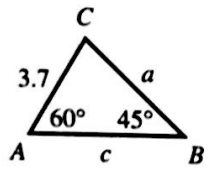
SECTION 5.5 EXERCISES

In Exercises 1–4, solve the triangle.

1.



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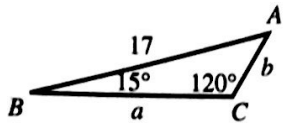

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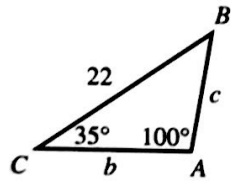

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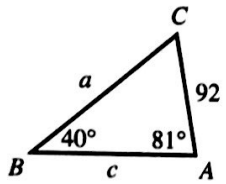


In Exercises 5–8, solve the triangle.

5. $A = 40°, \quad B = 30°, \quad b = 10$

6. $A = 50°, \quad B = 62°, \quad a = 4$

7. $A = 33°, \quad B = 70°, \quad b = 7$

8. $B = 16°, \quad C = 103°, \quad c = 12$

In Exercises 9–12, solve the triangle.

9. $A = 32°, \quad a = 17, \quad b = 11$

10. $A = 49°, \quad a = 32, \quad b = 28$

11. $B = 70°, \quad b = 14, \quad c = 9$

12. $C = 103°, \quad b = 46, \quad c = 61$

In Exercises 13–18, state whether the given measurements determine zero, one, or two triangles.

13. $A = 36°, \quad a = 2, \quad b = 7$

14. $B = 82°, \quad b = 17, \quad c = 15$

15. $C = 36°, \quad a = 17, \quad c = 16$

16. $A = 73°, \quad a = 24, \quad b = 28$

17. $C = 30°, \quad a = 18, \quad c = 9$

18. $B = 88°, \quad b = 14, \quad c = 62$

In Exercises 19–22, two triangles can be formed using the given measurements. Solve both triangles.

19. $A = 64°, \quad a = 16, \quad b = 17$

20. $B = 38°, \quad b = 21, \quad c = 25$

21. $C = 68°, \quad a = 19, \quad c = 18$

22. $B = 57°, \quad a = 11, \quad b = 10$

23. Determine the values of b that will produce the given number of triangles if $a = 10$ and $B = 42°$.

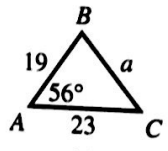
(a) two triangles **(b)** one triangle **(c)** zero triangles

24. Determine the values of c that will produce the given number of triangles if $b = 12$ and $C = 53°$.

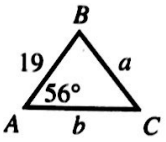
(a) two triangles **(b)** one triangle **(c)** zero triangles

In Exercises 25 and 26, decide whether the triangle can be solved using the Law of Sines. If so, solve it. If not, explain why not.

25.

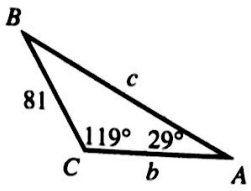


(a)

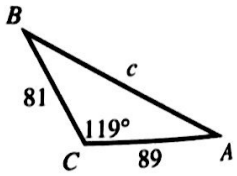


(b)

26.



(a)



(b)

In Exercises 27–36, respond in one of the following ways:

(a) State, "Cannot be solved with the Law of Sines."

(b) State, "No triangle is formed."

(c) Solve the triangle.

27. $A = 61°, \quad a = 8, \quad b = 21$

28. $B = 47°, \quad a = 8, \quad b = 21$

29. $A = 136°, \quad a = 15, \quad b = 28$

30. $C = 115°, \quad b = 12, \quad c = 7$

31. $B = 42°, \quad c = 18, \quad C = 39°$

32. $A = 19°, \quad b = 22, \quad B = 47°$

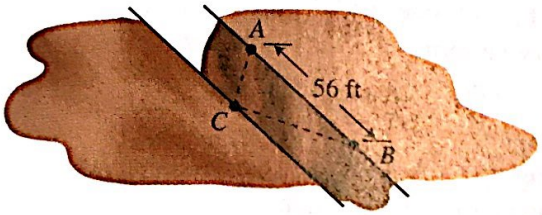
33. $C = 75°, \quad b = 49, \quad c = 48$

34. $A = 54°, \quad a = 13, \quad b = 15$

35. $B = 31°, \quad a = 8, \quad c = 11$

36. $C = 65°, \quad a = 19, \quad b = 22$

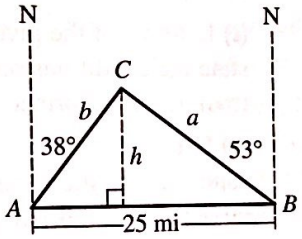
37. **Surveying a Canyon** Two markers A and B on the same side of a canyon rim are 56 ft apart. A third marker C, located across the rim, is positioned so that $\angle BAC = 72°$ and $\angle ABC = 53°$.



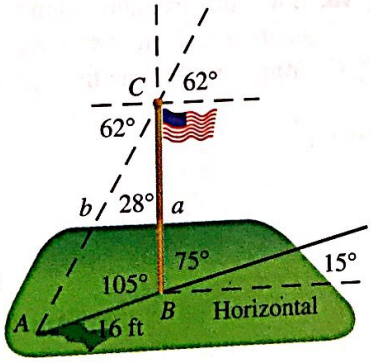
(a) Find the distance between C and A.

(b) Find the distance between the two canyon rims. (Assume they are parallel.)

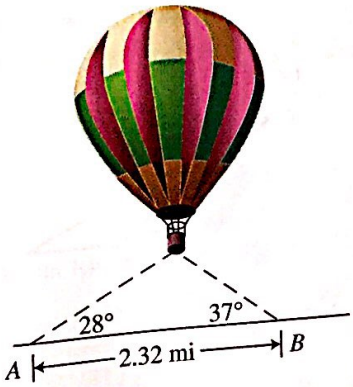
38. **Weather Forecasting** Two meteorologists are 25 mi apart located on an east-west road. The meteorologist at point A sights a tornado 38° east of north. The meteorologist at point B sights the same tornado at 53° west of north. Find the distance from each meteorologist to the tornado. Also find the distance between the tornado and the road.



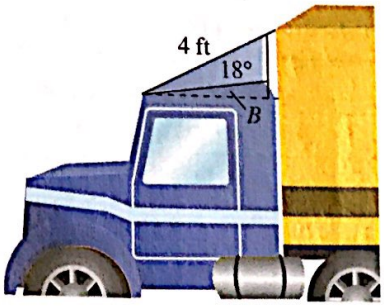
39. **Engineering Design** A vertical flagpole stands beside a road that slopes at an angle of 15° with the horizontal. When the angle of elevation of the Sun is 62°, the flagpole casts a 16-ft shadow downhill along the road. Find the height of the flagpole.



40. **Altitude** Observers 2.32 mi apart see a hot-air balloon directly between them but at the angles of elevation shown in the figure. Find the altitude of the balloon.



41. **Reducing Air Resistance** A 4-ft airfoil attached to the cab of a truck reduces wind resistance. If the angle between the airfoil and the cab top is 18° and angle B is 10°, find the length of a vertical brace positioned as shown in the figure.

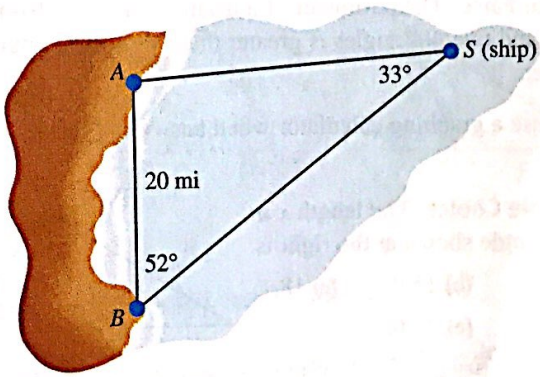


42. **Group Activity** **Ferris Wheel Design** A Ferris wheel has 16 evenly spaced cars. The distance between adjacent chairs is 15.5 ft. Find the radius of the wheel (to the nearest 0.1 ft).

43. **Finding Height** Two observers are 600 ft apart on opposite sides of a flagpole. The angles of elevation from the observers to the top of the pole are 19° and 21°. Find the height of the flagpole.

44. **Finding Height** Two observers are 400 ft apart on opposite sides of a tree. The angles of elevation from the observers to the top of the tree are 15° and 20°. Find the height of the tree.

45. **Finding Distance** Two lighthouses A and B are known to be exactly 20 mi apart on a north-south line. A ship's captain at S measures $\angle ASB$ to be 33°. A radio operator at B measures $\angle ABS$ to be 52°. Find the distance from the ship to each lighthouse.

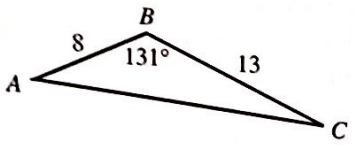


46. **Using Measurement Data** A geometry class is divided into ten teams, each of which is given a yardstick and a protractor to find the distance from a point A on the edge of a pond to a tree at a point C on the opposite shore. After they mark points A and B with stakes, each team uses a protractor to measure angles A and B and a yardstick to measure distance AB. Their measurements are given in the table below.

SECTION 5.6 EXERCISES

In Exercises 1–4, solve the triangle.

1.



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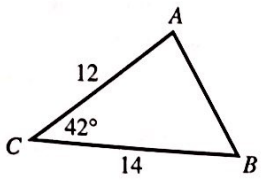

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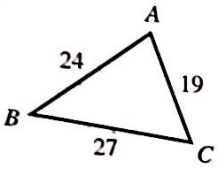

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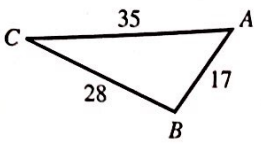


In Exercises 5–16, solve the triangle.

5. $A = 55°,\ b = 12,\ c = 7$

6. $B = 35°,\ a = 43,\ c = 19$

7. $a = 12,\ b = 21,\ C = 95°$

8. $b = 22,\ c = 31,\ A = 82°$

9. $a = 1,\ b = 5,\ c = 4$

10. $a = 1,\ b = 5,\ c = 8$

11. $a = 3.2,\ b = 7.6,\ c = 6.4$

12. $a = 9.8,\ b = 12,\ c = 23$

13. $A = 42°,\ a = 7,\ b = 10$

14. $A = 57°,\ a = 11,\ b = 10$

15. $A = 63°,\ a = 8.6,\ b = 11.1$

16. $A = 71°,\ a = 9.3,\ b = 8.5$

In Exercises 17–20, find the area of the triangle.

17. $A = 47°,\ b = 32$ ft, $c = 19$ ft

18. $A = 52°,\ b = 14$ m, $c = 21$ m

19. $B = 101°,\ a = 10$ cm, $c = 22$ cm

20. $C = 112°,\ a = 1.8$ in., $b = 5.1$ in.

In Exercises 21–28, decide whether a triangle can be formed with the given side lengths. If so, use Heron's formula to find the area of the triangle.

21. $a = 4,\ b = 5,\ c = 8$

22. $a = 5,\ b = 9,\ c = 7$

23. $a = 3,\ b = 5,\ c = 8$

24. $a = 23,\ b = 19,\ c = 12$

25. $a = 19.3,\ b = 22.5,\ c = 31$

26. $a = 8.2,\ b = 12.5,\ c = 28$

27. $a = 33.4,\ b = 28.5,\ c = 22.3$

28. $a = 18.2,\ b = 17.1,\ c = 12.3$

29. Find the radian measure of the largest angle in the triangle with sides of 4, 5, and 6.

30. A parallelogram has sides of 18 and 26 ft, and an angle of 39°. Find the shorter diagonal.

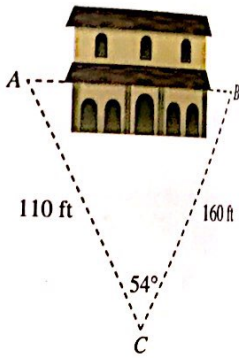
31. Find the area of a regular hexagon inscribed in a circle of radius 12 inches.

32. Find the area of a regular nonagon (9 sides) inscribed in a circle of radius 10 inches.

33. Find the area of a regular hexagon circumscribed about a circle of radius 12 inches. [*Hint*: start by finding the distance from a vertex of the hexagon to the center of the circle.]

34. Find the area of a regular nonagon (9 sides) circumscribed about a circle of radius 10 inches.

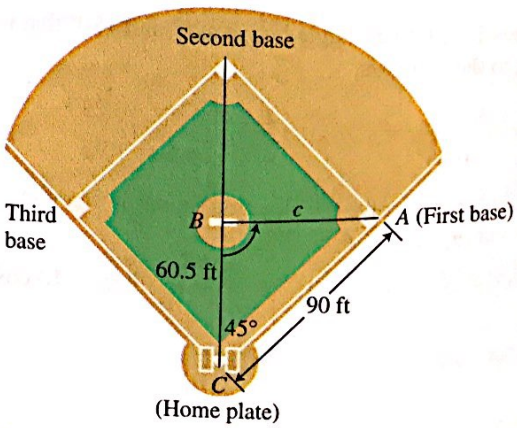
35. Measuring Distance Indirectly Juan wants to find the distance between two points A and B on opposite sides of a building. He locates a point C that is 110 ft from A and 160 ft from B, as illustrated in the figure. If the angle at C is 54°, find distance AB.



36. Designing a Baseball Field

(a) Find the distance from the center of the front edge of the pitcher's rubber to the far corner of second base. How does this distance compare with the distance from the pitcher's rubber to first base? (See Example 5.)

(b) Find $\angle B$ in $\triangle ABC$.

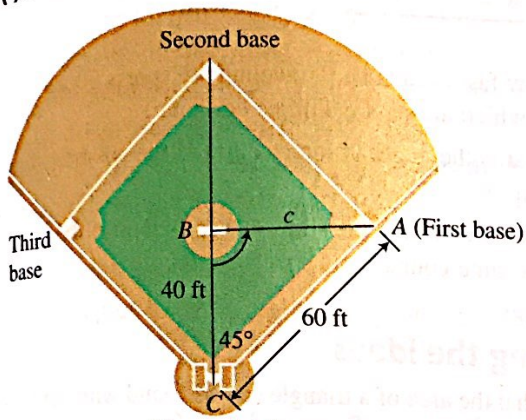


37. Designing a Softball Field In softball, adjacent bases are 60 ft apart. The distance from the center of the front edge of the pitcher's rubber to the far corner of home plate is 40 ft.

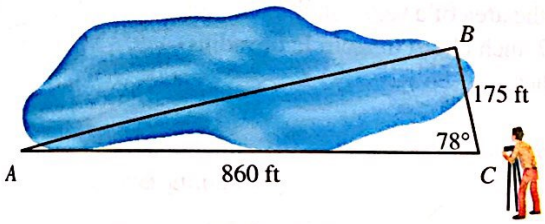
(a) Find the distance from the center of the pitcher's rubber to the far corner of first base.

(b) Find the distance from the center of the pitcher's rubber to the far corner of second base.

(c) Find $\angle B$ in $\triangle ABC$.



38. Surveyor's Calculations Tony must find the distance from A to B on opposite sides of a lake. He locates a point C that is 860 ft from A and 175 ft from B. He measures the angle at C to be 78°. Find distance AB.

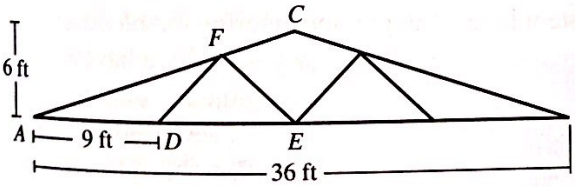


39. Construction Engineering A manufacturer is designing the roof truss that is modeled in the figure shown.

(a) Find the measure of $\angle CAE$.

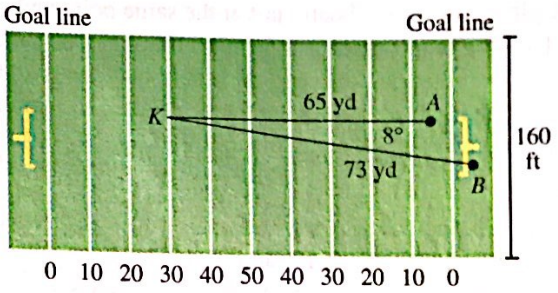
(b) If $AF = 12$ ft, find the length DF.

(c) Find the length EF.

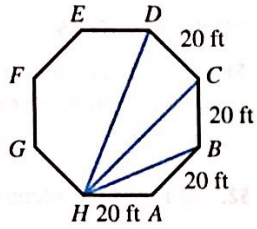


40. Navigation Two airplanes flying together in formation take off in different directions. One flies due east at 350 mph, and the other flies east-northeast at 380 mph. How far apart are the two airplanes 2 h after they separate, assuming that they fly at the same altitude?

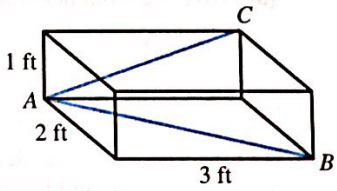
41. Football Kick The player waiting to receive a kickoff stands at the 5 yard line (point A) as the ball is being kicked 65 yd up the field from the opponent's 30 yard line. The kicked ball travels 73 yd at an angle of 8° to the right of the receiver, as shown in the figure (point B). Find the distance the receiver runs to catch the ball.



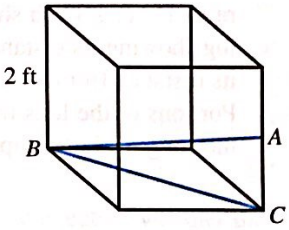
42. Group Activity Architectural Design Building Inspector Julie Wang checks a building in the shape of a regular octagon, each side 20 ft long. She checks that the contractor has located the corners of the foundation correctly by measuring several of the diagonals. Calculate what the lengths of diagonals HB, HC, and HD should be.



43. Connecting Trigonometry and Geometry $\angle CAB$ is inscribed in a rectangular box whose sides are 1, 2, and 3 ft long as shown. Find the measure of $\angle CAB$.



44. Group Activity Connecting Trigonometry and Geometry A cube has edges of length 2 ft. Point A is the midpoint of an edge. Find the measure of $\angle ABC$.



Standardized Test Questions

45. True or False If $\triangle ABC$ is any triangle with sides and angles labeled in the usual way, then $b^2 + c^2 > 2bc \cos A$. Justify your answer.

46. True or False If a, b, and θ are two sides and an included angle of a parallelogram, the area of the parallelogram is $ab \sin \theta$. Justify your answer.

You may use a graphing calculator when answering these questions.

47. Multiple Choice What is the area of a regular dodecagon (12-sided figure) inscribed in a circle of radius 12?

(a) 427 **(b)** 432 **(c)** 437 **(d)** 442 **(e)** 447

48. Multiple Choice The area of a triangle with sides 7, 8, and 9 is

(a) $6\sqrt{15}$. **(b)** $12\sqrt{5}$. **(c)** $16\sqrt{3}$.
(d) $17\sqrt{3}$. **(e)** $18\sqrt{3}$.