2.RECILINEAR MOTION

Average Velocity (in an interval) :

$$v_{av} = \bar{} = \langle v \rangle = \frac{\text{Total displacement}}{\text{Total time taken}} = \frac{\vec{r}_f - \vec{r}_i}{\Delta t}$$

Average Speed (in an interval)

$$\text{Average Speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

Instantaneous Velocity (at an instant) :

$$v_{inst} = \lim_{\Delta t \to 0} \frac{\Delta r}{\Delta t}$$

Average acceleration (in an interval):

$$= \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t}$$

Instantaneous Acceleration (at an instant):

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

Graphs in Uniformly Accelerated Motion along a straight line (a 0)

x is a quadratic polynomial in terms of t. Hence x – t graph is a parabola.

x-t graph

v is a linear polynomial in terms of t. Hence v–t graph is a straight line of slope a.

v-t graph

a–t graph is a horizontal line because a is constant.

a-t graph

Maxima & Minima

$\frac{dy}{dx} = 0$ & $\frac{d}{dx}\left(\frac{dy}{dx}\right) < 0$ at maximum and $\frac{dy}{dx} = 0$ & $\frac{d}{dx}\left(\frac{dy}{dx}\right) > 0$ at minima.

Equations of Motion (for constant acceleration)

(a) $v = u + at$

(b) $s = ut + \frac{1}{2}at^2$ $s = vt - \frac{1}{2}at^2$ $x_{n} = x_0 + ut + \frac{1}{2}at^2$

(c) $v^2 = u^2 + 2as$

(d) $s = \frac{(u+v)}{2}t$

(e) $s_n = u + \frac{a}{2}(2n - 1)$

For freely falling bodies : (u = 0)

(taking upward direction as positive)

(a) $v = gt$

(b) $s = \frac{1}{2}gt^2$ $s = vt + \frac{1}{2}gt^2$ $h_n = h - \frac{1}{2}gt^2$

(c) $v^2 = 2gs$

(d) $s_n = \frac{g}{2}(2n - 1)$