3 (b) A particle is projected up an inclined plane with initial speed 80 m s^{-1}.
The line of projection makes an angle of $30°$ with the inclined plane and the plane is inclined at an angle θ to the horizontal.
The plane of projection is vertical and contains the line of greatest slope.
The particle strikes the plane at an angle of $\tan^{-1}\frac{2}{\sqrt{3}}$.

Find **(i)** the value of θ

(ii) the speed with which the particle strikes the plane.

(i) $r_j = 0$

$0 = 80\sin 30.t - \frac{1}{2}g\cos\theta.t^2$

$\Rightarrow \quad t = \dfrac{80}{g\cos\theta}$ — 5

$v_i = 80\cos 30 - g\sin\theta\left(\dfrac{80}{g\cos\theta}\right)$ — 5

$= 40\sqrt{3} - 80\tan\theta$

$v_j = 80\sin 30 - g\cos\theta\left(\dfrac{80}{g\cos\theta}\right)$ — 5

$= -40$

$\tan\ell = \dfrac{-v_j}{v_i}$

$\dfrac{2}{\sqrt{3}} = \dfrac{40}{40\sqrt{3} - 80\tan\theta}$

$\tan\theta = \dfrac{\sqrt{3}}{4} \quad \Rightarrow \quad \theta = 23.4°$ — 5

(ii) $v_i = 20\sqrt{3}$

$v_j = -40$ } — 5

$\text{speed} = \sqrt{(20\sqrt{3})^2 + (-40)^2}$

$= 20\sqrt{7}$ or $52.9\ \text{m s}^{-1}$ — 5

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