

SEC SET D: PAPER 2

QUESTION 8 (75 MARKS)

Question 8 (a)

Two surveyors want to find the height of an electricity pylon. There is a fence around the pylon that they cannot cross for safety reasons. The ground is inclined at an angle. They have a clinometer (for measuring angles of elevation) and a 100 metre tape measure. They have already used the clinometer to determine that the ground is inclined at 10° to the horizontal.



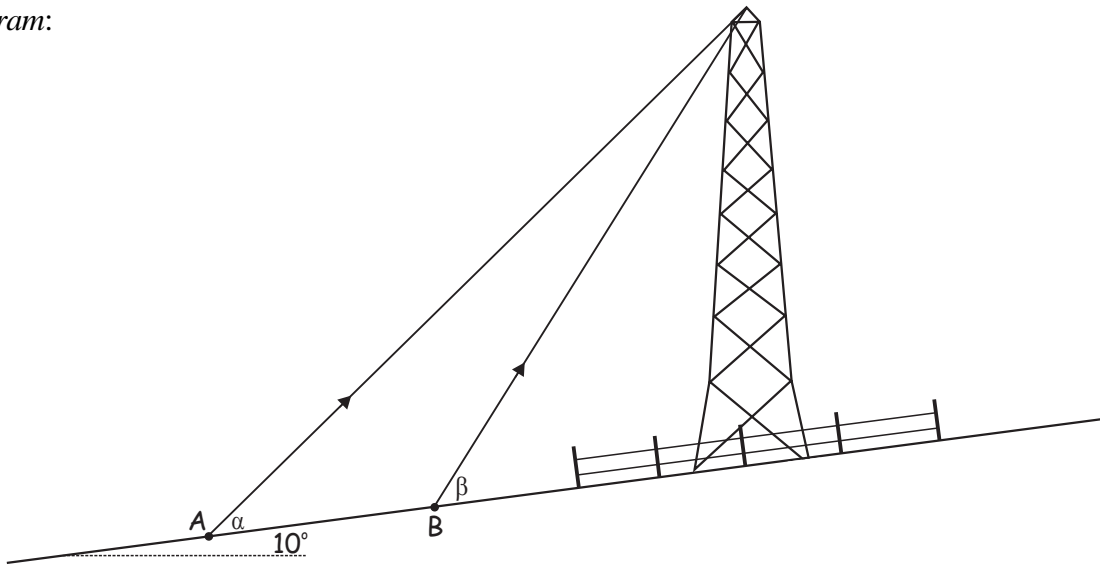
Question 8 (a) (i)

Explain how you would find the height of the pylon.

Your answer should be illustrated on the diagram below. Show the points where you think they should take measurements, write down clearly what measurements they should take, and outline briefly how these can be used to find the height of the pylon.

SOLUTION

Diagram:



Measurements to be taken:

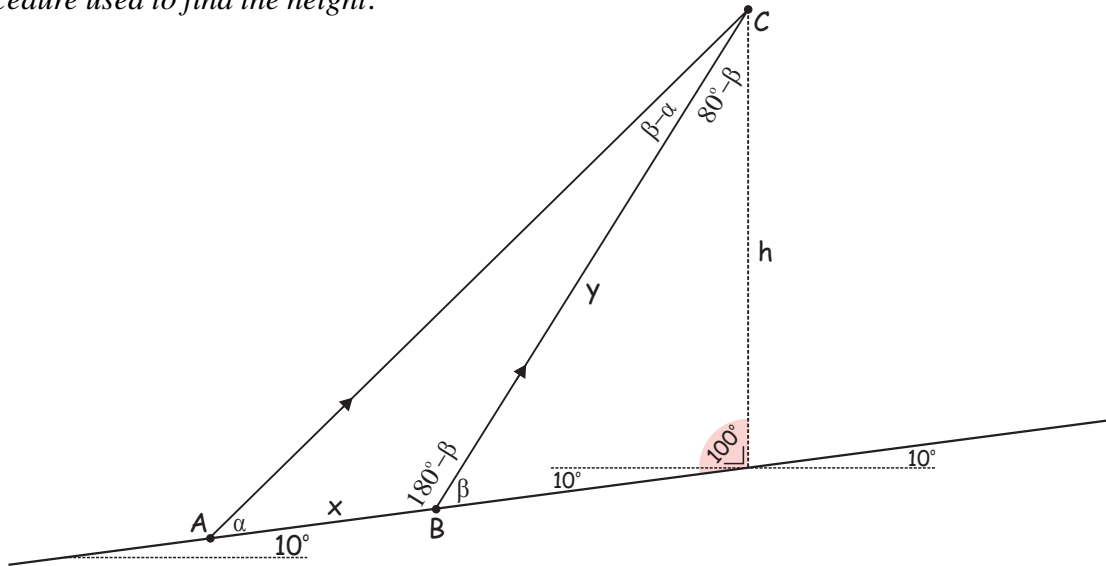
Go to point *A* and using the clinometer measure the angle of elevation α to the top of the pylon.

[NOTE: As you are standing on a 10° slope you need to subtract 10° from your clinometer reading.]

Go to point *B* and measure the angle of elevation β .

Using the measuring tape measure the distance $|AB|$. Call this distance x .

Procedure used to find the height:



Let $|BC| = y$. Use the Sine Rule on the left hand triangle to get an expression for y .

$$\frac{y}{\sin \alpha} = \frac{x}{\sin(\beta - \alpha)} \Rightarrow y = \frac{x \sin \alpha}{\sin(\beta - \alpha)} \quad \boxed{\frac{a}{\sin A} = \frac{b}{\sin B}}$$

Use the Sine Rule on the right hand triangle to get an expression for h .

$$\frac{h}{\sin \beta} = \frac{y}{\sin 100^\circ}$$

$$\therefore h = \frac{y \sin \beta}{\sin 100^\circ} = \frac{x \sin \alpha \sin \beta}{\sin(\beta - \alpha) \sin 100^\circ}$$

Question 8 (a) (ii)

Write down possible values for the measurements taken, and use them to show how to find the height of the pylon. (That is, find the height of the pylon using your measurements, and showing your work.)

SOLUTION

$$x = 10 \text{ m}, \alpha = 30^\circ, \beta = 45^\circ$$

$$h = \frac{x \sin \alpha \sin \beta}{\sin(\beta - \alpha) \sin 100^\circ} = \frac{10 \sin 30^\circ \sin 45^\circ}{\sin 15^\circ \sin 100^\circ} = 13.9 \text{ m}$$