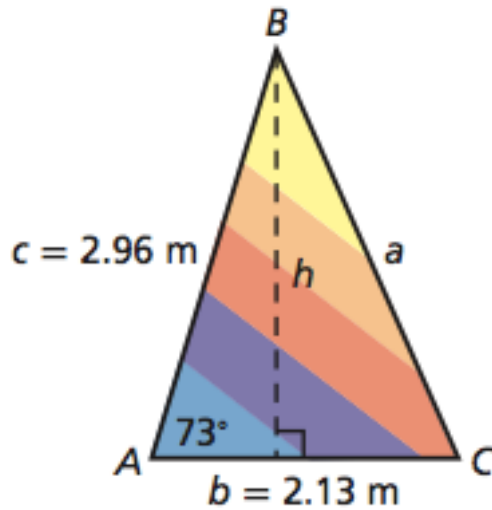


# The Law of Sines

## 13.5



Mr. Yen is not only a teacher of humility by day, but a sailor at night. He loves designing interesting sails and selling them on Ebay. There are various types and sizes of sails for different types and sizes of boats. However, all of the sails he makes are triangular shaped. The only information Mr. Yen needs to know the base and height of a sail for the boat size so that he could figure out amount of fabric needed.



The area of a triangle is  $\frac{1}{2}bh$ .

$$\text{In this case, } \sin A = \frac{h}{c}$$

$$h = (c)\sin A$$

If we plug this back into the area formula we would get

$$\text{Area} = \frac{1}{2}b(c)(\sin A)$$

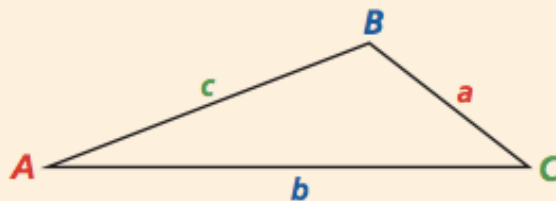
### Area of a Triangle

For  $\triangle ABC$ ,

$$\text{Area} = \frac{1}{2}bc \sin A$$

$$\text{Area} = \frac{1}{2}ac \sin B$$

$$\text{Area} = \frac{1}{2}ab \sin C$$

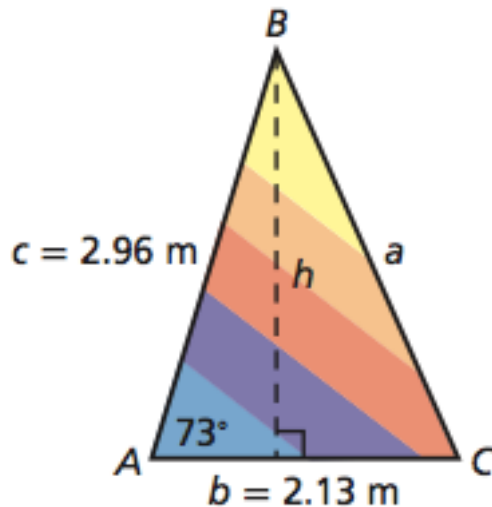


Capital letters = angles.

Lower case letters = sides.

Sometimes the sides and angles are not labeled. Just remember, the given angle lies between two given sides.

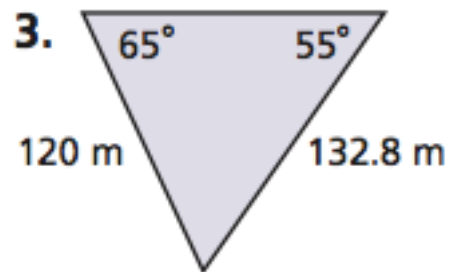
I Try:  
Find the area of the sail.



Identify the givens.	$A=73^\circ$ $b=2.13\text{m}$ $c=2.96\text{m}$
Plug into the law of sines.	$\text{Area} = \frac{1}{2}(b)(c)\sin A$
Plug in the givens.	$\text{Area} = \frac{1}{2}(2.13)(2.96)\sin 73^\circ$
Simplify	$\text{Area} = 3.015\text{m}^2$

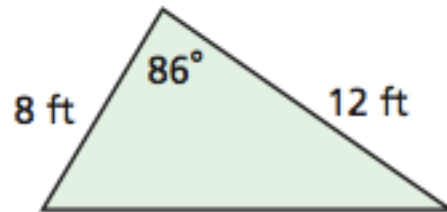
On the homework when it says to solve the triangle, it means to find all sides and angles!

We Try:  
Find the area of the triangle.



Identify the givens.	
Plug into the law of sines.	
Simplify	

You try with your partners:  
Odd Talk, Even Write



Identify the givens.	
Plug into the law of sines.	
Simplify	

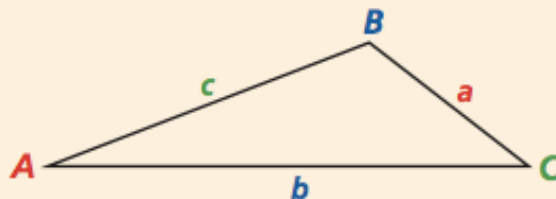
## Area of a Triangle

For  $\triangle ABC$ ,

$$\text{Area} = \frac{1}{2}bc \sin A$$

$$\text{Area} = \frac{1}{2}ac \sin B$$

$$\text{Area} = \frac{1}{2}ab \sin C$$



The area of  $\triangle ABC$  is equal to  $\frac{1}{2}bc \sin A$  or  $\frac{1}{2}ac \sin B$  or  $\frac{1}{2}ab \sin C$ . By setting these expressions equal to each other, you can derive the Law of Sines.

$$\frac{1}{2}bc \sin A = \frac{1}{2}ac \sin B = \frac{1}{2}ab \sin C$$

$$bc \sin A = ac \sin B = ab \sin C$$

*Multiply each expression by 2.*

$$\frac{\cancel{bc} \sin A}{\cancel{abc}} = \frac{\cancel{ac} \sin B}{\cancel{abc}} = \frac{\cancel{ab} \sin C}{\cancel{abc}}$$

*Divide each expression by abc.*

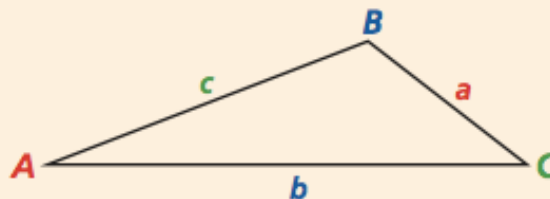
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

*Divide out common factors.*

## Law of Sines

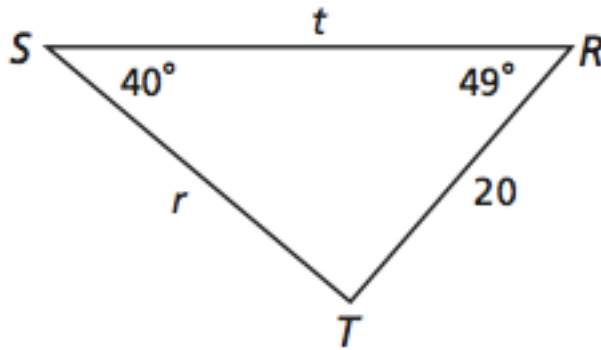
For  $\triangle ABC$ , the Law of Sines states that

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



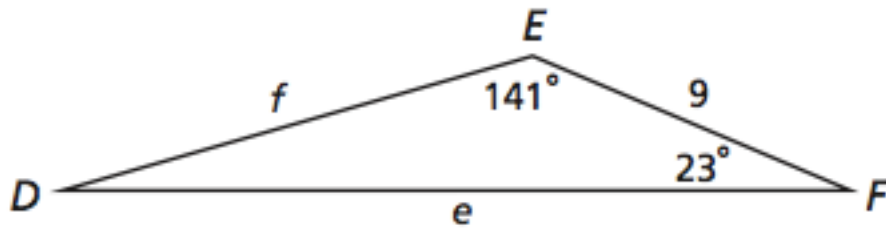
You need either ASA, AAS, or SSA to be able to use the Law of Sines.

I try:  
Solve for the triangle.



Identify the givens.	$40^\circ \rightarrow 20$ $49^\circ \rightarrow r$
Plug into the Law of Sines	$\frac{\sin 40^\circ}{20} = \frac{\sin 49^\circ}{r}$
Simplify	$r \sin 40^\circ = 20 \sin 49^\circ$ $r(.643) = 20(.755)$ $r(.643) = 15.1$ $r = 23.48$

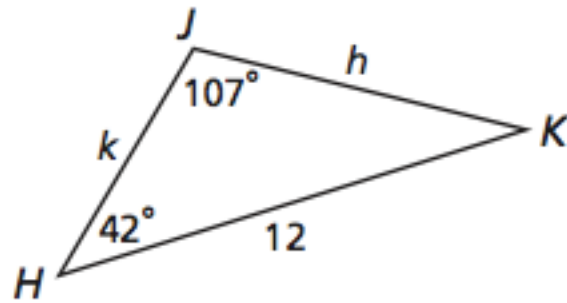
We Try:



Identify the givens.	
Plug into the Law of Sines	
Simplify	



You Try on whiteboards:  
Even Talk, Odd Write



Identify the givens.	
Plug into the Law of Sines	
Simplify	