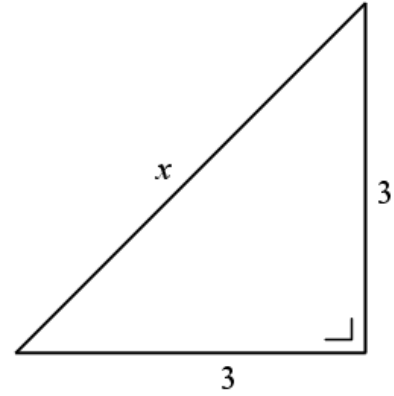


Question 1

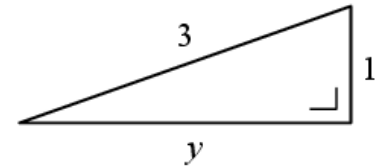
- (i) Use the diagram on the right to calculate the value of  $x$ .  
Give your answer in surd form.

$x = \sqrt{3^2 + 3^2}$ $= \sqrt{18} \text{ or } 3\sqrt{2}$	<p><i>Or:</i></p> $\sin 45^\circ = \frac{3}{x}$ $\frac{1}{\sqrt{2}} = \frac{3}{x}$ $x = 3\sqrt{2}$
--	--



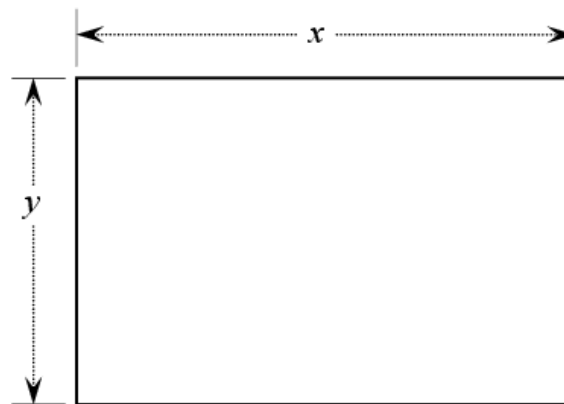
- (ii) Use the diagram below to calculate the value of  $y$ . Give your answer in surd form.

$y = \sqrt{3^2 - 1^2} = \sqrt{8} \text{ or } 2\sqrt{2}.$
--



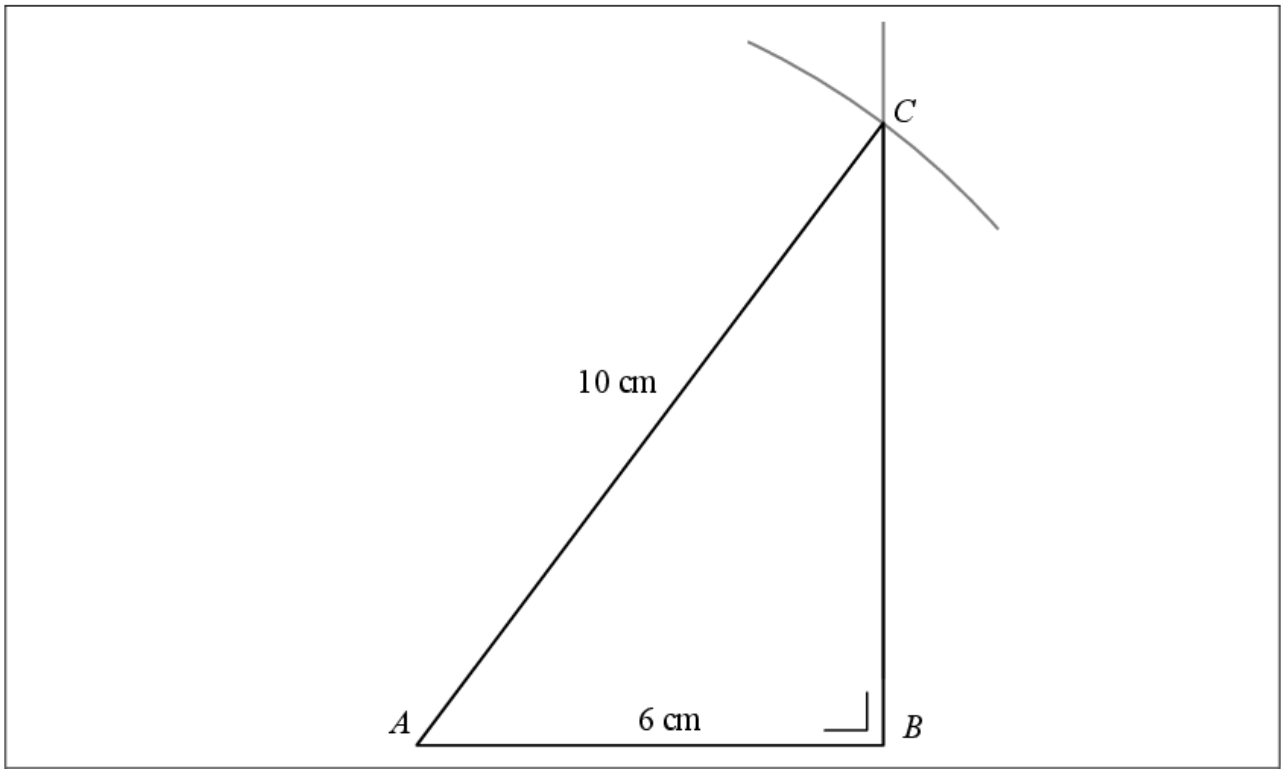
- (iii) A rectangle with sides of length  $x$  and  $y$  is drawn using the values of  $x$  and  $y$  from parts (i) and (ii), as shown below.

Write the **perimeter** of this rectangle in the form  $a\sqrt{2}$ , where  $a \in \mathbb{N}$ .



$\begin{aligned} \text{Perimeter} &= 2x + 2y \\ &= 2\sqrt{18} + 2\sqrt{8} \\ &= 2(3\sqrt{2}) + 2(2\sqrt{2}) \\ &= 10\sqrt{2}. \end{aligned}$
--

Question 2



*Note: It is also possible to work out the length of the third side,  $[BC]$ , using the Theorem of Pythagoras, and then construct  $[BC]$  and  $[AC]$ .*

- (ii) On your diagram, measure the angle  $\angle CAB$ . Give your answer correct to the nearest degree.

$$|\angle CAB| = \boxed{53^\circ}$$

- (iii) Let  $X$  be the whole number you wrote as your answer to (ii).

Use a calculator to find  $\cos X$ . Give your answer correct to 3 decimal places.

$$\cos(53^\circ) = 0.6018\dots = 0.602, \text{ correct to three decimal places.}$$

- (iv) Jacinta says that  $\cos(\angle CAB)$  is exactly 0.6, because  $\cos(\angle CAB) = \frac{\text{adjacent}}{\text{hypotenuse}}$ .

Explain why your answer in (iii) is **not** the same as Jacinta's.

$$\text{They are not the same because } |\angle CAB| = \cos^{-1}\left(\frac{6}{10}\right) = 53.1301\dots^\circ.$$

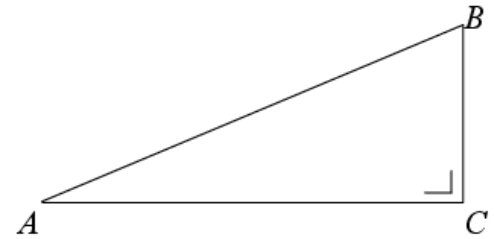
So if  $X$  is a whole number then  $\cos X$  can never be exactly 0.6.

Question 3

In the triangle  $ABC$ ,  $|AB| = 2$  and  $|BC| = 1$ .

(a) Find  $|AC|$ , giving your answer in surd form.

$$\begin{aligned} h^2 &= a^2 + b^2 \\ 2^2 &= |AC|^2 + 1^2 \\ \Rightarrow |AC| &= \sqrt{2^2 - 1^2} = \sqrt{3} \end{aligned}$$



(b) Write  $\cos \angle BAC$  and hence find  $|\angle BAC|$ .

$$\begin{aligned} \cos \angle BAC &= \frac{\sqrt{3}}{2} \\ |\angle BAC| &= 30^\circ \end{aligned}$$

(c) Sketch a right angled isosceles triangle in which the equal sides are 1 unit each and use it to write  $\cos 45^\circ$  in surd form.

$$\begin{aligned} \text{Hypotenuse} &= \sqrt{1^2 + 1^2} = \sqrt{2} \\ \cos 45^\circ &= \frac{1}{\sqrt{2}} \end{aligned}$$

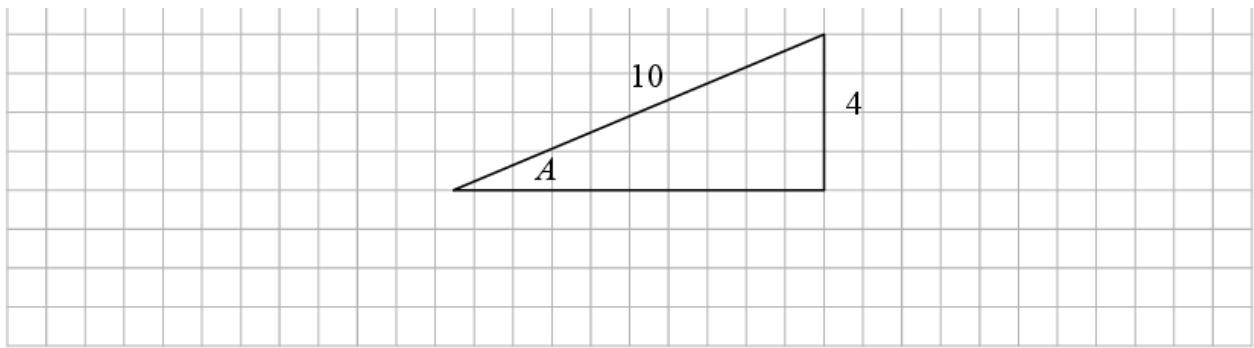
(d) Show that  $\cos 75^\circ \neq \cos 45^\circ + \cos 30^\circ$ .

$$\begin{aligned} \cos 75^\circ &= \frac{\sqrt{6} - \sqrt{2}}{4} = 0.2588 \\ \cos 45^\circ + \cos 30^\circ &= \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} = 0.7071 + 0.8660 = 1.5731 \\ (0.2588 &\neq 1.5731) \end{aligned}$$

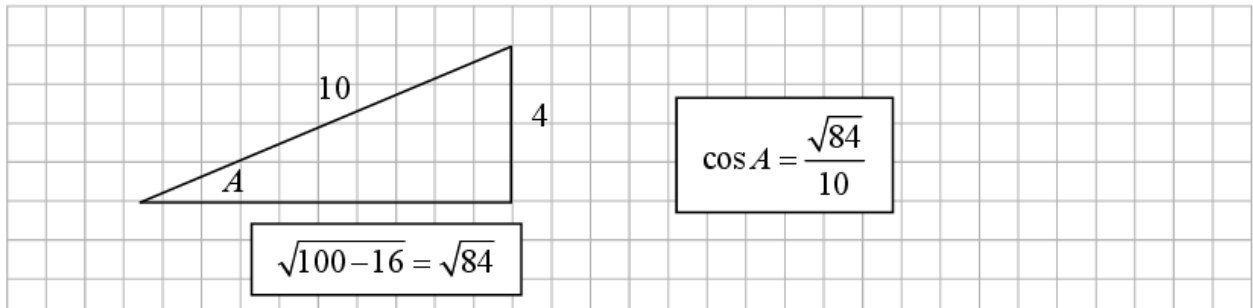
Question 4

$$\begin{aligned} \tan \theta &= \frac{32}{63} & \text{or} & & \tan \alpha &= \frac{63}{32} \\ \Rightarrow \theta &= 26.9277 & & & \Rightarrow \alpha &= 63.0723 \\ \Rightarrow \theta &= 26^\circ 55' 39.64'' & & & \Rightarrow \theta &= 90 - 63.0723 \\ &= 26^\circ 56' & & & &= 26.9277 \\ & & & & &= 26^\circ 55' 39.64'' \\ & & & & &= 26^\circ 56' \end{aligned}$$

Question 5



(b) Find, from your triangle,  $\cos A$  in surd form.



Question 6

$$\text{Ramp} = \sqrt{30^2 + 105^2}$$

$$= 109.2 \text{ cm}$$

OR

$$H^2 = 35^2 + 10^2$$

$$H = \sqrt{1225 + 100}$$

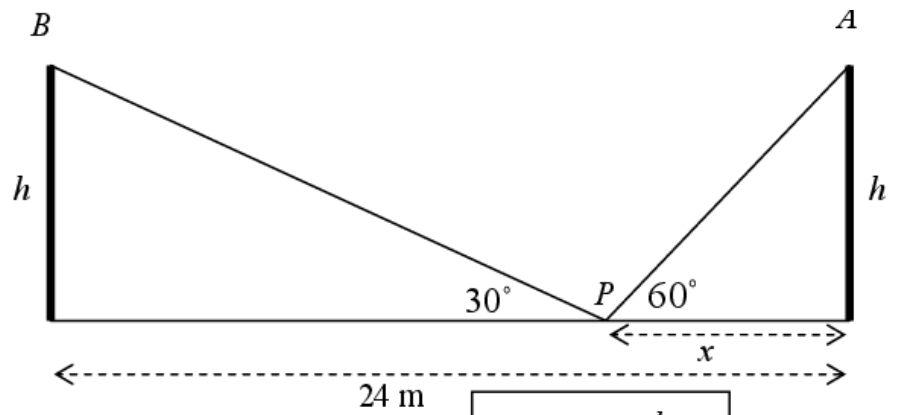
$$H = \sqrt{1325}$$

$$\text{Ramp} = 3 \times H$$

$$\text{Ramp} = 3 \times \sqrt{1325}$$

$$\text{Ramp} = 109.2 \text{ cm}$$

Question 7



(a) Write  $h$  in terms of  $x$ .

$$\tan 60^\circ = \frac{h}{x}$$

$$\sqrt{3} = \frac{h}{x}$$

$$h = \sqrt{3} x$$

$$\tan 60^\circ = \frac{h}{x}$$

$$1.732 = \frac{h}{x}$$

$$h = 1.732 x$$

$$\tan 30^\circ = \frac{h}{24 - x}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{24 - x}$$

$$h = \frac{24 - x}{\sqrt{3}}$$

(b) From  $P$  the angle of elevation to the top of pole  $B$  is  $30^\circ$ . Find  $h$ , the height of the two poles.

$$\tan 30^\circ = \frac{h}{24 - x}$$

$$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}x}{24 - x}$$

$$3x = 24 - x$$

$$4x = 24$$

$$x = 6$$

$$h = 6\sqrt{3} \text{ m}$$

$$\tan 30^\circ = \frac{h}{24 - x}$$

$$\frac{1}{1.732} = \frac{1.732x}{24 - x}$$

$$3x = 24 - x$$

$$4x = 24$$

$$x = 6$$

$$h = 6\sqrt{3} \text{ m or } 6(1.732)\text{m} = 10.39 \text{ m}$$