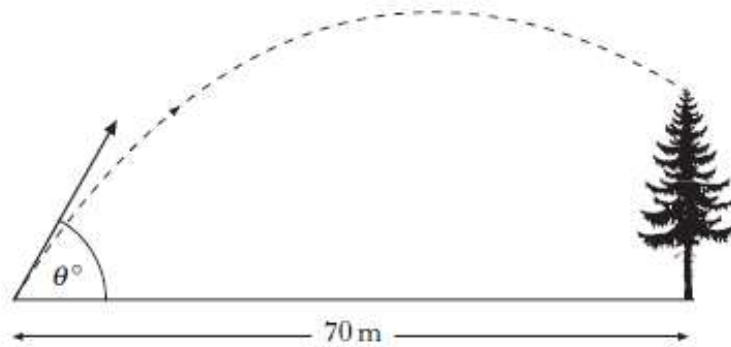


Homework 4

- 1) A golfer strikes a golf ball on a horizontal range, projecting the ball with speed 30 m s^{-1} at an angle θ° to the horizontal. After 3 seconds, the ball hits the top of a tree, which is situated at a horizontal distance of 70 metres from the point of projection.



Calculate the height of the tree.

4

- 2) On a horizontal cricket field, a batsman strikes a cricket ball towards a fielder standing 40 metres away. The ball is projected from ground level at an angle θ° to the horizontal, where $\tan \theta^\circ = \frac{3}{4}$, and is caught by the fielder when it is 2 metres above the ground, without having hit the ground first.

Calculate the speed with which the ball leaves the bat.

5

- 3) The greatest height reached by a projectile is one tenth of its range on horizontal ground. Calculate the angle of projection.

5

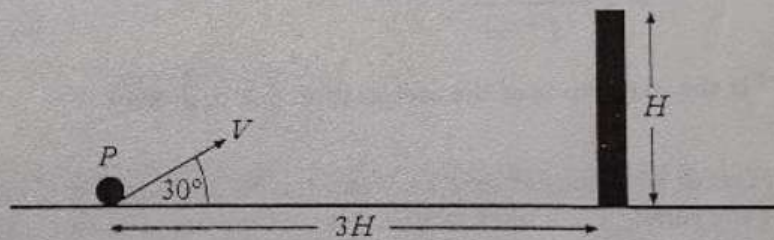
- 4) A golfer strikes a golf ball from O across a horizontal section of ground, giving the ball an initial speed of $V \text{ m s}^{-1}$ at an angle α to the horizontal.
- (a) Show that the range, R metres, of the golf ball is given by

$$R = \frac{V^2}{g} \sin 2\alpha. \quad 4$$

- (b) The golfer intends the ball to land between two points A and B on the horizontal section such that $OA = L$ metres, $OB = 2L$ metres and OAB is a straight line.
- Given that the angle of projection of the ball is 15° , show that the initial speed must satisfy

$$\sqrt{2} < \frac{V}{\sqrt{gL}} < 2. \quad 3$$

- 5) A football is kicked towards a wall from a point P on a horizontal playing field. The initial speed given to the ball is $V \text{ m s}^{-1}$ at an angle of 30° to the horizontal, as shown below. The wall is a horizontal distance $3H$ metres from the point P , where H is the height of the wall in metres.



Treating the ball as a particle, show that the ball goes over the wall if

$$V > \sqrt{\frac{6gH}{\sqrt{3}-1}},$$

where $g \text{ m s}^{-2}$ is the magnitude of the acceleration due to gravity.