Answer Key

MathWorks 12

Workbook

Pacific Educational Press

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ANSWER KEY

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Answer Key

CHAPTER 1
LINEAR RELATIONS
1.1 LINEAR RELATIONS IN TABLES AND GRAPHS

REVIEW: WORKING WITH SLOPE

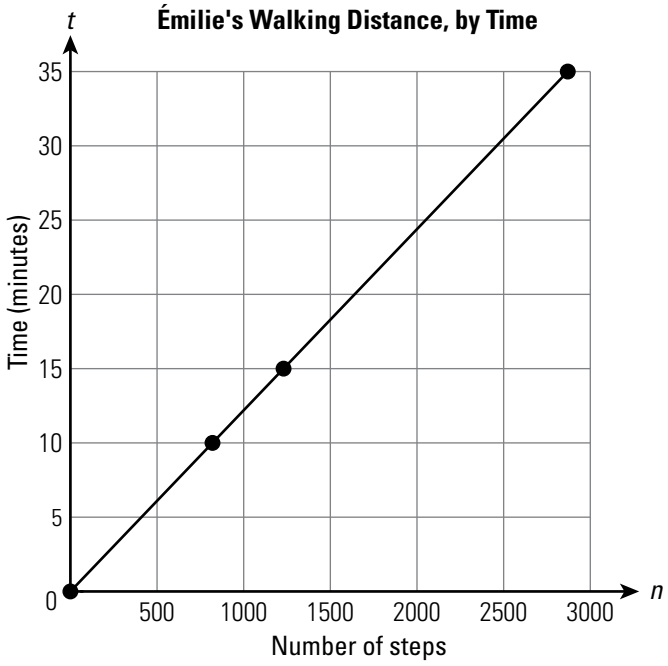
BUILD YOUR SKILLS, p. 10

1. $\frac{1}{7}$ or approximately 0.14
2. 263.2 cm
3. 45.7 cm

NEW SKILLS: WORKING WITH LINEAR RELATIONS

BUILD YOUR SKILLS, p. 14

4. a)



Yes, you should connect the points on the graph, because Émilie's walking distance will vary continuously with the amount of time walked.

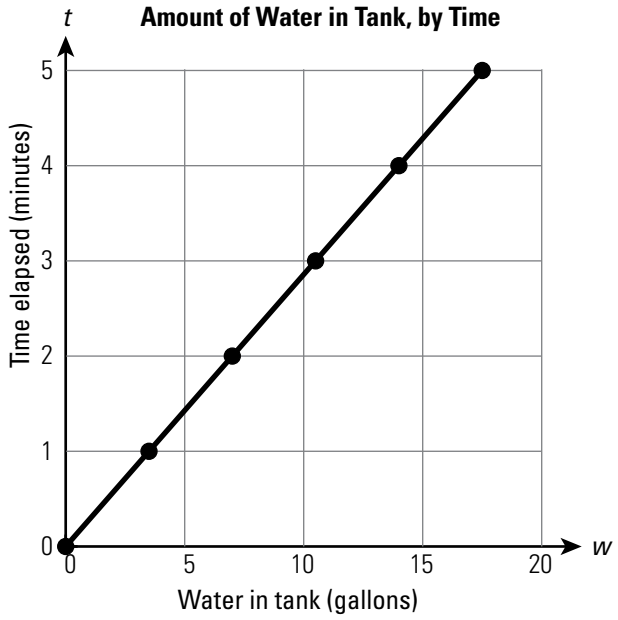
b) Yes, the graph appears to be linear. The slope is 82.

c) The slope represents the number of steps in a given time. This means that Émilie must be walking at a fairly steady pace of approximately 82 steps per minute.

5. a)

AMOUNT OF WATER IN TANK, BY TIME

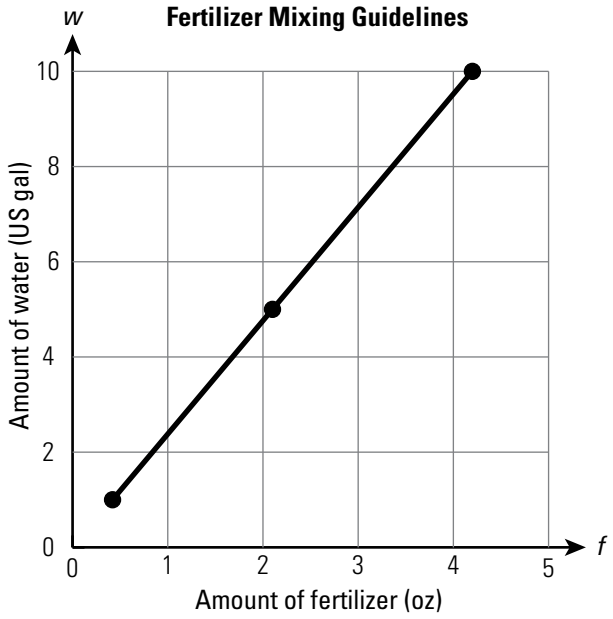
Time elapsed (minutes)	*Water in tank (gallons)*
0	0
1	3.5
2	7
3	10.5
4	14
5	17.5



b) The slope is 3.5. It indicates that the water tank is being filled at a rate of 3.5 gallons per minute.

c) 7.14 minutes

6. a)



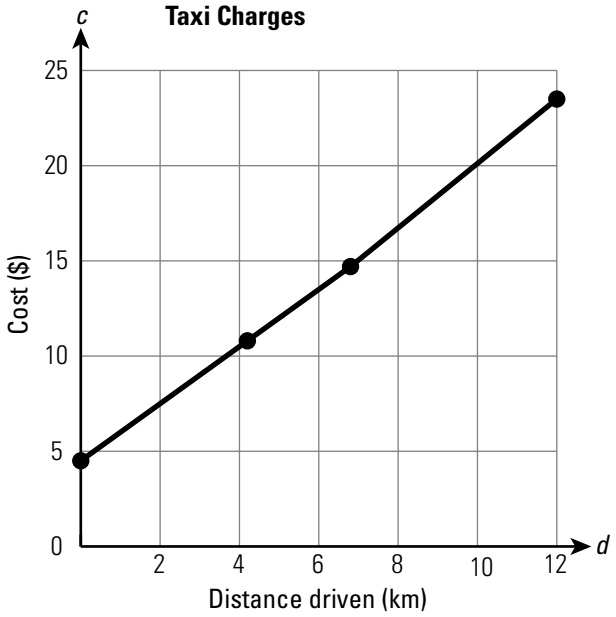
b) Yes, the graph shows a direct linear relation because it shows a straight line that passes through (0, 0).

c) 7 US gal

NEW SKILLS: WORKING WITH PARTIAL VARIATION

BUILD YOUR SKILLS, p. 18

7. a)



b) The slope is the same between any three points on the line. This tells you that the relationship between the distance driven and the cost is linear.

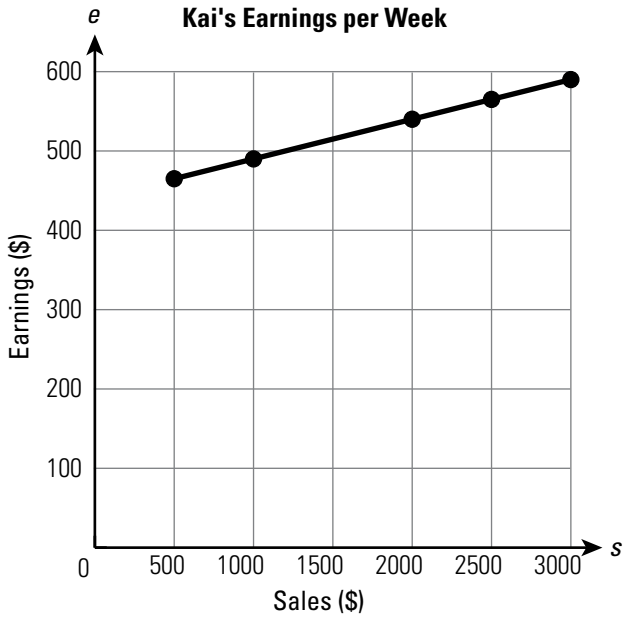
c) The slope represents the cost per kilometre driven in a taxi.

d) The *y*-intercept represents the starting cost (or pick-up fee) of a taxi ride.

8. a)

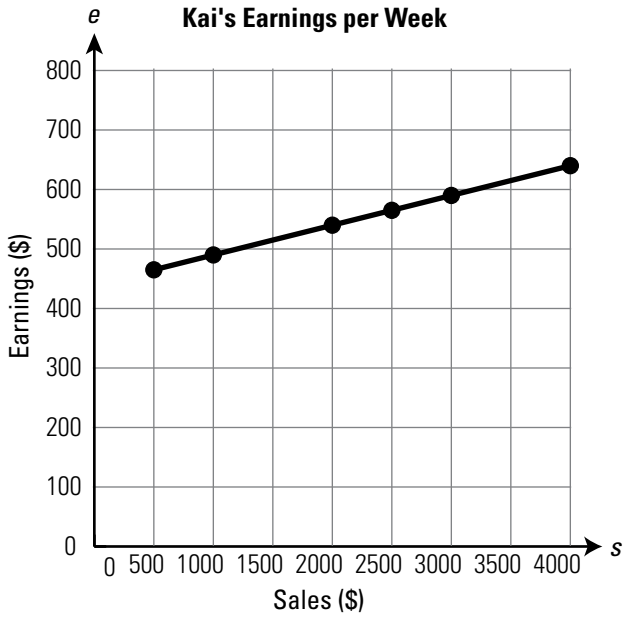
KAI'S EARNINGS PER WEEK

Sales	*Earnings*
$500.00	$465.00
$1000.00	$490.00
$2000.00	$540.00
$2500.00	$565.00
$3000.00	$440.00 + (0.05 × $3000.00) = $590.00



b) The graph shows a partial linear relation. It does not pass through the origin.

c)



Kai would earn $640.00 if he made sales of $4000.00 in one week.

d) The slope of 0.05 represents the amount of money Kai earns as commission ($0.05) per dollar of sales.

NEW SKILLS: WORKING WITH NEGATIVE SLOPE

BUILD YOUR SKILLS, p. 23

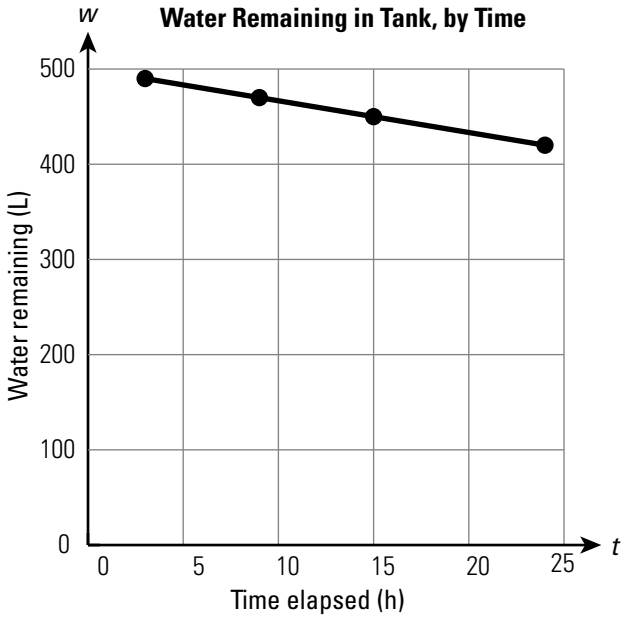
9. a) approximately $225.00

b) The slope of −15 indicates that Henrik spends on average $15.00/day for food.

10. a)

WATER REMAINING IN TANK, BY TIME

Time elapsed (h)	*Water remaining (L)*
3	490 L
9	470 L
15	450 L
24	420 L



b) slope $= -3\frac{1}{3}$ or about -3.33

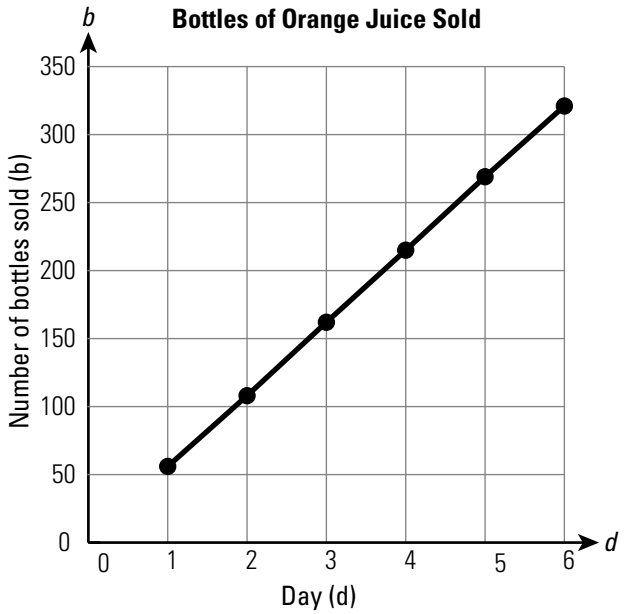
It represents the amount of water leaking out of the tank per hour.

c) 150 hours

NEW SKILLS: IDENTIFYING NON-LINEAR RELATIONS

BUILD YOUR SKILLS, p. 26

11. a)



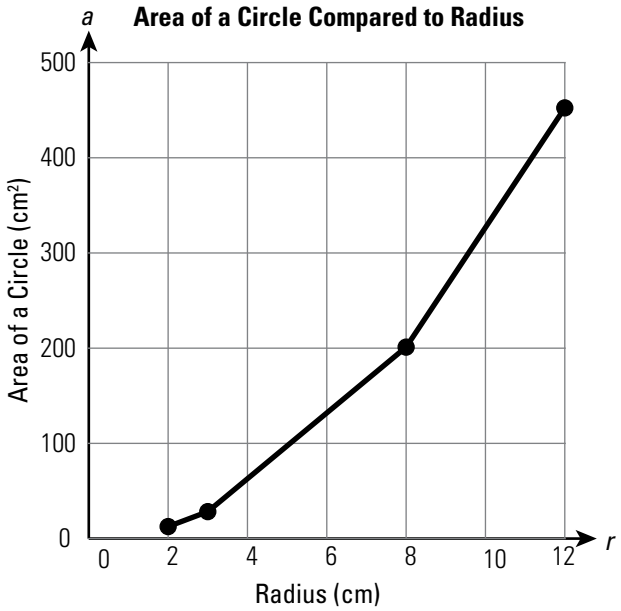
b) Yes, the graph does appear to be linear. However, the slopes of two sections of the graph are not the same, so the graph is not linear.

12. a)

AREA OF CIRCLE COMPARED TO RADIUS

Radius (cm)	*Area (cm²)*
2	12.6
3	28.3
8	201.1
12	452.4

b)



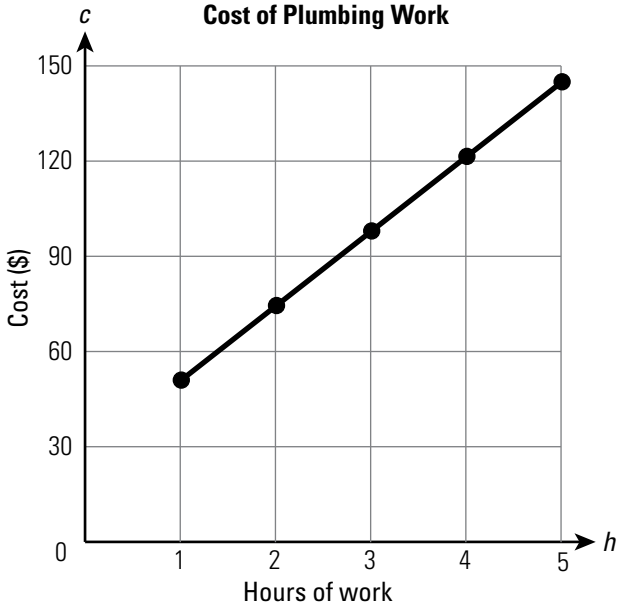
It is not linear, because the data points do not form a straight line and the slopes between the data points are not equal.

PRACTISE YOUR NEW SKILLS, p. 28

1. a) $\frac{1}{8}$ or 0.125

   b) 11.25 m

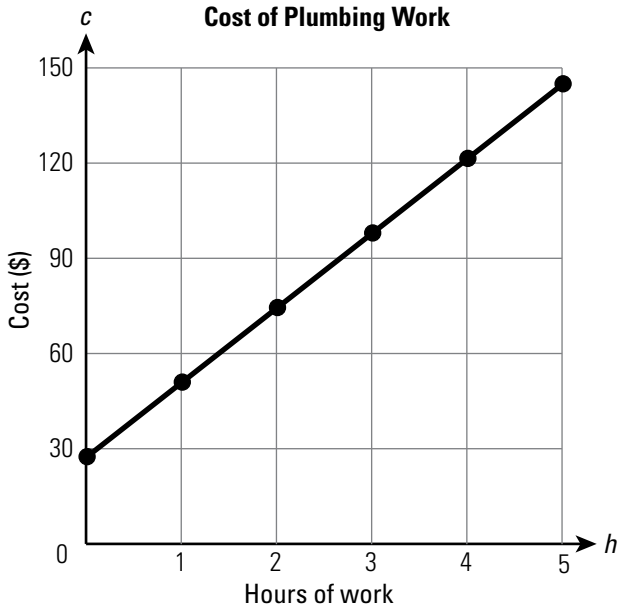
2. a)



Yes, this is a linear relationship because the data points form a straight line and the slope is the same between all points.

b) The slope is 23.50. It represents the hourly fee ($23.50/hour) that the plumber charges in addition to the flat rate for plumbing.

c)

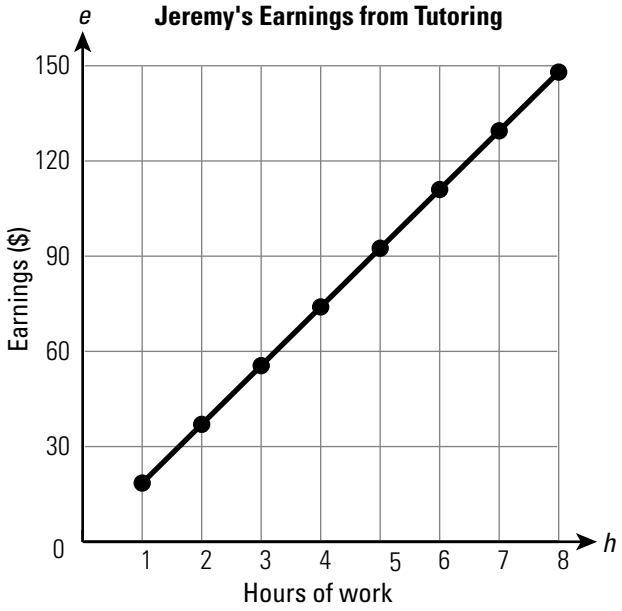


The *y*-intercept is approximately $27.50. This represents the flat rate that the plumber charges for making a house call.

3. a)

JEREMY'S EARNINGS FROM TUTORING	
Hours of work	*Earnings*
1	$18.50
2	$37.00
3	$55.50
4	$74.00
5	$92.50
6	$111.00
7	$129.50
8	$148.00

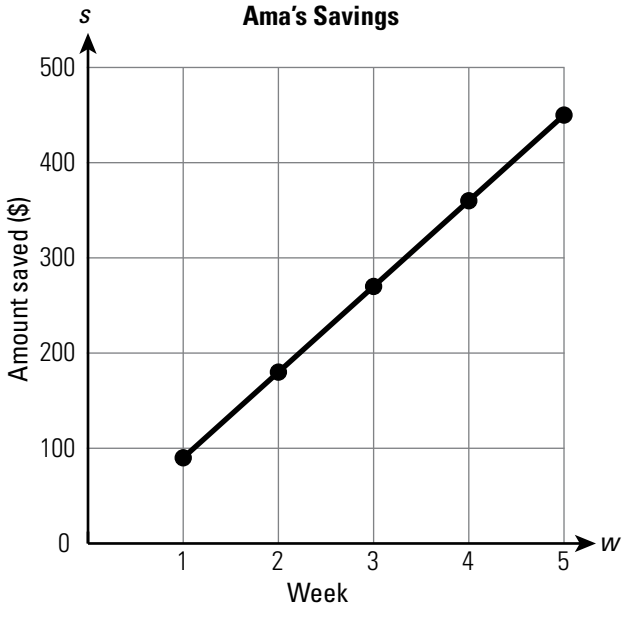
b)



Yes, you can connect the points on the graph because Jeremy probably earns wages for partial hours of work, and the line helps you to see the trend in the data.

4. a)

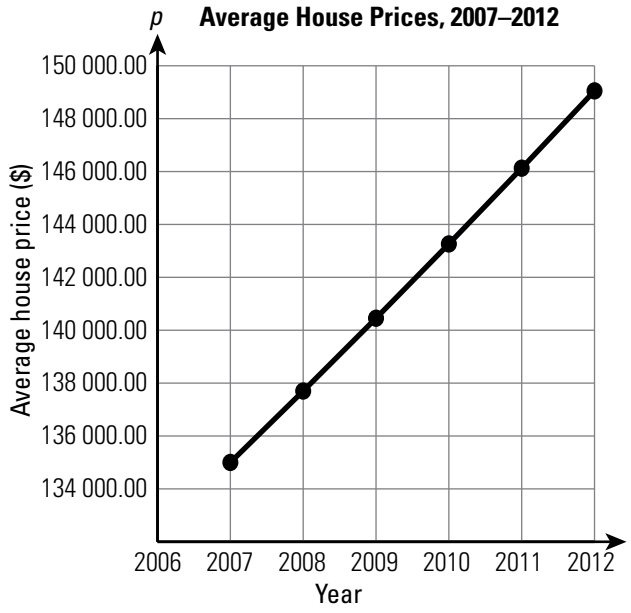
AMA'S SAVINGS	
Week	*Amount saved*
1	$90.00
2	$180.00
3	$270.00
4	$360.00
5	$450.00



b) The slope is 90.00. It represents the amount of money Ama saves per week.

5.

AVERAGE HOUSE PRICES, 2007–2012	
Year	*Average house price*
2007	$135 000.00
2008	$137 700.00
2009	$140 454.00
2010	$143 263.08
2011	$146 128.34
2012	$149 050.91



The slopes between two pairs of points are not the same, so the relationship is non-linear.

1.2 THE EQUATION OF A LINE

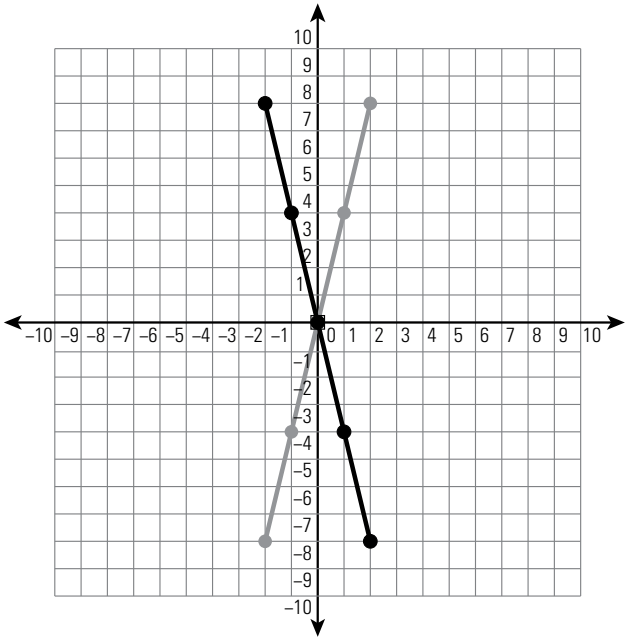
NEW SKILLS: WORKING WITH EQUATIONS OF DIRECT LINEAR RELATIONS

BUILD YOUR SKILLS, p. 33

1.

$y = -4x$	
x	y
–2	8
–1	4
0	0
1	–4
2	–8

$y = 4x$	
x	y
–2	–8
–1	–4
0	0
1	4
2	8

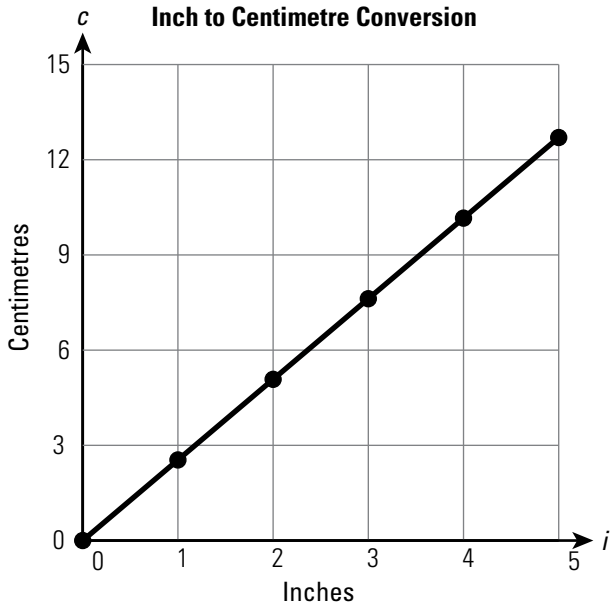


The slope of the first line ($y = -4x$) falls from left to right; the line has a negative slope. The slope of the second line ($y = 4x$) rises from left to right; the line has a positive slope. Both lines pass through the origin.

NEW SKILLS: WRITING EQUATIONS FOR DIRECT LINEAR RELATIONS

BUILD YOUR SKILLS, p. 35

2. a)



b) 2.54

c) centimetres = 2.54 × (inches)

d) 18 inches = 45.72 centimetres

3. a) pounds = 2.2 × (kilograms)

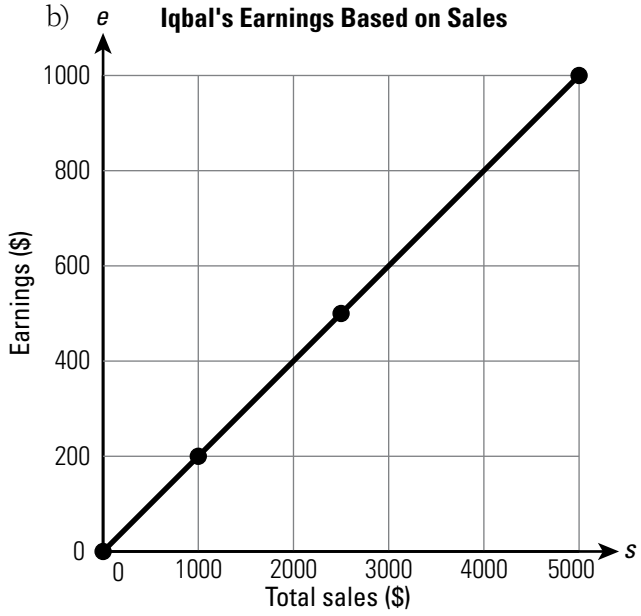
b) 15 kg = 33 lb

4. a)

IQBAL'S EARNINGS BASED ON SALES

Total sales	*Earnings*
0	0
$1000.00	$200.00
$2500.00	$500.00
$5000.00	$1000.00

b)



c) Iqbal's earnings equal 20% of his sales.

income = 0.20 × (sales)

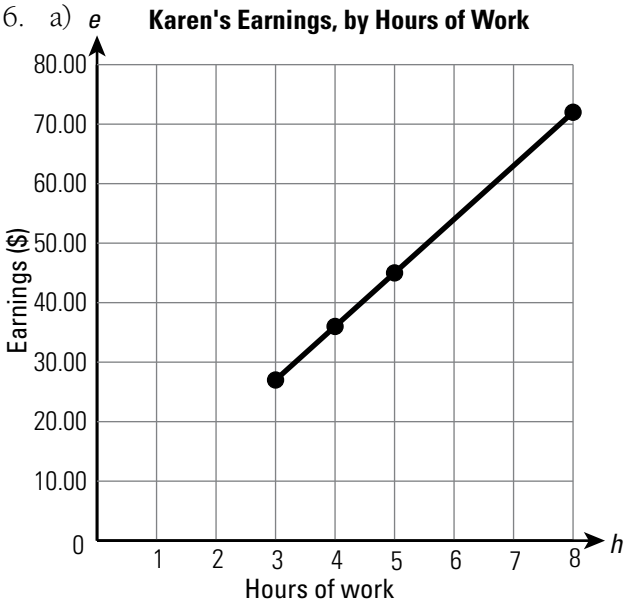
BUILD YOUR SKILLS, p. 39

5. a) The slope is 12. It represents the rate of the water flow. The tank is being filled at a rate of 12 cm of depth per hour.

b) depth of water = 12 × (time)

c) 30 hours

6. a)



b) The graph appears to be linear, because the data seems to form a straight line. The slope is the same any two pairs of points, so the relation is linear.

c) \$9.00/hour

d) earnings = \$9.00 × (hours of work)

e) 11 hours

NEW SKILLS: WORKING WITH EQUATIONS OF PARTIAL LINEAR RELATIONS

BUILD YOUR SKILLS, p. 42

7. a) $y = 6x - 5$

b) $y = \frac{3}{4}x + 15$

8. $y = -5x - 3$

When x is 3, y is –18.

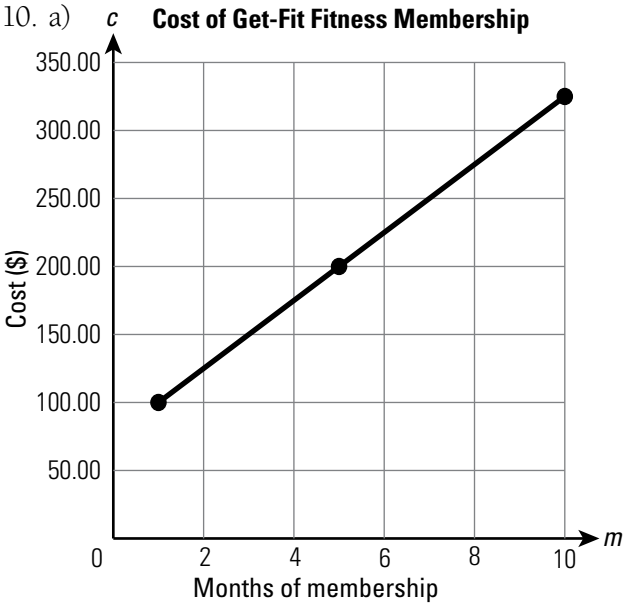
9. a) $y = 12.5x + 25.5$

b) 150.5

c) 15

BUILD YOUR SKILLS, p. 45

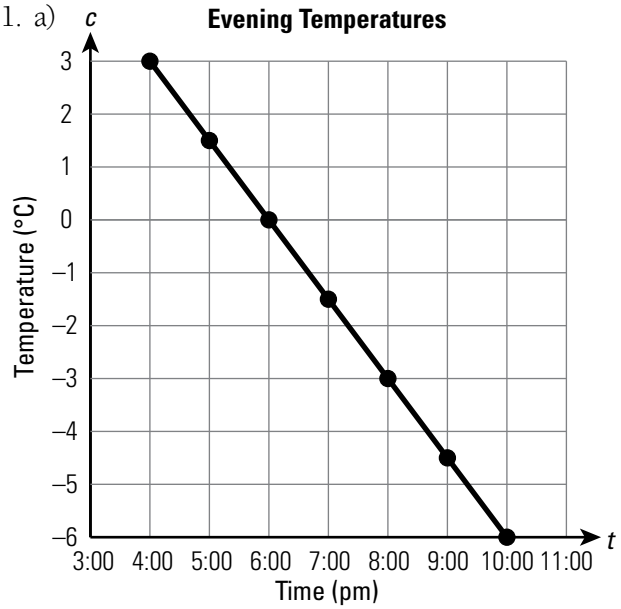
10. a)



b) cost of membership = \$25.00 × (months of membership) + \$75.00

c) \$300.00

11. a)



b) slope = –1.5

The slope represents the change in temperature per hour.

c) –6°C

d) Answers will vary. The trend is not likely to continue all night.

12. a) total cost = \$30.00 × (hours of work) + \$50.00

b) 6 hours

BUILD YOUR SKILLS, p. 48

13. a)

GINA'S EARNINGS BASED ON TOTAL SALES

Sales	*Earnings*
\$10 000.00	\$1150.00
\$20 000.00	\$1550.00
\$30 000.00	\$1950.00

b) earnings = 0.04 × (sales) + \$750.00

c) $4750.00

d) Gina would earn $850.00 more with the new salary and commission rate.

e) $15 000.00

14. a) cost A = $6.50 × (number of people)

cost B = $5.25 × (number of people) + $10.00

b) cost A = $143.00

cost B = $125.50

c) 8 sandwiches

PRACTISE YOUR NEW SKILLS, p. 50

1. a) earnings = $14.75 × (hours of work)

b) The slope is 14.75. It represents Koreen's earnings per hour of work.

c) $516.25

2. The slopes between two pairs of points are not equal, so the relationship is not linear.

3. a) 70 km/h

b)

MIGRATING GEESE'S DISTANCE FROM STARTING POINT, BY TIME ELAPSED

Time elapsed (h)	*Distance flown (km)*
0	0
1	70
2	140
3	210
4	280
5	350

c) distance travelled = 70 × (hours of travel)

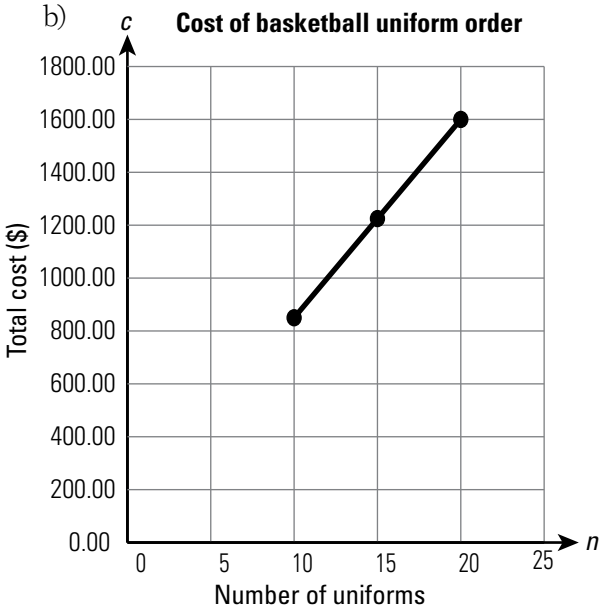
d) 42.9 hours

4. a)

COST OF BASKETBALL UNIFORM ORDER

Number of uniforms	*Total cost*
10	$850.00
15	$1225.00
20	$1600.00

b)



c) The slope is 75. It represents the cost per uniform (without the flat fee).

d) The *y*-intercept is the flat rate charged to set up the uniform design, $100.00.

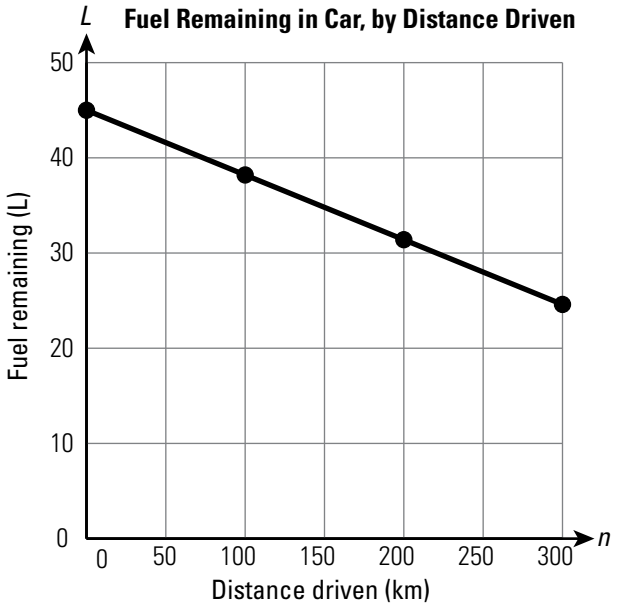
e) cost = $75.00 × (number of uniforms) + $100.00

5. a)

FUEL REMAINING IN CAR, BY DISTANCE DRIVEN

Distance driven (km)	*Fuel remaining (L)*
0	45
100	38.2
200	31.4
300	24.6

b)



c) 7.6 L

d) 661.8 km

e)

$$\text{fuel remaining in tank} = -\frac{6.8}{100}(\text{distance driven}) + 45$$

1.3 SCATTERPLOTS AND LINEAR TRENDS

BUILD YOUR SKILLS, p. 58

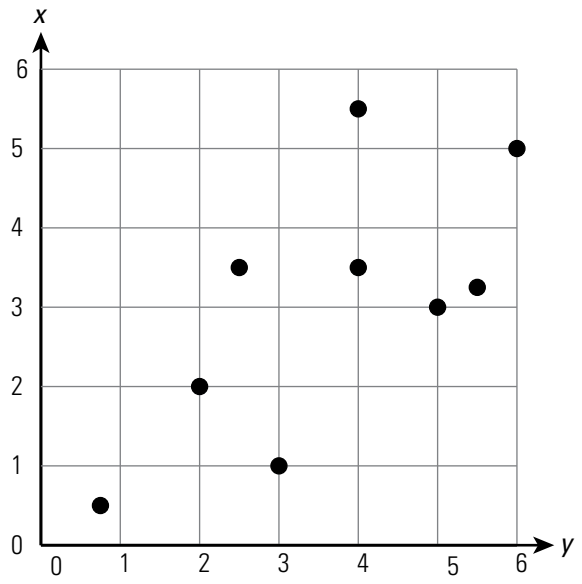
1. Similarities:

   - Both show linear relationships.
   - Both show partial linear relations.
   - Both have *y*-intercepts around 1.
   - Both show a positive correlation.

   Differences:

   - Scatterplot a) shows a strong correlation, while scatterplot b) shows a moderate correlation.
   - Scatterplot a) has one outlier, while scatterplot b) has none.

2. a)

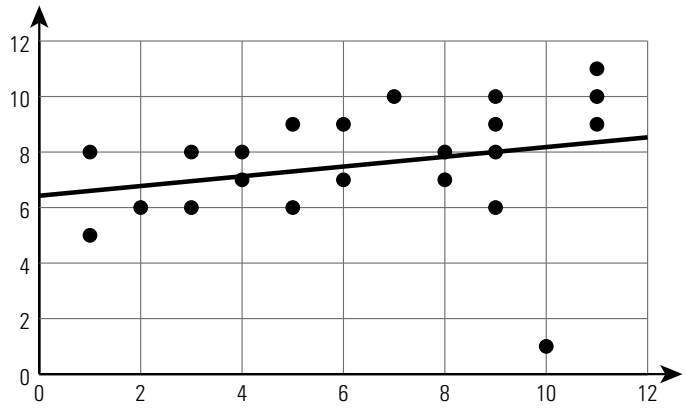


b) The relationship between *x* and *y* appears to be linear and direct.

The correlation between the variables is positive, and the strength of the correlation is weak.

Answers will vary regarding the presence of outliers. The data point at (4, 5.5) may be considered an outlier.

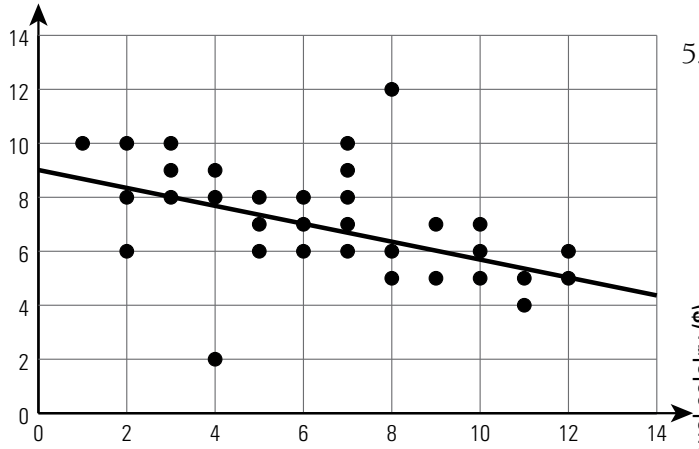
3. a)



Answers will vary based on where the line of best fit is drawn.

$$y = \frac{1}{6}x + 6.5$$

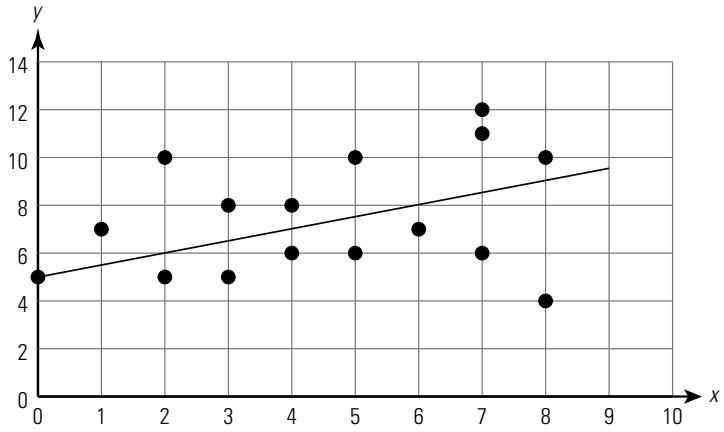
b)



Answers will vary based on where the line of best fit is drawn.

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

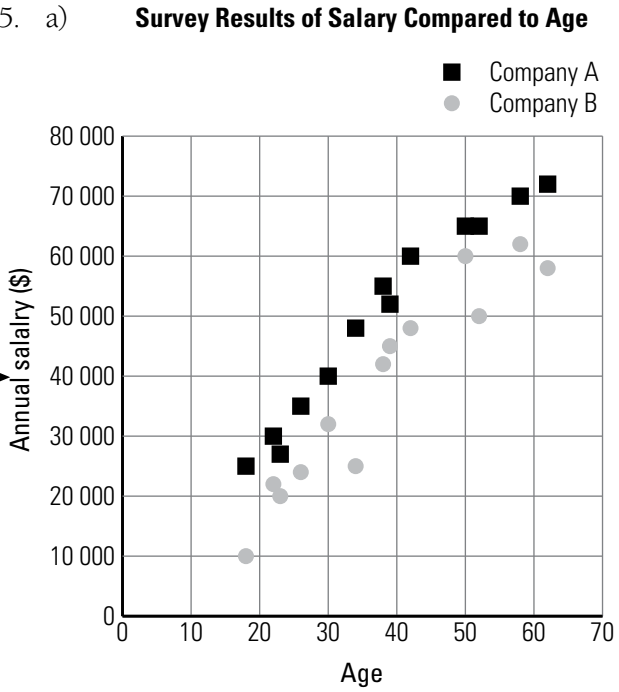
4. a) Answers will vary.



b) $y = \frac{1}{2}x + 5$

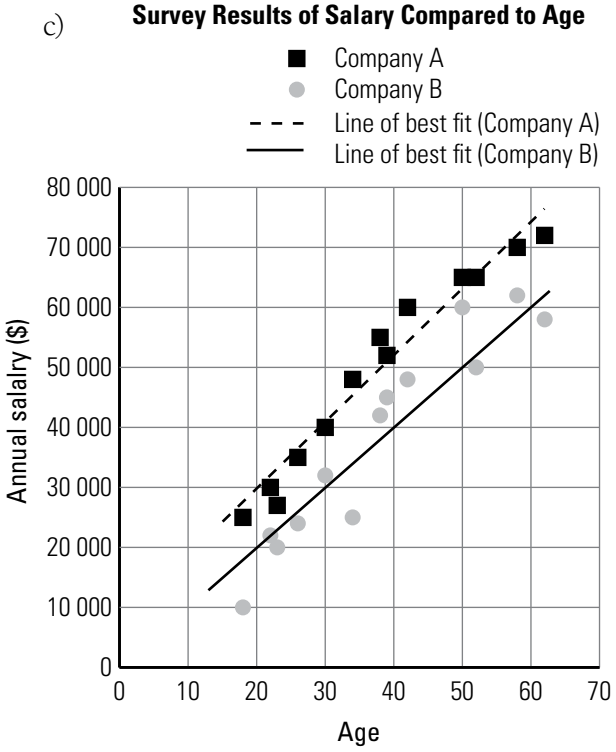
BUILD YOUR SKILLS, p. 65

5. a)



b) Both companies show a positive correlation between age and annual salary. The correlation is stronger for Company A. Salaries tend to be higher in Company A.

c)



Answers will vary based on where the lines of best fit are drawn.

Company A:

annual salary = 1000(age) + 10 000

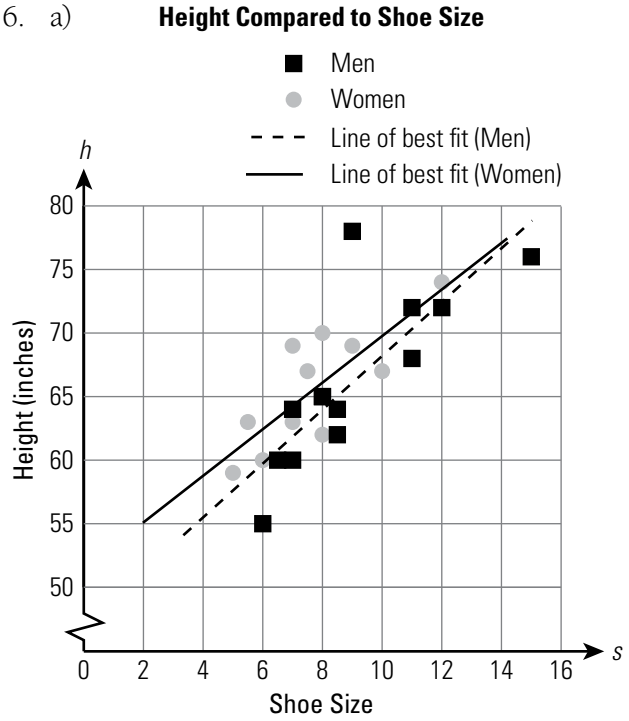
Company B:

annual salary = 1000(age)

d) Company A: $55 000.00

Company B: $45 000.00

6. a)



b) No, neither set of data shows a stronger correlation that the other. This is to be expected, as shoe size should vary by height for both males and females.

c) Answers will vary based on where the line of best fit is drawn.

Following the trend seen in the scatterplot, Robert Wadlow's shoe size would be 29.5.

d) Answers will vary based on where the line of best fit is drawn.

Following the trend seen in the scatterplot, Chandra Bahadur Dangi's shoe size would be –13.25. This does not make sense. Shoes do not come in a negative size. The ratio of his height compared to his shoe size must be different from that of a man of average height.

e) Answers will vary based on where the line of best fit is drawn.

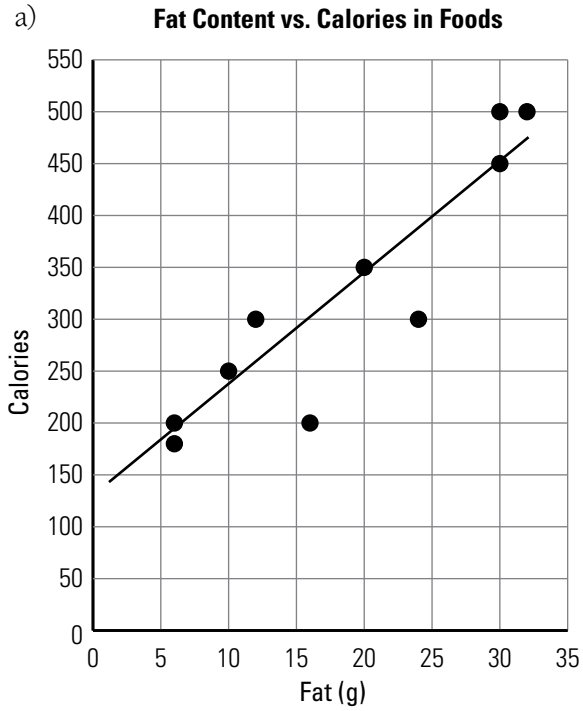
Following the trend seen in the scatterplot, Zen Jinlian's shoe size would be about 27.

PRACTISE YOUR NEW SKILLS, p. 68

1. a) The scatterplot shows a direct linear relation. The correlation is positive and strong. There is one outlier at (7, 0.5).

b) The scatterplot shows a partial linear relation. The correlation is negative and moderate. There are no outliers.

2. a)



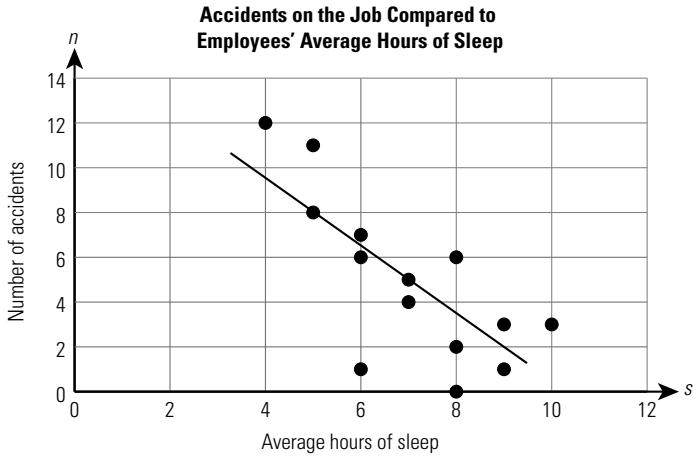
b) Answers will vary based on where the line of best fit is drawn.

calories = 10(fat content) + 150

c) Answers will vary based on where the line of best fit is drawn. Using the equation above, 290 calories.

3. a) The relationship between hours of sleep and number of accidents is linear and partial. The correlation between the variables is negative and moderate. There appears to be an outlier at (6, 1).

b)



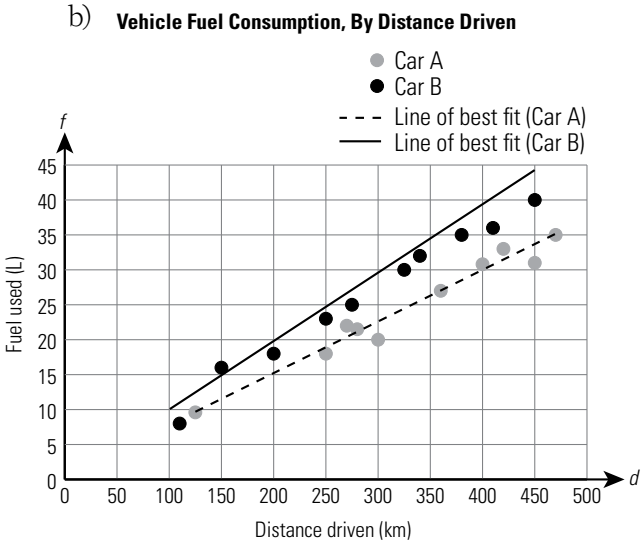
Answers will vary based on where the line of best fit is drawn.

$$\text{number of accidents} = -\frac{3}{2}(\text{hours of sleep}) + 15.5$$

c) It is not possible for the line of best fit to extend below 0 on the *y*-axis, because it is not possible to have a negative number of accidents.

4. a) Car A seems to be more fuel efficient. It uses less fuel by distance driven.

b)



Answers will vary based on where lines of best fit are drawn.

Car A:

fuel used = 0.075 × (distance driven)

Car B:

fuel used = 0.1 × (distance driven)

c) Car A: 400 km

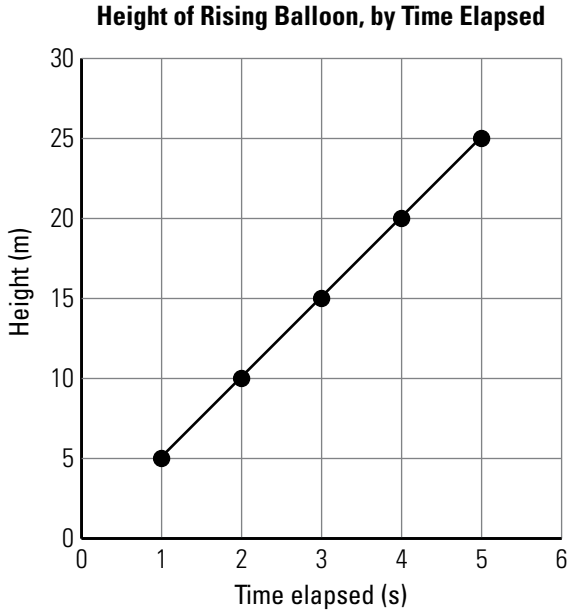
Car B: 300 km

CHAPTER TEST, p. 72

1. a)

HEIGHT OF RISING BALLOON, BY TIME ELAPSED

Time elapsed (seconds)	*Height (m)*
1	5
2	10
3	15
4	20
5	25



b) height = 5 × (time elapsed)

c) 60 seconds

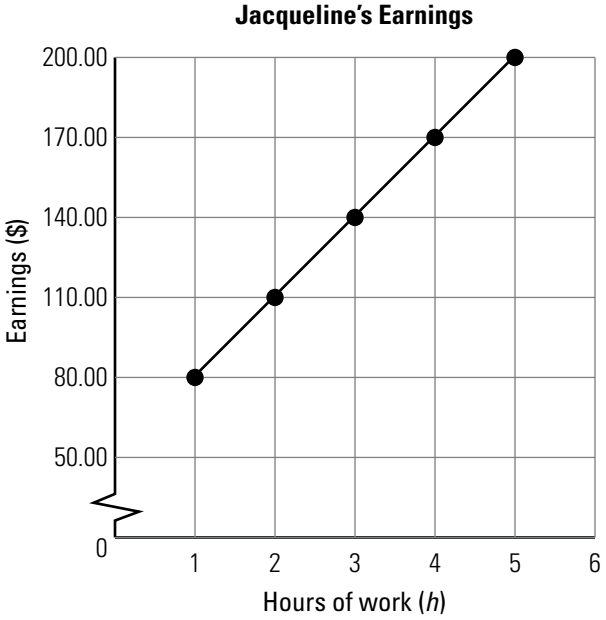
2. a) cost = \$7.50 × (hours of rental)

b) \$37.50

3. a)

JACQUELINE'S EARNINGS

Hours of work	*Earnings*
1	\$80.00
2	\$110.00
3	\$140.00
4	\$170.00
5	\$200.00



The relationship between hours of work and earnings is a partial linear relation.

b) The slope is 30. It represents Jacqueline's hourly wage (\$30.00).

c) The *y*-intercept is 50. It represents Jacqueline's flat fee for house calls (\$50.00).

d) earnings = \$30.00 × (hours of work) + \$50.00

4. a) **Gym A:**

cost = \$19.99 × (months of membership) + \$100.00

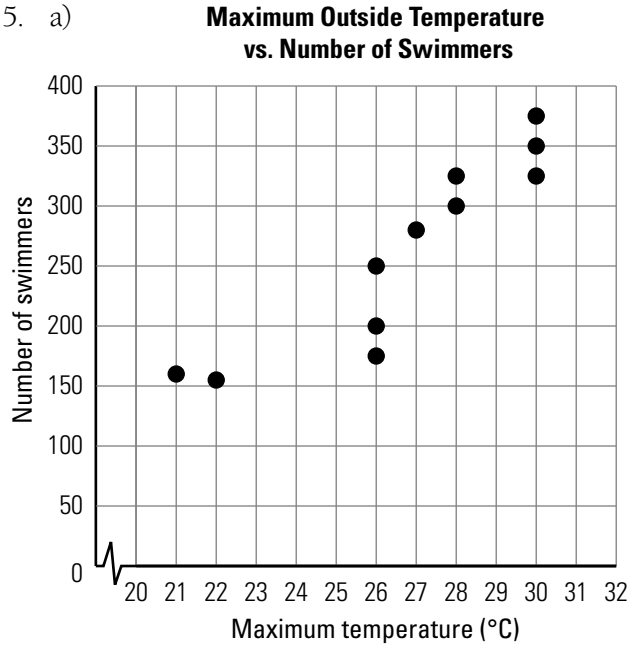
Gym B:

cost = \$29.99 × (months of membership)

b) Gym A

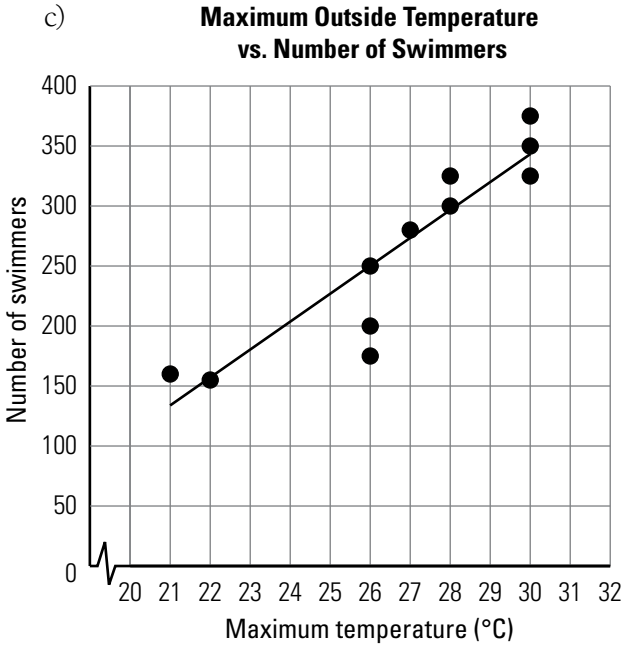
c) 10 months

5. a)



b) The relationship between maximum temperature and number of swimmers shows that, the higher the maximum temperature, the more swimmers will come to the pool. That is, the correlation between the variables is linear and positive.

c)



Answers will vary based on where the line of best fit is drawn.

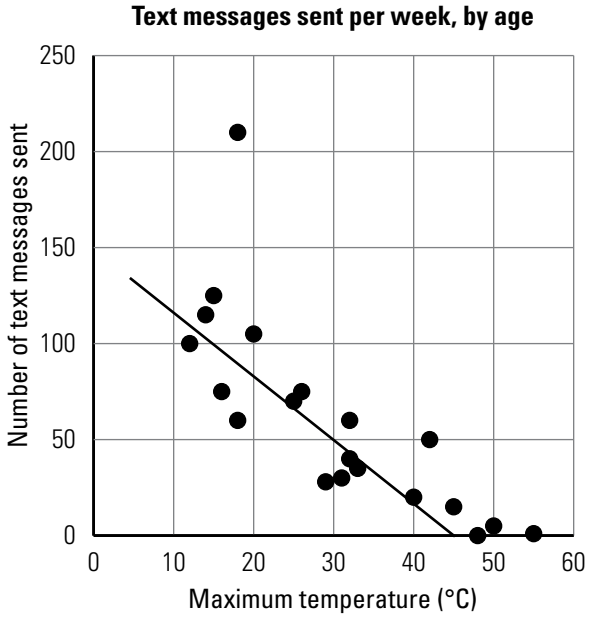
number of swimmers = 25 × (max. temperature) – 400

d) Answers will vary based on where the line of best fit is drawn.

475 swimmers

6. a) The relationship between age and number of text messages sent is linear and partial. The correlation is negative and strong. There appears to be one outlier in the data at about (18, 210).

b)



Answers will vary based on where the line of best fit is drawn.

$$\text{number of text messages sent} = -\frac{10}{3}(\text{age}) + 150$$

c) Answers will vary based on where the line of best fit is drawn. Using the equation above, 33 texts per week.

d) Answers will vary based on where the line of best fit is drawn. Using the equation above, 15 years old.

CHAPTER 2
LIMITS TO MEASUREMENT
2.1 ACCURACY AND PRECISION

REVIEW: WORKING WITH THE SYSTÈME INTERNATIONAL

BUILD YOUR SKILLS, p. 79

1. a) 1.80 m
   b) 76 m
   c) 8.4 km
   d) 9680 mm
2. See table at the bottom of this page.

REVIEW: WORKING WITH ROUNDING

BUILD YOUR SKILLS, p. 80

3. a) 567.3 mm
   b) 65.7 cm
   c) 2.2 m
   d) 0.1 km
4. a) 92.79 cm
   b) 6250.07 m
   c) 0.90 km
   d) 640.42 hm
5. a) 2988 km
   b) 13 m
   c) 6 cm
   d) 0 m

NEW SKILLS: WORKING WITH ACCURACY

BUILD YOUR SKILLS, p. 82

6. Answers will vary. It is not possible to accurately tell the time, but you can estimate the approximate time.
7. Answers will vary.
8. Answers will vary.

NEW SKILLS: WORKING WITH PRECISION AND ACCURACY

BUILD YOUR SKILLS, p. 84

9. precision = 1 cm
   uncertainty = ±0.5 cm
10. precision = 0.1 km
    uncertainty = ±0.05 km
11. precision = 0.1°C
    uncertainty = ±0.05°C

Build Your Skills, #2

UNITS OF LENGTH IN THE SYSTÈME INTERNATIONAL

millimetre (mm)	*centimetre (cm)*	*decimetre (dm)*	*metre (m)*	*decametre (dam)*	*hectometre (hm)*	*kilometre (km)*
2 800 000	280 000	28 000	2800	280	28	2.8
325.5	32.55	3.255	0.3255	0.032 55	0.003 255	0.000 325 5
1 785 000	178 500	17 850	1785	178.5	17.85	1.785

BUILD YOUR SKILLS, p. 85

12. a) 1.75 m ± 0.005 m

    b) 1.745 m to 1.755 m

13. a) precision = 10°C

    uncertainty = ±5°C

    b) maximum = 165°C

    minimum = 155°C

14. a) precision = 0.01 s

    b) 2:20.115 to 2:20.125

NEW SKILLS: ADDING AND SUBTRACTING VALUES WITH UNCERTAINTIES

BUILD YOUR SKILLS, p. 88

15. a) precision = 0.01 g

    uncertainty = ±0.005 g

    b) maximum = 14.96 g

    minimum = 14.94 g

16. a) 4 ± 0.25 L

    b) 375 ± 62.5 mL

    c) 3625 ± 312.5 mL or 3.625 L ± 0.3125 L

17. The maximum width of the kitchen cupboards is 131.5 cm. Since this is larger than the minimum width of the kitchen space, Danita cannot assume they will fit in the available space.

PRACTISE YOUR NEW SKILLS, p. 89

1. See table at the bottom of this page.

2. a) 1.09 km

   b) 30 cm

   c) 6021.1 mm

3. a) Answers will vary.

   b) Answers will vary.

   c) This method would give an accurate measurement.

4. a) precision = 1 cm

   11 ± 0.5 cm

5. a) precision = 2 mL

   uncertainty = ±1 mL

   b) maximum = 25 mL

   minimum = 23 mL

6. a) You can assume that the precision of the scale is to 0.1 kg.

   b) uncertainty = ±0.05 kg

   c) maximum = 22.55 kg

   minimum = 22.25 kg

7. 7.5 ± 0.15 m

Practise Your New Skills, #1

UNITS OF LENGTH IN THE SYSTÈME INTERNATIONAL

millimetre (mm)	*centimetre (cm)*	*decimetre (dm)*	*metre (m)*	*decametre (dam)*	*hectometre (hm)*	*kilometre (km)*
123 100	12 310	1231	123.1	12.31	1.231	0.1231
3159	315.9	31.59	3.159	0.3159	0.03159	0.003159
29 150 000	2 915 000	291 500	29 150	2915	291.5	29.15

2.2 TOLERANCES

REVIEW: ADDING AND SUBTRACTING FRACTIONS

BUILD YOUR SKILLS, p. 93

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

   b) $2\frac{5}{16}$

   c) $3\frac{1}{16}$

   d) $\frac{11}{16}$

   e) $9\frac{3}{8}$

   f) $3\frac{11}{16}$

NEW SKILLS: WORKING WITH TOLERANCE

BUILD YOUR SKILLS, p. 96

2. a) 25.5 ± 0.25 mm

   b) 19 ± 3°C

   c) 19.5″ ± 0.5″

3. a) nominal value = 34″

   ±range = $\frac{1}{4}$″

   b) tolerance = $\frac{1}{2}$″

   c) minimum value$^{+\text{tolerance}}_{-0}$: $33\frac{3}{4}$″$^{+\frac{1}{2}\text{″}}_{-0}$

   maximum value$^{+0}_{-\text{tolerance}}$: $34\frac{1}{4}$″$^{+0}_{-\frac{1}{2}\text{″}}$

4. a) tolerance = 0.12 mm

   b) 16.22 ± 0.06 mm

   c) $^{16.28\text{ mm}}_{16.16\text{ mm}}$

BUILD YOUR SKILLS, p. 98

5. **ACCEPTABLE MEASURED VALUES**

Measured dimension (m)	*Acceptable? (Yes/No)*
16.056 72	No
16.055 757	Yes
16.056 05	Yes
16.055 85	Yes
16.056 25	Yes
16.055 655	Yes
16.055 35	No

6. a) maximum = 355°F

   minimum = 345°F

   b) maximum = $18\frac{1}{8}$″

   minimum = $17\frac{7}{8}$″

   c) maximum = 25 mm

   minimum = 24.5 mm

   d) minimum = 1.175 cm

   maximum = 1.225 cm

   e) maximum = $3\frac{1}{2}$″

   minimum = $3\frac{3}{8}$″

   f) minimum = $24\frac{1}{4}$″

   maximum = $24\frac{3}{8}$″

7. a) maximum = 8.9025 cm

   minimum = 8.8975 cm

   b) 8.8975 cm $^{+0.005\text{ cm}}_{-0}$

BUILD YOUR SKILLS, p. 101

8. a) 98.5 ohms to 101.5 ohms

   b) 100 ± 1.5 ohms

9. a) maximum width = $7\frac{1}{2}''$

   minimum width = $7''$

   tolerance of the width = $\frac{1}{2}''$

   maximum length = $9\frac{1}{2}''$

   minimum length = $9''$

   tolerance of the length = $\frac{1}{2}''$

   b) It would be best to make the glass larger than necessary and than trim it as necessary. To demonstrate this, you could right the values as shown:

   width: $7\frac{1}{2}''\ ^{+0}_{-\frac{1}{2}''}$

   length: $9\frac{1}{2}''\ ^{+0}_{-\frac{1}{2}''}$

10. a) $^{1.22\text{ cm}}_{1.18\text{ cm}}$

    b) There is tolerance for the diameter of the peg because it has to be small enough that it fits in the hole, but big enough that it won't fall out.

2. a) width = $18''$

   height = $7''$

   b) tolerance of the width = $\frac{1}{8}''$

   tolerance of the height = $\frac{1}{8}''$

   c) width = $18 \pm \frac{1}{16}''$

   height = $7 \pm \frac{1}{16}''$

3. a) $^{10.25°C}_{9.75°C}$

   b) 10±0.25°C

4. tolerance = 0.0002 mg

   maximum = 0.0407 mg

   minimum = 0.0405 mg

5. a) 49.5 mm

   b) i) $^{64\text{ mm}}_{35\text{ mm}}$

   ii) $64\text{ mm}\ ^{+0}_{-29\text{ mm}}$

   iii) $35\text{ mm}\ ^{+29\text{ mm}}_{-0}$

   iv) 49.5 ± 14.5 mm

PRACTISE YOUR NEW SKILLS, p. 102

1. **TOLERANCES**

Nominal value	*Minimum value*	*Maximum value*	*Tolerance*	*± range*
115 mm	112 mm	118 mm	6 mm	3 mm
15 cm	12.5 cm	17.5 cm	5 cm	2.5 cm
90°F	85°F	95°F	10°F	5°F
$3\frac{3}{4}''$	$3\frac{5}{8}''$	$3\frac{7}{8}''$	$\frac{1}{4}''$	$\frac{1}{8}''$

CHAPTER TEST, p. 105

1. a) Accuracy is how exact a measurement is, or how close a measurement can be to the real value. Precision is the smallest unit of measurement that can be accurately read from a measuring device.

   Examples will vary.

   b) Uncertainty is the margin of error in a measurement, usually half the precision of the measuring device. Tolerance is the range of acceptable values in a measurement.

   Examples will vary.

2. Answers will vary.

3. a) kilometres

   b) millimetres

   c) metres

   d) centimetres or millimetres

4. a) precision = 0.1 km

   uncertainty = ±0.05 km

   b) precision = 1 cm

   uncertainty = ±0.5 cm

   c) precision = 0.01 kg

   uncertainty = ±0.005 kg

   d) precision = 0.1°C

   uncertainty = ±0.05°C

5. a) 3 cm ± 0.5 cm

   b) 26 mm ± 0.5 mm

   c) 26.0 mm ±0.25 mm

   d) 26.026 mm ±0.001 mm

6. maximum = $3\frac{5}{8}$ cups

   minimum = $3\frac{3}{8}$ cups

7. Item 1 (11. 3 kg) uncertainty = 0.05 kg

   Item 2 (965 g) uncertainty = 0.0005 kg

   Item 3 (5.6 kg) uncertainty = 0.05 kg

   combined weight of filled box = 17.865 kg ± 0.1005 kg

8. 536cm ± 1 cm

9. 9.75 kg to 10.25 kg

10. a) maximum diameter = 1.536 cm

    minimum diameter = 1.512 cm

    b)

ACCEPTABLE MEASURED VALUES

Drill hole diameter (cm)	*Acceptable? (Yes/No)*
1.5241 cm	Yes
1.5119 cm	No
1.532 cm	Yes
1.540 cm	No
1.5355 cm	Yes
1.537	No

11. a) 0.010 mm

    b) maximum = 0.805 mm

    minimum = 0.795 mm

12. a) 50°F

    b) 250°F

    c) i) 250±25°F

    ii) $^{275°F}_{225°F}$

    iii) $275^{+0}_{-50°F}$

    iv) $225^{+50°F}_{-0}$

CHAPTER 3
STATISTICS
3.1 MEAN, MEDIAN, AND MODE

REVIEW: ORGANIZING DATA

BUILD YOUR SKILLS, p. 110

1.

TABLE 1

Stem	*Leaf*
11	2, 5, 3
12	9, 3, 2
14	9, 2, 5, 4
15	5

TABLE 2

Stem	*Leaf*
11	2, 3, 5
12	2, 3, 9
14	2, 4, 5, 9
15	5

Ordered data set: 155, 149, 145, 144, 142, 129, 123, 122, 115, 113, 112

2.

TABLE 1

Stem	*Leaf*
5	9, 11.5, 11
6	2, 5, 8, 7, 9, 4, 7.5, 4.5
7	0.5, 2, 0

TABLE 2

Stem	*Leaf*
5	9, 11, 11.5
6	2, 4, 4.5, 5, 7, 7.5, 8, 9
7	0, 0.5, 2

Heights from shortest to tallest: 5′9″, 5′11″, 5′11.5″, 6′2″, 6′4″, 6′4.5″, 6′5″, 6′7″, 6′7.5″, 6′8″, 6′9″, 7′0″, 7′0.5″, 7′2″

NEW SKILLS: WORKING WITH ARITHMETIC MEAN

BUILD YOUR SKILLS, p. 112

3. a) 7.9

   b) 142.8

   c) 2

4. 84.8

5. –18.0°C

BUILD YOUR SKILLS, p. 113

6. a) 928

   b) Answers will vary.

7. Fran would need to earn 105% on her final test to earn a mean grade of 86%. This is not possible, which means that Fran will necessarily earn a mean of less than 86%.

8. a) $25.00

   b) $50.00

NEW SKILLS: WORKING WITH MEDIAN AND MODE

BUILD YOUR SKILLS, p. 116

9. a) $909.00

   b) $755.00

10. a) 24°C

    b) 26°C

BUILD YOUR SKILLS, p. 118

11. a) mean: $301 000.00

    median: $237 947.50

    mode: does not exist

    b) The median is the measure of central tendency that best represents the average house price.

12. a) mean: $4.54

    median: $4.69

    modes: $3.49, $3.99, $4.99, $5.99

    b) Answers will vary.

13. a) mean: 118.75 g

    median: 100 g

    mode: 100 g

    b) mode

PRACTISE YOUR NEW SKILLS, p. 120

1. a) mean: 5.8

   median: 6.5

   modes: 2, 3, 7, 8

   b) mean: 0°C

   median: –3°C

   mode: –3°C

2. a) $26 961.67

   b) $23 300.00

   c) $23 300.00

3. a) mean: 29.8°C

   median: 31.5°C

   mode: does not exist

   b) Answers will vary. In this case, the measures of central tendency do not give you any useful information.

4. 85%

5. mode

3.2 WEIGHTED AND TRIMMED MEANS AND OUTLIERS

NEW SKILLS: WORKING WITH OUTLIERS AND TRIMMED MEANS

BUILD YOUR SKILLS, p. 124

1. a) 218.5

   b) outliers: 476 and 524

   trimmed mean: 155.2

2. a) –6.6°C

   b) Wednesday

   c) –9.4°C

   d) trimmed mean

3. a) $31 166.67

   b) outliers: $60 000.00; also omit $15 000.00

   trimmed mean: $28 000.00

   c) Answers will vary.

NEW SKILLS: WORKING WITH WEIGHTED MEANS—PERCENTAGE OF A TOTAL

BUILD YOUR SKILLS, p. 126

4. 83%
5. 94.5% or 95%
6. $392.00

NEW SKILLS: WORKING WITH WEIGHTED MEANS—REPEATING ITEMS

BUILD YOUR SKILLS, p. 128

7. 24.2
8. about 2
9. $19.00

PRACTISE YOUR NEW SKILLS, p. 129

1. a) $519 728.57

   b) outlier: $1 356 000.00; also omit $289 000.00

   trimmed mean: $398 620.00

   c) trimmed mean
2. 87%
3. a) 12.5 hours

   b) outlier: 21; also omit 9

   trimmed mean: 11.9 hours

   c) trimmed mean

   d) Answers will vary.
4. 38.4 lb
5. $19.88

3.3 PERCENTILE RANKING

BUILD YOUR SKILLS, p. 133

1. a) 10th percentile

   b) 10th percentile
2. a) 20th percentile

   b) 0

   c) 95th percentile
3. a) 50th percentile

   b) 7th percentile

   c) 93rd percentile

BUILD YOUR SKILLS, p. 136

4. 19th percentile
5. 40th percentile
6. a) 23rd percentile

   b) 95th percentile

   c) A percentile ranking tells you what percentage of values are lower than the value being ranked, and it is impossible for 100% of the values in a list to be lower than the given value, so even the largest number in a data set cannot be in the 100th percentile.

BUILD YOUR SKILLS, p. 137

7. $30 000.00
8. 72
9. a) 24th percentile

   b) 99th percentile

   c) Answers will vary.

PRACTISE YOUR NEW SKILLS, p. 139

1. a) 69th percentile

   b) 46th percentile

2. a) 13th percentile

   b) 102

   c) 60th percentile

3. a) 60th percentile

   b) 97th percentile

   c) $500 000–$599 999

CHAPTER TEST, p. 140

1. 75.8%
2. $9.05/m
3. 85.5%
4. a) mean: 152.6 cm

   median: 147.5 cm

   mode: 143 cm

   Answers will vary regarding which measure of central tendency best represents the average height in the class.

   b) outlier: 200 cm; also omit 135

   trimmed mean: 150.1 cm

   c) 50th percentile

5. a) 92nd percentile

   b) 25–29 minutes

CHAPTER 4
PROBABILITY AND ODDS
4.1 EXPERIMENTAL PROBABILITY

REVIEW: SIMPLIFYING FRACTIONS

BUILD YOUR SKILLS, p. 144

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

   b) $\frac{4}{7}$

   c) $\frac{3}{7}$

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

REVIEW: WORKING WITH FRACTIONS, DECIMALS, AND PERCENTAGES

BUILD YOUR SKILLS, p. 146

2.

CONVERTING BETWEEN FRACTIONS, DECIMALS, AND PERCENTAGES

Fraction	*Decimal*	*Percentage*
$\frac{89}{100}$	0.89	89%
$\frac{67}{100}$	0.67	67%
$\frac{2}{37}$	≈ 0.054	5.4%
$\frac{3}{100}$	0.03	3%
$\frac{9}{20}$	0.45	45%
$\frac{11}{12}$	≈ 0.92	92%

NEW SKILLS: WORKING WITH EXPERIMENTAL PROBABILITY

BUILD YOUR SKILLS, p. 148

3. a) $\frac{15}{31}$

   b) 74

4. a) i) $\frac{77}{850}$, 0.09, 9%, or 77 out of 850

   ii) $\frac{198}{425}$, 0.47, 47%, or 198 out of 425

   iii) $\frac{1}{850}$, 0.001, 0.1%, or 1 out of 850

   b) 159

5. a) $\frac{5}{104}$, 0.05, 5%, or 5 out of 104

   b) $\frac{1}{26}$, 0.04, 4%, or 1 out of 26

   c) 269

NEW SKILLS: WORKING WITH SAMPLE SIZE

BUILD YOUR SKILLS, p. 150

6. Katcha has used a very small sample in a very specific subset of the total population; therefore, this is not a logical conclusion. She would need to consider the population outside her classroom and outside Vancouver.

7. The poll only considered a very small sample size, less than 0.1% of the total city population. It is not safe to say Ms. Quon will win the election. Because you are not given any demographic information, it is not safe to assume that the sample size is representative of the city population as a whole.

8. The discrepancy in the poll results is due to the polling methods used. The first company conducted the survey by telephone, to home telephone numbers. Many young people do not have home phone numbers, and instead rely only on cell phones. This survey method likely resulted in a sample of mostly older respondents.

   The second company polled people at a mall, a community centre, and a university campus. The mall and the community centre are probably frequented by people of all ages. However, the people surveyed at the university campus were probably mostly younger people. Therefore, the survey method likely resulted in a sample biased with a mostly young population.

PRACTISE YOUR NEW SKILLS, p. 151

1. **WAYS OF EXPRESSING PROBABILITY**

Fraction	*Decimal*	*Percentage*	*Words*
$\frac{3}{4}$	0.75	75%	3 out of 4
$\frac{29}{500}$	0.058	5.8%	5.8 out of 100, or 58 out of 1000
$\frac{6}{13}$	≈ 0.46	46%	24 out of 52
$\frac{149}{200}$	0.745	74.5%	74.5 out of 100, or 745 out of 1000
$\frac{17}{55}$	≈ 0.31	31%	17 out of 55

2. $\frac{4}{29}$, 0.14, 14%, or 4 out of 29

3. a) $\frac{1}{92}$

   b) 54

4. a) $\frac{3}{5}$, 0.6, 60%, or 3 out of 5

   b) 240

5. This is not necessarily a reasonable conclusion; a judgement on the difficulty of the test based on only 3 students' grades could be wrong. The teacher would likely reassess using a larger sample size (perhaps 25% of 50% of the students).

6. a) 20%

   b) 45

   c) 40 votes

4.2 THEORETICAL PROBABILITY

BUILD YOUR SKILLS, p. 155

1. a) $\frac{3}{10}$, 0.3, 30%, or 3 out of 10
   b) $\frac{4}{5}$, 0.8, 80%, or 4 out of 5
   c) $\frac{3}{10}$, 0.3, 30%, or 3 out of 10
2. a) $\frac{1}{6}$, 0.17, 17%, or 1 out of 6
   b) $\frac{1}{2}$, 0.5, 50%, or 1 out of 2
   c) $\frac{1}{3}$, 0.33, 33%, or 1 out of 3
3. a) $\frac{1}{2}$, 0.5, 50%, or 1 out of 2
   b) $\frac{1}{2}$, 0.5, 50%, or 1 out of 2

BUILD YOUR SKILLS, p. 158

4. $\frac{1}{6}$, 0.17, 17%, or 1 out of 6
5. $\frac{1}{2}$, 0.5, 50%, or 1 out of 2
6. $\frac{1}{5}$, 0.2, 20%, or 1 out of 5

BUILD YOUR SKILLS, p. 159

7. $\frac{4}{51}$, 0.078, 7.8%, or 4 out of 51
8. a) $\frac{2}{5}$, 0.4, 40%, or 2 out of 5
   b) $\frac{17}{44}$, 0.39, 39%, or 17 out of 44
   c) $\frac{3}{11}$, 0.27, 27%, or 3 out of 11
   d) $\frac{15}{43}$, 0.35, 35%, or 15 out of 43

PRACTISE YOUR NEW SKILLS, p. 160

1. a) $\frac{1}{13}$, 0.08, 8%, or 1 out of 13
   b) $\frac{3}{26}$, 0.12, 12%, or 3 out of 26
   c) $\frac{2}{13}$, 0.15, 15%, or 2 out of 13
2. a) $\frac{1}{6}$, 0.17, 17%, or 1 out of 6
   b) $\frac{1}{10}$, 0.1, 10%, or 1 out of 10
   c) As the sample size increases, the results should approach those expected by the theoretical probability. If Pacale rolled the dice 1000 times, she could expect to roll a sum of 7 about 167 times.
3. a) $\frac{1}{6}$, 0.17, 17%, or 1 out of 6
   b) $\frac{1}{2}$, 0.5, 50%, or 1 out of 2
4. a) 27
   b) $\frac{1}{27}$, 0.04, 4%, or 1 out of 27
5. a) $\frac{4}{19}$, 0.21, 21%, or 4 out of 19
   b) $\frac{5}{18}$, 0.28, 28%, or 5 out of 18
6. $\frac{1}{6}$, 0.17, 17%, or 1 out of 6

4.3 ODDS AND PROBABILITY

BUILD YOUR SKILLS, p. 164

1. a) 1:3 or 1 to 3
   b) 12:1 or 12 to 1

2. a) 3:497 or 3 to 497

   b) 497:3 or 497 to 3

   c) 497:3

3. There must be an equal number of red and non-red marbles in the bag. There must be an even number of marbles in the bag, but you cannot be sure of how many.

BUILD YOUR SKILLS, p. 166

4. a) 1:1025 or 1 to 1025

   b) $\frac{1}{1026}$ or 1 out of 1026

   c) 500:13 or 500 to 13

5. a) 7:31 or 7 to 31

   b) 23:15 or 23 out of 15

   c) $\frac{23}{38}$, 0.61, 61%, or 23 out of 38

6. a) 1:2 or 1 to 2

   b) 7:2, or 7 to 2

   c) $\frac{4}{9}$, 0.44, 44%, or 4 out of 9

BUILD YOUR SKILLS, p. 168

7. 169

8. 17

9. $\frac{5}{7}$, 0.71, 71%, or 5 out of 7

PRACTISE YOUR NEW SKILLS, p. 169

1. **ODDS AND PROBABILITY**

Event	*Odds in favour*	*Odds against*	*Probability*
Rolling an even number with a six-sided die	1:1	1:1	$\frac{1}{2}$
Rolling doubles with two dice	1:5	5:1	$\frac{1}{6}$
Drawing a spade from a deck of cards	1:3	3:1	$\frac{1}{4}$
Drawing a 5 from a deck of cards	1:12	12:1	$\frac{1}{13}$

2. 1:1

3. a) 5

   b) 1 out of 200, $\frac{1}{200}$, 0.005, or 0.5%

4. a) 1:99 or 1 to 99

   b) $\frac{99}{100}$, 0.99, 99%, or 99 out of 100

   c) 99:1 or 99 to 1

CHAPTER TEST, p. 171

1. **WAYS OF EXPRESSING PROBABILITY**

Fraction	*Decimal*	*Percentage*	*Words*
$\frac{3}{125}$	0.024	2.4%	3 out of 125
$\frac{23}{100}$	0.23	23%	23 out of 100
$\frac{1}{16}$	0.0625	6.25%	1 out of 16
$\frac{47}{50}$	0.94	94%	94 out of 100, or 47 out of 50

2. a) $\frac{5}{13}$, 0.38, 38%, or 5 out of 13

   b) 3:10 or 3 to 10

   c) 5:11 or 5 to 11

3. a) $\frac{8}{675}$, 0.012, 1.2%, or 8 out of 675

   b) 1185

4. a) $\frac{1}{13}$, 0.08, 8%, or 1 out of 13

   b) $\frac{1}{25}$, 0.04, 4%, or 1 out of 25

   c) In an experiment of such a large number of trials, the number of aces drawn should be closer to the theoretical probability than the experimental probability. In 2000 trials, you can expect an ace to be drawn approximately 154 times.

5. a) $\frac{19}{250}$, 0.076, 7.6%, or 19 out of 250

   b) 152

   c) 2

CHAPTER 5
PROPERTIES OF GEOMETRIC FIGURES
5.1 TRIANGLES

REVIEW: WORKING WITH RIGHT TRIANGLES

BUILD YOUR SKILLS, p. 176

1. a) $y \approx 84.1$ cm

   b) $a \approx 77.6$ mm

   c) $p \approx 74.4$ cm

2. a) 1.3 cm

   b) 23.2 mm

   c) 7.0 cm

3. a) 32°

   b) 42°

   c) 52°

NEW SKILLS: WORKING WITH PROPERTIES OF TRIANGLES

BUILD YOUR SKILLS, p. 182

4. a) $\angle M = 60°$

   b) equilateral and acute triangle

5. a) 11.3 m

   b) right isosceles triangle

   c) right isosceles triangle

6. 390 cm^2

BUILD YOUR SKILLS, p. 185

7. a) 48 feet

   b) $\angle A = 90°$

      $\angle B = 45°$

      $\angle C = 45°$

   c) ΔABC is right isosceles.

      ΔABD is right isosceles.

8. Each piece of cross-bracing is 49.7 inches long.

9. Brace AF is 5.5 m long.

PRACTISE YOUR NEW SKILLS, p. 187

1. a) 83°

      The triangle is acute and scalene.

   b) The other base angle is 15°. The angle at the peak is 150°.

      The triangle is obtuse and isosceles.

   c) The two missing angles are each 60°.

      The triangle is acute and equilateral.

2. The first roof truss is a king post truss. It can be divided into three separate triangles:

   - ABC is isosceles; and
   - ABD and BDC are right scalene.

   The second roof truss is a queen post truss. It can be divided into seven separate triangles:

   - ACE is isosceles;
   - ACF and CFE are right scalene;
   - BCF and DCF are scalene; and
   - ABF and EDF are scalene.

   The third roof truss is a fink truss. It can be divided into twelve separate triangles:

   - ACE is isosceles;
   - ACG and ECF are scalene;
   - CGF is isosceles;
   - ABG and EDF are scalene,
   - BGC and DFE are scalene;
   - CFD and CBG are right scalene; and
   - ACF and CGE are scalene.

3. a) $\angle CDE = 60°$

   b) DE = 15 cm

   c) If Nadine wants the fence to be about 2 m high, she will need to use 8 rows of lattice.

5.2 QUADRILATERALS

REVIEW: WORKING WITH PARALLEL LINES AND TRANSVERSALS

BUILD YOUR SKILLS, p. 191

1. $\angle 1 = 110°$

   $\angle 2 = 120°$

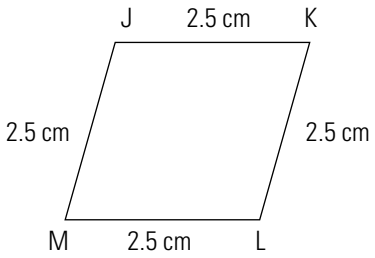
   $\angle 3 = 60°$

   $\angle 4 = 60°$

2. $\angle 1 = 123°$

NEW SKILLS: WORKING WITH QUADRILATERALS

BUILD YOUR SKILLS, p. 194

3. 

   $\angle J = 104°$

   $\angle K = 76°$

   $\angle L = 104°$

   $\angle M = 76°$

   JKLM is a rhombus.

4. $\angle Q = 118°$

   $\angle R = 62°$

   $\angle S = 62°$

   PQRS is an isosceles trapezoid.

BUILD YOUR SKILLS, p. 197

5. a) ∠DCF must be increased by 2° by raising brace CD.

   b) ∠CAB = 94°

   ∠DCE will be a corresponding angle to ∠CAB, and they will be equal.

   c) isosceles trapezoid

6. a) 85°

   b) 168 750 cm^3

7. a) ∠BCE = 45°

   ∠CBE = 45°

   ΔBEC is a right isosceles triangle.

   b) ∠EAD = 60°

   ∠ECD = 60°

   c) ∠BCD = 105°

   ∠BAD = 105°

   d) Ian will need 2200 cm^2 of each material to make his kite.

PRACTISE YOUR NEW SKILLS, p. 200

1. a) ∠A = 115°

   This is a rhombus.

   b) PR = 5 cm

   This is an isosceles trapezoid.

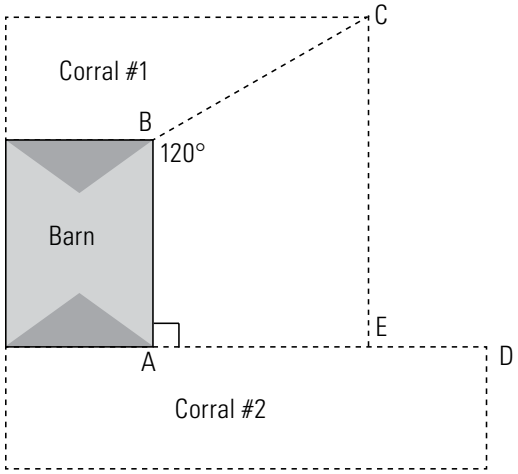
   c) WX = 1.5 cm

   This is a kite.

   d) ∠L ≈ 56°

   This is a right trapezoid.

2. a) For the new fence to be parallel to AB, the fence and wall AD of corral #2 need to be perpendicular, and angle ∠BCE needs to be supplementary to the 120° angle, or 60°.



   b) When the new fence is built, the enclosure (ABCE) will be a right trapezoid.

3. a) 23.2 cm

   b) ∠ADC = 124°

   c) ∠DCB = 56°

5.3 REGULAR POLYGONS

NEW SKILLS: WORKING WITH REGULAR POLYGONS

BUILD YOUR SKILLS, p. 205

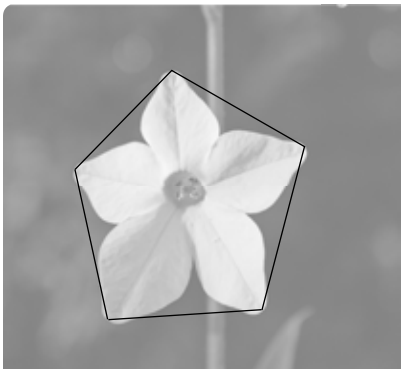
1. Melanie is wrong: the angles in a regular dodecagon are not half the size of those in a regular hexagon. The interior angles of a regular dodecagon are each 150°. The interior angles of a regular hexagon are 120°.

2.

INTERIOR ANGLE SIZE IN REGULAR POLYGONS

Regular polygon	*Angle size*
Triangle	60°
Square	90°
Pentagon	108°
Hexagon	120°
Heptagon	128.6°
Octagon	135°
Nonagon	140°
Decagon	144°
Dodecagon	150°

3. Join the ends of the petals to create a polygon.



The petals approximately form a regular pentagon. The angle at each vertex is approximately 108°.

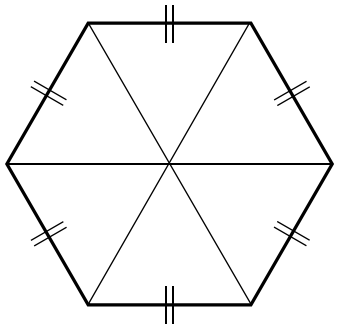
4. Tiles in the shape of equilateral triangles could be used to tile a floor. Six triangular tiles would be needed to surround the common point.

   Square tiles could be used to tile a floor. Four square tiles would be needed to surround the common point.

5. a) 1080°

   b) 80 feet

6. a)



   b) Each interior angle of each triangle is 60°. The triangles are equilateral.

   c) 23.4 m^2

PRACTISE YOUR NEW SKILLS, p. 210

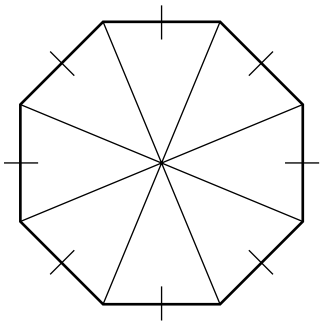
1. 20 sides

2. a) The building's interior angles are each 108°.

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

   c) The model's interior angles are also 108°.

3.



The area of the floor of the Seacow Head Lighthouse is 55.76 m^2.

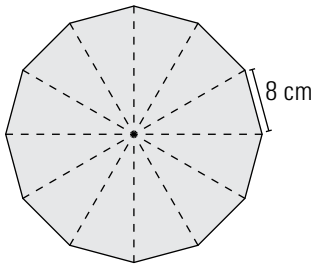
4. a) The Barbados dollar is a heptagon.

   The sum of interior angles is 900°.

   b) 128.6°

5. a) 150°

b)

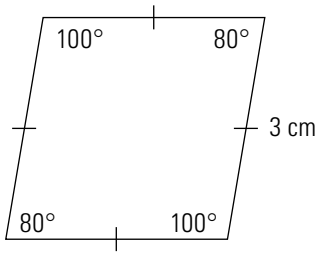


The clock is 31 cm wide.

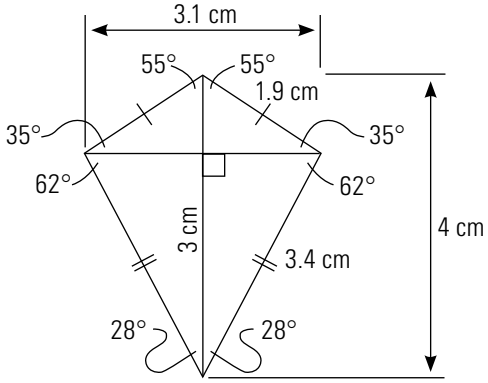
CHAPTER TEST, p. 213

1. See table at the bottom of this page.

2. a) This is a rhombus.



b) This is a kite.



3. a) $\angle Y = 112°$

b) $h \approx 2.8$ cm

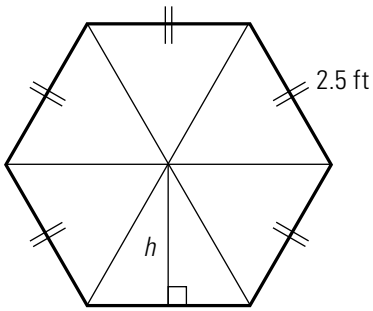
c) isosceles trapezoid

4. Each of the base angles is 52°.

5. a) $\angle 1 = 115°$

b) ABCD is a parallelogram.

6.



The area of the hot tub is 16.5 ft^2.

Chapter Test, 1

PROPERTIES OF POLYGONS

At least two equal sides	*At least two congruent angles*	*At least one pair of parallel sides*	*Interior angles add up to 360°*	*A regular polygon*
parallelogram	parallelogram	trapezoid	trapezoid	square
rhombus	rhombus	parallelogram	parallelogram	equilateral triangle
isosceles trapezoid	isosceles trapezoid	rhombus	rhombus	regular pentagon
rectangle	rectangle	isosceles trapezoid	isosceles trapezoid	
square	square	rectangle	rectangle	
equilateral triangle	equilateral triangle	square	square	
isosceles triangle	isosceles triangle			
regular pentagon	regular pentagon			

7. a) BE ≈ 8.9 ft

   b) ΔABE is a right scalene triangle.

   c) ΔBEC is an acute isosceles triangle.

CHAPTER 6
TRANSFORMATIONS
6.1 SINGLE TRANSFORMATIONS

NEW SKILLS: WORKING WITH TRANSLATIONS

BUILD YOUR SKILLS, p. 221

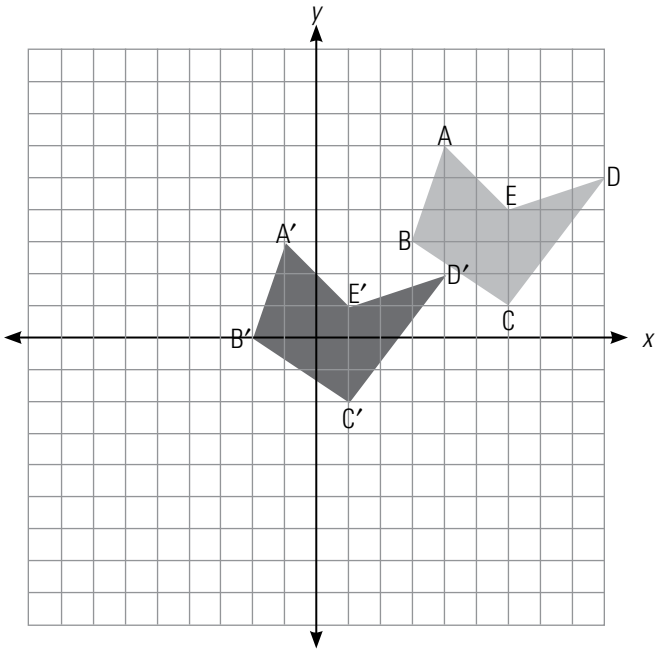
1. A′(–1, 3)

   B′(–2, 0)

   C′(1, –2)

   D′(4, 2)

   E′(1, 1)

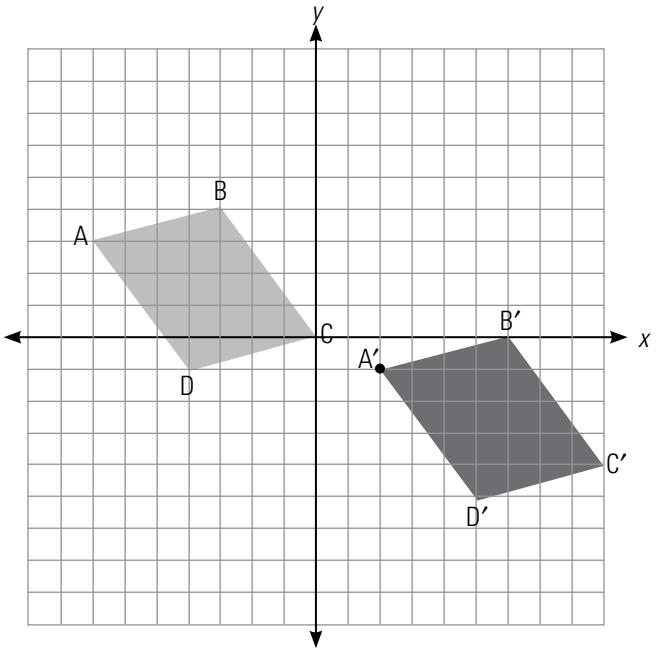


2. a) A′(2, –1)

   B′(6, 0)

   C′(9, –4)

   D′(5, –5)



   b) It moved 9 units to the right and 4 units down.

3. Shape 1 is a translation of ABCD. The translation applied was 5 units to the right and 3 units down.

4. a) 1 unit west and 2 units north

   b) 1000 m west and 1500 m north

NEW SKILLS: WORKING WITH REFLECTIONS

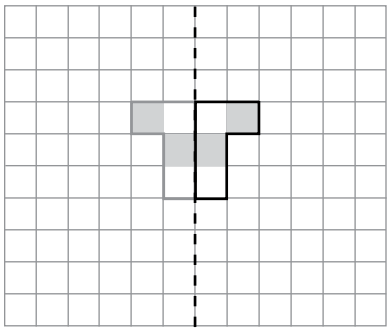
BUILD YOUR SKILLS, p. 225

5. Answers will vary. An example is provided.

6. Answers may vary based on the typeface or style of handwriting used. In a sans serif typeface, the following letters look the same when written upside down.

   B, C, D, E, H, I, K, O, X

7.



BUILD YOUR SKILLS, p. 227

8. a) A′(3, –1)

B′(5, –2)

C′(3, –6)

D′(3, –3)

E′(1, –2)

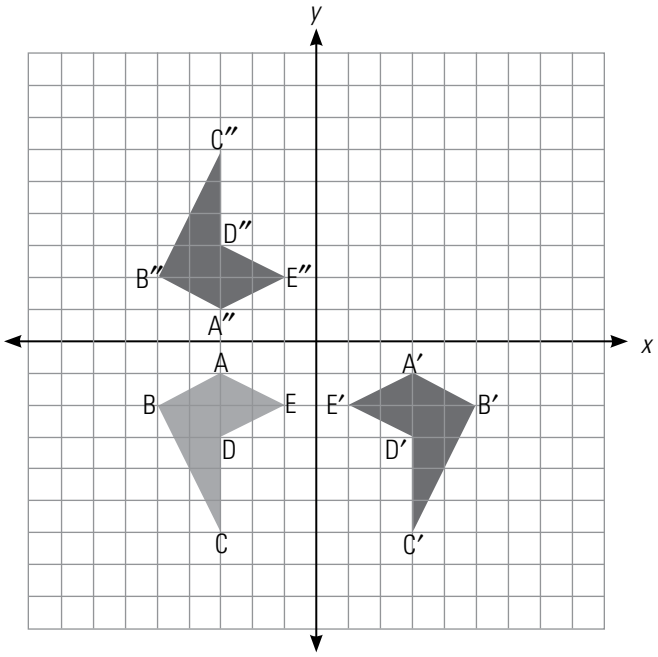
b) A″(–3, 1)

B″(–5, 2)

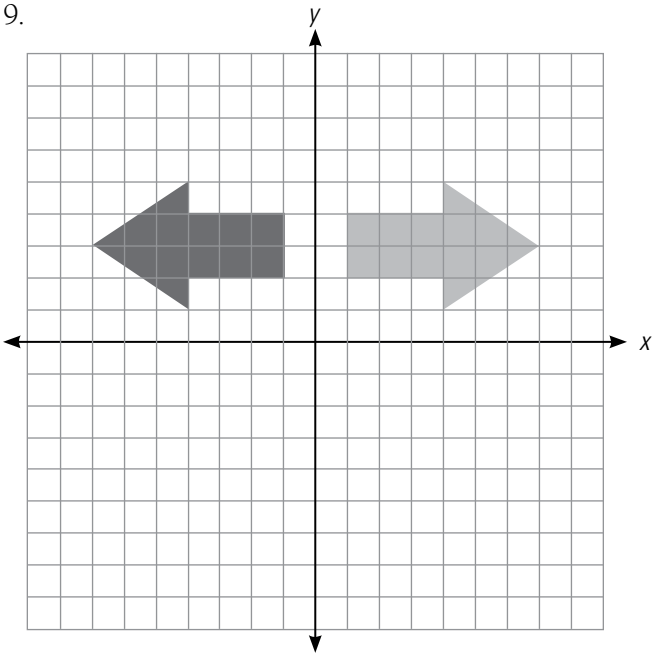
C″(–3, 6)

D″(–3, 3)

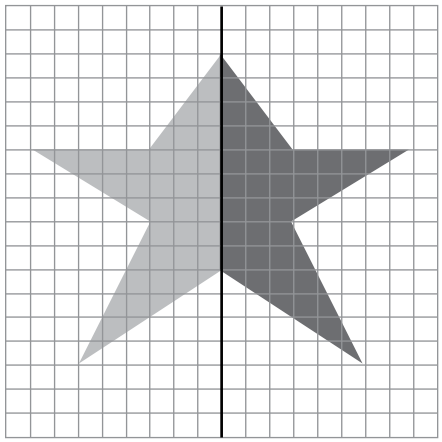
E″(–1, 2)



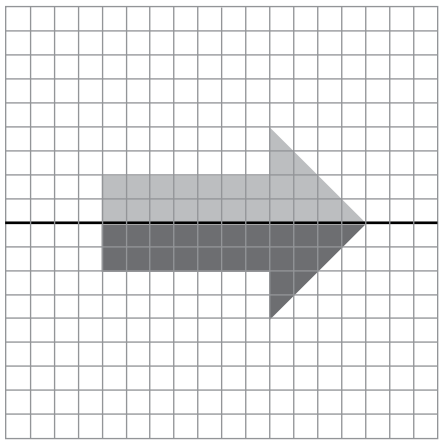
9.



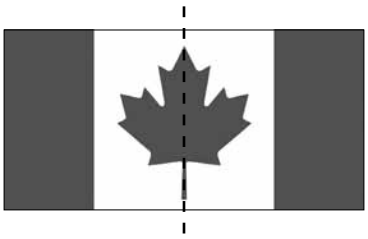
10. a)



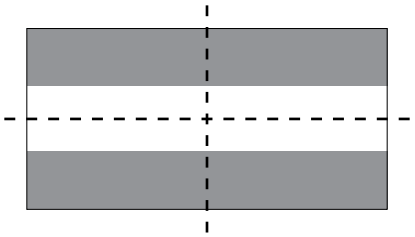
b)



11. The Canadian flag has a vertical line of symmetry.

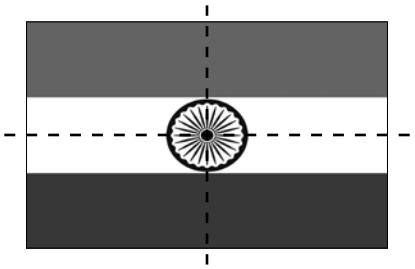


The Austrian flag has vertical and horizontal lines of symmetry.



The flag of the United Kingdom is not symmetrical.

The Indian flag has vertical and horizontal lines of symmetry.



The Brazilian flag is not symmetrical.

The South Korean flag is not symmetrical.

12. If you look an original shape and its image reflected over a line as a whole, it is a symmetrical image. A symmetrical image can be created by reflecting half the image over a line.

NEW SKILLS: WORKING WITH ROTATIONS

BUILD YOUR SKILLS, p. 232

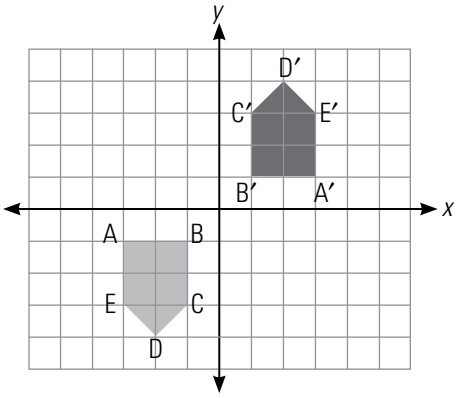
13. a) A′(3, 1)

B′(1, 1)

C′(1, 3)

D′(2, 4)

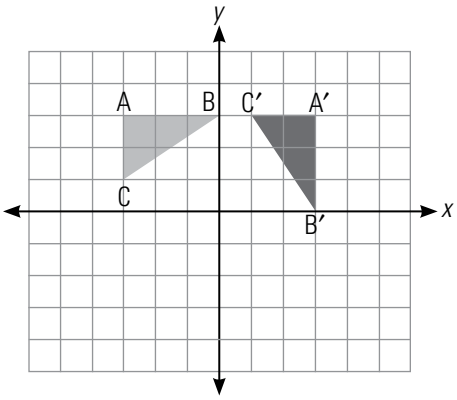
E′(3, 3)



b) A′(3, 3)

B′(3, 0)

C′(1, 3)

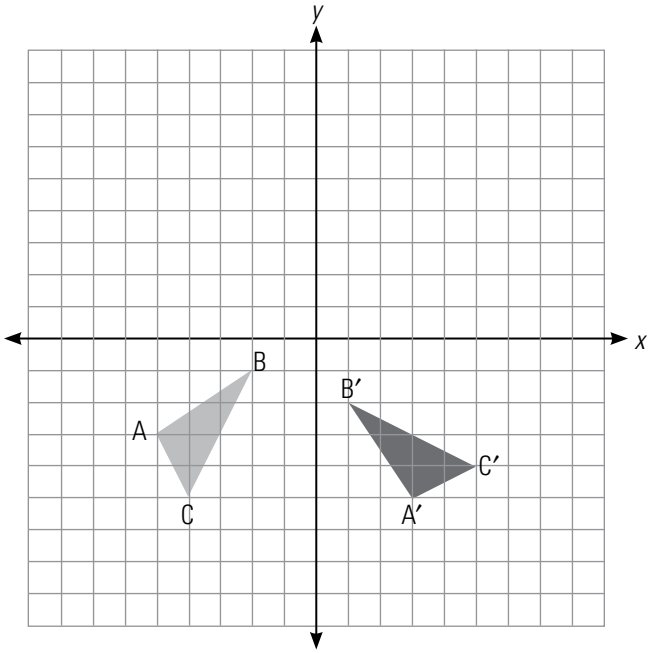


14. a) When a shape in the first quadrant is rotated 90° counter-clockwise about the origin, it will move to the second quadrant. A 90° counter-clockwise rotation gives the same result as a 270° clockwise rotation. The *y*-coordinate changes signs, then the *x*-coordinate and the *y*-coordinate switch positions.

    b) A′(3, –5)

    B′(1, –2)

    C′(5, –4)



    c) A 90° counter-clockwise rotation gives the same result as a 270° clockwise rotation, so the resulting image is the same as in b).

15. blade 2

NEW SKILLS: WORKING WITH DILATIONS

BUILD YOUR SKILLS, p. 235

16. a) 36.4 cm, 44.8 cm, and 67.2 cm

    This is an enlargement.

    b) 2.08 cm, 2.56 cm, and 3.84 cm

    This is a reduction.

17. a) The photograph cannot be perfectly dilated to fit in the 5 inch by 8 inch frame.

    The photograph cannot be perfectly dilated to fit in the 8 inch by 10 inch frame.

    Rob could use the frames if he crops the dilated photograph to fit the dimensions of the frame.

    b) 2 feet 3 inches by 3 feet 9 inches

18. a) width: 39 cm

    height: 32.5 cm

    b) length: 33.75 cm

    width: 22.5 cm

    height: 18.75 cm

PRACTISE YOUR NEW SKILLS, p. 237

1. a) A′(–3, –3)

    B′(0, –1)

    C′(3, –2)

    D′(2, –4)

    E′(–1, –4)

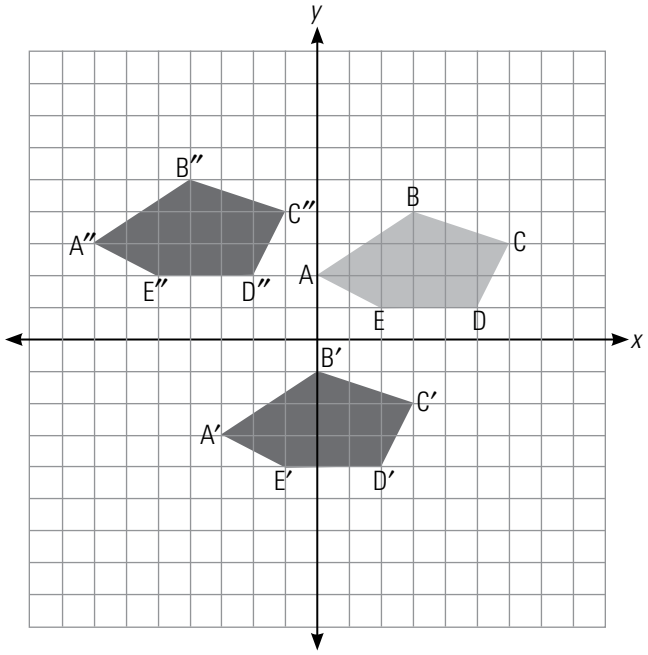
    b) ABCDE moved 7 units to the left and 1 unit up.

    A″(–7, 3)

    C″(–1, 4)

    D″(–2, 2)

    E″(–5, 2)



2. a) A′(2, 1)

   B′(5, 2)

   C′(6, 4)

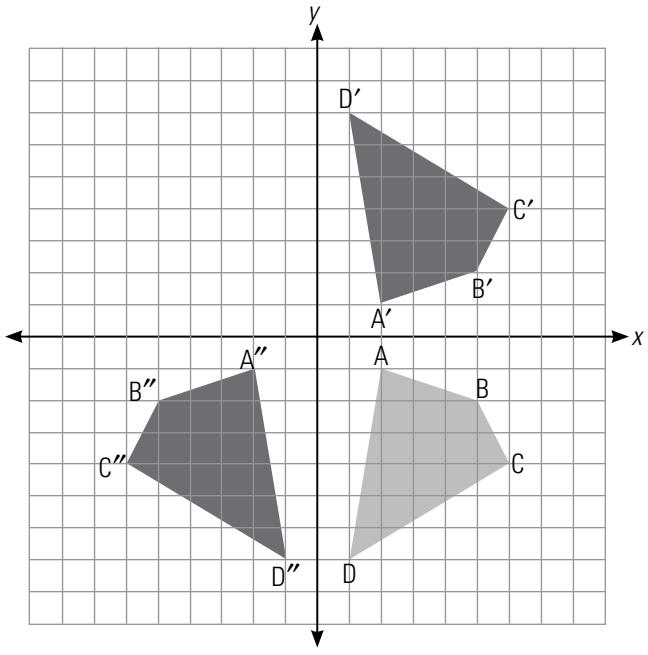
   D′(1, 7)

   b) A″(–2, –1)

   B″(–5, –2)

   C″(–6, –4)

   D″(–1, –7)

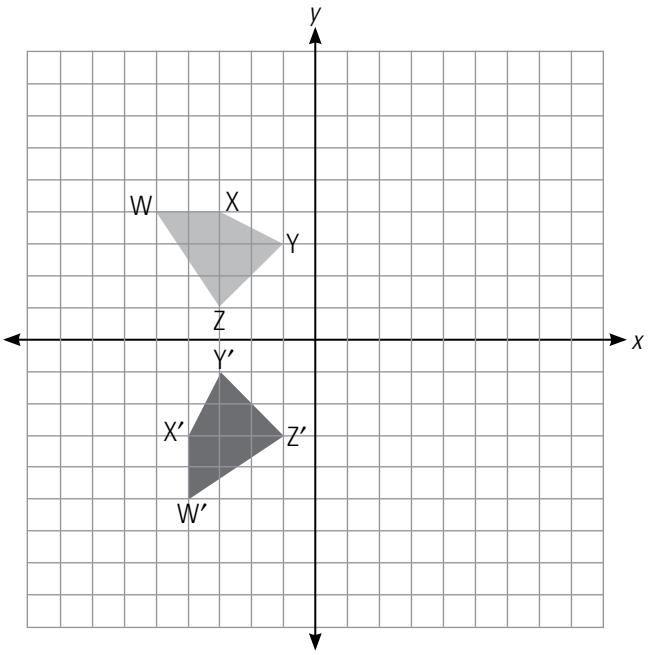


3. W′(–4, –5)

   X′(–4, –3)

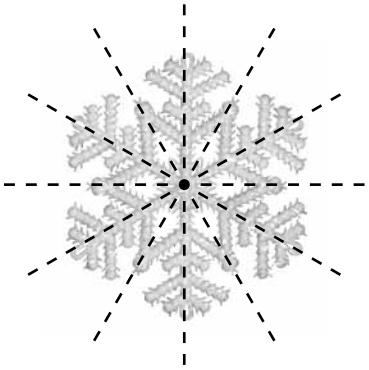
   Y′(–3, –1)

   Z′(–1, –3)



4. Butterfly: 1 line of symmetry

Snowflake: 6 lines of symmetry



Spiral: not symmetrical

5. a) reduced

   b) 1.45 m tall in $\frac{1}{100}$ scale

   0.29 m tall in $\frac{1}{500}$ scale

   c) $\frac{1}{20}$ or 0.05

6.2 MULTIPLE TRANSFORMATIONS

BUILD YOUR SKILLS, p. 242

1. After the 270° clockwise rotation:

   A(–4, 4) → A′(–4, –4)

   B(–3, 4) → B′(–4, –3)

   C(–1, 4) → C′(–4, –1)

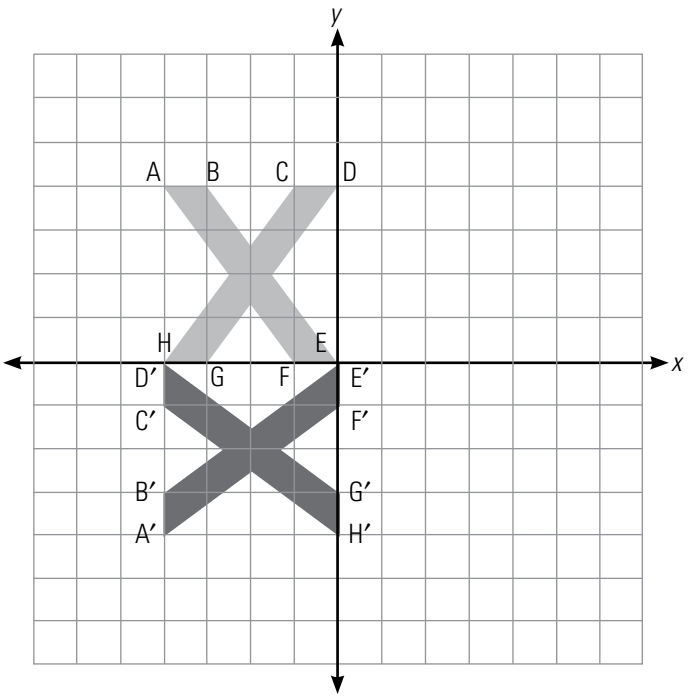
   D(0, 4) → D′(–4, 0)

   E(0, 0) → E′(0, 0)

   F(–1, 0) → F′(0, –1)

   G(–3, 0) → G′(0, –3)

   H(–4, 0) → H′(0, –4)



   After the translation:

   A′(–4, –4) → A″(–2, –7)

   B′(–4, –3) → B″(–2, –6)

   C′(–4, –1) → C″(–2, –4)

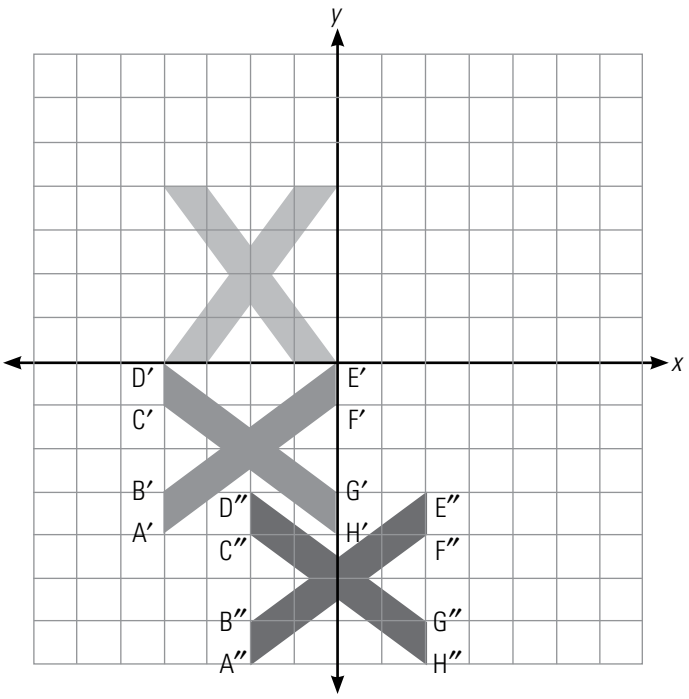
   D′(–4, 0) → D″(–2, –3)

   E′(0, 0) → E″(2, –3)

   F′(0, –1) → F″(2, –4)

   G′(0, –3) → G″(2, –6)

   H′(0, –4) → H″(2, –7)



2. It was translated 6 units to the right. It did not move vertically.

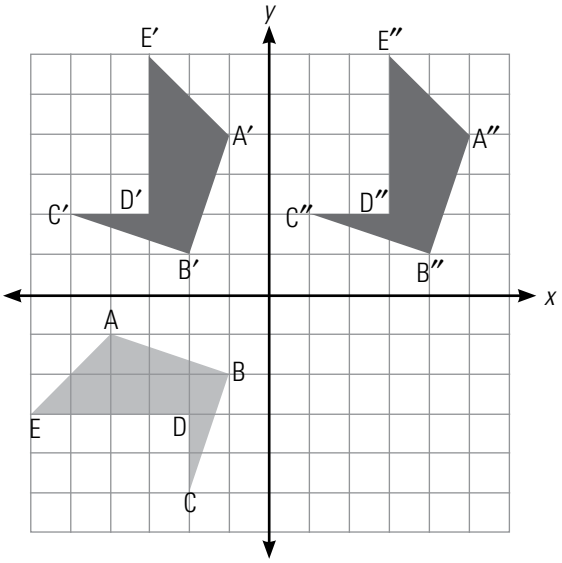
3. a) A″(5, 4)

   B″(4, 1)

   C″(1, 2)

   D″(3, 2)

   E″(3, 6)



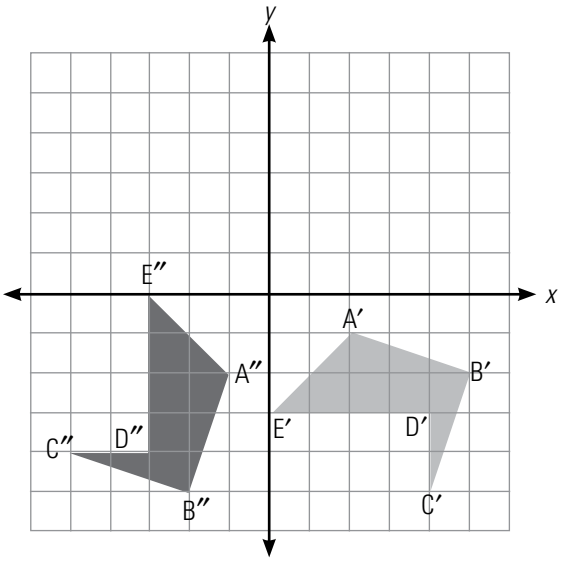
b) A″(–1, –2)

B″(–2, –5)

C″(–5, –4)

D″(–3, –4)

E″(–3, 0)

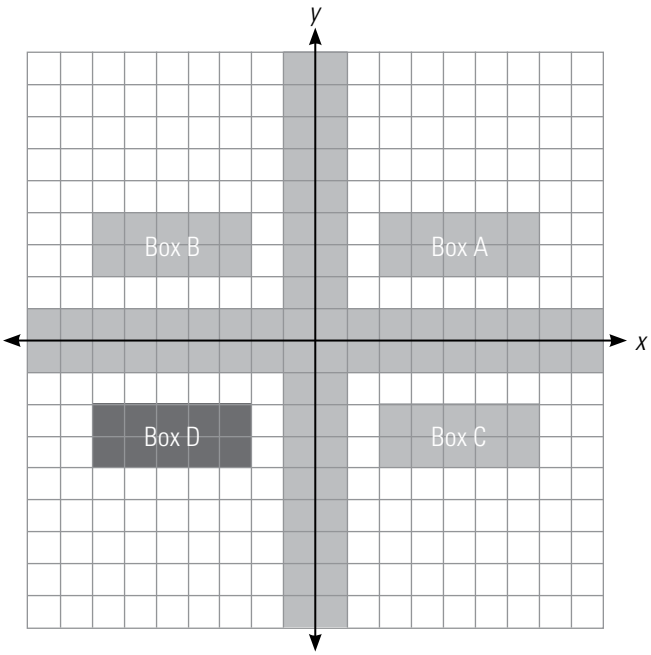


c) No, the images in a) and b) are not the same. The order in which the transformations are performed affects the final result of the transformations.

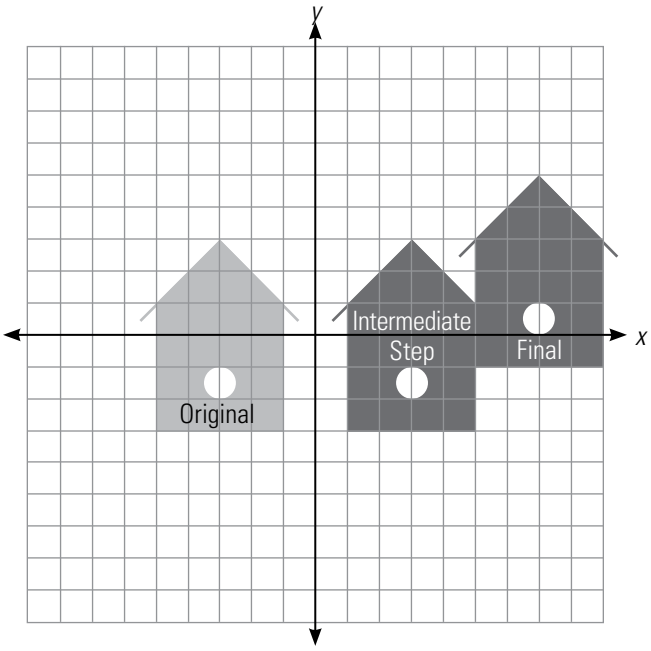
4. a) Box B has vertices at (–2, 2), (–2, 4), (–7, 4), and (–7, 2).

b) Box C has vertices at (2, –2), (2, –4), (7, –4), and (7, –2).

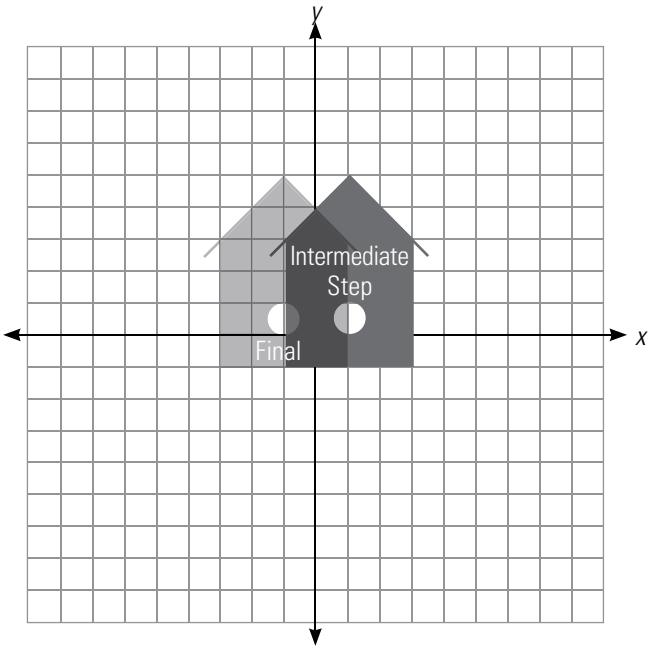
c) Box D has vertices at (–2, –2), (–2, –4), (–7, –4), and (–7, –2).



5. a) The final image has vertices at (5, –1), (9, –1), (9, 3), (7, 5), and (5, 3).



b) The final image has vertices at (–3, –1), (1, –1), (1, 3), (–1, 5), and (–3, 3).



c) No, the resulting images in a) and b) are not the same because the order in which the transformations are performed affects the final result of the transformations.

6. The transformation has to have been a rotation, because the orientation of the shape changed. The rotation could have been a 90° rotation counter-clockwise about the origin or a 270° rotation clockwise about the origin.

7. The transformation involved a reflection over the *x*-axis, because the resulting image is upside down.

   Shape JKLMN was translated 5 units to the right and 5 units down, then was reflected over the *x*-axis.

8. Camila is right. There has to have been a reflection over the x-axis involved for vertex A to have moved to the bottom of the image at location A′. The image could be the result of a reflection over the x-axis followed by a translation of 5 units to the right and 4 units down.

PRACTISE YOUR NEW SKILLS, p. 249

1. After the 90° clockwise rotation:

   A′(–1, 6)

   B′(–1, 2)

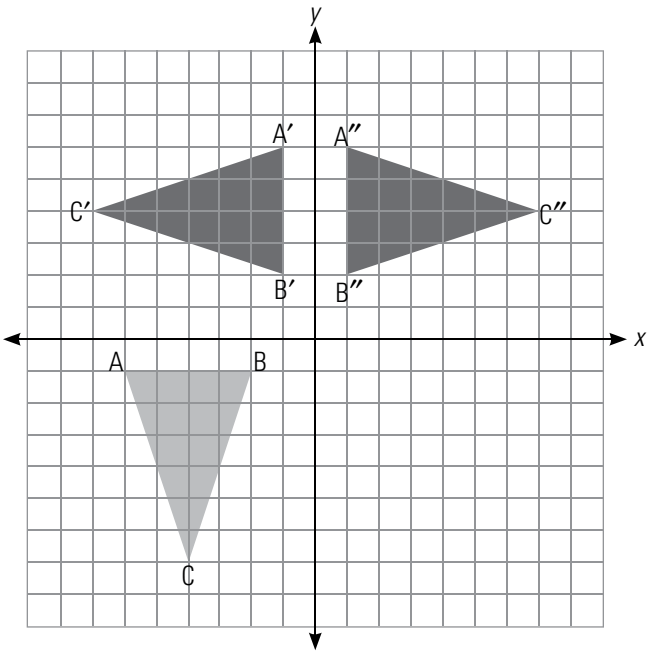
   A′(–7, 4)

   After the reflection over the y-axis:

   A″(1, 6)

   B″(1, 2)

   C″(7, 4)



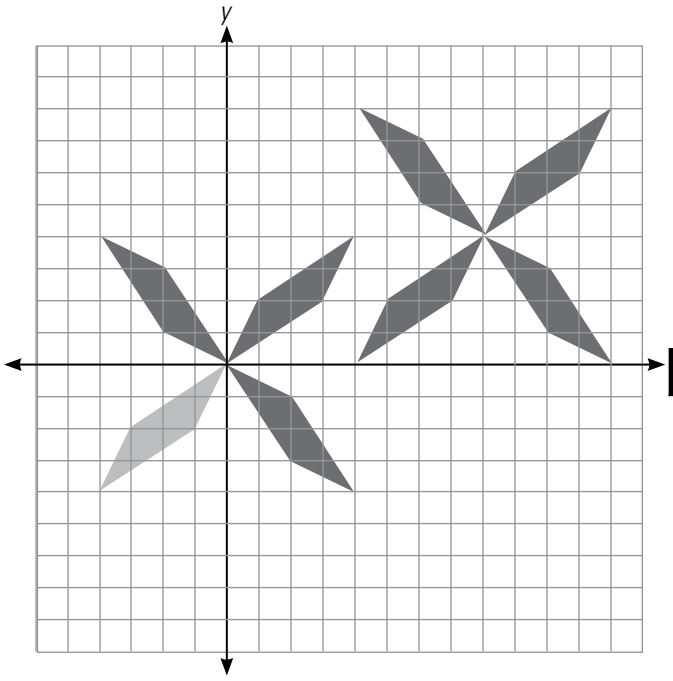
2. After the translation, the pattern will have vertices at:

   (8, 4)
   (7, 2)
   (4, 0)
   (5, 2)

(8, 4)
(6, 5)
(4, 8)
(6, 7)

(8, 4)
(9, 6)
(12, 8)
(11, 6)

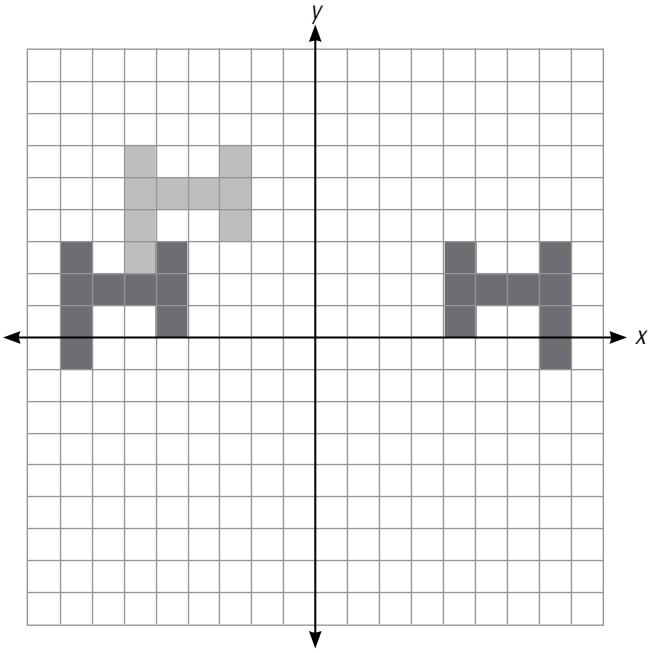
(8, 4)
(10, 3)
(12, 0)
(10, 1)



3. a) The transformation was a 90° rotation clockwise about the origin, followed by a translation 1 unit to the right and 4 units down.

   b) The transformation was a reflection over the *x*-axis, followed by a translation 8 units to the right and 6 units up.

4. a) The final image will have vertices at: (4, 0), (5, 0), (5, 1), (7, 1), (7, –1), (8, –1), (8, 3), (7, 3), (7, 2), (5, 2), (5, 3), and (4, 3).



   b) It needs to move 2 units to the right and 3 units down.

CHAPTER TEST, p. 252

1. a) A′(–2, –1)

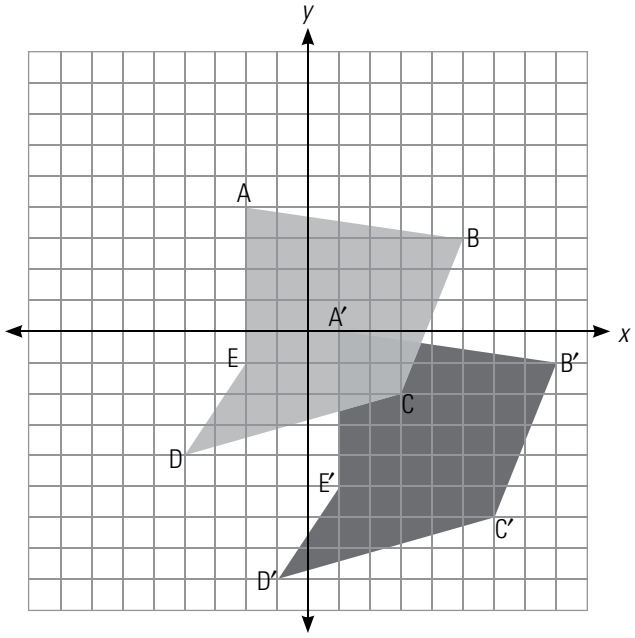
   b) C′(5, 3)

2. a) fourth quadrant

   b) B′(4, –7)

3. a) 3 units to the right and 4 units down

   b) A′(1, 0)
   B′(8, –1)
   C′(6, –6)
   D′(–1, –8)
   E′(1, –5)



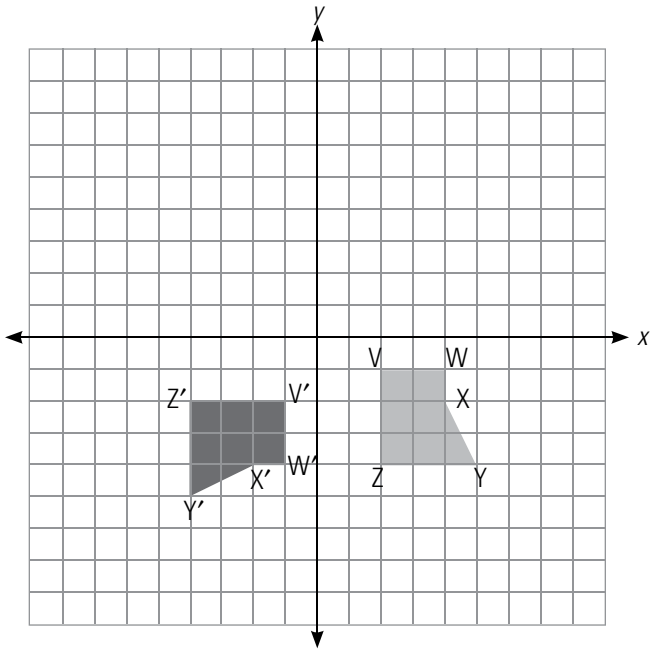
4. a) V(2, –1) → V′(–1, –2)

W(4, –1) → W′(–1, –4)

X(4, –2) → X′(–2, –4)

Y(5, –4) → Y′(–4, –5)

Z(2, –4) → Z′(–4, –2)



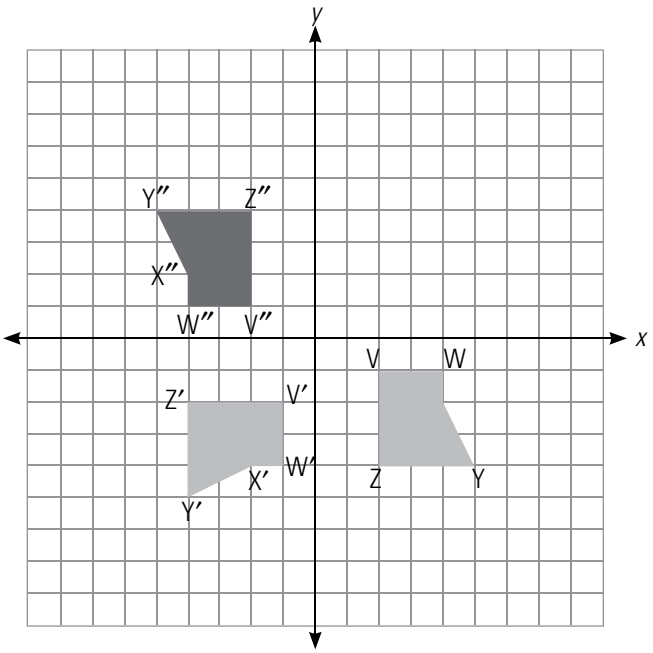
b) V(2, –1) → V″(–2, 1)

W(4, –1) → W″(–4, 1)

X(4, –2) → X″(–4, 2)

Y(5, –4) → Y″(–5, 4)

Z(2, –4) → Z″(–2, 4)



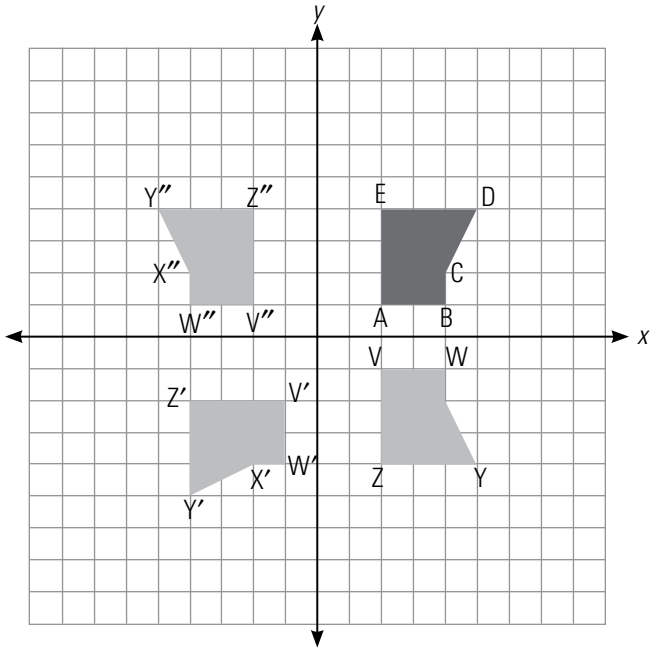
c) V″(–2, 1) → A(2, 1)

W″(–4, 1) → B(4, 1)

X″(–4, 2) → C(4, 2)

Y″(–5, 4) → D(5, 4)

Z″(–2, 4) → E(2, 4)



5. A″(1, –2)

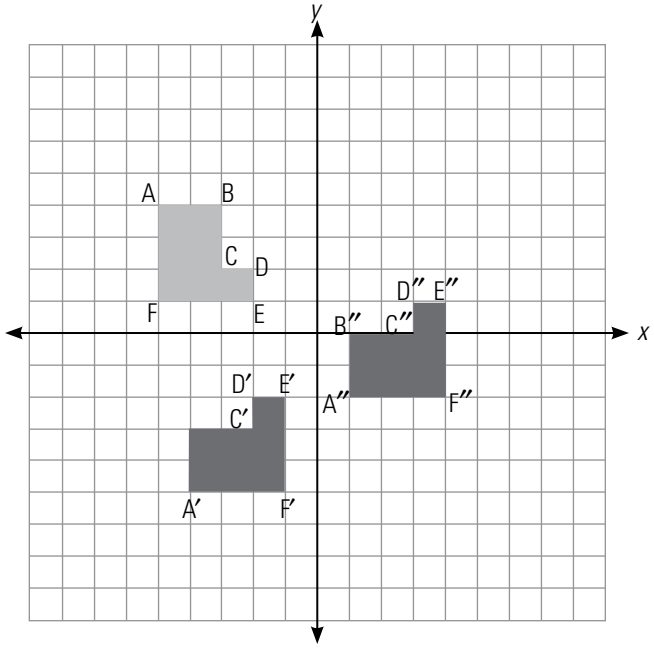
   B″(1, 0)

   C″(3, 0)

   D″(3, 1)

   E″(4, 1)

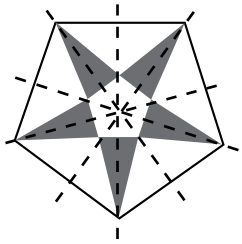
   F″(4, –2)



6. Answers will vary. Possible solutions include:

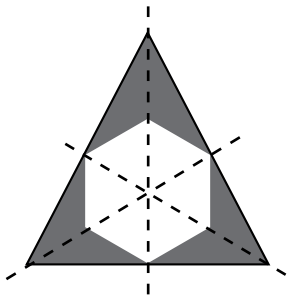
   - a reflection over the *x*-axis, followed by a reflection over the *y*-axis, then a translation 1 unit to the right;
   - a translation of 1 unit to the left, followed by a reflection over the *x*-axis and a reflection over the *y*-axis;
   - a rotation of 180° about the origin, followed by a translation of 1 unit to the right; or
   - a translation of 1 unit to the left, followed by a rotation of 180° about the origin.

7. a) The image has 5 lines of symmetry.



   b) The image has no lines of symmetry.

   c) The image has 3 lines of symmetry.



   d) The image has no lines of symmetry.

8. a) scale factor = 1.714 or $\frac{12}{7}$

   The largest doll is about 20.6 cm tall.

b) diameter: 2.1 cm

height: 3.6 cm

c) The new set of dolls is not a dilation of the first set of dolls.

CHAPTER 7
TRIGONOMETRY
7.1 THE SINE LAW

REVIEW: WORKING WITH TRIGONOMETRIC RATIOS

BUILD YOUR SKILLS, p. 258

1. a) 4.4 cm

   b) 69.8 cm

   c) 12.3 cm

   d) 164.1 m

2. a) 41°

   b) 40°

   c) 43°

   d) 48°

NEW SKILLS: WORKING WITH THE SINE LAW

BUILD YOUR SKILLS, p. 262

3. a) 624.9 m

   b) 12.4 cm

   c) 54.3 cm

BUILD YOUR SKILLS, p. 264

4. a) $\angle A \approx 30°$

   b) $\angle H \approx 38°$

   c) $\angle N \approx 25°$

   $m \approx 14.9$ cm

BUILD YOUR SKILLS, p. 266

5. 4.9 m

6. a) 14.7 m

   b) 7.3 m

   c) 4.3 m

7. 2750.4 m

BUILD YOUR SKILLS, p. 270

8. 74°

9. a) 49°

   b) 3.5 m

PRACTISE YOUR NEW SKILLS, p. 271

1. a) $q \approx 133.5$ m

   b) $\angle Z \approx 49°$

   $x \approx 2.8$ m

2. 5.7 m

3. 144.1 m

4. a) 131.8 m

   b) 93.2 m

   c) 93.2 m

5. 2.1 km

7.2 THE COSINE LAW

NEW SKILLS: WORKING WITH THE COSINE LAW

BUILD YOUR SKILLS, p. 276

1. a) $r \approx 5.8$ km

   b) $y \approx 8.5$ cm

2. 195.4 m

3. Sheena has to walk 467.9 m farther than if she could take a straight-line path to Linh's house.

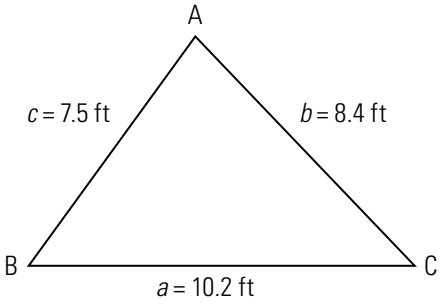
BUILD YOUR SKILLS, p. 279

4. a) $\angle Z \approx 17°$

   b) $\angle T \approx 42°$

5. 19°

6. a)



   b) $\angle A \approx 80°$

   $\angle B \approx 54°$

   $\angle C \approx 46°$

BUILD YOUR SKILLS, p. 282

7. 172.4 km

8. 764.6 m

9. 72°

PRACTISE YOUR NEW SKILLS, p. 284

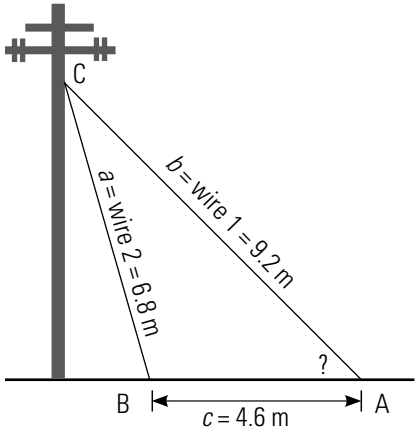
1. a) $x \approx 7.5$ m

   b) $\angle M \approx 61°$

2. 5.5 km

3. 5.5 km

4.



   a) $\angle A \approx 45°$

   The first wire is installed at an angle of elevation of 45°.

   b) 6.5 m

   c) 6.5 m

CHAPTER TEST, p. 287

1. a) $p \approx 57.0$ cm

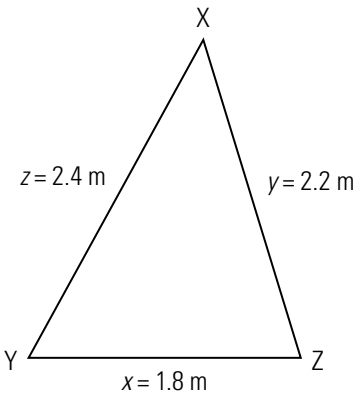
   b) $\ell \approx 15.6$ cm

2. a) $\angle A \approx 71°$

   b) $\angle Z \approx 57°$

3. 32.6 m

4.



$\angle X \approx 46°$

$\angle Y \approx 62°$

$\angle Z \approx 72°$

5. a) 4.3 km

   b) Meg would have to travel 47° west of north to get to the stranded boater.

6. a) Kumar is 141.0 m from the eagle.

   Meriah is 260.2 m from the eagle.

   b) 137.9 m

CHAPTER 8
OWNING A SMALL BUSINESS
8.1 START A SMALL BUSINESS

REVIEW: WORKING WITH COMPOUND INTEREST

BUILD YOUR SKILLS, p. 294

1. a) total amount to be repaid = $8744.67

   monthly payments = $364.36

   b) total amount to be repaid = $9993.63

   monthly payments = $166.56

2. a) Option 1: $5307.99

   Option 2: $5348.81

   b) Option 1: $221.17

   Option 2: $148.58

   c) Answers will vary.

NEW SKILLS: CONSIDERING SMALL BUSINESS OPPORTUNITIES

BUILD YOUR SKILLS, p. 296

3. There are 7874 youth under the age of 15 in Courtenay. There are 7035 youth under the age of 15 in Duncan.

   Courtenay would be a better location to start the fitness class because it has more potential clients. (However, you might want to consider other factors such as how spread out the population is within the area.)

4. a) 6103

   b) 183

NEW SKILLS: WORKING WITH START-UP AND OPERATING COSTS

BUILD YOUR SKILLS, p. 298

5. Answers will vary.

6. Answers will vary.

BUILD YOUR SKILLS, p. 300

7. a) Yes, Marcus does have enough money saved to start his business. He has $625.00 more saved than he needs to start his business.

   b) Answers will vary.

8. a) approximately 7 months

   b) Answers will vary.

9. a) $625.00

   b) $657.30

BUILD YOUR SKILLS, p. 303

10. Answers will vary.

11. a)

Item	*Cost*	*Start-up or Operating?*
Business licence	$175.00/year (paid in full at start-up)	Operating
Gasoline	$175.00/month	Operating
Vehicle insurance	$200.00/month	Operating
Ladders	$650.00	Start-up
Coveralls and clothes	$175.00	Start-up
Cleaning cloths	$25.00	Start-up
Canvas sheeting	$285.00	Start-up
Paint brushes and trays	$150.00	Start-up
Phone bill	$50.00/month	Operating
Trowels, crack filler, sand paper	$75.00	Start-up
Miscellaneous	$100.00	Start-up

   b) $2060.00 (Note that although the business licence is not a start-up cost, it must be paid before Jarrod can start his business, so it is included here.)

12. a)

Item	*Cost*	*Start-up or Operating?*
Ice cream	$500.00/month	Operating
Ice cream cart	$3000.00	Start-up
Business licence	$200.00/year (paid in full at start-up)	Operating
Insurance	$2500.00/year (paid in full at start-up)	Operating
Printing a sign for her cart	$100.00	Start-up
Gasoline	$200.00/month	Operating

   b) $6500.00

   c) 48%

   d) She needs to borrow $4800.00.

   She will have to repay $5249.40 for the loan.

PRACTISE YOUR NEW SKILLS, p. 305

1. Anna should choose the location outside Handsome Home, because the people who pass by this location are more likely to want to stop for a foot massage. The people passing by The Toy Top are mostly mothers with children—the mothers are unlikely to want to get a foot massage while they have their children with them, because it would be difficult to supervise and entertain them. The location outside Handsome Home sees mainly adults alone or in pairs; these potential customers are much more likely to want a foot massage.

2. Answers will vary.

3.

JAM AND JELLY BUSINESS START-UP AND OPERATING COSTS

Expense	*Start-up or Operating?*
Business license	Operating
Cash box	Start-up
Signs for booth	Start-up
Jars	Operating
Fruit and other ingredients	Operating
Booth cost (per market date)	Operating

4. a)

Item	*Cost*	*Start-up or Operating?*
Ladder	$250.00	Start-up
Other tools	$500.00	Start-up
Business licence (annual)	$125.00	Operating
Advertising signs	$50.00	Start-up
Truck (used)	$15 000.00	Start-up
Signage for truck	$100.00	Start-up
Phone bill (monthly)	$80.00	Operating
Vehicle insurance (monthly)	$200.00	Operating
Gasoline (weekly)	$50.00	Operating
Vehicle maintenance (annual)	$500.00	Operating

b) $16 025.00 (Note that, although the business licence is not a start-up cost, Michael needs to pay it before he opens his business.)

c) Michael needs to borrow $11 025.00.

He will have to repay $14 268.80 for the loan.

5. a) Option 1: $4564.66

Option 2: $4564.66

b) Option 1: $126.80

Option 2: $186.00

c) Answers will vary.

8.2 OPERATE A SMALL BUSINESS

NEW SKILLS: WORKING WITH REVENUE AND EXPENSES

BUILD YOUR SKILLS, p. 310

1.

Item	*Revenue or Expense?*	*Fixed or Variable?*
Rent	Expense	Fixed
Business insurance	Expense	Fixed
Employee wage	Expense	Fixed
Telephone and internet bill (flat rate plan)	Expense	Fixed
Tip from client	Revenue	Variable
Utility bill	Expense	Variable*
Bill for printer cartridges from supplier	Expense	Variable
Payment for design services	Revenue	Variable
Monthly website maintenance fee	Expense	Fixed
Bill for paper from supplier	Expense	Variable

* Utility bill could also be considered fixed if Sam is on an equalized payment plan.

2. a)

Item	*Cost*	*Fixed or Variable?*
Carpet shampooer repair	$175.00	Variable
Shampoo	$125.00	Variable
Advertising (ongoing ads in newspaper)	$75.00/month	Fixed
Business license	$110.00/year	Fixed
Van insurance	$125.00/month	Fixed
Gas	$300.00/month	Variable
Salaries for Kate and Marc	$2160.00/ month each	Fixed
Telephone (fixed rate plan)	$70.00	Fixed

b) $4590.00

3. a)

Item	*Cost*	*Expense or Revenue?*	*Fixed or Variable?*
Loan payment for purchase of stand	$175.00	Expense	Fixed
Monthly business license	$45.00	Expense	Fixed
Food supplies	$1700.00	Expense	Variable
Wages for employees	$525.00	Expense	Fixed
Insurance	$175.00	Expense	Fixed
Hot dog sales	$3500.00	Revenue	Variable
Tips	$92.00	Revenue	Variable

b) Expenses: $2620.00

Revenue: $3592.00

NEW SKILLS: WORKING WITH PROFIT, LOSS, AND THE BREAK-EVEN POINT

BUILD YOUR SKILLS, p. 313

4. a) Serge's company had a profit of $75.00.

b) 211

5. 303

6. a) $3993.54

b) Chanh must provide 45 rides in one month.

Answers regarding the reasonableness will vary.

NEW SKILLS: MAKING PROFITABLE BUSINESS DECISIONS

BUILD YOUR SKILLS, p. 317

7. Answers will vary.

8. a) $694.00 profit

b) $499.00 profit

c) Answers will vary.

PRACTISE YOUR NEW SKILLS, p. 318

1.

Item	*Revenue or Expense?*	*Fixed or Variable?*
Rent	Expense	Fixed
Insurance	Expense	Fixed
Office supplies (printer paper, ink)	Expense	Variable
Monthly payment from regular client	Revenue	Fixed
Utility bill	Expense	Variable
Telephone and internet bill (flat rate plan)	Expense	Fixed
Payment from client for a one-time job	Revenue	Variable
Repair bill for fixing printer	Expense	Variable

2.

Item	*Value*	*Revenue or Expense?*
Cheques from customers	$700.00	Revenue
Cleaning supplies	$24.86	Expense
Cheques from customers	$500.00	Revenue
Employee wages	$568.00	Expense
Employee wages	$496.00	Expense
Cash from customers	$550.00	Revenue
Cleaning supplies	$65.32	Expense
Cheques from customers	$600.00	Revenue
Cash from customers	$300.00	Revenue
Employee wages	$512.00	Expense
Cheques from customers	$250.00	Revenue
Employee wages	$512.00	Expense
Vacuum repair	$64.24	Expense

b) $657.58 profit

c) Answers will vary.

3. a) Publishing company: $17 375.00

   Self-publishing: $29 750.00

   b) Answers will vary.

4. $16.86

5. a) $124.50

   b) $41.50/hour

   c) Answers will vary.

8.3 BUY OR LEASE A VEHICLE FOR YOUR BUSINESS

NEW SKILLS: BUYING AND LEASING VEHICLES

BUILD YOUR SKILLS, p. 323

1. a) New truck: $25 067.90

   Used truck: $23 928.45

   b) Answers will vary.

2. a) $20 154.75

   b) $1179.02

3. $44 960.24

BUILD YOUR SKILLS, p. 327

4. a) $1792.27

   b) $32 589.27

5. a) $35 352.00

   b) $43 550.00

   c) Answers will vary.

6. a) $5425.00

   b) $25 769.00

BUILD YOUR SKILLS, p. 330

7. Option 1: $30 279.00

   Option 2: $30 690.80

   Option 3: $28 607.91

8. $14 755.29

9. a) $18 865.00

   b) $28 615.00

   c) Buying the vehicle without leasing it would cost $7615.00 less than buying it at the end of the lease.

PRACTISE YOUR NEW SKILLS, p. 332

1. $19 441.40

2. $36 639.84

3. a) $17 545.20

   b) $25 686.86

   c) $514.31

   d) Answers will vary.

4. a) $25 560.00

   b) $41 690.00

   c) It would cost $8705.27 less to purchase the vehicle rather than leasing it.

CHAPTER TEST p. 335

1. a) Start-up costs: the goods and services you may need to purchase before you begin operating your business

   b) Operating expenses: the ongoing cost of space, equipment, supplies, and other items required to run a business

   c) Profit: the amount by which revenue exceeds expenses for a given period

   d) Break-even point: the point at which business expenses equal sales revenue

2.

Item	*Start-up or Operating?*
Basic tools	Start-up
Ladder	Start-up
Rental storage space	Operating
Truck payments	Operating
Phone bill	Operating
Gas	Operating

3. a) $3087.00

   b) Janelle does not quite have enough money to cover her start-up costs. She is $87.00 short. Suggested spending adjustments will vary.

4. a) Option 1: $5551.02

   Option 2: $5624.32

   b) Option 1: $154.20

   Option 2: $156.31

5. 39

6. a)

Item	*Value*	*Revenue or Expense?*
Payment from customer	$500.00	Revenue
Soil	$56.00	Expense
Payment from customer	$250.00	Revenue
Employee wages	$625.00	Expense
Plants	$512.00	Expense
Payment from customer	$700.00	Revenue
Gas for truck	$100.00	Expense
Truck insurance	$130.00	Expense
Truck repair	$300.00	Expense
Employee wages	$512.00	Expense
Payment from customer	$1000.00	Revenue
Telephone bill	$80.00	Expense

   b) $135.00 profit

7. a) $29 329.24

   b) $4579.24

   c) $488.82

8. a) $25 000.00

   b) $39 950.00

   c) She will pay $10 050.00 less if she buys the vehicle instead of leasing and then buying it.