Day 4 – Applications of the Sine Law

To use the **Sine Law** to solve a triangle you must know either

1. 2 sides and 1 angle (across from a known side)
2. 2 angles and any side

Recall that:

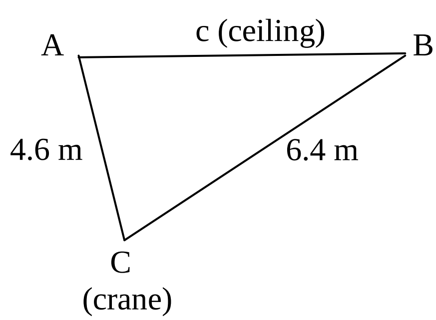
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad \textbf{\textit{OR}} \qquad \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Work through the word problems that follow to consolidate your understanding of the sine law and its application to real world contexts.

Then you may wish to complete the formative quiz on the sine law.

Finally, work through some word problems assigned by your Mathematics teacher.

Example: An overhead crane is suspended from a ceiling by two chains. One chain is 4.6 m long and forms an angle of 60° with the ceiling. The other chain is 6.4 m long. What angle does the larger chain make with the ceiling?



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

$$\frac{6.4}{\sin 60} = \frac{4.6}{\sin B}$$

$$6.4 \sin B = 4.6 \sin 60$$

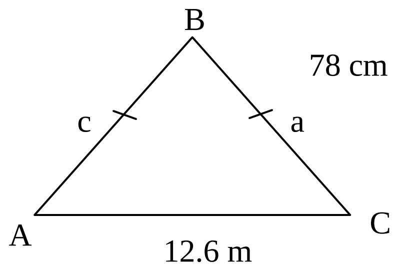
$$\sin B = \frac{4.6 \sin 60}{6.4}$$

$$< B = \sin^{-1}\left(\frac{4.6 \sin 60}{6.4}\right)$$

$$< B \cong 38^{o}$$

$\therefore$ The second chain makes an angle of 38° with the ceiling.

Example: A cottage under construction is to be 12.6 m wide. The two sides of the roof are to be supported by rafters that meet at an angle of 50°. How long should the rafters be if they are the same length?

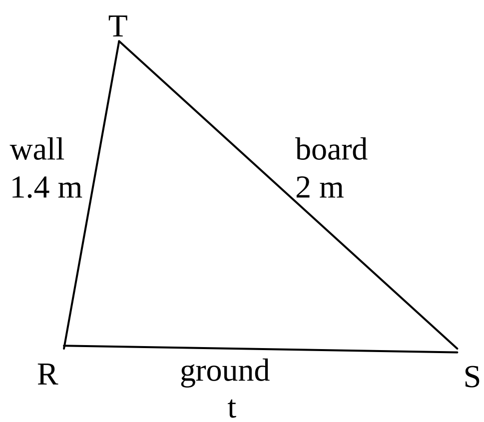


$$\begin{aligned}
&< A + < C + 50^o = 180^o \\
&x + x + 50^o = 180^o \\
&2x + 50^o = 180^o \\
&2x = 180^o - 50^o \\
&2x = 130^o \\
&x = 65^o
\end{aligned}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$
$$\frac{a}{\sin 65} = \frac{12.6}{\sin 50}$$
$$a \sin 50 = 12.6 \sin 65$$
$$a = \frac{12.6 \sin 65}{\sin 50}$$
$$a \cong 14.9m$$

$\therefore$ The rafters are both 14.9 m long.

<u>Example</u>: A wall that is 1.4 m long has started to lean and now makes an angle of 80^o with the ground. A 2 m board is jammed between the top of the wall and the ground to prop up the wall.



a) What angle does the board make with the ground?

$$\frac{2}{\sin 80} = \frac{1.4}{\sin S}$$
$$2 \sin S = 1.4 \sin 80$$
$$\sin S = \frac{1.4 \sin 80}{2}$$
$$< S = \sin^{-1}\left(\frac{1.4 \sin 80}{2}\right)$$
$$< S \cong 44^o$$

$\therefore$ The board makes an angle of 44^o with the ground.

b) What angle does the board make with the wall?

$$\angle T + 44^o + 80^o = 180^o$$
$$\angle T = 180^o - 44^o - 80^o$$
$$\angle T = 56^o$$

$\therefore$ The board makes an angle of 56^{o} with the wall.

c) How far is the board from the base of the wall?

$$\frac{2}{\sin 80} = \frac{x}{\sin 56}$$
$$x \sin 80 = 2 \sin 56$$
$$x = \frac{2 \sin 56}{\sin 80}$$
$$x \cong 1.7m$$

$\therefore$ The board is approximately 1.7 m from the wall.