YAKEEN NEET 2.0

2026

Motion in a Straight Line

Physics

Lecture - 11 Part - [B]

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Todays Goal

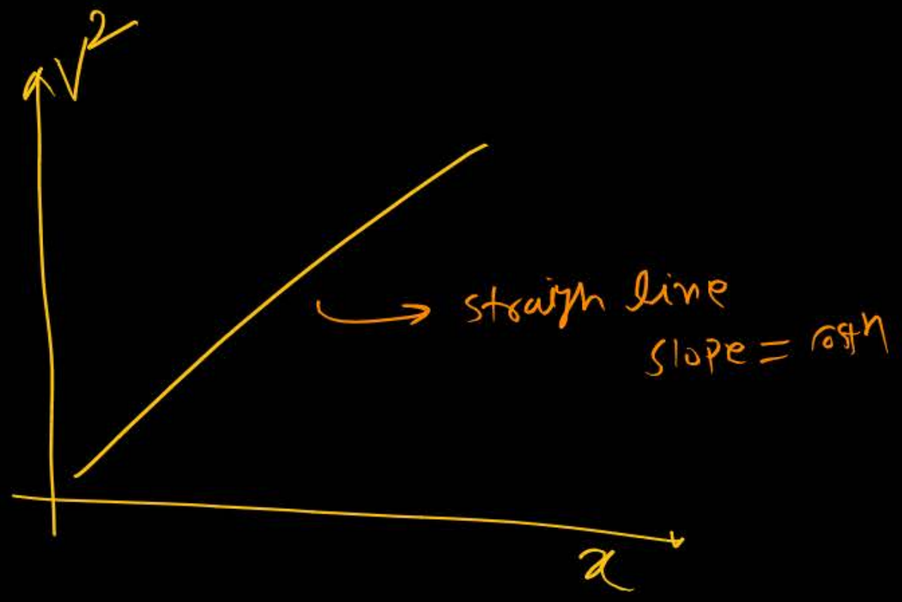
→ H/w , PhD on Graph :—

(Part-02)

→ V/x , a/t , a/x , x/t & Graph Conversion

V^2/x graph.

#



MR* Box

slope of v-t ⟶ acc^n

slope of v-x ⟶ a/v

slope of v^2-x ⟶ 2a

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

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

$$= \frac{dv^2}{dv} \times \left(\frac{dv}{dx}\right)$$

$$= 2\left(v \times \frac{dv}{dx}\right)$$

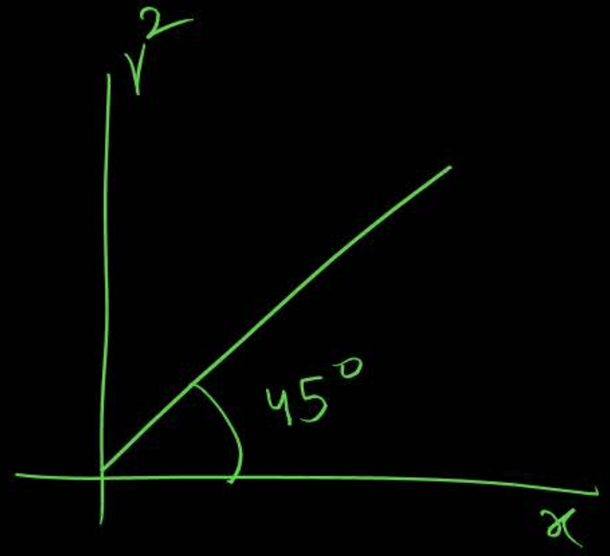
$\frac{dx^2}{dx} = 2x$

$a = v\frac{dv}{dx}$

Area $= \int v^2 dx$ = not imp.

Slope of (v^2-x) graph $= 2 \times a$

$$\text{acc}^n = \frac{\text{slope of } (v^2\text{-}x)}{2}$$



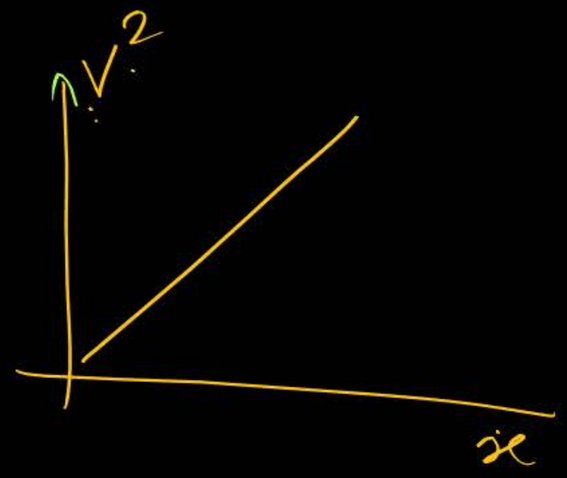
find acc

slope = tanus = 1

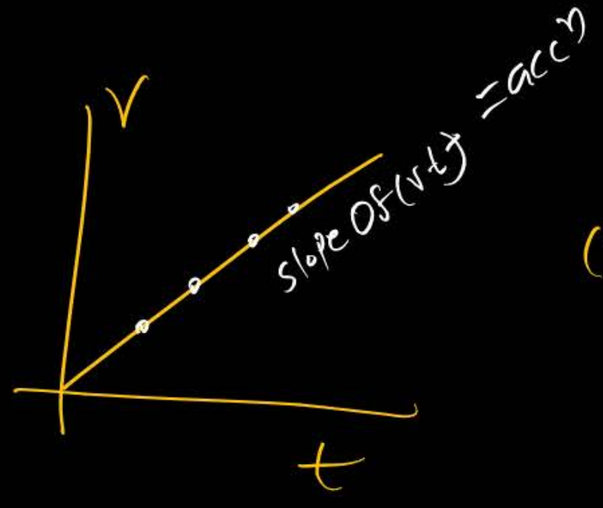
$$a = \frac{\text{slope}}{2} = \frac{1}{2}\ m/s^2$$

gn which graph acc^n is cost^n (uniform) :—

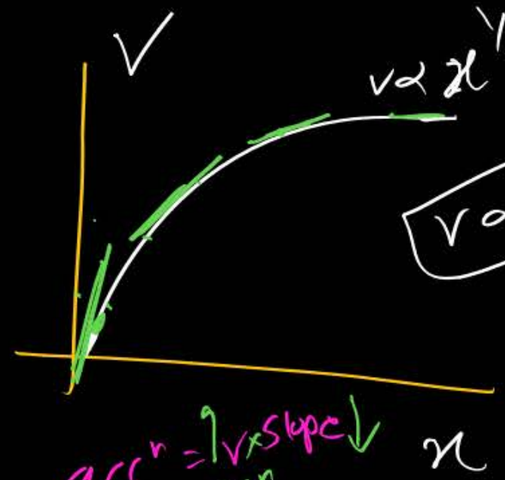
(a)



(b)



(c)



method - 1

$V^2 \propto x$

$V \propto \sqrt{x}$

$\Rightarrow$ acc^n = cost^n

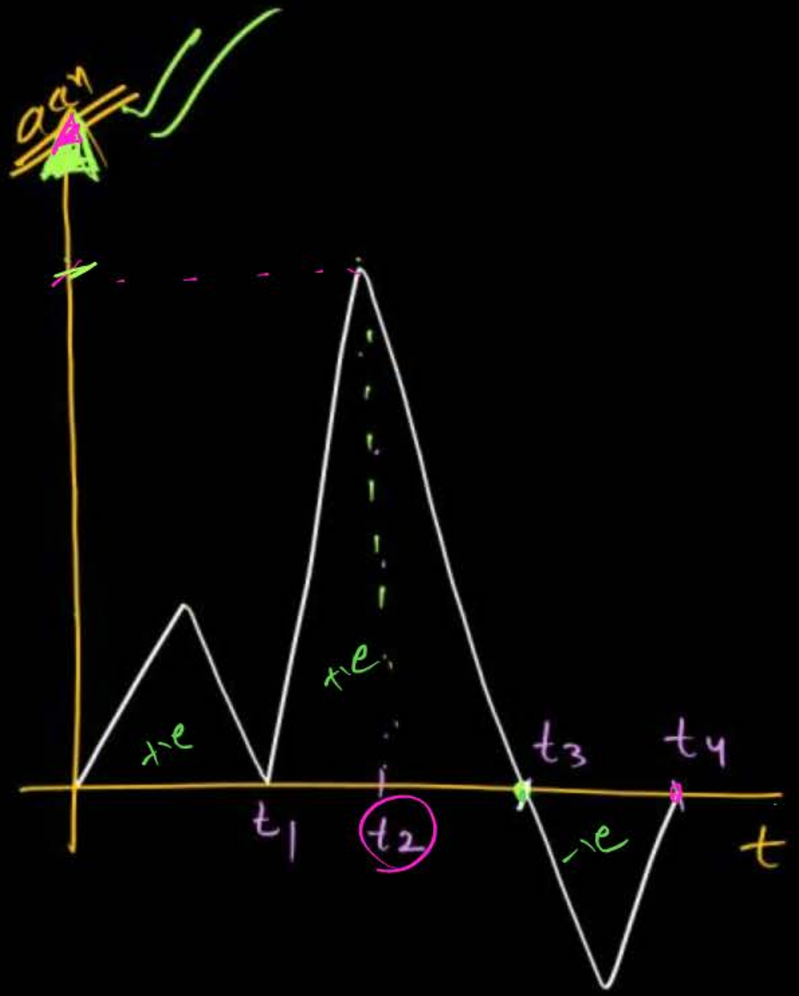
method - 2

Slope of $v^2 = x$ graph is $= 2a$

cost$^n = 2a$

$a = \frac{\text{cost}^n}{2}$

(d) all of these



acc^{n} is max^{m} at :??

(a) t_1

(b) t_2

(c) t_3

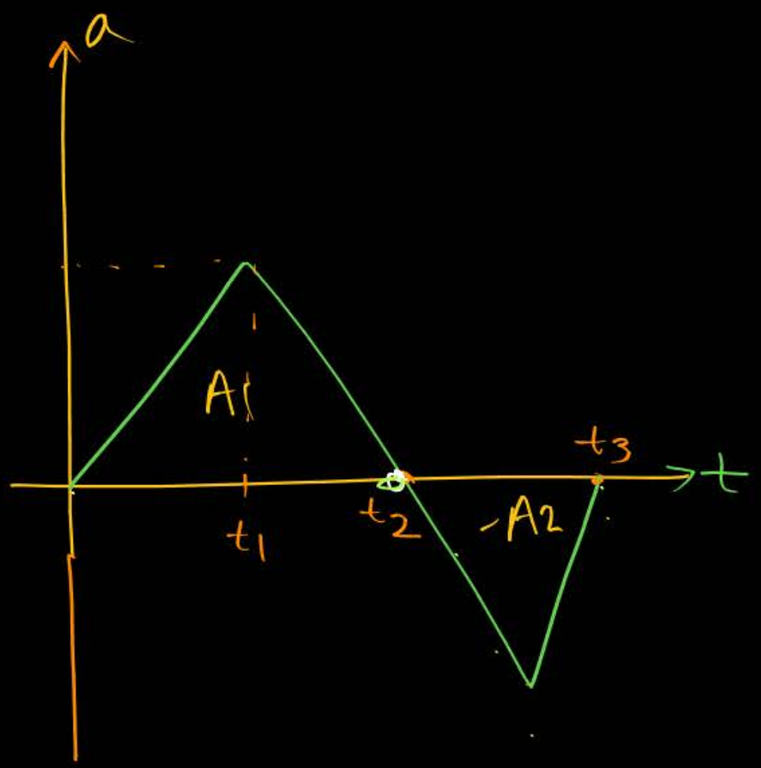
(d) t_4

Velocity max^{m} at t_3

but accn max^{m} at t_2

Area of a/t graph is change in velocity

Accⁿ – time graph :–



Accⁿ is zero at t_2.

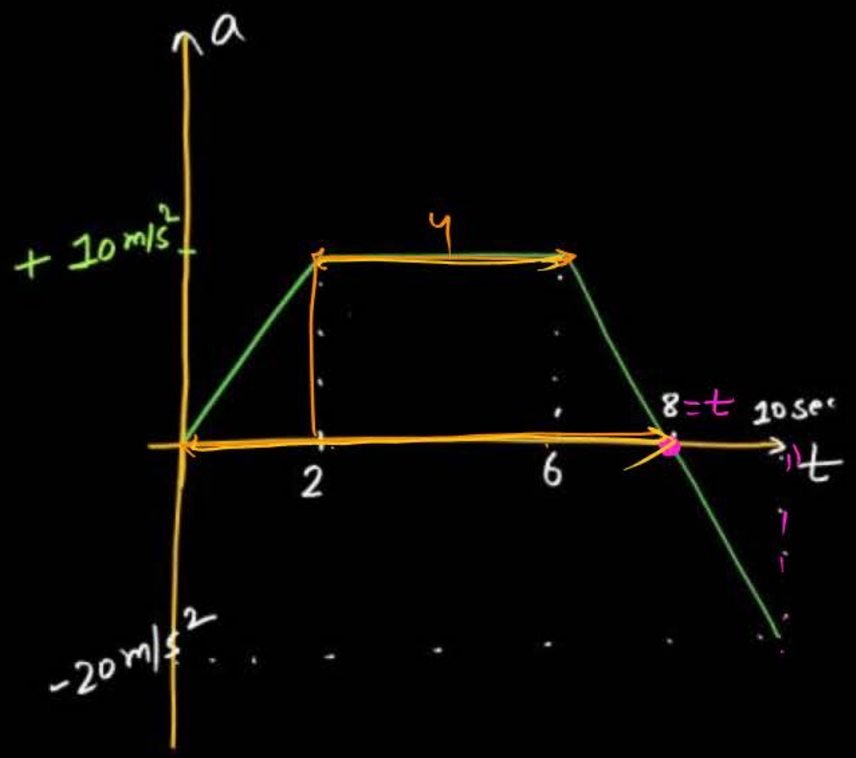
Accⁿ is +ve B/w 0 to t_2 #

Accⁿ is –ve B/w 0 to t_3

$$\text{Slope of } a\text{-}t \text{ graph} = \frac{da}{dt} = \text{Jerk}$$ झटका

$$\Rightarrow \text{change in velocity} = A_1 - A_2$$

If intial velocity of object is $-10\,m/s$, Then find velocity at $t = 8\,sec$.



$$\text{Area} = \frac{1}{2}(4+8)\times 10$$

$$= \frac{1}{2}\times 12^{6}\times 10$$

$$\Delta v = 60\ m/s$$

$$v_f - v_i = 60$$

$$v_f + 10 = 60$$

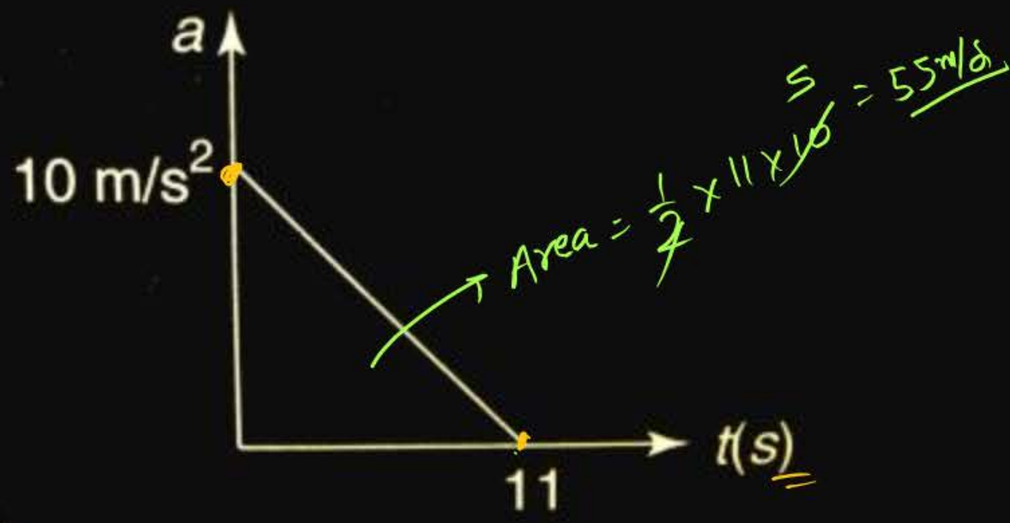
$$v_f = (60-10) = 50\ m/s$$

H/W

Question

A particle starts from rest. Its acceleration (a) versus time (t) is as shown in the figure. The maximum speed of the particle will be **[IIT-JEE (Screening) 2004]**

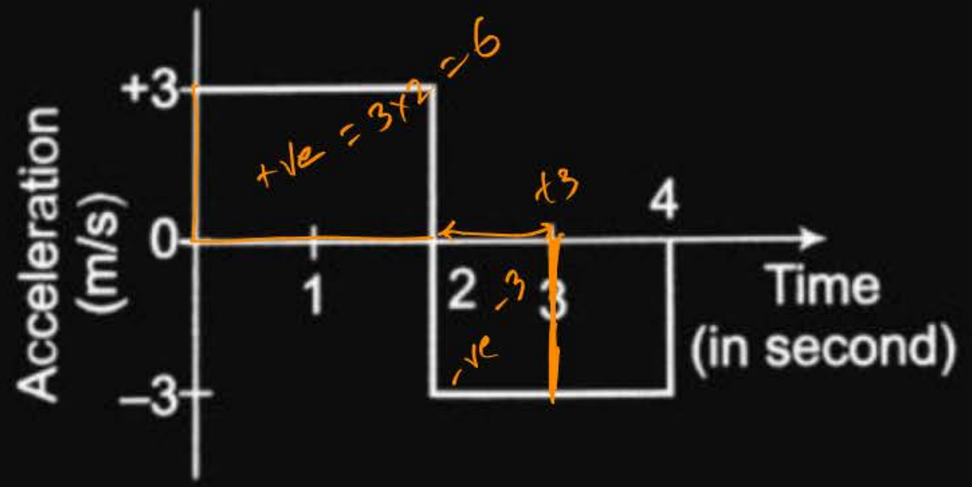
1. 110 m/s
2. 55 m/s
3. 550 m/s
4. 660 m/s



Question

A particle starts from rest at $t = 0$ and moves in a straight line with an acceleration as shown below. The velocity of the particle at $t = 3$s is

1. 2 m/s
2. 3 m/s
3. 4 m/s
4. 6 m/s



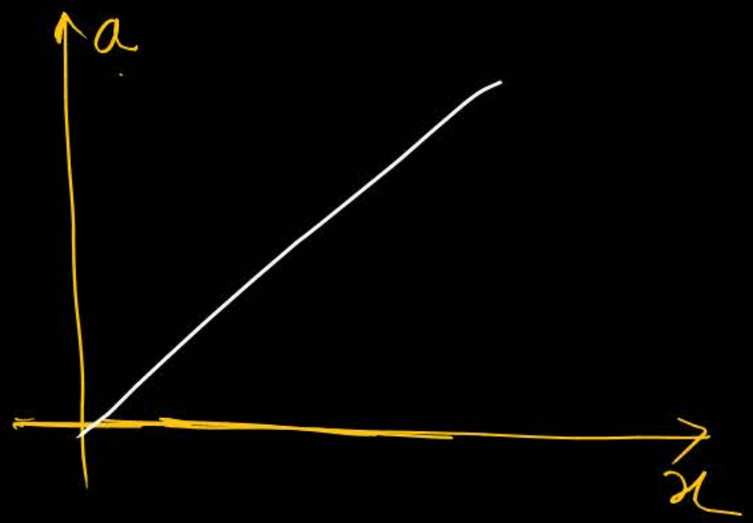
ΔV = Area

$V_f - 0 = 6 - 3 = 3$

$V_f = 3$ m/s

H/W

⊛ a/x graph.



Slope of a/t graph — $\frac{da}{dt}$ = Jerk

Slope of a/x graph $\frac{da}{dx}$ = acc^n gradient

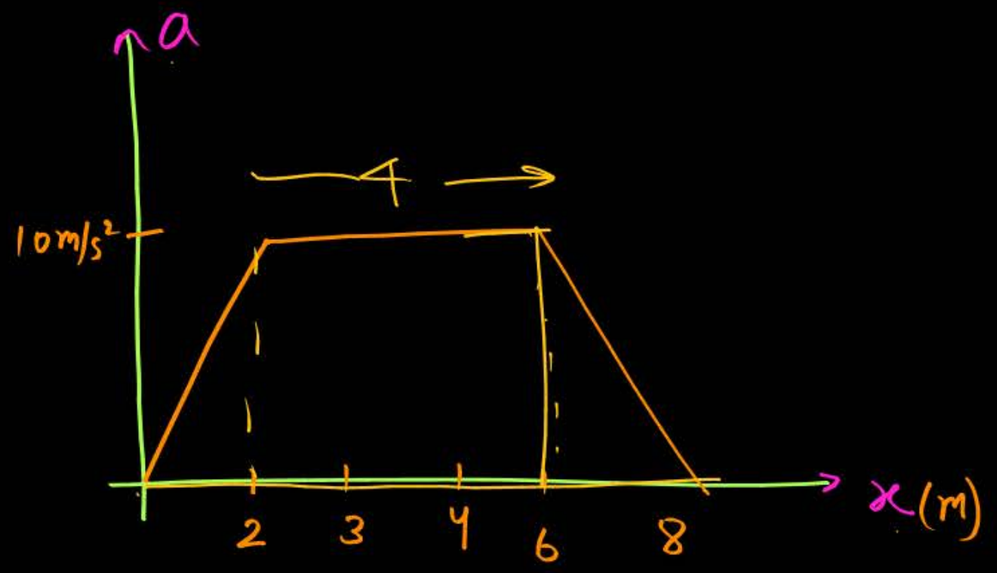
⊛ Area of A/x graph is $= \frac{v^2-u^2}{2}$

$$\text{Area} = \int a\,dx \qquad a = \frac{dv}{dt}$$

$$= \int \frac{dv}{dt}\,dx \times \qquad a = v\frac{dv}{dx}$$

$$= \int v\frac{dv}{dx} \times dx = \int_u^v v\,dv = \left[\frac{v^2}{2}\right]_u^v = \frac{v^2-u^2}{2} = \text{Area of a/x graph:-}$$

(2) If intial velocity is 1 m/s then find velocity at $x = 8m$.



$$\frac{v^2 - u^2}{2} = \text{Area}$$

$$\frac{v^2 - 1^2}{2} = \frac{1}{2}(4+8) \times 10$$

$$\frac{v^2 - 1}{2} = 60$$

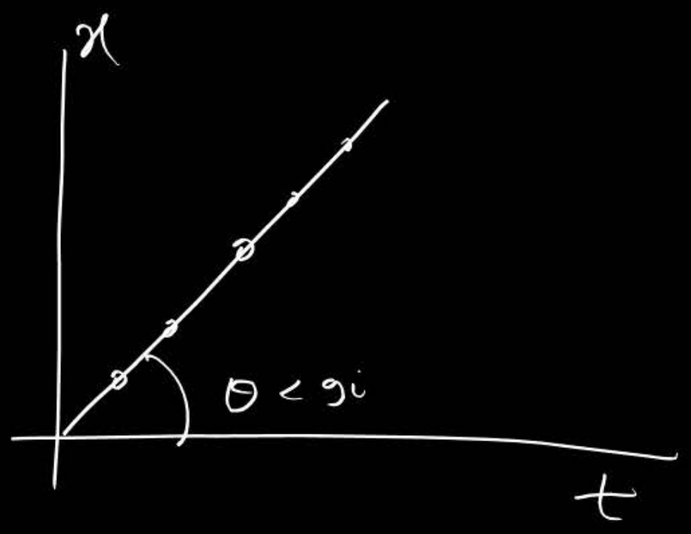
$$v^2 - 1 = 120$$

$$v^2 = 120 + 1 = 121$$

$$v = \sqrt{121} = 11 \text{ m/s}$$

	graph B/w P.Q	Slope	Area.
1.	$x - t$		X
2.	$v - t$		
3.	$v - x$		
4.	$v^2 - x$		
5.	$a - t$	X	
6.	$a - x$	X	

Position – time



Velocity = +ve ∵ (as)

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

Velocity = slope of x(Position)-time graph

$$\text{Area} = \int x\,dt = \text{area}$$

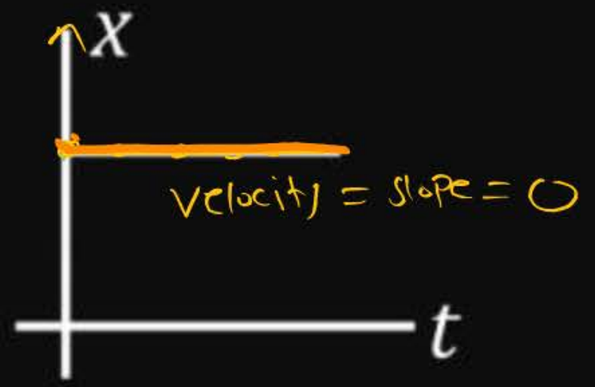
y^{th} coordinate → Position

Slope → velocity

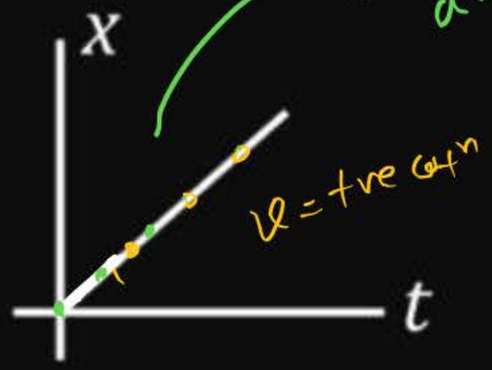
Question

Comment nature of motion for given graph?

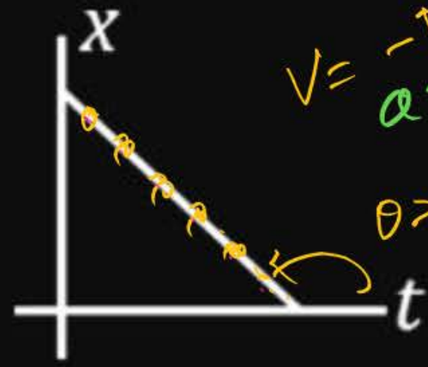
(i)



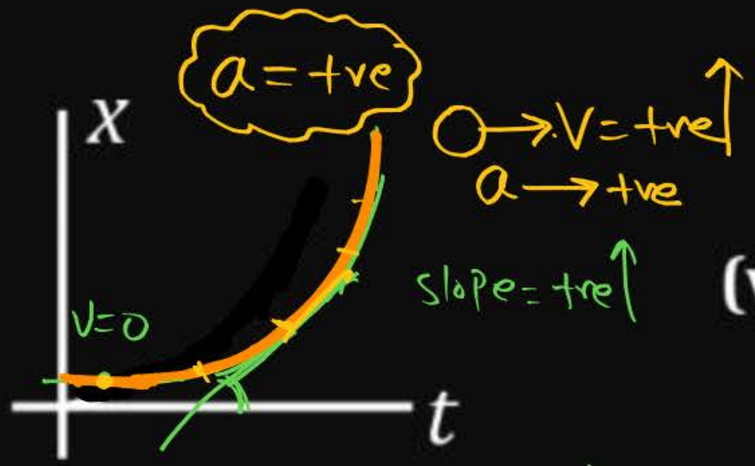
(ii)



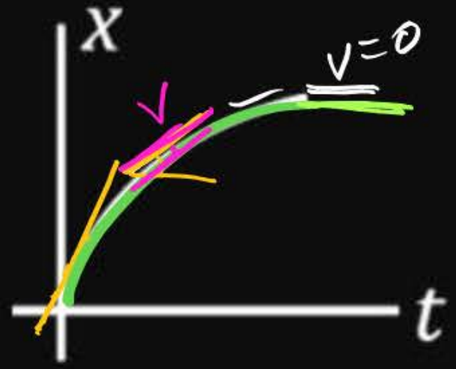
(iii)

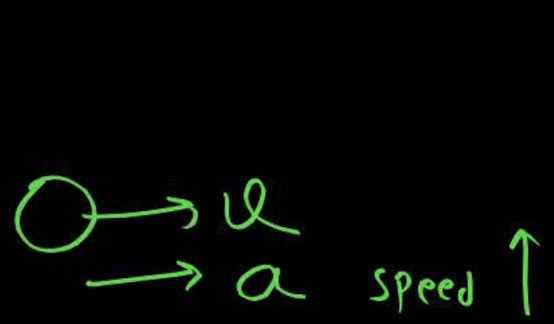


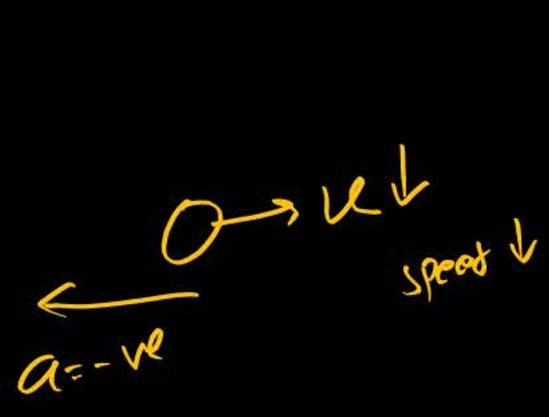
(iv)

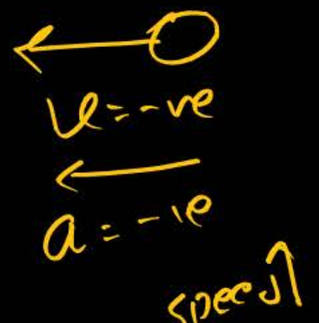


(v)




u
a
speed ↑


u ↓
speed ↓
a = -ve

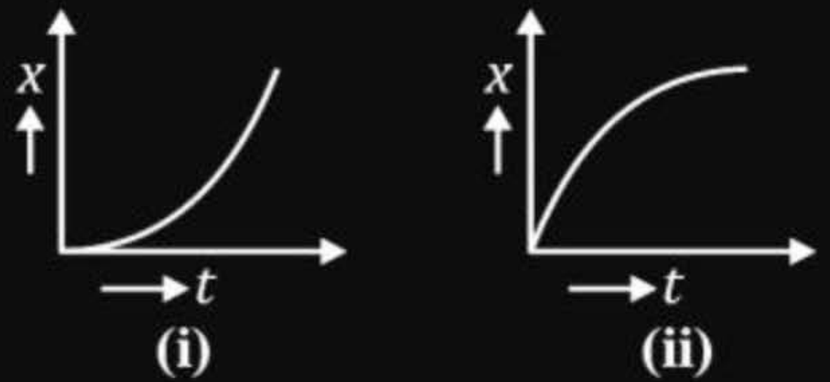

u = -ve
a = -ve
speed ↑


v = -ve
a = +ve

Question

Best Possible answer (H/W)

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

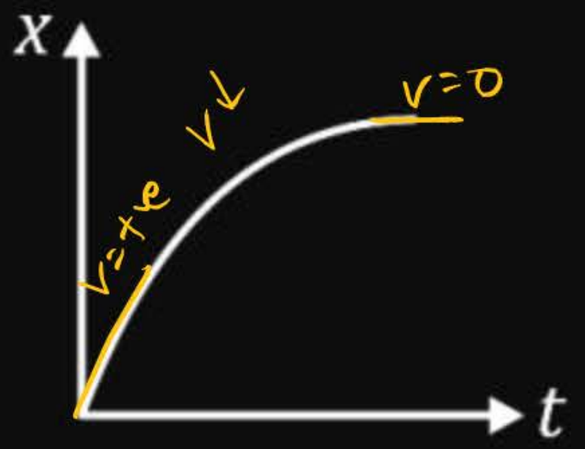


1. Both the particles are having a uniformly accelerated motion
2. Both the particles are having a uniformly retarded motion
3. Particle (i) is having a uniformly accelerated motion while particle (ii) is having a uniformly retarded motion
4. Particle (i) is having a uniformly retarded motion while particle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

Question

Acceleration for given position-time graph is

1. –ve
2. +ve
3. zero
4. increasing



THANK YOU