1a/ vertical motion: $s = ?$

$u = 25 \sin 40$

$v = 0$

$a = -9.8$

t

$$v^2 = u^2 + 2as$$
$$0 = (25 \sin 40)^2 + 2(-9.8)s$$
$$s = \underline{13 \text{ m}} \quad (2sf)$$

b/ vertical motion (to top) ~~$v = u + at$~~

$$v = u + at$$
$$0 = 25 \sin 40 + (-9.8)t$$
$$t = 1.639...$$

total time = 2 (Ans)

= 3.28 seconds

horizontal motion $s = ?$

$u = 25 \cos 40$

$v = 25 \cos 40$

$a = 0$

$t = 3.28$

$$s = (25 \cos 40)(3.28) + \tfrac{1}{2}(0)(3.28)^2$$

$$= 25 \cos(40) \times 3.28$$

$$= \underline{63 \text{ m}} \quad (2sf)$$

2a) vertical: s horizontal: s

$u = 4$ $u = 3$

$v = ?$ $v = ?$

$a = -9.8$ $a = 0$

$t = 2$ $t = 2$

$v = u + at$ $v = u + at$

$= 4 + (-9.8)(2)$ $= 3 + 0(2)$

$= -15.6$ $= 3$

$\text{Speed} = \sqrt{15.6^2 + 3^2}$

$= \underline{16 \ ms^{-1}}$ (2sf)

b) vertical: $s = ?$

$u = 4$

$v = 0$

$a = -9.8$

$t =$

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

$0 = (4)^2 + 2(-9.8)s$

$s = 0.82 \ m$ (2sf)

Greatest Height $= 20.82 \ m$

c) $s = -20$ $s = ut + \frac{1}{2}at^2$

$u = 4$ $-20 = 4t - 4.9t^2$

$v =$ $0 = 4.9t^2 - 4t - 20$

$a = -9.8$

$t = ?$ $t = \dfrac{-(-4) \pm \sqrt{(-4)^2 - 4(4.9)(-20)}}{2(4.9)}$

$= \underline{2.47 \ s}$ or -1.65 ✗

t cannot be negative.

Horizontal

$s = ?$

$u = 3$

$v = 3$

$a = 0$

$t = 2.47$

$s = 2.47(3)$

$= \underline{7.4\ m\ (2sf)}$

3a) vertical $s = 0$

$u = 25 \sin\theta$

$v =$

$a = -9.8$

$t = 5$

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

$0 = 5(25\sin\theta) + \frac{1}{2}(-9.8)(5)^2$

$0 = 125\sin\theta - 122.5$

$122.5 = 125\sin\theta$

$\sin\theta = 49/50$

$\theta = \sin^{-1}(49/50)$

$= 78.5^\circ$ $\quad 79^\circ$ (2 sf)

b) $s = ?$

$u = 25\cos(\text{"}78.5\text{"})$

$v =$

$a = 0$

$t = 5$

$s = ut$

$= 5(25\cos(\text{"}78.5\text{"}))$

$= 24.87$

$= 25\,m$ (2 sf)

4a/ Vertical: $s = 16$

$u = u \sin 60 = \frac{\sqrt{3}}{2} u$

$v = 0$

$a = -9.8$

$t = ?$

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

$0 = \left(\frac{\sqrt{3}}{2} u\right)^2 + 2(-9.8)(16)$

$0 = \frac{3}{4} u^2 - 313.6$

$313.6 = 0.75 u^2$

$418.1\dot{3} = u^2$

$u = 20.448...$

$= 20.4 \text{ ms}^{-1}$ (3sf)

b/ ~~$v = u + a$~~ $s = -20$

$u = 20.4 \sin 60$

$v =$

$a = -9.8$

$t = ?$

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

$v^2 = (20.4 \sin 60)^2 + 2(-9.8)(-20)$

$= 705.6$

$v = \pm 26.56$

$v = u + at$

$-26.56 = 20.4 \sin 60 + (-9.8)t$

$t = 4.52$ s

Horizontal distance: $s = ut$

$= 20.4 \cos 60 \cdot 4.52$

$= 46.188...$

$= \underline{46 \text{ m}}$ (2sf)

5a/ vertical: $s = 24$

$u = 4k$

$v = 0$

$a = -g$

$t =$

$$v^2 = u^2 + 2as$$
$$0 = (4k)^2 + 2(-g)(24)$$
$$0 = 16k^2 - 48g$$
$$48g = 16k^2$$
$$3g = k^2$$
$$k = \sqrt{3g}$$

b/ To the top:

$$v = u + at$$
$$0 = 4\sqrt{3g} + -9.8t$$
$$t = 2.213\ldots$$

total time = $2 \times$ Ans

$= 4.426\ldots$ seconds

Horizontal distance:

$s = ut$

$= 3\sqrt{3g} \cdot$ "4.426"

$= \underline{72\ m}$

6a/ vertical $s = y$

$u = u \sin\theta$

$v =$

$a = -g$

$t = t$

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

$$y = u\sin\theta \cdot t + \frac{1}{2}(-g)t^2$$

$$y = ut\sin\theta - \frac{g}{2}t^2 \qquad (1)$$

horizontal: $s = x$

$u = u\cos\theta$

$v =$

$a = 0$

$t = t$

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

$$x = u\cos\theta \cdot t$$

$$x = ut\cos\theta$$

$$t = \frac{x}{u\cos\theta} \qquad [\text{Sub. into } (1)]$$

$$y = u\left(\frac{x}{u\cos\theta}\right)\sin\theta - \frac{g}{2}\left(\frac{x}{u\cos\theta}\right)^2$$

$$y = \frac{ux\sin\theta}{u\cos\theta} - \frac{g}{2}\frac{x^2}{u^2\cos^2\theta}$$

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

b/ $2 = 6\tan 45 - \dfrac{9(6)^2}{2u^2(\cos 45)^2}$

$2 = 6 - \dfrac{36g}{u^2}$

$\dfrac{36g}{u^2} = 4$

$9g = u^2$

$\underline{\underline{u = 3\sqrt{g}}}$

when $x = 6$ $\quad t = \dfrac{6}{3\sqrt{g}\cos 45}$

$= 0.9035079\ldots$

vertical : $v = u + at$

$= 3\sqrt{g}\sin 45 + (-9.8)(0.9035)$

$= -2.21\ ms^{-1}$

horizontal : $v = 3\sqrt{g}\cos 45$

$= 6.64\ ms^{-1}$

speed $= \sqrt{(2.21)^2 + (6.64)^2}$

$= \underline{\underline{7\ ms^{-1}}}$