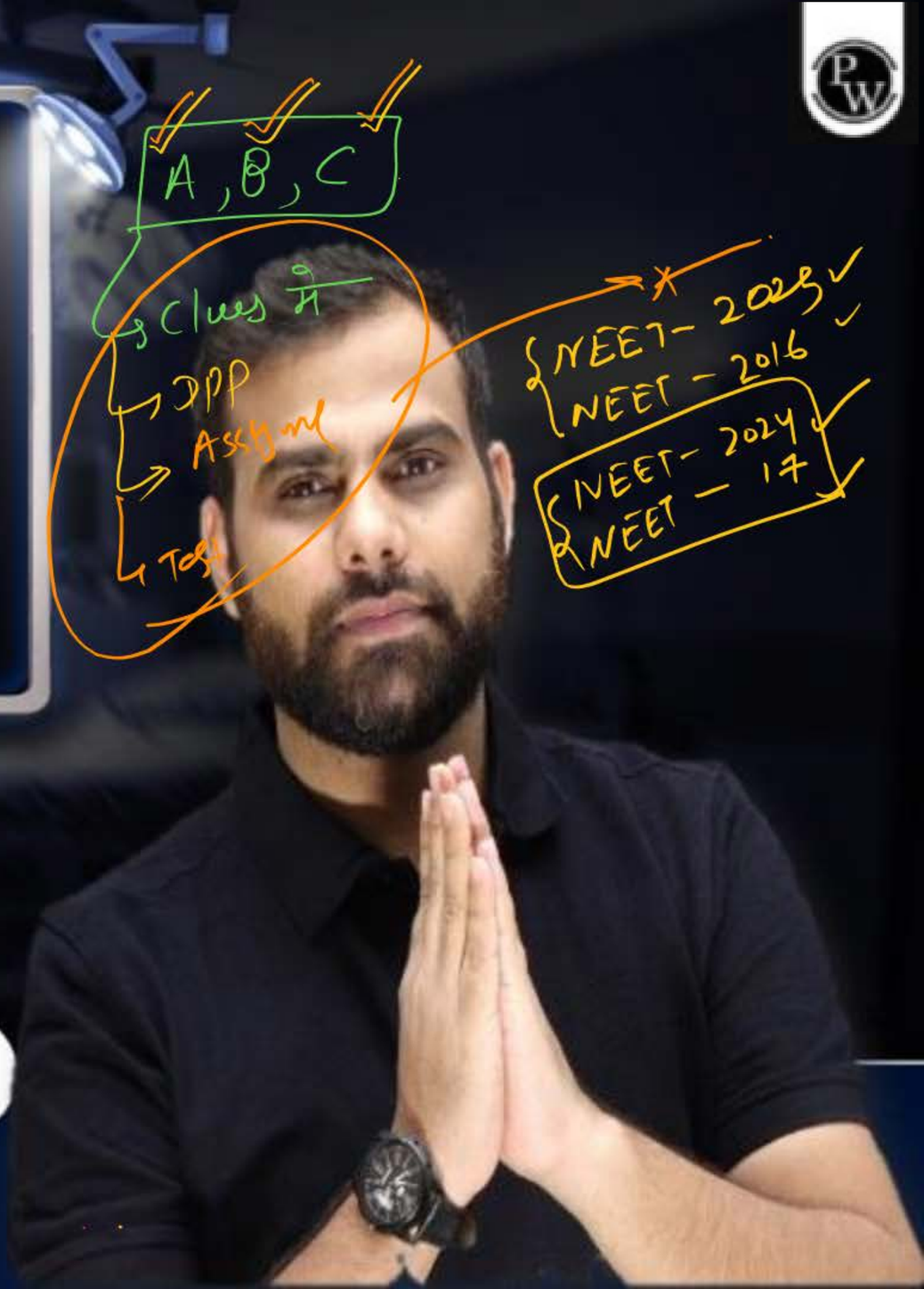
YAKEEN NEET 2.0

2026

Motion in a Plane

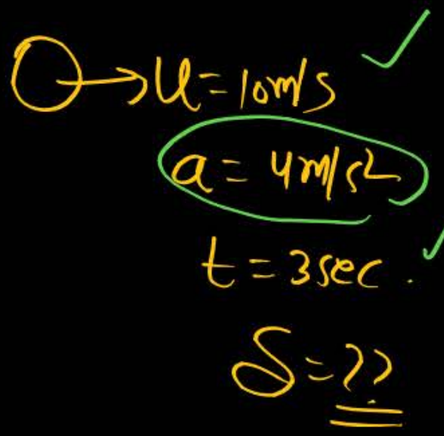
Physics | **Lecture - 7**

By- Manish Raj (MR Sir)



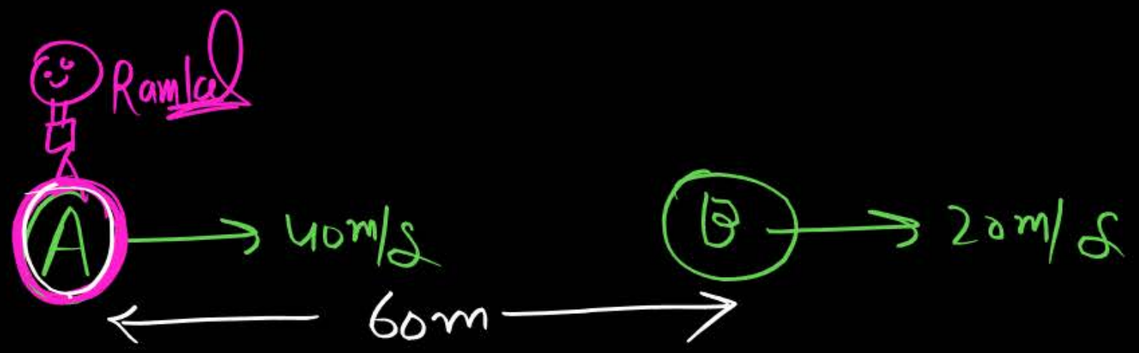
Todays Goal.

- Revision (H/W)
- Relative motion in 1-D (Part-02)



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

Relative motion → जब 2 या 2 से Jayda Motion में हो

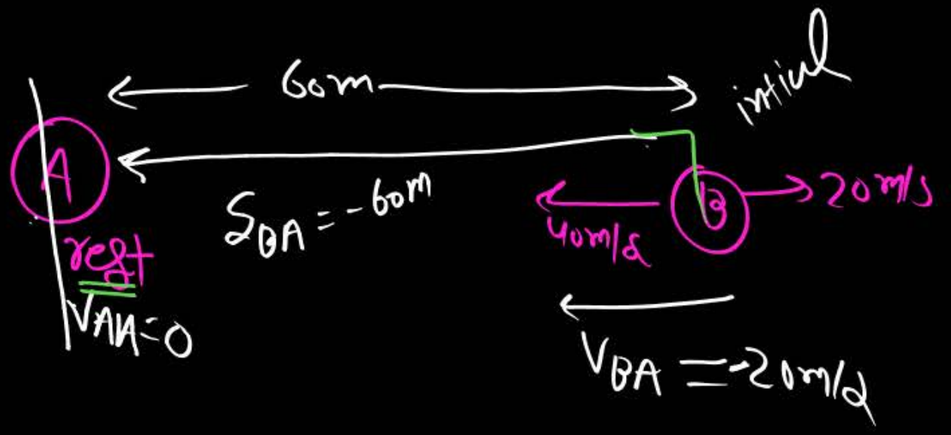


$S_{BA} = u_{BA}t + \frac{1}{2}a_{BA}t^2$ (0)

$-60 = -20t$

$t = 3$

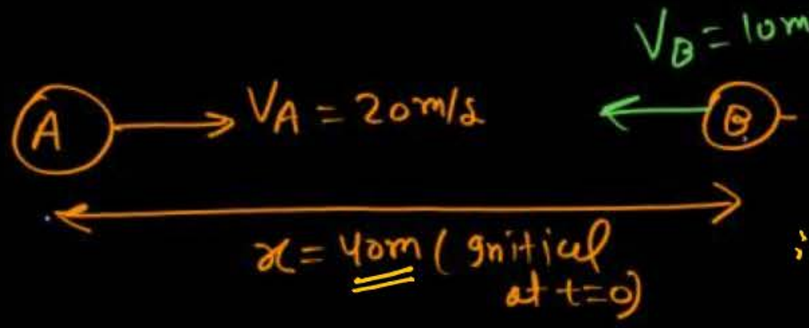
$t = 3\,sec$



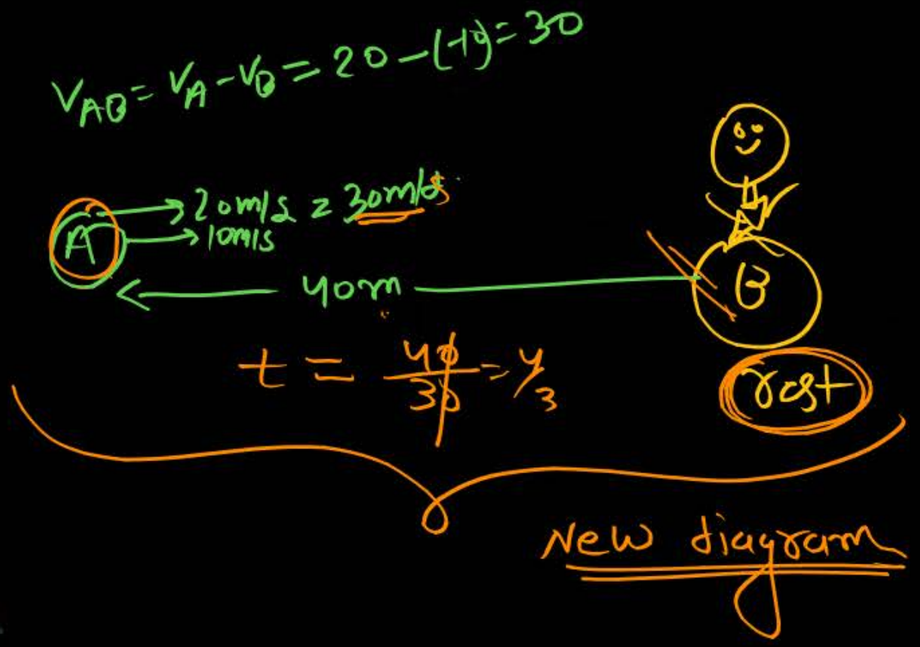
MR* Box -

Kisi ek ke sar par (Ramlal) ko bitha do and usko rest pe man lo, dusre object ko Ramlal ke respect me dekho. Ramlal ke respect me velocity / accn / disp^n nikal ke eq^n of motion laya o do.

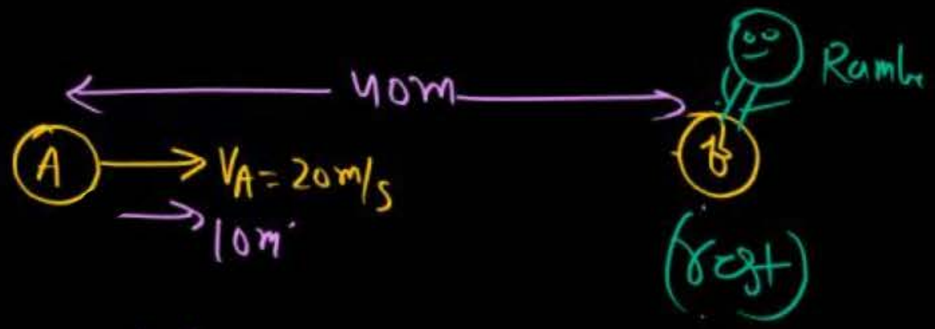
Q)



find time when they will meet :-



Soln



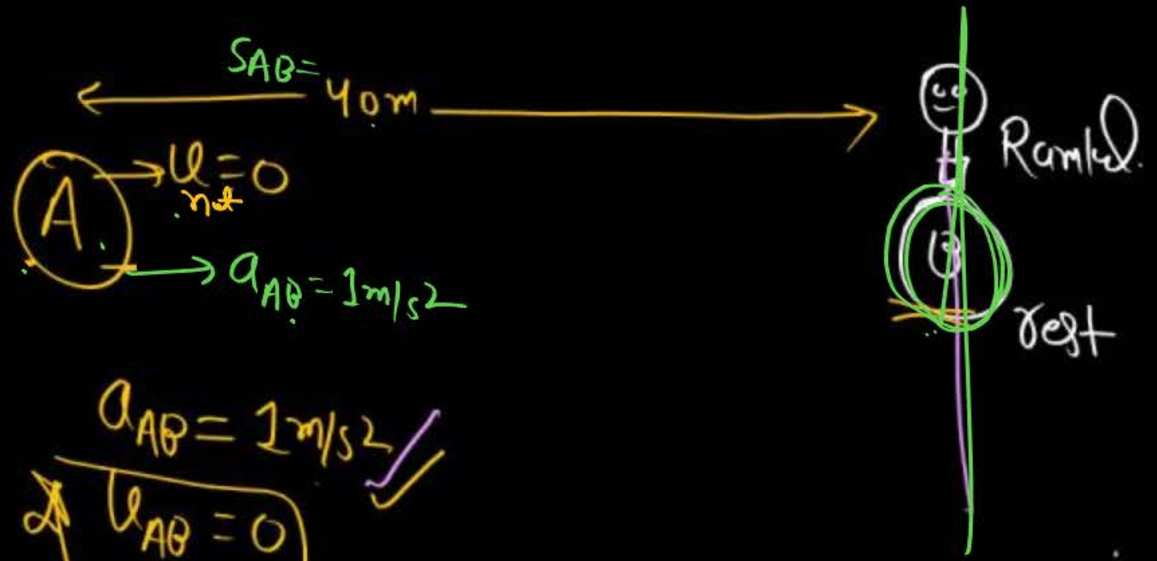
$V_{AB} = 30 m/s$

$t = \frac{40}{20} = \frac{\text{dist}^n}{\text{speed}} = 4/3$ sec.

⑧

Soln

Find time when they will meet.



$a_{AB} = 1 m/s^2$ ✓

~~$u_{AB} = 0$~~

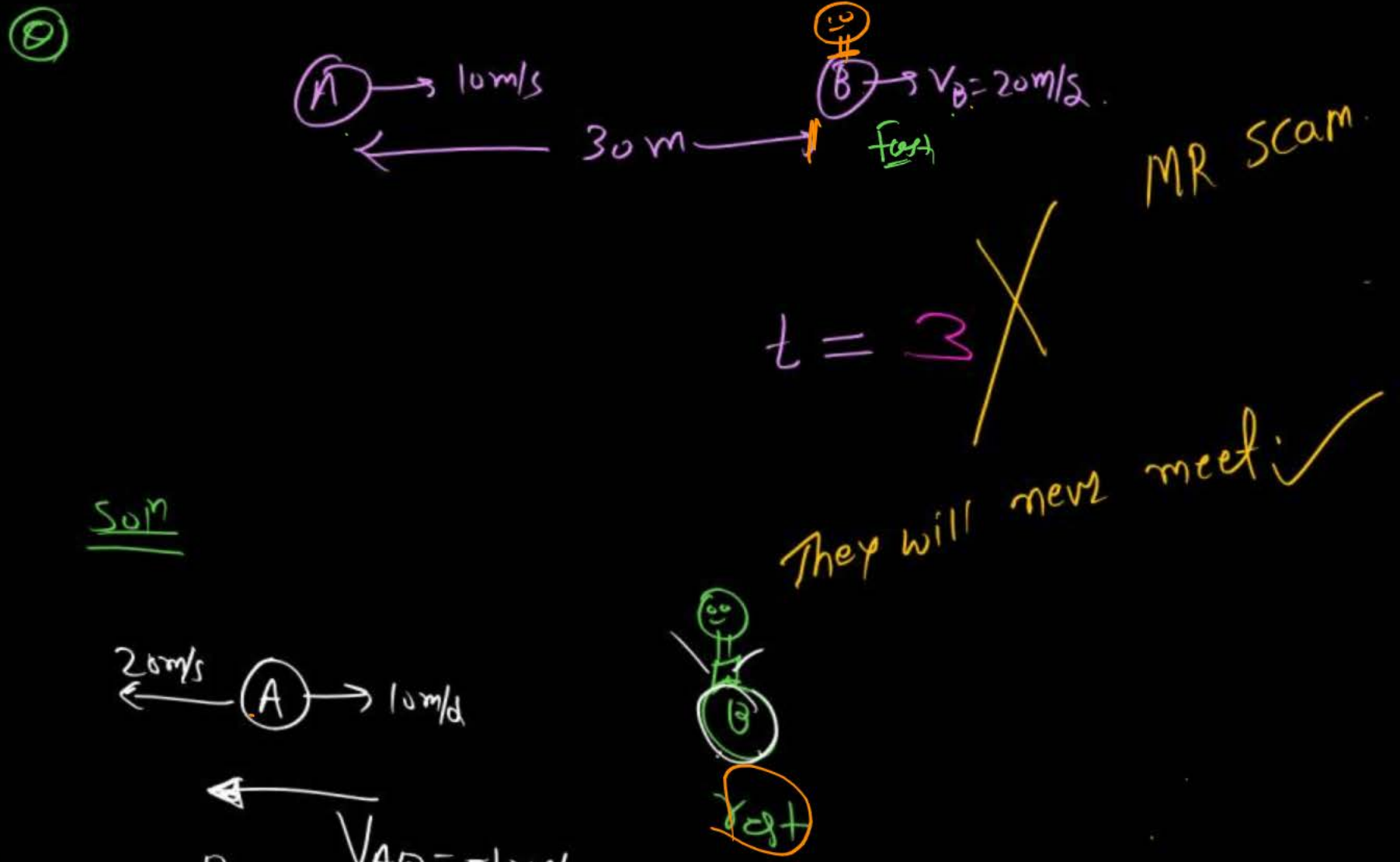
Soln

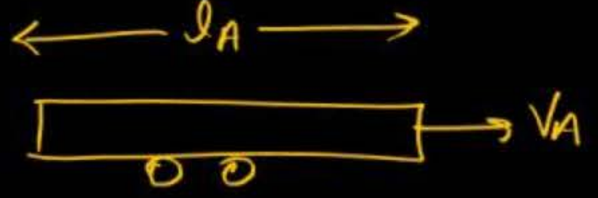
$$S_{AB} = \overset{0}{u_{AB}} + \frac{1}{2} a t_{AB}^2$$

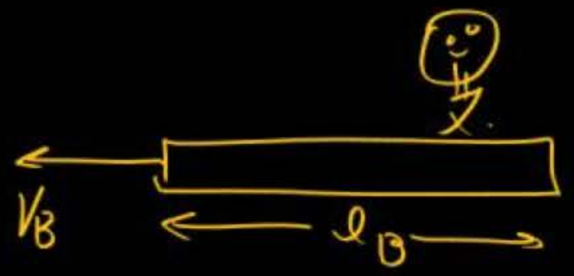
$$40m = \frac{1}{2} \cdot 1 \cdot t^2$$ ✓

$$t = \sqrt{80} = \sqrt{16 \times 5}$$

$$t = 4\sqrt{5}\ sec$$


A
10m/s
30m
B
V_B = 20m/s
Fast
MR Scam
$t = 3$
They will never meet
Son
20m/s
A
10m/s
$V_{AB} = -10$m/s
Backward
B
Dad

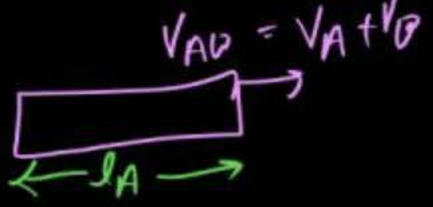


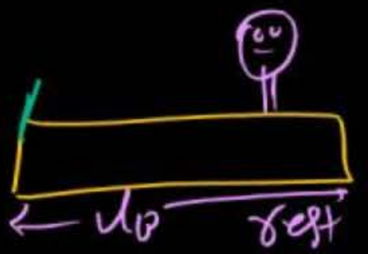


Soln

$$t = \frac{(l_A + l_B)}{V_A + V_B}$$

time to cross





Question

Two trains each of length 100 m moving parallel towards each other at speed 72 km/h and 36 km/h respectively. In how much time will they cross each other? (NEET)

1. 4.5 s
2. 6.67 s
3. 3.5 s
4. 7.25 s

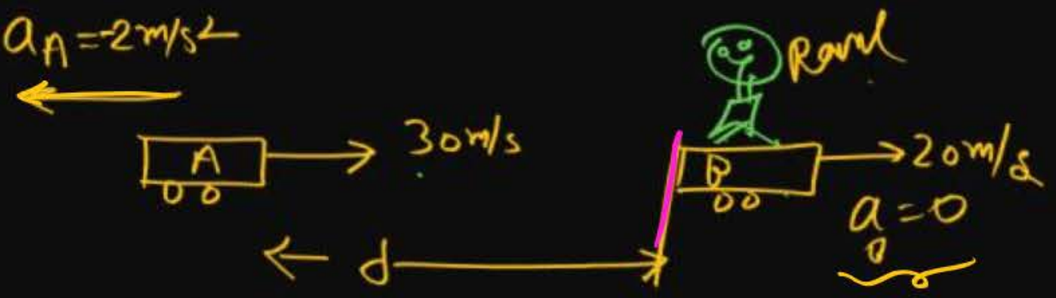
Soln $t = \frac{200}{30}$

$= \frac{20}{3} = 6.67$

Question

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/s^2. There will be no collision when

1. $d < 2.5$ m
2. $d > 125$ m
3. $d > 25$ m
4. $d < 125$ m

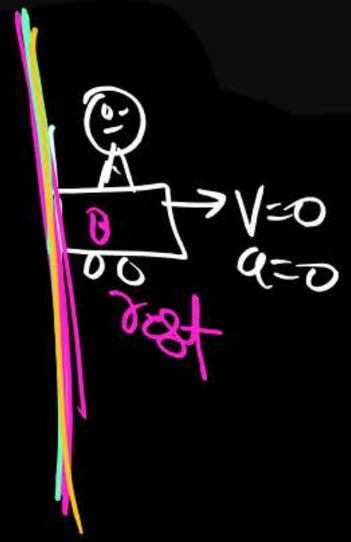


Sol^n

$V_{AB} = (30 - 20) = 10$ m/s

$a = -2$ m/s²

s (stopping) $= \frac{(10)^2}{2 \times 2} = \frac{100}{4} = 25$ m

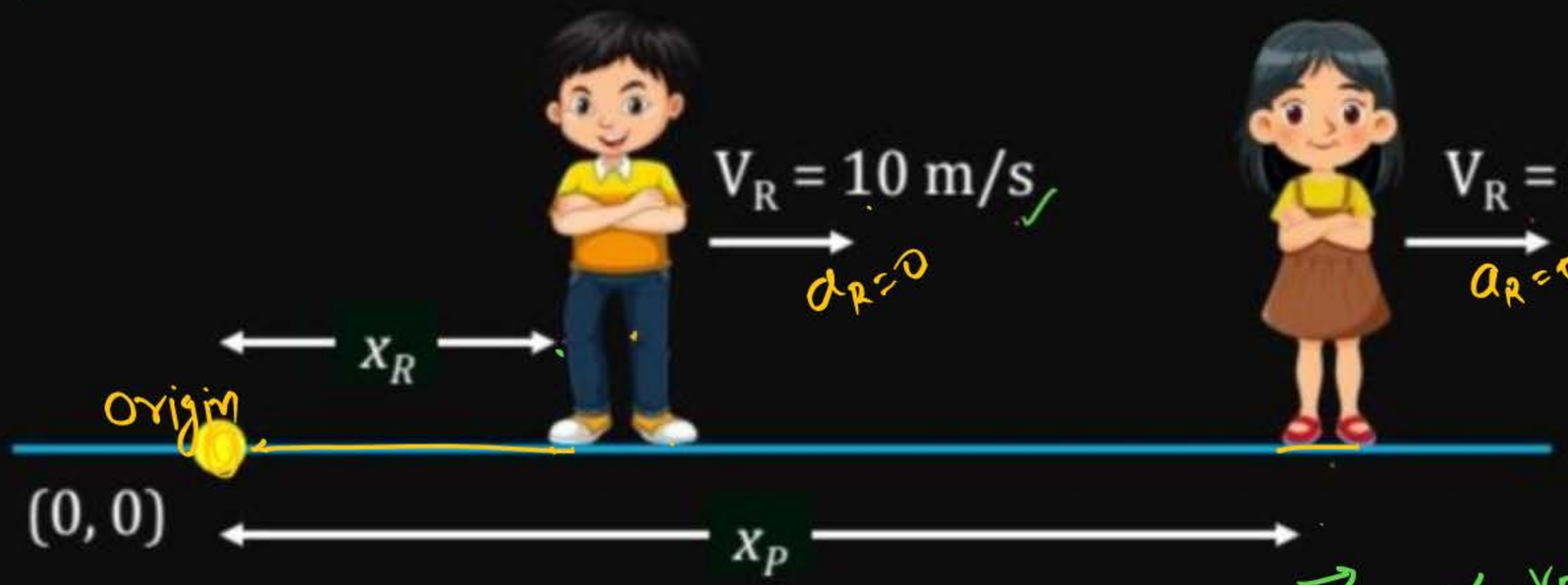


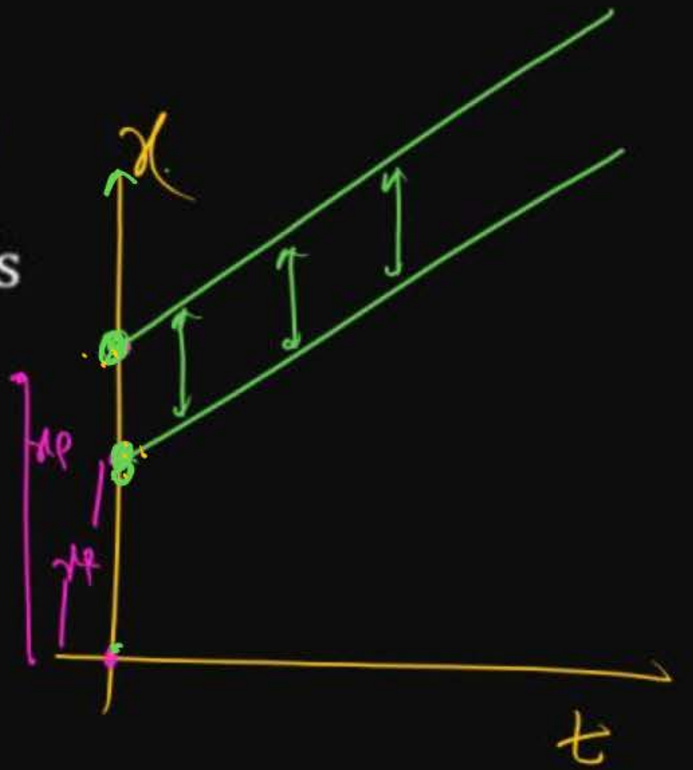
$25 < d$

Question

Draw position-time graph and comment on relative separation?

H/w





$\vec{V}_{RP} = V_R - V_P$

$= 10 - 10 = 0$

$S_{RP} = u_{RP}t + \frac{1}{2}a_{RP}t^2$

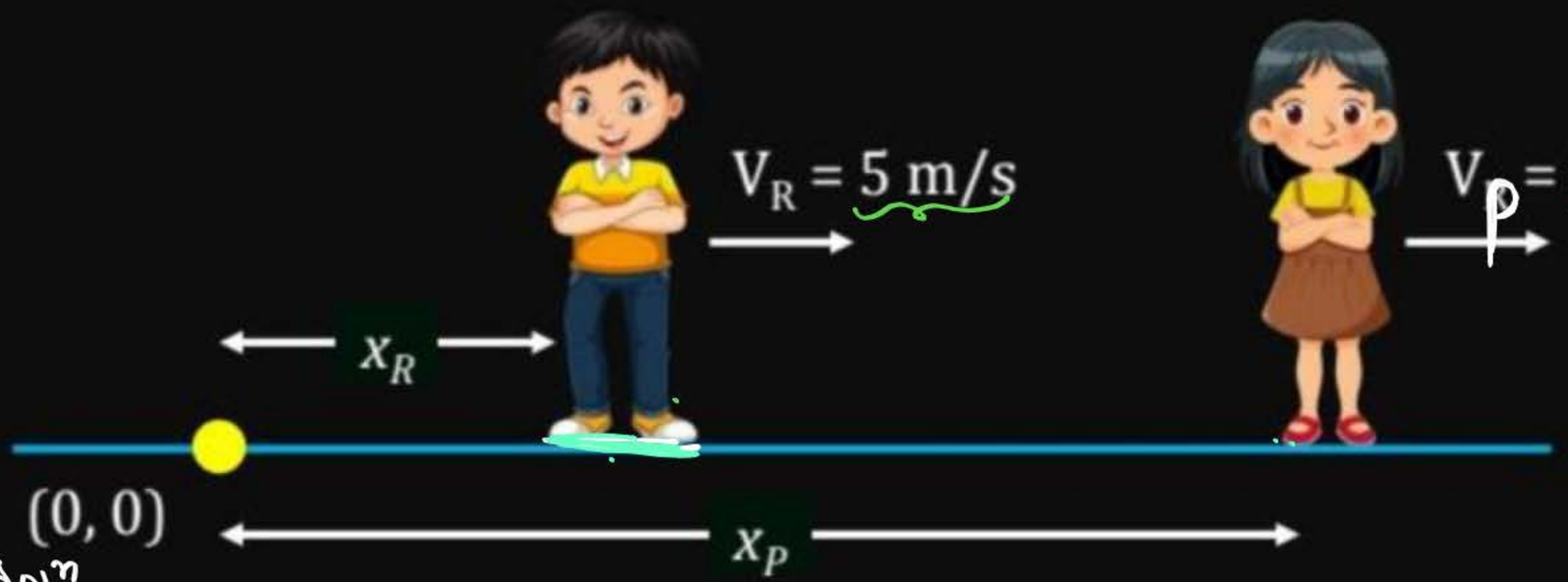
$S_{RP} = 0$

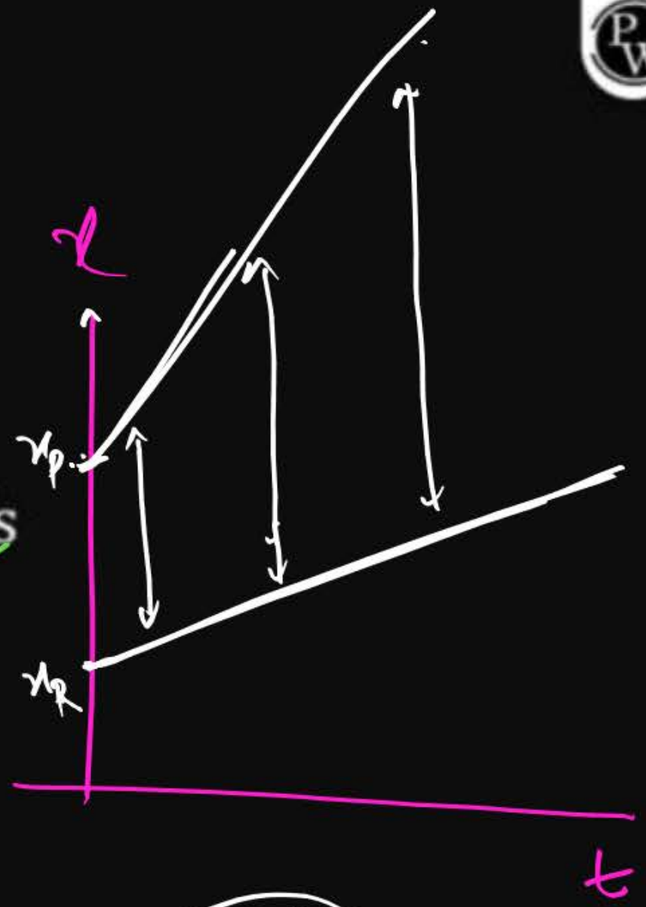
Relative disp^m = 0

Slope of Posit-time Graph = velocity

Question

Draw position-time graph and comment on relative separation?





$\vec{V}_{12} = -\vec{V}_{21}$

$= 10 - 5 = 5$ m/s

Ramkul ke pass

$\vec{V}_{R\,Rmkl} = V_R - V_P$

$= 5 - 10$

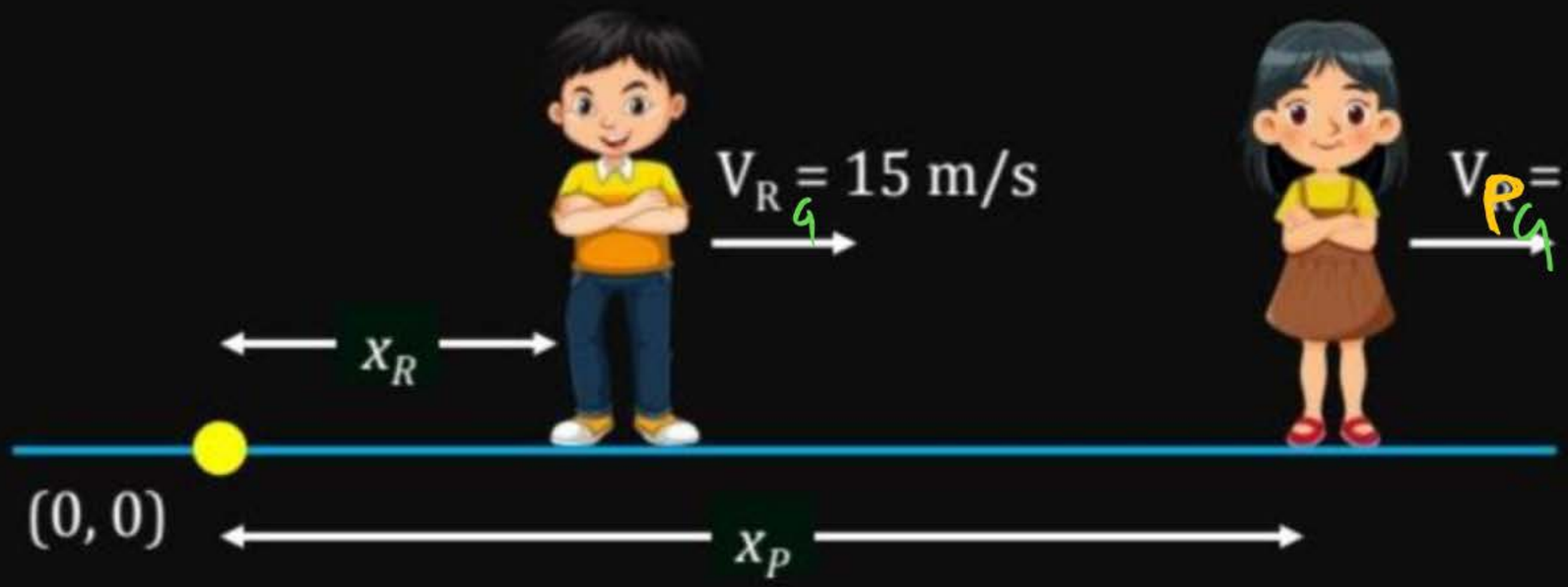
$\vec{V}_{RR} = -5$ m/s

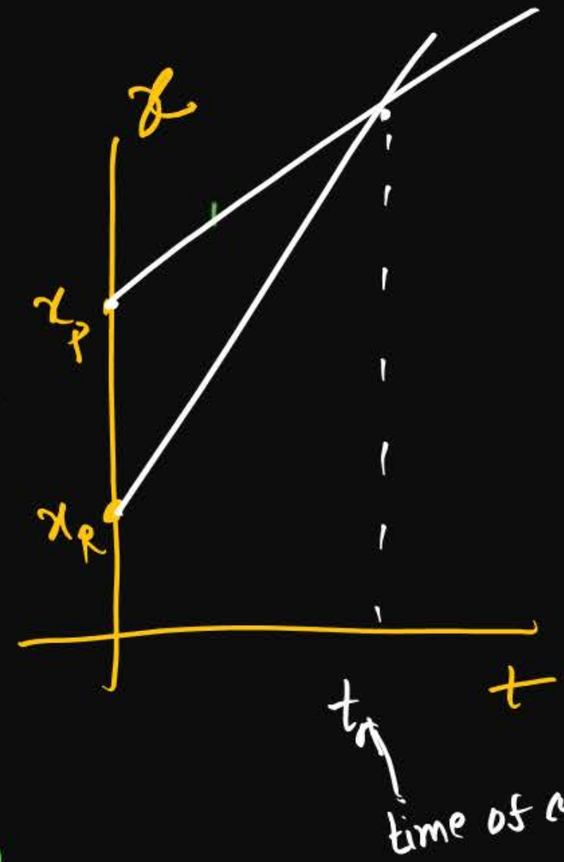
$\vec{V}_{PR} = -\vec{V}_{RP}$

Question

Draw position-time graph and comment on relative separation?

w/w





$\vec{V}_{RPinky} = \vec{V}_R - \vec{V}_P$

$= 15 - 10$

$= 5$ m/s.

$\vec{V}_{Pinky\ Ram/al\ (observer)} = \vec{V}_P - \vec{V}_R$

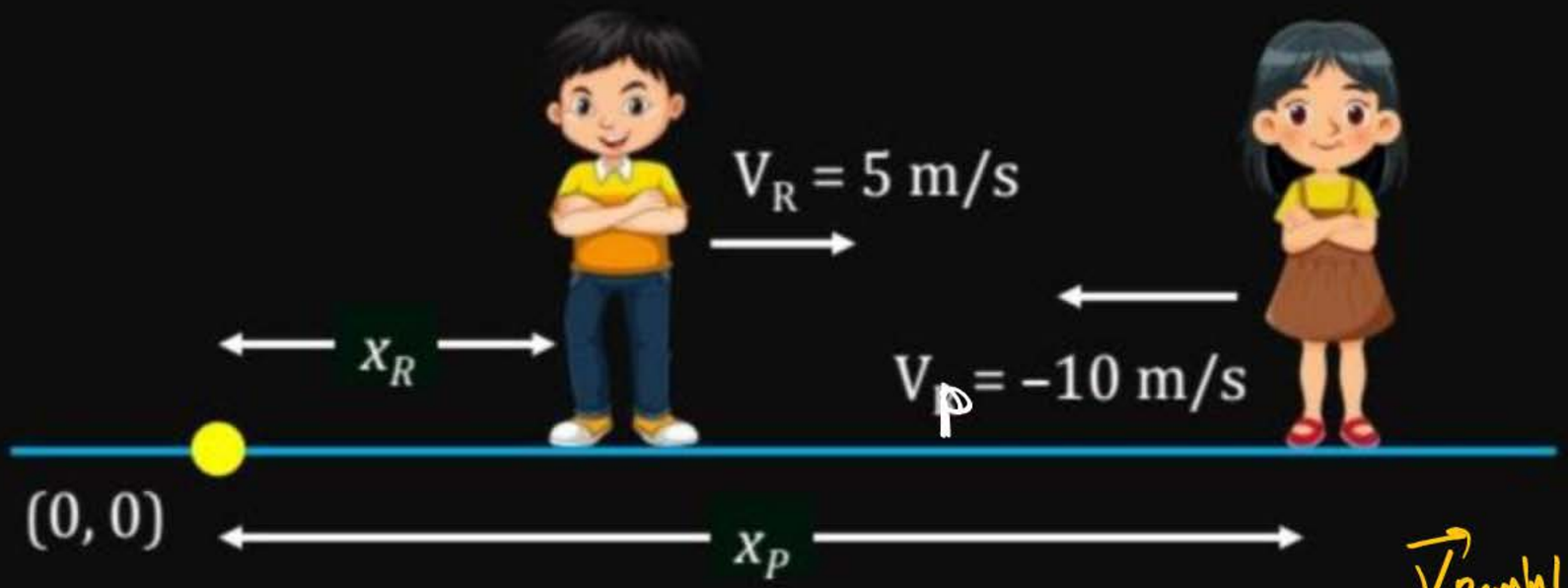
$= 10 - 15$

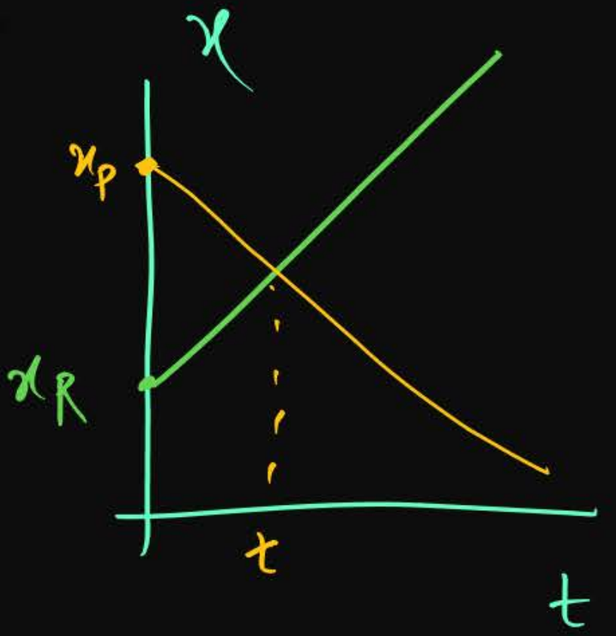
$= -5$ m/s

Question

Draw position-time graph and comment on relative separation?

H/W





$\vec{V}_{Pink\ (Ramlal)} = \vec{V}_P - \vec{V}_R$

$= -10 - 5$

$= -15$ m/s.

$\vec{V}_{Ramlal\ (pinky)} = \vec{V}_R - \vec{V}_P$

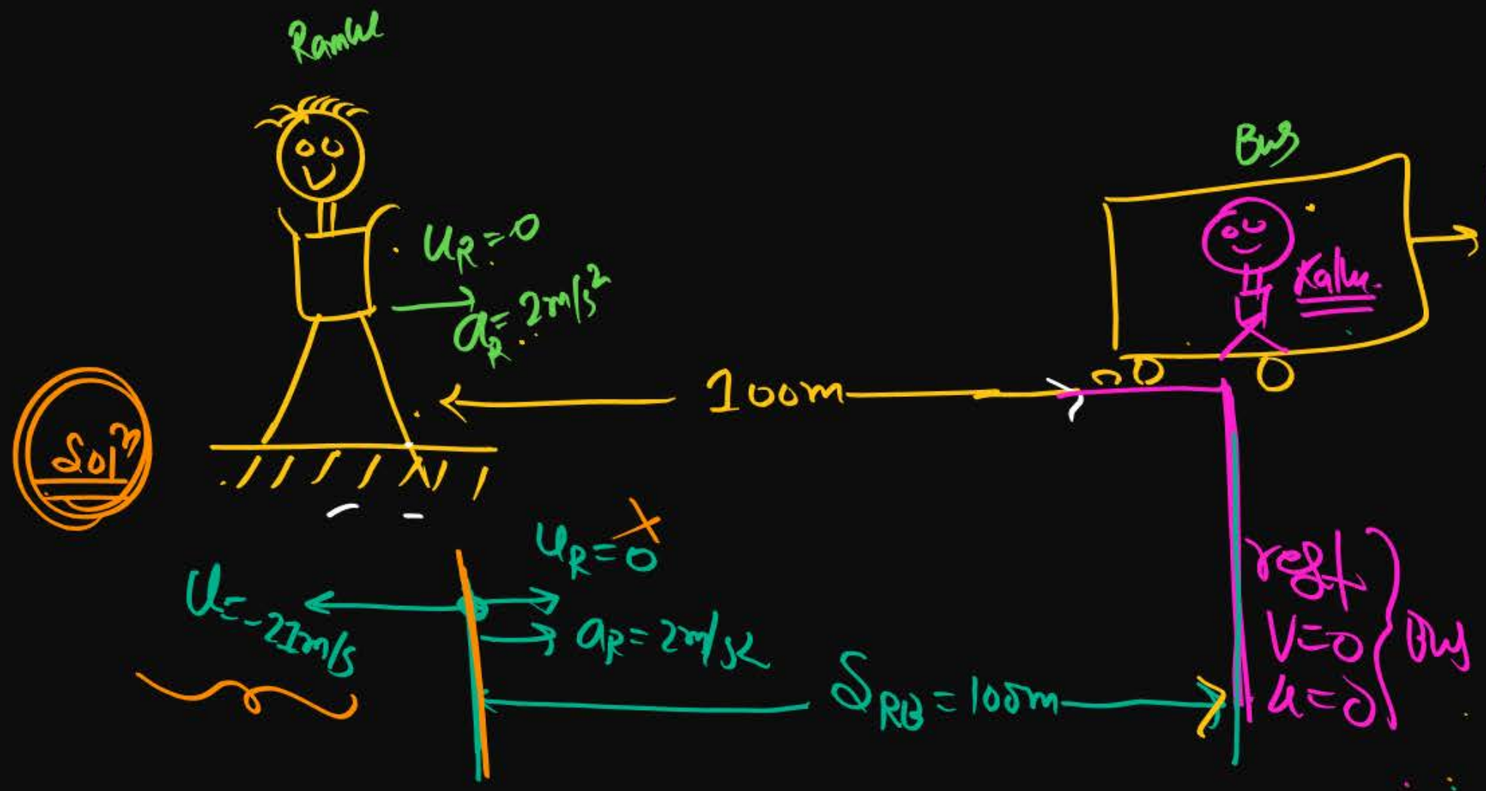
$= 5 - (-10)$

$= +15$ m/s

Question

Bus is moving with constant velocity 21 m/s and Ramlal starts his motion from rest and constant acceleration 2 m/s^2. If initial distance is 100 m then find time when Ramlal will catch the bus.

H/W



$$S_{RB} = u_{RB}t + \frac{1}{2}a_{RB}t^2$$

$$100 = -21t + \frac{1}{2}(2)t^2$$

$$t^2 - 21t - 100 = 0$$

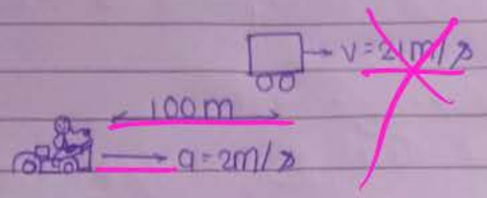
$$t^2 - 25t + 4t - 100 = 0$$

$$t(t-25) + 4(t-25) = 0$$

$$(t-25)(t+4) = 0$$

$t = 25$ ✓ $\quad t = -4$ ✗

Bus is moving with cont^n velocity 21 m/s & Romlal starts his motion from rest & cont^n accn 2m/s^2. If initial distance is 100m then Find time when Romlal will catch the bus



$t = ?$

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

$100 = \frac{1}{2} \times 2 \times (t)^2$

$t = 10\,sec$

$v^2 - u^2 = 2as$

$v^2 = 2 \times 2 \times 100$

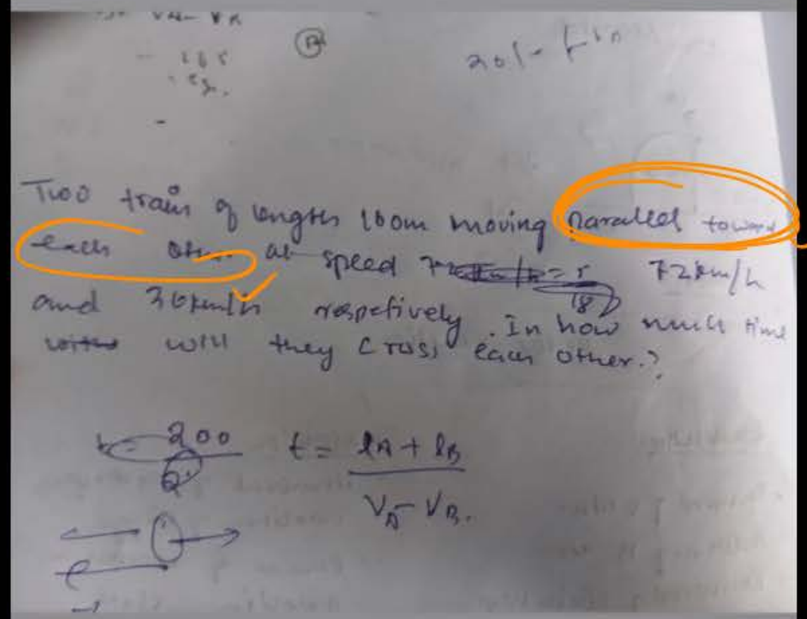
$v = \sqrt{400}$

$v = 20\,m/s$

↳ Romlal final velocity.

@MRSIR_MRSTAR

Sir isme time 10sec hi aayega na



Two trains of lengths 100m moving parallel towards each other at speed 72km/h and 36km/h respectively. In how much time will they cross each other?

$t = \frac{200}{6}$

$t = \frac{l_A + l_B}{v_A - v_B}$

Ye question aap ne velocity ko minus kyu nhi kiya hai kyuki train parallel jarai toh @mrsir_mrstar

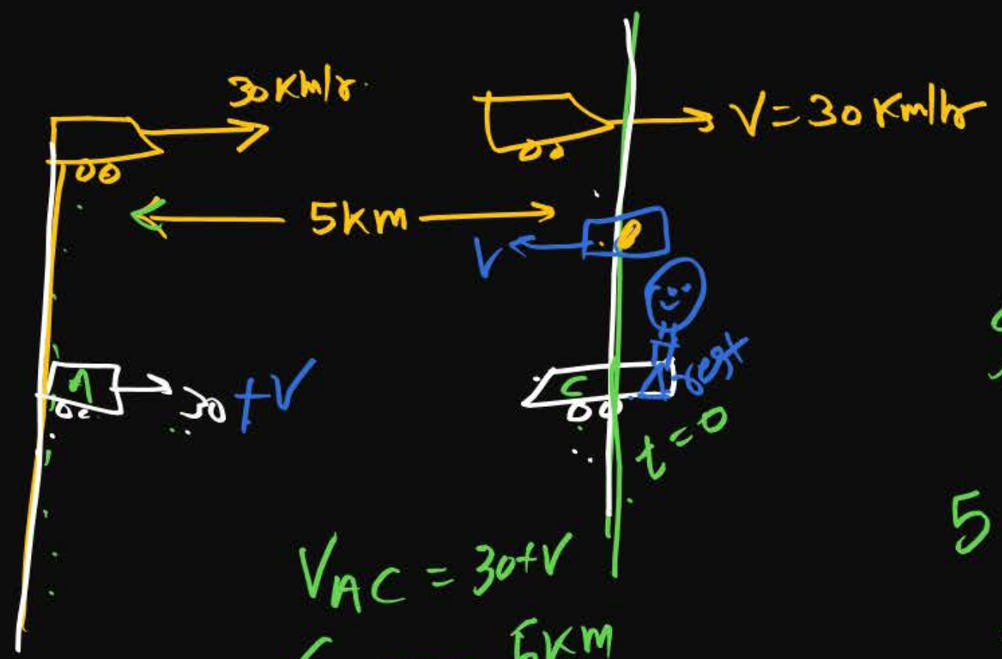
Question

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

H/W

1. 30 km/h
2. 25 km/h
3. 40 km/h
4. 45 km/h

$t = 4$ mint $= 4\left(\frac{1}{60}\text{ hr}\right) = \frac{1}{15}\text{ hr}$



$V_{AC} = 30 + V$

$S_{AC} = 5\text{km}$

$S_{AC} = V_{AC}\, t$

$5 = (30 + V)\frac{1}{15}$

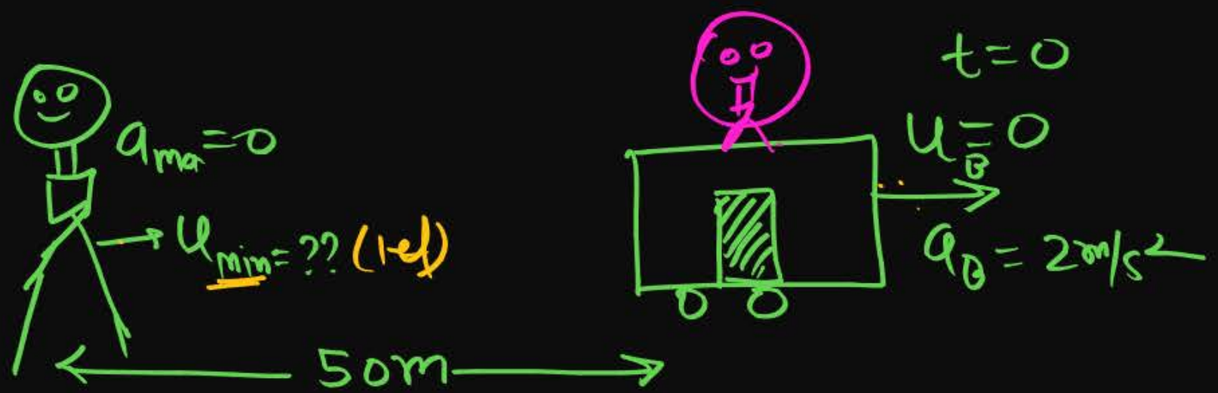
$75 = 30 + V$

$V = 75 - 30$

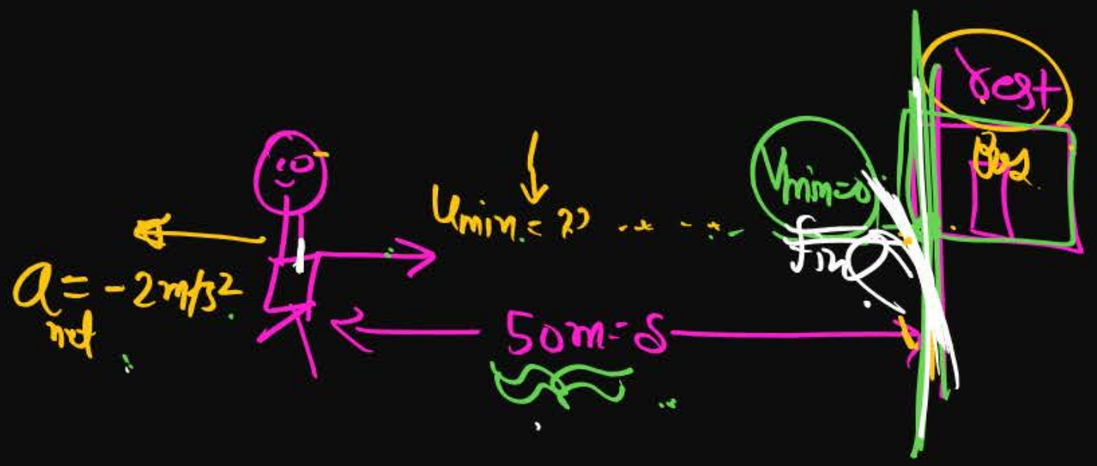
$= 45\text{ km/h}$

Question

Find minimum velocity of man so that he can catch the bus who starts motion from rest and acceleration 2 m/s². as shown in figure :- (50m dist^n Question में given है)



stopping dist^n



(3rd eqn of motion

$v_f^2 - u^2 = 2as$

$0 + u_m^2 = 2(+2)s$

$u_m^2 = 4 \times 50$

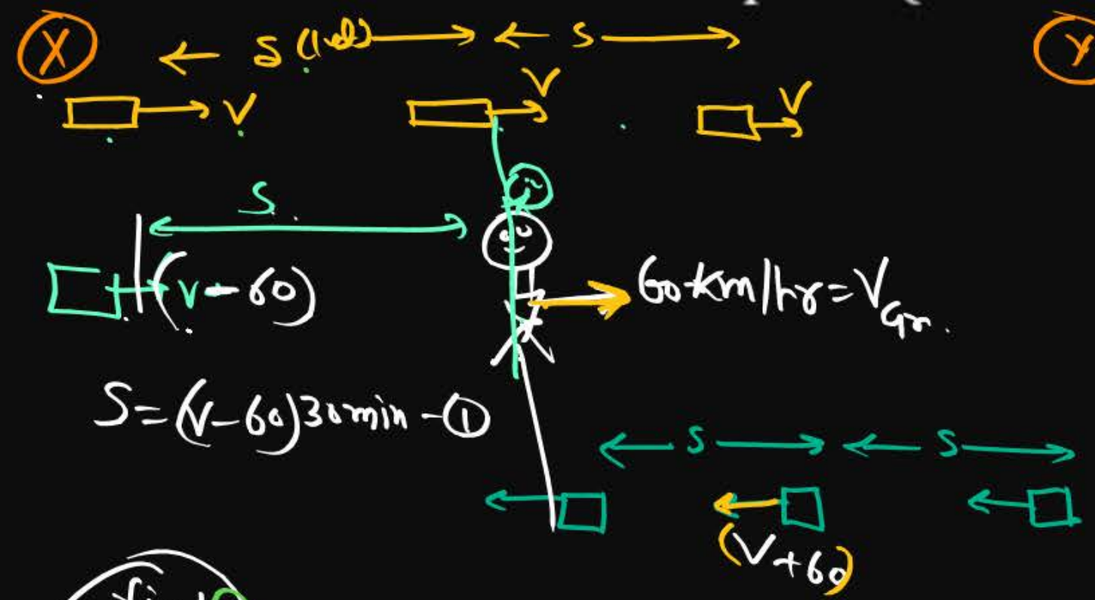
$u_m = \sqrt{200}$ m/s

Question

Two cities X and Y are connected by a regular bus service with a bus leaving in either direction every T min. A girl is driving scooty with a speed of 60 km/h in the direction X to Y notices that a bus goes past her every 30 minutes in the direction of her motion, and every 10 minutes in the opposite direction. Choose the correct option for the period T of the bus service and the speed (assumed constant) of the buses.

[NEET 2025]

1. 9 min, 40 km/h
2. 25 min, 100 km/h
3. 10 min, 90 km/h
4. 15 min, 120 km/h



Find S w.r.t V then find T

H/W

① = ②

$(V-60)3 = (V+60)1$

$3V - 180 = V + 60$

$3V - V = 180 + 60$

$2V = 240$

$V = 120$ km/hr

$$\vec{V}_{AB} = \vec{V}_A - \vec{V}_B$$

$$\vec{V}_{AB} = \vec{V}_{AG} - \vec{V}_{BG}$$

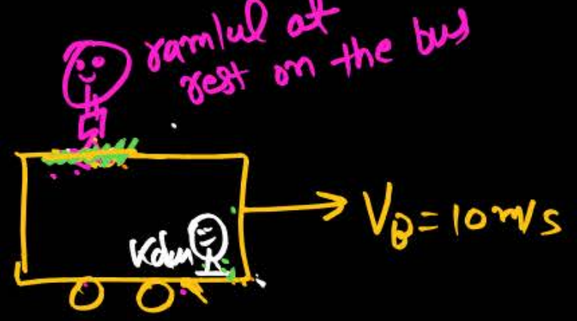
Correct $\vec{V}_{AB} = \vec{V}_{A\,lift} - \vec{V}_{B\,lift}$

$$\vec{V}_{AB} = \left(\vec{V}_A - \vec{V}_{lift}\right) - \left(\vec{V}_B - \vec{V}_{lift}\right)$$

$$= V_A - V_{lift} - V_B + V_{lift}$$

Boxed $\vec{V}_{AB} = \vec{V}_A - \vec{V}_B$

Relative motion on moving frame



$\Rightarrow \vec{v}_{R(Bus)} = 0$

$\Rightarrow$ $v_{Ramlal\ w.r.t\ ground} = ??$

$= 10 m/s$ ✓

Moving frame ~~pr~~
object frame ki velocity ko as it is le. leta hai.

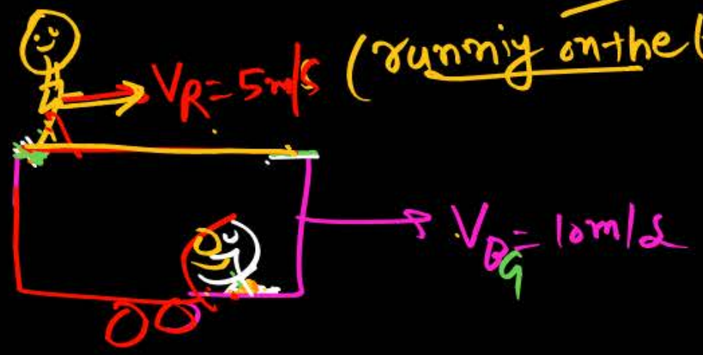
alternate method

$\vec{v}_{Ram\,Bus} = \vec{v}_{RG} - \vec{v}_{BG}$

$0 = \vec{v}_{RG} - 10$

$\vec{v}_{R\,Ground} = +10 m/s$ ✓

Q.



extra (running on the bus)

$v_{R\,Bus\ (extra)} = 5$ m/s ✓

$v_{Ram/Ground} = 5 + 10 = 15$ m/s ✓
(Bus + extra)

$\vec{V}_{Ram\,in\,Bus} = \vec{V}_{RG} - \vec{V}_{BG}$

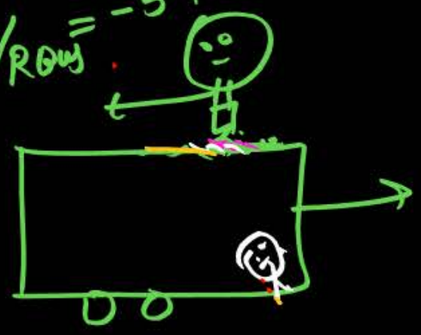
$\vec{V}_{R\,Bus} = 15 - 10$

$= 5$ m/s

MR * Bus

Bus ke andar se sirf extra dikhai dega, Ground se (extra + Bus) done dikhega

(Ramlal running on surface of Bus) $V_{R/Bus} = -5\ m/s$



$V_{Bus} = 10\ m/s$

G

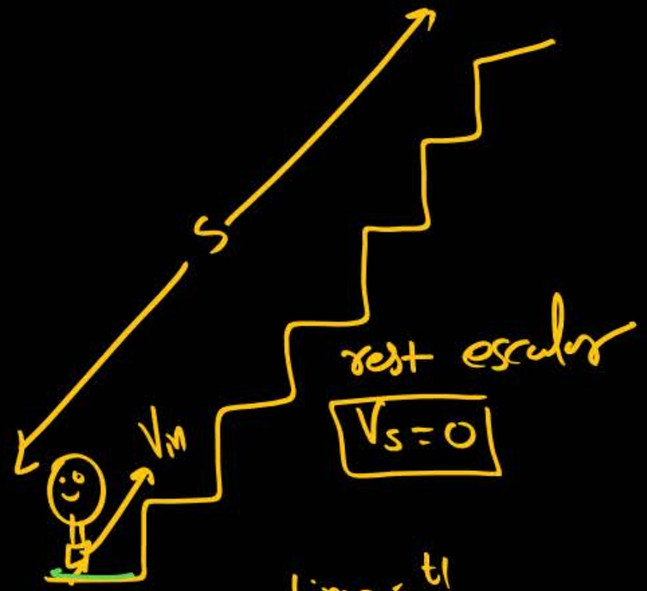
$\overrightarrow{V}_{Ram/Bus} = -5\ m/s$ ✓

Groun

$V_{R/Groun} = 10 - 5$

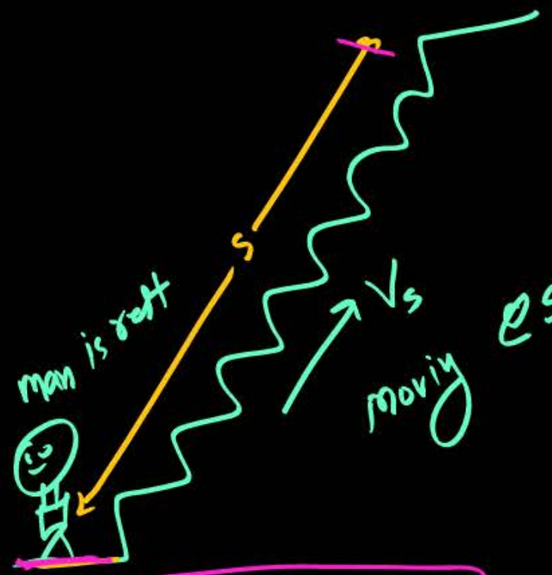
$= 5\ m/s$ ✓

escalators



time = t_1

$$S = V_m t_1 \quad -(1)$$



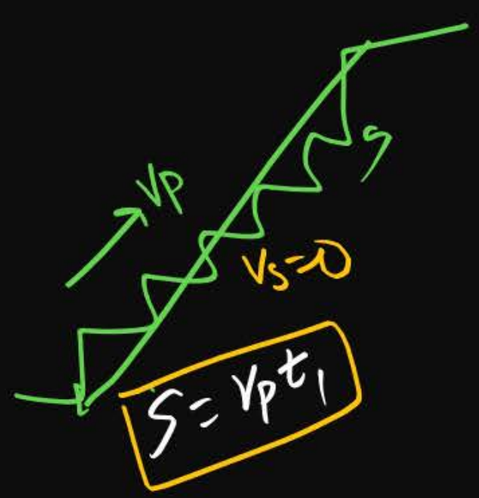
$$S = V_s t_2$$

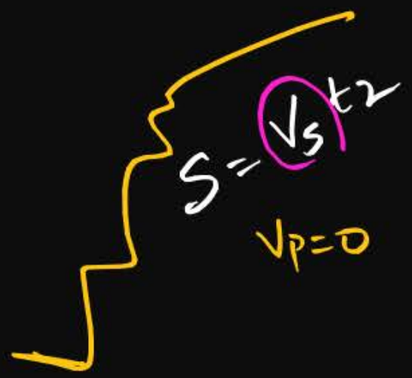
$$S = (V_m + V_s)\, t_3$$

Question

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]

1. $\frac{t_1 + t_2}{2}$
2. $\frac{t_1 t_2}{t_2 - t_1}$
3. $\frac{t_1 t_2}{t_2 + t_1}$
4. $t_1 - t_2$





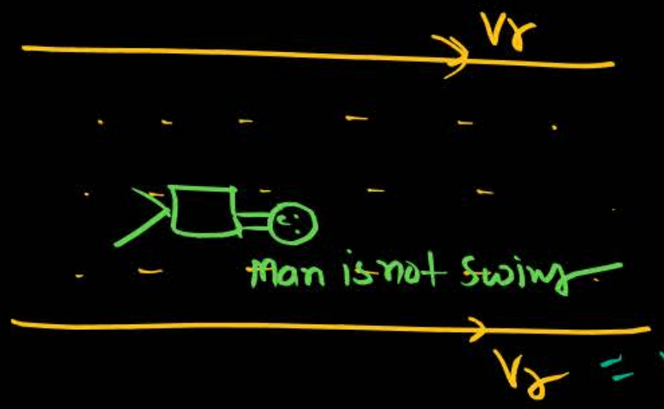
dist^n = speed × t
Both are moving
$S = (V_p + V_s)\,t$
Put value of V_p & V_s

$$S = \left(\frac{S}{t_1} + \frac{S}{t_2}\right) t$$

$$\frac{1}{t} = \frac{1}{t_1} + \frac{1}{t_2}$$

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

River ka Case



$v_{man/ground} = v_r$ — (1)

$v_{man\ w.r.t\ river}$ = ??

formula

$$v_{MR} = v_{MG} - v_{RG}$$

velocity of man w.r.t river $= v_r - v_r$

$= 0$

Case-2

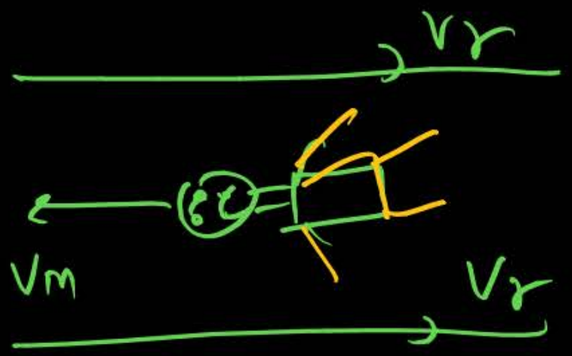
Velocity of man by which he Can swim = Velocity of man w.r.t river

Same

$V_{man/ground} = V_r + V_m$

$V_{man\ w.r.t\ river} = V_m$

man is swing up-stream (opposite to flow of river)



So,

$$\begin{cases} v_{man/river} = -V_m \\ v_{man/ground} = V_r - V_m \end{cases}$$

2-D → Motion in Plane
Class quest PDF

THANK YOU