

YAKEEN NEET 2.0

2026

Motion in a Straight Line

Physics

Lecture - 04

By- Manish Raj (MR Sir)



Today's goal

→ H/W

→ Inst. Speed & velocity

Acceleration

~~Speed is More important than direction:—~~

Direction is More important than speed.
(Kidhar) (How fast)

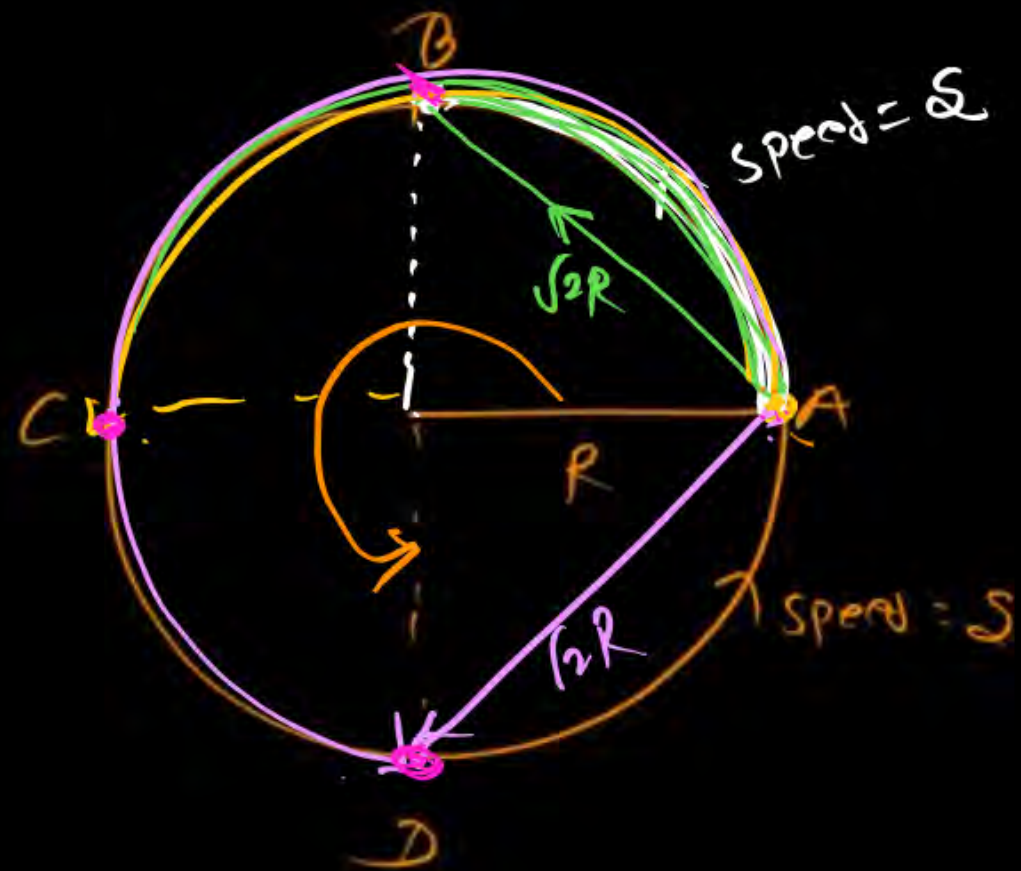
MR. Sir



@MRPHYSICSS

Rapid test → 25 questions → 6-7 mint

n/w लिखना है।



Circumferenzen = $2\pi R$

$$\# \quad t = \frac{\text{dist}^n}{\text{speed}} = \frac{2\pi R}{45} = \frac{\pi R}{25}$$

Motion	time	Avg speed $= \frac{\text{dis}^n}{\text{time}}$	Avg vel
AB	$\frac{\pi R}{2s}$	$\frac{2\pi R}{2\pi \left[\frac{\pi R}{2s} \right]} = s$	$\frac{\sqrt{2}R}{\frac{\pi R}{2s}} = \frac{2\sqrt{2}s}{\pi}$
AC	$t = \frac{\pi R}{s}$	s	$\Rightarrow \frac{2\pi R s}{\pi R} = \frac{2s}{\pi}$
AD	$t = \frac{3\pi R}{2s}$	s	$\frac{\sqrt{2}R}{\frac{3\pi R}{2s}} = \frac{2\sqrt{2}s}{3\pi}$
AA	$t = \frac{2\pi R}{s}$	s	0

Question

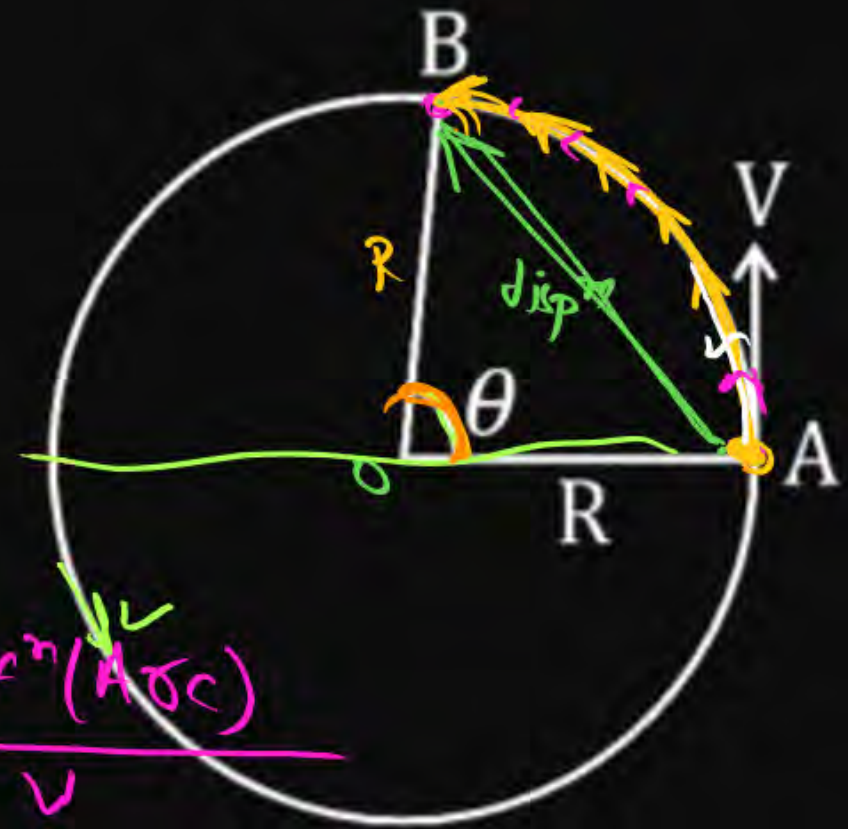
Not 2 में लिख



Object is moving on circular path with speed v then find avg. velocity when it moves an angle θ .

$$\text{Avg velocity} = \frac{2R \sin(\theta/2)}{\text{time}} = \frac{\text{disp}^m}{\text{time}}$$

$$= \frac{2R \sin(\theta/2)}{\frac{R\theta}{v}}$$



$$\text{time} = \frac{\text{dist}^m(\text{Arc})}{v}$$

$$t = \frac{R\theta}{v}$$

MR*

Play with physy lec 20

$$\text{Avg velocity} = \frac{v \sin(\theta/2)}{(\theta/2)}$$

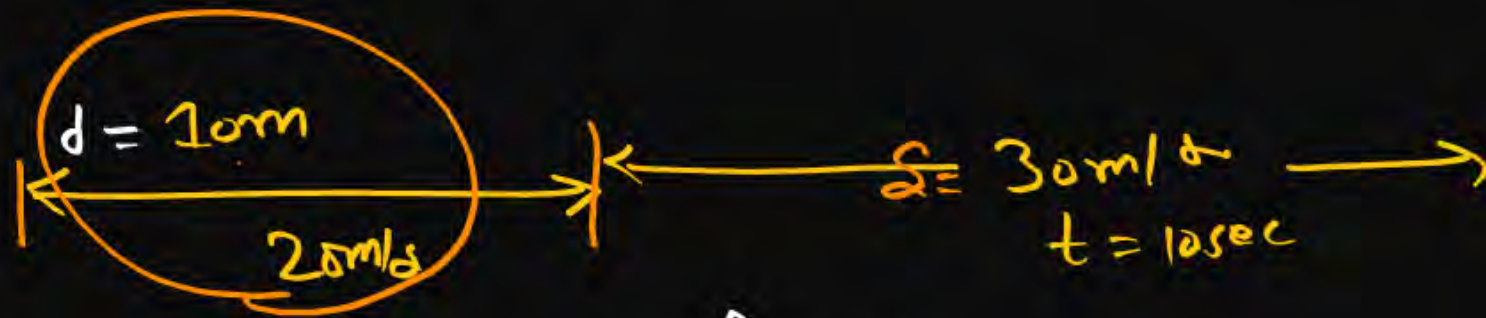
if $\theta = \pi$
 $\text{Avg velocity} = \frac{v \sin(\pi/2)}{\pi/2} = \frac{2v}{\pi}$

Question

H/W नोट्स में लिख लो



Object ~~mass~~ ^{move} 10m with speed 20 m/s and then it moves with speed 30 m/s for 10 sec. Then find average speed for complete journey?



यहाँ कोई formula नहीं लगा

Soln

$$\text{Avg speed} = \frac{d_1 + d_2}{t_1 + t_2}$$

$$= \frac{10\text{m} + 30 \times 10}{\frac{10}{20} + 10} = \frac{310}{10.5} \text{ m/s} = \underline{\underline{29.5 \text{ m/s}}}$$

equal distance

$$S_{\text{Avg}} = \frac{2S_1S_2}{S_1 + S_2}$$

equal time interval

$$S_{\text{Avg}} = \frac{S_1 + S_2}{2}$$

Question

H/W

Note: $\frac{a}{b}$ में a और b को सरल करें।



Object ~~runs~~ ^{move} 20m with speed 20 m/s and then it moves with speed 30 m/s for 20m. Then find average speed for complete journey?

$$\text{Avg speed} = \frac{2S_1S_2}{S_1 + S_2}$$

$$= \frac{2 \times 20 \times 30}{20 + 30}$$

$$= \frac{8}{40 \times 30}{50}$$

$$= \underline{\underline{24 \text{ m/s}}}$$

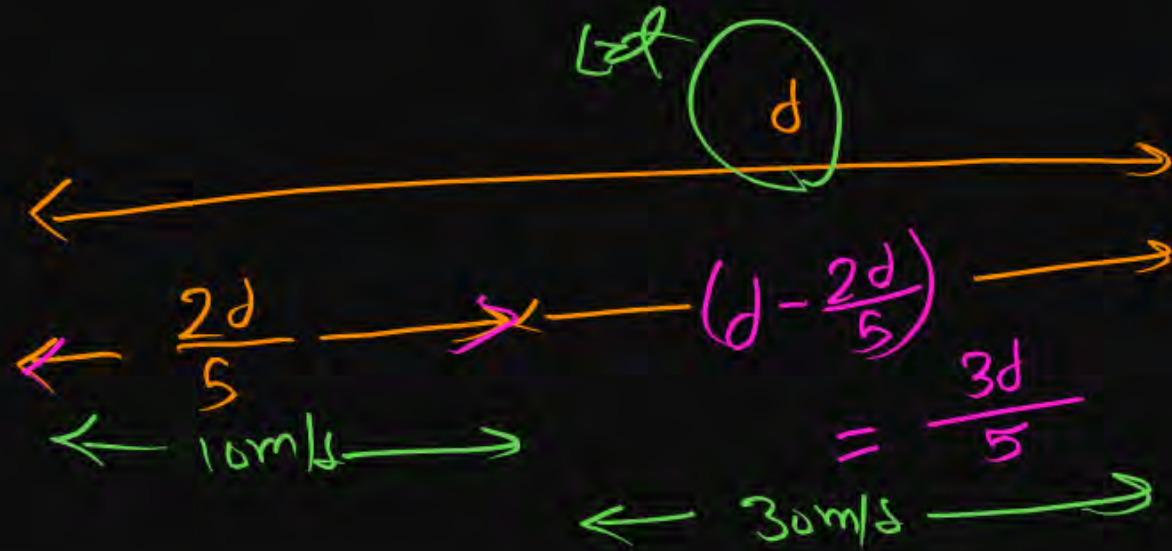
Question

H/W



✓ If object moves $\frac{2}{5}$ th distance of journey with speed 10 m/s and remaining with 30 m/s then average speed will be :

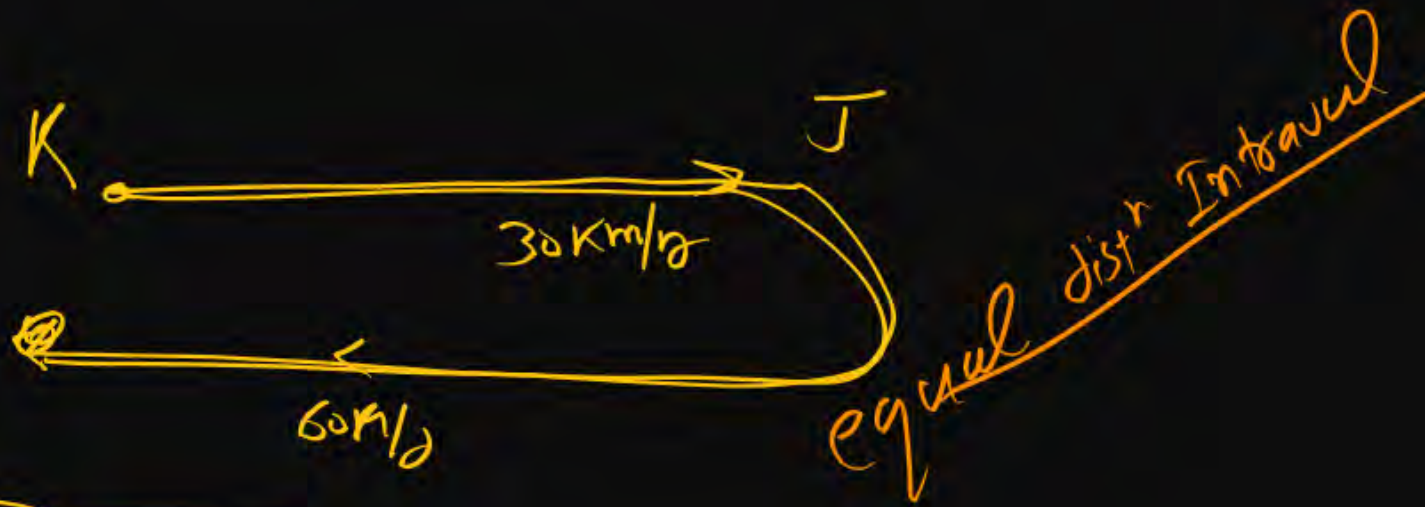
do not write



$$\text{Avg speed} = \frac{d}{\frac{\frac{2d}{5}}{10} + \frac{\frac{3d}{5}}{30}}$$

$$= \frac{d}{\cancel{d} \left(\frac{1}{25} + \frac{1}{50} \right)} = \frac{1}{\frac{2+1}{50}} = \frac{50}{3} \text{ m/s}$$

A car travels from Kota to Jaipur with speed 30 km/h, and it returns along the same path with speed 60 km/h. Calculate average speed of the car.



$$S_{\text{Avg}} = \frac{2 \times 30 \times 60}{30 + 60} = 40$$

Question

H/W



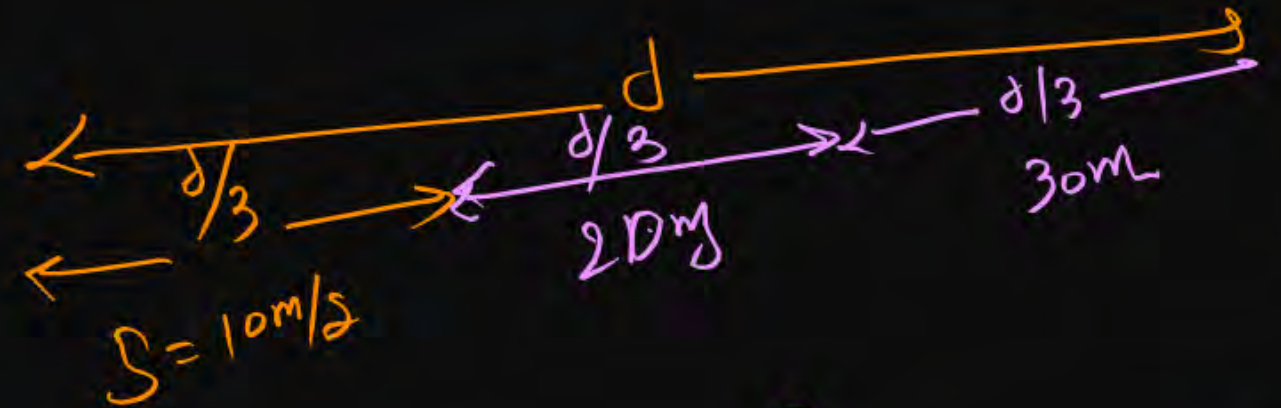
A body covers first one-third of the distance with velocity 10 ms^{-1} in same direction, the second one-third with a velocity 20 ms^{-1} and last one-third with a velocity of 30 ms^{-1} . The average velocity of body is

1 17.8 ms^{-1}

2 ✓ 16.4 ms^{-1}

3 ✗ 18.3 ms^{-1}

4 ✗ 20.2 ms^{-1}



$$S_{avg} = \frac{3}{\frac{1}{10} + \frac{1}{20} + \frac{1}{30}}$$

$$= \frac{3}{\frac{6+3+2}{60}} = \frac{3 \times 60}{11} = \frac{180}{11}$$

Object moves with v_1 for $t/3$ and with v_2 for $2t/3$ then find average speed.

Ans

$$\text{Avg speed} = \frac{d_1 + d_2}{t_1 + t_2}$$

$$= \frac{v_1 \cancel{t/3} + v_2 \cancel{2t/3}}{\cancel{t/3} + \cancel{2t/3}} = \frac{\left(\frac{v_1}{3} + \frac{2v_2}{3}\right) \cancel{t}}{\cancel{t}}$$

$$= \frac{v_1 + 2v_2}{3}$$

Ans

Question

HW

⊗ Likh lena
not 2 ✓



A bus travels its half distance of journey with speed 5 m/s . It covers remaining distance in two equal time intervals with speed 15 m/s . Calculate average speed of the bus for the whole journey. 25 m/s

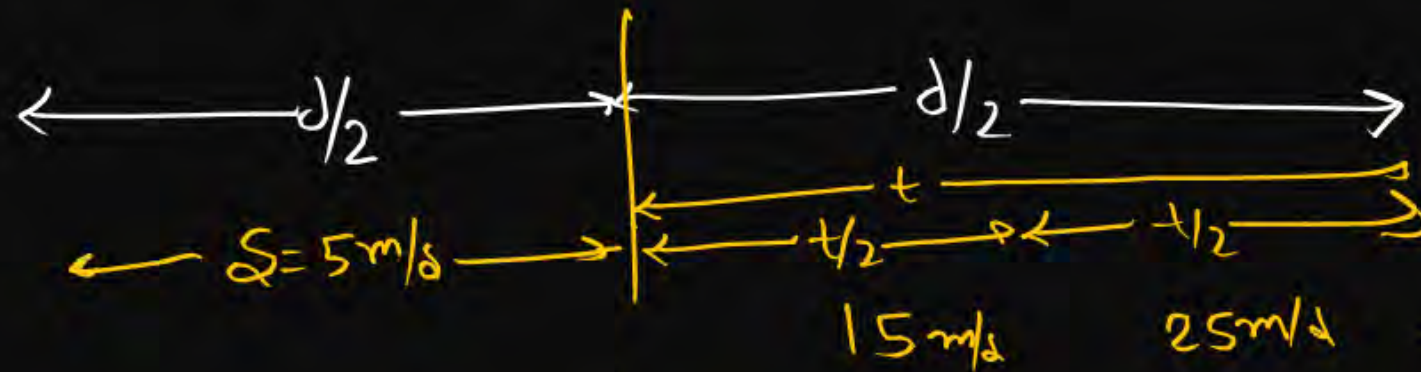


Diagram showing the calculation of average speed for the second part of the journey:

Speed $S = 5 \text{ m/s}$ (circled in green)

Equal time intervals

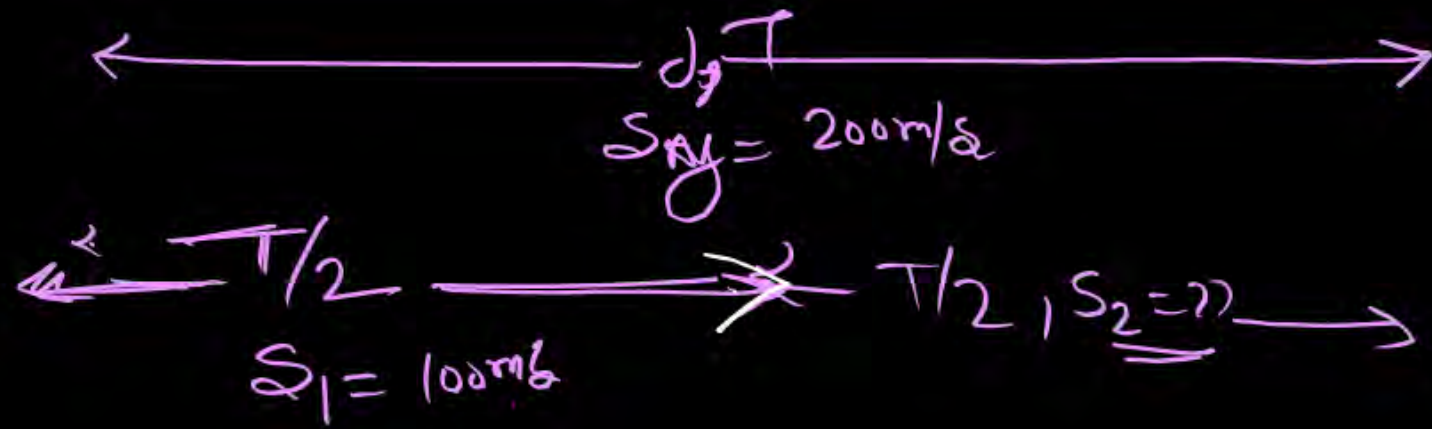
$$S_1 = \frac{15 + 25}{2} = \frac{40}{2} = \underline{\underline{20 \text{ m/s}}}$$

$$S_{\text{Avg}} = \frac{2 \times 5 \times 20}{2/5} = \underline{\underline{8 \text{ m/s}}}$$

MRA → 3 usko
assignment n
solve kar lena

लिखना है Note में

(Q) Avg speed of train b/w Two station is 200 m/s if it moves with speed 100 m/s for half time of total Journey then find speed for other half time

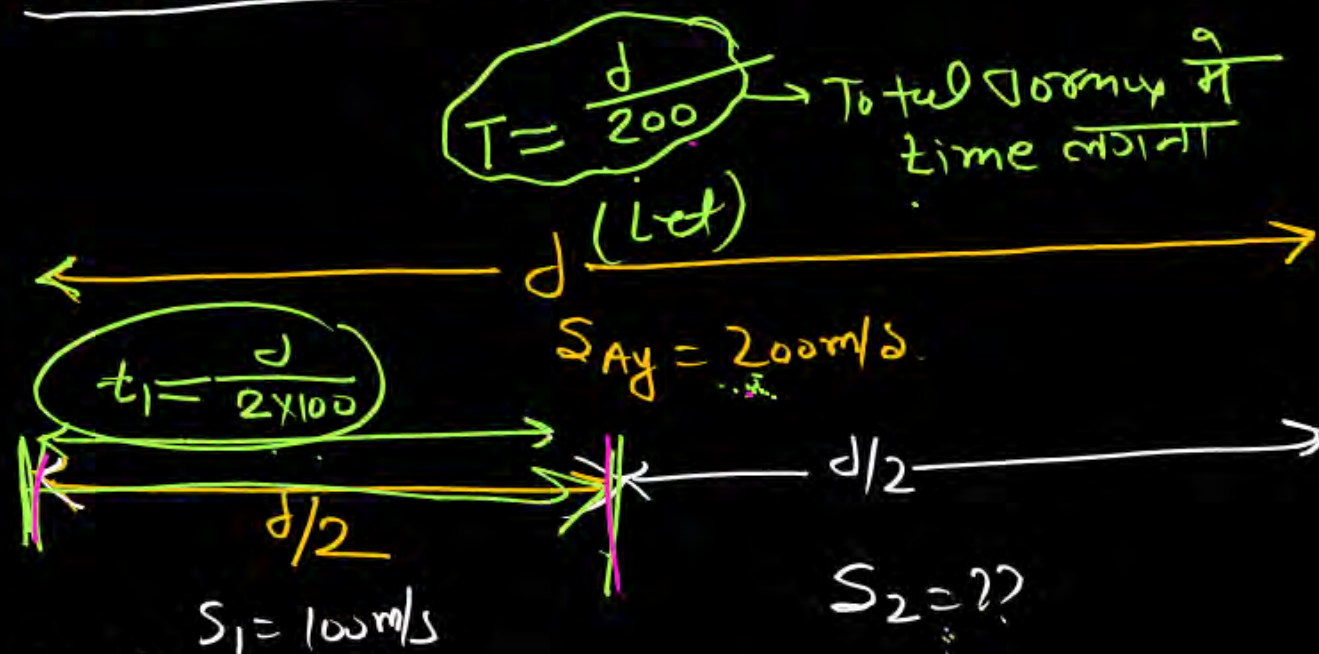


$$\# S_{\text{Avg}} = \frac{S_1 + S_2}{2}$$

$$\frac{100 + S_2}{2}$$
$$100 - 100 = S_2 \rightarrow S_2 = 300 \text{ m/s}$$

लिखना है Note में

(Q) Avg speed of train b/w Two station is 200 m/s if it moves with speed 100 m/s for half distance of total Journey then find speed for other half distance??



equal distⁿ

$$S_{Avg} = \frac{2 S_1 S_2}{S_1 + S_2}$$

$$200 = \frac{2 \times 100 \times S_2}{100 + S_2}$$

$$100 + S_2 = S_2$$

$$100 = 0$$

Kyun nahi aa raha
answr??
detu scam
है

gf in this question speed for 1st half distⁿ is 150 m/s . then find $S_2 = ??$

Solⁿ

$$\frac{2 \times 150}{200} = \frac{2 \times 150 \times S_2}{150 + S_2}$$

$$2(150 + S_2) = 3S_2$$

$$300 + 2S_2 = 3S_2$$

$$S_2 = 300 \text{ m/s}$$

प्रश्न 2)

Motion of A & B will be: —

(a) A → 2D
B → 1D

(b) Both in 2D

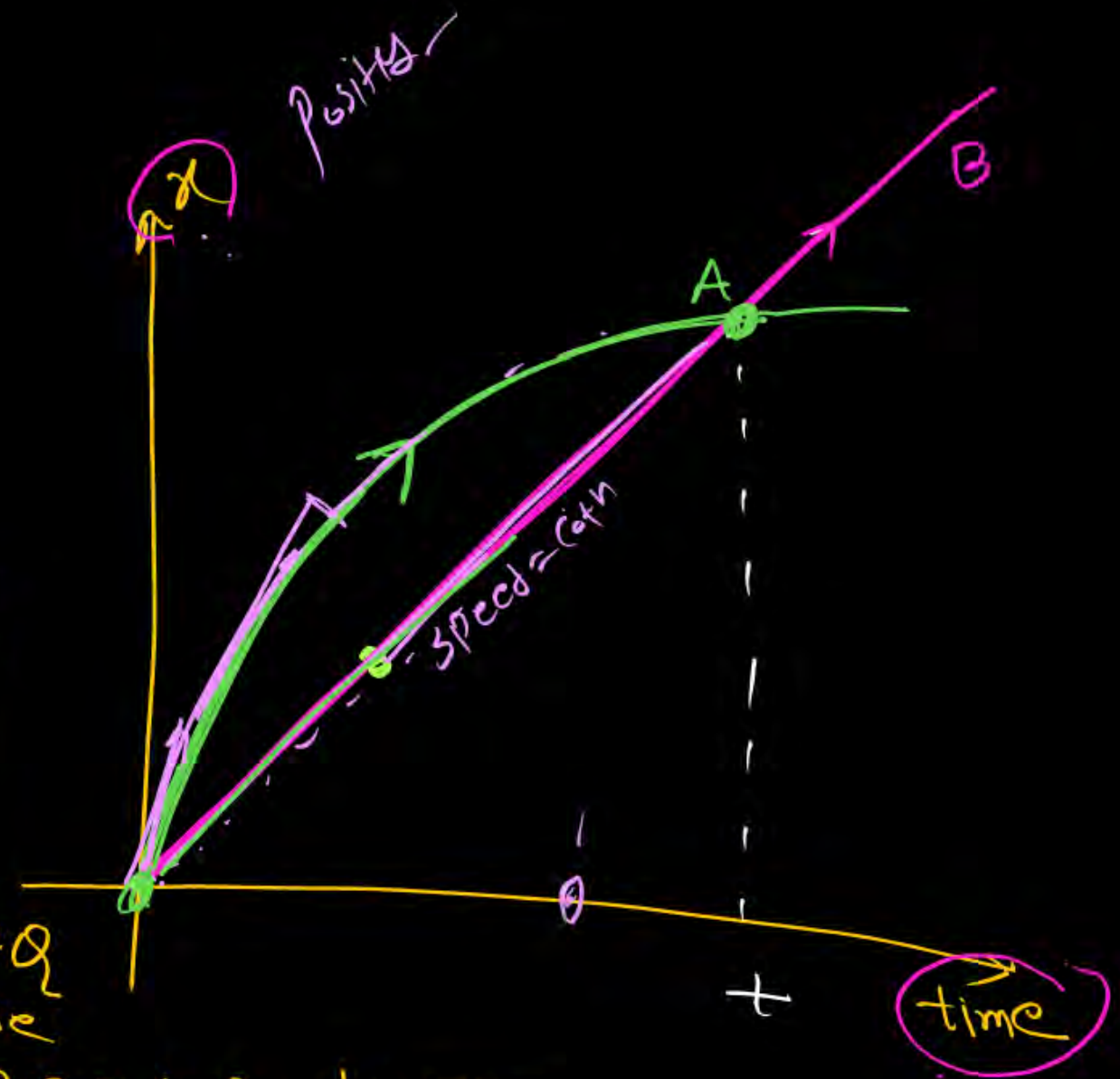
☒ (c) Both in 1D

(d) A → 1D
2D

MR Boy Joradhar

Kisi bhi graph se
4 baate Pata Kar
Sakte hai.

- (1) yth co-ordinate or P.Q yth component se
- (2) xth co-ordinate or P.Q x component se
- (3) Slope (P.Q) = $\frac{\Delta y}{\Delta x} = \frac{dy}{dx}$
- (4) Area (P.Q) = $\int y dx$

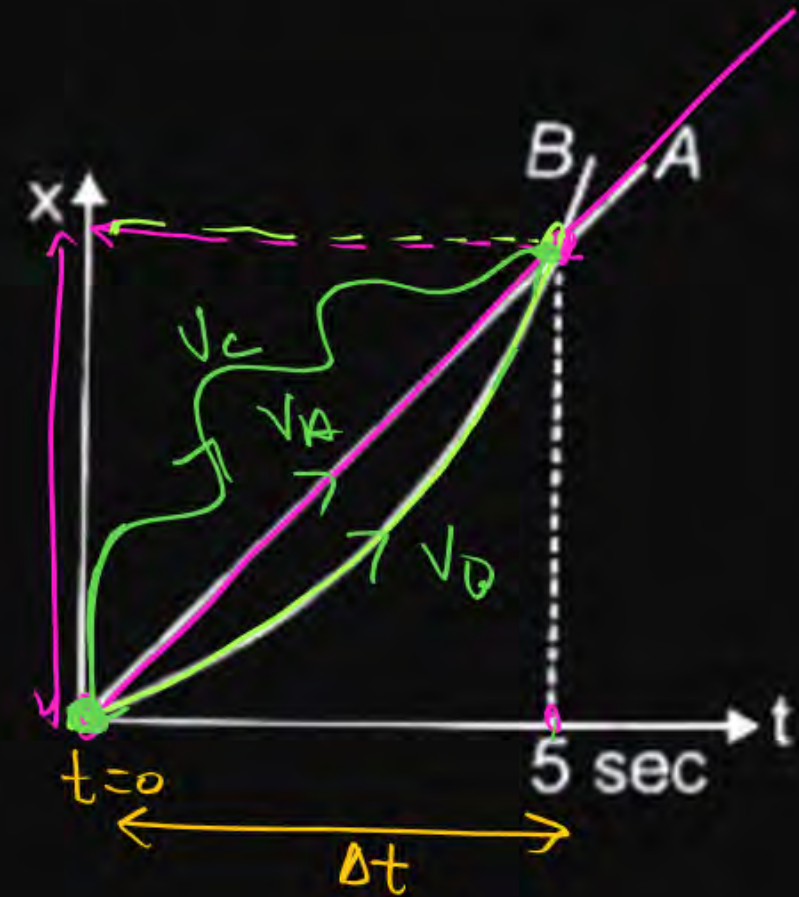


Question

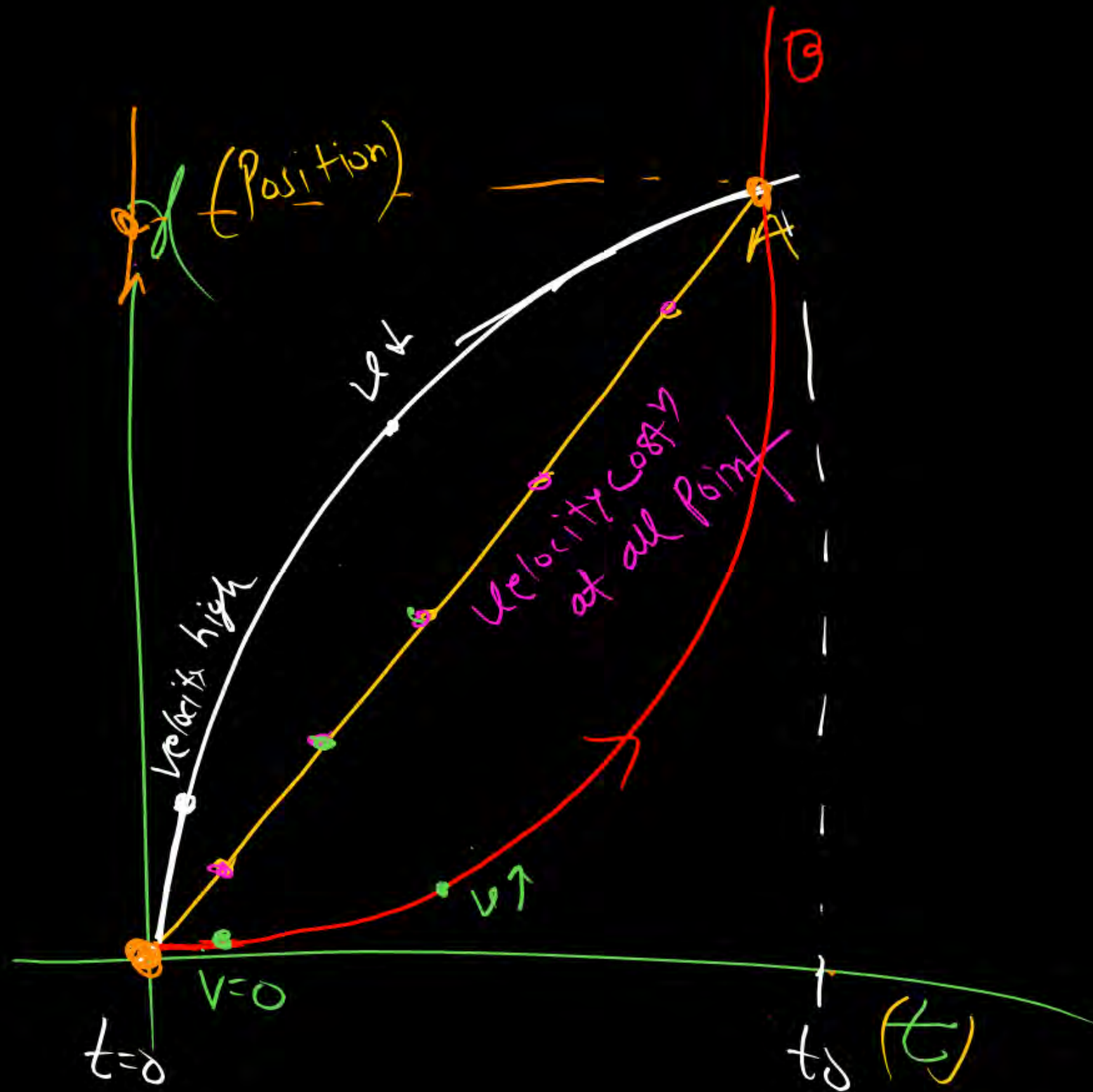
Position-time graph for two particles A and B as shown in figure. If both the particles start from origin, and average velocity of A and B during interval of 5 sec are v_A and v_B , then

- 1 $v_A > v_B$
- 2 $v_B > v_A$
- 3 $v_A = v_B = v_c$
- 4 $v_A = 2v_B$

X Avg ke liye
initial &
final dekhte hai



(likho)



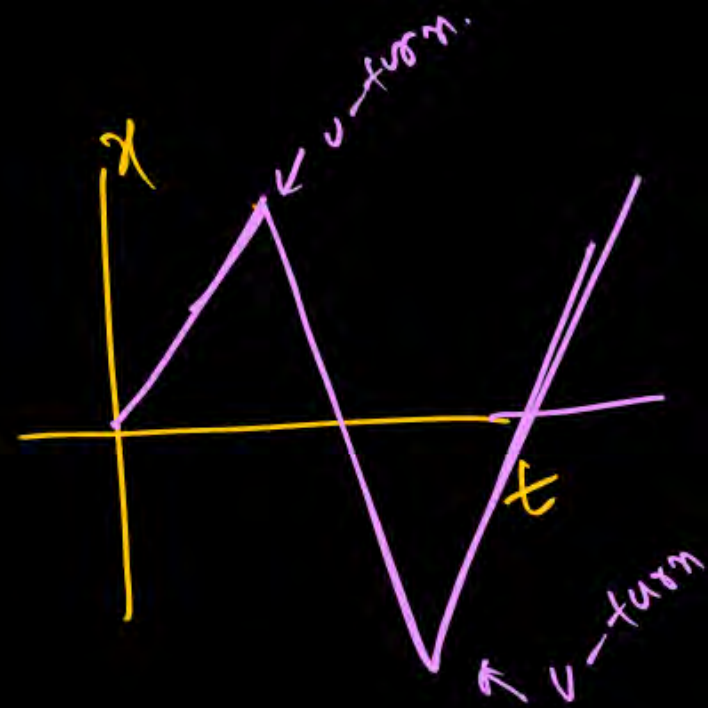
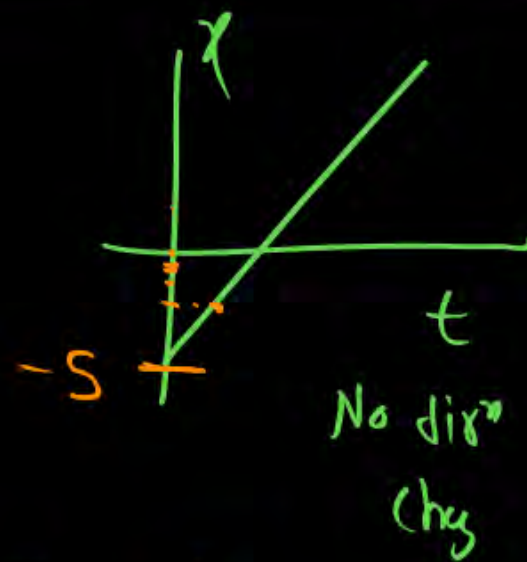
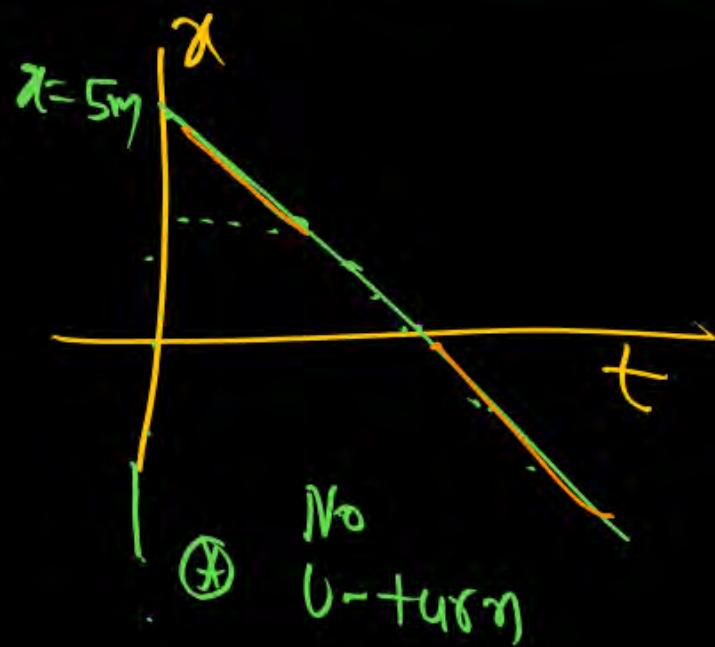
$$(\text{Slope}) = \frac{dx}{dt} = \text{Inst}^{\text{y}}$$

velocity

$$(\text{Slope})_{g_4} = \tan \theta$$

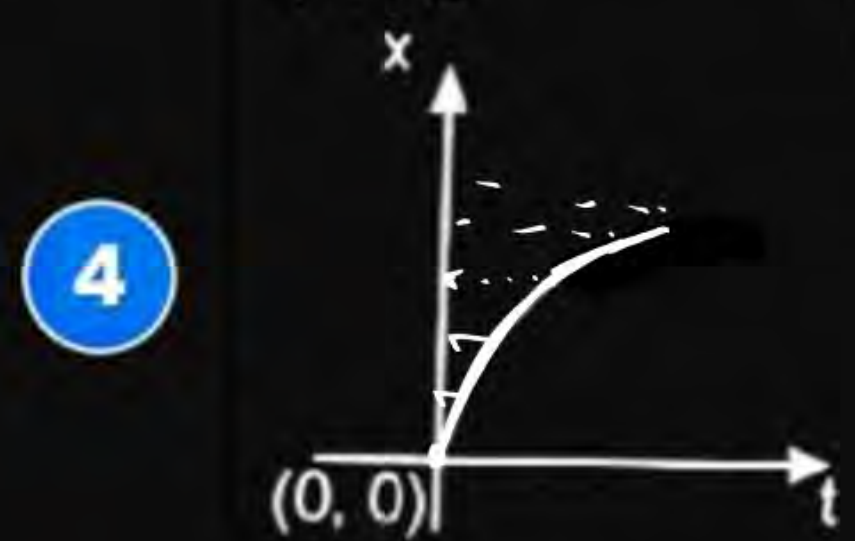
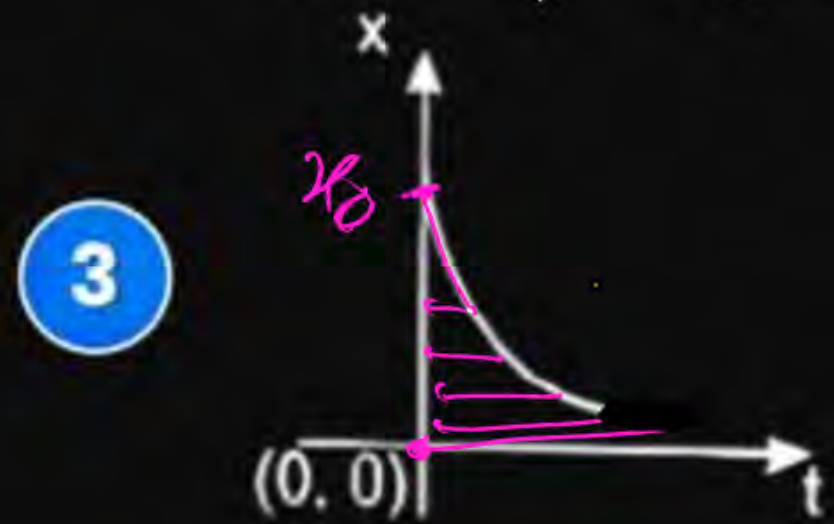
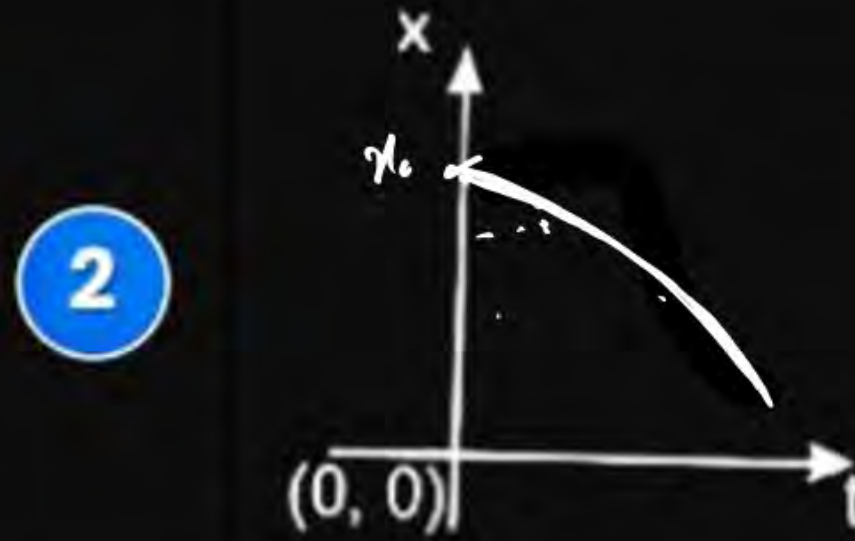
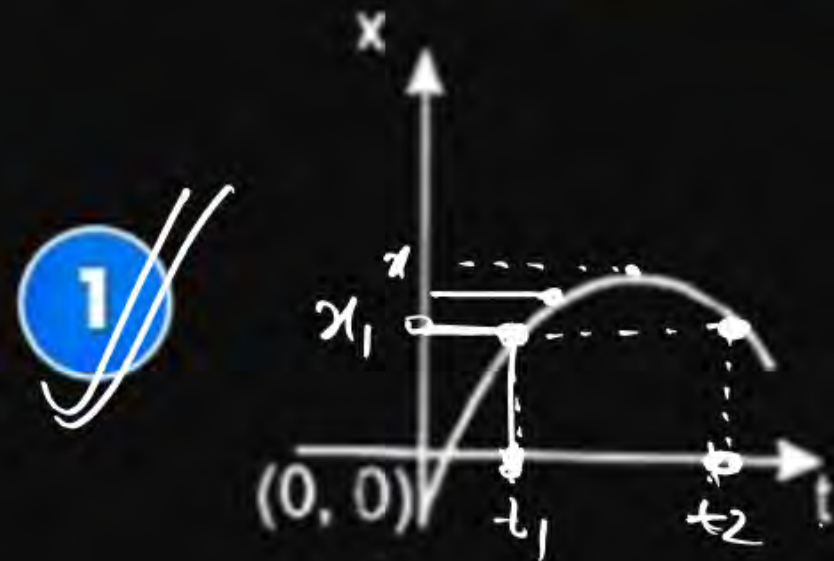
$t=0$ to $t=t_0$ tak
 Time graph ka Avg velocity
Same hai
Initial & final

U-turn (dirⁿ change of motion)
 \Rightarrow x/t graph me U-turn waha hota hai Jaha x increase se decreasing ho Jay Ya x decrease se increasing ho Jay.



Question

Among the four graphs, there is only one graph for which average velocity = 0 is possible for a particular time interval.



$$\text{Avg velocity} = \frac{\vec{x}_f - \vec{x}_i}{\Delta t}$$

if $v_{\text{avg}} = 0$ then
dis^m must be zero.
when $(\underline{x_i = x_f})$

Is magnitude of Average velocity is always equal to Avg. speed ??

Solⁿ

No →

distance may or may not equal to dis^m

Q) If Avg speed is zero.
then what about Avg velocity ??

Ans →

Soln

$$\text{Avg speed} = 0 = \frac{\text{total dist}^n}{(\text{total time})}$$

$\text{dist}^n = 0$

* यहाँ dist^n

disⁿ must be zero

Avg velocity must zero.

If Avg speed is not
zero then, Avg velocity?

Soln.



→ May or may not be
Avg. velocity zero

gf Avg. velocity is zero
then, Avg speed will be ??

Soln

Case-1 यत्ना हि नहीं
 $\text{disp}^m = 0$

Case-2



May or may not be zero.

gf Avg. velocity is not
zero, then Avg speed ??

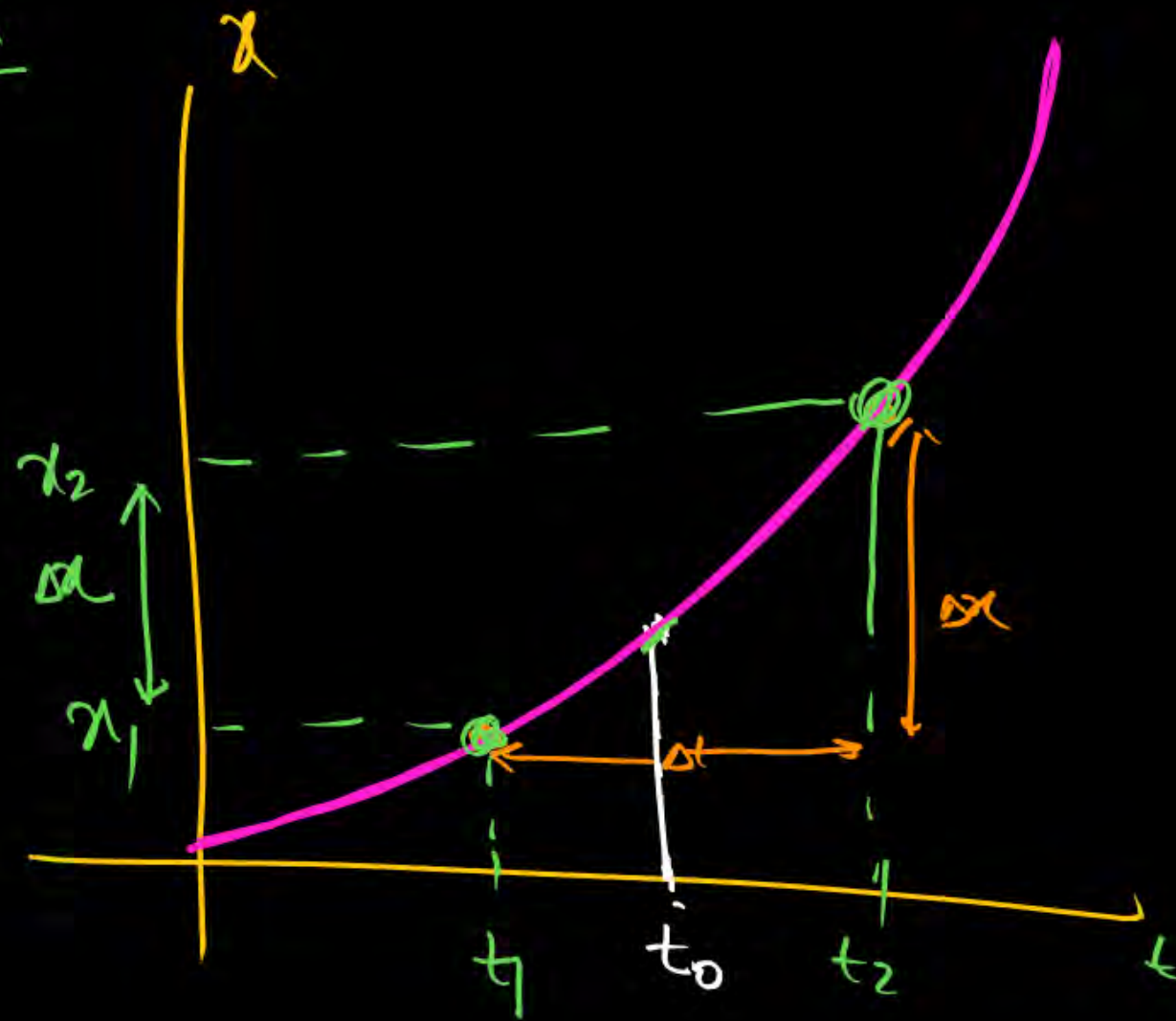
Soln

There is disp^m one case only



✓ Avg speed must not
be zero.

Diffⁿ B/w Avg. velocity /
 & instantaneous velocity

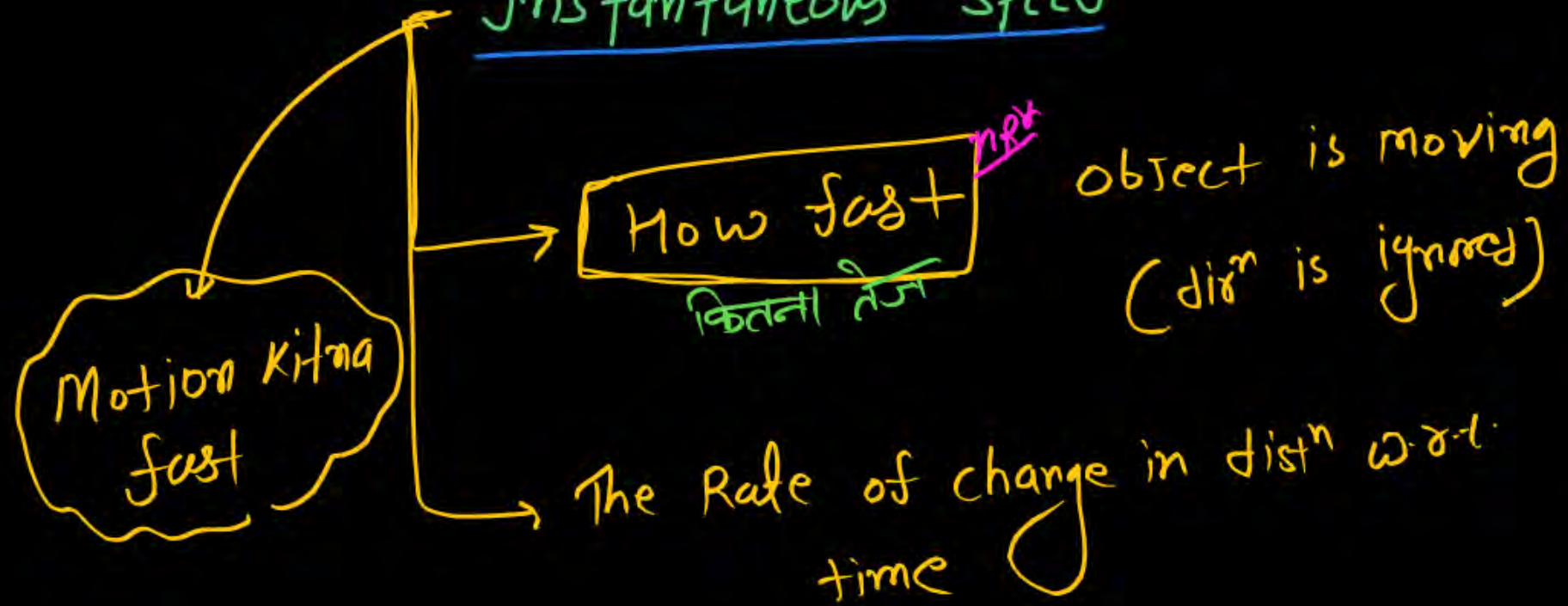


MR* Box
 use diffⁿ or
 inst. slope for
 instantaneous velocity
 and inst. speed.

⊖ Avg velocity = $\frac{\Delta x}{\Delta t}$ → No differentiation

Inst velocity = inst slope = $\frac{dx}{dt}$

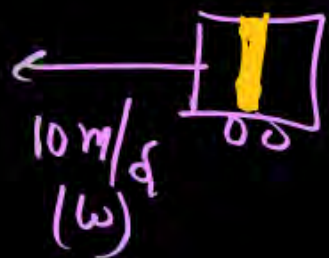
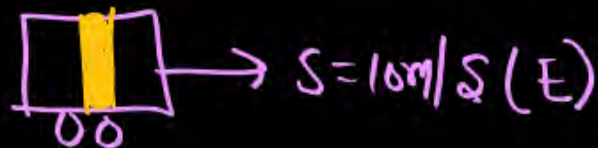
Instantaneous speed



$$\# \quad s_{\text{inst}} = \frac{dx}{dt}$$

= Slope of distⁿ-time graph

→ Scales



(Same speed)
Velocity different

Instantaneous velocity

कितना तेज / कहाँ
→ How fast & where
object is moving.

→ vector

Rate of change in Positⁿ
w.r.t time

$$\vec{v}_{\text{ins}} = \frac{d\vec{x}}{dt}$$

slope of Position/time graph

$$\text{inst speed} = |\text{inst. velocity}|$$

always correct

Magnitude of velocity is speed { because in infinitely small
time distⁿ & disp^m same }

Basic math me padha hai

$$\langle v \rangle = \frac{\int v dt}{\int dt}$$

$$\langle F \rangle = \frac{\int F dt}{\int dt}$$

$$\langle E \rangle_{\text{Avg.}} = \frac{\int E dt}{\int dt}$$

sirf speed ya velocity
Kahi likha hai,
time interval bhi
Nahi diya hai to
han usko instantaneous
manege

gf speed is constant then Avg speed will be ??

→ solⁿ Avg speed $\langle s \rangle = \frac{\int s_{\text{inst}} dt}{\int dt} = \frac{s_{\text{inst}} \int dt}{\int dt} = \underline{s_{\text{inst}}}$

gf velocity is constant then Avg. velocity will be ??

Avg velocity = instantaneous velocity

Object is moving with constant velocity :—

Uniform motion

uniform velocity

velocity = How fast / Where (direction)
 ↓ ↓
 con con

→ Only in 1-D motion. without
change in dir

uniform \longleftrightarrow constant

Object is moving
with uniform speed;

⊗ How fast is con
but Not given
about dir

motion may or may
not be uniform.

→ velocity may or may
not be con.

(Q) If speed is constⁿ then what about velocity ??
H/w

(Q) If speed is variable then what about velocity
H/w

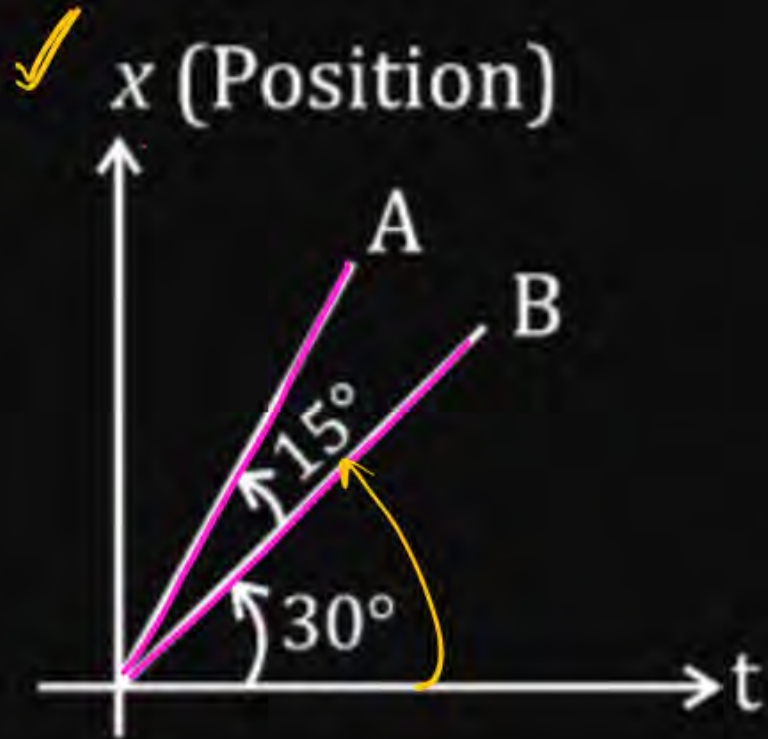
gf velocity is constⁿ then what about speed ??
(H/w)

gf velocity is variable then what about speed
(H/w)

Question



Find ratio of velocity of A to B.



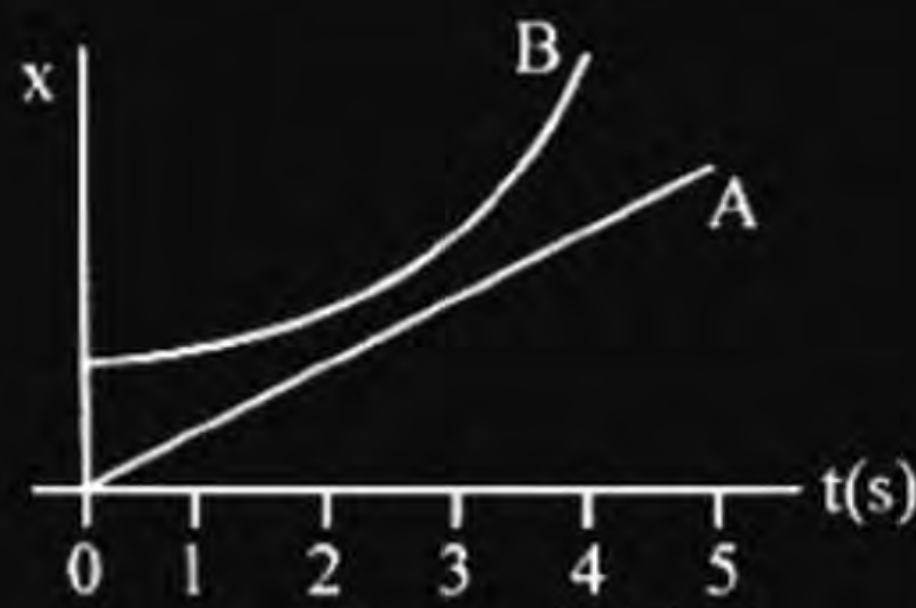
$$\begin{aligned} \text{slope} \Rightarrow \text{velocity}_A &= \tan \theta_A = \tan 45^\circ \\ &= \frac{1}{\sqrt{3}} = \underline{\underline{\sqrt{3}:1}} \\ \text{velocity}_B &= \tan \theta_B = \tan 30^\circ \end{aligned}$$

Question

H/W

In the figure shown below, the position versus time graph of two particles A and B is shown. Select the correct statement:

- 1 The speed of B was initially greater than that of A and finally less than that of A.
- 2 The speed of B was initially less than that of A and finally greater than that of A.
- 3 The speed of B was initially as well as finally greater than that of A.
- 4 The speed of B was initially as well as finally less than that of A.



likhna hai

(Q) gf Position

$$x = \alpha t^2 + \beta t - \gamma$$

then (i) find velocity and Position at time t'

(ii) initial velocity & position ($t=0$)

(iii) velocity & position at $t = \underline{2 \text{ sec}}$

$$v = \frac{dx}{dt} = \alpha(2t) + \beta - 0$$

$$V = 2\alpha t + \beta$$

velocity as function of time

$$(x) = \alpha t^2 + \beta t - \gamma$$

initial velocity

$$V(t=0) = \beta \text{ m/s}$$

$$\begin{aligned} V(t=2) &= 2\alpha \times 2 + \beta \\ &= 4\alpha + \beta \end{aligned}$$

$$x(t=0) = 0 + 0 - \gamma = -\gamma \text{ m}$$

$$(x = 4\alpha + 2\beta - \gamma) \text{ m}$$

Ans

Question



If position $x = t^2 + 4t + 6$. Find avg. speed and avg. velocity in 2-sec.

MR* \rightarrow differentiate Nahi Karna.

$$\text{Avg speed} = \frac{(\text{total dist}^n)}{\text{total time}}$$

$$\text{Avg velocity} = \frac{(\text{total disp}^n)}{\text{total time}}$$

distⁿ = dispⁿ
 $= x_f - x_i$

$$x = t^2 + 4t + 6 \quad \checkmark$$

$$\frac{dx}{dt} = 2t + 4$$

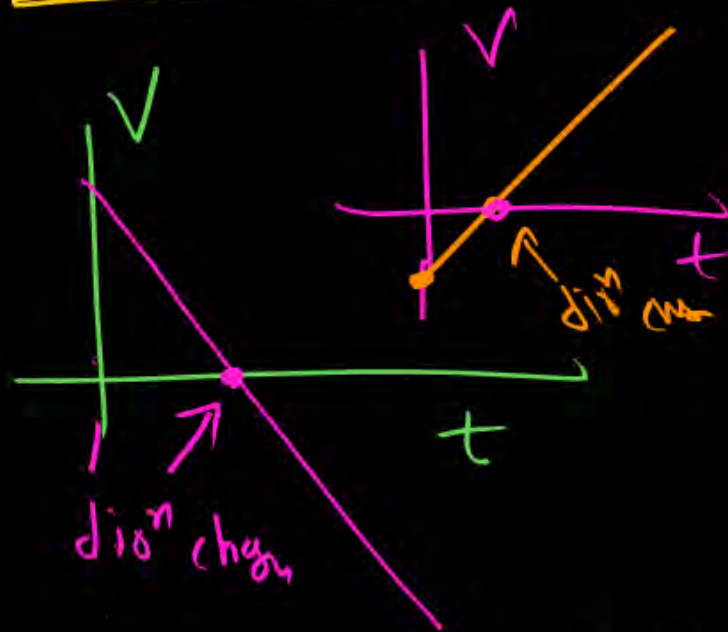
$$v = 2t + 4 \quad \checkmark$$



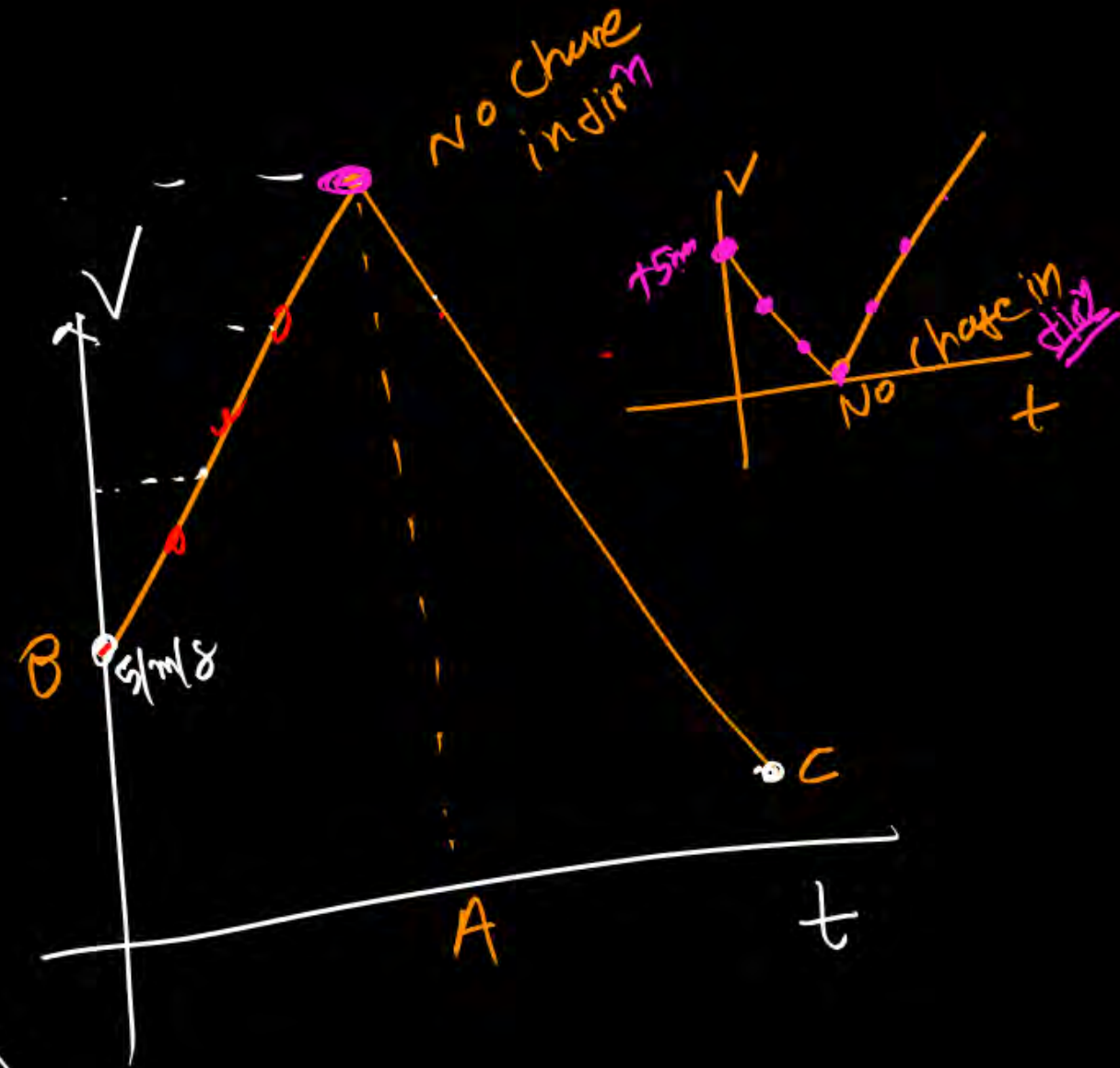
(Q) Direction change kaha hua??

- ~~(a)~~ A
(b) B
(c) C

MR Scam



~~(d)~~ Kahi Nahi



V/t graph
jo dir^n change
waha hota hai

Tab velocity +ve se -ve ho jata hai

or velocity -ve se +ve ho jata hai

velocity \rightarrow +ve

\rightarrow motion ka dir^n (आगे) hoga

velocity \rightarrow -ve

motion ka dir^n (पीछे) hoga.

Question



Position of object $x = 10t - 2t^2$. Find time when object comes to at rest.

H/W Not 2nd

Position of object $x = t^2 - 4t + 5$ then find Avg.
speed and Avg. velocity in $t = 3$ sec.

धन
Note में
लिखना है

position $x = \frac{t^3}{3} - 2t^2 + 4t$ find Avg speed and Avg velocity in 3-sec.

H/w Note
अ मिश्रित
ए।

Question



A particle is moving such that its position coordinates (x, y) are $(2\text{m}, 3\text{m})$ at time $t = 0$, $(6\text{m}, 7\text{m})$ at time $t = 2\text{s}$ and $(13\text{m}, 14\text{m})$ at time $t = 5\text{ s}$. The average velocity vector \vec{v}_{avg} from $t = 0$ to $t = 5\text{ s}$ is:

नोट कि
सही विकल्प
PYQ.

1 $\frac{1}{5}(13\hat{i} + 14\hat{j})$

2 $\frac{7}{3}(\hat{i} + \hat{j})$

3 $2(\hat{i} + \hat{j})$

4 $\frac{11}{5}(\hat{i} + \hat{j})$

Question



Object is moving with constant speed then velocity of object:

- 1 may be variable
- 2 must be constant
- 3 must be variable
- 4 may be zero

राम
सही विकल्प

Question



A particle is executing a circular motion of radius R with a uniform speed v . After completing half the circle, the change in velocity and in speed will be respectively

Not a
A → EF
model

1 zero, zero

2 $2v$, zero

3 $2v$, $2v$

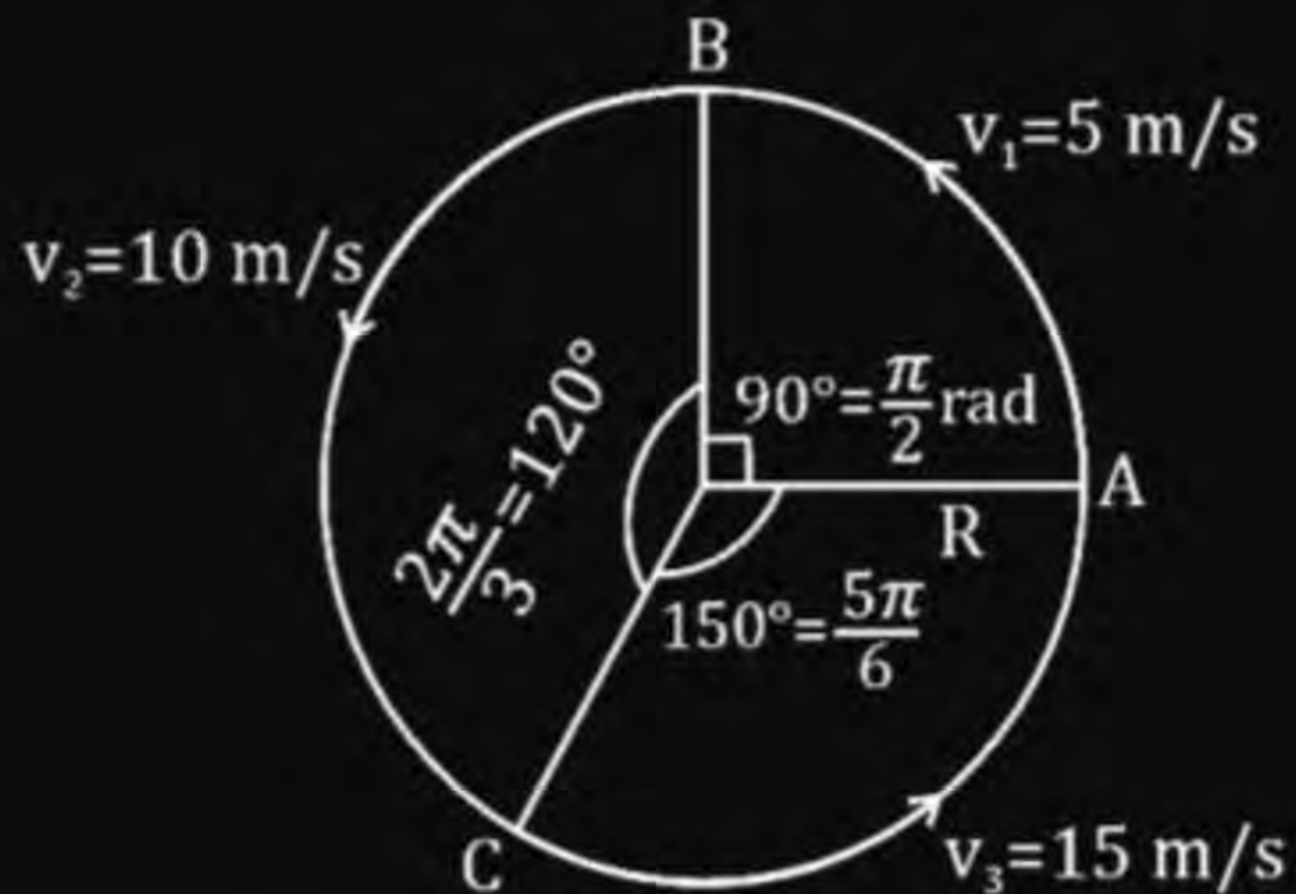
4 zero, $2v$

Question



A man is moving on circular path as shown then find avg. speed in one rotation.

H/W
Nahi likhna



Question



If object is moving with speed $v = 3t^2$; then find avg. speed in 2-sec.

H/W (Notes 9/11)

THANK
YOU