7: A small stone is projected from a point O on horizontal ground.

The stone is projected with speed $20\,\text{m s}^{-1}$ at an angle α to the ground.

When the stone is 11 m above the ground

- the vertical velocity component of the stone has magnitude $V\,\text{m s}^{-1}$
- the horizontal velocity component of the stone has magnitude $2V\,\text{m s}^{-1}$

In a model of the motion

- the stone is modelled as a particle moving freely under gravity
- **the acceleration due to gravity is modelled as being $10\,\text{m s}^{-2}$**

Using the model and the principle of conservation of mechanical energy,

(a) show that $V = 6$

(4)

Figure 3 shows a plane fixed to the ground at an angle of 60°

The stone hits this plane at the point A.

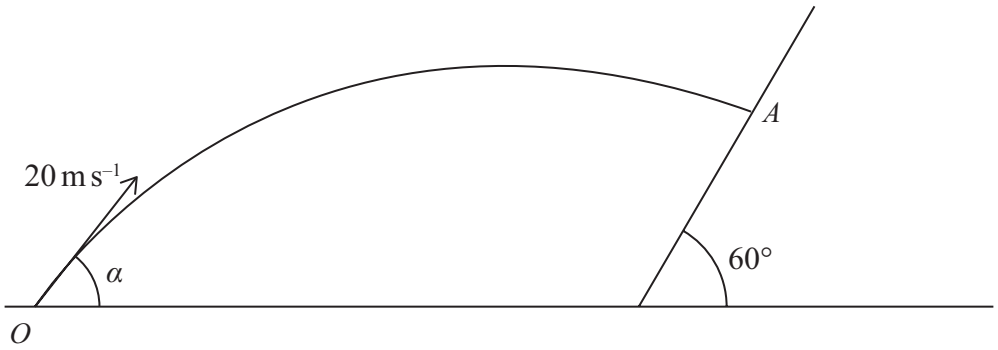


Figure 3

The direction of the motion of the stone is perpendicular to the plane at the instant the stone hits A.

Using the model,

(b) find the height of A above the ground, giving your answer to 2 significant figures.

(6)

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(Total for Question 7 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS

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