5. The fixed points X and Y lie on horizontal ground.

At time $t = 0$, a particle P is projected from X with speed $u\,\text{m s}^{-1}$ at angle θ to the ground.

Particle P moves freely under gravity and first hits the ground at Y.

(a) Show that $XY = \dfrac{u^2 \sin 2\theta}{g}$

(6)

The points A and B lie on horizontal ground. A vertical pole CD has length 5 m. The end C is fixed to the ground between A and B, where $AC = 12\,\text{m}$.

At time $t = 0$, a particle Q is projected from A with speed $20\ \text{m s}^{-1}$ at 60° to the ground.

Particle Q moves freely under gravity, passes over the pole and first hits the ground at B, as shown in Figure 4.

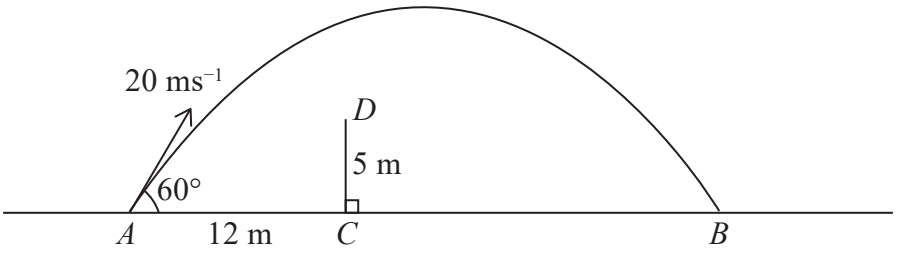


Figure 4

(b) Find the distance CB.

(2)

(c) Find the height of Q above D at the instant when Q passes over the pole.

(4)

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Question 5 continued

(Total for Question 5 is 12 marks)