YAKEEN NEET 2.0

2026

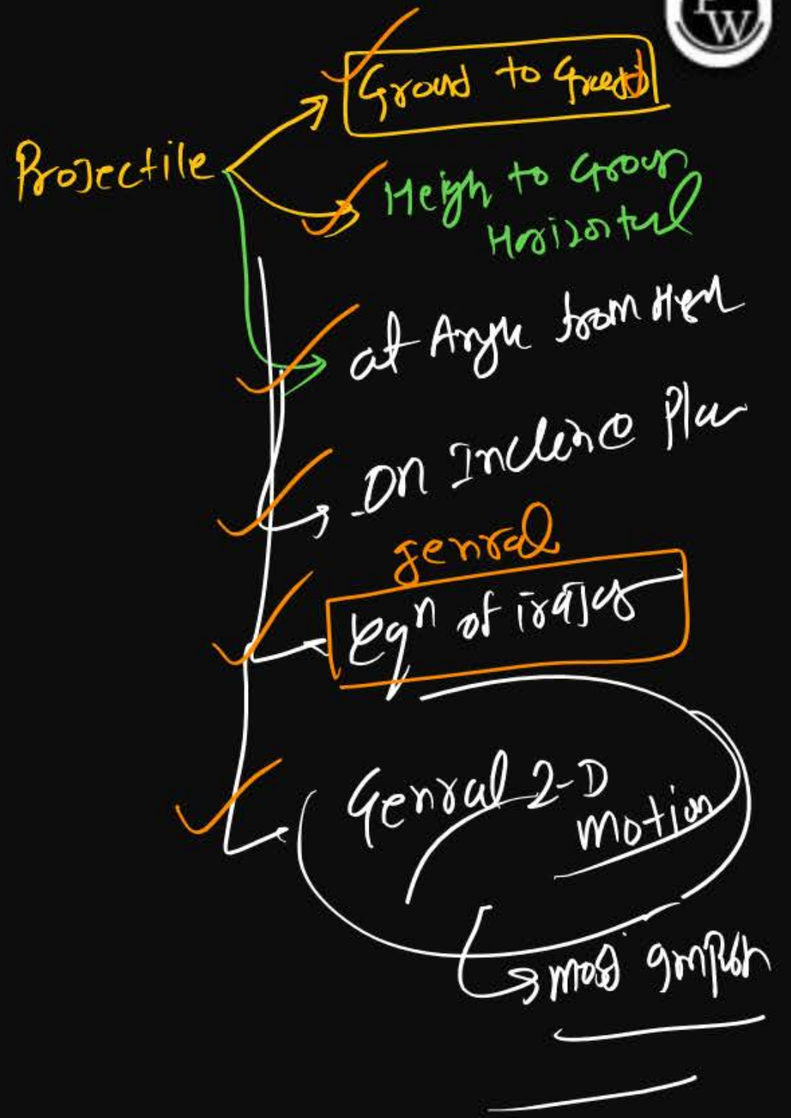
Motion in a Plane

Physics | Lecture - 6

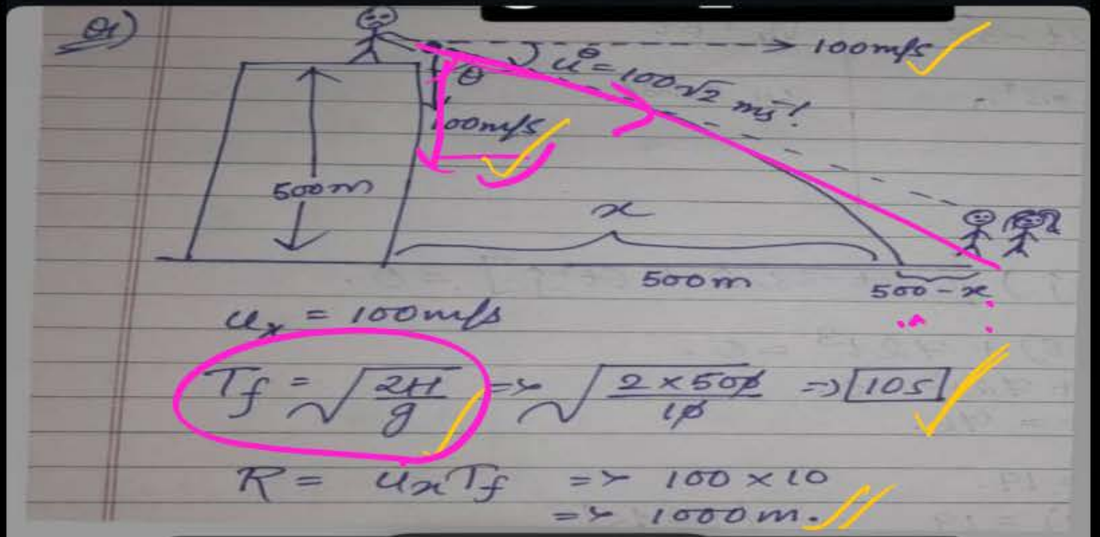
By- Manish Raj (MR Sir)

Topics to be covered

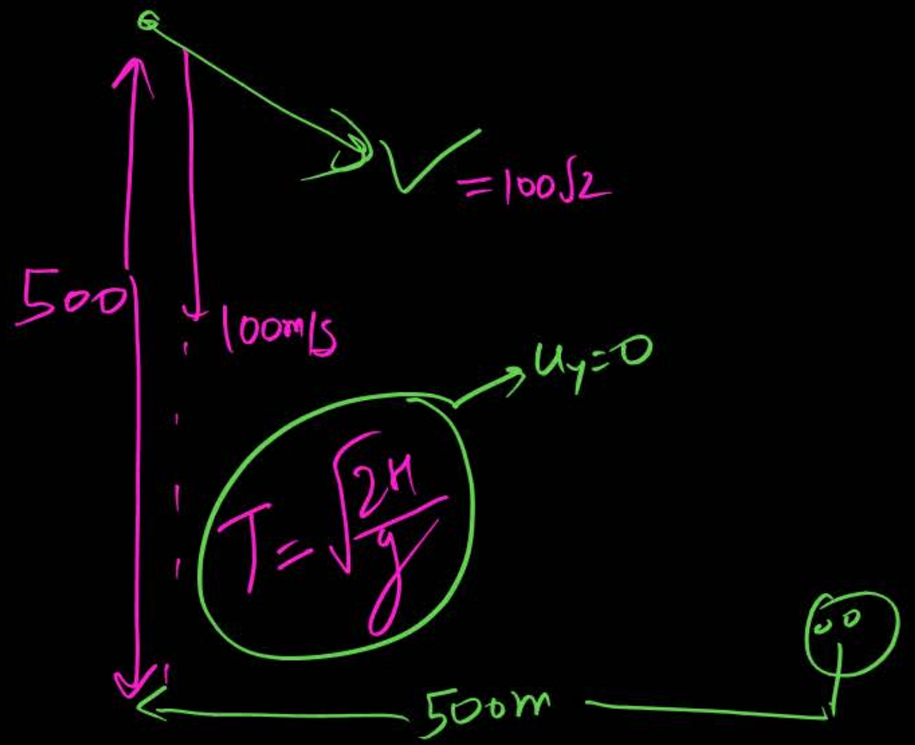
1. # Ramlal Scam.
2. Relative motion in 1-D
3.
4.



10:19 5G



Sir aap Message sent hle wala diya gaya case me 500m distance hai tower aur kallua ke bich me, lekin calculation me normally 1000m range aa raha hai, kya iye aapne MR SCAM wala question diya hai??



Ques

At highest point → H_{max}

$R/2$

$\frac{R}{2} = \frac{u^2 \sin 2\theta}{2g}$

for remaining R → $g' = \frac{g}{0.81}$

$\frac{R}{2} = \frac{u^2 \sin 2\theta}{2g}(0.81)$

New range $= \frac{R}{2}(1+0.81)$

$= \frac{R}{2}(1.81)$

$= 0.905\,R$

$n = 0.905$

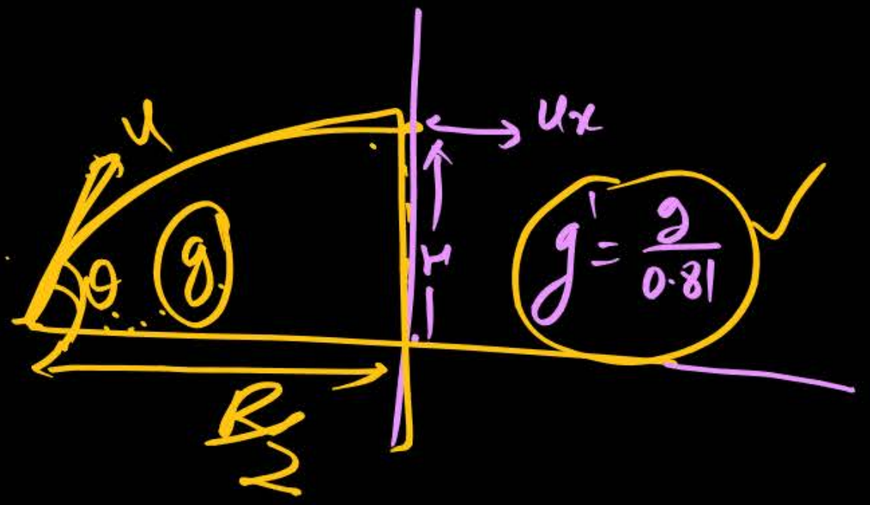
@MRSIR_MRSTAR

A projectile is fired from horizontal ground with speed v and projection ang
When the acceleration due to gravity is g, the range of the projectile is d. If at the highest point in its trajectory, the projectile enters a different region where the effective acceleration due to gravity is $g' = \frac{g}{0.81}$ then the new range is $d' = nd$. The value of n is ____.

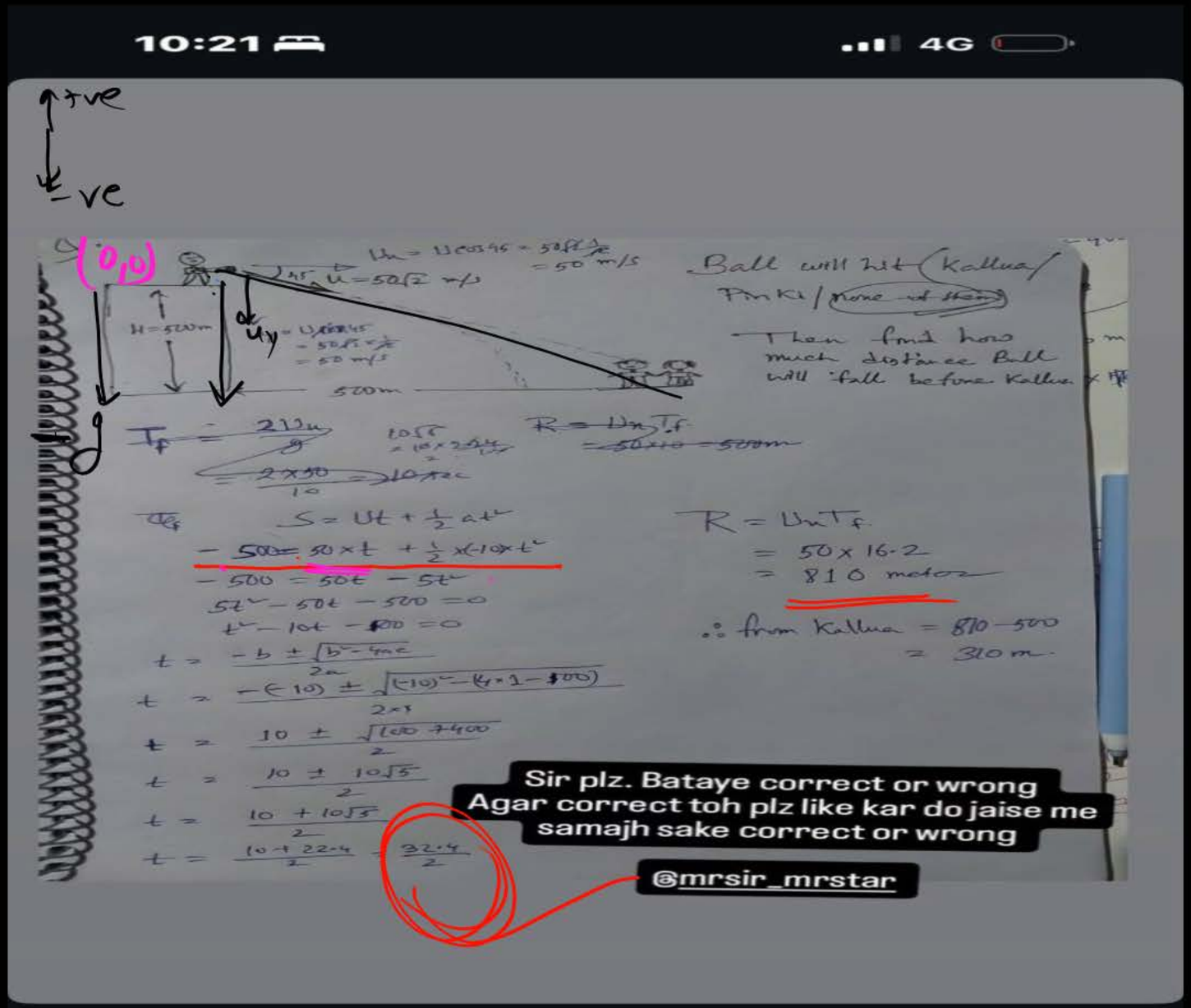
[JEE Adv. 2022]

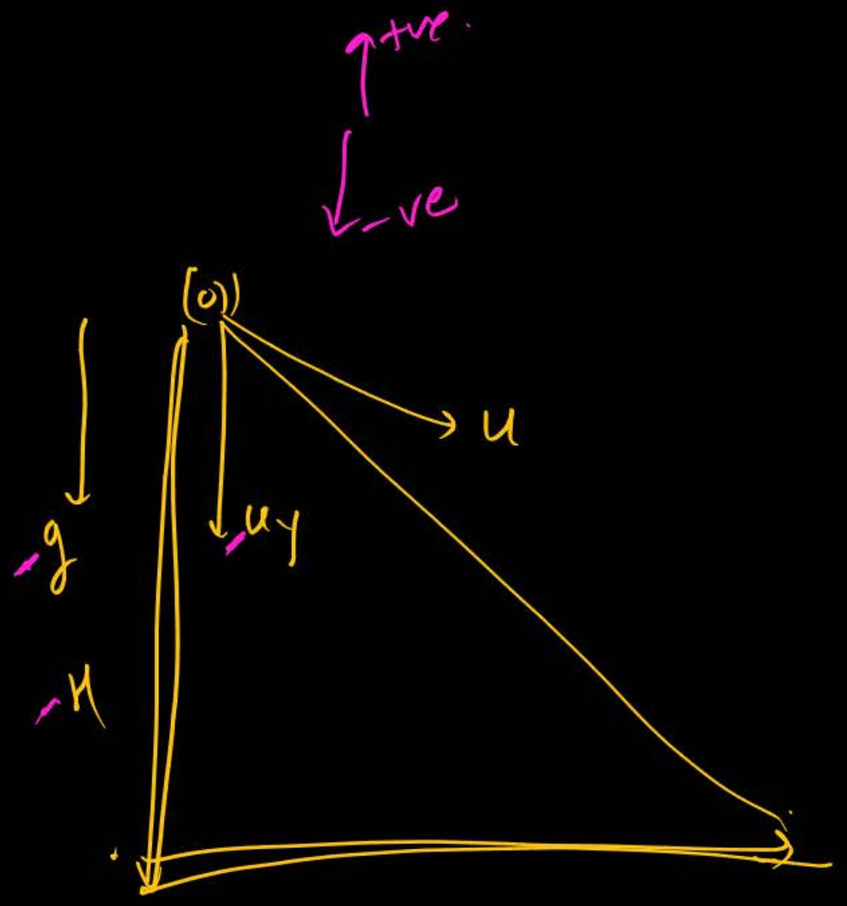
Download

Sir this question could be solved this way as well??



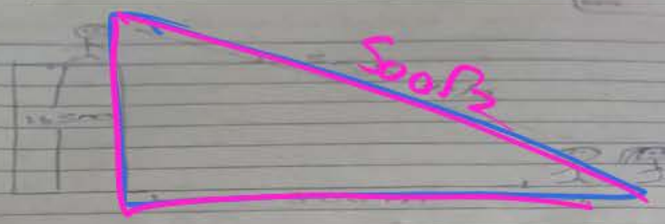
56% aise hi


10:21
4G
+ve
-ve
(0,0)
$u = 50\sqrt{2}$ m/s
$u_x = u\cos 45 = 50\sqrt{2}\,\frac{1}{\sqrt{2}} = 50$ m/s
$u_y = u\sin 45 = 50\sqrt{2}\,\frac{1}{\sqrt{2}} = 50$ m/s
H = 500m
500m
g
Ball will hit (Kallua/ Pinki/ none of them)
Then find how much distance Ball will fall before Kallua
$T_f = \frac{2u_y}{g} = \frac{2\times 50}{10} = 10$ sec
$R = u_x T_f = 50\times 10 = 500$m
$S = ut + \frac{1}{2}at^2$
$-500 = 50\times t + \frac{1}{2}\times(-10)\times t^2$
$-500 = 50t - 5t^2$
$5t^2 - 50t - 500 = 0$
$t^2 - 10t - 100 = 0$
$t = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
$t = \frac{-(-10) \pm \sqrt{(-10)^2-(4\times 1-100)}}{2\times 1}$
$t = \frac{10 \pm \sqrt{100+400}}{2}$
$t = \frac{10 \pm 10\sqrt{5}}{2}$
$t = \frac{10 + 10\sqrt{5}}{2}$
$t = \frac{10+22.4}{2} = \frac{32.4}{2}$
$R = u_x T_f$
$= 50\times 16.2$
$= 810$ meter
∴ from Kallua $= 810 - 500$
$= 310$ m
Sir plz. Bataye correct or wrong
Agar correct toh plz like kar do jaise me samajh sake correct or wrong
@mrsir_mrstar

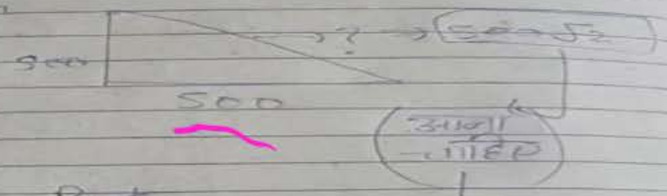

+ve
-ve
(0)
u
u_y
g
H

7:06 4G

Sir ji dekho ham simple ye soch k bhi approximate answer nikaal skte hai kya
@mrsir_mrstar



Sir, ye Right angle triangle Jesa bhi to hai isliye ham bol skte hai ki
agar



But

$\hookrightarrow$ आया है $50\sqrt{2}$

तो $500\sqrt{2} - 50\sqrt{2}$

$\Rightarrow 500 \times 1.4 - 50 \times 1.4$

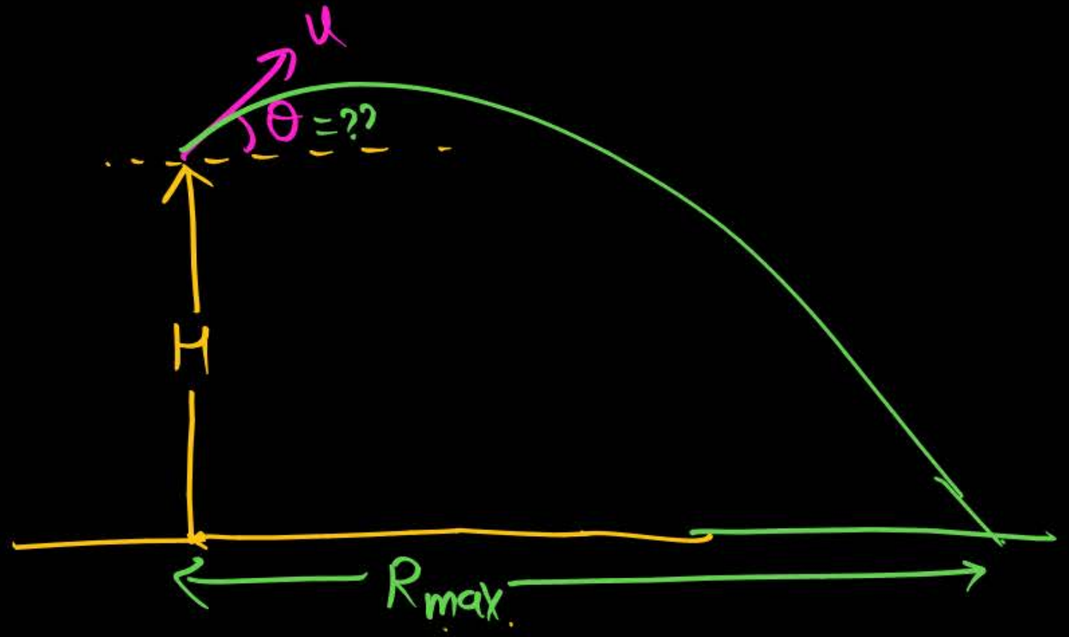
$\approx 700.0 - 7.0$

≈ 693

$\approx 693 - 500 \approx 190$

Q

If object is projected from some height then Angle of Projection for Max^{m} Range will be ??



(a) $\theta > 45^{\circ}$ ✗

(b) $\theta < 45^{\circ}$ (40%) ✓

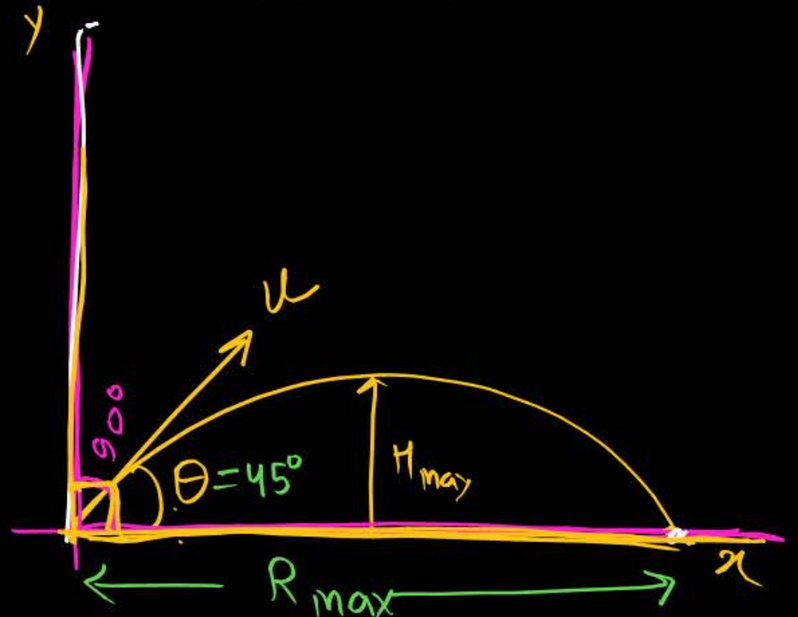
(c) $\theta = 45^{\circ}$ ✗

(d) don't know

very good

(#)

Case-1 Ground to Ground.

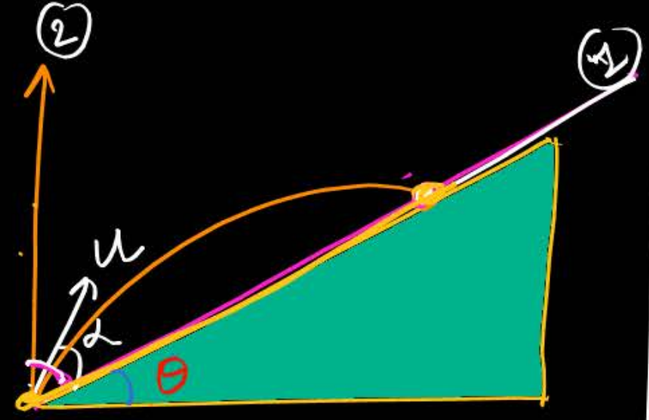


for Max^m Range θ must be 45°

$$\frac{H}{R_{max}} = \frac{\tan 45°}{4}$$

$$H = \frac{R_{max}}{4}$$

Case-2



α = Angle of Projection
θ = Angle of Inclination.

find α for max^m Range.

total Angle b/w ① & ② lines = 90 − θ

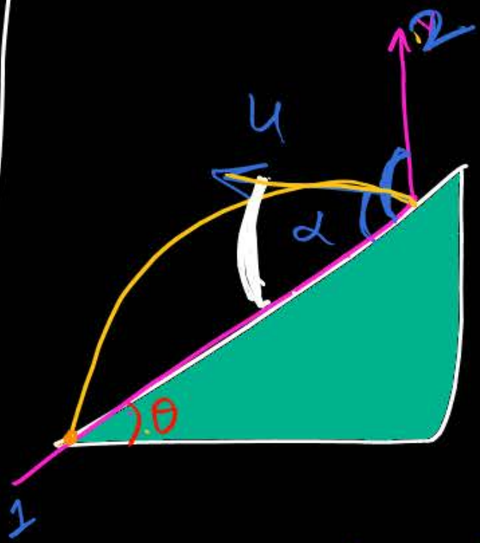
$$\alpha = \frac{90-\theta}{2}$$

$$\alpha = 45 - \frac{\theta}{2}$$

for max^m

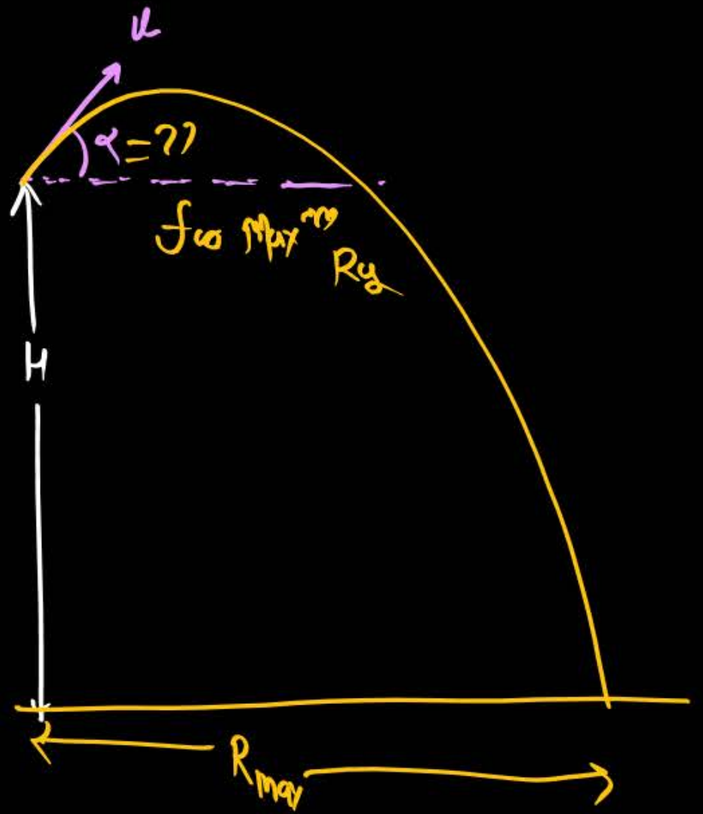
Case-3

find α for max^m Range

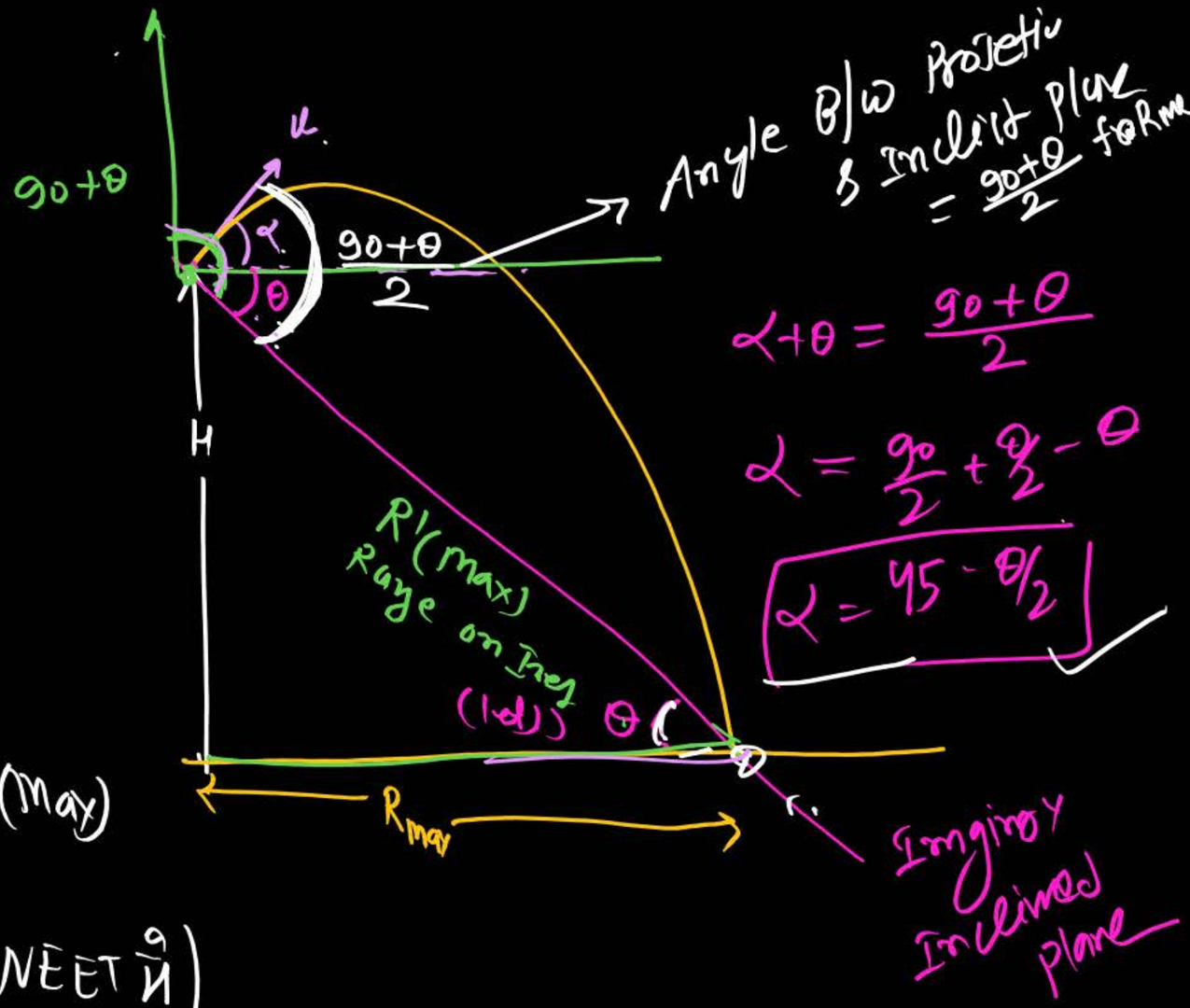


Angle b/w line 1 & line 2 = 90° + θ

$$\alpha(\text{for max Ru}) = \frac{90°+\theta}{2} = \left(45° + \frac{\theta}{2}\right)$$



for R'(max)

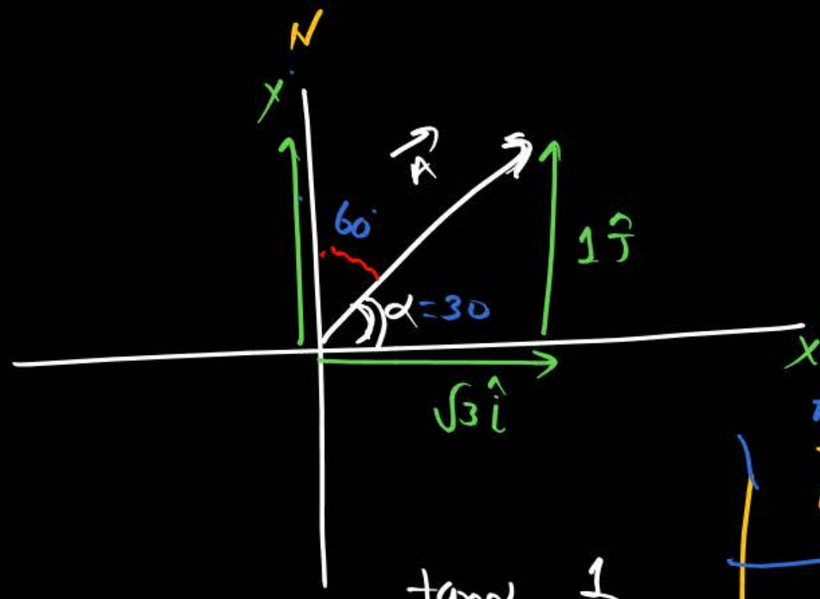


(नहीं आएगा NEET में)

Revision of vector

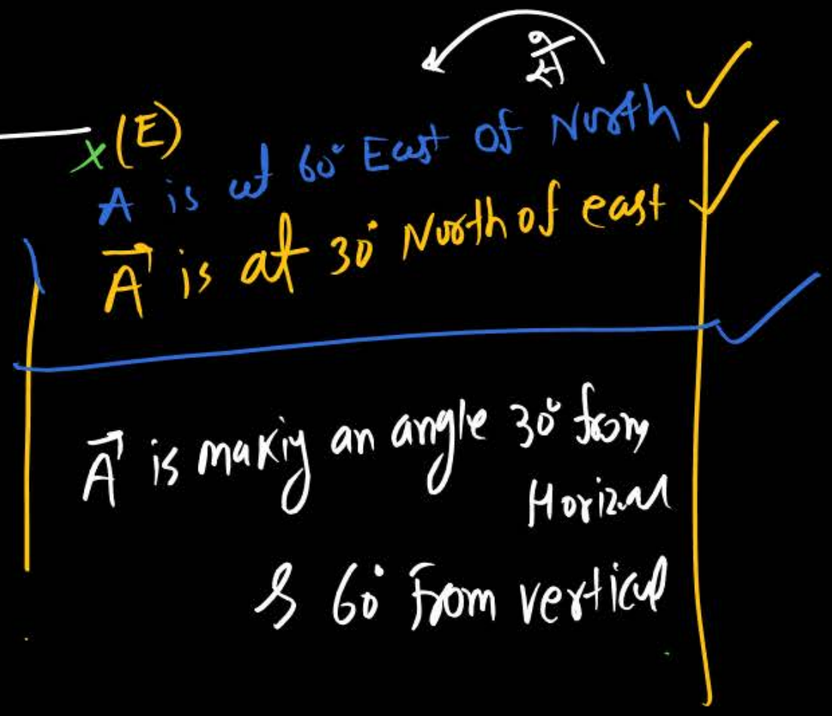
$$\vec{A} = \sqrt{3}\,\hat{i} + \hat{j}$$

dir^n from x-axis :—



$$\tan\alpha = \frac{1}{\sqrt{3}}$$

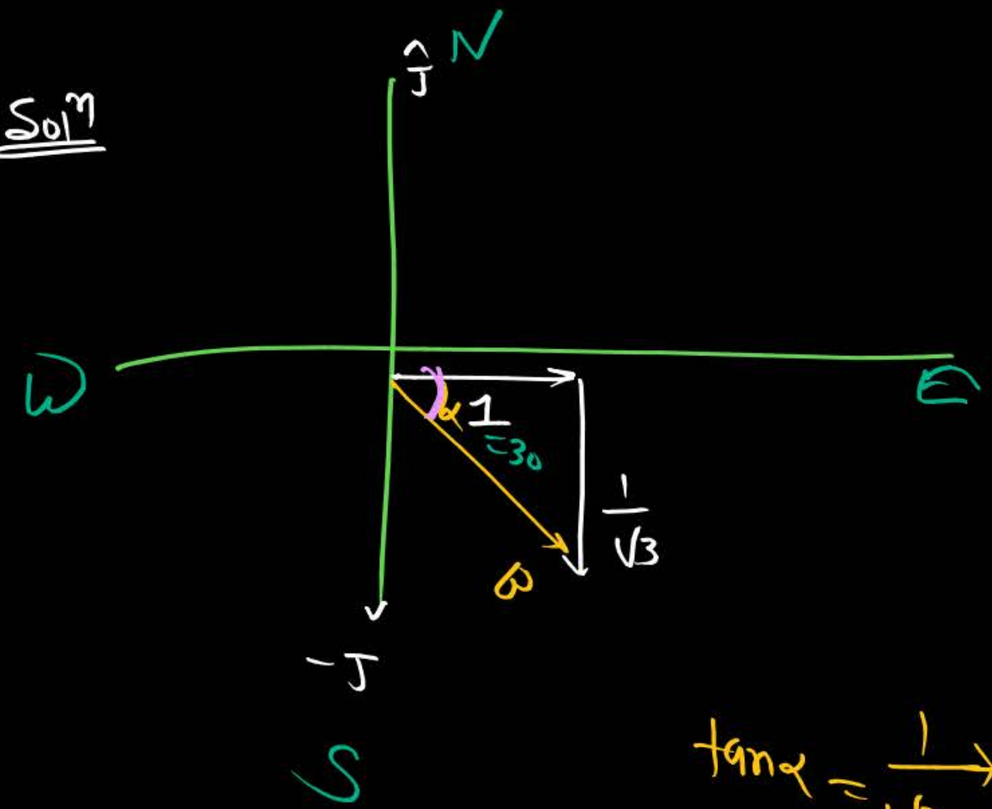
$\alpha = 30°$



(a) $\vec{B} = i - \frac{1}{\sqrt{3}}\hat{j}$

find dirⁿ of $\vec{B}$

Solⁿ



$\tan\alpha = \frac{1}{\sqrt{3}} \times \frac{1}{1}$

$\alpha = 30$

MR* Box :—
Jab bhi vecto ka dirⁿ nikalna ho. x-y plane me Vecto ko draw karo.

⇒ B is making 30° — from Horizontal

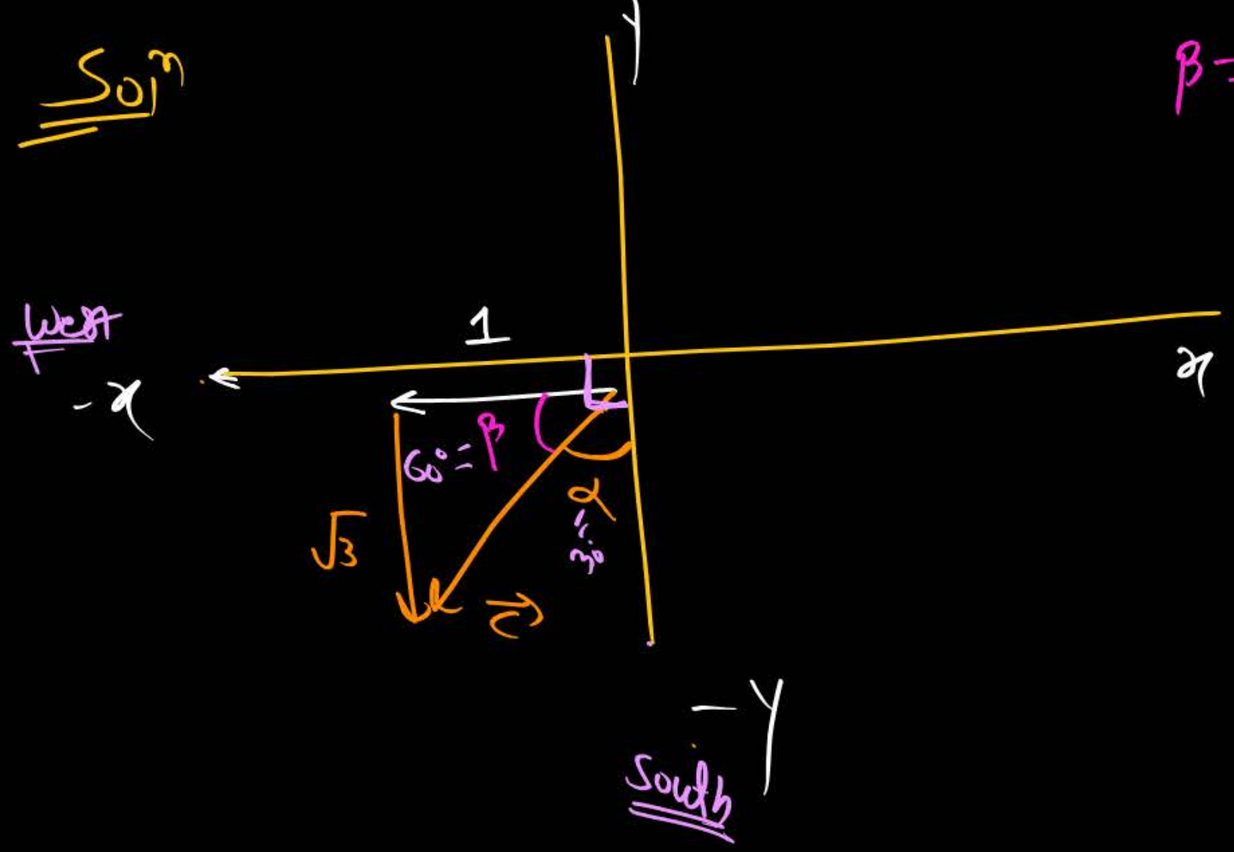
⇒ 60° from vertical

⇒ B is at 30° south of East

(4) $\vec{C} = -\hat{i} - \sqrt{3}\,\hat{j}$

find **Angle from vertical**.

Soln



$\tan\beta = \frac{\sqrt{3}}{1}$

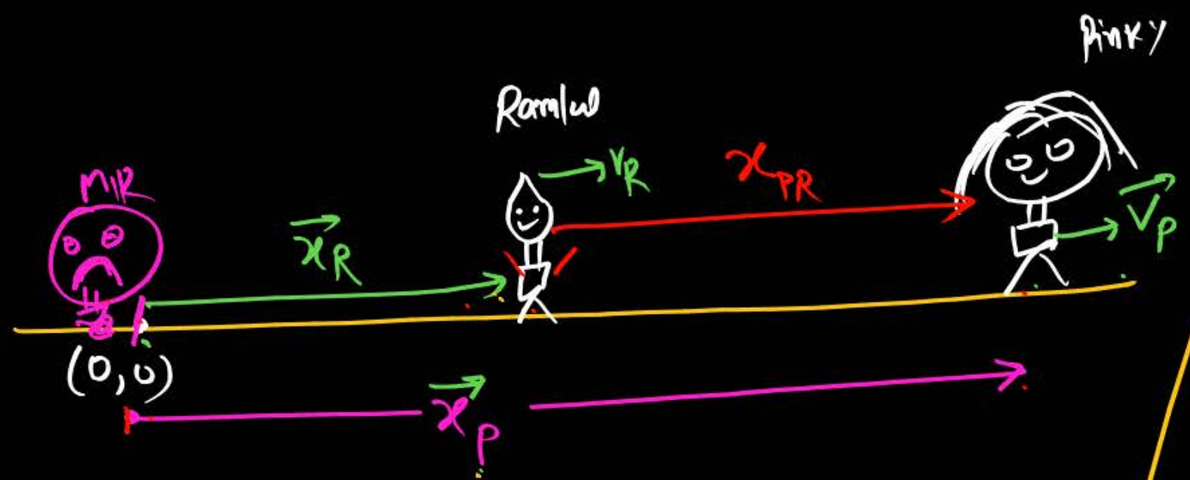
$\beta = 60°$

$\alpha = 30°$

↳ from vertical.

$\vec{C}$ is at 30° west of south.

Relative motion



x_R = Position of Ramlal from origin.

x_P = Position of Pinky from origin.

$$\vec{x}_{PR} = \vec{x}_P - \vec{x}_R$$

$\vec{x}_{PR}$: Position of pinky w.r.t Ramlal (observer)

Diff^n

$$\frac{dx_{PR}}{dt} = \frac{d\vec{x}_P}{dt} - \frac{dx_R}{dt}$$

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

$\vec{V}_{PR}$: velocity of pinky w.r.t Ramlal (observer)

Object

Diff^n

$$\vec{a}_{PR} = \vec{a}_P - \vec{a}_R$$

$\vec{a}_{PR}$: acc^n of Pinky w.r.t Ramlal

MR* Box

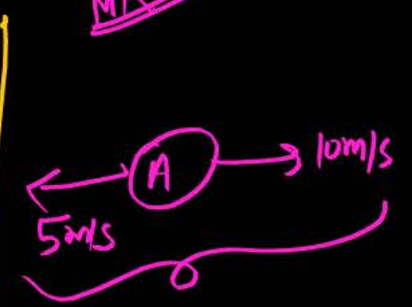
object ka relative velocity ke liye, object ki actual velocity ko as it is; lenge and observer ki velocity ulata kar ke object me add kar dega.

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

$= 10 - 5$

$= 5 m/sec$

MR*

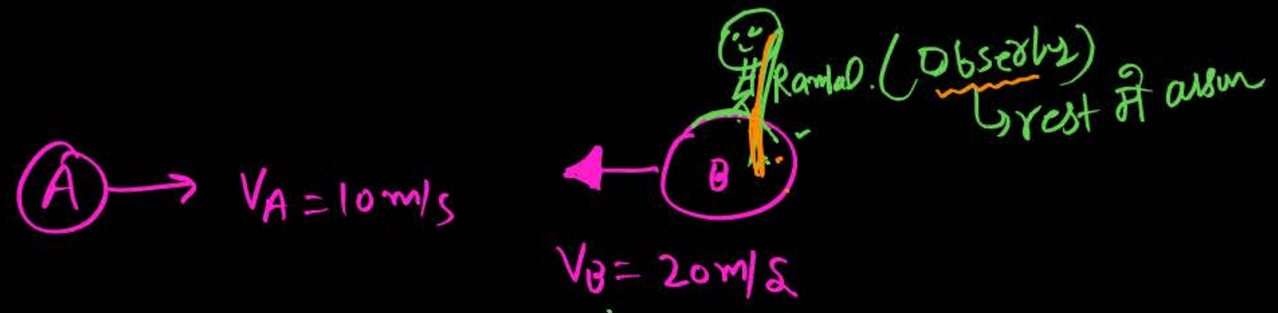


$V_{AB} = 5 m/s$

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

$= 5 - 10 = -5 m/s$

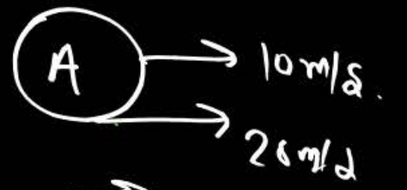
$V_{BA} = -5 m/s$



Soln

$\vec{V}_{AB} = ??$ → observer

MR*



$\vec{V}_{AB} = 30\ m/s.$

formula

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

$$= 10\ m/s - (-20)$$

$$= 30\ m/s.$$

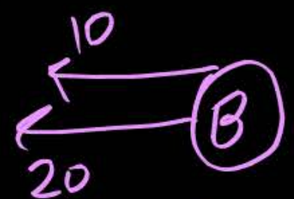
formula

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

$$= -20 - 10$$

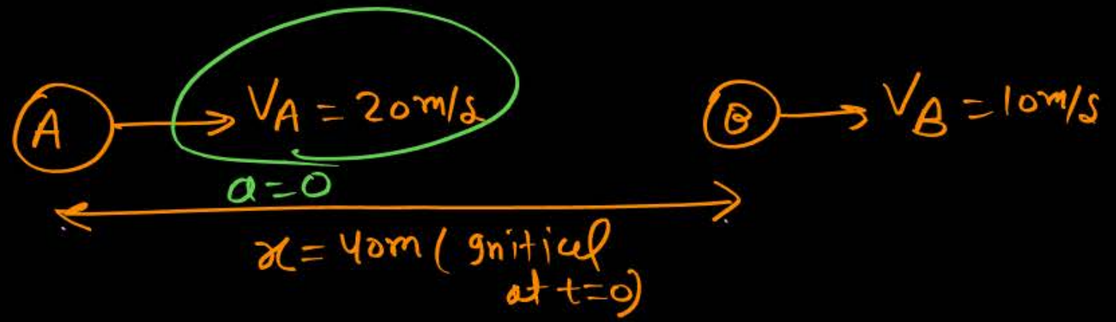
$$= -30\ m/s$$

MR*



$V_{BA} = -30\ m/s$

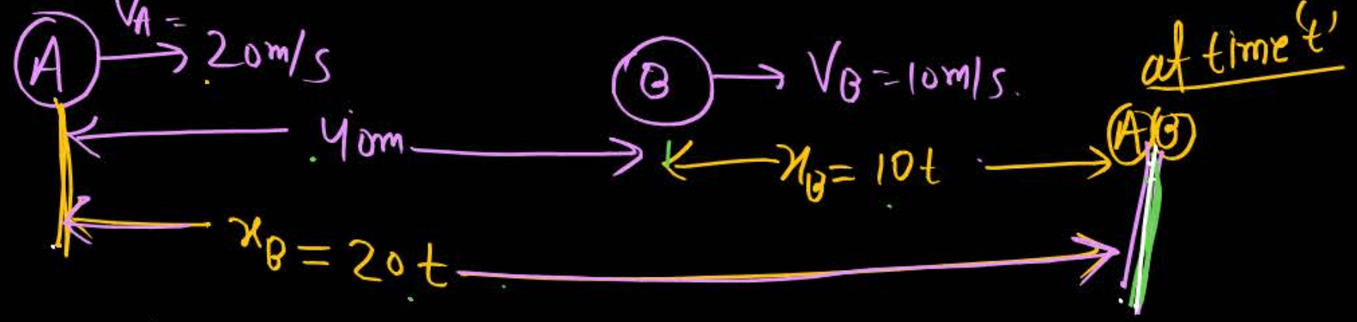
Q)



find time when they will meet :-

Without relative

Soln

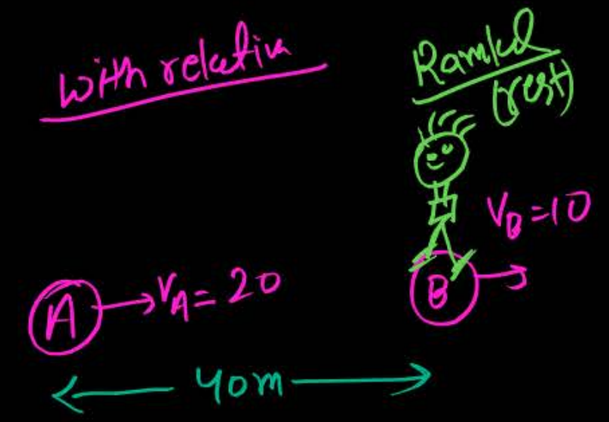


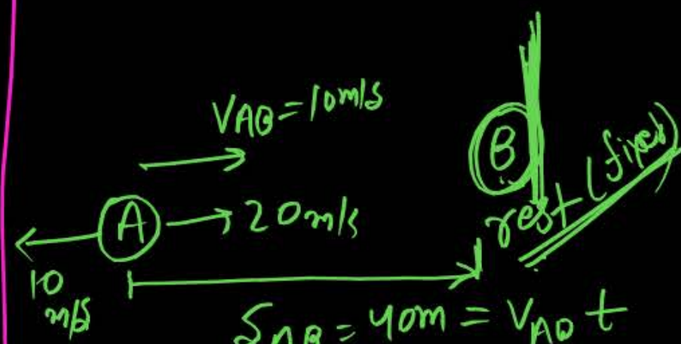
$\hookrightarrow$ $40 + 10t = 20t$

$40 = 10t$

$t = 4 sec$

With relative

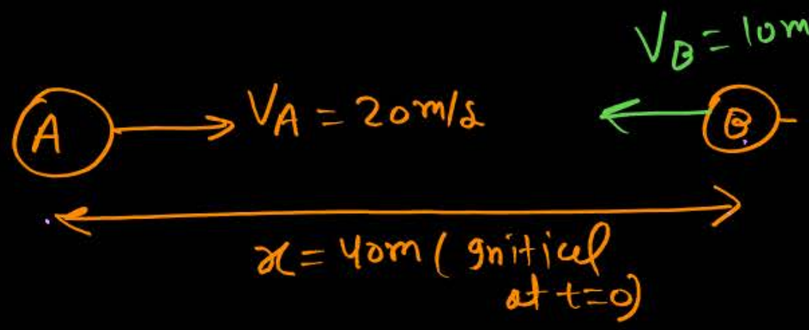




$40 = 10 t$

$t = 4 sec$ ✓

(Q)



find time when they will meet :-

Sol^n

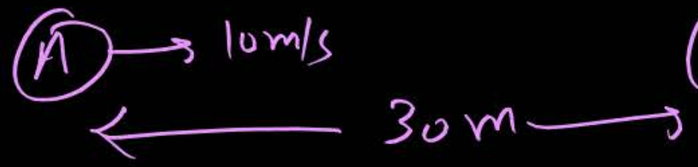
$V_{AB} = 30 m/s$

$t = \frac{40}{30} = \frac{\text{dist}^n}{\text{speed}} = 4/3$ sec.

MR^{ji} Box

Ramlal (observer) jis par baith jayga usko rest me manega. or uski velocity ulta kar ke usme add kar dega. ✓✓

Q



MR Scam.

$t = 3$ ✗

They will never meet ✓

Sol^n

Right

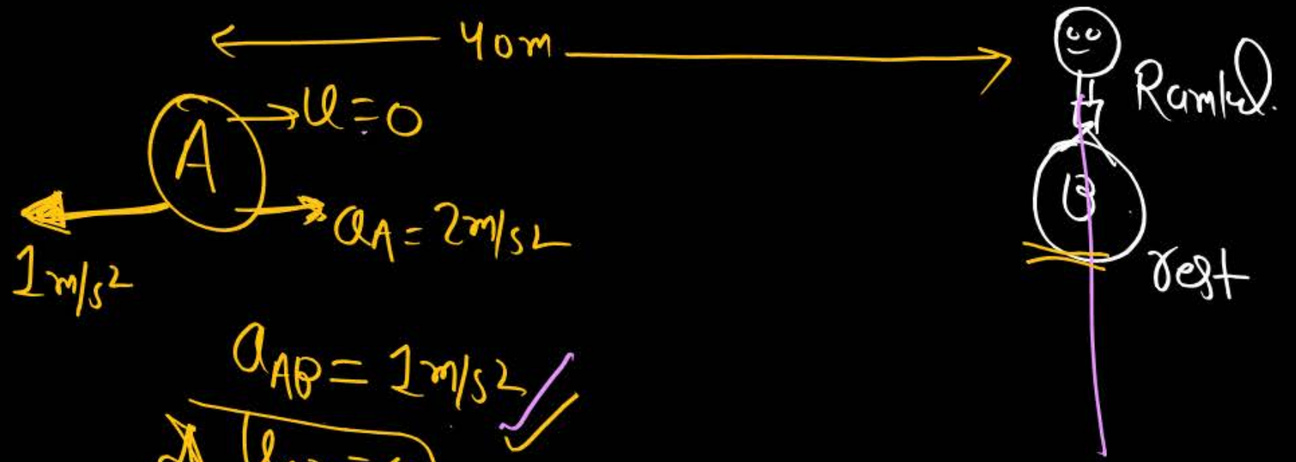
$V_{AB} = -10$ m/s.

Backward

Q

Soln

Find time when they will meet.



$a_{AB} = 1\,m/s^2$

$\boxed{u_{AB} = 0}$

Soln

$$S_{AB} = \cancel{u_{AB}t}^{\,0} + \frac{1}{2} a_{AB} t^2$$

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

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

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

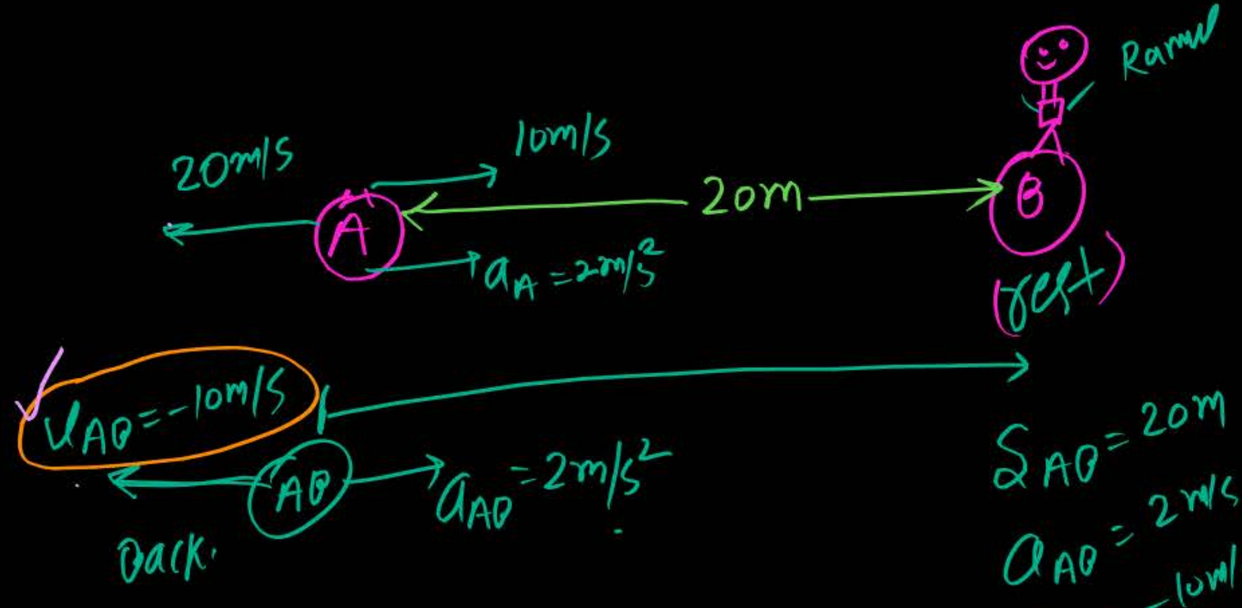
(a)

Soln

18%

(a) never meet

(b) Will meet



$s_{AB} = u_{AB}t + \frac{1}{2}a_{AB}t^2$

$20 = -10t + \frac{1}{2}(2)t^2$

$t^2 - 10t - 20 = 0$

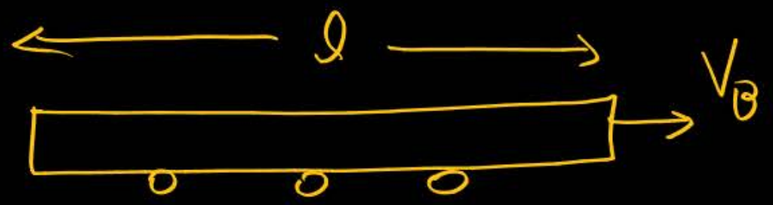
$t = \frac{10 \pm \sqrt{100 - 4(-20)}}{2}$

$t = \left(\frac{10 \pm \sqrt{180}}{2}\right)$ Ans

no need to slow

Sol

(Q)

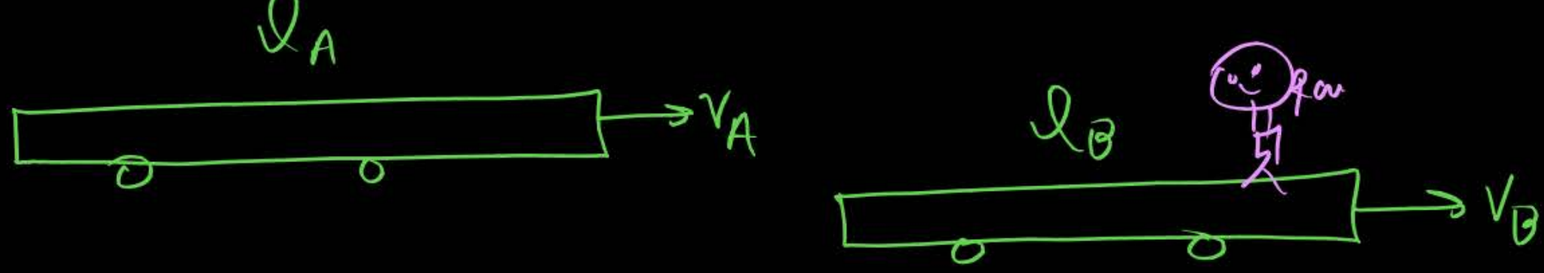


find time taken by train to Cross the man. ??

Soln

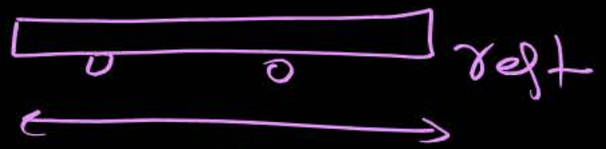
$$t = \frac{l}{V_0}$$

Q

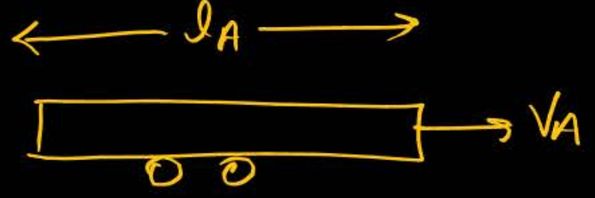


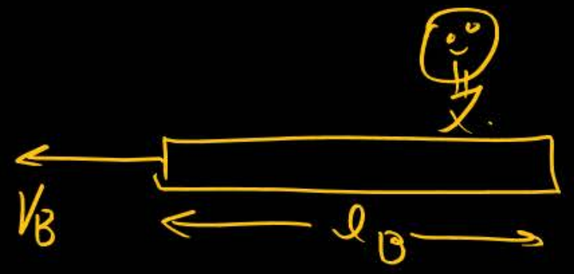
Q find time when A will overtake train B ($V_A > V_B$).

Soln



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





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

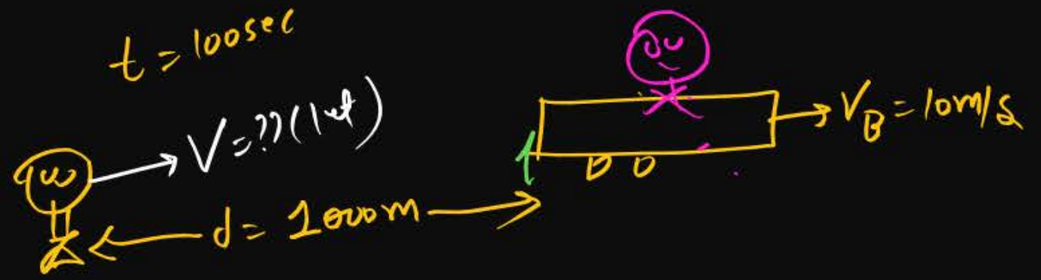
$= \frac{20}{3} = 6.67$

Question

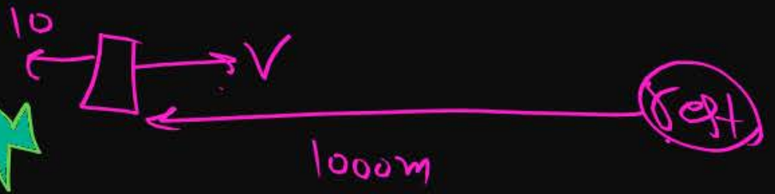
A bus is moving with a speed of 10 ms^{-1} on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus? [2009]

(NEET)

1. 40 ms^{-1}
2. 25 ms^{-1}
3. 10 ms^{-1}
4. 20 ms^{-1}



Length of Bus is ignored



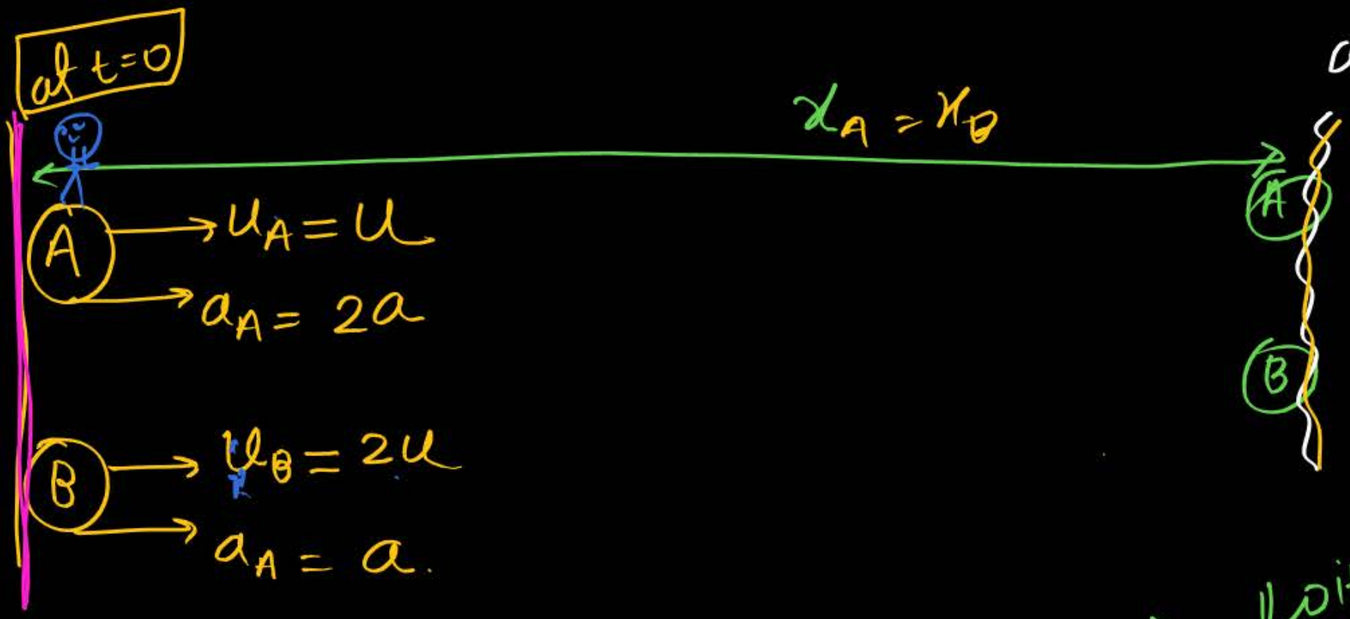
$x\ km/hr = x \times \frac{5}{18}\ m/s$

$V_{SB} = V - 10 = \frac{1000}{t} = \frac{dist'}{time}$

$V - 10 = \frac{1000}{100}$

$V = 20\ m/s.$

(Q)



Soln Without relative (मनडरी)

$$x_A = x_B$$

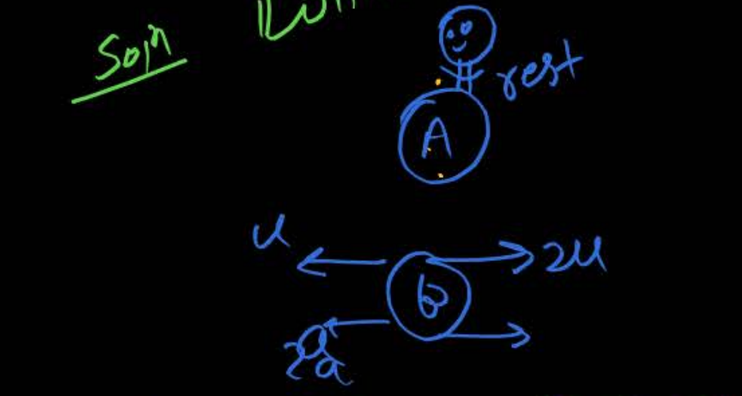
$$ut + \frac{1}{2}(2a)t^2 = 2ut + \frac{1}{2}at^2$$

$$at^2 - \frac{1}{2}at^2 = 2ut - ut$$

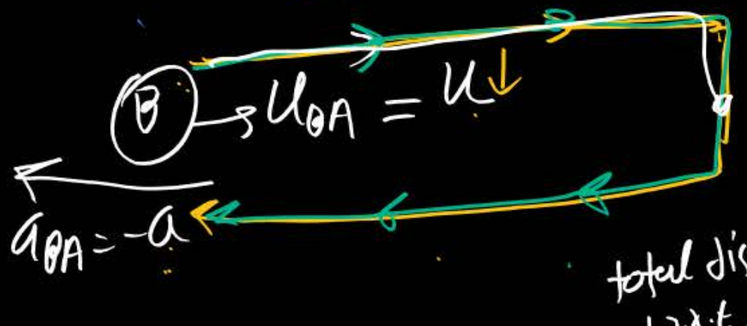
$$\frac{at^2}{2} = ut$$

Ans $t = \frac{2u}{a}$

Soln With Relative (Power of Relative)



$t_{total} = \frac{2u}{a}$ ✳



$H_{max}(\text{total}) = \frac{u^2}{2a}$

total dist^n of B w.r.t A $= \left[\frac{u^2}{2a}\right] \times 2$

Question

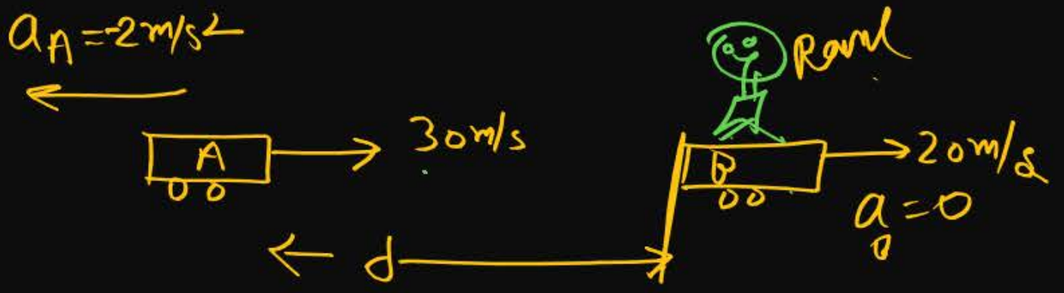
Two cars A and B are moving in same direction with velocities 30 m/s and 20 m/s. When car A is at a distance d behind the car B, the driver of the car A applies brakes producing uniform retardation of 2 m/s². There will be no collision when

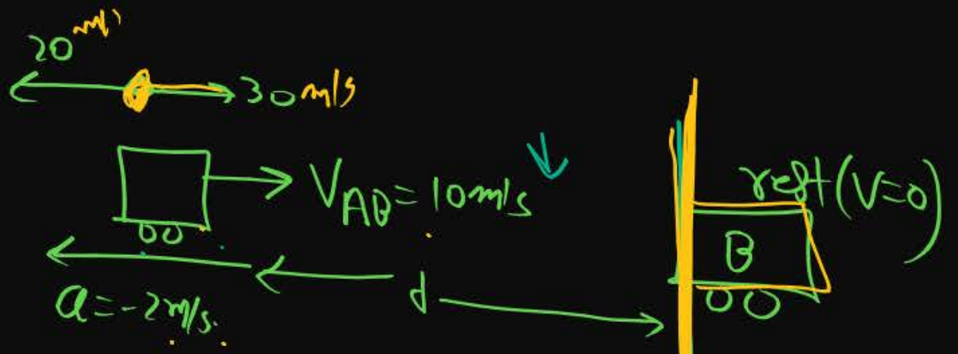
(1) $d < 2.5$ m

(2) $d > 125$ m

(3) $d > 25$ m

(4) $d < 125$ m





To avoid colls.

$\boxed{d > 25 m}$

(#) $S = \frac{u_{AB}^2}{2a} = \frac{(10)^2}{2 \times 2} = \frac{100}{4} = 25 m$

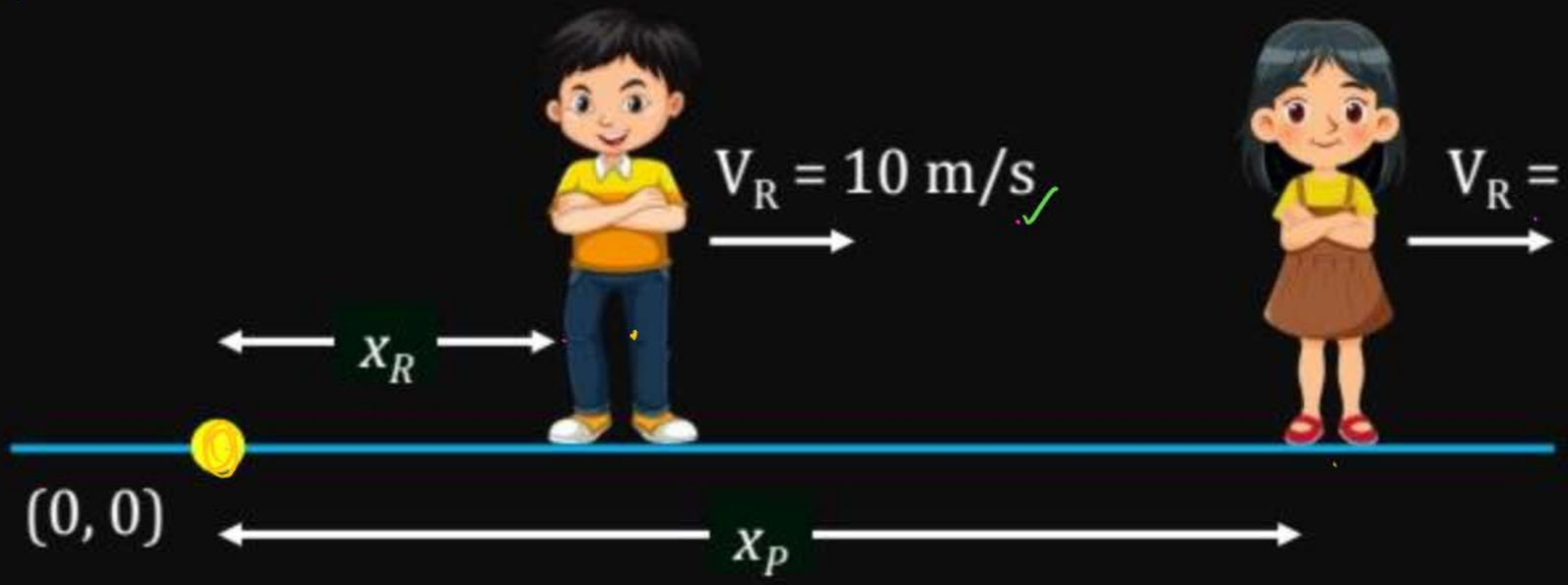
one line A

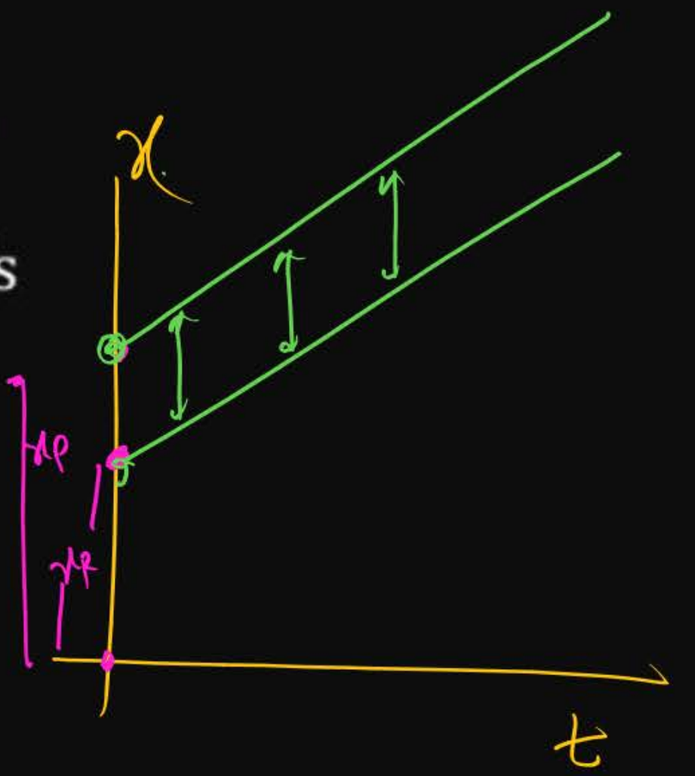
(Same as stopping distn)

Question

Draw position-time graph and comment on relative separation?

H/W

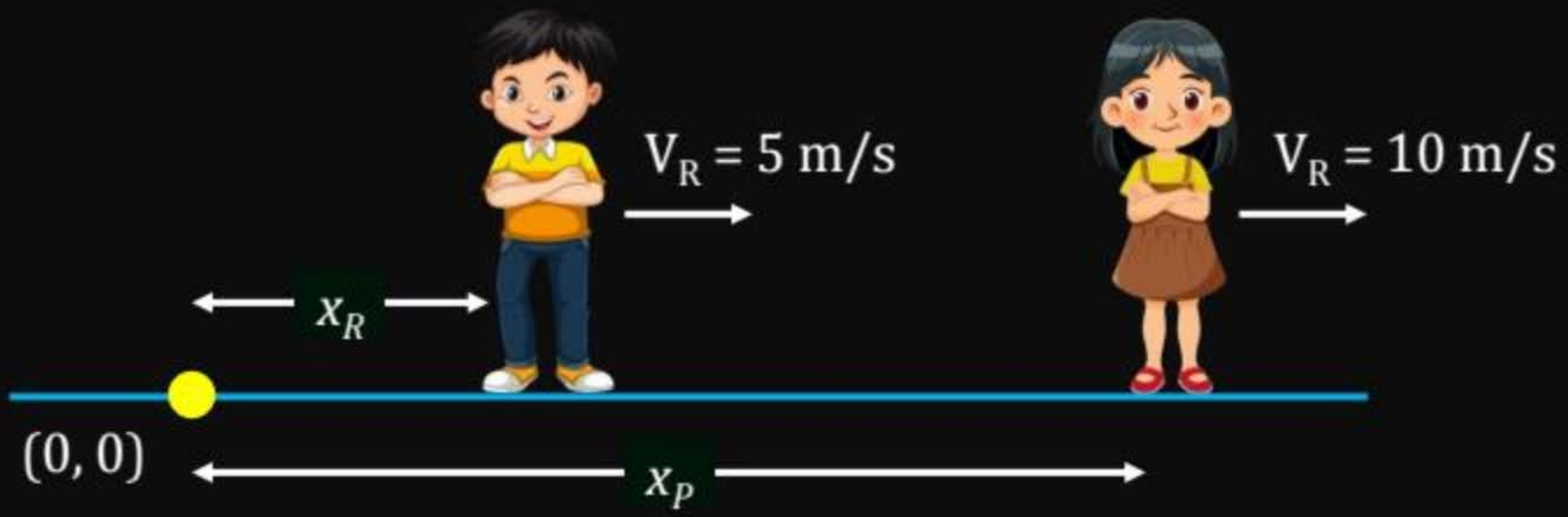




Slope of Posit-time Graph = velocity

Question

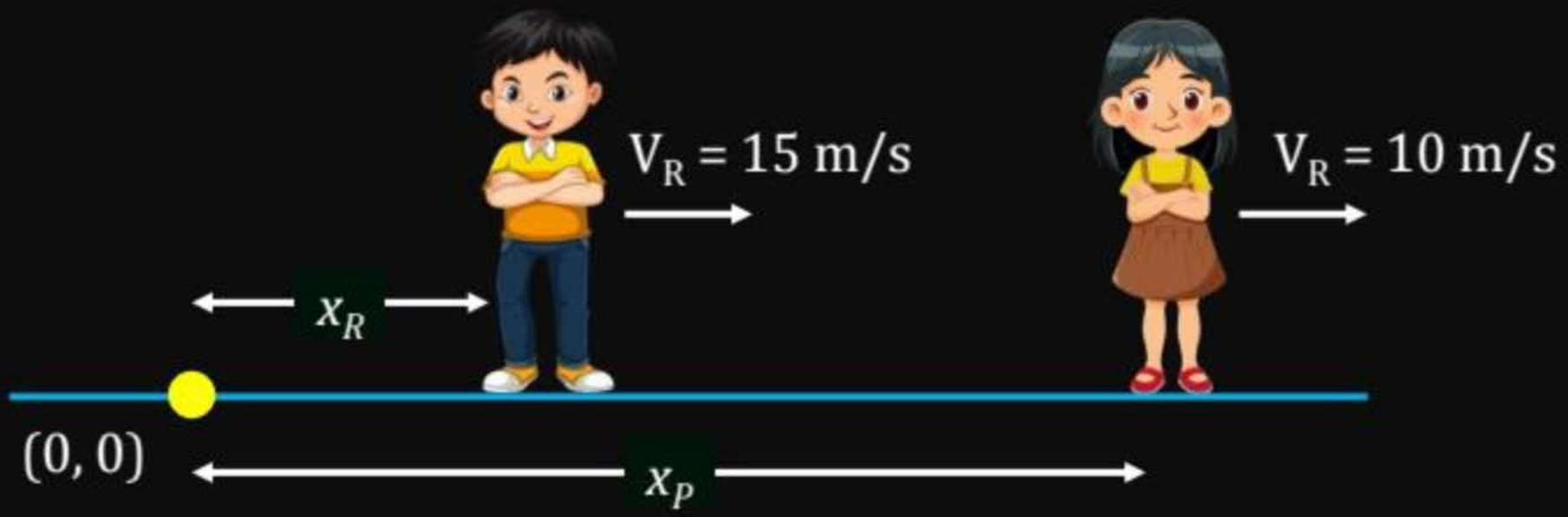
Draw position-time graph and comment on relative separation?



Question

Draw position-time graph and comment on relative separation?

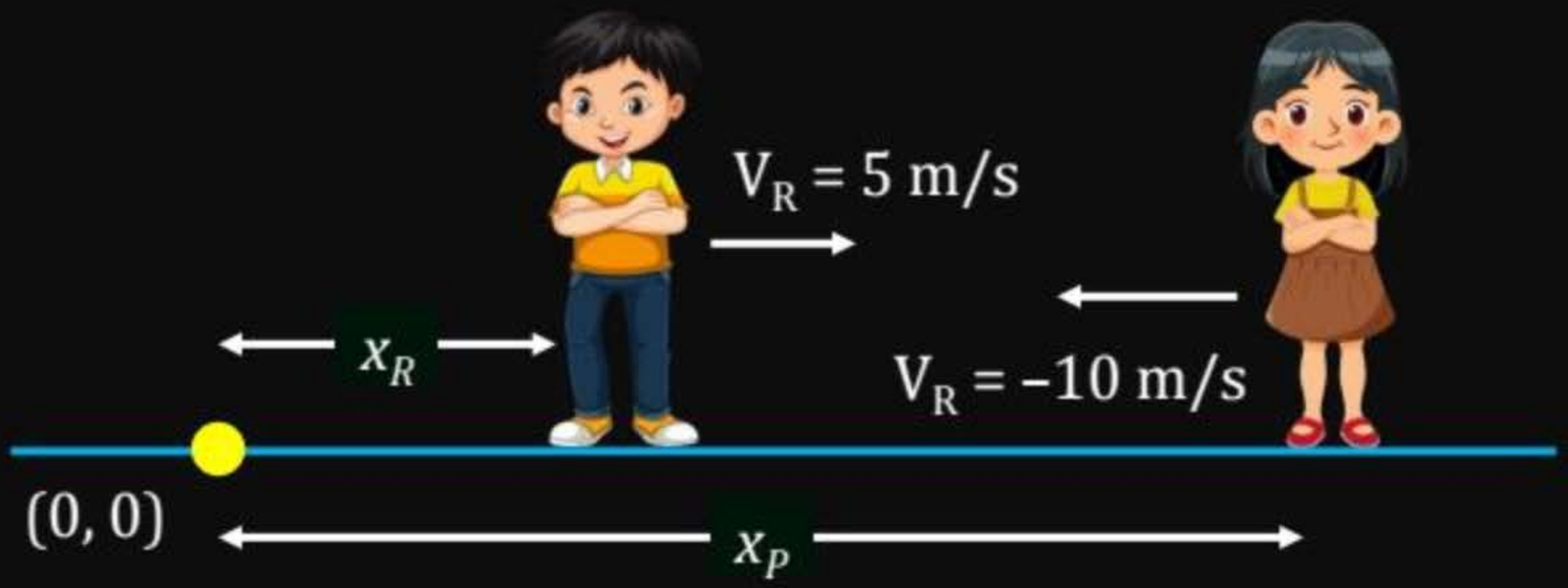
H/W



Question

Draw position-time graph and comment on relative separation?

H/W



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

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

Question

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

H/W

1. 1.6 s
2. 5 s
3. 8 s
4. 10 s

THANK YOU

for 2-D Class PDF