

# 12.3 Law of Sines

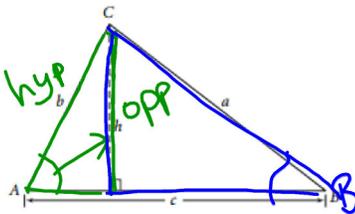
## Purpose:

To find the missing sides and angles of non-right triangles.

## Learning Target:

I can use the Law of Sines to find missing sides and angles of triangles.

Law of Sines Investigation: Consider  $\triangle ABC$  with height  $h$ .



a. Use the small triangle on the left to find  $h$  in terms of angle  $A$  and side  $b$ .

~~$\sin A = \frac{h}{b}$~~   
 $h = b \cdot \sin A$

b. Use the small triangle on the right to find  $h$  in terms of angle  $B$  and side  $a$ .

~~$\sin B = \frac{h}{a}$~~   
 $h = a \cdot \sin B$

c. Use the results from parts a and b and algebra to show that  $\frac{\sin A}{a} = \frac{\sin B}{b}$ .

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

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

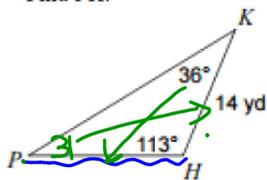
**Law of Sines:** Used to find missing sides and angles of non-right triangles.

For a triangle with angles  $A$ ,  $B$ , and  $C$  and side lengths of  $a$ ,  $b$ , and  $c$  ( $a$  opposite  $A$ ,  $b$  opposite  $B$ , and  $c$  opposite  $C$ )...

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

Use the Law of Sines to find the missing side length below.

1. Find PH.



$$180 - 113 - 36$$

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

~~$$\frac{\sin 36}{PH} = \frac{\sin 31}{14}$$~~

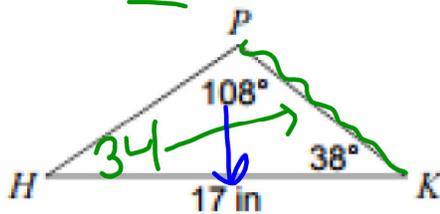
$$\frac{PH \cdot \sin 31}{\sin 31} = \frac{14 \cdot \sin 36}{\sin 31}$$

$$PH = 16$$

$$\frac{14 \cdot .5878}{.515}$$

Use the Law of Sines to find the missing side length below.

2. Find PK.



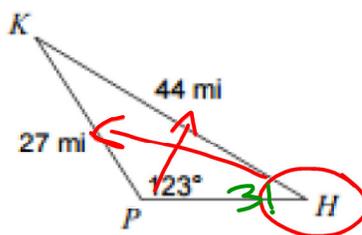
$$\frac{\sin A}{a} = \frac{\sin B}{b}$$
~~$$\frac{\sin 34}{PK} = \frac{\sin 108}{17}$$~~

$$\frac{PK \cdot \cancel{\sin 108}}{\cancel{\sin 108}} = \frac{17 \cdot \sin 34}{\sin 108}$$

$$PK = 10$$

Use the Law of Sines to find the missing angle below.

3. Find  $m\angle H$ .



$$\frac{\sin A}{a} = \frac{\sin B}{b}$$
~~$$\frac{\sin H}{27} = \frac{\sin 123}{44}$$~~

$$\frac{\sin 31}{27} = \frac{\sin 123}{44} \quad \frac{44 \cdot \sin H}{44} = \frac{27 \cdot \sin 123}{44}$$

$$\approx .019$$

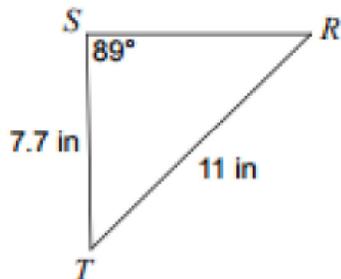
$$\approx .019$$

$$H = \sin^{-1}(\quad)$$

$$H = 31^\circ$$

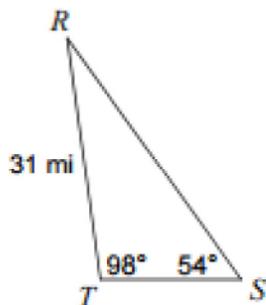
Use the Law of Sines to find the missing angle below.

4. Find  $m\angle R$ .



Find all the missing sides and angles in the triangle below.

- 5.



$m\angle R = \underline{\hspace{2cm}}$

$TS = \underline{\hspace{2cm}}$

$RS = \underline{\hspace{2cm}}$