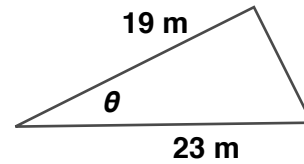
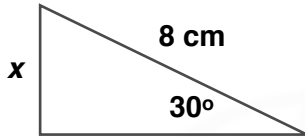


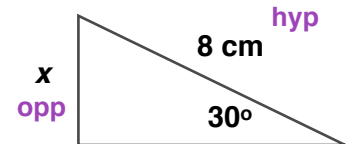
## Sine Rule

### Starter

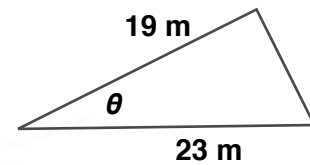
1. Both triangles are right-angled triangles. Give your answers to 3 s.f.  
 (a) Find the value of  $x$ . (b) Find the value of  $\theta$ .  
 Remember the Japanese word for trigonometry: **SOHCAHTOA**.



**Working:** (a) **Label the given and unknown side**  
**Choose which trig. ratio to use: sine**  
 $\sin 30 = \frac{x}{8}$   
 $x = 8 \sin 30 = 4 \text{ cm}$



(b) **Label the given sides**  
**Choose which trig. ratio to use: cos**  
 $\cos \theta = \frac{19}{23}$   
 $\theta = \cos^{-1} \frac{19}{23} = 34.3^\circ$



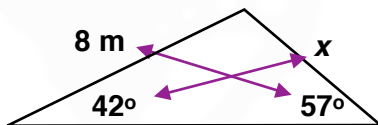
Finding angles: use  $\frac{\sin A}{a} = \frac{\sin B}{b}$

Finding sides: use  $\frac{a}{\sin A} = \frac{b}{\sin B}$

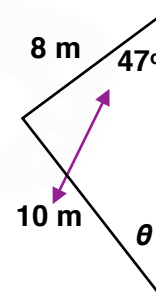
**N.B.** Always draw an arrow connecting an angle and its opposite side.  
 Always draw a diagram.

**E.g. 1** Find the marked side or angle:

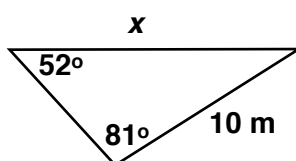
(a)



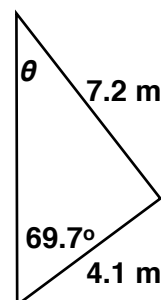
(b)



(c)



(d)



**Working:** (a) Finding a side so use  $\frac{a}{\sin A} = \frac{b}{\sin B}$

$$\frac{x}{\sin 42} = \frac{8}{\sin 57} \Rightarrow x = \frac{8 \sin 42}{\sin 57} = 6.38 \text{ m}$$

(b) Finding an angle so use  $\frac{\sin A}{a} = \frac{\sin B}{b}$

$$\frac{\sin \theta}{8} = \frac{\sin 47}{10} \Rightarrow \sin \theta = \frac{8 \sin 47}{10}$$

$$\theta = \sin^{-1}\left(\frac{8 \sin 47}{10}\right) = 35.8^\circ$$

(c) Draw arrows on your diagram connecting angles and opposite sides  
Finding a side so use  $\frac{a}{\sin A} = \frac{b}{\sin B}$

$$\frac{x}{\sin 81} = \frac{10}{\sin 52} \Rightarrow x = \frac{10 \sin 81}{\sin 52} = 12.5 \text{ m}$$

(d) Draw arrows on your diagram connecting angles and opposite sides

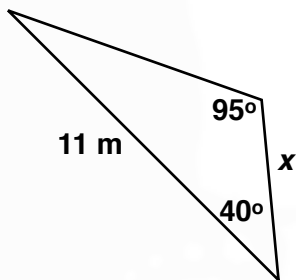
Finding an angle so use  $\frac{\sin A}{a} = \frac{\sin B}{b}$

$$\frac{\sin \theta}{4.1} = \frac{\sin 69.7}{7.2} \Rightarrow \sin \theta = \frac{4.1 \sin 69.7}{7.2}$$

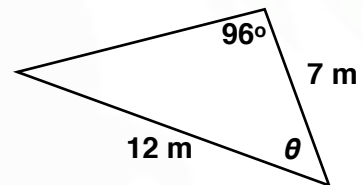
$$\theta = \sin^{-1}\left(\frac{4.1 \sin 69.7}{7.2}\right) = 32.3^\circ$$

**E.g. 2** Find the marked side or angle:

(a)



(b)



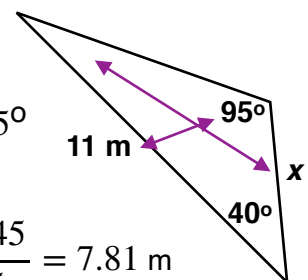
**Working:**

(a) The unknown side is not opposite a known angle.

Angle opposite  $x$  is  $180 - 95 - 40 = 45^\circ$

Finding a side:

$$\frac{x}{\sin 45} = \frac{11}{\sin 95} \Rightarrow x = \frac{11 \sin 45}{\sin 95} = 7.81 \text{ m}$$



- (b) The unknown angle,  $\theta$ , does not have a known side opposite it.  
Therefore, calculate the angle opposite 7 first.

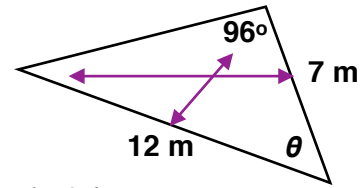
Let the angle opposite 7 be  $x$ .

Finding an angle:  $\frac{\sin A}{a} = \frac{\sin B}{b}$

$$\frac{\sin x}{7} = \frac{\sin 96}{12} \Rightarrow \sin x = \frac{7 \sin 96}{12}$$

$$x = \sin^{-1}\left(\frac{7 \sin 96}{12}\right) = 35.46^\circ$$

$$\theta = 180 - 96 - 35.46 = 48.5^\circ \text{ (3 s.f.)}$$



**E.g. 3** A triangular piece of metal PQR is such that  $\angle RPQ = 61^\circ$ , length QR = 13.1 mm and length PQ = 7.2 mm. Find the size of  $\angle PQR$ , correct to 1 dp.

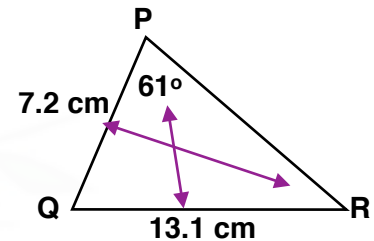
**Working:** Draw a diagram and include the arrows.

Finding an angle:  $\frac{\sin A}{a} = \frac{\sin B}{b}$

$$\frac{\sin Q}{7.2} = \frac{\sin 61}{13.1} \Rightarrow \sin Q = \frac{7.2 \sin 61}{13.1}$$

$$Q = \sin^{-1}\left(\frac{7.2 \sin 61}{13.1}\right) = 90.3^\circ$$

$$\angle PQR = 90.3^\circ \text{ (1 d.p.)}$$



Video:  
Video:  
Video:

[Sine rule \(finding sides\)](#)  
[Sine rule \(finding angles\)](#)  
[Sine rule \(ambiguous case\)](#)

[Solutions to Starter and E.g.s](#)

### Exercise

9-1 class textbook:	p579 E18.1 Qu 1-6
A*-G class textbook:	p539 E18.1 Qu 1-6
9-1 homework book:	p195 E18.1 Qu 1-9
A*-G homework book:	p149-150 E18.1 Qu 1-8

[Homework book answers \(only available during a lockdown\)](#)