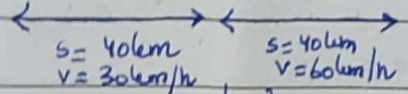
Date

246-0559

Beril-Ujin-khan. (BSCS-14).

Q1). (a).

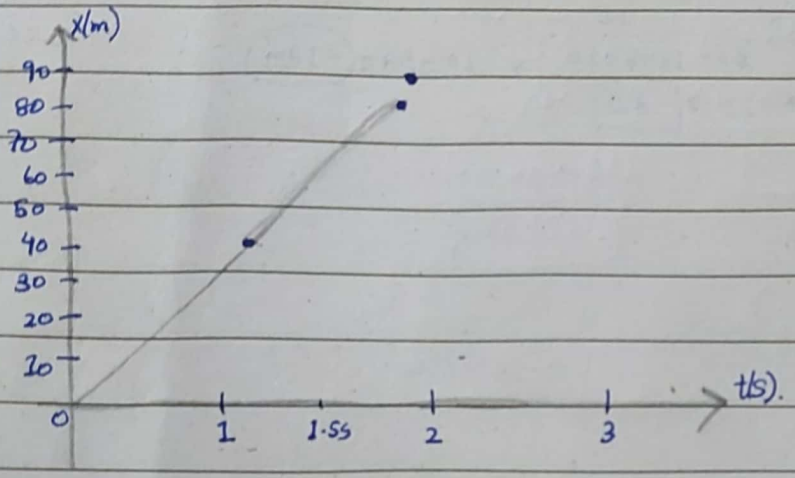



$V = \frac{2v_1v_2}{v_1+v_2} = \frac{2\times(30)(60)}{90} \rightarrow \boxed{40\text{ m/s}}$

(b). Average speed = $\frac{\text{Total distance}}{\text{Total time}} = \frac{80}{1.333+0.666} = \boxed{40\text{ m/s.}}$

first Part $t = \frac{40}{30} = 1.333s$, second Part $= t = \frac{40}{60} = 0.666s$

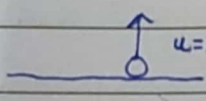
(c).




$t_1 = 1.33s$

$t_2 = 0.666s.$

Q2). Ans:-




$V = u + at$

$0 = 30 - 9.8t \rightarrow \boxed{t = 3.06s} \rightarrow$ To reach max height.

For Total time = ~~3.06×2~~ =

$= 3.06 \times 2 = \boxed{6.12s}$

Q3). Ans:-

$x = 3t - 4t^2 + t^3$

(a). $x^{(1)} = 3(1) - 4(1)^2 + (1)^3 = 0m$

(b). $x(2) = 3(2) - 4(2)^2 + (2)^3 = -2m$

(c). $x(3) = 3(3) - 4(3)^2 + (3)^3 = 0m$

(d). $x(4) = 3(4) - 4(4)^2 + (4)^3 = 12m.$

(e). $\Delta x = \Delta x_4 - \Delta x_0$

$\Delta x = 12 - [0] = \boxed{12m}$

$x = 3(0) - 4(0)^2 + (0)^3 = \boxed{0m}$

(f). Average velocity = $\frac{\Delta x}{\Delta T} = \frac{12-(-2)}{4-2} = \frac{14}{2} = \boxed{7.0\text{ m/s}}$

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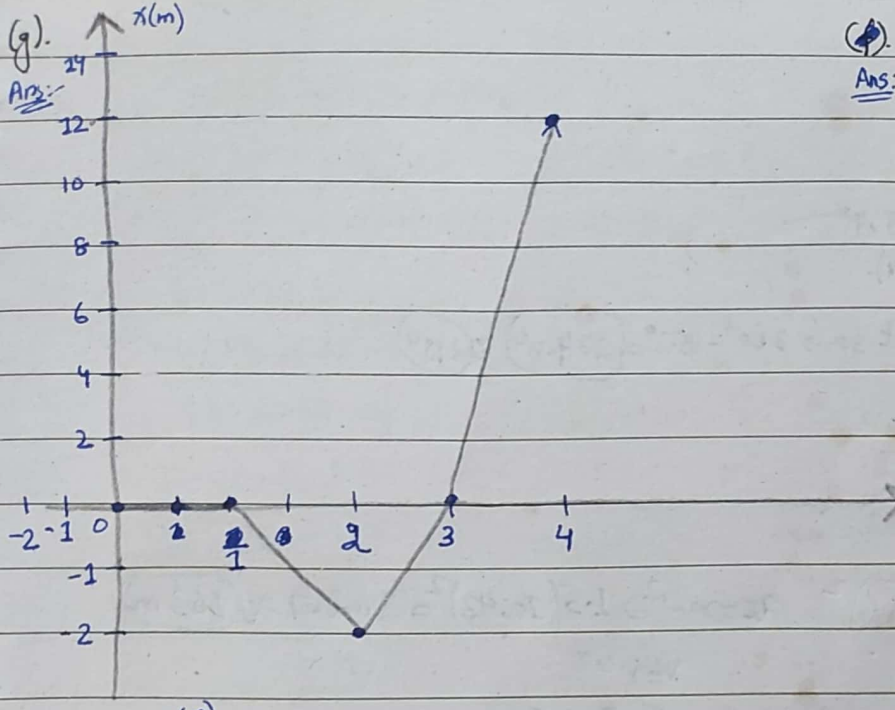
Date

$u = -0.2t$

(g).

Ans:-



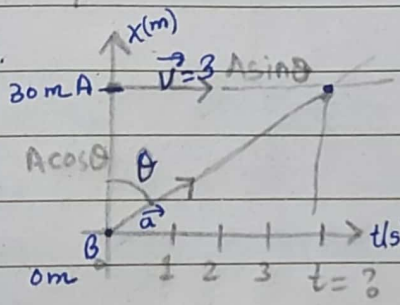

(f).

Ans:- for calculating using graph average velocity b/w 2 to 4s first at 4.0s the value of x is 12m and at t=2s the value of x is

$-2 \to 50 \to \Delta x = 14,\ \Delta t = 2s$

so Average velocity = 7m/s.

(4).



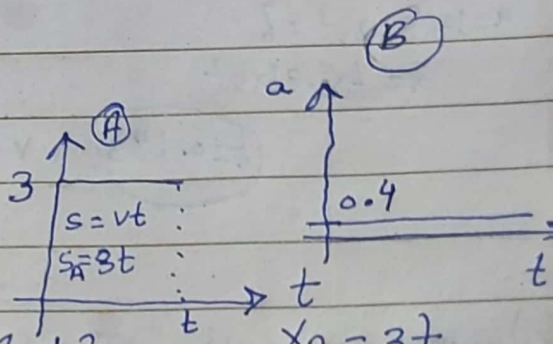

$y = 30m$

velocity at $y = 30m \to 3 m/s$.

constant acceleration $B \Rightarrow 0.4 m/s^2$

$B = S = 0,\ a = 0.4,\ t = ?$

$A = S = 30,\ v = 3,\ a = 0,\ t = ? \to$




$S_y = uyt + \frac{1}{2}at^2$

$30 = (0) + \frac{1}{2}(a\cos\theta)t^2$

$t^2 = \frac{150}{a\cos\theta}$

$10a\sin^2\theta = 15a\cos\theta$

$\frac{10\sin^2\theta}{\cos^2\theta} = \frac{15a}{a\cos\theta}$

$10\sin^2\theta = 15\cos\theta$

$10 - 10\cos^2\theta = 15\cos\theta$

$10\cos^2\theta + 15\cos\theta - 10 = 0$

$x = 0.5,\ x = -2$

$\cos\theta = 0.5$

$\theta = 60°$

$x_A = 3t$

$x_A = x_B$

$3t = \frac{1}{2}x(a\sin\theta)t^2$

$t = \frac{1}{b}(0.4\sin\theta)\frac{25}{\cos\theta}$

$t = 10\tan\theta$

(5). (a) $r = (2.0t^3 - 5t)i + (6 - 7t^4)j$

$r = (2(2)^3 - 5(2))i + (6 - 7(2)^4)j \to \boxed{\vec{r} = 6i - 106j}$

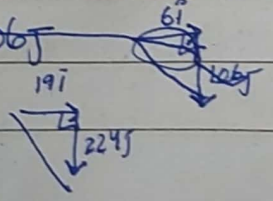
(b). $V = (6t^2 - 5)i + (-28t^3)j$

$V = (6(2)^2 - 5)i + (-28(2)^3)j \to \boxed{\vec{V} = 19i - 224j}$

(c). $a = (12t)i - (84t^2)j \to a = (12(2))i - 84(2)^2 = \boxed{\vec{a} = 24i - 336j}$

(d). ~~$V(2) = 6i - 106j$~~

$V(2) = 19i - 224j$



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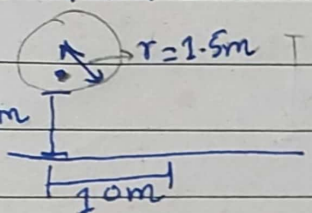
$\tan\theta = \left|\frac{224}{19}\right| \rightarrow \theta = 85.2°$ in 4th quadrant so $\rightarrow 360° - 85.2° = \boxed{274.8°} \approx \boxed{275°}$

06).

Ans:-




$a_c = r\omega^2 \rightarrow 1.5(10.42)^2 = 162.9 \approx \boxed{163\ m}$

$a=10,\ s=2,\ t=?$

$2 = \frac{1}{2} \times 9.81 \times t^2$

$\boxed{t = 0.64\ s}$

$s = vt$

$10 = v(0.64)$

$\boxed{v = 15.63}$

$v = r\omega$

$15.63 = 1.5 \times \omega$

$\boxed{\omega = 10.42}$

07) (a). $a(t) = At - B(t)^2 \rightarrow a(t) = 1.5t - 0.12t^2$

Ans:-

$v(t) = \frac{1.5t^2}{2} - \frac{0.12t^3}{3} \rightarrow v(t) =$

At $t=0, v=0, s=0$

$\boxed{v(t) = 0.75t^2 - 0.04t^3}$

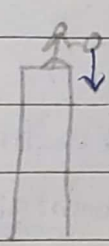
$\frac{dv}{dt} = \frac{0.75t^3}{3} - \frac{0.04t^4}{4} \rightarrow \boxed{0.25t^3 - 0.01t^4 = a(t)}$

(b). Ans:- $a=0 \rightarrow \frac{dv}{dt} = 0 \rightarrow 0 = t(1.5 - 0.12t)$

$\boxed{t = 12.5s}$

$v(12.5) = 0.75(12.5)^2 - 0.04(12.5)^3 = 39.0625 \approx \boxed{39.1\ m/s}$

Q8).

(a). 

$u = 6\,m/s$, $a = +9.81\,m/s$

$v = u + at$

$v = 6 + (9.8)(2) =$ **25.62 m/s**

(b). $2as = v^2 - u^2$

$s \times 2 \times 9.81 = 25.62^2 - 6^2$

$s =$ **31.62 m**

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

$20 = 6t + 4.9t^2$

$5t^2 + 6t - 10 = 0$

$t =$ **0.94 s**

$v = u + at$

$v = (6) + (9.81)(0.94)$

$v =$ **15.22 m/s**

Q9). (a). Ans:- $s = 25$, $t = 20s$ Average velocity $= \frac{25}{20} =$ **1.25 m/s**

(b). $\frac{-25}{15} =$ **−1.67 m/s.**

(c). $25 - 25 = 0$ so Average velocity $= \frac{\Delta x}{\Delta t} = \frac{0}{\Delta t} =$ **0 m/s**

(d). Average speed $= \frac{\text{Total distance}}{\text{Total time}} = \frac{25+25}{20+15} =$ **1.43 m/s**

Q10). (i). $\frac{dx}{dt} = -3t^2 + 4t - 2$, $y = 6t^2 - 4t$

$v = -6t + 4$, $y = 12t - 4$

$a_x = -6$, $a = a_y = 12$ → So acceleration is constant on both x, y components so acceleration is also constant.

(ii). $x_x = -3t^3 - 4t$, $^x y = -5t^2 + 6$

$v_x = -9t^2 - 4$, $v_y = -10t$ → as only y component of acceleration is constant, x will be changing as it will also change so overall acceleration would also be not constant.

(iii) $\vec{r} = (2t^2)\hat{i} - (4t+3)\hat{j}$

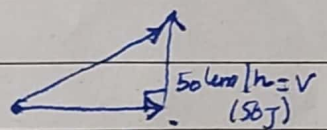
$\vec{v} = (4t)\hat{i} - (4)\hat{j}$

$\vec{a} = 4\hat{i} - 0\hat{j} = \vec{a} = 4\hat{i}$ Here x component of acceleration is 4 which will be constant as $\hat{i}$ is not dependent on (t) so total acceleration will be constant as y component will also be constant.

(iv). $\vec{r} = (4t^3 - 2t)\hat{i} + 3\hat{j}$

$\vec{v} = (12t^2 - 2)\hat{i} + 8\hat{j}$ Here x component will vary as (t) will change so acceleration will not be constant and as y component is zero so it will be constant but overall acceleration will not be constant.

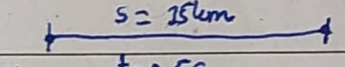
Q11). Ans:-




$a = \frac{v_f - u_i}{t} = \frac{50\hat{j} - 60\hat{i}}{2} = \frac{78.1}{2} \times \frac{1000}{3600} = \boxed{10.9\ m/s^2}$

$a = \sqrt{a_x^2 + a_y^2} \rightarrow \sqrt{(-60)^2 + (50)^2} = \boxed{78.1}$

Q12). Ans:-




college → home = $t = 20\text{min} = \frac{20}{60} = 0.33s$

$t = 30\text{min} \rightarrow \frac{30}{60} = (0.5s)$

(a). Average speed = $\frac{\text{Total distance}}{\text{Total time}} = \frac{15}{0.5} = \boxed{30m/s}$

(b). Average speed = $\frac{30}{0.5 + 0.33} = \boxed{36.1m/s}$

(c). Average velocity = $\frac{\Delta x}{\Delta t} = \frac{15 - 15}{0.5 + 0.33} = (0\ m/s)$

Q13). (a). Ans:- $x = -4t + 2t^2 \rightarrow$ At $t=0$ to $t=1 \rightarrow x = -4(1) + 2(1)^2 = -2m$, At $t=0 = x=0$

so $\boxed{\Delta x = -2m} \rightarrow t=0$ to $t=1s$

$x_1 = -4t + 2t^2 \rightarrow$ At $t=1s \rightarrow x = -2m$

$x_3 = -4(3) + 2(3)^2 \rightarrow 6m$

$\rightarrow$ so $x = x_3 - x_1 \rightarrow 6 - (-2) = (8m)$

V=60

Bezilud Dinkuhan [244-0559].

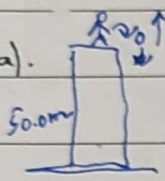
Date

(B). Average velocity ($t=0$ to $t=3s$) $\rightarrow \frac{\Delta x}{\Delta t} = \frac{-2-0}{1-0} = \boxed{-2\,m/s}$

Average velocity ($t=1s$ to $t=3s$) $\rightarrow \frac{\Delta x}{\Delta t} = \frac{8}{2} = \boxed{4\,m/s}$

(c). $v = -4 + 4t \rightarrow -4 + 4(\frac{5}{2}) \rightarrow \boxed{6\,m/s}$

Q14). (a).




$u = 20\,m/s, a = -10, v = 0$

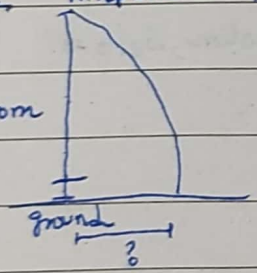
$V = u + at$

$0 = 20 - 9.81t \rightarrow \boxed{t = 2.04s}$

(b). $s = ut + \frac{1}{2}at^2 \rightarrow s = (20)(2.04) + \frac{1}{2}(-9.81)(2.04)^2 = \boxed{20.4m}$ so Max Height $= 50 + 20.4 = \boxed{70.4m}$

(c). Total time $= 2.04 \times 2 = 4.08 \approx \boxed{4.1s}$ To reach to return point.

Q15). Ans:-




Airplane $\rightarrow u = 40\,m/s$, $a = +9.81$

$s = ut + \frac{1}{2}at^2$ $\quad u_y = 0$ [vertical component]

$100 = 0 + \frac{1}{2}(9.81)(t)^2 \rightarrow t = \sqrt{\frac{200}{9.81}} = \boxed{4.52s}$

$s = vt$

$s_x = 40 \times (4.52) = 180.61m \approx \boxed{180m}$