

1.

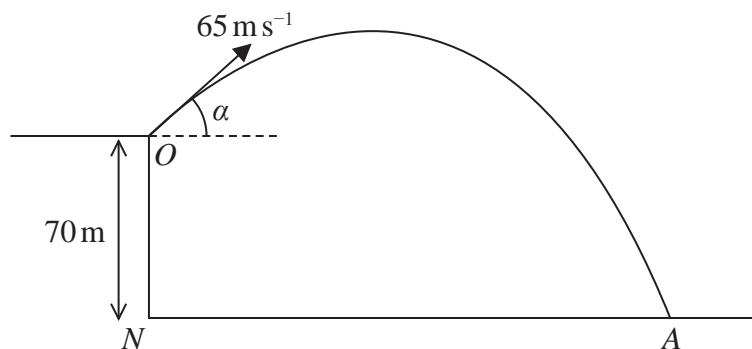


Figure 3

A small stone is projected with speed 65 m s^{-1} from a point O at the top of a vertical cliff.

Point O is 70 m vertically above the point N .

Point N is on horizontal ground.

The stone is projected at an angle α above the horizontal, where $\tan \alpha = \frac{5}{12}$

The stone hits the ground at the point A , as shown in Figure 3.

The stone is modelled as a particle moving freely under gravity.

The acceleration due to gravity is modelled as having magnitude 10 m s^{-2}

Using the model,

(a) find the time taken for the stone to travel from O to A , (4)

(b) find the speed of the stone at the instant just before it hits the ground at A . (5)

One limitation of the model is that it ignores air resistance.

(c) State one other limitation of the model that could affect the reliability of your answers. (1)



3.

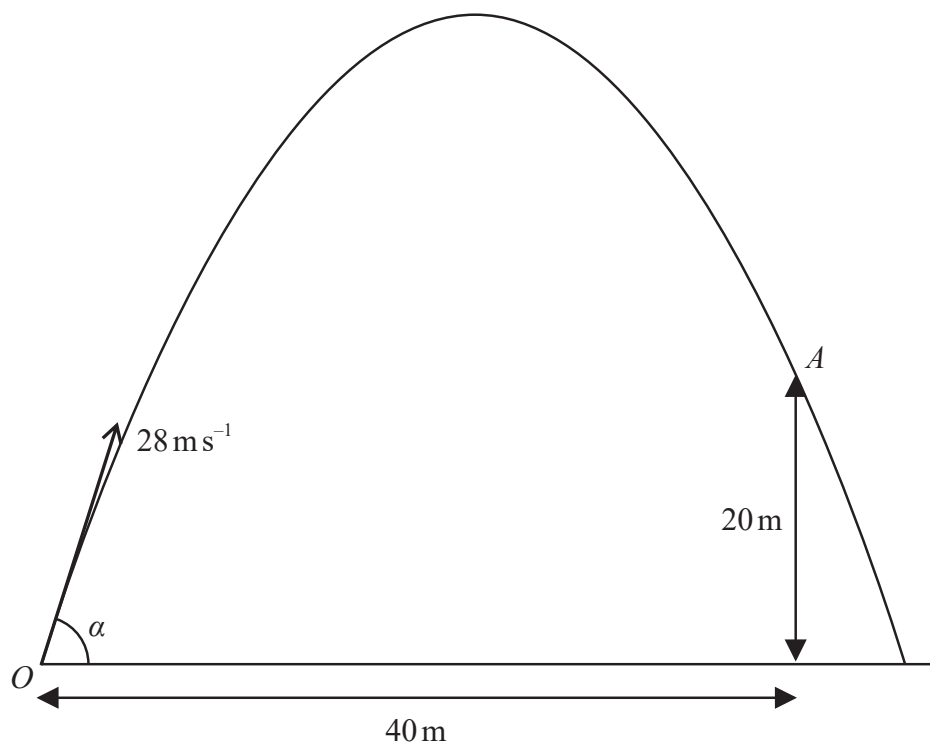


Figure 2

A small ball is projected with speed 28 m s^{-1} from a point O on horizontal ground.

After moving for T seconds, the ball passes through the point A .

The point A is 40 m horizontally and 20 m vertically from the point O , as shown in Figure 2.

The motion of the ball from O to A is modelled as that of a particle moving freely under gravity.

Given that the ball is projected at an angle α to the ground, use the model to

(a) show that $T = \frac{10}{7 \cos \alpha}$ (2)

(b) show that $\tan^2 \alpha - 4 \tan \alpha + 3 = 0$ (5)

(c) find the greatest possible height, in metres, of the ball above the ground as the ball moves from O to A . (3)

The model does not include air resistance.

(d) State one other limitation of the model. (1)

