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SIR PRATEEK JAIN

. IIT JEE & NEET FACULTY (KOTA)
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. RESEARCH WORK WITH HC VERMA SIR AT IIT KANPUR
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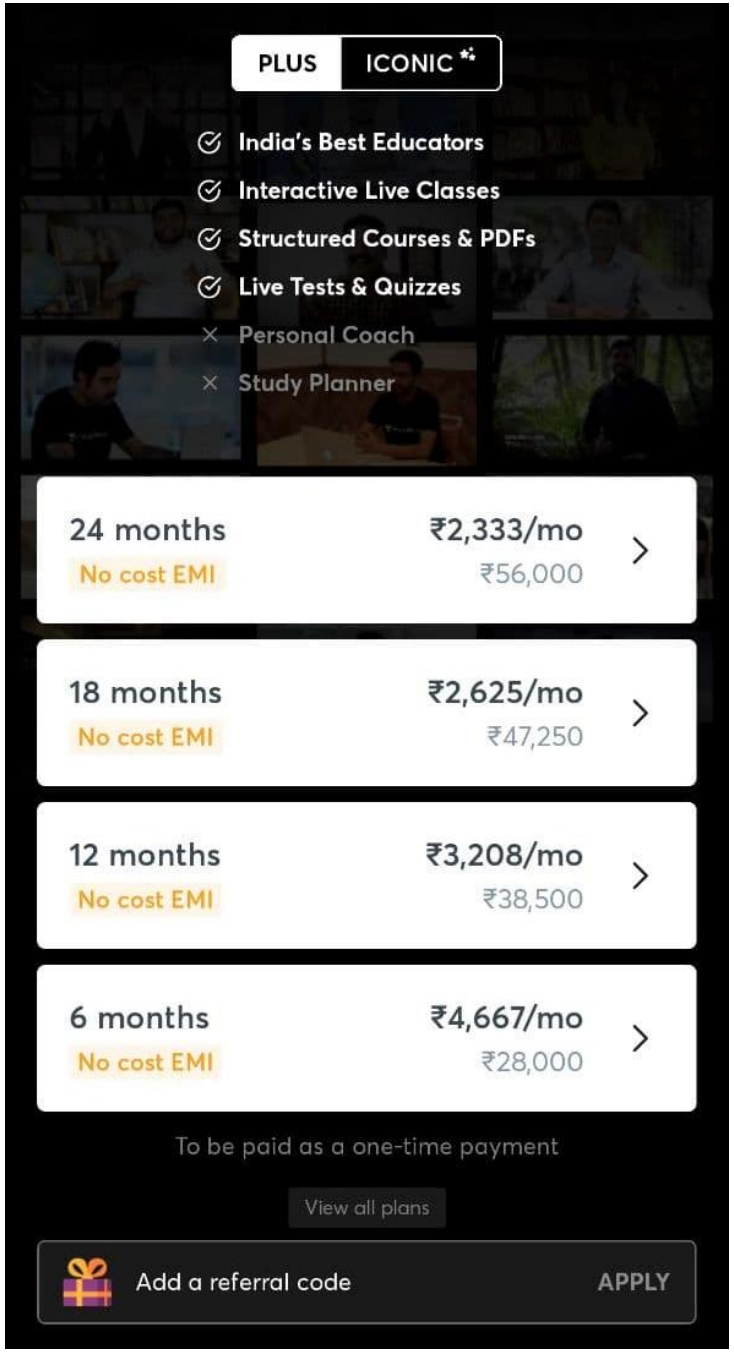

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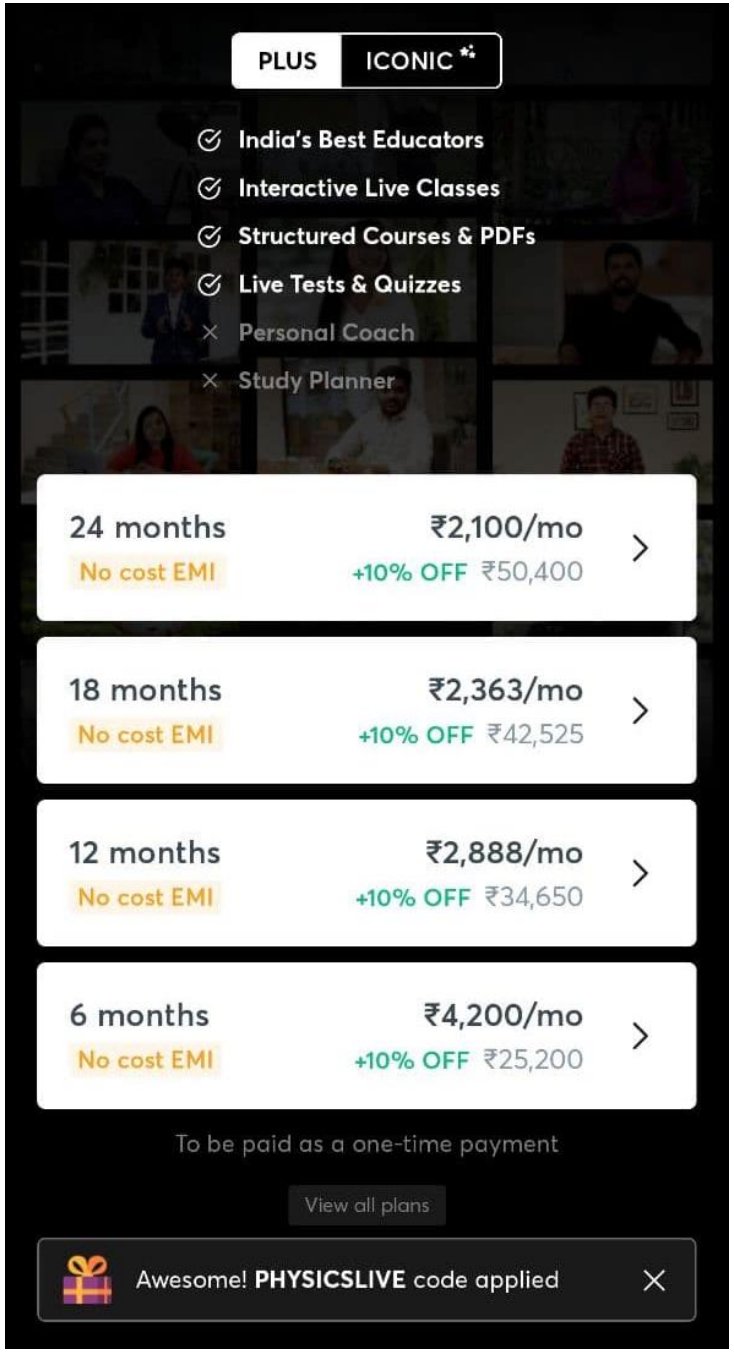

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Physics DPP

DPP-4 Position, Velocity and Acceleration Graph

By PRATEEK JAIN SIR

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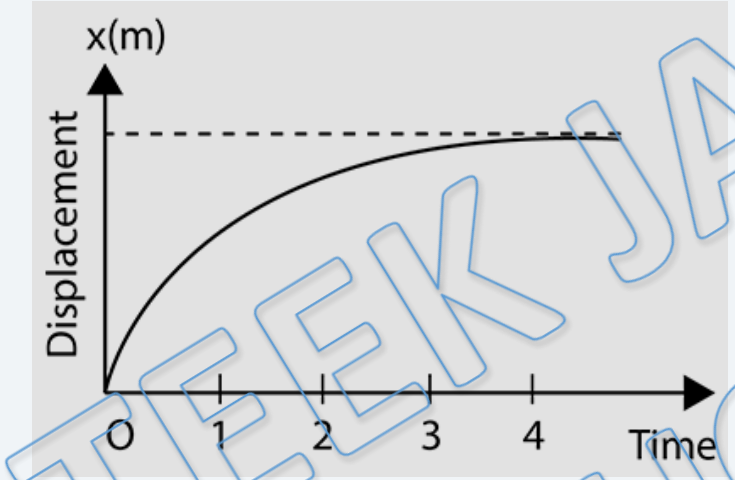
Q) The displacement of a particle as a function of time is shown in figure. The figure indicates that:



(a) the particle starts with a certain velocity but the motion is retarded and finally the particle stops.

(b) the velocity of the particle is constant throughout.

(c) the acceleration of the particle is constant throughout.

(d) the particle starts with constant velocity, the motion is accelerated and finally the particle moves with another constant velocity.

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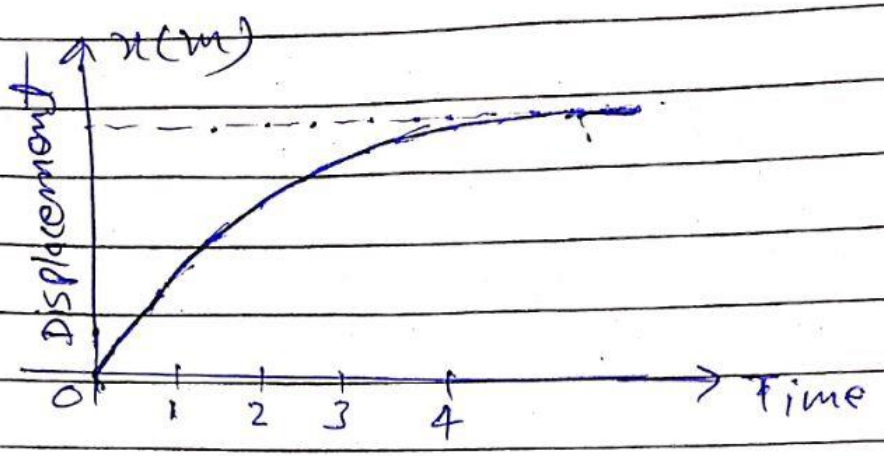
Ans. a



initially at origin, slope of $x-t$ curve is not zero

$$\frac{dx}{dt} = v \neq 0$$

$\therefore$ initially is starts with some velocity.

But as time increases $\Rightarrow \frac{dx}{dt}$ decreases

$$\Rightarrow \frac{dx}{dt} = v \Rightarrow \text{decreases}$$

speed decreasing.

and after some time slope become constant and zero

$\therefore$ finally $\frac{dx}{dt} = v = 0$

$\therefore$ some retardation is present as velocity is decreasing.

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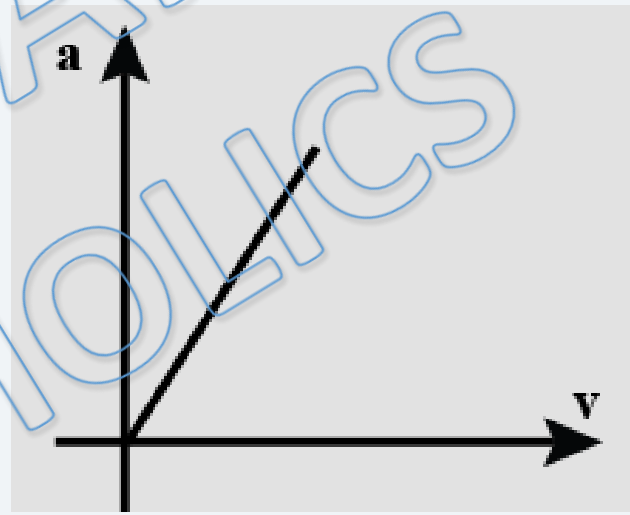
Q) The acceleration-velocity graph of a particle moving in a straight line is shown in figure. Then the slope of the velocity-displacement graph:



(a) Increases linearly

(b) Decreases linearly

(c) Is constant

(d) Increases parabolically

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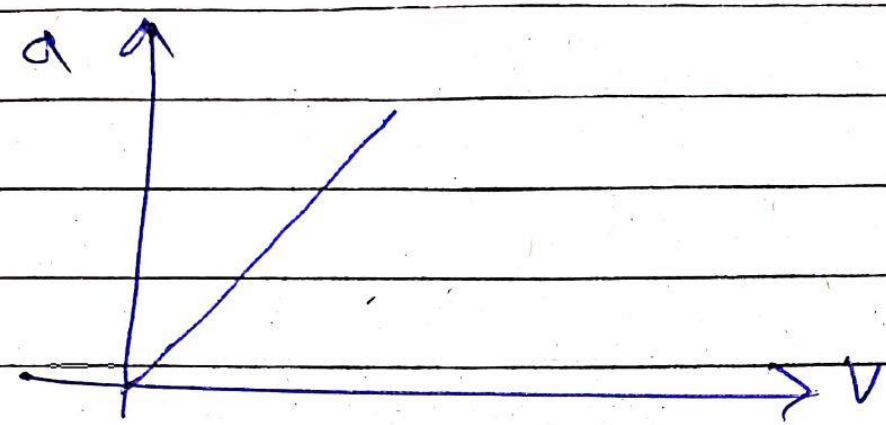
Ans. c



$a = cV$ [a-V curve = line]

$$\frac{V\,dV}{dx} = cV$$

$$\int dV = c\int dx$$

$$\boxed{V = cx + c}$$

Straight line

Slope - c = constant.

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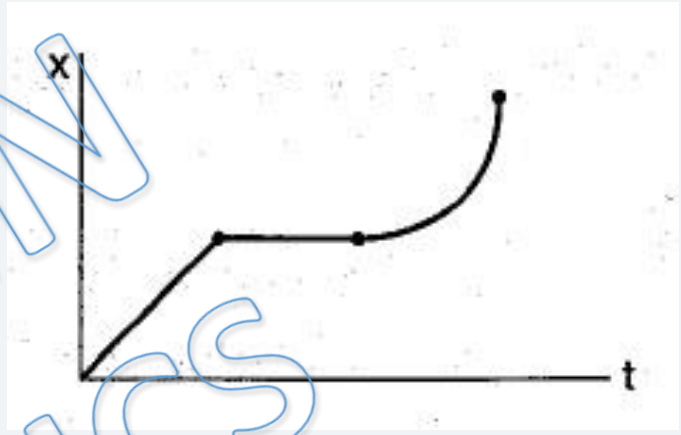
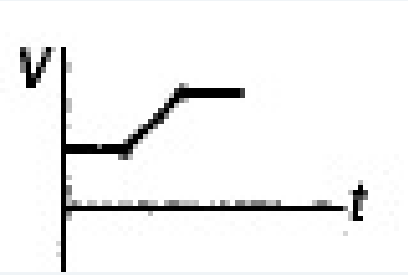
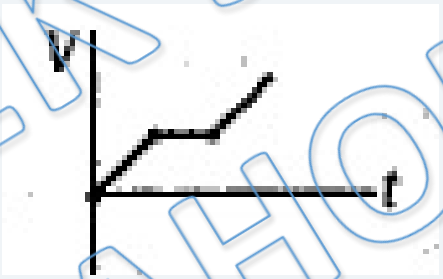
Q) A particle moving along the x-axis. Its position x as a function of time t recorded as shown in the figure .
Identify which of the following graphs of velocity v as a function of time t is equivalent to the above graph?



(a)



(b)



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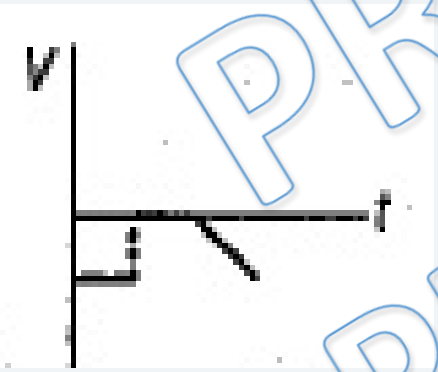
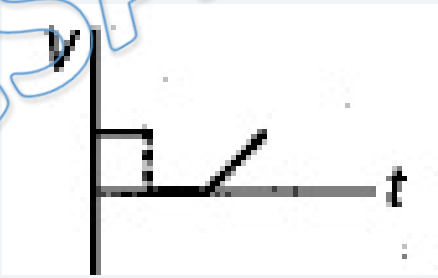


(d)



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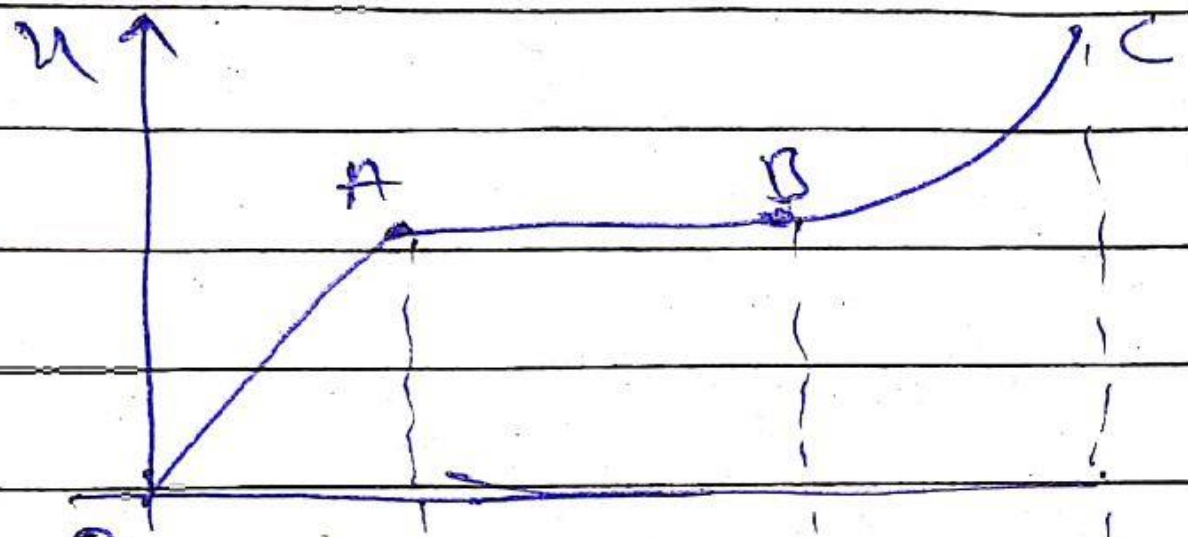
Ans. d



OA → straigh line

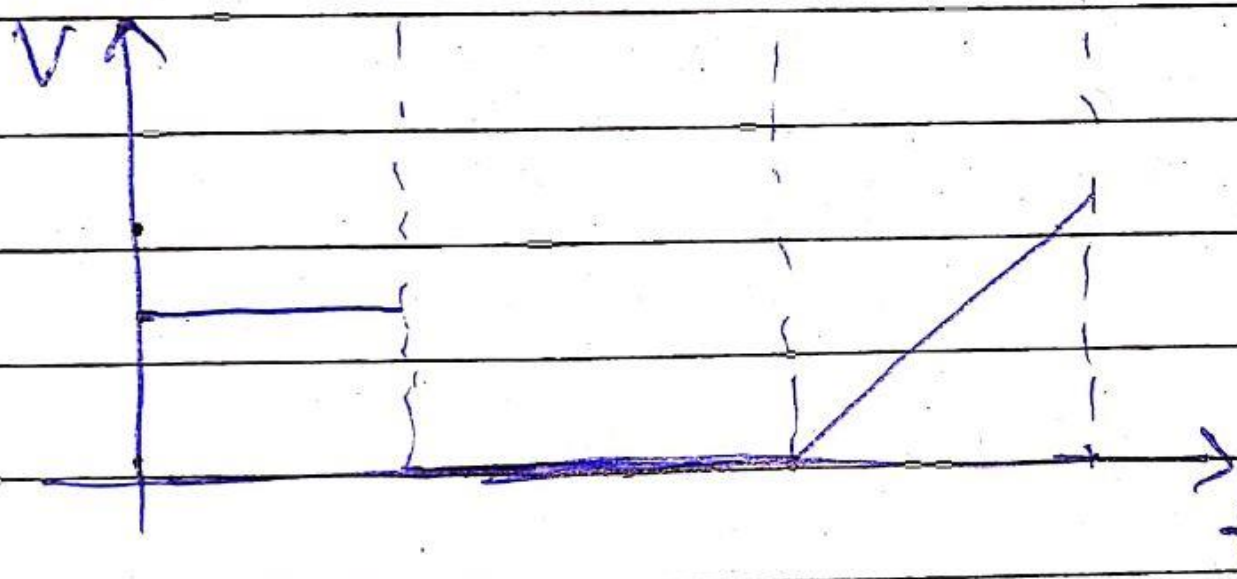
V = constant

a = 0

AB → x = constant

V = 0

a = 0



BC → Parabola

$V = \frac{dx}{dt} = +ve$

V → increasing

a = constant.

Q) The displacement-time graph of a freely falling body is:

(a) straight line passing through the origin
(b) straight line intersecting x and y axes
(c) parabola
(d) hyperbola

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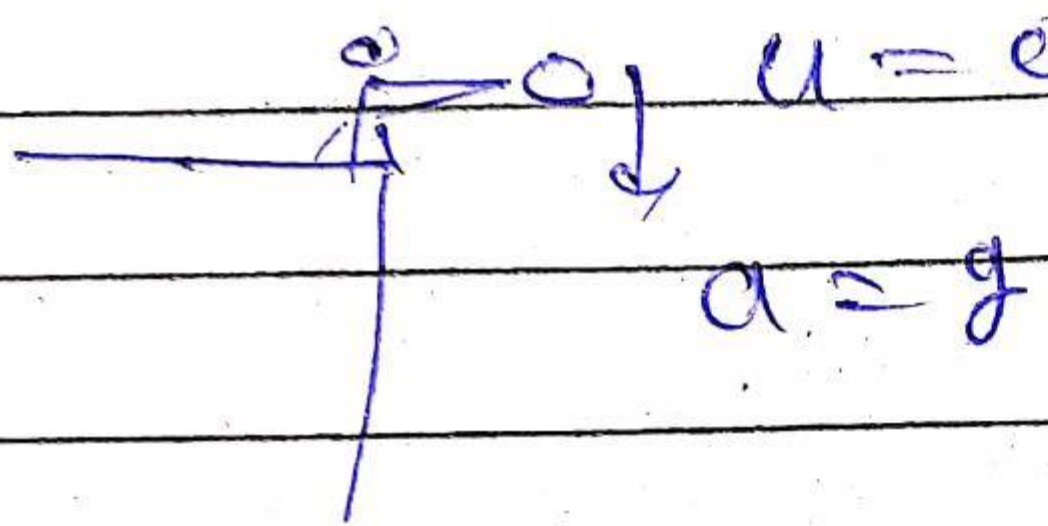
Ans. c

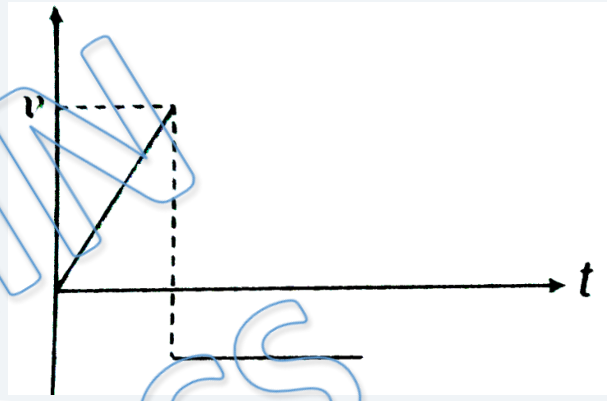


a = constant

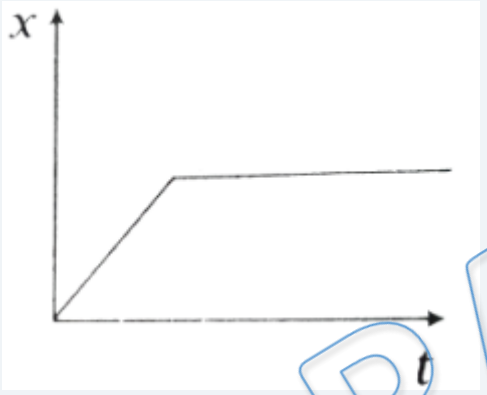
→ v-t curve → Straight line

→ x-t curve → Parabola

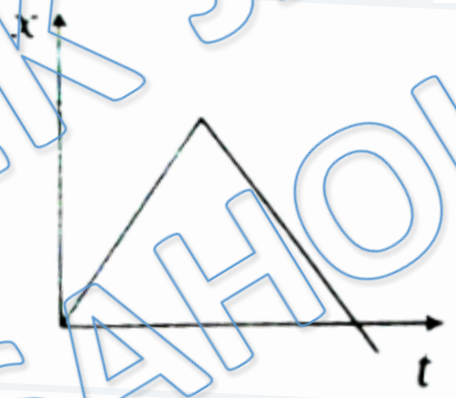
Q) The velocity-time graph for a particle moving along X-axis is shown in the figure. The corresponding displacement-time graph is correctly shown by:



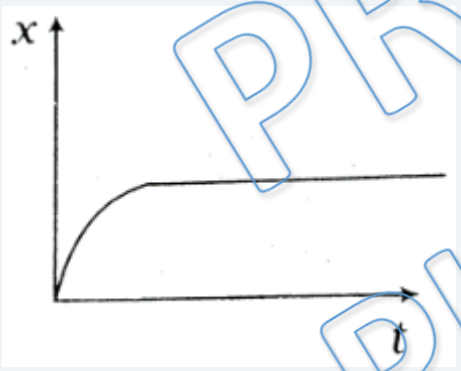
(a)



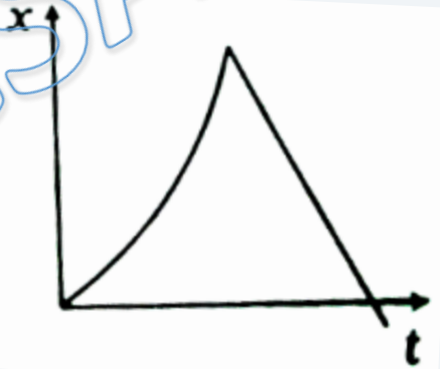
(b)



(c)



(d)



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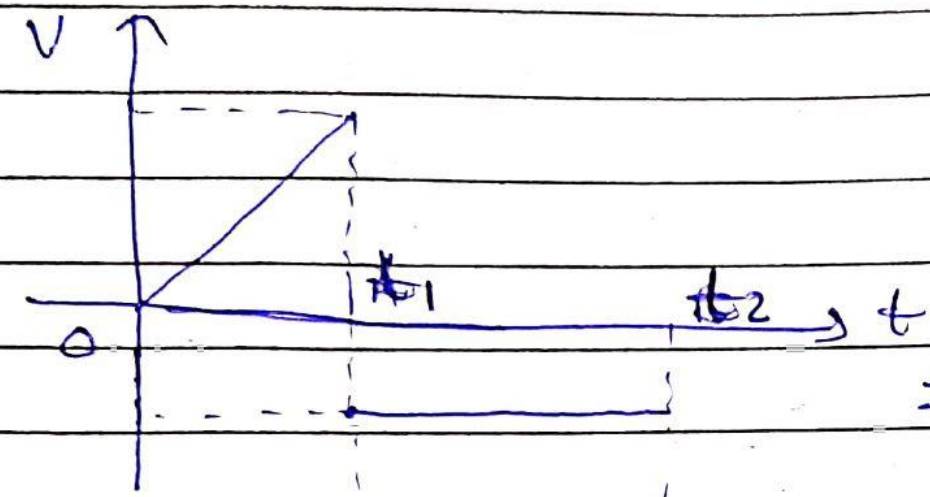
Ans. d



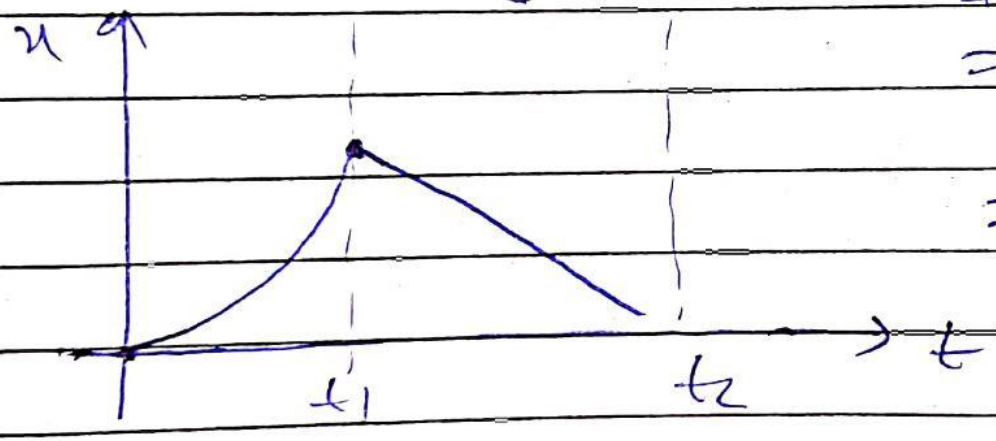
$0-t_1 \Rightarrow$ V-t curve is straigh line

$\Rightarrow$ x-t curve will be parabola.

$t_1 - t_2$

$\Rightarrow$ V-t curve is constant

$\Rightarrow$ x-t curve will be straight line

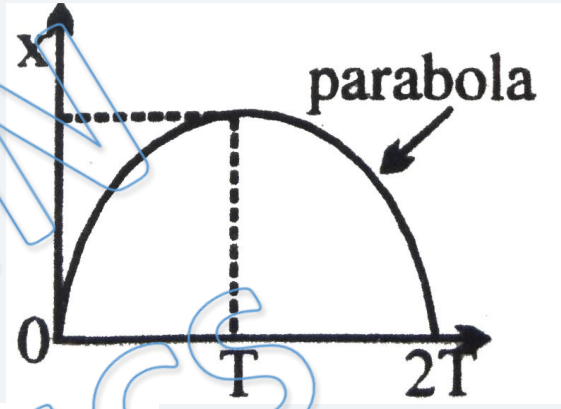


in (t_1, t_2) interval

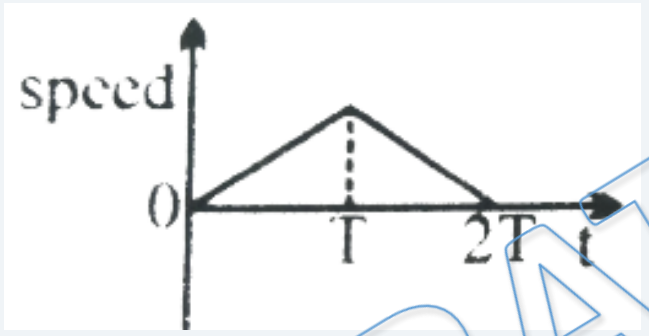
$V =$ -ve but constant

$\frac{dx}{dt} =$ -ve constant

Q) The x-t graph of particle moving along a straight line is shown in figure:



(a)



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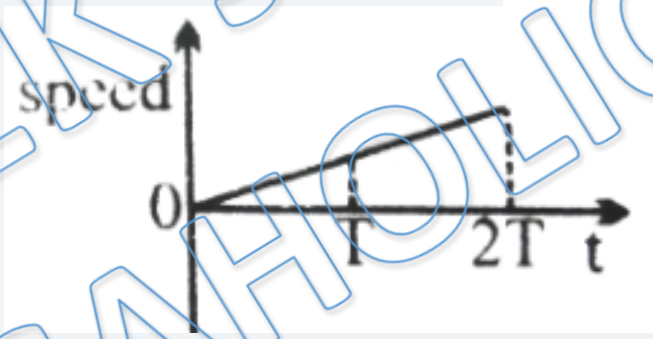

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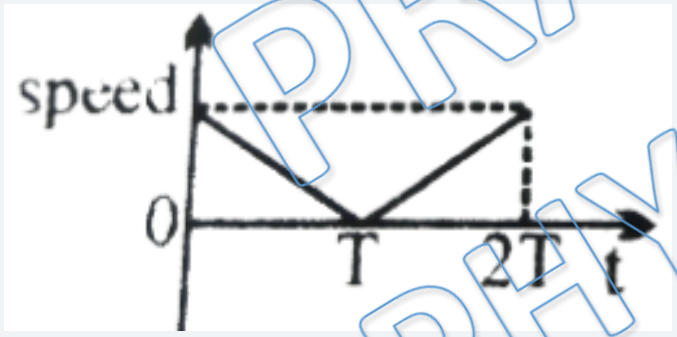

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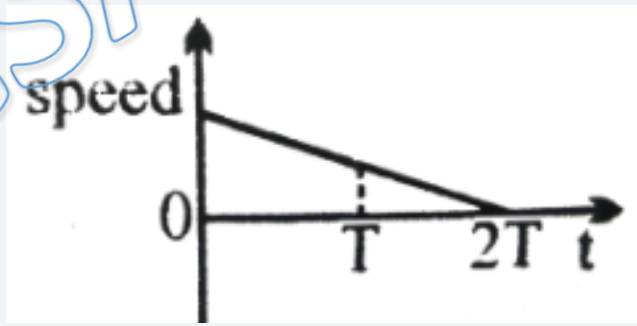

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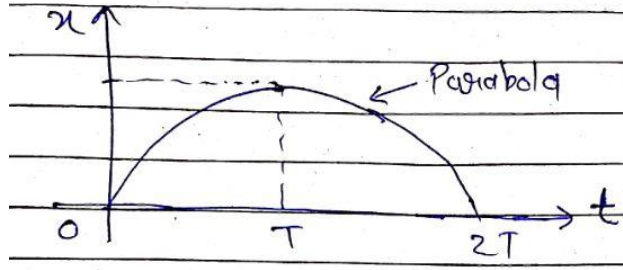
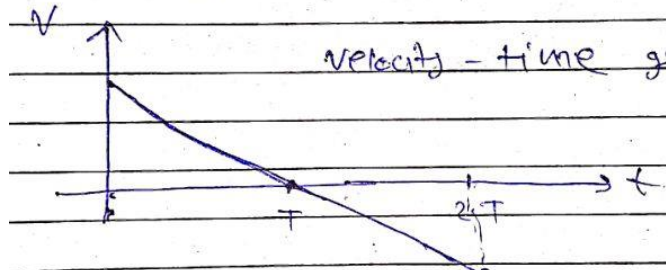
Ans. c



0 - T ⇒ Slope of x-t curve is decreasing ⇒ V = decreasing. positive and

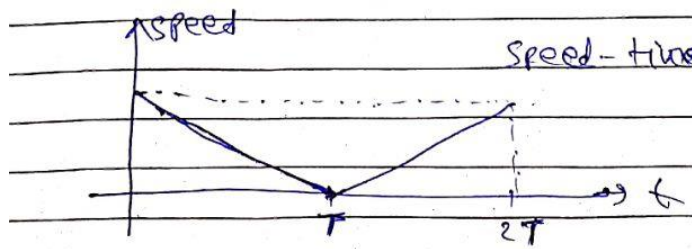
T-2T ⇒ Slope of x-t curve is negative and increasing.



at t = T, Slope of x-t curve is - zero

∴ $V_{at\ t=T}$ = zero

speed = always +ve.



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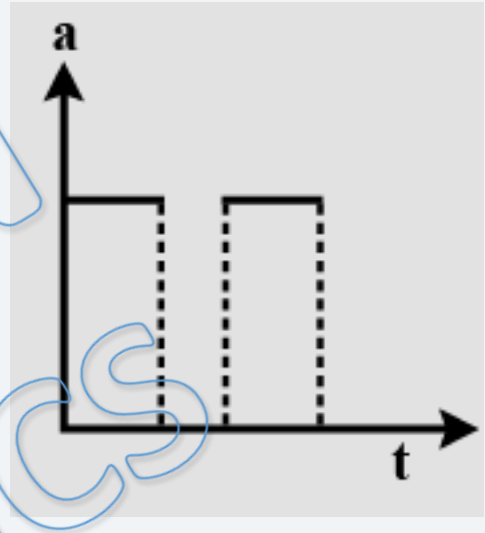
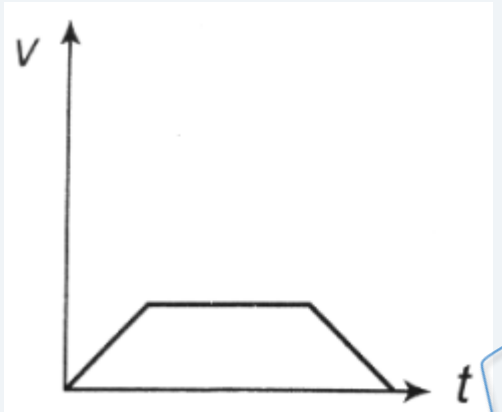
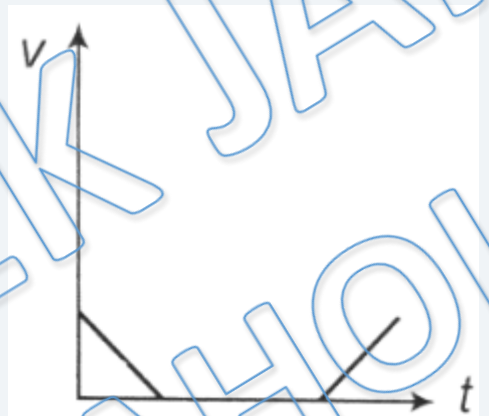
Q) The x-t graph of particle moving along a straight line is shown in figure:



(a)



(b)



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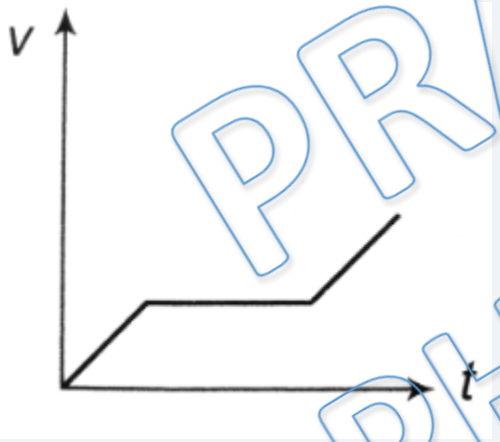
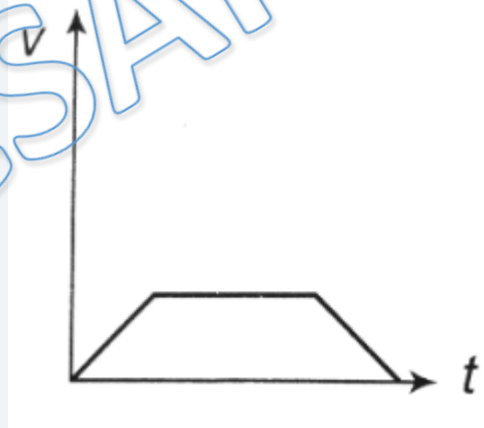


(d)



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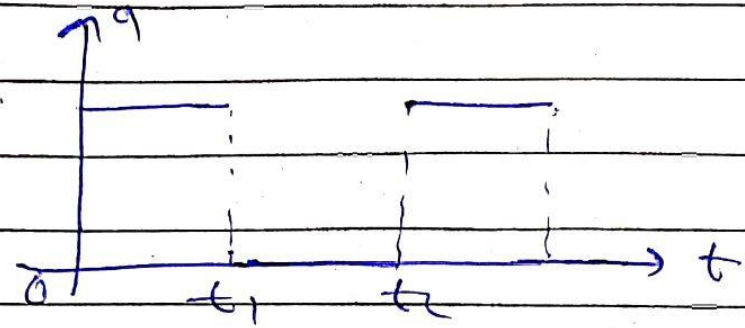
Ans. c



$0 - t_1 \Rightarrow$ a = constant (+ve)

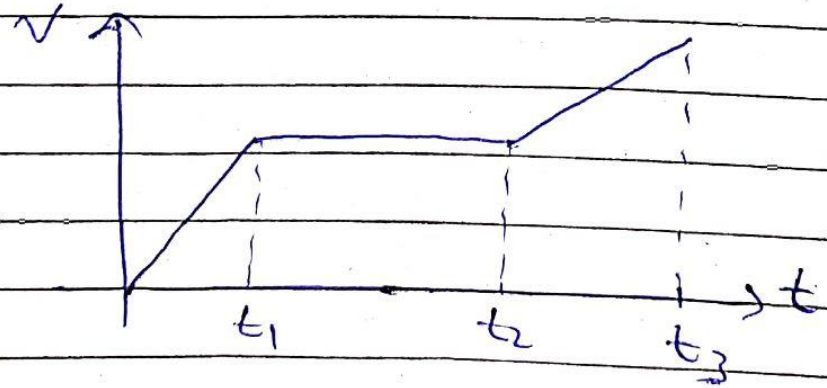
V - increases

$t_1 - t_2 \Rightarrow$ a = zero

V = constant

$t_2 - t_3 \Rightarrow$ a = constant (+ve)

V = increases



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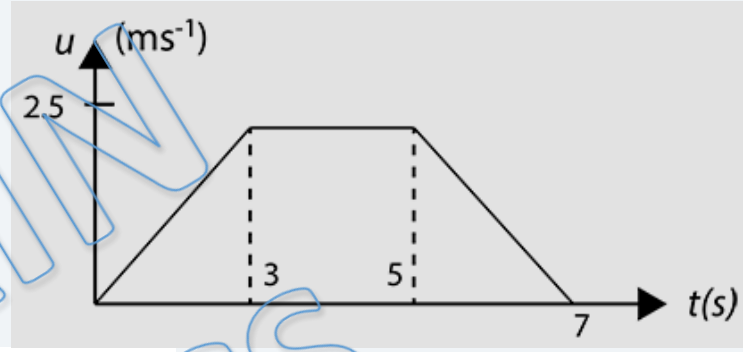
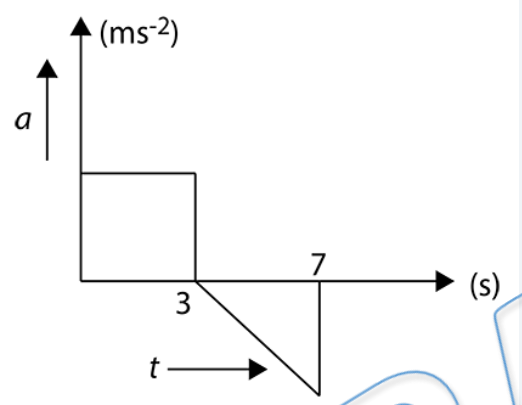
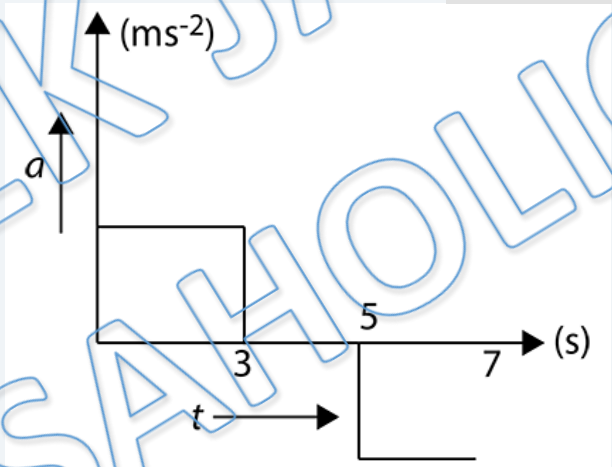
Q) Velocity (u)-time (t) graph of a body is as shown in the figure. acceleration (a)-time (t) graph of the motion of the body is:



(a)



(b)



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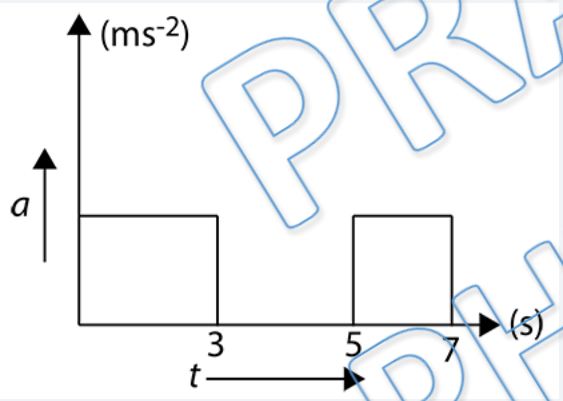

(d) none of these

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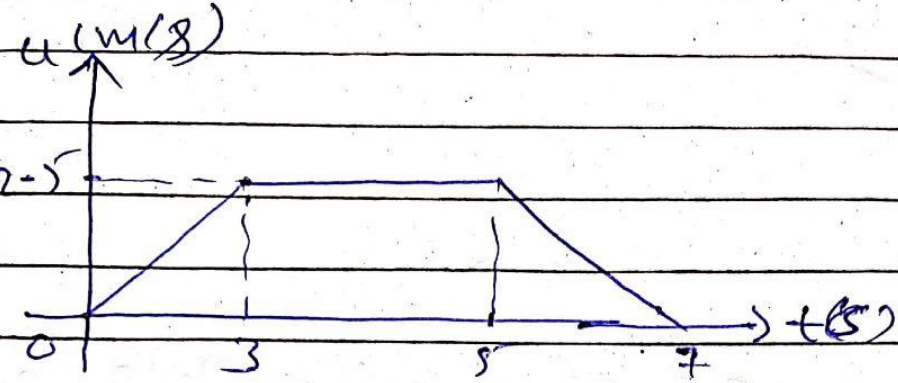
Ans. b

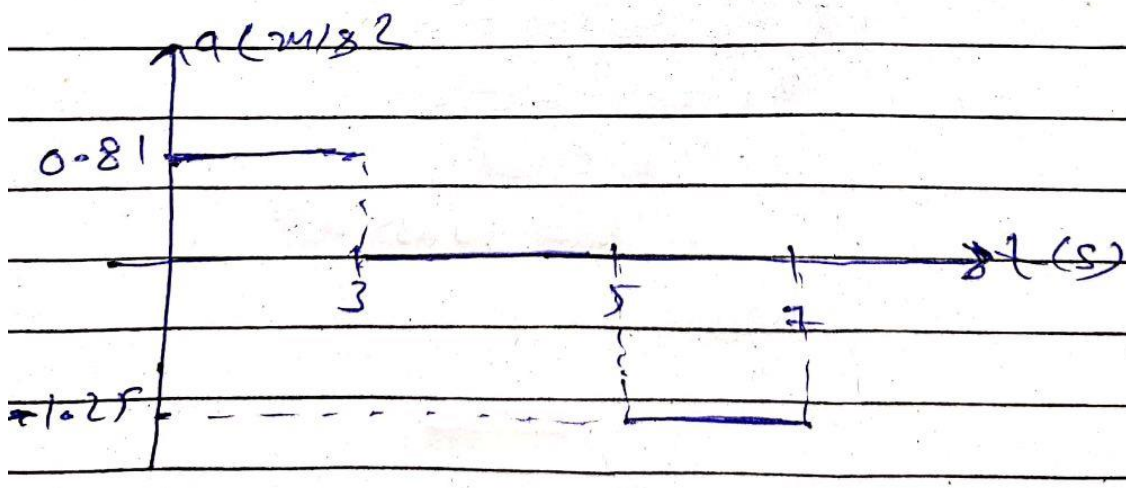


$0-3$; $a = \frac{2.5}{3} = 0.81 \text{ m/s}^2$

$3-5$; $u = 2.5 \text{ m/s}$ = constant

$\therefore a = \text{zero}$

$5-7$; $a = \frac{0-2.5}{7-5} = \frac{-2.5}{2} = -1.25 \text{ m/s}^2$



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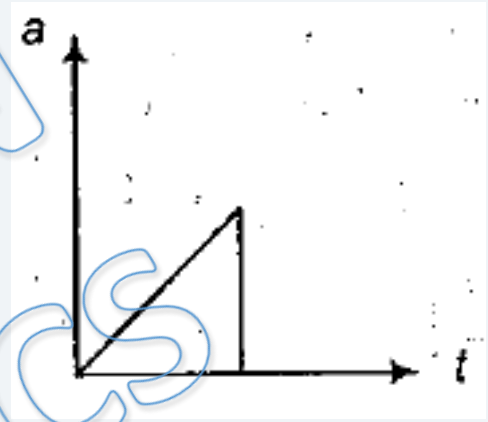
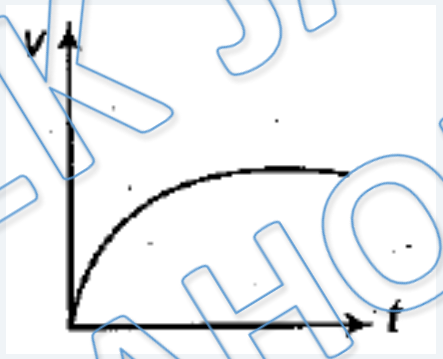
Q) The acceleration-time graph of a body is shown. The most probable velocity-time graph of the body is :

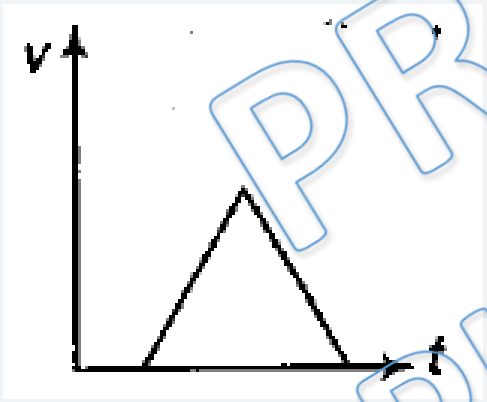


(a)

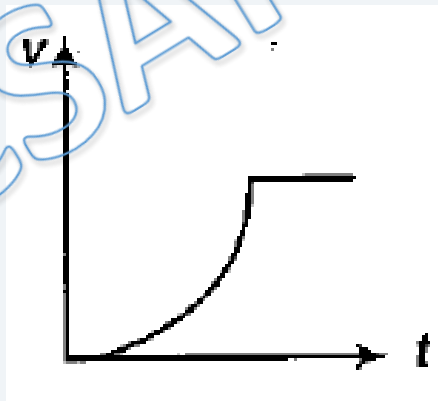
(b)



(c)



(d)



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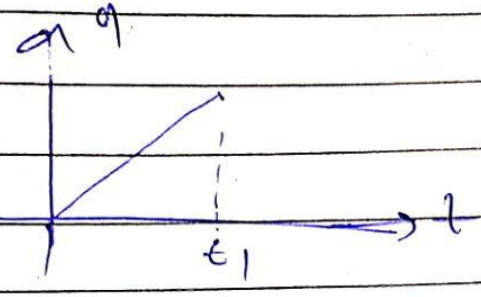
Ans. d



$a = kt$ $\quad$ k - Slope (constant)

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

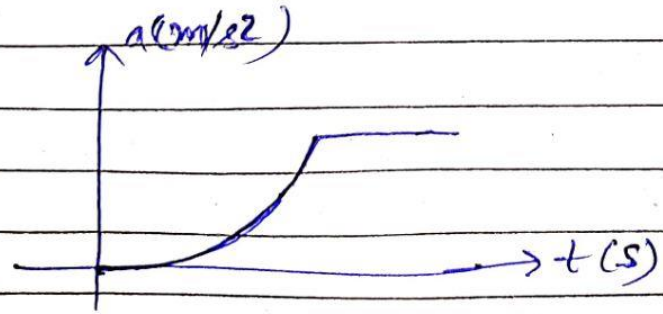
$$v = \frac{1}{2}kt^2 + c$$

Eg; ∴ v-t graph is upward parabola for $t = 0$ to $t = t_1$

and after $t = t_1$

$a = 0$

∴ v = constant



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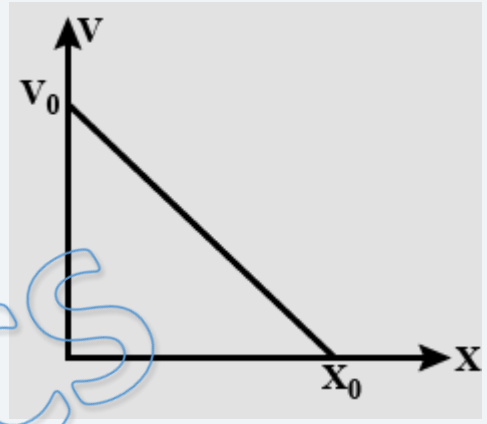
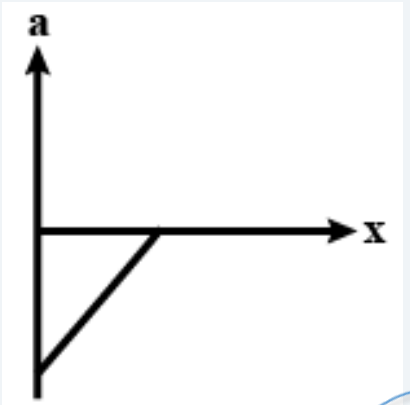
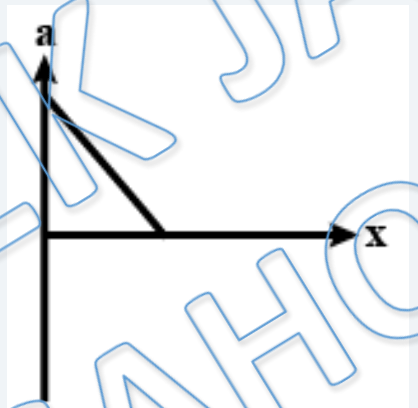
Q) The given graph shows the variation of velocity With displacement. Which one of the graph given below correctly represents the variation of acceleration With displacement?



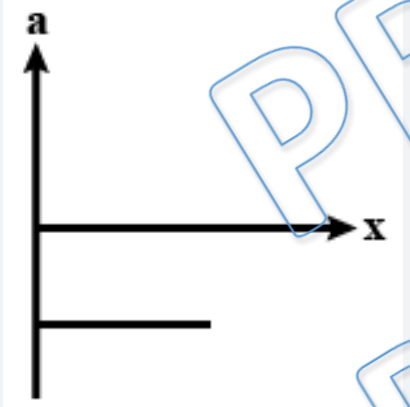
(a)



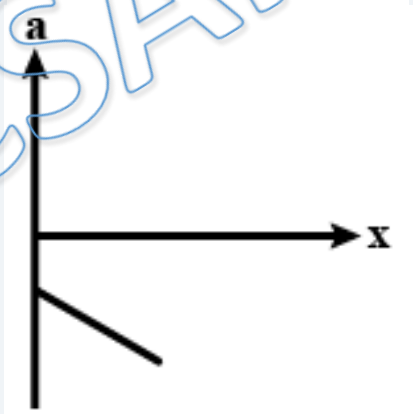
(b)



(c)



(d)



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Ans. a

$V = -mx + u$

where; $m = \tan\theta = -\frac{V_0}{x_0}$

& $u = V_0$

$V = -mx + V_0$

differentiate w.r.t. t

$$\frac{dV}{dt} = -m\frac{dx}{dt} + 0$$

$$\frac{dV}{dt} = -m(v)$$

$$= -m(-mx + V_0)$$

$$= m^2x \oplus mV_0$$

$$\frac{dV}{dt} = m^2x - mV_0$$

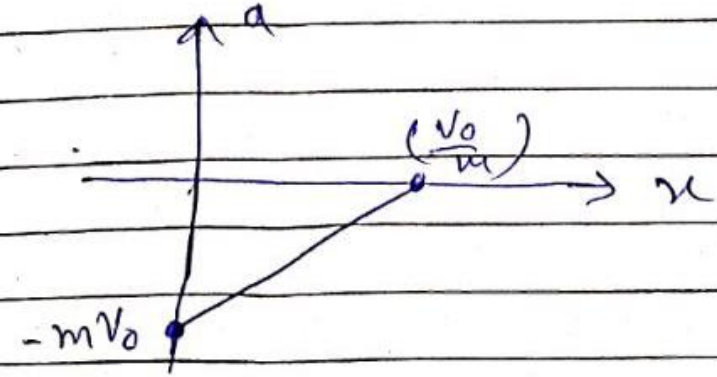
m & m^2 = Constants

$$a = m^2x - mV_0$$

at, $x = 0$

$a = -mV_0$

& for $a = 0$; $m^2x - mV_0 = 0 \Rightarrow x = \frac{V_0}{m}$



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Chalo Niklo