

# Motion of a Projectile

## Question Paper

Level	Pre U
Subject	Maths
Exam Board	Cambridge International Examinations
Topic	Mechanics- Motion of a Projectile
Booklet	Question Paper

**Time Allowed:** 30 minutes

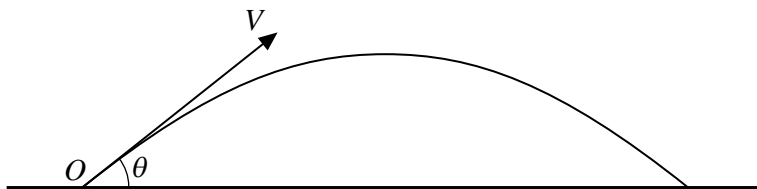
**Score:** /25

**Percentage:** /100

**Grade Boundaries:**

- 1 A stone is projected vertically upwards from ground level at a speed of  $30 \text{ m s}^{-1}$ . It is assumed that there is no wind or air resistance. Find the maximum height it reaches and the total time it takes from its projection to its return to ground level. [5]
- 2 A particle is projected from a point  $O$  with initial speed  $U$  at an angle  $\theta$  above the horizontal. At time  $t$  after projection the position of the particle is  $(x, y)$  relative to horizontal and vertical axes through  $O$ .
- (i) Write down expressions for  $x$  and  $y$  at time  $t$ . Hence derive the cartesian equation of the trajectory of the particle. [4]
  - (ii) A player in a cricket match throws the ball with speed  $30 \text{ m s}^{-1}$  to another player who is 45 metres away. Assume that the players throw and catch the ball at the same height above the ground. Show that there are two possible trajectories and find their respective angles of projection. [4]
  - (iii) Describe briefly one advantage of each trajectory. [2]

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A projectile is fired from a point  $O$  in a horizontal plane, with initial speed  $V$ , at an angle  $\theta$  to the horizontal (see diagram).

- (i) Show that the range of the projectile on the horizontal plane is

$$\frac{2V^2 \sin \theta \cos \theta}{g}. \quad [4]$$

There are two vertical walls, each of height  $h$ , at distances 30 m and 70 m, respectively, from  $O$  with bases on the horizontal plane. The value of  $\theta$  is  $45^\circ$ .

- (ii) If the projectile just clears both walls, state the range of the projectile. [1]
- (iii) Hence find the value of  $V$  and of  $h$ . [5]