Advanced Revision

25 sessions

Revision through questions ✓

Do Homework ✓

Discuss regularly ✓

Do more than one correct, comprehension, match the column.

$v = u + at$

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

$v^2 = u^2 + 2as$

$= vt - \frac{1}{2}at^2$

$S = \frac{u+v}{2}t$

$S_n = u + \frac{a}{2}(2n-1)$

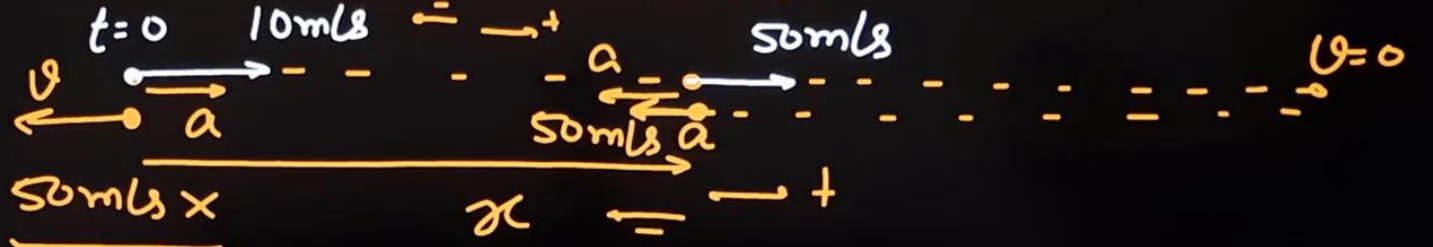
$\vec{v} = \frac{d\vec{r}}{dt}$

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

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

Ex A body moving along straight line has initial velocity 10m/s and some constant acceleration. When velocity of body becomes 50m/s, acc is reversed in dirn without changing magnitude. Find speed of body when it reaches the initial point.

Sol:-



$v^2 = (-50)^2 + 2(-a)(-x)$ $\quad$ $v^2 = u^2 + 2as$ $\quad$ $50^2 = 10^2 + 2ax$

$2ax = 2400$

$v^2 = (-50)^2 + 2ax$

$= 2500 + 2400$

$= 4900$

$v^2 = 4900$ $\quad$ $v = \pm 70$

$v^2 = 50^2 + 2ax$

$v^2 = 2500 + 2400 = 4900$

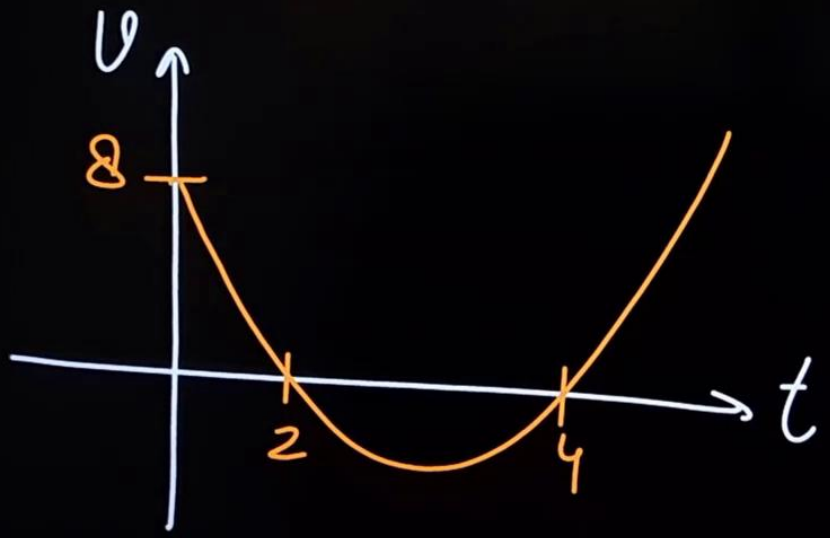
$= 6$ $\quad$ $v = 70 m/s$

Ex position of particle moving on st. line $x = \frac{t^3}{3} - 3t^2 + 8t + 5$

find ① distance travelled in 5 sec

② distance travelled during retardation.

Sol: $v = \frac{dx}{dt} = t^2 - 6t + 8 = 0$ → $t = 2$ sec, $t = 4$ sec



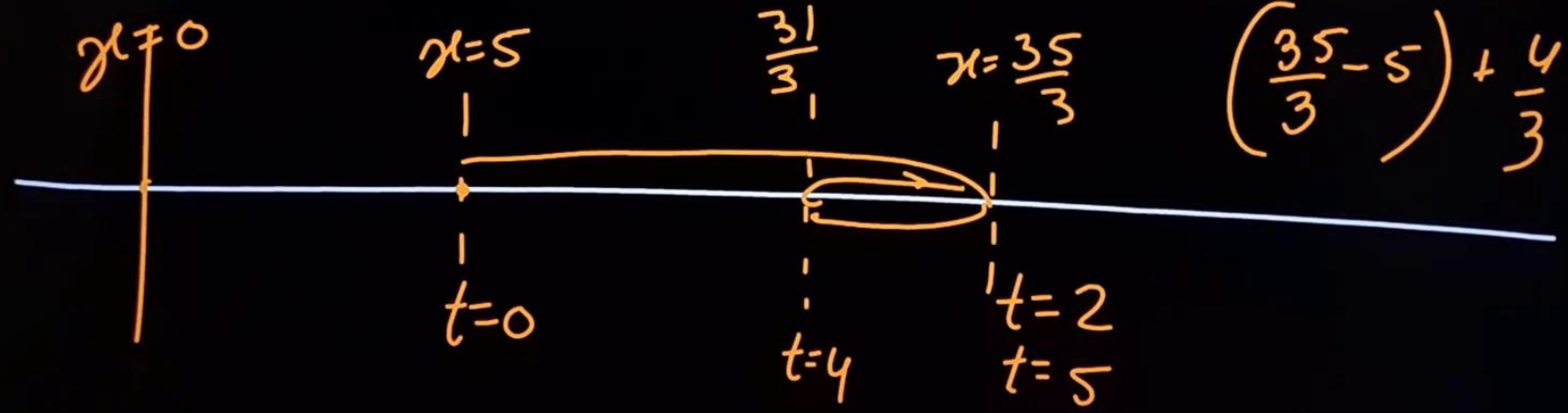
$$x = \frac{t^3}{3} - 3t^2 + 8t + 5$$

$t = 0 \Rightarrow \quad x = 5$

$t = 2 \Rightarrow \quad x = \frac{8}{3} - 12 + 16 + 5 = \frac{8}{3} + 9 = \frac{35}{3}$

$t = 4 \Rightarrow \quad x = \frac{64}{3} - 48 + 32 + 5 = \frac{64}{3} - 11 = \frac{64 - 33}{3} = \frac{31}{3}$

$t = 5 \Rightarrow \quad x = \frac{125}{3} - 75 + 45 = \frac{125}{3} - 30 = \frac{35}{3}$



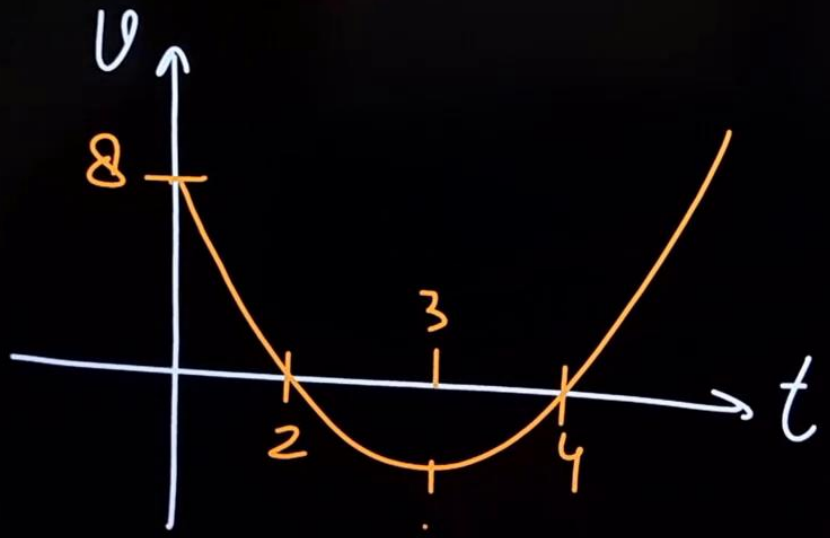
$$\left(\frac{35}{3} - 5\right) + \frac{4}{3} \times 2 = \frac{5}{1}$$

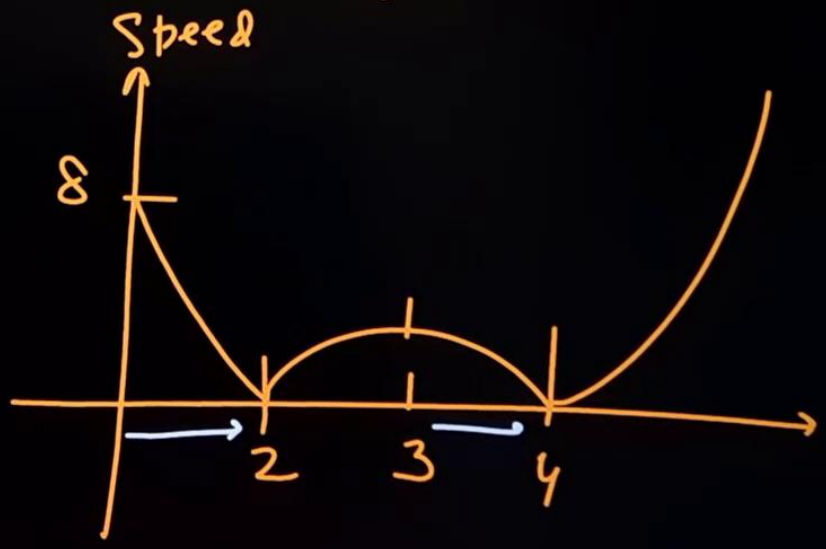
Ex position of particle moving on st. line $x = \frac{t^3}{3} - 3t^2 + 8t + 5$

Find ① distance travelled in 5 sec

② distance travelled during retardation.

$v = \frac{dx}{dt} = t^2 - 6t + 8 = 0$ → $t = 2$ sec, $t = 4$ sec





Aug-04-2021 10:

$0-2 \Rightarrow \frac{35}{3} - 5$

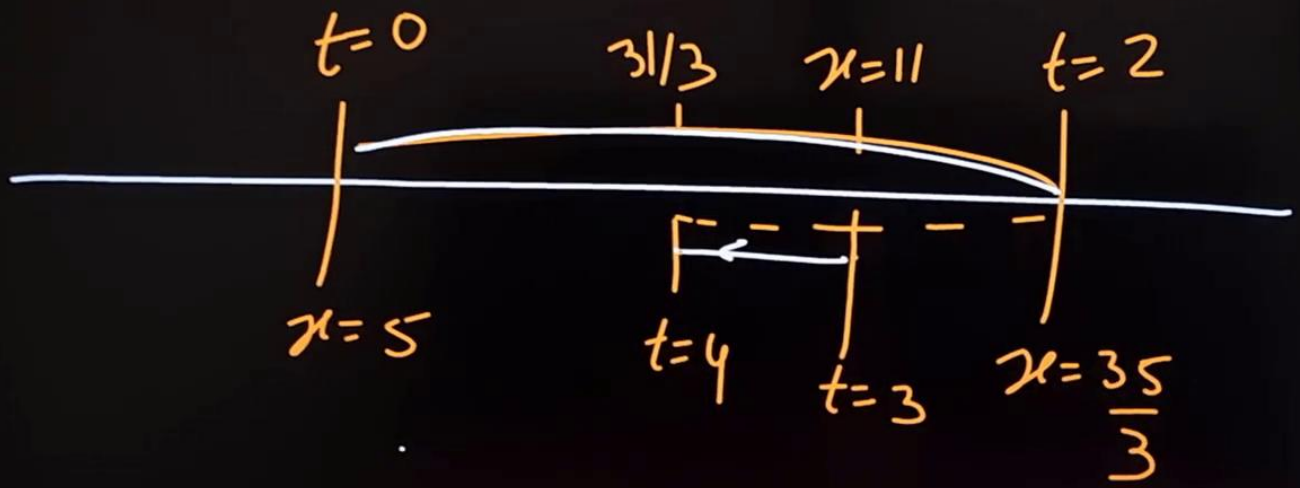
$11 - \frac{31}{3} = \frac{2}{3}$

(3-4)

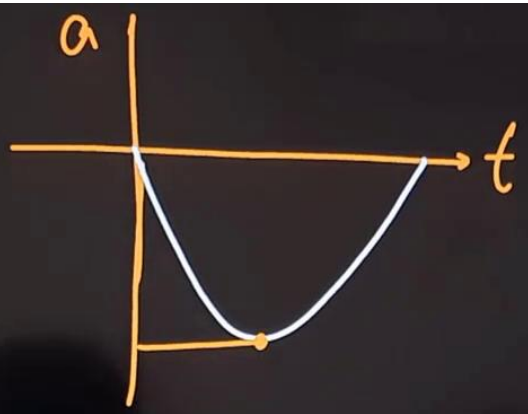
$x = \frac{t^3}{3} - 3t^2 + 8t + 5$

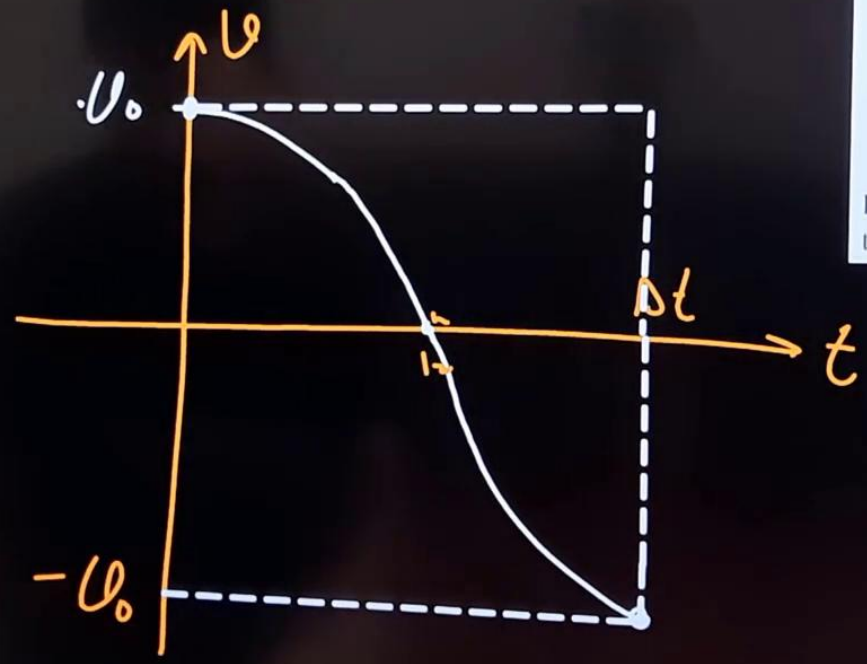
$= 9 - 27 + 24 + 5$

$= 11$

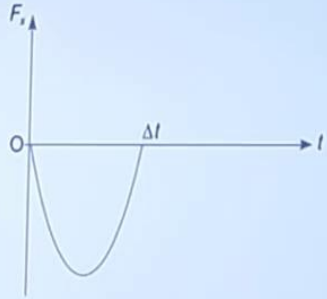


$a = F/m$



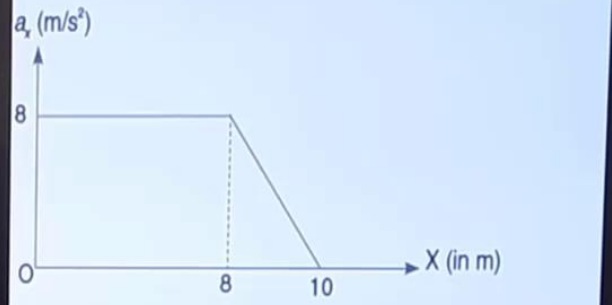


A ball travelling in positive X direction with speed V_0 hits a wall perpendicularly and rebounds with speed V_0. During the short interaction time (Δt) the force applied by the wall on the ball varies as shown in figure.



Draw the velocity-time graph for the ball during the interval 0 to Δt

A particle starts from rest (at $x = 0$) when an acceleration is applied to it. The acceleration of the particle changes with its co-ordinate as shown in the fig. Find the speed of the particle at $x = 10m$.



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

$\int_0^v v\,dv = \frac{v^2}{2} - \frac{0^2}{2} = \frac{v^2}{2}$ = area under the

$\frac{1}{2} \times (18\ m) \times 8\ \frac{m}{sec^2}$

$72\ \frac{m^2}{sec^2} = \frac{v^2}{2} \Rightarrow v^2 = 144\ m^2/sec^2$

$v = 12\ m/s$

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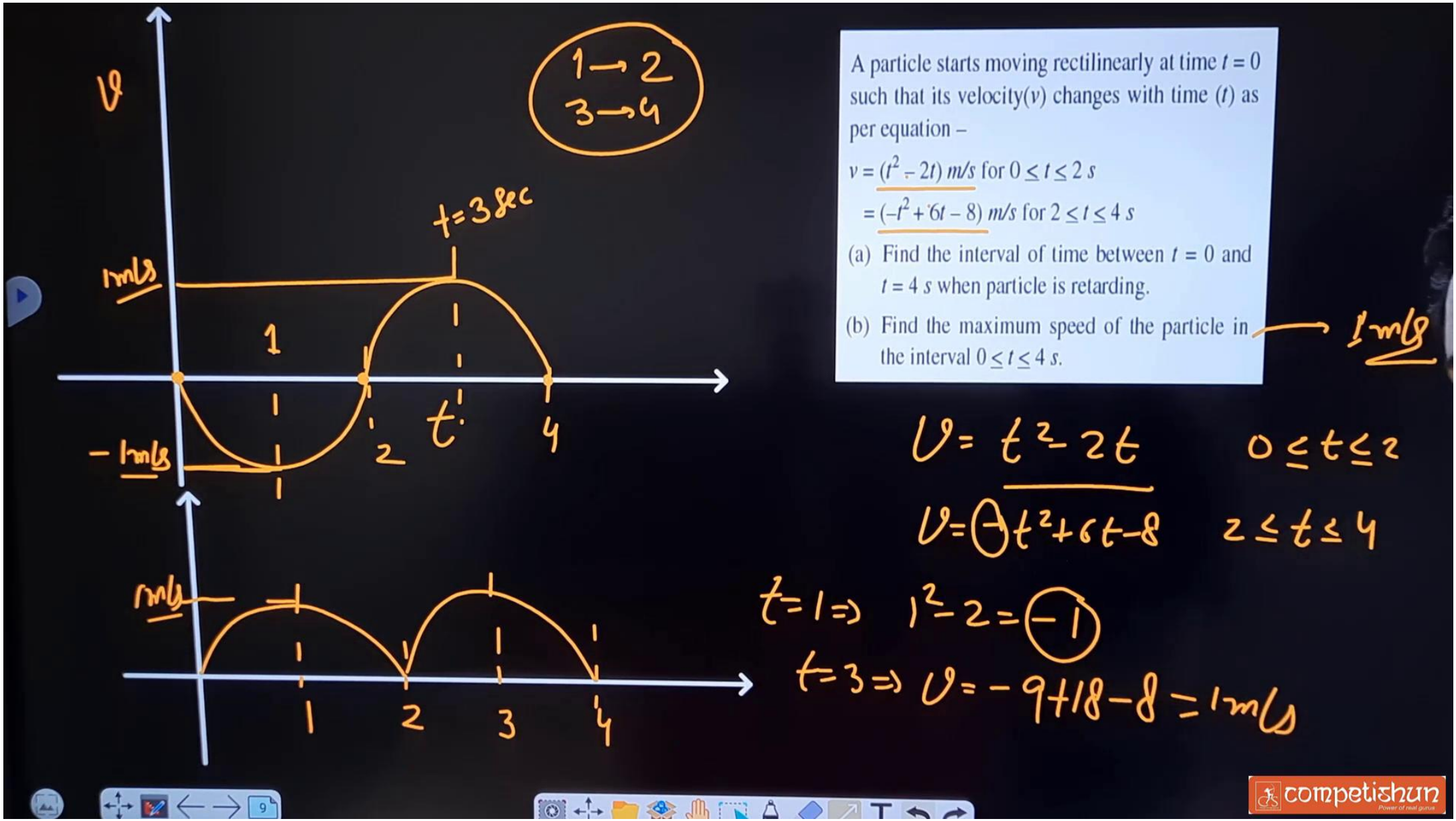
Power of real guru



A particle starts moving rectilinearly at time $t = 0$ such that its velocity(v) changes with time (t) as per equation –

$v = (t^2 - 2t)$ *m/s* for $0 \le t \le 2$ *s*

$= (-t^2 + 6t - 8)$ *m/s* for $2 \le t \le 4$ *s*

(a) Find the interval of time between $t = 0$ and $t = 4$ *s* when particle is retarding.

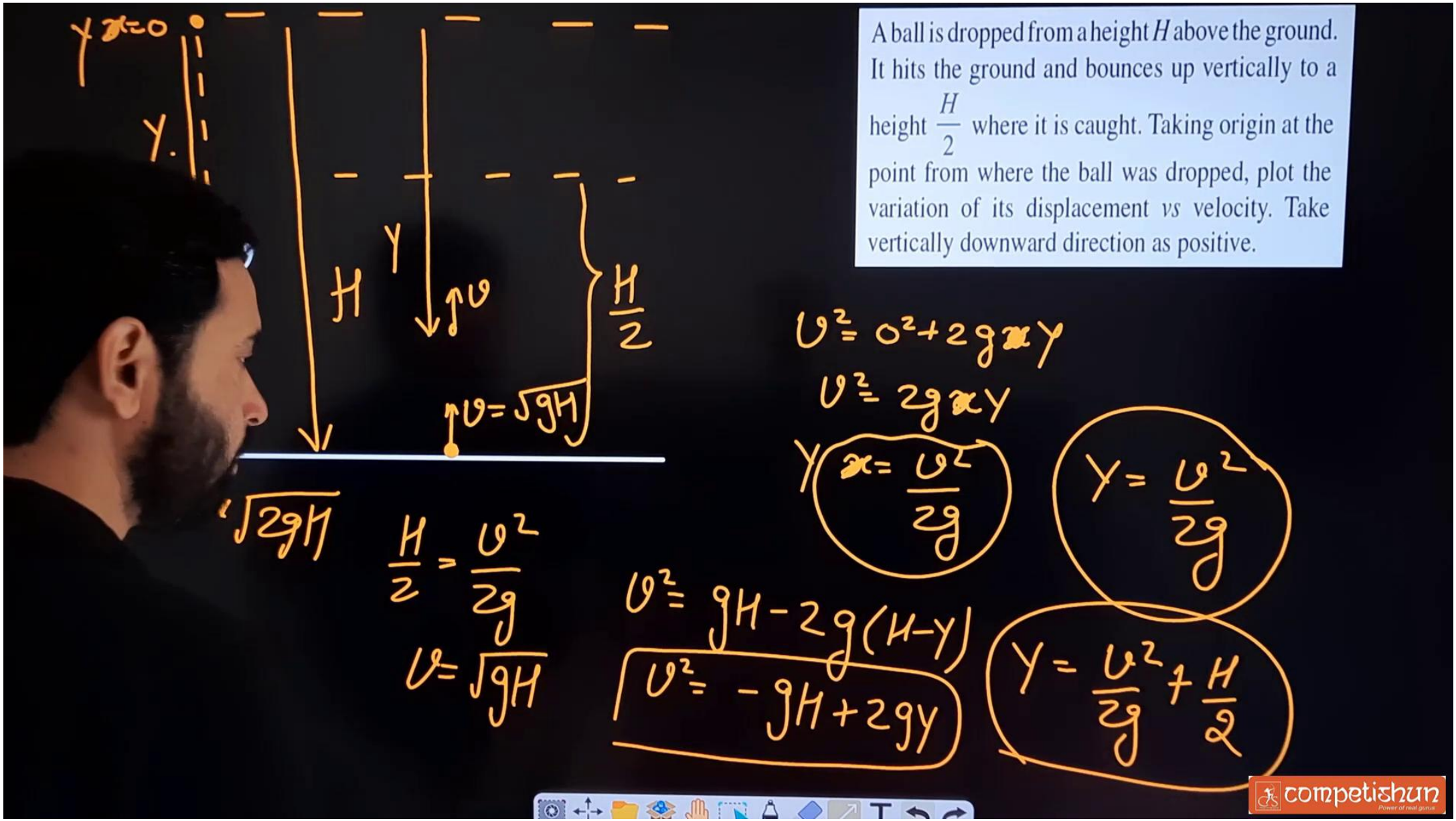
(b) Find the maximum speed of the particle in the interval $0 \le t \le 4$ *s*. → 1 m/s

$v = t^2 - 2t \quad 0 \le t \le 2$

$v = -t^2 + 6t - 8 \quad 2 \le t \le 4$

$t = 1 \Rightarrow 1^2 - 2 = -1$

$t = 3 \Rightarrow v = -9 + 18 - 8 = 1 \text{ m/s}$


A ball is dropped from a height H above the ground. It hits the ground and bounces up vertically to a height $\frac{H}{2}$ where it is caught. Taking origin at the point from where the ball was dropped, plot the variation of its displacement *vs* velocity. Take vertically downward direction as positive.
y x=0
Y
H
Y
v
H/2
v=√gH
√2gH
H/2 = v²/2g
v=√gH
v² = 0²+2gxY
v² = 2gxY
x = v²/2g
Y = v²/2g
v² = gH-2g(H-Y)
v² = -gH+2gY
Y = v²/2g + H/2
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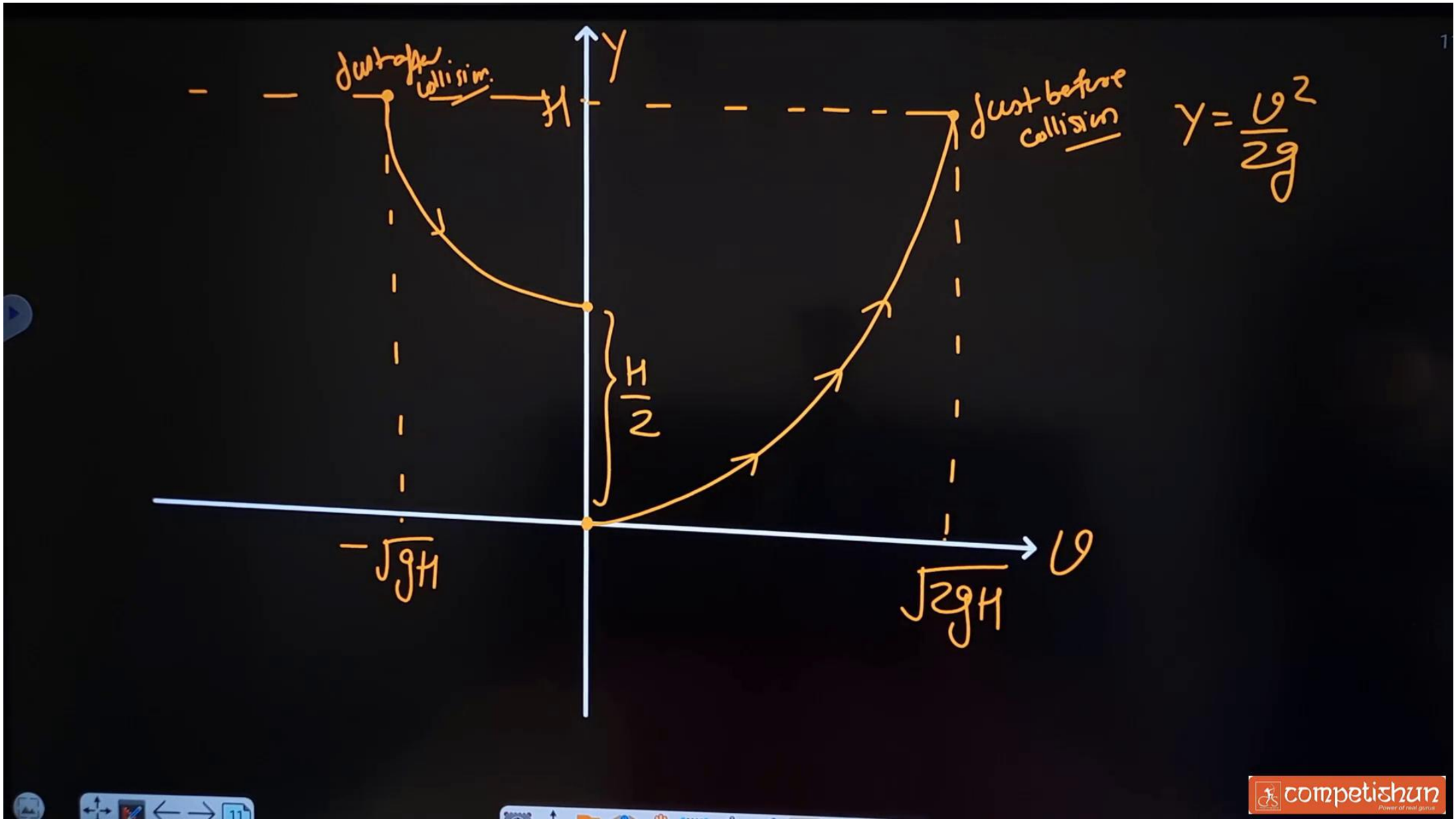
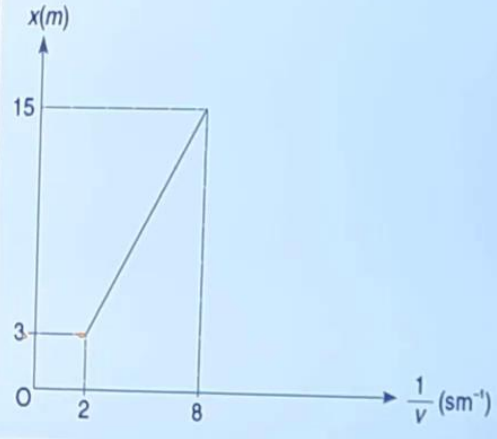
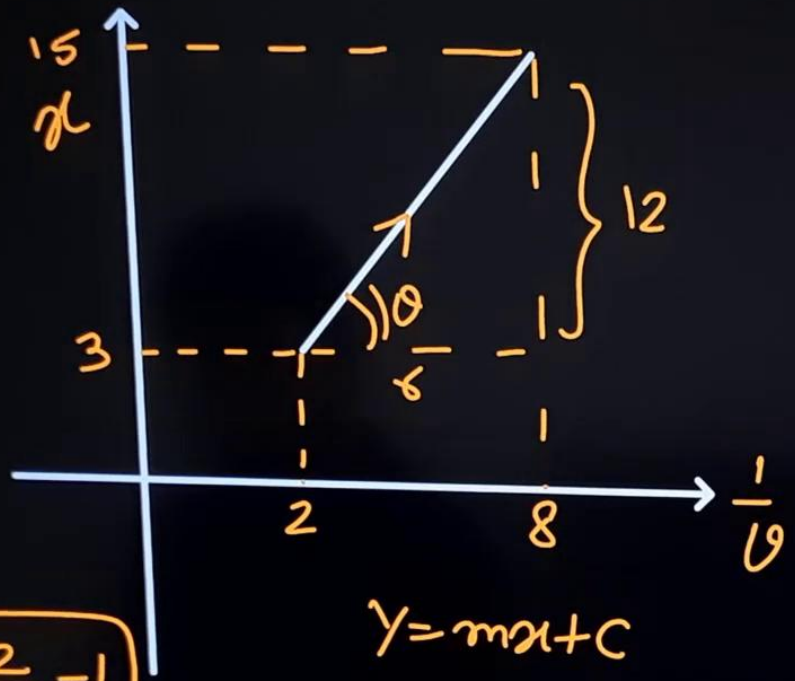

just after collision
H
Y
just before collision
$Y = \frac{v^2}{2g}$
$\frac{H}{2}$
$-\sqrt{gH}$
$\sqrt{2gH}$
v

Aug-04-2021 11:03

Graph of position (x) vs inverse of velocity $\left(\frac{1}{v}\right)$ for a particle moving on a straight line is as shown. Find the time taken by the particle to move from $x = 3\ m$ to $x = 15\ m$.



Et



$y = mx + c$

$x = \frac{2}{v} - 1$

$x = 2\frac{1}{v} + c \Rightarrow$ (0)

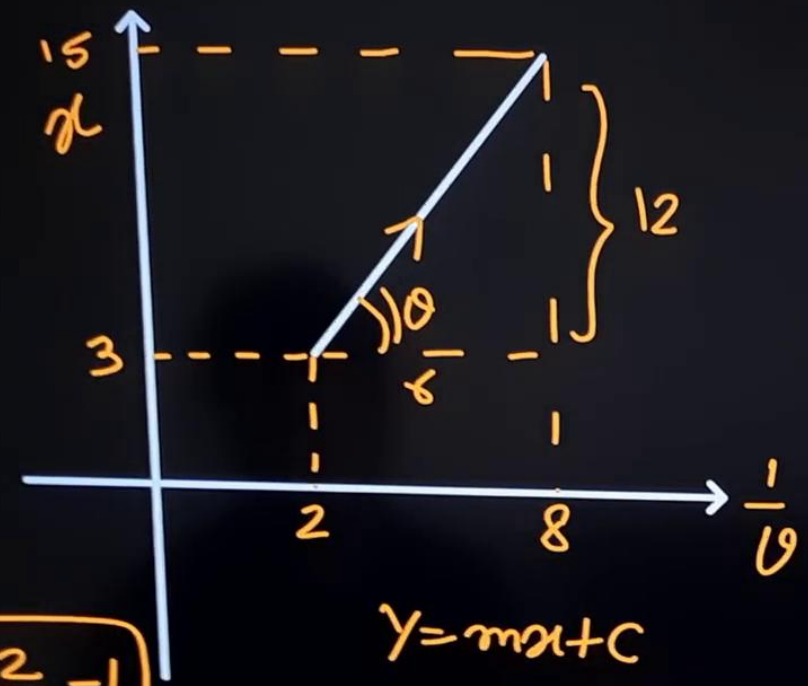
$1 = \frac{2}{v}$

$x = 2\left(\frac{1}{v}\right) + c \Rightarrow 3 = 2 \times 2 + c$

$\frac{2}{v^2} = \frac{dx}{dt}$

$c = -1$

Ex



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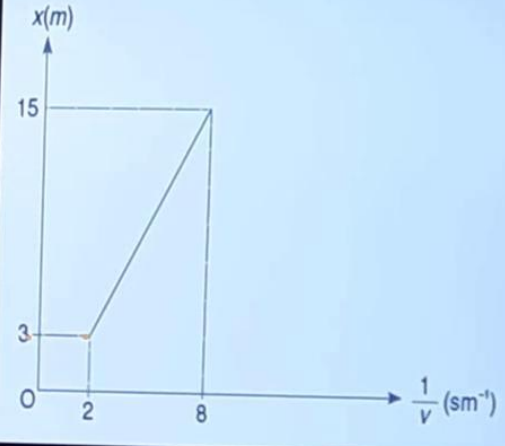


$y = mx + c$

$x = \frac{2}{v} - 1$

$x = 2\frac{1}{v} + c \Rightarrow$ (1)

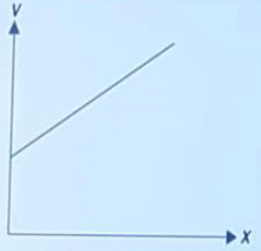
$x + 1 = \frac{2}{v}$

$x = 2\left(\frac{1}{v}\right) + c \Rightarrow 3 = 2 \times 2 + c$

$c = -1$

$v = \frac{2}{x+1} = \frac{dx}{dt}$

(a) A particle is moving along the x axis and its velocity vs position graph is as shown. Is the acceleration of the particle increasing, decreasing or remains constant?



(b) A particle is moving along x axis and its velocity (v) vs position (x) graph is a curve as shown in the figure. Line APB is normal to the curve at point P. Find the instantaneous acceleration of the particle at $x = 3.0\ m$.