REST AND MOTION

DISTANCE

- The length of the actual path traversed by the particle is termed as its distance.
- Distance = S = length of path ACB.
- Scalar quantity and is measured in meter. It can never decrease with time.

DISPLACEMENT

- The change in position vector of the particle for a given time interval is known as its displacement.
- Displacement = B – A
- It can decrease with time. Vector quantity and is measured in meter.

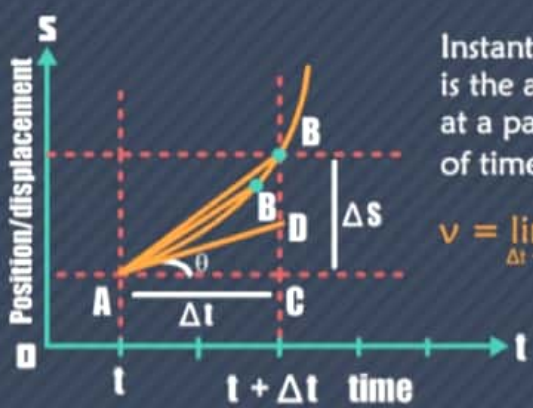
AVERAGE VELOCITY

$$\text{Average Velocity } (\vec{v}_{av}) = \frac{\text{Total Displacement}}{\text{Total Time Taken}} = \frac{\vec{B} - \vec{A}}{t}$$

AVERAGE SPEED

$$\text{Average Speed}(v_{av}) = \frac{\text{Total Distance Travelled}}{\text{Total Time Taken}} = \frac{S}{t}$$

INSTANTANEOUS VELOCITY



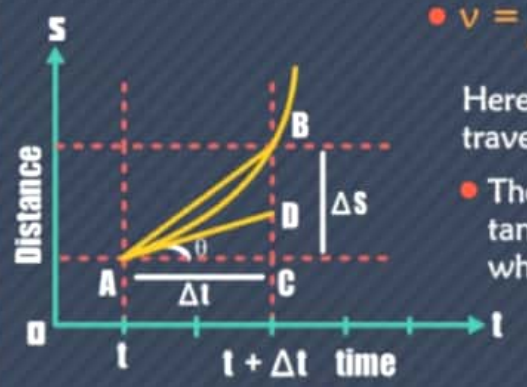
Instantaneous velocity is the average velocity at a particular instant of time.

$$v = \lim_{\Delta t \to 0} \frac{\Delta r}{\Delta t} = \frac{dr}{dt}$$

INSTANTANEOUS SPEED

- The instantaneous speed is the speed at a particular instant of time.

$$v = \lim_{\Delta t \to 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}$$



Here Δs is the distance travelled in time Δt.

- The slope of the tangent equal ds/dt, which is equal to the instantaneous speed at 't'.

$$v = \tan(\theta) = \frac{DC}{AC} = \frac{ds}{dt}$$

EQUATIONS OF MOTION

1. $v = u + at$
2. $v^2 - u^2 = 2as$
3. $s = ut + \frac{1}{2}at^2$
4. $s_{nth} = u + \frac{a}{2}(2n - 1)$

ACCELERATION

When the velocity of a moving object/particle changes with time, we can say that it is accelerated.

Average Acceleration

$$a_{av} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1} = \frac{\Delta\vec{v}}{\Delta t}$$

Instantaneous Acceleration

$$\vec{a} = \lim_{\Delta t \to 0} \vec{a}_{av} = \frac{d\vec{v}}{dt}$$

REACTION TIME

It's the difference between the time when one see a situation to the time when one acts.

Reaction Time $\Delta t = t_1 - t_0$