YAKEEN NEET 2.0

2026

Motion in a Straight Line

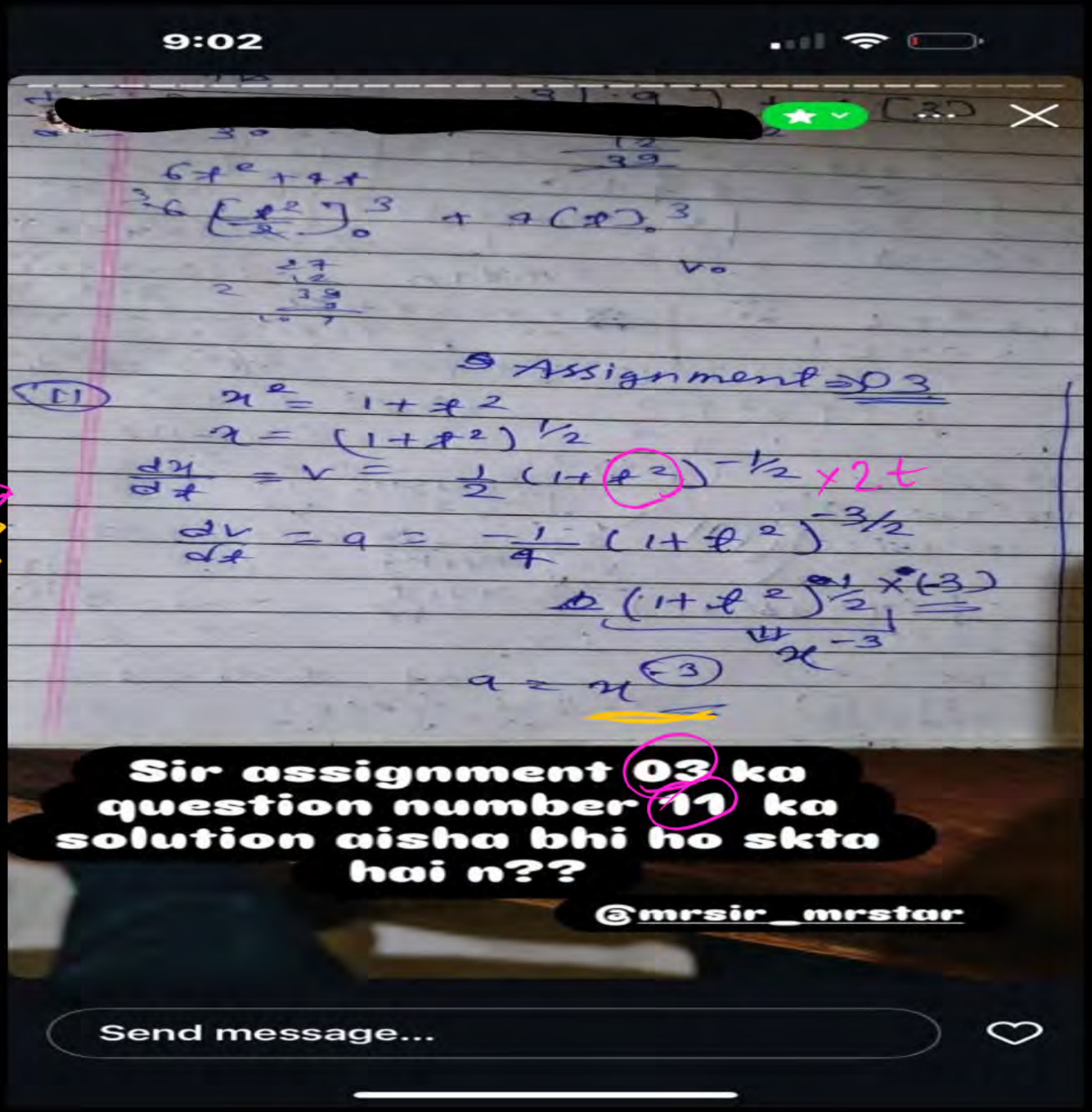
Physics | Lecture - 9

By- Manish Raj (MR Sir)

Todays Goal

H/W solution (Revision)

Graph & its application (v-t)



Ramlal scam

$x = (1+t^2)^{1/2}$

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

$v = \frac{1}{2}(1+t^2)^{-\frac{1}{2}} \times 2t$

$a = \frac{dv}{dt}$

Question

HW

Object starts his motion from rest and constant acceleration then find ratio of displacement in 6^{th} sec and 6 sec.

$u = 0$

$S_{nth} = u^{0} + \frac{a}{2}(2n-1)$

$= \frac{a}{2}(11)$

$S_{t=n\text{-sec}} = ut^{0} + \frac{1}{2}at^2$

$= \frac{1}{2}a(6)^2$

$\frac{S_{nth}}{S_{n\cdot}} = \frac{\frac{a}{2}11}{\frac{a}{2}36} = \frac{11}{36}$ Ans (NEET)

(#)

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

↑ total displ in time t

$S_{nth} = u + \frac{a}{2}(2n-1)$

Likha करिए:

Revision

object starts from rest ($u=0$) & const^n acc^n then

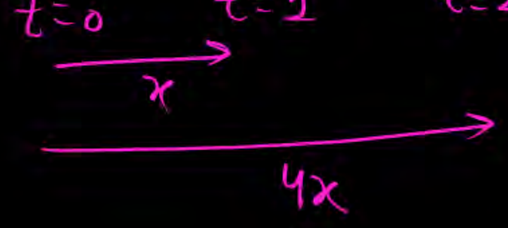
$$S_{1\,sec} = \frac{1}{2}a(1)^2 = a/2$$

$$S_{2\,sec} = \frac{1}{2}a(2)^2 = 4(a/2)$$

$$S_{1sec} : S_{2sec} = a/2 : 4(a/2)$$

$$= 1 : 4$$

$$= x : 4x$$



Displ^m in time t: $S = ut + \frac{1}{2}at^2$ ($u = 0$)

$$S_t = \frac{1}{2}at^2 = x(\text{say})$$

Displ^m in time $t' = 2t$:

$$S_{2t} = \frac{1}{2}a(2t)^2$$

$$= \frac{1}{2}a\,4t^2$$

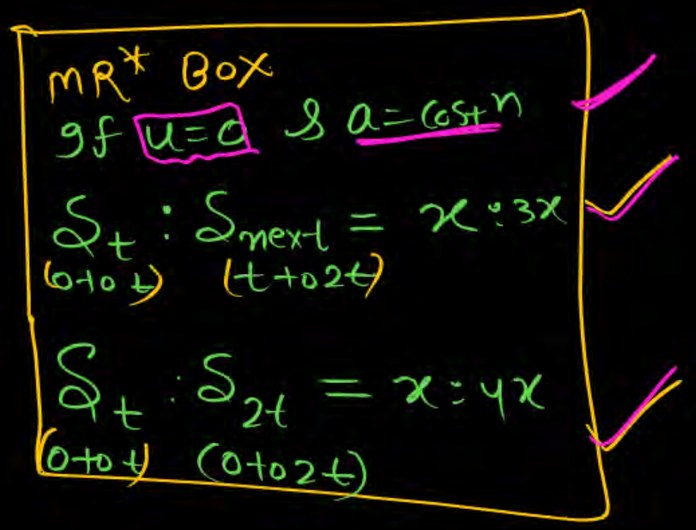
$$= 4\left(\frac{1}{2}at^2\right)$$

$$= 4x$$

$S_{1\,0sec} : S_{2\,0sec} = x : 4x$

$S_{5sec} : S_{10se} = x : 4x$

$S_{10sec} : S_{next\ 10sec} = x : 3x$


MR* Box
If u=0 & a=constn
$S_t : S_{next} = x : 3x$
(0 to t) (t to 2t)
$S_t : S_{2t} = x : 4x$
(0 to t) (0 to 2t)

Question

A particle starts from rest and constant acceleration it moves 40 m in 3 sec then find distance in next 3 sec or 3 sec to 6 sec.

$S_1 : S_2 = x : 3x$

$= 40 : 3 \times 40$

$= 120$ Ans

Question

A small toy starts moving from the position of rest under a constant acceleration. If it travels a distance of 10m in t s, the distance travelled by the toy in the next t s will be:

[JEE Main 2022]

1. 10 m
2. 20 m
3. 30 m
4. 40 m

Question

Object starts from rest ($u=0$) and constant acceleration, it moves 80 m in 6-sec then find displacement in 12-sec.

$S_{6sec} : S_{12sec} = x : 4x$

MR*

$= 80 : 4 \times 80$

$= 80 : 320\ m$

Matlom se doori inR* Jarura

Ans

मजदूरी

$u = 0$, $t = 6\ sec$, $S = 80\ m$

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

$80 = 0 + \frac{1}{2} a (6)^2$

$160 = a\, 36$

$a = \frac{160}{36} = \frac{80}{18} = \frac{40}{9}$

Total dispⁿ in $t = 12\ sec$

$S_{in\ 12sec} = ut + \frac{1}{2} a t^2$

$= \frac{1}{2} \cdot \frac{40}{9} (12)^2$

$= \frac{40}{2 \times 9} \times 12 \times 12$

$= 320\ m$

(2) Object starts his motion from rest and constant acceleration, moves 90m in 1st sec then find disp^{m} in 2-sec.

$$S_{1sec} : S_{2se} = x : 4x$$

$$= 90 : 4 \times 90$$

$$= 90 : 360\,m$$

Ans

Question

H/W

A particle experiences a constant acceleration for 20 sec after starting from rest. If it travels a distance S_1 in the first 10 sec and a distance S_2 in the next 10 sec, then:

NEET–2014

1. $S_1 = S_2$
2. $S_1 = S_2/3$
3. $S_1 = S_2/2$
4. $S_1 = S_2/4$

$S_1 : S_2 = 1 : 4$ ✗

$S_1 : S_2 = 1 : 3$

$\frac{S_1}{S_2} = \frac{1}{3} \Rightarrow S_1 = \frac{S_2}{3}$

Question

A motor car moving with a uniform speed of 20 m/sec comes to stop on the application of brakes after travelling a distance of 10 m. Its acceleration is:

1. $20\ \text{m/sec}^2$
2. $-20\ \text{m/sec}^2$
3. $-40\ \text{m/sec}^2$
4. $+2\ \text{m/sec}^2$

$u = 20\ \text{m/s}$ $\quad v = 0$

3rd eqn of motion

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

$0 - (20)^2 = 2 \times a \times 10\ \text{m}$

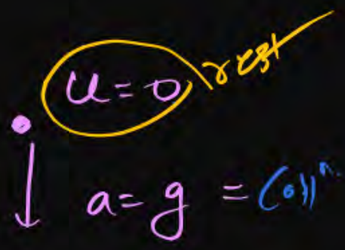
$a = \frac{-400}{20}$

$a = -20\ \text{m/s}^2$

Question

What will be the ratio of the distance moved by a freely falling body from rest in 4^{th} and 5^{th} seconds of journey? **[1989]**

1. 4 : 5
2. 7 : 9
3. 16 : 25
4. 1 : 1



$S_1 : S_2 : S_3 : S_4 : S_5 = 1 : 3 : 5 : 7 : 9 : 11 : 13$

Question

A body starts from rest travelled a distance 120 m in the 8^{th} sec then acceleration is:

1. 10
2. 8
3. 16
4. 4

$S_{n^{th}} = u + \frac{a}{2}(2n-1)$

$120 = 0 + \frac{a}{2}(2\times 8 - 1)$

find (a)

all H/w done

likhai

(Q) Object starts his motⁿ with speed u and costⁿ accⁿ aftr some distance its velocity becoms v then find velocity of object at mid Point :-

(Compᵗ Jaan)

1st half →

$$v^2 - u^2 = 2ad \quad -①$$

$$v_m^2 - u^2 = 2a\frac{d}{2} \quad -②$$

$$\frac{v^2-u^2}{v_m^2-u^2} = \frac{1}{(1/2)}$$

$$v^2 - u^2 = 2(v_m^2 - u^2)$$

$$v^2 - u^2 = 2v_m^2 - 2u^2$$

$$v^2 - u^2 + 2u^2 = 2v_m^2$$

$$v^2 + u^2 = 2v_m^2$$

$$\left\{ v_{m_{rms}} = \sqrt{\frac{v^2+u^2}{2}} \right\}$$ rms velocity at mid point

#

$$v_{Avg} = \frac{u+v}{2}$$

Question

An engine of a train, moving with uniform acceleration, passes the signal-post with velocity u and the last compartment with velocity v. The velocity with which middle point of the train passes the signal post is: **[JEE Main 2021]**

1. $\frac{u+v}{2}$
2. $\sqrt{\frac{v^2+u^2}{2}}$
3. $\frac{v-u}{2}$
4. $\sqrt{\frac{v^2-u^2}{2}}$

Do not write

Likha hai

Object is Project up with u then find its velocity at Mid Point :—

$$v_{mid} = \sqrt{\frac{u^2 + 0}{2}}$$

$$= \left(\frac{u}{\sqrt{2}}\right) Ans$$

Question

A car is moving along a straight road with a uniform acceleration. It passes through two points P and Q separated by a distance with velocity 30 km/h and 40 km/h respectively. The velocity of the car midway between P and Q is **[1988]**

1. 33.3 km/h
2. $20\sqrt{2}$ km/h
3. $25\sqrt{2}$ km/h
4. 35 km/h.

$$v_{mid} = \sqrt{\frac{(30)^2+(40)^2}{2}}$$

$$= \sqrt{\frac{2500}{2}}$$

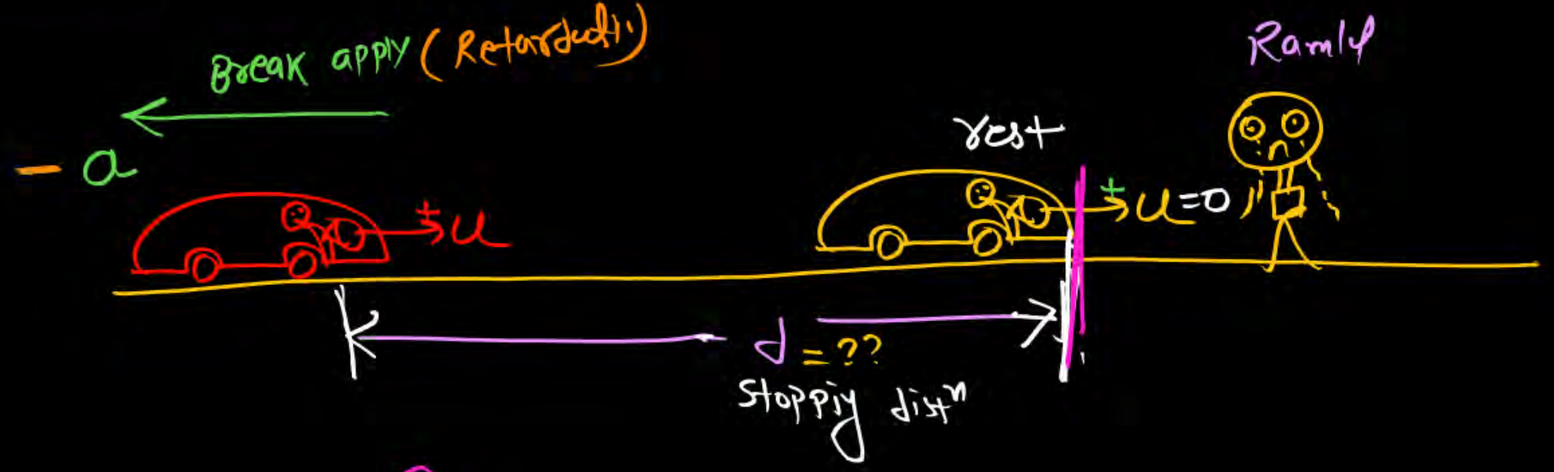
$$= \frac{50}{\sqrt{2}} = \frac{25\times\sqrt{2}}{\sqrt{2}}$$

$$= 25\sqrt{2}$$

दोनों के बीच में स्थित वेग

लिखना है

Stopping distance



$$d \propto u^2 \quad (a = \text{same})$$

(#) $v^2 - u^2 = 2as$ ($v = 0$)

$0 - u^2 = 2(-a)d$

$d = \frac{+u^2}{+2a}$

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

Ratta नहीं लगाना

* time after which car will stop :-

$v = u + at$

$+u = +at$

$t = u/a$

If $u = 10\ m/s$

$d_1 = \frac{(10)^2}{2a} = \frac{100}{2a}$

If $u = 20\ m/s$

$d_2 = \frac{(20)^2}{2a} = \frac{400}{2a} = 4d_1$

MR = DR

x km/hr $\longrightarrow$ $x \times \frac{5}{18}$ m/sec

Question

$u_i = 72 \times \frac{5}{18} = 20\ m/s$ ✓

A bus moving along a straight highway with speed of 72 km/h is brought to halt within 4s after applying the brakes. The distance travelled by the bus during this time (Assume the retardation is uniform) is _____ m.

[JEE Main 2024]

$(V=0)$ final speed.

1st eqn of motion

$V = u + at$

$0 = 20 + a \times 4$

$4a = -20$

$a = -5\ m/s^2$

This is correct but मजबूरी में

3rd eqn →

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

$0 - (20)^2 = 2 \times (-5)\, s$

$-400 = -10\, s$

$s = 40\ m$

$S = ut + \frac{1}{2}at^2$ 40m

(Right) $s = \left(\frac{u+v}{2}\right)t$

$s = \left(\frac{20+0}{2}\right) \times 4$

$s = 40\ m$

कितना है!

Question

A car is moving with speed of 150 km/h and after applying the break it will move 27m before it stops. If the same car is moving with a speed of one third the reported speed then it will stop after travelling _____ m distance.

[JEE Main 2022]

MR*

$d \propto u^2$

$d' \propto u'^2 \propto \left(\frac{u}{3}\right)^2$

$= \frac{u^2}{9}$

$d' = \frac{d}{9} = \frac{27}{9} = 3m$

$u_1 = 150 km/hr$

$u_2 = \frac{150 km/r}{3} = 50 km/hr$

Case-1 $\quad d_1 = \frac{u_1^2}{2a}$

$\Rightarrow$

Case-2 $\quad d_2 = \frac{u_2^2}{2a}$

$\frac{27}{d_2} = \frac{(150)^2}{(50)^2} = \frac{150 \times 150 \times 150}{50 \times 50}$

$\frac{27}{d_2} = 3$

$d_2 = 3m$

Correct

Question

Object starts his motion with u and constant acceleration a then find its velocity at one 3rd displacement of complete journey if final velocity is V.

(Q) Object starts his motion with 20 m/s and retardation $-6\ m/s^2$ then displ^m in 4^{th} sec.

हिंदी

$$S_{n^{th}} = u + \frac{a}{2}(2n-1)$$

$$= 20 - \frac{6}{2}(2\times 4 - 1)$$

$$S_n = 20 - 3\times 7$$

$$\boxed{S_{n^{th}} = -1\ m}$$

Ans

CAR is moving with intial speed 55 m/s and retardation -10 m/s²

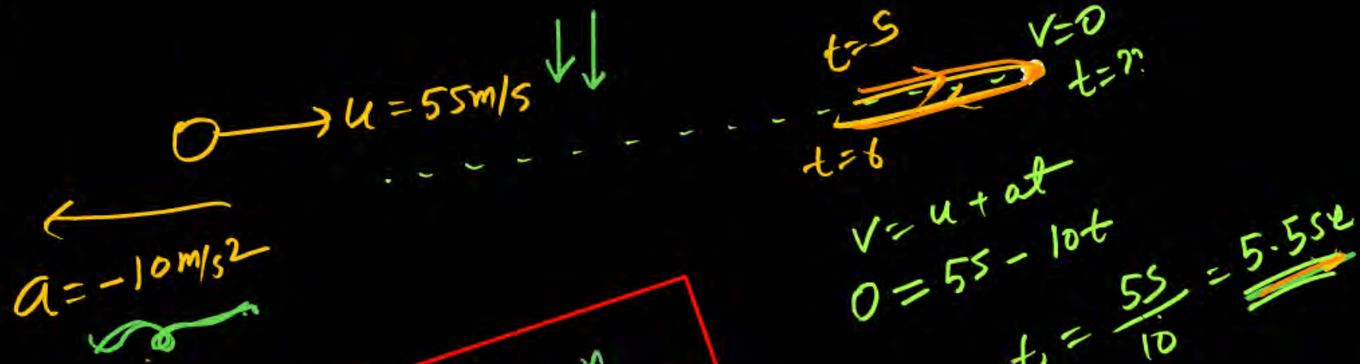
find distance in 6th sec.

5s to 6 sec

Soln

MR Scam.

(a) zero (80%) 414 X



$v = u + at$

$0 = 55 - 10t$

$t = \frac{55}{10} = 5.5s$

distance ≠ displ^n

→ wait for calculation of distance

* application of graph.

→ $S_{n+1} = u + \frac{a}{2}(2n-1)$

displ^m

$= 55 - \frac{10}{2}(2\times6-1)$

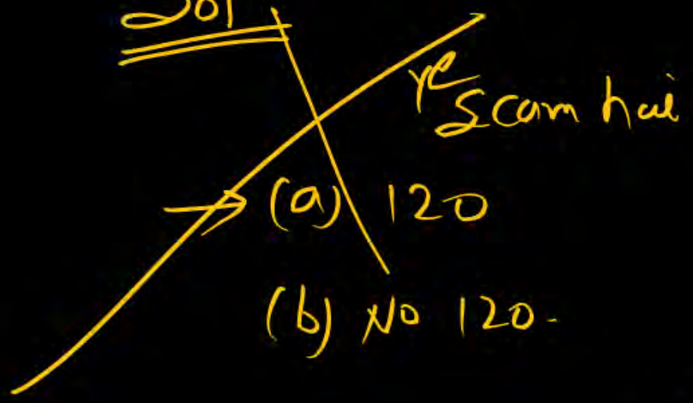
$= 55 - 5\times11$

$= 55 - 55 = 0$

(Q) object starts his motion with 10m/s and const acc^n _ disp^m traveled is 40m in 3sec then find disp^m. next 3 - sec.

Yaha $u=0$ नहीं है।

Soln

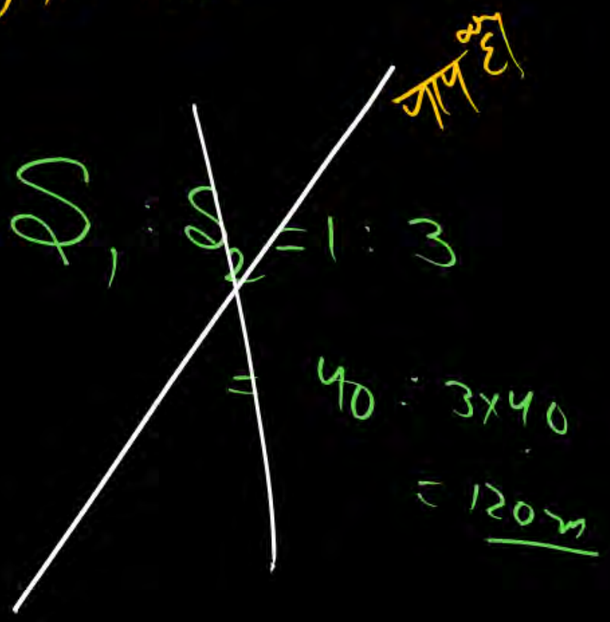


Ratio वहीं लगेगा

Application of graph

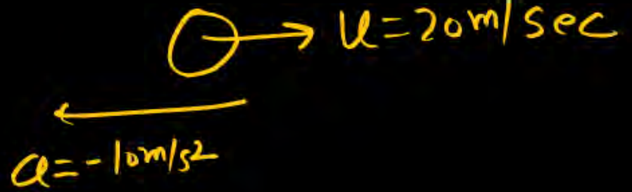
graph se Karenge

(#) $S_1 : S_2 = 1 : 3$

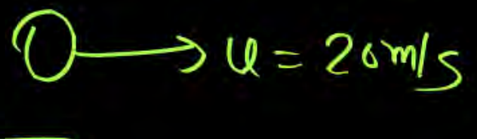


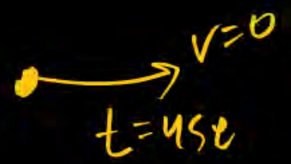
$= 40 : 3 \times 40$

$= 120m$



t=2sec
→ v=0





कितनी देर में रुकेगा

@ Initial velocity of object is 60m/s and retardation $-10m/s^2$ find distance moved by object is 8-sec,

Distance ≠ dist" → U turn हो रहा है।

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

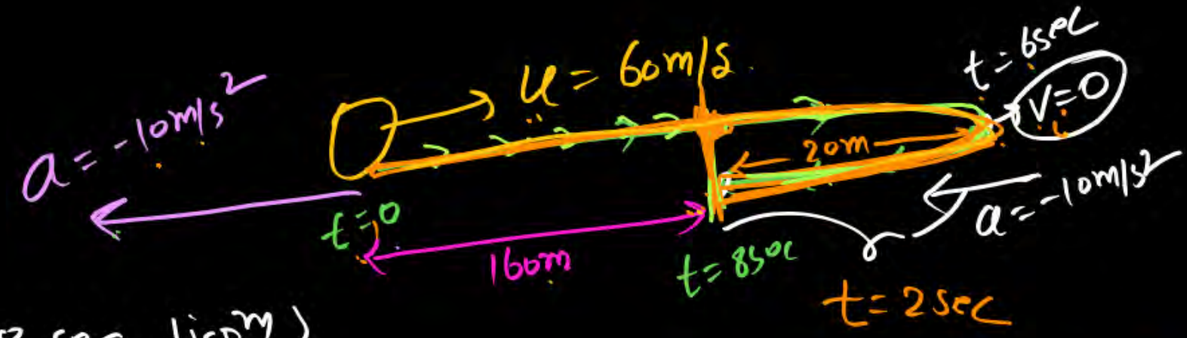
$S = 60\times8 - \frac{1}{2}\times10\times(8)^2$

$= 480 - 5(64)$

$= 480 - 320$

$= 160m$

* $\int$ cam $\frac{a^2}{\varepsilon}$



gn 8-sec displ^n is 160m but Not dist^n

Total dist^n in 8-sec = 200m

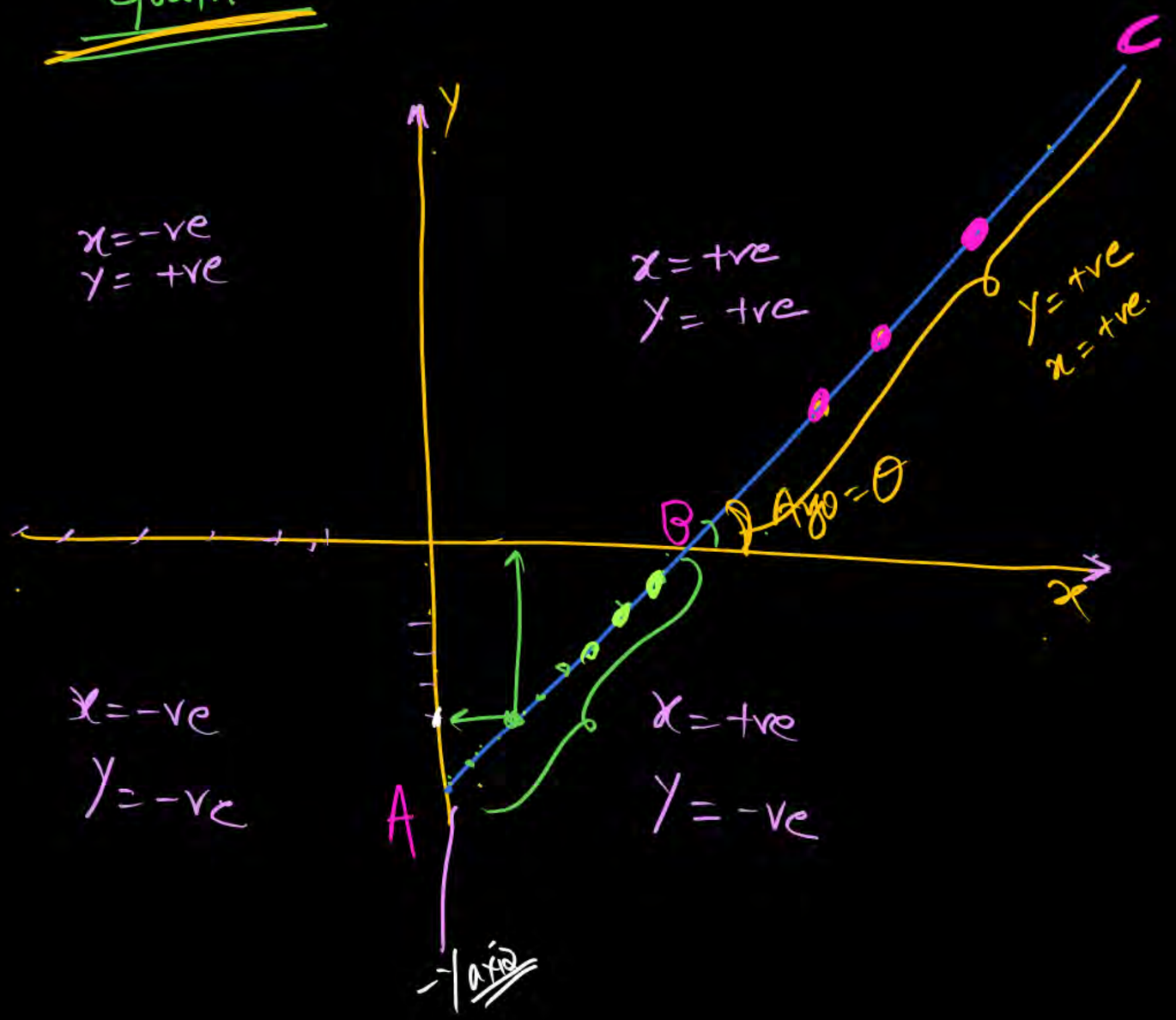
$S = \frac{1}{2}(-10)(2)^2$

$S = \frac{1}{2}\times(-10)\times4^2$

$S = -20m$

(Applicatⁿ of graph)

Graph:- लिखो



$\theta < 90°$ $m = +ve$

$\theta > 90°$ $m = -ve$

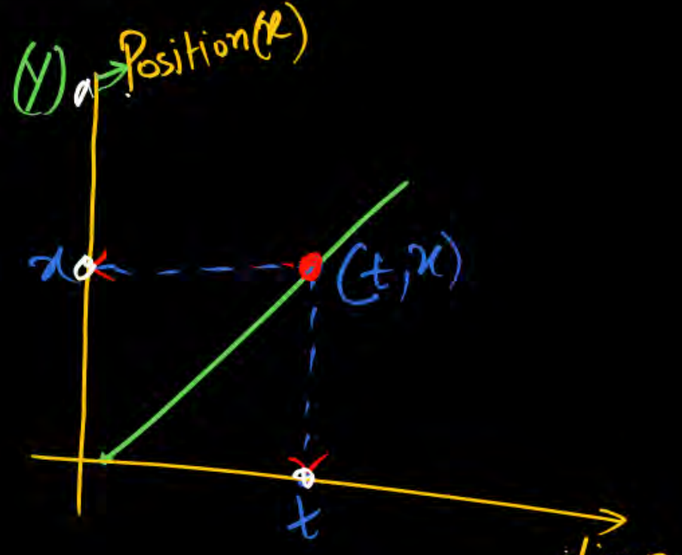
$$\text{Slope} = \tan\theta = \frac{dy}{dx}$$

Slope of straight line remain same

AB → +ve

BC → +ve

$$\text{Area under Curve} = \int y\,dx$$



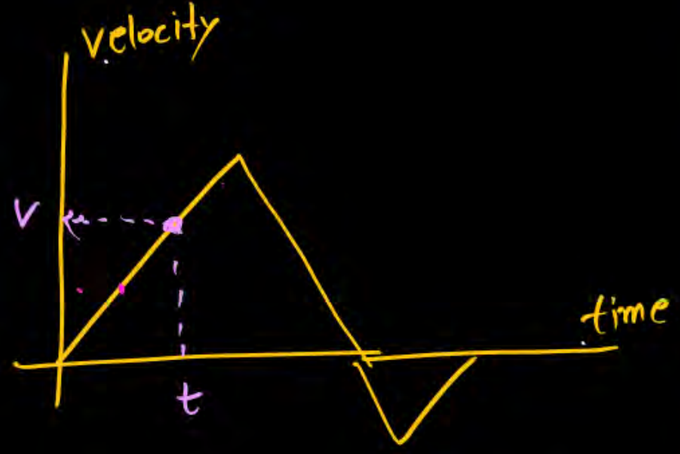
$$\text{Slope} = \frac{dy}{dx}$$ → Position, x = time

$$\text{Slope} = \frac{dx}{dt} = \text{velocity}$$

y^{th} Co-ordinate → Position

x^{th} Co-ordinate → time

✗ Area $\int x\,dt$ = नहीं



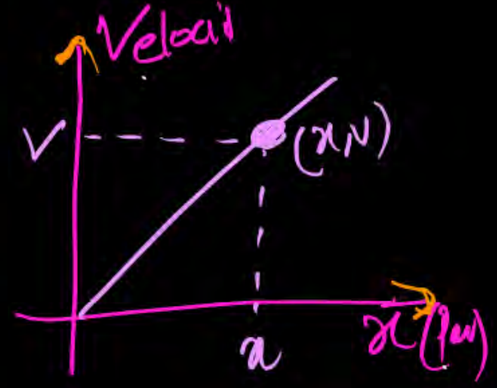
y^{th} co-ordinate → velocity

x^{th} coordinate → time

$$\text{Slope} = \frac{dv}{dt} = \text{acc}^n$$

Area under Curve = disp^m.

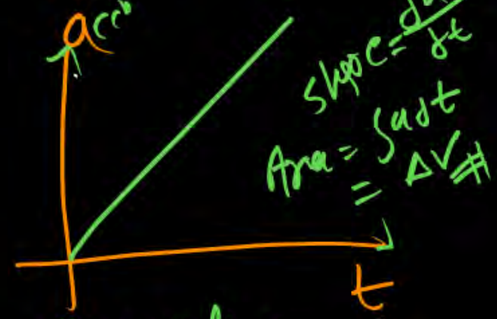
Change in position $= \int v\,dt$ = disp^m



y^{th} Coordinate → velocity

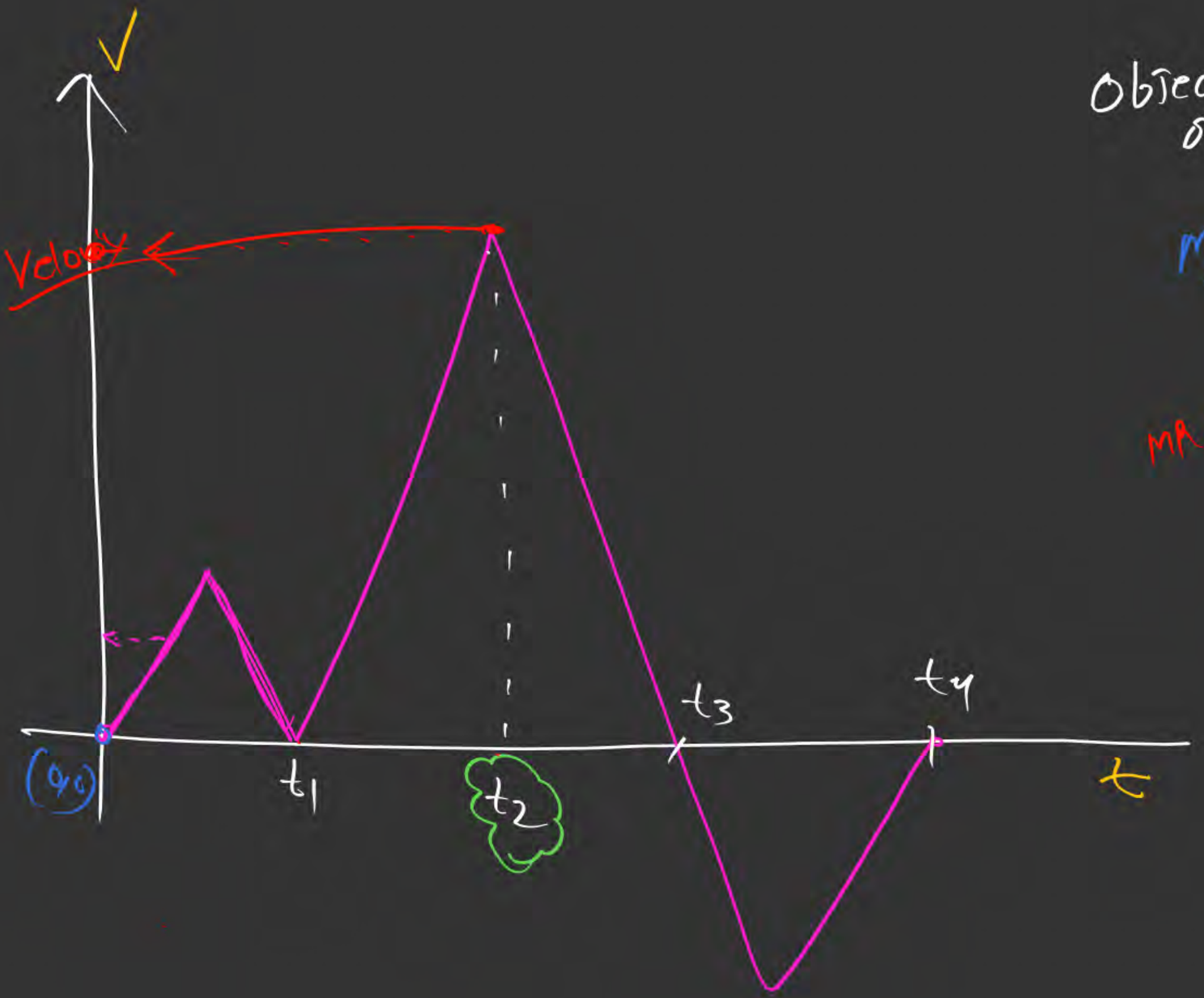
x^{th} cordinate → Position

✱ $$\text{Slope} = \frac{dv}{dx}$$



y^{th} cordinate → acc

x^{th} cordin → time



Object starts from origin (0,0), then

Max^m Position (displ^m) of object at time

MA SCOM

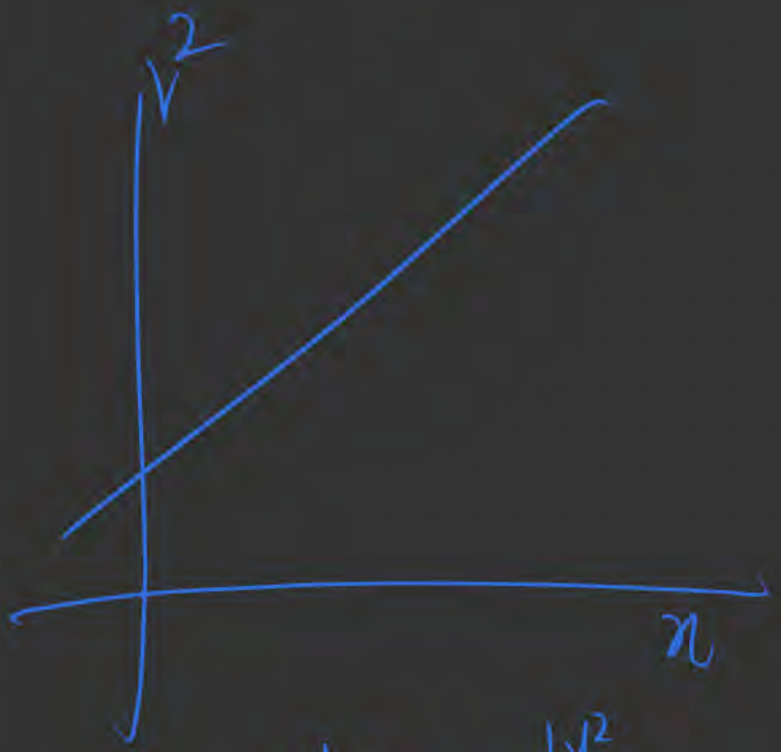
(a) t_1

~~for (b)~~ t_2 X

(c) t_3

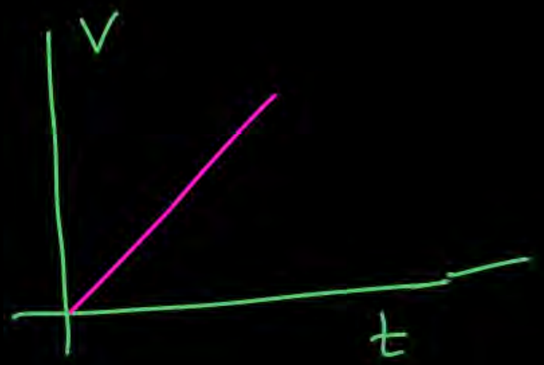
(d) t_4

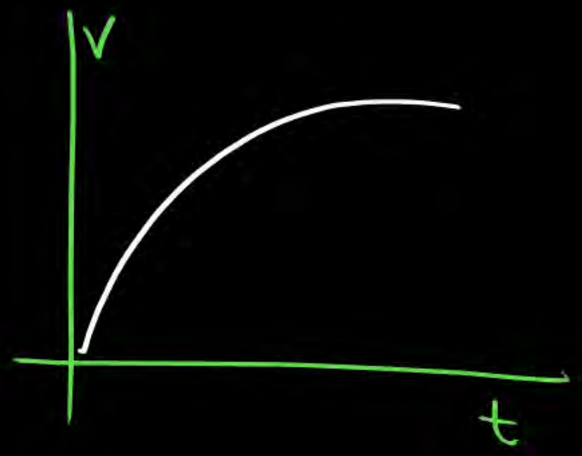
$$\frac{dv^2}{dt} = \text{slope}$$



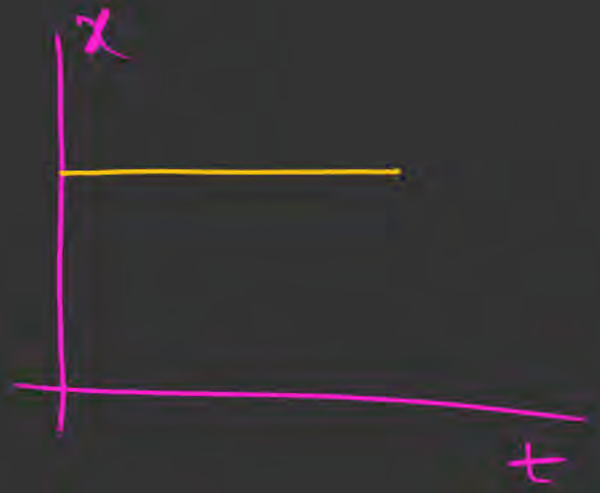
$$\text{slope} = \frac{dv^2}{dx}$$

find Nature of acceleration in given graph :—





H/W
acc^{n} +ve, -ve
Increas / decreasing
लिखना है।



H/W

Write Nature of velocity.

THANK YOU