6D Deriving Formulae

1. A particle is projected from a point on a horizontal plane with an initial velocity U at an angle θ above the horizontal, and moves freely under gravity until it hits the plane at point B. Given that the acceleration due to gravity is g, find expressions for:

a) The time of flight, T

b) The range, R, on the horizontal plane

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

Show that:

$$y = x\tan\theta - \frac{gx^2}{2u^2}(1 + \tan^2\theta)$$

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

   Find the two possible values of θ, giving your answers to the nearest degree.

   (Use the formula we have just calculated)