Section 11.4 The Sine Rule

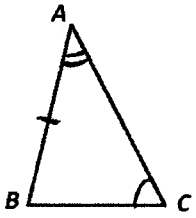
Oblique triangles have no right angles. That means you cannot use the Pythag Thm or standard sine, cosine, or tangent to find missing angles and sides. Also remember angles in a triangle add to 180°.

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).

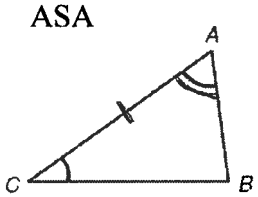
The Sine Rule:

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

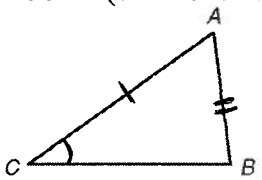
AAS



ASA



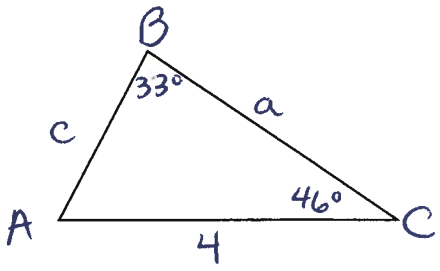
SSA (see last example)



The proof can be seen on page 380. NOTE: the rule can also be set up upside down (see book pg 381)

Example: Solve the following triangle. Round answers to the nearest tenth.

B = 33°, C = 46°, $b = 4$



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

$A = 180 - 46 - 33$

$A = 101°$

$c \sin 33 = 4 \sin 46$

$c = 5.3$

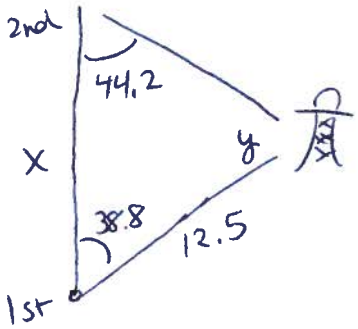
$\frac{\sin 33}{4} = \frac{\sin 101}{a}$

always use exact values whenever possible!

$a \sin 33 = 4 \sin 101$

$a = 7.2$

Example: A ship is sailing due north. At a certain point the bearing of a lighthouse that is 12.5 km away from the boat's current position is N 38.8° E. Later on, the captain notices that the bearing of the lighthouse has become S 44.2° E. How far did the ship travel between the two observations of the lighthouse?



$180 - 44.2 - 38.8$

$y = 97°$

$\frac{\sin 44.2}{12.5} = \frac{\sin 97}{x}$

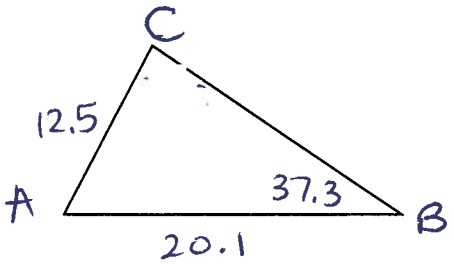
$x = 17.8$ km

Exercise 11G 1 a & c, 2–4

See investigation pg 384

Example: Solve the following triangle. Round answers to the nearest tenth.

$o = 12.5$, $c = 20.1$, $B = 37.3°$



$\frac{\sin 37.3}{12.5} = \frac{\sin C}{20.1}$

$\sin C = \frac{20.1 \sin 37.3}{12.5}$

$C = 77.0°$

$A = 180 - 37.3 - 77$

$A = 65.7°$

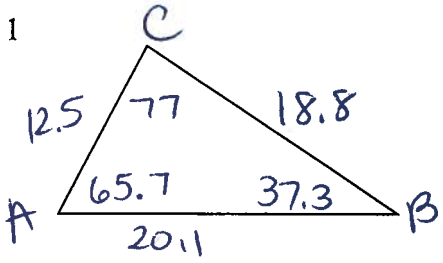
$\frac{\sin 37.3}{12.5} = \frac{\sin 65.7}{a}$

$a = 18.8$

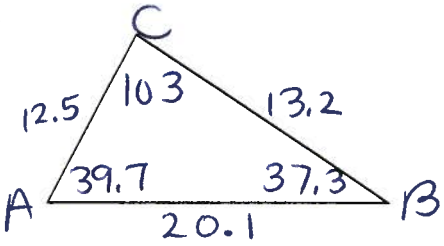
Now, this is called the ambiguous case (SSA) since when I did my inverse sine I got an answer in Quad I, I must figure out my possible angle in Quad II (since we were looking for where sine is positive) which would be $180 - 77.0 = 103.0°$.

Now continue the problem by finding an additional A value ($180 - 37.3 - 103$) which is 39.7°. Then use that new A to find a new *a* which would be 13.2. Now do a sketch to ensure that is possible. Remember that the smallest angle must be across from the smallest side, largest angle across from the largest side, etc

Option 1

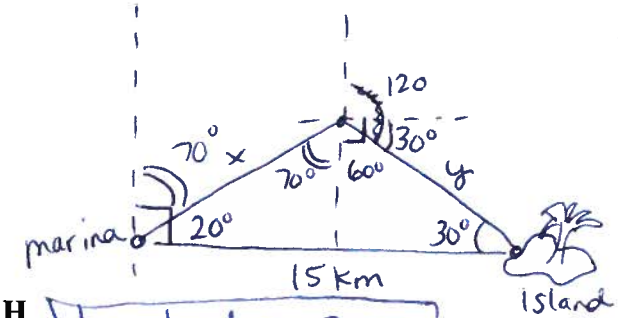


Option 2



Example

Kurt wants to sail his boat from a marina to an island 15 miles east of the marina. Along the course, there are several small islands they must avoid. He sails first on a heading of 70°and then on a heading of 120°. What is the total distance he travels before reaching the island?



$\frac{\sin 130}{15} = \frac{\sin 30}{x}$ $\quad$ $\frac{\sin 130}{15} = \frac{\sin 20}{y}$

$x = 9.79$ $\quad$ $y = 6.697$

total
16.487 miles

Exercise 11 H

1 a, b, d, e, 2, 3