d) $R = -78t^2 + 1230t$
e) between \$6.76 and \$9.01

Chapter Self-Test, page 363

1. Answers may vary, e.g.,
a) $-2.9, 0.9$ **b)** $-2, 0$ **c)** $-3, 1$
2. **a)** $-7, 2$ **c)** $4, -4$
b) about 0.12, about 1.68 **d)** about 2.58, about -0.58
3. **a)** $(-3, -32)$ **b)** $(2.5, -42.75)$
4. yes, because all quadratic equations have a vertex, so it is possible to write an equation in vertex form by completing the square
5. **a)** 0; e.g., $D = -40$; the discriminant is negative
b) 1; e.g., the vertex is on the x-axis; both factors are the same
c) 1; e.g., the vertex is on the x-axis; both factors are the same
6. **a)** No. The maximum revenue is \$1050.
b) either 48 or 252
c) either 76 or 224
d) 150
7. 6 m by 12 m
8. Answers may vary, e.g.,
Reason 1: I could not make a square using those algebra tiles.
Reason 2: When 3 is factored out of all the terms, the coefficient of x is 2. This means that the constant term would have to be $\left(\frac{2}{2}\right)^2 \times 3 = 3$, not 6, to be a perfect square.
9. \$3.25 (\$15.67 would be an unreasonable increase)

Cumulative Review Chapters 4–6, page 365

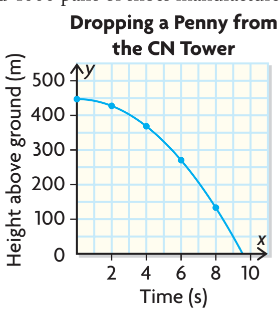
1. D	**6.** D	**11.** C	**16.** D	**21.** C
2. B	**7.** C	**12.** D	**17.** C	**22.** B
3. A	**8.** B	**13.** A	**18.** A	**23.** B
4. C	**9.** D	**14.** C	**19.** C	**24.** D
5. A	**10.** D	**15.** A	**20.** A	**25.** D

26. Write each relation in factored form.

The relation for Sid is $P = -6(n - 4)(n - 8)$. The maximum profit occurs at (6, 24), which is the vertex of the graph of the relation. The maximum profit is \$24 000; it occurs when 6000 pairs of shoes are manufactured and sold. The break-even points are 4000 and 8000 pairs of shoes manufactured and sold.

The relation for Nancy is $P = -8(n - 1)(n - 4)$. The maximum profit occurs at (2.5, 18), which is the vertex of the graph of the relation. The maximum profit is \$18 000; it occurs when 2500 pairs of shoes are manufactured and sold. The break-even points are 1000 and 4000 pairs of shoes manufactured and sold.

27. **a)**



b) Yes. The second differences are constant.
c) Answers may vary, e.g., $y = -4.9x^2 + 447$
d) $y = -4.9x^2 + 447$; answers may vary, e.g., the fit is perfect.
e) about 298.8 m above the ground
28. **a)** Equation ①: Profit is maximized at \$1960, when $x = 6$. Selling price is \$25.99.
Equation ②: Profit is maximized at \$1653.69, when $x = 2.25$. Selling price is \$22.24.
b) Equation ①: Zeros occur when $x = -8$ and $x = 20$. The break-even prices are \$11.99 and \$39.99.
Equation ②: Zeros occur when $x = -10.01$ and $x = 14.51$. The break-even prices are \$9.98 and \$34.50.
c) Answers may vary, e.g., the recommended selling price is \$25.99, based on equation ①. This gives the greatest possible profit.

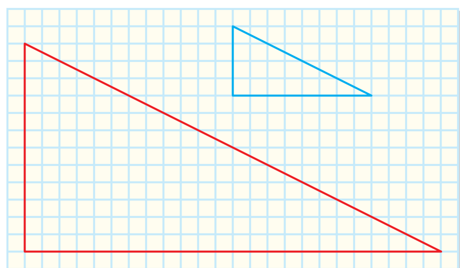
Chapter 7

Getting Started, page 370

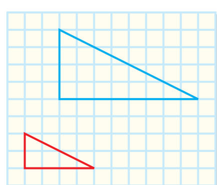
1. **a)** ii **b)** iv **c)** v **d)** iii **e)** i **f)** vi
2. **a)** 1 **c)** 17.5 **e)** 3.38
b) 8 **d)** 13.5 **f)** 2
3. **a)** 6.0 m **b)** 10.5 cm
4. **a)** 2.8 cm **b)** 3.5 cm or 3.4 cm
5. **a)** 5:7 **b)** $\frac{1}{2}$ **c)** $-4{:}1$ **d)** $\frac{3}{4}$
6. **a)** 31° **b)** 33° **c)** 74° **d)** 60°
7. **a)** congruent; Both are the same shape and size.
b) similar; Both are the same shape but different sizes.
8. the length of the side between the two 50° angles
9. 40.7 m
10. Answers may vary, e.g.,
a) ... they are opposite angles; ... they are the corresponding angles in a case with parallel lines
b) ... they are supplementary; ... they are the three interior angles in a triangle

Lesson 7.1, page 378

1. Yes. Corresponding angles are equal and the sides are proportional.
2. **a)** $\triangle MNO$ **b)** $\triangle JLK$, $\triangle FDE$, $\triangle HGI$
3. **a)**



b)



4. a) i) similar
ii) $\angle ABC = \angle DEF$, $\angle BCA = \angle EFD$, $\angle CAB = \angle FDE$;
scale factor: $\dfrac{DE}{AB} = \dfrac{EF}{BC} = \dfrac{DF}{AC} = 0.5$
b) i) similar
ii) $\angle MNO = \angle QPO$, $\angle NOM = \angle POQ$, $\angle OMN = \angle OQP$;
scale factor: $\dfrac{QP}{MN} = \dfrac{QO}{MO} = \dfrac{PO}{NO} = 0.5$
c) i) congruent
ii) $\angle GHI = \angle JLK$, $\angle HIG = \angle LKJ$, $\angle IGH = \angle KJL$;
$GH = JL$, $HI = LK$, $IG = KJ$
d) i) similar
ii) $\angle RSV = \angle UTV$, $\angle SVR = \angle TVU$, $\angle VRS = \angle VUT$;
scale factor: $\dfrac{UT}{RS} = \dfrac{VT}{VS} = \dfrac{VU}{VR} = 0.6$

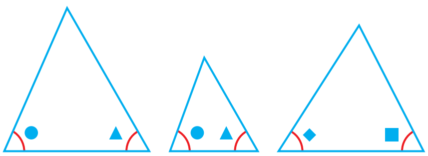
5. Yes. Answers may vary, e.g., the sides in the larger triangle are twice the length of the corresponding sides in the smaller triangle. The scale factor of 2 means that the length of each side in the larger triangle is two times the length of the corresponding side in the smaller triangle. The scale factor of $\frac{1}{2}$ means that the length of each side in the smaller triangle is half the length of the corresponding side in the larger triangle.

6. a) $\angle L$; angles must be listed in order when defining similar triangles.
b) $PR = 36$ cm, $QR = 39$ cm

7. a) $x = 60°$, $y = 30°$
b) $b = 5.5$ cm, $c \doteq 4.8$ cm
c) $a = 8$ m, $z = 40°$
d) $c = 7.0$ cm, $d \doteq 10.6$ cm, $e \doteq 5.3$ cm

8. a) $a = 60°$, $b = 5$ cm
b) $c = 60°$, $d = 40°$, $e = 50°$
c) $f = 55°$, $g = 4$ cm, $h = 55°$
d) $i = 2.4$ cm

9. Answers may vary, e.g.,



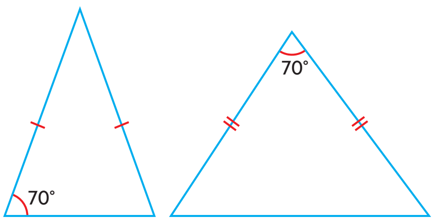
10. equilateral because each angle is always 60°

11. 0.75 cm

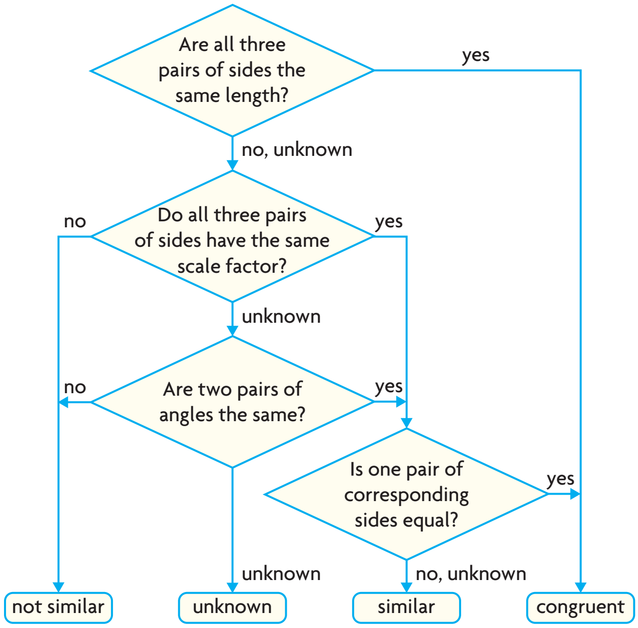
12. 13.3 cm

13. about 38 m

14. Not necessarily, e.g., consider the following two triangles:



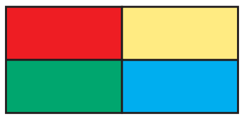
15. Answers may vary, e.g.,



16. Answers may vary, e.g., $\angle ACD = \angle BAD$, $\angle ADC = \angle ADB$, so $\triangle ACD \sim \triangle BAD$; $\angle ABC = \angle ABD$, $\angle ACB = \angle DAB$, so $\triangle ABC \sim \triangle DBA$
$\dfrac{AB}{BD} = \dfrac{BC}{AB}, \dfrac{AD}{BD} = \dfrac{CD}{AD}$
$AB \times AB = BC \times BD$, $AD \times AD = CD \times BD$
$AB^2 + AD^2 = BD(BC + CD)$
Substitute $BC + CD = BD$ into the equation above.
$AB^2 + AD^2 = BD^2$

17. Create two interior right triangles by drawing the altitude of the original triangle from the vertex of the 90° angle to the hypotenuse. Join the midpoints of the sides in the larger interior right triangle. This forms a total of five congruent triangles.

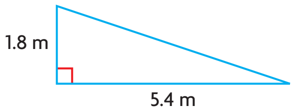
18. Answers may vary, e.g.,



Lesson 7.2, page 385

1. a) Answers may vary, e.g., $\angle ABC = \angle EBD$; the sum of the angles in a triangle is 180°, so the sum of $\angle A$ and $\angle C$ equals the sum of $\angle D$ and $\angle E$. $\angle A = \angle C$ because $\triangle ABC$ is isosceles, and $\angle D = \angle E$ because $\triangle EBD$ is isosceles. So, $\angle A = \angle C = \angle D = \angle E$. Therefore, the corresponding angles are equal.
b) Answers may vary, e.g., $\frac{8}{2} = 4$; the scale factor of 4 means that the length of each side in the larger triangle is four times the length of the corresponding side in the smaller triangle. Also, $\frac{2}{8} = \frac{1}{4}$; the scale factor of $\frac{1}{4}$ shows that the length of each side in the smaller triangle is $\frac{1}{4}$ times the length of the corresponding side in the larger triangle.

2. **a)**



b) 36.6 m

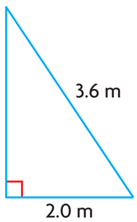
3. **a)** $\triangle ABC \sim \triangle DEC$, $\angle B = \angle E = 90°$; $\angle C$ is in both triangles, so $\angle A = \angle CDE$. Therefore, corresponding angles are equal.
b) about 9 m

4. **a)** distance from the top of Brian's head to the top of his shadow
b) They are both right triangles and have equal angles of elevation.
c) Answers may vary, e.g., $\frac{1229.5}{4.0} \doteq 307.4$; the scale factor of about 307.4 shows that the length of each side in the larger triangle is about 307.4 times the length of the corresponding side in the smaller triangle. Also, $\frac{4.0}{1229.5} \doteq 0.0033$; the scale factor of about 0.0033 shows that the length of each side in the smaller triangle is about 0.0033 times the length of the corresponding side in the larger triangle.
d) about 553.3 m

5. 25.0 m

6. **a)** Answers may vary, e.g., $\angle B = \angle E$, $\angle BCA = \angle ECD$ (opposite angles of intersecting lines)
b) $\frac{BC}{EC}$
c) 520 m

7. **a)**



b) Answers may vary, e.g., the angle between each ladder and the ground is the same because the ladders are parallel. Also, the wall makes an angle of 90° with the ground in each triangle.
c) about 3.0 m, about 2.0 m

8. about 4.1 m

9. 18.65 m

10. not necessarily, because you need to know the proportions of the screens to be sure

11. 22.35 m

12. 16.0 m

13. **a)** either AC or EF
b) Answers may vary, e.g., given AC,
$$y = \sqrt{AC^2 - 5.2^2},\ x = \frac{5.2 \times 3.4}{AC}$$

14. about 115 m

15. **a)** side length of photograph = 18 cm; area of frame + area of photo = 466.56 cm^2; side length of frame = 21.6 cm;
$$\text{scale factor} = \frac{21.6}{18} = 1.2$$
b) $\text{width} = \frac{21.6 - 18}{2} = 1.8$, or 1.8 cm

Mid-Chapter Review, page 390

1. **a)** $\triangle EFD$ **b)** $\triangle NOM$

2. **a)** $\angle RST$ **c)** $\frac{BC}{ST}$ or $\frac{CA}{TR}$ **e)** $\frac{TR}{CA}$ or $\frac{RS}{AB}$
b) $\angle STR$ **d)** $\triangle BCA$ **f)** $\angle BAC$

3. $\frac{a}{f} = \frac{b}{d} = \frac{c}{e}$

4. True. If you know two of the angles, you can always calculate the third angle. If you know all of the angles in the two triangles, you can determine whether the triangles are similar.

5. $x \doteq 5.4$ units, $y \doteq 5.3$ units

6. **a)** 5 units **b)** 18 units
c) No. The ratio of the corresponding sides is not equal: $\frac{6}{15} \neq \frac{8}{18}$

7. about 14.5 m

8. perimeter = 36 cm; area = 54 cm^2

9. 6.00 m

10. yes

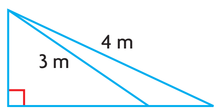
Lesson 7.3, page 393

1. **a)** opposite: BC, EF; adjacent: AB, DE; hypotenuse: AC, DF
b) **i)** $\frac{3}{5} = \frac{12}{20}$ **ii)** $\frac{4}{5} = \frac{16}{20}$ **iii)** $\frac{3}{4} = \frac{12}{16}$

2. **a)** $\triangle KJC$, $\triangle IHC$, $\triangle GFC$, $\triangle EDC$
b) **i)** $\frac{AB}{AC}, \frac{KJ}{KC}, \frac{IH}{IC}, \frac{GF}{GC}, \frac{ED}{EC}$
ii) $\frac{BC}{AC}, \frac{JC}{KC}, \frac{HC}{IC}, \frac{FC}{GC}, \frac{DC}{EC}$
iii) $\frac{AB}{BC}, \frac{KJ}{JC}, \frac{IH}{HC}, \frac{GF}{FC}, \frac{ED}{DC}$
c) **i)** $\frac{AB}{AC} = \frac{KJ}{KC} = \frac{IH}{IC} = \frac{GF}{GC} = \frac{ED}{EC}$
ii) $\frac{BC}{AC} = \frac{JC}{KC} = \frac{HC}{IC} = \frac{FC}{GC} = \frac{DC}{EC}$
iii) $\frac{AB}{BC} = \frac{KJ}{JC} = \frac{IH}{HC} = \frac{GF}{FC} = \frac{ED}{DC}$

3. **a)** about 3 m
b) The slopes are the same because the rise and the run are from similar triangles.

4. 3 m ramp



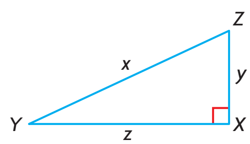
Lesson 7.4, page 398

1. **a)** BC **b)** AC **c)** AB

2. **a)** 0.6745 **b)** 0.9781 **c)** 0.6561 **d)** 0.2079

3. **a)** 30° **b)** 45° **c)** 60° **d)** 60°

4. **a)**



b) $\sin Y = \frac{y}{x}$, $\cos Y = \frac{z}{x}$, $\tan Y = \frac{y}{z}$

5. a) $\frac{8}{17} \doteq 0.4706$ d) $\frac{8}{15} \doteq 0.5333$
b) $\frac{15}{17} \doteq 0.8824$ e) $\frac{8}{17} \doteq 0.4706$
c) $\frac{15}{8} = 1.8750$ f) $\frac{15}{17} \doteq 0.8824$

6. a) false; $\frac{2.5}{5.6} \neq 0.4$ c) false; $\frac{2.5}{5.6} \neq 0.8929$
b) true; $\frac{5.0}{2.5} = 2$ d) true; $\frac{5.0}{5.6} \doteq 0.8929$

7. a) about 67°
b) No. After x is calculated, you can determine y using the fact that the sum of the angles in a triangle is 180°.

8. a) 4.2 units d) 2.1 units
b) 12.4 units e) 30.0 units
c) 74.6 units f) 14.1 units

9. a) $\cos \theta$ b) $\tan \theta$ c) $\sin \theta$

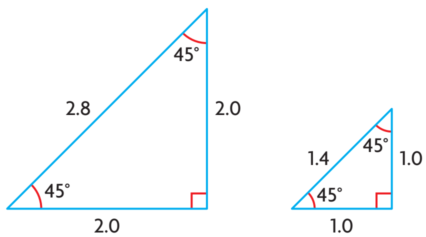
10. a) 17 cm; $\sin \theta = \frac{15}{17}$, $\cos \theta = \frac{8}{17}$, $\tan \theta = \frac{15}{8}$
b) 5 cm; $\sin \theta = \frac{5}{13}$, $\cos \theta = \frac{12}{13}$, $\tan \theta = \frac{5}{12}$

11. a) 61.9° b) 22.6°

12. a) 23.6° b) 63.6° c) 71.6° d) 30.0°

13. Not necessarily; it means that the ratio of the lengths of these two sides is 1:2.

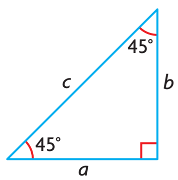
14. Answers may vary, e.g.,



Since two sides in each triangle are the same measure, both triangles are isosceles. Also, since the angles in both triangles are 45°, 45°, and 90°, the triangles are similar.

15. a) yes, if the selected angle is $\angle C$
b) yes, if the selected angle is $\angle A$
c) No. The hypotenuse is always opposite the right angle.

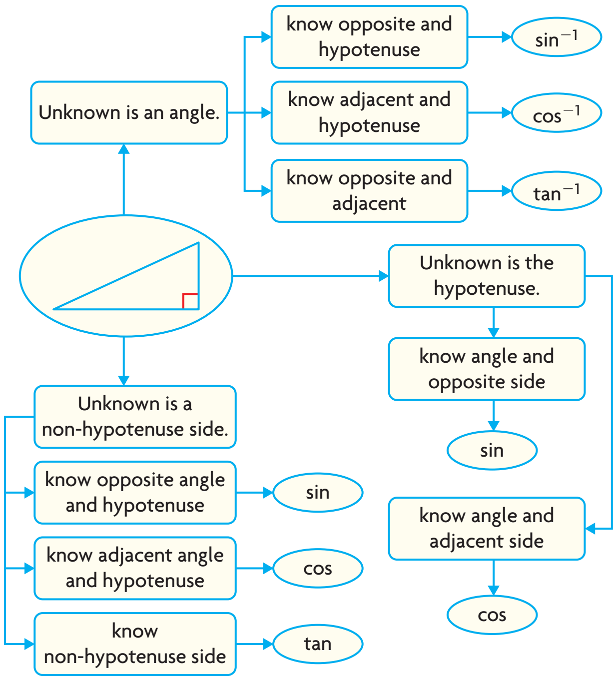
16. 45°, $\frac{a}{c} = \frac{b}{c}$



17. Answers may vary, e.g., if θ increases but the side adjacent to it stays constant, then the side opposite it must get longer. This is the reason why $\tan \theta$ (the ratio of the opposite side to the adjacent side) increases.

Lesson 7.5, page 403

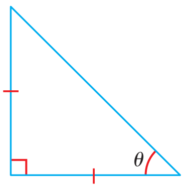
1. a) 2.2 km b) 34.4 cm
2. a) 37° b) 51°
3. $\theta = 53°$, $a \doteq 14$ cm, $b \doteq 11$ cm
4. a) 65° b) 37°
5. a) i) $\sin 50° = \frac{x}{90}$, $\cos 40° = \frac{x}{90}$ ii) 69 mm
b) i) $\tan 51° = \frac{x}{30}$, $\tan 39° = \frac{30}{x}$ ii) 37 cm
6. a) 45° b) 30° c) 53°
7. a) $\angle A \doteq 51°$, $\angle B = 39°$
b) $A \doteq 26°$, $\angle B = 64°$
8. a) 51° b) 38°
9. about 137 m
10. $i = 8$ cm, $j \doteq 7$ cm
11. 2.9 m
12. a) incorrect; $\sin A = \frac{22.5}{25.5}$ d) correct
b) correct e) correct
c) incorrect; $\cos C = \frac{22.5}{25.5}$ f) correct
13. a) $b = 9$ mm, $\angle A = 32°$, $\angle C = 58°$
b) $\angle L = 18°$, $j = 10$ cm, $l = 3$ cm
c) $\angle Q = 48°$, $q = 14$ km, $r = 19$ km
14. a) No. The angle will be about 79°.
b) minimum: 1.7 m; maximum: 2.3 m
15. a) Answers may vary, e.g.,



b) Yes. If you are solving for an angle, an inverse trigonometric ratio is needed.
16. about 39.6 mm or about 40 mm

Answers

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

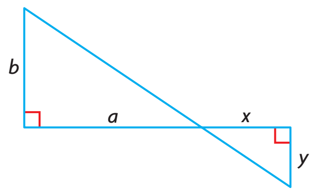
1. 18 m
2. about 2.7 m
3. about 53°
4. about 68°
5. about 31°
6. about 36°
7. 0.5°
8. 130 000 m^2
9. about 42°
10. about 8°
11. about 21 m
12. about 56°
13. about 12.0 m
14. Answers may vary, e.g., I would first draw the height of the triangle from the base to the topmost vertex. Then I would calculate 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. $AD = 100 \text{ m} \times \tan 40° \doteq 84$ m; $BD = 100 \text{ m} \times \tan 20° \doteq 36$ 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 b) 0.9135 c) 0.1392 d) 0.6018
6. a) 20 b) 8 c) 6 d) 50
7. a) 30° b) 60° c) 49° d) 51°