

# The Sine Rule

We use the sine rule for non-right angled triangles.

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

We denote the angles by capital letters A, B, C

We denote the sides opposite each angle by the lower case letters a, b, c.

**To use the sine rule**, choose an appropriate pair, depending on what you know in the triangle.

e.g.  $\frac{a}{\sin A} = \frac{b}{\sin B}$  or  $\frac{a}{\sin A} = \frac{c}{\sin C}$  or  $\frac{b}{\sin B} = \frac{c}{\sin C}$

**If you are finding an angle**, you can invert the formulae.

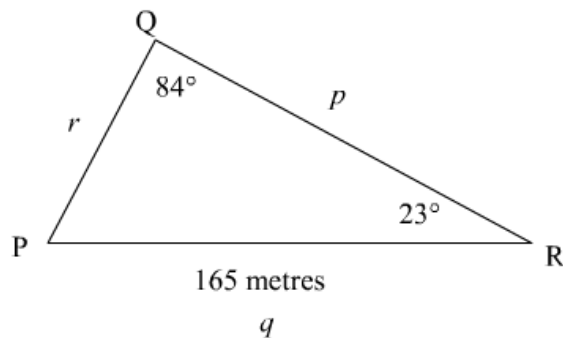
e.g.  $\frac{\sin A}{a} = \frac{\sin B}{b}$  or  $\frac{\sin A}{a} = \frac{\sin C}{c}$  or  $\frac{\sin B}{b} = \frac{\sin C}{c}$

## Example

Find the length of PQ in triangle PQR

Use the **sine rule**

Tick what you have and what you want just as before



$$\frac{p}{\sin P} = \frac{q}{\sin Q} = \frac{r}{\sin R}$$

Use:  $\frac{q}{\sin Q} = \frac{r}{\sin R}$

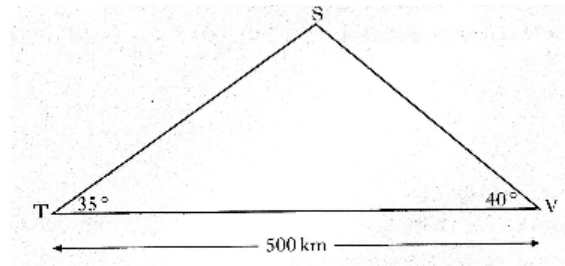
So,  $\frac{165}{\sin 84} = \frac{r}{\sin 23}$

and  $\frac{165 \times \sin 23}{\sin 84} = r$

thus  $r = 64.8$  metres (1 d.p.)

A TV signal is sent from a transmitter T, via a satellite S, to a village V, as shown in the diagram.

The village is 500 kilometres from the transmitter. The signal is sent out at an angle of  $35^\circ$  and is received in the village at an angle of  $40^\circ$ .



Calculate the height of the satellite above the ground.

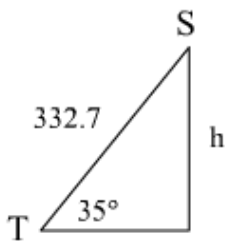
Use Sine Rule to find either side ST or SV

Then use SOH-CAH-TOA to find perpendicular height.

First find angle at S =  $180^\circ - (35^\circ + 40^\circ)$  S is  $105^\circ$

$$\frac{ST}{\sin 40} = \frac{500}{\sin 105}$$

$$ST = \frac{500 \sin 40}{\sin 105} \Rightarrow ST = 332.731\dots$$



$$\sin 35 = \frac{h}{332.7}$$

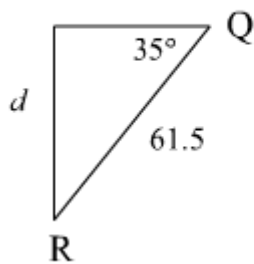
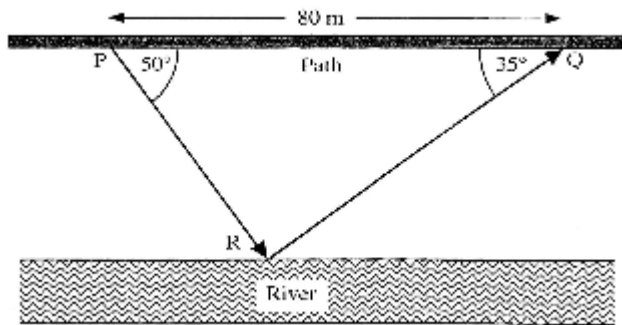
$$h = 332.7 \times \sin 35 = 190.828\dots$$

height of satellite = 190 km

The path in the diagram opposite runs parallel to the river.

Jennifer leaves the path at P, walks to the river to bathe her feet at R and rejoins the path further on at Q.

Calculate the distance between the river and the path.



Basically same as previous question

$\angle PRQ = 95^\circ$  Find RQ using sine rule

$$\frac{RQ}{\sin 50} = \frac{80}{\sin 95} \quad RQ = 61.5 \text{ metres}$$

Now use SOH-CAH-TOA to find distance

Let distance between river and path be  $d$  metres.

$$\sin 35 = \frac{d}{61.5} \quad \text{hence, } d = 35.3 \text{ metres}$$