Day 3 – The Sine Law

Many real world situations involve triangles that do not contain right triangles.

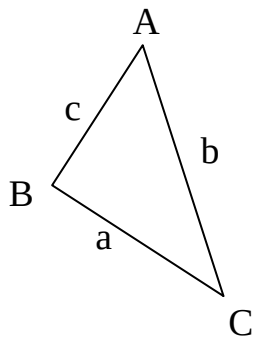
Since the primary trig ratios (SOH CAH TOA) only apply to right triangles, we must look at a different relationship between the sides and angles of a non-right triangle.

The **Sine Law** relates sides and angles in a triangle in the following way:

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

OR

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

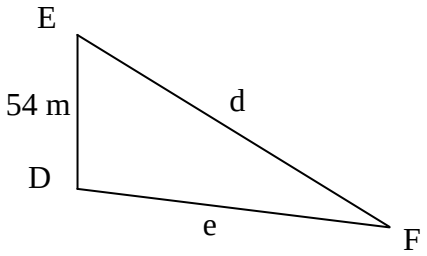


The length of any side, divided by the sine of the opposite angle, is the same for all 3 pairs of sides and angles!

NOTE: You only need to have a minimum of 2 ratios to solve for a missing side and/or angle.

Using the Sine Law to Find a Side

Example: Given ΔDEF, find e.



$$\frac{e}{\sin E} = \frac{f}{\sin F}$$

$$\frac{e}{\sin 50} = \frac{54}{\sin 34}$$

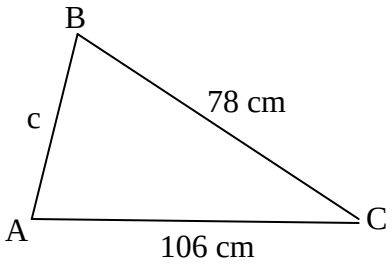
$$e \sin 34 = 54 \sin 50$$

$$e = \frac{54 \sin 50}{\sin 34}$$

$$e \cong 74m$$

Using the Sine Law to Find an Angle

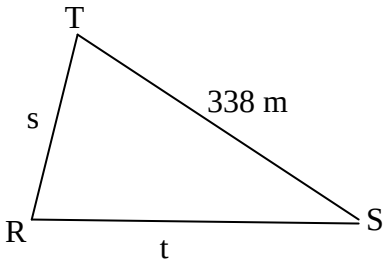
Example: Given ΔABC, find $< B$.



$$\frac{a}{\sin A} = \frac{b}{\sin B}$$
$$\frac{78}{\sin 47} = \frac{106}{\sin B}$$
$$78 \sin B = 106 \sin 47$$
$$\sin B = \frac{106 \sin 47}{78}$$
$$< B = \sin^{-1}\left(\frac{106 \sin 47}{78}\right)$$
$$< B \cong 84^o$$

Using the Sine Law to Solve a Triangle

Example: Given ΔRST, with $r = 338m$, $< T = 43^o$ and $< S = 78^o$, find the measures of t, s and $< R$.



Find $< R$.

$$< R + 43^o + 78^o = 180^o$$
$$< R = 180^o - 43^o - 78^o$$
$$< R = 59^o$$

Find t.

$$\frac{338}{\sin 59} = \frac{t}{\sin 43}$$
$$t \sin 59 = 338 \sin 43$$
$$t = \frac{338 \sin 43}{\sin 59}$$
$$t \cong 268.9m$$

Find s.

$$\frac{338}{\sin 59} = \frac{s}{\sin 78}$$
$$s = \frac{338 \sin 78}{\sin 59}$$
$$s \cong 385.7m$$