# KINEMATICS

1. Distance and displacement
2. Avg & Inst. (speed & vel.)
3. Avg accl$^n$ & Inst. accl$^n$
4. Graphs
5. Equation of motion
6. Motion under gravity.
7. Projectile Motion

---

## ① Distance and Displacement :-

Distance = |Displacement| (Jab particle straight line me travel kare aur disx$^n$ na badle)

Distalce > |Displacement| (Jab particle disx$^n$ badle)

## ②

avg speed > |avg vell (Jab particle disx$^n$ badle)

avg speed = |avg vel.| (Jab straight line me travel kare aur disx$^n$ na badle)

Inst speed = |Inst. vel| ← (always)

## Calculation of <vel>

i) $f(x)$ ← using this find $x_i$ & $x_f$.

ii) Use formula

$$\langle vel \rangle = \frac{x_f - x_i}{\text{total time}} = \frac{\Delta x}{\Delta t}$$

ज़रूरी !!

## Calculation of <speed>

(*) <speed> pata karne ke lia direction (दिशा) pata hona zaroori hai.

Question dekh ker pahle rasta pata karo then

$$\langle speed \rangle = \frac{\text{total distance}}{\text{total time}}$$

## Acceleration and Average Accleration

$$\langle accl^n \rangle = \frac{v_f - v_i}{t_f - t_i} = \frac{\Delta v}{\Delta t}$$

$$accl^n = \frac{dv}{dt} = \frac{d^2x}{dt^2} = v\frac{dv}{dx}$$

$\vec{v}$, $\vec{x}$ ← same sign ← particle move away from origin

$\vec{v}$, $\vec{x}$ ← opposite sign ← particle move towards origin

# Graph :-

① $x-t$ graph me 2 points ko jodne wale line ka slope avg. vel. deta hai

② Agar wo 2 points bahut jada close ho (tend to coincide) then us point ka slope will give inst. vel.

## All KCs

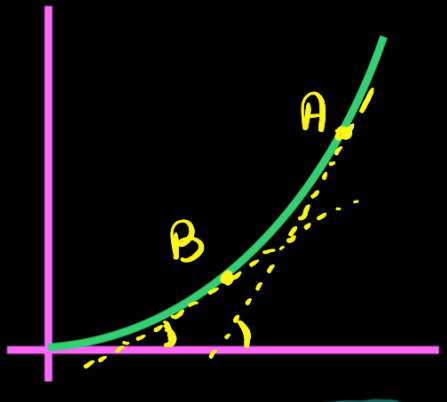
$\vec{v}$, $\vec{a}$ ← same sign ← particle will speed up.

$\vec{v}$, $\vec{a}$ ← opposite sign ← particle will speed down.

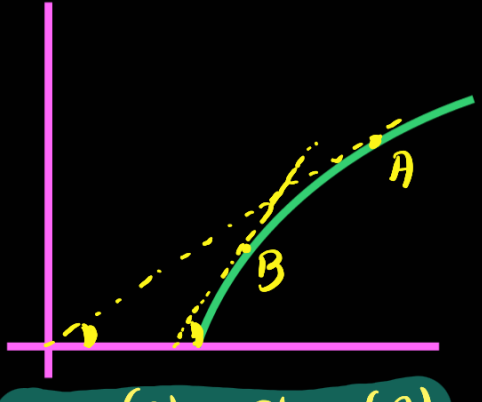
Jab velocity hamesha +ve ho means disp$^{n}$ not changed means no turning point is there.

$v-t$ graph ka area

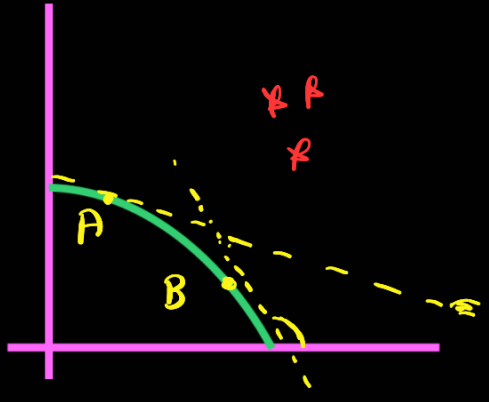
- $x$ axis ke upar aur niche wale area ka sum will give distance.
- $x$-axis ka upar wala area minus niche wala area will give displacement.




Slope (A) > Slope (B)




Slop (A) < Slope (B)




Physics → Slope (A) < Slope (B)

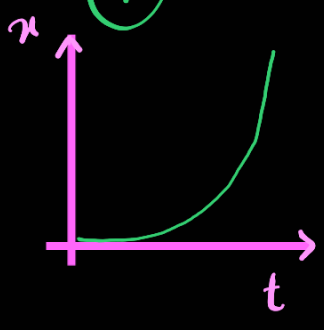
Maths → Slope (A) > Slope (B)

In x-t graph (only)

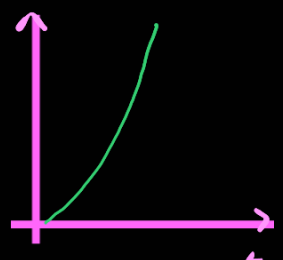
- graph → smile → accl$^n$ → +ve
- graph → sad → accl$^n$ → −ve

graphs me always sabse pahle dekho dia kya hai (x-t, v-t, a-t, ....) fir dekho pucha kya hai uske baad hi question solve karo .....

## खतरे वाली बातें !

① 


लोटा - लोटी
initial vel. = 0



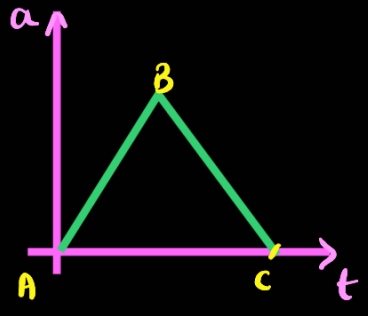

चांच
initial vel. ≠ 0

② If particle moving in +x then :-

v > 0 ✓
v < 0 ✗

| | |
|---|---|
| a > 0 | x > 0 |
| a < 0 | x < 0 |

← may be correct or may be incorrect.

③ 


← velocity is maximum at C
∴ Bcoz, accl$^n$ ghat badh raha hai means velocity ke change hone ka rate badh ghat raha hai
velocity throughout the journey badh hi raha hai.

④ If a = constant (a ≠ 0) → v-t graph → straight line
x-t graph → parabolla

But vice-versa is not true.

$$\langle \text{accl}^n \rangle = \frac{\int (\text{accl}^n)\,dt}{\int dt} \qquad \langle \text{vel.} \rangle = \frac{\int \text{vel.}\,dt}{\int dt}$$

$$\langle \text{kaddu} \rangle = \frac{\int (\text{kaddu})\,dt}{\int dt}$$

# Kinematics (2.0)

## Equation of Motion

- $v = u + at$
- $s = ut + \frac{1}{2}at^2$
- $v^2 = u^2 + 2as$

} Apply only when $a$ = constant.

④ $s$ = displacement ★
$s \neq$ distance ★★

$$S_n = u + \frac{1}{2}(2n-1)a$$ ← displacement in $n^{th}$ sec.

or

$$S_n = (S \text{ upto } n^{th} \text{ sec}) - S \text{ upto } (n-1)^{th} \text{ sec.})$$

## Projectile Motion

$$T = \frac{2u\sin\theta}{g} = \frac{2u_y}{a_y}$$

$$R = \frac{u^2 \sin 2\theta}{g} = u_x T = \frac{2u_x u_y}{a_y}$$

$$H = \frac{u^2\sin^2\theta}{2g} = \frac{u_y^2}{2a_y}$$

# Equation of Trajectory

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

$$y = x\tan\theta\left(1 - \frac{x}{R}\right)$$

## Some Important Points

For projectile, when $u \rightarrow$ fix (constant)

then,

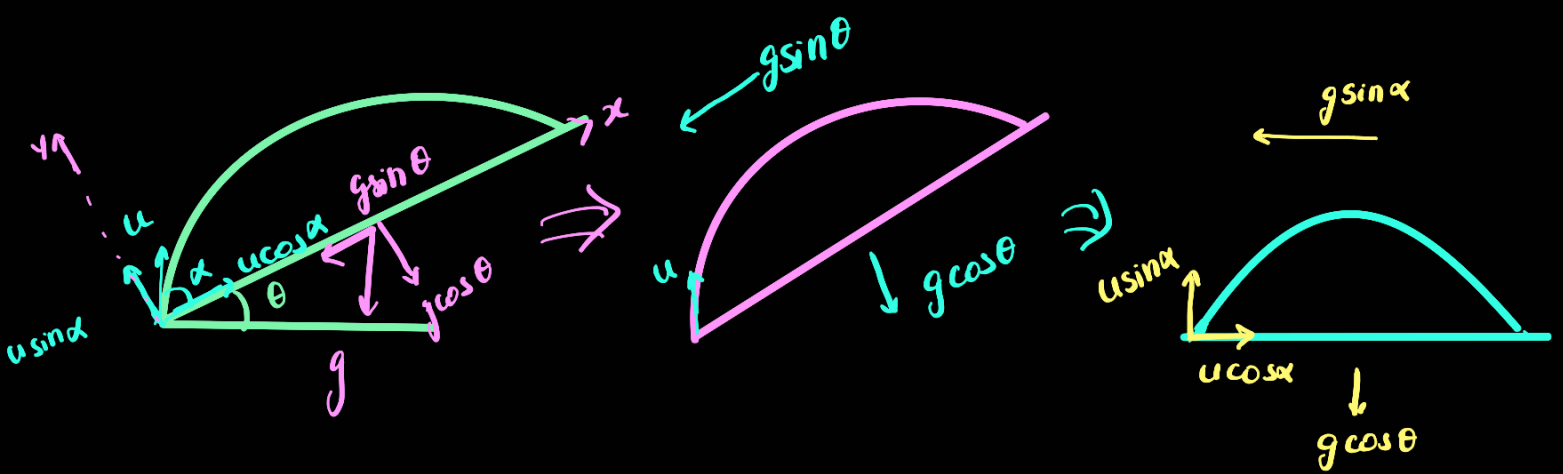
Height and Time of flight max. at $\theta = 90°$

Horizontal Range max. at $\theta = 45°$

Kisi bhi chalti hui gadi se agar kisi chij ko 't' time par giraya jaie to 't' time par jo velocity us gadi ka hoga wahi velocity us chij ki mil jiega

Yad rakho sirf us t time par jo speed hai wahi particle ko milega accl$^n$ nhi milega cahe gadi throughout the motion accelerate ker raha ho.

# Motion in Inclined Plane




Normal Projectile motion me sabse bcalo hathiyar hai $a_x = 0$ & $v_x$ = constant.
Jab Question na samajh aie to ise socho

## RELATIVE MOTION

$V_{A/B}$ = Velocity of A w.r.t. velocity of B.

Constant for any frame of reference

$$\vec{V}_{A/B} = \vec{V}_A - \vec{V}_B$$

Rain Man Proble → Solve notes Questions for Revision.