ARJUNA NEET BATCH

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

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

MOTION WITH CONSTANT ACCELERATION

$\int_{t=0}^{t} a\,dt = \int_{u}^{v} dv$

$at = v - u$

LECTURE - 08

$\frac{dx}{dt} = u + at$

$v - u = at$

Motion with Constant Acceleration :

final velocity

$$\vec{V} = \vec{u} + \vec{a}t$$

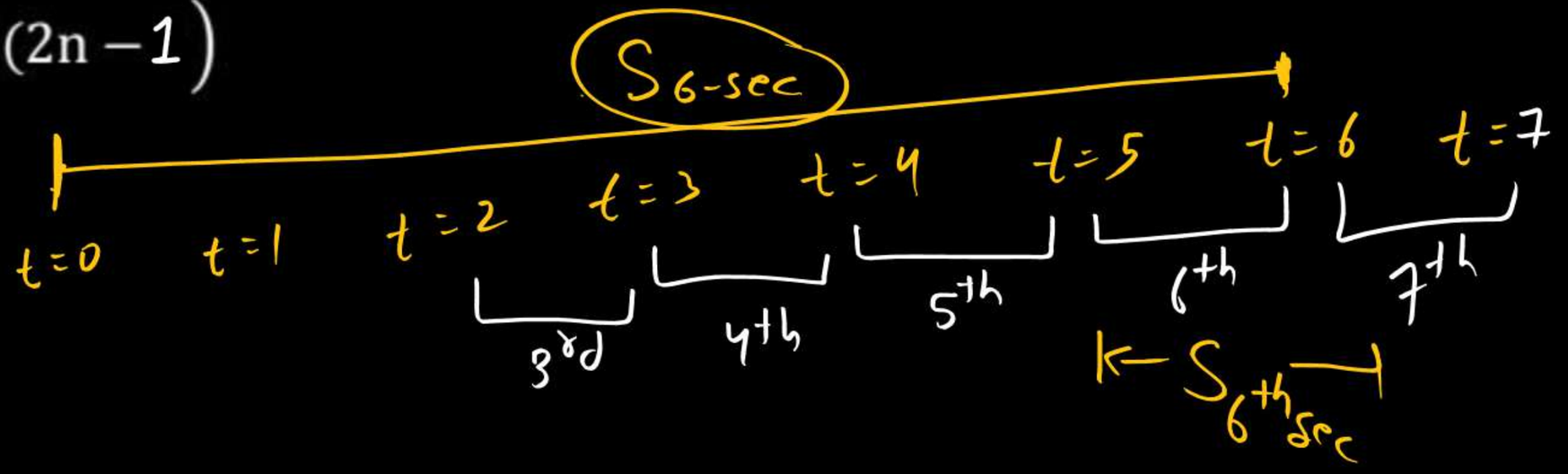
$$V^2 - u^2 = 2\vec{a} \cdot \vec{s}$$

$$\vec{s} = \vec{u}t + \frac{1}{2}\vec{a}t^2$$

$$S_{nth} = \vec{u} + \frac{a}{2}(2n-1)$$

$$\vec{V}_{Arg} = \frac{\vec{u} + \vec{v}}{2}$$

$$\vec{s} = \left(\frac{\vec{u} + \vec{v}}{2}\right)t$$



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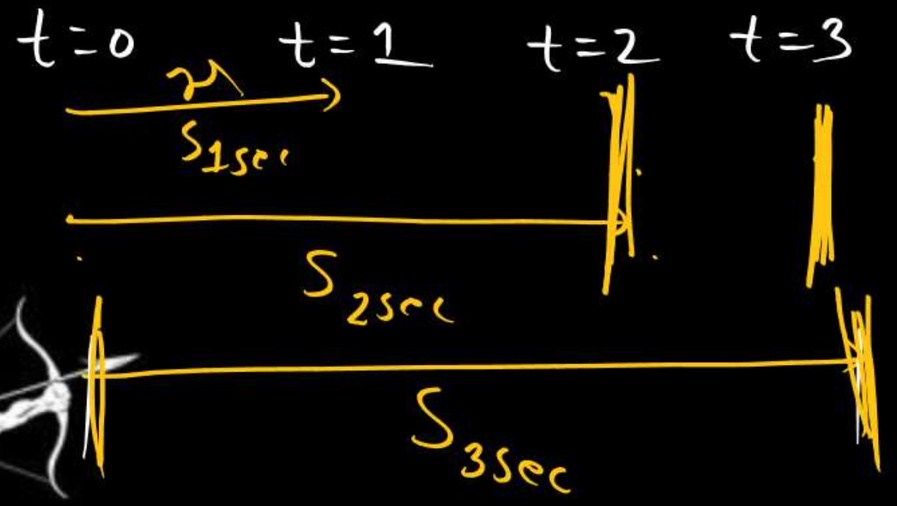
Object starts his motion from rest and constant acceleration then find Ratio of distance in 1-sec, 2-sec, 3-sec.

$u = 0$ $\quad a = (\text{constant})$

$$S_{1\,sec} : S_{2\,sec} : S_{3\,sec} = 1 : 4 : 9 = \left(\frac{a}{2}\right) : 4\left(\frac{a}{2}\right) : 9\left(\frac{a}{2}\right)$$



$$S_{2\text{-}sec} : S_{4\text{-}sec} : S_{6\text{-}sec} = 1 : 4 : 9$$

$$S_{t\,sec} : S_{2t\,sec} = 1 : 4$$

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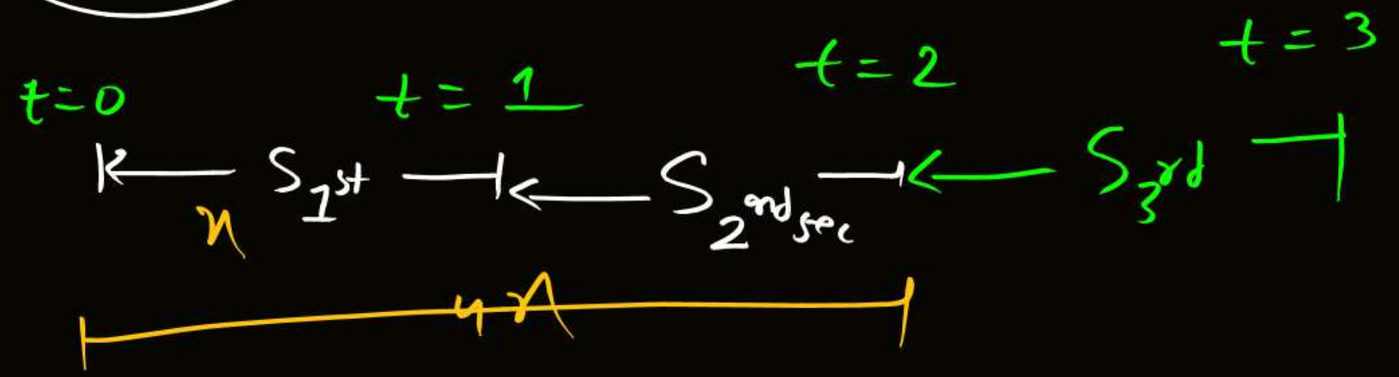
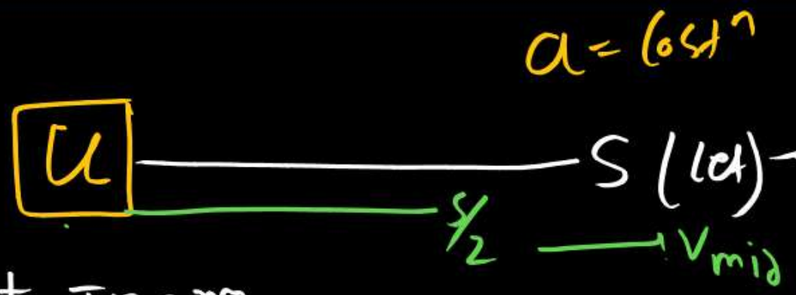
$u = 0$ (rest)

$a = \text{cost}^n$



$S_{1^{st}} : S_{2^{nd}} : S_{3^{rd}} = x : 3x : 5x$ (odd no. of Ratio)

Object starts his motion from $\underline{u}$ and constant acceleration then find velocity at mid point if velocity at end point is V.



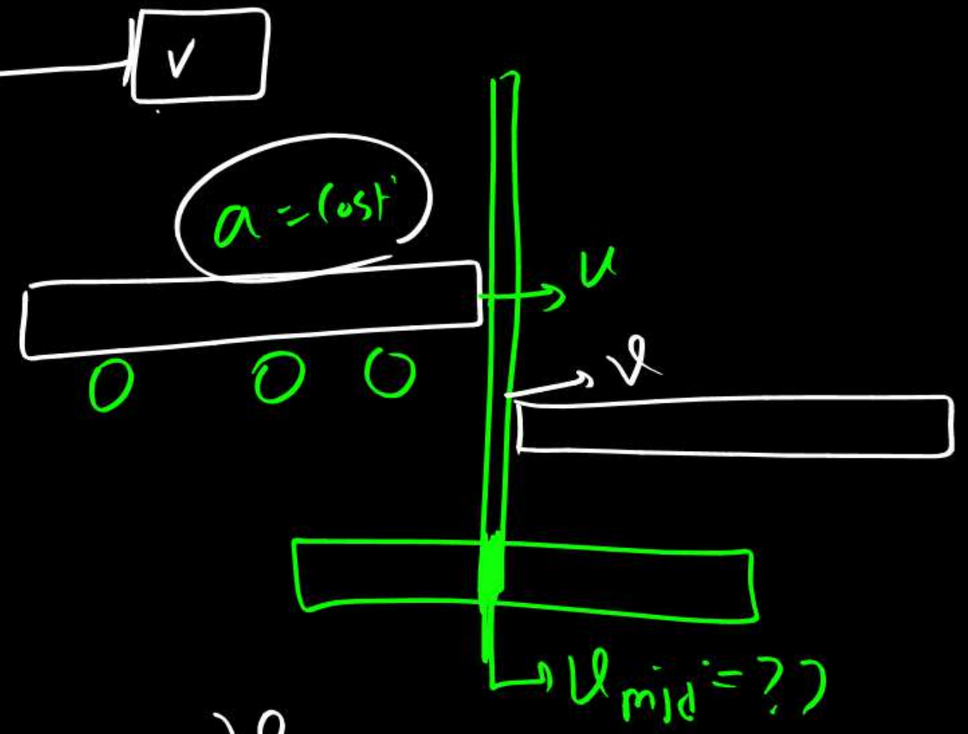
Compt Journey

$$v^2 - u^2 = 2as \quad - (i)$$

$$v_{mid}^2 - u^2 = 2a\frac{s}{2} \quad - (ii)$$

$$\frac{v^2 - u^2}{v_{mid}^2 - u^2} = 2$$

$$v_{mid} = \sqrt{\frac{u^2 + v^2}{2}}$$



$$v_{mid} = \sqrt{\frac{u^2 + v^2}{2}}$$

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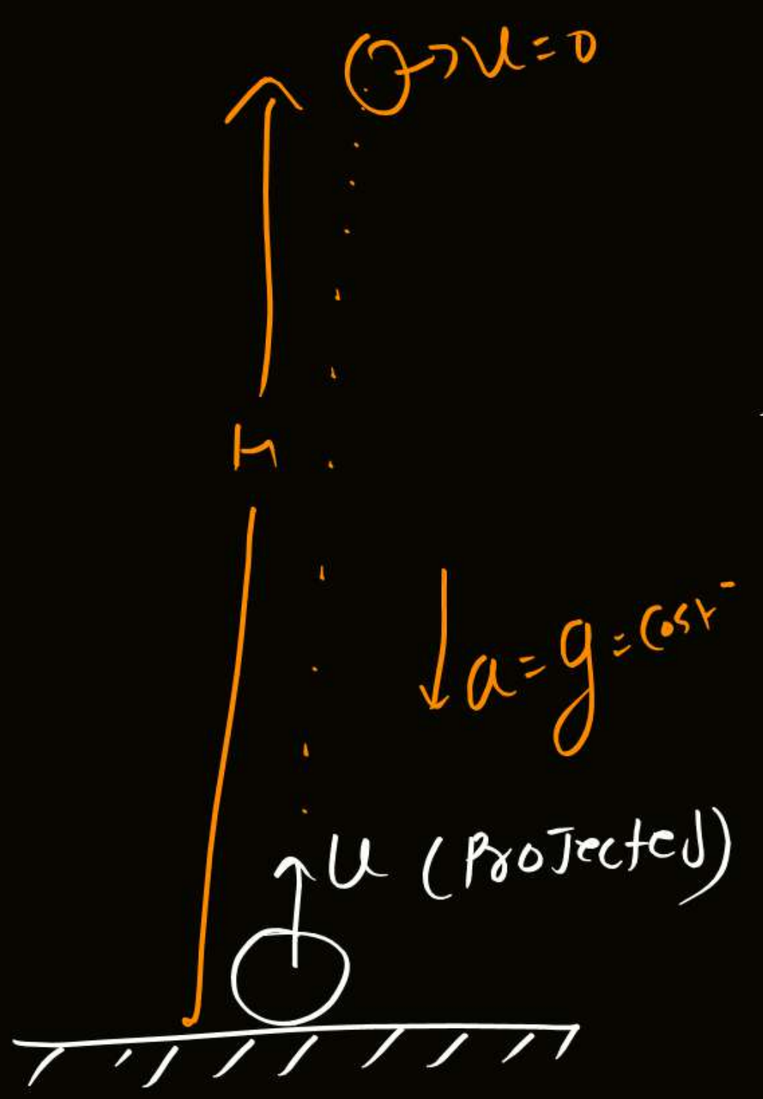
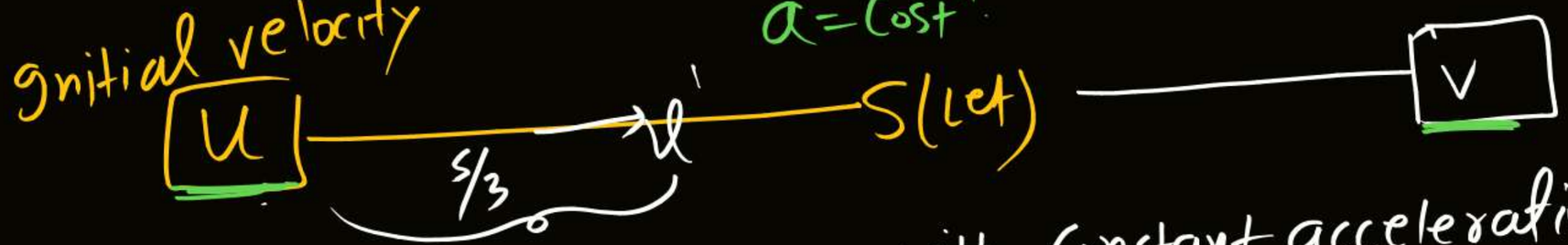


Find velocity at mid point of the max^m height ??

Imp^x

$$v_{mid} = \sqrt{\frac{u^2 + v^2}{2}}$$

$$v_{mid} = \sqrt{\frac{u^2}{2}} = \frac{u}{\sqrt{2}}$$



object is moting with Constant acceleration then Find velocity at $\frac{1}{3}$rd of the Compt Journey.

Compt Journy

$$v^2 - u^2 = 2as \quad -(1)$$

for $\frac{1}{3}$rd dispm

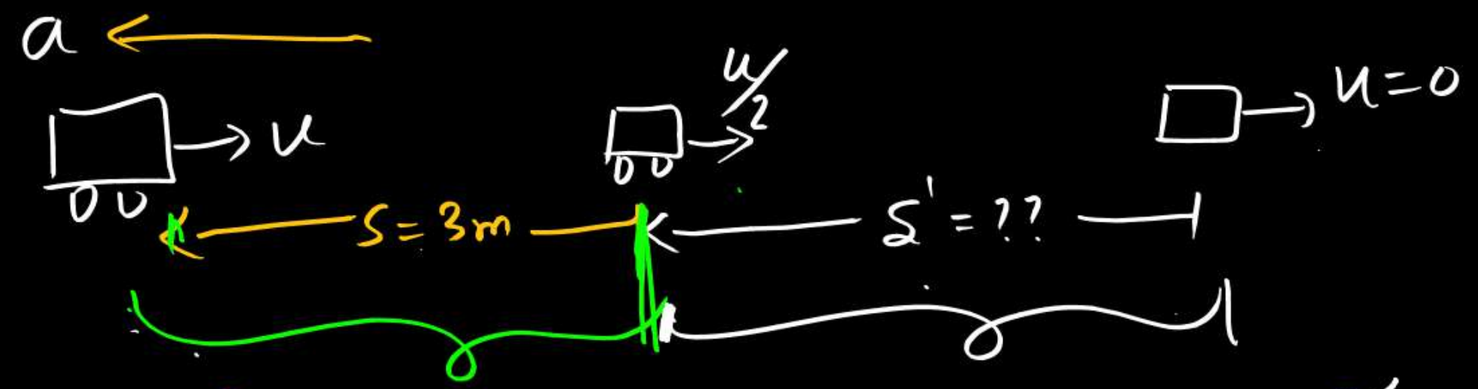
$$v'^2 - u^2 = \frac{2as}{3} \quad -(11)$$

$$\frac{v^2 - u^2}{v'^2 - u^2} = \frac{3}{1}$$

$$v^2 - u^2 = 3v'^2 - 3u^2$$

$$\sqrt{\frac{v^2 + 2u^2}{3}} = v' \quad *$$

Object starts his motion from u and due to constant retardation it loose half velocity after a displacement of 3m then find further displacement after which object comes to at rest.



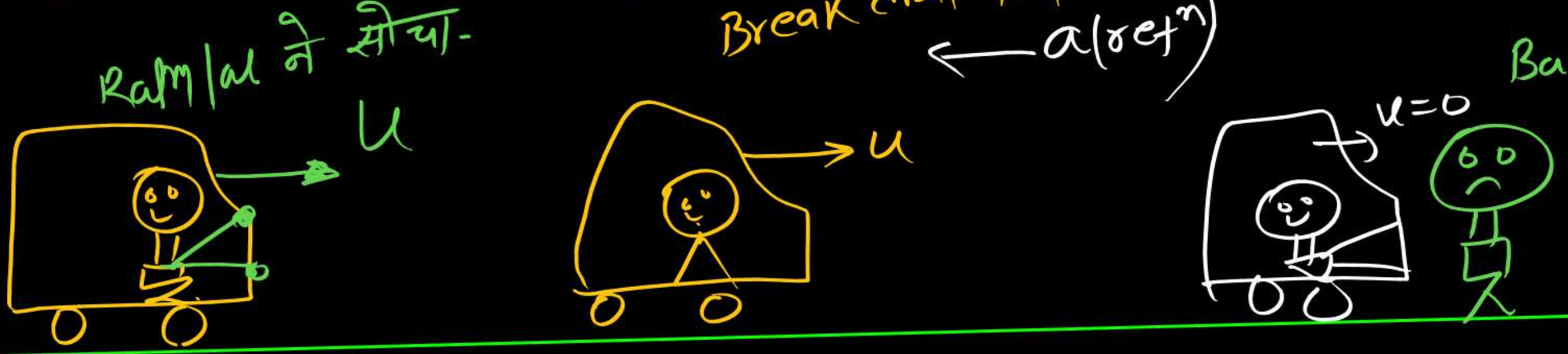
$$\frac{\left(\frac{u}{2}\right)^2 - u^2 = 2a(3)}{(0)^2 - \left(\frac{u}{2}\right)^2 = 2as'}$$

$$\frac{+\frac{3u^2}{4}}{+\frac{u^2}{4}} = \frac{3}{s'}$$

$$3s' = 3$$

$$\boxed{s' = 1\text{m}}$$

STOPPING DISTANCE and reaction Time



t, s ——— S_0 (stopping dist^n)

↳ Reaction time

$$t = \frac{s}{u}$$

Reaction

$$0 / u^2 = 2(-a)S_0$$

$$S_0 = \frac{u^2}{2a}$$ *

← Imp^t

A car moving with a speed of 50 km/hr can be stopped by brakes after at least 6m. If the same car is moving at a speed of 100 km/hr the minimum stopping distance is :

(a) 6 m
(b) 12 m
(c) 18 m
(d) 24 m

Ans (24m)

मजदूरी

$$\Rightarrow S = \frac{u^2}{2a}$$

$$6m = \frac{(50 km/hr)^2}{2a}$$

$$a = \frac{50 \times 50}{2 \times 6}$$

$$S_0 = \frac{u'^2}{2a} = \frac{100 \times 100^2}{2 \times \frac{50 \times 50}{12}} = 4 \times 6 = 24m$$

MR** $S \propto u^2$ $S \propto \frac{1}{a}$ - Same

$S' \propto (2u)^2 = 4$ times

$= 24m$

An object accelerates from rest to a velocity 27.5 m/s in 10 sec then find distance covered by object in next 10 sec :

(a) 550 m

(b) 137.5 m

(c) 412.5 m

(d) 275 m

Soln

MR*

$u = 0$ ← $t = 10$ Sec → $V = 27.5$ m/s

$$u_{Avg} = \frac{27.5}{2}$$

$$S = u_{Avg} \times time = \frac{27.5}{2} \times 10 = \frac{275}{2}$$

$$S' = (3S) = \frac{3}{2}(300) = 450$$

ज्यादा

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A motor car moving with a uniform speed of 20 m/sec comes to stop on the application of brakes after travelling a distance of 10 m. Its acceleration is :

(a) $20\ m/sec^2$

(b) $-20\ m/sec^2$

(c) $-40\ m/sec^2$

(d) $+2 m/sec^2$

$$s = \frac{u^2}{2a}$$

$$v^2 - u^2 = 2as$$

$$10\,m = \frac{400}{2a}$$

$$a = -20\ m/s^2$$

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The velocity of a body moving with a uniform acceleration of $2 m/sec^2$ is 10 m/sec. Its velocity after an interval of 4 sec is :

(a) 12 m/sec

(b) 14 m/sec

(c) 16 m/sec

(d) 18 m/sec

$a = 2 m/s^2$

$u = 10 m/s$

$v = u + at$

$= 10 + 2 \times 4 = 18 m/s$

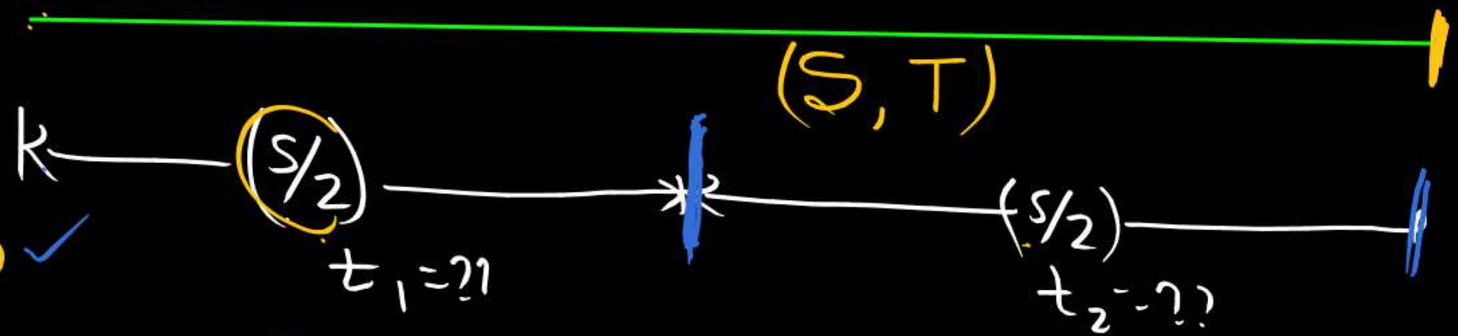
Object starts his motion from rest and constant acceleration takes time T for s displacement then find time taken for 1st half and 2n half displacement.

$a = \text{const}^n$

2nd eqn of motion $u = 0$

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

$S = \frac{1}{2}aT^2$ — ①



2nd half Journey

$\frac{S}{2} = \frac{1}{2}at_2^2$

for 1st half Journey

$\frac{S}{2} = \frac{1}{2}at_1^2$ — ⑪

⑪/①

$\frac{S/2}{S} = \frac{\frac{1}{2}at_1^2}{\frac{1}{2}aT^2}$

$t_1^2 = \frac{T^2}{2}$

$t_1 = \frac{T}{\sqrt{2}}$ **

$t_2 = T - t_1$

$\left(t_2 = T - \frac{T}{\sqrt{2}}\right)$ //

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$$\left[\frac{t_1}{t_2} = \frac{T/\sqrt{2}}{T - \frac{T}{\sqrt{2}}} = \frac{\frac{T}{\sqrt{2}}}{\frac{T}{\sqrt{2}}(\sqrt{2}-1)} = \frac{1}{\sqrt{2}-1}\right]$$

$u = 0 \quad a = (\text{const})^n$

K ⟵ S, t_1 ⟶ ⟵ S, t_2 ⟶ ⟵ S, t_3 ⟶ K ⟵ S, t_4 ⟶

$$t_1 : t_2 : t_3 : t_4 = 1 : \sqrt{2}-\sqrt{1} : (\sqrt{3}-\sqrt{2}) : (\sqrt{4}-\sqrt{3}) : \sqrt{5}-\sqrt{4}$$

A body of mass 10 kg is moving with a constant velocity of 10 m/s. When a constant force acts for 4 seconds on it, it moves with a velocity 2 m/sec in the opposite direction. The acceleration produced in it is :

(a) 3 m/sec^2

(b) −3 m/sec^2

(c) 0.3 m/sec^2

(d) −0.3 m/sec^2

$M = 10kg$

$(u = 10m/s)$

$t = 4\,sec$

$V = 2m/s$

$a = \frac{v-u}{t} = \frac{2-10}{4} = \frac{-8}{4} = -2\,m/s^2$ ✗

$\vec{a} = \frac{\vec{v_f} - \vec{v_i}}{t} = \frac{-2-(10)}{4} = \frac{-12}{4} = -3\,m/s^2$

$v = -2m/s$

→ and constant.

A body starts from rest. What is the ratio of the distance travelled by the body during the 4^{th} and 3^{rd} second :

(a) 7/5 (b) 5/7

(c) 7/3 (d) 3/7

$u=0$ ⟶ $a=$ const.

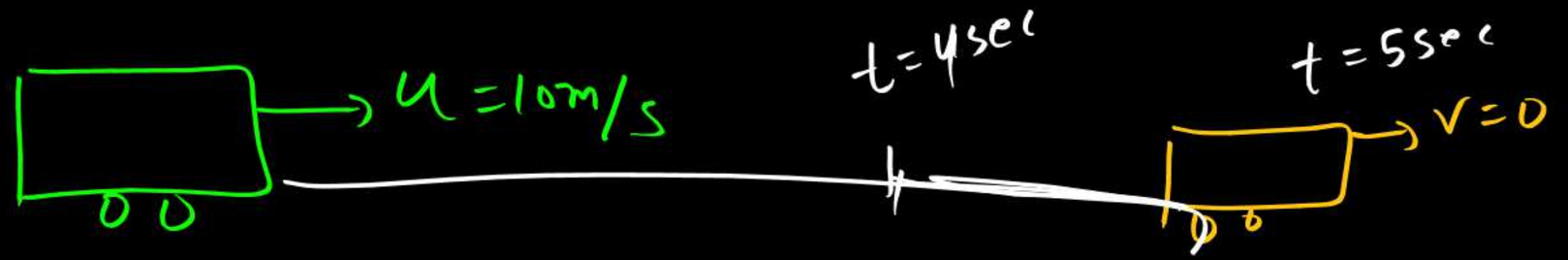
$$\frac{S_{4^{th}}}{S_{3^{rd}}} = \frac{\frac{a}{2}(2\times4-1)}{\frac{a}{2}(2\times3-1)} = \frac{7}{5}$$ Ans

The initial velocity of the particle is 10 m/sec and its retardation is $2m/sec^2$. The distance moved by the particle in 5^{th} second of its motion is :

(a) 1 m (b) 19 m

(c) 50 m (d) 75 m

$t = 4sec$ to $t = 5sec$



$-a = 2 m/s^2$

$v = u + at$

$0 = 10 - 2t$

$t = 5 sec$

$S_{n^{th}} = 10 - \frac{2}{2}(2 \times 5 - 1)$

$= 10 - 1(9) = \underline{1 m}$

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$v = 10$ m/s

$a = -2$ m/s^2

Find distance in 6– sec

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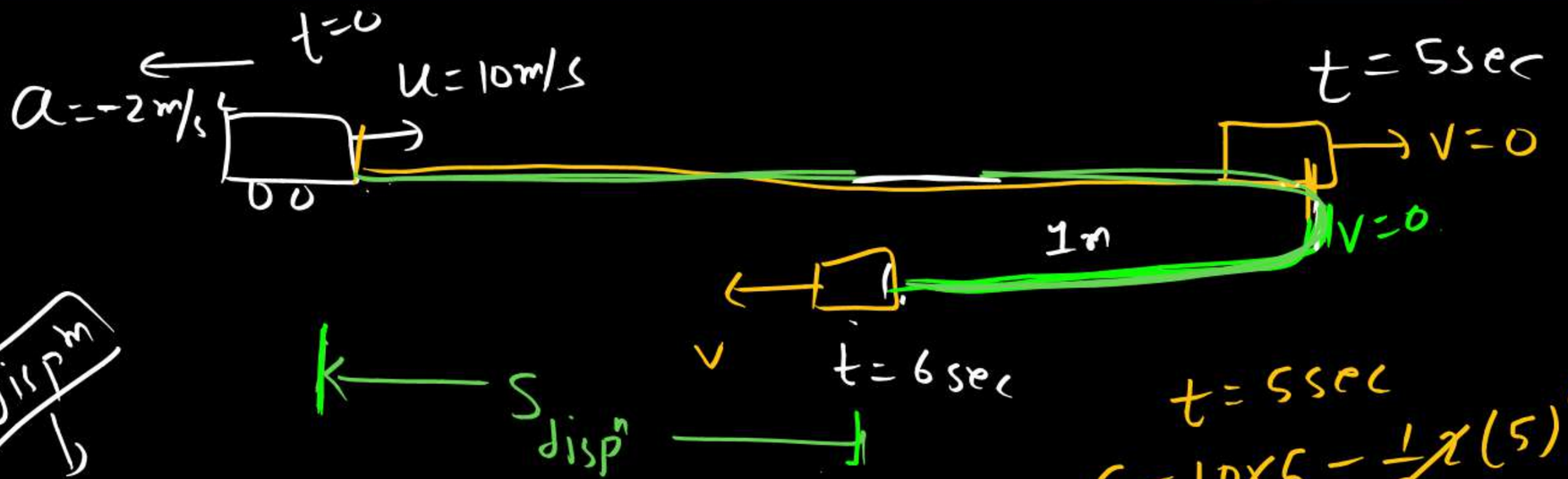

time after which car comes to at rest

$v = u + at$

$0 = 10 - 2t$

$t = 5$ sec

$t = 5$ sec

$S = 10\times5 - \frac{1}{2}\times2\times(5)^2 = 25$ m

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

$S = 10\times6 - \frac{1}{2}2(6)^2 = 60 - 36$

$= 24$ m

$S_{5\text{ to }6\text{ sec}} = ut + \frac{1}{2}at^2$

$= 0 - \frac{1}{2}\times2(1)^2 = 1$ m

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REST TO REST MOTION

NEET

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THANK YOU ☺