

MAC 1114

Trigonometry Applications: Law of Sines and Cosines

Worksheet

*When to Use:
ASA and SAA
are given*

Law of Sines (ratio)

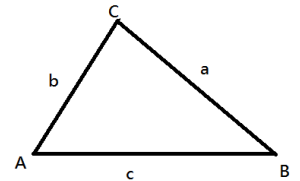
$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Case 1: given ASA

A = 50°, B = 68°, c = 230.

Hint: angles are usually given in Capital letters and sides in small letters.

1. You can find C. (Hint: sum of all angles in a triangle = 180)
2. Set up the ratio using the given side and one of the other angles.
_____ = _____ and solve for the missing side.



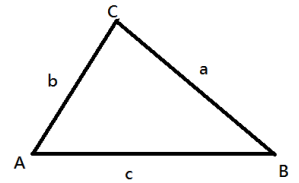
3. You can repeat this if you need to know all the sides.

Case 2: given SAA

B = 10°, C = 100°, c = 115

You have enough information to set up a ratio.

_____ = _____ (solving for b); continue if you need to find the other side.



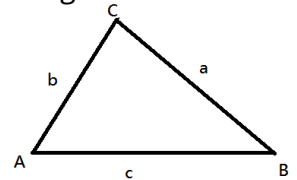
Keep in mind that you can find A using the fact that the sum of the angles in a triangle is 180 °.

Case 3: SSA (no solution)

a = 20, c = 45, A = 125°

Set up the ratio to solve for C

_____ = _____ *YOU* do this you get sin C = 1.84 > 1 so outside of the range for sine values!
Therefore, this problem has no solution.



Case 4: given SSA (one solution)

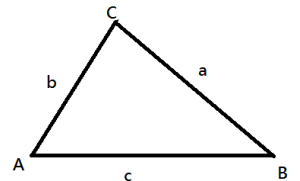
A = 110°, c = 15, a = 28

Set up the ratio for this one using the appropriate ratio.

_____ = _____

This will give you sin C = .503 or C = 30° or 150°

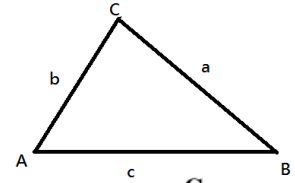
Let's try 30°: B = 180 - (110 + 30) = 40°. Let's try 150°: B = 180 - (110 + 150) = -80°. X (can't draw a triangle with a negative angle), so we reject this one. Thus, there is only one solution to this problem.



Case 5: SSA (2 solutions)

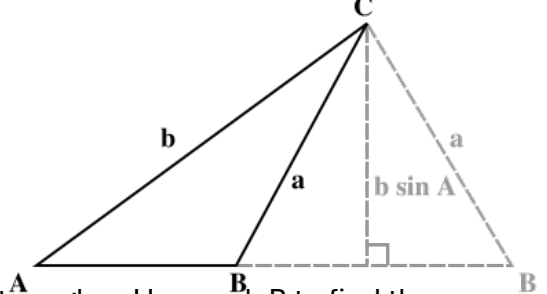
$a = 26, c = 15, C = 29^\circ$

_____ = _____ ; solve for A, this will give you 57.2° or 122.8°



Let's try 75.2° : $B = 180 - (57.2 + 29) = 93.8^\circ$ ✓

Let's try 150° : $B = 180 - (122.8 + 29) = 28.2^\circ$ ✓



Since there are two legitimate values for B, we will have two triangles. Use each B to find the remaining missing pieces for the two triangles.

Law of Cosines

$$a^2 = b^2 + c^2 - 2bc \cos(a)$$

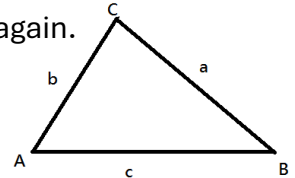
$$b^2 = a^2 + c^2 - 2ac \cos(b)$$

$$c^2 = a^2 + b^2 - 2ab \cos(c)$$

When to Use: when you know 2 sides and the angle between them or if you know all 3 sides.

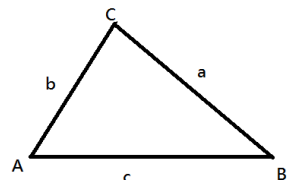
Case 1: SSS

$a = 21.2$ ft., $b = 24.6$ ft., and $c = 12$ ft. Since you don't know any angle, just pick 1 to find first! After you find one angle, you can switch back to law of sines or use the cosine again.



Case 2: SAS

$C = 134^\circ$, $a = 20$ and $b = 8$. Hint: find C first, then switch back to the law of sines.



Applications

1. A car travels east for 1 hour at 40 mi/hr. The train turns northeast and travels for 30 minutes longer. How far is it from its starting point?
2. A cell phone tower is supported by two guy wires (165 ft. and 180 ft.) on opposite sides. Each wire is attached to the top of the tower and anchored to the ground. The shorter wire makes an angle of 67° with the ground. How far apart are the anchor points?

Answers 1. 56 miles, 2. 161.1 ft