

- (a) By differentiating the equation of the trajectory or otherwise, find the coordinates of A . [5]

1

[3]

- (b) Find the speed of P immediately before it collides with the barrier.

Given that the coefficient of restitution between the barrier and the particle is $\frac{1}{9}$, find the horizontal distance travelled by P after it strikes the barrier. [4]

Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

③

- 4 A particle Q is initially positioned at a distance d vertically above a particle P . Particle P is projected with speed U at an angle α above the horizontal. At the same time, Q is projected at an angle β below the horizontal. Both particles move freely under gravity. The particles collide at time T after the projections.

- (a) Show that $d = UT(\sin \alpha + \cos \alpha \tan \beta)$. [4]

[illegible]

④

(b) Given that $\alpha = 30^\circ$ and $\beta = 60^\circ$, find d in terms of U and g .

[3]

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- 2

- (a)

$$y = 2x - \frac{25x^2}{u^2}.$$

[1]

- (b)

Find the set of possible values of D .

[5]

- 2 A particle P is projected with speed 24 m s^{-1} at an angle θ° above the horizontal from a point O on a horizontal plane, and moves freely under gravity. At a horizontal distance 35 m from O , there is a vertical wall of height 10 m which is perpendicular to the vertical plane of motion of P .

- (a) Determine the two values of θ for which P just clears the wall. [4]

- (b) Given that P clears the wall, find the minimum distance from point O where P can land. [2]

7 A particle P is projected from a point O with speed U at an angle 45° above the horizontal and moves freely under gravity.

- (a) State the vertical and horizontal components of velocity at time t . [1]

At time T , particle P is moving at an angle of 60° below the horizontal.

- (b) Show that $T = \frac{U}{2g}(\sqrt{2} + \sqrt{6})$. [3]

At time T , the particle strikes a smooth horizontal plane at a point which is a horizontal distance D from O and a vertical distance H below O .

- (c) Find the ratio $H : D$. [4]

After striking the horizontal plane, P rebounds with speed w . The coefficient of restitution between P and the plane is $\frac{2}{3}$.

- (d) Find w in terms of U . [3]

For the answer to any question, the question number must be clearly

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