11 B

Trigonometry

Exercise 2.7 – Modelling and Problem Solving

Question 14:

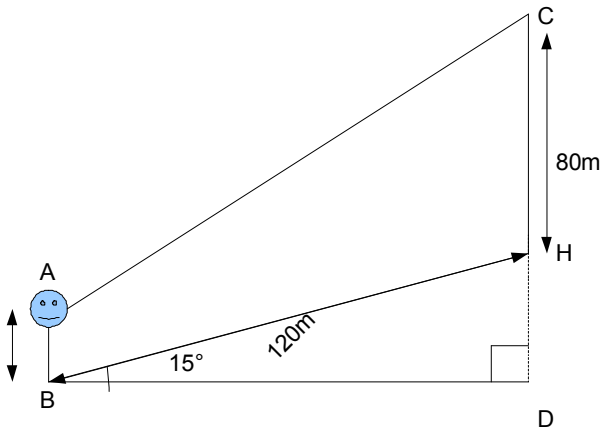
A person whose eye level is 1.8m from the ground stands at the base of a road that is at a constant incline of 15° to the horizontal. There is a building 80m tall at a distance of 120m from the base of the road where the person is standing, as measured along the road.

a) Find the vertical distance that the base of the building is above the ground where the person standing.

b) Calculate the angle of elevation of the top of the building from the person's eye.

14a)

Solution



Finding DH

In ΔBDH:

$$\sin 15^\circ = \frac{DH}{120}$$

So:

$DH = 120 \times \sin 15^\circ$ Cross multiplying

$= 31.0582...$

$DH \approx 31m$ Rounding off the answer

Answer: The base of the building is about 31 m above the ground where the person is standing.

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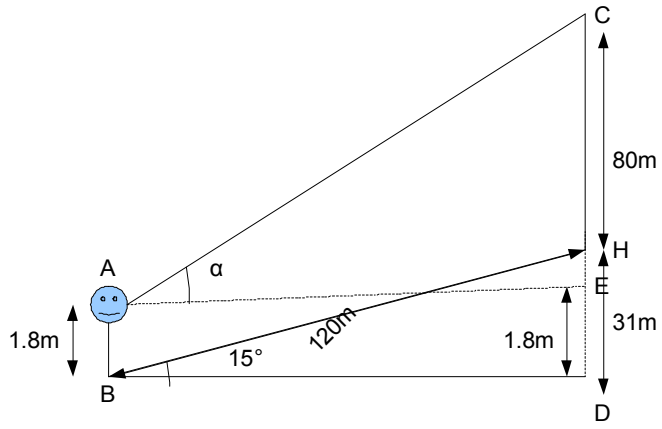
14b)

Solution



Finding α

31 m - 1.8 m = 29.2 m

In ΔBDH:

$$\cos 15^\circ = \frac{BD}{120}$$

BD = 115.91109...

BD ≈ 116m

AE = BD

= 116m

AEDB is a rectangle so opposite sides are equal

EC = 80 + 31 -1.8

= 109.2m

In ΔACE:

$$\tan \alpha = \frac{109.2}{116}$$

You do not need to calculate tan α at this stage

$$\alpha = \tan^{-1}\left(\frac{109.2}{116}\right)$$

α = 43° 17'

Answer: The angle of elevation of the top of the building from the person's eye is 43° 17'.