5 A particle P is projected with speed $u\,\mathrm{m\,s}^{-1}$ at an angle of 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 $t\,$s are denoted by $x\,$m and $y\,$m respectively.

(a) Starting from the equation of the trajectory given in the List of formulae (MF19), show that

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

[1]

When $\theta = \tan^{-1}2$, P passes through the point with coordinates $(10, 16)$.

(b) Show that there is no value of θ for which P can pass through the point with coordinates $(18, 30)$.

[6]