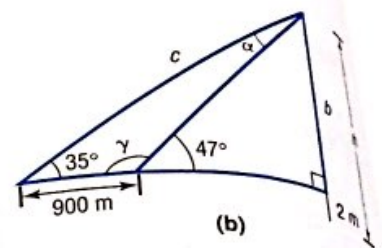
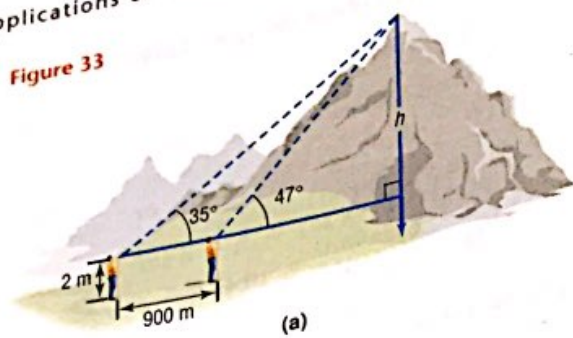


Figure 33



**Solution** Figure 33(b) shows the triangles that replicate the illustration in Figure 33(a). Since  $\gamma + 47^\circ = 180^\circ$ , we find that  $\gamma = 133^\circ$ . Also, since  $\alpha + \gamma + 35^\circ = 180^\circ$ , we find that  $\alpha = 145^\circ - \gamma = 145^\circ - 133^\circ = 12^\circ$ . We use the Law of Sines to find  $c$ .

$$\frac{\sin \alpha}{a} = \frac{\sin \gamma}{c}$$

$$c = \frac{900 \sin 133^\circ}{\sin 12^\circ} = 3165.86$$

$\alpha = 12^\circ, \gamma = 133^\circ, a = 900$

Using the larger right triangle, we have

$$\sin 35^\circ = \frac{b}{c}$$

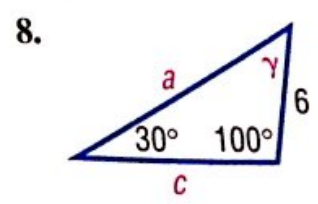
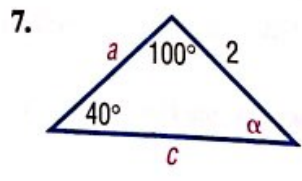
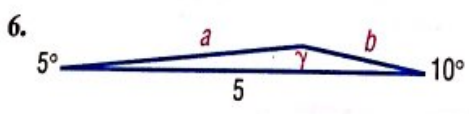
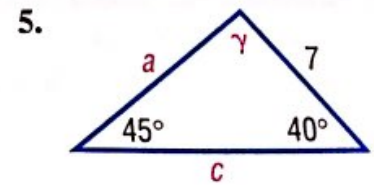
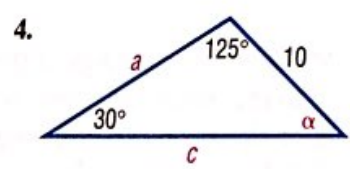
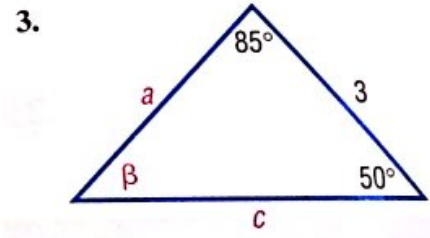
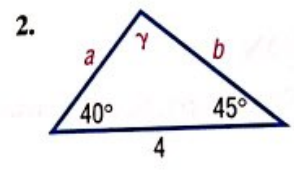
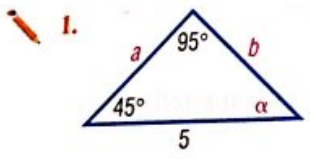
$$b = 3165.86 \sin 35^\circ = 1815.86 \approx 1816 \text{ meters}$$

The height of the peak from ground level is approximately  $1816 + 2 = 1818$  meters.

**NOW WORK PROBLEM 31.**

## 8.2 EXERCISES

In Problems 1–8, solve each triangle.



In Problems 9–16, solve each triangle.

9.  $\alpha = 40^\circ$ ,  $\beta = 20^\circ$ ,  $a = 2$

12.  $\alpha = 70^\circ$ ,  $\beta = 60^\circ$ ,  $c = 4$

15.  $\alpha = 40^\circ$ ,  $\beta = 40^\circ$ ,  $c = 2$

10.  $\alpha = 50^\circ$ ,  $\gamma = 20^\circ$ ,  $a = 3$

13.  $\alpha = 110^\circ$ ,  $\gamma = 30^\circ$ ,  $c = 3$

16.  $\beta = 20^\circ$ ,  $\gamma = 70^\circ$ ,  $a = 1$

11.  $\beta = 70^\circ$ ,  $\gamma = 10^\circ$ ,  $b = 5$

14.  $\beta = 10^\circ$ ,  $\gamma = 100^\circ$ ,  $b = 2$

In Problems 17–28, two sides and an angle are given. Determine whether the given information results in one triangle, two triangles, or no triangle at all. Solve any triangle(s) that results.

17.  $a = 3$ ,  $b = 2$ ,  $\alpha = 50^\circ$

20.  $a = 2$ ,  $c = 1$ ,  $\alpha = 120^\circ$

23.  $b = 4$ ,  $c = 6$ ,  $\beta = 20^\circ$

26.  $b = 4$ ,  $c = 5$ ,  $\beta = 95^\circ$

18.  $b = 4$ ,  $c = 3$ ,  $\beta = 40^\circ$

21.  $a = 4$ ,  $b = 5$ ,  $\alpha = 60^\circ$

24.  $a = 3$ ,  $b = 7$ ,  $\alpha = 70^\circ$

27.  $a = 2$ ,  $c = 1$ ,  $\gamma = 25^\circ$

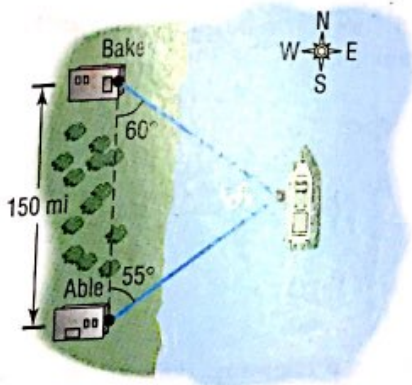
19.  $b = 5$ ,  $c = 3$ ,  $\beta = 100^\circ$

22.  $b = 2$ ,  $c = 3$ ,  $\beta = 40^\circ$

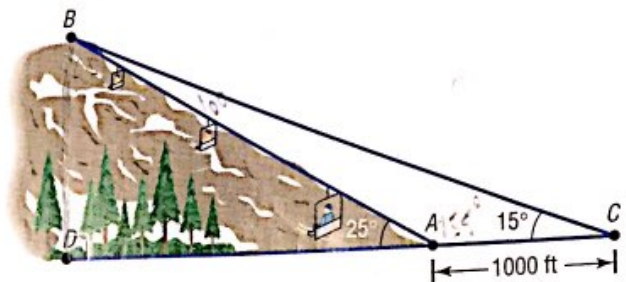
25.  $a = 2$ ,  $c = 1$ ,  $\gamma = 100^\circ$

28.  $b = 4$ ,  $c = 5$ ,  $\beta = 40^\circ$

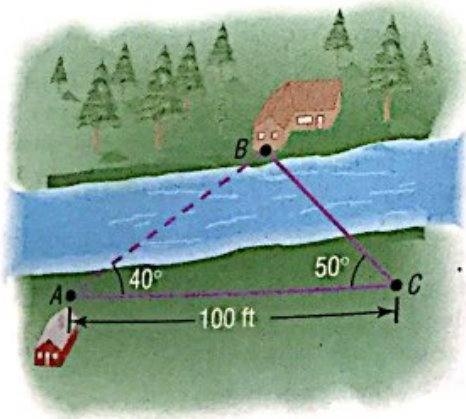
29. **Rescue at Sea** Coast Guard Station Able is located 150 miles due south of Station Baker. A ship at sea sends an SOS call that is received by each station. The call to Station Able indicates that the ship is located N55°E; the call to Station Baker indicates that the ship is located S60°E.
- (a) How far is each station from the ship?
- (b) If a helicopter capable of flying 200 miles per hour is dispatched from the nearest station to the ship, how long will it take to reach the ship?



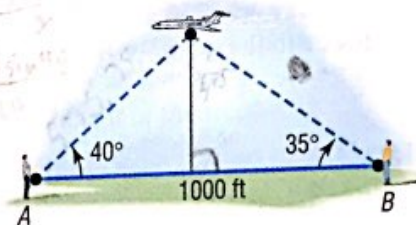
31. **Finding the Length of a Ski Lift** Consult the figure. To find the length of the span of a proposed ski lift from A to B, a surveyor measures the angle  $DAB$  to be  $25^\circ$  and then walks off a distance of 1000 feet to C and measures the angle  $ACB$  to be  $15^\circ$ . What is the distance from A to B?



30. **Surveying** Consult the figure. To find the distance from the house at A to the house at B, a surveyor measures the angle  $BAC$  to be  $40^\circ$  and then walks off a distance of 100 feet to C and measures the angle  $ACB$  to be  $50^\circ$ . What is the distance from A to B?



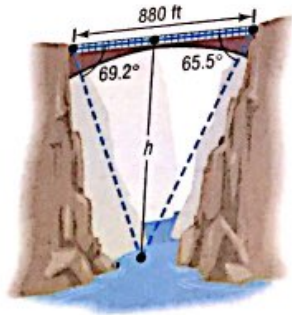
32. **Finding the Height of a Mountain** Use the illustration in Problem 31 to find the height  $BD$  of the mountain at B.
33. **Finding the Height of an Airplane** An aircraft is spotted by two observers who are 1000 feet apart. As the airplane passes over the line joining them, each observer takes a sighting of the angle of elevation to the plane, as indicated in the figure. How high is the airplane?



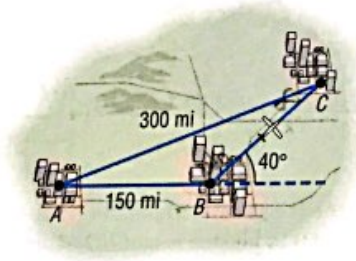
34. **Finding the Height of the Bridge over the Royal Gorge** The highest bridge in the world is the bridge over the Royal Gorge of the Arkansas River in Colorado.\*

\*Source: Guinness Book of World Records.

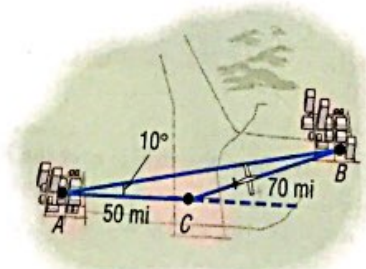
Sightings to the same point at water level directly under the bridge are taken from each side of the 880-foot-long bridge, as indicated in the figure. How high is the bridge?



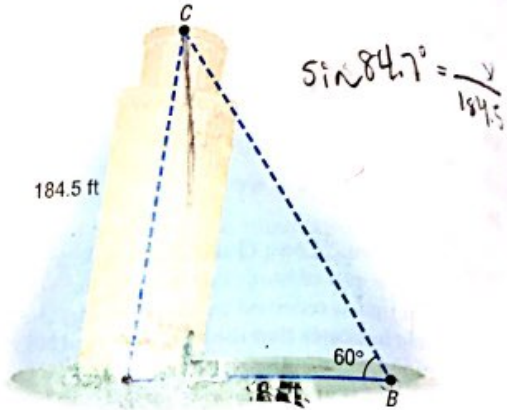
35. **Navigation** An airplane flies from city  $A$  to city  $B$ , a distance of 150 miles, and then turns through an angle of  $40^\circ$  and heads toward city  $C$ , as shown in the figure.
- If the distance between cities  $A$  and  $C$  is 300 miles, how far is it from city  $B$  to city  $C$ ?
  - Through what angle should the pilot turn at city  $C$  to return to city  $A$ ?



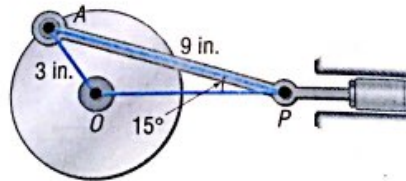
36. **Time Lost due to a Navigation Error** In attempting to fly from city  $A$  to city  $B$ , an aircraft followed a course that was  $10^\circ$  in error, as indicated in the figure. After flying a distance of 50 miles, the pilot corrected the course by turning at point  $C$  and flying 70 miles further. If the constant speed of the aircraft was 250 miles per hour, how much time was lost due to the error?



37. **Finding the Lean of the Leaning Tower of Pisa** The famous Leaning Tower of Pisa was originally 184.5 feet high.\* At a distance of 123 feet from the base of the tower, the angle of elevation to the top of the tower is found to be  $60^\circ$ . Find the angle  $CAB$  indicated in the figure. Also, find the perpendicular distance from  $C$  to  $AB$ .



38. **Crankshafts on Cars** On a certain automobile, the crankshaft is 3 inches long and the connecting rod is 9 inches long (see the figure). At the time when the angle  $OPA$  is  $15^\circ$ , how far is the piston ( $P$ ) from the center ( $O$ ) of the crankshaft?



39. **Constructing a Highway** U.S. 41, a highway whose primary directions are north-south, is being constructed along the west coast of Florida. Near Naples, a bay obstructs the straight path of the road. Since the cost of a bridge is prohibitive, engineers decide to go around the bay. The illustration shows the path that they decide on and the measurements taken. What is the length of highway needed to go around the bay?

\*In their 1986 report on the fragile seven-century-old bell tower, scientists in Pisa, Italy, said that the Leaning Tower of Pisa had increased its famous lean by 1 millimeter, or 0.04 inch. This is about the annual average, although the tilting had slowed to about half that much in the previous 2 years. (Source: United Press International, June 29, 1986.)

PISA, ITALY. September 1995. The Leaning Tower of Pisa has suddenly shifted, jeopardizing years of preservation work to stabilize it, Italian newspapers said Sunday. The tower, built on shifting subsoil between 1174 and 1350 as a belfry for the nearby cathedral, recently moved 0.07 inch in one night. The tower has been closed to tourists since 1990.