MOTION IN A STRAIGHT LINE

Distance
- actual path length
- → scalar

Displacement
- → shortest possible path length
- → vector

{disp ≤ distance}

Speed
$\frac{\text{distance}}{\text{time}}$

→ scalar

$\frac{\Delta x}{\Delta t}$

avg speed = $\frac{\text{distance}}{\text{time}}$

velocity
$\frac{\text{displacement}}{\text{time}}$

→ vector

avg V = $\frac{\Delta \vec{x}}{\Delta t}$

Acceleration :-
$$\vec{a} = \frac{\Delta \vec{V}}{\Delta t}$$

motion under gravity

u ↑ g (−ve) (downward vector)

$$\boxed{V = \frac{dx}{dt}} \quad a = \frac{dv}{dt}$$

$$\boxed{a = \frac{d^2x}{dt^2}}$$

V_{max} :- $\frac{dv}{dt} = 0$

Equation of Motion:
$$V = u + at$$
$$s = ut + \frac{1}{2}at^2$$
$$v^2 = u^2 + 2as$$

Stopping distance:
a ← u → V=0

← S →

$$\boxed{S = \frac{u^2}{2a}}$$

Motion under gravity:
u ↑ ↓ g

same level, same speed only direction is different.

$$\boxed{H_{max} = \frac{u^2}{2g}}$$

Time of flight :
u, S=0

$$\boxed{T = \frac{2u}{g}}$$

Time :-
$$S = ut + \frac{1}{2}at^2$$
$$-h = 0 - \frac{1}{2}gt^2$$
$$\boxed{t = \sqrt{\frac{2h}{g}}}$$

h ↓ g

Final Velocity (v) :
$$v^2 = u^2 + 2as$$
$$\boxed{v = \sqrt{2gh}}$$

just before reaching the ground dropped from top.

Accelerated Particle :-
u=0

t_1, h ↓ v

$t_1, 3h$

$t_1, 5h$

V.V.I

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

GRAPH THEORY :-
x–t graph: slope = $\frac{dx}{dt}$ = V

V–t graph: slope = $\frac{dv}{dt}$ = a

a–t graph: slope = $\frac{da}{dt}$ → NIL

y–x graph: slope = $\frac{dy}{dx}$ = tan θ, constant

* Uniform motion :-
x–t: +ve, const.

v–t: uniform motion

a–t: a = 0

* Uniform acceleration:-
x–t: +ve, increase

v–t: (+ve) (const), slope = a

a–t: (+)

* Uniform retardation:-
x–t: +ve, decrease

v–t: (−ve), constant

a–t: (−ve) (const)

* Area of a graph:
x–t

v–t: displacement

a–t: a = $\frac{dv}{dt}$

area = $\int y\,dx$

adt = dv

area = change in velocity