Instantaneous Velocity

- This quantity tells us how fast it moves at different instants of time
- We call it Instantaneous velocity or simply velocity ‘v’ at an Instant ‘t’
- The velocity at an instant is defined as the limit of the average velocity as the time interval approaches zero

$$v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$$

$$= \frac{dx}{dt}$$

It is the rate of change of position with respect to time

Acceleration

The Velocity of an object changes during its course of Motion - How to describe this change?

Acceleration

It is defined as the rate of change of velocity with time

The average acceleration $\bar{a}$ over a time interval is defined as the change of velocity divided by the time interval :

$$\bar{a} = \frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta v}{\Delta t} \qquad (3.4)$$

where v_2 and v_1 are the instantaneous velocities or simply velocities at time t_2 and t_1. It is the average change of velocity per unit time. The SI unit of acceleration is m s^{-2} .

Instantaneous Acceleration

It is the limiting value of the Average Acceleration as time interval becomes zero

$$a = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t} = \frac{dv}{dt}$$