

Topic 19: Exercises on Harder 3 Projectile Motion
Level 1, Part 2

1. A projectile is fired with speed V at an angle of elevation α from a point O and hits a stationary target at a distance d from O on the same level. Find the value of V .

$$\left(\frac{dg}{\sin 2\alpha} \right)^{1/2}$$

2. A projectile is fired with speed V at an angle of elevation α from a point O . At the instant of projection the target is fired from a point at a distance d from O on the same level with speed u and angle of elevation β in the plane of the path of the projectile and away from O . Given that the projectile hits the target, find the time at which this occurs.

$$\frac{d \sin \alpha}{U} \cdot \frac{1}{\sin(\beta - \alpha)}$$

3. A and B are two points on level ground 110 m apart. A particle is projected from A towards B with speed 60 ms^{-1} at an angle of elevation of 30° . At the same instant another particle is projected from B towards A with speed 50 ms^{-1} . Given that the two particles collide, find

(a) the angle of projection of the second particle;

$$\tan^{-1} \frac{3}{4}$$

(b) the time of collision.

$$3\sqrt{3} - 4\text{ s}$$

4. A particle is projected from a point O with speed v at an angle of elevation α . After a time t , where $t < \frac{v \sin \alpha}{g}$, the angle of elevation of the particle from O is θ and the angle which the direction of the velocity makes with the horizontal is ϕ . Show that $2 \tan \theta = \tan \phi + \tan \alpha$.

5. Two particles are projected simultaneously from a point O with speeds U and V and angles of elevation α and β respectively. Show that at any time t during their flight, the line joining them is inclined at an angle θ to the horizontal, where $\tan \theta = \frac{U \sin \alpha - V \sin \beta}{U \cos \alpha - V \cos \beta}$.