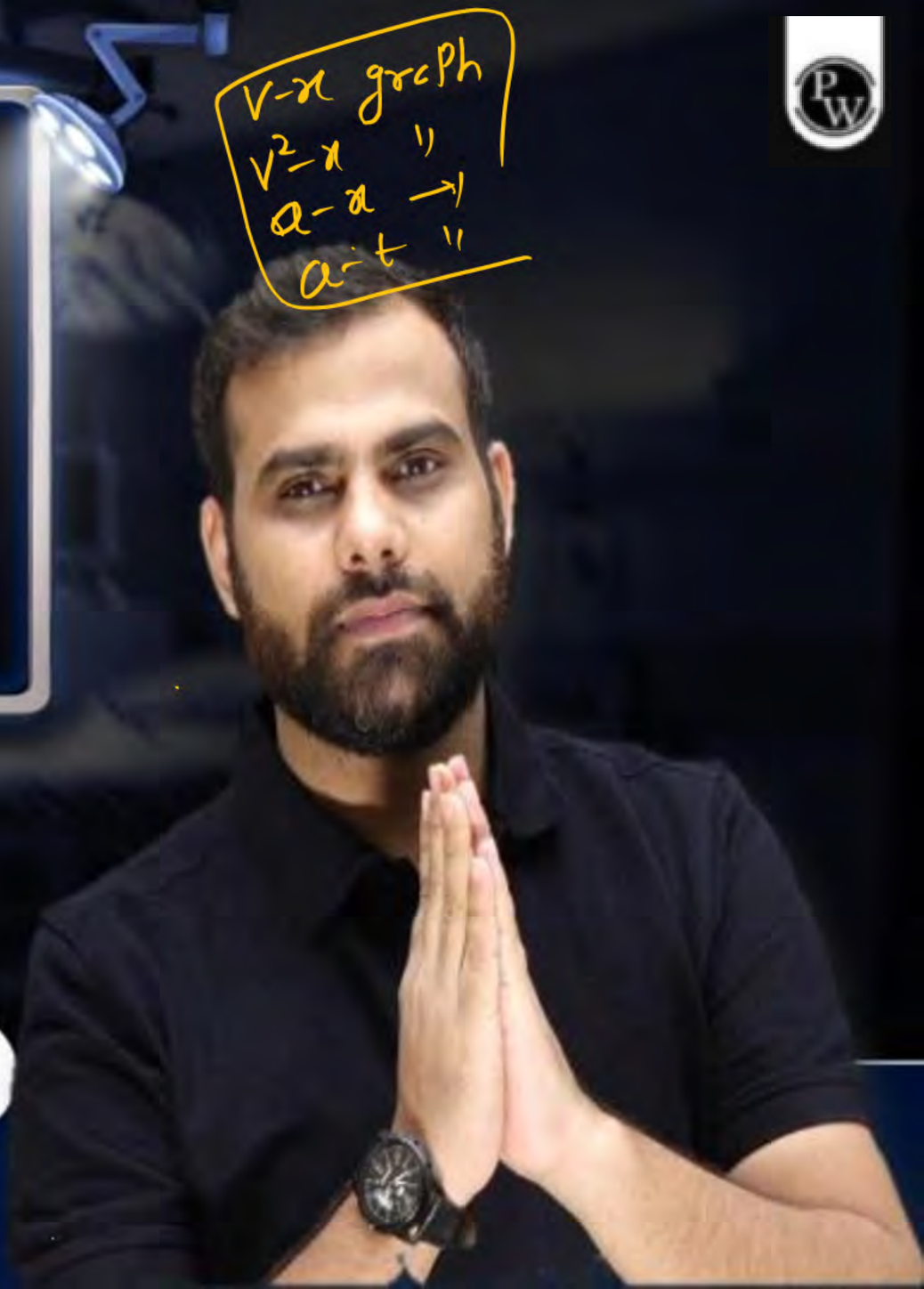
YAKEEN NEET 2.0

2026

Motion in a Straight Line

Physics | Lecture - 12

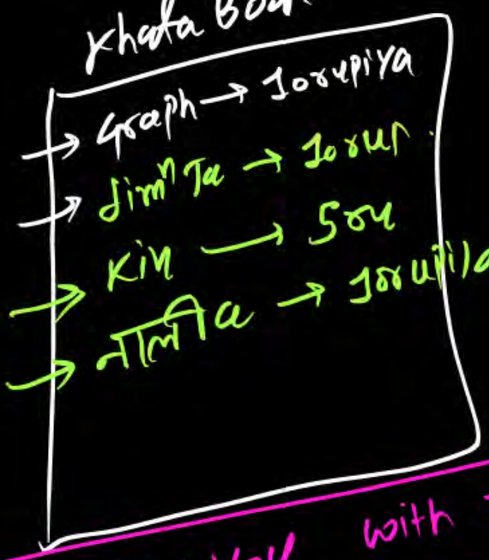
By- Manish Raj (MR Sir)



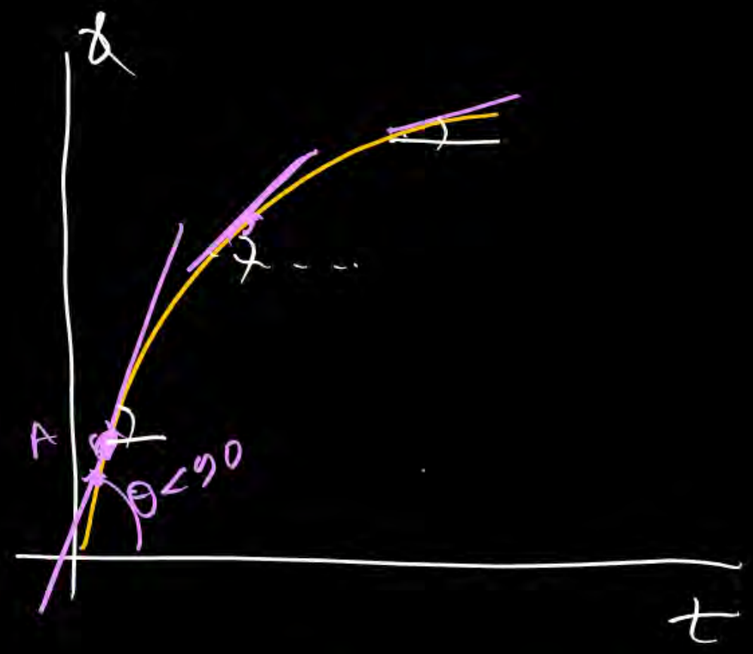
Todays Goal

- Graph Conversion
- motion undr gravity :—

graph b/w p & Q	Slope	Area
* $x - t$		
* $v - t$		
$V - x$ $V^2 - x$		
* $a - t$		
$a - x$		



g. M.R. will Pay You with zero % GST but You have to come after 2 Selection, shaw this Khata book with proof → Marks By MRK

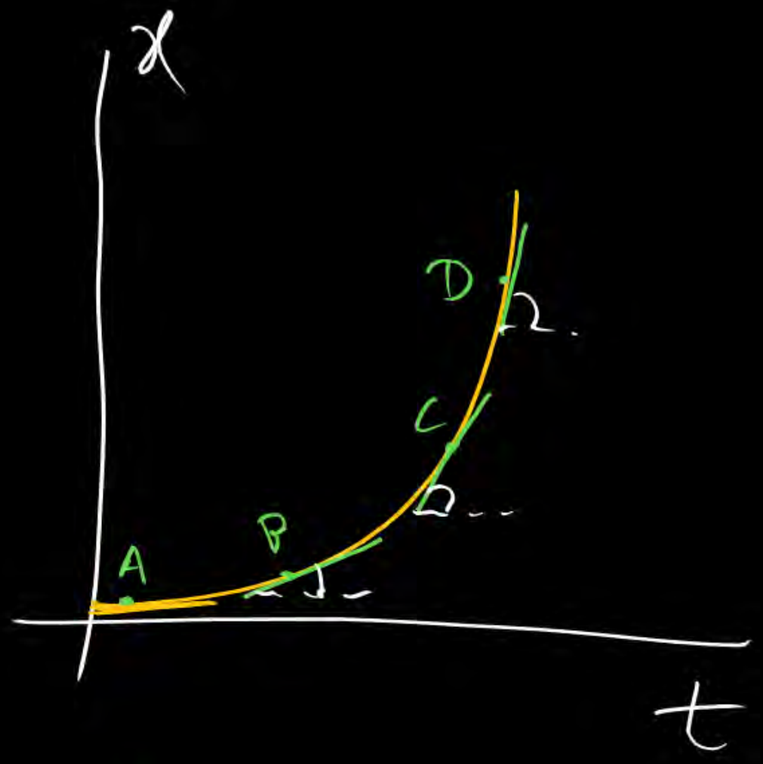


m_A = +ve & ↓

Velocity +ve & ↓

O ⟶ +ve (speed ↓)

⟵ (a = -ve)



$m_A = 0$

m_B = +ve

m_C = +ve

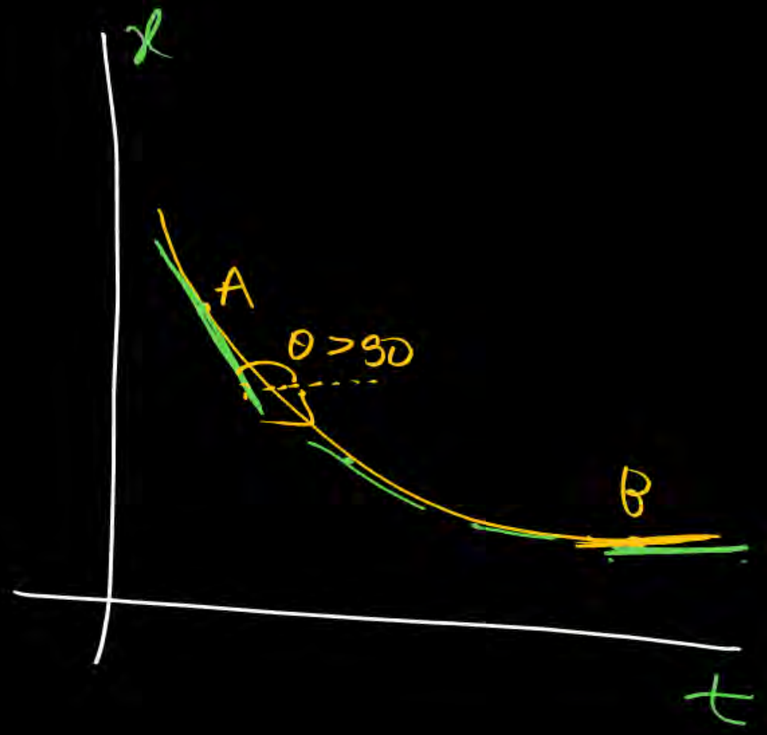
Velocity +ve ↑

O → v = +ve

Speed ↑

→ a = +ve.

लिखना है।



magnitude of velocity is speed

Speed at B = 0

Speed ↓
from A to B

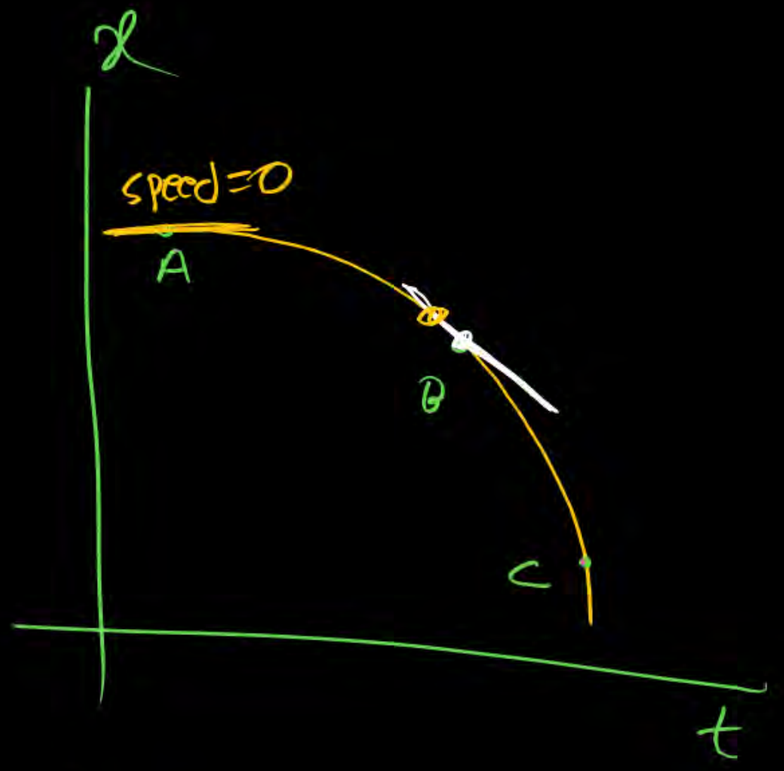
Velocity at A = -ve

Positive aaegi hoga.

v = -ve

Speed ↓

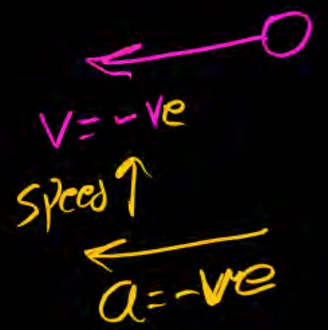
लिखना है:—

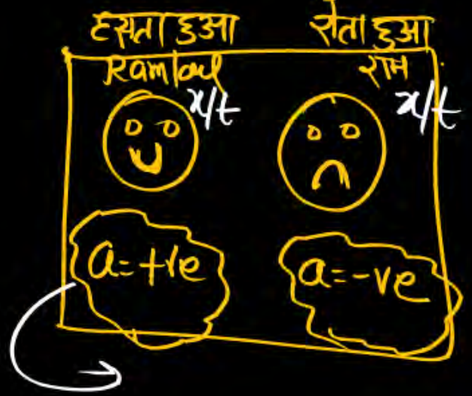


$Speed_A = 0$ ✓

$(Speed)_B \neq 0$ ✓

Velocity = -ve ✓
at B & C





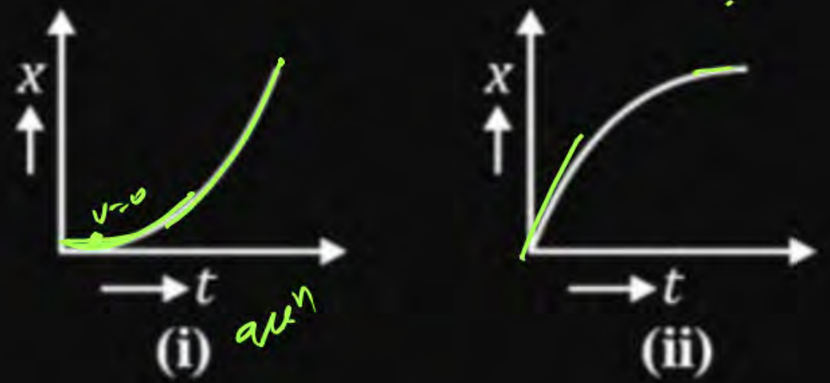
GP speed increasing then a & v are Parallel
GP speed decreasing then a & v are opposite

speed में +ve -ve नहीं लगते

Question

Best Possible answer (HW)

Figures (i) and (ii) below show the displacement-time graphs of two particles moving along the x-axis. We can say that



(i) (ii)

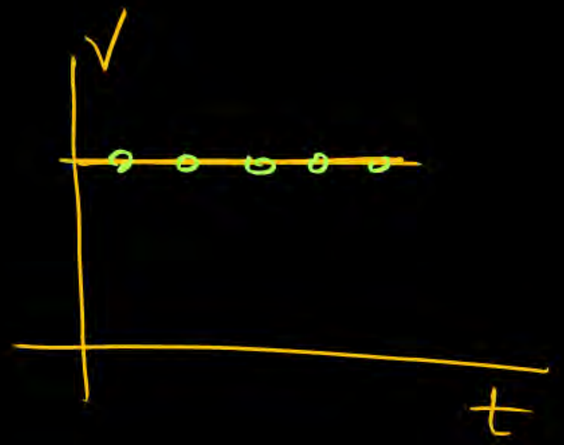
1. Both the particles are having a uniformly accelerated motion
2. Both the particles are having a uniformly retarded motion
3. Particle (i) is having a uniformly accelerated motion while particle (ii) is having a uniformly retarded motion
4. Particle (i) is having a uniformly retarded motion while particle (ii) is having a uniformly accelerated motion

Graph Conversion.

MR* Box

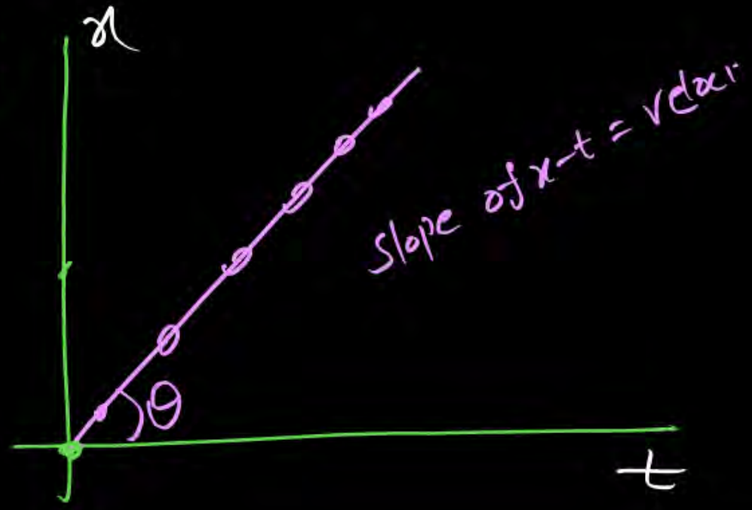
In graph conversion nature of motion remain same.

graph Conversion me given graph ya Jo convert kayke banega uske slope pe focus Karo.



Convert this into x-t graph (if initial x=0)

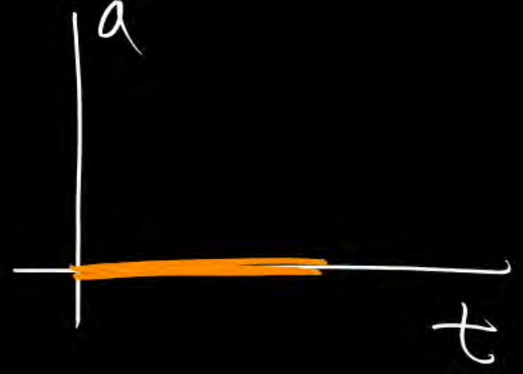
m_{R^+} → slope x-t graph ka velocity/ dega.

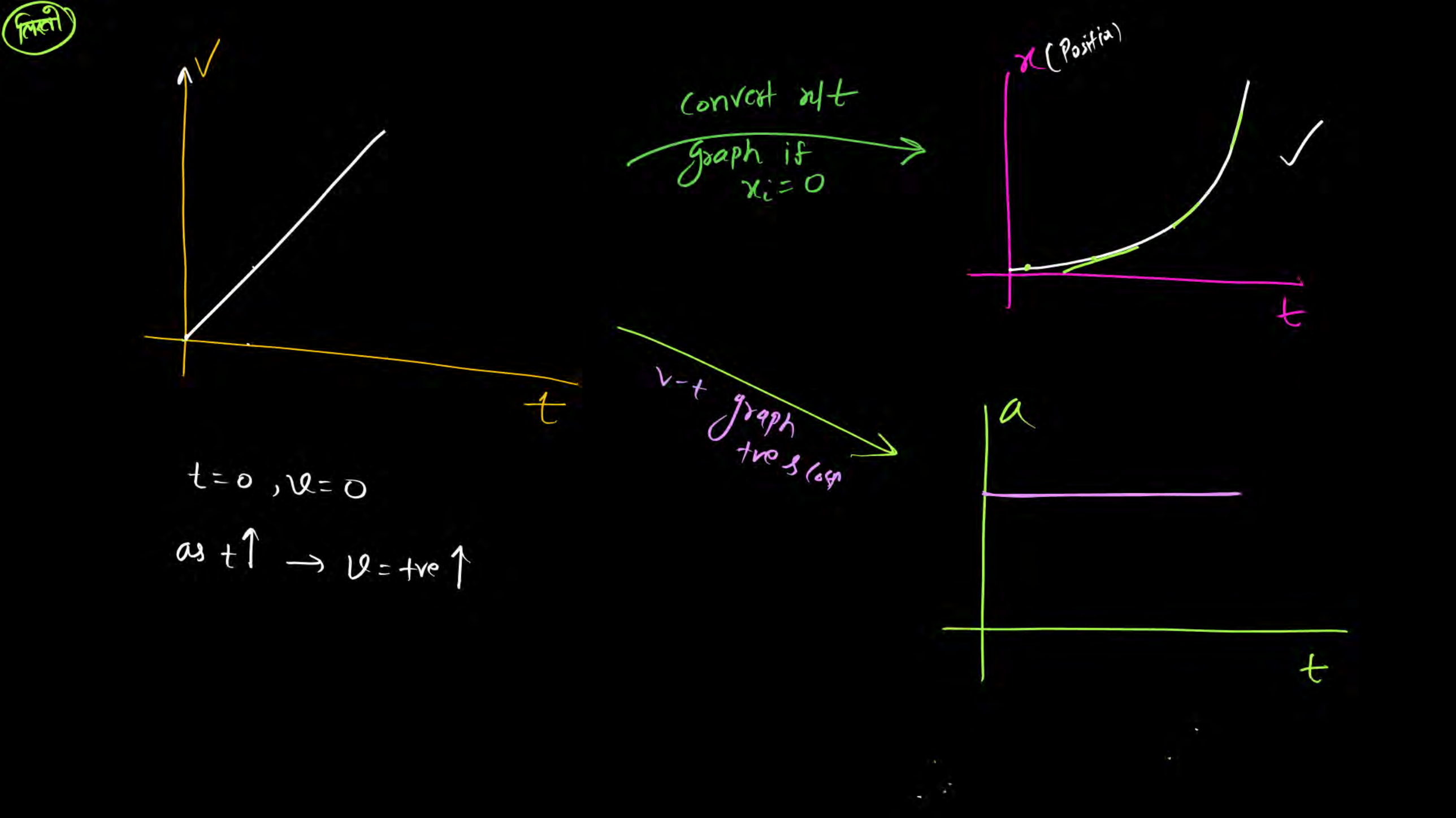


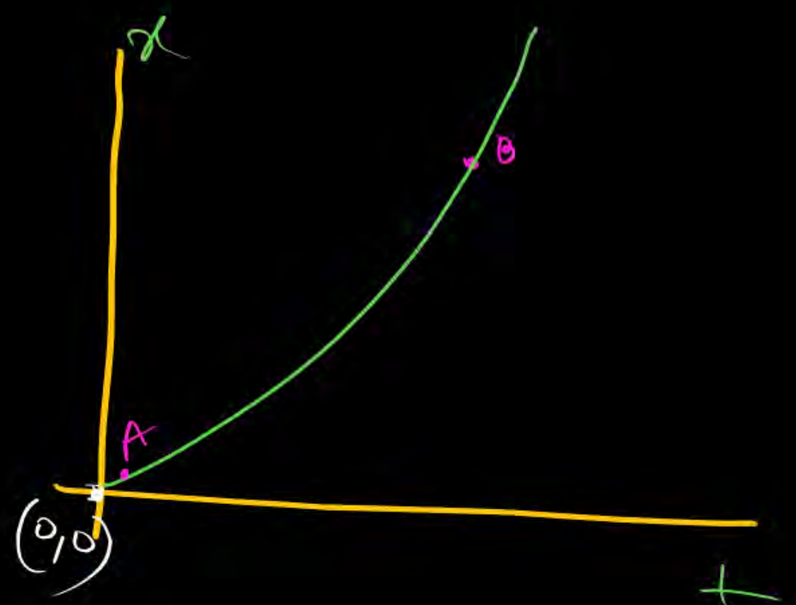
Convert a-t graph.

m_{R^2} → v/t graph ka slope

लिस्ती




Example
v
t
Convert x/t
Graph if
$x_i = 0$
x (Positive)
t
v-t graph
+ve slope
a
t
$t = 0, v = 0$
as $t \uparrow \rightarrow v = +ve \uparrow$



Speed is zero at

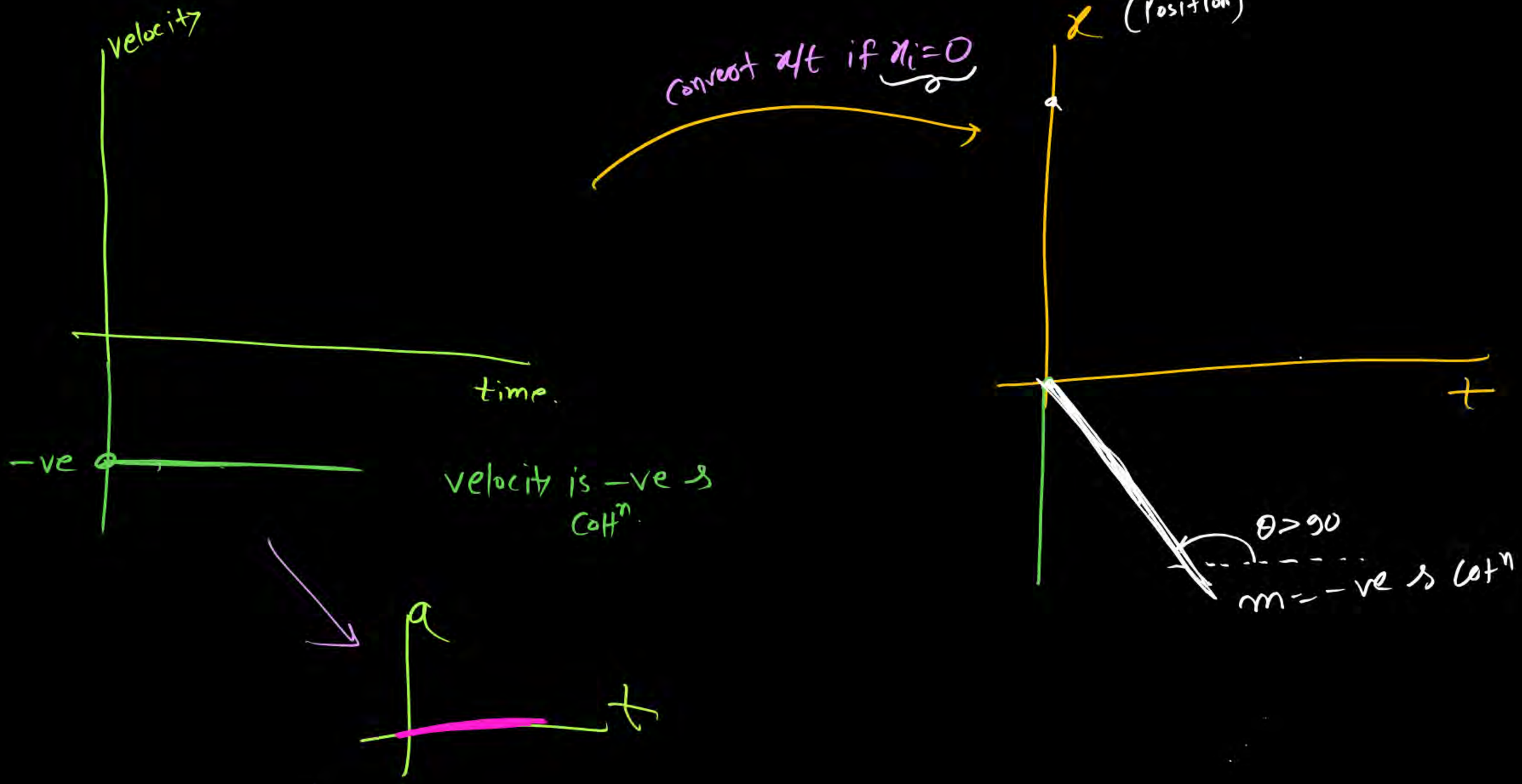
~~(a)~~ A

~~(b)~~ B

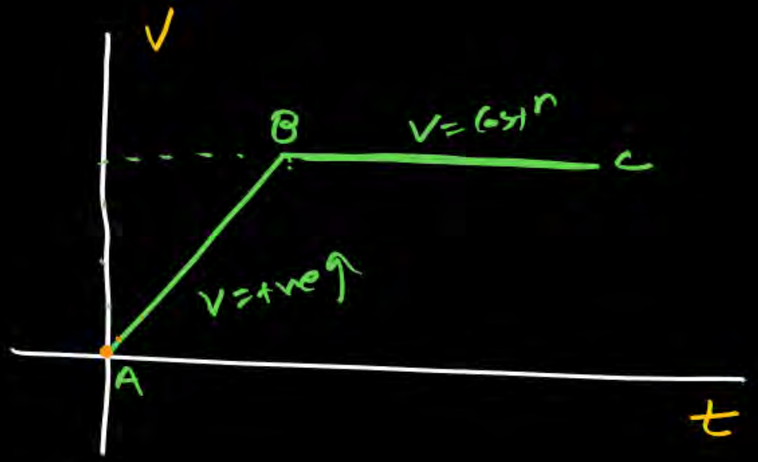
Speed is not zero at A & B.

at $t=0$ speed is zero??

Ans → NO

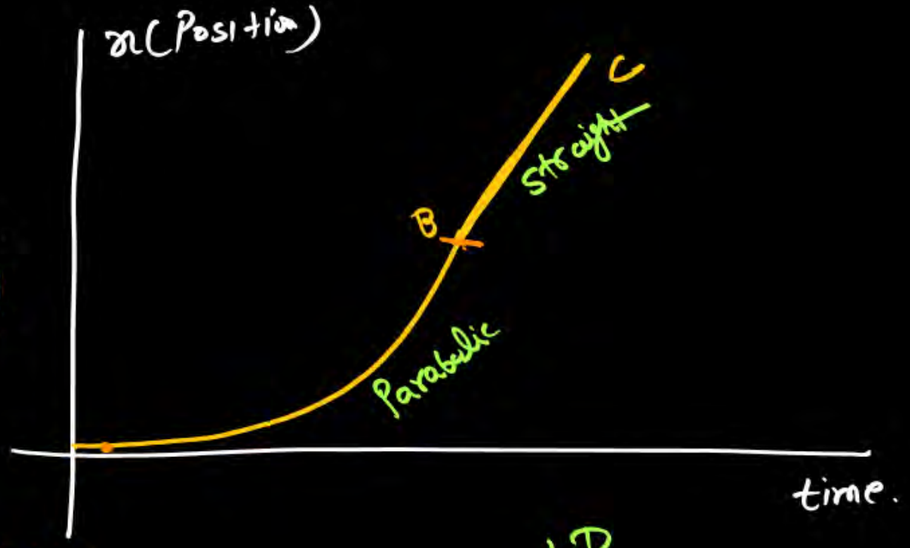

Velocity
time.
-ve
velocity is -ve ⇒ Coⁿ.
a
t
Convert x/t if $x_i = 0$
x (Position)
a
t
θ > 90
m = -ve ⇒ Coⁿ

Likho

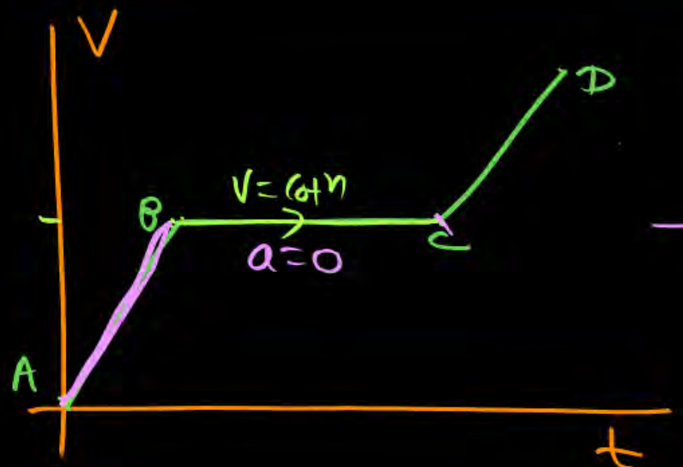


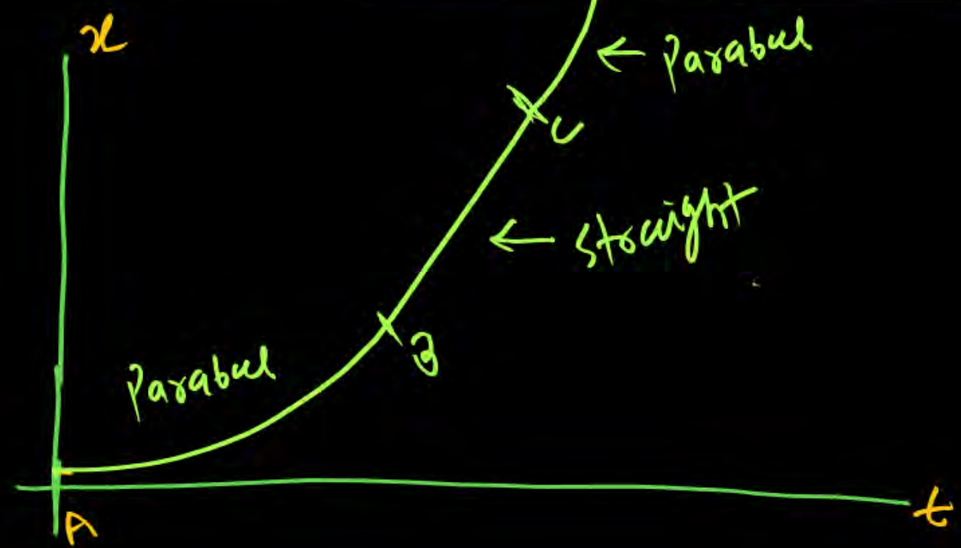
Convert (x/t) graph.

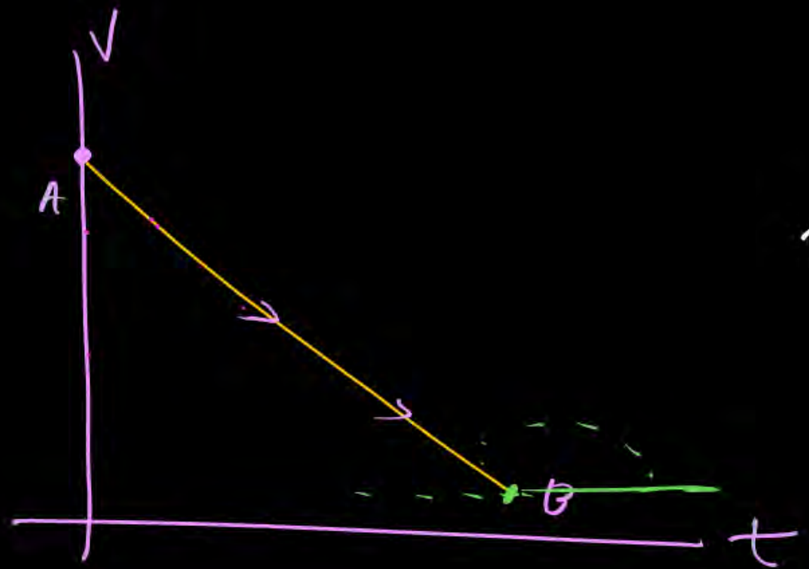
$x_i = 0$ (given hai)



Slope of x/t is velocity

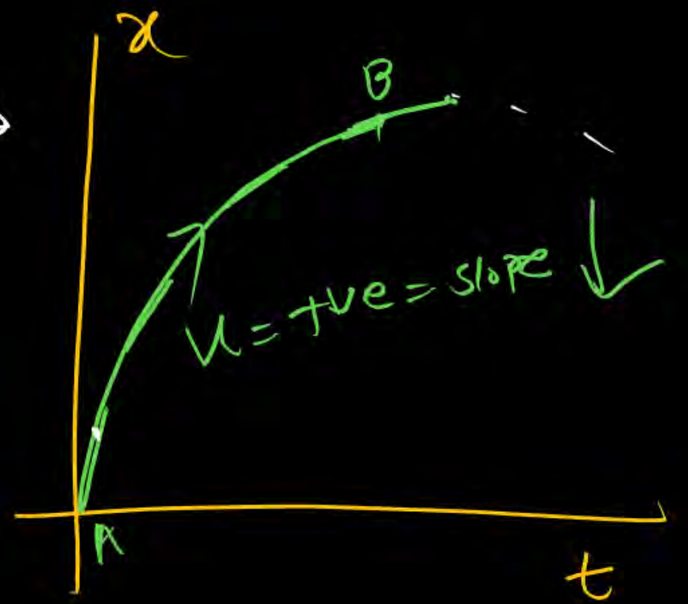






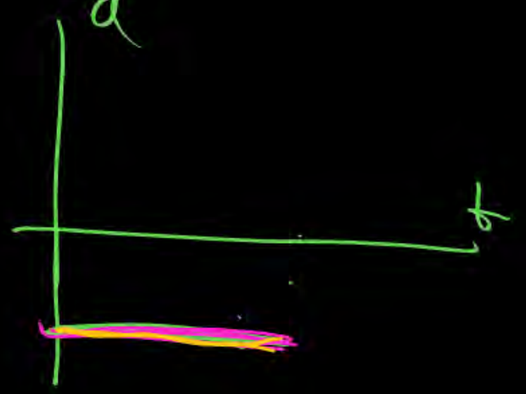
If $u_i = 0$ then

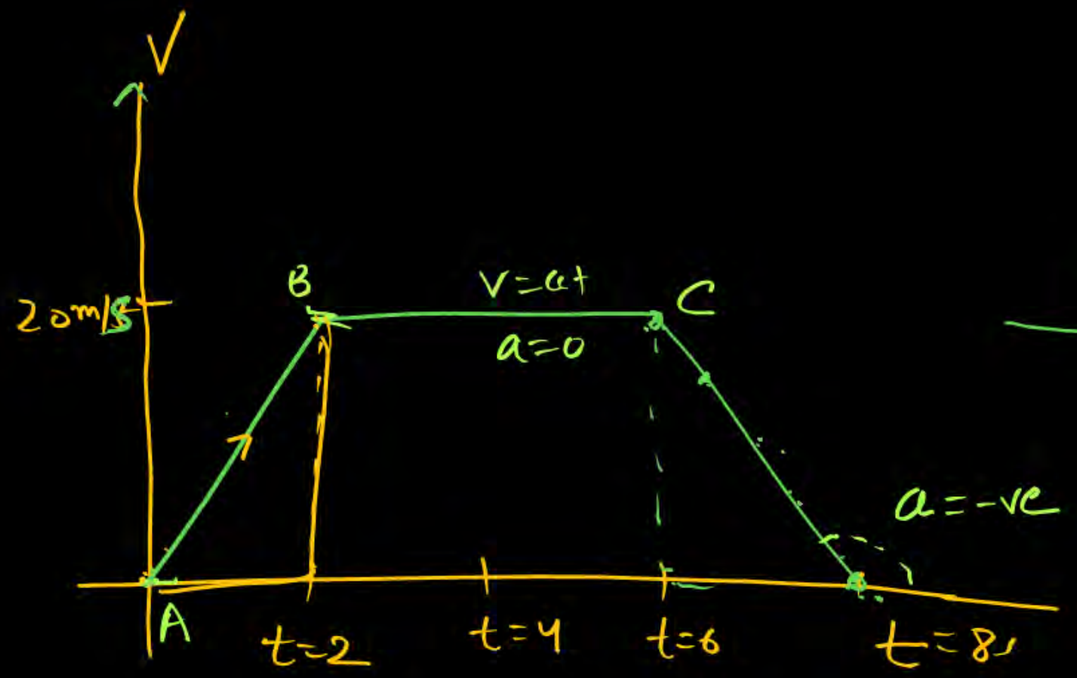
Convert x/t graph.



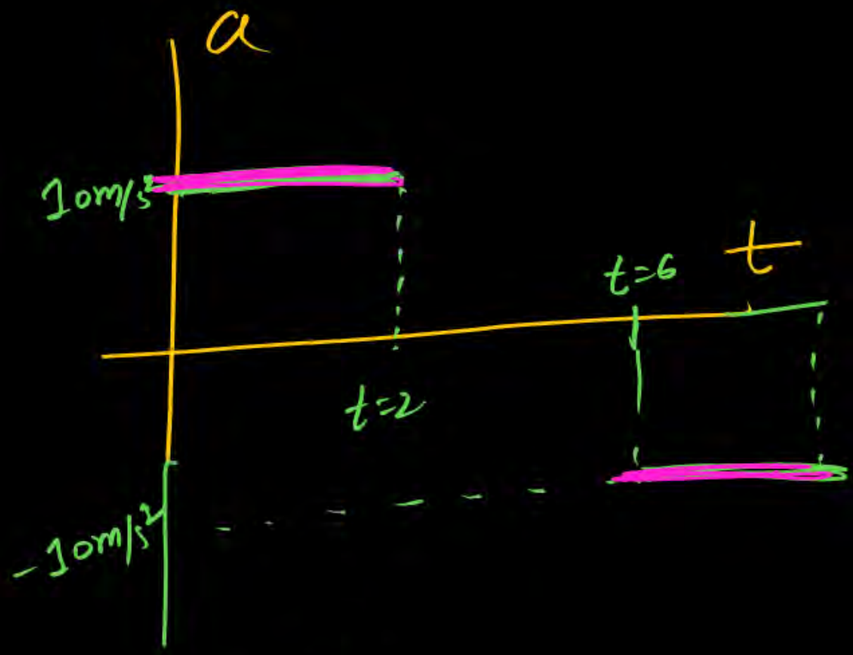
(#) v = +ve (↓) → slope of x/t +ve & decreasing.

Convert a/t graph.





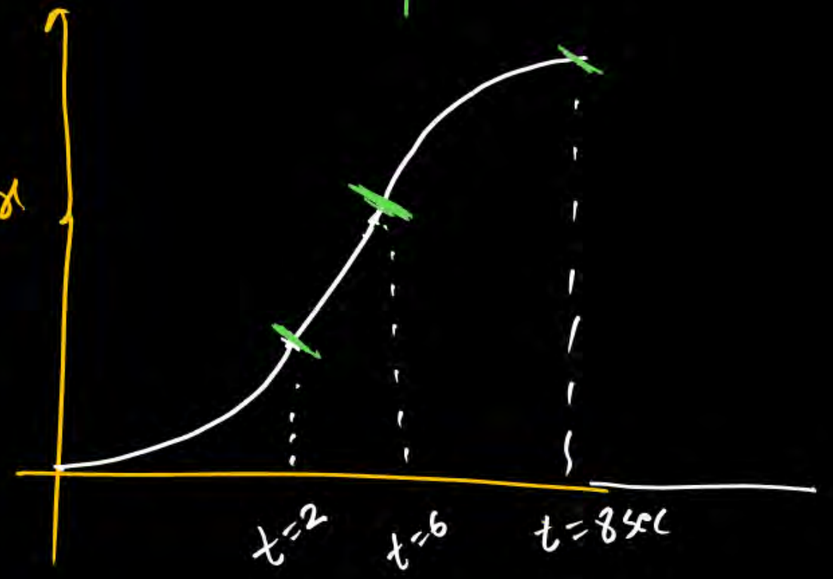
Convert in alt graph

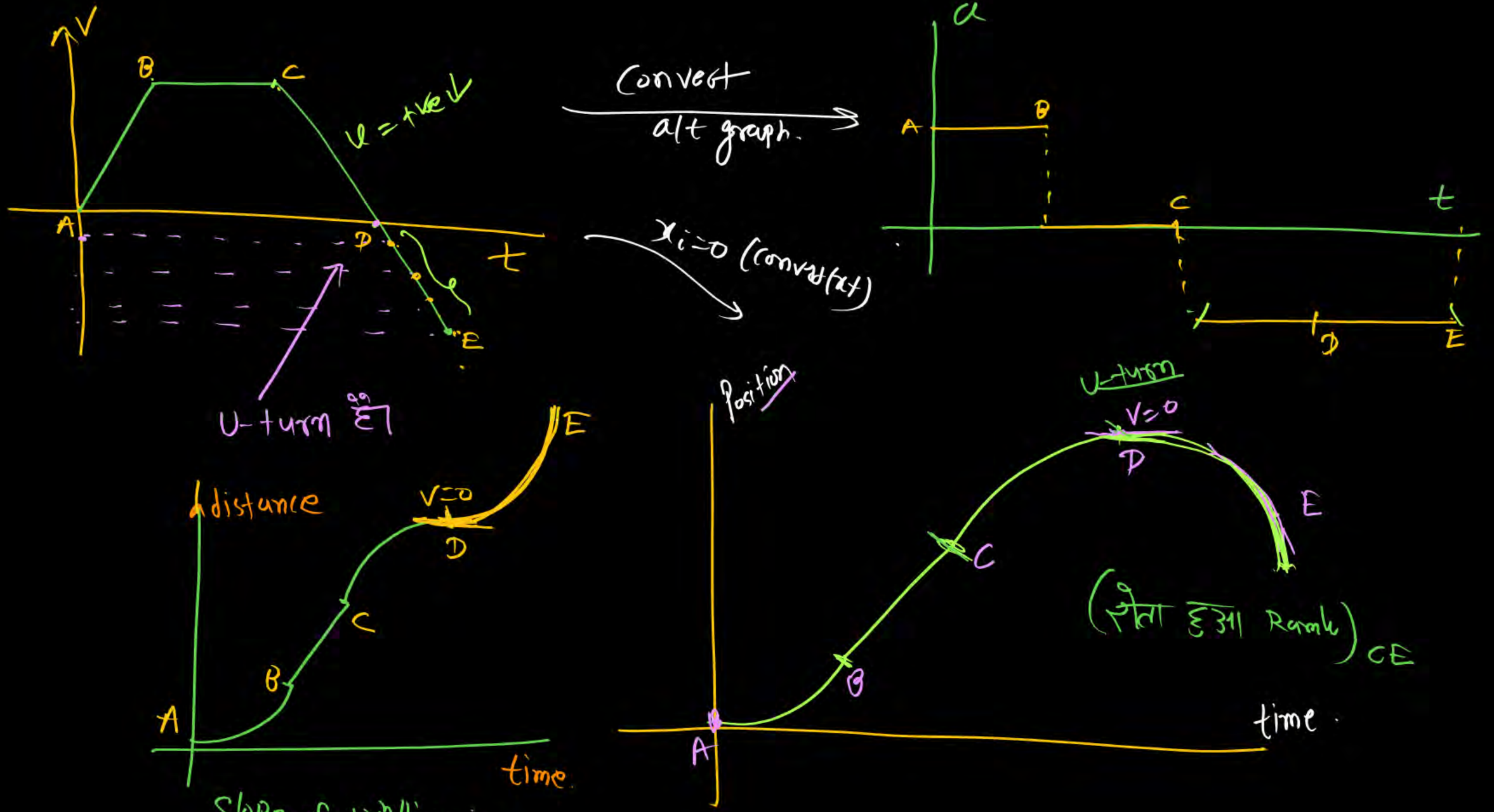


No U-turn in this graph

→ Continous object aage bhag raha hai

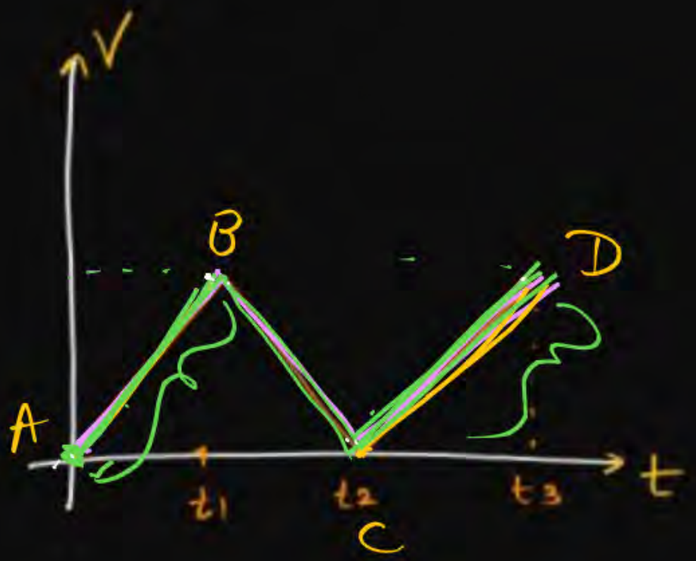
Convert / alt gf $x_i = 0$

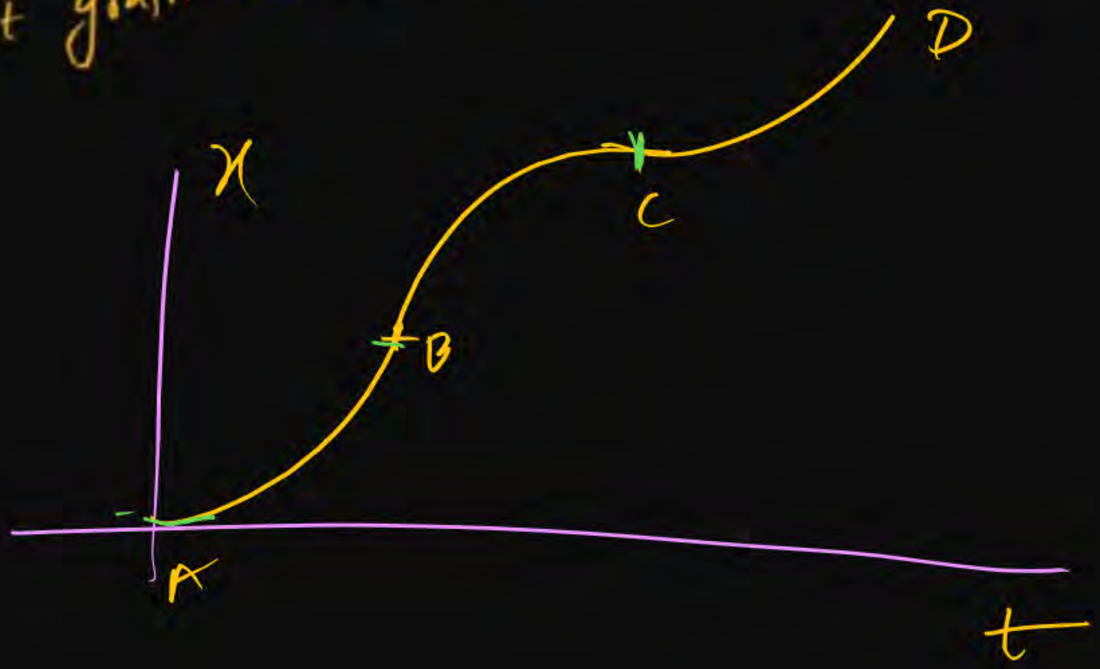


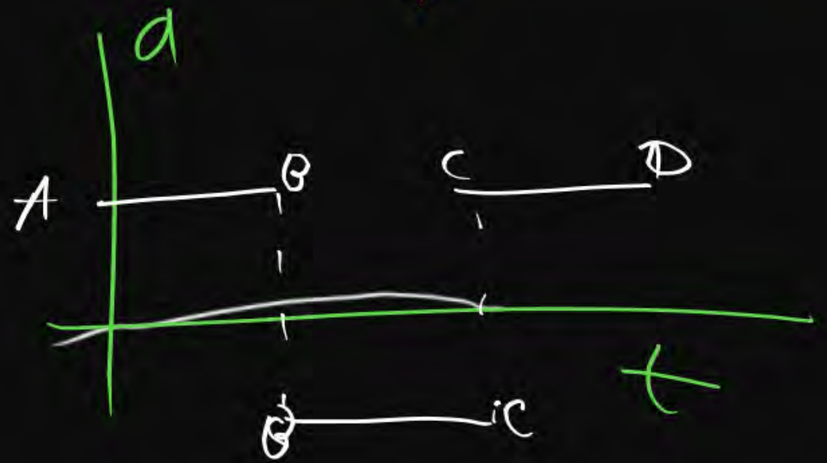

V
B
C
A
D
E
t
v = +ve ↓
Convert
alt graph.
a
A
B
C
t
D
E
$x_i = 0$ (convert)
U-turn ई
distance
V=0
D
E
C
B
A
time
Slope of dist^n/time is
Speed.
Position
U-turn
V=0
D
E
C
B
A
time
(सीधा हुआ Rank) CE

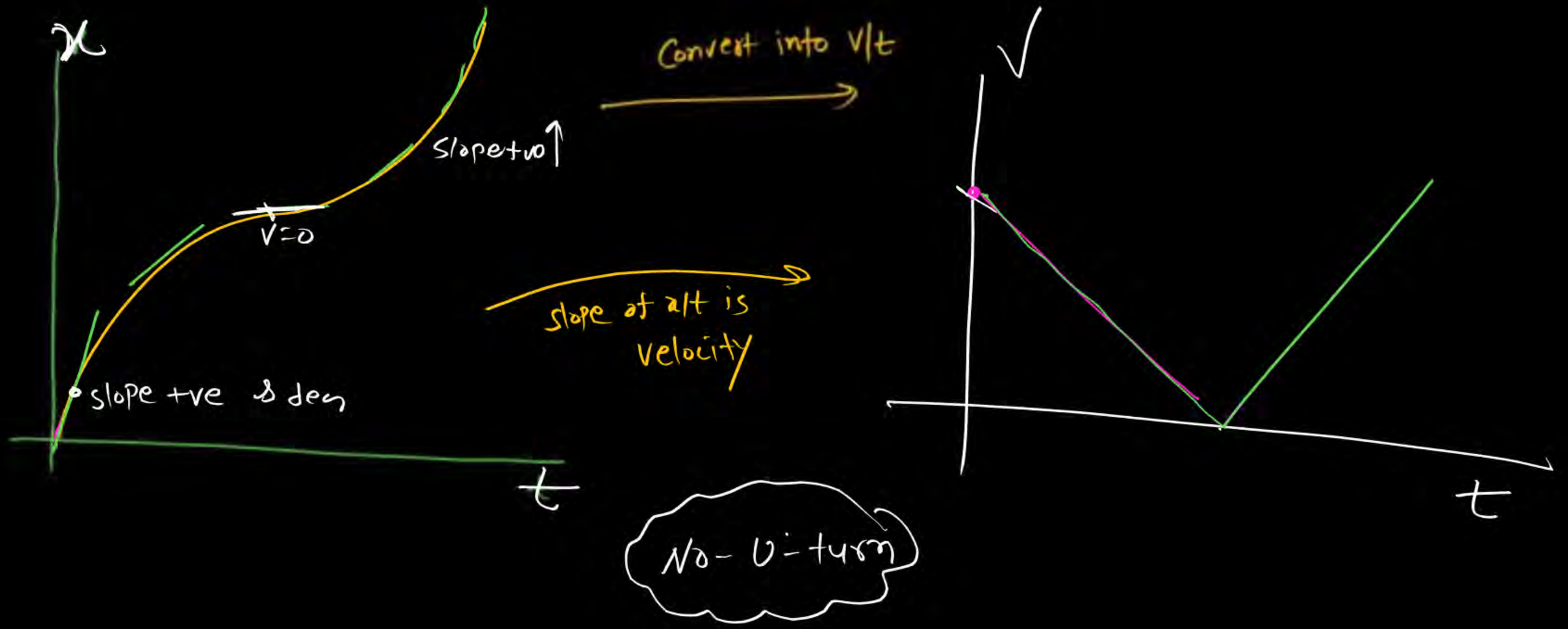
Graph Conversion

Convert v/t graph into a/t and x/t

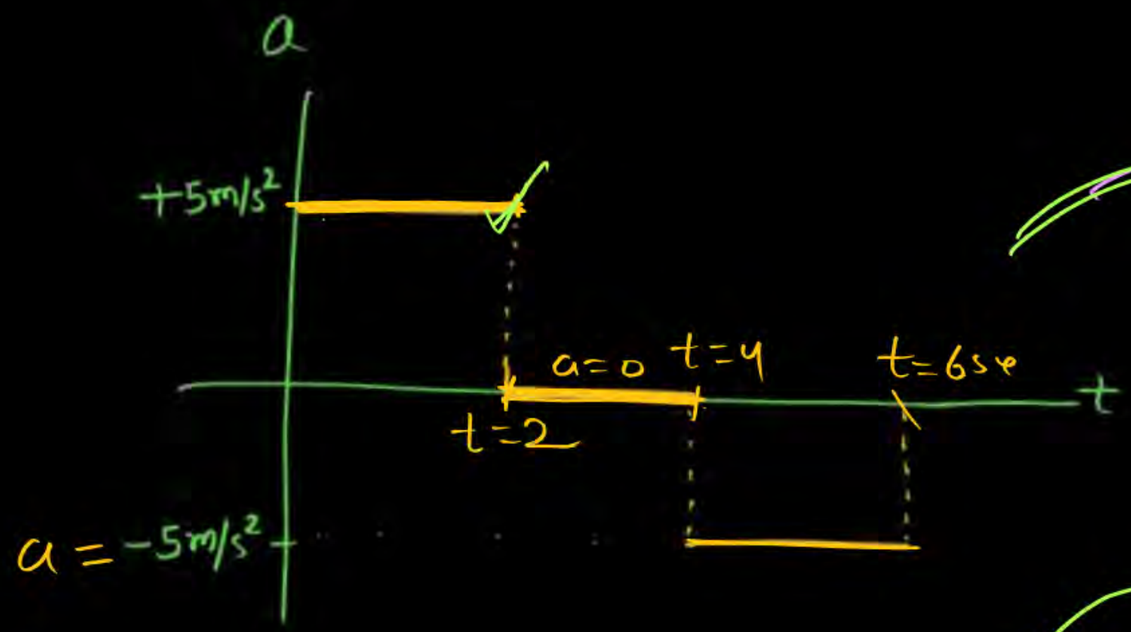


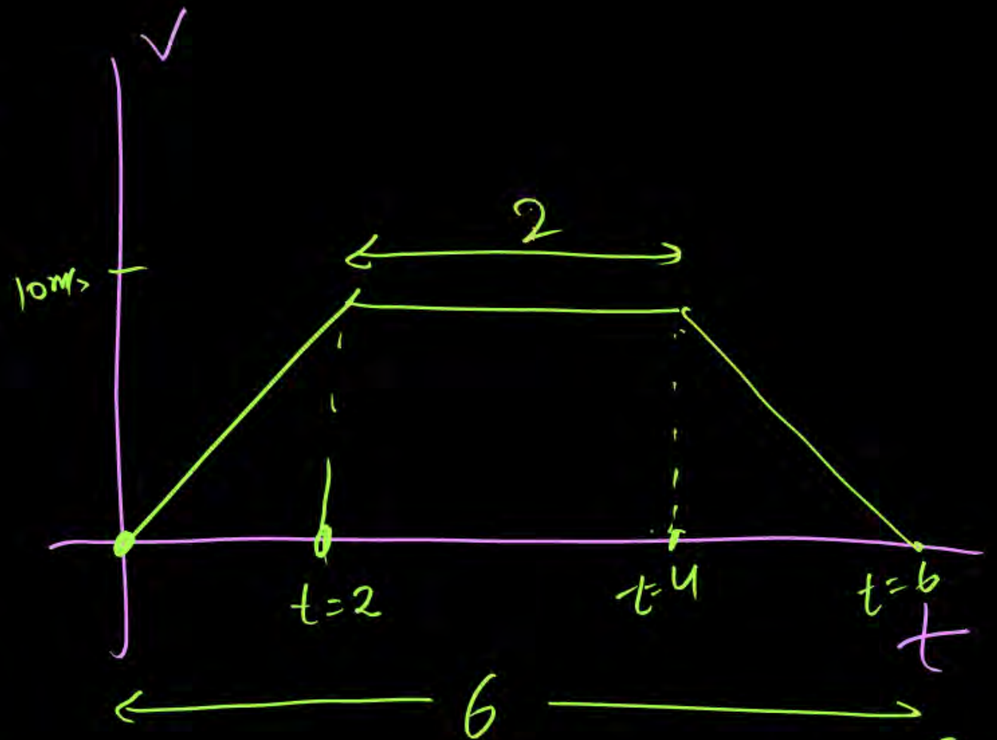





x
slope +ve & den
slope +ve ↑
V=0
t
Convert into V/t
slope of x/t is velocity
V
t
No-U-turn

If initial velocity is zero then find total distance travalled by object :- for given acc^{n} - time graph :-





$v = u + at$

$v = 0 + 5 \times 2$

$v = 10 m/s$

velocity at t=2sec

Area $= \frac{1}{2} \times (6+4) \times 10$

$= 8 \times 5 = 40m$

Question ঘর পর লিখনা শুরু

The position (x) of a particle moving along x-axis varies with time (t) as shown in figure. The average acceleration of particle in time interval $t = 0$ to $t = 8$ s is

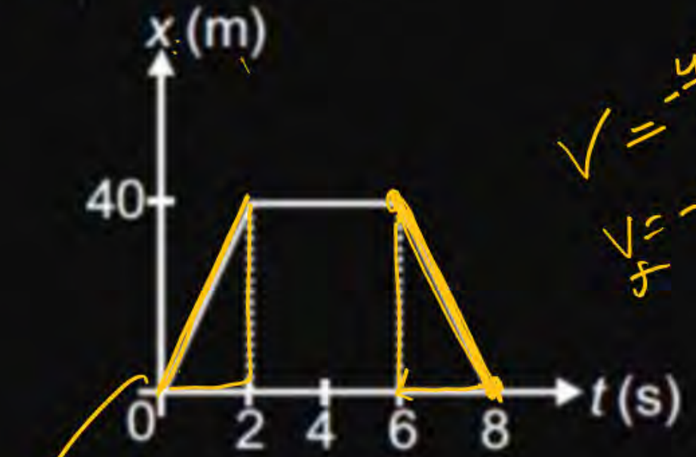
1. $3\ m/s^2$
2. $-5\ m/s^2$
3. $-4\ m/s^2$
4. $2.5\ m/s^2$

$$a_{Avg} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$$

$$= \frac{-20-20}{8}$$

$$= -\frac{40}{8}$$

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

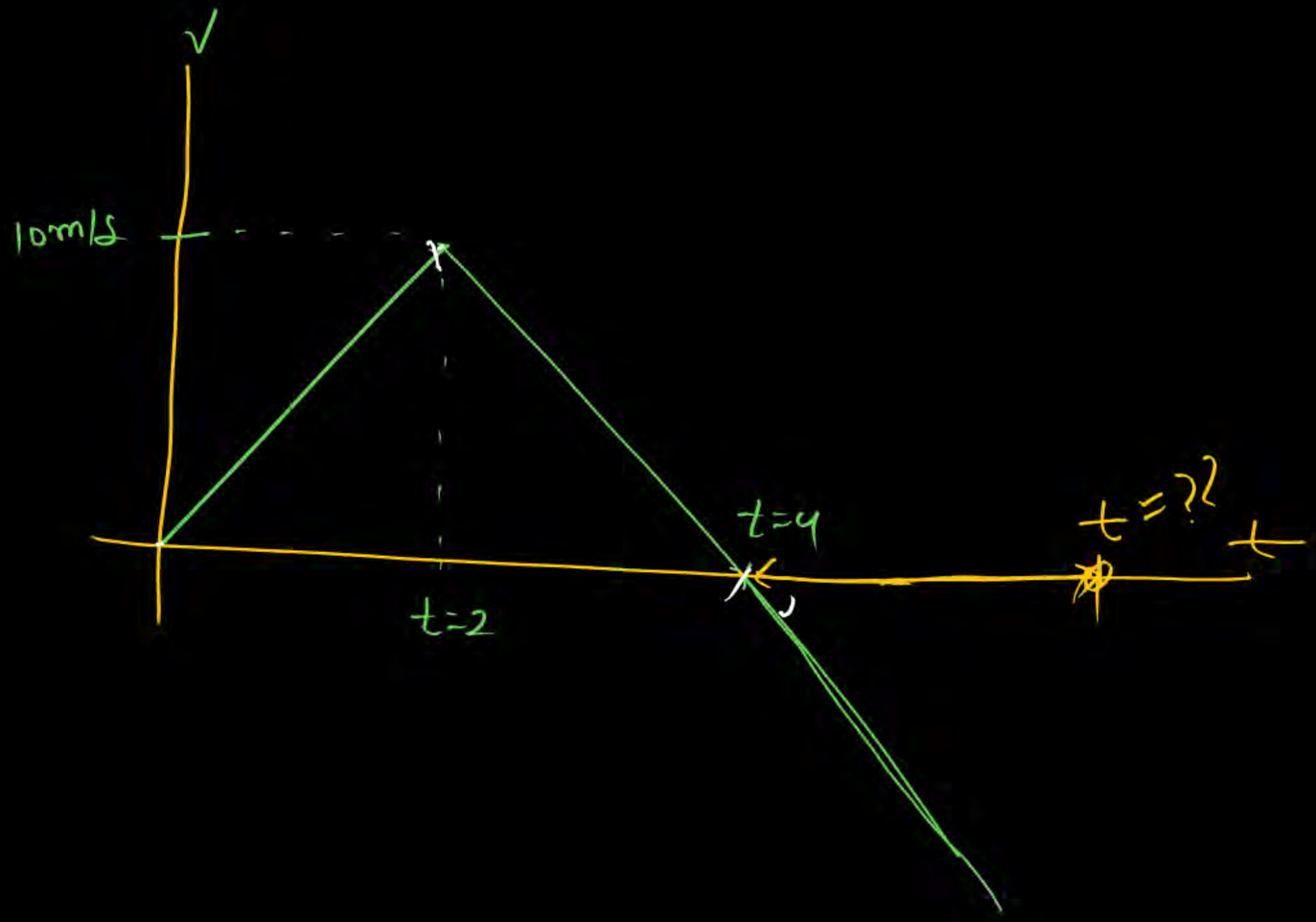


$V = \frac{-40}{2}$

$V_f = -20$ m/s

$V_i = \frac{40}{2} = 20$ m/s

MRB



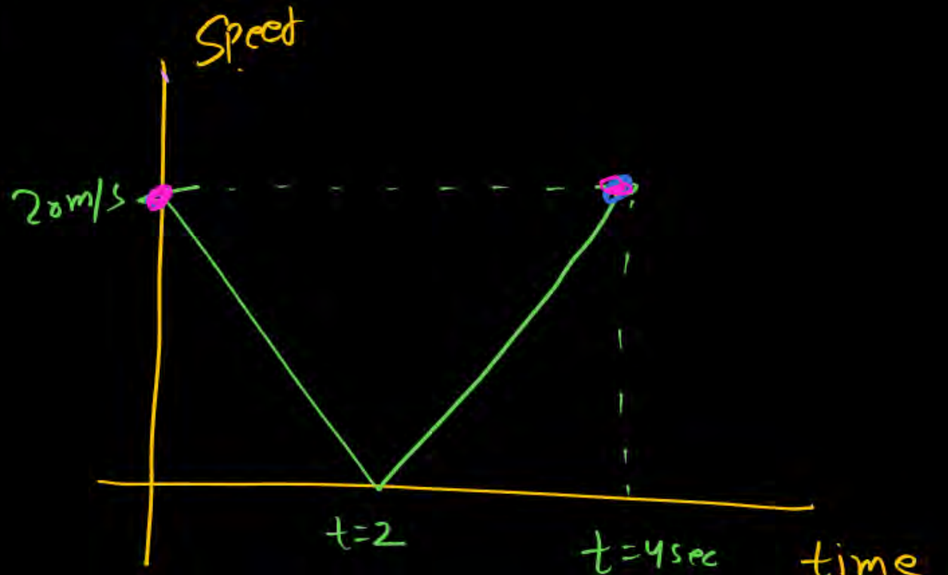
find Time when disp^{m} of object will be zero??

$t = 8$ sec ✗

Correct Ans

$t = 4 + 2\sqrt{2}$ ✓

MRQ



find Avg acc^n in 4-sec. ??

$$\vec{a}_{Avg} = \frac{V_f - V_i}{\Delta t}$$

$$= 0$$

(a) 0
(b) 10 m/s^2
(c) $-$ 10m/s^2
(d) all of them

Speed = 20m/s
$\vec{V}_f = +20$ m/s
$\vec{V}_f = -20$ m/s

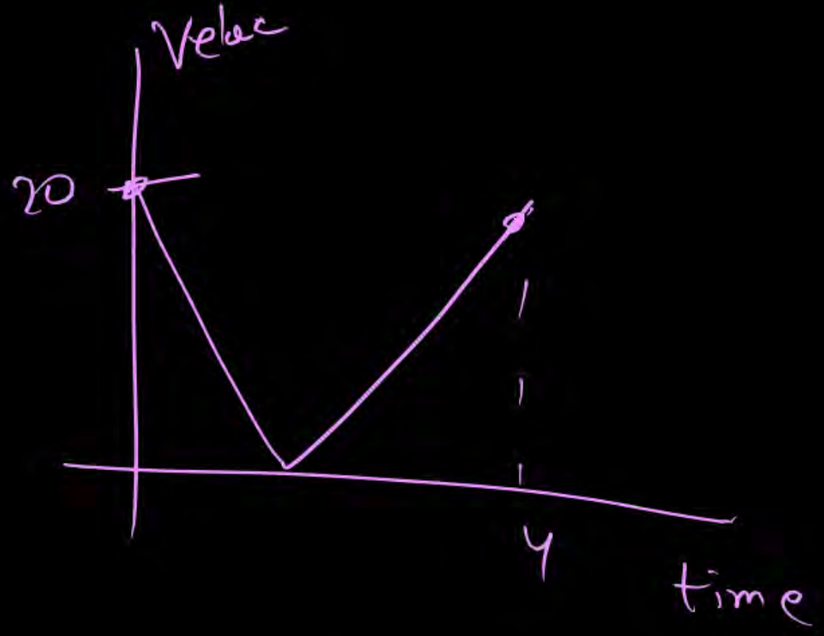
$\vec{V}_i = +20$m/s
$\vec{V}_i = -20$m/s
velocity

$$\vec{a}_{Avg} = \frac{\vec{V}_f - \vec{V}_i}{\Delta t} = \frac{20-20}{4} = 0$$

$$= \frac{20-(-20)}{4} = \frac{40}{4}$$

$$= 10 m/s^2$$

$$a = \frac{-20-(20)}{4} = \frac{-40}{4} = -10 m/s^2$$



$a = 0$

Any

(Q) object starts his motⁿ from rest and costⁿ $\boxed{\text{acc}^n = 10\ m/s^2}$ then find velocity, accⁿ, dispᵐ, distⁿ aftⁿ every one-sec.

Solⁿ

$u = 0$, $a = +10\ m/s^2$ (coⁿ) → NR*

$v = u + at$

$V_{3sec} = 0 + 10 \times 3 = 30$

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

$s_{t=1} = \frac{1}{2}10(1)^2 = 5m$

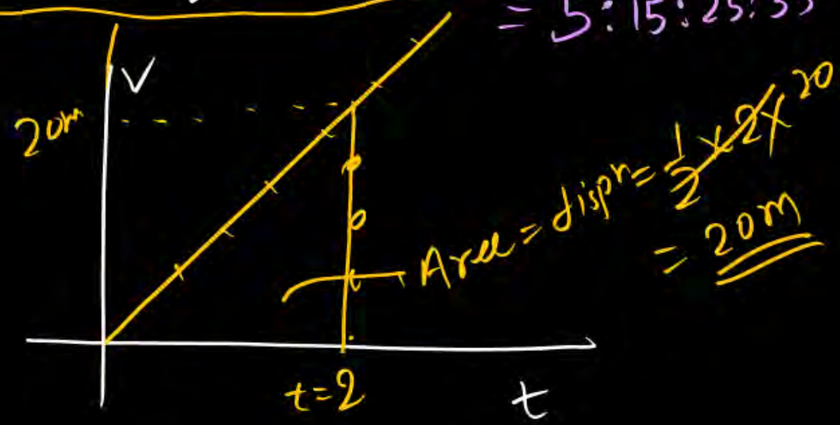
$s_{t=2} = \frac{1}{2}10(2)^2 = 5 \times 4 = 20m$

$s_{t=4} = \frac{1}{2} \times 10(4)^2 = 80m$

time	accⁿ	Velocity	dispᵐ	distⁿ
$t = 0$	$a = 10\ m/s^2$	0	0	0
$t = 1$ sec	$10\ m/s^2$	$10\ m/s$	$5m$	$5m$
$t = 2$ sec	$10\ m/s^2$	$20\ m/s$	$20m$	$20m$
$t = 3$ sec	$10\ m/s^2$	$30\ m/s$	$45m$	$45m$
$t = 4$ sec	$10\ m/s^2$	$40\ m/s$	$80m$	$80m$

$s_{1sec} : s_{2sec} : s_{3sec} : s_{4sec} = 5 : 20 : 45 : 80$
$= x : 4x : 9x : 16x$

$s_{1^{st}sec} : s_{2^{nd}} : s_{3^{rd}} : s_{4^{th}} = x : 3x : 5x : 7x$
$= 5 : 15 : 25 : 35$



Motion under gravity

→ $a = 10\ m/s^2$ downward. (air resistance ignored)

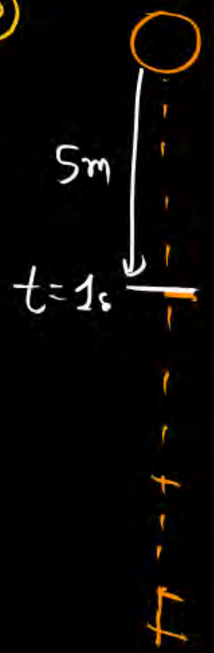
→ all equation of motion is valid (does not depend on mass of object)

-ve

Case → 1

(0,0)

+ve (let)



drop

$u = 0$

$a = g = +10\ m/s^2$

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

$$= 0 \times 1 + \frac{1}{2} 10 (1)^2$$

$$= 5m$$

$$\begin{cases} S_{1st} : S_{2nd} : S_{3rd} = x : 3x : 5x : 7x \\ \qquad\qquad = 5m : 15 : 25m : 35m \\ S_{1sec} : S_{2sec} : S_{3sec} = x : 4x : 9x = 5 : 20 : 45 : 80 \end{cases}$$

Object droped & its Time of flight is (4 sec) then find Height :—

$$S = \cancel{ut}^{0} + \frac{1}{2}at^2$$

$$S = \frac{1}{2} \times 10 (4)^2$$

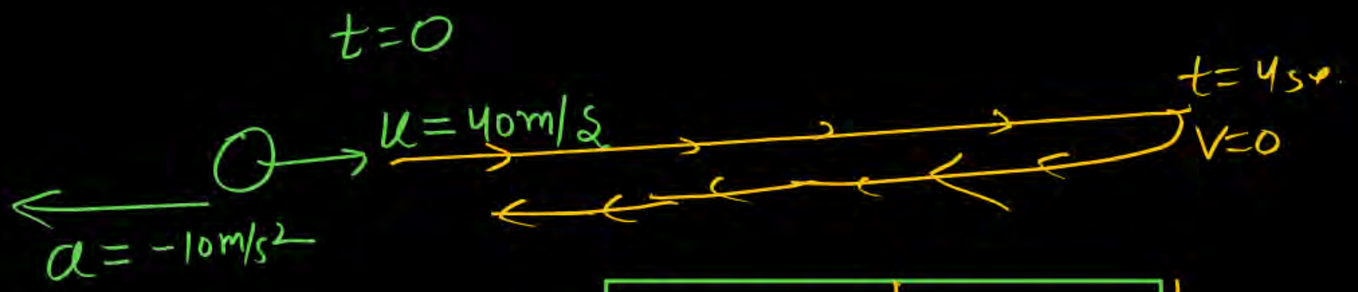
$$= 5 \times 16$$

$$= 80m$$

$x : 4x : 9x : (16x) : 25x$

$16 \times 5 = (80)$

Object starts his motion with 40m/s & acc^{n} $-10m/s^2$ then find velocity & disp^{m} aft$_{}$ every s.



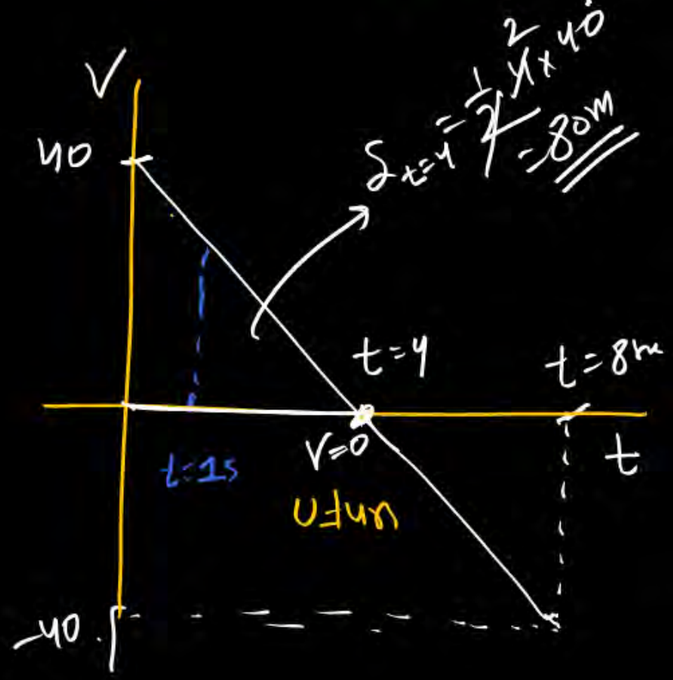
time	velocity
t=0	V=40
t=1sec	30
t=2sec	20
t=3sec	10
t=4sec	0
t=5sec	-10

$V = u + at$

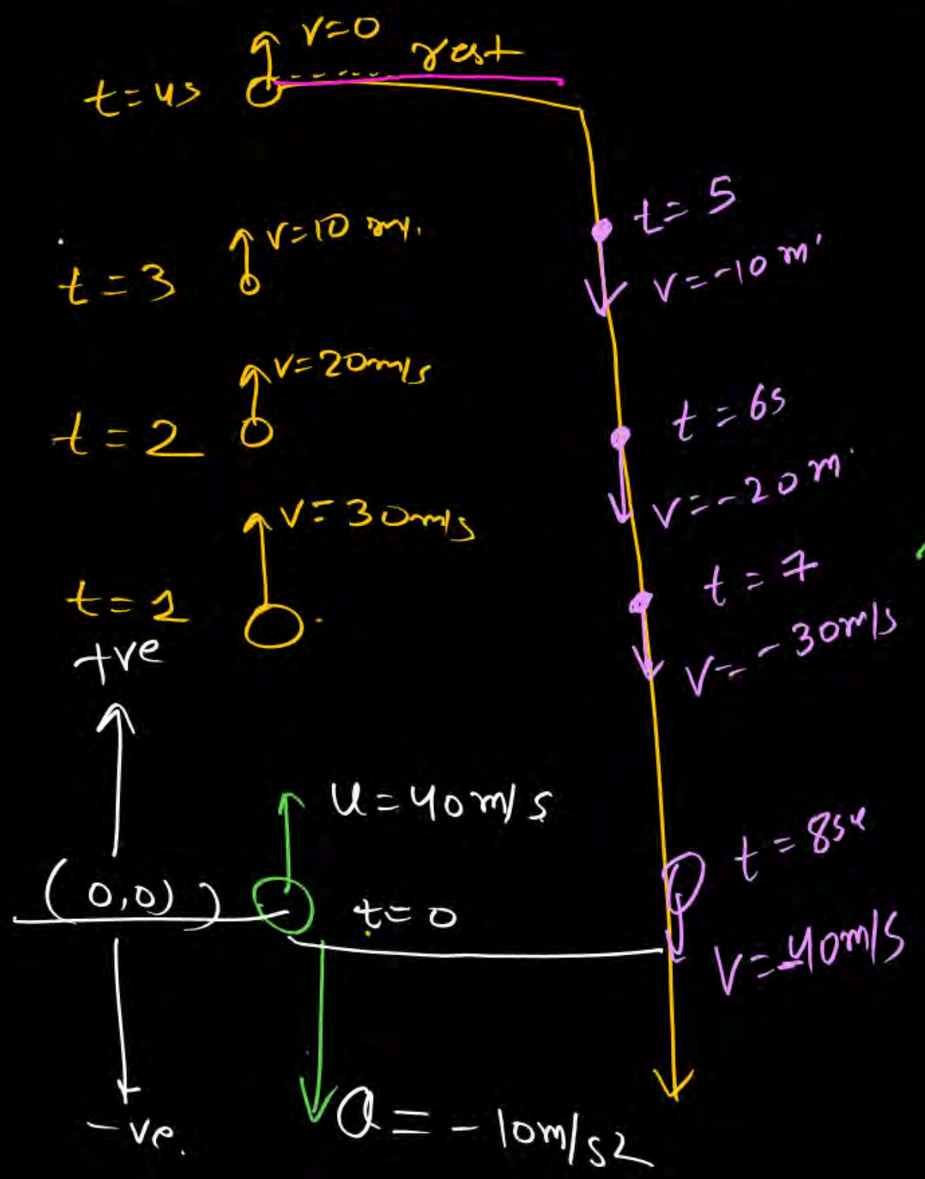
$V_{t=8} = 40 - 10 \times 8$

$V_{t=8} = 40 - 80$

$= -40 m/s$



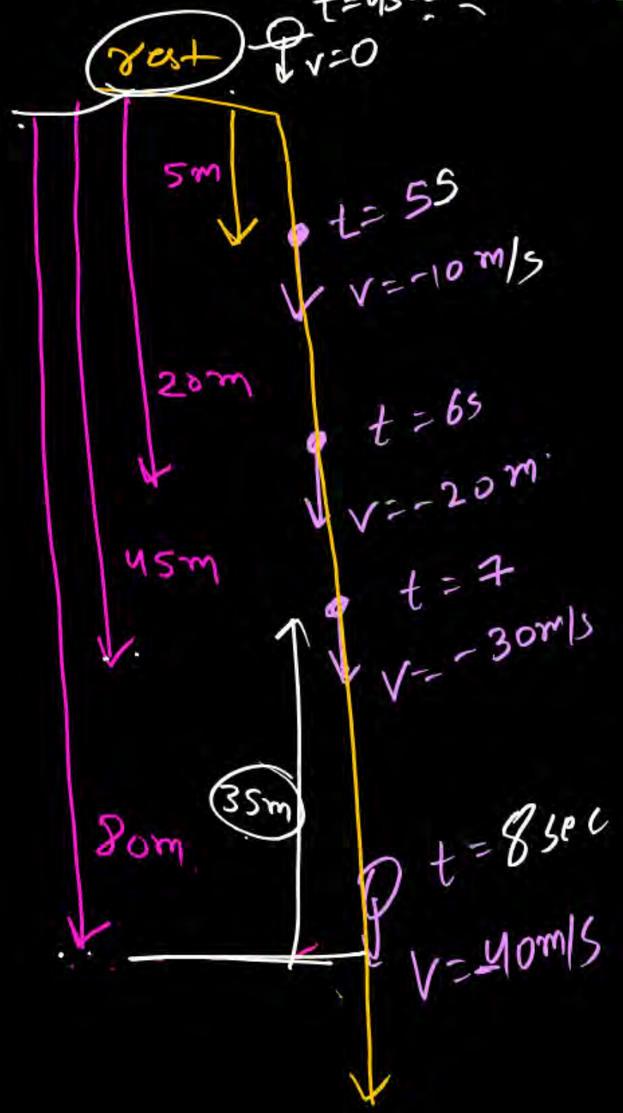
(4) Object starts his motion with 40m/s & acc^{n} $-10\,m/s^2$ then find velocity & disp^{m} after every s.



Sirf downward Journey

Same as Case-1

Jo drop wala case tha



Question

Motion under gravity is an example of

1. Non-uniform acceleration, uniform motion
2. Non-uniform motion, Non-uniform acceleration
3. Non-uniform motion, uniform acceleration
4. Uniform motion, uniform acceleration

Question

Object is dropped from height '*H*' from ground ten find time taken to reach ground and velocity at ground.

Question

Ball is drop and move 85 m in n^{th} sec then find that time interval.

Question

Ball is dropped from 125 m then distance moved in last 2 sec of Journey.

Question

Ball is dropped then find ratio of distance in 3^{rd} sec and 7^{th} sec?

Question

Object is dropped and distance in last 1 sec is equal to 1^{st} 3 sec then find height from ground from where ball is dropped.

Question

A ball is dropped at $t = 0$ sec after 1 sec 2^{nd} ball is dropped after 2 sec 3^{rd} ball is dropped, after 3 sec, 4^{th} ball is dropped. Then, find distance between 2^{nd} and 3^{rd} ball when 4^{th} ball is about to fall.

Question

A particle is dropped under gravity from rest from a height h and it travels a distance $\frac{9h}{25}$ in the last second, the height h is :

Question

Ball is projected with speed 40 m/s then find:

(i) H_{max} =

(ii) T_f =

(iii) T_{upward} =

(iv) Speed after t = 5 sec, 6 sec

(v) Distance in 6 sec

(vi) Displacement in 6 sec

(vii) Average speed in 7 sec

(viii) Average velocity in 5 sec

(ix) Distance moved in 8^{th} sec

THANK YOU