6.4) Projectile motion formulae

Worked example

A particle is projected from a point with speed U at an angle of elevation α and moves freely under gravity. When the particle has moved a horizontal distance x, its height above the point of projection is y.

(a) Show that $y = x\tan\alpha - \frac{gx^2}{2u^2}(1+\tan^2\alpha)$

A particle is projected from a point O on a horizontal plane, with speed $14\ ms^{-1}$ at an angle of elevation α. The particle passes through a point B, which is at a horizontal distance of 16m from O and at a height of 4m above the plane.

(b) Find the two possible values of α, giving your answers to the nearest degree.

Your turn

A particle is projected from a point with speed U at an angle of elevation α and moves freely under gravity. When the particle has moved a horizontal distance x, its height above the point of projection is y.

(a) Show that $y = x\tan\alpha - \frac{gx^2}{2u^2}(1+\tan^2\alpha)$

A particle is projected from a point O on a horizontal plane, with speed $28\ ms^{-1}$ at an angle of elevation α. The particle passes through a point B, which is at a horizontal distance of 32m from O and at a height of 8m above the plane.

(b) Find the two possible values of α, giving your answers to the nearest degree.

a) Shown

b) $\alpha = 27°, 77°$ (nearest degree)