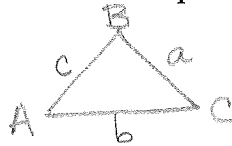


The Law of Sines (8-6)

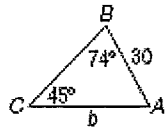
What do we do if its not a right Δ?

The Law of Sines In any triangle, there is a special relationship between the angles of the triangle and the lengths of the sides opposite the angles.

Law of Sines	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$
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Example 1 In $\triangle ABC$, find b .



$$\frac{\sin B}{b} = \frac{\sin C}{c}$$

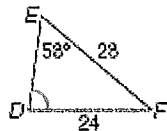
$$\frac{\sin 74}{b} = \frac{\sin 45}{30}$$

$$30 \cdot \sin 74 = b \cdot \sin 45$$

$$\frac{30 \cdot \sin 74}{\sin 45} = \frac{b \cdot \sin 45}{\sin 45}$$

$$40.78 = b$$

Example 2 In $\triangle DEF$, find $m\angle D$.



$$\frac{\sin D}{d} = \frac{\sin E}{e}$$

$$\frac{\sin D}{28} = \frac{\sin 58}{24}$$

$$24 \cdot \sin D = 28 \cdot \sin 58$$

$$\sin D = .9894$$

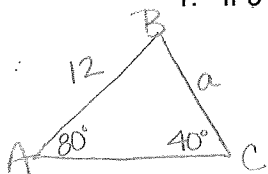
$$\sin^{-1}(\sin D) = \sin^{-1}(.9894)$$

$$D = 81.65^\circ$$

Find each measure using the given measures of ABC.

Round angle measures to the nearest degree and side measures to the nearest tenth.

1. If $c = 12$, $m\angle A = 80$, and $m\angle C = 40$, find a .



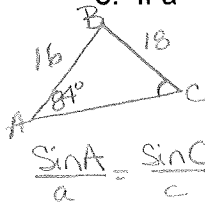
$$\frac{\sin 80}{a} = \frac{\sin 40}{12}$$

$$12 \cdot \sin 80 = a \cdot \sin 40$$

$$\frac{\sin A}{a} = \frac{\sin C}{c}$$

$$18.4 = a$$

3. If $a = 18$, $c = 16$, and $m\angle A = 84$, find $m\angle C$.



$$\frac{\sin 84}{18} = \frac{\sin C}{16}$$

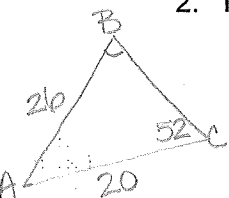
$$16 \sin 84 = 18 \sin C$$

$$.8840 = \sin C$$

$$C = \sin^{-1}.8840$$

$$C = 62^\circ$$

2. If $b = 20$, $c = 26$, and $m\angle C = 52$, find $m\angle B$.



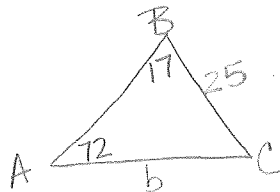
$$\frac{\sin B}{20} = \frac{\sin 52}{26}$$

$$\sin B = .6062$$

$$B = 37^\circ$$

$$\frac{\sin B}{20} = \frac{\sin 52}{26}$$

4. If $a = 25$, $m\angle A = 72$, and $m\angle B = 17$, find b .



$$\frac{b \cdot \sin 72}{\sin 72} = \frac{25 \cdot \sin 17}{\sin 72}$$

$$b = 7.7$$

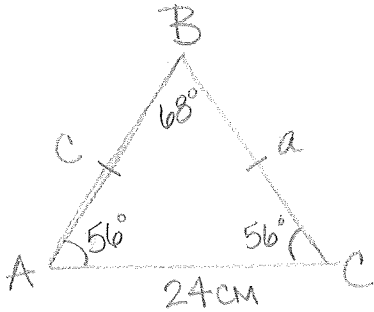
$$\frac{\sin 72}{25} = \frac{\sin 17}{b}$$

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° . Find the perimeter of the triangle.



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

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

$$a = 21.5 \text{ cm}$$

$$c = 21.5 \text{ cm}$$

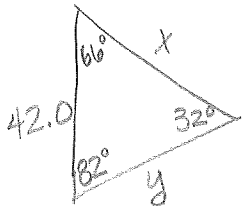
$$P = 24 + 21.5 + 21.5$$

$$P = 67 \text{ cm}$$

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.

5. One side of a triangular garden is 42.0 feet. The angles on each end of this side measure 66° and 82° . Find the perimeter of the garden.



$$\frac{\sin 32}{42} = \frac{\sin 66}{y}$$

$$y = \frac{42 \sin 66}{\sin 32}$$

$$y = 72.4$$

$$\frac{\sin 32}{42} = \frac{\sin 82}{x}$$

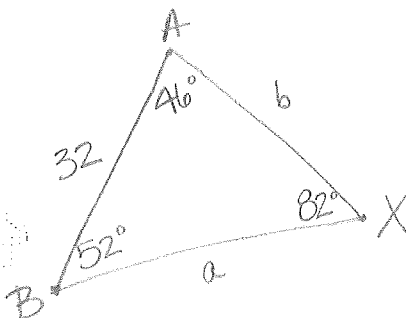
$$x = \frac{42 \sin 82}{\sin 32}$$

$$x = 78.5$$

$$P = 42.0 + 72.4 + 78.5$$

$$P = 192.9 \text{ ft.}$$

6. Two radar stations A and B are 32 miles apart. They locate an airplane X at the same time. The three points form $\triangle XAB$, which measures 46° , and $\triangle XBA$, which measures 52° . How far is the airplane from each station?



$$\frac{\sin 82}{32} = \frac{\sin 46}{a}$$

$$a = \frac{32 \sin 46}{\sin 82}$$

$$a = 23.2 \text{ miles from station B}$$

$$\frac{\sin 82}{32} = \frac{\sin 52}{b}$$

$$b = \frac{32 \sin 52}{\sin 82}$$

$$b = 25.5 \text{ miles from station A}$$