

## Day 7 – Sine Law and Cosine Law

The primary trig ratios, the sine law and the cosine law can be used to solve problems involving triangles. The method you use depends on the information you know about the triangle and what you want to determine.

**Trig ratios** are used to solve triangles involving **right triangles only!**

To solve a problem involving a **non-right triangle** you must use either the **sine law** or the **cosine law**.

Use **Sine Law** when you know: 

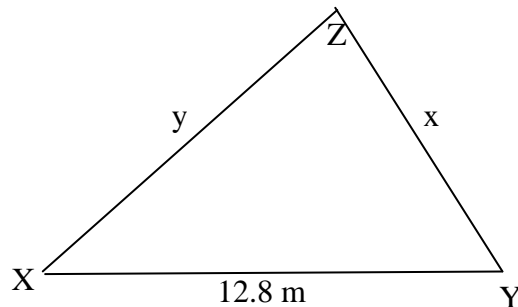
- 2 sides and one opposite angle
- 2 angles and any side

Use **Cosine Law** when you know: 

- all 3 sides
- 2 sides and the contained angle

*IMPORTANT NOTE: If it is possible to use either the sine law or the cosine law, the sine law would be easier!*

Example: Chris is building a house and he needs to know information about the roof's design. The base of the roof is 12.8 m wide and the rafters form angles of  $48^\circ$  and  $44^\circ$  to the horizontal. How long, to the nearest tenth of a metre, is each rafter?



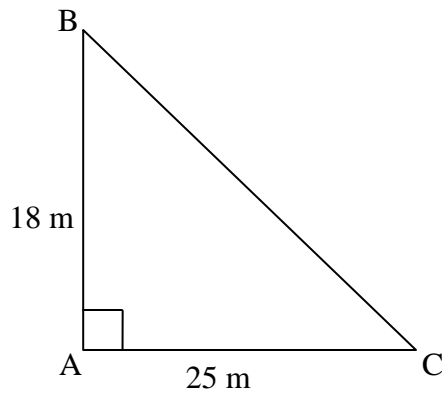
$$\begin{aligned}\frac{z}{\sin Z} &= \frac{x}{\sin X} \\ \frac{12.8}{\sin 88} &= \frac{x}{\sin 48} \\ x \sin 88 &= 12.8 \sin 48 \\ x &= \frac{12.8 \sin 48}{\sin 88} \\ x &\cong 9.5m\end{aligned}$$

$$\begin{aligned}\angle Z + 44^\circ + 48^\circ &= 180^\circ \\ \angle Z &= 180^\circ - 44^\circ - 48^\circ \\ \angle Z &= 88^\circ\end{aligned}$$

$$\begin{aligned}\frac{z}{\sin Z} &= \frac{y}{\sin Y} \\ \frac{12.8}{\sin 88} &= \frac{y}{\sin 44} \\ y \sin 88 &= 12.8 \sin 44 \\ y &= \frac{12.8 \sin 44}{\sin 88} \\ y &\cong 8.9m\end{aligned}$$

$\therefore$  The two rafters are 9.5 m and 8.9 m long.

Example: Simon measures the angle of elevation from the ground to the top of an 18 m high wind turbine. He sets a clinometer on the ground 25 m from the base of the tower. What is the angle of elevation?



Find angle C.

$$\tan C = \frac{\text{opp}}{\text{adj}}$$

$$\tan C = \frac{18}{25}$$

$$\angle C = \tan^{-1}\left(\frac{18}{25}\right)$$

$$\angle C \cong 36^\circ$$

$\therefore$  The angle of elevation to the top of the tower is  $36^\circ$ .