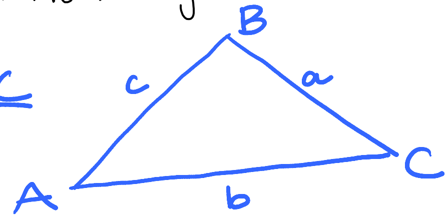
Law of Sines

- used to find sides and angles in non-right triangles

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



- use when you have two angles and one side ASA, AAS

OR

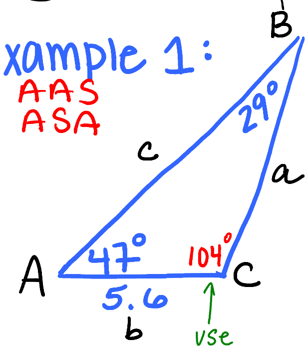
- two sides and one non-included angle SSA → ASS

MUST HAVE A COMPLETE RATIO TO USE LAW OF SINES

1. If given two angles, find third (angle sum = 180°)
2. Set up proportion with angle and corresponding sides.
3. cross multiply and solve.

Example 1:

AAS
ASA



use triangle angle sum to find

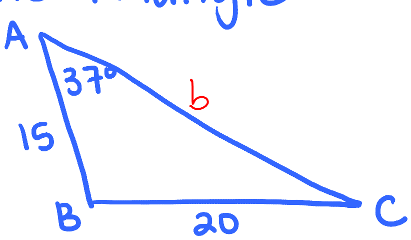
$$\frac{\sin 29}{5.6}$$

$\frac{\sin 47}{a} = \frac{\sin 29}{5.6}$	$\frac{\sin 29}{5.6} = \frac{\sin 104}{c}$
$5.6 \sin 47 = a \sin 29$	$5.6 \sin 104 = c \sin 29$
$\frac{5.6 \sin(47)}{\sin(29)} = a$	$\frac{5.6 \sin 104}{\sin 29} = c$
$8.4 = a$	$11.2 = c$

Example 2: ASS – One or Two Triangles

One Triangle

use inverse when finding an angle



Baseline Proportion

$$\frac{\sin 37}{20}$$

$\frac{\sin 37}{20} = \frac{\sin C}{15}$	$\frac{\sin 37}{20} = \frac{\sin 116.2}{b}$
$15 \sin 37 = 20 \sin C$	$20 \sin 116.2 = b \sin 37$
$\frac{15 \sin 37}{20} = \sin C$	$\frac{20 \sin 116.2}{\sin 37} = b$
$.45136\ldots = \sin C$	$29.8 = b$
$\sin^{-1}(\text{ANS}) = C$	
$26.8 = C$	

$26.8 = c$

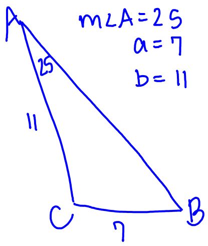
Therefore $m\angle B = 116.2$
(used $\triangle$ angle sum)

AMBIGUOUS CASE – when given two sides and a non-included angle, there may be more than one triangle possible.

$m\angle A = 25 \quad b = 11 \quad a = 7$

Possible Picture

$m\angle A = 25$
$a = 7$
$b = 11$



$$\frac{\sin 25}{7}$$

$$\frac{\sin 25}{7} = \frac{\sin B}{11}$$

$$11 \sin 25 = 7 \sin B$$

$$\frac{11 \sin 25}{7} = \sin B$$

$$\sin^{-1}(\text{ANS}) = B$$

we will analyze later $\rightarrow$ $41.6° = B$

$113.4 = C$

$$\frac{\sin 25}{7} = \frac{\sin 113.4}{c}$$

$$7 \sin 113.4 = c \sin 25$$

$$\frac{7 \sin 113.4}{\sin 25} = c$$

$15.2 = c$

Triangle 1

A 25
B 41.6
C 113.4

Triangle 2

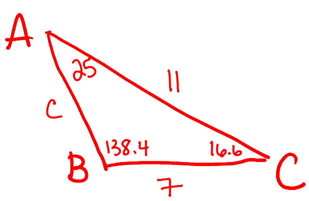
— given → A 25
— supplement → B 138.4
check angle sum C 16.6

$\overline{180}$

is there room for a 3rd angle?

✓ second $\triangle$ is possible

Because a second $\triangle$ is possible, you now must find the alternate third side



$$\frac{\sin 25}{7} = \frac{\sin 16.6}{c}$$

$$7 \sin 16.6 = c \sin 25$$

$$\frac{7 \sin 16.6}{\sin 25} = c$$

$$4.7 = c$$

WATCH VIDEO LINK FOR FURTHER EXPLANATION!