

- 7 A particle P is projected with speed u at an angle θ above the horizontal from a point O on a horizontal plane and moves freely under gravity. The horizontal and vertical displacements of P from O at a subsequent time t are denoted by x and y respectively.

- (a) Use the equation of the trajectory given in the List of formulae (MF19), together with the condition $y = 0$, to establish an expression for the range R in terms of u , θ and g . [2]

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- (b) Deduce an expression for the maximum height H , in terms of u , θ and g . [2]

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It is given that $R = \frac{4H}{\sqrt{3}}$.

- (c) Show that $\theta = 60^\circ$. [1]

It is given also that $u = \sqrt{40} \text{ m s}^{-1}$.

- (d) Find, by differentiating the equation of the trajectory or otherwise, the set of values of x for which the direction of motion makes an angle of less than 45° with the horizontal. [4]

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