

**8-6 Study Guide and Intervention** *(continued)***The Law of Sines**

**Use the Law of Sines to Solve Problems** You can use the **Law of Sines** to solve some problems that involve triangles.

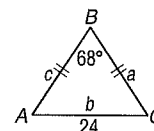
**Law of Sines**

Let  $\triangle ABC$  be any triangle with  $a$ ,  $b$ , and  $c$  representing the measures of the sides opposite the angles with measures  $A$ ,  $B$ , and  $C$ , respectively. Then  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$ .

**Example**

**Isosceles  $\triangle ABC$  has a base of 24 centimeters and a vertex angle of  $68^\circ$ . Find the perimeter of the triangle.**

The vertex angle is  $68^\circ$ , so the sum of the measures of the base angles is 112 and  $m\angle A = m\angle C = 56^\circ$ .



$$\frac{\sin B}{b} = \frac{\sin A}{a}$$

Law of Sines

$$\frac{\sin 68^\circ}{24} = \frac{\sin 56^\circ}{a}$$

 $m\angle B = 68^\circ$ ,  $b = 24$ ,  $m\angle A = 56^\circ$ 

$$a \sin 68^\circ = 24 \sin 56^\circ$$

Cross multiply.

$$a = \frac{24 \sin 56^\circ}{\sin 68^\circ}$$

Divide each side by  $\sin 68^\circ$ .

$$\approx 21.5$$

Use a calculator.

The triangle is isosceles, so  $c = 21.5$ .

The perimeter is  $24 + 21.5 + 21.5$  or about 67 centimeters.

**Exercises**

**Draw a triangle to go with each exercise and mark it with the given information. Then solve the problem. Round angle measures to the nearest degree and side measures to the nearest tenth.**

- One side of a triangular garden is 42.0 feet. The angles on each end of this side measure  $66^\circ$  and  $82^\circ$ . Find the length of fence needed to enclose the garden.
- Two radar stations  $A$  and  $B$  are 32 miles apart. They locate an airplane  $X$  at the same time. The three points form  $\angle XAB$ , which measures  $46^\circ$ , and  $\angle XBA$ , which measures  $52^\circ$ . How far is the airplane from each station?
- A civil engineer wants to determine the distances from points  $A$  and  $B$  to an inaccessible point  $C$  in a river.  $\angle BAC$  measures  $67^\circ$  and  $\angle ABC$  measures  $52^\circ$ . If points  $A$  and  $B$  are 82.0 feet apart, find the distance from  $C$  to each point.
- A ranger tower at point  $A$  is 42 kilometers north of a ranger tower at point  $B$ . A fire at point  $C$  is observed from both towers. If  $\angle BAC$  measures  $43^\circ$  and  $\angle ABC$  measures  $68^\circ$ , which ranger tower is closer to the fire? How much closer?

**8-6 Skills Practice*****The Law of Sines***

Find each measure using the given measures from  $\triangle ABC$ . Round angle measures to the nearest tenth degree and side measures to the nearest tenth.

1. If  $m\angle A = 35$ ,  $m\angle B = 48$ , and  $b = 28$ , find  $a$ .
2. If  $m\angle B = 17$ ,  $m\angle C = 46$ , and  $c = 18$ , find  $b$ .
3. If  $m\angle C = 86$ ,  $m\angle A = 51$ , and  $a = 38$ , find  $c$ .
4. If  $a = 17$ ,  $b = 8$ , and  $m\angle A = 73$ , find  $m\angle B$ .
5. If  $c = 38$ ,  $b = 34$ , and  $m\angle B = 36$ , find  $m\angle C$ .
6. If  $a = 12$ ,  $c = 20$ , and  $m\angle C = 83$ , find  $m\angle A$ .
7. If  $m\angle A = 22$ ,  $a = 18$ , and  $m\angle B = 104$ , find  $b$ .

Solve each  $\triangle PQR$  described below. Round measures to the nearest tenth.

8.  $p = 27$ ,  $q = 40$ ,  $m\angle P = 33$
9.  $q = 12$ ,  $r = 11$ ,  $m\angle R = 16$
10.  $p = 29$ ,  $q = 34$ ,  $m\angle Q = 111$
11. If  $m\angle P = 89$ ,  $p = 16$ ,  $r = 12$
12. If  $m\angle Q = 103$ ,  $m\angle P = 63$ ,  $p = 13$
13. If  $m\angle P = 96$ ,  $m\angle R = 82$ ,  $r = 35$
14. If  $m\angle R = 49$ ,  $m\angle Q = 76$ ,  $r = 26$
15. If  $m\angle Q = 31$ ,  $m\angle P = 52$ ,  $p = 20$
16. If  $q = 8$ ,  $m\angle Q = 28$ ,  $m\angle R = 72$
17. If  $r = 15$ ,  $p = 21$ ,  $m\angle P = 128$