

2.RECILINEAR MOTION

Average Velocity (in an interval) :

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

Average Speed (in an interval)

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

Instantaneous Velocity (at an instant) :

$$\vec{v}_{inst} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t}$$

Average acceleration (in an interval):

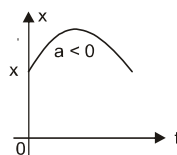
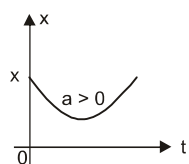
$$= \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t}$$

Instantaneous Acceleration (at an instant):

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

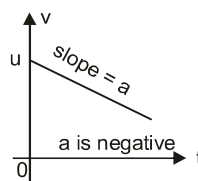
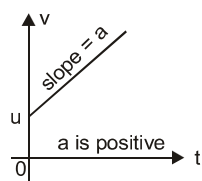
Graphs in Uniformly Accelerated Motion along a straight line ($a \neq 0$)

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



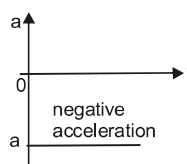
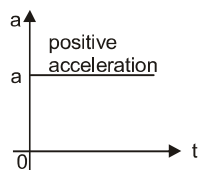
x-t graph

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

$$\frac{dy}{dx} = 0 \text{ \& } \frac{d}{dx} \frac{dy}{dx} < 0 \text{ at maximum and } \frac{dy}{dx} = 0 \text{ \& } \frac{d}{dx} \frac{dy}{dx} > 0 \text{ at minima.}$$

Equations of Motion (for constant acceleration)

(a) $v = u + at$

(b) $s = ut + \frac{1}{2} at^2$ $s = vt - \frac{1}{2} at^2$ $x_n = x_i + ut + \frac{1}{2} at^2$

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