YAKEEN NEET 2.0

2026

Motion in a Straight Line

Physics | Lecture - 03

By- Manish Raj (MR Sir)

Topics to be covered

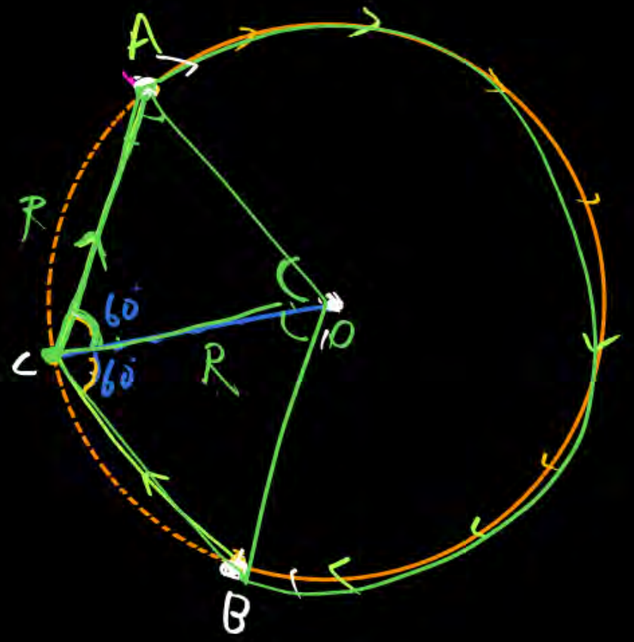
1. # Avg. speed & Avg velocity
2.
3.
4.

सीखना है Now

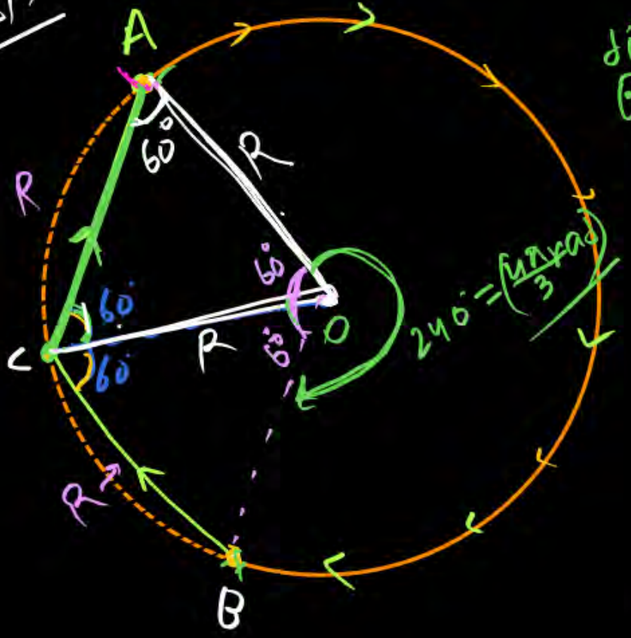
Object is moving on circle of Radius 21cm = R along circular path then chord then distance & displacement in one Rev.

Soln

$$|\text{disp}^m|_{A\to A} = 0$$



Soln



dist^n AB → $ABC = R\theta$

$= R\frac{4\pi}{3}$ rad

dist^n BCA → $2R$

$= \frac{4\pi}{3}R + 2R$

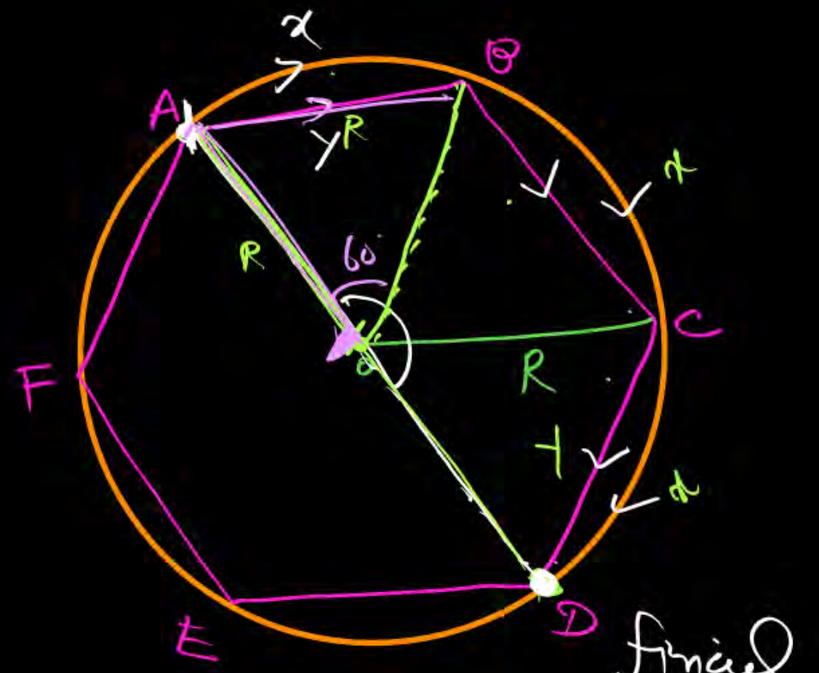
$= \frac{4\pi}{3}21 + 2\times21$

$= \frac{4\times22}{3\times\cancel{7}}\times\cancel{21} + 42$

$= 88 + 42$

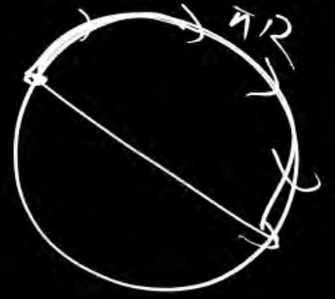
$= 130$ cm

$$\left|\frac{\text{disp}^{m} \text{ of } x}{\text{disp}^{m} \text{ of } y}\right|_{A \text{ to } D} = 1:1$$



final

$$\left|\frac{\text{dist}^{n} \text{ of } x}{\text{dist}^{n} \text{ of } y}\right|_{A \text{ to } D} = \frac{\pi R}{3R}$$



Question

In the cube of side 'a' shown in the figure, the vector from the central point of the face $ABOD$ to the central point of the face $BEFO$ will be **[10 Jan, 2019 (Shift-1)]**

1. $\frac{1}{2}a(\hat{k}-\hat{i})$
2. $\frac{1}{2}a(\hat{i}-\hat{k})$
3. $\frac{1}{2}a(\hat{j}-\hat{i})$
4. $\frac{1}{2}a(\hat{j}-\hat{k})$

$\vec{r}_G = \frac{a}{2}\hat{i} + \frac{a}{2}\hat{k}$

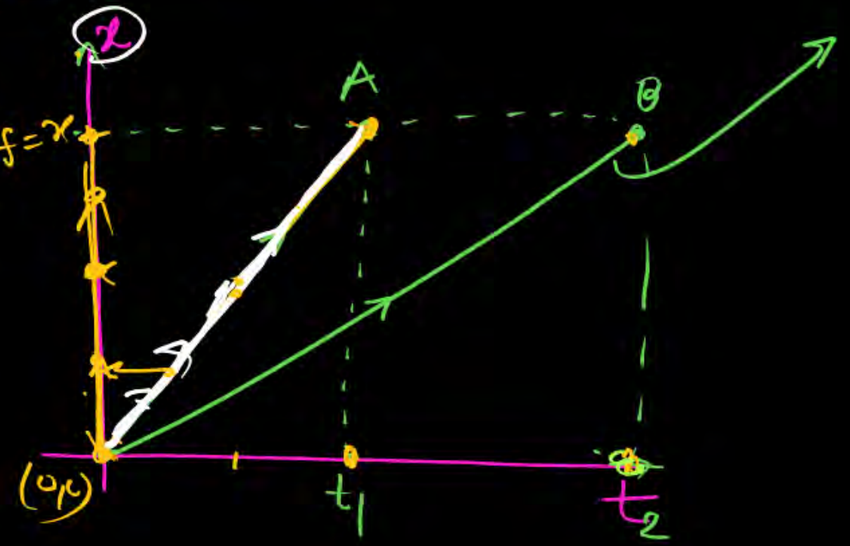
$\vec{r}_H = \frac{a}{2}\hat{j} + \frac{a}{2}\hat{k}$

$\vec{d}_{isp^m} = \vec{r}_H - \vec{r}_G = \frac{a}{2}\hat{j} + \frac{a}{2}\hat{k} - \frac{a}{2}\hat{i} - \frac{a}{2}\hat{k}$

$= \frac{a}{2}\hat{j} - \frac{a}{2}\hat{i}$

$disp^n = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2}$

distance & displ^m

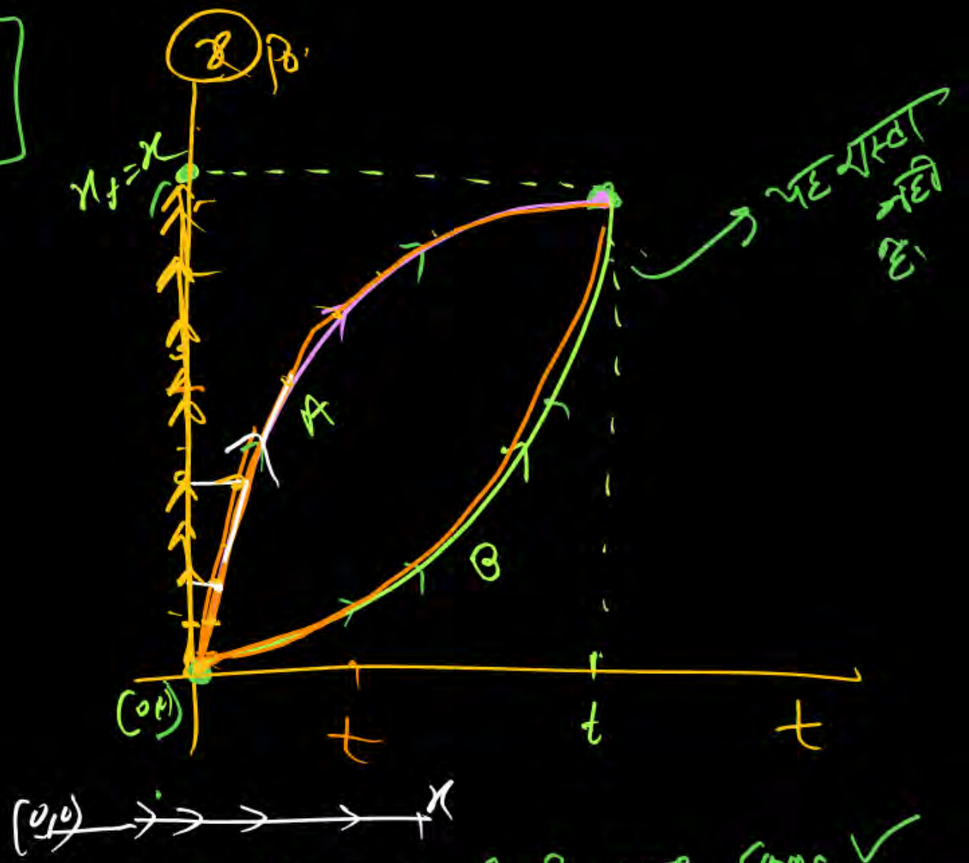


displ^m of A & B same

dist^n & displ^n equal

Note

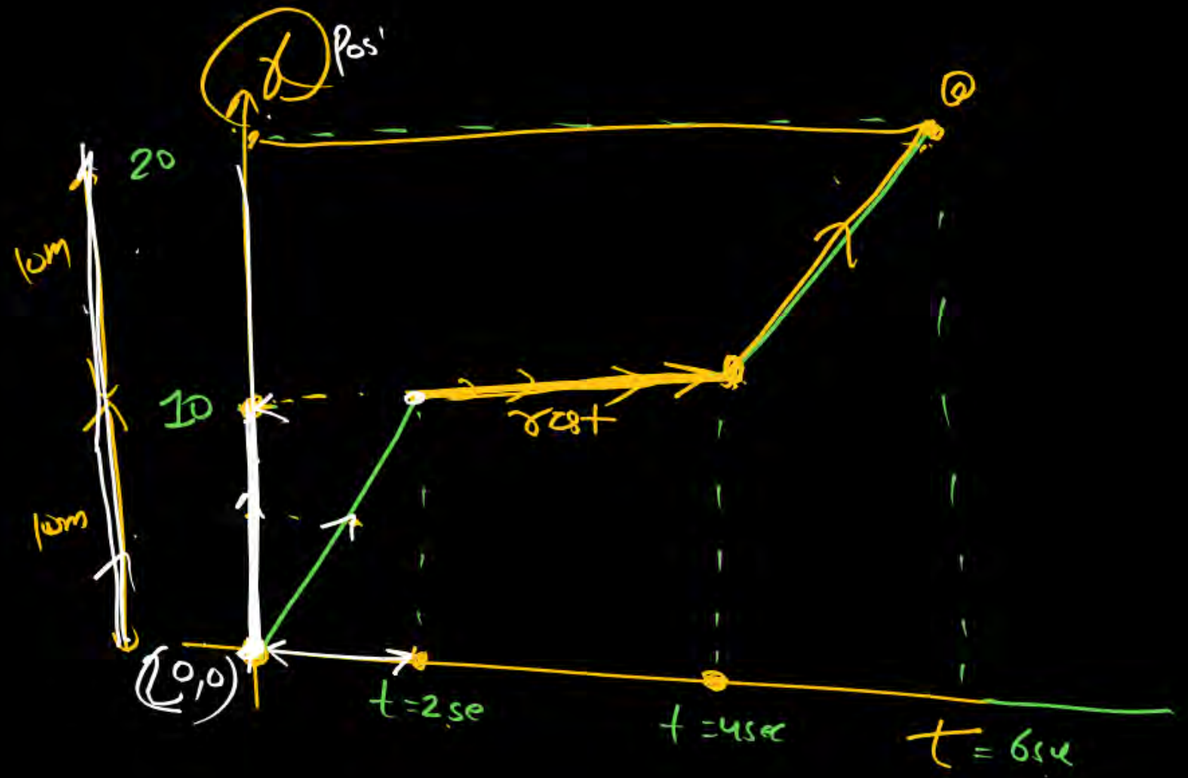
graph ka length path नहीं है।



यह संख्या नहीं है।

displ^m of A & B are same ✓

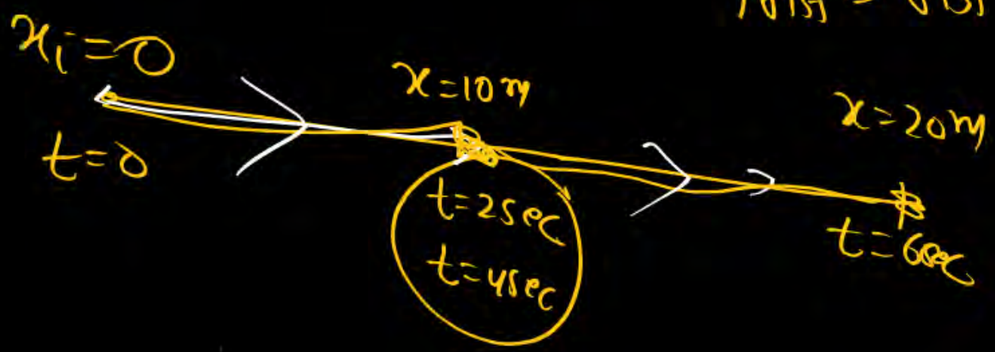
distance = displ^m



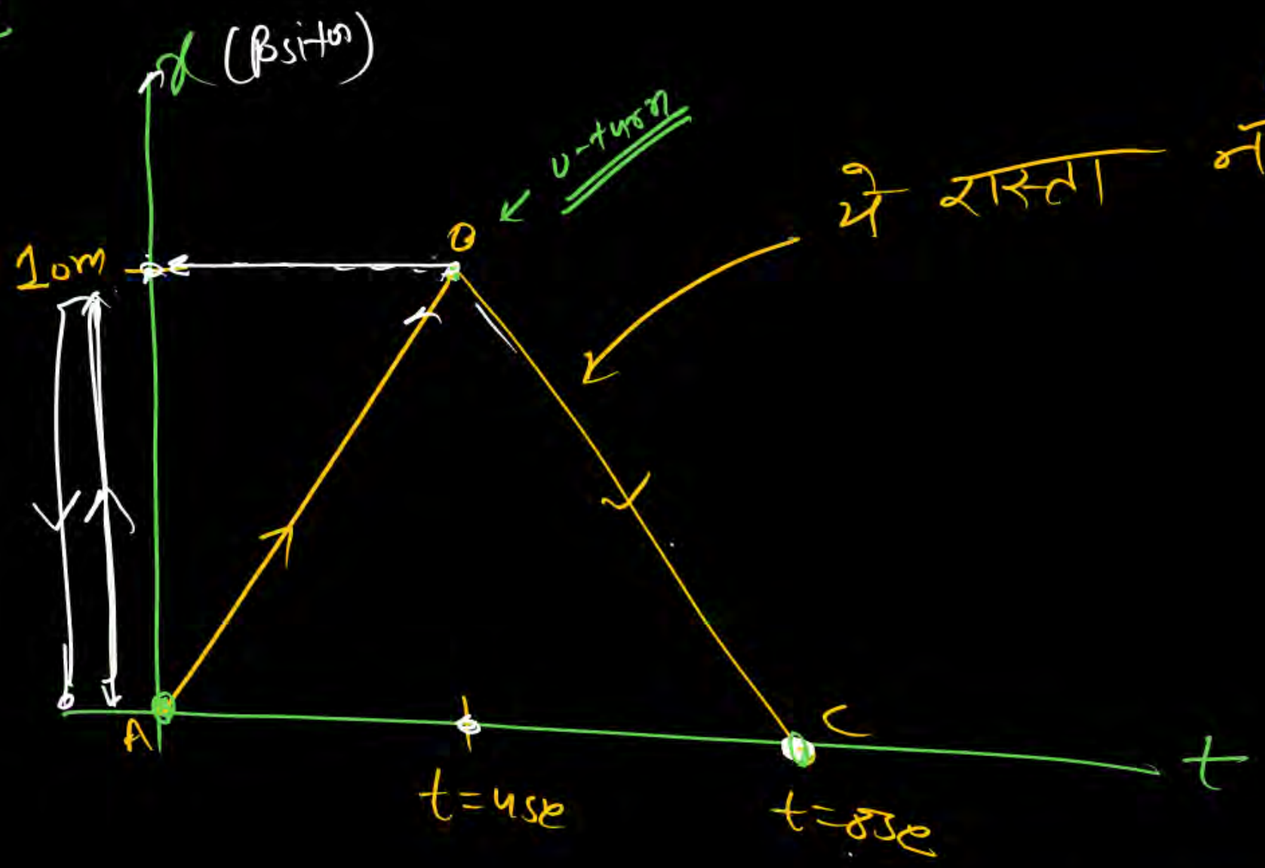
γ (1-D) move कर रहा है.

No-Uturn

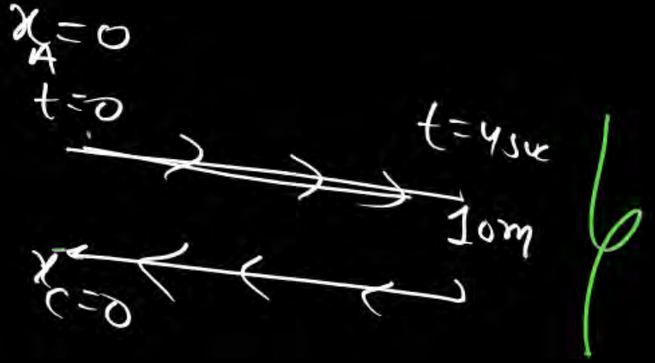
$|\text{dist}^n = \text{disp}^m|_{AB} = 20m$



लिखना है

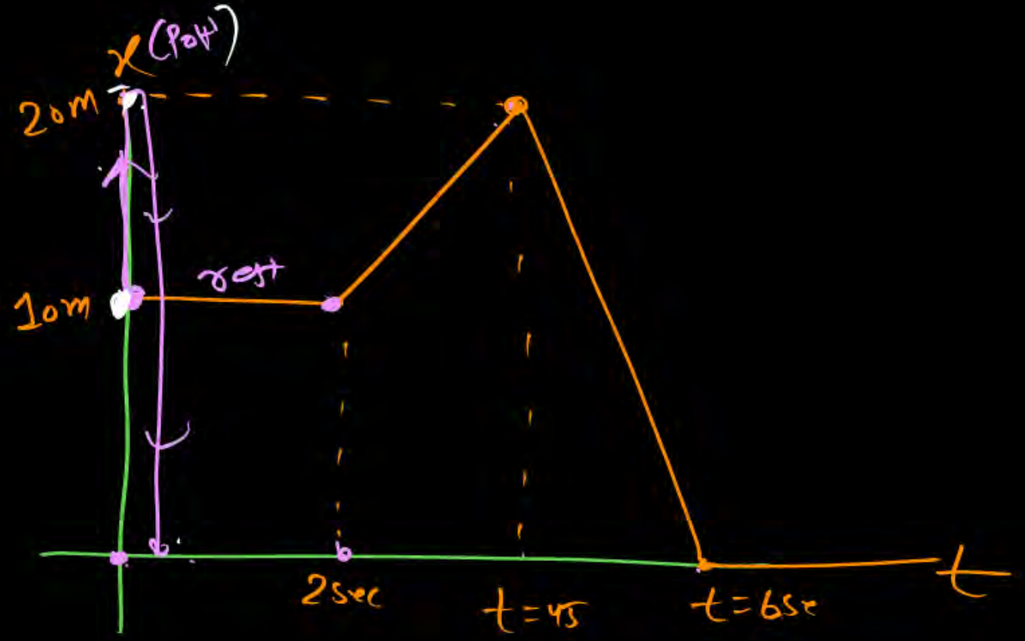


ये रास्ता नहीं है।

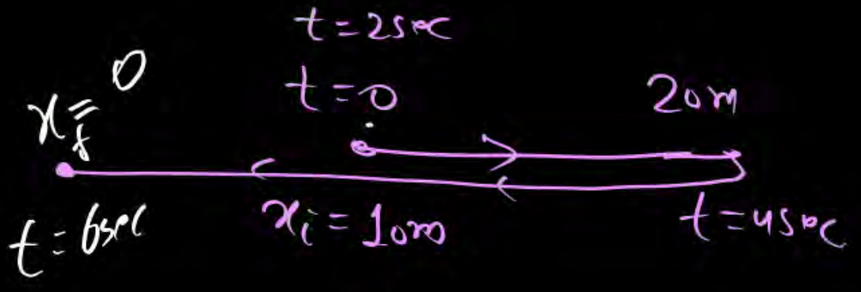


$dist^n = 2om$

$disp^m = 0$

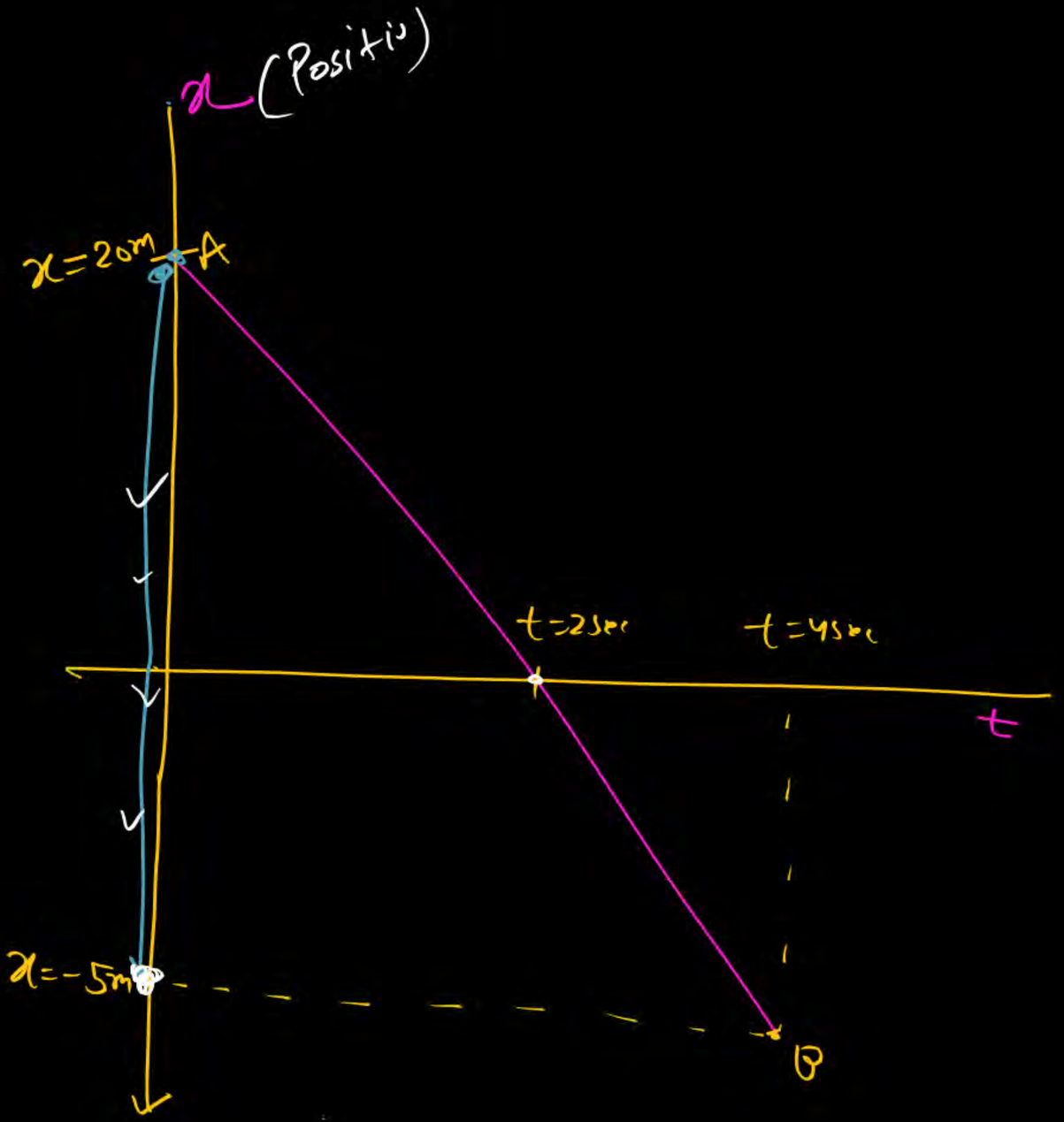


⇒ Totoal distⁿ = 30m



⇒ total dispᵐ = 0 − 10

= −10m.

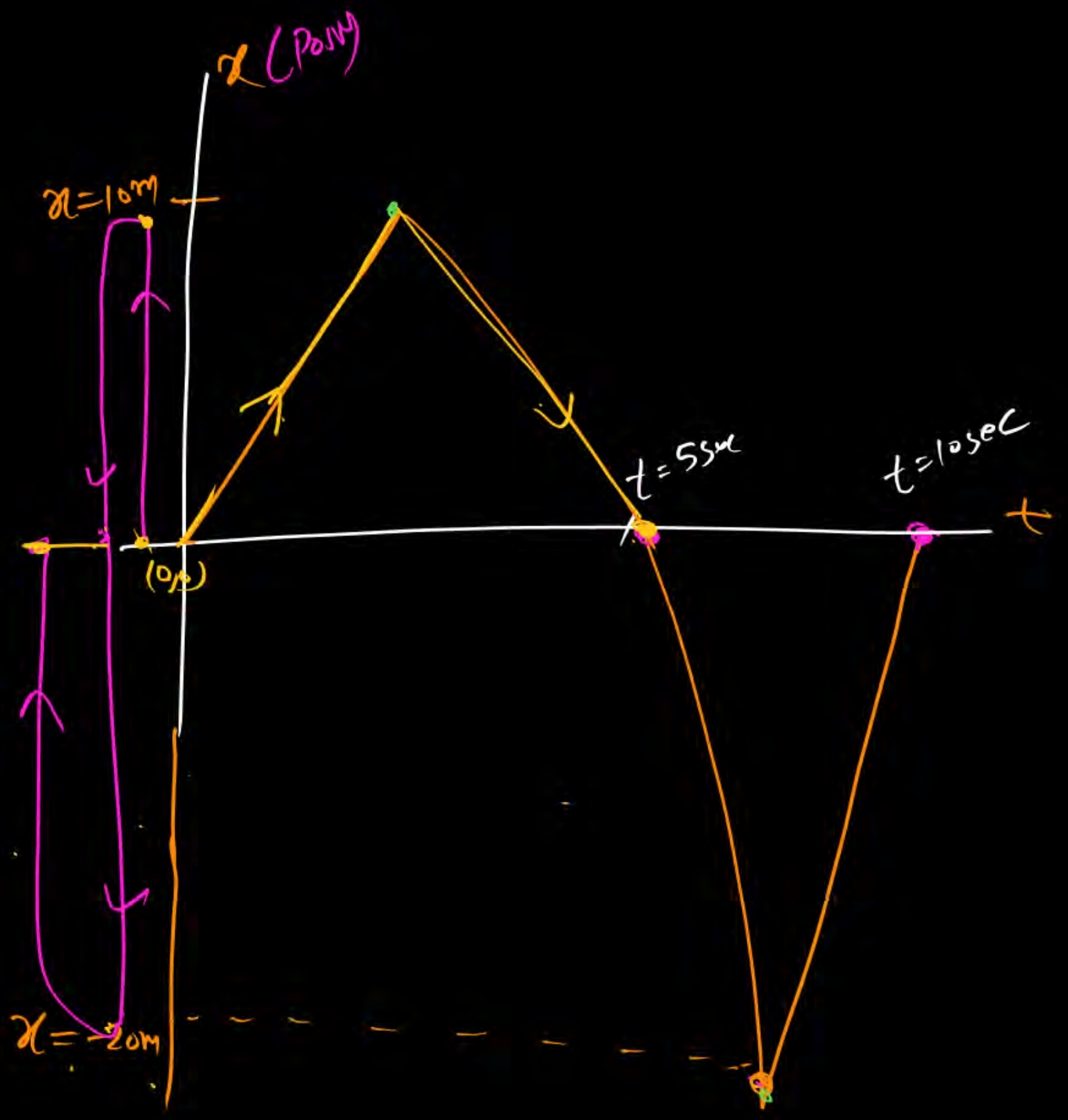


MRK → Graph Path Nahi hai but Position Jis - axis Par hai Woo Path hai ✓

Dist^n = 25m

Disp^n = −5 − (20)

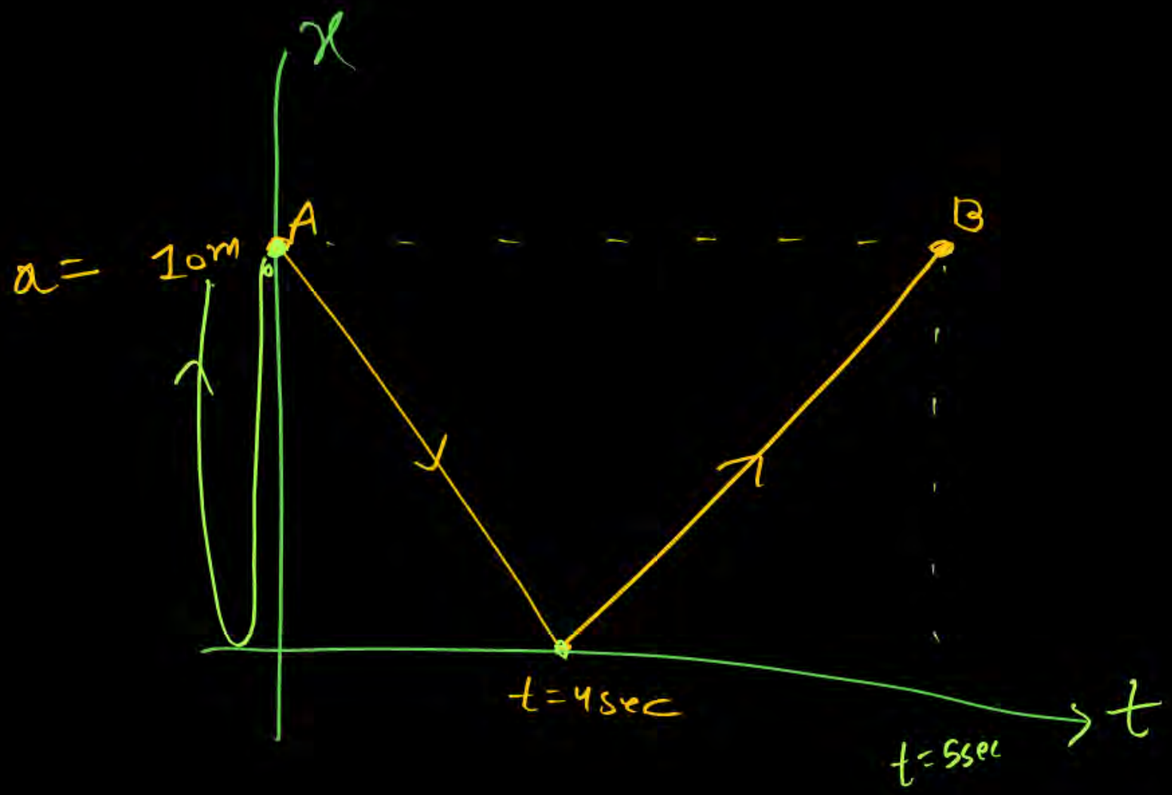
= −25m



$$\text{disp}^{m} \text{ in } 10\,\text{sec} = 0$$

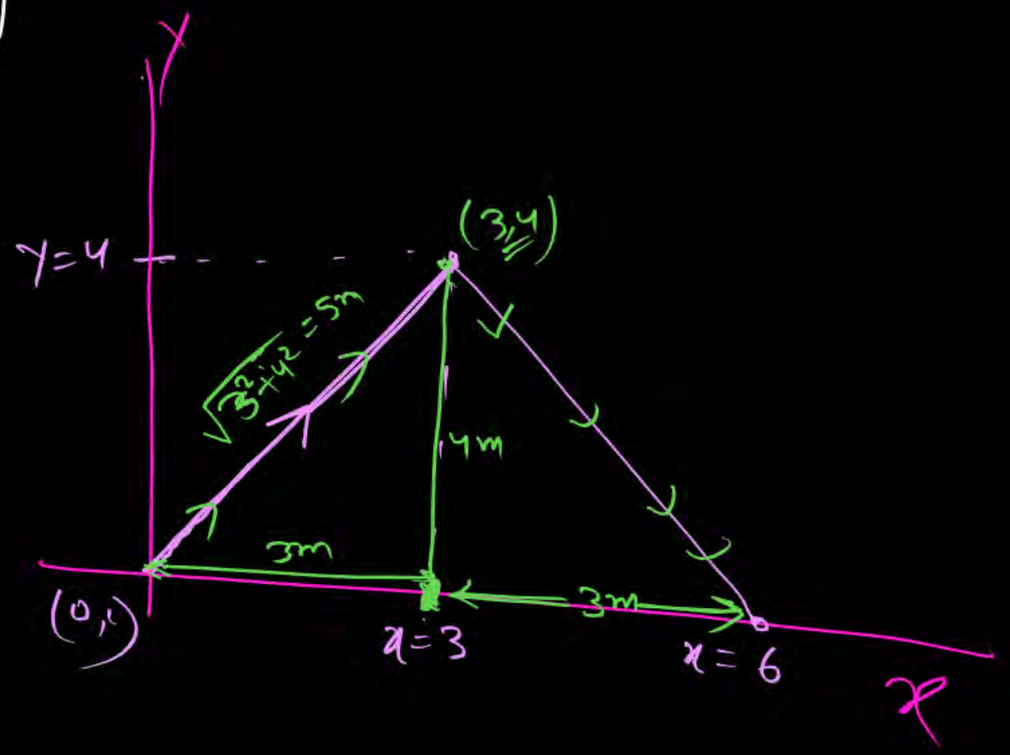
$$\text{distance in } 10\,\text{sec} = 60\,\text{m}$$

2 - Uturn



$$\left\{\begin{array}{l} \text{distance} = 20\,m \\ \text{displacement} = 0 \end{array}\right]$$

MR Scam



$|dist^n|_{AB} = 5+5 = 10m.$

$|disp^m|_{AB} = \vec{r_f} - \vec{r_i}$

$= (6\hat{i}+0\hat{j}) - (0,0)$

$= 6\hat{i}\ m$

(*) This graph is b/w y & x-axis (Y-x plane) यहाँ graph ki path hai

x & y दोनों Position के

My **girlfriend** said she needs some **Time** and **Distance**

Is **she** Calculating

gnst. speed ✗
or Avg. speed ✓
??

Time

gn time 't'

at time 't'

Avg. speed = $\frac{\text{Total dist}^n}{\text{total time}} = \frac{\Delta x}{\Delta t}$

Scalar

unit m/s

$\langle s \rangle = \frac{\text{total Path leng}^n}{\text{total time}}$

How fast Object is moving in an intaval does not know about instant.

gnst. speed = $\frac{dx}{dt}$

= Rate of Change in dist^n

⇒ How fast object is moving at an gnstant

Overs	Run
1	3
2	2
3	7
4	5
5	3

$$\text{Avg run Rate} = \frac{\text{Total Run}}{\text{total overs}}$$

$$= \frac{3+2+7+5+3}{5}$$

$$= \frac{20}{5} = 4 \text{ Run/Over}$$

MR*

Minimum Speed < Avg speed < Maximum Speed

$$\text{Avg speed} = \frac{\text{Total distance}}{\text{total time}}$$

$$\text{Avg velocity} = \frac{\text{Total disp}^{m}}{\text{total time}}$$

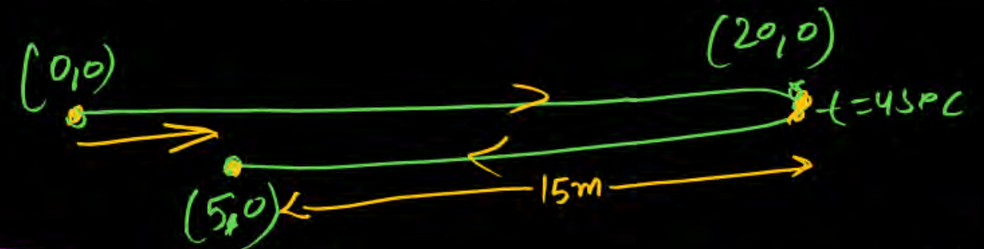
Expᵐ -1

Avg speed $= \frac{20}{4} = 5\text{m/s}$

Avg velocity $= \frac{20}{4} = 5\text{m/s}$

} No U-turn, No dirⁿ chaye

Ex-2



Avg speed $= \frac{20+15}{10} = \frac{35}{10} = 3.5\text{m/s}$

Avg velocity $= \frac{5}{10} = \frac{1}{2}\text{m/s}$

Ex-3

Avg speed $= \frac{10+10+20}{10} = \frac{40}{10} = 4\text{m/s}$

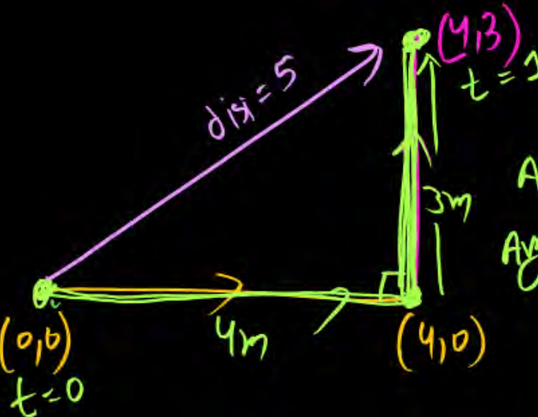
Avg velocity $= \frac{20}{10} = 2\text{m/s}$

No dirⁿ chaye
Avg speed = |Avg velocity|

dirⁿ is changing
Avg speed > |Avg velocity|

Avg speed ≥ |Avg velocity|

Ex-4

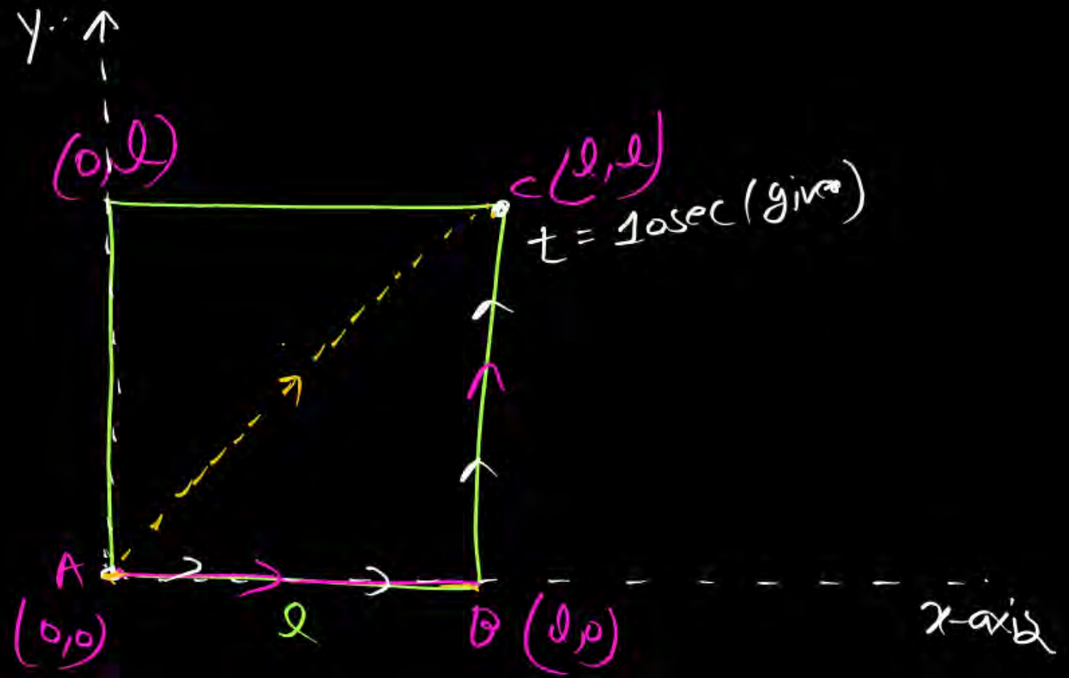


Avg speed $= \frac{7}{10} = 0.7\text{m}$

Avg velocity $= \frac{5}{10} = 0.5\text{m/s}$

#

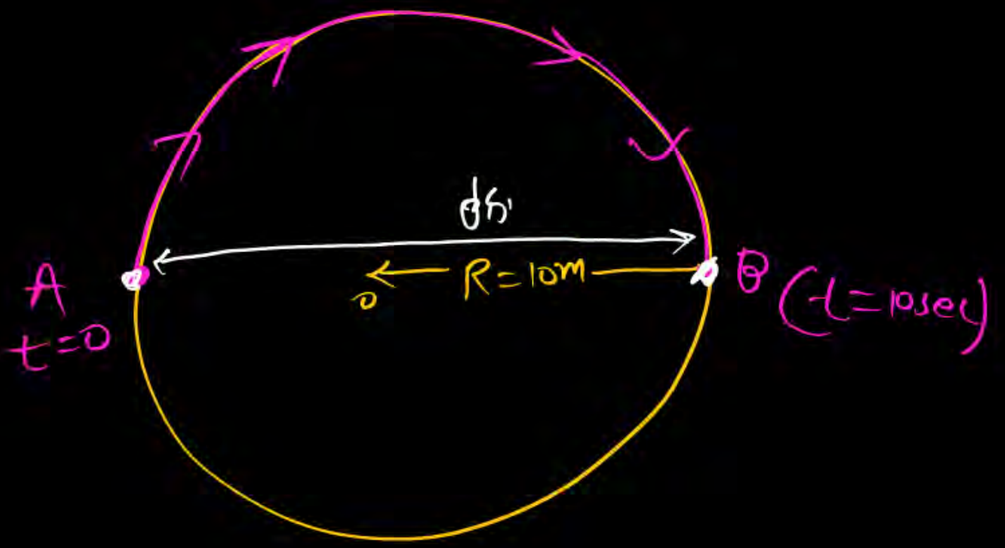
9



$$(\text{Avg speed})_{A\to C} = \frac{2l}{10}\ \text{m/s}$$

$$|\text{Avg velocity}|_{A\to C} = \frac{\sqrt{2}l}{10}\ \text{m/s}.$$

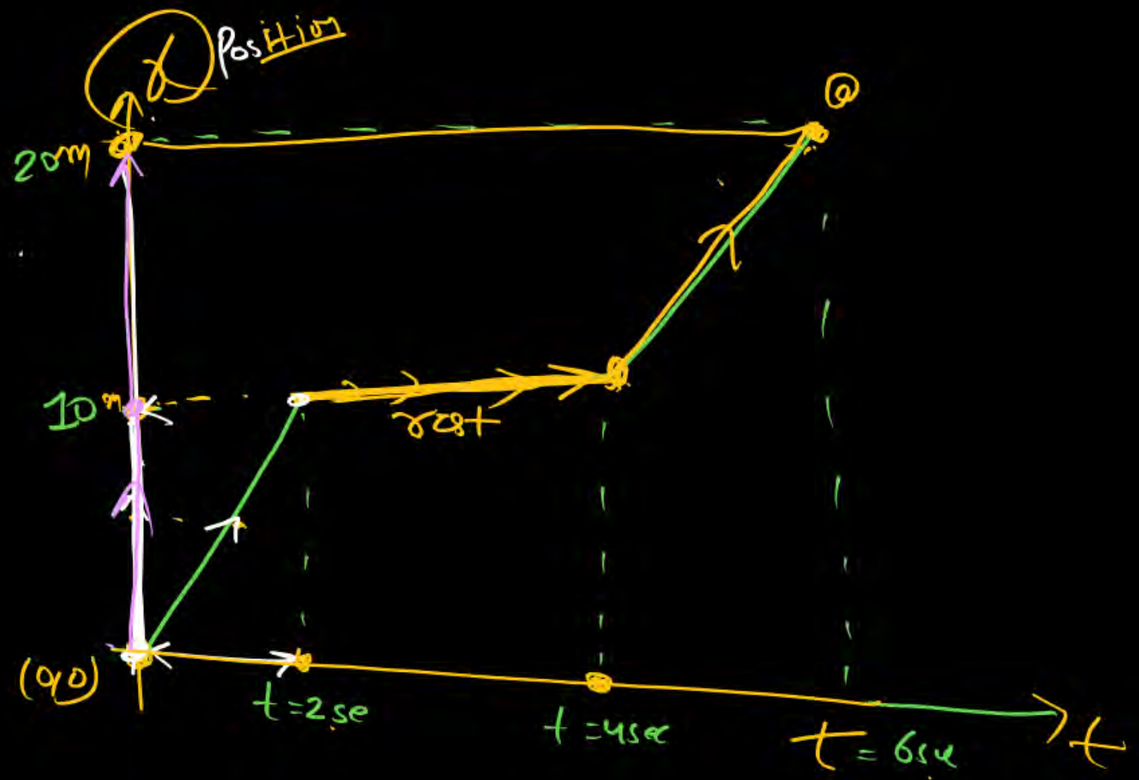
#



$$(\text{Avg speed})_{A\to B} = \frac{\pi R}{t} = \frac{\pi \times 10}{10} = \pi \text{ m/s} = 3.14 \text{ m/s}$$

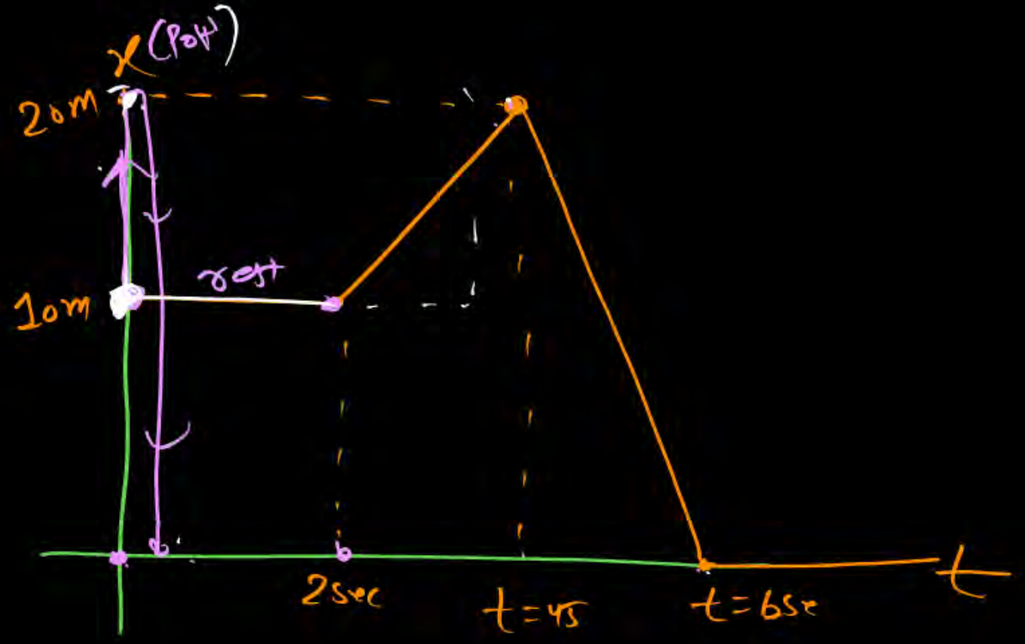
$$(\text{Avg velocity})_{A\to B} = \frac{2R}{10} = \frac{2\times 10}{10} = 2 \text{ m/s}$$

Feel



$$\left\{ \begin{array}{l} (\text{Avg speed})_{6\,\text{sec}} = \dfrac{20\,\text{m/s}}{6} \\ (\text{Avg velocity})_{6\,\text{sec}} = \dfrac{20\,\text{m/s}}{6} \end{array} \right\}$$

Q



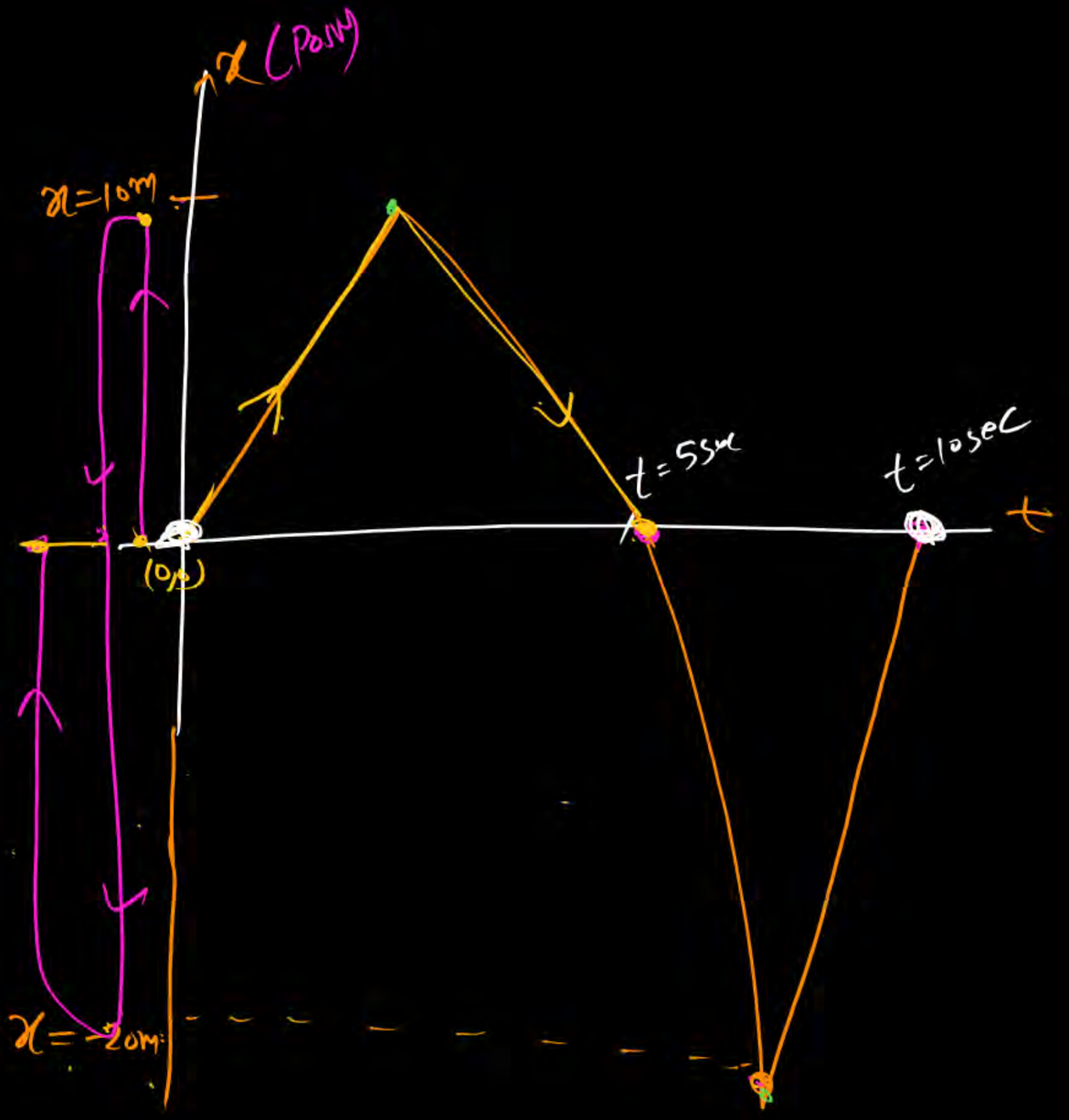
$$\left(\text{Avg speed}\right)_{\text{in 6sec}} = \frac{30}{6} = 5\,m/s$$

$$\left(\text{Avg velocity}\right)_{\text{in 6sec}} = \frac{-10}{6}\ m/s$$

Totatl distⁿ = 30m ✓

total dispᵐ = 0 − 10

= −10m.



disp^m in 10 sec $= 0$

distance in 10sec $= 60m$]

$$(\text{Avg speed})_{10\text{sec}} = \frac{60}{10} = 6\,m/s$$

$$(\text{Avg velocity})_{10\text{sec}} = 0$$

Ans

(8) Particle moves 10m in 2sec then in same dirⁿ moves 20m in 1sec then fig Avg speed, & velocity.

(#) Avg speed = Avg velocity $= \frac{30}{3} = 10\,m/s$

(a) Object moves with speed s_1 for time t_1 then moves with speed s_2 for time t_2 then find Avg. speed.

dist^n = speed x time

always valid for any type of motion

$$\text{Avg speed} = \frac{\text{total dist}^n}{\text{total time}}$$

$$= \frac{d_1 + d_2}{t_1 + t_2}$$

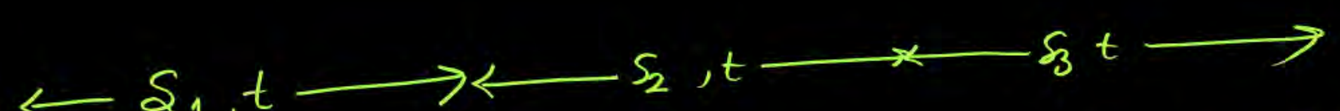
$$\text{Avg speed} = \frac{s_1 t_1 + s_2 t_2}{t_1 + t_2}$$

If $t_1 = t_2 = t$ (equal time interval)

$$\text{Avg speed} = \frac{s_1 \times t + s_2 t}{2t}$$

$$= \frac{t(s_1 + s_2)}{2t}$$

$$\text{Avg speed} = \frac{s_1 + s_2}{2}$$

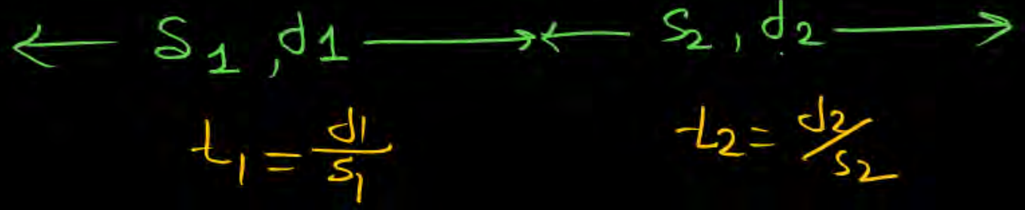


s_1, s_2 & s_3 are speed for 3- equal time intraval :-

* Avg speed $= \frac{s_1 + s_2 + s_3}{3}$

Imp

@ object moves with speed s_1 for dist^n d_1 & with s_2 for dist^n d_2 then find Avg speed. #



$t_1 = \frac{d_1}{s_1}$ $\quad$ $t_2 = \frac{d_2}{s_2}$

$d = s \times t$

$t = d/s$

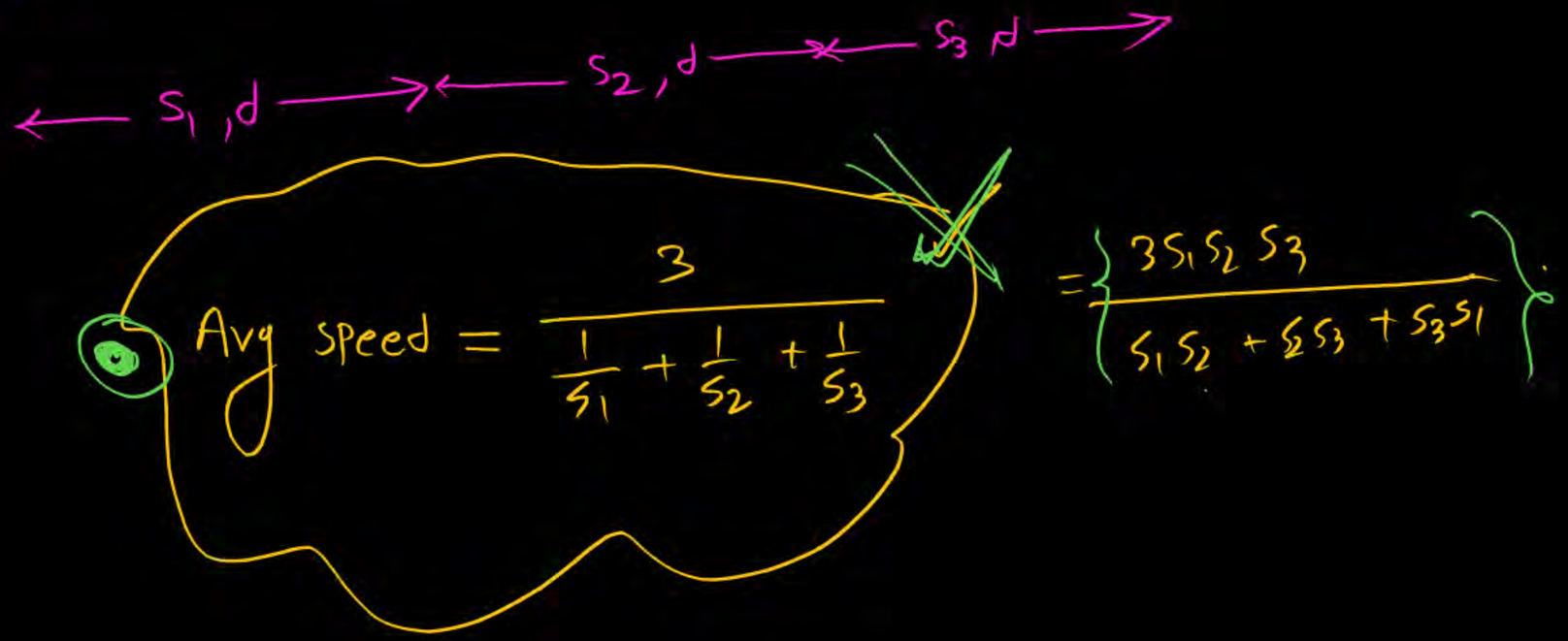
Avg speed $= \frac{d_1 + d_2}{\frac{d_1}{s_1} + \frac{d_2}{s_2}}$

if $d_1 = d_2 = d$ (Two equal distance in travel)

Avg speed $= \frac{2d}{d\left(\frac{1}{s_1} + \frac{1}{s_2}\right)} = \frac{2}{\frac{1}{s_1} + \frac{1}{s_2}}$

@ Avg speed $= \frac{2}{\frac{1}{s_1} + \frac{1}{s_2}} = \frac{2 s_1 s_2}{s_1 + s_2}$ #

If 3 equal distance intervals



Question

A vehicle travel half the distance with v and remaining half with $2v$ then average speed?

NEET-2013

1. $v/3$ (0.33v)
2. $4v/3$ (1.33 v)
3. $2v/3$ = 0.66 v
4. $3v/4$ (0.75 v)

use → mR^*

$S_{min} < S_{Avg\ speed} < S_{max}$

equal dist interval

$$S_{Avg} = \frac{2 \times v \times 2v}{v + 2v} = \frac{4v^2}{3v} v = \frac{4v}{3}$$

Question

A train has speed 60 km/hr for one hour and 40 km/hr for next half hour, then average speed

NEET

1. 50
2. 53.33
3. 48
4. 70

$$\text{Av speed} = \frac{d_1 + d_2}{t_1 + t_2}$$

$$= \frac{60 \times 1 + 40 \times \frac{1}{2}}{1 + \frac{1}{2}}$$

$$= \frac{60 + 20}{3/2} = \frac{80}{3/2}$$

$$= \frac{80 \times 2}{3}$$

$$= \frac{160}{3} = 53.3$$

Question

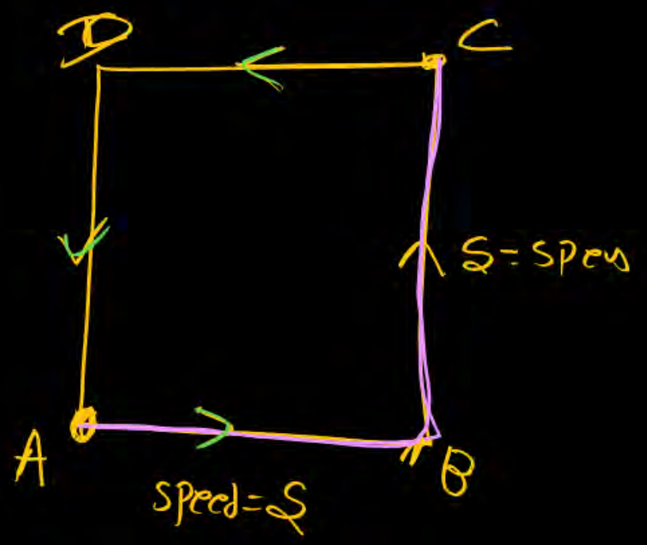
do not work

Object moves for 10s with speed 20 m/s and then it moves with speed 30 m/s for next 10 sec. Then find average speed for complete journey?

$$\text{Avg speed} = \frac{S_1 + S_2}{2} = \frac{20 + 30}{2}$$

$$= \frac{50}{2} = 25 \text{ m/s}$$

object is moving with speed 'S' on square of side ℓ then find Avg. speed and Avg velocity velocity. for given motion

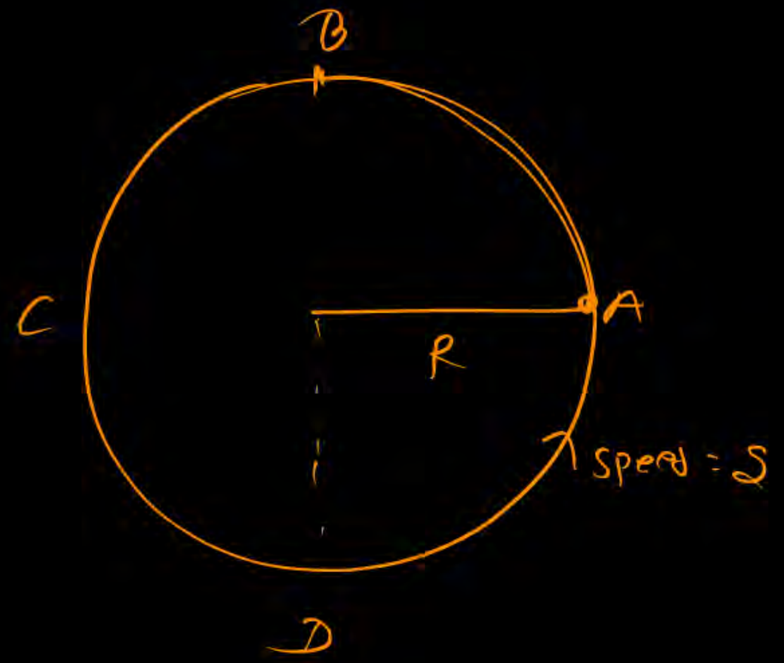


motion	time	(Avg speed)	Avg vel.
A → B	$t_1 = \ell/s$	$= \frac{\ell}{\ell/s} = s$	$\frac{\ell}{t_1}$
A → C	t_2 $2\ell/s$	$\frac{\sqrt{2}\ell}{\sqrt{2}\ell/s} = s$	$\frac{\sqrt{2}\ell}{t_2}$
A → D	$3\ell/s$	s	$t = \ell/t_3$
A → O	$4\ell/s$	s	

$$\text{Speed} = \frac{d}{t}$$

$$t = \frac{d}{\text{speed}}$$

11/20



Motion	time	Avg speed	Avg vel.
AB			
AC			
AD			
AA			

Question H/W

Object mass 10m with speed 20 m/s and then it moves with speed 30 m/s for 10 sec. Then find average speed for complete journey?

Question H/W

Object mass 20m with speed 20 m/s and then it moves with speed 30 m/s for 20m. Then find average speed for complete journey?

Question H/W

If object moves $\frac{2}{5}^{th}$ distance of journey with speed 10 m/s and remaining with 30 m/s then average speed will be :

Question H/W

A car travels from Kota to Jaipur with speed 30 km/h, and it returns along the same path with speed 60 km/h. Calculate average speed of the car.

Question H/W

A body covers first one-third of the distance with velocity 10 ms^{-1} in same direction, the second one-third with a velocity 20 ms^{-1} and last one-third with a velocity of 30 ms^{-1}. The average velocity of body is

1. 17.8 ms^{-1}
2. 16.4 ms^{-1}
3. 18.3 ms^{-1}
4. 20.2 ms^{-1}

Question

H/W

Object moves with v_1 for $t/3$ and with v_2 for $2t/3$ then find average speed.

Question

HW

A bus travels its half distance of journey with speed 5 m/s. It covers remaining distance in two equal time intervals with speed 15 m/s. Calculate average speed of the bus for the whole journey.

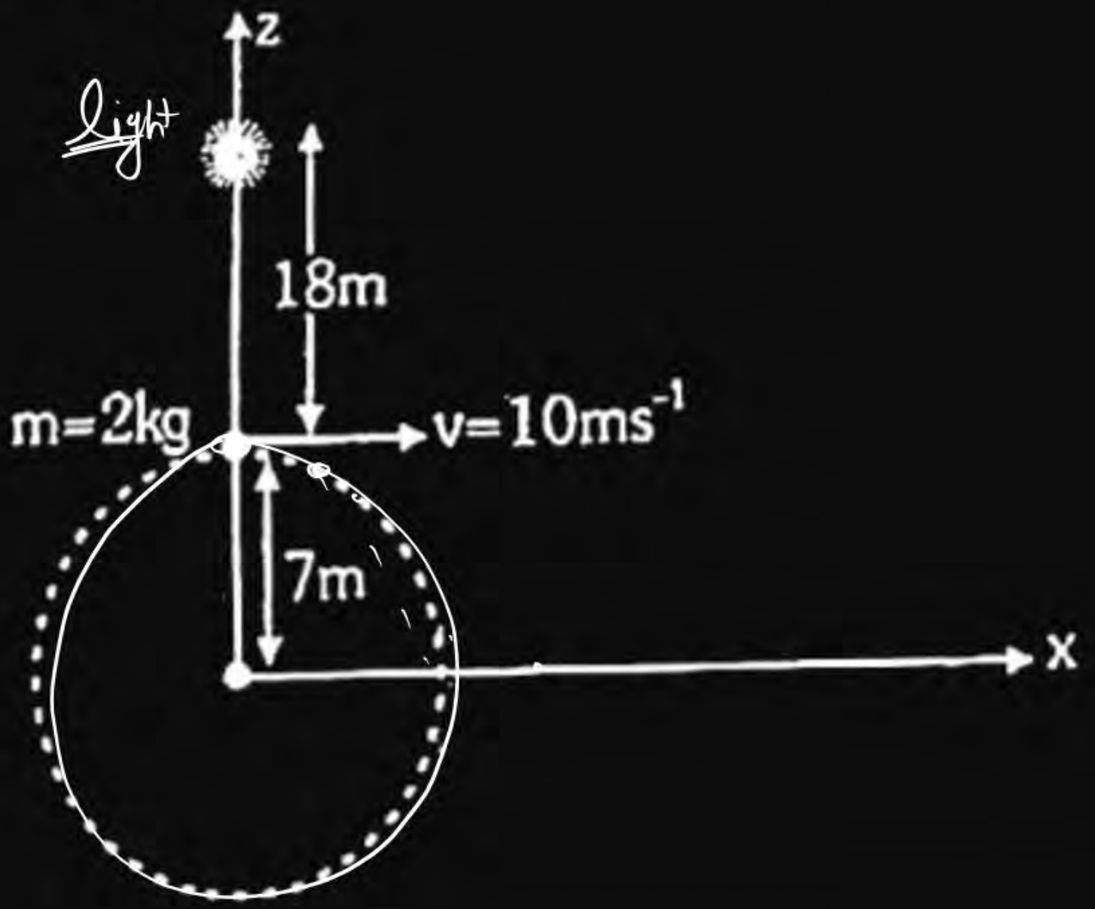
Question

MR* Q1

must try

A particle of mass m is moving with constant speed in a vertical circle in x-z plane. There is a small bulb at some distance on z-axis. The maximum distance of the shadow of the particle on x-axis from origin equal to

1. $\frac{175}{24}$ m
2. $\frac{125}{24}$ m
3. 25 m
4. 24 m



Question MRQ

A blind person after walking 10 steps in one direction, each of length 80 cm, turns randomly to the left or to the right by 90°. After walking a total of 40 steps the maximum possible displacement of the person from his starting position could be

1. 320 m
2. 32 m
3. $16/\sqrt{2}$ m
4. $16\sqrt{2}$ m

Question MRQ

A man starts from his house with uniform speed. After taking a few turns, he reaches his house. There are two ways to reach house:

(A) Take left turn after 4 min, again left turn after 3 min, again left turn after 6 min, one more left turn after 3 min, finally move 2 min to reach house.

(B) Take right turn after 3 min, left turn after 2 min, right turn after 3 min, again right turn after 1 min, again right turn after 6 min. Finally move 3 min to reach house.

All turns are at 90°. Which of the following is correct:

1. Distance travelled in (A) path is more than (B)
2. Distance travelled in (B) path is more than (A)
3. Distance travelled in (A) & (B) both path is same,
4. Insufficient information

THANK YOU