

10. a) 81 **b)** -125 **c)** -128

11. a) -64 **b)** -1 **c)** 2187

12.

Repeated Multiplication	Exponential Form	Value
a) $(-3) \times (-3) \times (-3)$	$(-3)^3$	-27
b) $(-4) \times (-4)$	$(-4)^2$	16
c) $(-1) \times (-1) \times (-1)$	$(-1)^3$	-1
d) $(-7) \times (-7)$	$(-7)^2$	49
e) $(-10) \times (-10) \times (-10)$	$(-10)^3$	-1000

13. No, because $(-6)^4 = 1296$ and $-6^4 = -1296$

14. $3 \times 3 \times 3 = 3^3$

15. a)

Month	Body Length (cm)
Beginning	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1024

b) $2^5 = 32$ cm **c)** After 6 months.

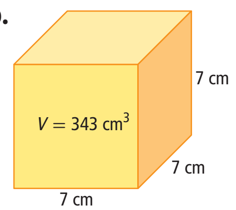
16. 1^{22}, 2^5, 7^2, 4^3, 3^4

17. $2^{15} = 32\ 768$

18. a) 3^2 **b)** $(-3)^2$

19. Example: Multiplication is repeated addition. For example, $3 \times 5 = 3 + 3 + 3 + 3 + 3$
$= 15$
Powers are a way to represent repeated multiplication. For example, $3^5 = 3 \times 3 \times 3 \times 3 \times 3$
$= 243$

20.



21. Example: 12×12, $2 \times 6 \times 2 \times 6$, $2 \times 2 \times 3 \times 2 \times 2 \times 3$

22.

Exponential Form	Value
5^3	125
5^4	625
5^5	3 125
5^6	15 625
5^7	78 125
5^8	390 625
5^9	1 953 125
5^{10}	9 765 625

a) An even exponent has 625 as its last three digits. An odd exponent has 125 as its last three digits. **b)** 625

23.

Exponential Form	Value
3^1	3
3^2	9
3^3	27
3^4	81
3^5	243
3^6	729
3^7	2 187
3^8	6 561
3^9	19 683
3^{10}	59 049
3^{11}	177 147
3^{12}	531 441

a) Example: The units digit follows a pattern of 3, 9, 7, 1 **b)** Example: I predict that the units digit will be a 7. The cycle is of length 4. So, with an exponent of 63, the cycle would go through 15 times, with a remainder of 3. That means that the units digit would be the third number in the cycle, which is a 7.

3.2 Exponent Laws, pages 106–107

5. a) $4^7 = 16\ 384$ **b)** $7^6 = 117\ 649$ **c)** $(-3)^7 = -2187$
6. a) $5^5 = 3125$ **b)** $(-6)^6 = 46\ 656$ **c)** $8^3 = 512$
7. a) $4^3 \times 4^4 = 4^7$ **b)** $2^5 \times 2^2 = 2^7$ **c)** $9^4 \times 9^7 = 9^{11}$
8. $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^9$
9. a) $5^2 = 25$ **b)** $3^4 = 81$ **c)** $(-4)^4 = 256$
10. a) $7^3 = 343$ **b)** $(-8)^2 = 64$ **c)** $(-2)^1 = -2$
11. a) $\frac{6^4}{6^3} = 6^1$ **b)** $\frac{3^8}{3^2} = 3^6$ **c)** $\frac{5^7}{5^1} = 5^6$
12. $\frac{(-5)^7}{(-5)^2}$
13. $\frac{(6^2)^3}{6^3} = 6^3$
14. a) $3^8 = 6561$ **b)** $7^4 \times (-3)^4 = 194\ 481$
c) $\frac{5^4}{6^4} = \frac{625}{1296}$
15. a) $-4^6 = -4096$ **b)** $3^4 \times 4^4 = 20\ 736$ **c)** $\frac{4^3}{5^3} = \frac{64}{125}$
16. $[(2)^2]^4$
17.

Expression	Repeated Multiplication	Powers
a) $[2 \times (-5)]^3$	$2 \times (-5) \times 2 \times (-5) \times 2 \times (-5)$	$2^3 \times (-5)^3$
b) $(9 \times 8)^2$	$9 \times 8 \times 9 \times 8$	$9^2 \times 8^2$
c) $\left(\frac{2}{3}\right)^4$	$\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$	$\frac{2^4}{3^4}$

18. a) 1; Example: $2^4 = 16$
$2^3 = 8$
$2^2 = 4$
$2^1 = 2$
$2^0 = 1$

b) $\frac{2^4}{2^4} = \frac{16}{16} = 1$ and $\frac{2^4}{2^4} = 2^{4-4} = 2^0$

Therefore, $2^0 = 1$.

19. a) $-4^0 = -1$ because $4^0 = 1$, so $-(1) = -1$ **b)** -1
20. a) $\frac{20^2}{50^2}$ **b)** $\left(\frac{2}{5}\right)^2$
21. a) 3^{11} **b)** $(-4)^3$
22. Example: Jenny multiplied the exponents in step 2. She should have added the exponents.
23. Example: $4^1 \times 4^4$, $4^2 \times 4^3$, $4^0 \times 4^5$
24. Example: Place 3 in the numerator and 5 in the denominator.
25. Example: **a)** $81^3 = 27^4$ **b)** $81^6 = 27^8$
26. a) 121 **b)** 33

3.3 Order of Operations, pages 111–113

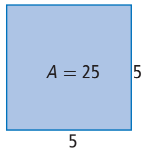
5. a) 128 **b)** 63 **c)** -1250 **d)** -12
6. a) $4 \times 2^4 = 64$ **b)** $3 \times (-2)^3 = -24$
c) $7 \times 10^5 = 700\ 000$ **d)** $-1 \times 9^4 = -6561$
7. Example: **a)** $4 \times 3^2 = 36$ **b)** $-5 \times 4^3 = -320$
8. a) 18 **b)** 70 **c)** 535 **d)** 73
9. a) -11 **b)** 58 **c)** 1 **d)** 44
10. a) $3(2)^3 = 24$, and $2(3)^2 = 18$, so $3(2)^3$ is greater by 6. **b)** $(3 \times 4)^2 = 144$, and $3^2 \times 4^2 = 144$, so the expressions are equal. **c)** $6^3 + 6^3 = 432$, and $(6 + 6)^3 = 1728$, so $(6 + 6)^3$ is greater by 1296.
11. In step 3, Justine should have multiplied 4 by 9. The correct answer is -27.
12. In step 1, Katarina should have squared 4 correctly to obtain 16. The correct answer is 76.
13. $9^3 - 7^3 = 386$ cm^3
14. a) 49 **b)** 2401 **c)** $7^1 + 7^2 + 7^3 + 7^4 = 2800$
15. $6^2 - 5^2 = 11$ cm^2
16. $10^2 - 8^2 = 36$ cm^2
17. 1 953 125
18. a) Question 2: \$12 500, question 3: \$50 000, question 4: \$200 000
b) 6 questions **c)** The 8th question.
d) $3125(4^0) + 3125(4^1) + 3125(4^2) + 3125(4^3) = 265\ 625$
19. a) 48 **b)** 3×2^4 **c)** Example: It represents the number of coaches who made the first six calls.
d) It represents the round number of the calls.
e) $3 \times 2^6 = 192$ **f)** $5 \times 2^3 = 40$
20. $2^{2^{22}}$

3.4 Using Exponents to Solve Problems, pages 118–119

3. 216 cm^3
4. Area of square: $14^2 = 196$ cm^2; Surface area of cube: $6(6)^2 = 216$ cm^2. The surface area of the cube is larger.
5. a) 60 **b)** 14 580 **c)** $20(3^n)$
6. a) 400 **b)** 1600 **c)** 819 200
7. a) Example: If an assumption that she needs 100 cm^2 of overlap is made, she would need 12 796 cm^2 of paper.
8. 9×10^{13} joules
9. a) It represents the number of questions.
b) It represents the possible answers for each question.
c) TTTT, TTTF, TTFT, TFTT, TTFF, TFTF, TFFT, FFFF, FFFT, FFTF, FTFF, FFTT, FTFT, FTTF, FTTT
d) $2^{10} = 1024$
10. $60^3 = 216\ 000$
11. a) 37.5 m **b)** 180 m
c) Example:
C 0.75 × 60 × (2000 ÷ 1000) x^2 = 180.
12. a) The term “googol” was created by nine year old Milton Sirotta, the nephew of the American mathematician Edward Kasner who was investigating very large numbers at the time. The Latin word for “a lot” is “googis”. Google™ possibly used that name to suggest the enormous amount of information their search engine could be used to investigate. **b)** 100 zeros. **c)** The time to write a googol as a whole number is the time it would take to write a 1 followed by 100 zeros, a total of 101 digits. If two digits could be written per second, it would take 101 ÷ 2 or about 51 s.
13. a) Same base, different exponent: $3^7 \div 3^5 = 3^{7-5} = 3^2 = 9$
Rule: Divide the larger power by the smaller power and evaluate. This will indicate how many times as large the larger power is compared to the smaller power.
Different base, same exponent: $6^4 \div 5^4 = \left(\frac{6}{5}\right)^4 = \frac{1296}{625}$
Rule: Divide the larger power by the smaller power, express as a single power with a fractional base, then evaluate. This will indicate how many times as large the larger power is compared to the smaller power.
b) $32^4 = (2^5)^4 = 2^{20}$ $64^3 = (2^6)^3 = 2^{18}$ $2^{20} \div 2^{18} = 2^2 = 4$
So 32^4 is four times as large as 64^3.

Chapter 3 Review, pages 120–121

1. coefficient
2. exponential form
3. base
4. power
5. exponent
6. a) 2^3 **b)** $(-3)^4$
7. a) $4 \times 4 \times 4 \times 4 \times 4 \times 4$ **b)** $6 \times 6 \times 6 \times 6$
c) $(-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5)$
d) $-(5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5)$
8. Area = 25 square units

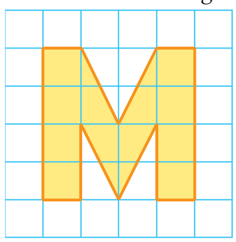


9. $4 \times 4 \times 4 = 4^3 = 64$
$V = 64$ cm^3
10. -3^4, 9, 2^5, 7^2, 4^3
11. a) $3 \times 3 \times 5 \times 5 \times 5 \times 5$
b) $(-3) \times (-3) \times (-3) \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
12. a) $2^3 \times 2^2 = 2^5$ **b)** $\frac{4^2 \times 4^4}{4^3} = 4^3$
13. a) $(-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) \times (-5) = (-5)^7$ **b)** $3^2 \times 3^2 \times 3^2 \times 3^2 = 3^8$
14. a) $6^3 \times 4^3$ **b)** $7^5 \times (-2)^5$
15. a) $\frac{4^2}{5^2}$ **b)** $\frac{2^4}{7^4}$
16. a) -16 **b)** 1 **c)** 243
17. Example: **a)** $(-2)^2 + (-2)^3 = -4$
b) $(2^3)^2 - 4 \times 6^0 = 60$
c) $(-3)^4 - (-3)^3 + (2 \times 4)^2 = 172$
18. a) 47 **b)** 9 **c)** 1 **d)** $1\frac{16}{25}$
19. In step 2, the error is that Ang added 81 + 7 when he should have multiplied 7 and 8.
20. 150 m^2
21. a) 80 **b)** 640
22. a) 4.9 m **b)** 19.6 m **c)** 176.4 m

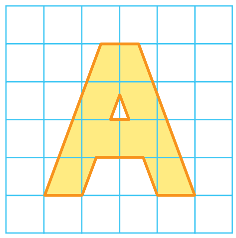
Chapter 4 Scale Factors and Similarity

4.1 Enlargements and Reductions, pages 136–138

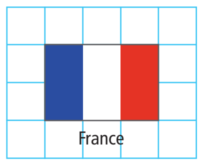
4. a) Use a 1-cm grid instead of a 0.5 cm grid.



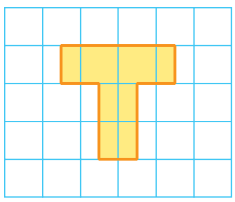
b) Use a 1-cm grid instead of a 0.5 cm grid.



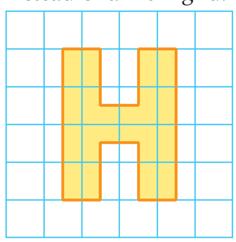
5. Use a 2-cm grid instead of a 0.5 cm grid.



6. a) Use a 0.5-cm grid instead of a 1 cm grid.

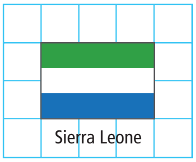


b) Use a 0.5-cm grid instead of a 1 cm grid.



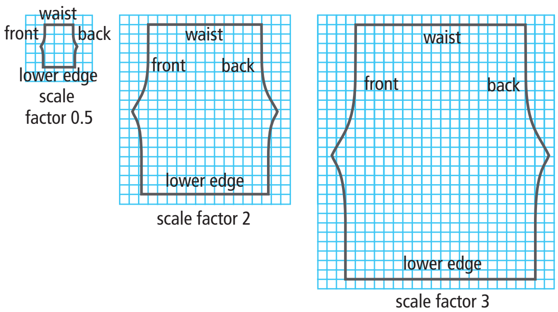
7. a) greater than 1 **b)** equal to 1 **c)** less than 1

8.

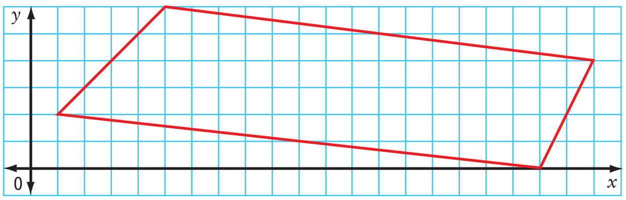


9. a) enlargement **b)** 100. The lens makes all dimensions of the original image appear to be enlarged by 100 times.
10. Examine the font used in both posters. Mia's font is 0.5 cm high, and Hassan's is 0.25 cm high. Mia's font is twice the height of Hassan's, so the scale factor is 2.
11. Example: Measure the width of the sunglasses in both images. Determine the scale factor. Then, see if the scale factor applies to another pair of corresponding parts (e.g. the width of the mouth).
12. a) width = 27 cm, length = 54 cm
b) width = 4.5 cm, length = 9 cm

13.

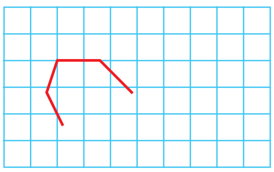


14.

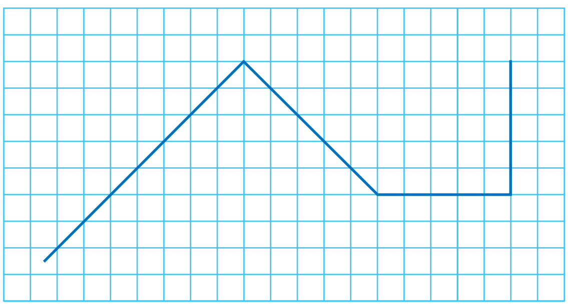


15. Example: You could reduce the image with a scale factor of $\frac{1}{4}$. Then, width = 10.5 cm, height = 7.5 cm, depth = 2.5 cm

17. a)

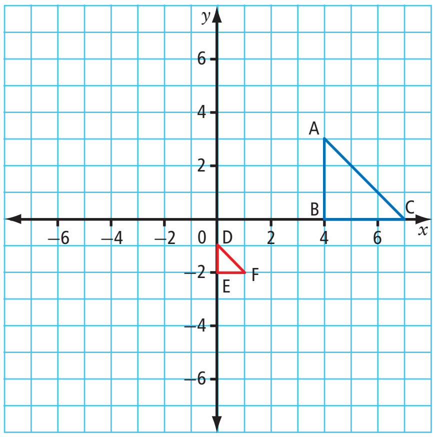


b)



4.2 Scale Diagrams, pages 143–145

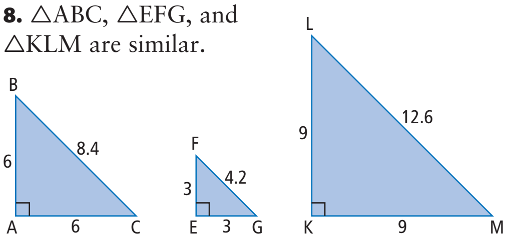
4. a) Divide 144 by 3. **b)** Divide 117 by 5.2.
5. a) 13 **b)** 126
6. a) 1210 cm or 12.1 m **b)** 16 mm
7. a) 38.9 m **b)** 14 m
8. a) 0.15 **b)** 1.68
9. a) 0.02 **b)** 0.5
10. 0.02
11. 0.04
12. $\frac{1}{16\ 000\ 000}$
13. a) 6.3 cm **b)** Yes, an actual egg could have a length of approximately 6.3 cm.
14. a) $\frac{1}{15}$ **b)** The length of the footprint image is approximately 3.4 cm. With the scale factor of $\frac{1}{15}$, the actual length of the footprint is approximately 51 cm. **c)** Example: The span of a human hand to the footprint could be approximately 1:2.1. The footprint is approximately 2 times as large as a human hand span.
15. 50 000
16. Yes, it will fit. The model will measure 2.5 m in height, giving it a 0.5 m clearance.
17. length = 17.4 m, height = 4.35 m
18. a) 2 **b)** 3 **c)** 1.5 **d)** $\frac{1}{3}$ **e)** $\frac{2}{3}$
19. a) $\frac{1}{1800}$ **b)** 2700 cm or 27 m
20. a)



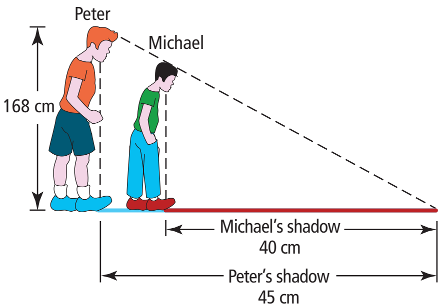
b) Yes, the sides of the larger triangle are 3 times the length of the sides of the smaller triangle. **c)** $\frac{1}{3}$ **d)** 3
e) Area of $\triangle$ABC is 4.5 square units; area of $\triangle$DEF is 0.5 square units. **f)** 1:0.1; 1:9 **g)** The scale factor of the area is 3 times larger than the scale factor of the sides (when comparing $\triangle$DEF : $\triangle$ABC)
21. a) 2.6 m **b)** 5.2 m
22. a) 2.5, $\frac{2}{5}$ **b)** Example: Scale factors between a smaller object and a larger one are often easier to use.

4.3 Similar Triangles, pages 150–153

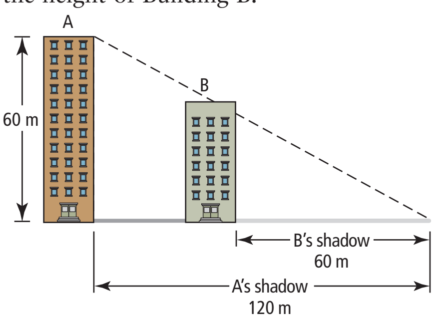
4. Corresponding angles: ∠P and ∠T, ∠Q and ∠U, ∠R and ∠V.
Corresponding sides: PQ and TU, PR and TV, QR and UV.
5. Corresponding angles: ∠A and ∠Y, ∠B and ∠W, ∠C and ∠X.
Corresponding sides: AB and YW, BC and WX, AC and YX.
6. Yes, the triangles are similar because the sides are the proportional; the sides are related by a scale factor of 5.
7. No, the triangles are not similar because the sides are not proportional.
8. △ABC, △EFG, and △KLM are similar.



9. $x = 56$
10. $x = 10$
12. 2.0 m
13. 4.0 m
14. 7.68 m
15. $x = 76.25$ cm
16. Peter is taller. Michael is 149.3 cm tall.



17. Example: Two buildings, A and B, stand side by side. Building A casts a shadow of 120 m and is 60 m tall. Building B has a shadow of 60 m. Using the diagram, find the height of Building B.

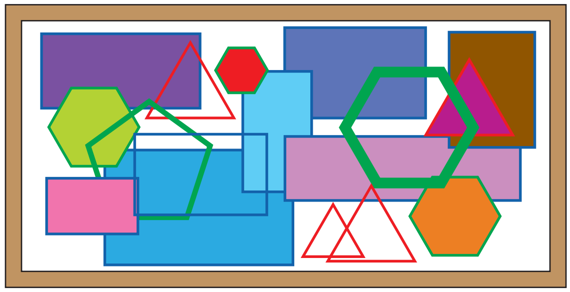


$$\frac{60}{120} = \frac{x}{60}$$
Building B is 30 m tall.

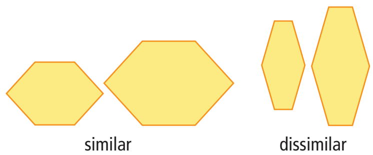
18. a) $x = 420.48$ m **b)** The shadow may not reach the street level due to surrounding buildings.
19. a) No, the corresponding angles are not equal. The angle measures of one triangle are: 50°, 60°, and 70°. The angle measures of the other triangle are: 50°, 50°, and 80°. **b)** Yes, the triangles are similar because they both have angle measures of 45°, 60°, and 75°.
20. a) 13.3 cm and 16.0 cm **b)** 1:2.67
21. First, measure your height, and the length of the building's shadow. After measuring your own shadow, find the ratio of your shadow to the building's shadow. Then, divide your height by that value to find the height of the building.
22. $ZY = 4.9$ cm
23. The area is 150 cm^2.

4.4 Similar Polygons, pages 157–159

3. a) Similar **b)** Not similar
4.

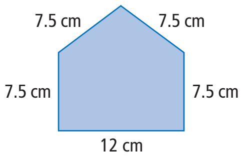


5. $x = 4$
6. $x = 2.8$ m
7. No. The corresponding angles must be the same.
8. a)



b) The two similar hexagons are similar to the photo because the interior angles are the same and the side lengths are related by a scale factor. The two dissimilar hexagons do not have these properties.
9. The side length of the game board will be 15.0 cm.
10. a) 7.5 m **b)** 1080°. Example: An octagon can be divided into six non-overlapping triangles.
11. a) The final enlargement should be 6 times the size of the original diagram. **b)** The corresponding angles are equal, and the dimensions are all enlarged by the same proportion.
12. 39.3 cm
13. 14.1 cm

14. a) $\frac{1}{20}$ **b)**



c) $\text{length}_{\text{model}} = 15$ cm, $\text{width}_{\text{model}} = 12$ cm

15. 19 250 L

16. The ratio of areas to the ratio of corresponding side lengths in similar polygons is equal to the scale factor comparing side lengths squared.

17. The volume ratio is the same as the side ratio cubed.

18. a) The similar polygons have 7 sides, so they are heptagons. **b)** Example: Each heptagon is a reduction of the centre heptagon, with the scale factor decreasing with distance from the centre.

Chapter 4 Review, pages 160–161

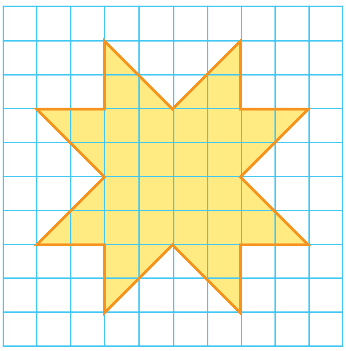
1. POLYGON

2. SIMILAR

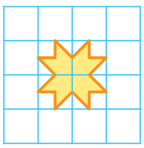
3. SCALE FACTOR

4. PROPORTION

5. a)



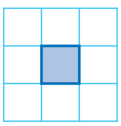
b)



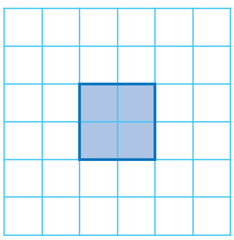
6. The vertical height of the drawing is 3 cm. The enlarged egg will have a vertical height of 9 cm.

7. The vertical height of the drawing is 3 cm. The reduced drawing will have a vertical height of 1.5 cm.

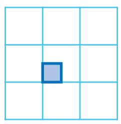
8. a)



b)



c)



9. $\frac{2}{13}$

10. a) 14 cm **b)** 13.9 cm

11. 8.7 cm

12. $\frac{1}{10\,000\,000}$

13. No. The corresponding sides are not proportional.

14. $x = 10$

15. $x = 3$

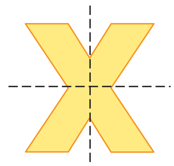
16. No. They are not similar.

17. 10.1 cm

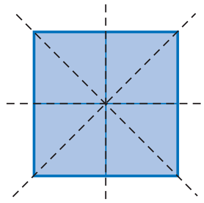
18. $x = 7.2$; $y = 9.6$

Chapters 1–4 Review, pages 166–168

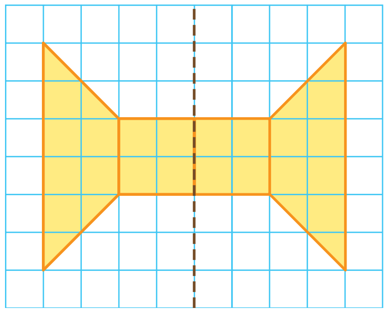
1. a)



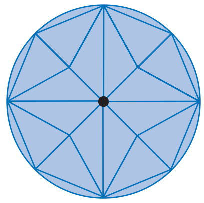
b)



2. Example: The shape could be traced and cut out, then flipped over the dashed line and traced as the reflected image or each point could be reflected over the dashed line and connected to create the shape.



3.



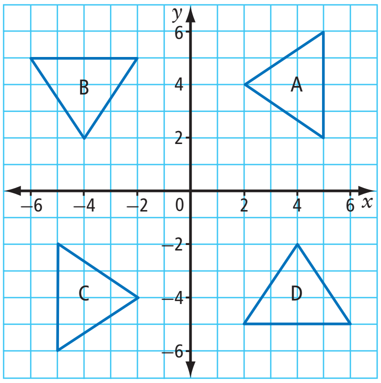
a) Example: There are four lines of symmetry, 1 vertical, 1 horizontal and 2 oblique. **b)** Example: 4

c) 90°, $\frac{1}{4}$ revolution

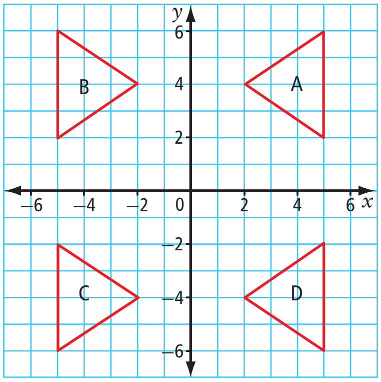
4. a) Example: Diameter of circular cake and side length of square cake are 25 cm. Height of both cakes is 10 cm. Square: 1625 cm^2, circle: 1276.5 cm^2

b) Example: Square: 2625 cm^2, an increase of 61.5%. Circle: 2276.3, an increase of 78.3%.

5. a)



b)



6. a) 11 250 cm^2 **b)** 10 000 cm^2, a decrease in surface area of 1250 cm^2

7. $-2\frac{3}{4}$, -0.9, $-\frac{4}{5}$, $-\frac{2}{3}$, $0.\overline{6}$, 2.7

8. $-6\frac{7}{20}$

9. a) -1, -0.68 **b)** 4, 3.6 **c)** 4, 4.6 **d)** -1, -1.07
e) -2, -2.03 **f)** -20, -22.26 **g)** 4, 3.41 **h)** 1, 1

10. a) 2, $2\frac{1}{5}$ **b)** $-1\frac{1}{3}$, $-1\frac{1}{15}$ **c)** $-\frac{25}{12}$, $-\frac{19}{12}$
d) $-\frac{1}{3}$, $-\frac{7}{24}$ **e)** $-\frac{3}{70}$, $-\frac{3}{70}$ **f)** $\frac{5}{6}$, $\frac{5}{6}$ **g)** -2, $-1\frac{17}{18}$
h) 6, $6\frac{1}{4}$

11. a) 2 cm, 1.6 cm **b)** 0.1 km, 0.1 km
c) 0.2 mm, 0.22 mm **d)** 1 km, 1.01 km

12. 6.8 m

13. 4^{17}

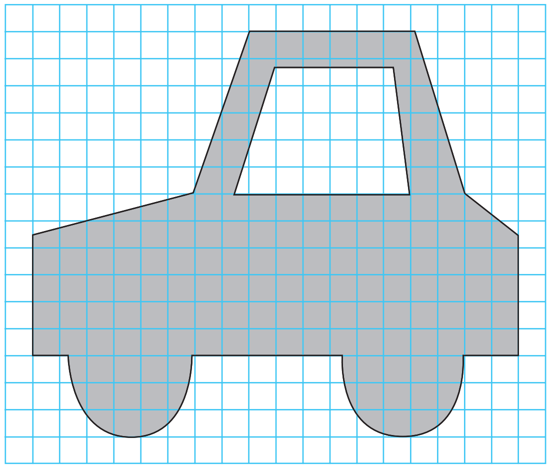
14. 3

15. $(-4)^9$, $-262\ 144$

16. $21 \times 21 \times 21 \times 21$, $3^4 \times 7^4$

17. a) 1600 **b)** 25 600

18.



19. a) 12 **b)** 18.5 **c)** 0.414

20. $x = 1$

21. 647 km; assuming the distance on the diagram measures 4.2 cm

22. Rectangles B and D and rectangles A and F are similar.

23. a) hexagons, triangles, heptagons **b)** The hexagons are similar, the triangles are similar, and the heptagons are similar. Example: Each triangle shares two edges with hexagons and one edge with a heptagon. The similar shapes decrease in size with distance from the centre.

Chapter 5

5.1 The Language of Mathematics, pages 179–182

5. a) 3, trinomial **b)** 1, monomial **c)** 4, polynomial
d) 1, monomial

6. a) 1, monomial **b)** 3, trinomial **c)** 1, monomial
d) 2, binomial

7. a) $6x$ and -15 **b)** $7 + a + b$ **c)** $3x - y$ and $4c^2 - cd$

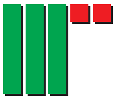
8. a) degree 1, 2 terms **b)** degree 2, 2 terms
c) degree 2, 3 terms

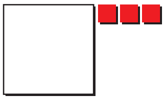
9. a) degree 2, 2 terms **b)** degree 2, 3 terms
c) degree 0, 1 term

10. a) $2 + p$ and $2x^2 - y^2$
b) $3b^2$, $4st + t - 1$, and $2x^2 - y^2$
c) b **d)** $2 + p$ and $4st + t - 1$

11. a) $2x - 3$ **b)** $x^2 - 2x + 1$ **c)** $-x^2 + 3x - 2$

12. a) $2x^2 + 4$ **b)** $-x^2 - 2x - 4$ **c)** 4

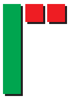
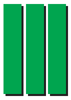
13. a)  **b)**  **c)** 

14. a) 

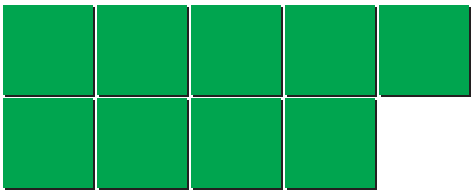
b) 

c) 

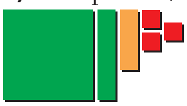
15. a) Example: $x + 2$ **b)** Example: $3x$

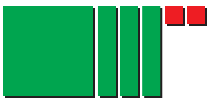
c) Example: $9x^2$



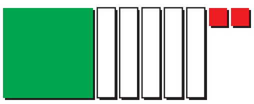
d) Example: $x^2 + x + y + 3$



16. a) Example: Both tiles share a common dimension of 1 unit. **b)** $x + 3$
17. a) $6x$ **b)** $2x + 3$ **c)** $x^2 + 4x$
18. Example: The expression $x^2 + 3x + 2$ is a trinomial of degree 2.



19. a) 2 **b)** 6 **c)** 1 **d)** 2 **e)** -5
20. a) $3x^2 - 2x + 1$
b) Example: $d^2 - 5d + 2$



21. a) $8 + x$, x represents the unknown number
b) $x + 5$, x represents the amount of money **c)** $w + 4$, w represents the width of the page **d)** $5x + 2$, x represents the unknown number **e)** $3n - 21$, n represents the number of people
22. a) Example: The Riggers scored 5 more than triple the number of goals scored by the Raiders. **b)** Example: The number of coins remaining from a purse containing 10 coins after an unknown number of coins were removed
23. a) a represents the number of adults and c represents the number of children
b) $215
c) $23a + 17c$
24. $10a + 5s$, where a represents the number of adults and s represents the number of students.
25. a) $2w + s$ **b)** w represents the number of wins and s represents the number of shoot-out losses **c)** 4
d) 28 **e)** Two possible records for Team B are: 8 wins, 12 shoot-out losses, and 0 losses in regulation time ($2 \times 8 + 12 = 28$); 10 wins, 8 shoot-out losses, and 2 losses in regulation time ($2 \times 10 + 8 = 28$).
26. a) binomial of degree 1 **b)** Example: 5 could be the charge per person, 75 could be the cost of renting the room. **c)** $825
27. a) Example: $2c - w$, where c represents the number of correct answers and w represents the number of wrong answers. **b)** All 25 questions correct would result in a maximum score of 50 points. All 25 questions wrong would result in a minimum score of -25.

c)

Number Correct	Number Wrong	Number Unanswered	Score
20	5	0	35
20	4	1	36
20	3	2	37
20	2	3	38
20	1	4	39
20	0	5	40

28. 2
29. a) $6x + 6$ **b)** $x + 3 = 2x$ **c)** $x + 3 = 2x$, subtract x from both sides, $3 = x$
30. Example: $xz + 4y + 3$
31. a) Example: $d = st$, where d represents distance, s represent speed, and t represents time.

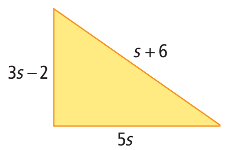
b)

Part of Race	Distance (km)	Speed (km/h)	Time (h)
swim	d_1	1.3	$\frac{d_1}{1.3}$
cycle	d_2	28.0	$\frac{d_2}{28}$
run	d_3	12.0	$\frac{d_3}{12}$

c) $\frac{d_1}{1.3} + \frac{d_2}{28} + \frac{d_3}{12}$ **d)** 3.416 h, assuming that Deidra races at her average pace **e)** 12.868 h

5.2 Equivalent Expressions, pages 187–189

5. a) coefficient: -3; number of variables: 1
b) coefficient: 1; number of variables: 1
c) coefficient: 0; number of variables: 0
6. a) coefficient: 4; number of variables: 1
b) coefficient: -1; number of variables: 3
c) coefficient: -8; number of variables: 2
7. a) x^2 and xt **b)** $-ts$ and xt **c)** $3x$ and $4t$ **d)** $-ts$
8. a) $2a$ and $-7.1a$ **b)** $3m$ and $\frac{4}{3}m$
c) -1.9 and 5; $6p^2$ and p^2
9. a) $-2k$ and $104k$ **b)** $\frac{1}{2}ab$ and ab
c) -5 and 5; $13d^2$ and d^2
10. a) $-4x^2 + 4x$ **b)** $-3n - 1$ **c)** $-q^2 - q$ **d)** $c - 4$
e) $5h^2 - h$ **f)** $-j^2 + 5j - 6$
11. a) $-2d^2 - 3d$ **b)** $-y^2 + 3y$ **c)** $p^2 + p - 2$
d) $4m + 2$ **e)** $3q^2 - 4q$ **f)** $-3w^2 + 3w - 4$
12. B, C, and E
13. Example: Yes. 2 m and 1 m are expressed in the same unit of measurement, so they can be considered like terms. Their sum is 3 m. 32 cm and 63 cm are expressed in the same unit of measurement, so they can be considered like terms. Their sum is 95 cm.
14. a) Example: The amount of liquid in a can is reduced by 3 mL. **b)** Example: The number of coloured markers is 5 more than twice the number of pens.
15. a) Example: $p^2 + p^2 - 6p + 3p + 5 - 3$
b) Example: $10x^2 - 13x^2 + x + 4x - 10 + 6$
c) $r^2 + r^2 + 2r^2 - 7q^2 + 5q^2 - 3qr$
16. a) $10d + 3$ **b)** $4w + 18$
17. a)



b) $9s + 4$
18. a) $5n - 700$, where n represents the number of students **b)** \$550 **c)** Example: estimate: 150; actual: 141
19. a) $60n + 54$ **b)** \$174
c) $60n + 54 + \frac{60n + 54}{2}$; $90n + 81$
20. a) $3000 + 16b$ **b)** \$12 600 **c)** \$21 **d)** \$19
21. a) Raj combined $3x - 5x$ incorrectly; it should be $-2x$. He also combined $-8 + 9$ incorrectly; it should be 1.
b) $-2x + 1$
22. a) $x + 3x + 7 + 2x - 5$ **b)** $6x + 2$
23. When $y = w$. Example: Assign a value to x, such as $x = 10$. Substitute this value into the two expressions. The first expression becomes $y + 13$. The second expression becomes $w + 13$. If the two expression are equal, then $y = w$.

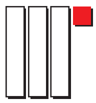
24. a)

Wholesale Price (\$)	Expression for Retail Price	Retail Price (\$)
8.00	$8 + (0.4)(8)$	11.20
12.00	$12 + (0.4)(12)$	16.80
30.00	$30 + (0.4)(30)$	42.00
x	$x + 0.4x$	$1.4x$

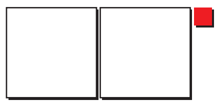
b) Example: $x + 10 + (0.4)(x + 10) = x + 10 + 0.4x + 4$
$= 1.4x + 14$
Or multiply 1.4 by x, which yields $1.4x$, and multiply 1.4 by 10, which yields 14.
25. a) Zip: $100 + 2p$, where p represents the number of posters; Henry: $150 + p$, where p represents the number of posters **b)** Zip: \$350; Henry: \$275
c) Total cost is \$850. Add Zip's price to Henry's price: \$500 + \$350 = \$850. Or add like terms: $100 + 2p + 150 + p = 250 + 3p$, and then substitute $p = 200$. Simplify to \$850.

5.3 Adding and Subtracting Polynomials, pages 196–199

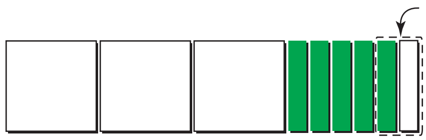
5. C
6. a) $5x - 7$ **b)** $-5a^2 - a + 2$ **c)** $10p$ **d)** $2y^2 + 6y - 6$
7. a) $3x + 4$ **b)** $-n + 3$ **c)** $b^2 - 1$ **d)** $a^2 - a - 1$
8. a) $-3x + 1$ **b)** $x^2 - 2x - 3$



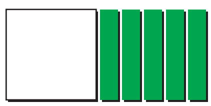
9. a) $x - 1$ **b)** $-2x^2 + 1$



10. a) $9x$ **b)** $-5d - 6$ **c)** $2x^2 - 3x + 5$
11. a) $-3x + 7$ **b)** $-4g^2 + 4g - 2.5$ **c)** $-v^2 - 8v + 1$
12. B
13.

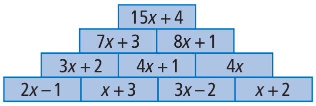


Remove $-2x^2 - x$.



14. a) $-3x - 2$ **b)** $-5b^2 - 9b$ **c)** $-3w + 7$
d) $-m^2 + m$
15. a) $13c - 3$ **b)** $-4r^2 - 3r - 6$ **c)** $2y^2 - 7y$
d) $8j^2 - 4j + 8$
16. a) the perimeter **b)** $6x$ **c)** 30; Example: The expression in part b) was used because it involved fewer steps.

17.



18. a) $399d + 160$; d represents the number of days the backhoe is rented. **b)** $550d + 160$ **c)** $949d + 160$ **d)** $151d$

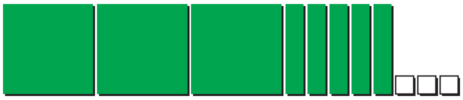
19. a) $-x + 5 + 3x + 1$ **b)** A: $(-x + 5) - (4x - 3) = -5x + 8$; B: $(3x + 1) - (4x - 3) = -x + 4$

20. a) $17n + 2150$ **b)** \$12 350 **c)** The expression represents the difference in the cost of printing and the cost of shipping; $13n + 1850$

21. The second line should be $4p^2 - p + 3 - p^2 - 3p + 2$, and the result of $(-p - 3p)$ is not $-3p$, so the answer should be $3p^2 - 4p + 5$.

22. a) $10x - 12$ **b)** $2a^2 - a - 4$ **c)** $5t^2 - 6t + 9$ **d)** $-2.3x + 0.4$

23. a) $3x^2 + 5x - 3$



b) $x^2 - 5x - 3$

24. $4x^2 + 2x$

25. a) Example: Assume you also pay \$0.12 for punctuation. For St. Mary's High School, $C = (25)(0.12)(31) + (25)(0.12)(19)$

b) Example: For St. Mary's High School, $C = (25)(0.12)(31) + (25)(0.12)(19) + (25)(17.95)$

c) Example: $C = (25)(17.95) + (25)(0.12)(n)$, where n represents the number of letters.

d) $(3n + 448.75) + (3n + 448.75) = 6n + 897.5$

26. a) \$37 **b)** \$35 **c)** $7l + 5s + 38$, assuming at least one large print and at least one small print.

27. $w + 23 + w + 8 + w + 23 + w + 8 = 4w + 62$

28. a) $(-n^2 + 3600n) - (-3n^2 + 8600) = 2n^2 + 3600n - 8600$ **b)** profit; Example: Replacing n with 20 in the expression $2n^2 + 3600n - 8600$ yields a positive answer of \$64 200.

29. $1004x$

30. $8w + 142$

Chapter 5 Review, pages 200–201

1. D
2. E
3. D
4. A
5. C
6. B

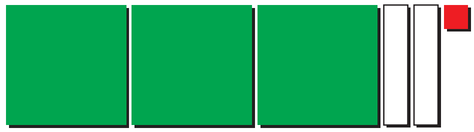
7. a) 4 terms, polynomial **b)** 2 terms, binomial **c)** 1 term, monomial **d)** 3 terms, trinomial

8. a) This is a degree 2 polynomial because the term with the highest degree $(6x^2)$ has a degree of 2.
b) This is a degree 2 polynomial because the term with the highest degree (ab) has a degree of 2.
c) This is a degree 1 polynomial because the term with the highest degree (y) has a degree of 1.

9. a) Example: $3y - 11$ **b)** Example: $a + 2b - 7c$ **c)** $m^2 - 4$ **d)** 18

10. a)

b)



11. a) $x^2 - 3x + 2$ **b)** $-2x^2 + x$ **c)** $-3x + 2$

12. a) x represents the number of video games sold and y represents the number of books sold. **b)** \$104 **c)** $7.25d + 5c$, where d represents the number of DVDs and c represents the number of CDs

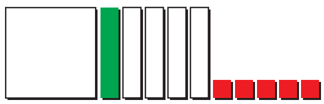
13. One term has the variable x; the other does not have the variable x. So, the two terms cannot be like terms.

14. a) coefficient: 8, variables: x and y, exponent: 2
b) coefficient: −1, variable: c, exponent: 2
c) There are no coefficients or variables because this term is a constant.

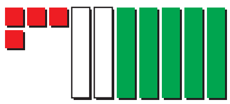
15. a) $3s$ and $-8s$ **b)** $-2x^2$ and x^2, $3xy$ and $3xy$

16. Example: Like terms must be identical except for the coefficients. Four sets of examples that contain at least three like terms are:
a) $16z, x, 2z, -z, y$ **b)** $-ab, a, 4b, 6ab, -2ba$
c) $m, m^2, -m, m^3, 6m$ **d)** $xy, 4yx, -11yx, 10s^2, -4yx$

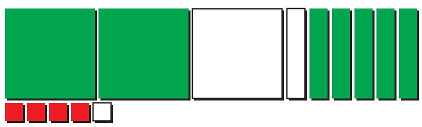
17. $-x^2 - 3x + 5$



18. a) $4 + 3x$

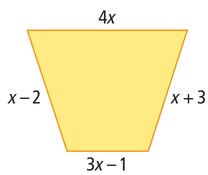


b) $x^2 + 4x + 3$



19. a) $13a + 4$ **b)** $-2b^2 + 3b$ **c)** $7c + 2$

20. Perimeter $= 9x$



21. a) $20 + 1.50n$, where n represents the number of hours renting the locker **b)** $20 + 3n$, where n represents the number of hours renting the tube **c)** $40 + 4.5n$

22. a) $5x - 4$, $3x - 2$ **b)** Example: The processes are similar in that the like terms were combined. The processes are different in that one involved addition and the other involved subtraction.
23. Yes. Example: The opposite term of $2x^2$ is $-2x^2$ and the opposite term for $-3x$ is $3x$.
24. a) 3 **b)** $-7 + a$ **c)** $-x^2 + 2x - 4$
25. a) Example: Group together the like terms: $(3p - p) + (4q - 5q) + (-9 + 2) = 2p - q - 7$. Another method is to change the order of the terms and line up the polynomials vertically.

$$\begin{array}{r} 3p + 4q - 9 \\ \underline{-p - 5q + 2} \\ 2p - q - 7 \end{array}$$

b) Example: The first method is preferred because the terms are grouped horizontally.
26. a) $3p + 2$ **b)** $4a^2 - 7a - 7$
27.

		$-4t-2$			
	$-t-4$		$3t-2$		
$t-1$		$2t+3$		$-t+5$	

28. a) $140 + 12n$, where n represents the number of people attending **b)** Example: Another class decides to spend more on food and refreshments for their party and less on printing, decorations, and awards. Their cost for food is \$15/person and \$100 for the other items. The sum of the costs for both classes is $(140 + 12n) + (100 + 15n) = 240 + 27n$. The difference of the costs is $(140 + 12n) - (100 + 15n) = 40 - 3n$.

Chapter 6

6.1 Representing Patterns, pages 217–219

4. a) Example: Every time an octagon is added the number of sides increases by 6.
b)

Number of Octagons, n	Number of Sides, s
1	8
2	14
3	20
4	26

c) $s = 6n + 2$; s represents number of sides, n represents number of octagons **d)** 104 **e)** 120
5. a)

Figure Number, n	Number of Circles, c
1	5
2	8
3	11

b) Example: Three circles are added for each subsequent figure. **c)** $c = 3n + 2$; c represents number of circles, n represents figure number **d)** 53 **e)** 36
6. a)

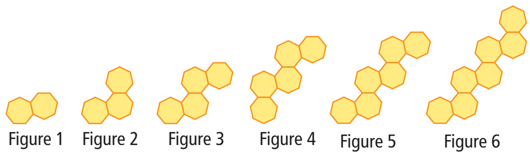
Figure Number, n	Number of Green Tiles, t
1	8
2	12
3	16

b) Example: Four green tiles are added for each subsequent figure. **c)** $t = 4n + 4$; t represents number of green tiles, n represents figure number **d)** 100 **e)** 43

7. a)

Term, t	Value, v
1	7
2	16
3	25
4	34
5	43

b) $v = 9t - 2$ **c)** 1105 **d)** 40
8. a) Each subsequent term has one additional heptagon.



b)

Figure Number, n	Perimeter, P (cm)
1	12
2	17
3	22
4	27
5	32
6	37

c) $P = 5n + 7$; P represents perimeter in centimetres, n represents figure number **d)** 67 cm **e)** 22
9. a)

Term, t	Value, v
1	-5
2	-8
3	-11
4	-14
5	-17

b) $v = -3t - 2$ **c)** -149 **d)** 39
10. a) $y = 3x + 13$ **b)** $p = 7r + 17$ **c)** $t = 2.7k - 4$ **d)** $w = -3.5f + 3$
11. a) $s = 4t + 2$, s represents number of seats, t represents number of tables **b)** 22 **c)** Example: Substitute $t = 5$ into the equation and solve for s. **d)** 7
12. a)

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

b) $C = 15n + 125$; C represents cost, n represents number of T-shirts. The numerical coefficient is the cost for each additional T-shirt. **c)** \$5795 **d)** 148
13. a) $t = 2s - 4$; t represents number of tiles, s represents size of frame **b)** 56 **c)** 100 cm by 100 cm

14. a)

Sighting Number, n	Year, y
1	1758
2	1834
3	1910
4	1986
5	2062
6	2138
7	2214

b) 2062 **c)** $y = 76n + 1682$; y represents year, n represents sighting number **d)** No. By substituting $y = 2370$ into the equation and solving for n, a decimal answer results. Therefore, the comet will not appear in 2370.

15. a) 127 **b)** Substitute $y = 45\ 678$ into the equation $y = 3x + 1$, and solve for x. If x is a whole number, then 45 678 is 1 more than a multiple of 3.

16. a) $l = 4.5(n - 1)$; l represents length of row, n represents number of trees **b)** 46 trees will not be evenly spaced because the number of trees has a decimal in the answer.

17. a)

Number of Rebounds, n	Rebound Heights, h (m)
0	2
1	$1\frac{1}{3} \approx 1.33$
2	$\frac{8}{9} \approx 0.89$
3	$\frac{16}{27} \approx 0.59$
4	$\frac{32}{81} \approx 0.39$
5	$\frac{64}{243} \approx 0.26$

b) 0.39 m **c)** No, this relation is not linear. The rebound heights do not decrease at a constant rate with each bounce.

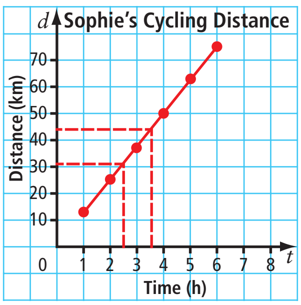
6.2 Interpreting Graphs, pages 226–230

4. a) 14 km, interpolation **b)** 7 h

5. a) 14 **b)** 1.5

6. a) −3.5 **b)** −2.5

7. a)



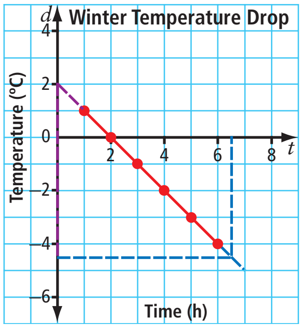
b) 31 km **c)** 3.5 h

8. a) 29 m **b)** 10.2 min

9. a) approximately 15.5 **b)** approximately 2.6

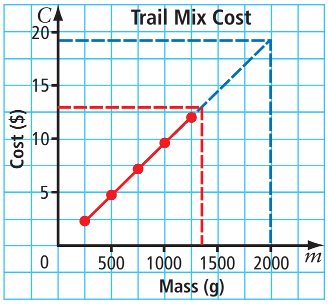
10. a) 2 **b)** 4

11. a)



b) −4.5 °C **c)** 12 noon

12. a)



b) $19 **c)** 1400 g

13. a) It is reasonable to interpolate and extrapolate the graph. The submarine can be underwater for a fraction of a minute, and the graph shows a linear relationship. **b)** 3.5 min **c)** 160 m

14. a) Yes, the graph is linear, and it is reasonable to determine the income from the number of programs as long as the number of programs is a whole number. **b)** $250, interpolation **c)** 5000

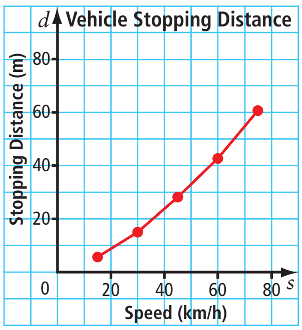
15. a) 1 h **b)** 1.8 h **c)** 3.2 h

16. a) Yes, the graph is linear, and it is reasonable to determine the cost from the number of minutes used. **b)** $55 **c)** 45 min

17. a) The cost for renting four days is $280. The cost per day is $70. Divide the cost for four days by the number of days. **b)** 6 days

18. a) 5.3 s **b)** 143 m **c)** The skydiver is accelerating at a constant rate.

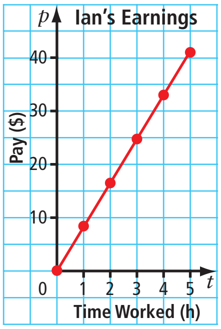
19. a)



b) As the speed increases the stopping distance also increases. **c)** Example: 2 m, 36 m, 80 m **d)** Example: 20 km/h, 65 km/h, 85 km/h **e)** Example: 17 m, 26 m **f)** The graph is not a straight line because the rate of deceleration of the car is different for different speeds of the car.

6.3 Graphing Linear Relations, pages 239–243

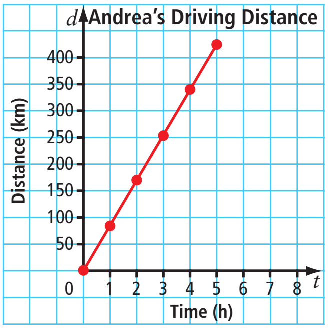
4. a)



b) The graph represents the equation because his pay increases at a rate of $8.25 for each hour worked. The rate at which his pay increases is the coefficient in the equation.

c) $66; substitute $t = 8$ into the equation and solve for p, or use the graph to estimate his pay using extrapolation.

5. a)

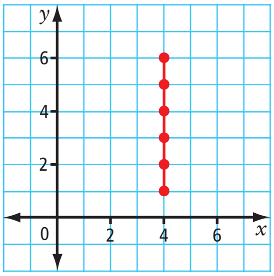


b) 3.5 h

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

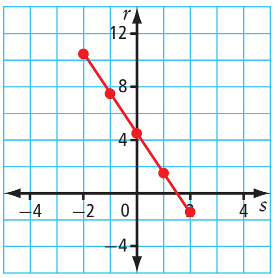
7. a)

x	y
4	0
4	1
4	2
4	3
4	4



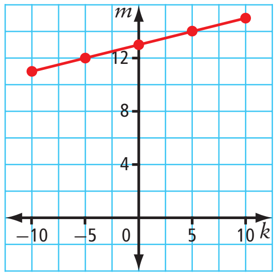
b)

s	r
−2	10.5
−1	7.5
0	4.5
1	1.5
2	−1.5



c)

k	m
−10	11
−5	12
0	13
5	14
10	15



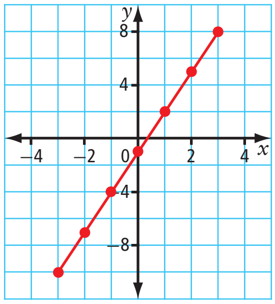
8. a) $C = 1.75m$ **b)** approximately 2.9 kg **c)** Yes, because the values exist beyond and between the points. However, a cost or mass value less than zero does not exist.

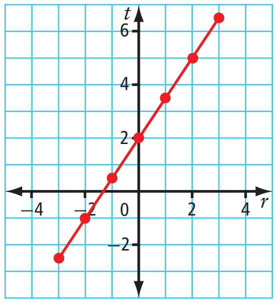
9. a) $h = 6t$ **b)** 30 cm **c)** Yes, because the values exist beyond and between the points. However, a height or time value less than zero does not exist.

10. a) $y = -4x$ **b)** $y = 2.5x + 2$

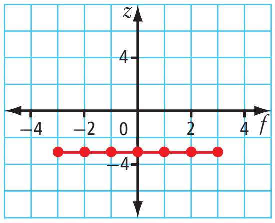
11. a) $y = 0.5x - 1$ **b)** $x = 4$

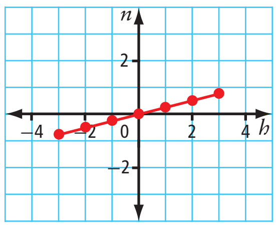
12. a) $y = 3x - 1$ **b)** $t = 1.5r + 2$





c) $z = -3$ **d)** $n = 0.25h$

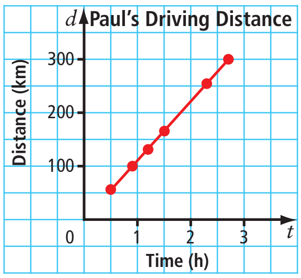




13. a) 1350 m **b)** 11 min **c)** $A = 90t$ **d)** 90 m/min

14. a) $t = 20$ min **b)** T = 50 °C **c)** 5 °C/min

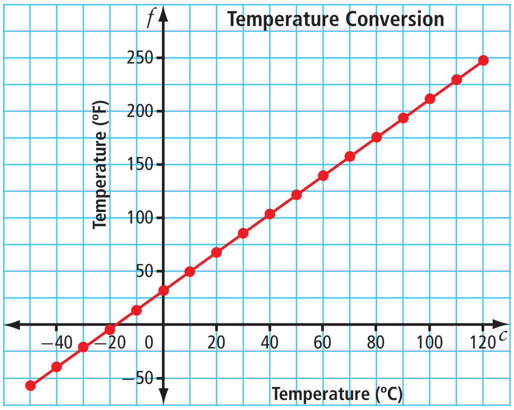
15. a)



b) 220 km **c)** 1.8 h **d)** $d = 110t$ **e)** 110 km/h

16. a)

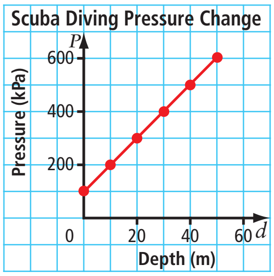
Temperature (°C)	Temperature (°F)
−50	−58
−40	−40
−30	−22
−20	−4
−10	14
0	32
10	50
20	68
30	86
40	104
50	122
60	140
70	158
80	176
90	194
100	212
110	230
120	248



b) 212 °F **c)** This is the point where the graph intersects the y-axis. **d)** −40°

17. a)

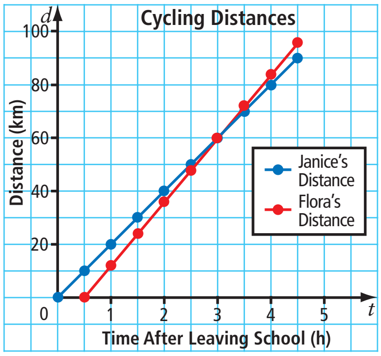
Depth, d (m)	Pressure, P (kPa)
0	102.4
10	203.7
20	305.0
30	406.3
40	507.6
50	608.9



b) 250 kPa is the approximate pressure using interpolation **c)** 39.25 m **d)** 102.4 kPa is the air pressure at sea level ($d = 0$).

18. a) Girls' growth appears to be linear at greater than 24 months of age. **b)** Girls' growth appears to be non-linear prior to 24 months of age.

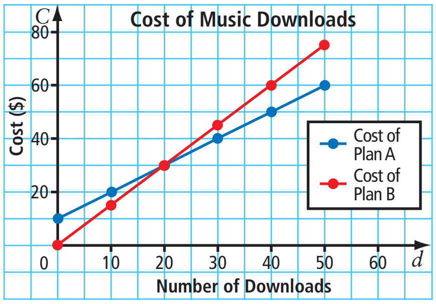
19. a)



Time, t (h)	Janice's Distance, j (km)	Flora's Distance, f (km)
0	0	n/a
0.5	10	0
1	20	12
1.5	30	24
2	40	36
2.5	50	48
3	60	60
3.5	70	72
4	80	84
4.5	90	96

b) This is where the two lines intersect. **c)** At 3:00 p.m. or after 3 h **d)** At 3:30 p.m. or after 3.5 h

20. a)



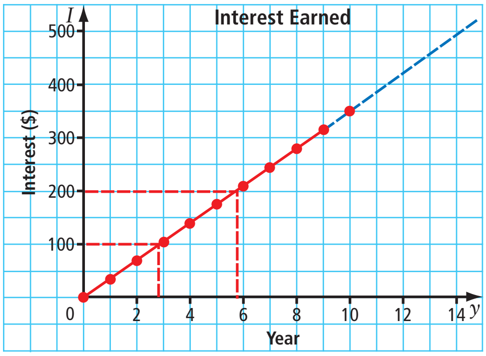
Number of Downloads, d	Cost of Plan A, A ($)	Cost of Plan B, B ($)
0	10	0
10	20	15
20	30	30
30	40	45
40	50	60
50	60	75

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

21. a)

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

b) \$350



c) 2.85 years, 5.7 years **d)** approximately 14 years

Chapter 6 Review, pages 244–245

1. linear relation
2. extrapolation
3. constant
4. linear equation
5. interpolate
6. a)

Figure Number, *n*	Number of Toothpicks, *T*
1	4
2	7
3	10
4	13
5	16
6	19

b) Three toothpicks or one square is added in each figure.
c) $T = 3n + 1$ **d)** 31 **e)** The numerical coefficient of n is 3. This is the number of additional toothpicks in each subsequent figure. The constant is 1 and this represents the difference between the number of toothpicks in figure 1 and the number of toothpicks added each time.

7. a)

Time, *t* (weeks)	Savings, *s* (\$)
0	56
1	71
2	86
3	101
4	116
5	131

b) $s = 15t + 56$ **c)** \$581 **d)** 29.6 or 30 weeks

8. a)

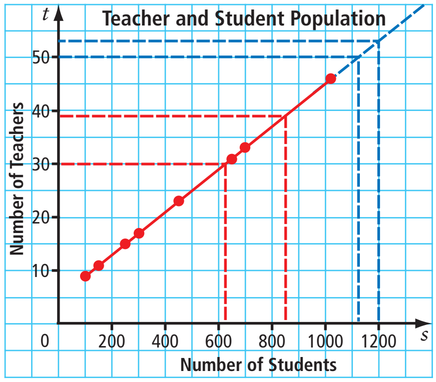
Pairs of Shoes Sold, *s*	Earnings, *E* (\$)
0	50
1	52
2	54
3	56
4	58
5	60
6	62
7	64
8	66
9	68
10	70

b) $E = 2s + 50$ **c)** \$74; You can extrapolate using a graph, or substitute and solve using the equation.

9. a) \$70 **b)** 2800 trees

10. a) 84 kPa, 70 kPa **b)** 825 m, 3000 m
c) Yes, because values of air pressure and altitude both exist beyond and between points on the graph.

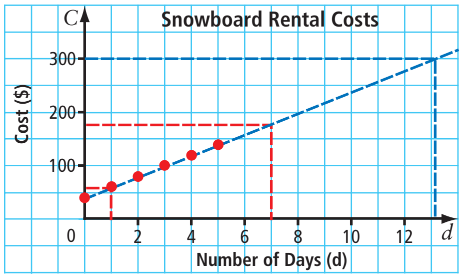
11. a)



b) 38 teachers, 54 teachers
c) 600 students, 1100 students

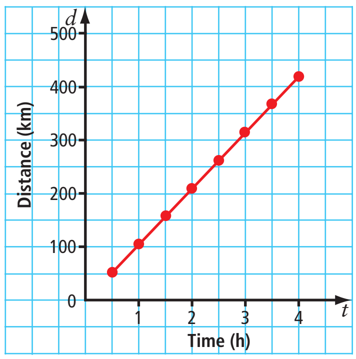
12. a)

Number of Days, *d*	Cost, *C* (\$)
0	40
1	60
2	80
3	100
4	120
5	140



b) \$60, \$180 **c)** A snowboard would become cheaper to buy after 13 days. **d)** Substitute the known value into the equation and solve for the unknown value.

13.

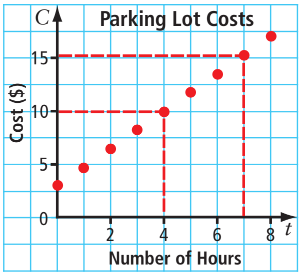


a) Example: You are driving from Toronto to Ottawa at a speed of 105 km/h. **b)** Example: $d = 105t$
c) The numerical coefficient in this equation is 105. This represents the speed at which the car is travelling per hour. The constant is zero.

14. a)

Number of Hours, t	Cost, C (\$)
0	3.00
1	4.75
2	6.50
3	8.25
4	10.00
5	11.75
6	13.50
7	15.25
8	17.00

b)

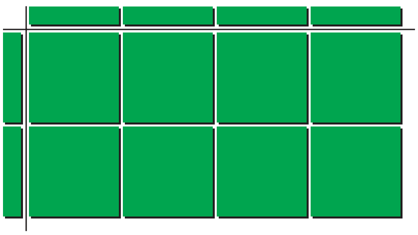


c) \$10.00 **d)** 7 h **e)** $C = 1.75t + 3$

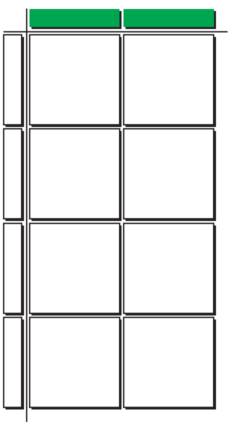
Chapter 7

7.1 Multiplying and Dividing Monomials, pages 260–263

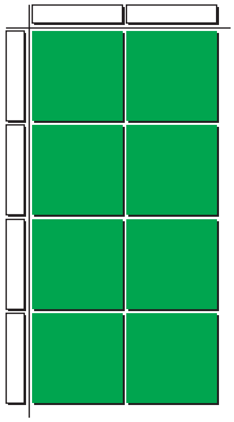
3. a) $(2x)(3x) = 6x^2$ **b)** $(-2x)(3x) = -6x^2$
c) $(-2x)(-3x) = 6x^2$
4. a) $(3x)(3x) = 9x^2$ **b)** $(-2x)(-2x) = 4x^2$
c) $(2y)(x) = 2xy$
5. a) $8x^2$



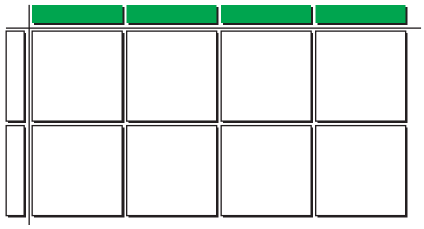
b) $-8x^2$



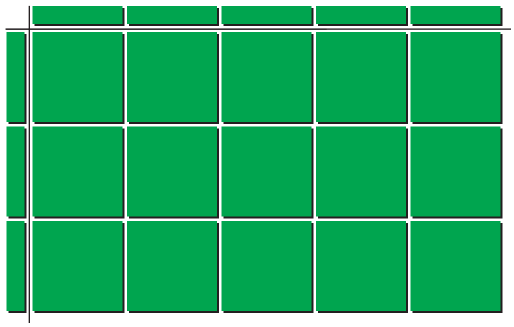
c) $8x^2$



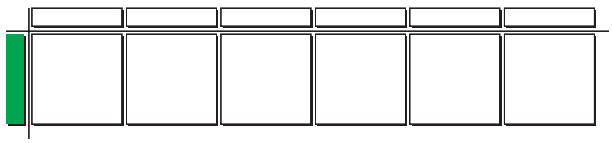
d) $-8x^2$



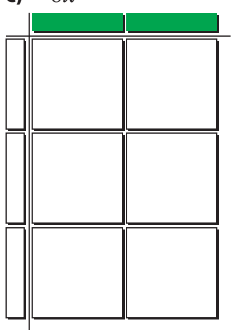
6. a) $15x^2$



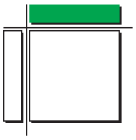
b) $-6x^2$



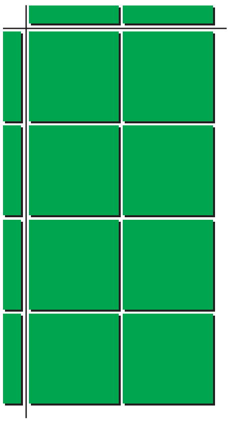
c) $-6x^2$



d) $-x^2$

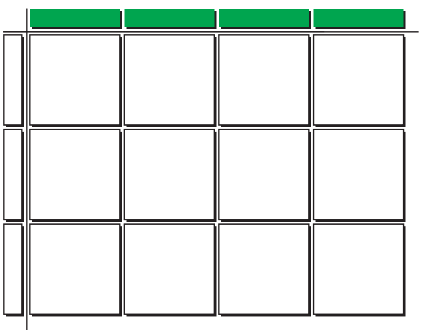


7. a) $10y^2$ **b)** $-18ab$ **c)** $9q^2$ **d)** $2x^2$ **e)** $6rt$ **f)** $-4.5p^2$
8. a) $6n^2$ **b)** $28k^2$ **c)** $-10w^2$ **d)** $-9x^2$ **e)** $-4mn$ **f)** $-7t^2$
9. $19.5x^2$
10. $34.02z^2$
11. a) $\frac{6x^2}{3x} = 2x$ **b)** $\frac{8xy}{2y} = 4x$ **c)** $\frac{-6x^2}{2x} = -3x$
12. a) $\frac{9x^2}{-3x} = -3x$ **b)** $\frac{-6x^2}{-2x} = 3x$ **c)** $\frac{15xy}{5y} = 3x$
13. a) $4x$

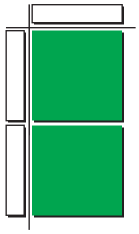


b) x

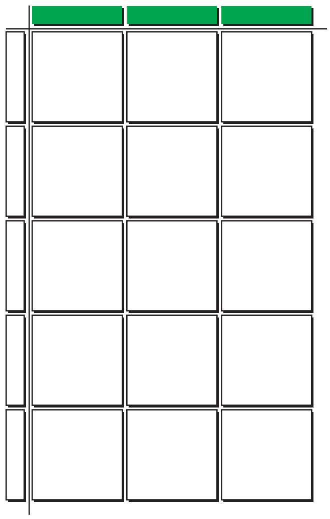
c) $-3x$



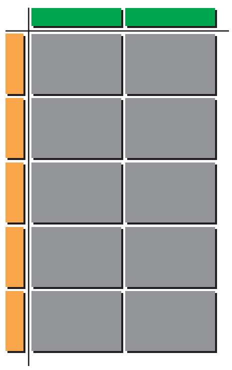
d) $-2x$



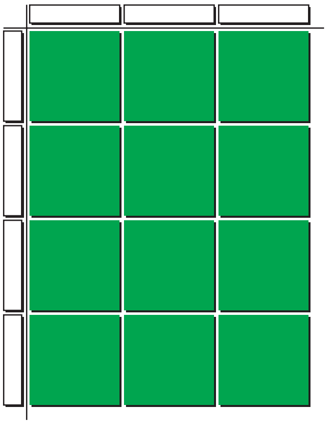
14. a) $-5x$



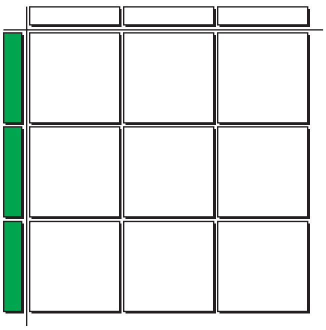
b) $5y$



c) $-4x$



d) $3x$



15. a) $7x$ **b)** $5t$ **c)** $25t$ **d)** 4 **e)** 27 **f)** $-1.5p$

16. a) $12.4x$ **b)** 3.75 **c)** 3 **d)** $-6p$ **e)** 0.25 **f)** $\frac{x}{3}$

17. a) $33x^2$ **b)** $20p^2$ **c)** $\frac{w^2}{4}$

18. a) $3x$ **b)** $6w$

19. a) $3.6d$

20. No, it will not fit. If x represents the width of Claire's space, then the length is $3x$ and the area is $x(3x) = 3x^2$. So $3x^2 = 48$, and by solving the equation, $x = 4$. The width of Claire's space is 4 m. The length is then 12 m, which is not long enough for a 12.5 m patio.

21. 4

22. a) $\frac{4}{\pi}$ **b)** $\frac{4}{\pi}$

23. If x represents the width of the dogsled, then the length is $4x$ and the area if $x(4x) = 4x^2$. So $4x^2 = 3.2$, and by solving the equation, $x \approx 0.89$. The width of the dogsled is about 0.89 m and the length is about 3.56 m. This is just barely long and wide enough for the equipment to fit.

24. a) 5 cm **b)** $SA = 24xy + 40x + 30y$

25. Example: They are similar because you have to divide 9 by 3 in each one. However, they differ because you get a fraction in the quotient for one, but not the other.

26. 1

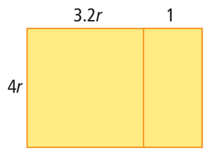
27. a) $1.25x^2$ **b)** 9031.25 cm^2

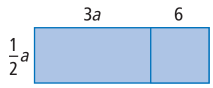
7.2 Multiplying Polynomials by Monomials, pages 269–271

4. a) $(3x)(2x + 4) = 6x^2 + 12x$
b) $(4k)(3k + 3.6) = 12k^2 + 14.4k$
c) $(k)(3.2k + 5.1) = 3.2k^2 + 5.1k$

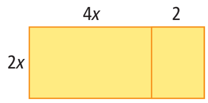
5. a) $(4y)(3y + 7) = 12y^2 + 28y$
b) $(3.5f)(f + 2) = 3.5f^2 + 7f$
c) $(2k)(7 + 0.9k) = 14k + 1.8k^2$

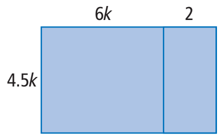
6. a) $12.8r^2 + 4r$ **b)** $\frac{3}{2}a^2 + 3a$





7. a) $8x^2 + 4x$ **b)** $27k^2 + 9k$

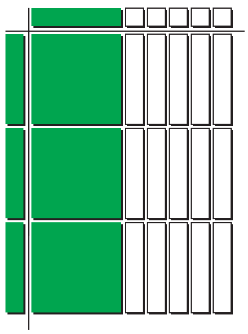




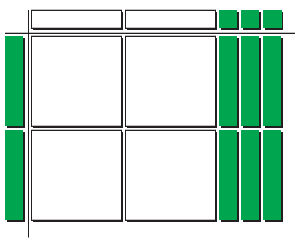
8. a) $(2x)(3x + 1) = 6x^2 + 2x$
b) $(-x)(-x - 3) = x^2 + 3x$
c) $(3x)(-x + 2) = -3x^2 + 6x$

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

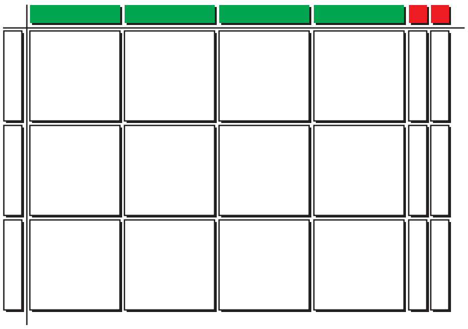
10. a) $3x^2 - 15x$



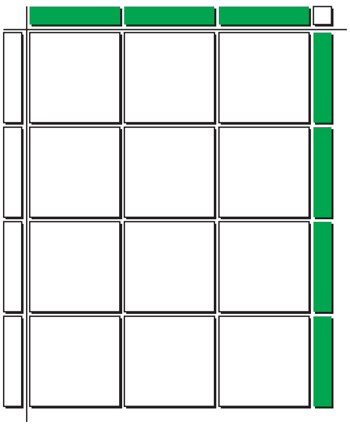
b) $-4x^2 + 6x$



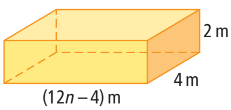
11. a) $-12x^2 - 6x$



b) $-12x^2 + 4x$



12. a) $6x^2 - 2x$ **b)** $6p^2 - 2.4p$ **c)** $3.5m - 6m^2$
d) $-0.5r^2 + 2r$ **e)** $16.4n - 57.4$ **f)** $3x^2 + 6xy + 12x$
13. a) $8j^2 - 12j$ **b)** $-3.6w^2 + 8.4w$ **c)** $24x - 14.4x^2$
d) $-\frac{3}{7}v - 7$ **e)** $3y - 9y^2$ **f)** $-64a^2 - 56ab - 16a$
14. a) $12x^2 - 9x$ **b)** $P = 3x + 3x + 4x - 3 + 4x - 3$
$P = 14x - 6$
15. a) $w^2 - 2w$ **b)** $8\ \text{m}^2$
16. a) $1.5w^2 + 5.5w$ **b)** $420\ \text{m}^2$
17. $16x^2 + 8x$
18. a) $9x^2 - 12x$ **b)** $1845\ \text{m}^2$
19. a) $16x^2 + 12x$ **b)** $4x^3 + 4x^2$
20. $SA = 226.19\ \text{cm}^2$
21. a)

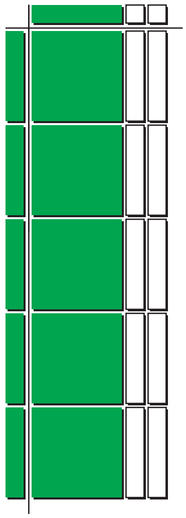


b) $(96n - 16)\ \text{m}^2$ **c)** $(96n - 32)\ \text{m}^3$

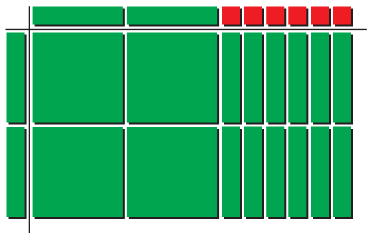
7.3 Dividing Polynomials by Monomials, pages 275–277

4. a) $\frac{(6x^2 + 4x)}{2x} = 3x + 2$ **b)** $\frac{4x^2 + 6x}{2x} = 2x + 3$
c) $\frac{(6x^2 - 3x)}{3x} = 2x - 1$

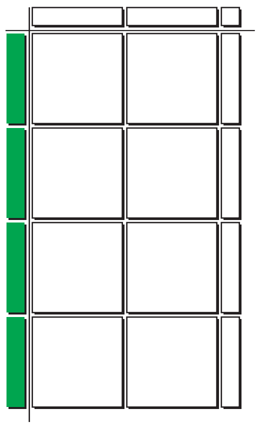
5. a) $\frac{-x^2 - 4x}{x} = -x - 4$ **b)** $\frac{8x^2 + 12x}{-4x} = -2x - 3$
c) $\frac{-3x^2 + 15x}{-3x} = x - 5$
6. a) $x - 2$



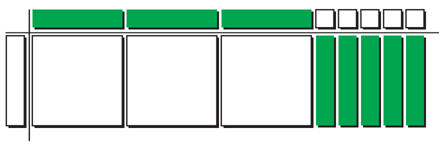
b) $2x + 6$



7. a) $-2x - 1$



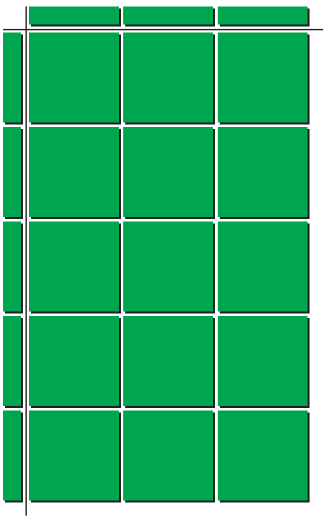
b) $3x - 5$



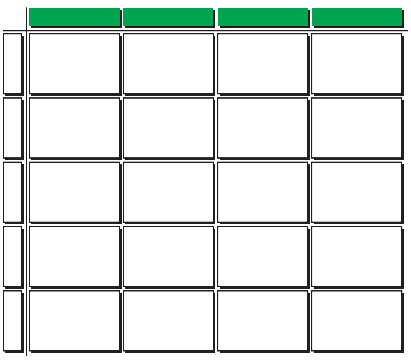
8. **a)** $y + 2.1$ **b)** $6m^2 - 3.1m + 12$ **c)** $3y + 1$ **d)** $v - 0.9$
9. **a)** $0.9c + 1.2$ **b)** $2x + 8y$ **c)** $-0.2s - 0.3t$
d) $-28w^2 - 14w + 1$
10. $2x^2 + 3x$
11. **a)** $A = 12.5w^2 - 5w$ **b)** $l = 12.5w - 5$
c) $l = 2.5$ m, $V = 0.9$ m^3
12. $9x + 4$
13. The length is $(3x - 1)$ units.
14. **a)** $s = 4.9t + v$ **b)** 24.5 m/s
15. **a)** $12f + 3.1$ **b)** $2b - a + 1$ **c)** $-24x^2 + 18x - 2$
16. $3x + 1.5$
17. $x + 6 : 15x$
18. $12x + 4xy + 6y$

Chapter 7 Review, pages 278–279

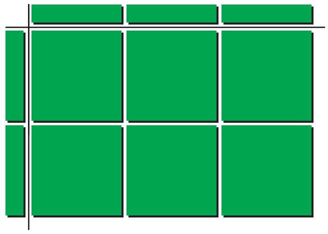
1. C
2. F
3. B
4. A
5. **a)** $15x^2$



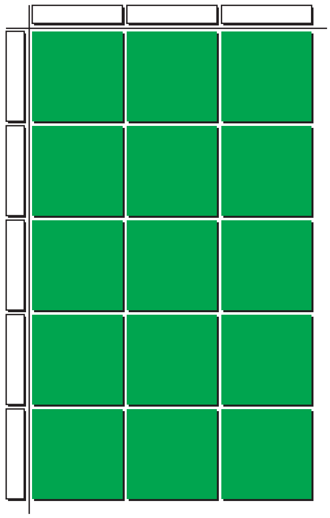
b) $-20xy$



6. **a)** $8.64xy$ **b)** $-6a^2$
7. **a)** $3x$



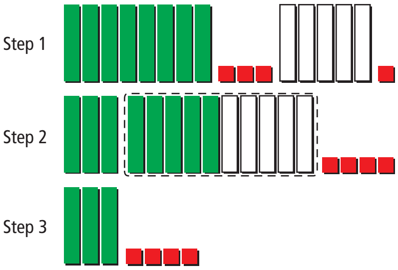
b) $-5a$



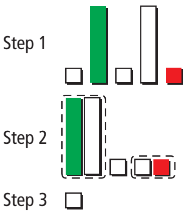
8. **a)** $4r$ **b)** y
9. 20 cm by 80 cm
10. $2 : \pi$
11. **a)** $(1.3y)(3y + 5) = 3.9y^2 + 6.5y$
b) $(1.2f)(f + 4) = 1.2f^2 + 4.8f$
12. **a)** $(3x)(2x + 4) = 6x^2 + 12x$
b) $(2x)(-3x - 1) = -6x^2 - 2x$
13. **a)** $46x^2 - 28x$ **b)** $\frac{2}{3}p^2 - \frac{1}{2}p$
14. $12x^2 + 6x$
15. **a)** $\frac{x^2 + 5x}{x} = x + 5$ **b)** $\frac{-4x^2 + 12x}{-2x} = 2x - 6$
16. **a)** $6n - 1$ **b)** $10 - 2x$
17. $2x + 4$
18. $x + \frac{1}{2}$
19. Naullaq will need 5 blocks of ice to fill the drinking tank. The answer must be rounded up because 4 blocks will not fill the tank and Naullaq is only cutting full blocks.

Chapters 5–7 Review, pages 284–286

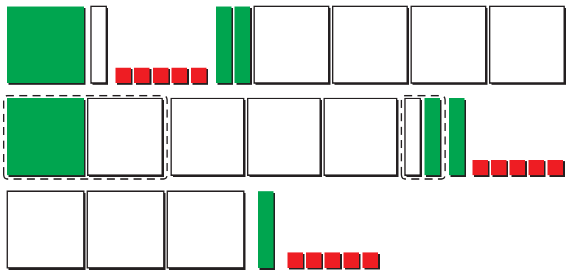
1. a) Perimeter $= 2(x + 1) + 2(x + 3)$
b) Area $= x^2 + 4x + 3$
2. a) $3c + 4$



b) $-x$



c) $3g^2 + g + 5$

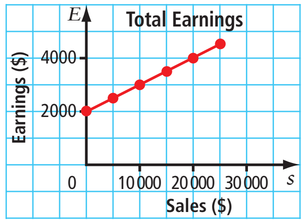


3. a) $7m - 2$ **b)** $4w^2 + w + 4$ **c)** $7y^2 - 9y - 2.5$
4. a) $-3z - 2$ **b)** $-d^2 - 6cd + 6d - 5$ **c)** $2(-x^2 + 2xy)$
5. a) Example: $I = 10c + 8h + 3p$, where I represents the shop's income, c represents the number of comic books sold, h represents the number of hardcover books sold and p represents the number of paperback books sold. **b)** \$221 **c)** Example: 70 comic books, 3 hardcover books, 2 paperback books or 3 comic books, 5 hardcover books, 10 paperback books.
6. $10(n + 4)$
7. a) Starting with 4 tiles, add 4 tiles for each new figure **b)** $t = 4n$, where t is the number of tiles and n is the figure number. **c)** 32

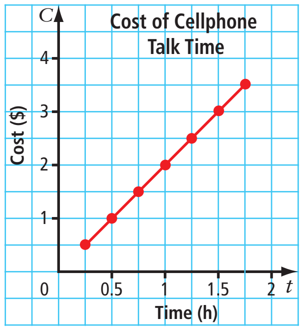
8. a)

Week	Savings (\$)
0	112
1	137
2	162
3	187
4	212
5	237

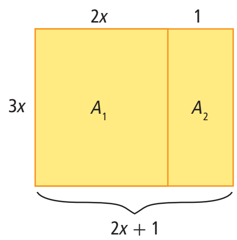
b) $s = 112 + 25w$, where s is Monika's savings and w is the number of weeks. **c)** 13.52 weeks or 3.38 months
9. a) \$515 **b)** 3.2 h **c)** \$605
10. a)



b) \$17 500 **c)** \$35 000 **d)** \$22 500
11. a) Example:

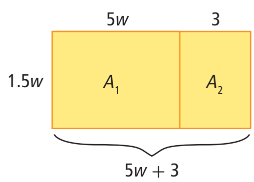


A cell phone company charges \$0.50 for every 0.25 h of talk-time purchased. **b)** $C = 2t$, where C is the cost of talk-time and t is the talk-time purchased, in hours.
c) \$6.50
12. a) $12x^2$ **b)** $-10y^2$ **c)** $-0.5s^2$ **d)** $2t^2$
13. a) $8.4x$ **b)** $-6h$ **c)** $3n$ **d)** $-4p$
14. a)



$A_1 + A_2 = 6x^2 + 3x$

b)



$A_1 + A_2 = 7.5w^2 + 4.5w$

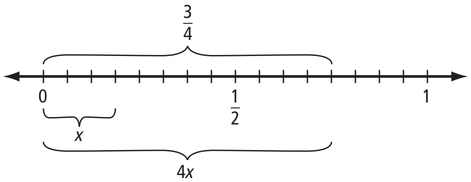
15. $w(2w + 3)$
16. a) $3g + 2$ **b)** $-2x + y$ **c)** $-(3f^2 - 20)$ **d)** $48n + 16$
17. $2x - 1$

Chapter 8

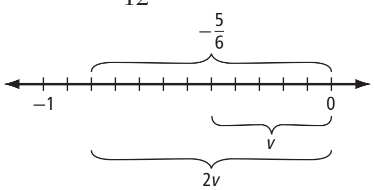
8.1 Solving Equations: $ax = b$, $\frac{x}{a} = b$, $\frac{a}{x} = b$, pages 301–303

4. $3x = 0.27$, $x = 0.09$

5. $x = \frac{3}{16}$



6. a) $v = -\frac{5}{12}$



b) $x = \frac{4}{5}$ or 0.8

c) $a = -\frac{16}{15}$ **d)** $x = \frac{3}{2}$

7. a) $x = \frac{12}{5}$ **b)** $y = -\frac{3}{5}$ **c)** $n = \frac{7}{8}$ **d)** $w = \frac{7}{16}$

8. a) $x = -0.625$ **b)** $e = 1.65$

9. a) $h = 14.76$ **b)** $c = 3.2$

10. a) $a = -0.2$ **b)** $m = 0.75$

11. a) $n = 2.85$ **b)** $x = 0.55$

12. a) $d = 318.75$ km **b)** $t = 1.6$ h

13. $0.05n = 2.00$, $n = 40$

14. $s = 6.45$ cm

15. d is greater than zero because the value of $-\frac{5}{d}$ is negative. Therefore, d must be positive.

16. $d = 17.4$ cm

17. $n = 6$, hexagon

18. 214 students did not buy the yearbook.

19. A score of 25 would give a mark of 100%.

20. The Yukon Territory covers 4.8% of Canada.

21. Her net monthly income is $2500.

22. The team scored 110 points together.

23. The sale price was $999.96.

24. They expect to attract about 111 new volunteers.

25. The side length is 8.3 cm.

26. a) $x = \frac{3}{5}$ **b)** $z = 3.24$ **c)** $y = \frac{6}{5}$ **d)** $f = -0.495$

27. a) $t = -0.51$ **b)** $h = -0.78$

28. a) $x = -\frac{3}{8}$ **b)** $t = \frac{1}{3}$ **c)** $y = \frac{5}{4}$ **d)** $g = -\frac{4}{3}$

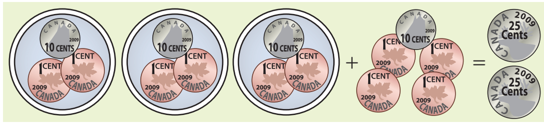
29. a) There are 54 coins in the jar.
b) There are 19 dimes.

30. The cyclist's speed is 21 km/h.

8.2 Solving Equations: $ax + b = c$, $\frac{x}{a} + b = c$, pages 311–313

5. $x = 0.20$

6. $x = 0.12$



7. a) $y = 0.25$ **b)** $d = \frac{7}{8}$ **c)** $n = -3$ **d)** $r = \frac{1}{5}$

8. a) $h = \frac{5}{24}$ **b)** $x = -\frac{3}{16}$ **c)** $d = \frac{9}{8}$ **d)** $g = -\frac{12}{7}$

9. a) $x = -2.1$ **b)** $r = 6.984$

10. a) $n = -0.037$ **b)** $k = -1.512$

11. a) $v = -0.116$ **b)** $x = 3.2$

12. a) $d = 55.5$ **b)** $a = 14.3$

13. four toppings

14. 168 km

15. $35

16. a) $2206 **b)** $7600

17. 11.6 m

18. 4.82 cm

19. 332.7 mm

20. 112 cm or 1.12 m, 138 cm or 1.38 m

21. 101 mm

22. 5 h

23. Sharifa. It will only take 7 weeks for her to save enough money.

24. 3.75 min

25. 108.2 million km

26. a) Example: $\frac{x}{2} + 1 = \frac{4}{3}$ **b)** Example: $\frac{x}{0.4} + 1 = -1$

27. Example: John is 2.5 years older than twice his brother's age. John is 12.5 years old. How old is his brother?
$2b + 2.5 = 12.5$, $b = 5$
John's brother is 5 years old.

28. a) $w = -\frac{14}{3}$ **b)** $x = -\frac{1}{9}$

29. a) $y = -1.14$ **b)** $s = 8.28$

30. a) $x = 0.5$ **b)** $n = \frac{16}{3}$ **c)** $h = -1.408$ **d)** $y = -2$

31. $x = -0.85$

32. 500 m

8.3 Solving Equations: $a(x + b) = c$, pages 319–321

5. $3(x + 0.05) = 0.60$, $x = 0.15$

6. a) $x = 2.3$ **b)** $c = 3.45$ **c)** $a = -5.7$ **d)** $r = 0.3$

7. a) $u = 11.36$ **b)** $m = -3.93$ **c)** $v = 1.68$ **d)** $x = 3.41$

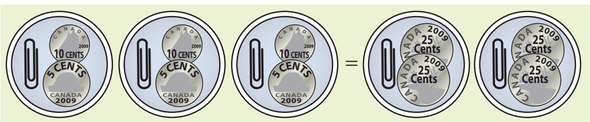
8. a) $n = -\frac{5}{2}$ **b)** $x = \frac{19}{2}$ **c)** $w = -\frac{2}{9}$ **d)** $g = \frac{13}{4}$

9. a) $y = -\frac{1}{5}$ **b)** $q = -\frac{17}{2}$ **c)** $e = -\frac{13}{2}$ **d)** $p = \frac{15}{4}$

10. a) $x = 3.4$ **b)** $k = -63.6$ **c)** $q = -2.27$
d) $a = -5.9$
11. a) $q = 1.1$ **b)** $y = 0.071$ **c)** $n = -2.18$ **d)** $p = 0$
12. $x = -1.7$
13. a) $3(x + 1.05) = 9.83$, $x = 2.2$
14. $x = 6.76$
15. 3.3 °C
16. $d = -0.45$
17. \$2.99
18. \$37.50
19. \$6.40/skin
20. a) $h = 7.8$ cm **b)** $a = 1.3$ m
21. 15.6 cm
22. 15 years old
23. a) $x = -2.3$ **b)** $y = 4.9$ **c)** $f = 2.8$ **d)** $t = -8.98$
24. a) $d = -16.8$ **b)** $r = 3.5$ **c)** $g = 1.6$ **d)** $h = -18$
25. The longer side is 0.5 units and the shorter side is 0.25 units.
26. -15
27. 1 h 27.6 min
28. a) $n = \frac{4}{x} + 3$ **b)** $n = \frac{4}{x} + 3$
c) Divide first, because it involves fewer steps.

8.4 Solving Equations: $ax = b + cx$, $ax + b = cx + d$, $a(bx + c) = d(ex + f)$, pages 326–329

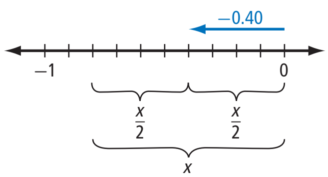
4. $3x + 0.15 = 2x + 0.30$, $x = 0.15$
5. $x = \$0.55$



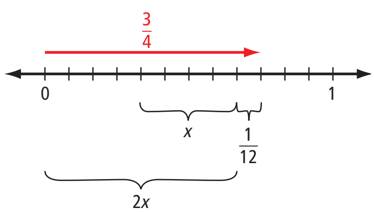
6. a) $x = 6.4$ **b)** $y = 3$ **c)** $a = -0.8$ **d)** $g = \frac{6}{7}$
7. a) $n = \frac{4}{3}$ **b)** $w = -2.2$ **c)** $p = 4.25$ **d)** $e = \frac{3}{10}$
e) $d = -18$
8. a) $k = 0.5$ **b)** $p = -21$ **c)** $u = 3$ **d)** $h = -\frac{5}{2}$
9. a) $r = -2.55$ **b)** $c = 0.4$ **c)** $k = 8$ **d)** $p = \frac{11}{3}$
10. a) $q = 0.22$ **b)** $x = -5$ **c)** $y = 0.75$ **d)** $x = \frac{5}{2}$
11. a) $s = -0.4$ **b)** $g = 7.8$ **c)** $x = 6$ **d)** $m = -2$
12. a) $c = -3.36$ **b)** $n = 3.38$ **c)** $x = 1.39$ **d)** $a = -0.17$
13. a) 19 nickels **b)** \$1.90
14. 5 weeks
15. Rectangle A: 2.5 units by 3.1 units;
Rectangle B: 0.1 units by 5.5 units
16. a) $x = 1.4$ **b)** The perimeter of each triangle is 23.3 units.
17. 33 min
18. Each rectangle has an area of 13.68 square units.
19. a) 17.5 min **b)** 1.3125 km
20. $f = 180$ cm
21. 12 movies/year
22. The speed of the current is 7.07 km/h.
23. a) Yes. When the distributive property is applied to both sides of the expression, the result is two identical expressions. **b)** Yes. When the distributive property is applied to both sides of the expression, the result is two identical expressions.
24. Example: My dad always tells the same story about how hard he worked when he first came to Canada. He said he worked after school as a server in a restaurant earning \$$x$/h. One day, he worked 3.5 h and had \$1.2 in tips. Another day, he worked 4 h and had \$0.90 in tips. Both days, he earned the same amount of money. How much was my dad getting per hour?
25. Example: One video store charges a \$5 annual membership fee and \$4 per movie. Another store charges no membership fee, but \$5 per movie. How many movies per year would you have to rent for the cost to be the same at both stores? Let m represent the number of movies. $4m + 5 = 5m$, $m = 5$ movies.
26. a) $x = 17.5$ **b)** $y = -30$ **c)** $d = 2.2$ **d)** $j = 1.5$
27. a) $a = 1.125$ **b)** $s = 9$ **c)** $q = -3$ **d)** $z = -1.25$
28. $k = \frac{10 - x}{3}$
29. $n = -1.2$
30. a) $x = \frac{1}{14}$ **b)** $y = -\frac{1}{3}$

Chapter 8 Review, pages 330–331

1. D, B, A, C, C
2. opposite operation
3. distributive property
4. $x = -0.8$



5. a) $d = -\frac{1}{10}$ **b)** $y = 8.04$ **c)** $h = -17.5$ **d)** $u = 1.9$
6. a) $w = -4.7$ **b)** $k = 9.0$
7. a) $m = 43.3$ g **b)** $v = 12.5$ cm^3
8. 60 goals
9. $x = \frac{1}{3}$



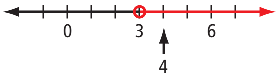
10. a) She should have divided by -3. **b)** $g = 3$

11. a) $t = -14.56$ **b)** $x = 9.5$ **c)** $r = \frac{4}{3}$ **d)** $v = -\frac{20}{7}$
12. $34.95
13. 58.6 Earth days
14. a) $e = -6.7$ **b)** $r = 1.5$ **c)** $h = -21.1$ **d)** $q = \frac{7}{8}$
15. $m = -1.97$
16. $k = 3.225$ m
17. $21.75
18. a) $n = 15$ **b)** $f = 1.75$ **c)** $g = -1.6$ **d)** $h = -60$
e) $v = -\frac{11}{6}$
19. a) $a = 1.9$ **b)** $P = 25.2$ units
20. $w = 7.5$ cm

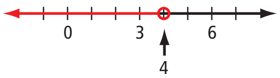
Chapter 9

9.1 Representing Inequalities, pages 347–349

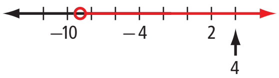
5. a) Example: $x \geq 3$ **b)** Example: $x < 7$
c) Example: $x \leq -13$ **d)** Example: $x > -1.5$
6. a) Yes; 4 is greater than 3.



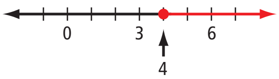
b) No; 4 is not less than 4.



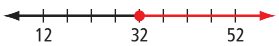
c) Yes; 4 is greater than -9.



d) Yes; 4 is greater than or equal to 4.

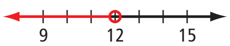


7. a) Example: All values greater than or equal to 8. Three possible values are 11, 15, and 22.
b) Example: All values less than -12. Three possible values are -14, -21.5, and -100.
c) Example: All values less than or equal to 6.4. Three possible values are 1, 3, and 6.4.
d) Example: All values that exceed -12.7. Three possible values are -11, 0, and 33.
8. a)

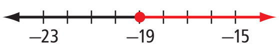


b) $p \geq 32$
9. a) All values greater than 4. **b)** All values less than or equal to -2. **c)** All values greater than or equal to -13.
10. a) Example: $x < 12.7$ or $12.7 > x$
b) Example: $y > 4.65$ or $4.65 < y$
c) Example: $y \leq -24.3$ or $-24.3 \geq y$
11. a)

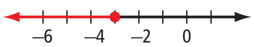
b)



c)

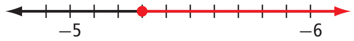


d)

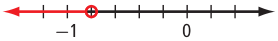


12. a)

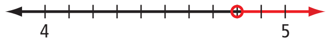
b)



c)

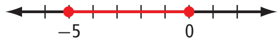


d)



13. a)

b)



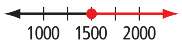
c)

d)

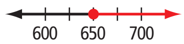
14. a)

b) Example: The values of -10.0 and -9.8 are both less than -9.3, so they are not possible values. Conversely, -9.0 is larger than -9.3 so it is a possible value.

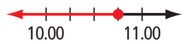
15. a) The value is greater than or equal to 20, and less than or equal to 27; $20 \leq x$ and $x \leq 27$ **b)** The value is less than 2, and greater than -6; $-6 < x$ and $x < 2$ **c)** The value is less than -8, and greater than or equal to -9.2; $-9.2 \leq x$ and $x < -8$
16. a) $m \geq 18\ 000$ **b)** $t \leq 8$ **c)** $d > 700$
17. a)



b) $x \geq 1500$
18. a) Paul will beat the record if he finishes the race in less than 41.5 s. **b)** $t < 41.5$
19. a) Example: A school environmental awareness club hopes to recycle at least 650 cans each month.
b)

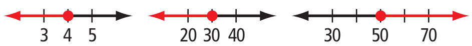


c) $c \geq 650$
20. a) $m \leq 10.75$ **b)**

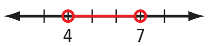


21. a) Shanelle will have to pay more insurance if the distance between her home and workplace is farther than 15 km. **b)**

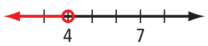
22. a)



b) $w \leq 4$; $s \leq 30$; $m \geq 50$
23. a) $x = 6$ **b)** Since the only possible value for x that satisfies both inequalities is 6, there will be a single solid dot on the number line at 6.
24. $50 < s \leq 80$
25. a) All values greater than 4 and less than 7

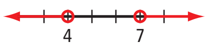


b) All values less than 4

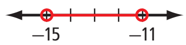


c) All values greater than 7

d) All values less than 4 and greater than 7

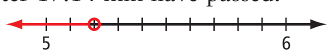


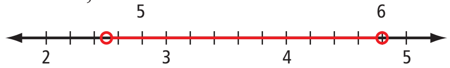
9.2 Solving Single-Step Inequalities, pages 357–359

5. a) $x \geq 29$ **b)** $-7 < x$ **c)** $x > -13.8$ **d)** $35 \leq x$
6. a) $y \geq 9$ **b)** $-14.5 < y$ **c)** $y \leq -4$ **d)** $y > 6.25$
7. a) $x > 150$ **b)** $x \leq 36$ **c)** $2.4 \geq x$ **d)** $x > -30$
8. a)–c) No, the inequality is not changed because there is no multiplication or division by a negative number.
d) Yes, the direction of the inequality is changed because there is division by a negative number.
e) Yes, the direction of the inequality is changed because there is multiplication by a negative number.
f) No, the inequality is not changed because there is no multiplication or division by a negative number.
9. a) yes **b)** yes **c)** yes **d)** no
10. a) yes **b)** no **c)** no **d)** yes
11. a) yes **b)** no **c)** yes **d)** yes
12. a) yes **b)** No; the correct answer is $x > -16$, not $x > 16$.
13. a) No; the correct solution is $-9 \geq x$, not $-11 \geq x$.
b) yes
14. a) $85f \leq 1400$ **b)** $f \leq 16.47$ **c)** No, the boundary value is not a positive integer, which is required when discussing the number of fence sections.
15. a) $6w > 50$ **b)** $w > 8.\overline{3}$. Megan must win 9 or more races to move up to the next racing category. **c)** No, the number of races won will be a non-negative integer.
16. a) Example: Three solutions are -6, -20.2, and -10. Three non-solutions are 0, -4, and 8.6.
b) Example: Three solutions are 0, -2, and 5.5. Three non-solutions are -11, -8, and -16.
17. Example: The inequality sign is reversed because each side was divided by a negative number, -5.
18. a) Example: The single sharpening cost is about \$6. When this is divided by 48, the answer is 8. So, if the skates need to be sharpened more than 8 times, the monthly charge would be a better option.
b) $5.75s > 49$; $s > 8.52$. It would be better to take advantage of the monthly special if the skates were sharpened more than 8 times. The estimate and solution to the inequality are the same.
19. a) $0.03p \geq 250$; $p \geq 8333.\overline{3}$. The owner would need to make a profit of at least \$8333.33 in order to donate at least \$250 to the local charity. **b)** Example: Check the boundary point, $8333.\overline{3}$, and then check that both sides of the inequality are equal: $0.03(8333.\overline{3}) = 250$. Check a number that is larger than the boundary value (9000) and see that it is a solution: $0.03(9000) = 270$. Since 270 is larger than 250, then 9000 is a solution to the inequality.
20. $0.084k \leq 57$; $k \leq 678.57$; They can travel no more than 678.57 km, assuming the car consumes the average amount of fuel.
21. a) Natalie must run 8 laps in order to complete the 3200-m distance: $3200 \div 400 = 8$. The total time of 9 min 23 s is equivalent to 563 s: $9 \times 60 + 23 = 563$. The expression $8x$ represents her total time, where x is her average time per lap. Consequently, her total time must be less than the current record of 563 s: $8x < 563$.
b) $x < 70.375$
22. $\frac{s}{5} \geq 120$; $s \geq 600$. She will have to spend at least \$600 to get at least 120 points.
23. a) $115d \geq 1000$; $4d \leq 50$ **b)** $d \geq 8.70$; $d \leq 12.5$
c) Chris can build between 9 and 12 doghouses and stay within his guidelines.
24. $x > -\frac{5}{6}$
25. 

26. The mass of the energy bar must be between 66.67 g and 76.92 g.
27. a) $x \leq 5$ **b)** $x \geq 5$
28. a) $-14 \leq x$ and $x \leq -1$ **b)** $-1 < x$ and $x < 6$
c) $\frac{5}{2} \geq x$ and $x > -\frac{3}{2}$

9.3 Solving Multi-Step Inequalities, pages 365–367

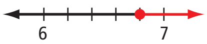
3. a) $x < 11$ **b)** $x > -20$ **c)** $50 \leq x$
4. a) $y \leq 10.4$ **b)** $-2.1 > y$ **c)** $y > -108$ **d)** $x \leq 3\frac{1}{5}$
5. a) Check the boundary value: $3(8) + 11 = 35$. Check another number in the solution set, $x = 10$: $3(10) + 11 = 41$. Since 41 is greater than 35, the solution is correct. **b)** Solve the inequality: $24 - 5x - 24 > 39 - 24$. Finally, simplify $\frac{-5x}{-5} < \frac{15}{-5}$ to get the solution, $x < -3$.
6. a) $x < 6$ **b)** $x \geq 11$ **c)** $x < -\frac{9}{8}$ **d)** $x > 39$
7. a) $y < 2$ **b)** $y \leq 10$ **c)** $y > \frac{28}{9}$ **d)** $y \geq 3$
8. a) Example: Let j represent the number of jerseys; $40j + 80 < 50j$ **b)** Example: Let n represent the number of text messages sent in one month; $0.12n < 0.05n + 15$
9. a) $0.05p + 10 > 0.04p + 15$ **b)** John will have to deliver more than 500 papers to make the *Advance* the better offer.
10. a) Example: ABC Rentals would be a better deal if you travel less than 200 km per day ($30 \div 0.15$).
b) $0.14k + 25 < 55$ **c)** ABC Rentals will be the better option if Kim travels less than 214.3 km per day.
11. Kevin's weekly sales must be at least \$4000 for Dollar Deal to pay more.
12. Print Express would be the better option if more than 236 yearbooks are ordered.
13. The member's plan is a better deal when 22 or more buckets of balls are used per month.
14. Molly must sell at least 72 candles in order to make a profit.
15. The first tank will contain less water after $27\frac{3}{11}$ minutes have passed.
16. a) Example: Estimate: 20 min **b)** Rob will be closer to the top after 17.14 min have passed.
17. $x < 5.2$; 

18. 

19. Lauren can cut 34, 35, or 36 lawns per month and stay within her guidelines.
20. a) Ella is correct when $x > 0$.
b) Ella is incorrect when $x \leq 0$. Example: Ella is correct when $x = 2$, but she is incorrect when $x = -11.2$.
21. $9 \geq x$ and $x \geq -2$
22. $x > 0$

Chapter 9 Review, pages 368–369

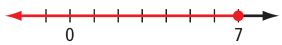
1. inequality
2. graphically; algebraically
3. open circle
4. solution
5. boundary point
6. closed circle
7. a) Example: Savings $\leq$ 40%
b) Example: Free shipping for purchases $\geq$ \$500
c) Example: Number of items on sale $>$ 80
8. a) Example: The bicycle must be at least 6.8 kg in mass.



b) Example: The bicycle must be less than or equal to 185 cm.

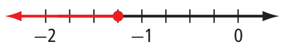
9. a) $x > 13$; A number greater than 13.
b) $x \leq 8.6$. A number less than or equal to 8.6.
10. a)

b)



c)

d)



11. Example:

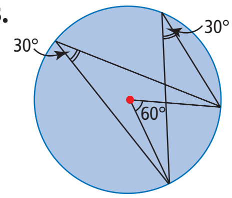
Linear Inequality	One Solution Value	One Non-solution Value
$r > -4$	3	−10
$0 \leq s \leq 7$	3.4	11
$9.5 > t$	8	22
$v \leq -\frac{5}{4}$	−2	0

12. a) $d > -3$ **b)** $5.4 < a$ **c)** $-33 \geq b$ **d)** $c < -16$
13. a) No, the solution is incorrect. The boundary value of 8 is correct but the direction is incorrect.
b) The solution is correct.
14. a) $14.5t \geq 600$ **b)** Tim must work at least 41.4 h per week to achieve his goal.
15. Danielle can buy a maximum of 13 scoops of ice cream and stay within her budget.
16. No, the solution is incorrect. The boundary value is correct but the direction is incorrect.
17. a) Yes, the solution is correct. **b)** Example: First, check that the boundary value creates an equation. Then, check a solution value in the original inequality and see if it results in a true inequality statement.
18. a) $x < 45$ **b)** $7.5 > x$ **c)** $x \geq -1$ **d)** $x < -20$
e) $1.4 \leq x$ **f)** $x < -\frac{9}{8}$
19. The maximum number of people that can attend the banquet is 64.
20. Greg would need to purchase at least 201 tracks per month to make Plan A the better option.

Chapter 10

10.1 Exploring Angles in a Circle, pages 382–385

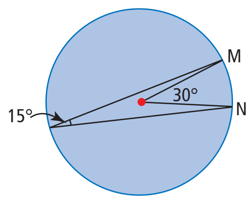
3. ADB and AEB are inscribed angles that are subtended by the same arc as the central ACB. The measure of ACB is 82°. Therefore, ADB and AEB have measures that are half the measure of ACB. Half of 82 is 41. So, the measure of ADB is 41° and the measure of AEB is 41°.
4. a) 23°. Example: The inscribed angles subtended by the same arc of a circle are equal. **b)** 46° Example: A central angle is twice the measure of an inscribed angle subtended by the same arc.
5.



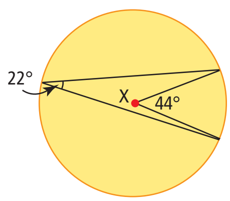
6. a) 90°. Example: ∠ABD is an inscribed angle subtended by the diameter of the circle. **b)** 8 cm
7. a) 90° **b)** 11.3 cm
Example: Since △CFG is a right triangle, by the Pythagorean relationship,

$$\begin{aligned} 8^2 + 8^2 &= FG^2 \\ 64 + 64 &= FG^2 \\ 128 &= FG^2 \\ \sqrt{128} &= FG \\ 11.3 &\approx FG \end{aligned}$$

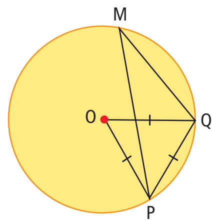
8. Example: Jacob could place his flashlight anywhere on the major arc MN.



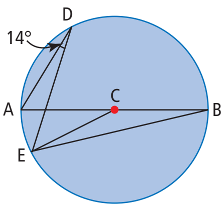
9. Example: In the diagram, X is the ideal location.



10. a) 76°. Example: $\angle ACD$ is a central angle subtended by the same arc as the inscribed angle $\angle ABD$. Its measure is twice the inscribed angle's measure. **b)** $\triangle ACD$ is an isosceles triangle because the sides AC and DC are radii of the same circle and are therefore equal.
c) 52°. Subtract the measure of $\angle ACD$, 76°, from 180° and divide by 2.
11. a) 130° **b)** 65°. $\triangle FCE$ is an isosceles triangle since sides FC and EC are radii of the same circle. Therefore, the measure of $\angle ECF = 180° - 2(25°) = 130°$. $\angle EGF$ is an inscribed angle subtended by the same arc as the central angle $\angle EGF$ and is therefore one half its measure.
12. a) 15° **b)** 24° **c)** 48° **d)** 30°
13. a) 56° **b)** 90° **c)** a right triangle **d)** 90°
14. No. Example: Neither $\triangle ADB$ or $\triangle ACB$ are right triangles. The Pythagorean relationship can only be used with right triangles.
15. a) $x = 45°, y = 45°$ **b)** $x = 60°, y = 120°$
c) $x = 15°, y = 30°$ **d)** $x = 35°, y = 45°$
16. In the diagram, find the measure of $\angle PMQ$.



17. The measure of $\angle ACE = 28°$ and the measure of $\angle ABE = 14°$.



18. a) $x = 25°, y = 50°$ **b)** $x = 95°, y = 55°$
19. 14.14 cm
20. a) 9° **b)** 17°
21. a) $180° \div 2 = 90°$ **b)** $180° - 90° - 27° = 63°$
c) 63°. $\angle AEG$ is opposite $\angle BEH$ and therefore equal.
d) 60° **e)** 120°

10.2 Exploring Chord Properties, pages 389–393

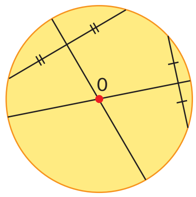
4. 9 cm. Example: Since $\triangle ACE$ is a right triangle, by the Pythagorean relationship,

$$\begin{aligned} 12^2 + CE^2 &= 15^2 \\ 144 + CE^2 &= 225 \\ CE^2 &= 81 \\ CE &= \sqrt{81} \\ CE &= 9 \end{aligned}$$

5. 8.1 mm. Example: Draw radius HC to form a right triangle. By the Pythagorean relationship,

$$\begin{aligned} 4^2 + 7^2 &= CH^2 \\ 16 + 49 &= CH^2 \\ 65 &= CH^2 \\ \sqrt{65} &= CH \\ 8.1 &\approx CH \end{aligned}$$

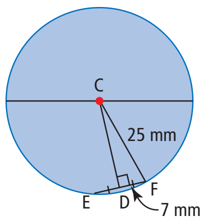
6. Example: Hannah should draw any two chords on the circle. She should then locate and draw the perpendicular bisectors of each chord. The intersection of the perpendicular bisectors is the centre of the trampoline.



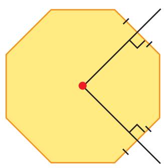
7. 30 m. Example: Find the length of EB by using the Pythagorean relationship.

$$\begin{aligned} 8^2 + EB^2 &= 17^2 \\ 64 + EB^2 &= 289 \\ EB^2 &= 225 \\ EB &= \sqrt{225} \\ EB &= 15 \end{aligned}$$

Double the length of EB to obtain the length of AB. $2(15) = 30$. The length of AB is 30 m.
8. 16 cm
9. a) 5.2 **b)** 5.6
10. 7 cm
11. 16 cm^2
12. 24 mm



13. Example: Locate and draw the perpendicular bisectors of any two sides of the octagon. The point where the two perpendicular bisectors intersect is the centre of the octagon.



14. Example: Draw any two chords. Locate and draw the perpendicular bisectors of the two chords. The point of intersection of the two perpendicular bisectors is the centre of the circle. Measure the distance from the centre of the circle to the endpoint of any chord. If the measurement is 8 cm, his diagram was accurate.
15. a) 90°. An inscribed angle that subtends a diameter has a measure of 90°. **b)** 12 cm. $\triangle ADE$ is a right triangle. By using the Pythagorean relationship,

$$\begin{aligned} 16^2 + AD^2 &= 20^2 \\ 256 + AD^2 &= 400 \\ AD^2 &= 144 \\ AD &= \sqrt{144} \\ AD &= 12 \end{aligned}$$

c) 9.6 cm. $\triangle$DFE is a right triangle. By using the Pythagorean relationship,

$$\begin{aligned} 12.8^2 + DF^2 &= 16^2 \\ 163.84 + DF^2 &= 256 \\ DF^2 &= 92.16 \\ DF &= \sqrt{92.16} \\ DF &\approx 9.6 \end{aligned}$$

d) 19.2 cm. The length of BD = twice the length of DF.

$$\begin{aligned} BD &= 2DF \\ BD &= 2(9.6) \\ &= 19.2 \end{aligned}$$

16. a) 65°. ∠HMP subtends the same arc as the central angle that has a measure of 130°. Therefore, the measure of ∠HMP is half of 130°. **b)** 90°. Segment CJ is the perpendicular bisector of chord MP. Therefore ∠HEM is 90°. **c)** 25°. ∠HEM is 90°. Therefore, $\triangle$HME is a right triangle, so 180° − 90° − 65° = 25°.
d) 25°. ∠MPJ is an inscribed angle subtending the same arc as the inscribed angle of 25°. **e)** 50°. ∠HCP and ∠PCE are supplementary angles. **f)** 40°. $\triangle$CEP is a right triangle, so 180° − 90° − 50° = 40°.

17. 1.2 m

18. Example: Gavyn made two mistakes. The first mistake is that the diagram is labelled incorrectly: segment AC should be labelled as 13 cm. The second mistake is that segment AC is the hypotenuse, not a leg. So, by the Pythagorean relationship, $EC^2 + AE^2 = AC^2$. The correct length of AB is 24 cm.

19. 15.6 mm

20. a) If a bisector of a chord passes through the centre of a circle, then the bisector is perpendicular to the chord.
b) 22° and 68°

21. Since the bisectors of chords AB and DE pass through the centres of their respective circles, the bisectors are perpendicular to chords AB and DE. Two line segments perpendicular to the same segment are parallel.

10.3 Tangents to a Circle, pages 399–403

3. a) 90°. ∠BDC is 90° because segment AB is tangent to the circle at point D and segment DC is a radius. **b)** 150°. ∠DCB = 30° because triangle DBC is a right triangle and 180° − 90° − 60° = 30°. Since ∠DCB and ∠DCE are supplementary angles, ∠DEC = 180° − 30° = 150° **c)** $\triangle$CDE is an isosceles triangle since two sides are radii of the circle and are therefore equal. **d)** 15°. ∠DEC is an inscribed angle subtending the same arc as central angle ∠DCB, which is 30°. Therefore, ∠DEC = $\frac{1}{2}$ the measure of ∠DCB.

4. a) $\triangle$CGL is an isosceles triangle since two sides are radii of the circle and are therefore equal. **b)** 160°. Since $\triangle$CGL is isosceles, 180° − 10° − 10° = 160°.
c) 20°. Since ∠JCH is a central angle subtending the same arc as ∠JGC, which is 10°, the measure of ∠JCH is twice the measure of ∠JGC.
d) 90°. Since segment JH is tangent to the circle at point H, it is perpendicular to the radius CH.
e) 70°. Since triangle CJH is a right triangle and ∠JCH = 20°, 180° − 90° − 20° = 70°.

5. a) 8 m. Since triangle ABD is a right triangle, by using the Pythagorean relationship,

$$\begin{aligned} 6^2 + BD^2 &= 10^2 \\ 36 + BD^2 &= 100 \\ BD^2 &= 64 \\ BD &= \sqrt{64} \\ BD &= 8 \end{aligned}$$

b) 4 m. Since chord BE is the same measure as a radius and the diameter is 8 m, the measure of chord BE is 4 m.
c) 90°. ∠BED is a right angle because it is an inscribed angle subtending a diameter.
d) 7 m. Since $\triangle$DEB is a right triangle, by using the Pythagorean relationship,

$$\begin{aligned} 4^2 + DE^2 &= 8^2 \\ 16 + DE^2 &= 64 \\ DE^2 &= 48 \\ DE &= \sqrt{48} \\ DE &\approx 7 \end{aligned}$$

6. a) 10 mm. The diameter is twice the measure of the radius. **b)** Yes. Since inscribed angle ∠GJH subtends the diameter GH, it is therefore a right angle. **c)** 8.7 mm. Since $\triangle$GHJ is a right triangle, by using the Pythagorean relationship,

$$\begin{aligned} 5^2 + HJ^2 &= 10^2 \\ 25 + HJ^2 &= 100 \\ HJ^2 &= 75 \\ HJ &= \sqrt{75} \\ HJ &\approx 8.7 \end{aligned}$$

d) 90°. Since segment FG is tangent to the circle at point G and segment CG is a radius of the circle, angle FGH = 90°.
e) 12.2 mm. Since $\triangle$FGH is a right triangle, by using the Pythagorean relationship,

$$\begin{aligned} 7^2 + 10^2 &= FH^2 \\ 49 + 100 &= FH^2 \\ 149 &= FH^2 \\ \sqrt{149} &= FH \\ 12.2 &\approx FH \end{aligned}$$

7. 16.8 m, 11.8 m

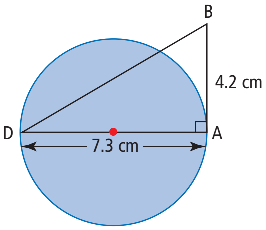
8. a) 17 m **b)** 12 cm

9. a) 35° **b)** 164°

10. a) Rectangle. Example: It is a rectangle because opposite sides are equal and all angles are 90°.
b) 30 cm

11. 8.4 cm. Since △ABD is a right triangle, by using the Pythagorean relationship,

$$\begin{aligned} 4.2^2 + 7.3^2 &= DB^2 \\ 17.64 + 53.29 &= DB^2 \\ 70.93 &= DB^2 \\ \sqrt{70.93} &= DB \\ 8.4 &\approx DB \end{aligned}$$

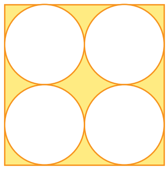


12. a) 90°. Since segment AD is tangent to the circle at point D and DB is a diameter, a right angle is formed at the point of tangency. **b)** 45°. Since △ADB is an isosceles right triangle, (180° − 90°) ÷ 2 = 45°.
c) 45°. ∠DFE is an inscribed angle subtending the same arc as inscribed angle, ∠DBA which is 45°.
13. a) 90°. Since line l is tangent to the circle at point H and CH is a radius, a right angle is formed. **b)** 90°. Since chord JK is parallel to line l and line l is perpendicular to segment CH, segment JK is perpendicular to segment CH.
c) 8.5 cm. Since a line passing through the centre of a circle that is perpendicular to a chord bisects the chord.
d) 3.2 cm. Since △CGJ is a right triangle, by using the Pythagorean relationship,

$$\begin{aligned} 8.5^2 + CG^2 &= 9.1^2 \\ 72.25 + CG^2 &= 82.81 \\ CG^2 &= 10.56 \\ CG &= \sqrt{10.56} \\ CG &\approx 3.2 \end{aligned}$$

14. $x = 11$, ∠JGH = 53°
15. 40°. Example: The inscribed angle of 85° subtends the same arc as a central angle. Therefore, the measure of the central angle is twice the measure of the inscribed angle, or 170°. One of the angles of the right triangle has a measure of 170° − 140° = 30°.
So, 180° − (90° + 30°) = 60°.

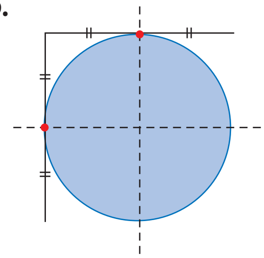
16. Example: The four congruent circles represent watered regions of the square field. The circles are tangent to the sides of the square. If the area of the field is 400 m^2, what is the area of the field that is not watered?



Answer: The side length of the square is the square root of the area of the square, or 20 m. The radius of each circle is 5 m. To find the area of the unwatered region, subtract the area of the four circles from the area of the square field.

$$\begin{aligned} 400 - 4\pi r^2 &\approx 400 - 314.16 \\ &\approx 85.8 \end{aligned}$$

The area of the unwatered region is 85.8 m^2
17. 96 cm
18. B has coordinates (6, 2). C has coordinates (4, 6).
19.



20. 146 cm
21. 17.6 cm
22. 43.6 cm

Chapter 10 Review, pages 404–405

1. radius
2. inscribed angle
3. chord
4. perpendicular bisector
5. a) 24° **b)** 48°
6. $x = 48°$, $y = 48°$
7. No, the central angle inscribed by the same arc as the inscribed angle has a measure that is twice as large.
8. 18°
9. 90°
10. 28°
11. Example: The perpendicular bisector of a chord passes through the centre of the circle.
12. Example: She should have found the perpendicular bisector of her string and the perpendicular bisector of a second string. The intersection of the two perpendicular bisectors would be the location of the centre of the table.

13. 48 m. Since $\triangle$ACB is a right triangle, by using the Pythagorean relationship,

$$10^2 + AB^2 = 26^2$$
$$100 + AB^2 = 676$$
$$AB^2 = 576$$
$$AB = \sqrt{576}$$
$$AB = 24$$

The radius is 24 m. The diameter AE is twice the radius, or 48 m.

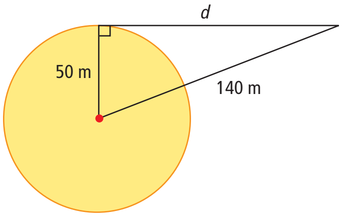
14. Example: Two chords should be drawn. Then the perpendicular bisector of each chord should be drawn. The intersection of the two perpendicular bisectors is the centre of the circle. Next, find the measure from the centre to a point on the circle. This distance is the radius, which would be used to find the circumference.

15. 6.3 cm

16. 133°

17. 6 mm

18. The horizontal distance was 131 m. The variable, *d*, represents the horizontal distance.



19. a) 90°. The line that is tangent to a circle at a point of tangency is perpendicular to the radius at that point. **b)** 42°. $\triangle$CEF is a right triangle, so $180° - 90° - 48° = 42°$ **c)** 138°. $\angle$ECD and $\angle$ECF are supplementary angles, so $180° - 42° = 138°$.
d) 21°. $\triangle$DEC is an isosceles triangle, so $\angle DEC = (180° - 138°) \div 2 = 21°$.
e) 69°. $\angle AED + \angle DEC + \angle CEF = 180°$, so $180° - 90° - 21° = 69°$.
f) 21°. $\angle$EDB is an inscribed angle that subtends the same arc as the central angle $\angle$ECF, which is 42°, and is therefore one half its measure.

20. a) 42° **b)** 48°

Chapter 11

11.1 Factors Affecting Data Collection, pages 419–421

4. Example: **a)** The responses would be biased. The soccer team would have no interest in uniforms for the volleyball team. **b)** The responses would be biased. Truck drivers would probably respond that they prefer to drive trucks. **c)** The cost of the survey would be high and may outweigh the benefits of the study. **d)** The influencing factor is use of language. The positive descriptions of "most sturdy" and "expertly designed" could prompt them to choose Invincible Bikes.

5. Example: **a)** No bias. **b)** The bias is asking only owners of boarding horses and using the negative word "annoying". Rewrite: "Where should the stable be located?" **c)** The bias is asking only riders and including "on the site of the stable." Rewrite: "Where should a public park be built?"

6. Example: **a)** The influencing factor is the use of language. The respondent may not prefer either of the two choices. Rewrite: "What soda do you prefer?"
b) The influencing factor is asking the opposition party member. Rewrite: "Who do you think is the best prime minister in Canadian history?" **c)** The person responding may be confused by the question. Rewrite: "Do your appliances and tools need any maintenance? If yes, do you know about the Hands-On-Repair Company?" **d)** This is private information. Students may not know their parents' income. No suggestion for a rewrite.

7. Example: **a)** "Which riding trails would you support closing?" **b)** "Who is your favourite male movie star?" **c)** "What is the cheapest way to travel a long distance?"

8. Example: **a)** "What sport do you like to watch?"
b) "What is your favourite flavour of ice cream?"
c) "Do you use the Internet to watch TV? If yes, what shows do you watch most often online?"

9. Example: **a)** "What juice flavour is your favourite?" or "Which of the following is your favourite juice flavour? a) apple, b) orange, c) pineapple, d) grapefruit, e) other"
b) "What is your favourite shirt colour?" or "Which of the following is your favourite shirt colour? a) yellow, b) black, c) white, d) red, e) other"
c) "What kind of diet do you support?" or "Which type of diet do you support? a) natural food, b) high protein, c) low carbohydrates, d) low fat, e) other"

10. Example: **a)** Ask people ages 13 to 19; "What sport do you like best?" **b)** Ask cell-phone owners; "What is most important consideration when buying a cell phone?" **c)** Ask people who use a media source; "What media source do you trust the most?"

11. Example: **a)** "Have you tried Crystal Juice? If yes, would you consider buying it as your regular juice?"
b) "Do you use cough medicines? If yes, which brands do you use?" **c)** "If you were hiking in the bush and came across a moose, what would you do?" **d)** "Do you have Internet access? If yes, how satisfied are you with the level of service you receive?"

12. Example: **a)** The use of "expensive store" in the question makes the question biased. Rewrite: "Where have you purchased clothing items within the past year?" **b)** Asking members of the golf club makes the question biased. Rewrite: "Are you in favour of the proposed highway?"

13. Example: **a)** Biased question: "Do you prefer mindless computer games or mind stimulating board games like chess?" Rewrite: "What kind of games do you prefer to play?"
14. Example: **a)** Question 1: "Would you consider going on an Arctic adventure tour? If yes, what activities would appeal to you?" Question 2: "If you were going on an Arctic adventure tour, which of the following activities would interest you? a) dogsledding, b) white-water rafting, c) mountain climbing, d) big game hunting" Question 3: "Have you ever gone on a trip to the Arctic? If yes, what activities did you participate in?"
c) The use of language is the influencing factor that creates the bias. The words "mindless" and "mind stimulating" could sway a participant's answer to the survey question.
15. Example: If the source of the poll is a political party, the survey question may contain influencing factors that would affect the outcome.

11.2 Collecting Data, pages 427–429

4. Example: **a)** The population would be people who listen to rock bands. Since this population size could be quite large, a sample would be the most time- and cost-effective. **b)** The population would be this year's grade 9 students. A sample or population could be used, depending on the number of grade 9 students.
c) The population would be customers of the store who buy soccer shirts. A sample or population could be used, depending on the number of customers.
d) The population would be people who use shampoo. Since most people use shampoo, the population would be too large. A sample would be more appropriate.
5. Example: **a)** The population would be people who use the Internet at home. Since the population would be very large, a sample would be less time-consuming and more cost-effective. **b)** The population would be people associated with the school. A sample would be less time-consuming. **c)** The population would be customers of an electronics store who use the repairs and service department. A sample or population could be used, depending on the number of customers.
d) The population would be people with special needs. A sample would be appropriate. It would be difficult to find and ask all people with special needs.
6. Example: **a)** Voluntary response; place an ad in the newspaper asking people to respond. **b)** Stratified; count the number of people in different categories of people associated with the school: students, parents, and staff. Ask a proportional number of people from each group. **c)** Systematic; ask every 10th repair/service customer. **d)** Voluntary response; place an ad in the newspaper asking people with special needs to respond.
7. Example: **a)** Ask people listening to the show to volunteer to phone-in their opinions. This is a voluntary response sample. **b)** Take a random sample by assigning each school a number, and have a random number generator select 25 numbers.
c) Take a convenience sample by asking the first 50 teenagers who enter the mall on a Saturday. **d)** Take a convenience sample by asking the first 50 people who enter a coffee shop downtown.
8. Example: **a)** Population; there are not that many hospitals. **b)** Sample; it would be too costly and time-consuming to ask all grade 9 students. **c)** Population; all parachutes should be tested because their use involves life or death. **d)** Sample; it would be too costly and time-consuming to test all bike tires.
9. Adults represent 50% of the population, teens represent 20% of the population, and children represent 30% of the population. Kristi could stratify by asking 5 adults, 2 teens, and 3 children.
10. a) The population is the students of the school.
b) The sample is students who use the cafeteria.
c) For the first question, yes, students who use the cafeteria would have an opinion about paint colours for the walls. For the second question, no, students who do not use the cafeteria should also be included in the survey regarding the use of the cafeteria for graduation.
d) No, he should not use the same sample for each question. Even though both questions refer to the cafeteria, the two questions are unrelated. Students who use the cafeteria would have an opinion about paint colours for the walls. But students who do not use the cafeteria should be included in the survey regarding the use of the cafeteria for graduation.
11. a) Yes, there is a bias in Enzo's sample. The bias is surveying people at a baseball game regarding spending the budget on baseball equipment.
b) A random sample of ten students from each class would reflect the overall opinion of the students.
12. There could be 20 different responses from either method. The sample is too small to yield a conclusive result. If Anita uses a stratified sample that is larger, then her method would be better due to more people being involved. Also, the stratified sample would ensure that all departments are represented.
13. Example: She must have enough friends to make a large sample. Her friends' families must represent the population of Canadian households.
14. Example: **a)** Yes; $\frac{12}{50}$ is 24%, so 24% of the people in the survey are allergic to dogs. No; The fact that none of the 50 people surveyed are allergic to hedgehogs does not mean that no people are allergic to hedgehogs.
b) "Are you allergic to any animals? If yes, what animal are you allergic to?" There may be other animals that are not on the list that people are allergic to. Some people may not have allergies to any animals.

16. Example: **a)** The survey assumes everyone surveyed is aware of what the fire department is doing. Rewrite: "Have you had the fire department perform a service for you? If yes, how would you rate the service?"
b) Influencing factors: Who was asked? When were they asked? How were they asked? It could have been a convenience sample that asked people who lived around the fire station. It may have been a voluntary response sample, where people were asked to mail in a response to a survey question that was placed in their mailbox. A random, stratified, or systematic survey would reflect opinions more accurately.

11.3 Probability in Society, pages 435–439

4. He assumed that the random sample was large enough to represent the entire population of light bulbs.
5. If the sample is accurate, 4080 toothpicks would be damaged. Assumption: The sample was random and large enough to represent the population of toothpicks.
6. a) Yes, only vegetarians were sampled. Assuming that there are non-vegetarians in the school population, the supervisor made a false prediction.
b) Example: Ask a larger sample of students, stratifying vegetarian and non-vegetarian students.
7. a) The prediction may be correct, but a larger sample would be more accurate. **b)** Use a larger sample.
8. a) 10 people **b)** The theoretical probability is $33\frac{1}{3}\%$. This assumes each of the three candidates has the same chance of winning. **c)** The experimental probability of 53% is greater than the theoretical probability of $33\frac{1}{3}\%$.
d) If the winner receives the greatest number of votes and the poll represents the population of voters, Candidate A will win.
9. a) 20% **b)** Assumption: Each movie type has the same chance of being selected. **c)** 20%
d) The probabilities are the same. **e)** 600 movies
10. a) 6.5 **b)** 7 **c)** 6 **d)** The samples are close indicators because they were off by 0.5 from the mean of all ten judges.
11. a) The sample is too small, so it may not represent the population of grade 9 students who work part-time. It could be biased. **b)** No, since the sample could be biased.
12. The experimental probability of having a boy is 48.7%. Since this is slightly less than the theoretical probability of 50%, the results confirm the article's claim.
14. a) John used theoretical probability assuming that each vehicle has an equal chance of passing the bus stop. Cathy used an experimental probability method based on her past experience. **b)** John's prediction was 20%. Cathy's was 40%. The experimental probability was about 13%. John was closer.
c) 105 trucks.
15. a) The theoretical probability of giving birth to a girl is $\frac{1}{2}$. So, the theoretical probability of having three girls is $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$. **b)** 0% **c)** The theoretical probability is 12.5% or $\frac{1}{8}$ and the experimental probability is 0%.
d) No, both the theoretical and experimental probabilities are very low. **e)** Assumption: The probability that a newly-born child is a boy is 50%.
16. a) Example: Yes, the sample was random and sufficiently large. **b)** 25% **c)** 1509 students
d) Assumption: The proportion in the general population is the same as the proportion in the sample.

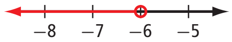
Chapter 11 Review, pages 444–445

1. H
2. C
3. E
4. A
5. G
6. D
7. B
8. I
9. F
10. Example: **a)** The wording is an influencing factor. The use of the word "increased" will tend to make people respond negatively. **b)** The wording is confusing, "What is store-bought bread?" **c)** The sample is biased. Only juice drinkers are asked the survey question.
11. Example: **a)** The influencing factor is the use of language. The question assumes that respondents like cheesecake. Rewrite: "Do you like cheesecake? If yes, what is your favourite flavour?" **b)** The influencing factor is a bias by stating that "everyone loves the Rockets." Rewrite: "Do you like rock music? If yes, who is your favourite rock group?" **c)** The influencing factor is ethics, assuming respondents download music from the Internet. Rewrite: "Do you download music from the Internet? If yes, what music did you download in the past month?"
12. Example: **a)** The population is teens in Canada. Take a stratified sample by categorizing teens by where they live: rural, city, small town. **b)** The population is students in your school. Take a random sample by systematically choosing every 10th student from an alphabetical list. **c)** The population is the gas station retailers in the community. Take a random sample by placing the name of each retailer in a box, and drawing ten names.

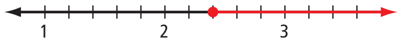
13. a) This is a convenience sample. This sample may not typify the average mall shopper. b) This is a type of stratified sample. But unless the population of each province or territory is the same, selecting 20 youths from each group is not a proportional selection. c) This is a convenience sample. Selecting employees from one store location may not typify the average employee of a fast-food chain.
14. Example: a) A stratified sample of the doctors, nurses, and hospital administrators would be representative of the hospital's needs. b) A systematic sample of every 10th customer who buys a sundae would give a representative random sample.
15. a) convenience b) stratified c) systematic
16. a) Approximately 304 trout b) Assumptions: All fish are equally easy to catch. None of the fish died and none were born. The stream is a closed system and the fish cannot "escape" into a lake or ocean.
c) Example: Wait less time, but long enough to ensure a thorough mixing of the fish. Perhaps four or five days would give more accurate results.
17. Example: a) No. Her sample is biased since all the sample members were also members of her class.
b) She could take a systematic sample by obtaining an alphabetical list of all the grade 9 students and asking every 10th student on the list.
18. Assumption: The sample represents the population of grade 9 students.
Group 1: I agree with this statement because only 12.5% indicated they spent the most money on clothes.
Group 2: I disagree with this statement because only 27% chose cell phones. Cell phones are more expensive than many other forms of entertainment. This may lead students to spend more money on them, but they could attend movies or buy music more often.
Group 3: I agree with this statement because 27% of 500 is 135.
Group 4: I disagree with this statement because less than half of the sample spent money on these items.

Chapters 8–11 Review, pages 450–452

1. a) $x < 1$, since 8 times x is less than 8. $x = \frac{1}{20}$
b) $x > 1$, since x divided by 9 is close to 1, x must be close to 9. $x = 7.5$ c) $x > 1$, since 7 divided by x is less than 1, x must be greater than 7. $x = 28$
d) $x < 1$, since for x to fit into 1 almost 3 times, x must be less than 1. $x = \frac{2}{5}$
2. 3.4 m
3. $3.49
4. 2.5 h
5. 21
6. a) $x \leq 17$ b) $-6.6 \leq x < -5$
7. a) $x < -6$

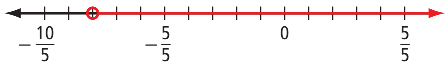


b) $2.4 \leq x$



8. a) $8 \leq x$ b) 1.3 million $< x$ c) $x \leq 3.7\%$ d) $x \leq 10\%$
9. a) $x < 8.8$

b) $x > -\frac{8}{5}$



c) $-50 \leq x$

d) $12 \leq x$

10. a) $4.5 \leq x$ b) $20 < x$ c) $13 > x$ d) $-9 \leq x$
11. More than approximately 9.29 t
12. a) $145t \leq 800$ b) 5.5 or fewer hours
13. after 40 h
14. $\angle DEB = 47°$, $\angle DCB = 94°$
15. CE = 5.4 cm
16. EF = 48 mm
17. 138 cm
18. Example: a) The wording leads the respondents to choose cards. Rewrite: "Do you play cards?"
b) People surveyed may not drink milk. Rewrite: "Do you drink milk? If yes, what type do you prefer to drink?"
19. Example: a) The population is students.
b) A convenience sample could be used, in which you ask your friends. A systematic sample could be used, in which you obtain an alphabetical list of students in your school, and ask every 10th student on the list.

20. Example: **a)** The population is the audience of the talk show. A voluntary sample of people watching the show could be used. **b)** The population is the people in the book store. The author could use a convenience sample by asking the first 50 people who enter the store.
c) The population is the students of the school. The sample could be a systematic sample of every 20th student on the school roster.
21. Example: **a)** The population is department managers and sales associates. **b)** The sampling method is random. **c)** Yes; there is a random sample of 20 stores, a random sample of 40 departments, and a random sample of department managers and sales associates.
22. Example: **a)** Since the grade 9 students were the only ones sampled, they assumed they knew what the elementary students would want to eat for the barbecue. **b)** A stratified sample would work best. Group the school by grades, and take a proportional sample of each grade.
23. a) 50% **b)** The assumption is that there is an equal chance of each answer being either correct or incorrect.
c) Example: Flipping a coin could be used to model this experiment. **e)** An experiment of only ten trials may not be enough to accurately predict the outcome.