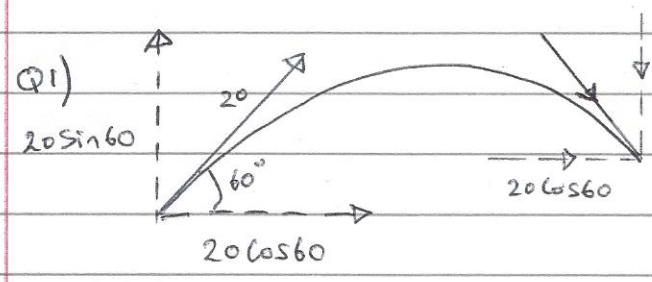
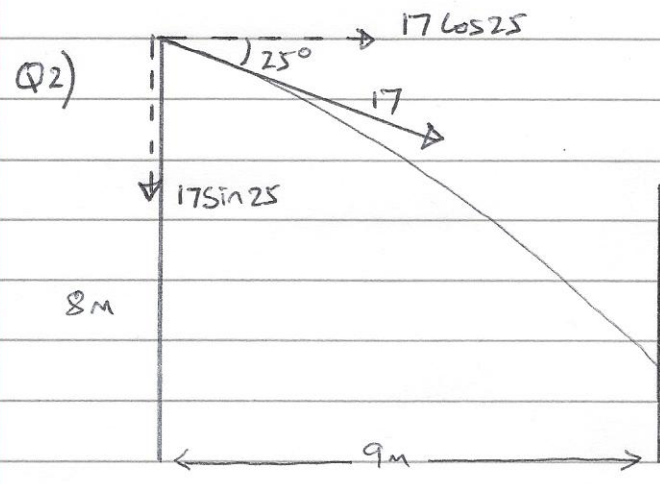
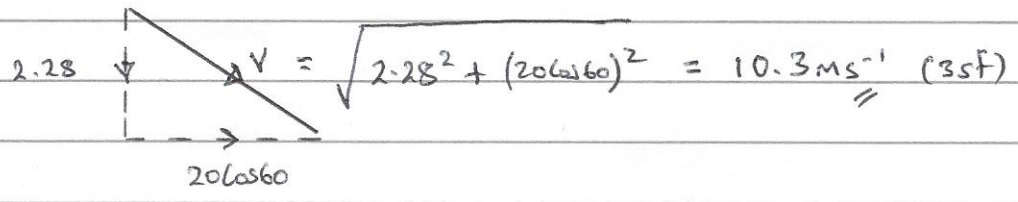


M2 Revision Projectiles



Vertical Motion $suvat$
 $s = x, u = 20 \sin 60, v = ?, a = -9.8, t = 2$
 $v = u + at$
 $v = 20 \sin 60 - 9.8 \times 2 = -2.28 \text{ ms}^{-1}$



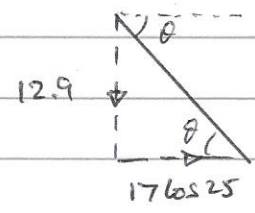
a) Time of flight? Horizontal Motion
 $s = ut \quad 9 = 17 \cos 25 \times t$
 $t = \frac{9}{17 \cos 25} = 0.584 \text{ s}$

Vertical Motion
 $s = ?, u = 17 \sin 25, v = x, a = 9.8, t = 0.584$
 $s = ut + \frac{1}{2} at^2$
 $s = 17 \sin 25 \times 0.584 + \frac{1}{2} \times 9.8 \times 0.584^2$
 $s = 5.87 \text{ m}$

\therefore Height above ground = $8 - 5.87 = 2.13 \text{ m}$

b) Vertical component of velocity? $suvat$

$s = (5.87), u = 17 \sin 25, v = ?, a = 9.8, t = 0.584$ use $v = u + at$
 $v = 17 \sin 25 + 9.8 \times 0.584 = 12.9$
 $\theta = \tan^{-1} \left(\frac{12.9}{17 \cos 25} \right) = 40.0^\circ$



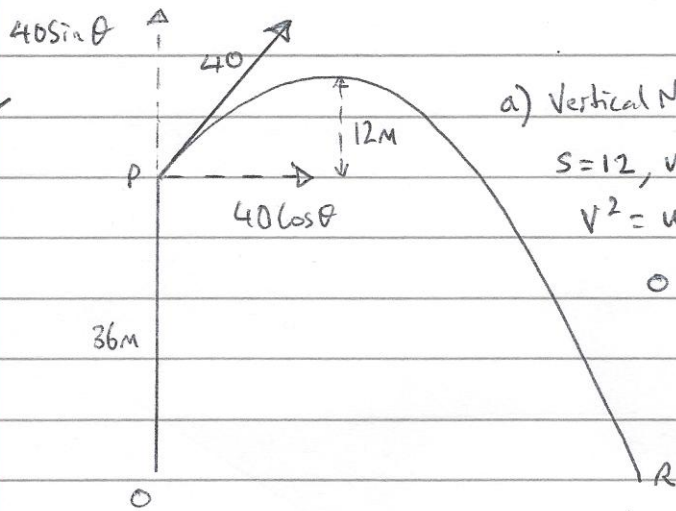
40.0° below the horizontal.

c) KE before = $\frac{1}{2} m v_1^2$

KE after = $\frac{1}{2} m v_2^2 \times 0.7 = \frac{1}{2} m v_1^2 \times 0.7 \quad \therefore v_2^2 = v_1^2 \times 0.7$

new speed = $\sqrt{v_1^2 \times 0.7} = \sqrt{(12.9^2 + (17 \cos 25)^2) \times 0.7} = 16.8 \text{ ms}^{-1}$

Q3



a) Vertical Motion suvat

$$s = 12, u = 40 \sin \theta, v = 0, a = -9.8, t = x$$

$$v^2 = u^2 + 2as$$

$$0 = (40 \sin \theta)^2 + 2x(-9.8) \times 12$$

$$\sin \theta = \frac{\sqrt{2 \times 9.8 \times 12}}{40}$$

$$\theta = 22.5^\circ \text{ (3sf)}$$

b) Time of flight? Vertical Motion suvat

$$s = -36, u = 40 \sin(22.5), v = x, a = -9.8, t = ?$$

$$s = ut + \frac{1}{2}at^2$$

$$-36 = 40 \sin(22.5)t - 4.9t^2$$

$$4.9t^2 - 40 \sin(22.5)t - 36 = 0$$

$$t = \frac{40 \sin(22.5) + \sqrt{(40 \sin(22.5))^2 - 4 \times 4.9 \times -36}}{9.8} = 4.69$$

Horizontal Motion $s = ut$ $s = 40 \cos(22.5) \times 4.69 = 173 \text{ m}$
 (= OR) (3sf)

c) Vertical Motion suvat

$$s = -36, u = 40 \sin(22.5), v = ?, a = -9.8, t = 4.69$$

$$v = u + at$$

$$v = 40 \sin(22.5) - 9.8 \times 4.69 = -30.7$$

