KINEMATICS

LECTURE - 02

fi.

⭐ Doubts of the Day

❖ Moksh (distance / displacement)

❖ Speed / Velocity

🍀 Instantaneous and Average velocity and speed

* Numerical's on speed velocity

How to cover backlog ??
* *

why extra lecture ??

time-table ? (6-7hr)

Books ?? → * Notes/DPP/
concept is clear ── Topic wise / PYQ
but question solve करने म
time लगता है।

जितना बड़ा **सपना** होगा
उतनी बड़ी **तकलीफें** होगी
और जितनी बड़ी **तकलीफें** होगी
उतनी बड़ी **कामयाबी** होगी.

$\checkmark$ Vertically Upward $\checkmark$

$$|disp^n| = \sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2}$$

$$|disp^n|_{min^m} \text{ or}$$
$$\text{shortest dist}^b$$
$$\text{b/w to point}$$

$y = e^x \times \ln x$

$$\boxed{\ln x = \log x}^{**}$$

$\left(derivative \right) \implies$ differentiation.

⊕ Rectilinear motion

How $disp^m$ is $+ve$ / but distance is only
$\rightarrow -ve$ $+ve$

$(disp^m)_1 = +5km$

$disp^m_2 = -5km$

$\rightarrow dir^n$

$-ve$

$-5km$

P.W office.

$+ve$

$direction$

$disp^m = 5km$ (east)

Ram W

$d = 5km$ $\rightarrow$ Comp^t or Incomplete.

$\rightarrow dist^n$ (Path length)

$\rightarrow$ number

If Distance = 0

then correct statement is:-

(1) ❖ Object may be at rest $\quad$ (F ✗) Wrong

(2) ❖ Object must be at rest $\quad$ (T ✓) correct

If Displacement = 0

then correct statement is:-

(1) ❖ Object must be at rest $\quad$ (F)

(2) ❖ Object may be at rest $\quad$ (T)

$$x_i = x_f$$

Case-1

object is at rest

Fill the box for Distance and Displacement

# Displacement	[A] ?	[B] ?	Displacement of object is zero	Displacement of object is not zero
# Distance	Distance is zero	Distance is not zero	[C] ?	[D] ?

[A] → disp^m must be zero if distance is zero

[B] → disp^m may be zero or may not be zero.

[C] → may or may not be zero

[D] → must be non zero

$$Speed = \frac{10 \, Km/hr}{= 20 \, Km/hr}$$
$$= \frac{0}{15h}$$

$$V = \frac{120 \, K.}{200 \, K/hr}$$
$$= 100 \, Kmh$$

Over	1	2	3	4
Run	8	2	6	4

Avg Run Rate = 5 run/ovr

RAMLAL

KALIPUR

200 km

(t = 4hr)

DELHI

Avg. Speed = $\dfrac{total \; dist^n}{total \; time} = \dfrac{200 \, Km}{4 \, hr}$

$$= 50 \, Km/hr$$

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$\boxed{A} \rightarrow \cancel{x} 2 \text{ om/s}$ ⃝

$\uparrow 2 \text{ om/s (upws)}$

$\underleftarrow{\quad} \boxed{B}$

-2 om/s

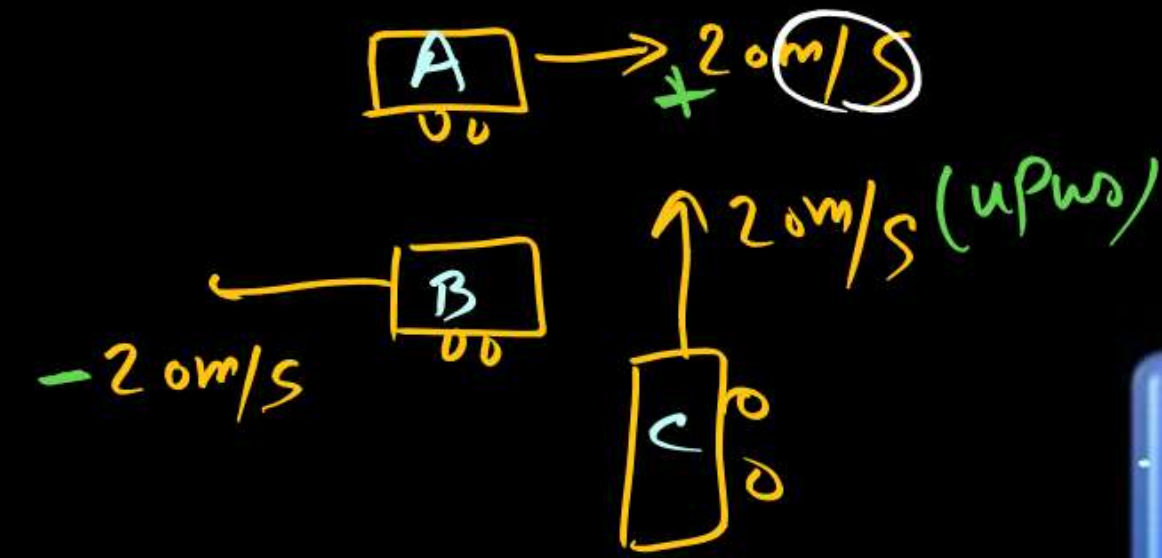$\boxed{C} \begin{smallmatrix} o \\ o \end{smallmatrix}$

\# $\underline{\text{Slope}} = (\tan\theta) = \text{diff}^n = \dfrac{dx}{dt} = \text{Inst. speed}$

$\text{dist}^n = x$

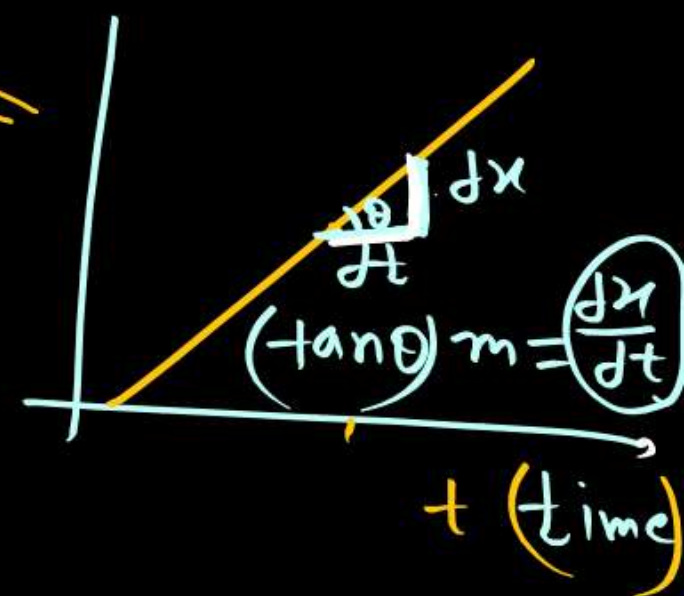## SPEED (How Fast)

\# speed does not have direction

\# speed is a scalar

\# unit $\boxed{m/s}$

$(\text{In inst} \cdots)$

(at an instant)

$\dfrac{dx}{dt}$

$(\tan\theta) \, m = \dfrac{dx}{dt}$

$t \text{ (time)}$

In time 't'

⃝ $\text{Avg. Speed} = \dfrac{\text{Total Distance}}{\text{Total Time}}$

At time 't'

$\text{Instantaneous Speed} = \dfrac{dx}{dt}$

$\boxed{\text{Avg speed} = \dfrac{(\Delta x)}{\Delta t}}$

* $\rightarrow$ No differntian.

$\boxed{\text{Inst. speed}} = \dfrac{d\boxed{x}}{dt} = $ The Rate of change in $\boxed{\text{dist}^n}$ w.r.t. time.

differentiation

$\rightarrow$ Slope of dist^n-time graph is speed.

vector = magnitud/dir^n

→ direction of velocity along disp^n (on the diretion of motion)

VELOCITY
(How Fast / Where)

"instant"

(in travel)

(In time 't') Disp^m

Avg. Velocity = $\dfrac{\text{Total Distance}}{\text{Total Time}}$

At time 't'

Instantaneous Velocity = $\left(\dfrac{dx}{dt}\right)$ = The Rate of change in disp^n w.r.t. time.

Avg velocity = $\dfrac{x_f - x_i}{\Delta t}$

= $\dfrac{\text{total change in Position}}{\text{total time}}$

↳ diff^n of Position/disp^m w.r.t time

↳ slope of disp^m/time graph

**Inst. velocity** $=$ Inst. speed $\times$ direction

⤷⟹ Always correct
→ because at an instant distance and
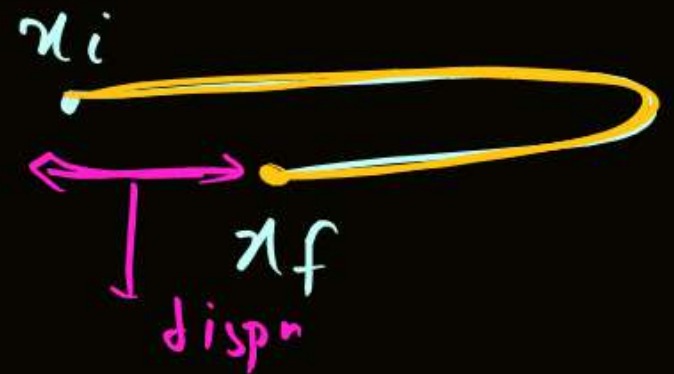displacement will be same.
→ direction can't change at an instant

x_i

Avg. Velocity $=$ Avg. speed $\times$ direction.

⤷ on an intraval there may be cange in direction.

x_f
dispⁿ

• Object is moving without change in directⁿ $\Rightarrow$ Avg speed $= |$Avg. velocity$|$
• Object is moving with change in direction   Avg speed $>$ Avg velocity

| Average Velocity | = Avg Speed

→ gt is correct only if direction is not changing.

Speed always +ve
  → 20 m/s
  → 30 m/s

velocity max be +ve or −ve

velocity = 10 m/s east

| Inst. Velocity | = Ins. Speed

→ always correct

| Avg velocity | ≤ Avg speed

→ always corr.

Q) A object is moving with constant velocity then what about speed ?

(Velocity = How Fast/where)

$\Rightarrow$ velocity = How fast /where

velocity = speed · direction

Cos^n

same velocity
Uniform velocity
or Constant velocity
both are same

Ans $\rightarrow$ (speed must be Constant)

जब Avg/Inst. given ना हो सिर्फ velocity लिखा हो तो

हम $\rightarrow$ Instantaneous

Consider कर्ता

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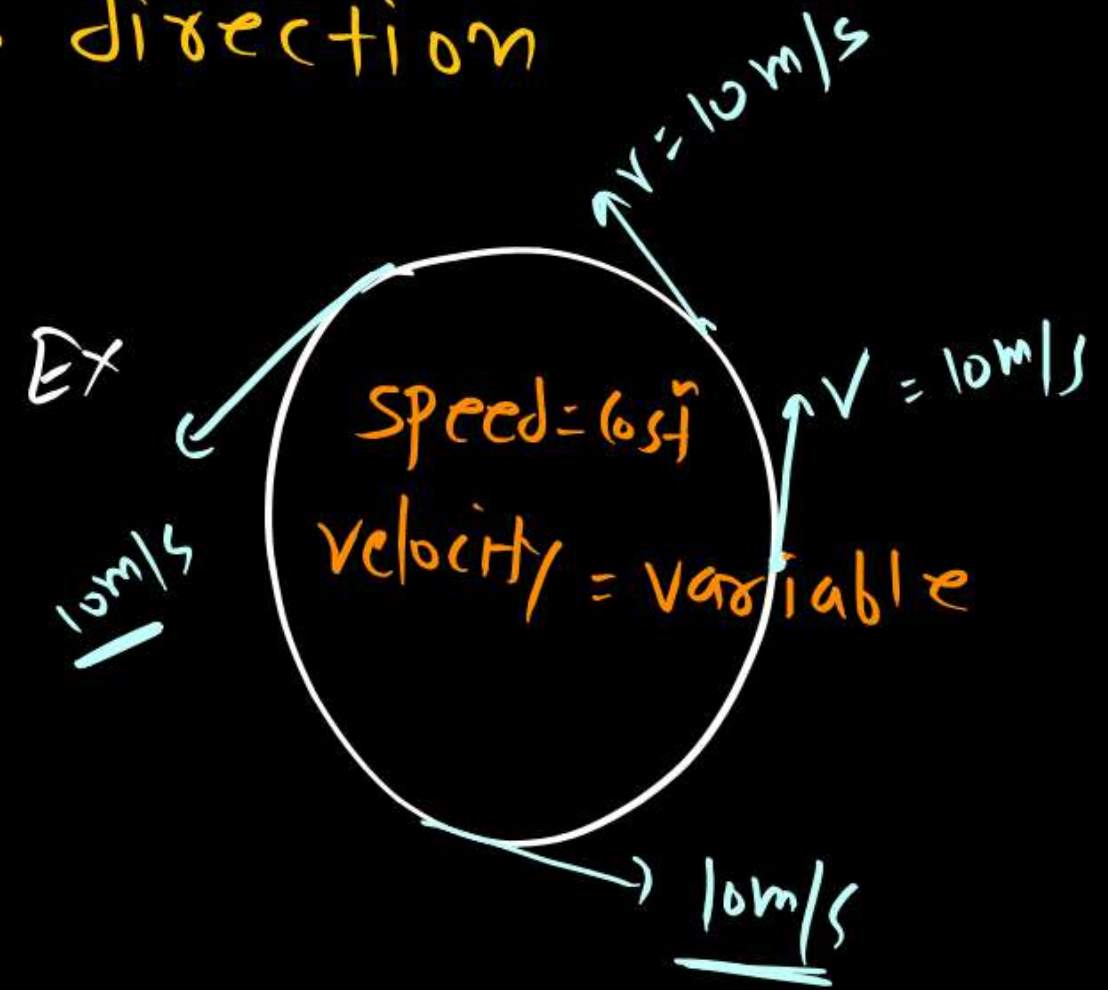Sol^n Information about direction is not given
          direction may be const^n or variable

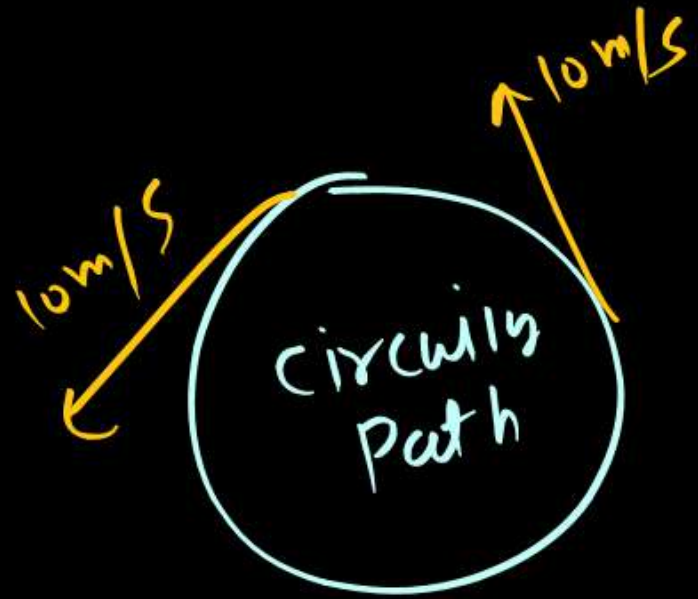$$Velocity = speed \cdot direction$$

(1) velocity must be const^n $\left(F\right)$

(2) velocity may cost^n $\left(T\right)$

EX

$v = 10$ m/s

$v = 10$ m/s

10 m/s

speed = 6s^n

velocity = variable

10 m/s

If object is moving with variable then what about Speed ?

velocity

10 m/s

10 m/s

circular path

Velocity = speed • direction

(A) speed may be variable (T)

(B) speed must be variable (F)
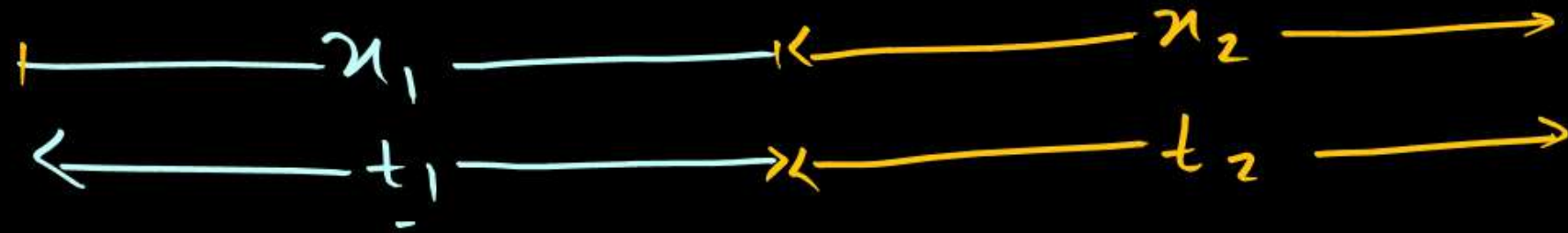
If object is moving with $\boxed{\text{variable speed}}$ then then what about velocity

Ans $\rightarrow$ (A) velocity must be variable (T)

$\longrightarrow 10 \text{m/s} \qquad \longrightarrow 15 \text{m/s} \qquad \longrightarrow 20 \text{m/s}$

Object is moving on a straight line without change in direction moves x_1 distance in time t_1 & x_2 distance in time t_2 then average speed & average velocity is

$$\text{Avg speed} = \left| \text{Avg velocity} \right| = \frac{\text{total dist}^n}{\text{total time}}$$

$$\boxed{\text{Avg. speed} = \frac{x_1 + x_2}{t_1 + t_2}}$$

Object moves with speed V_1 for time t_1 and with speed V_2 for time t_2 then find Average Speed.

$$A \overset{Let (x_1)}{\underset{t_1, V_1}{\longleftarrow}} B \overset{Let (x_2)}{\underset{V_2, t_2}{\longrightarrow}} C$$

$$\left|Avg\ speed\right| = \frac{total\ dist^n}{total\ time} = \frac{x_1 + x_2}{t_1 + t_2}$$

Comp^t Journey

$$Speed = \frac{dist^n}{time}$$

$$x_1 = V_1 t_1$$

$$x_2 = V_2 t_2$$

$$S_{Avg\ speed} = \frac{V_1 t_1 + V_2 t_2}{t_1 + t_2}$$

gf time intraval $t_1 = t_2 = t$

$$Avg\ speed = \frac{V_1 + V_2}{2} \longrightarrow Ratta$$

#

Object moves X_1 distance with speed V_1 & X_2 distance with speed V_2 then Average Speed of the total Journey.

$$S = \frac{d}{t}$$

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

time (t_1) let   let (t_2)

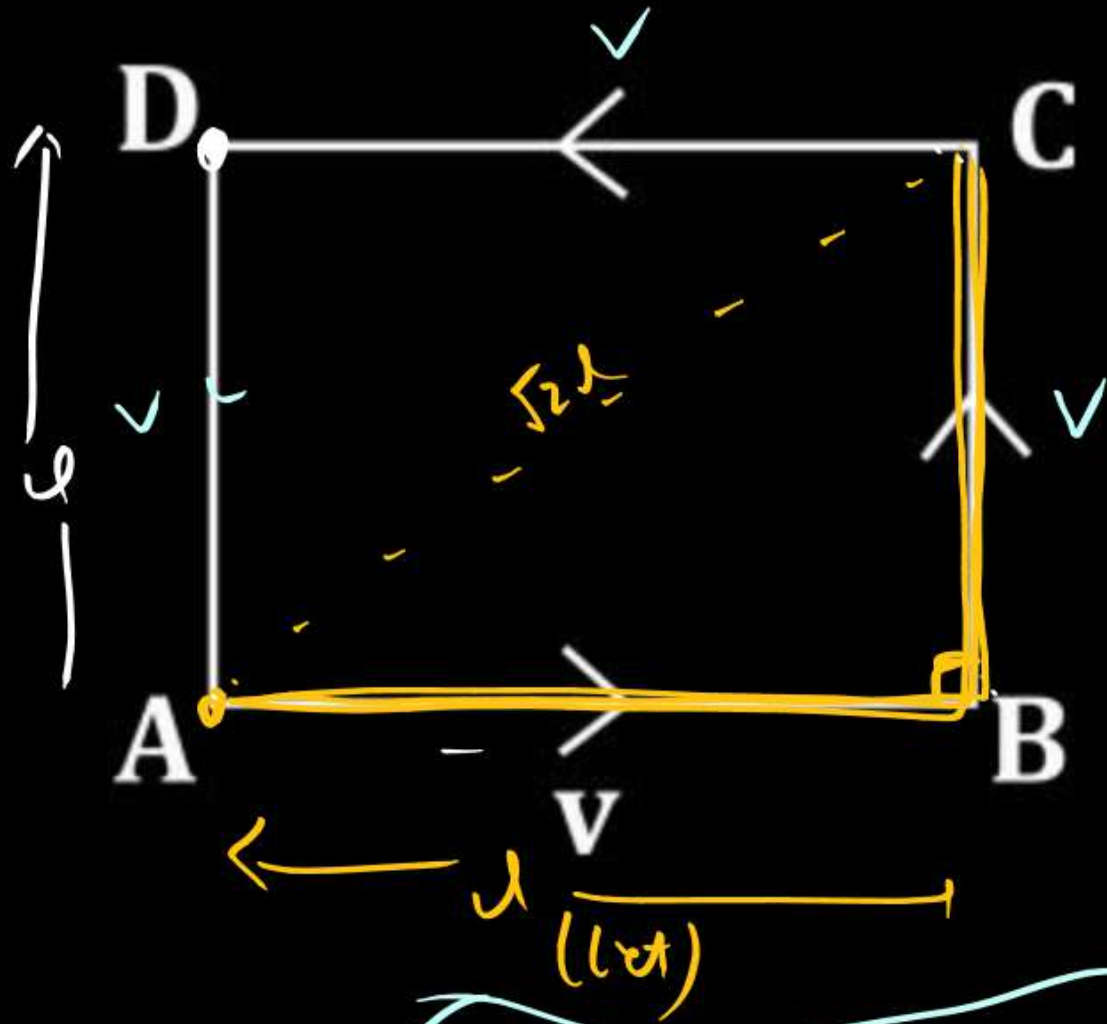A ←——————— x_1, V_1 ——————→ B ——————— x_2, V_2 ——————→ C

$$\text{Avg speed} = \frac{x_1 + x_2}{t_1 + t_2} = \boxed{\frac{x_1 + x_2}{\frac{x_1}{V_1} + \frac{x_2}{V_2}}}$$

If $x_1 = x_2 = x$ (dist^n are same)

$$\text{Avg speed} = \frac{2x}{x\left(\frac{1}{V_1} + \frac{1}{V_2}\right)} = \frac{2V_1 V_2}{V_1 + V_2} \rightarrow \text{Rate}$$

Object is moving with constant speed on square ~~trake~~ then find Average Velocity. Path

Motion	Avg. Speed	Avg. Velocity
A→B	✓	$\frac{\ell}{\ell/v} = v$
A→C	✓	$\frac{\sqrt{2}\ell}{time} = \frac{\sqrt{2}\ell}{\left(\frac{2\ell}{v}\right)} = \frac{\sqrt{2}v}{2} = v/\sqrt{2}$
A→D	✓	$\frac{\ell}{time} = \frac{\ell}{\frac{3\ell}{v}} = \boxed{v/3}$
A→A	✓	0

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

$\sqrt{2}\ell$

ℓ (let)

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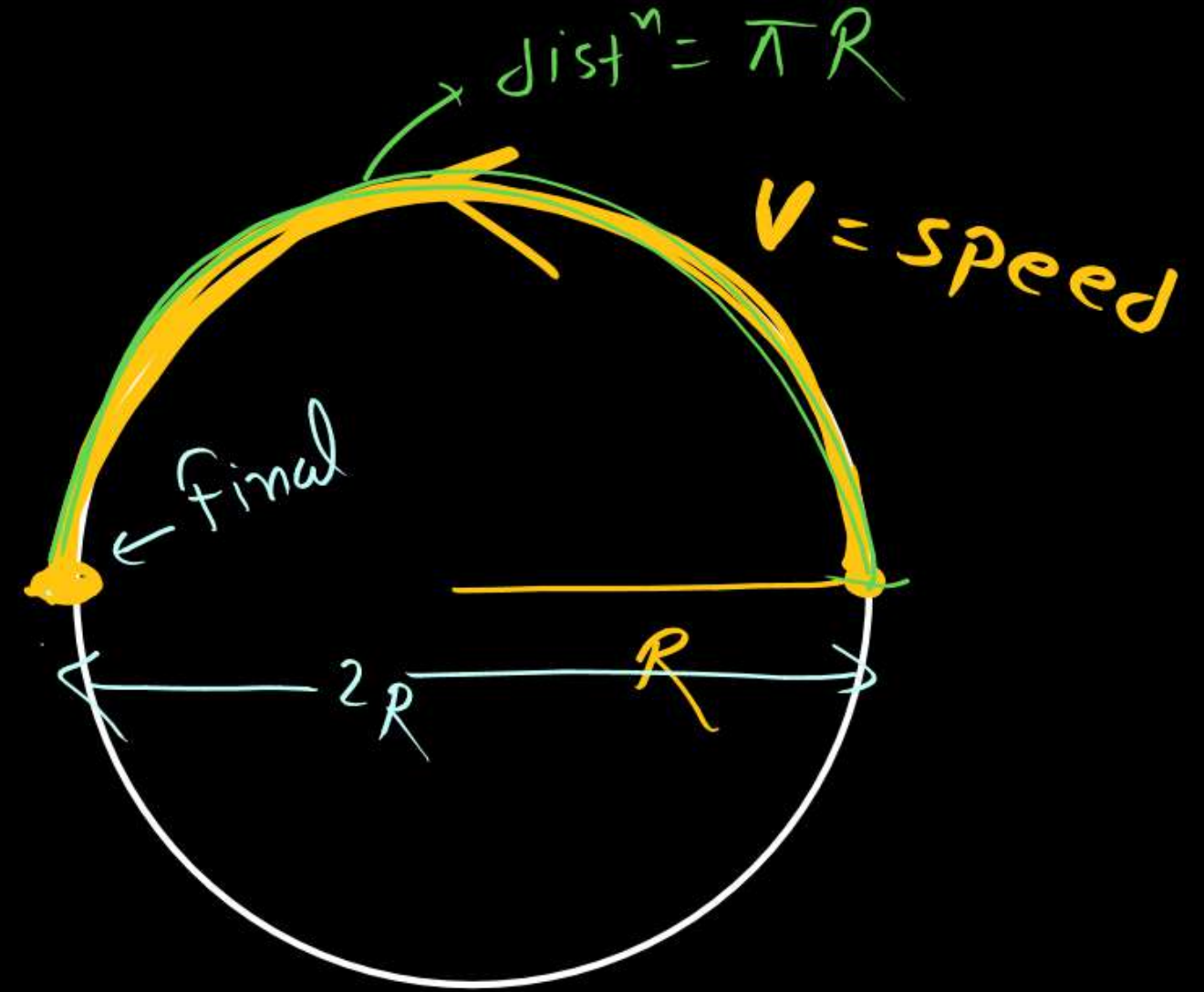**Object is moving on circular path with constant speed then find Average Velocity when it completed half revolution.**

Avg velocity = $\dfrac{\text{total disp}^n}{\text{total time}}$

$= \dfrac{2R}{\dfrac{\pi R}{V}} = \boxed{\dfrac{2V}{\pi}}$

$\underline{Ans}$

$\boxed{\text{total time} = \dfrac{\text{dist}^n}{\text{speed}}}$

dist^n = πR

V = speed

← final

2R

R

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thanks
for watching