YAKEEN NEET 2.0

2026

Kinematics

PHYSICS

KPP- -20

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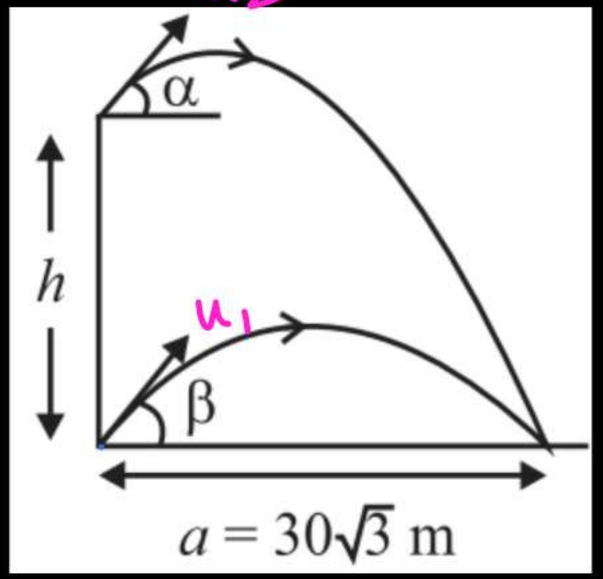
Question - 1

Shots are fired simultaneously from the top and bottom of a vertical cliff with the elevation $\alpha = 30°$, $\beta = 60°$, respectively (figure). The shots strike an object simultaneously at the same point. If $a = 30\sqrt{3}$ m is the horizontal distance of the object from the cliff, then the height h of the cliff is:



(1) 30 m (2) 45 m

(3) 60 m (4) 90 m

$u_2 \cos\alpha = u_1 \cos\beta$

$u_2 \frac{\sqrt{3}}{2} = 10\sqrt{6} \times \frac{1}{2}$

$u_2 = 10\sqrt{2}$

$30\sqrt{3} = \frac{u^2 \times \sin 120}{10}$

$30\sqrt{3} = \frac{u^2 \cdot \sqrt{3}}{2 \times 10}$

$u = 10\sqrt{6} = u_1$

$T = \frac{2 \times 10\sqrt{6} \times \sqrt{3}}{2 \times 10}$

$T = \sqrt{18}$

$-h = (u_2 \sin\alpha)t - \frac{1}{2} \times 10 \times t^2$

$-h = 10\sqrt{2} \times \frac{1}{2} \times \sqrt{18} - \frac{1}{2} \times 10 \times 18$

$-h = 30 - 90$

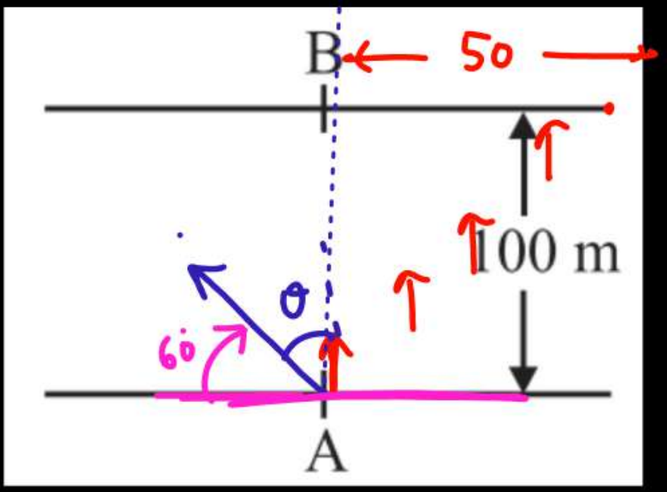
$h = 60$

Ans : (3)

Question – 2

A man swims from a point A on one bank of a river of width 100 m. When he swims perpendicular to the water current, he reaches the other bank 50 m downstream. The angle to the bank at which he should swim, to reach the directly opposite point B on the other bank is

(1) 10° upstream
(2) 20° upstream
(3) 30° upstream
(4) 60° upstream



$v_{m/r} = v$

$v_r = v/2$

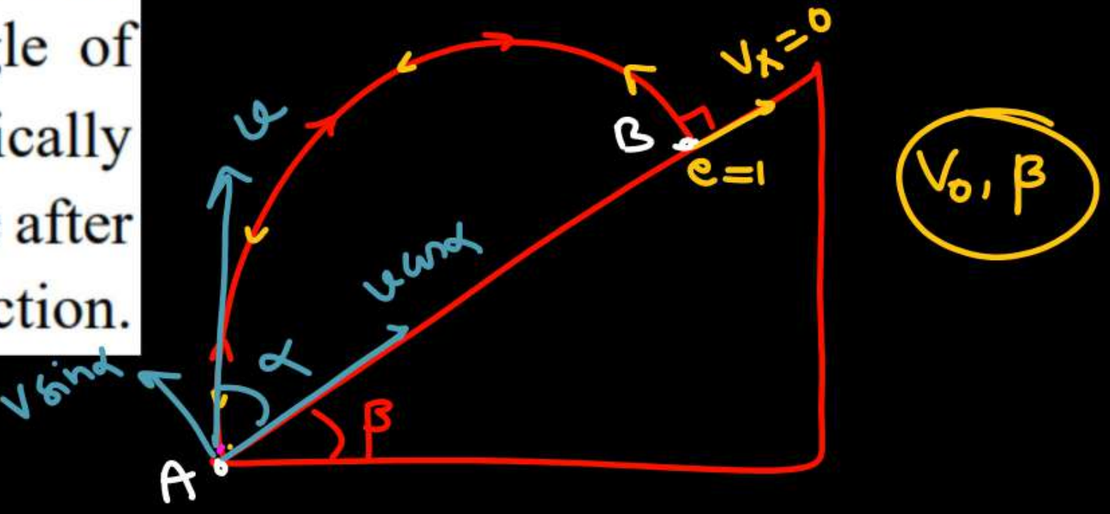
$\sin\theta = \frac{v/2}{v} = \frac{1}{2}$

$\theta = 30°$

Ans : (4)

Question – 3

A body is projected up with a speed v_0 along the line of greatest slope of an inclined plane of angle of inclination β. If the body collides elastically perpendicular to the inclined plane, find the time after which the body passes through its point of projection.



$\text{(x)} \equiv 0 = u\cos\alpha - g\sin\beta\, t$

$t = \frac{u\cos\alpha}{g\sin\beta} = \frac{2u_y}{a_y} = \frac{2u\sin\alpha}{g\cos\beta}$

Ans (2t)

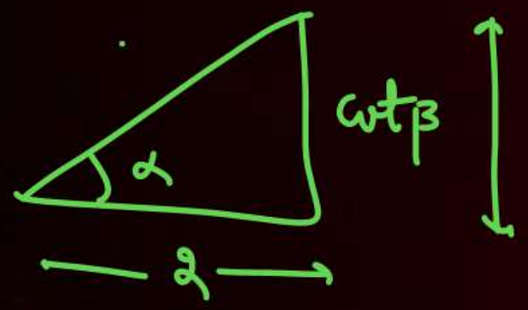
$\frac{\cos\alpha}{\sin\beta} = \frac{2\sin\alpha}{\cos\beta}$

$\boxed{\cot\beta = 2\tan\alpha}$

Ans $\equiv 2t = \frac{2u\cos\alpha}{g\sin\beta}$

Ans : $T' = 2T = \frac{4v_0}{g\sqrt{1+3\sin^2\beta}}$

$$\frac{\cot\beta}{2} = \tan\alpha$$



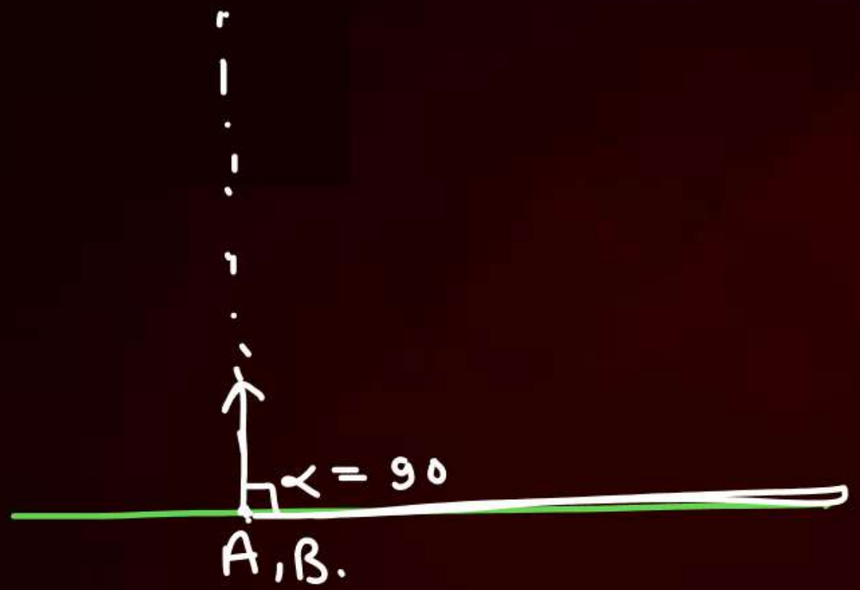
$$\frac{2u\cos\alpha}{g\sin\beta} = \frac{2v \times 2}{\sqrt{(2^2+\cot^2\beta)}\cdot g\cdot\sin\beta}$$

$$= \frac{4V}{g\sqrt{4\sin^2\beta + \sin^2\beta\cdot\cot^2\beta}}$$

$$= \frac{4V}{g\sqrt{4\sin^2\beta + \cos^2\beta}}$$

$$= \frac{4V}{g\sqrt{3\sin^2\beta + \sin^2\beta + \cos^2\beta}}$$

$$= \frac{4V}{g\sqrt{3\sin^2\beta + 1}}$$



$$2 \times \frac{2u}{g}$$

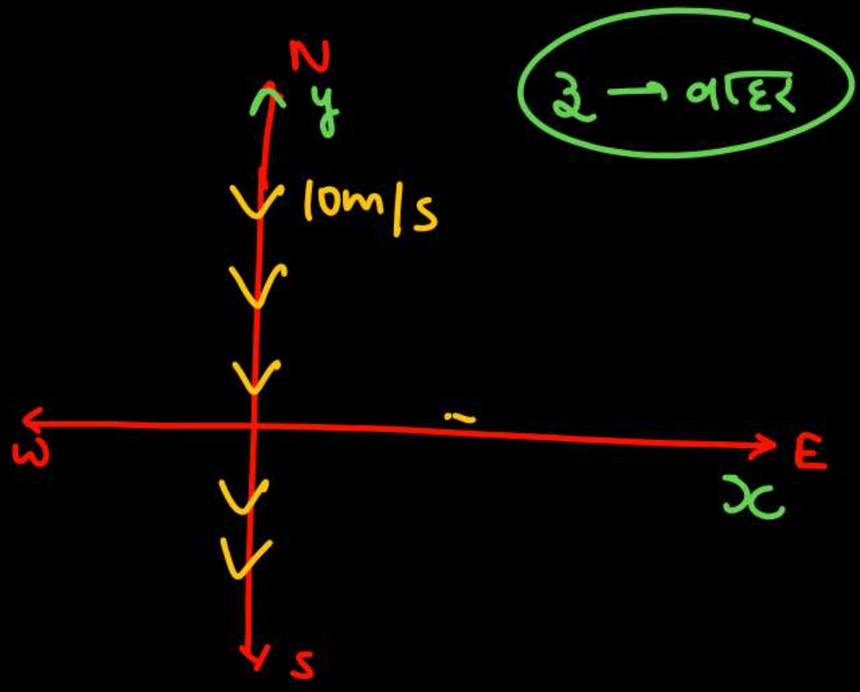
Question - 4

Rain is falling vertically with a velocity of 25 ms^{-1}. A man is walking with a speed of 10 ms^{-1} in the north to south direction. What is the direction in which he should hold his umbrella to safe him self from the rain?

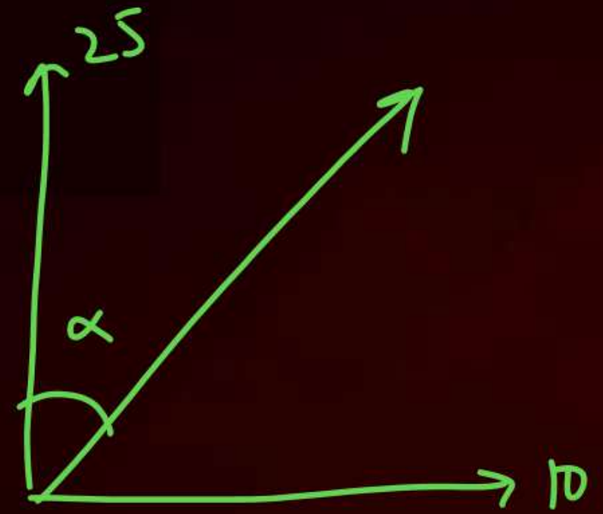
$\vec{v}_{r/m} = -25\hat{k} - (-10\hat{j})$

$= 10\hat{j} - 25\hat{k}$

Umbrella $\Rightarrow -\vec{v}_{r/m} \Rightarrow -10\hat{j} + 25\hat{k}$



Ans : The men should hold his umbrella at an angle $\tan^{-1}(0.4)$ with vertical towards south



$$\tan\alpha = \frac{10}{25} = .4$$

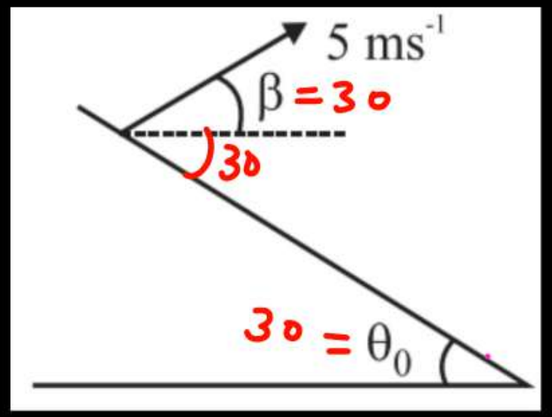
$$\alpha = \tan^{-1}(.4)$$

Question – 5

An inclined plane makes an angle $\theta_0 = 30°$ with the horizontal. A particle is projected from this plane with a speed of 5 ms^{-1} at an angle of elevation $\beta = 30°$ with the horizontal as shown in figure.

(a) Find the range of the particle on the plane when it strikes the plane.

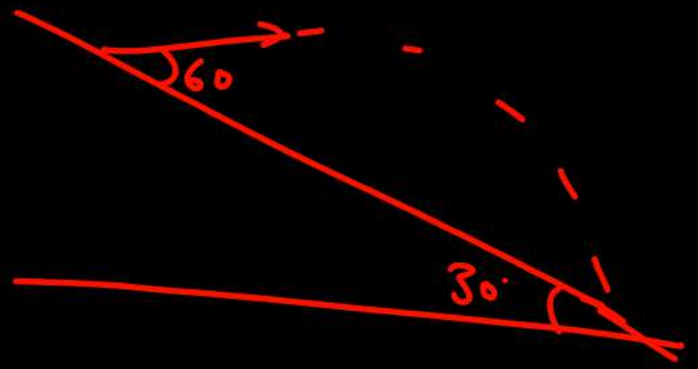
(b) Find the range of the particle for $\beta = 120°$.



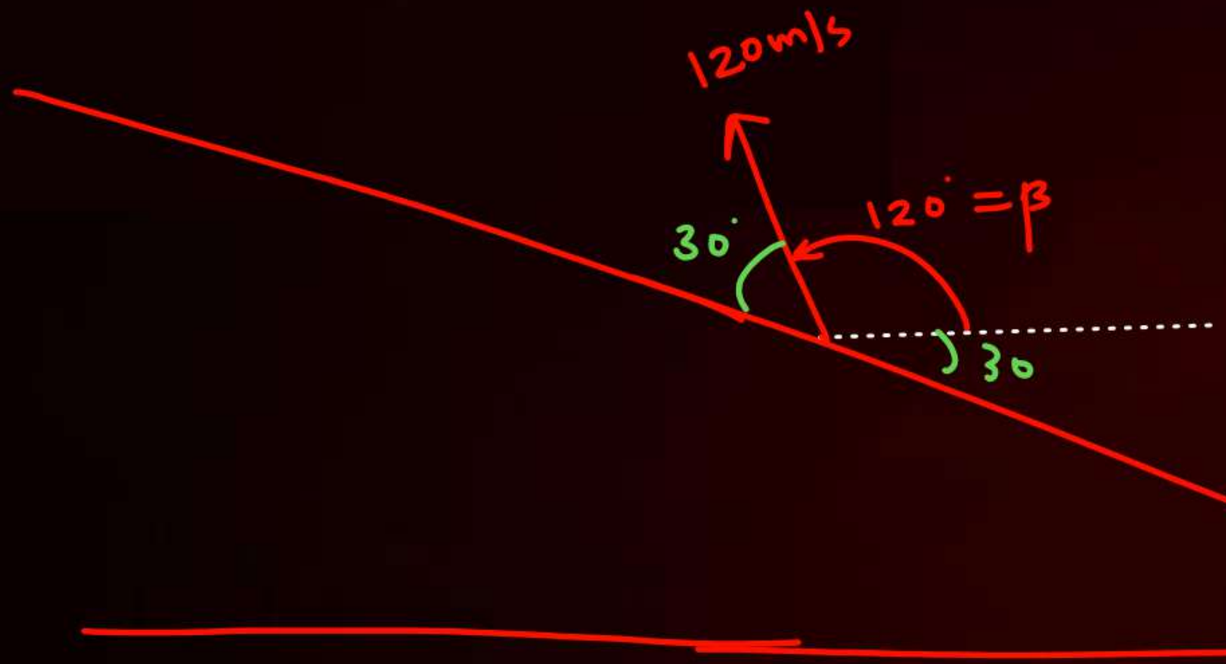
(a) $R = (5\cos 60)T + \frac{1}{2}(g\sin 30)T^2$

$T = \frac{2u_y}{a_y} = \frac{2 \times 5 \sin 60}{g \cos 30} =$ ✓

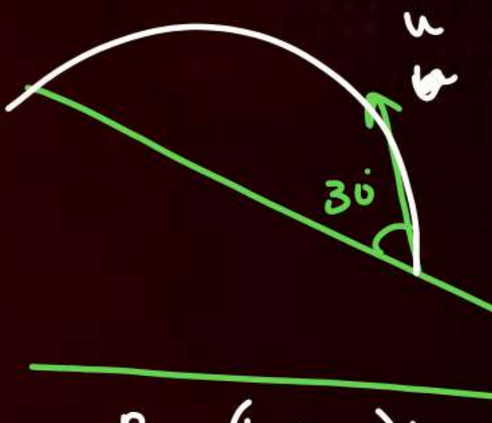
(b)



Ans : (a) 5 m, (b) 5/3 m



Q

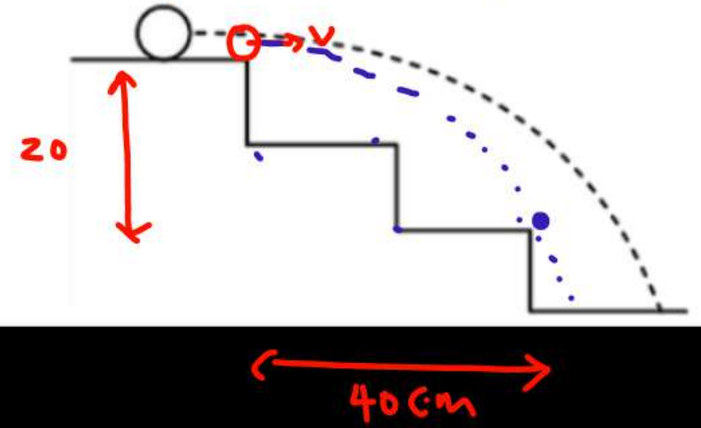


$$R = (u\cos 30)t - \frac{1}{2}(g\sin 30)t^2$$

$$T = t = \frac{2 \times u\sin 30}{g\cos 30}$$

Question – 6

A staircase contains three steps each 10 cm high and 20 cm wide. What should be the minimum horizontal velocity of the ball rolling off the uppermost plane so as to hit directly the lowest plane? (in m s^{-1}).



$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 20}{10 \times 100}}$$

$$= \frac{2}{10}$$

$$x = \frac{40}{100} = v \times t$$

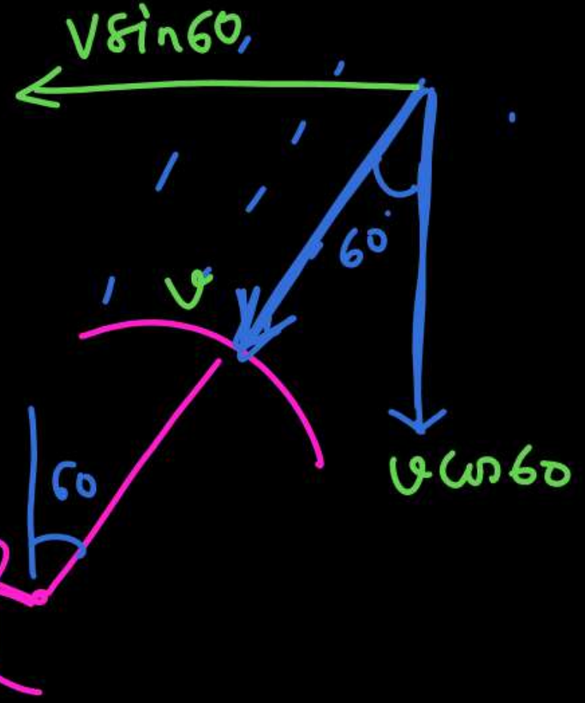
$$\frac{4}{10} = v \times \frac{2}{10}$$

$\therefore$

Ans : (2)

Question – 7

A person standing on a road has to hold his umbrella at 60° with the vertical to keep the rain away. He throws the umbrella and starts running at 20 ms^{-1}. He find that rain drops are hitting his head vertically. Find the speed of the rain drops with respect to (a) the road and (b) the moving person.



(a) $V\sin 60 = 20$

$V = \frac{20 \times 2}{\sqrt{3}} = \frac{40\sqrt{3}}{3}$

(b) $V\cos 60 = V \times \frac{1}{2}$

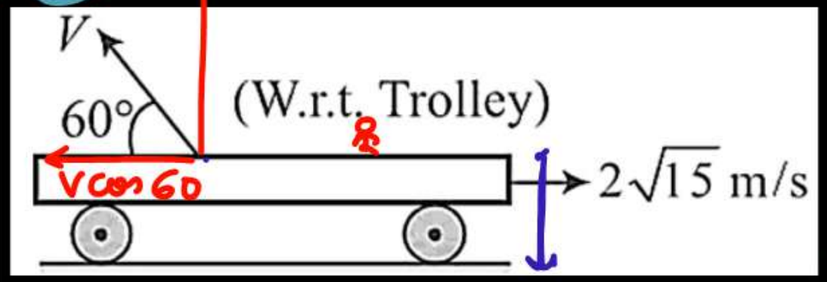
Ans : (a) $\frac{40\sqrt{3}}{3}$ ms^{-1}; (b) $\frac{20\sqrt{3}}{3}$ ms^{-1}

Question - 8

$\vec{v}_{ball/ground} = 0$

$\vec{v}_{ball/trolley} = \vec{v}_b - \vec{v}_{trolley}$

A particle is projected from a stationary trolley. After projection, the trolley moves with a velocity $2\sqrt{15}$ m/s . For an observer on the trolley, the direction of the particle is as shown in the figure while for the observer on the ground, the ball rises vertically. The maximum height reached by the ball from the trolley is h meter. The value of h will be _____.



$V \sin 60 = v_y$

$V \cos 60 = 2\sqrt{15}$

$V \frac{1}{2} = 2\sqrt{15}$

$V = 4\sqrt{15}$

$$\frac{v_y^2}{2a_y} = \frac{(V \sin 60)^2}{2 \times 10} = \frac{\left(\frac{4\sqrt{15} \times \sqrt{3}}{2}\right)^2}{20} = \frac{16 \times 45}{4 \times 20} = 9$$

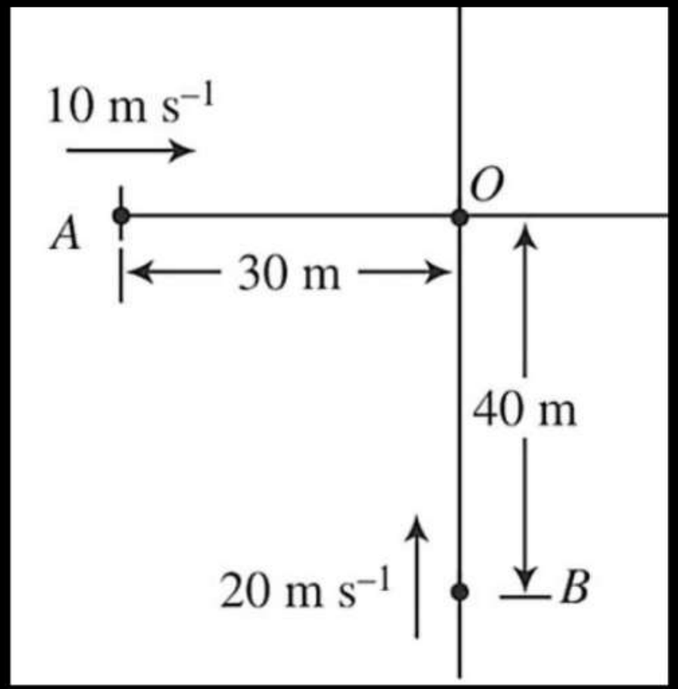
Ans : (9)

Question – 9

Two particles A and B are moving with uniform velocity as shown in figure given below at $t = 0$.

(a) Will the two particles collide?

(b) Find out the shortest distance between two particles.



Ans : **(a) the particles will not collide**

(b) $d_{\text{short}} = 4\sqrt{5}\,\text{m}$

Question – 9

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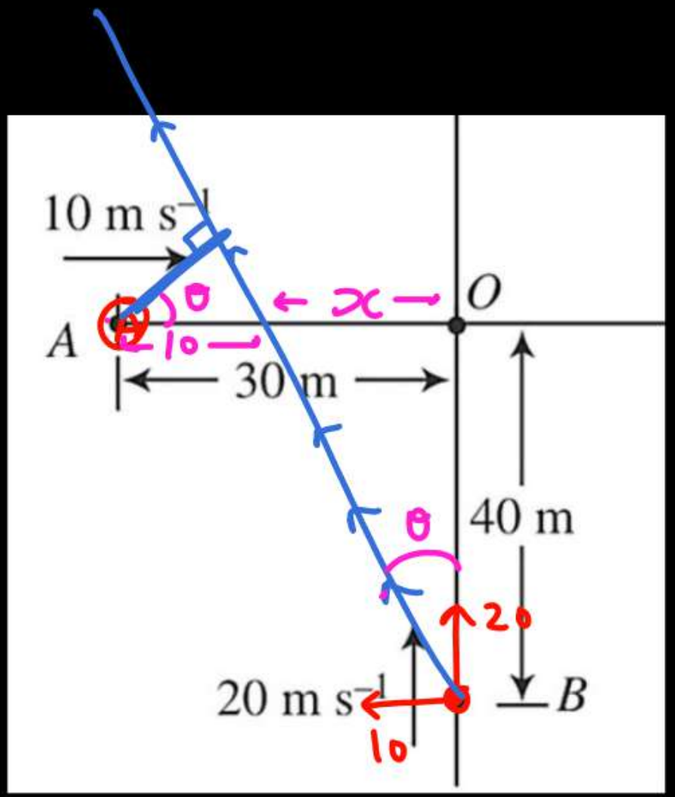
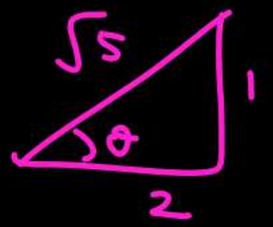




$\vec{v}_{BIA} = 20\hat{j} - 10\hat{i}$

$\tan\theta = \frac{1}{2} = \frac{x}{40}$

$x = 20$

$d_{min} = 10\cos\theta = 10\frac{2}{\sqrt{5}} = 4\sqrt{5}$

Ans : **(a) the particles will not collide**

(b) $d_{short} = 4\sqrt{5}$ m

Question – 10

A standing man observes rain falling with the velocity of 20 ms^{-1} at an angle of 30° with the vertical.

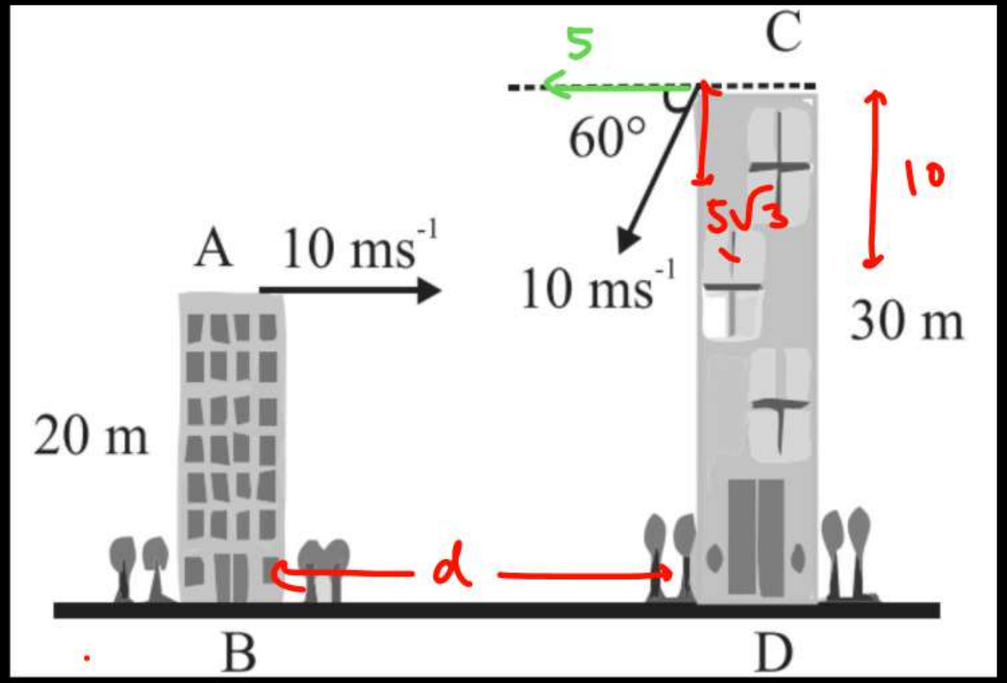
(a) Find the velocity with which the man should move so that rain appears to fall vertically to him.

(b) Now if he further increases his speed, rain again appears to fall at 30° with the vertical. Find his new velocity.

Ans : (a) 10 ms^{-1}; (b) 20 ms^{-1}

Question – 11

Two towers AB and CD are situated at distance d apart as shown in figure. AB is 20 m high and CD is 30 m high from the ground. A particle is thrown from the top of AB horizontally with a velocity of $10\ ms^{-1}$ towards CD. Simultaneously, another particle is thrown from the top of CD at an angle 60° to the horizontal towards AB with the same magnitude of initial velocity as that of the first object. The two particles moving in the same vertical plane collide in mid-air. Calculate the distance d between the towers.



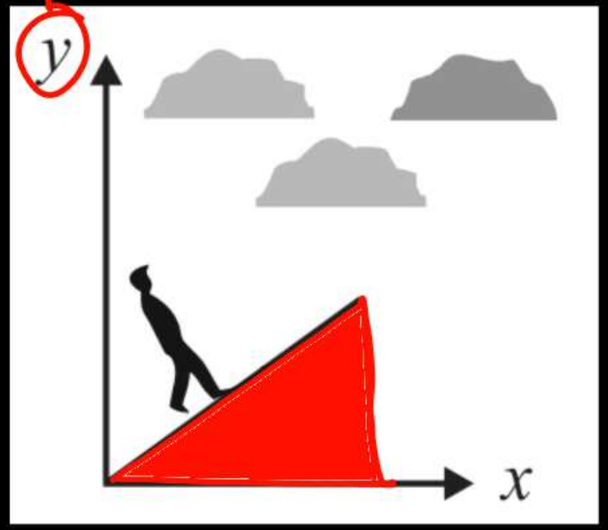
$t = \frac{10}{5\sqrt{3}}$

$d = 15 \times \frac{10}{5\sqrt{3}} = 10\sqrt{3}$

Ans : $10\sqrt{3}$ m

Question - 12

To a man running upwards on the hill, the rain appears to fall vertically downwards with 4 ms^{-1}. The velocity vector of the man w.r.t. earth is $(2\hat{i}+3\hat{j})ms^{-1}$. If the man starts running down the hill with the same speed, then determine the relative speed of the rain w.r.t. man.



$\vec{v}_{r/m} = -4\hat{j}$

$\vec{v}_r - (2\hat{i}+3\hat{j}) = -4\hat{j}$

$\vec{v}_r = 2\hat{i} - \hat{j}$

$\vec{v}_{r/m} = \vec{v}_r - \vec{v}_m$ → नहीं

$\vec{v}_{r/m} = (2\hat{i}-\hat{j}) - (-2\hat{i}-3\hat{j})$

$= 4\hat{i}+2\hat{j}$

result = $\sqrt{20}$

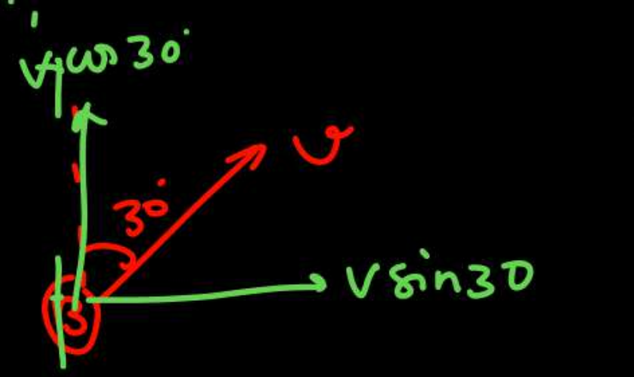
Ans : $\sqrt{20}\,ms^{-1}$

Question – 13

Ship A is travelling with a velocity of 5 km h^{-1} due east. A second ship is heading 30° east of north. What should be the speed of second ship if it is to remain always due north with respect to the first ship?

(1) 10 km h^{-1} (2) 9 km h^{-1}

(3) 8 km h^{-1} (4) 7 km h^{-1}

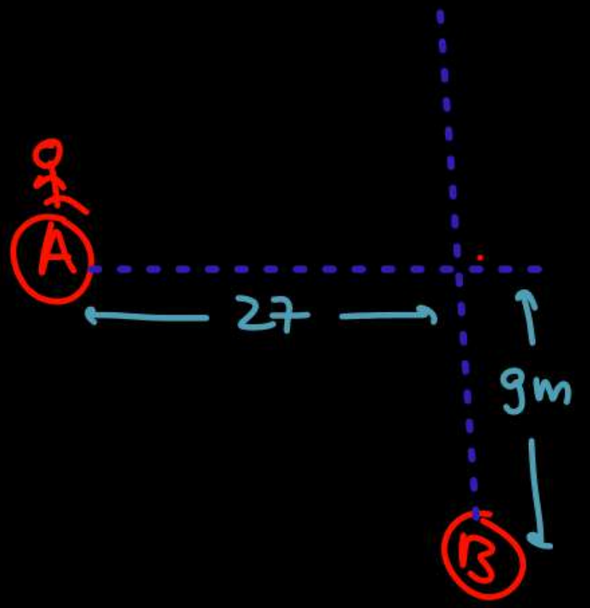


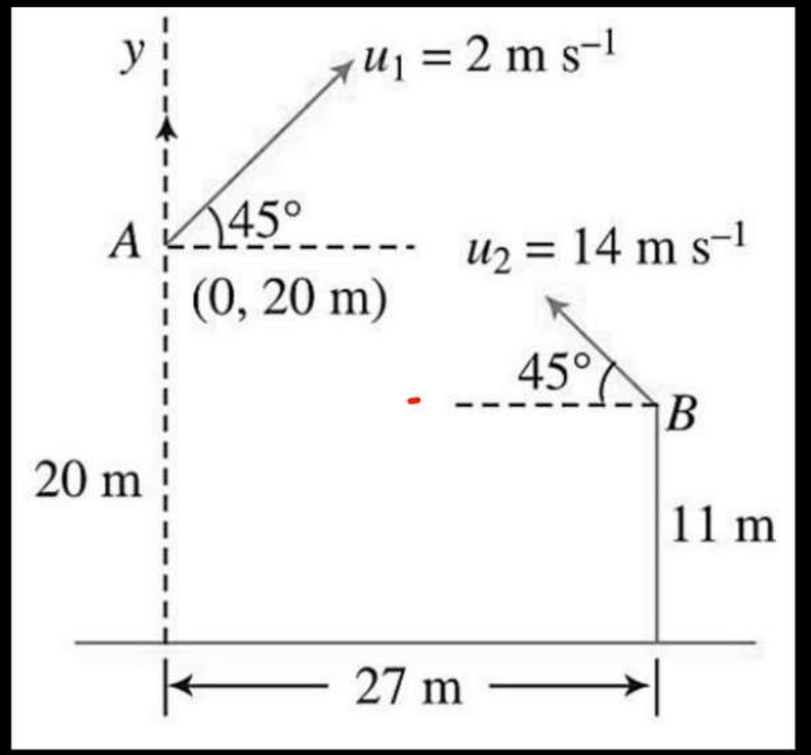
$v \sin 30 = 5$

Ans : (1)

Passage for questions no. 14 to 16

Two particles are thrown simultaneously from points A and B with velocities $u_1 = 2\ \text{ms}^{-1}$ and $u_2 = 14\ \text{ms}^{-1}$, respectively, as shown in figure.





Question - 14

The relative velocity of B as seen from A in

(1) $-8\sqrt{2}\hat{i}+6\sqrt{2}\hat{j}$ (2) $4\sqrt{2}\hat{i}+3\sqrt{3}\hat{j}$

(3) $3\sqrt{5}\hat{i}+2\sqrt{3}\hat{j}$ (4) $3\sqrt{2}\hat{i}+4\sqrt{3}\hat{j}$

Ans : (1)

Question - 15

The direction (angle) with horizontal at which B will appear to move as seen from A is:

(1) 37°
(2) 53°
(3) 15°
(4) 90°

$\vec{v}_{B/A} \equiv$ ✓

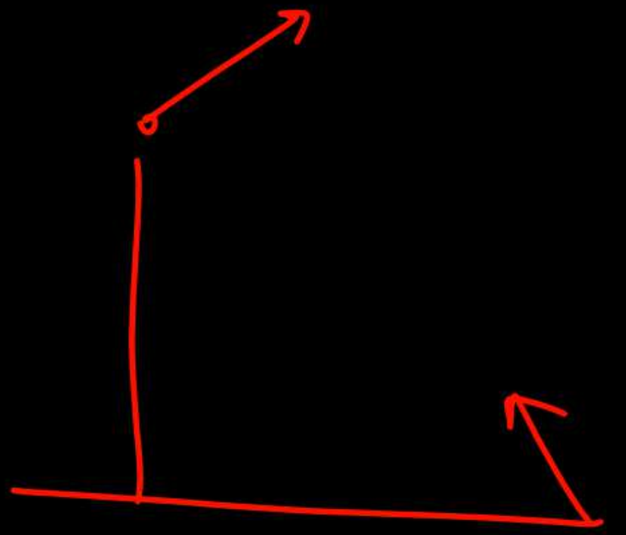
Ans : (1)

Question – 16

Minimum separation between A and B is:

(1) 3 m (2) 6 m

(3) 12 m (4) 9 m



Ans : (4)

THANK YOU