Motion of a Projectile

Question Paper 8

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Motion of a Projectile
Sub Topic	
Booklet	Question Paper 8

Time Allowed: **56 minutes**

Score: **/46**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 A particle is projected with speed $65\,\text{m s}^{-1}$ from a point on horizontal ground, in a direction making an angle of α° above the horizontal. The particle reaches the ground again after 12 s. Find

(i) the value of α, [3]

(ii) the greatest height reached by the particle, [2]

(iii) the length of time for which the direction of motion of the particle is between 20° above the horizontal and 20° below the horizontal, [5]

(iv) the horizontal distance travelled by the particle in the time found in part **(iii)**. [1]

2 A stone is projected horizontally with speed $8\,\text{m s}^{-1}$ from a point O at the top of a vertical cliff. The horizontal and vertically upward displacements of the stone from O are x m and y m respectively.

(i) Find the equation of the stone's trajectory. [2]

The stone enters the sea at a horizontal distance of 24 m from the base of the cliff.

(ii) Find the height above sea level of the top of the cliff. [2]

3 A stone is projected from a point on horizontal ground with speed $25\,\text{m s}^{-1}$ at an angle θ above the horizontal, where $\sin\theta = \frac{4}{5}$. At time 1.2 s after projection the stone passes through the point A. Subsequently the stone passes through the point B, which is at the same height above the ground as A. Find the horizontal distance AB. [5]

4 An object of mass 0.4 kg is projected vertically upwards from the ground, with an initial speed of $16\,\text{m s}^{-1}$. A resisting force of magnitude $0.1v$ newtons acts on the object during its ascent, where $v\,\text{m s}^{-1}$ is the speed of the object at time t s after it starts to move.

(i) Show that $\frac{\text{d}v}{\text{d}t} = -0.25(v + 40)$. [2]

(ii) Find the value of t at the instant that the object reaches its maximum height. [5]

5 A stone is projected from a point O on horizontal ground with speed V m s^{-1} at an angle θ above the horizontal, where $\sin\theta = \frac{3}{5}$. The stone is at its highest point when it has travelled a horizontal distance of 19.2 m.

(i) Find the value of V. [3]

After passing through its highest point the stone strikes a vertical wall at a point 4 m above the ground.

(ii) Find the horizontal distance between O and the wall. [4]

At the instant when the stone hits the wall the horizontal component of the stone's velocity is halved in magnitude and reversed in direction. The vertical component of the stone's velocity does not change as a result of the stone hitting the wall.

(iii) Find the distance from the wall of the point where the stone reaches the ground. [4]

6 A particle is projected from horizontal ground with speed u m s^{-1} at an angle of $\theta°$ above the horizontal. The greatest height reached by the particle is 10 m and the particle hits the ground at a distance of 40 m from the point of projection. In either order,

(i) find the values of u and θ,

(ii) find the equation of the trajectory, in the form $y = ax - bx^2$, where x m and y m are the horizontal and vertical displacements of the particle from the point of projection.

[7]