① Soln-

$y = ax^2 - bx^2$

① $\tan\theta = a \rightarrow \theta = \tan^{-1} a$

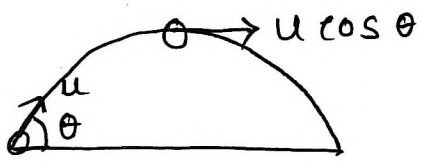
② $R = \frac{a}{b}$

$R \tan\theta = 4H$

$\frac{a}{b} \times a = 4H$

$\boxed{H = \frac{a^2}{4b}}$ ans (C)

② Soln

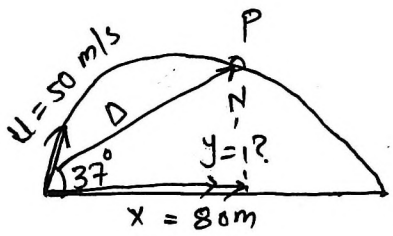


$u\cos\theta = u$

$\cos\theta = \frac{1}{2}$

$\theta = 60^\circ$ Ans (B)

③ Soln-



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

$80 = 50 \times \cos 37\, t$

$8 = 50 \times \frac{4}{5} \times t$ $\boxed{t = 2 \text{ sec}}$

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

$y = \frac{10}{\cancel{50}} \times \frac{3}{\cancel{5}} \times 2 - 5 \times 4$

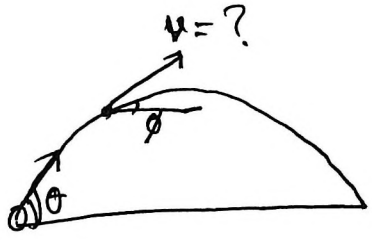
$y = 60 - 20 = 40\text{ m}$

$D = \sqrt{y^2 + x^2}$

$D = \sqrt{(40)^2 + (80)^2}$

$D = 40\sqrt{1+4} = 40\sqrt{5}\text{ m}$ Ans (C)

④ Soln-



$u\cos\theta = v\cos\theta$

$v = \frac{u\cos\theta}{\cos\phi}$

$v = u\cos\theta \sec\phi$

Ans (C)

⑤ Soln- $u_x = 1\ m/s$ $\quad u_y = 2\ m/s$

$x = u\cos\theta t$ $\quad y = u\sin\theta t - \frac{1}{2}gt^2$

$x = 1 \times t$ $\quad y = 2t - 5t^2$

$\boxed{t = x}$ $\quad \boxed{y = 2x - 5x^2}$ Ans (B)

⑥ Soln- $T = 10\ s$

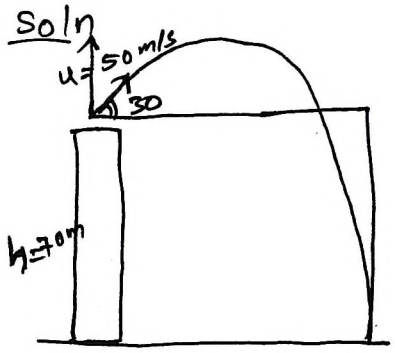
$R = 500\ m$

$H = \frac{1}{8}gT^2$

$H = \frac{1}{8} \times 10 \times 100$

$= 125\ m$ Ans (A)

⑦ Soln



$s_y = u_y t + \frac{1}{2}a_y t^2$

$-70 = 25t - \frac{1}{2}gt^2$

$-70 = 25t - 5t^2$

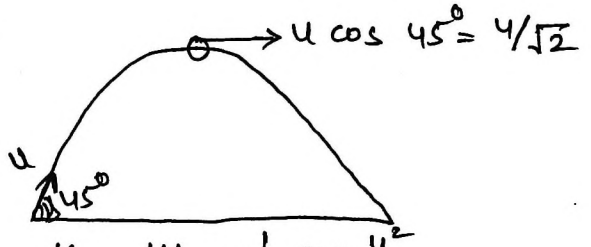
$-14 = 5t - t^2$ $\quad \boxed{t = 7\ sec}$

$t^2 - 5t - 14 = 0$

$t^2 - 7t + 2t - 14 = 0$

$t = 7$ Ans (C)

⑧ Soln



$K_{max\ Ht} = \frac{1}{2}m \times \frac{u^2}{2}$

$= \frac{1}{2} \times \left(\frac{1}{2}mu^2\right) = \frac{K}{2}$

$\boxed{K_{max\ Ht} = K_i \cos^2\theta}$

Ans (C)

(9) Soln

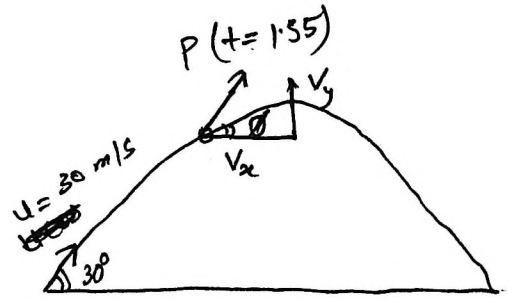
$P_H = m u \cos\theta$

$P_H = P_i \cos\theta$

$P_H = P \cos 30^\circ$

$= \frac{\sqrt{3} P}{2}$ Ans (C)

(10) Soln



$\tan\phi = \frac{V_y}{V_x}$

$\tan\phi = \frac{u \sin\theta - gt}{u \cos\theta}$

$\tan\phi = \frac{30 \times \frac{1}{2} - 10 \times 1.5}{30 \times \frac{\sqrt{3}}{2}} = 0$

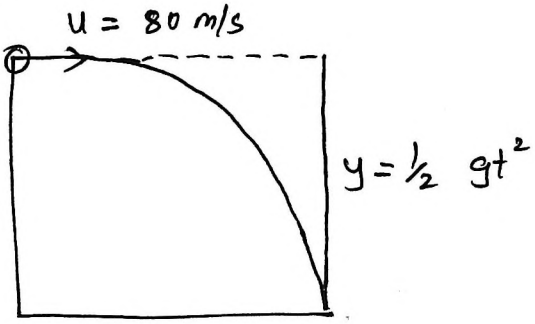
$\tan\phi = 0$

$\phi = 0$

Particle is at Max Ht.

Ans (A)

(11) Soln

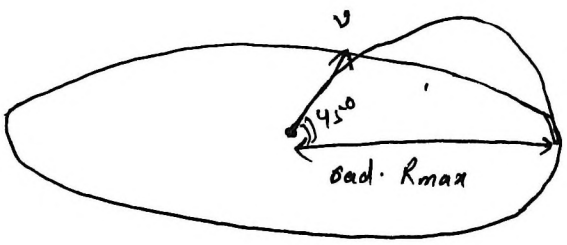


$y = \frac{1}{2} \times g \times 1$

$= 4.9 m$

Ans (D)

(12) Soln



$A_{max} = \pi r^2 = \frac{\pi v^4}{g^2}$

Ans (B)

(13) Soln Necessary condition for coll^n is

$u_{1y} = u_{2y}$

$v_i \sin 30 = v_2$

$$\frac{1}{2} = \frac{v_2}{v_1}$$

Ans (C)

(14) Soln

$$R = \frac{\sqrt{3}\, v^2}{2g}$$

$$H = \frac{v^2}{8g}$$

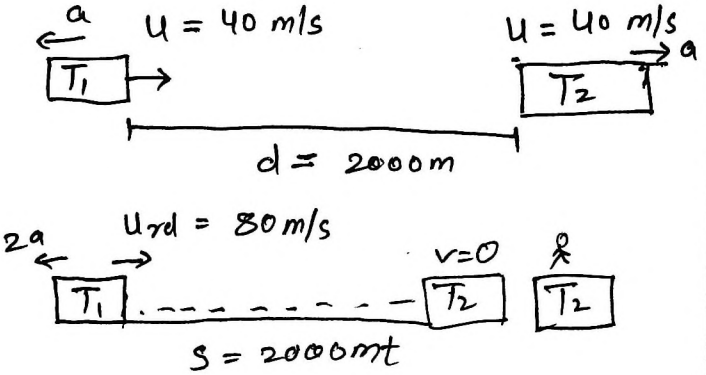
$R \tan\theta = 4H$

$$\frac{\sqrt{3}v^2}{2g} \times \tan\theta = 4 \times \frac{v^2}{2g}$$

$$\tan\theta = \frac{1}{\sqrt{3}} \quad \theta = 30^\circ$$

Ans (B)

(15) Soln



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

$0 = (80)^2 - 2 \times 2a \times 2000$

$$a = \frac{6400}{8000}$$

$a = 0.8\ m/s^2$

Ans (A)

(16) Soln

$$x = \frac{1}{(t+5)^2}$$

$$v = \frac{dx}{dt} = \frac{-1}{(t+5)^2}$$

$$a = \frac{+2}{(t+5)^3}$$

$$v \propto \frac{1}{(t+5)^2}$$

$$(t+5) \propto \frac{1}{v^{1/2}}$$

$$a \propto \frac{1}{\left(\frac{1}{v^{1/2}}\right)^3}$$

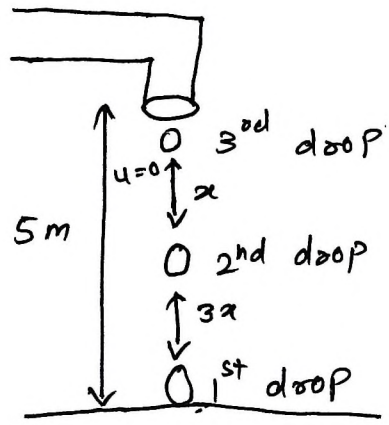
$a \propto v^{3/2}$

$$a \propto \frac{1}{\left(\frac{1}{x}\right)^3}$$

$a \propto x^3$ X

Ans (B)

(17) Soln



$4x = 5$

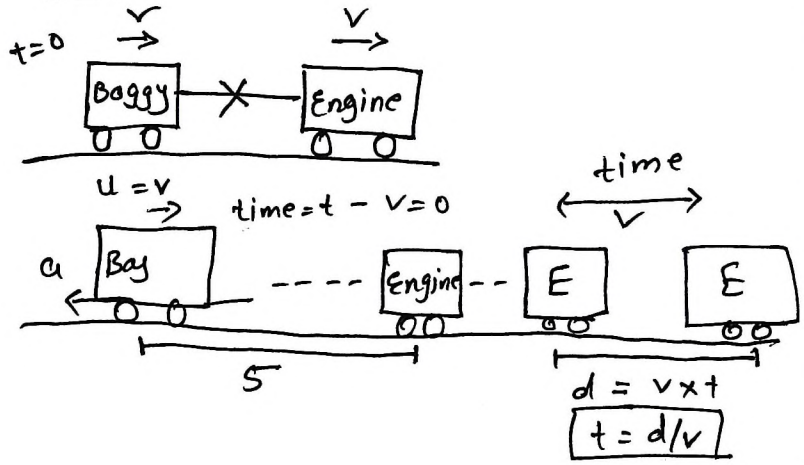
$x = 5/4$

height of 2nd drop above ground $= 3x$

$= \frac{15}{4} = 3.75\,m$

Ans (B)

(18) Soln



Boggy

$\rightarrow v = u - at$

$0 = v - a \times \frac{d}{v}$

$a = \frac{v^2}{d}$

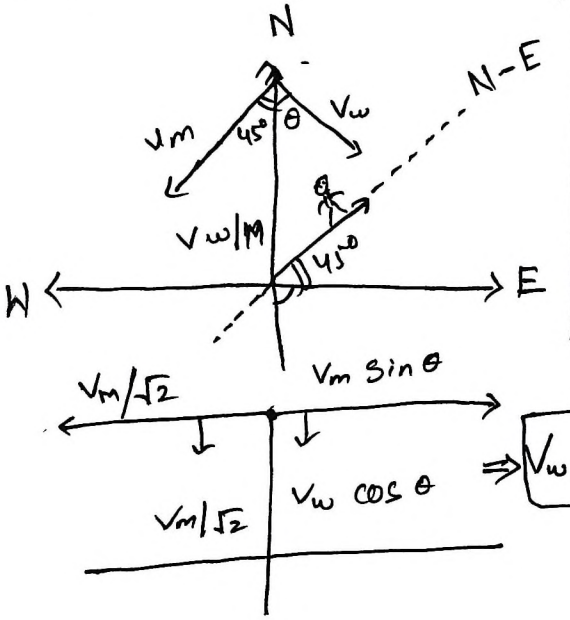
$\rightarrow v^2 = u^2 - 2as$

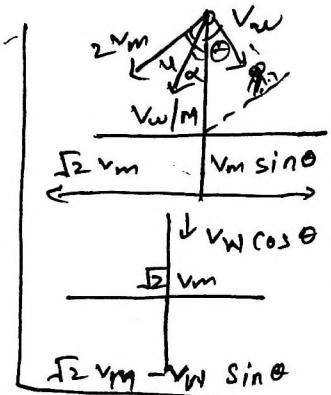
$0 = v^2 - 2 \times \frac{v^2}{d} \times s$

$s = \frac{d}{2}$

Ans (B)

(19) Soln





$\alpha = \cot^{-1} 2$

$\cot \alpha = 2$

$\cot \alpha = \frac{\sqrt{2} v_m + v_w \cos\theta}{\sqrt{2} v_m + v_w \sin\theta}$

$2 = \frac{\sqrt{2} v_m + v_w \cos\theta}{\sqrt{2} v_m - \frac{v_m}{\sqrt{2}}}$

$2\sqrt{2} v_m - \sqrt{2} v_m = \sqrt{2} v_m + v_w \cos\theta$

$v_w \cos\theta = 0$

$\cos\theta = 0$

$\theta = 90°$ Towards east

$V_w \sin 90 = \frac{v_m}{\sqrt{2}}$

$\Rightarrow V_w \sin\theta = \frac{v_m}{\sqrt{2}} \quad -(1)$

Ans (D)

(20) Soln $x = 4(t-2) + 9(t-2)^2$

$v = 4 + 2 \cdot 9 \times (t-2) \Rightarrow$ initial vel $(t=0) = 4 - 4.9$

$A = 2.9$ Ans (B)

(21) Soln

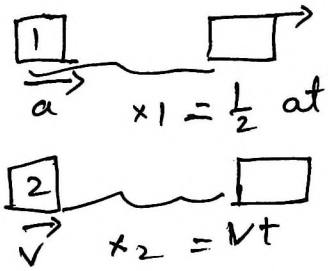
$$\frac{dv}{dt} = -2.5\sqrt{v}$$

$$\int_{6.25}^{0} v^{-1/2}\, dv = \int_{0}^{t} -2.5\, dt$$

$$(2\sqrt{v})_{6.25}^{0} = -2.5 \times t$$

$$-2 \times 2.5 = -2.5 \times t$$ Ans (A)

(22) Soln $u = 0;\ x = 0;\ t = 0$



$$x_1 - x_2 = \frac{1}{2}at^2 - vt$$ Ans (A)

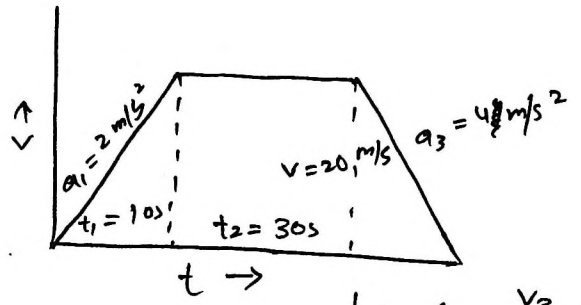
(23) Soln $S^{nth} = u + \frac{1}{2}a(2n-1)$

$S^{4th} = \frac{1}{2}a(7)$

$S^{3rd} = \frac{1}{2}a \times 5$

$\frac{S^{4th}}{S^{3rd}} = 7/5$ Ans (A)

(24) Soln



$$\tan\theta = \frac{v}{t} \times a$$

$$v = at = 20\ m/s$$

$$\tan\theta = \frac{v_3}{t_3} = \frac{20}{t_3} \cdot y$$

$$t_3 = 53$$

Distance = Area of Graph

$$= \frac{1}{2}(45 \times 30) \times 20$$

$$= 750\ m$$

Ans (A)

(25) Soln

$$\frac{dv}{dt} = -kv^3$$

$$\int_{v_0}^{v} \frac{dv}{v^3} = \int_0^t -k\,dt$$

$$\left(\frac{v^{-2}}{-2}\right)_{v_0}^{v} = -kt$$

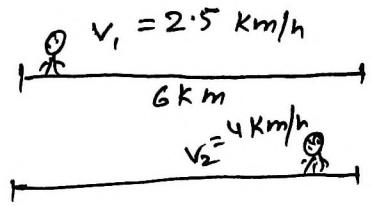
$$\frac{-1}{2v^2} + \frac{1}{2v_0^2} = -kt$$

$$\frac{1 + 2v_0^2 kt}{2v_0^2} = \frac{1}{2v^2}$$

$$v = \sqrt{\frac{v_0^2}{2v_0^2 kt + 1}} = \frac{v_0}{\sqrt{2v_0^2 kt + 1}}$$

Ans (D)

(26) Soln

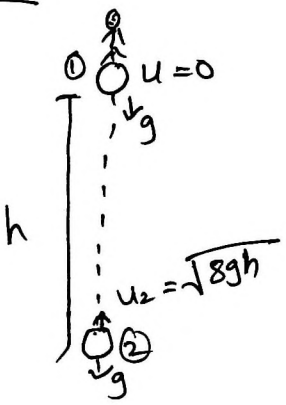


$$\vec{v} = \frac{2v_1 v_2}{v_1 v_2}$$

$$v = \frac{2.5 \times 2 \times 4}{6.5} = \frac{40}{13}\ km/h$$

Ans (C)

(27) Soln

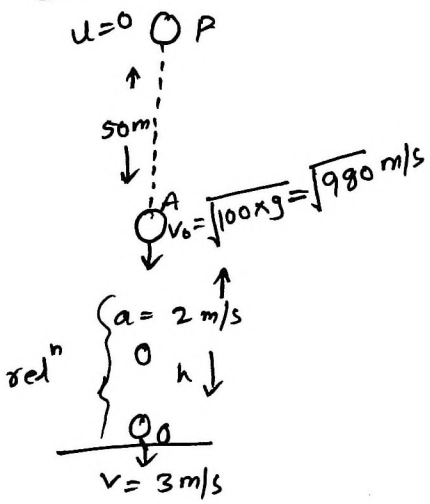


$$t = \frac{d_{vel}}{V_{rel}} = \frac{h}{\sqrt{8gh}} = \sqrt{\frac{h}{8g}}$$

Ans (A)

(28) Soln Ans (A)

(29) Soln



$v^2 = u^2 - 2ah$

$9 = 980 - 2\times 2\times h$

$h = \frac{971}{4}$

total Ht $= \frac{971}{4} + 50$

$= 293$ m

Ans (A)

(30) Soln

$$\bar{V} = \frac{\text{total Distance}}{\text{Total Time}} \qquad \bar{V} = \frac{120}{20} \text{ m/min} = 6 \text{ m/min}$$

Total Distance $= 40 + 0 + 60 + 20 = 120$ m Ans (B)

(31) Soln

$$x = \frac{k}{b}\left[1 - e^{-bt}\right]$$

$$\frac{dx}{dt} = \frac{k}{b}\left[0 - e^{-bt} \times (-b)\right]$$

$$\boxed{V = +K e^{-bt}}$$

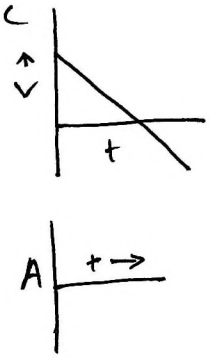
Ans (A)

(32) Soln

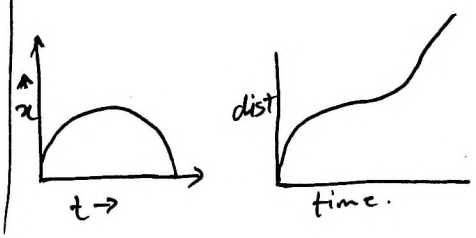
$\rightarrow a = -at^2 + bt + c$

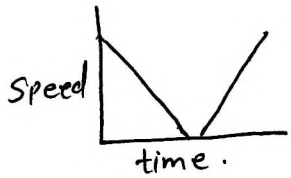
$\rightarrow V = -2at + b$

$\rightarrow A = -2a$



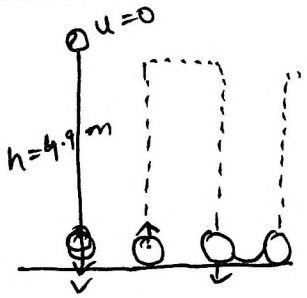
Distace ~~graph~~ time graph





Ans

(33) Soln



$v = u - gt$

$v = -gt$

Ans (C)

(34) Soln

$S_1 = 0 + \frac{1}{2}a(P-1)^2$

$S_1 = \frac{1}{2}a(P^2+1-2P)$ — (1)

$S_2 = \frac{1}{2}a(P^2)$

$S = 0 + \frac{1}{2}a \cdot [2 \times (P^2 \times P+1)$

$S = \frac{1}{2}a[2P^2 - 2P + 2 - 1]$

$S = \frac{1}{2}a(2P^2 - 2P + 1)$

$\boxed{S = S_1 + S_2}$ Ans (A)

(35) Soln Ans (B)

(36) soln

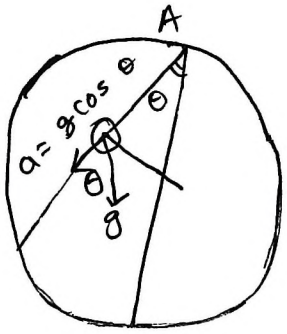
(1) $\cos\theta = \frac{d}{2R}$

$d = 2R\cos\theta$

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

$2R\cancel{\cos\theta} = \frac{1}{2}g\cancel{\cos\theta}\,t$

$t = \sqrt{\frac{4R}{g}}$



$\boxed{t = 2\sqrt{\frac{R}{g}}}$

Ans (C)

(37) Soln $H_t = \frac{1}{2} \times 132 \times 1200$

$= 60 \times 1200\ m$ Ans (A)

(38) Soln

$\frac{dt}{dx} = 2\alpha x + \beta = \frac{1}{v}$

$v = \frac{1}{2\alpha x + \beta}$

$v^2 = \frac{1}{(2\alpha x + \beta)^2}$

$\frac{2v\,dv}{dx} = \frac{1}{(2\alpha x - \beta)^3} \times 2\alpha$

$a = \frac{-2\alpha}{(2\alpha x - \beta)^3}$

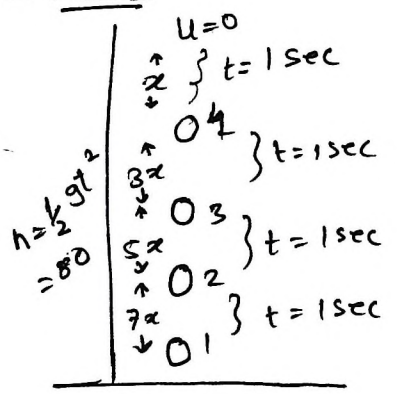
$a = -2\alpha v^3$

direct $a = -$(double diff) $\times v^3$

$= -(-2\alpha) v^3$

Ans (A)

(39) Soln



$16x = 80$

$x = 5$

35, 25, 15

Ans (A)

(40) Soln Ans (D)

(41) Soln

$t = 0 \quad u = 0 \quad x = 0$

$a = 6t + 5$

$\int_0^v dv = \int_0^t 6t\,dt + \int_0^t 5\,dt$

$v = \frac{6t^2}{2} + 5t$

$v = 3t^2 + 5t$

$\frac{dx}{dt} = 3t^2 + 5t$

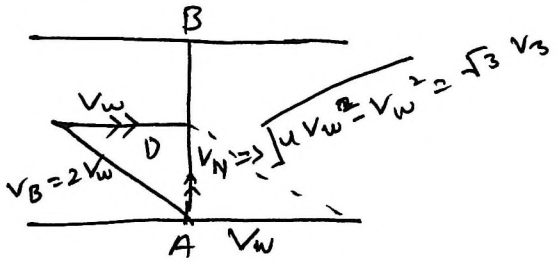
$\int_0^x dx = \int_0^t 3t^2\,dt + \int_0^t 5t\,dt$

$x = t^3 + \frac{5t^2}{2}$

$x = 1 + \frac{5}{2} = \frac{7}{2} = 3.5\ m$

Ans (B)

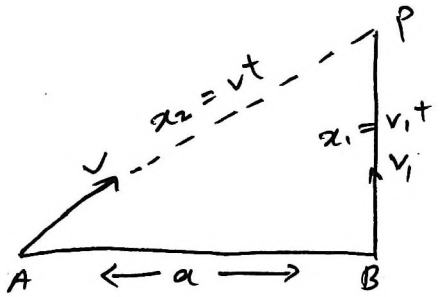
(42) Soln



$$t = \frac{D}{\sqrt{3}V_w} = \frac{2D}{\sqrt{3}V_w}$$

Ans (A)

(43) Soln



$$v^2t^2 = v_1^2t^2 + a^2$$

$$t^2(v^2 - v_1^2) = a^2$$

$$t = \sqrt{\frac{a^2}{v^2 - v_1^2}}$$

Ans (B)

(44) Soln

$$a_y = a = \frac{d^2y}{dt^2} \cdot \frac{d^2x}{dt^2} = 0$$

$$y = bx^2 \qquad V_x = \frac{dx}{dt} = ?$$

$$\frac{dy}{dt} = 2bx\frac{dx}{dt}$$

$$\frac{d^2y}{dt^2} = 2b\left[\frac{dx}{dt} \times \frac{dx}{dt} + \frac{d^2x}{dt}x\right]$$

$$a = 2b\left[V_x^2 + 0\right]$$

$$V_x = \sqrt{\frac{a}{2b}}$$

Ans (B)

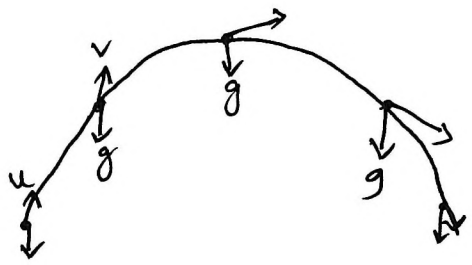
(45) soln

area = $v - u = 8 - 4$

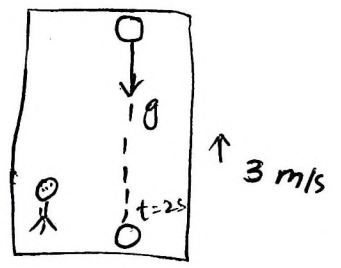
$v = 4$ m/s Ans (B)

(46) soln Ans (A)

(47) Soln Ans (A)



(48) Soln

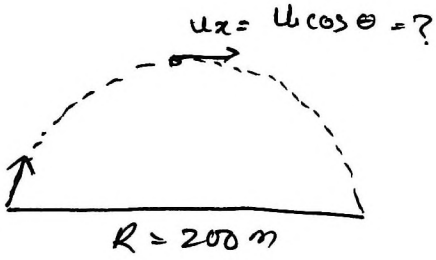


$$S = ut + \frac{1}{2}at^2$$

$$S = \frac{1}{2} g \times 4 = 2g = 19.6\ cm$$

Ans (A)

(49) Soln



$T = 5\ s$

$$R = \frac{2u^2 \sin\theta \cos\theta}{g}$$

$$\frac{2u \sin\theta}{g}$$

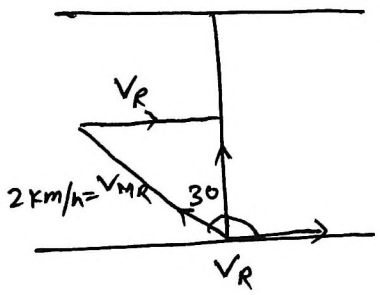
$$\frac{R}{T} = u \cos\theta$$

$$\frac{200}{5} = u \cos\theta$$

$$u \cos\theta = 40\ m/s$$

Ans (A)

(50) Soln $V_{M,R} = 2\ km/h$



$$\sin 30^\circ = \frac{V_R}{2}$$

$$\frac{1}{2} = \frac{V_R}{2}$$

$$V_R = 1\ km/h$$

Ans (A)