Physics 4A

Chpt 4 Even Solutions

18, 22, 26, 34, 42, 54

(18)

y direction

$y_f - y_0 = v_{y0}t - \frac{1}{2}gt^2$

$0 - 1.9 = 0 - \frac{1}{2}(9.8)t^2$

$t = \sqrt{\frac{1.9}{4.9}} = .62\ s$

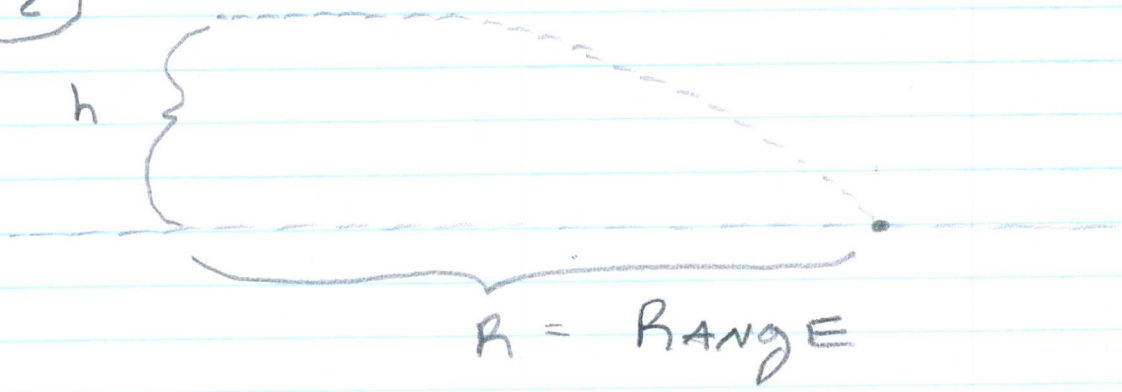
x direction

$x_f - x_0 = v_{x0}t + \frac{1}{2}\cancel{a}t^2$ ($a = 0$)

$\Rightarrow 4.5 - 0 = v_{x0}(.62)$

$$v_{x0} = \frac{4.5\ m}{.62\ s} = 7.22\ \frac{m}{s}$$

(22)



y direction

$$y_f - y_0 = v_{y_0} t - \frac{1}{2} g t^2$$

($v_{y_0} \to 0$)

$$0 - h = -\frac{1}{2} g t^2$$

$$\Rightarrow t = \sqrt{\frac{2h}{g}}$$

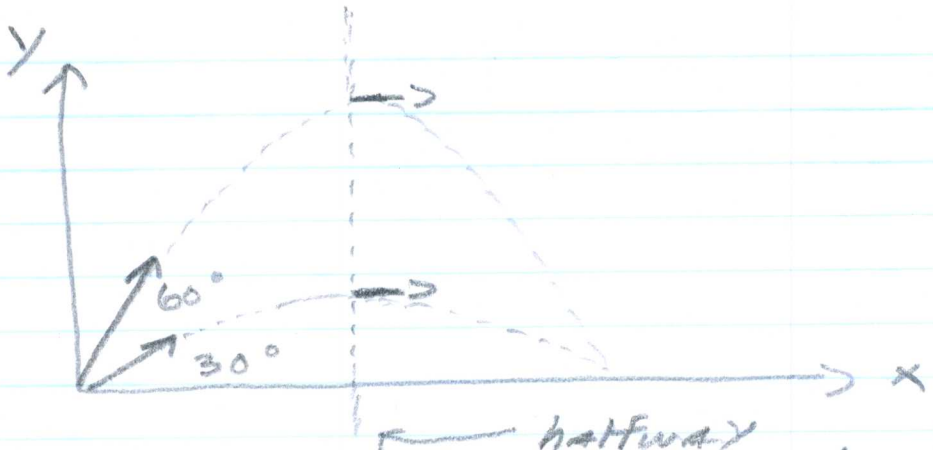
x direction

$$x_f - x_0 = v_{0x} t$$

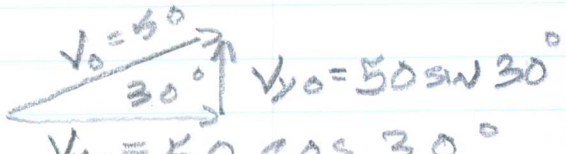
$$R - 0 = v_0 \sqrt{\frac{2h}{g}}$$

$$\boxed{R = v_0 \sqrt{\frac{2h}{g}}}$$

(26)



For $\theta = 30°$



$$V_{yf} = V_{y0} + a t_{1/2}$$

$$0 = 50 \sin 30° - g t_{1/2}$$

$\Rightarrow$ $t_{1/2}$ = time to reach halfway point

$$= \frac{50 \sin 30°}{9.8} = 2.55 \text{ s}$$

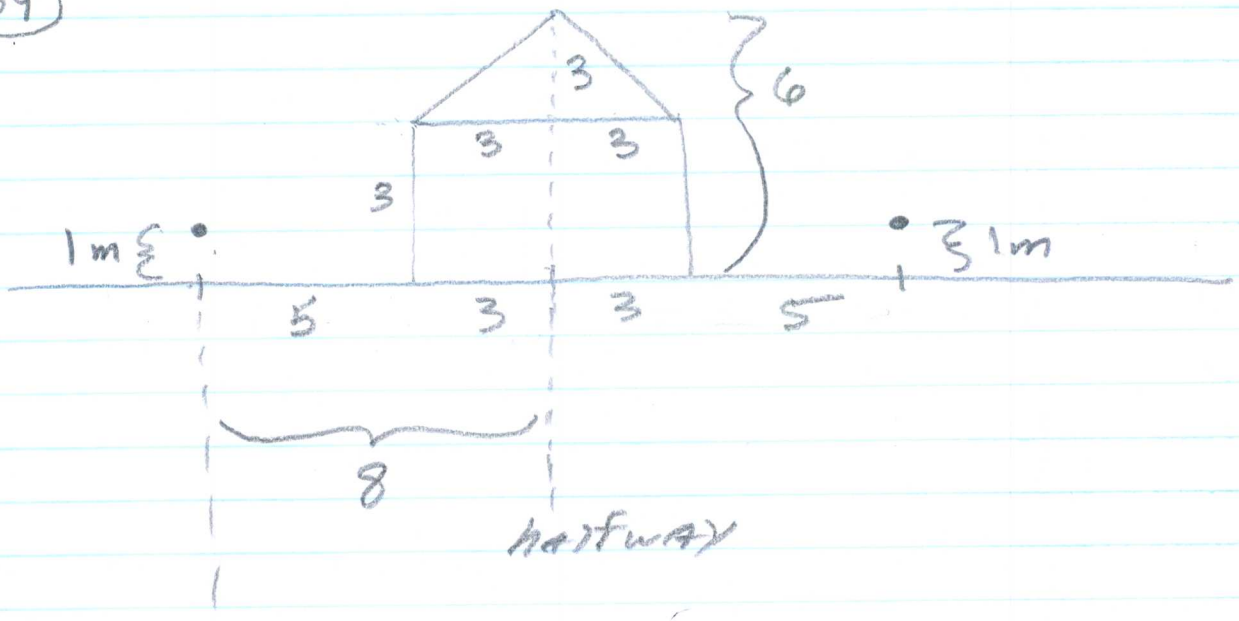
$$t_{\text{TOTAL}}_{30°} = 2 t_{1/2} = 5.1 \text{ s}$$

For $\theta = 60°$

$$t_{1/2} = \frac{50 \sin 60°}{9.8} = 4.41 \text{ s}$$

$$t_{\text{TOTAL}} = 2 t_{1/2} = 8.82 \text{ s}$$

(34)



y direction:

$$y_f - y_0 = v_{y0}t - \frac{1}{2}gt^2$$

$$v_{yf} = v_{y0} - gt$$

At halfway point

$$6 - 1 = 5 = v_0 \sin\theta\, t - \frac{1}{2}gt^2$$

$$\Rightarrow 0 = v_0 \sin\theta - gt$$

$$\Rightarrow v_0 \sin\theta = gt$$

$$\Rightarrow 5 = v_0 \sin\theta\, t - \frac{1}{2}gt^2$$

$$= gt^2 - \frac{1}{2}gt^2 = \frac{1}{2}gt^2$$

$$\Rightarrow t = \sqrt{\frac{10}{9.8}} = 1.01\ s$$

$$\Rightarrow V_0 \sin\theta = gt = 9.8(1.01) = 9.9$$

x direction (at halfway point)

$$x_f - x_0 = V_{x0}\, t$$

$$8 - 0 = V_0 \cos\theta\, t$$

$$\Rightarrow V_0 \cos\theta\, t = 8$$

$$\Rightarrow V_0 \cos\theta = \frac{8}{1.01} = 7.92\ s$$

$$\Rightarrow \frac{V_0 \sin\theta}{V_0 \cos\theta} = \frac{9.9}{7.92}$$

$$\Rightarrow \tan\theta = \frac{9.9}{7.92}$$

(b) $$\theta = \tan^{-1}\left(\frac{9.9}{7.92}\right) = 51.3^\circ$$

(a) $$V_0 \sin(51.3^\circ) = gt = 9.9$$

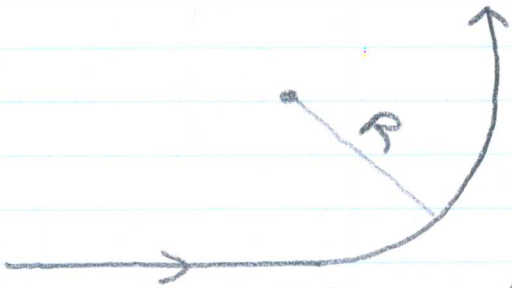
$$\Rightarrow V_0 = 12.4\ \frac{m}{s}$$

(42) $a = \frac{v^2}{R} = g$

$\Rightarrow v = \sqrt{gR} = \sqrt{(9.8)75}$

$$\boxed{v = 225.2 \ \frac{m}{s}}$$

(54)



$R = 120 \text{ m}$

$v = 65 \frac{km}{hr} = 65 \frac{km}{hr}\left(\frac{1 hr}{3600 s}\right)\left(\frac{1000 m}{km}\right)$

$= 18.1 \frac{m}{s}$

Need speed just as emerging from turn:

$$v_f^2 - v_0^2 = 2a(\Delta x)$$

v_f → emerging speed; v_0 ← entering speed; Δx → distance traveled around curve

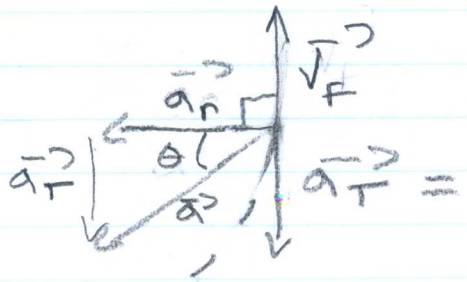
$\Delta x = \frac{1}{4}(2\pi R) = \frac{\pi R}{2} = 188.5 \text{ m}$

$$\Rightarrow V_f^2 - (18.1)^2 = 2(-0.65)(188.5)$$

$$\Rightarrow V_f^2 = 82.56$$

$$\Rightarrow a_R = \frac{V_f^2}{R} = \frac{82.56}{120} = .688 \frac{m}{s^2}$$

$\Rightarrow$



$$|\vec{a}| = \sqrt{a_R^2 + a_T^2} = \sqrt{.688^2 + (.65)^2}$$

$$\Rightarrow |\vec{a}| = .946 \frac{m}{s^2}$$

$$\tan\theta = \frac{a_T}{a_R} = \frac{.65}{.688} =$$

$$\theta = \tan^{-1}(.95)$$

$$= 43.4^\circ$$

$\Rightarrow$ Angle between $\vec{V}_f$ and $\vec{a}$ is $90 + 43.4 = 133.4^\circ$