ARJUNA NEET BATCH

KINEMATICS

LECTURE - 17

$\vec{A}$ $\hat{A}$

NEET

Todays goal

- question on relative motion
- vector

Q At $t=0$

A $\rightarrow$ 40 m/s (const^n)
$a=0$

B $\rightarrow$ $a = 2\,m/s^2$
$u=0$ (rest)

find time when they will meet again??

Sol^n

At t LCA

$S_A = S_B$

$[40\cancel{t}] = [\frac{1}{2}a t^{\cancel{2}}]\,t$

$t = \frac{\cancel{2}\times 40}{\cancel{2}} = 40$ sec

(मजदूरी)

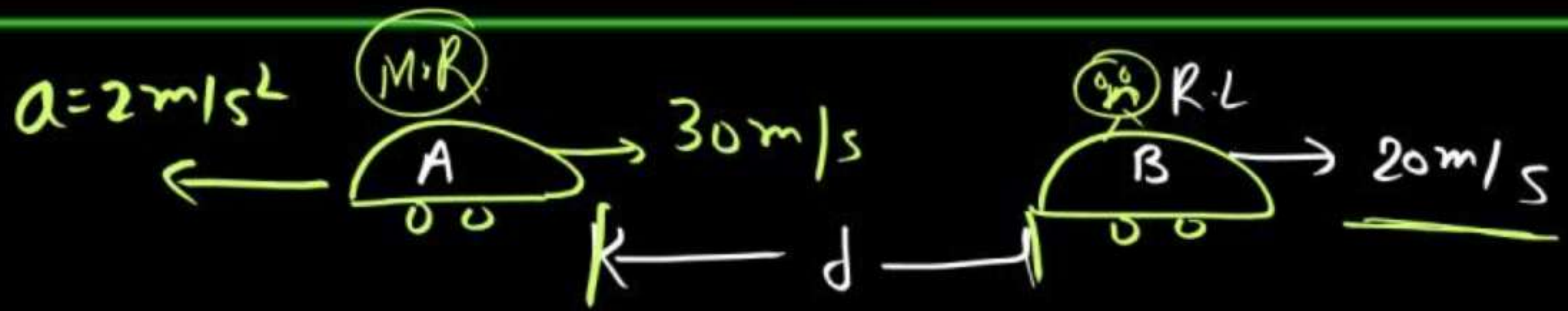
MR^x 2 m/s^2 A $u=40$

R.L B rest

$t = \frac{2\times u}{g} = \frac{2\times 40}{a(2)} = 40$ sec

Two cars A and B are moving in same direction with velocities 30 m/s and 20 m/s. When car A is at a distance d behind the car B, the driver of the car A applies brakes producing uniform retardation of 2 m/s². There will be no collision when

(a) $d < 2.5$ m
(b) $d > 125$ m
(c) $d > 25$ m
(d) $d < 125$ m



Solⁿ MR* (Motⁿ w.r.t B)

A → 30 − 20 = 10 m/s, $a = -2\ \text{m/s}^2$ ← d → B: V = 0, a = 0, rest

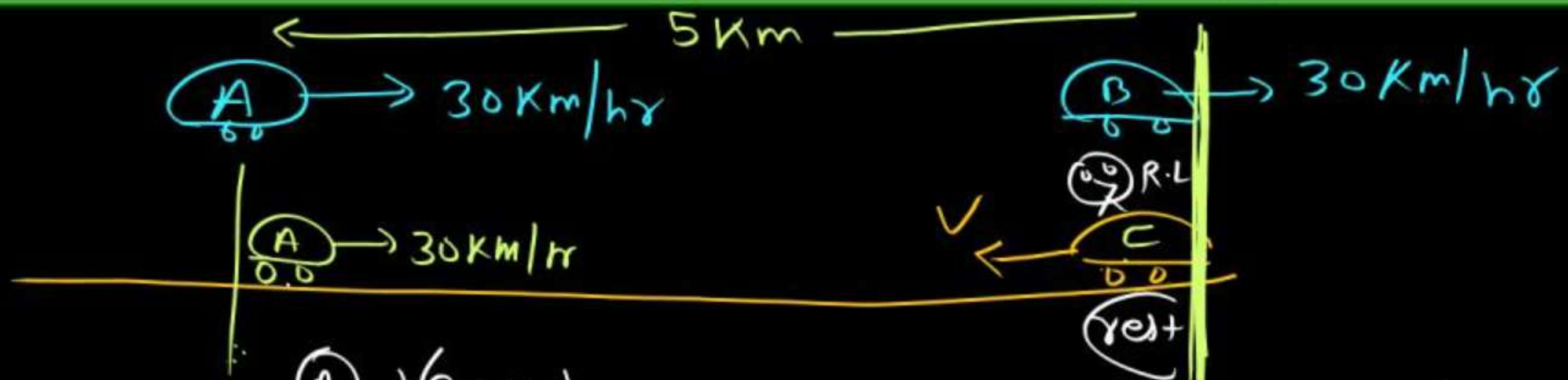
Stopping: $\dfrac{u^2}{2a} = \dfrac{100}{2 \times 2} = 25$

$\boxed{d \geq 25\ \text{m}}$

Two cars are moving in the same direction with a speed of 30 km/h. They are separated from each other by 5 km. Third car moving in the opposite direction meets the two cars after an interval of 4 minutes. The speed of the third car is

(a) 30 km/h
(b) 25 km/h
(c) 40 km/h
(d) 45 km/h

$t = 0$



$(A) \rightarrow (30 + v)$

$t = 4\,\text{mint}$

$|d = 5\,\text{Km}|$

$30 + v = \dfrac{5\,\text{Km}}{4\,\text{mint}} = \dfrac{5\,\text{Km}}{\frac{1}{15}\,\text{hr}} = 75$

$v = 75 - 30 = 45$

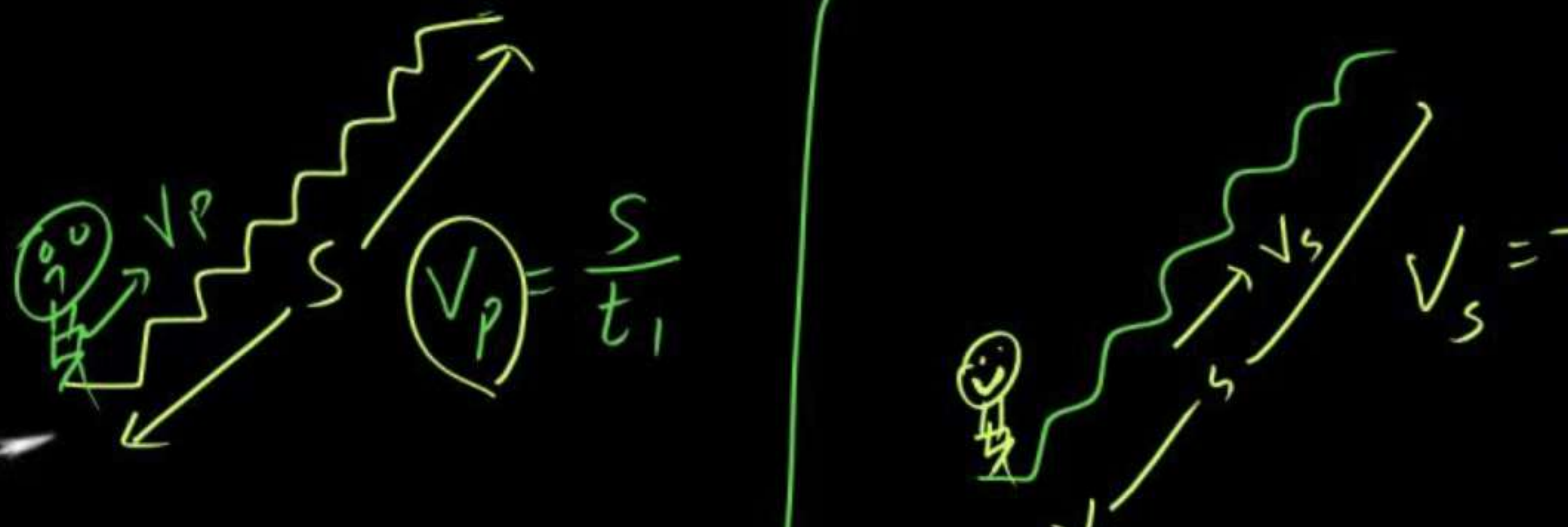
Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be [NEET-2017]

(a) $\frac{t_1 + t_2}{2}$

(b) $\frac{t_1 t_2}{t_2 - t_1}$

(c) $\frac{t_1 t_2}{t_2 + t_1}$

(d) $t_1 - t_2$



$V_p = \frac{S}{t_1}$

$V_s = \frac{S}{t_2}$

$V_p + V_s = \frac{S}{t}$

$\frac{S}{t_1} + \frac{S}{t_2} = \frac{S}{t}$

Q

1 $\rightarrow$ $u_1 = 10\, m/s$

$a_1 = 2\, m/s^2$

2 $\rightarrow$ $u_2 = 10\, m/s$

$a_2 = 2\, m/s^2$

$\boxed{a_{12} = 0}$ $\boxed{u_{12} = 0}$

Object 1 is at rest with respect to 2

but 1 & 2 both are moving with const^n acc^n w.r.t ground.

$t=0$

A $\rightarrow u_A = 20\,m/s$

$\rightarrow a_A = 5\,m/s^2$

$\rightarrow$ Motion of A is Non-uniform w.r.t Ground $(a_A = 5\,m/s^2)$

B $\rightarrow u_B = 10\,m/s$

$\rightarrow a_B = 5\,m/s^2$

$$\vec{a}_{AB} = \vec{a}_A - \vec{a}_B = (5-5) = \underline{0}$$

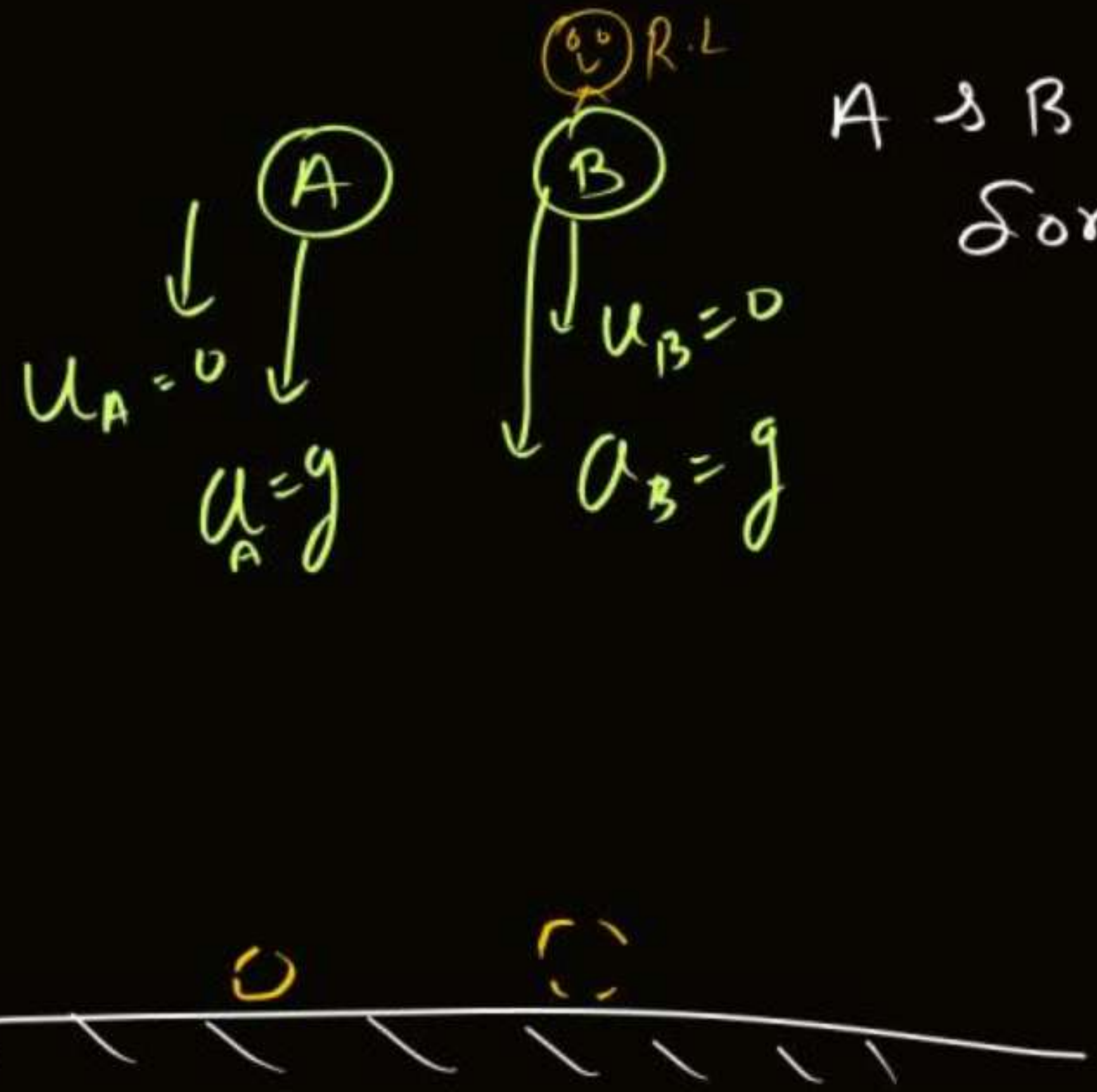
$$\vec{u}_{AB} = \vec{u}_A - \vec{u}_B = 20-10$$

$$= \underline{10\,m/s}$$

Motion of A w.r.t B is uniform with 10 m/s

$a_{AB} = 0$

Concept of relative motion in Motion Under gravity.



A & B droped from some height at same time

$t = 0$

$u_{AB} = 0$

$a_{AB} = a_A - a_B = g - g$
$= 0$

A always at rest w.r.t B

$\boxed{t=0}$ (A) $\downarrow a=g$ (B) $\downarrow a=g$ R.L.

(throw) $u_A = 10\,m/s$ $u_B = 5\,m/s$

$t = 1s$ $\downarrow 20\,m/s$ $\downarrow u = 15\,m/s$

$\boxed{t=2}$ $\downarrow 30\,m/s$ $\downarrow u = 25\,m/s$

$$\vec{a}_{AB} = a_A - a_B = 0$$

$$(u_{AB})_{t=0} = u_A - u_B = 10 - 5 = 5\,m/s$$

Motion of (A) w.r.t Ground $\rightarrow$ Non-uniform with $a=g$

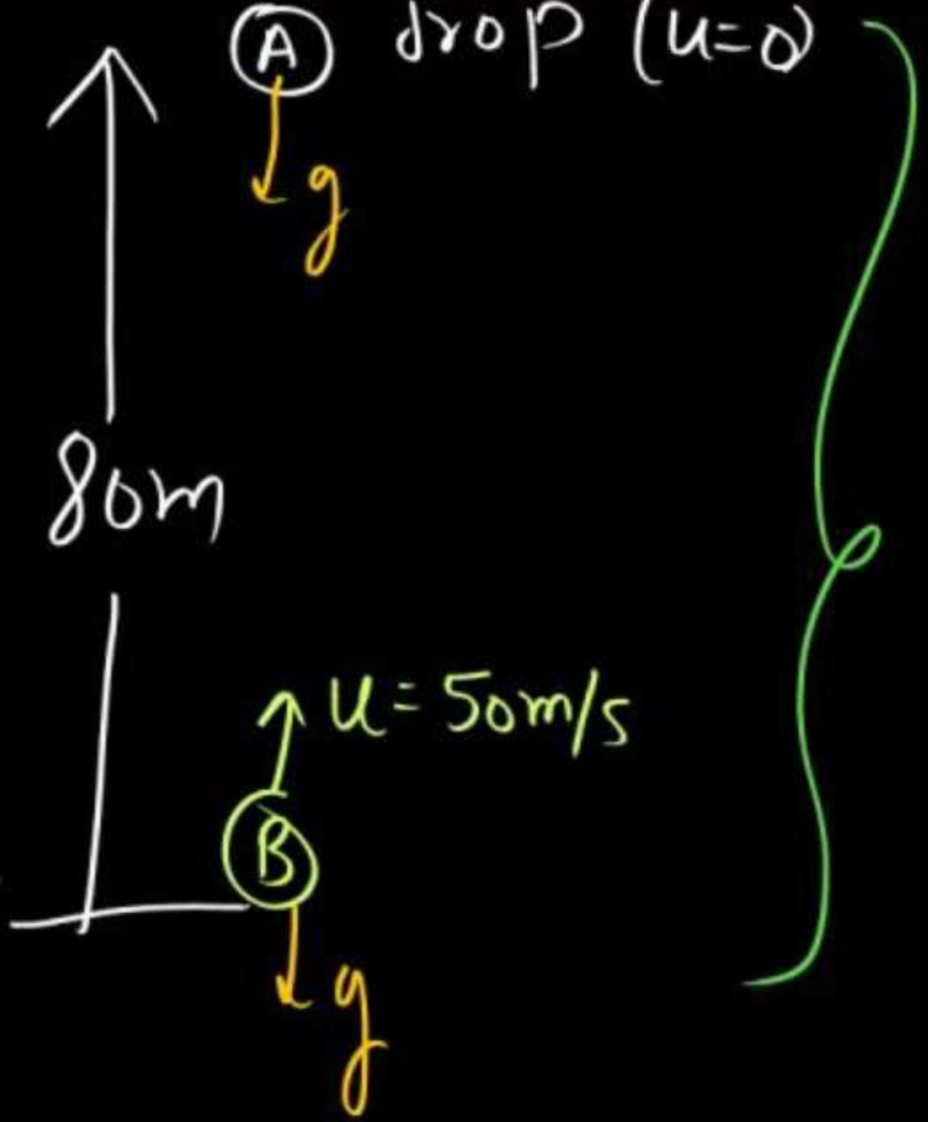
Motion of (A) w.r.t (B) $\rightarrow$ Uniform Motio

$\underline{a_{AB} = 0}$

A ball is dropped from the top of a building of height 80 m. At same instant another ball is thrown upwards with speed 50 m/s from the bottom of the building. The time at which balls will meet is

(a) 1.6 s (b) 5 s

(c) 8 s (d) 10 s



Sol^n

$u_{BA} = 50\,m/s = \text{const.}$

$\boxed{a_{BA} = 0}$

$s = ut + \cancel{\frac{1}{2}at^2}^{\,0}$

$8\cancel{0} = 5\cancel{0}\,t$

$t = \frac{8}{5} = 1.6\,s$

Q Ball A is thrown with velocity 10m/s and at a same time, from same poin Ball B is droped then find distance b/w then after 2-sec

$t=0$ A $\downarrow$ 10 m/s

B drop ($u=0$)

Sol^n. A B rest

R.L

$u_{AB} = 10\,m/s$

$a_{AB} = 0$

$t = 2\,sec$

$s = ut = 10 \times 2 = 20\,m$

Q A Ball is drop from Height H and another Ball is thrown downward $\boxed{\text{after 6-sec}}$ but they reach at ground at same time $t = 18\,sec$.

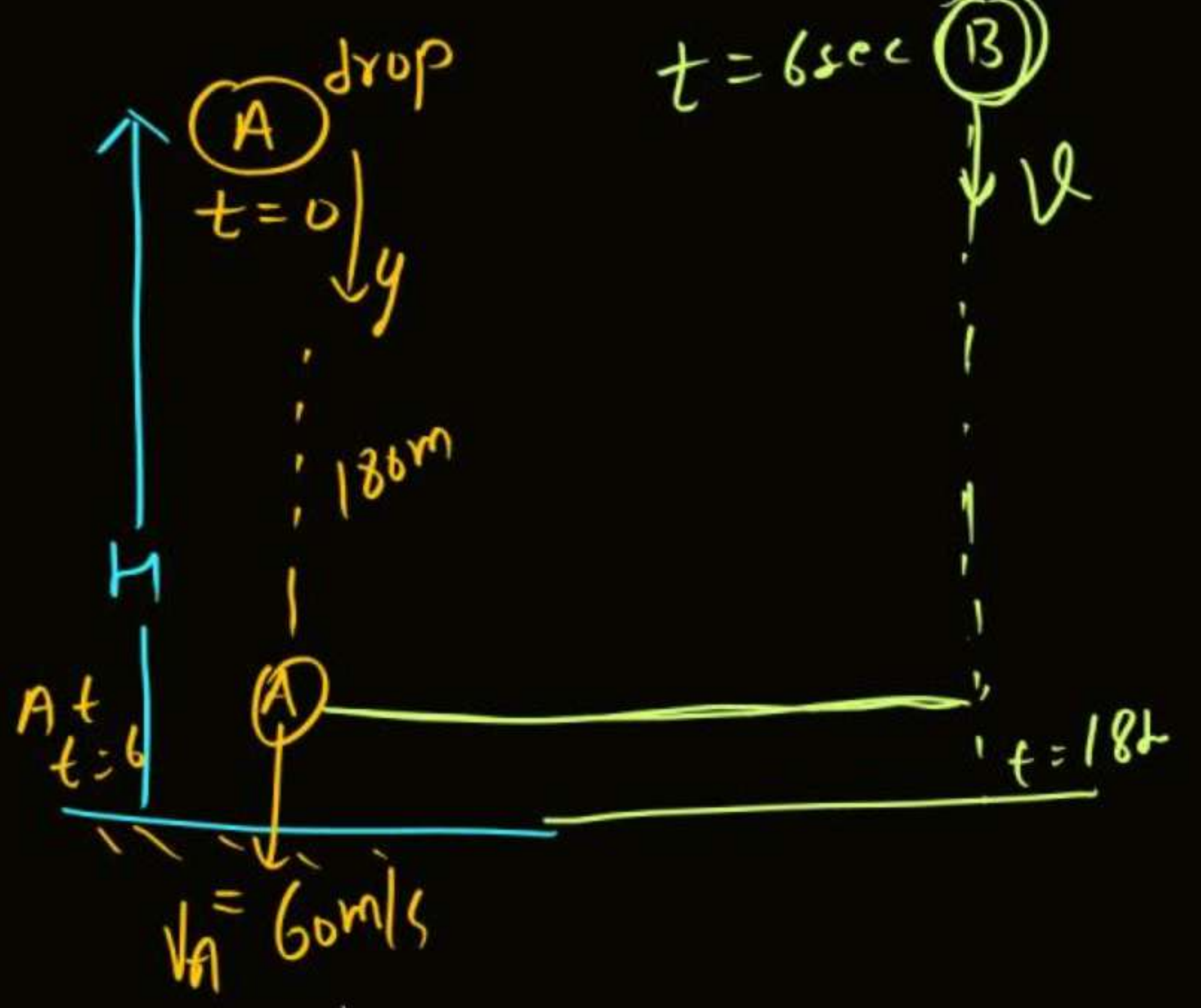
then initial velocity of 2^{nd} Ball

$t = 6\,sec$

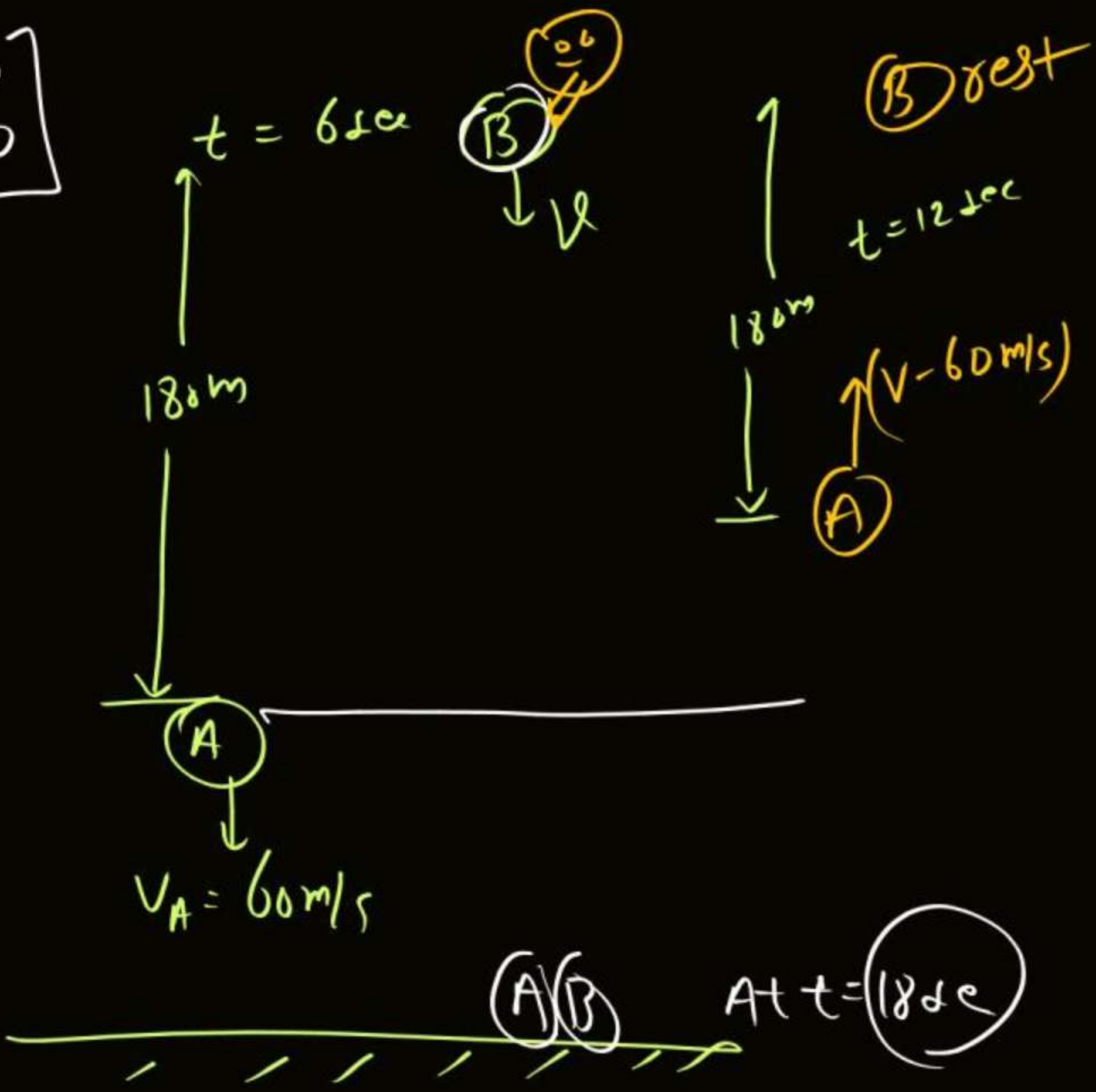
$s = ut + \frac{1}{2}at^2$

$s = \frac{1}{2} \times 10(6)^2$

$$\boxed{s = 180\,m}$$



$\boxed{4 \quad u=0,\ t=0}$



$V - 60 = \frac{\cancel{180}\ 15}{\cancel{12}}$

$V = 60 + 15 = \underline{\underline{75\ m/s}}$

2nd method

$t=0$

A drop
$u=0$

after 6 sec

B

u

$t = 12\,sec$

$$(S_A)_{t=18\,se} = (S_B) \text{ in } 12\text{-sec}$$

$$\frac{1}{2} g (18)^2 = u \times 12 + \frac{1}{2} g (12)^2$$

$$5(18)^2 = u\,12 + 5(12)^2$$

A

B'

$t = 18\,sec$

$$\boxed{u = 75\,m/s}$$

Scalar

→ have only magnitud
no, need of direction.

Ex Temprature / time

speed / distance

energy / Volume

density, Mass.

Work / current /

Power

Pressure

moment of inertia

Vector

→ have magnitue as well as direction.

Ex- velocity ($\vec{V}$)

displacement

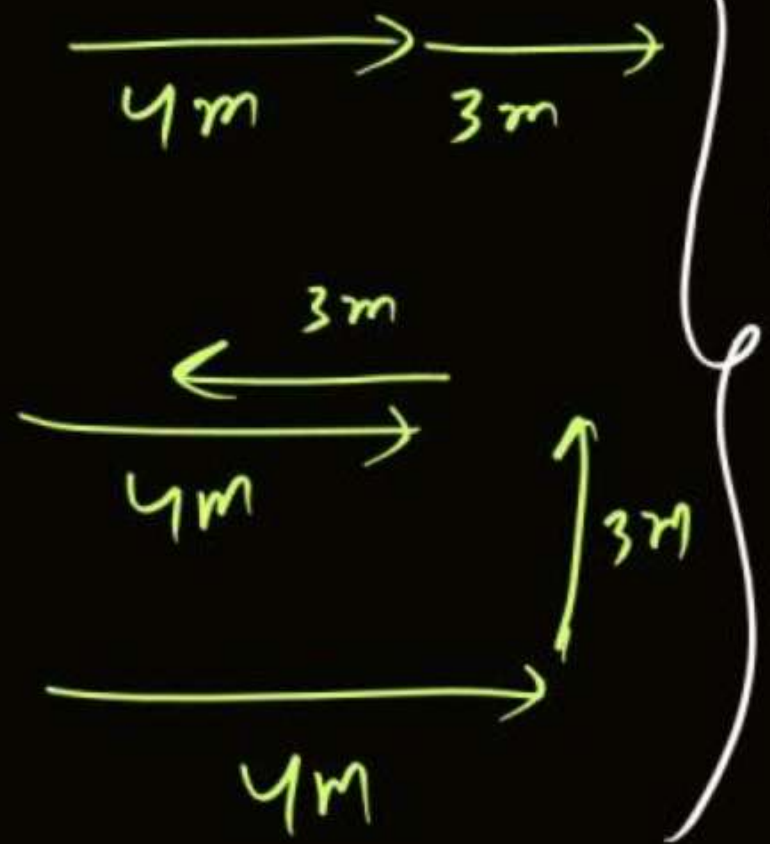
Force, Momentum

Angula dispm ($d\hat{\theta}$)

→ electric field / torque

Scalar

follows simple addition

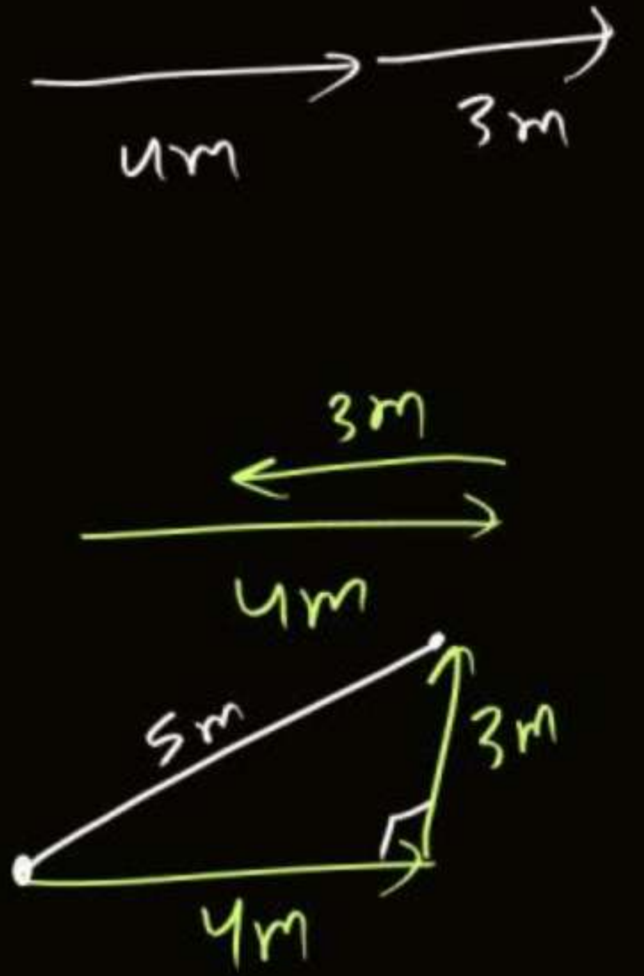


distance same in all case

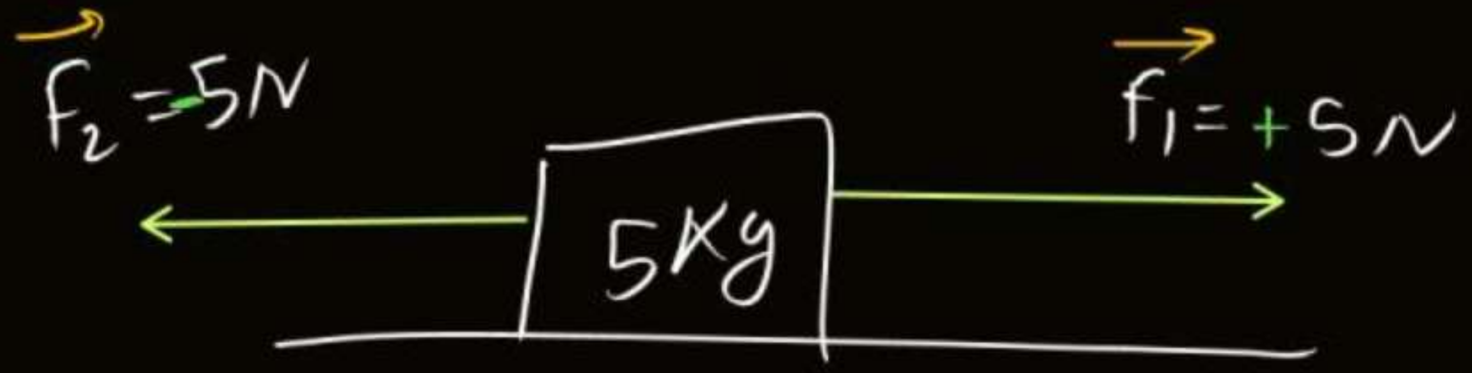
7m

vector

follow addition with direction



dispm
7m
1m
5m



$\boxed{F_{net} \text{ force} = 0}$

$\vec{F_1}$ & $\vec{F_2}$ vector is not same

Scalar additi.

$\boxed{5Kg + 5Kg}$

$\Downarrow$

$10Kg$

Scalar

Scalar can be change by canging its Magnitude Only

Ex - Speed (How fast)

$\boxed{\text{Vector}}$

Vector can be change, by changing magnitude only; or by direction only or by changin dir^n & magi both.

Ex velocity

The vector quantity among the following is

(a) Mass

(b) Time

(C) Distance

(d) Displacement

Representation of vector

① Mathmatically

$$\vec{A} = A\,\hat{A}$$

A vector — Magnitude — direc

Ex $\vec{V} = \boxed{10\ m/s}$ east

$$\vec{V} = v \times \hat{u}$$

$\vec{B}$ = vector

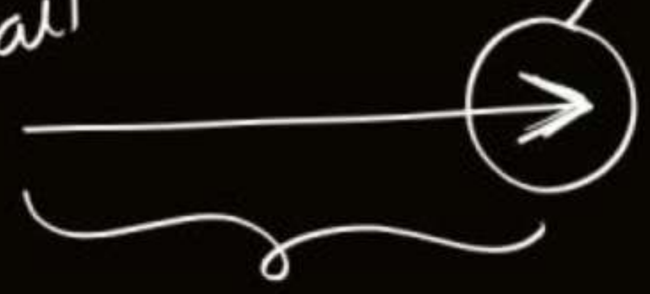
$\Rightarrow B$ = magnitude of vector

$\Rightarrow |\vec{B}|$ = magnitude of vector

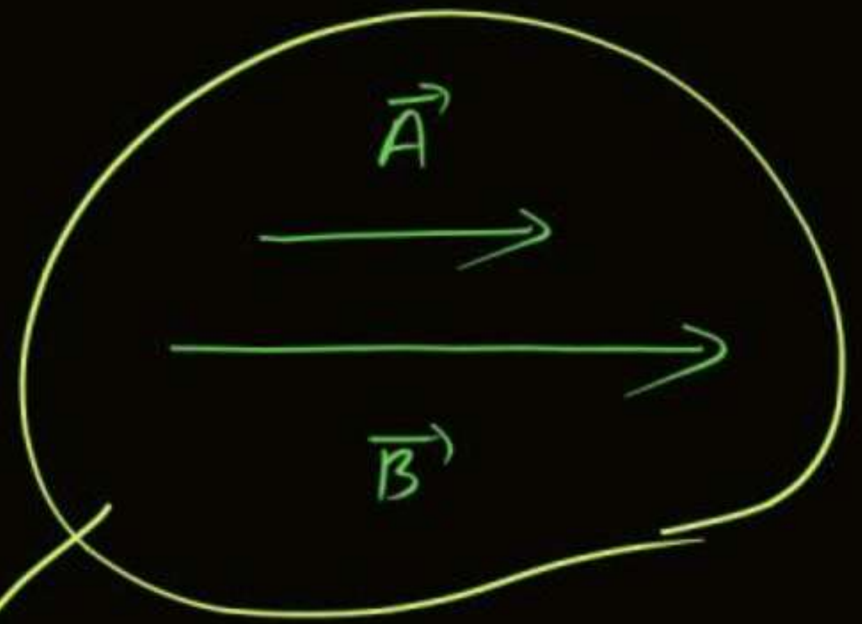
graphically

head (represent direction of vector)

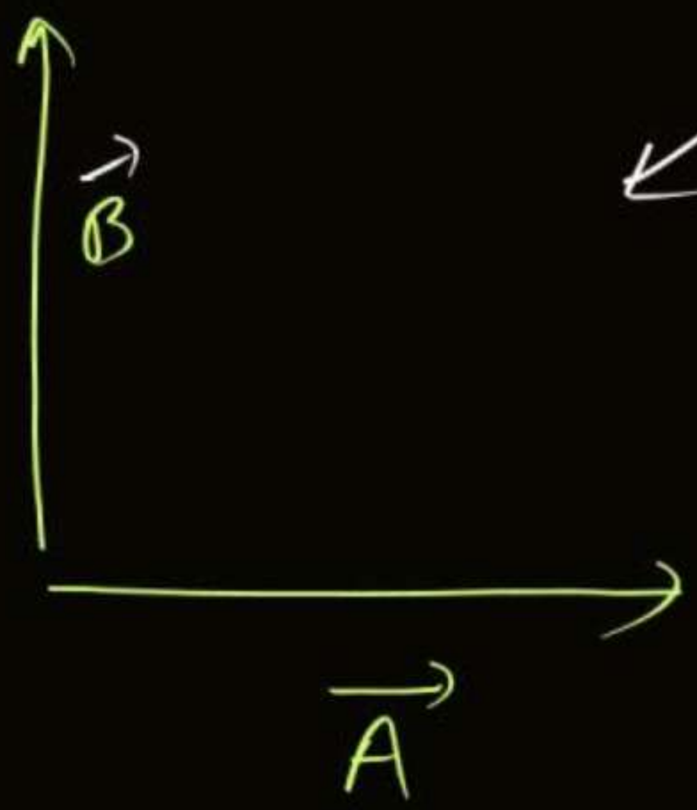
tail



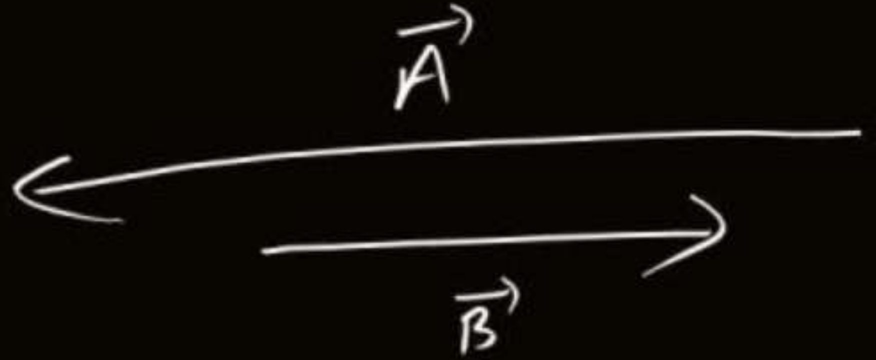
Magnitude of vector



both have same direction but diffrent magnitute.

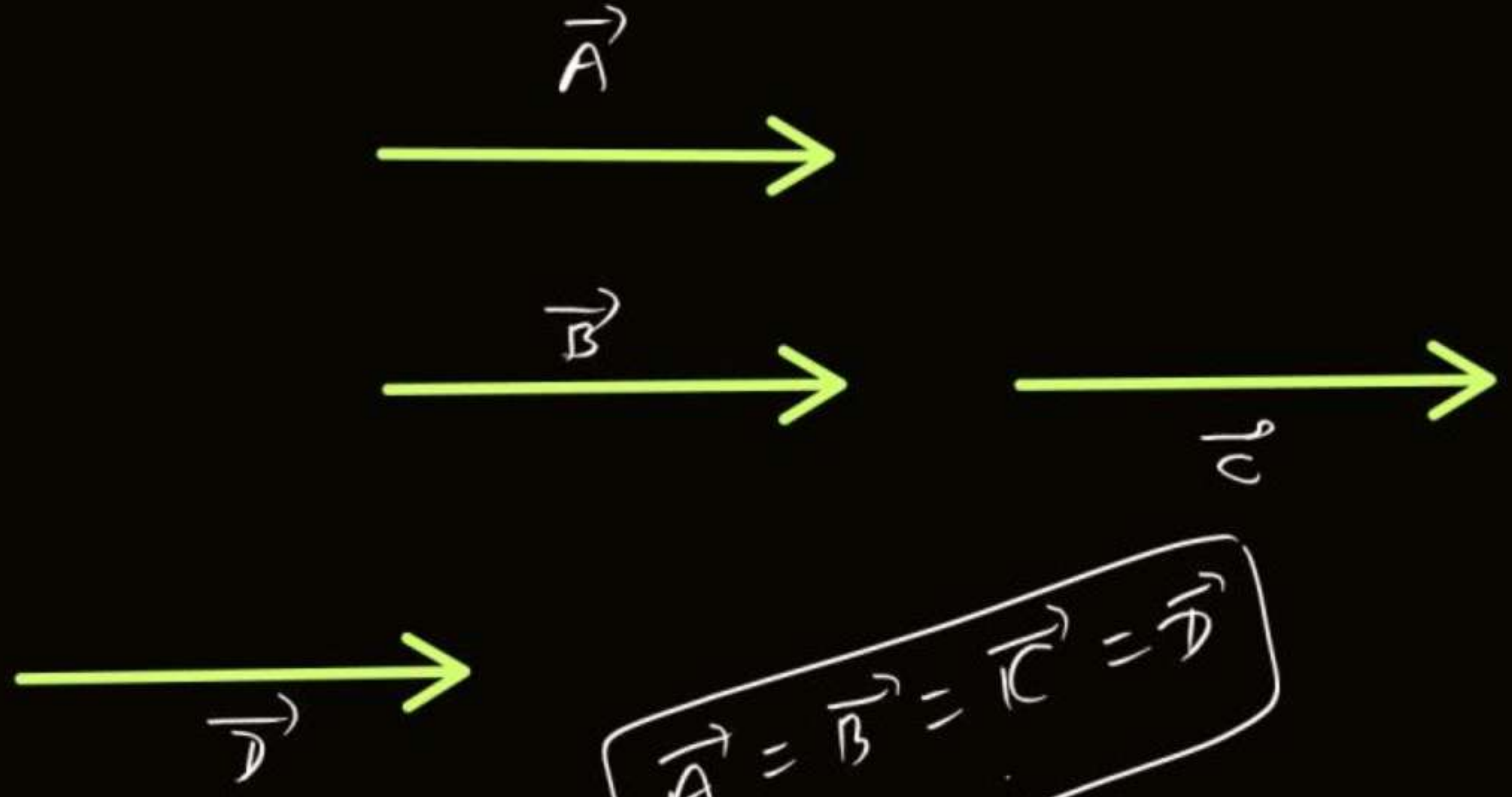


Same magnitude
diffrent direction

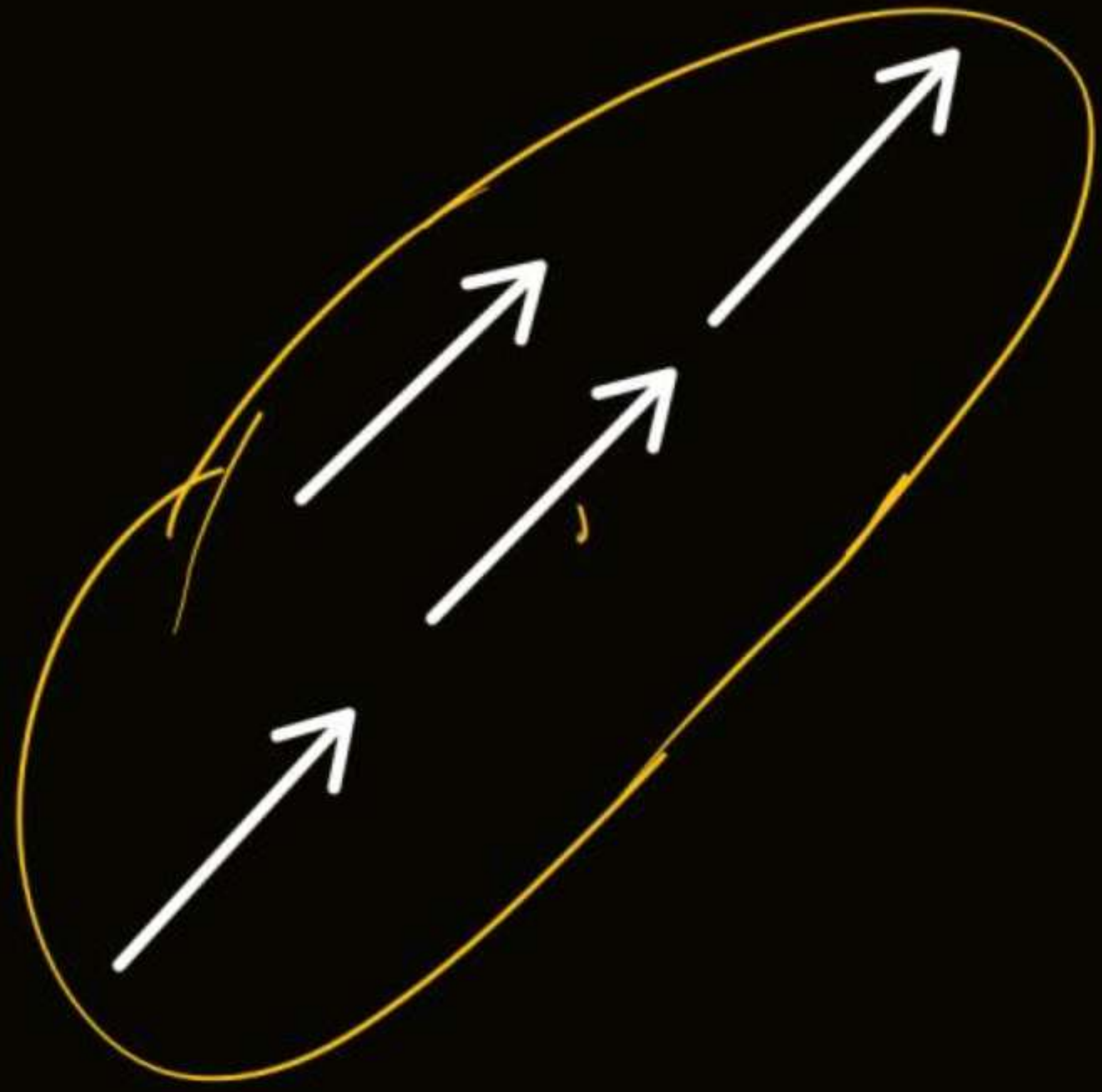


diffrent magnitude & opposite direction

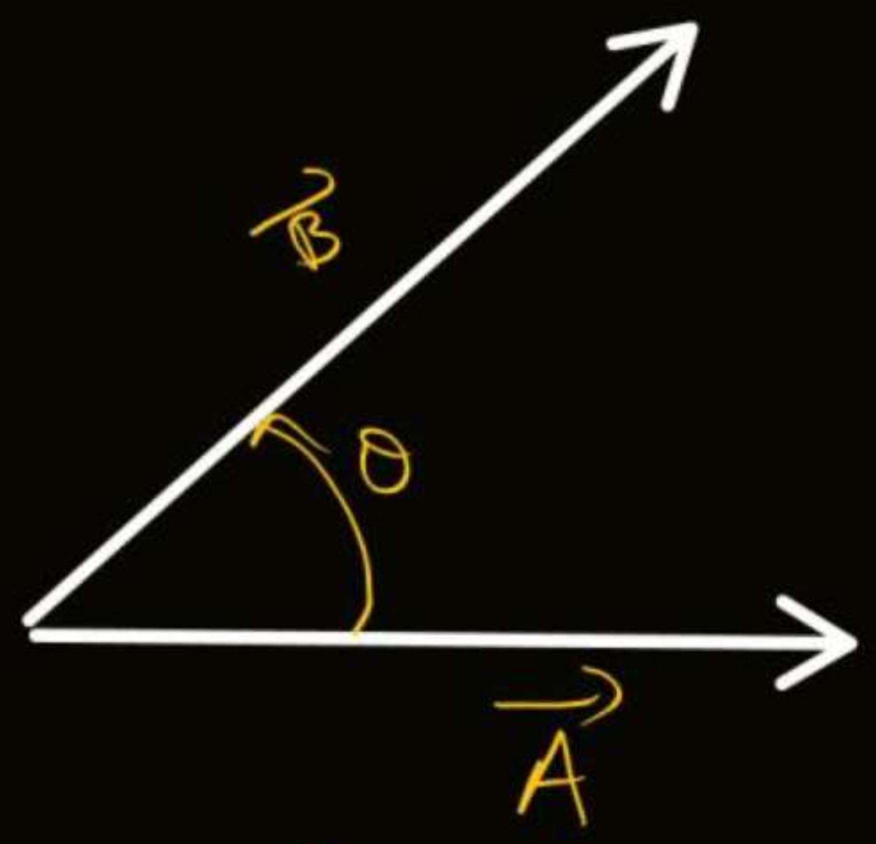
If vector shifted Parallel to It-self Keeping Magnitude and direction fixed, then vector remains same.



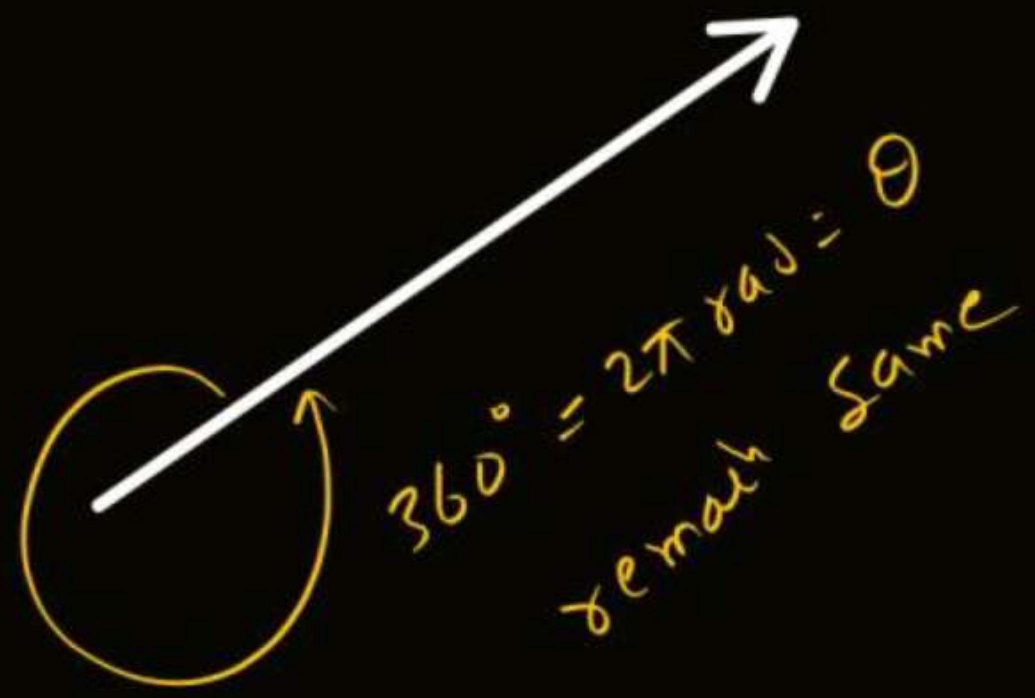
$$\boxed{\vec{A} = \vec{B} = \vec{C} = \vec{D}}$$



If vector rotate by angle (not equal to 2π) then Vector change due to direction.



$\vec{A} \neq \vec{B}$



THANK YOU ☺