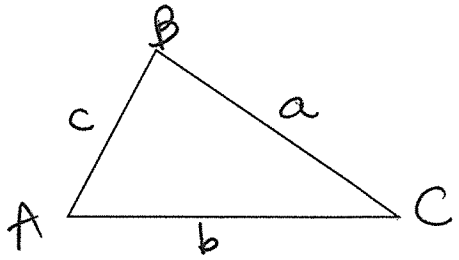
Section 6.3 The Sine Rule

Oblique triangles have no right angles. That means you cannot use the Pythag Thm or standard sine, cosine, or tangent to find missing angles and sides.

Remember the triangle at the right is in standard notation. That will always be used unless otherwise stated. Also remember angles add to 180°.

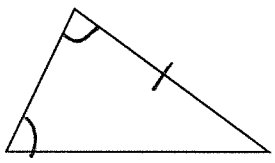


You can find missing parts of your triangle is you know two angles and any side (AAS or ASA) or two sides and an angle opposite one of them (SSA).

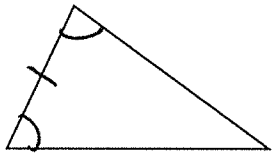
Law of Sines:

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

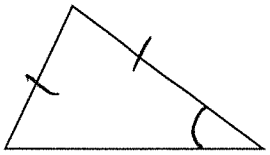
AAS



ASA

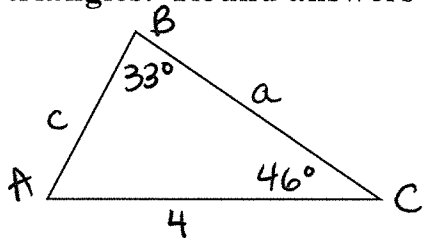


SSA **(see last example)**



Example: Solve the following triangles. Round answers to ~~the nearest tenth.~~ 3 sig figs

a) B = 33°, C = 46°, $b = 4$



$$\frac{4}{\sin 33°} = \frac{c}{\sin 46°}$$

cross multiply

$$4 \cdot \sin 46° = c \cdot \sin 33°$$

$$c = \frac{4 \cdot \sin(46°)}{\sin(33°)}$$

$$c \approx 5.28$$

$$A = 180° - 33° - 46° \rightarrow A = 101°$$

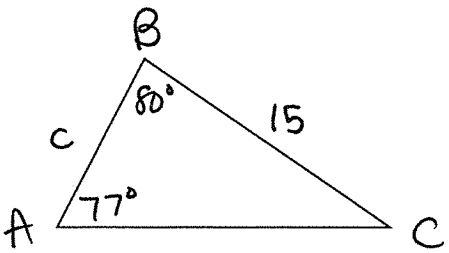
$$\frac{a}{\sin 101°} = \frac{4}{\sin 33°}$$

$$4 \cdot \sin 101° = a \cdot \sin 33°$$

$$a = \frac{4 \cdot \sin(101°)}{\sin(33°)}$$

$$a \approx 7.21$$

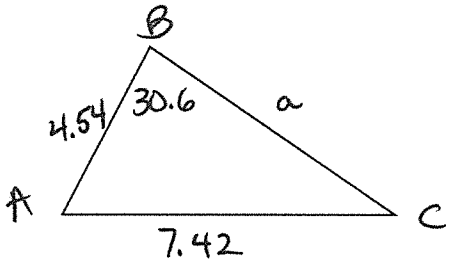
b) B = 80°, A = 77°, $a = 15$; Find c.



$$C = 180° - 80° - 77° \rightarrow C = 23°$$

$$\frac{15}{\sin 77°} = \frac{c}{\sin 23°} \rightarrow c \approx 6.02$$

c) B = 30.6°, $b = 7.42$, $c = 4.54$



$$\frac{7.42}{\sin 30.6^\circ} = \frac{4.54}{\sin C}$$

$$7.42 \cdot \sin C = 4.54 \cdot \sin 30.6^\circ$$

$$\sin C = \frac{4.54 \cdot \sin(30.6^\circ)}{7.42}$$

$$\sin C \approx 0.311 \text{ (Don't round)}$$

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

$$C \approx 18.1^\circ$$

$$A = 180^\circ - 30.6^\circ - 18.1^\circ$$

$$A = 131.3^\circ$$

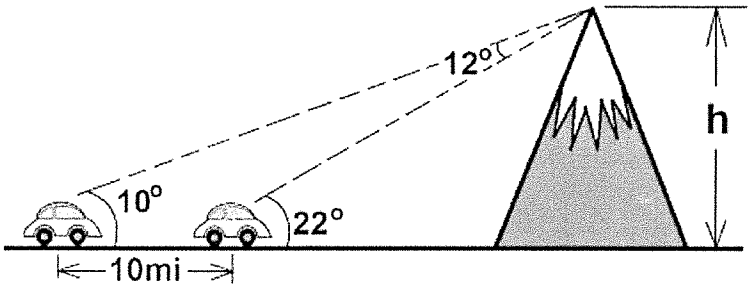
$$\frac{a}{\sin 131.3^\circ} = \frac{7.42}{\sin 30.6^\circ}$$

$$a = \frac{7.42 \cdot \sin(131.3^\circ)}{\sin 30.6^\circ}$$

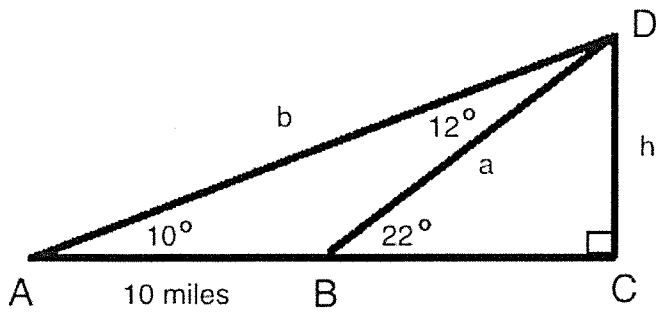
$$a \approx 10.9507 \approx 11.0$$

NOTE: Do NOT use the Pythag Thm to find the remaining side.
It is NOT a right triangle.

Example: Using the diagram below, find the height of the mountain.



We actually have two adjacent triangles...



Since ΔBDC is a right triangle, I could use right triangle trig if I knew a.

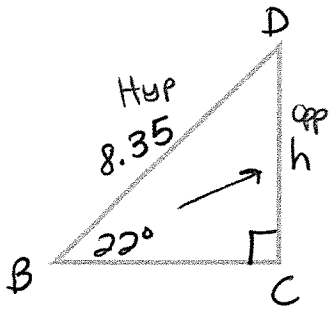
I can find a by using the Sine Rule on ΔABD.

Find a first:

$$\frac{10}{\sin 12^\circ} = \frac{a}{\sin 10^\circ}$$

$$a = 8.35$$

Now find h:



$$\sin 22^\circ = \frac{h}{8.35}$$

$$h = 8.35 \sin 22^\circ \approx 3.13 \text{ miles}$$