Answers

Chapter 1

Get Ready, pages 4 to 5

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

2. a) $\frac{1}{4}$ **b)** $\frac{1}{3}$
c) $\frac{1}{2}$ **d)** $\frac{5}{6}$
e) $\frac{3}{11}$ **f)** 1

3. a) 12 inches **b)** 6 inches
c) 3 inches **d)** 50%

4. a) \$0.13 **b)** \$0.26
c) \$0.39 **d)** \$1.30
e) \$2.60 **f)** \$3.90
g) \$13 **h)** \$26
i) \$39 **j)** \$43.29

5. a) 0.5, 50% **b)** 0.1, 10%
c) $\frac{7}{20}$, 35% **d)** $\frac{7}{100}$, 7%
e) $\frac{9}{100}$, 0.09 **f)** $\frac{9}{10}$, 0.9

6. a) 52 weeks **b)** 26 weeks
c) 4 **d)** 13 weeks
e) $\frac{1}{4}$

7. a) $\frac{1}{3}$ **b)** $\frac{1}{4}$
c) groceries and car **d)** \$1315
e) rent 38%, groceries 22.8%, car 24.7%, Internet 3%, phone 3.8%, entertainment 7.6%

8. a) The numbers on the vertical scale are "in thousands."
b) Example: Monday 45 000, Tuesday 30 000, Wednesday 85 000, Thursday 55 000, Friday 70 000, Saturday 187 500, Sunday 215 000
c) Example: 687 500
d) Example: Since most people do not work on weekends, they have more time to download music.

9. a) $4 \times 4 \times 4$ **b)** $2 \times 2 \times 2 \times 2$
c) 6×6 **d)** $10 \times 10 \times 10 \times 10$
e) $3 \times 3 \times 3 \times 3$ **f)** $5 \times 5 \times 5$
g) $2 \times 2 \times 2 \times 2 \times 2 \times 2$
h) $10 \times 10 \times 10 \times 10 \times 10 \times 10$

10. a) 64 **b)** 16
c) 36 **d)** 10 000
e) 81 **f)** 125
g) 64 **h)** 1 000 000

1.1 Accuracy and Precision, pages 6 to 19

On the Job 1 Check Your Understanding, pages 9 to 10

1. a) accurate
b) not accurate

2. Example: 130° could be considered accurate if the degree of precision is to the nearest 10 degrees.

3. C

4. The other two measurements are not accurate because they are given in centimetres.

5. 530 km

6. a) A distance cannot have units of hours.
b) Example: Joanne could mean it will take 5.3 h to drive from Edmonton, AB, to Saskatoon, SK. She could also mean the distance is represented by 5.3 cm, which is 530 km.
c) Example: Yes. This will help her have a good idea of the length of the trip so that she can plan the amount of fuel she needs, when to stop, and approximate time of arrival.

7. Chad did not actually measure the diameter of the table.

8. Example: The measuring wheel will most likely give a more precise measurement because it can measure the distance from end to end as one continuous length. A 10-metre measuring tape must be repositioned every 10 metres.

9. Examples:
a) It is very hot outside.
b) It will take a very long time to clean the room.
c) The object is very heavy.
d) His answer was completely wrong.

On the Job 2 Check Your Understanding, pages 13 to 14

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

2. a) $1\frac{5}{16}''$, $\frac{3}{4}''$, $1\frac{1}{8}''$ **b)** 3 cm, 2 cm, 3 cm
c) 3.3 cm, 1.9 cm, 2.9 cm

3. a) 50° **b)** 10°
c) 155°

4. a) 48°
b) 8°
c) 156°

5. a) bathroom scale: pounds, gym scale: tenths of a pound
b) The gym scale has greater precision because it has a smaller measurement unit, 0.1 pound.
c) Both scales are accurate but to different precisions of accuracy. The bathroom scale is accurate to the nearest 10 pounds, while the gym scale is accurate to the nearest 0.1 pound.

6. a) one tenth of a cent
b) Example: No. There are no coins for tenths of a cent. Prices are rounded to the nearest cent.
c) \$1.41 **d)** \$2.82
e) \$14.10 **f)** \$14.11
g) 141.1 cents

7. a) $5'\,7''$
b) $6'$
c) Example: Yes. There is only $\frac{1}{4}''$ difference and most people state their height to the nearest inch. The height is quite accurate relative to her actual height.
d) Example: No. She is almost $\frac{1}{2}'$ shorter than $6'$, which is an obvious difference. The height is not very accurate relative to her actual height.

On the Job 3 Check Your Understanding, pages 16 to 17

1. a) maximum: $22\frac{1}{4}''$, minimum: $21\frac{3}{4}''$
b) maximum: 46 °C, minimum: 44 °C
c) maximum: 360 °F, minimum: 340 °F
d) maximum: 1.01 m, minimum: 0.99 m
e) maximum: 1.001 m, minimum: 0.999 m
f) maximum: 5.2 lb, minimum: 4.8 lb

2. a) $\pm\frac{1}{4}''$ **b)** ± 1 °C
c) ± 10 °F **d)** ± 1 cm
e) ± 1 mm **f)** ± 0.2 lb

3. ± 5 g

4. 158 °F to 162 °F

5. a) maximum: 6.01 mm, minimum: 5.99 mm
b) maximum: 6.11 mm, minimum: 6.09 mm
c) 0.12 mm; The greatest possible distance is the difference between the maximum diameter of the nut and the minimum diameter of the bolt.
d) 0.08 mm
e) Example: To ensure that the bolt fits inside the nut, the inside diameter of the nut must be greater than the diameter of the bolt.

6. 347 g to 353 g

7. Examples:
a) Yes, it is accurate to $\pm$ 10 g. A 350-g package could have a reading from 340 g to 360 g.
b) No. Since cereal is sold by mass, the machines in the factory are likely more precise, to make sure they meet industry standards and maximize profit.

8. a) 7 inches; the middle of the given range of lengths
b) $7'' \pm 1''$

Work With It, pages 18 to 19

1. a) Example: nearest kilometre; that is the smallest unit given in the value
b) Example: nearest ten million kilometres
c) 2 098 232 km
d) Example: Yes. Knowing an approximate distance is probably acceptable for most situations, since the Earth's orbit is not circular.

2. Example: No. It is important to give the prescribed dosage. Raheem's method is too inaccurate.

3. a) baking soda: $\frac{1}{4}$ teaspoon
salt: $\frac{1}{8}$ teaspoon
b) Example: Yes. These are equivalent measures and the original recipe worked with the non-traditional amounts.

4. a) No. Sarah did not convert 8 feet to 96 inches. She actually needs 8640 square inches.
b) Yes. If the calculation is not accurate, Sarah will either not have enough material to make the duvet or have too much material, which is not returnable.

5. Example: The possible range of people that liked the new flavour is from 47% to 57%. Anything less than 50% results in a majority of the people disliking the new flavour.

6. Yes. Example: measuring the diameter of a flat washer to three decimal places, but not measuring the true diameter

7. Yes. Example: measuring the mass of a tin of soup as 300 g when the actual mass is 298 g
8. Example: Accuracy is how close a measured value is to the actual value. For example, if a window that actually measures 2.25 m by 1.5 m is labelled as 2 m by 2 m, this would not be accurate. Precision is the degree of exactness to which the measured value is taken. For example, 23 cm is less precise than 23.4 cm.
9. Example: A laser distance meter can be used to measure lengths, with a precision of $\frac{1}{16}''$, and determine area and volume. These are used by people in construction, remodelling, and landscaping fields. A speed square is a triangular-shaped tool used to draw lines or lay out angles, in degrees, for roofs, stairway, or decks. It is used by people in the construction field. A theodolite is an optical instrument for measuring angles, to fractions of a degree, in the horizontal and vertical planes. Theodolites are mainly used surveying.
10. Example: My measurements will be more accurate since one sixteenth is a smaller unit than one tenth.

1.2 Probability and Odds, pages 20 to 29

On the Job 1 Check Your Understanding, pages 24 to 25

1. a)

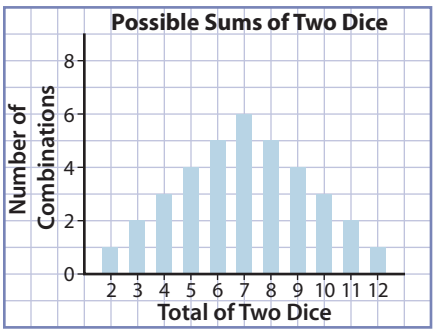
Total of Two Dice	Possible Outcomes	Number of Combinations
2	(1, 1)	1
3	(1, 2) (2, 1)	2
4	(1, 3) (2, 2) (3, 1)	3
5	(1, 4) (2, 3) (3, 2) (4, 1)	4
6	(1, 5) (2, 4) (3, 3) (4, 2) (5, 1)	5
7	(1, 6) (2, 5) (3, 4) (4, 3) (5, 2) (6, 1)	6
8	(2, 6) (3, 5) (4, 4) (5, 3) (6, 2)	5
9	(3, 6) (4, 5) (5, 4) (6, 3)	4
10	(4, 6) (5, 5) (6, 4)	3
11	(5, 6) (6, 5)	2
12	(6, 6)	1

b) 36

c) 7

d) $\frac{1}{6}$, approximately 16.67%

2. a)



b) Example: Yes

3. a) $\frac{1}{9}$

b) 11

4. a) $\frac{1}{2}$, 50%

b) $\frac{1}{4}$, 25%

c) $\frac{1}{13}$, approximately 7.7%

5. The probability of precipitation is 3 in 5, $\frac{3}{5}$, or 0.6.

6. a) $\frac{1}{50}$, 0.02, 2%

b) The medication is effective 9 times in 10, $\frac{9}{10}$, or 0.9.

c) Example: No. She does not get headaches often.

d) Example: Yes. He gets headaches regularly, so he would benefit from the medication.

7. a) moderate; 0.0005, $\frac{1}{2000}$

b) high; The probability that an electronic part in a television fails is 1 in 8.

c) Example: car: low; reliability, safety/injury concerns; television: moderate; built-in usage period for electronics

On the Job 2 Check Your Understanding, pages 27 to 28

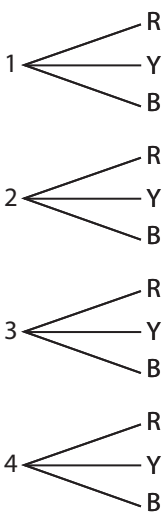
1. a) 1:51 **b)** 1:12
c) 1:3 **d)** 1:1

2. a) 1:5 **b)** 1:2
c) 1:1 **d)** 5:1

3. a) 1:9 **b)** 2:3
c) 3:2 **d)** 7:3

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

5. a)



b) 12 outcomes

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

d) 1 : 11

6. a) 1 : 15 **b)** 1 : 14

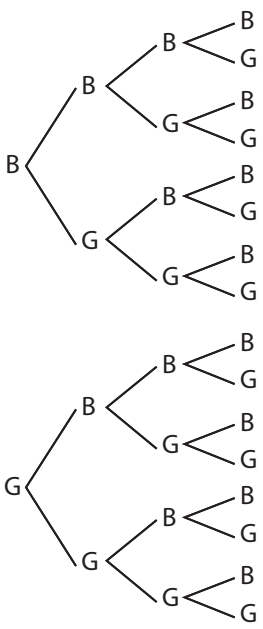
c) 1 : 1

7. a) 1 : 199 **b)** 180; 1 : 179

c) 1 : 50

Work With It, pages 28 to 29

1. a)



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

2. a) $\frac{1}{12}$ **b)** 1 : 11

3. a) 1 : 3, $\frac{1}{3}$ **b)** 2500

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

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

5. No. There is only a chance of winning and the odds are not in your favour. The probability of winning is $\frac{1}{6}$.

6. The odds are 1 : 1, or equal.

7. In the ratio $a : b$, the value of a must be greater than b.

8. They are the same because one of the numbers represents the number of successful outcomes. They are different because one of the numbers in odds represents unsuccessful outcomes, whereas probability uses total possible outcomes.

1.3 Theoretical and Experimental Probability, pages 30 to 41

On the Job 1 Check Your Understanding, pages 33 to 34

1. a) 50% **b)** 1 : 1

c) There is no guarantee. Each flip is independent.

2. a) 40 tails

b) It is uncertain, since each experiment is different.

3. a) 28% **b)** 50%

c) 1 : 1 **d)** 83 : 17

4. a) $\frac{1}{10}$, 10% **b)** $\frac{1}{5}$, 20%

c) $\frac{3}{10}$, 30% **d)** $\frac{2}{5}$, 40%

e) $\frac{1}{2}$, 50% **f)** $\frac{3}{5}$, 60%

5. a) $\frac{1}{52}$ **b)** 2%

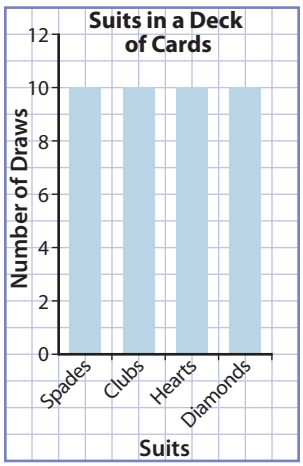
c) $\frac{1}{51}$ **d)** 2%

e) 12 cards

6. a) 25%

b) Example: I predict that I will get a card of each suit about 10 times.

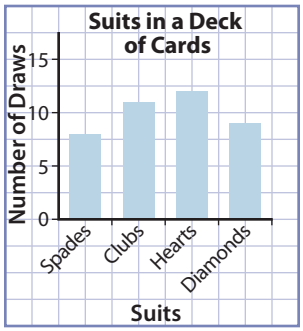
c)



d) Example:

Suit	Tally	Total
Spades	𝍸 |||	8
Clubs	𝍸 𝍸 |	11
Hearts	𝍸 𝍸 ||	12
Diamonds	𝍸 ||||	9

e) Example:



f) Example: My prediction was pretty close.

7. Examples:

a)

Coin	Tally	Total
Heads	𝍸 𝍸 𝍸 |||	18
Tails	𝍸 𝍸 ||	12

b) 12 **c)** 40%

d) I predict that the more times the coin is flipped, the closer the result gets to 50% for heads or tails.

e) 5%

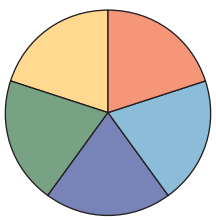
8. a) 216

b) (1, 1, 5), (1, 5, 1), (5, 1, 1), (2, 2, 3), (2, 3, 2), (3, 2, 2), (3, 3, 1), (3, 1, 3), (1, 3, 3), (4, 1, 2), (4, 2, 1), (2, 4, 1), (2, 1, 4), (1, 4, 2), (1, 2, 4)

c) $\frac{5}{72}$ or about 6.9%

9. a) 5

b) Example:



10. $\frac{1}{1296}$

On the Job 2 Check Your Understanding, pages 36 to 39

1. f), c), b), e), d), a)

2. a) 20% **b)** $\frac{1}{6}$

c) better

3. 50%

4. a) 1 : 3

b) Example: Theoretically, the odds were against both girls getting a spot, but they were lucky.

5. a) $\frac{3}{13}$

b) approximately 23%

c) about 6 times

d) about 12 times

e) Example:

Vowels	Consonants
𝍸 ||||	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 |

f) Example: 9

g) Example: 18%

h) Example: fairly close

6. 83%

7. **Step 1:** approximately 8 winners

Step 2: rolling a sum of 7

Step 3: Roll two dice. Every time a sum of 7 shows up, it represents a win.

Step 4: Examples:

a) 11 wins

b) My prediction is a little less than my experimental results.

c) Five students out of 23 had better experimental results. The experimental results get closer to the theoretical results for larger numbers of rolls. Fifty rolls is not that large.

8. a) $\frac{63}{95}$ or approximately 66%

b) 10

c) My prediction is based on the theoretical probability, which is not a guarantee that 66% of all cars will be serviced correctly.

9. a) $\frac{6}{49}$ **b)** $\frac{5}{48}$

c) $\frac{4}{47}$ **d)** $\frac{3}{46}, \frac{2}{45}, \frac{1}{44}$

e) $\frac{720}{10\ 068\ 347\ 520}$

f) $\frac{1}{13\ 983\ 816}$

Work With It, pages 39 to 41

1. a) 50%

b) 50%

c) 3 socks; If the first is black, the second sock might be white, but the third sock will be either black or white and he will then have a pair.

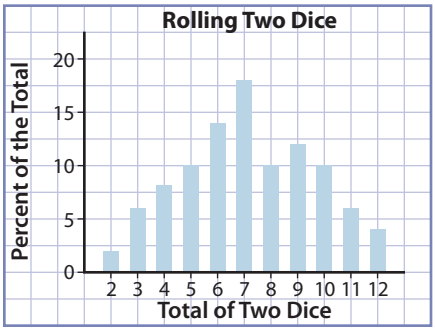
2. Examples:

Step 1:

a)–c)

Total of Two Dice	Tally	Number of Times Rolled	Percent of Total
2	|	1	2%
3	|||	3	6%
4	||||	4	8%
5	𝍸	5	10%
6	𝍸 ||	7	14%
7	𝍸 ||||	9	18%
8	𝍸	5	10%
9	𝍸 |	6	12%
10	𝍸	5	10%
11	|||	3	6%
12	||	2	4%

d)



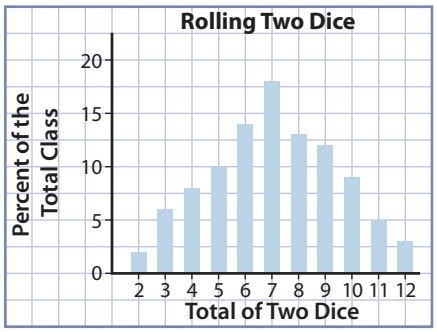
Step 2:

a) There are 24 students, so 1200 rolls.

b)

Total of Two Dice	Total Number of Times Rolled	Percent of Class Total
2	20	2%
3	66	6%
4	90	8%
5	124	10%
6	168	14%
7	220	18%
8	153	13%
9	144	12%
10	110	9%
11	65	5%
12	40	3%

c)



Step 3: The class graph is closer to the expected results because it reflects more rolls (1200 instead of only 50). The more times an experiment is performed, the closer the experimental probability is to the theoretical probability.

3. a) 17%

b) The likelihood of success increases because after the first guess there are 99 grid locations instead of 100.

c) 5% **d)** 3%

e) The probability increases because the remaining number of total grid locations to guess decreases.

4. Yes. The even sums are 2, 4, 6, 8, 10, and 12, and their probabilities are 3%, 8%, 14%, 14%, 8%, and 3%, respectively. The sum of these probabilities is 50%. The odd sums are 3, 5, 7, 9, and 11, and their probabilities are 6%, 11%, 17%, 11%, and 6%. The sum of these probabilities is 50%.

5. Example: No. While probabilities of certain events may not change, players can use these probabilities to increase their chances of winning.

6. Example: Yes. The chances of winning are typically quite low.

7. The probability of five coins landing on heads is more likely to occur. It is $\frac{1}{32}$ or 3.125%, while the probability of rolling a 12 with two dice is $\frac{1}{36}$ or 2.78%.

1.4 Working With Probability, pages 42 to 53

On the Job 1 Check Your Understanding, pages 46 to 48

1. a) 1:1 **b)** 1:5

c) 1:3 **d)** 1:1

2. a) 25 heads, 25 tails **b)** 10 3s

c) 10 hearts **d)** 40 times

3. a) 16.66667%, 17% **b)** 9.09091%, 9%

c) 11.11111%, 11% **d)** 0.01000%, 0%

4. a) $\frac{3}{5}$ b) $\frac{1}{12}$
   c) $\frac{3}{20}$ d) $\frac{37}{80}$
5. a) 60% b) Example: 8.33%
   c) 15% d) 46.25%
6. 267 boards
7. a) 99.8%
   b) Example: Yes, because 99.8% of 50 is 49.9 bulbs, or approximately 50 bulbs.
   c) 10 strands
   d) Example: The percent of defective bulbs is extremely low, and the manufacturer knows it will rarely need to replace bulbs. It is also good customer service, and this policy may persuade some customers to buy the product.
8. a) No
   b) about 21 dozen
   c) Example: No. The probability of finding a broken egg is 0.4%.
9. Examples:
   a) Yes. They should be prepared just to be safe, though the theoretical probability of 1% does not guarantee it will indeed happen.
   b) Answers may vary.
10. Examples:
    a) The player gets a hit 345 times for every 1000 at-bats. So, the player is likely to get a hit 34.5% of the time.
    b) A batting average over 0.400 is very rare because of the official definition of the term. To achieve a hit, the batter must reach first base safely, not just make contact with the ball. There are also a number of circumstances under which a plate appearance is not counted as an official at-bat. The 2012 MLB statistics lists only one player as having a batting average of 0.400 for the regular season, Josh Hamilton.

On the Job 2 Check Your Understanding, pages 50 to 52

1. a) 100% b) 51%–99%
2. Examples:
   a) D b) B
   c) A d) E
   e) C f) C
   g) C h) C
   i) B j) B
3. Pizza Perfect
4. a) 85%
   b) 40%
   c) 0%
   d) 0%; This has never happened in 20 years.
   e) Example: The ice has broken from April 25 to May 1 (inclusive) for 11 out of 20 years. There is a 55% chance the ice will break during this week, so they should not go ice fishing.
5. a) 40 people
   b) 20 000 people
   c) Example: What are the side effects? How bad is my nausea? How often do I get nausea?
6. a) 13 boxes
   b) approximately 3 tiles; 1% of 275 is 2.75
   c) 278 tiles; This accounts for the three possible broken tiles.
7. Example: Yes. There is only about a 14.3% chance that Ted will need a new transmission. If the car does need a new transmission, the cost of $2300 to replace the transmission is only $300 more than the listed price for this ten-year-old car.

Work With It, pages 52 to 53

1. Examples:
   a) Since 10% of the raspberries are spoiled, then 1 in 10 containers are spoiled. From a deck of cards select an ace to represent the number 1, and then cards with the numbers 2 to 10. Place all 10 cards in a bag. Designate one number, say 3, to represent a spoiled container of raspberries. Select one card from the bag and record the number. Put the card back in the bag and repeat the experiment.
   c) The number 3 was selected in 4 out of 50 trials, so 8% is the success rate.
   d) The experimental probability resulting from the simulation indicates that 8% of the raspberries in a shipment are spoiled.
2. a) about 11 TVs
   b) $560 000
   c) 84 customers
   d) Example: This allows the retailer to make additional money since they know that a very small percent of the TVs will break down within a three-year period. At the same time, some customers will purchase the extended warranty to have peace of mind.
   e) Example: Yes, I would purchase the extended warranty because without it, the cost of repairing a broken TV could be much higher than $50.

3. Example: The probability of 82% suggests that he is successful in approximately 8 out of 10 free throws. Since he has already had 8 successes, he most likely will not be successful on the ninth throw. However, it is possible that he will be successful. There is no guarantee that he will not be successful.

4. Examples:

a) I think Vera means that there is a very small probability of accurately predicting the weather for a total of six days in a row.

b) I agree with Vera because in my experience the weather forecast is often not accurate when predicting long-range weather (up to six days). However, it is a bit more accurate in predicting one or two days of weather.

5. Examples:

a) I think the person saying the expression is very confident that they will win the game. The chance of winning a lottery is very, very low, so the other player's chance of beating this person at the game is even lower than winning a lottery.

b) "fat chance," which means very little or no possibility; "in the bag," which means to have a good chance of success

6. Example: Insurance companies have actuaries who use statistics to determine the probabilities associated with occurrences of natural disasters. They also collect money from many people and businesses over a long period of time. They use this money to pay for losses that result from damage claims. If these events occur more often than expected, the insurance rates go up.

Chapter 1 Skill Check, pages 54 to 55

1. maximum temperature: 51.5 °C; minimum temperature: 48.5 °C

2. Examples:

a) The measurement of $\frac{7}{8}''$ is likely more precise, since it has a precision of $\frac{1}{8}''$ versus $1''$.

b) Measuring instruments with different levels of precision were used, or the measuring tool was not read properly.

3. a) $\frac{1}{200}$, 0.005, 0.5%, The probability that you will win the door prize is 1 in 200.

b) $\frac{1}{25}$, 0.04, 4%, The probability that somebody at your table will win the door prize is 1 in 25.

c) $\frac{1}{8}$, 0.125, 12.5%, The probability that you will win the door prize is 1 in 8.

4. a) 1 : 3 **b)** 51 : 1

5. c), a), d), b)

6. a) I expect the coin to land on tails 50% of the time (or 20 tails) and on heads the other 50% of the time (or 20 heads).

b) Example: 24 tails, 16 heads

c) Example: More repetitions of the experiment are needed so that the value of the experimental probability becomes closer to the theoretical probability.

7. a) odds in favour

b) 3 : 1

c) Example: The P.O.P. can help you make decisions about what to wear, whether you need an umbrella, and what activities to plan for the day.

8. a) 500 tickets; 7000 tickets

b) 100%

Chapter 1 Test Yourself, pages 56 to 57

1. D

2. C

3. B

4. D

5. a) No. Mike forgot to change 18 in. to 1.5 ft. Mike really only needs 30 cubic feet of sand.

b) Example: Yes. If the calculated amount of sand needed is too low, the sandbox will not be filled. If it is too high, Mike will buy too much sand, and may not be able to return it for a refund.

6. a) Example: nearest hundred kilometres; the last two places are 0s

b) 147 000 000 km

c) Example: Yes. For a number this large, the difference between the actual value and the rounded value is minimal.

7. a) 2 : 1 **b)** 1 : 1

c) 5 : 1 **d)** 1 : 2

8. Examples:

a) For each game Jackie plays, the odds in favour of winning are only 1 : 3. The games are independent of each other, so she only has a 25% chance of winning each time she plays. It is likely that she will not win.

b) Yes, it is always possible because she may get lucky.

9. a) Yes. 10% of 12 glasses is 1.2, so it is most likely that a damaged glass will be in the box.

b) They should order 19 cases, to take into consideration that 10% (or approximately 23) of the glasses might be damaged. This will ensure that there will be 200 undamaged glasses that can be sold.

10. $\frac{1}{7}$

Chapter 2

Get Ready, pages 62 to 63

1. a) 57, 62, 68, 75, 77, 82, 90
b) 0, 3, 12, 29, 34, 48, 50
c) 1.75, 1.82, 1.9, 2.05, 2.1, 2.3, 2.50
d) 55.3, 59.4, 67.4, 72.8, 84.2, 87.1
e) −143, −140, −139, −139, −125, −119, −117
f) −9.1, −7.2, −4.1, 0, 1, 2.2, 4

2. a) 60 **b)** 46
c) 2.65 **d)** approximately 16.1
e) −0.375 **f)** 1.15

3. a) 105, 100, 85, 65, 50, 30, 25, 20; 100, 85, 65, 50, 30, 25; approximately 59.17
b) 90, 83, 55, 47, 31, 12, 4; 83, 55, 47, 31, 12; 45.6
c) 4.6, 4.6, 3.4, 2.2, 2.0, 1.6, 1.4, 1.4; 4.6, 3.4, 2.2, 2.0, 1.6, 1.4; approximately 2.53
d) 25.8, 19.8, 16.1, 15.4, 13.2, 12.7, 10.0; 19.8, 16.1, 15.4, 13.2, 12.7; 15.44
e) 12, 10, 8, 4, 0, −2, −15, −20; 10, 8, 4, 0, −2, −15; approximately 0.83
f) 8.3, 6.0, 4.5, 2.7, 0, −1.4, −2.7, −8.2; 6.0, 4.5, 2.7, 0, −1.4, −2.7; approximately 1.52

4. a) estimate: 30; actual: 31.2
b) estimate: 32; actual: 35.2
c) estimate: 140; actual: 145.5
d) estimate: 25; actual: 22.55

5. a) 13, 15, 24, 32, 49, 55, 60; 32
b) 39, 43, 52, 64, 81, 81; 52 and 64
c) 24.9, 54.2, 63.8, 88.7, 94.0; 63.8
d) 1.2, 2.7, 4.8, 5.3, 6.2, 9.9; 4.8 and 5.3
e) −19, −17, −14, −10, −5, −1; −14 and −10
f) −5.7, 1.6, 2.5, 3.4, 8.4; 2.5

6. a) 2, 4, 4, 7, 10, 17, 19, 19, 22, 25, 31, 36; 2, 4, 4, 7, 10, 17; 22, 25, 31, 36
b) 157, 163, 187, 199, 204, 206, 216, 217, 222, 234, 239, 243; 157, 163, 187, 199, 204, 206; 222, 234, 239, 243
c) 88.0, 90.7, 97.6, 100, 101.4, 105.1; 88.0, 90.7, 97.6; 101.4, 105.1
d) 1.9, 2.7, 3.5, 5.4, 6.1, 7.4, 8.3, 9.8, 10.0; 1.9, 2.7, 3.5, 5.4, 6.1; 8.3, 9.8, 10.0
e) −25, −21, −15, −15, −11, −9, −6, −3, 0, 4, 5, 6, 7, 11, 12, 19, 24, 25; −25, −21, −15, −15, −11, −9, −6, −3, 0; 7, 11, 12, 19, 24, 25
f) −14.5, −3.8, −0.2, 8.6, 17.2, 19.4; −14.5, −3.8, −0.2; 17.2, 19.4

7. a)

Size	Tally	Frequency
S	𝍸	5
M	𝍸 |	6
L	𝍸 |	6
XL	||||	4

b)

Time (s)	Tally	Frequency
60	|||	3
61	|||	3
62	𝍸 |	6
63	||||	4
64	|||	3

8. a) $x = 26$ **b)** $x = 27$
c) $x = 3$

2.1 Measures of Central Tendency, pages 64 to 69

On the Job 1 Check Your Understanding, pages 68 to 79

1. a) 73 and 76 **b)** 144
2. a) 20 and 35 **b)** 8
3. a) 70 **b)** 70
4. a) 51 cm
b) Example: No. In this case the mode is the longest length, so it does not represent the centre of the data values.
5. a) detached homes
b) Example: Yes. The mode represents the type of property that she has had the most sales for in the past five years.

6. a)

Size	Tally	Frequency
34	||	2
36	𝍸	5
38	||||	4
40	|||	3
42	|	1

b) size 36
c) Example: No. There are 8 team members who wear sizes greater than the mode, and only 2 team members who wear sizes less than the mode.

On the Job 2 Check Your Understanding, pages 71 to 72

1. a) 21.5 **b)** 13
c) 60

2. a) Taylor left the second 1.1 out of the ordered list.
b) 1.2

3. a)

Stems (tens)	Leaf (ones)
3	8 8 9
4	0 1 2 2 3 4

b) 41 kg **c)** 40.5 kg

4. a) 10.03 s
b) Example: Yes. The median also happens to be the mode, and there are more times over and close to 10 s than below 10 s.

5. a) Ben is correct. The leaf numbers must first be arranged in ascending order. There are 20 numbers. The median is the average of the 10th and 11th numbers, 71 and 73, so the median is 72.
b) The person may not have arranged the numbers in ascending order.

On the Job 3 Check Your Understanding, pages 74 to 77

1. a) 103.4 **b)** 37.7
c) 19.3 **d)** 4.5
e) −19.9 **f)** 0.2

2.

Value, x	Weighting, w (%)	Product of Value and Weighting, wx
7.5	25	187.5
18.0	40	720
12.6	10	126
9.0	10	90
20.8	15	312
Totals	100	1435.5

The weighted mean is approximately 14.4.

3. a) grade 12
b) grade 7: 5 kg; grade 8: 4 kg; grade 9: 4.5 kg; grade 10: 6 kg; grade 11: 5 kg; grade 12: 5 kg
c) Example: Grade 10 should win the prize for most kilograms collected per student.

4. 20 hours

5. Example: Slugging percentage is a better indicator because the weighting of each type of hit is taken into consideration. A higher slugging percentage reflects that more triples and home runs were hit than singles or doubles. The batting average simply combines all the types of hits without giving priority to each type. A batter could have a perfect batting average of 1.000 just by being at bat 10 times and hitting 10 singles. The same batter would score a slugging percentage of 1.000 which is far from the perfect slugging percentage of 4.000.

Work With It, pages 77 to 79

1. a) Morning class:

Stems (tens)	Leaf (ones)
4	6
5	0 2 5 8
6	0 2 8
7	1 3 5 7
8	0 0 4
9	0 2 5

Afternoon class:

Stems (tens)	Leaf (ones)
4	0 6 8
5	3 4 5 5
6	2 3 5 5 8
7	0 1 2 2 3 3 6 9
8	4 5 8
9	0 2

b) morning class: mode 80, median 72, mean approximately 70.4; afternoon class: modes 55, 65, 72, 73, median 70, mean 67.96
c) 69

2. a) **i)** 20 tonnes
ii) 36 tonnes
iii) approximately 35.6 tonnes
b) Example: median mass or mean mass; The advantage of using the median is that it is the middle value and half the shipment masses are below this value while the other half are above it. A disadvantage of using the median is that it does not account for large gaps between the mass values or outliers. The advantage of using the mean is that it represents the "average" of all the masses received on shipment days. A disadvantage of using the mean is that it is influenced by the outliers, such as 20 and 59, and could be skewed to either the lower values or the higher values. The mode in this case represents the lowest mass, so it does not represent the "average" shipment mass.
c) James used the mean. The accountant multiplied the number of shipments by the average: 9×35.6, or 320.4. The actual number of tonnes was 320.

3. a) mean: approximately 8.1, median: 8; mode: 8
b) Example: mode size; It represents the size purchased most often. The manager would want to ensure that enough size 8 stock was available to meet the demand for sales.

4. Examples:
a) runner's median time; It represents the middle value of times the runner takes to run a given distance.
b) mode; It represents the type of movie that is most popular, or selected by the most number of grade 12 students.

5. Answers may vary.

6. a) Answers may vary.
b) Example: Yes. An advertiser could use the mode to represent the "average" even if the mode occurs only 3 times in a set of 20 data values. For instance, if 20 products or brands are tested and one product or brand is chosen 3 times, then the advertiser can say that it was the most popular product chosen of all those tested.

7. Example:
Median Salary
Advantage(s):
- represents the middle salary
- half of the salaries are above the median and half are below
- is an actual salary
- is not affected by the extreme low or high salaries

Disadvantage(s):
- could be skewed to either the lower end or the higher end

Average Number of Weeks of Vacation
Advantage(s):
- mean is a good representation of the centre of the values

Disadvantage(s):
- can be affected by extreme low values or high values, and by values that are often repeated, so it may be skewed
- can be a number that is not an actual value in a set of data

2.2 Using Other Statistical Measures, pages 80 to 93

On the Job 1 Check Your Understanding, pages 85 to 86

1. a) range: 47, outliers: 3, 6, 34, and 50
b) range: 49, outlier: 18
c) range: 11, outlier: 1
d) range: 14.9, outlier: 30.1

2. a) mean: approximately 18.3, trimmed mean: approximately 16.8
b) mean: approximately –14.4, trimmed mean: –17
c) mean: approximately 8.4, trimmed mean: 9
d) mean: approximately 41.8, trimmed mean: 43.2

3. a) 2 cm
b) mean: 3.08 cm, median: 2.9 cm, mode: 2.7 and 2.8
c) 4.6 cm; Example: Yes, she should remove the outlier, because doing so will give a more accurate representation of the growth.
d) range: 0.6 cm, median: 2.9 cm, mean: 2.95 cm; Removing the highest and lowest values changed the range the most. The mean changed slightly, but the median did not.

4. Examples:
a) Math test scores: 86%, 85%, 87%, 89%, 90%, 88%
b) English test scores: 80%, 60%, 81%, 82%, 82%, 83%

5. a) 707
b) median: 713, mean: approximately 718
c) 314 and 1021; Example: shorter and longer workday
d) approximately 725
e) No. The middle value of the ordered data remains the middle value even after the highest and lowest values are removed.
f) Example: The trimmed mean should be used, since the outlier values are quite extreme in this data set.
g) mean; When multiplied by 15, this will give the exact number of cases.

6. a) Ava used the mean calculated after removing the outlier, 43.8 cm.
b) Sebastian used the median of the original data.
c) Petra used the mean of the original data.
d) Example: There is only one outlier whose value is quite smaller than all the others in the data set. Therefore, it makes sense to use the mean calculated after removing the outlier to describe the typical snowfall in a provincial capital city.

On the Job 2 Check Your Understanding, pages 90 to 91

1. a) 9.5 **b)** 22
c) 180 **d)** 68
e) 14 **f)** 154

2. a) 3 **b)** 12
c) 159 **d)** 61
e) 8 **f)** 138

3. a) 15 **b)** 36
c) 205 **d)** 73
e) 17 **f)** 178

4. a) 50th percentile: 29, 25th percentile: 22, 75th percentile: 35
b) 12th rank, 64th rank, 91st rank

5. a) 10 **b)** 40th percentile
c) 100th percentile **d)** 18
e) Her score is in the 80th percentile.

6. a) 95th percentile **b)** 100th percentile
c) 152 cm
d) Example: A 17-year-old male who is 171 cm tall is in the 50th percentile.

7. Example: It is not possible to determine for sure whether either forest meets the criterion because the measurement of 115 cm is contained in a range of 110–119 cm. For a total of 80 trees, the 75th percentile represents the 60th tree. The table for forest A contains data for 80 trees, with only 5 trees above the required circumference and a possible 14 trees that may meet or surpass the required circumference. So, it might meet the criterion. Forest B has the needed 80 trees, with 16 trees above the required circumference. If the additional number of trees needed to meet the criterion exist in the 110–119 cm range, then this forest meets the required criteria.

Work With It, pages 92 to 93

1. a)

Stem (Tens)	Leaf (Ones)
1	9
2	4 8 9
3	0 1 3 5 5 7
4	0 1 1 5 6

b) mean: approximately 34.3; median: 35; mode: 35 and 41
c) 19
d) The mean would be 35.4, making it a little higher. The median would not change.

2. a) 0.5 s, 0.9 s, 1.3 s, 1.5 s
b) 4.7 s, 4.8 s, 5.1 s, 5.2 s
c) 4 s is between the 25th and the 75th percentile, so the driver is talking on a cell phone; 18 s is over the 75th percentile, so the driver is texting; 1 s is below the 25th percentile, so the driver is driving normally; 5.5 s is over the 75th percentile, so the driver is texting; 12.8 s is over the 75th percentile, so the driver is texting

3. a) Example: Yes, because 0.5 is an outlier that would lower the range, mean, and median scores.
b) Example: Ron may have been sick that day.
c) mean: 4, trimmed mean: 4.25; Example: I would use his trimmed mean because this is based on values that have a smaller range and better represent his typical scores.

4. Example: 15%, 16%, 19%, 19%, 58%, 68%, 77%, 80%, 81%, 83%, 85%, 87%, 87%, 88%, 89%, 90%, 95%, 98%, 99%, 100%
a) A percent is a score out of 100. For example, in the above list, 77% means 77 out of 100. A percentile is a value below which a certain percent of the data set fall. For example, in the above list, 98% is at the 90th percentile rank, since it is the 18th value from the smallest value.
b) 19% is the fourth value from the smallest, so it is at the 20th percentile rank.
c) 98% is at the 90th percentile rank, since it is the 18th value from the smallest value.

5. Example: Yes. Students receive marks based on how they perform in comparison to others in the course. So if marks are low due to a difficult topic or a difficult test, then the marks are adjusted so that the students who consistently receive higher marks stay in the top percentiles and those who receive lower marks stay in the lower percentiles.

6. Example: Percentiles can classify hourly wages and salaries to make comparisons within the same occupation or across different occupations.

7. Examples:
a) My BMI is 21.9.
b) BMI percentile shows how your BMI compares to other teens of your age and sex.
c) BMI percentile is related to health risks.

Weight Status Category	Percentile Range
Underweight	less than 5th percentile
Healthy weight	5th percentile to less than 85th percentile
Overweight	85th percentile to less than 95th percentile
Obese	equal to or greater than 95th percentile

2.3 Scatter Plots, pages 94 to 101

On the Job 1 Check Your Understanding, pages 98 to 99

1. a) iv) **b)** ii)
c) i) **d)** iii)

2. The scatter plot shows that as the age of a car increases, the value of a car decreases.

3. The scatter plot shows that as the length of fencing increases, the cost of fencing increases.
4. The scatter plot shows that there is no trend between the height of a student and the number of minutes per day the student spends texting.
5. a) As the temperature increases, the number of park visitors increases.
   b) approximately 118 visitors
   c) between 22.5 °C and 27 °C
   d) Example: approximately 150 visitors. I extrapolated the trend line.
6. a) As the temperature increases, the number of taxi requests decreases.
   b) Example: Have more taxis available or hire more drivers.
   c) Example: Extreme heat is uncomfortable for walking.
   d) Example: The manager could look at the weather for the week and use this to plan how many drivers will be needed based on the temperatures and the probability of precipitation.

Work With It, pages 100 to 101

1. As the speed of the boat increases, the fuel consumption increases.
2. There is no trend between shoe sizes of grade 12 students and their math marks.
3. Examples:
   a) The scatter plot represents a comparison between the number of weeks that pass and the height of a plant, in centimetres, from the time the seed is planted in the ground.
   b) The scatter plot represents a comparison between the outdoor temperature in degrees Celsius and the amount of snow, in centimetres, remaining on the ground.
   c) The scatter plot represents a comparison between the cost, in dollars, of 20 items in a store and the number of sales of each item on a given day.
4. Examples:
   a) No. 32% of Canadians were 15 years of age or younger as of 1955 and since there is an upward trend from 1955 to 1965, there would have been fewer in 1950. 30% would be a more accurate extrapolation for 1950.
   b) Yes, this is reasonable if the dots are followed based on the downward trend starting at 1995.
   c) No. The scatter plot shows upward trends and downward trends. There is an upward trend from 1955 to 1965, but then it changes to a generally downward trend from 1965 to 2005. There was no change between 1990 and 1995.
5. a) Ryan's time to run the race is decreasing. The trend is realistic because the more he trains, the faster he can run the race.
   b) No. Ryan will reach a limit for the fastest time his body can run.
6. Examples:
   a) The shoe size of grade 12 students and the number of hours they spend watching TV.
   b) The height of a plant since the time its seed was planted.
   c) The percent of students in a school whose hair colour is brown, red, black, blonde, or other.

Chapter 2 Skill Check, pages 102 to 103

1. a) mode: none, median: 26.5, average: 23.3
   b) Example: I would use the average, because this includes the highest and lowest values and there is quite a difference between these.
2. 79.75%
3. 7.0
4. a) $126 000
   b) $325 428.57
   c) $82 000 and $1.5 million
   d) $139 200
   e) Example: The trimmed mean, since it better represents the smaller range of the majority of the homes she sold.
5. a) 80th percentile
   b) 50th percentile: 20.5, 25th percentile: 16
6. a) Example: 9 or 11 years
   b) Example: 75 cm
   c) Example: 190 cm
   d) As age increases, height increases. No. Once a male has grown to his maximum height, his height will not change.

Chapter 2 Test Yourself, pages 104 to 105

1. A
2. C
3. B
4. D
5. C
6. a) As the lobster's age increases, so does its mass.
   b) Example: 40 pounds
   c) Example: 5.5 years

d) Example: No. The scatter plot would have to be extended along the horizontal axis, because the age for such a lobster would be greater than nine years. The vertical axis reaches 45 pounds, so it does not need to be extended.

7. a) mean: \$15.25, median: \$14.38, mode: none
b) \$43.50
c) \$1.50 and \$45.00
d) \$13.25
e) Example: The mean best represents the typical price, since it includes the outliers and is the average of the amount of money Min Lee spent.

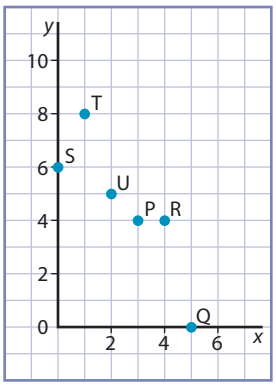
8. Ross's weighted mean mark of 71.9% is higher than his average mark.

Chapter 3

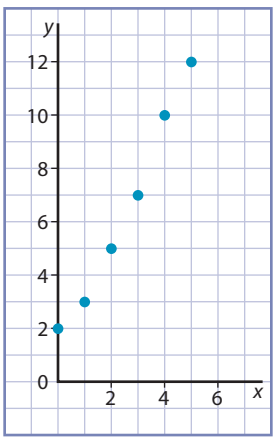
Get Ready, pages 110 to 111

1. B(1, 7), C(3, 3), D(2, 5), E(6, 0), F(0, 8)

2.



3.



Example: As the x-values increase, the y-values also increase. The points go up to the right.

4. Examples:
a) 90 cm **b)** 48 cm

5. Examples:
a) 2.08 m; The winning heights are close to but not equal or greater than 2.1 m.
b) The Olympics are held every four years, so they did not occur in those years.

6. a) $\frac{5}{2}$ **b)** $\frac{1}{2}$
c) undefined **d)** 1
e) 0

7. a) an increasing pattern that starts at 2 and increases by 2 each time
b) an increasing pattern that starts at 0 and increases by 7 each time
c) an increasing pattern that starts at 1 and each subsequent number is double the previous number
d) a decreasing pattern that starts at 200 and each subsequent number is half of the previous number
e) a decreasing pattern that starts at 9 and decreases by 4 each time
f) an increasing pattern that starts at 1 and each subsequent number is 10 times the previous number

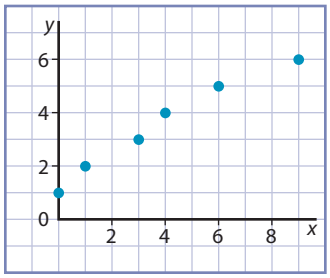
8. a) 17 **b)** 4
c) 9 **d)** 300
e) 5.5 **f)** 7000

3.1 Understanding Linear Trends and Relationships, pages 112 to 126

On the Job 1 Check Your Understanding, pages 117 to 119

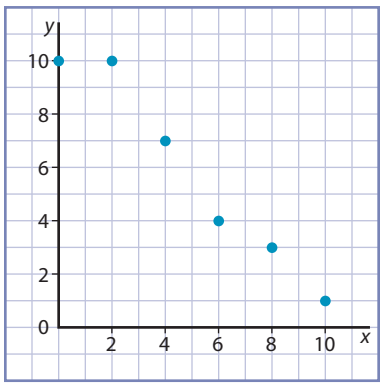
1. a) positive linear trend
b) not linear
c) negative linear trend
d) positive linear trend

2. a)



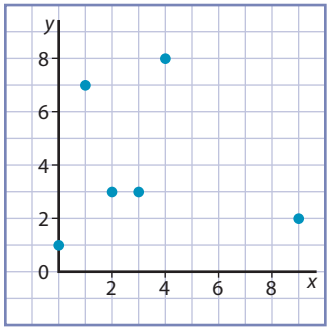
positive linear trend

b)



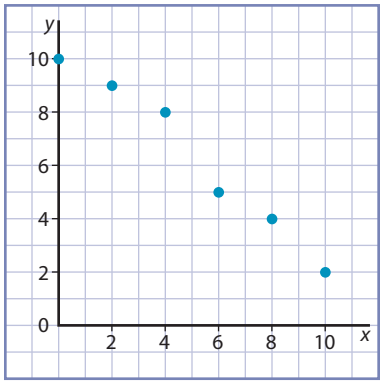
negative linear trend

c)



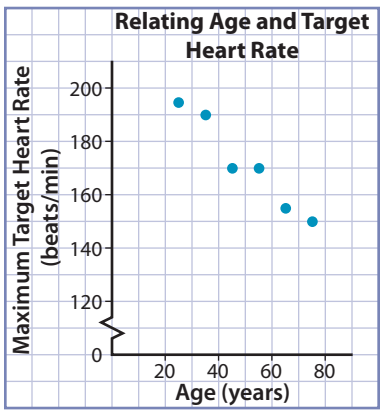
not linear

d)



negative linear trend

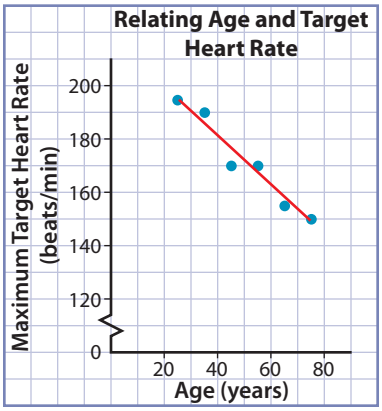
3. a)



The points appear to show a negative linear trend.

b) As age increases, the maximum target heart rate decreases.

c)



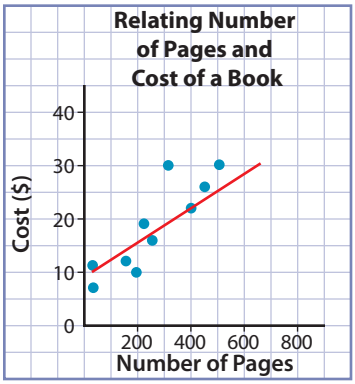
The line of best fit is a good representation of the trend in the relationship, since the majority of the points are either on the line or very close to the line.

d) Examples:

i) 190 beats/min

ii) 47 years old

4. a)



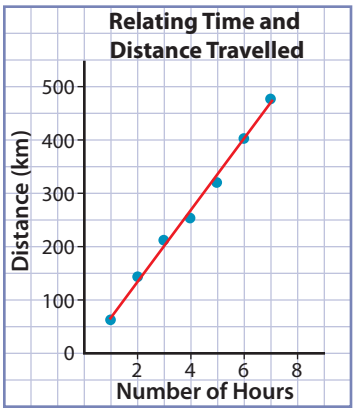
b) As the number of pages increases, the cost appears to increase.

c) Examples:

i) $25

ii) 400 pages

5. a)



b) There is a positive linear relationship between the variables.

c) Examples:

i) 30 km

ii) 3.5 h

On the Job 2 Check Your Understanding, pages 123 to 124

1. a) linear; points lie on a straight line

b) non-linear; points do not lie on a straight line

c) linear; points lie on a straight line

d) non-linear; points do not lie on a straight line

2. a) #1c); The graph shows a positive linear relationship.

b) #1b); The graph shows a positive non-linear relationship.

c) #1a); The graph shows a positive linear relationship.

d) #1d); The graph shows no linear trend.

3. a) differences in successive x-values: $+1, +1, +1$; differences in successive y-values: $+1, +1, +1$; linear relationship

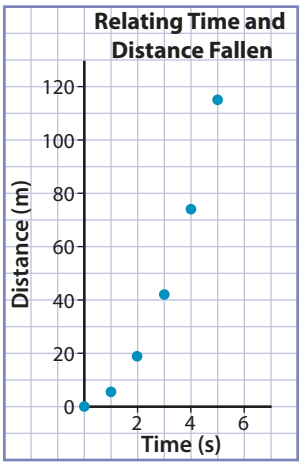
b) differences in successive x-values: $+1, +1, +1$; differences in successive y-values: $+1, +3, +5$; non-linear relationship

c) differences in successive x-values: $+1, +1, +1$; differences in successive y-values: $-3, -3, -3$; linear relationship

d) differences in successive x-values: $+1, +2, +3$; differences in successive y-values: $+30, -20, +5$; non-linear relationship

4. a) non-linear relationship; The successive y-values change by different amounts.

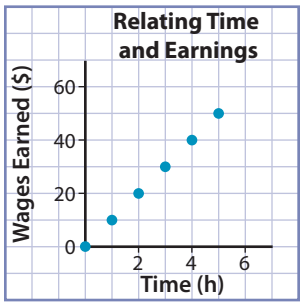
b)



b) Yes. The points on the graph do not lie on a straight line.

5. a) Example:

Time (h)	Wages Earned ($)
0	0
1	10
2	20
3	30
4	40
5	50



b) linear

c) The successive y-values change by the same amount, $+10$.

d) The points lie on a straight line.

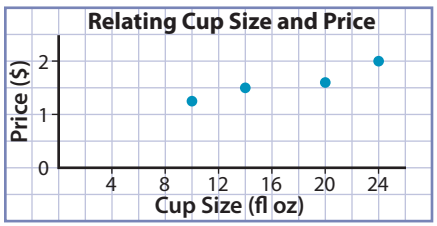
6. a)

Time (years)	Laptop Value ($)
0	1600
1	800
2	400
3	200
4	100

b) non-linear; The successive y-values change by different amounts.

Work With It, pages 125 to 126

1. a)



b) The trend is non-linear. The points on the graph do not lie on a straight line.

2. Step 2:

b) Example: I predict the relationship is non-linear because I think that the farther the metre stick is moved from the wall, the more the height drops down. It does not decrease at a constant rate.

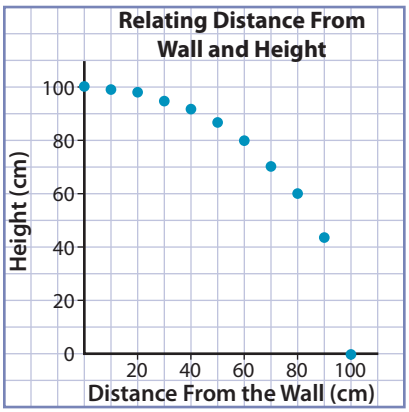
Step 3:

c) Example:

Distance Between Bottom of Stick and Wall (cm)	Height of Top of Stick (cm)
0	100
10	99
20	98
30	95
40	92
50	87
60	80
70	71
80	60
90	44
100	0

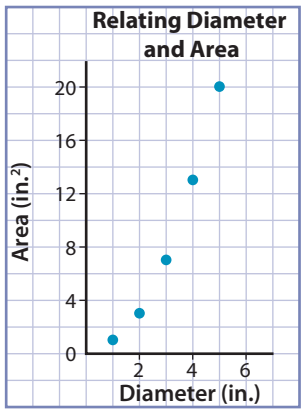
Step 4:

a)



b) Yes. The graph shows a non-linear relationship, since the points do not lie on a straight line.

3. a)



b) non-linear

c) The points on the graph do not lie on a straight line.

d) The successive area values increase by different amounts.

4. The relationship is linear when the differences between successive values of the variables are constant. Otherwise, it is non-linear.

5. Example: Both graphs will have the same values for year 0 and year 1. The graphs will have different values for year 2 and later. The graph for item B is non-linear, since the amount of decrease is different from year to year. The graph for item A is linear, since there is a constant decrease of $10 from year to year.

6. Example: In a linear relationship, all the points on the graph lie on a straight line, and the differences in the successive values of the variables is constant. In a linear trend, the points do not lie on a straight line, but there is a straight line of best fit; the differences in the successive values of the variables is not exactly constant, but they are almost constant.

7. Example: The points of the graphs of non-linear relationships may follow different patterns that do not have common features. For example, the points may be scattered all over the graph, or they may curve up to right.

3.2 Direct Variation, pages 127 to 142

On the Job 1 Check Your Understanding, pages 131 to 132

1. A is a direct variation because the initial value is $0 and the rate of change is $15/h.
D is a direct variation because from the pattern, the initial value would be $0 and the rate of change is $20/day.

2. a) 240 **b)** 4, 12
c) 0, 35, 140 **d)** 0.00, 15.00, 30.00

3. a) initial value: 0 km, rate of change: 80 km/s
b) initial value: 0 points, rate of change: 4 points/game
c) initial value: 0 words, rate of change: 35 words/min
d) initial value: $0, rate of change: $7.50/year

4.

Number of Toppings	Cost ($)
0	0.00
1	1.75
2	3.50
3	5.25
4	7.00
5	8.75

The relationship is a direct variation because the initial value is $0 and the rate of change is $1.75/topping.

5. a) Example: The relationship is not a direct variation because the initial value is not 0.

b)

Season	Cumulative Earnings (million $)
1991–92	3
1992–93	6
1993–94	9

Yes. The initial value is not 0 since I do not know his earnings for previous years.

c) $12 million

6.

Carpet Runner Length (m)	Cost ($)
1	12.99
2	25.98
3	38.97
4	51.96
5	64.95
6	77.94
7	90.93
8	103.92
9	116.91
10	129.90

7.

Time (months)	Cumulative Membership Amount ($)
0	20
1	45
2	70
3	95
4	120
5	145
6	170

This is not a direct variation relationship because the initial value is 20, not 0.

On the Job 2 Check Your Understanding, pages 135 to 136

1. A, because the y-intercept is 0 and the slope is 10.
C, because the y-intercept is 0 and the slope is 2.5.

2. Examples: Graphs may vary.

a) The y-intercept of the lines must be 0.

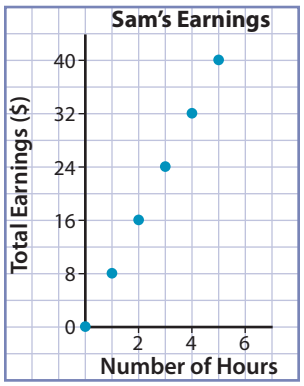
b) The y-intercept of the lines must not be 0.

3. a)

Number of Hours	Total Earnings ($)
0	0
1	8
2	16
3	24
4	32
5	40

b) $8/h

c)



d) A solid line is reasonable because he will receive pay for babysitting part of an hour.

e) slope: 8; y-intercept: 0

f) 2.5 h

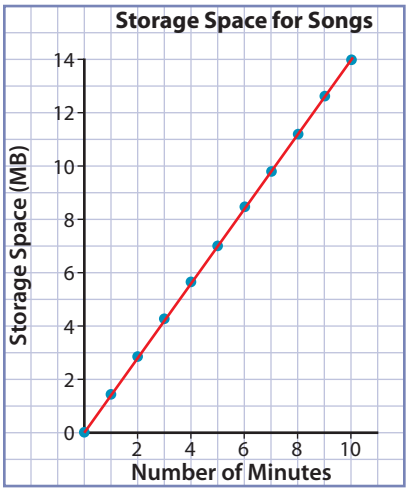
g) The y-intercept would still be 0, but the slope would be 9. The line would be steeper.

4. a)

Number of Minutes	Storage Space (MB)
0	0.0
1	1.4
2	2.8
3	4.2
4	5.6
5	7.0
6	8.4
7	9.8
8	11.2
9	12.6
10	14.0

b) and **c)**

A solid line is appropriate to represent storage space for a part of a minute.



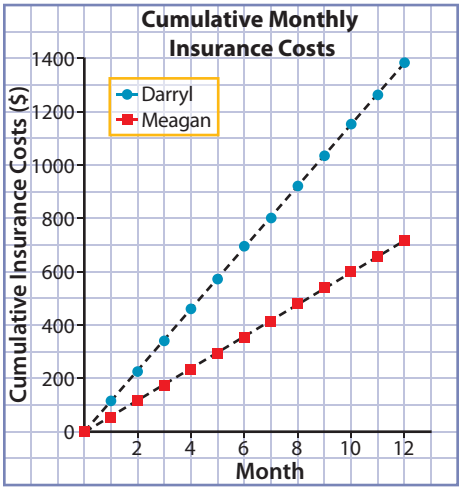
d) y-intercept: 0; slope: 1.4

5. a)

Month	Cumulative Insurance Costs ($)
1	115
2	230
3	345
4	460
5	575
6	690
7	805
8	920
9	1035
10	1150
11	1265
12	1380

b) and **c)**

A dashed line is used because the insurance cost is charged for each month but can be calculated for a part of a month.



d) Both graphs have a y-intercept of 0 and both are dashed lines. The slopes of the lines are different. The line for Darryl is steeper, with slope of 115. The line for Meagan's is less steep, with slope of 60.

6. a) Example: The graph will be a solid line with y-intercept 50, to represent the $50 service fee. The slope of the line will be 25, to represent the rate of $25/h that she charges. The line will be solid because she can charge for part of an hour.

b) No, because the initial value (or y-intercept) is 50, not 0.

On the Job 3 Check Your Understanding, pages 139 to 140

1. a)

t	C ($C = 11t$)
0	0
1	11
2	22
3	33

b) The successive t-values change by $+1$ and the successive C-values change by $+11$.

c) Yes. The initial value is 0, and the points form a line with a slope of 11.

2. a) 0, 4, 8, 12

b) Yes. The initial value is 0 and the rate of change is 4.

c) The graph is a straight line with the y-intercept at 0 and a slope of 4.

3. a) 0, 1, 4, 9

b) No. While the s-intercept is 0, the rate of change of the successive A-values is not constant.

4. a) 5, 55, 105, 155

b) No. The initial value is 5, not 0.

5. A, B, C, G, and H

6. a) $I = 0.99d$

b) \$0, \$0.99, \$1.98, \$2.97

c) Yes. The initial value is \$0 and the rate of change is \$0.99/download.

d) **i)** \$9900

ii) \$247 500

iii) \$1 435 500

7. a) \$26.70/kg

b) $C = 26.70A$, where C is cost, in dollars, and A is the amount of almonds, in kilograms.

c) \$8.33

d) This situation represents a direct variation. The graph would be a straight line with a y-intercept of 0 and a slope of 26.70.

8. a) $m = 86k$, where m represents the money raised, in dollars, and k represents the number of kilometers walked.

b) \$688

c) 9 km

9. Example: The equation is a better model because you can input any number for one variable and solve for the other accurately and precisely. Tables and graphs can be used to estimate values, but these estimates may not be as accurate or precise, especially if you have to interpolate or extrapolate answers.

Work With It, pages 141 to 142

1. a)

Time (h)	Calories Burned
0	0
1	500
2	1000
3	1500
4	2000

b) 1750 calories

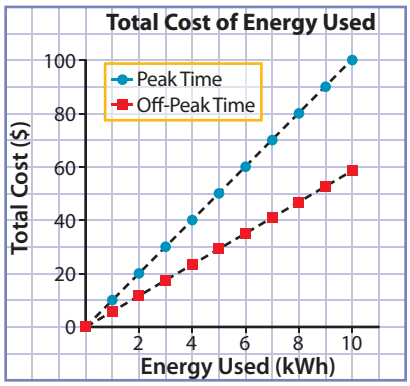
c) 2500 calories; Add 500 to the calories burned for 4 h.

d) The initial value is 0 calories and the rate of change is 500 calories per hour.

2. a)

Energy Used (kWh)	Total Cost (¢)
0	0
1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
10	100

a) and **b)**



c) 20.5¢

3. a) $E = 0.08d$

b) The graph would be straight line with a y-intercept of 0 and a slope of 0.08.

c) \$661.36, \$586.40, \$393.20, \$406.72

4. Yes, it is direct variation because a steady speed means that the rate of change is constant and the initial value is 0, since the distance travelled at time 0 is 0 km.

5. a) Yes. The graph of $C = \pi d$ would be a straight line with an initial value of 0 and a slope of π.

b) No. The formula for area is $A = \frac{1}{4}\pi d^2$, which does not represent a straight line. The successive A-values do not increase by the same amount.

6. Example: Bryan's answer is partly correct. He also needs to say that the circumference is a fixed multiple of the diameter.

7. a) The points on the graph form a straight line and I know the y-intercept. I do not know the slope.

b) It is 0.

c) No. This depends on whether the data values between plotted points are valid.

8. Example: I agree with the first part of the statement. All direct variation graphs are linear because they are straight lines with a y-intercept of 0. I disagree with the second part of the statement. Not all linear graphs are direct variations because their y-intercept may be a value other than 0.

3.3 Partial Variation, pages 143 to 159

On the Job 1 Check Your Understanding, pages 147 to 148

1. B is a partial variation because the graph is a line with an initial value that is not 0 and the rate of change is \$4/h. D is a partial variation because the graph is a line with an initial value that is not 0 and the rate of change is 200.

2. a) 520, 560

b) 34, 42, 46

c) 28, 52, 76

d) 1025, 1050, 2000

3. a) rate of change: \$40/week, fixed amount: \$400

b) rate of change: 4 cm/h, fixed amount: 30 cm

c) rate of change: \$12/h, fixed amount: \$28

d) rate of change: \$25/year, fixed amount: \$1000

4.

Number of Toppings	Total Cost (\$)
0	11.50
1	13.00
2	14.50
3	16.00
4	17.50
5	19.00
6	20.50

This represents a partial variation because the initial fixed charge is \$11.50 (not 0), and the rate of change is \$1.50/topping.

5.

Shoe Size	Shoe Length (in.)
4	$8\frac{3}{4}$
5	9
6	$9\frac{1}{4}$
7	$9\frac{1}{2}$
8	$9\frac{3}{4}$
9	10
10	$10\frac{1}{4}$

This represents a partial variation because the initial value is $8\frac{3}{4}$ in. (not 0), and the rate of change is $\frac{1}{4}$ in./shoe size.

6. a) initial value: \$99, rate of change: \$49/month

b) \$148

c)

Number of Months	Total Cost (\$)
0	99
1	148
2	197
3	246
4	295
5	344
6	393
7	442
8	491
9	540
10	589
11	638
12	687

d) The graph is a dashed line that goes up to the right with a y-intercept of 99 and a slope of 49.

7. a)

Time (h)	Charge (\$)
0	30
1	50
2	70
3	90
4	110
5	130
6	150
7	170
8	190

b) \$100

c) i) \$95 **ii)** \$117.50

On the Job 2 Check Your Understanding, pages 152 to 153

1. B; The graph is a line with y-intercept of 10, not 0.
D; The graph is a line with y-intercept of 200, not 0.

2. Examples: Graphs may vary.

a) The graphs are lines with a y-intercept that is not 0.

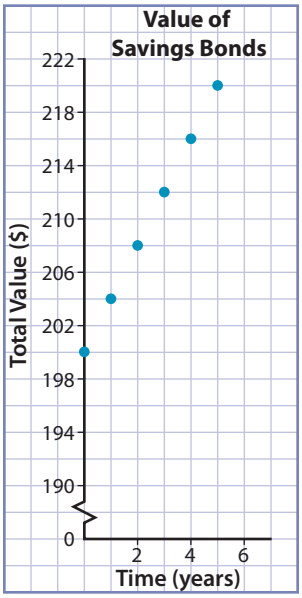
b) The graphs can be non-linear or linear. For those that are linear, the y-intercept must be 0.

3. a) $4

b)

Time (years)	Total Value ($)
0	200
1	204
2	208
3	212
4	216
5	220

c) You would not draw a line because the interest is only paid at the end of the year.

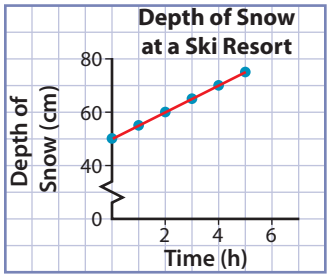


d) The graph of the linear relationship would be steeper, with a slope of 6, and have the same y-intercept of 200.

4. a)

Time (h)	Depth of Snow (cm)
0	50
1	55
2	60
3	65
4	70
5	75

b) A solid line is reasonable because the data are continuous.

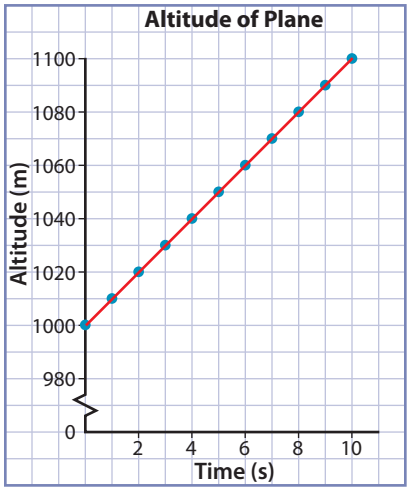


c) The slope is 5 and the y-intercept is 50.

d) Since the rate of change is 5 cm/h, only 10 cm are added to the depth of snow at 2 h (60 cm) to get the depth of snow at 4 h (70 cm).

e) Example: 2.5 h

5. a) and **b)**

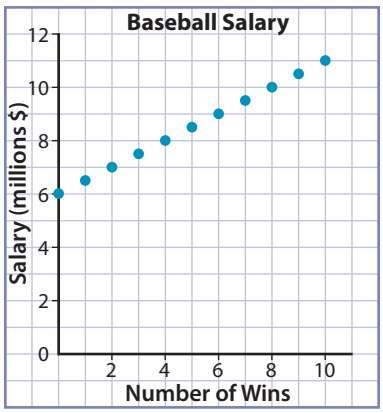


It is reasonable to connect the points with a solid line because the data are continuous.

c) Example: 4.5 s

d) The line would be steeper, with a slope of 15, and the y-intercept would be lower, at 500.

6. a) You would not draw a line because the bonus is only paid for a win. Data values between plotted points are not valid.



b) The relationship would represent a direct variation. The initial value (y-intercept) would be \$0, and the rate of change would be \$500 000/win.

On the Job 3 Check Your Understanding, pages 156 to 157

1. a)

s	E ($E = 200 + 10s$)
0	200
1	210
2	220
3	230

b) Yes, the linear relationship models a partial variation since the initial value is 200 and the rate of change is 10.

2. a)

x	y
0	1
1	4
2	7
3	10

b) Yes. This models a partial variation since this is a linear relationship with an initial value of 1 and a rate of change of 3.

c) The graph is a line that goes up to the right with a y-intercept of 1 and a slope of 3.

3. a)

s	P
0	0
1	4
2	8
3	12

b) No. This models a direct variation, since this is a linear relationship with an initial value of 0 and a rate of change of 4.

4. E and F

5. E: slope: 65, C-intercept: 70; F: slope: –6, y-intercept: 2

6. a) 1500; This represents the initial distance from home.

b) $-90x$; This represents the change in distance.

c) 870 km

d) approximately 16.7 h

7. a) 50; This represents the initial speed of the car on the ramp.

b) $10t$; This represents the change in speed.

c) 70 km/h

d) 4 s

e) Example: The speed of the car would be 250 km/h, which exceeds any speed limit, and the car is limited by its top speed.

f) The graph would be a solid line that goes up to the right with a y-intercept of 50 and a slope of 10.

8. a) 35; This represents the initial fitting fee.

b) $20d$; This represents the change in total cost.

c) \$175

Work With It, pages 158 to 159

1. a) \$500

b) \$150; \$30

c) $650 - 500$; $(650 - 500) \div 5$

d) The cost is $650 + 30(33)$, or \$1640.

2. a) A line is not appropriate since Tang saves by the month. Data values between plotted points are not valid.

b) initial savings at 0 months

c) the rate of change, or the amount saved per month

d) 10 months

e) $S = 1000 + 100m$, where S is the money saved, in dollars, and m is time, in months.

3. a) There is a fixed amount, 32, and a variable amount, $1.8C$.

b) a straight solid line that goes up to the right, with C-intercept of 32 and slope of 1.8

c) 77 °F

d) –40 °F

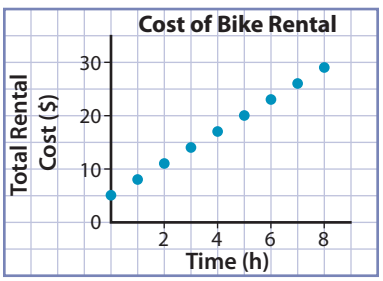
4. a)

Time (h)	Total Rental Cost (\$)
0	5
1	8
2	11
3	14
4	17
5	20
6	23
7	26
8	29

b) linear; The rate of change is 3.

c) partial variation; the initial value is \$5.

d)



A line is not appropriate since the resort charges for whole hours.

e) The slope is 3 and the y-intercept is 5.
f) $C = 5 + 3n$
g) \$26; Example: I used the table because it was easy to just look at the cost for 7 h.

5. a) The initial value of the dependent variable is not 0 and the successive values of the dependent variable change by a constant amount.
b) The graph is a line whose y-intercept is not 0.
c) The equation has a fixed part and a variable part.

6. From a graph, the initial value is the y-intercept and the rate of change is the slope of the line.

7. From an equation, the initial value is the fixed value and the rate of change is the coefficient of the variable part of the equation.

8. Direct variation graphs are lines with a y-intercept of 0, while partial variation graphs are lines with a y-intercept other than 0.

Chapter 3 Skill Check, pages 160 to 161

1. a) negative linear trend
b) positive linear trend, linear relationship
c) no linear trend
d) positive linear trend

2. B, C, and D; As the values of the independent variable increase or decrease by a constant amount, the values of the dependent variable have a constant rate of change.

3. a)

Minutes	Number of Words Typed
0	0
1	45
2	90
3	135
4	180
5	225
6	270
7	315
8	360
9	405
10	450

b) $w = 45m$
c) Straight dashed line with y-intercept of 0 and slope of 45.
d) 337 words; A fraction of a word is not acceptable so round down to 337 from 337.5.
e) 1226 words; A fraction of a word is not acceptable, so round down to 1226 from 1226.25.

4. a) fixed cost: \$350; variable cost: \$400/week
b) $C = 350 + 400w$, where C is the cost, in dollars, and w is the number of weeks.
c) straight dashed line with a y-intercept of 350 and a slope of 400
d) \$1950
e) \$3550
f) Since the rate of change is \$400/week, only \$1600 is added to the cost for 4 weeks (\$1950) to get the cost for 8 weeks (\$3550).

Chapter 3 Test Yourself, pages 162 to 163

1. C
2. B
3. B

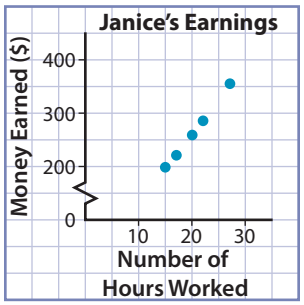
4. a) B is a direct variation because the initial value is 0 and the rate of change is 2.
b) A is a partial variation because the initial value is 1 and the rate of change is 1.

5. a) B and D; straight lines with initial value of 0
b) A; straight line with a non-zero initial value

6. a) C; represents a direct variation with a slope of 14.50 and E-intercept of 0
b) D; represents a partial variation with a fixed value of 75 and a variable part of $40t$

7. a) slope: 4, y-intercept: 7
b) slope: 4, y-intercept: 0
c) slope: 1.5, y-intercept: 7

8. a) \$13/h
b)



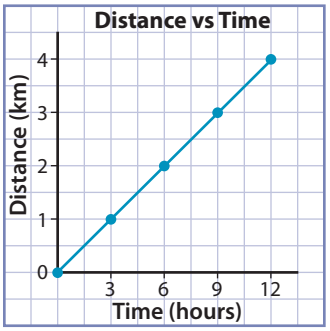
c) It is reasonable to connect the points with a solid straight line. The solid line shows that the relationship is continuous.
d) The slope is 13 and the y-intercept is 0.
e) direct variation; initial value is 0 and rate of change is 13
f) $E = 13n$; \$468

9. a) linear; rate of change is \$64/h
b) direct variation; initial value is \$0
c) $C = 64n$, where C represents total labour cost, in dollars, and n represents time worked, in hours.
d) \$147.20

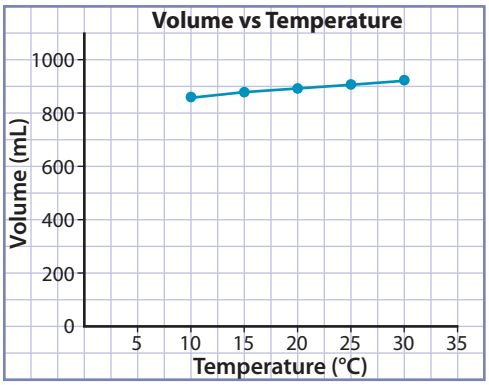
Chapter 4

Get Ready, pages 168 to 169

1. a) $2165 **b)** $1928
c) $55 556
2. a) $3600 **b)** $6400
c) $33 600
3. a) 62.3%, 0.623 **b)** 84.0%, 0.840
c) 0.2%, 0.002 **d)** 0.1%, 0.001
4. a) estimate: 60%; actual: 57.1%
b) estimate: 5%; actual: 4.2%
c) estimate: 25%; actual: 23.1%
d) estimate 50%; actual: 49.2%
5. a) $115.38
b) estimate: $3000; actual: $2999.88
6. 59
7. $155.95
8. a) $37.72 **b)** $1.24
9. $406
10. a) The relation is linear.



b) The relation is linear.



11. a) 40 houses
b) 10 houses
c) year 2
d) Example: I would hire Mr. Adams because he sold 215 houses in six years, whereas Mr. Blake only sold 180 houses.
12. a) 5 years **b)** 4 years
c) 3 years
13. a) 24 months **b)** 36 months
c) 48 months

4.1 Owning a Vehicle, pages 170 to 189

On the Job 1 Check Your Understanding, pages 175 to 176

1. a) $5085 **b)** No
2. a) $428.98 **b)** $220.60
c) $462.47 **d)** $255.02
3. a) $15 443.28; $15 883.20; $16 648.92; $18 361.44
b) Example: I would choose a 1.9% interest rate for a 3-year term because the total amount paid is the least.
4. a) $7099.20 **b)** $1099.20
5. a) car 1: $311.40; car 2: $376.42
b) $18 684; $13 551.12
c) Example: Since Kylie drives a lot, she should buy the one-year-old car because it should still have a warranty and should be more reliable than the three-year-old car.
6. Example: John has saved enough money to buy either truck, so he does not have to borrow. I think John should buy truck 2 because it is less expensive. Also, since it is in good condition and has regularly scheduled maintenance, if it breaks down repairs can be done.
7. Example: The monthly payments for SUV 1 are $1014.44, and the total cost will be $24 346.56, so the cost of financing is $475.35. The monthly payments for SUV 2 are $629.84, and the total cost will be $22 674.24, so the cost of financing is $1656.04. If Vanessa can afford the monthly payments, then SUV 1 is the best deal because the cost of financing is lower and there is a warranty for 1 year or 20 000 km, which is worth having.

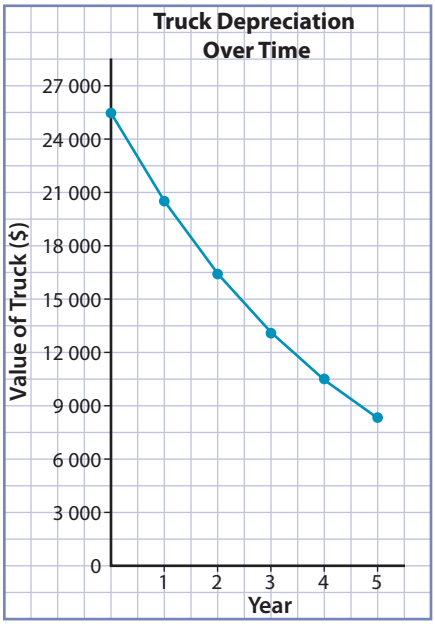
On the Job 2 Check Your Understanding, pages 180 to 182

1. a) $23 389.87 **b)** $30 565.37
c) $22 780.80 **d)** $23 106.24
2. a) **i)** $354.09 **ii)** $390.30
iii) $410.73 **iv)** $439.99
b) The higher the interest rate, the higher the monthly payment.
c) $6961.63
3. a) **i)** $511.21 **ii)** $350.73
iii) $270.63 **iv)** $222.68
b) The longer the loan, the less the monthly payment as long as the interest rate is the same.

4. a) **i)** $12 269.04 **ii)** $12 626.28
iii) $12 990.24 **iv)** $13 360.80

b) Example: Advantages for longer terms: The monthly payments are lower, so a person may select the longer term if they cannot afford the monthly payments of a shorter term based on their income and other expenses for the month.
Disadvantages for longer terms: Since the monthly payments are lower, it takes longer to pay off the loan and the cost of the loan is higher at the end of term, which means you pay more for the car.
Advantages for shorter terms: The loan is paid off more quickly and the cost of financing is less.
Disadvantages for shorter terms: Since the monthly payments are higher, not everyone can afford these payments based on their income and expenses.

5. a) $32 798.25 **b)** $546.64
c) $791 **d)** $13.19/month
e) $8393.52



6. a) $386.99
b) $4643.88; $18 575.36
c)

Year	Total Amount Paid ($)	Amount Owed ($)
0 (now)	0	23 219.24
1	4 643.88	18 575.36
2	9 287.76	13 931.48
3	13 931.64	9 287.60
4	18 575.52	4 643.72
5	23 219.40	0

7. a) $29 589.05
b) **i)** $575.69
ii) $464.88
iii) $391.03
c) **i)** $27 633.12
ii) $27 892.80
iii) $28 154.16
d) Example: Greg would save $521.04 in the total amount that he pays for the truck.
e) Example: Greg may not have enough money in his budget to comfortably afford the monthly payments of the 4-year loan.

8. a) King's Autos: $337.59, B&B Vehicles: $331.75
b) King's Autos: $16 204.32, B&B Vehicles: $15 924
c) B&B Vehicles made the best offer. Even though the financing is higher, for the same time period the overall total cost of the car is less by $280.32.

On the Job 3 Check Your Understanding, pages 186 to 187

1. a) $409.22 **b)** $509.24
c) $246.93 **d)** $365.72
2. a) $24 553.20 **b)** $24 443.52
c) $14 815.80 **d)** $13 165.92
3. a) $2043.84 **b)** $800.96
c) $629.76 **d)** $3044.40
4. a) $29 277.05 **b)** $366.32
c) $523.27 **d)** $17 740.31
e) $15 408.72 **f)** $33 149.03
5. $11 653.72
6. Example: The total cost of leasing the truck is $22 368. The total cost of buying the truck is $33 000. Joe would save $10 632 if he leases the truck, so Joe should lease the truck.
7. a) 16 080 km
b) Example: Yes. She drives less than 20 000 km, which is a typical amount allowed when taking a lease.
8. a) $40 082.23 **b)** $582.46
c) $34 947.60 **d)** $5134.63

Work With It, pages 188 to 189

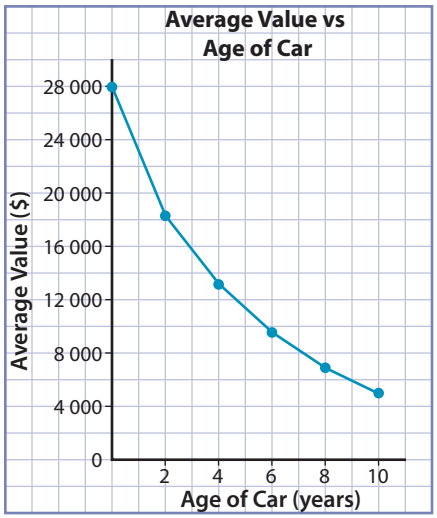
1. No. There are 52 weeks in a year, and since Bob makes biweekly payments, he will make 26 payments each year for a total of 130 payments in 5 years. Lorne makes only 60 payments. Bob will pay $41 464.80 and Lorne will pay $38 275.20. Bob pays $3189.60 more than Lorne.

2. **Step 1:** $895
Step 2: Example: Anna should consider added costs associated with driving a car, such as the price of gas. She should also consider putting aside some money for unexpected expenses and emergencies.
Step 3: 4-year loan monthly payment: $537.12; 5-year loan monthly payment: $431.62; 6-year loan monthly payment: $361.29
Step 4: 2-year loan monthly payment: $529.68; 3-year loan monthly payment: $359.94; 4-year loan monthly payment: $275.14
Step 5: Example:
Anna,
I would buy the four-year-old car because the total cost is less than half of the new car and the used car will not depreciate as much as the new car. You can also pay it off more quickly and save more of your own money to buy something else. Since you have about $895 per month after expenses I would suggest you choose the 3-year loan so that you will not be too tight with money, since you have to also pay for gas and possible other expenses. You can get the car paid off reasonably quickly and the total cost of the car would be $12 957.84, which means the cost of financing the car is only $747.84. You could take the 2-year loan, and then the cost of financing the car is $502.32, but your monthly payments are higher and you may not have enough money for gas or money for an emergency.
Good luck with your choice of car.

3. **a)** Example: make and model of car, initial value of the car, kilometres on car, age of the car

b) The older the car, the lower the average value after depreciation.

c)



d) Example: $15 500, $8500

4. Examples:

a) What are the financing options? What warranty is available? What are the models and option packages that come with each truck? What is the fuel consumption for each truck? What are the safety features of each truck?

b)

New Truck	
Pros of Buying	**Cons of Buying**
• brand new • warranty • interest rate should be lower and the loan can be over a longer period of time	• most expensive • depreciates more than the used trucks

Two-Year-Old Truck	
Pros of Buying	**Cons of Buying**
• newer than four-year-old truck • some warranty • less expensive than a new truck • depreciates less than the new truck	• more expensive than the four-year-old truck • has some kilometres • interest rate is usually higher and over a shorter term

Four-Year-Old Truck	
Pros of Buying	**Cons of Buying**
• least expensive • depreciates less than the other trucks	• no warranty • has most kilometres • more likely to need repairs

c) I would buy the four-year-old truck. It will be the least expensive and will depreciate the least, so it is the best value for my money.

5. Examples:

a) the monthly payments, the total cost of the lease, the length of the lease, how many kilometres the lessee is allowed to drive per year, the charge for additional kilometres, who pays for repairs and other expenses, whether the lessee wants to purchase the car at the end of the lease

b) Many people prefer to drive a newer vehicle which is under warranty and not worry about owning the vehicle and repairs. By leasing, the lessee does not worry about depreciation. The lessee has more time to decide if they like the vehicle and whether they want to purchase it when the lease expires.

6. Example:
Leasing a Vehicle
Advantages:
- always drive newer vehicles
- under warranty for most of the lease period
- monthly payments are usually lower
- up-front expenses are usually lower
- easier to obtain a lease than a loan for financing the total cost of a vehicle
- maintenance costs are usually lower

Disadvantages:
- more expensive if the lessee decides to buy the car
- if someone always leases a car, the monthly payments never stop
- you have to pay for kilometres driven in excess of yearly allowance

Purchasing a Vehicle
Advantages:
- belongs to the owner
- eventually the monthly payments end
- can sell the vehicle
- no annual kilometre limits
- can be less expensive over a long period

Disadvantages:
- age-related repairs
- depreciates over time
- same vehicle for a longer period

7. Example: No. Other costs she may have are interest on each payment, first down payment, delivery fee payment, extra kilometre payments, and possible repair expenses.

4.2 Operating a Vehicle, pages 190 to 201

On the Job 1 Check Your Understanding, pages 194 to 195

1. **a)** $515 **b)** $435.50
   c) $375.50 **d)** $260.75
2. **a)** $206.55 **b)** $2478.52
   c) $9914.08
   d) $1240/year or $103.33/month
3. **a)** $496.55
   b) $207.50
   c) Example: No. Ben should not pay extra money for a warranty. The extended warranty will cover the car until it is six years old. Typically, a new car should not need extensive repairs in the first six years.
4. $3914.40
5. approximately 16.11%
6. **a)** Larger vehicles have greater fixed costs, and sports cars have the greatest fixed costs. The size of a car makes a difference, and whether a car is a sports car makes a difference. Larger cars cost more and insurance will be more expensive, and the same is true for sports cars. Often these cars have more luxury options, so insurance premiums are often higher.
   b) $2065.92/year
   c)

Vehicle Type	Five-Year Fixed Costs
Sub-Compact	$23 000
Compact	$28 000
Mid-Size	$37 000
Full-Size	$44 000
SUV	$48 000
Sports car	$68 000

7. **a)** $314.24 **b)** $6394.88
8. Example: Since Maya drives 35 000 km each year, she will drive 175 000 in five years. Both the five-year/100 000 km manufacturer's warranty and the extended three-year/160 000 warranty will expire before the car is six years old. Cars usually do not need extensive repairs in the first six years, so Maya should not pay extra money for the extended warranty.

On the Job 2 Check Your Understanding, page 199

1. **a)** 72 L **b)** 144 L
   c) 52.2 L **d)** approximately 11.0 L
   e) 86.4 L **f)** approximately 39.0 L
2. Examples:
   a) $84.60 **b)** $105.75
   c) $133.95
3. $610.15
4. $203.23
5. $4660
6. Example: Ruth should ask a mechanic about possible future repair and maintenance costs for her current car. She should determine the annual fixed and variable costs of her current car and consider the kilometres on her current car. Ruth should calculate her monthly income and expenses. Then, she should explore the total cost of financing of a new car. Ruth should also determine the monthly payments and the terms of the lease. By reviewing and comparing all this information Ruth can then decide what she can afford and if it is worth keeping her six-year-old car.

Work With It, pages 200 to 201

1. Example:

Fixed Costs	Variable Costs
• licence • monthly car loan payment • insurance • extended warranty	• gas • oil and filter change • tire rotation • replace windshield wipers, air filter, brakes, tires, timing belt • fix chip in front windshield

2. a) Example: $2918.70

b) The value of the car will be 85% of its original value after one year.

c) $440/year

d) $11 774.70

3. a) No. The SUV, including insurance, will cost $1011/month. After expenses are deducted, the Sullivan family has only $607.67/month to spend on a vehicle.

b) Example: Try to finance the car over a longer period of time. Try to find a lower rate of interest for financing. Try to reduce monthly spending on other areas, such as entertainment, furnishings, and clothing. Consider using part of their savings toward a down payment to reduce the monthly payments.

4. a) Example: Hybrid cars have excellent fuel economy and are better for the environment.

b) $10 848

c) gas: $528.08/month, $6336.96/year; hybrid: $717.75/month, $8613/year

d) gas: 1692 L; hybrid: 828 L

e) Example: $1218.24

f) Example: Joanne would pay $2276.04 more per year if she buys the hybrid, but she would save $1218.24 per year on gas. So, the hybrid would only cost an extra $1057.80 per year. This amount could actually become less if gas prices increase or she does mostly city driving. Maintenance costs for hybrids are comparable to gas cars, but their overall depreciation rate is slightly higher than gas cars. Hybrid cars are better for the environment, but seem to be more expensive.

5. Example:

Own a Car

Pros:

- features that make it comfortable for travelling
- safety features in case of accidents (air bags)
- space available for carrying extra passengers or items
- travels at greater speeds than a bicycle

Cons:

- more expensive to purchase and maintain
- requires fixed and variable costs over the life of the car
- runs on gas
- requires a licence

Own a Bicycle

Pros:

- inexpensive initial purchase
- lower costs for maintenance and repairs
- no licence required
- no gas required
- good exercise
- good for environment

Cons

- not comfortable for long trips, bad weather
- limited space for carrying items
- travel is slower
- no air bags or safety features in case of accident
- typically cannot carry a passenger

6. Examples:

a) i) In general, the more extreme the climate, the more costly it is to own a car and the shorter the life span of the car. In colder climates, winter tires/chains and rustproofing may be needed, which are extra expenses. In milder climates, vehicles remain in reasonably good condition for longer periods of time.

ii) The more a car is driven, the faster the mileage increases. This affects the warranty, so if an extended warranty is purchased the cost increases. Mileage also affects the depreciation value of the car, so a higher mileage means faster depreciation. Mileage also affects the repair and maintenance schedules, and often more repairs are needed as the mileage increases.

b) Some factors that affect gas consumption are engine size, distance, speed, driving habits, terrain, and cargo/towing.

7. Example: The distance driven is only a variable cost. Although the variable costs may double, the fixed costs will not.

4.3 Operating a Small Business, pages 202 to 215

On the Job 1 Check Your Understanding, pages 207 to 208

1. Examples:

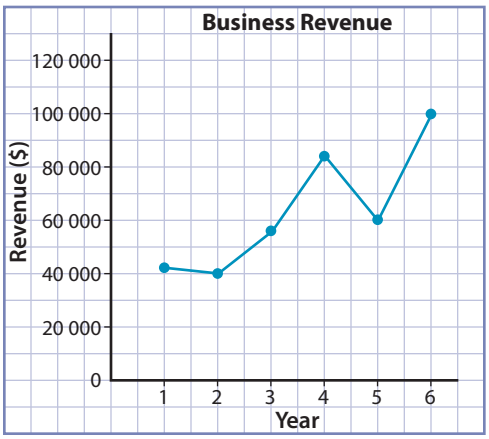
a) Fixed expenses: store rental, wages, advertising, insurance; Variable expenses: cost of merchandise, taxes, utilities

b) Fixed expenses: advertising, insurance, wages; Variable expenses: gas for equipment used, plants, soil, mulch

c) Fixed expenses: wages; Variable expenses: gas, magazines

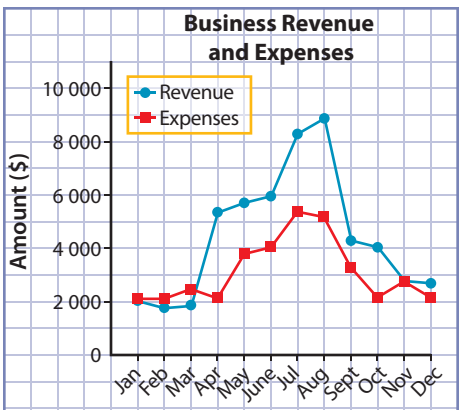
d) Fixed expenses: rent, wages, insurance; Variable expenses: cooking oil, utilities, paper plates, cups, potatoes, ketchup, salt, soft drinks

2. a)



b) The graph is not a linear relation. The revenue does not change by the same amount each year.

3. a)



b) $3158.33

c) $4475. 83

d) July

e) August

4. a) June and July; Example: Many weddings and graduations occur in these months.

b) January and October

c) October

d) January

e) Yes; October

5. Example: Fixed expenses: stand rent, insurance; Variable expenses: hot dogs, buns, propane, ketchup, relish, mustard, paper plates, soft drinks

6. a) Example: Fixed expenses: advertising, trailer rental; Variable expenses: gas, oil, maintenance/repairs

b) $375/month

c) $910/month

d) August; Example: Many people go away on holidays in August, so she may have received additional clients. Perhaps the grass needed cutting more often due to rain or improved growing conditions.

On the Job 2 Check Your Understanding, pages 212 to 214

1. profit; $56 890.02

2. a) Example: October and December; Costumes are popular for Halloween in October, and Santa and elf costumes are popular for Christmas in December.

b) year 2; $44 688.67

3. a) $106 599.21 **b)** $58 332.77

4. a) $202 891.21

b) 37%

c) 55%

5. 18%

6. a) April and August

b) February and March

c) January and November

7. a) $28 546

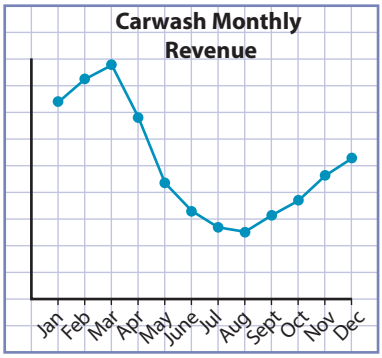
b) Example: No. The start-up expenses are quite high, and it will take some time for Alex's business to make enough revenue to compensate for the expenses and achieve a profit.

8. Examples:

a) November, December, January, and February; The weather is colder during these months and more people will go skating. Also, hockey teams compete and use rinks more regularly.

b) Kent should try to reduce his expenses during the other months to avoid experiencing a loss. He may even want to take a month off to have $0 expenses, if possible.

9. payroll $41 536, advertising $281.60, supplies $1478.40, insurance $6969.60, equipment $19 993.60
10. Example:



Work With It, pages 214 to 215

1. Example: Kris's greatest expenses are rent and taxes. He should look for another place that offers lower rent. He should also cut back on meals and entertainment. He should look into different telephone/Internet plans that are less costly, and into reducing his advertising costs.
2. **a)** $28 304.43 **b)** $43 716.98
3. Revenue is all the income received from the sales of goods and/or services that a business provides. Expenses is the money spent to operate the business.
4. Revenue is all the income received from the sales of goods and/or services that a business provides. Profit occurs when the revenue is greater than the expenses.
5. Examples:
   - **a)** Catering service: Offices and hotels may use catering to provide food for business meetings or events. Such services may be required for special occasions such as birthdays, anniversaries, weddings, showers, and graduations.
   - **b)** Beach umbrella and chair rental business: These are items that many tourists would rent to use for a day on the beach.
   - **c)** Garden centre: Farmers would most likely need to purchase a variety of plants, seeds, soil products, weed and insect control products, and tools to take care of the produce they grow.
6. Examples:
   - **a)** Longer hours of operation could provide opportunity for more profit by providing customers with greater shopping hours. At the same time, this would increase wages and the cost of utilities.
   - **b)** Seasonal variations may increase profits during peak seasons and decrease profits during non-peak seasons. If expenses are high during non-peak seasons, then hopefully they are offset by the additional sales made during the peak seasons. In some cases a business may shut down during non-peak seasons to avoid added expenses.
   - **c)** Competition from larger companies can reduce the profit of smaller businesses because larger companies can offer customers a greater diversity of products and services for less money, since they can buy products in greater bulk. On the other hand, some customers prefer the more personal nature of dealing with a smaller business.
7. Examples:
   - **a)** No. Not everyone who comes through the door makes a purchase of a product or service.
   - **b)** The measure of the success of a business is the profit made from year to year. This shows that the revenues are greater than the expenses.
   - **c)** expenses are greater than revenue, customer base is too small, prices of products and services are too high and not competitive, quality of products and services are unsatisfactory, advertising does not attract enough customers, location of business is not convenient
8. Example: What are the start-up costs? What location would be best for my business? Will I need to hire employees? What products and services should I sell? What prices should I set for these products and services? What is my projected revenue for each month and the first year? What should be my hours of operation? What are different ways to advertise, and how much will they cost? Will my business be affected by the seasons?

Chapter 4 Skill Check, pages 216 to 217

1. **a)** $43 550.20 **b)** $924.07
   c) $44 355.36 **d)** $805.16
   e) $40 550.20; She would pay $860.41/month, which is $63.66 less per month.
2. $21 458.66
3. **a)** $648.25 **b)** $2350/year
4. **a)** Example: $85.20
   b) 40.26 L; Example: $57.17
5. $360

6. a) Example: rent, taxes, utilities, sewing supplies, wages, phone/Internet, advertising
b) $2855.83/month
c) $4858.33
d) No. Sarah's revenue is greater than her expenses, so she made a profit.
e) $24 030
f) July and August; Example: Perhaps customers have more time to sew during the summer months. Customers may have home projects, such as making curtains. Sarah may also have had sale promotions of fabric left over from winter and spring, which would bring increased revenue.

Chapter 4 Test Yourself, pages 218 to 219

1. B
2. C
3. A
4. B
5. B
6. B
7. a) $15 677.62
b) $261.29
c) $6270.96; $9406.66
8. Examples:
a) A person should buy a used car if their monthly net income is too low to afford the monthly payments of a new car.
b) A person should buy a new car if their net monthly income is high enough to afford the monthly payments on a new vehicle. Some people prefer to have a warranty, which comes with new cars.
c) A person should lease a car if they prefer to have a warranty and want to always drive a new car. Over the long run it is more costly to lease, but lease payments are often lower than monthly payments to finance owning a car.
9. $5620
10. a) $2178.33
b) $3131.50
c) Yes. In October, the expenses are greater than the revenue.
d) annual profit; $11 438
e) Example: increase the price for customers to use the rink, increase hours of operation, find ways to reduce costs

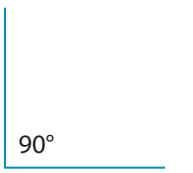
Chapter 5

Get Ready, pages 224 to 225

1. a) rectangle
b) trapezoid
c) parallelogram
d) trapezoid
e) pentagon
f) hexagon

2. Estimates may vary.
a) 7°
b) 120°
c) $\angle A = 90°$, $\angle B = 30°$, $\angle C = 60°$
d) $\angle D = 70°$, $\angle E = 70°$, $\angle F = 110°$, $\angle G = 110°$

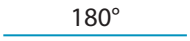
3. a)



b)

c)

d)



4. a) 15.7
b) 1.21
c) 9.2
d) 31.4
e) 2.22
f) 32.1

5. a) 100
b) 23.4
c) 6.75
d) 2025
e) 7.22
f) 26.04

6. Examples:
a) Divide into a rectangle and a square. Area = 188.2 cm^2.
b) Divide into two rectangles and a triangle. Area = 50.4 cm^2.
c) Divide into one rectangle and two triangles. Area = 14.5 m^2.

7. a) 60.4 cm
b) approximately 35.5 cm
c) 19.6 m

5.1 Angle Properties of Polygons, pages 226 to 237

On the Job 1 Check Your Understanding, pages 230 to 232

1. 135°
2. 60°
3. a) Example: 84°, 34°, 62°
b) none
c) All angles are acute.
d) 3 acute angles
e) No. It depends on the size of the angles, but there are only three possibilities: three acute angles, two acute angles and one obtuse angle, or a right angle and two acute angles.

4. **a)** Yes for #1 and #2; no for #3
b) Example: circle, star, and chevron

5. **a)** 180° **b)** 360°
c) 1080°

6. All

7.

	Polygon	Number of Interior Angles	Sum of Interior Angles	Measure of Each Interior Angle
a)	Equilateral triangle	3	180°	60°
b)	Square	4	360°	90°
c)	Rectangle	4	360°	90°
d)	Regular pentagon	5	540°	108°
e)	Regular hexagon	6	720°	120°

8.

	Polygon	Right Angles	Obtuse Angles	Acute Angles	Equal Angles
a)	Isosceles triangle	possible	possible	possible	2
b)	Scalene triangle	possible	possible	possible	none
c)	Equilateral triangle	none	none	all	3
d)	Square	all	none	none	all
e)	Rectangle	all	none	none	all
f)	Parallelogram	none	2	2	2 pairs
g)	Isosceles trapezoid	none	2	2	2 pairs
h)	Quadrilateral	possible	possible	possible	possible
i)	Regular pentagon	none	5	none	5
j)	Regular hexagon	none	6	none	6

9. **a)** 8 angles **b)** 135°

10. **a)** 108° **b)** 54°

On the Job 2 Check Your Understanding, pages 235 to 236

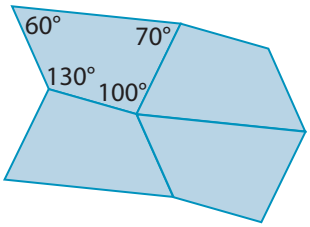
1. **a)** Yes; Arrange so that the interior angles where the vertices meet are 50°, 80°, 50°, 50°, 80°, 50°.
b) Yes; Arrange so that the interior angles where the vertices meet are 60°, 50°, 70°, 60°, 50°, 70°.
c) Yes; The sum of the interior angles where the vertices meet is 360°.

2. **a)** Yes; Arrange so that the interior angles where the vertices meet are 100°, 80°, 80°, 100°.
b) No; There is no combination of interior angles that sums to 360°.
c) Yes; Arrange so that the interior angles where the vertices meet are 35°, 130°, 85°, 110°.

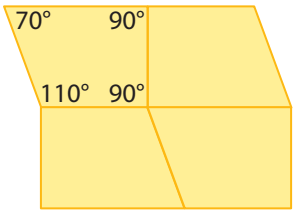
3. equilateral triangle, square, regular hexagon

4. Examples:

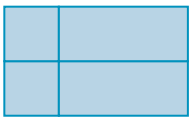
a)



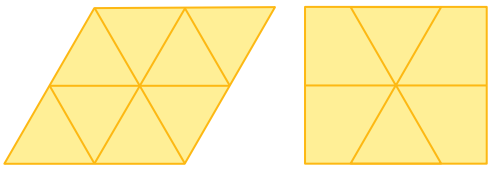
b)



5. Yes. Example:



6. Example:



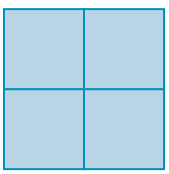
Work With It, pages 236 to 237

1. **a)** isosceles triangle or scalene triangle
b) square or rectangle
c) regular hexagon
d) regular pentagon

2. **a)** cannot be changed to tessellate in a straight line
b) change all angles to 60°
c) change all angles to 90°

3. Examples:

a)



b)

4. Example:

5. The pattern is a tessellation because a repeated pattern of geometric shapes covers the surface area with no overlaps or gaps.

6. Example: All three types of triangles have three angles whose sum is 180°. However, the measures and types of interior angles differ:

Triangle	Measures of Interior Angles	Types of Interior Angles
Equilateral	60°	• three acute
Isosceles	Two equal angles	• one right and two acute • one obtuse and two acute • three acute
Scalene	All different	• one right and two acute • three acute • one obtuse and two acute

7. a) The measure of the interior angles become larger and closer to 180°.

b) circle

8. The measure of the interior angle of a regular pentagon is 108°, which does not divide evenly into 360°. If two adjacent angles of an irregular pentagon total 180°, then the pentagon will tessellate.

9. Example: honeycombs, flowers, tile designs, wall paper designs, fabric designs, art

5.2 Side Lengths and Diagonal Properties of Polygons, pages 238 to 247

On the Job 1 Check Your Understanding, pages 241 to 243

1. a) BC = 4 in., CD = 3 in., BD = 5 in.

b) QO = 5 cm, MO = 10 cm, PO = 9 cm, PQ = 7 cm

c) DG = 3 cm, HF = 2.1 cm, GE = 4.2 cm, ∠GHF = 90°

d) FG = 6.5 cm, FH = 9.2 cm, ∠GFE = 90°, ∠EIH = 90°

e) PQ = 4 m, ∠QTR = 85°, ∠PTQ + ∠QTR + ∠RTS + ∠PTS = 360°

f) KL = 6 ft, ∠KNL = 100°, ∠JNK = 80°, ∠LNM = 80°

2.

	Polygon	Number of Equal Side Lengths	Number of Sets of Parallel Sides	Number of Equal Diagonals
a)	Rectangle	2 sets of 2	2 sets of 2	2
b)	Square	4	2 sets of 2	2
c)	Isosceles trapezoid	1 set of 2	1 set of 2	2
d)	Parallelogram	2 sets of 2	2 sets of 2	none

3. a) square, rectangle, parallelogram, trapezoid, isosceles trapezoid

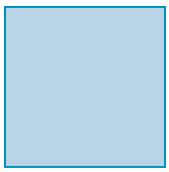
b) square

c) square, rectangle, isosceles trapezoid

4. Sketches may vary.

a) rectangle

b) square



c) quadrilateral

5. No. The opposites sides are equal in length, but the diagonals are not equal in length.

6. Draw the diagonals of the square. The point of intersection is the centre of the circle.

7. a) 26.75 m^2

b) Measure the sides to see if opposite sides are equal, and measure the diagonals to see if they are equal.

c) Find the intersection of the diagonals drawn from opposite corners of the bathroom.

8. Yes. Each side measures 1.6 m, which is enough room to fit the bench.

9. 29.25 m^2

On the Job 2 Check Your Understanding, pages 245 to 246

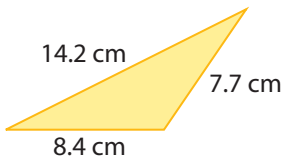
1. a) Yes **b)** No

c) No

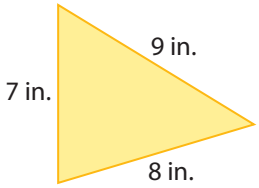
2. a) No **b)** No

c) Yes

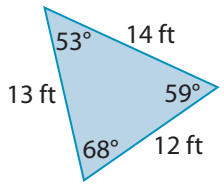
3. #1b)



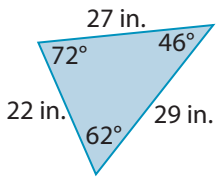
#1c)



#2a)



#2b)



4. Answers may vary.
5. The smallest angle should be across from the smallest side, so interchange the 30° and 52° labels.
6. No. Interchange the 106° and 44° labels.

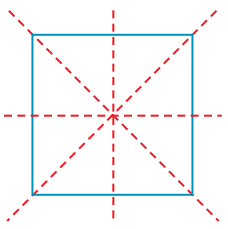
Work With It, pages 246 to 247

1. **a)** 5 diagonals
   b) 9 diagonals
   c) 20 diagonals
2. Find the point of intersection of the diagonals of the square.
3. No. It is not possible to tessellate the triangle because it is an impossible triangle.
4. The angles in each isosceles triangle are incorrect. The two equal angles should measure 54°, not 55°, since each angle in a regular pentagon is 108°. The angle at the centre should measure 72°, not 70°, since the sum of the angles of a triangle is 180°.
5. Answers may vary.
6. Measure the sides to check that they are equal. Draw the diagonals and measure to see if they are equal.
7. A rectangle, just like a parallelogram, has two pairs of equal sides and two pairs of parallel sides.
8. Example: All the sides and angles are equal.

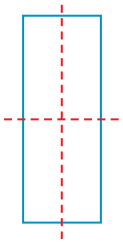
5.3 Symmetry, pages 248 to 257

On the Job 1 Check Your Understanding, pages 251 to 252

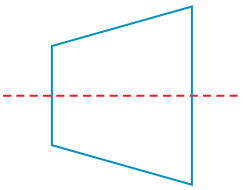
1. **a)** square
   b) rectangle
   c) isosceles trapezoid
   d) square
2. **a)**



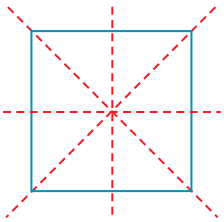
b)



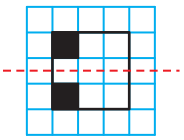
c)



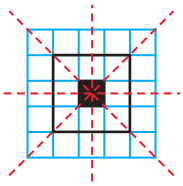
d)



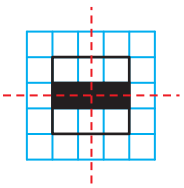
3. Examples:
a)



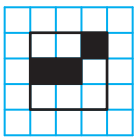
b)



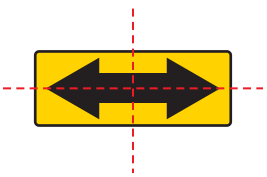
c)



d)

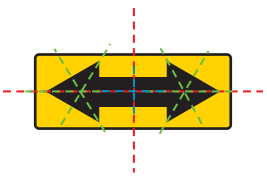


4. **a)**



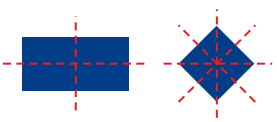
b) two rectangles of different sizes and two equilateral triangles of the same size

c)



d) 10 lines of symmetry from part c)
e) Example: yield sign (equilateral triangle with 3 lines of symmetry), stop sign (regular octagon with 8 lines of symmetry), speed limit sign (rectangle with 2 lines of symmetry)
f) Example: falling rocks, school zone, moose crossing, deer crossing

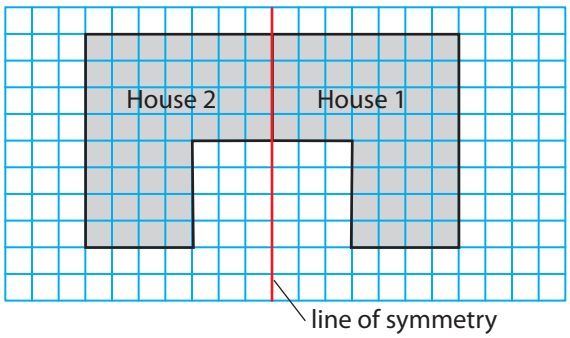
5. **a)** square and rectangle; both have symmetry



b) isosceles trapezoid; has symmetry

c) rectangle and parallelogram; the rectangles have symmetry but the parallelogram does not have symmetry

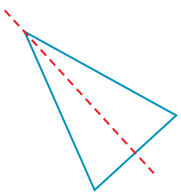
6.



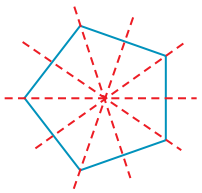
On the Job 2 Check Your Understanding, pages 255 to 256

1. a) isosceles triangle **b)** regular pentagon
c) isosceles trapezoid **d)** equilateral triangle

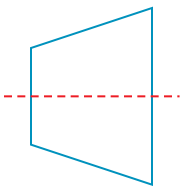
2. a)



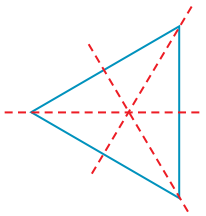
b)



c)

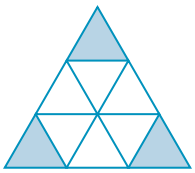


d)

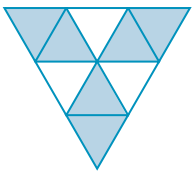


3. Examples:

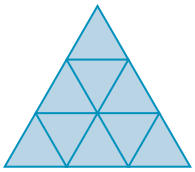
a)



b)



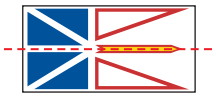
c)



4. Eight lines of symmetry. Four of them are diagonals through opposite vertices, and four of them are lines that cut opposite sides in half.

5. Examples:
a) a tile in the shape of an isosceles triangle
b) a rectangular placemat
c) a circular tabletop

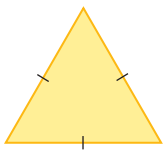
6. a) right scalene
b) 1 line of symmetry



c) Answers may vary.

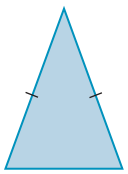
Work With It, page 257

1. a)

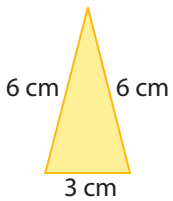


b) not possible

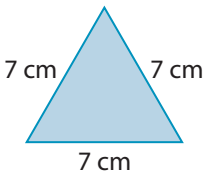
c)



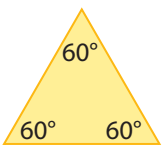
d)



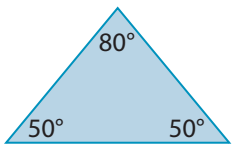
e)



f)



g)



2. a) equilateral **b)** none
c) isosceles **d)** isosceles
e) equilateral **f)** equilateral
g) isosceles

3. 180°

4. Eight lines of symmetry. Four of them are diagonals through opposite vertices, and four of them are lines that cut opposite sides in half.

5. a) 24 isosceles triangles and 7 squares
b) 4 lines of symmetry

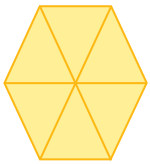
6. Answers may vary.

7. Answers may vary.

Chapter 5 Skill Check, pages 258 to 259

1. a) sum of angles: 540°, interior angle: 108°
b) sum of angles: 1080°, interior angle: 135°
c) sum of angles: 1440°, interior angle: 144°
d) sum of angles: 1620°, interior angle: approximately 147.3°

2. Yes. Example: 65°, 65°, and 50°



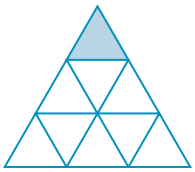
3. approximately 306 in.^{2}

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

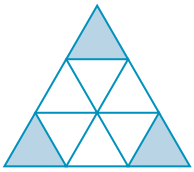
5. PS = 7 cm, SR = 4 cm, ∠S = 57°, ∠R = 123°

6. Examples:

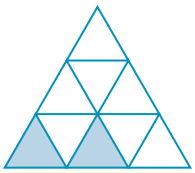
a)



b)



c)



7. 6 ways

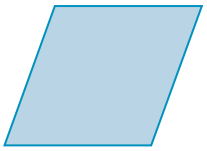
8. a) square, 4 lines of symmetry
b) rectangle, 2 lines of symmetry
c) parallelogram, no lines of symmetry
d) isosceles trapezoid, 1 line of symmetry

Chapter 5 Test Yourself, pages 260 to 261

1. D
2. C
3. D
4. C
5. D
6. a) rectangle

b) trapezoid

c) parallelogram

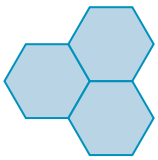


7. a) rug 1: 27 180 cm^2; rug 2: 2.61 m^2 or 26 100 cm^2
b) rug 1: 8 lines of symmetry; rug 2: 6 lines of symmetry
c) rug 1

8. Example:

Number of Sides	4	8
Name of Regular Polygon	Square	Octagon
Number of Lines of Symmetry	4	8
Number of Diagonals	2	20
Sum of Interior Angles	360°	1080°
Measure of Each Interior Angle	90°	135°

9. Example: regular hexagon; each interior angle measures 120°

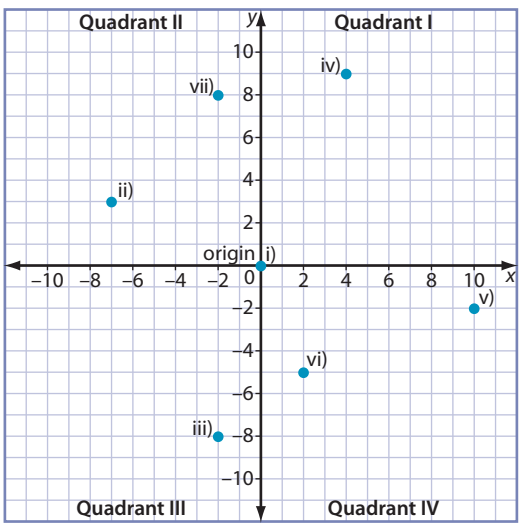


Chapter 6

Get Ready, pages 266 to 267

1. a) go south 2 blocks and east 1 block
b) go north 3 blocks and west 1 block
c) go north 2 blocks and east 4 blocks

2.

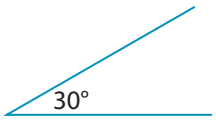


3. **a)** I **b)** III
c) IV **d)** II
e) I **f)** IV

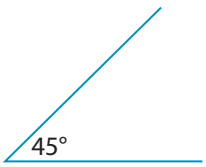
4. **a)** P **b)** S
c) Q **d)** R
e) T **f)** U

5. **a)** similar figures **b)** not similar figures
c) similar figures **d)** similar figures

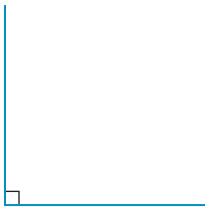
6. **a)**



b)

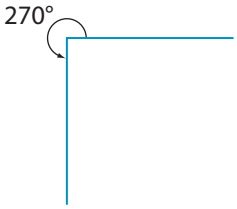


c)



d)

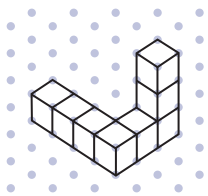
e)



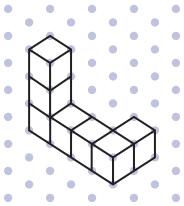
f)

8. **a)**

b)



c)



6.1 Dilations, pages 268 to 281

On the Job 1 Check Your Understanding, pages 272 to 274

1. $\angle P = \angle T$, $\angle Q = \angle U$, $\angle R = \angle V$, $\frac{PQ}{TU} = \frac{PR}{TV} = \frac{QR}{UV}$

2. **a)** No. $\frac{SR}{WV} = \frac{TU}{XY} = 3$, but $\frac{ST}{WX} = \frac{RU}{VY} = 4.0625$.

b) No. $\frac{XY}{LM} \neq \frac{XZ}{LM} \neq \frac{YZ}{MN}$

3. No. Corresponding sides are not proportional.

4. **a)** No. $\angle E = \angle I = 90°$, $\angle F = \angle J = 90°$, $\angle G = 83°$ and $\angle K = 80°$, $\angle H = 97°$ and $\angle L = 100°$

b) No. $\angle A = 104°$ and $\angle W = 110°$, $\angle B = 47°$ and $\angle X = 43°$, $\angle C = 29°$ and $\angle Y = 27°$

5. **a)** Yes. Since the corresponding sides are proportional and the corresponding angles are equal, the two polygons are similar. Polygon LMNJK is a reduction of polygon CDEAB by a scale factor of $\frac{1}{3}$.

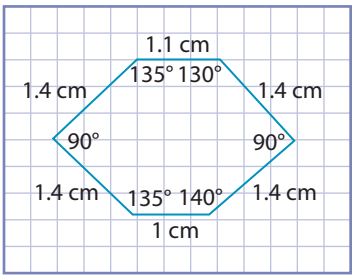
b) Yes. Since the corresponding sides are proportional and the corresponding angles are equal, the two polygons are similar. Polygon FGHIJK is a reduction of polygon UVWXYZ by a scale factor of $\frac{2}{3}$.

c) No. Since corresponding sides are not proportional and corresponding angles are not equal, the two polygons are not similar. The polygon JKLMN is not a reduction of polygon PQRST.

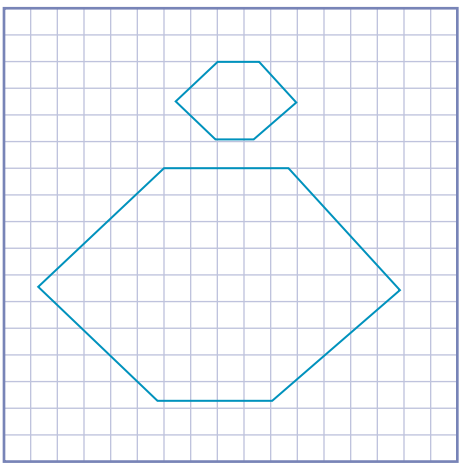
6. Example: The angles of the two triangles measure 70°, 70°, and 40°. The sides can measure 3 cm, 3 cm, and 2 cm or 12 cm, 12 cm, and 8 cm.

7. **a)** Examples:

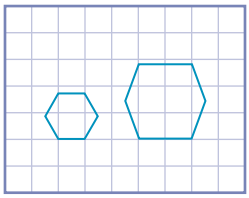
i)



ii)



iii)



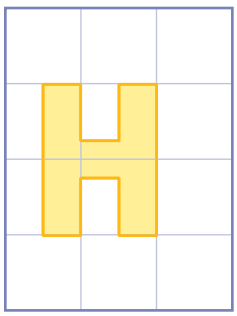
b) The hexagons are similar if corresponding angles are equal and corresponding sides are proportional. Otherwise, they are not similar.

8. a) approximately 1.4

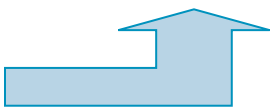
b) 7 m

On the Job 2 Check Your Understanding, pages 278 to 279

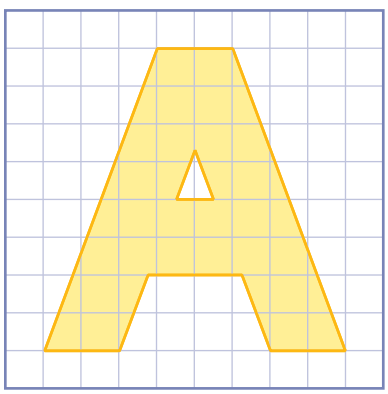
1. a)



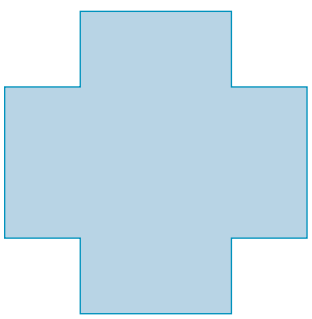
b)



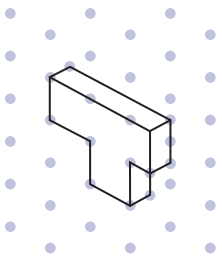
2. a)



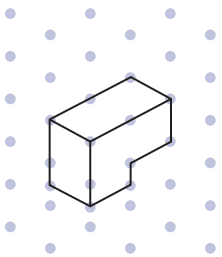
b)



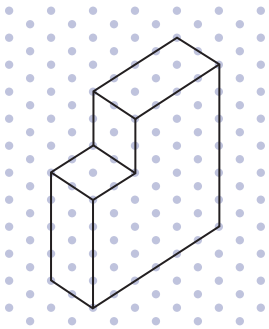
3. a)



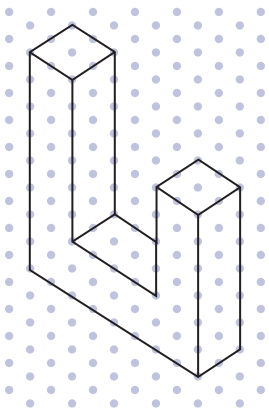
b)



4. a)



b)

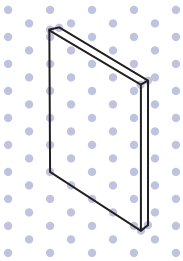


5. a) Enlargement. A microscope lens makes an object look bigger.

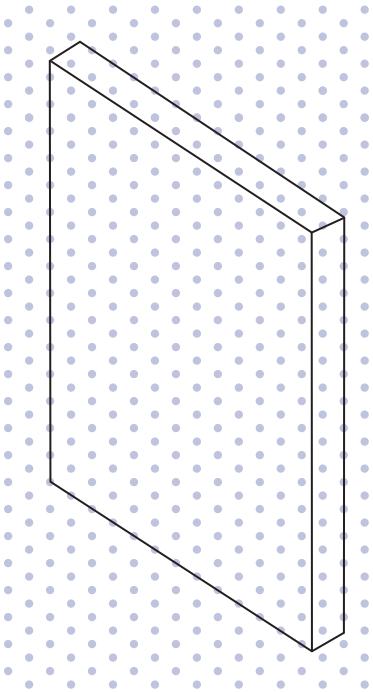
b) Enlargement by 100X, as indicated on the bottom right corner of the image. It means 100 times magnification.

6. Examples:

a) scale: 1 unit represents 5 cm



b) scale: 1 unit represents 5 cm



7. $\frac{1}{137}$ or approximately 0.0073

Work With It, pages 280 to 281

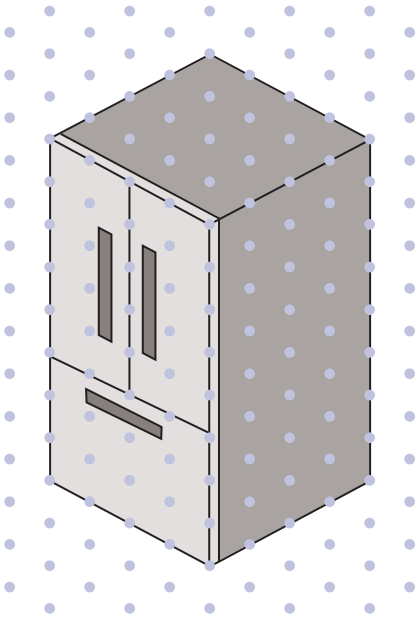
1. a) 3 mm and 6 mm; scale factor of 2

2. a) Yes. Corresponding angles are equal. The ratio of the corresponding sides is approximately 2.67.

b) 4.8 m

3. 4.7 m by 8.3 m

4. scale: 1 unit represents 3 units on original drawing



5. Example: Draw a rectangle that exactly fits each plane and then measure the corresponding sides to determine if they are in the same ratio. The ratio of the lengths is 1.5 and the ratio of the widths is approximately 1.48. Since the ratios are not the same, the larger photo is not proportional to the smaller.

6. Example: Yes. Regular hexagons are similar, so the formations will be similar. However, the honeycombs in the reduction would be more densely packed together, while those in the enlargement would be much less so.

6.2 Translations, pages 282 to 291

On the Job 1 Check Your Understanding, pages 285 to 286

1. a) 8 units right and 2 units down

b) 1 unit right and 6 units down

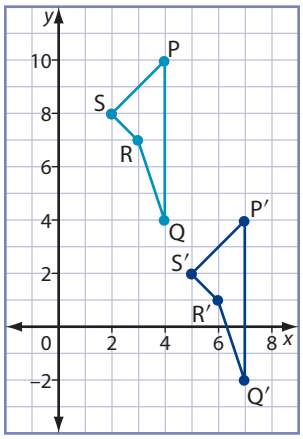
2. a) (7, 2) **b)** (4, –3)

c) (–2, 3) **d)** (6, 10)

e) (–6, –10)

3. image 1

4. a)

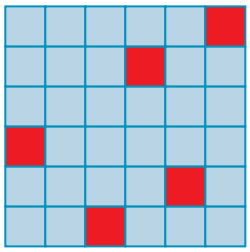


b) P′(7, 4), Q′(7, –2), R′(6, 1), S′(5, 2)

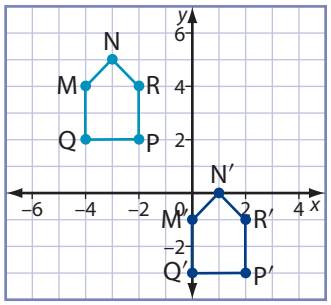
5. 7 units right and 9 units up

6. From top to bottom: 4 units up, 2 units right and 4 units up, 4 units right and 4 units up, 1 unit right and 2 units up, 3 units right and 2 units up, 2 units right, 4 units right

7.



8. a) and **b)**

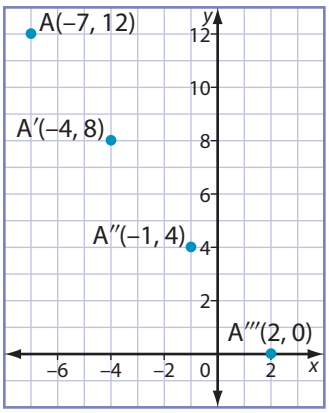


c) 4 units right and 5 units down

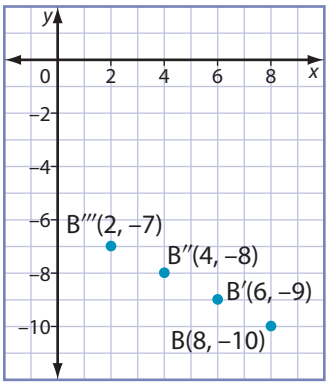
On the Job 2 Check Your Understanding, pages 289 to 290

1. Example: 1 unit down and 2 units right

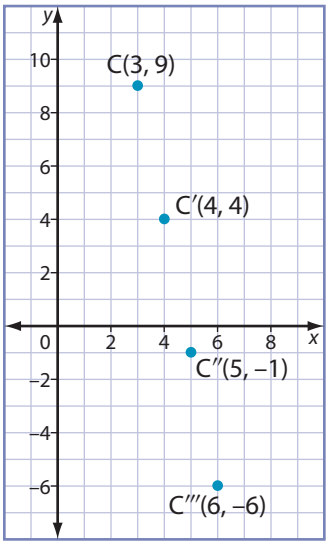
2. a)



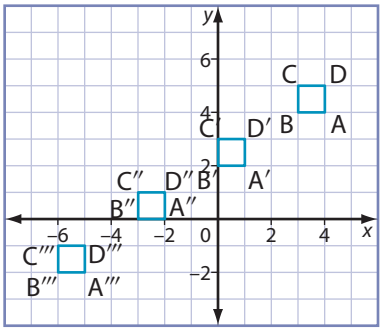
b)



c)

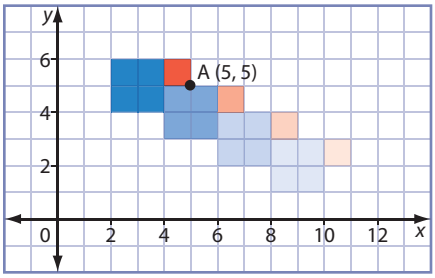


3.

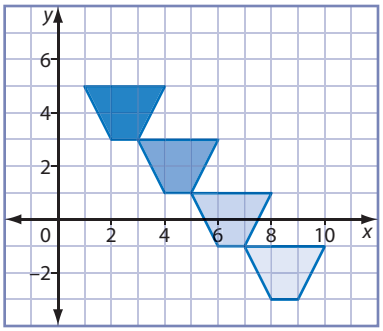


4. a) Example: 1 unit down and 2 units right

b)



5. Example: 2 units down and 2 units right



6. Move Part A 250 m to the right and move Part B 190 m to the right.

7. a) Example: The pattern made up of a square tile above a rectangular tile has been translated 1 unit down and 1 unit right.

b) No. Moving up/down and then right/left results in the same position as moving left/right and then up/down. The translation in one direction does not affect the translation in the other direction.

Work With It, page 291

1. Answers may vary.

2. a) 4 units right and 1 unit up

b) 80 units right and 20 units up

3. Example: From d4, move 2 squares up and 1 square right to e6. Then, move 2 squares right and 1 square down to g5. Finally, move 2 squares up and 1 square right to h7.

4. Example: Successive translations can be used to show the movement of a cartoon character from one position to another by repeatedly or sequentially drawing the character on a grid and applying the translations.

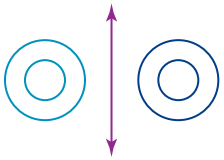
6.3 Reflections, pages 292 to 301

On the Job 1 Check Your Understanding, pages 295 to 296

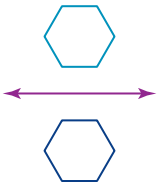
1. a) reflection **b)** not a reflection

c) reflection

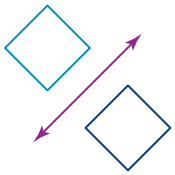
2. a)



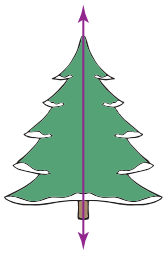
b)



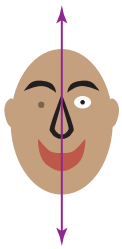
c)



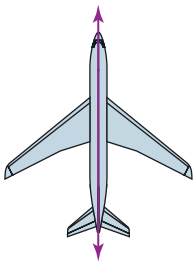
3. a)



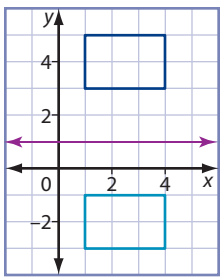
b)



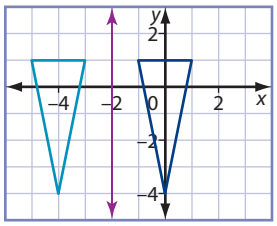
c)



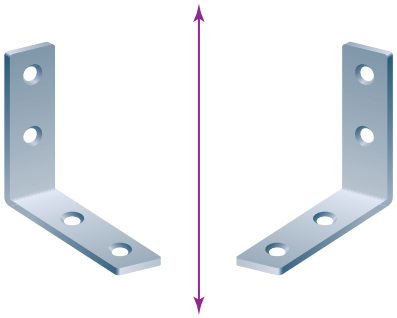
4. a)



b)



5.



6. Answers may vary.

7. Examples:

a) Use a ruler or string to act as a line of symmetry along the forehead, nose, and mouth of the sculptured face. Check that points, such as the eyes, ears, cheeks, and other facial features, are the same distance from the line of symmetry, and that the corresponding features are the same size.

b) In a reflection the size of shapes or features do not change. They are equal distance from the line of symmetry and mirror images of each other.

On the Job 2 Check Your Understanding, pages 299 to 300

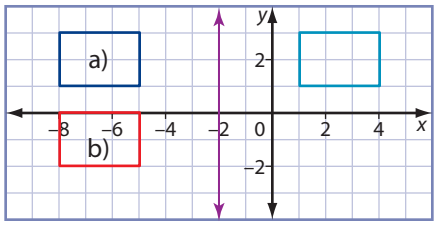
1. Examples:

a) This pattern could be made from only translations, only reflections, or a combination of translations and reflections.

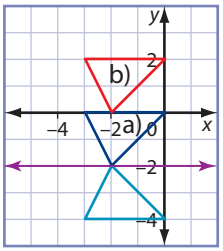
b) The locations of the triangles in this pattern could be a combination of translations and reflections.

c) The shape in this pattern is transformed by a combination of translations and reflections.

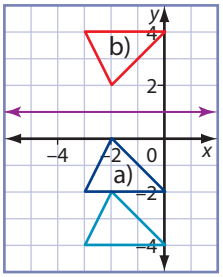
2.



3. a)



4. a) and **b)**



c) No

5. block 1: translated 1 unit right; reflected over a diagonal line of reflection and translated 1 unit right; reflected over a diagonal line of reflection and translated 1 unit right and 1 unit down. block 2: translated 1 unit right; translated 1 unit right and 1 unit down. block 3: translated 2 units right and 2 units up.

6. a) A becomes A′ by a translation of 2 units right and 2 units down. B becomes B′ by a translation of 2 units right.

b) Answers may vary.

7. Answers may vary.

8. Example: Method 1: The polygon is reflected over a vertical line of reflection, a diagonal line of reflection, and a horizontal line of reflection. Method 2: The polygon is translated right, along a diagonal, or down.

Work With It, page 301

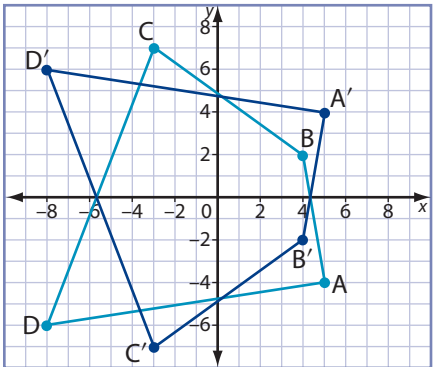
1. Answers may vary.

2. Answers may vary.

3. Example: No. Since a square has four equal sides and angles, it is difficult to see the changes caused by reflections and translations. If a figure such as a triangle is reflected over the x-axis, the image cannot be obtained by using a translation because the orientation of the three vertices changes.

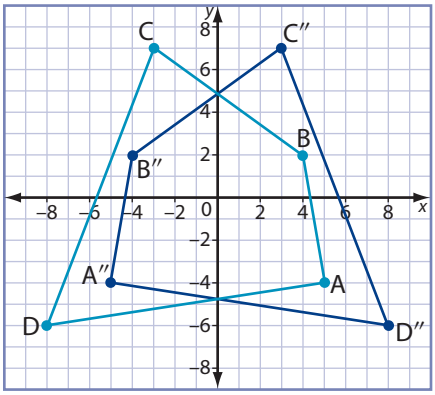
4. Example: The image is neither reflected left to right nor up to down, but reversed front to back, at right angles to the mirror. So, when you wave your right hand, your reflection is still waving the right hand but we confuse it with a left hand because the reflection looks like a person whose left hand is moving.

5. a) and **b)**



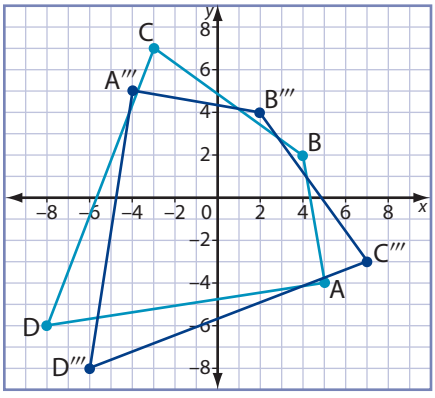
A′(5, 4), B′(4, –2), C′(–3, –7), D′(–8, 6); Compared to the original points, the y-coordinates of the image points have the opposite sign and the x-coordinates are the same.

c)



A″(–5, –4), B″(–4, 2), C″(3, 7), D″(8, –6); Compared to the original points, the x-coordinates of the image points have the opposite sign and the y-coordinates are the same.

d)

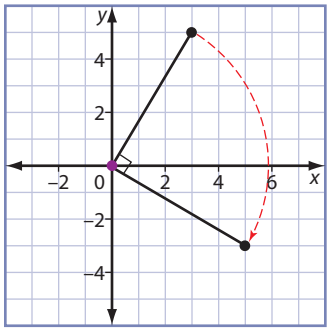


A‴(–4, 5), B‴(2, 4), C‴(7, –3), D‴(–6, –8); Compared to the original points, the x-coordinates and y-coordinates of the image points are in reverse order.

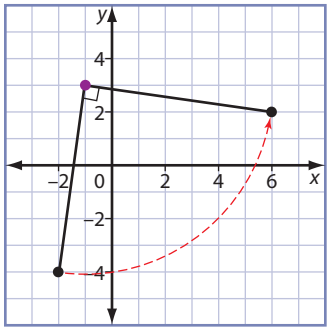
6.4 Rotations, pages 302 to 315

On the Job 1 Check Your Understanding, pages 308 to 310

1. a) (5, –3)

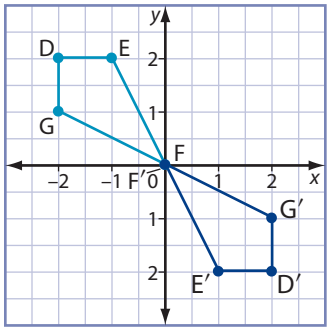


b) (6, 2)

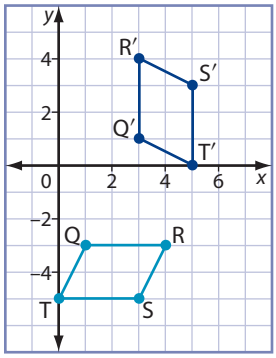


2. a) (–10, –5) **b)** (–4, 2)

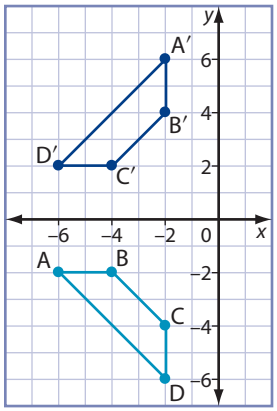
3. a)



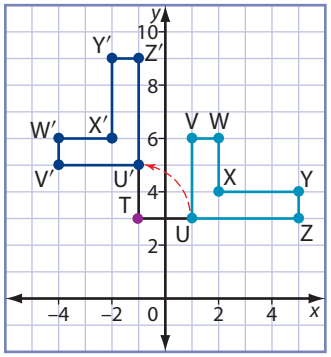
b)



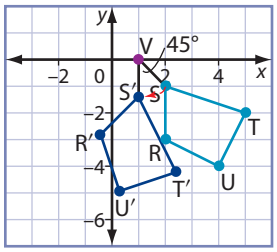
c)



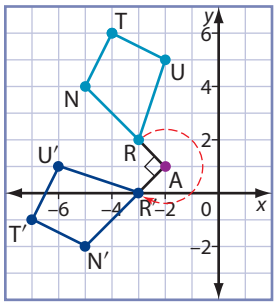
4. a)



b)



c)



5. Example: circle rotated any angle measure about its centre

6. a)

b) 72°

7. After the two rotations, the coordinates of the image are the same as those of the original figure.

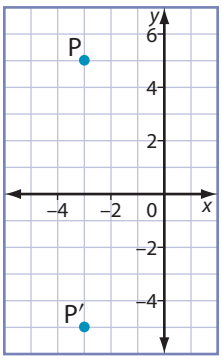
8. B(−8, 2)

9. a) Example: Design one blade of the fan and then duplicate the blade by rotating it through an angle that divides evenly into 360°. For example, by rotating it through an angle of 60°, the fan will have 6 blades.

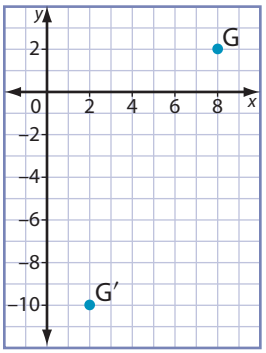
b) Answers may vary.

On the Job 2 Check Your Understanding, pages 313 to 315

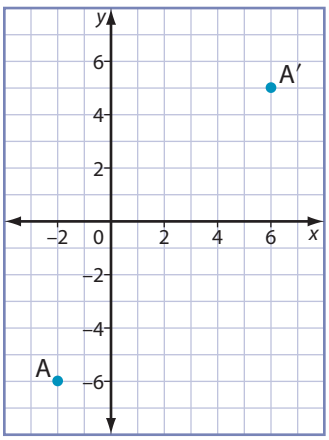
1. a)



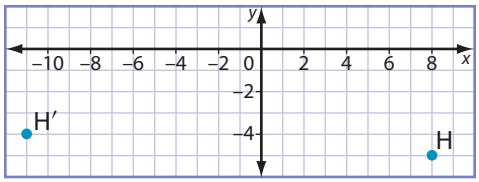
b)



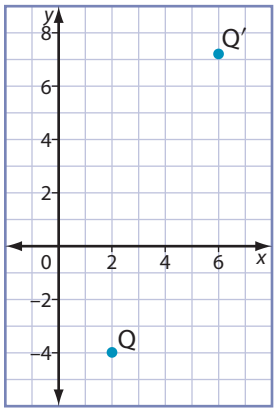
2. a)



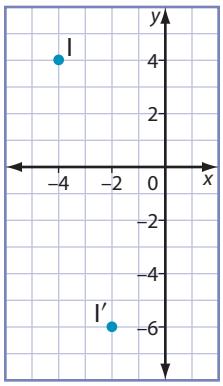
b)



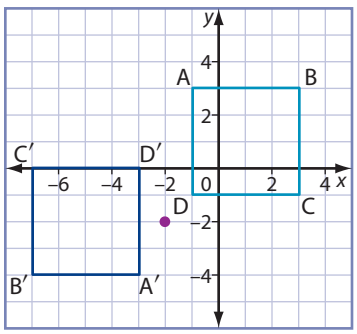
3. a)



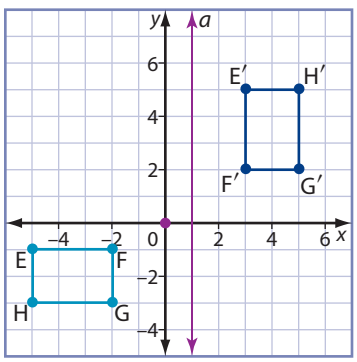
b)



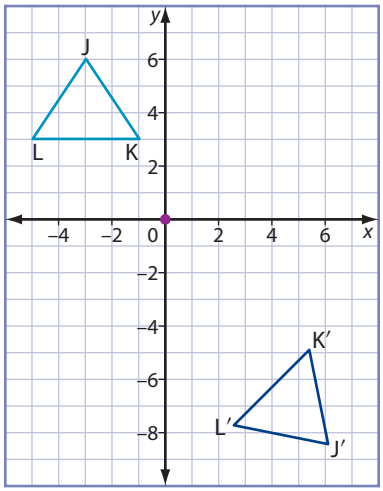
4. a)



b)



c)



5. (–6, 6)

6. a) centre of the snowflake; 120°; 6 lines of symmetry

b) centre of the flower; 288°, 5 lines of symmetry

7. Examples:

a) Rotate the top square block and 2 smaller side blocks 180° about the centre of the pattern.

b) Rotate the top right rectangular block and right small square block 90° counterclockwise about the centre of the large square. Rotate the same two blocks 180°, and finally 90° clockwise.

8. Answers may vary.

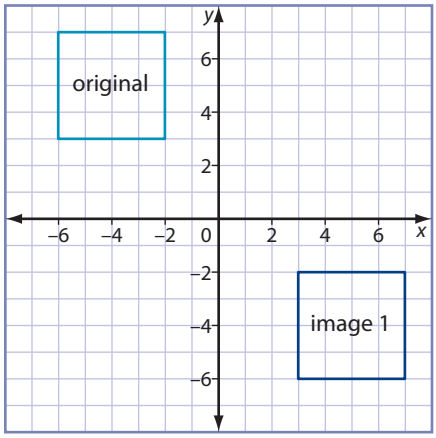
9. Answers may vary.

10. Example: First create the bottom row of triangles using horizontal translations. Then, create a horizontal line of reflection through the top vertex of these triangles. Finally, reflect the bottom row of triangles over the horizontal line.

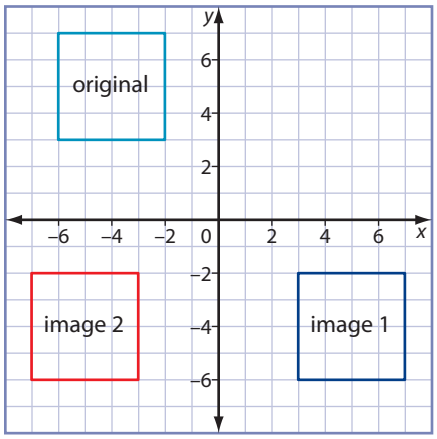
Work With It, page 315

1. Examples:

a)



b)



c) Image 1 and image 2 are a reflection of each other in the *y*-axis.

d) Rotate the original square 90° clockwise and translate it 8 units down. Rotate the original square 90° counterclockwise.

2. Examples:

a) i) The inside centre oval is rotated 180° and shifted up to obtain the top inside oval.

ii) Rotate each piece at the top of the logo 90° clockwise through the centre of the logo.

b) Answers may vary.

3. a) rotation of 180° about the centre of the card

b) Example: Cards are designed this way so that a player and a dealer can see them right side up and upside down from either side of a table, such as in a casino.

c) ace of hearts, spades, and clubs; three of hearts, spades, and clubs; five of hearts, spades, and clubs; six of hearts, spades, and clubs; seven of hearts, spades, diamonds, and clubs; eight of hearts, spades, and clubs; nine of hearts, spades, and clubs

4. Similarities: The size and shape of the figure do not change.

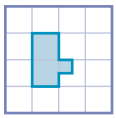
Differences: The orientation of the figure may change for a rotation but not for a translation.

Chapter 6 Skill Check, pages 316 to 317

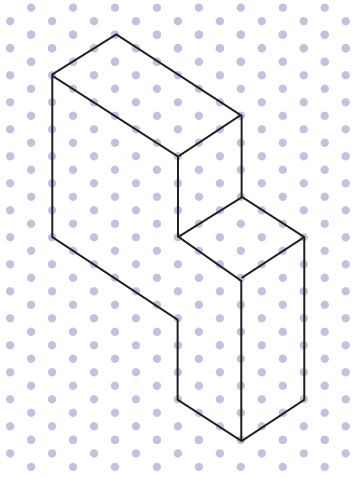
1. a) Yes. All the corresponding angles are equal and the corresponding sides are proportional.

b) 0.68

2. a)

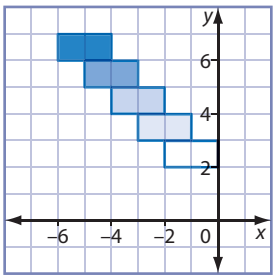


b)

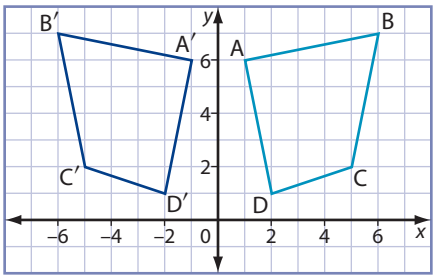


3. Translate 5 units right and 4 units down.

4.



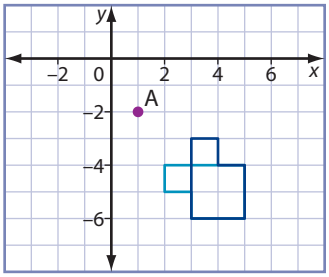
5.



6. Example: You see real-life reflections in a mirror, a pond, and mosaic designs.

7. A, B, C are all rotations.

8.



Chapter 6 Test Yourself, pages 318 to 319

1. A

2. D

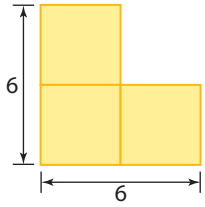
3. A

4. B

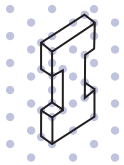
5. A

6. (–11, –3)

7. a)



b)



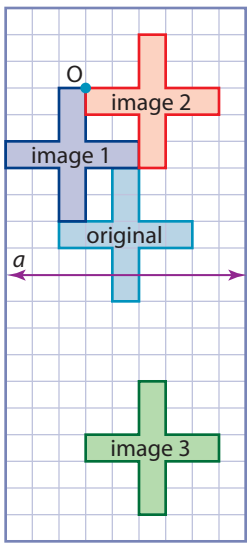
8. a) reflection over the y-axis

b) translation 4 units down

c) 180° rotation around point (4, 2)

d) reflection over the y-axis and translation 4 units up

9.



10. Example: Reflect triangle 1 over a horizontal line along its base to obtain triangle 3. Translate triangle 1 up and left to obtain triangle 2. Translate triangle 1 up and right to obtain triangle 4.

Chapter 7

Get Ready, pages 324 to 325

1. a) 0.602 **b)** 0.454
c) 4.705 **d)** 0.990
e) 0.839 **f)** 0.883

2. a) 37° **b)** 17°
c) 18° **d)** 78°
e) 66° **f)** 64°

3. a) 70° **b)** 43°

4. a) 18° **b)** 27°
c) 60° **d)** 54°

5. a) 20.0 cm **b)** 41.0 m

6. a) 11.0 m **b)** 13.1 cm
c) 12.1 ft **d)** 10.0 in.

7. a) 96 **b)** 173.7
c) 24.73 **d)** 29.17

7.1 The Sine Law, pages 326 to 337

On the Job 1 Check Your Understanding, pages 330 to 331

1. $\frac{e}{\sin E}$ and $\frac{f}{\sin F}$

2. a) ∠D, e and ∠E or f and ∠F

b) ∠E, d and ∠D or f and ∠F

c) ∠F, e and ∠E or d and ∠D

3. a) $a = 12.3$ cm **b)** $c = 48.1$ m
c) $a = 24.6$ in. **d)** $c = 24.8$ ft

4. a) $a = 35.3$ m **b)** $b = 41.3$ cm
c) $y = 8.4$ m **d)** $d = 39.1$ cm

5. a) 603.8 m **b)** 1248.3 m

6. 41.6 ft

7. a) Length b represents the length of the lake, not length c. Jason must solve $\frac{a}{\sin A} = \frac{b}{\sin B}$.

b) 28.3 km

On the Job 2 Check Your Understanding, pages 334 to 335

1. a) $\frac{\sin E}{e}$ and $\frac{\sin F}{f}$

2. a) d, e and ∠E or f and ∠F

b) e, d and ∠D or f and ∠F

c) f, e and ∠E or d and ∠D

3. a) ∠A = 9° **b)** ∠B = 47°
c) ∠B = 17° **d)** ∠C = 29°

4. a) ∠A = 59° **b)** ∠C = 31°
c) ∠Y = 39° **d)** ∠D = 32°

5. a) ∠A = 32°, ∠C = 66° **b)** ∠B = 17°, ∠C = 138°

6. ∠A = 39°, ∠B = 66°

7. ∠B = 49°

8. 66°

Work With It, pages 336 to 337

1. a) 10.5 yd **b)** 12.3 yd

2. a) 36° **b)** 4.7 m

3. a) $\pm \frac{1}{2}$ mi

b) maximum distance: 14.1 mi, minimum distance: 13.2 mi

4. a) No opposite side length is known for the three given angles.
b) No opposite angle measure is known for a given side lengths, and no opposite side length is given for the known angle measures.

5. Yes. The sine law can be used for $\triangle ABC$ since two sides and an angle opposite one of them (SSA) are known. The sine law cannot be used for $\triangle DEF$ since no opposite angle measure is known for a given side length, and no opposite side length is given for the known angle measure.

6. a) Stacey substituted the value of q for p and the value of p for q.
b) Example: Stacy could have labelled the opposite side for each angle.

7. a) 71°
b) 71°
c) Example: I prefer the first version of the sine law because the unknown value is in the numerator. This makes it easier to rearrange the terms to calculate the required angle.
d) Example: The second version of the sine law since the unknown value c is in the numerator. There is less rearranging of terms to calculate the required value when this form is used.

7.2 The Cosine Law, pages 338 to 351

On the Job 1 Check Your Understanding, pages 342 to 344

1. a) $e^2 = d^2 + f^2 - 2df \cos E$
b) $f^2 = e^2 + d^2 - 2ed \cos F$

2. a) $\angle D$, e, and f **b)** $\angle E$, d, and f
c) $\angle F$, e, and d

3. a) 13.7 m **b)** 14.8 km
c) 20.4 km **d)** 20.3 in.

4. a) 5.6 cm **b)** 6.1 cm

5. 742.7 m

6. 5.5 m

7. 10.2 km

8. 29.7 km

9. 26.9 m

On the Job 2 Check Your Understanding, pages 347 to 348

1. a) $\cos E = \dfrac{d^2 + f^2 - e^2}{2df}$

b) $\cos F = \dfrac{d^2 + e^2 - f^2}{2de}$

2. a) d, e, and f **b)** d, e, and f
c) d, e, and f

3. a) $\angle C = 19°$ **b)** $\angle C = 26°$

4. a) $\angle B = 25°$ **b)** $\angle C = 53°$
c) $\angle E = 52°$ **d)** $\angle Y = 31°$

5. 6°

6. 62°

7. 70°

Work With It, pages 349 to 351

1. 51.4 km

2. 175.3 yd

3. 2.0 km

4. The angles will differ slightly based on order solved for and law applied. Example: $\angle C = 124°$, $\angle A = 42°$, $\angle B = 14°$

5. 53°, 63.5°, 63.5° or 64°, 64°, 52°

6. Example: Using the given values with each of the three versions of the cosine law to determine the three unknown angle measures results in 108°, 41°, and 31°. Since the sum of the angles is 180°, the side lengths can form a triangular frame. However, one of the angle measures is not less than 90°. So, it is not possible to build an acute triangular frame.

7. 53.0 m

8. Examples:
a) $\angle G$ is opposite side g. The correct form is $\cos G = \dfrac{h^2 + i^2 - g^2}{2hi}$.
b) Side g is opposite $\angle G$. The correct form is $g^2 = i^2 + h^2 - 2ih \cos G$.

9. a) the angle between the two known sides
b) the third side

10. Example: I would use the cosine law in the form $b^2 = a^2 + c^2 - 2ac \cos B$ to determine b. Then, the cosine law in the form $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$ can be used to find $\angle A$. Then, use the sum of the angles in a triangle is 180° to find $\angle C$.

11. Answers may vary.

7.3 Solving Trigonometric Problems, pages 352 to 359

On the Job 1 Check Your Understanding, pages 356 to 357

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

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

3. a) 21.7 km **b)** 35.2 cm
c) 20° **d)** 33°

4. a) 37° **b)** 20.6 m

5. $\angle F = 79°$, $\angle D = 57°$, $\angle E = 44°$

Work With It, pages 358 to 359

1. a) 25.8 km **b)** 25.0 km
2. 93.2 cm
3. a) 36° **b)** 50.3 cm
4. a) 9.3 m **b)** 12.0 m
c) 42.6 m
5. a) 25° **b)** 27.6 cm
6. Examples:
a) No. One side length is required to apply the sine law and determine a second side length. Then, the sine law or cosine law can be used to determine the third side length.
b) Yes. The cosine law can be used to determine one angle. The sine law or cosine law can be used to determine a second angle. The third angle can be determined by subtracting the other two angles from 180°, or using the cosine law or sine law.
7. a) They are both correct. There is enough information to use either law.
b) Example: I would use the sine law because it is a simpler calculation.
8. Answers may vary.
a) To use the sine law the known information must be SSA or AAS.
b) To use the cosine law the know information must be SSS or SAS.

Chapter 7 Skill Check, pages 360 to 361

1. a) 85° **b)** 43.3 in.
c) 45.5 in.
2. a) 60° **b)** 78°
c) 24.9 km
3. a) 16° **b)** 9.5 m
4. a) 8.1 m **b)** 4.6 ft
5. a) $\angle C = 120°$, $\angle A = 38°$, $\angle B = 22°$
b) $\angle E = 81°$, $\angle F = 81°$, $\angle D = 18°$
6. 83.3 mi
7. a) sine law; two angles and one corresponding opposite side length are known
b) cosine law; two side lengths and the contained angle are known
8. Examples:
a) 1480.7 m
b) I used the sine law since two angles and a side length opposite one of those angles are known. The problem could have also been solved using the cosine law, since two sides and the contained angle are known. Then, the answer is 1456.7 m.

Chapter 7 Test Yourself, pages 362 to 363

1. C
2. B
3. A
4. D
5. C
6. a) 21.4 m **b)** 100°
c) 27.5 m
7. a) 48° **b)** 4.3 km
8. 2.4 km
9. 18.8 yd
10. a) 80.3 m **b)** 89°