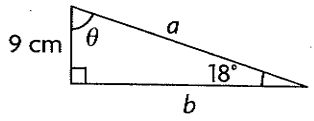
8. In $\triangle PQR$, $\angle R = 90°$ and $p = 12.0$ cm.

a) Determine r, when $\angle Q = 53°$.

b) Determine $\angle P$, when $q = 16.5$ cm.

9. Solve this triangle.



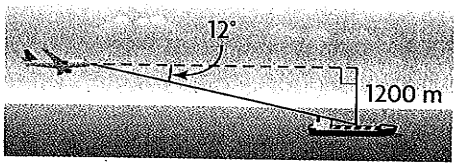
10. Maria needs to load cars onto a transport truck. She is planning to drive up a ramp, onto the truck bed. The truck bed is 1.5 m high, and the maximum angle of the slope of the ramp is 35°.

a) How far is the rear of the truck from the point where the ramp touches the ground?

b) How long should the ramp be? Round your answer to one decimal place.

Lesson 7.6

11. A search-and-rescue airplane is flying at an altitude of 1200 m toward a disabled ship. The pilot notes that the angle of depression to the ship is 12°. How much farther does the airplane have to fly to end up directly above the ship?



12. The angle of elevation from the top of a 16 m building to the top of a second building is 48°. The buildings are 30 m apart. What is the height of the taller building?

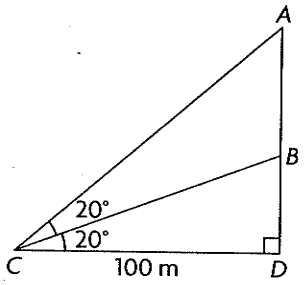
13. A cyclist pedals his bike 6.5 km up a mountain road, which has a steady incline. By the time he has reached the top of the mountain, he has climbed 1.1 km vertically. Calculate the angle of elevation of the road.

14. Two watch towers at an historic fort are located 375 m apart. The first tower is 14 m tall, and the second tower is 30 m tall.

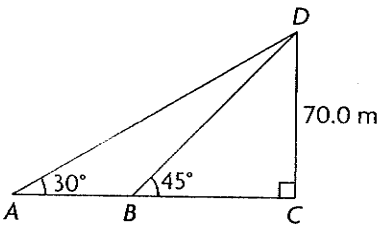
a) What is the angle of depression from the top of the second tower to the top of the first tower?

b) The guards in the towers simultaneously spot a suspicious car parked between the towers. The angle of depression from the lower tower to the car is 7.7°. The angle of depression from the higher tower is 6.3°. Which guard is closer to the car? Explain how you know.

15. Calculate the length of AB using the information provided. Show all your steps.



16. A swimmer observes that from point A, the angle of elevation to the top of a cliff at point D is 30°. When the swimmer swims toward the cliff for 1.5 min to point B, he estimates that the angle of elevation to the top of the cliff is about 45°. If the height of the cliff is 70.0 m, calculate the distance the swimmer swam.



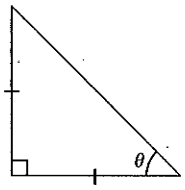
17. A plane takes off in a straight line and travels along this line for 10 s, when it reaches a height of 300 m. If the plane is travelling at 60 m/s, at what angle is the plane ascending?

17. a) $\sqrt{3}$

b) 2

c) $\sin 30° = \frac{1}{2}$, $\cos 30° = \frac{\sqrt{3}}{2}$, $\tan 30° = \frac{1}{\sqrt{3}}$; $\sin 60° = \frac{\sqrt{3}}{2}$, $\cos 60° = \frac{1}{2}$, $\tan 60° = \frac{\sqrt{3}}{1}$; $\sin 30° = \cos 60°$, $\sin 60° = \cos 30°$, $\tan 30° = \frac{1}{\tan 60°}$

18. a) Answers may vary, e.g.,



b) $\sin\theta = \cos\theta \doteq 0.7071$; this makes sense because the opposite side and adjacent side are the same length.

Lesson 7.6, page 412

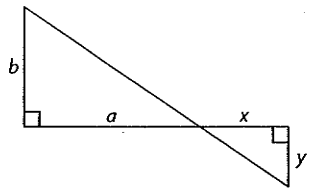
1. 18 m
2. about 2.7 m
3. about 53°
4. about 68°
5. about 31°
6. about 36°
7. 0.5°
8. 130 000 m^2
9. about 42°
10. about 8°
11. about 21 m
12. about 56°
13. about 12.0 m
14. Answers may vary, e.g., I would first draw the height of the triangle from the base to the topmost vertex. Then I would calculate the height using $h = 120 \times \sin 40°$. Next, I would determine the area of the triangle in square metres using $A = 0.5(100)(h)$. Finally, I would multiply the area by the cost of sod per square metre.
15. a) 165 m b) 297 m
16. about 109.4 m^2
17. about 86°
18. Answers may vary, e.g.,
Draw a diagram.
If two sides are given, use the Pythagorean theorem to determine the third side.
If one acute angle is given, calculate the third angle measure using the fact that the sum of the interior angles is 180°.
To solve for a side, use the appropriate trigonometric ratio.
To solve for an angle, use the appropriate inverse trigonometric ratio.
19. a) 36° b) 13.3 cm
20. about 37°

Chapter Review, page 416

1. Yes. They are similar. Answers may vary, e.g., all the corresponding pairs of angles are equal: $\frac{9}{4} = \frac{11.25}{5} = \frac{6.75}{3}$. The scale factor is 2.25, which means that the length of each side in the larger triangle is 2.25 times the length of the corresponding side in the smaller triangle.
2. similar; about 3 cm
3. $x \doteq 1.0$ m, $y \doteq 0.6$ m
4. about 29.17 m
5. a) $\sin A \doteq \frac{4}{9}$, $\cos A \doteq \frac{8}{9}$, $\tan A = \frac{1}{2}$
b) 27°
6. a) 14.7 b) 19.8
7. 34°
8. a) about 19.9 cm or about 20 cm
b) about 36°
9. $\theta = 72°$, $a \doteq 29$ cm, $b \doteq 28$ cm
10. a) about 2.1 m b) 2.6 m
11. about 5646 m
12. about 49 m
13. about 10°
14. a) about 2°
b) the guard on the first tower, which is 14 m tall; Answers may vary, e.g., the guard on the first tower is about 104 m from the car. The guard on the second tower is about 273 m from the car.
15. $AD = 100$ m $\times \tan 40° \doteq 84$ m; $BD = 100$ m $\times \tan 20° \doteq 36$ m; $AB = AD - BD \doteq 48$ m
16. about 51 m
17. 30°

Chapter Self-Test, page 418

1. $a = 11.80$ units, $b = c = 18.88$ units
2. 9.2 m
3. a) 2.3 b) 17.8 c) 82.0° d) 38.9°
4. a) about 52 cm b) about 67°
5. a) $\angle C = 76°$, $a \doteq 21.9$ cm, $c \doteq 21.3$ cm
b) $f \doteq 10.4$ mm, $\angle D \doteq 49°$, $\angle E \doteq 41°$
6. ramp: 14.34 m, run: 14.29 m
7. Answers may vary, e.g., let the width of the river be b. If the surveyors can measure x, y, and a, then they can use similar triangles to calculate b.



8. 39°
9. 5310 m

Chapter 8

Getting Started, page 422

1. a) ii b) iii c) v d) iv e) vi f) i
2. a) $a = 80°$, $b = 60°$, $c = 40°$, $d = 120°$, $e = 60°$
b) $i = 80°$, $j = 75°$, $k = 80°$
c) $f = 55°$, $g = 35°$, $h = 55°$
d) $l = 55°$, $m = 125°$, $n = 55°$
3. a) longest: AC; shortest: AB
b) longest sides: DE, EF; shortest: DF
4. a) greatest: $\angle B$; least $\angle A$ b) greatest: $\angle D$; least: $\angle F$
5. a) 0.8192 c) 0.1392
b) 0.9135 d) 0.6018
6. a) 20 b) 8 c) 6 d) 50
7. a) 30° b) 60° c) 49° d) 51°

PRACTICE Questions

Lesson 8.1

1. Jane claims that she can draw an acute triangle using the following information: $a = 6$ cm, $b = 8$ cm, $c = 10$ cm, $\angle A = 30°$, and $\angle B = 60°$. Is she correct? Explain.

2. Which of the following are not correct for acute triangle DEF?

a) $\dfrac{d}{\sin D} = \dfrac{f}{\sin F}$

b) $\dfrac{\sin E}{e} = \dfrac{\sin D}{d}$

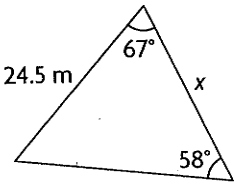
c) $f \sin E = e \sin F$

d) $\dfrac{d}{\sin D} = \dfrac{\sin F}{f}$

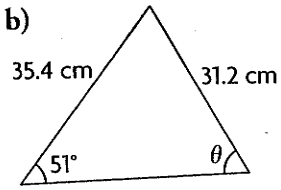
Lesson 8.2

3. Calculate the indicated side length or angle measure in each triangle.

a)



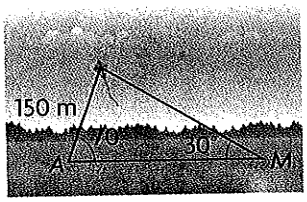
b)



4. In $\triangle ABC$, $\angle B = 31°$, $b = 22$ cm, and $c = 12$ cm. Determine $\angle C$.

5. Solve $\triangle ABC$, if $\angle A = 75°$, $\angle B = 50°$, and the side between these angles is 8.0 cm.

6. Allison is flying a kite. She has released the entire 150 m ball of kite string. She notices that the string forms a 70° angle with the ground. Marc is on the other side of the kite and sights the kite at an angle of elevation of 30°. How far is Marc from Allison?



Lesson 8.3

7. Which of these is not a form of the cosine law for $\triangle ABC$? Why not?

a) $a^2 = b^2 + c^2 - 2bc \cos B$

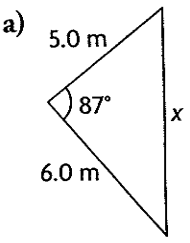
b) $c^2 = a^2 + b^2 - 2ab \cos C$

c) $b^2 = a^2 + c^2 - 2ac \cos B$

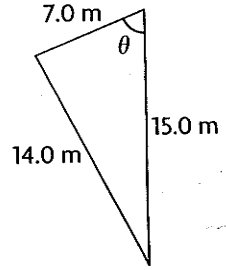
Lesson 8.4

8. Calculate the indicated side length or angle measure.

a)



b)

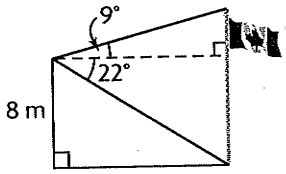


9. Solve $\triangle ABC$, if $\angle A = 58°$, $b = 10.0$ cm, and $c = 14.0$ cm.

10. Two airplanes leave an airport at the same time. One airplane travels at 355 km/h. The other airplane travels at 450 km/h. About 2 h later, they are 800 km apart. Determine the angle between their paths.

Lesson 8.5

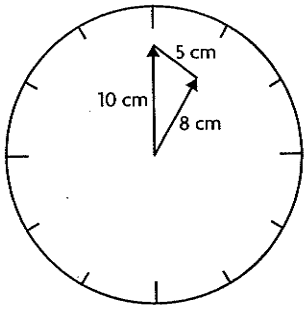
11. From the top of an 8 m house, the angle of elevation to the top of a flagpole across the street is 9°. The angle of depression is 22° to the base of the flagpole. How tall is the flagpole?



12. A bush pilot delivers supplies to a remote camp by flying 255 km in the direction N52°E. While at the camp, the pilot receives a radio message to pick up a passenger at a village. The village is 85 km S21°E from the camp. What is the total distance that the pilot will have flown by the time he returns to his starting point?

13. A canoeist starts from a dock and paddles 2.8 km N34°E. Then she paddles 5.2 km N65°W. What distance, and in which direction, should a second canoeist paddle to reach the same location directly, starting from the same dock?

16. Answers will vary, e.g., Problem: The minute hand of a clock is pointing at the number 12 and is 10 cm long. The hour hand is 8 cm long. The distance between the tips of the hands is 5 cm. What time could it be? Answer: Use the cosine law to determine the angle formed by the hands, and then determine which number(s) the hour hand could be pointing at, keeping in mind that consecutive numbers on a clock form a 30° angle from the centre. (There are two possible times, depending on whether the hour hand is behind or ahead of the minute hand.)



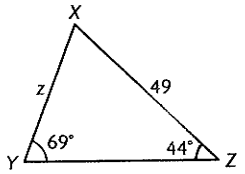
17. about 96 m
18. 50.0 cm^2

Chapter Review, page 453

1. No. e.g., $6^2 + 8^2 = 10^2$, so $\triangle ABC$ is a right triangle.
2. Part d) is not correct for acute triangles.
3. a) about 23.7 m b) about 62°
4. about 16°
5. $\angle C = 55°$, $a \doteq 9.4$ cm, $b \doteq 7.5$ cm
6. about 295 m
7. a) not a form of the cosine law; it should end with cos A
   b) form of the cosine law
   c) form of the cosine law
8. a) about 7.6 m b) about 68°
9. $\angle B \doteq 44°$, $\angle C \doteq 78°$, $a \doteq 12.2$ cm
10. about 58°
11. about 11 m
12. about 584 km
13. about 5.5 km, about N35°W

Chapter Self-Test, page 454

1. a) about 43° b) about 2.37 cm
2. $\angle R = 52°$, $p \doteq 25$ cm, $q \doteq 19$ cm
3. a) Answers will vary, e.g.,



   b) $z \doteq 36$ units
4. about 117 km
5. about 502.1 m
6. about 11.6 cm
7. about 28.3 m^2
8. about 131 m
9. Answers may vary, e.g., if the angle is formed by the two given sides, use the cosine law. If not, use the sine law to determine a second angle, subtract the two angle measures from 180°, then use the sine or cosine law.

Cumulative Review Chapters 7–8, page 456

1. B	5. D	9. D	13. A	17. A
2. B	6. A	10. D	14. B	18. D
3. D	7. B	11. C	15. B	19. B
4. C	8. C	12. A	16. C	

20. Option B is less costly. For Option A, the cost of cable down the cliff is \$276. The cost of underwater cable is $\frac{23}{\tan 14°}$, which adds up to \$3320.18. For Option B, the change in elevation from the station to the first tower is $\sin^{-1}\left(\frac{8}{39}\right) = 11.84°$, which means 3 extra supports are needed. This costs \$75. The cost of cable from the station to the subdivision is $17(39 + 34 + 33 + 61 + 23) = 3230$. The total cost is \$3305.

21. a) 52° b) 63°

Appendix A

A-1 Operations with Integers, page 461

1. a) 3 c) −24 e) −6
   b) 25 d) −10 f) 6
2. a) < c) >
   b) > d) =
3. a) 55 c) −7 e) $\frac{15}{7}$
   b) 60 d) 8 f) $\frac{1}{49}$
4. a) 5 c) −9 e) −12
   b) 20 d) 76 f) −1
5. a) 3 c) −2 e) 8
   b) −1 d) 1 f) $\frac{1}{4}$

A-2 Operations with Rational Numbers, page 462

1. a) $-\frac{1}{2}$ c) $\frac{2}{15}$ e) $\frac{16}{9}$ or $1\frac{7}{9}$
   b) $\frac{7}{6}$ or $1\frac{1}{6}$ d) $\frac{775}{24}$ or $32\frac{7}{24}$ f) $\frac{2}{3}$
2. a) $\frac{1}{5}$ c) $\frac{1}{15}$ e) $\frac{36}{5}$ or $7\frac{1}{5}$
   b) $\frac{3}{10}$ d) $-\frac{1}{18}$ f) $-\frac{2}{5}$

A-3 Exponent Laws, page 463

1. a) 16 b) 1 c) 9 d) −9 e) −125 f) $\frac{1}{8}$
2. a) 2 b) 31 c) 9 d) $\frac{1}{18}$ e) −16 f) $\frac{13}{36}$
3. a) 9 b) 50 c) 4 194 304 d) $\frac{1}{27}$
4. a) x^8 b) m^9 c) y^7 d) a^{bc} e) x^6 f) $\frac{x^{12}}{y^9}$
5. a) x^5y^6 b) $108m^{12}$ c) $25x^4$ d) $\frac{4u^2}{v^2}$