YAKEEN NEET 2.0

2026

Motion in a Plane

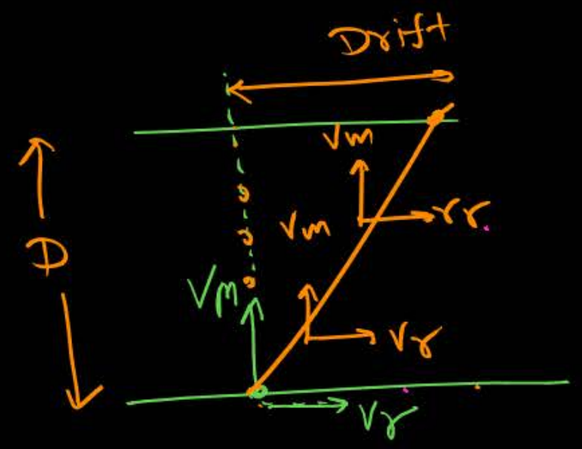
Physics | Lecture - 11

By- Manish Raj (MR Sir)

Todays Goal

↳ Question on 2-D Relative motn

min^m time



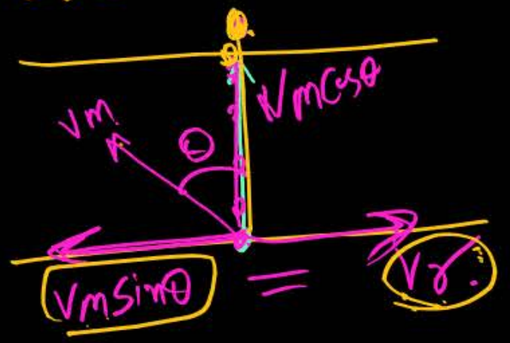
$$t_{min} = \frac{D}{v_m}$$

$$Drift = v_r \cdot t$$

$$\vec{v}_{mgrs} = v_m\hat{j} + v_r\hat{i}$$

minimum Path (zero drift)

$v_m > v_r$



$$\vec{v}_{(mgrs)x} = 0$$

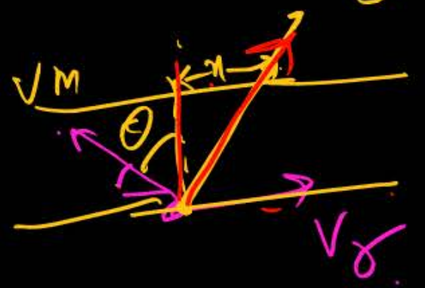
$$t = \frac{D}{v_m\cos\theta}$$

$$Drift = 0$$

$$v_m\sin\theta = v_r$$

minimum Path

$v_m < v_r$ (यहाँ flow जाएगा)



zero Drift Not possible

$$\sin\theta = \frac{v_m}{v_r}$$

θ for minimum drift

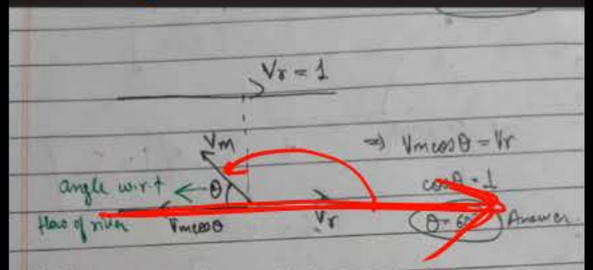
@mrsir_mrstar

@mrsir_mrstar

Question

A man wishes to swim across a river 0.5 km. wide. If he can swim at the rate of 2 km/h. in still water and the river flows at the rate of 1 km/h. The angle (w.r.t. the flow of the river) along which he should swim so as to reach a point exactly opposite his starting point, should be

1. 60°
2. 120°
3. 145°
4. 90°



Sir issme peeche se bhi to angle le kar solve kr sakte hai kyuki question me to bas itna likha hai ki flow of river ke respect me theta kya hai

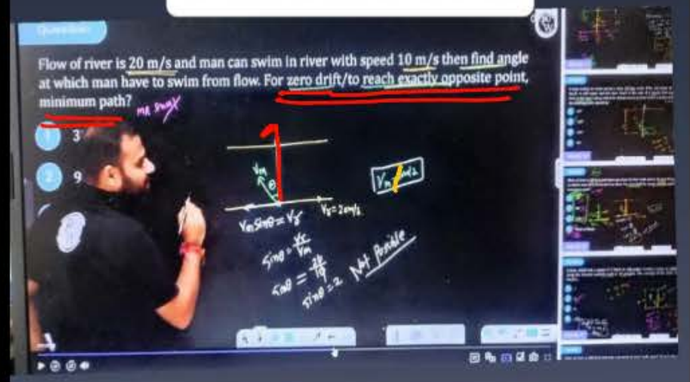
But answer kuch aur aa rha hai 😭

Add to your story

Mentions · aur_domsto 9m

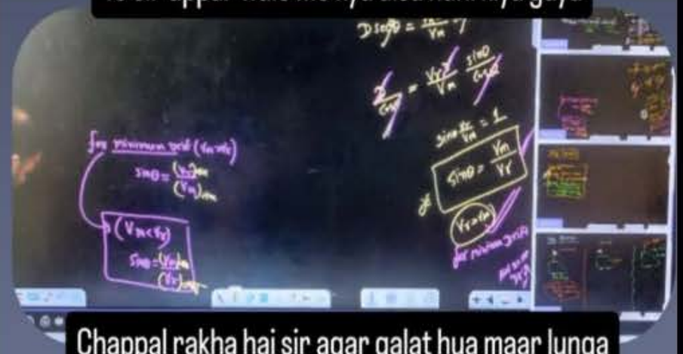
See translation

@MRSIR_MRSTAR



Sin theeta chota/bada hota hai to uppar wale me bhi chota/bada kar sakte the the

To sir uppar wale me kyu aisa nahi kiya gaya

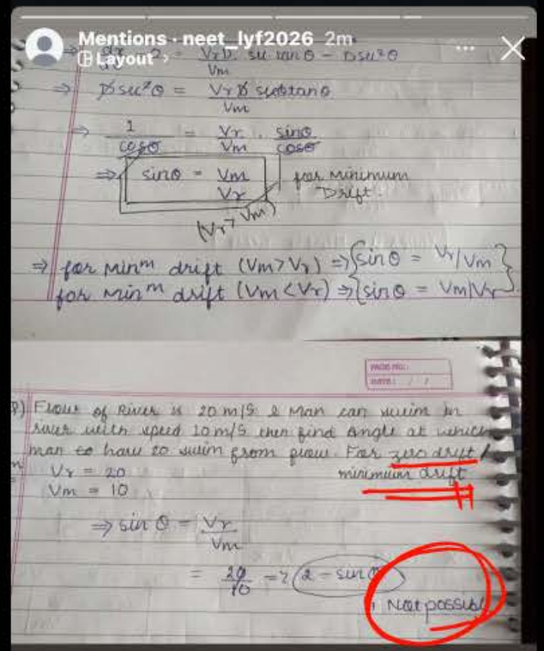


Chappal rakha hai sir agar galat hua maar lunga

8:28

Mentions · neet_lyf2026 2m

Layout



Sir aapne jo minimum drift ka case btaya vr>vm to sinthetha vm/vr ho jaega.. usko iss ques m nhi lga skte kya?

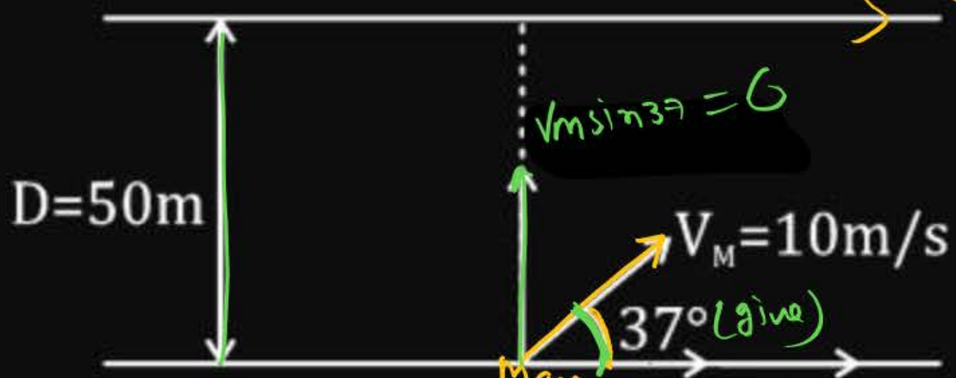
@MRSIR_MRSTAR

Add to your story

Send message...

Question H/W

Find drift and time taken to cross the river.



$V_r = 5\,m/s$ (velocity)

$V_m \sin 37 = 6$

$V_m \cos 37°$

$= 10 \times \frac{4}{5} = 8\,m/s$ ✓

$$t = \frac{D}{V_m \sin 37°}$$

$$t = \frac{50}{6}$$

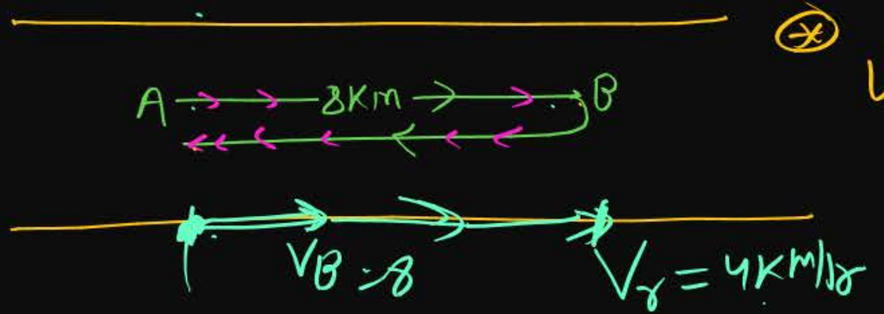
$Drift = (8+5)\,t$

$= 13\left(\frac{50}{6}\right) m$

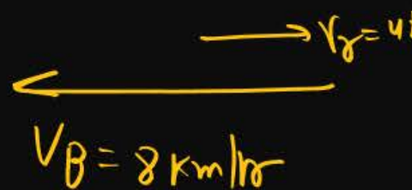
Question

A boat takes 2 hours to go 8 km and come back in still water lake. With water velocity of 4 km/hr, the time taken for going upstream of 8 km and coming back is

1. 140 min
2. 150 min
3. 160 min
4. 170 min



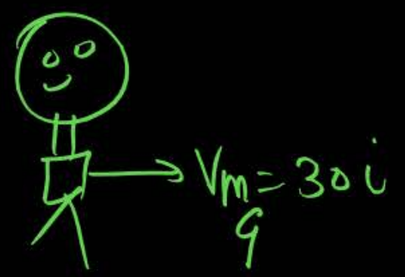
$$v_B = \frac{16\text{ km}}{2\text{ hr}} = 8\text{ km/hr}$$

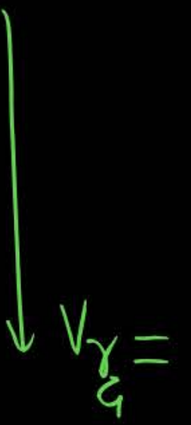


$$t_{AB(\text{Downstr})} = \frac{8\text{ km}}{12\text{ km/hr}} = \frac{2}{3}\text{ hr} = \frac{2}{3}\times 60 = 40\text{ min}$$

$$t_{BA(\text{Upstr})} = \frac{8\text{ km}}{4\text{ km/hr}} = 2\text{ hr} = 120\text{ min}$$

(Q) A man is running in horizontal dirⁿ with speed 30 m/s. and rain is falling (vertical downward) with 40 m/s. then in which dirⁿ man will hold his umbrela.





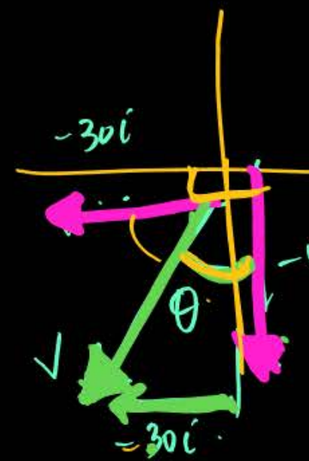
$\vec{u}_{Rain\ man} = \vec{V}_R - \vec{V}_m$

$V_{Rm} = -40\hat{j} - 30\hat{i}$

$|\vec{u}_{Rm}| = \sqrt{(40)^2 + (30)^2}$

$= \sqrt{1600 + 900}$

$= 50$ m/s



$\tan\theta = \frac{3\phi}{4\phi}$

$\tan\theta = \frac{3}{4}$

$\theta = 37°$ from vertical

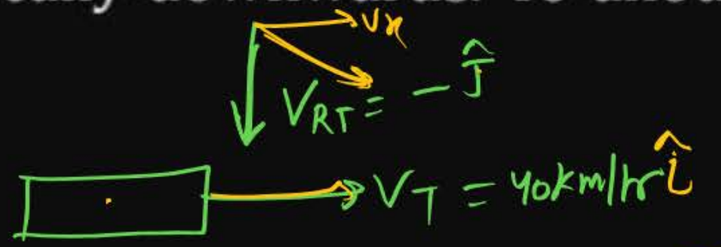
30^m

$\tan 37° = 3/4$

$\tan 53° = 4/3$

Question

A man sitting in a bus travelling in a direction from west to east with a speed of 40 km/h observes that the rain-drops are falling vertically downwards. To another man standing on ground the rain will appear.



$$\vec{V}_{RT} = \vec{V}_{RG} - \vec{V}_{TG}$$

$$-\hat{j} = \vec{V}_{RG} - 40\hat{i}$$

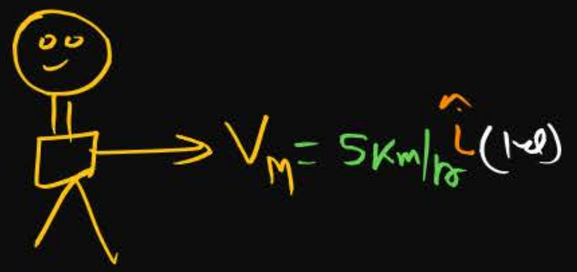
$$\vec{V}_{RG} = 40\hat{i} - \hat{j}$$

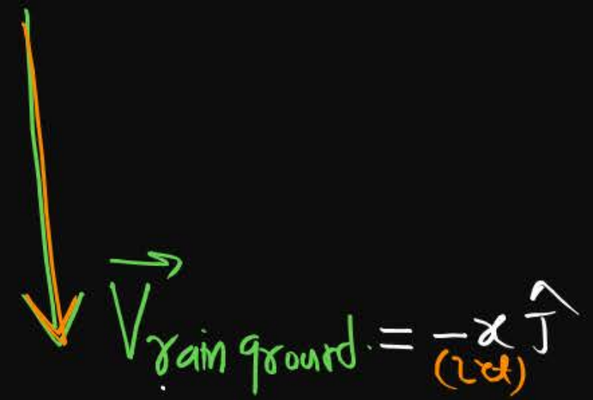
1. To fall vertically downwards
2. To fall at an angle going from west to east
3. To fall at an angle going from east to west
4. The information given is insufficient to decide the direction of the rain

Question

A man walks in rain with a velocity of 5 kmh^{-1}. The rain drops strike at him at an angle of 45° with the horizontal. Velocity of rain if it is falling vertically downward

1. 5 kmh^{-1}
2. 4 kmh^{-1}
3. 3 kmh^{-1}
4. 1 kmh^{-1}

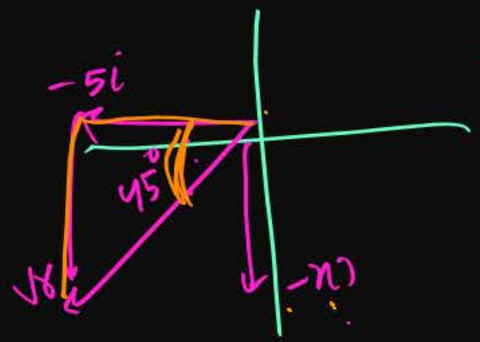




$$\vec{V}_{Rman} = \vec{V}_{rg} - \vec{V}_{mg}$$

$$\vec{V}_{Rman} = -x\hat{j} - 5\hat{i}$$

45°



$\tan 45° = \frac{x}{5}$

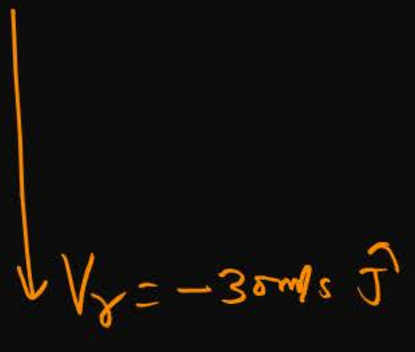
$1 = \frac{x}{5}$

$x = 5 Km/hr$

Question

Rain is falling vertically with a speed of 30 ms^{-1}. A woman rides a bicycle with a speed of 10 ms^{-1} form north to south direction. What is the direction in which she should hold her umbrella?

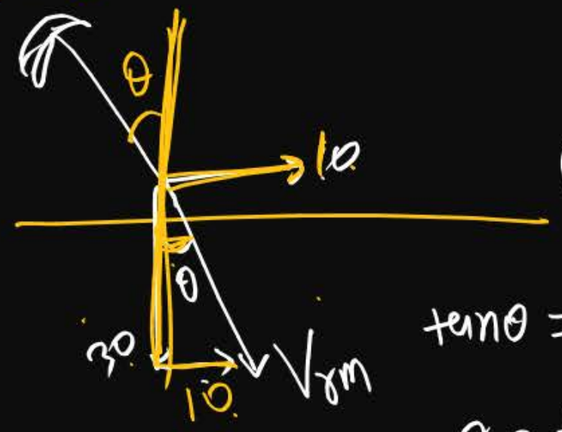
दर पर निर्भर



$$\vec{v}_{rman} = \vec{v}_r - \vec{v}_m$$

$$= -30\hat{j} - (-10\hat{i})$$

$$= -30\hat{j} + 10\hat{i}$$



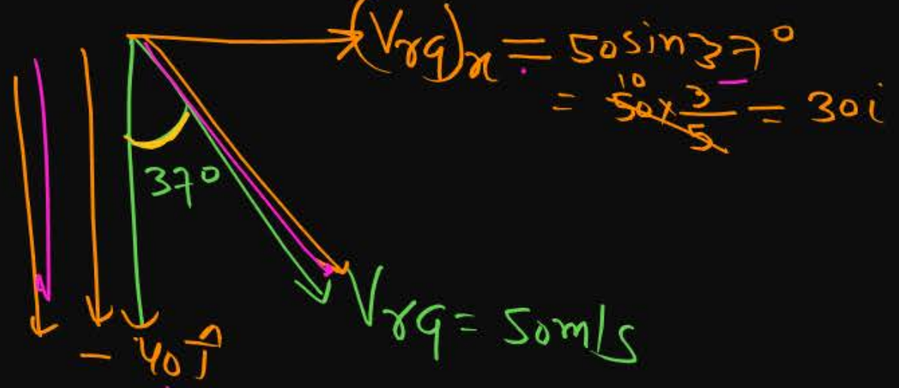
$\tan\theta = \frac{10}{30}$

$\theta = \tan^{-1}\left(\frac{1}{3}\right)$ from vertical

towards North

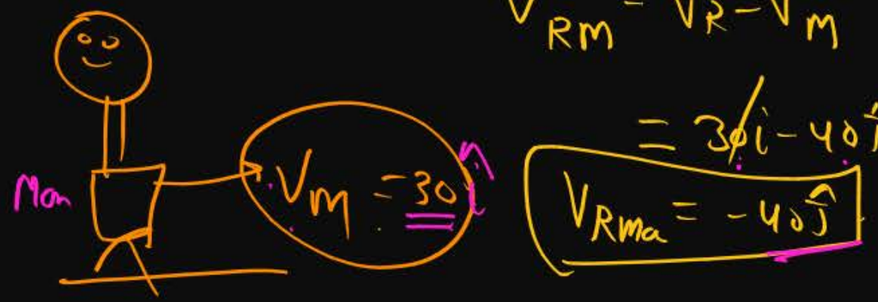
Question

Man is at rest an find rain is falling with speed 50 m/s at angle 37° from vertical; now man starts moving with speed V_m, then find V_m so that rain appears to falling vertical downward with respect to moving man; also find V_{rm} / V_r



$$\left|\frac{\vec{V}_{Rm}}{\vec{V}_{rain}}\right| = \frac{40}{50} = \frac{4}{5}$$

man



$\vec{V}_{RM} = \vec{V}_R - \vec{V}_M$

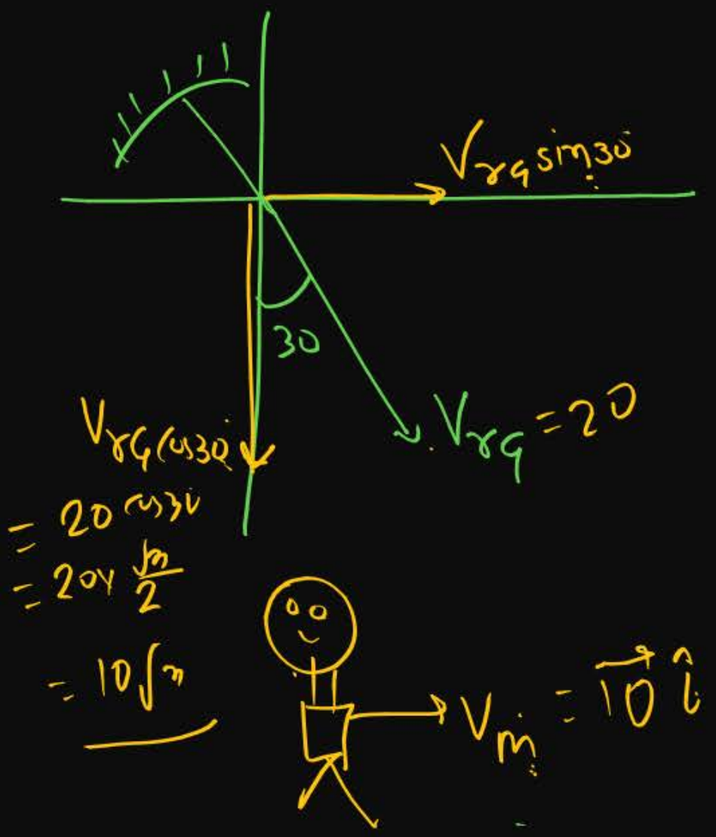
$= 30\hat{i} - 40\hat{j} - 30\hat{i}$

$V_{Rma} = -40\hat{j}$

Question

A man standing on a road has to hold his umbrella at 30° with the vertical to keep the rain away. He throws the umbrella and starts running at 10 km/hr then he finds that rain drops are hitting his head vertically, then speed of rain drops with respect to moving man:

1. 20 km/hr
2. $10\sqrt{3}$ km/hr
3. $10/\sqrt{3}$ km/hr
4. 10 km/hr



$V_{rg}\sin 30 = V_m$

$V_{rg}\frac{1}{2} = 10$

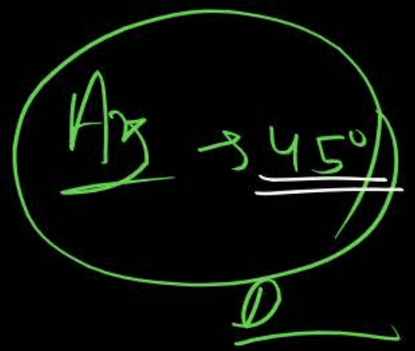
$V_{rg} = 20$

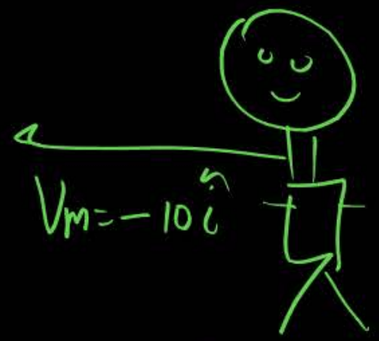
Q) Rain is falling with 50m/s at angle 37° from vertical towards east

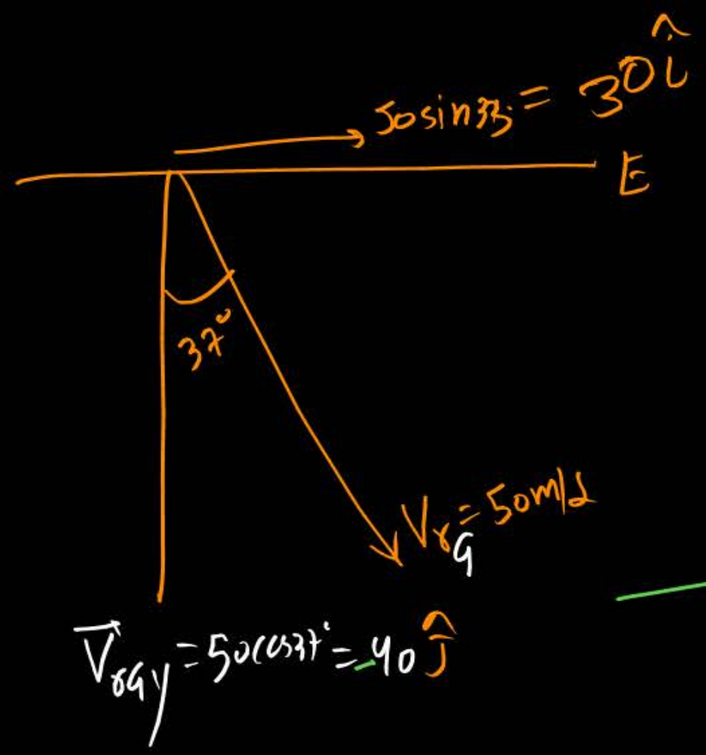
समझना है

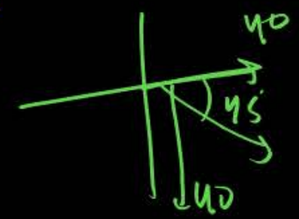
man start running with 10m/s in west then, rains appears to fall at an angle to moving man.

or he should hold his umbrella.









⊕ $\vec{V}_{RM} = \vec{V}_R - \vec{V}_M = 30\hat{i} - 40\hat{j} - (-10\hat{i}) = 40\hat{i} - 40\hat{j} = \vec{V}_{Rw}$

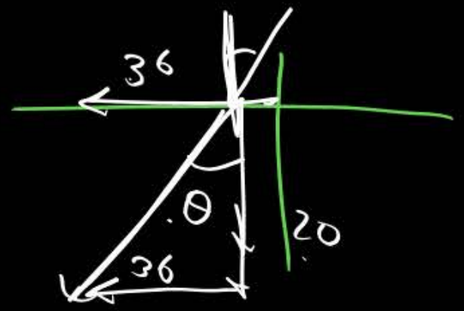
$|\vec{V}_{RM}| = 40\sqrt{2}$

(a) CAR is moving with speed 36 m/s in east & rain is falling at 72 km/hr vertical downward find Angle at which rain strike to the vertical mirror of CAR.

$\vec{v}_c = 36\ m/s$

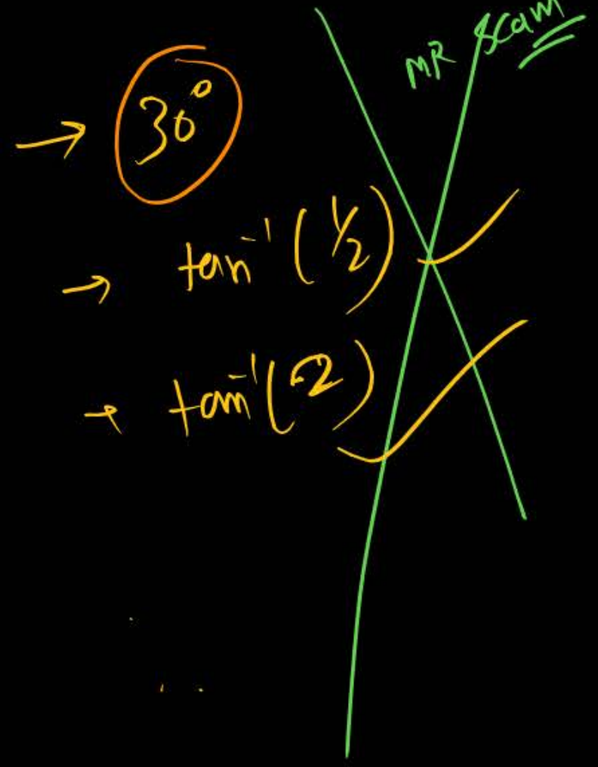
$v_{rain} = -72\ km/hr = -\frac{72 \times 5}{18}\ m/s = -20\ m/s$

$\vec{v}_{Rc} = \vec{v}_R - \vec{v}_c = -20\ m/s\,\hat{j} - 36\,\hat{i}$



$\tan\theta = \frac{36}{20} = \frac{9}{5}$

Ans $\theta = \tan^{-1}\left(\frac{9}{5}\right)$



Question

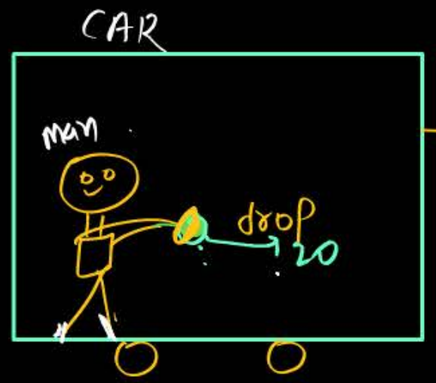
A car with vertical windshield moves in a rain storm at a speed of 40 km/hr. The rain drops fall vertically with constant speed of 20 m/s. The angle at which rain drops strike the windshield is

H/w

1. $\tan^{-1}\frac{5}{9}$
2. $\tan^{-1}\frac{9}{95}$
3. $\tan^{-1}\frac{3}{2}$
4. $\tan^{-1}\frac{2}{3}$

find velocity and acc^n of Ball w.r.t CAR and Ground when Ball is just droped

air resistance = 0



$u = 20\ m/s$ ✓

$acc^n = 0$ ✓

MR* Box

Moving frame se Ball ko drop karte hai to Ball frame ki velocity le leta hai but frame ki acc^n nahi.

free fall = $-g$ downward

$\vec{u}_{Ball/ground} = 20\ m/s\ \hat{i}$

$\vec{a}_{Ball/ground} = -10\ m/s^2\ \hat{j}$

Just after drop

$\vec{u}_{Ball/CAR} = \vec{V}_B - \vec{V}_C$

$= 20 - 20$

$= zero$

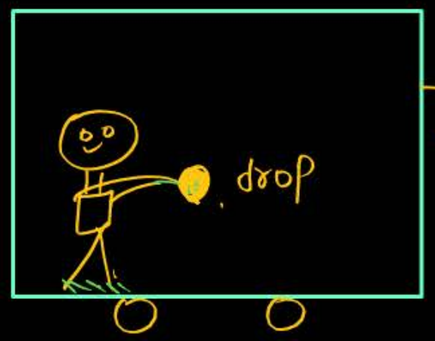
$\vec{a}_{Ball\ CAR} = \vec{a}_B - \vec{a}_C$

$= -g\hat{j} - 0$

$= -g\hat{j}$

Case-2

at $t=0$



$\rightarrow u = 20\,m/s\,\hat{i}$

$\rightarrow a_{cc^n} = 5\,m/s^2\,\hat{i}$

Just after drop.

$$\begin{cases} v_{Ball/ground} = 20\,m/s\,\hat{i} \quad \checkmark \\ a_{Ball/ground} = -10\,m/s^2\,\hat{j} \quad \checkmark \end{cases}$$

free fall

to gr. Ball

Just after drop

$$\vec{u}_{Ball/CAR} = \vec{v}_B - \vec{v}_C = 20 - 20 = 0 \quad \checkmark$$

$$\vec{a}_{Ball/CAR} = \vec{a}_{Ball/G} - \vec{a}_{CAR/G}$$

$$= -10\,m/s^2\,\hat{j} - 5\,m/s^2\,\hat{i}$$

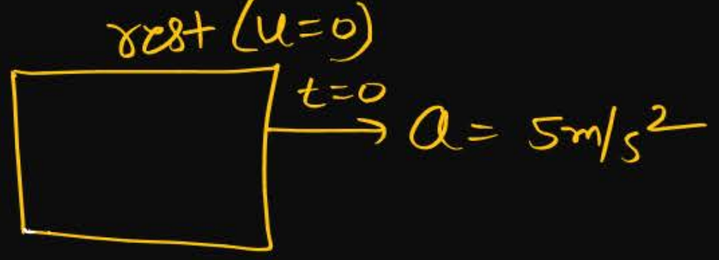
$$= \left(-10\,\hat{j} - 5\,\hat{i}\right) m/s^2$$

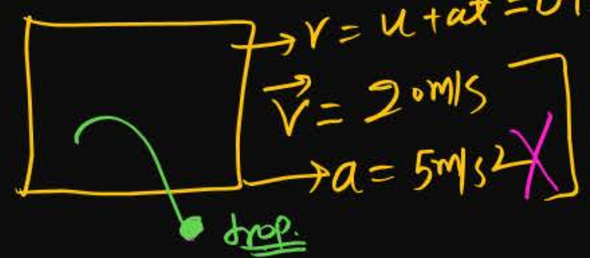
Question

A car starts from rest and accelerates at 5 m/s^2 at t = 4s, a ball is dropped out of a window by a person sitting in the car. What is the velocity and acceleration of the ball at t = 6s? (Take g = 10 m/s^2)

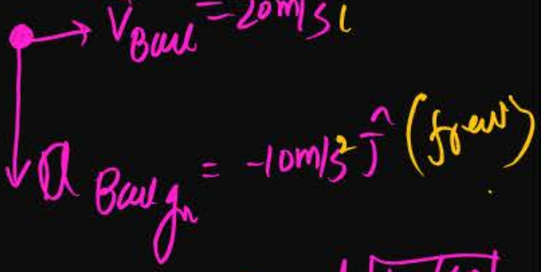
[NEET 2021]

1. 20 m/s, 5 m/s^2
2. 20 m/s, 0
3. $20\sqrt{2}$ m/s, 0
4. $20\sqrt{2}$ m/s, 10 m/s^2 (free fall)





at time of drop (t=4)



in x-axis
$a_x = 0$
$u_x = 20\hat{i}$ (const)

in y-axis
$u_y = 0$
$a_y = -10 m/s^2$
$v = u_y + at = 0 - 10 \times 2 = -20\hat{j}$

After t=2 more sec at t=6sec
$v \rightarrow 20\hat{i} - 20\hat{j}$
$a_{Ball} = -10 m/s^2$

Case-3

$u_{lift} = 30\,m/s$ ↑

$(a = 0)_{lift}$ rest.

① $\vec{u}_{Ball/ground} = 30\,m/s\,\hat{j}$

② $a_{Ball\,ground} = -g\,\hat{j} = -10\,m/s^2\,\hat{j}$

Jab tak Ball free Nahi huaa tab tak Uska ccc^n Balloon/CAR or lift ke equal hoga.

Just after drop

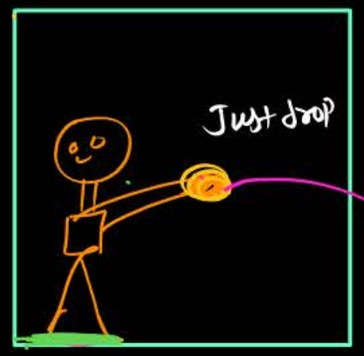
$\vec{u}_{Ball/lift} = 0 = \vec{u}_B - \vec{u}_{lift}$

$a_{Ball/lift} = \vec{a}_0 - \vec{a}_0$

$= -g\hat{j} = -10\,m/s^2\,\hat{j}$

$g_{eff} = g$

Case-4



$u_{lift} = 20\,m/s$ ↑

$a_{lift} = 5\,m/s^2$ ↑

$u_{Ball/ground} = 20\,m/s\,\hat{j}$ ↑

$a = -g = -10\,m/s^2\,\hat{j}$ ↓ free fall

} Just after drop

$$\vec{u}_{Ball,Ground} = 20\,m/s\,\hat{j}$$

$$a_{Ball/ground} = -10\,m/s^2$$

Just after drop

$$\vec{u}_{Ball/lift} = 0 \quad \because v_{Ball} - v_{lift} = 0$$

$$\vec{a}_{Ball/lift} = \vec{a}_{Ball,g} - \vec{a}_{lift,g}$$

$$= -10\hat{j} - 5\hat{j}$$

$$= -(15\,m/s^2\,\hat{j})$$

Question

NEET(AIPMT)

A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively

1. g, g
2. $g - a, g - a$
3. $g - a, g$
4. a, g

$a_{lift} = a$ ↓

$a_{Ball/ground} = +g\hat{j}$

$(a_{Ball\ lift}) = \vec{a}_{Ball} - \vec{a}_{lift} = g - (a)$

$= g - a$

$\# \ g_{eff} = (g - a)$

$a_{Ball\ ground} = +g$

MR* Boy

→ lift Ke respect me Solve Karo

→ $a_{Ball/lift(drop)} = 0$

$(\vec{a}_{lift})_{geff} = g - a$ (downward acm)

→ $t = \sqrt{\frac{2h}{g_{eff}}}$

Question

In a lift moving up with an acceleration of 5 ms^{-2}, a ball is dropped from a height of 1.25 m. The time taken by the ball to reach the floor of the lift is _____ (nearly)

($g = 10\ ms^{-2}$)

1. 0.3 second
2. 0.2 second
3. 0.16 second
4. 0.4 second

$u_{(lift)}$

$a = +5\ m/s^2$

$-ve$

$g_{eff} = g + a$

time ke liye lift frame:

$\vec{u}_{B/lift} = \vec{u}_B - \vec{u}_{lift}$

$= u - u = 0$

$\vec{a}_{Ball/lift} = \vec{a}_B - \vec{a}_l$

$= -g - 5$

$= -10 - 5$

$= -15\ m/s^2$

$S_{Ball/lift} = -1.25\ m$

$\left[S = ut + \frac{1}{2}at^2\right]_{w.r.t\ lift}$

$-1.25 = \frac{1}{2}(-15)t^2$

$\frac{2.5}{15} = t^2$

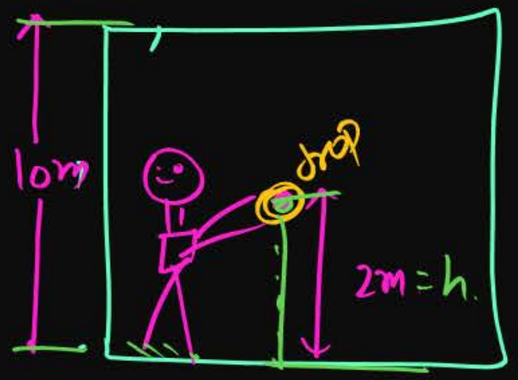
$t = \sqrt{\frac{2.5}{15}} = \frac{1}{\sqrt{6}}$

$t = 0.4\ sec$

Question

A coin is released inside a lift at a height of 2m from the floor of the lift. The height of the lift is 10m. The lift is moving with an acceleration of 9 m/s^2 downwards. The time after which the coin will strike with the floor of lift is (g = 10 m/s^2)

1. 4 s
2. 2 s
3. $\frac{4}{\sqrt{21}}$ s
4. $\frac{2}{\sqrt{11}}$ s



a_{lift} = 9 m/s² ↓ +ve

$g_{rel} = g - a$

$g_{rel} = 10 - 9 = 1\ m/s^2$

$u_{ball\ lift} = 0$

$a_{ball\ lift} = a_B - a_{lift}$

$= 10\ m/s^2 - 9\ m/s^2$

$a_{Ball/lift} = 1\ m/s^2$

$S = 2\ m$ (Ball)

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

$2 = \frac{1}{2} \cdot 1 \cdot t^2$

$t^2 = 4$

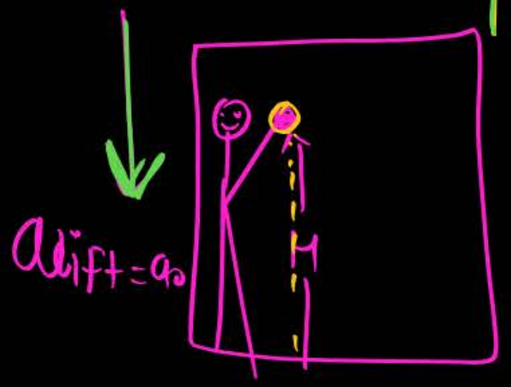
$t = 2$ sec

$a_{dif} = a$

$u_{dif} = u$

$$H = \frac{1}{2}(g-a)t^2$$

$$t = \sqrt{\frac{2H}{g+a}}$$ ✓



$a_{lift} = a_0$

$u_{lift} = u_0 \hat{j}$

$$t = \sqrt{\frac{2H}{g-a}}$$

(MR* Box)

→ lift ke respect me Solve karo

→ $u_{Ball/lift} = 0$ (drop ke case me)

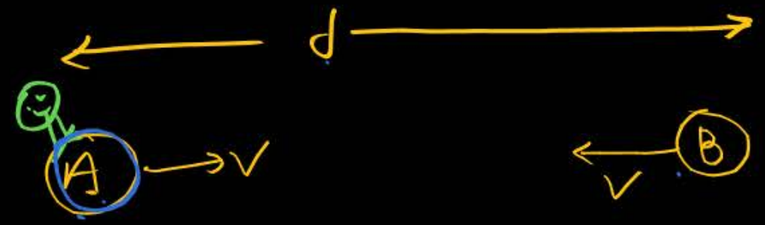
→ $(u_{Ball\ lift})_{eff} = g \pm a$

$$T = \sqrt{\frac{2h}{(g \pm a)}}$$

Question

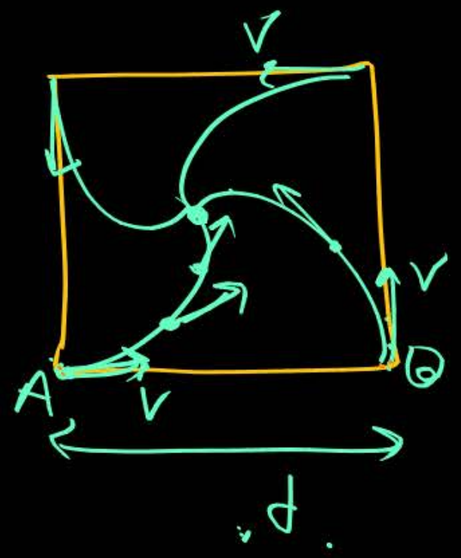
A coin is dropped in a lift. It takes time t_1 to reach the floor when lift is stationary. It takes time t_2 when lift is moving up with constant acceleration. Then:

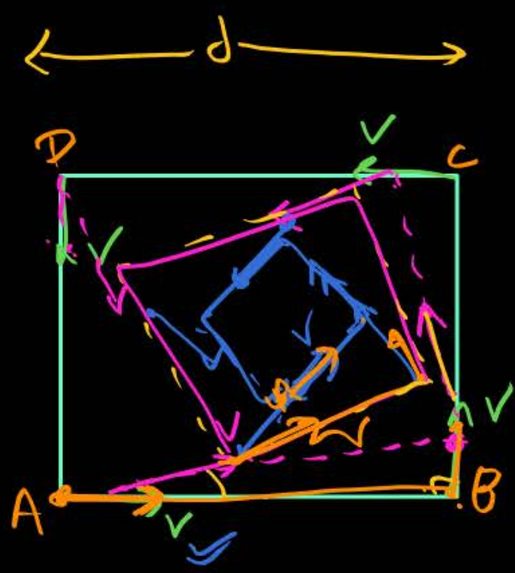
1. $t_1 > t_2$
2. $t_2 > t_1$
3. $t_1 = t_2$
4. $t_1 >> t_2$



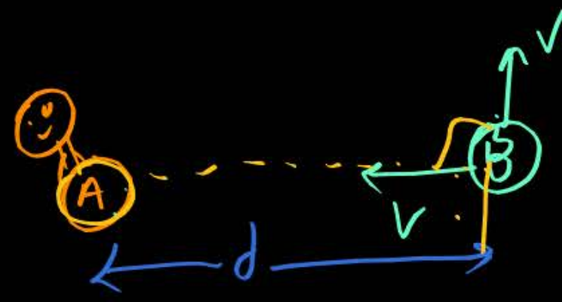
find time when they will meet

$$t = \frac{d}{2v}$$ Ans





at $t = 0$

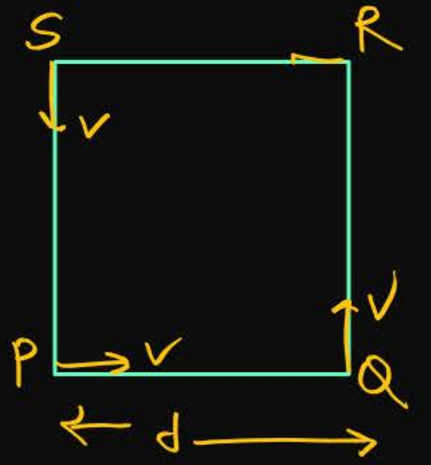


only motion in x-a.

$$(\text{time}) = \left(\frac{d}{V}\right)_{Ans}$$

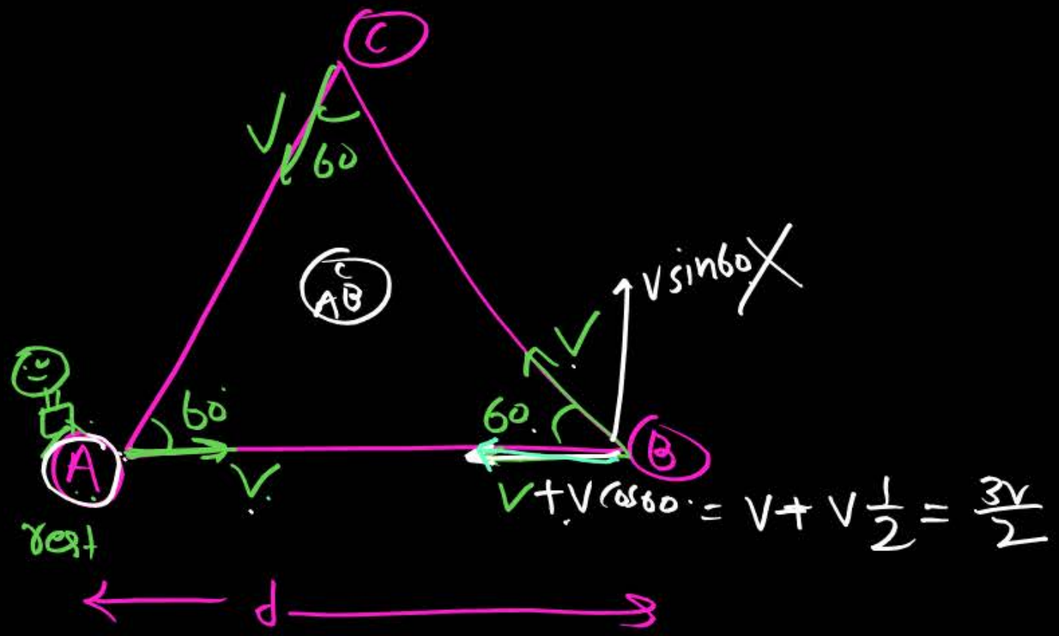
Question

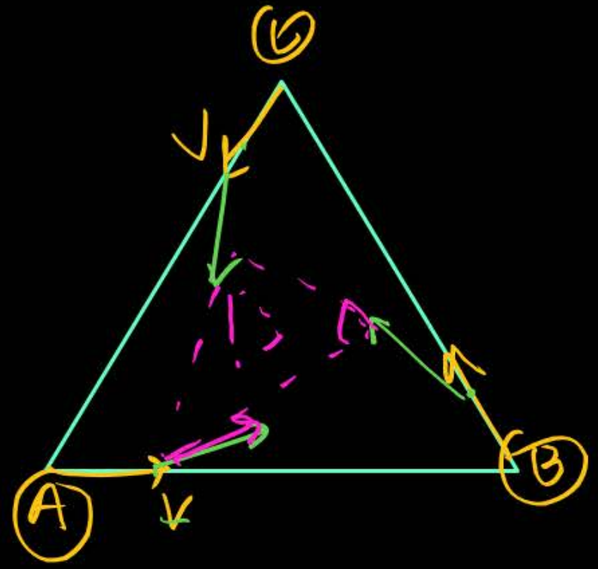
Four persons P, Q, R and S are initially at the tour corners of a square of side d. Each person now moves with a constant speed v in such a way that P always moves directly towards Q, Q towards R, R towards S, and S towards P. The four persons will meet after time



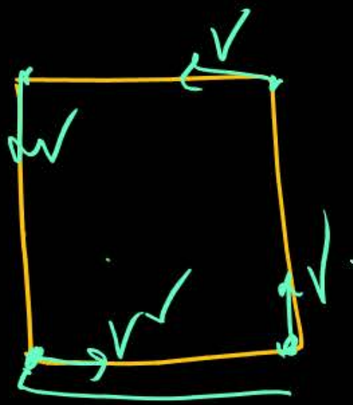
1. $\frac{d}{2v}$
2. $\frac{d}{v}$
3. $\frac{3d}{2v}$
4. They will never meet

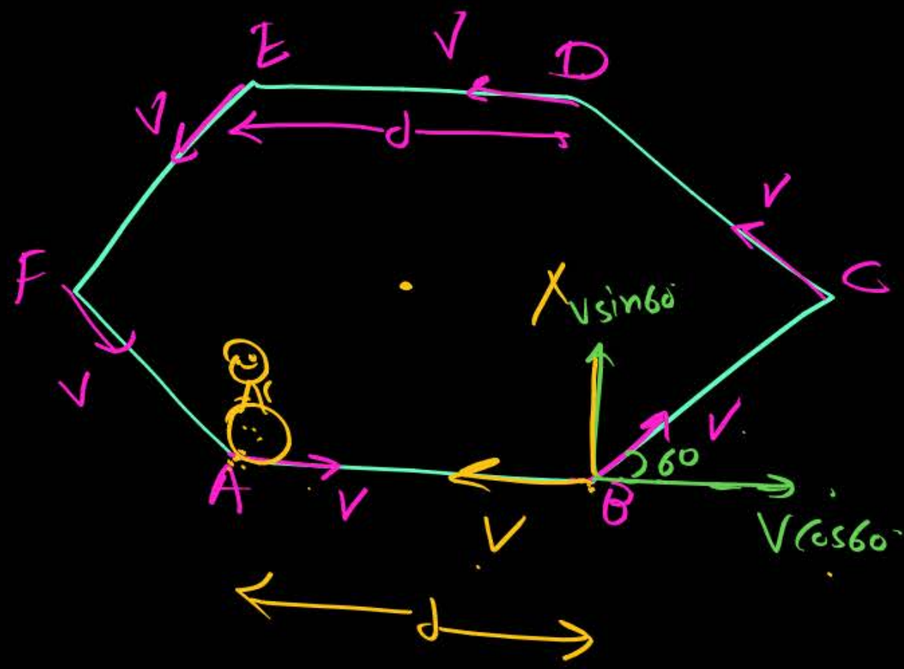
equilateral Triangle





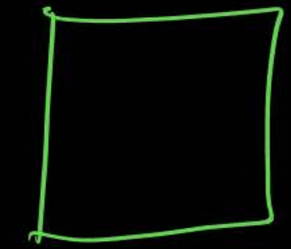
$$t = \frac{d}{(v_{relative})} = \frac{d}{3v/2} = \frac{2d}{3v}$$

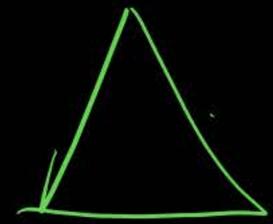


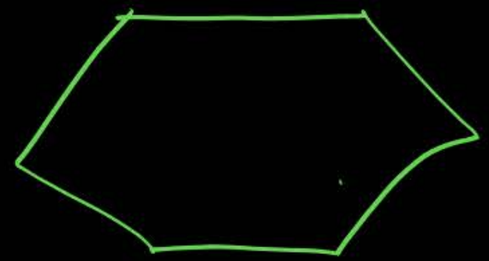


$$(V_{BA})_x = V/2$$

$$t = \frac{d}{V/2} = \frac{2d}{V}$$





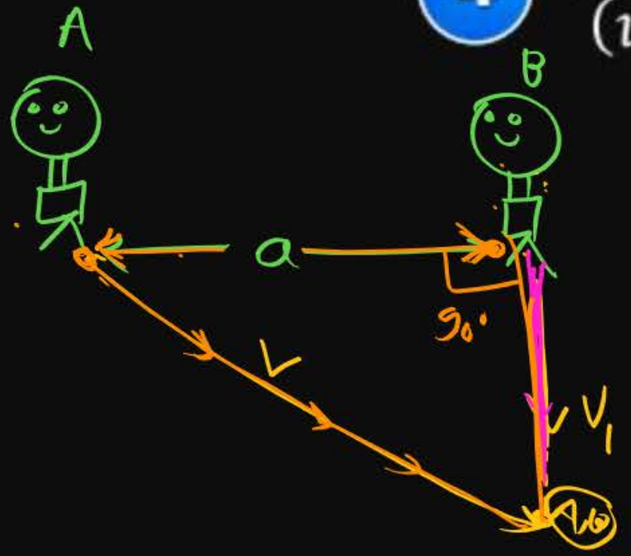


Question

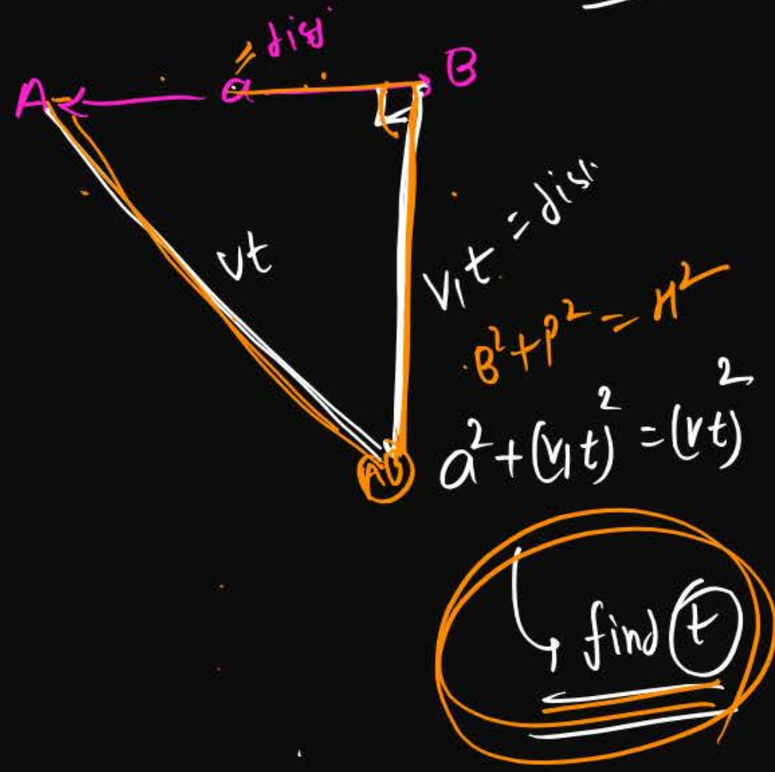
AIPMT

Two boys are standing at the ends A and B of a ground where AB = a. The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t, where t is:

1. $\frac{a}{\sqrt{v^2 + v_1^2}}$
2. $\frac{a}{\sqrt{v^2 - v_1^2}}$
3. $\frac{a}{(v - v_1)}$
4. $\frac{a}{(v + v_1)}$



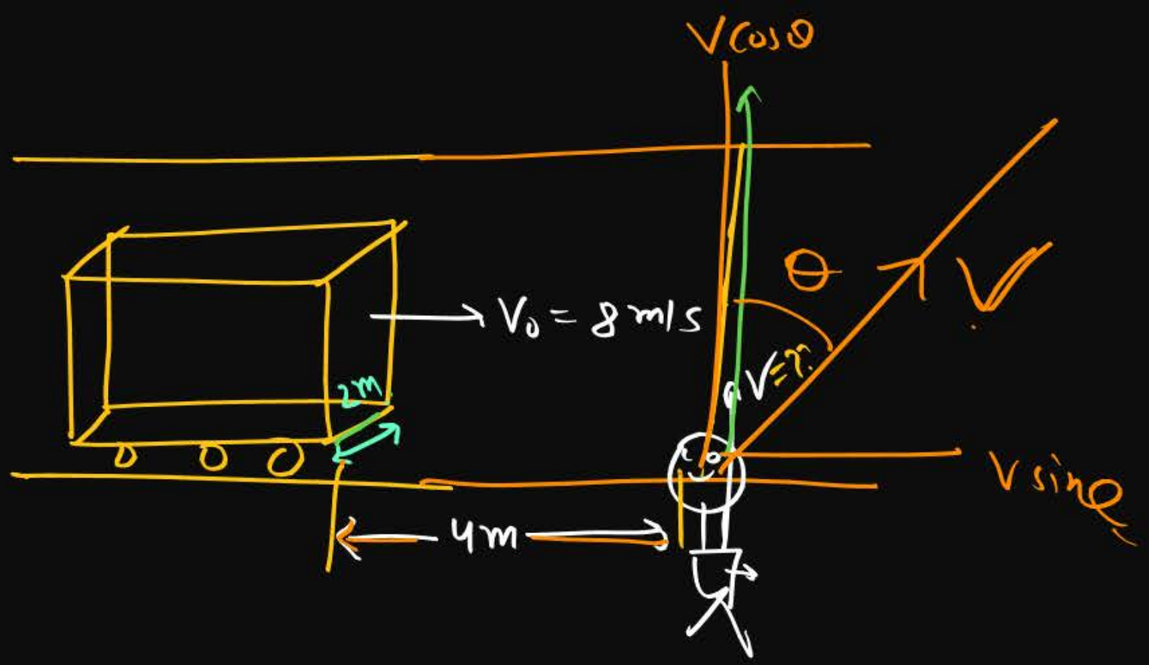
hint



Question

A 2m wide truck is moving with a uniform speed $V_0 = 8\ ms^{-1}$ along a straight horizontal road. A pedestrian (man) starts to cross the road with a uniform speed v, when the truck is 4 m away from him. The minimum value of v so that he can cross the road safely is

1. $2.62\ ms^{-1}$
2. $4.6\ ms^{-1}$
3. $3.57\ ms^{-1}$
4. $1.414\ ms^{-1}$
5. 4 m/s.

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THANK YOU