PRAYAS 2.0

FOR IIT - JEE 2023

2027

Icr

Shivendu Sir

Motion in 1-D

-01

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(Live class)

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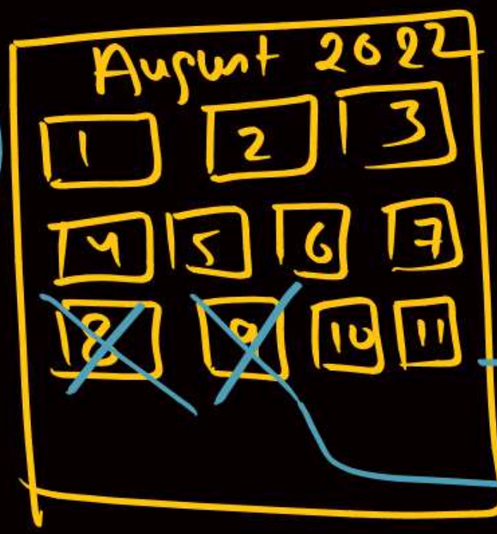
Calendar

Motivation

#2



Target (20th Jan) → 162 days

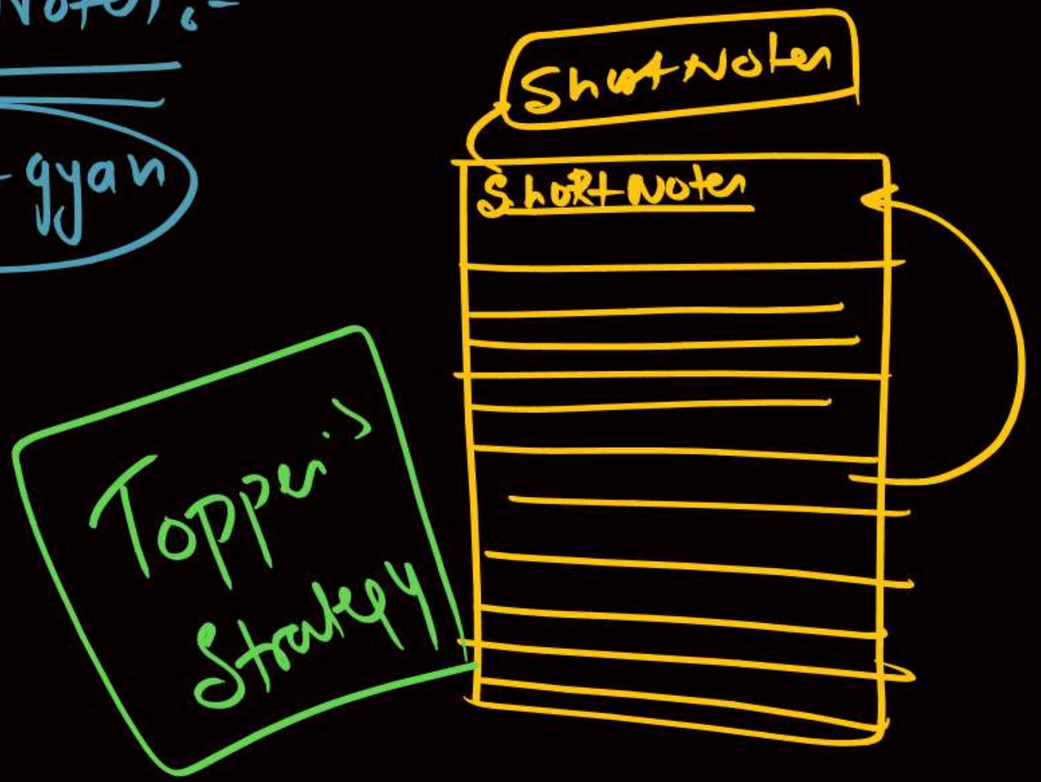
→ 161 days left

→ 160 day left.

लोहा जितना तपता है, उतनी ही ताकत भरता है
सोने को जितनी आग लगे, वो उतना प्रखर निखरता है
हीरे पर जितनी धार लगे, वो खूब चमकता है
मिट्टी का बर्तन पकता है, तब धुन पर खूब खनकता है
सूरज जैसा बन ना है, तो सूरज जैसा जलना होगा
नदियों सा आदर पाना है, तो पर्वत छोड़ निकलना होगा
और हम आदम के बेटे है, तो क्यों सोचे राह सरल होगा
Aकुछ ज्यादा वक़्त लगेगा, पर संघर्ष जरूर सफल होगा
हर एक संकट का हल होगा वो आज नहीं तो कल होगा

Short Notes :-

Gupt gyan



Introduction To Motion

Kinematics :- "Understanding of Motion without Knowing the Cause." → NLM

चाल = $\frac{\text{दूरी}}{\text{समय}}$

Speed = $\frac{\text{distance}}{\text{time}}$

REST AND MOTION :-

Both are Relative

Change in position w.r.t time is defined as Motion

	Rest	Motion
Sweety w.r.t Chinty	-Rest	X
Sweety w.r.t Aryan	X	✓

Gupt gyan:- No body in at Condition of Absolute Rest or Motion
Rest and Motion are Observer dependent.

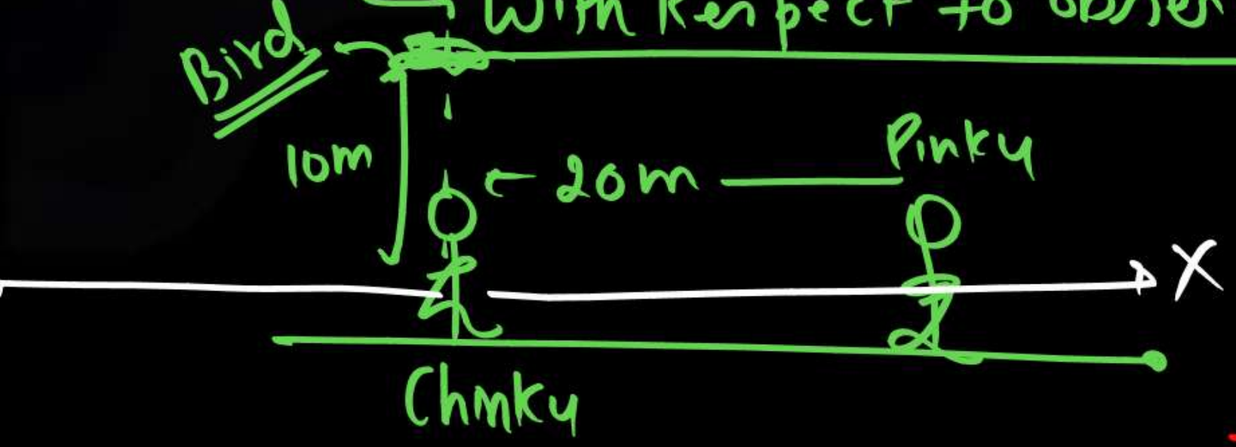
For our Consideration Earth is Assumed to be at Rest until and Unless Any special condition given in Question.

Q. Aryan in at Rest
W.r.t ground

Our Default Observer is ground

FRAME OF REFERENCE :-

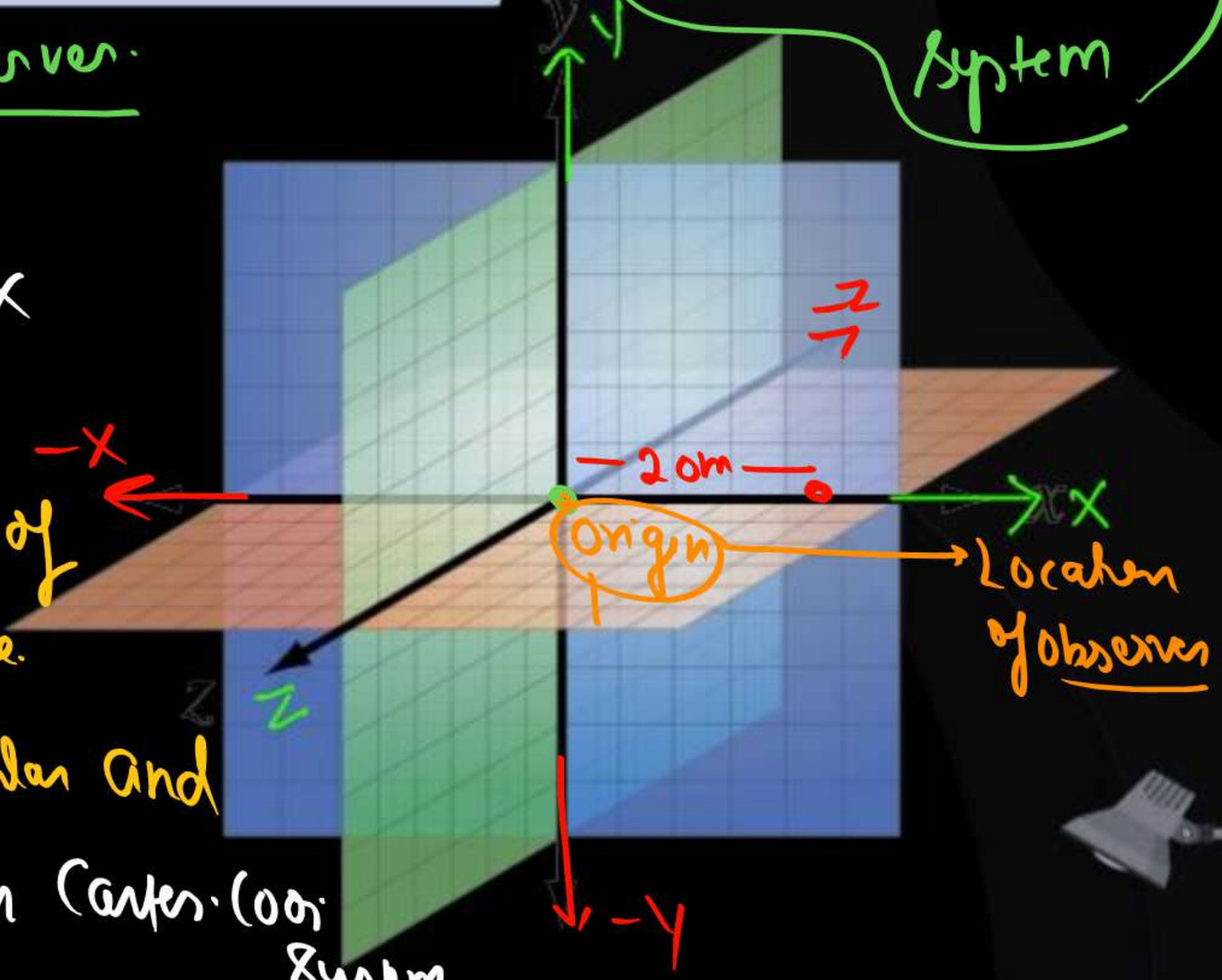
∴ With Respect to observer.

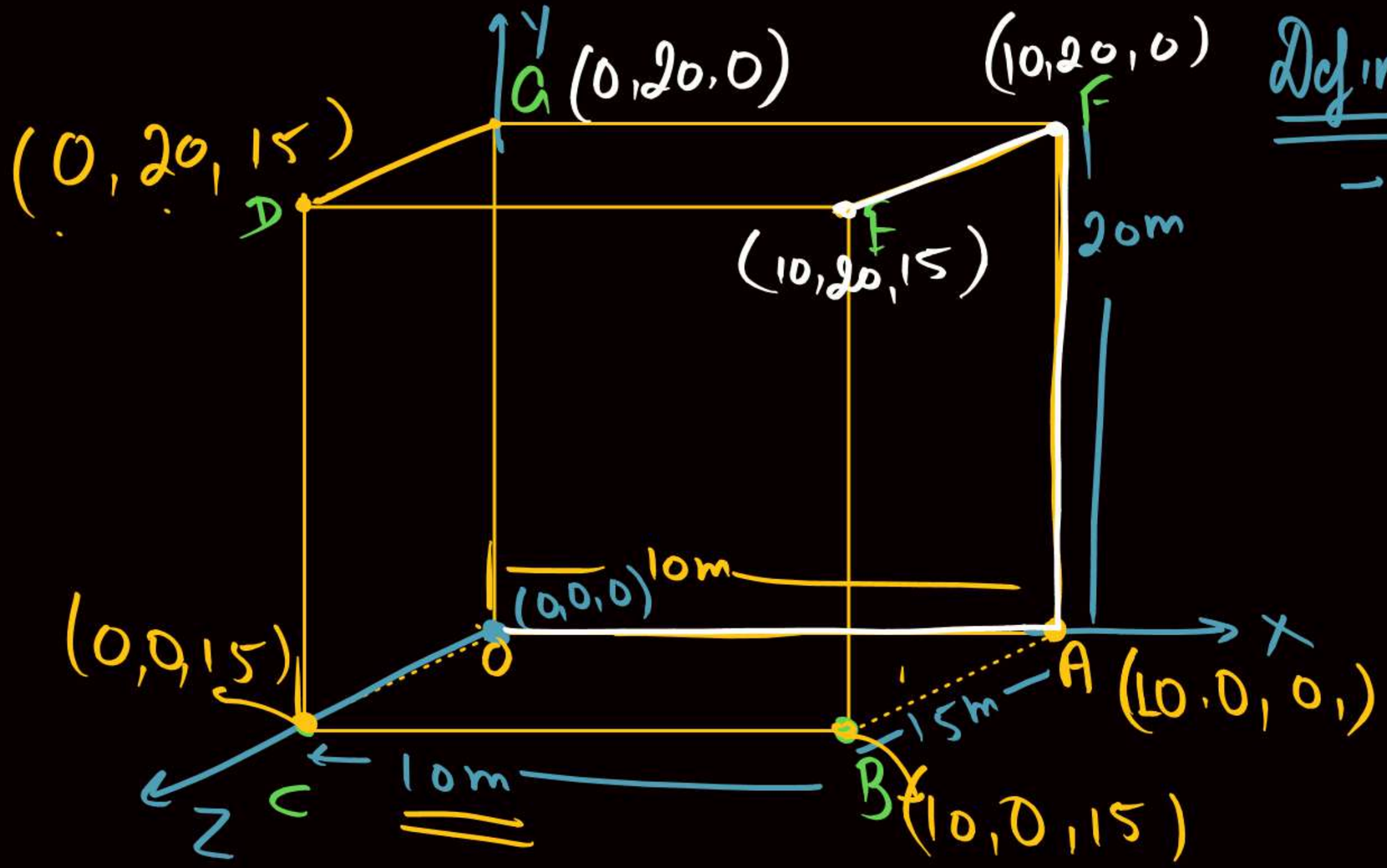


→ In order to define location of a point Uniquely. We define.

3-axis (Mutually perpendicular and one origin) is called as Cartes. Coor. System.

Cartesian co-ordinate System



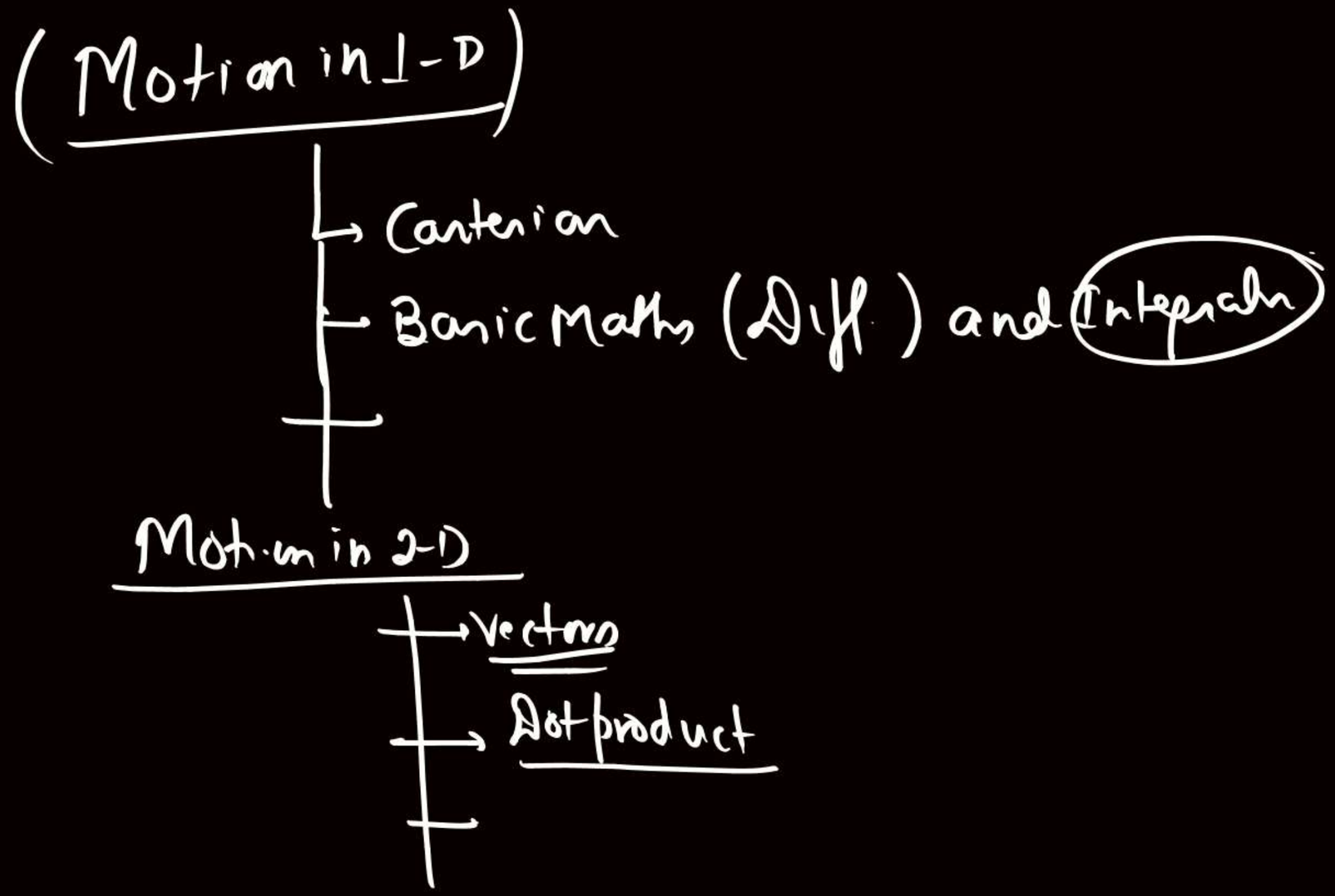


Defining location

- (Co-ordinates)

(X, Y, Z)

- Z → Displacement in Z-dir
- Y → Displacement in Y-dir
- X → Displacement in X-dir


Motion in 1-D
Cartesian
Basic Maths (Diff.) and Integrals
Motion in 2-D
Vectors
Dot product

Distance and Displacement

"Length of Path travelled"

→ (Scalar Quantity)

Min. Distance b/w Initial and final points

→ (Vector Quantity)

Dir. of Disp:- $(\overrightarrow{AB})$

A boy completes one round of a circular track of radius 20 m in 50 seconds. The displacement at the end of 4 minute 10 second will be

(1) 40 m (2) 20 m

(3) 80 k m (4) Zero

4 min - 10 sec

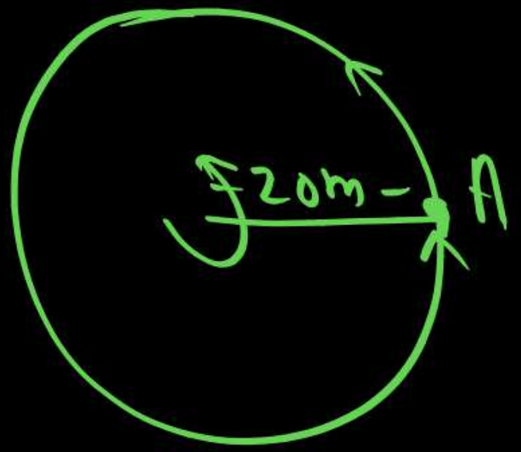
$= 4 \times 60 + 10$

$= 240 + 10$

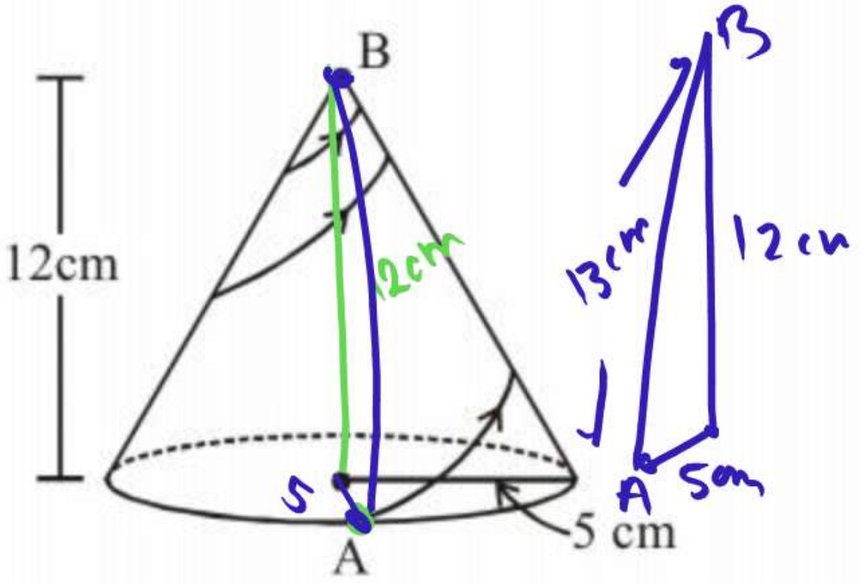
$= 250$ sec

No of Rounds

$= \frac{250}{50} = 5$ Round



An insect starts climbing a conical birthday hat of radius 5 cm at base. It starts from point A and reaches point B, taking spiral path on the hat. Find out its displacement if height is 12 cm:-



(1) 12 cm (2) 8 cm (3) 13 cm (4) 25 cm

Question-

A hall has the dimensions 10 m × 10 m × 10 m. A fly starting at one corner ends up at a diagonally opposite corner. The magnitude of its displacement is nearly

(1) $5\sqrt{3}$ m

(2) $10\sqrt{3}$ m

(3) $20\sqrt{3}$ m

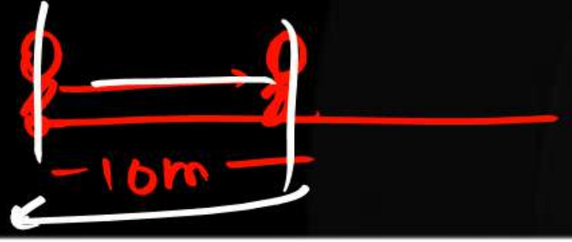
(4) $30\sqrt{3}$ m

Cube diagonal

$= \sqrt{l^2+b^2+h^2}$

$= \sqrt{10^2+10^2+10^2}$

$= 10\sqrt{3}$



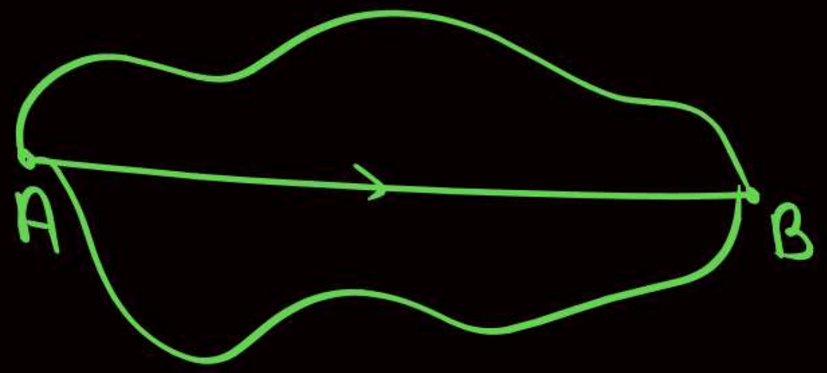
Distance		Displacement	
1.	Scalar Quantity	1.	Vector Quantity (direction from initial to final position)
2.	Depends on path	2.	Depends on initial and final position
3.	For a moving body it always increases	3.	For a moving body it can increase or decrease
4.	For a moving body it is always positive, never be negative or zero.	4.	For a moving body it can be positive, negative or zero.
5.	If distance travelled is zero, then body must be at rest.	5.	If displacement is zero, then body either is at rest or passing through its initial position
6.	There are infinite value of distance between two fixed points	6.	There is only one unique value of displacement between two fixed points.

Distance Ⓐ >

Ⓑ <

Ⓒ ≥

Ⓓ ≤



Displacement

Gupt gyan

If particle is moving such that it's direction is constant

Distance = Displacement

Speed and Velocity :-

Avg Speed :-

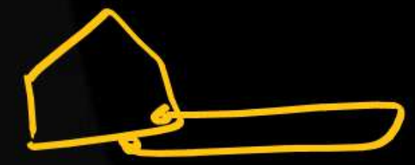
$$\langle \text{Speed} \rangle_{avg} = \frac{\text{total distance}}{\text{total time}}$$

Avg. velocity :-

$$\langle \vec{V} \rangle_{avg} = \frac{\text{total Displacement.}}{\text{total time}}$$

HCV Exercise

When a person leaves his home for sightseeing by his car, the meter reads 12352 km. When he returns home after two hours the reading is 12416 km. (a) What is the average speed of the car during this period ? (b) What is the average velocity ?



disp = 0

$$\langle Speed_{avg} \rangle = \frac{\text{total Dist}}{\text{time}}$$

$$= \frac{12416 - 12352}{2\ hr.}$$

$$= 64/2 = 32\ km/hr$$

$$\langle \vec{V}_{avg} \rangle \Rightarrow \frac{0}{2}$$

$$= 0\ km/hr$$

Select the correct statements from the following.

S1 :Average velocity is path length divided by time interval.

S2. In general, average speed ≥ |average velocity|

S3. A particle moving in a given direction with a non-zero velocity can have zero speed.

S4. The magnitude of average velocity is the average speed.

(1) S_1 (2) S_2 (3) S_3 (4) S_4

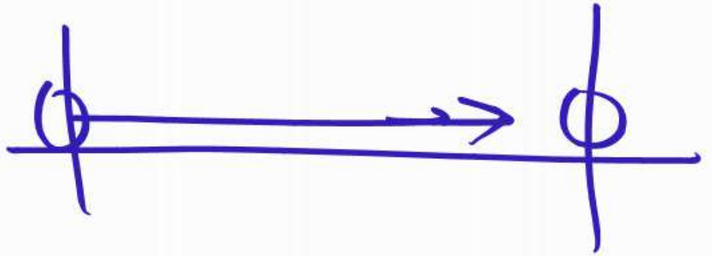
$\frac{\text{total Distance}}{t} \geq \frac{\text{total Displ.}}{t}$

avg. speed ≥ |avg velocity|

The magnitude of average velocity is equal to the average speed when a particle moves :

(1) on a curved path

(2) in the same direction

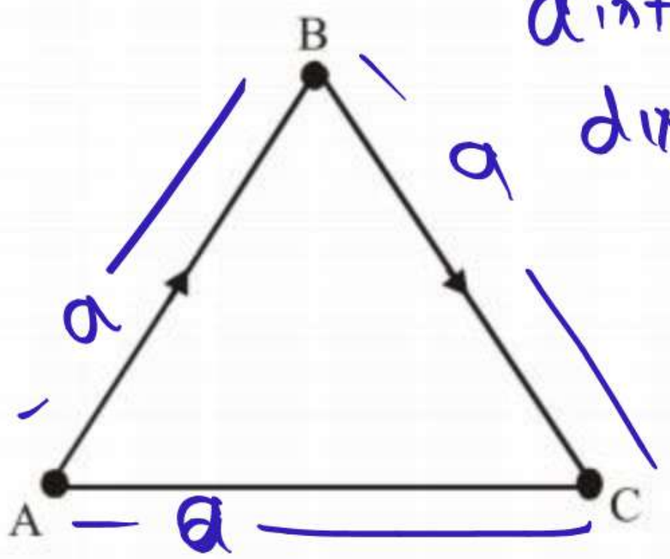


(3) with constant acceleration

(4) with constant retardation

$$\frac{\text{t. distance}}{\text{time}} = \frac{\text{disp}}{\text{time}}$$

A man walks on a equilateral triangle along path ABC with constant speed then the ratio of average speed and magnitude of average velocity for A to C :-



distance = 2a

disp = a

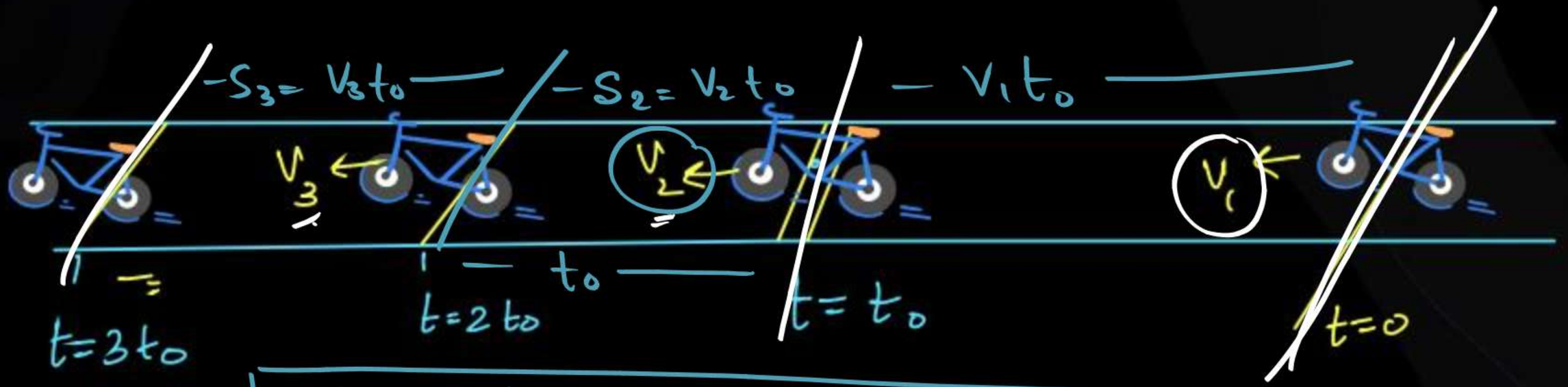
(1) 1 (2) 2 (3) $\frac{1}{2}$ (4) None

$$Speed_{avg} = \frac{2a}{t}$$

$$\langle Velocity \rangle = \frac{a}{t}$$

$$\frac{\langle Speed \rangle}{\langle Velocity \rangle} = \frac{2}{1}$$

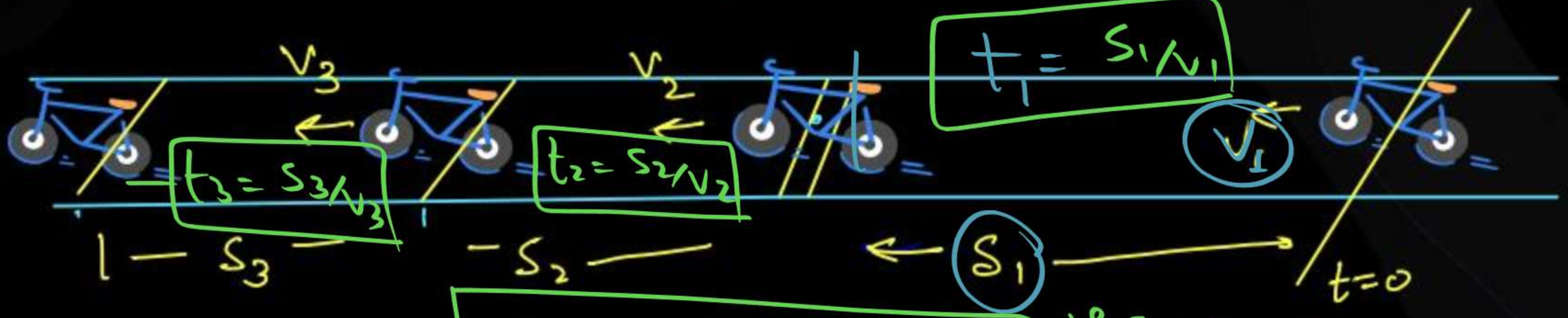
Displacement in Equal time Interval :-



$$\langle V \rangle = \frac{V_1 t_0 + V_2 t_0 + V_3 t_0}{t_0 + t_0 + t_0} = \frac{V_1 + V_2 + V_3}{3}$$

Displacement and Velocity

$$\langle v \rangle = \frac{s_1 + s_2 + s_3}{t_1 + t_2 + t_3}$$



$$\langle v \rangle = \frac{s_1 + s_2 + s_3}{s_1/v_1 + s_2/v_2 + s_3/v_3}$$

If $s_1 = s_2 = s_3 = s$

$$\langle v \rangle = \frac{3s}{s\left(\frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}\right)} = \frac{3v_1v_2v_3}{v_2v_3 + v_1v_2 + v_1v_3}$$

Equal time Interval

Avg speed = Avg velocity

A particle moves in straight line in same direction for 20 sec. with velocity 3 m/s and then moves with velocity 4 m/s for another 20 sec. and finally moves with velocity 5 m/s for next 20 sec. What is the average velocity of the particle ?

(1) 3 m/s
(2) 4 m/s
(3) 5 m/s
(4) Zero

$S_1 = 20\times3$	$S_2 = 4\times20$	$S_3 = 5\times20$
20 sec	20 sec	20 sec

$$\langle v \rangle = \frac{20\times3 + 20\times4 + 20\times5}{3(20)}$$

$$= \frac{3+4+5}{3} = 12\ m/s$$

A body covers one-third of the time with a velocity v_1 the second one-third of the time with a velocity v_2, and the last one-third of the time with a velocity v_3. The average velocity is :

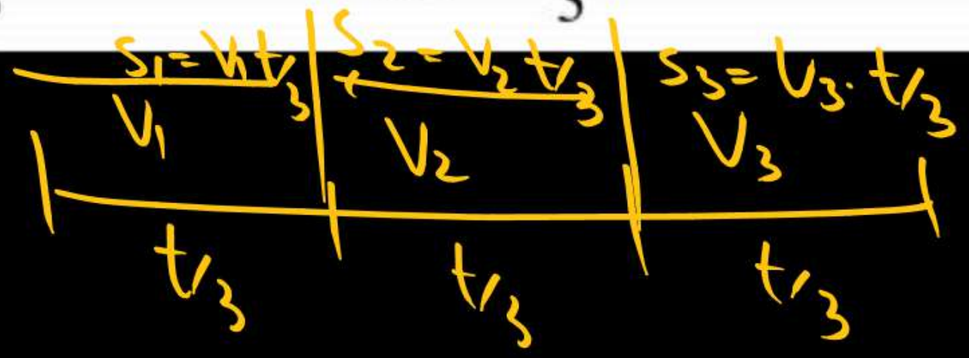
(1) $\frac{v_1 + v_2 + v_3}{3}$

(2) $\frac{3 v_1 v_2 v_3}{v_1 v_2 + v_2 v_3 + v_3 v_1}$

(3) $\frac{v_1 v_2 + v_2 v_3 + v_3 v_1}{3}$

(4) $\frac{v_1 v_2 v_3}{3}$

$$\langle v_{avg} \rangle = \frac{v_1 + v_2 + v_3}{3}$$



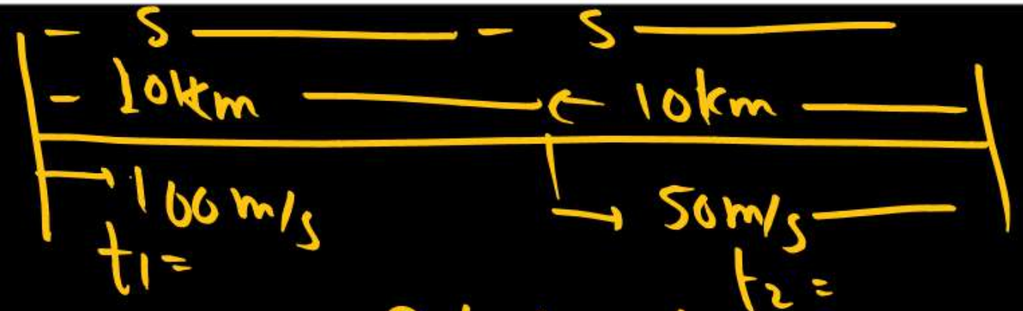
An object travels 10 km at a speed of 100 m/s and another 10 km at 50 m/s. The average speed over the whole distance is :-

(1) 75 m/s

(2) 55 m/s

(3) 66.7 m/s

(4) 33.3 m/s



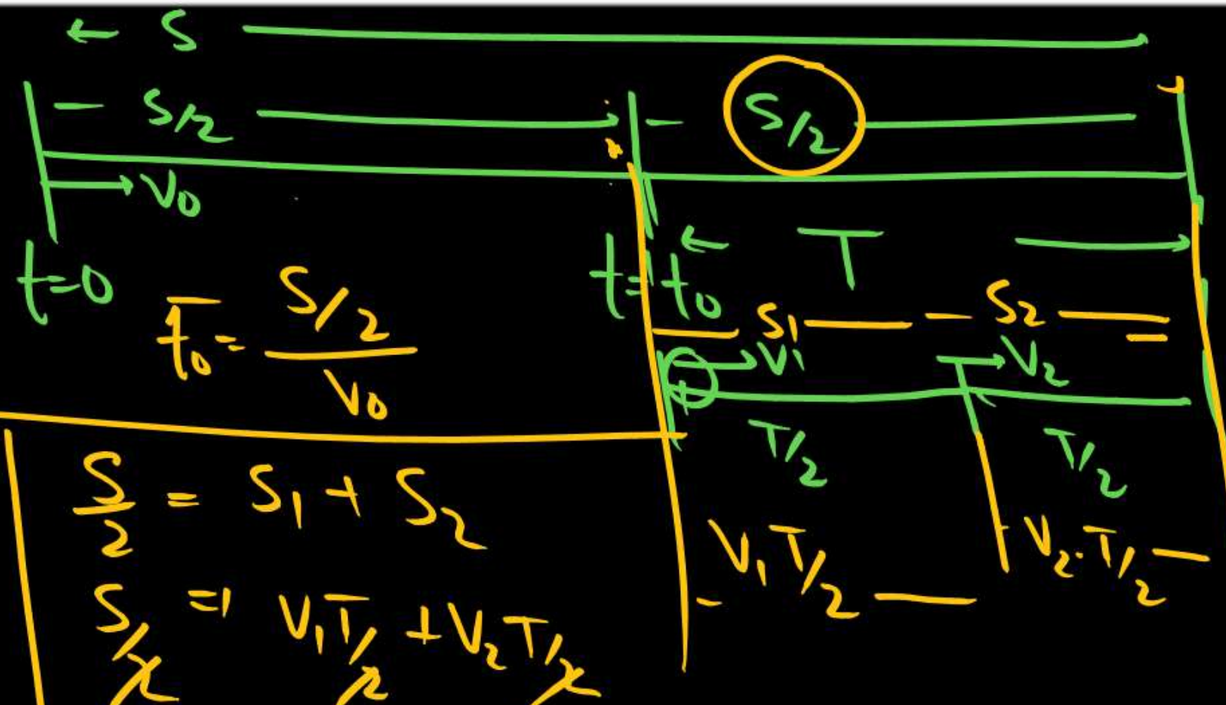
$$\Rightarrow \frac{2S}{\frac{S}{v_1}+\frac{S}{v_2}}$$

$$\Rightarrow \frac{2\times 10000}{\frac{10000}{100}+\frac{10000}{50}} = \frac{2}{\frac{1}{100}+\frac{1}{50}} \Rightarrow \frac{2\times 100}{3} \Rightarrow$$

Irodov

Irodov

1.2. A point traversed half the distance with a velocity v_0. The remaining part of the distance was covered with velocity v_1 for half the time, and with velocity v_2 for the other half of the time. Find the mean velocity of the point averaged over the whole time of motion.



$t_0 = \frac{S/2}{v_0}$

$\frac{S}{2} = S_1 + S_2$

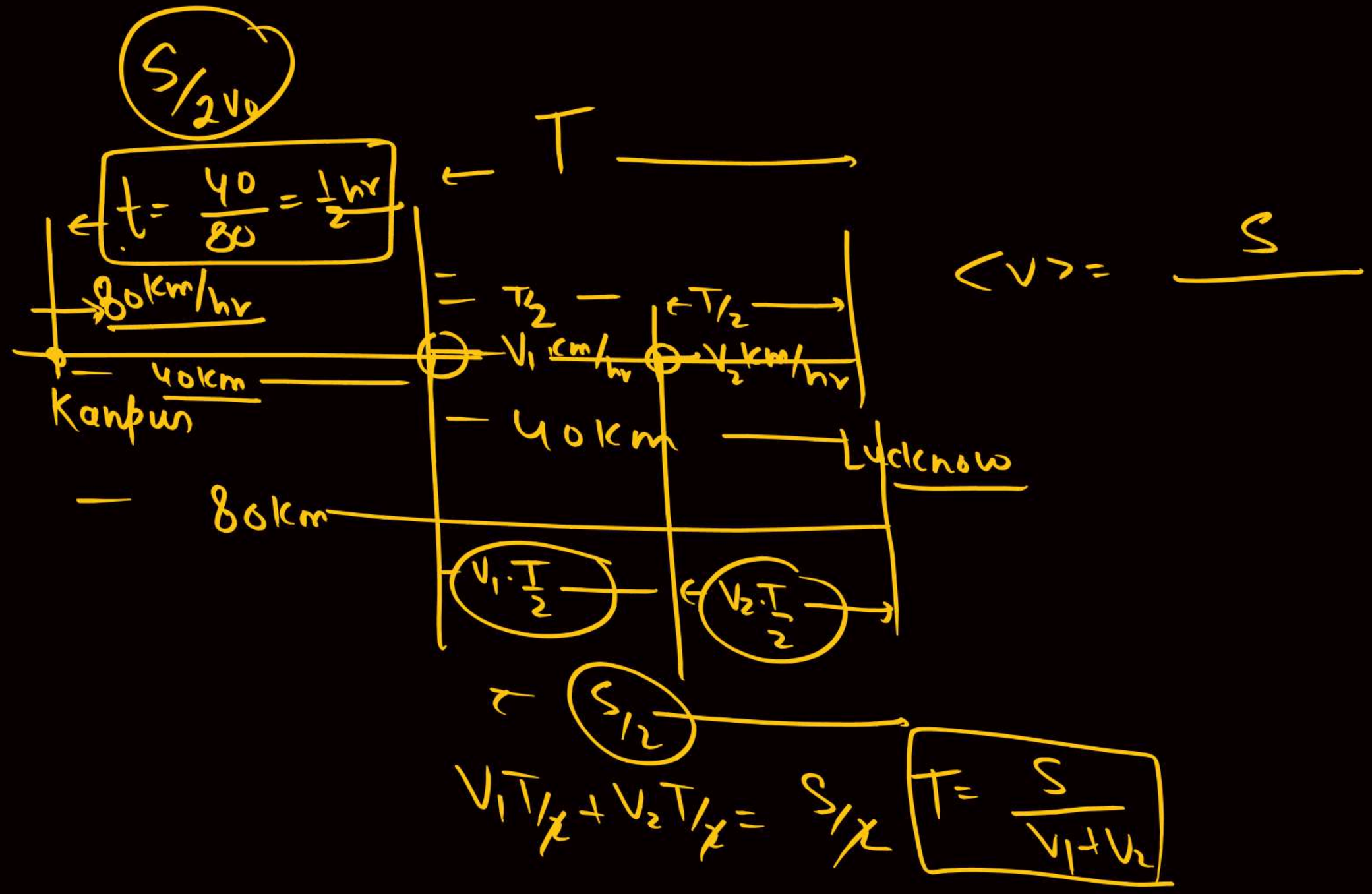
$\frac{S}{2} = v_1\frac{T}{2} + v_2\frac{T}{2}$

$T = \frac{S}{v_1 + v_2}$

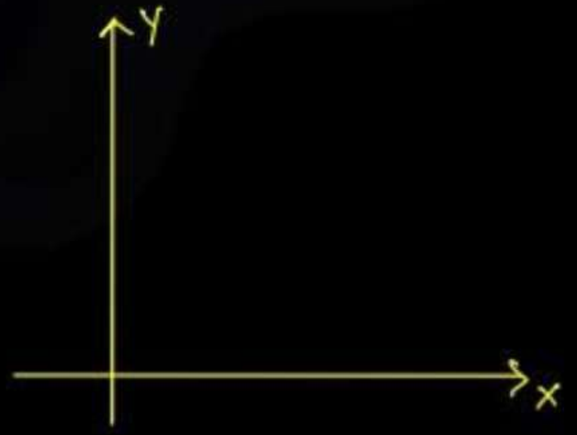
$\Rightarrow \langle v \rangle = \frac{S}{t_0 + T}$

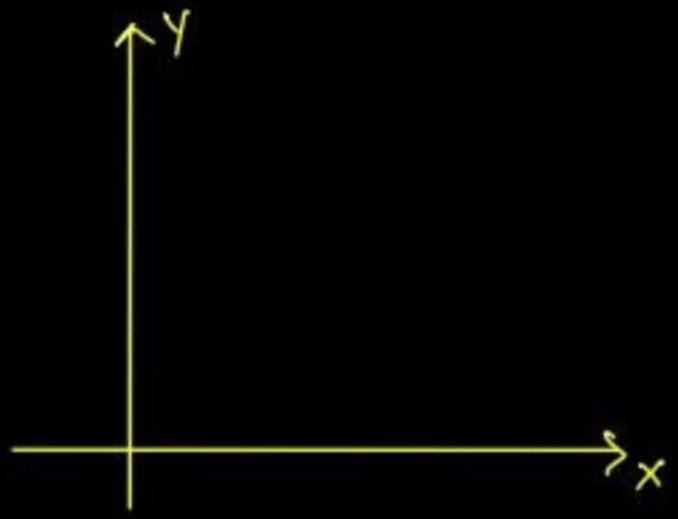
$= \frac{S}{\frac{S}{2v_0} + \frac{S}{v_1+v_2}}$

$= \frac{1}{\frac{1}{2v_0} + \frac{1}{(v_1+v_2)}}$


S/2V0
t = 40/80 = 1/2 hr
80km/hr
40km
Kanpur
T
T/2
T/2
V1 km/hr
V2 km/hr
40km
Lucknow
80km
V1·T/2
V2·T/2
S/2
V1T/2 + V2T/2 = S/2
T = S/(V1+V2)
<V> = S/T

GRAPHICAL VIEW :-

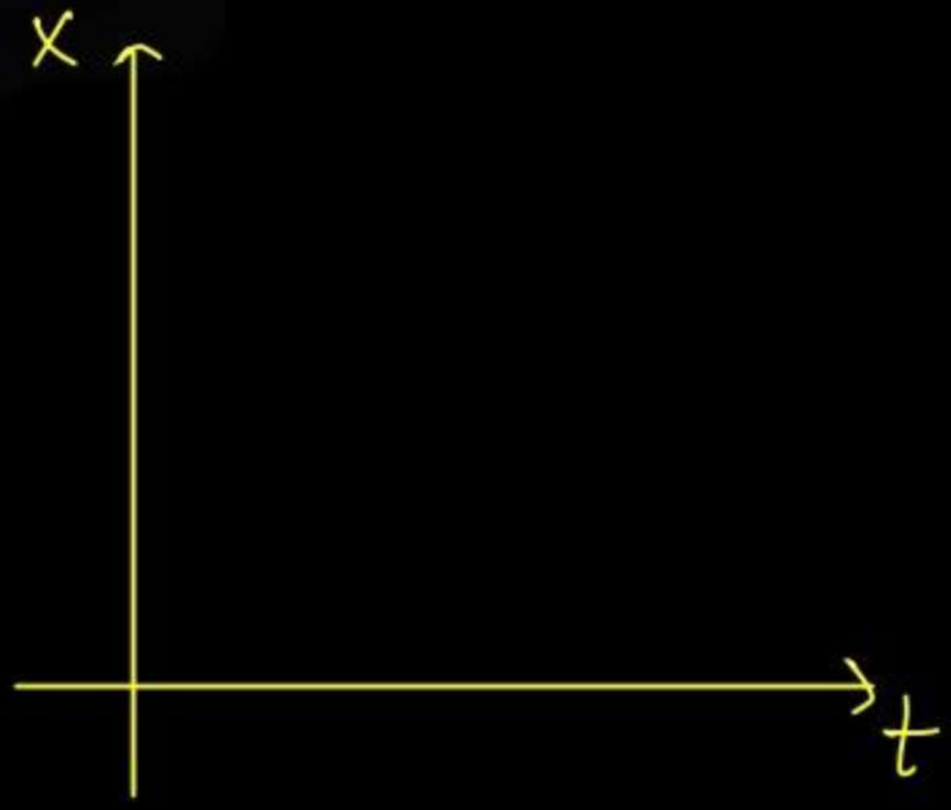




⇒ GRAPH defines the Relation b/w two variable.

How Y changes with x

Linear Graph :-



t	x
t = 0	x = 0
t = 1	x = 1
t = 2	x = 2
t = 3	x = 3
t = 4	x = 4

मुखड़े पर धूल लगी माना , माथा फूटा माना लेकिन ,
गालों पर थप्पड़ खाये है , जबड़ा टूटा माना लेकिन ,
माना के आंते अकड़ गई , पसलियों से लहू निकलता है ,
गिस गया है कंकर में घुटना , मिर्च सलिखे जलता है ,
माना के साँसे उखड़ रही, और धक्का लगता धड़कन से ,
लो मान लिया की काँप गया है , पूर्ण बदन अंतर्मन से ,
पर आँखों से अंगारे , नथनों से तूफ़ा लाऊंगा ,
में गिर गिर कर भी धरती पर , हर रोज़ खड़ा हो जाऊंगा ,
मुट्ठी में बींच लिया तारा , तुम नगर में ढोल पिटादो जी ,
अँधेरे हो लाख़ घने पर अँधेरे अनन्त नहीं ,


Thank
You