YAKEEN NEET 2.0

2026

Motion in a Plane

Physics

Assignment Solution 03

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Sangharsh Assignment

Motion in Plane-3

Question

A particle moves in xy-plane with velocity $\vec{v} = (2-t)\hat{i} + \frac{t^2}{4}\hat{j}$. where t in s gives v in m/s. The particle starts from origin. Find the y-coordinate when the x-coordinate becomes zero after start

1. $\frac{8}{5}$ s
2. $\frac{24}{3}$ s
3. $\frac{4}{3}$ s
4. $\frac{16}{3}$ s

$t=0$ $(0,0)$ (x,y)

$V = (2-t)\hat{i} + \frac{t^2}{4}\hat{j}$

$V_x = 2-t$

$\frac{dx}{dt} = 2-t$

$\int dx = \int 2\,dt - \int t\,dt$

$0 = 2t - \frac{t^2}{2}$

$t\frac{t}{2} = 2t$

$t = 4$ sec

$V_y = \frac{t^2}{4}$

$\frac{dy}{dt} = \frac{t^2}{4}$

$\int dy = \int \frac{t^2}{4}\,dt$

$y = \left[\frac{t^3}{3\times 4}\right]_0^4$

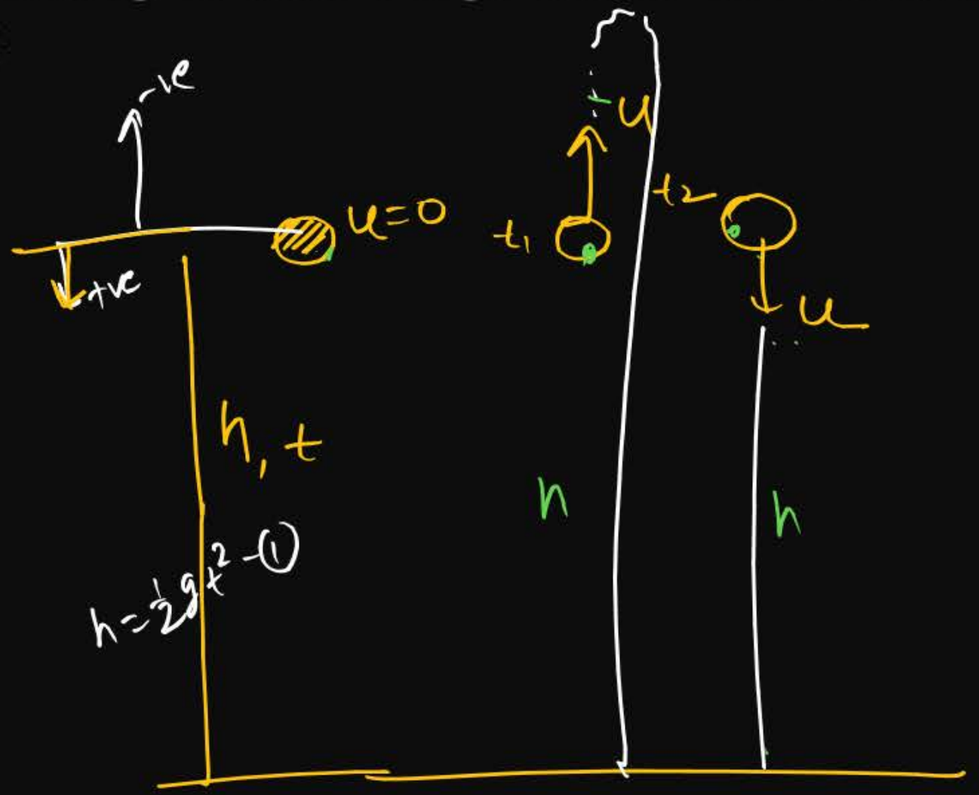
$= \frac{4\times 4\times 4}{3\times 4} = \frac{16}{3}$

$t=0$ y

Question

A stone is dropped from a minar of height h and it reaches after t seconds on earth. From the same minar if two stones are thrown (one upwards and other downwards) with the same velocity u and they reach the earth surface after t_1 and t, seconds respectively, then

1. $t = t_1 - t_2$
2. $t = \dfrac{t_1 + t_2}{2}$
3. $t = \sqrt{t_1 t_2}$
4. $t = t_1^2 t_2^2$



$h = -ut_1 + \frac{1}{2}gt_1^2$ —①×t_2

$h = ut_2 + \frac{1}{2}gt_2^2$ —①×t_1

$ht_2 = -ut_1t_2 + \frac{1}{2}gt_1^2t_2$

$ht_1 = ut_2t_1 + \frac{1}{2}gt_2^2t_1$

$h(t_1+t_2) = \frac{1}{2}gt_1t_2(t_1+t_2)$

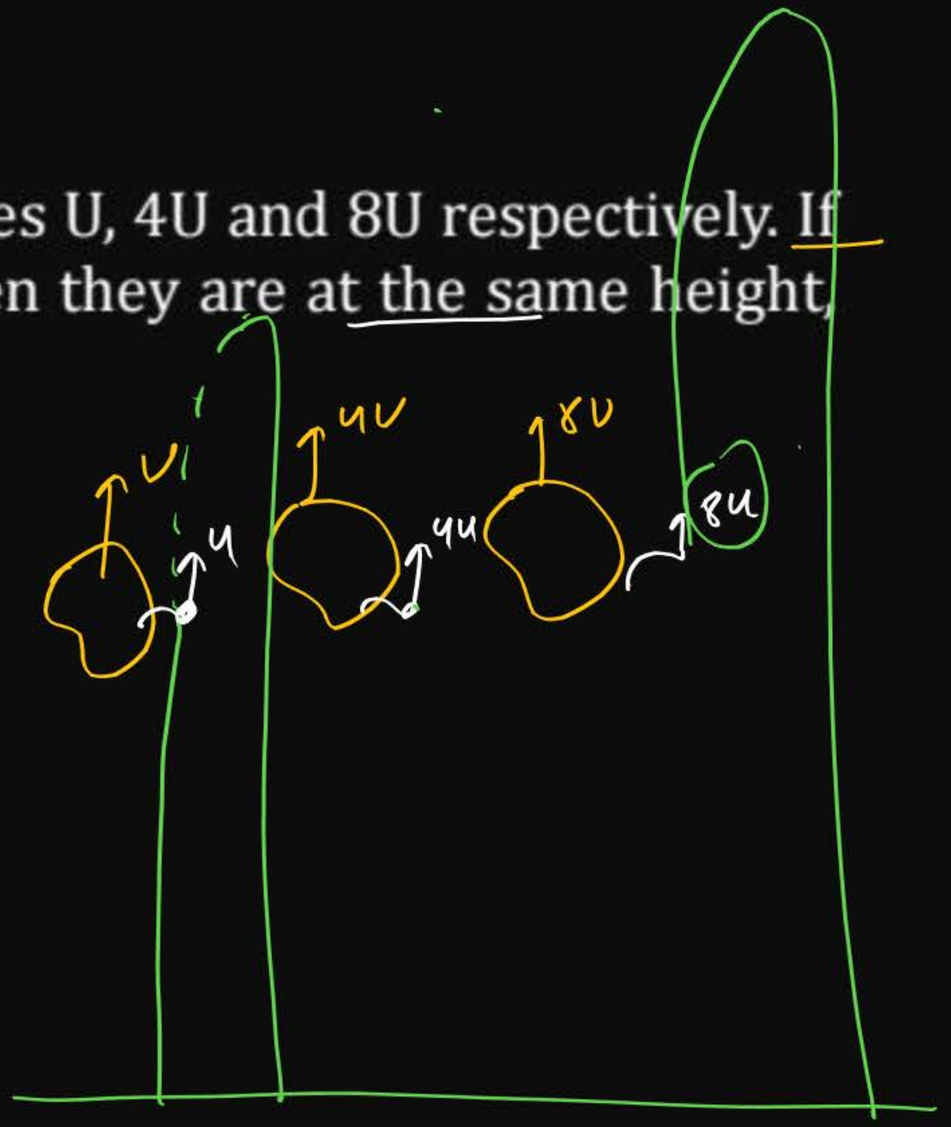
$\frac{1}{2}gt^2 = \frac{1}{2}gt_1t_2$

$t = \sqrt{t_1t_2}$

Question

P, Q and R are three balloons ascending with velocities U, 4U and 8U respectively. If stones of the same mass be dropped from each, when they are at the same height, then

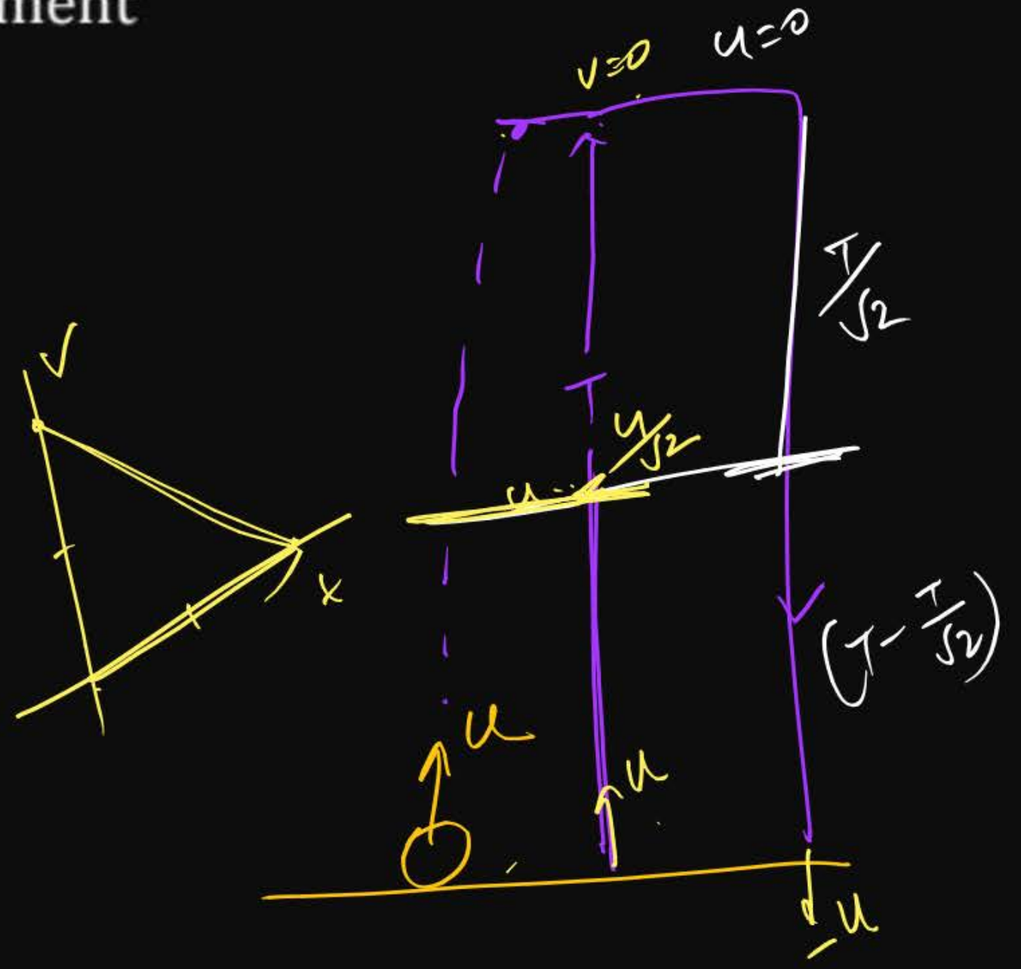
1. They reach the ground at the same time
2. Stone from P reaches the ground first
3. Stone from R reaches the ground first
4. Stone from Q reaches the ground first



Question

A body is projected up with a speed 'u' and the time taken by it is T to reach the maximum height H. Pick out the correct statement

1. It reaches $H/2$ in $T/2$ sec
2. It acquires velocity $u/2$ in $T/2$ sec
3. Its velocity is $u/2$ at $H/2$
4. Same velocity at $2T$



Question

An aeroplane is moving with a velocity u. It drops a packet from a height h. The time t taken by the packet in reaching the ground will be

1. $\sqrt{\frac{2g}{h}}$
2. $\sqrt{\left(\frac{2u}{g}\right)}$
3. $\sqrt{\left(\frac{h}{2g}\right)}$
4. $\sqrt{\left(\frac{2h}{g}\right)}$

Question

The distance between two particles is decreasing at the rate of 6 m/sec. If these particles travel with same speeds and in the same direction, then the separation increase at the rate of 4 m/s. The particles have speeds as

they are moving towards each other

1. 5 m/sec; 1 m/sec
2. 4 m/sec; 1 m/sec
3. 4 m/sec; 2 m/sec
4. 5 m/sec; 2 m/sec

$V_A + V_B = 6\ m/s$

$V_A - V_B = 4\ m/s$

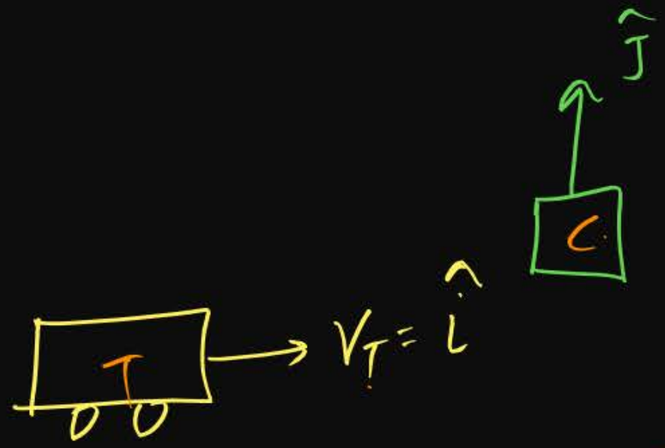
$2V_A = 10$

$V_A = 5\ m/sec$

Question

A train is moving towards east and a car is along north, both with same speed. The observed direction of car to the passenger in the train is

1. East-north direction
2. West-north direction
3. South-east direction
4. None of these



$\vec{V}_{CT} = \vec{V}_C - \vec{V}_T$

$= (\text{Not} - \text{west})$

Question

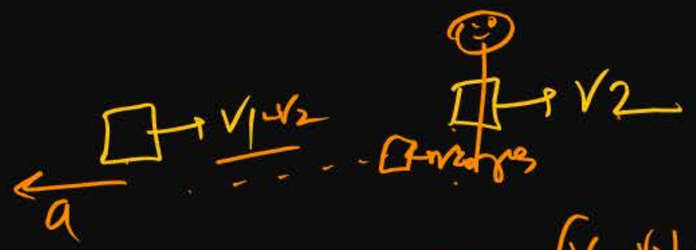
An express train is moving with a velocity v_1. Its driver finds another train is moving on the same track in the same direction with velocity v_2. To escape collision, driver applies a retardation a on the train, the minimum time of escaping collision will be

1. $t = \frac{v_1 - v_2}{a}$ Ans

2. $t_1 = \frac{v_1^2 - v_2^2}{2}$

3. Both (1) and (2)

4. None of these



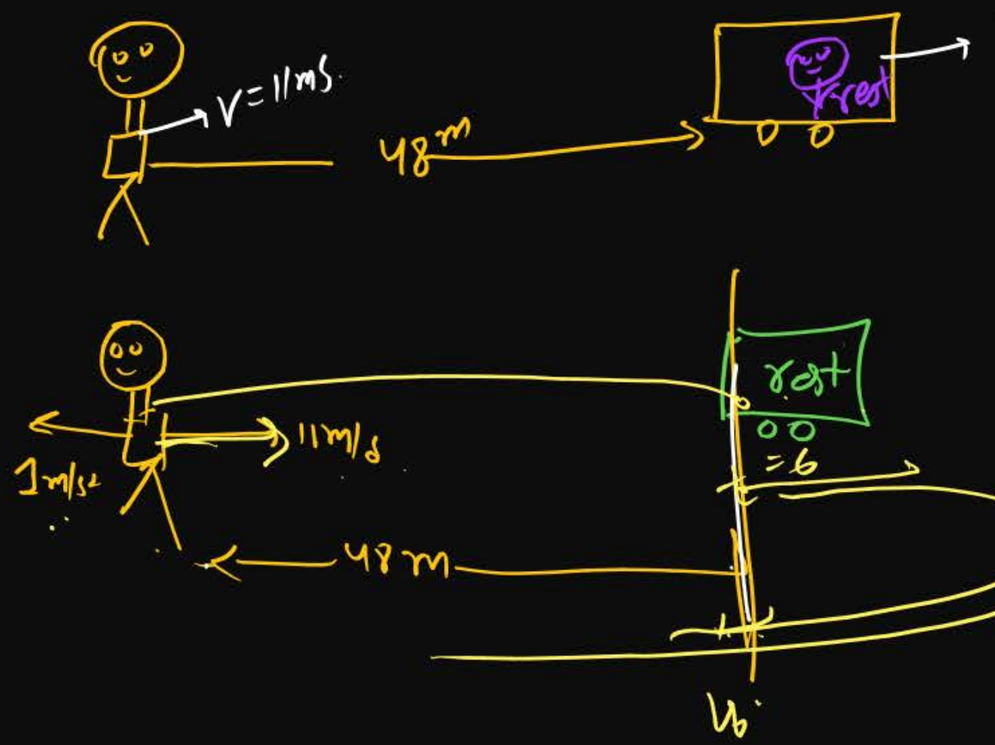
$0 = (v_1 - v_2) - at$

$t = \frac{v_1 - v_2}{a}$

Question

A man is standing behind a car at a distance of 48m. At a particular instant, the car starts accelerating at 1 m/s^2 and the man runs at a constant speed of 11 m/s in the same direction. The man will meet the car the first time at time

1. $t = 6s$
2. $t = 16s$
3. $t = 6s$ and $t = 16s$
4. None of these



$$S_{mc} = v_{mc}t + \frac{1}{2}a_{mc}t^2$$

$$48 = 11t - \frac{1}{2}1t^2$$

$$t^2 - 22t + 96 = 0$$

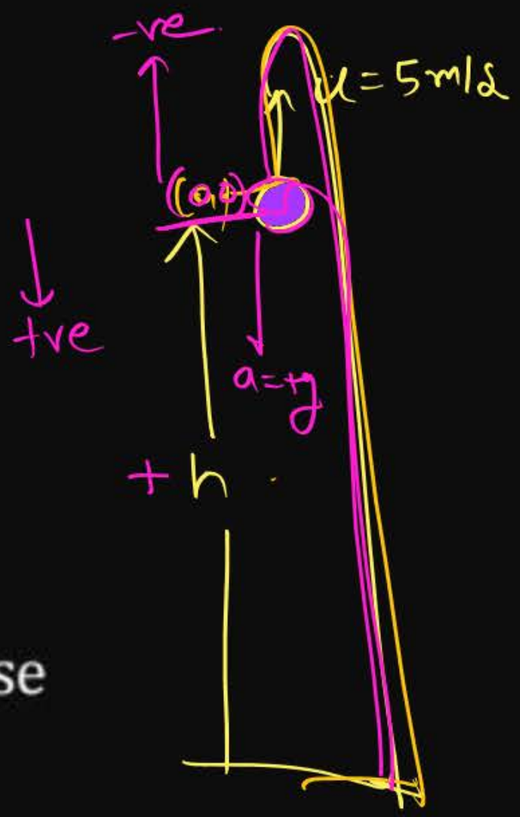
$$t^2 - 16t - 6t + 96 = 0$$

$$t_1 = 6,\ t_2 = 16$$

Question

A stone is thrown vertically upward from a bridge, with an initial velocity of 4.9 m/s. It strikes the water after 2s. What is the height of the bridge from the water level? ($g = 9.8\ m/s^2$)

1. 19.6 m ✗
2. 9.8 m ✓
3. 29.4 m
4. None of these



$$h = -5\times2 + \frac{1}{2}10(2)^2 = -10 + 5\times4$$

$$= -10 + 20$$

$$= 10m$$

Question

A juggler throws one ball into air, whenever the previous one is at its highest point. How high do the balls rise, if he throws 'n' balls each sec? (Acceleration due to gravity is g.)

$f = n = \frac{1}{T}$

1. $\frac{g}{4n^2}$
2. $\frac{g}{2n^2}$ Ans
3. $\frac{g}{n^2}$
4. $\frac{2g}{n^2}$

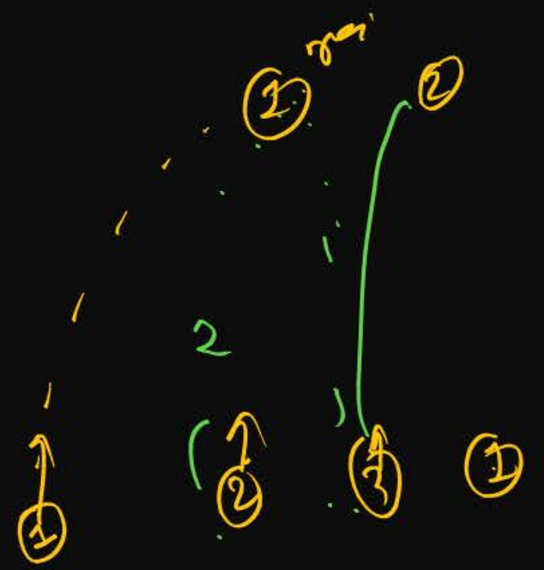
N (no of Ball) = 2

$\frac{2u}{g} = NT$

$\frac{2u}{g} = 2\left(\frac{1}{n}\right)$

$u = \frac{g}{n}$

$H_{max} = \frac{u^2}{2g} = \frac{g^2}{n^2 2g} = \frac{g}{2n^2}$



Question

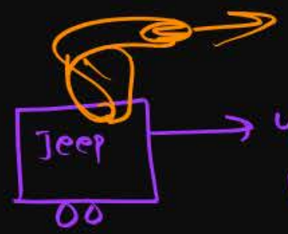
A particle is released from the top of a tower of height 150 m and another ball is thrown vertically upwards with velocity 20 m/s from a tower of height 50 m at the same time. Assume both are in a same vertical line. Then time after which they collide to each other: (take $g = 10\ m/s^2$)

1. 2s
2. 3s
3. 4s
4. 5s ✓

Question

A police jeep is chasing a thief with velocity of 45 km hr^{-1} who is moving in another jeep moving with velocity 153 km hr^{-1}. Police fires a bullet with muzzle velocity of 180 ms^{-1}. The velocity with which the bullet appears to strike the jeep of the thief, to the thief is

1. 150 ms^{-1}
2. 27 ms^{-1}
3. 450 ms^{-1}
4. 250 ms^{-1}



45 km/hr = $45 \times \frac{5}{18} = 12.5$

$V = 135$ km/hr $= 135 \times \frac{5}{18} = 42.5$

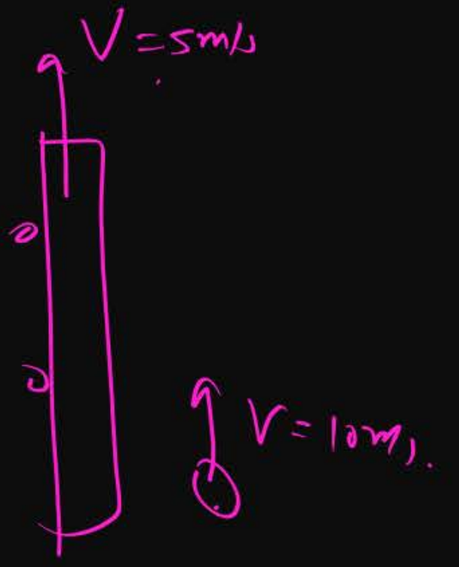
bullet fire karne ki velocity $V_{Bullet\ gun} = 180$ m/s

$V_{Bullet\ w.r.t.\ ground} = 180 + 12.5 = 192.5$ m/s ✓

$V_{B} = 192.5 - 42.5 = 150$ m/s

Question

A 150 m long train is moving in north direction with a velocity of 5 m/s and a parrot is also moving in north direction with a velocity of 10 m/s w.r.t. ground then find out (i) The time taken by parrot to cross the train (ii) Distance travel by the parrot during the crossing.

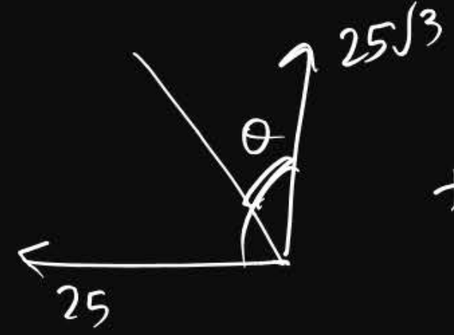


$t = \frac{150}{5} = 30$

$S = vt = 10 \times 30 = 300\,m$

Question

A car is moving with a speed of 25 km/hour in the East. A bus is moving with a speed of $25\sqrt{3}$ km/hour in the North. What will be the relative velocity of the bus for the car's driver?



$\tan\theta = \frac{25}{25\sqrt{3}}$

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

$\theta = 30^\circ$

$\vec{V}_C = 25\,m/s\,\hat{i}$

$\vec{V}_B = 25\sqrt{3}\,m\,\hat{j}$

$\vec{V}_{BC} = \vec{V}_B - \vec{V}_C$

$= 25\sqrt{3}\,\hat{j} - 25\,\hat{i}$

$|\vec{V}_{BC}| = \sqrt{(25\sqrt{3})^2 + (25)^2} = \sqrt{(25)^2(3+1)} = \sqrt{(25)^2 \times 4} = 25 \times 2 = 50$

Question

A car is moving with a speed of 25 km/h in East and car driver observes that a bus is moving with a speed of $25\sqrt{3}$ km/h in the north what will be actual velocity of bus.

$V_C = 25\ \text{km/hr}\ \hat{i}$

$V_{BC} = 25\sqrt{3}\ \hat{j}$

$\vec{V}_{BC} = \vec{V}_B - \vec{V}_C$

$25\sqrt{3}\hat{j} = \vec{V}_B - 25\hat{i}$

$V_B = 25\hat{i} + 25\sqrt{3}\hat{j}$

$|V_B| = 50\ \text{km/h}$

Question

The wind is blowing in south with velocity of 4 km/h and observer is travelling with velocity of $4\sqrt{3}$ km/h in east. Find out the velocity of wind appeared to observer.

$\vec{V}_{\text{wind obs}} = \vec{V}_{B} - \vec{V}_{\text{Obs}}$

$V_{\text{wind}} = -4 \text{ km/h}\,\hat{j}$

$V_{\text{obs}} = 4\sqrt{3}\,\hat{i}$

Question

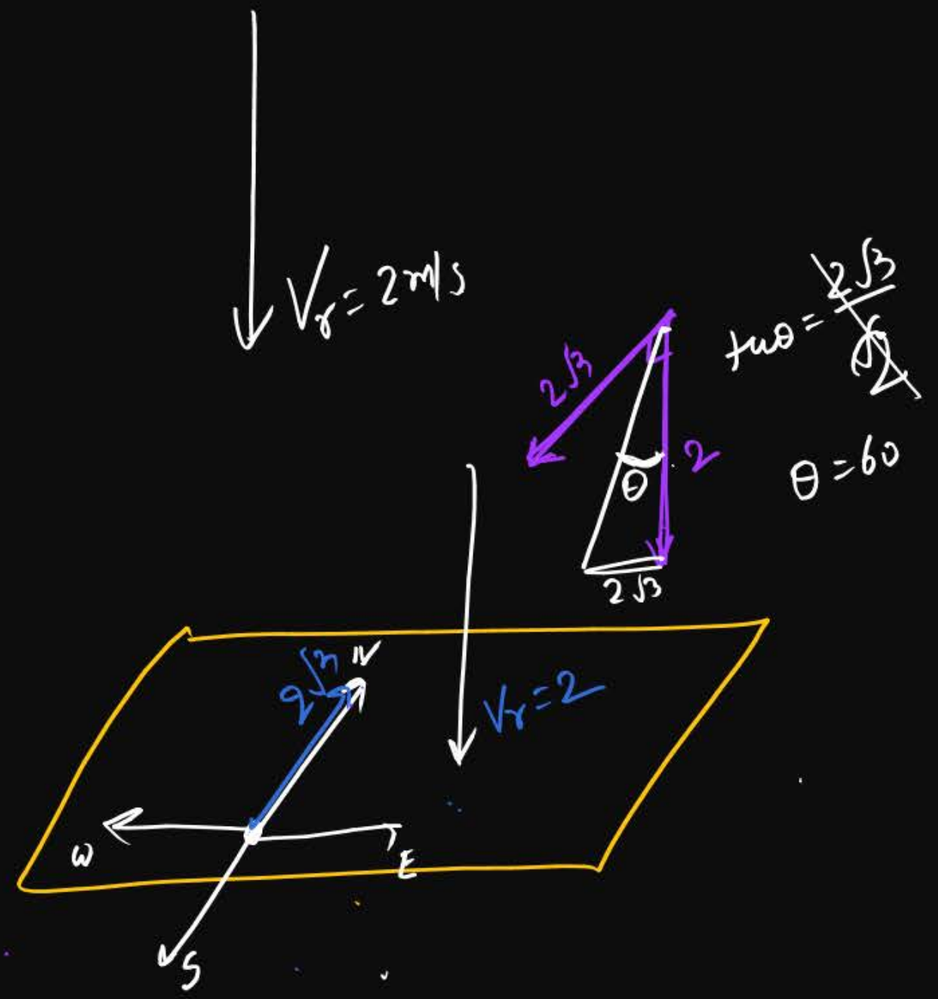
Rain is falling vertically downwards with a velocity of 2 m/s. A person is running to the North with a velocity of $2\sqrt{3}$ m/s. Find out the velocity and direction of rain as appeared to the person.

$$\vec{V}_{r\,per} = \vec{V}_r - \vec{V}_p$$

$$\vec{V}_{rp} = -2\hat{k} - 2\sqrt{3}\,\hat{i}$$

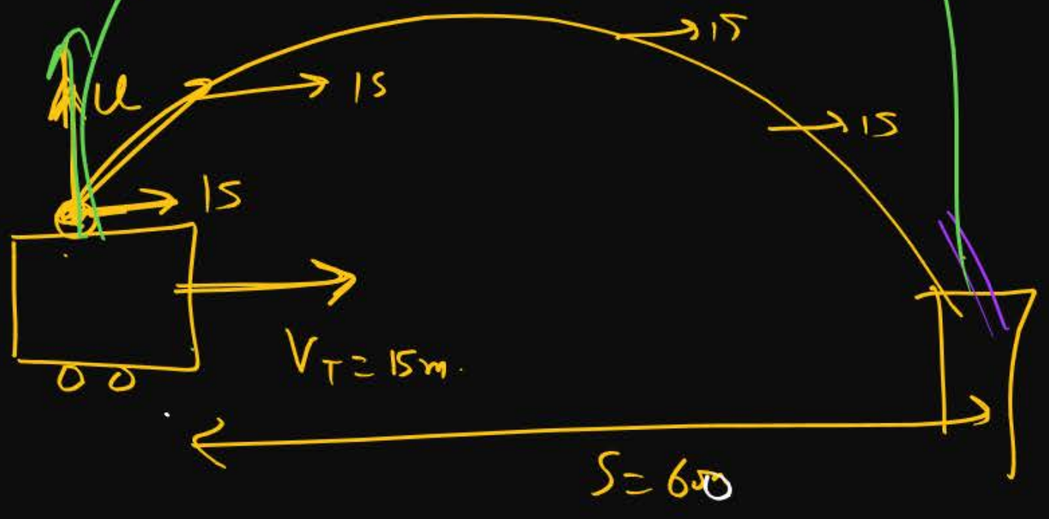
$$|\vec{V}_{rp}| = \sqrt{(2)^2 + (2\sqrt{3})^2}$$

$$= 4\ m/s$$



Question

A boy is standing on a truck moving with a constant velocity of 15 m/s on the horizontal road. The boy throws a ball in such a way that it returns to the truck after the truck has moved 60 m. Find the speed and the angle of projection (a) as seen by the truck and (b) as seen from the road.



$$t = \frac{60}{15} = 4 \text{ sec.}$$

$$T_f = \frac{2u_y}{g}$$

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

$$u_y = 20 \text{ m/s}$$

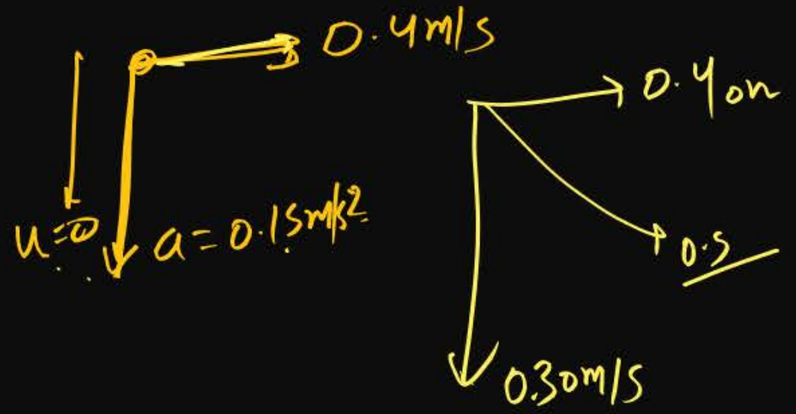
$u_{Ball\ T} = 20 \text{ m/s}$

$u_{Ball\ gr} = 20\hat{i} + 15\hat{j}$

Question

A particle moving with a velocity equal to 0.4 m/s is subjected to an acceleration of 0.15 m/s^2 for 2 s. in a direction at the right angle to its direction of motion. The resultant velocity is

1. 0.7 m/s
2. 0.5 m/s
3. 0.1 m/s
4. Between 0.7 and 0.1 m/s



Question

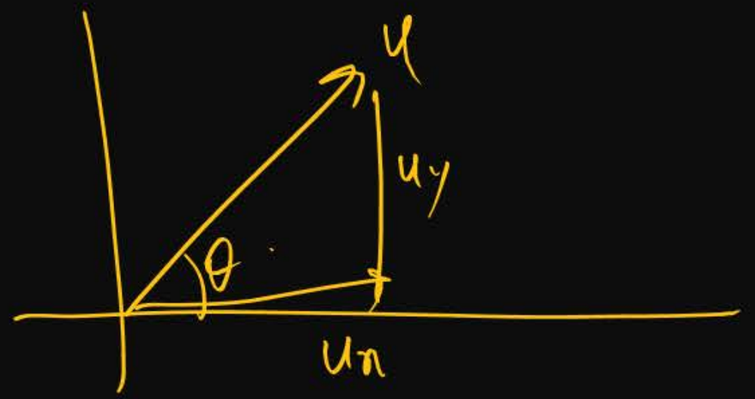
The height y and distance x along the horizontal plane of a projectile on a certain planet are given by $x = 6t$ m and $y = (8t - 5t^2)$ m. The velocity with which the projectile is projected is

$\frac{dx}{dt} = u_x = 6$

$(u_y)_{t=0} = 8$ ✓

$\tan\theta = \left(\frac{u_y}{u_x}\right) = \frac{8}{6} = \frac{4}{3}$

1. 8 m/s
2. 6 m/s
3. 10 m/s ✓
4. 0



Question

The coordinates of a moving particle at any time t are given by $x = \alpha r^2$ and $y = \beta t^2$. The speed of the particle at time t is given by

1. $\sqrt{\alpha^2 + \beta^2}$
2. $3t\sqrt{\alpha^2 + \beta^2}$
3. $3t^2\sqrt{\alpha^2 + \beta^2}$
4. $t^2\sqrt{\alpha^2 + \beta^2}$

$x = \alpha t^3$ $\quad y = \beta t^2$

$\frac{dx}{dt} = \alpha 2t$ $\quad \frac{dy}{dt} = 2\beta t$

$\vec{v} = 2\alpha t\hat{i} + 2\beta t\hat{j}$

$|\vec{v}| = \sqrt{(2\alpha t)^2 + (2\beta t)^2}$

$= 2t\sqrt{\alpha^2 + \beta^2}$

Question

A body starts from rest from the origin with an acceleration of 3 m/s^2 along the x-axis and 4 m/s^2 along the y-axis. Its distance from the origin after 2 s will be

1. 5 m
2. 10 m
3. 15 m
4. 20 m

$u_x = 0$

$a_x = 3 m/s^2$

$x = \frac{1}{2} a t^2$

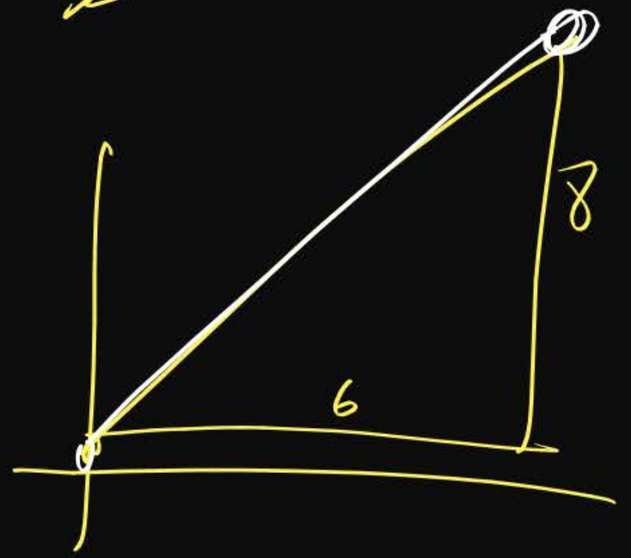
$= \frac{1}{2} 3 (2)^2$

$= 3 \times 2 = 6 i$

$u_y = 0$

$a_y = 4 m/s^2$

$y = \frac{1}{2} 4 (2)^2 = 8 j$



Question

$u\cos\theta = \frac{u}{2}$

$\cos\theta = \frac{1}{2}$

$\theta = 60^\circ$

Choose the correct option

1. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is 60°.

2. A missile is fired for maximum range with an initial velocity of 20 m/s, the range of the missile is 40 m.

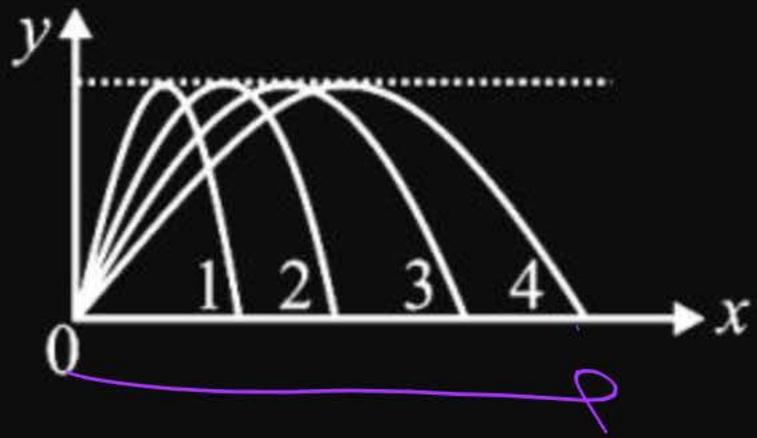
3. A ball is projected with a kinetic energy E at an angle of 45° to the horizontal. At the highest point during its flight, its kinetic energy will be E/2.

4. An object is projected at an angle of 45° with horizontal. The horizontal range and maximum height will be in the ratio 4 : 1

(1, 2, 3, 4)

Question

The figure shows four paths for a kicked football. Ignoring the effects of air on the flight, rank the paths according to the initial horizontal velocity component, highest first



$u_y = \text{same}$

$u_{x4} > u_{x3} > u_{x2}$

1. 1, 2, 3, 4
2. 2, 3, 4, 1
3. 3, 4, 1, 2
4. 4, 3, 2, 1 ✓

Question

In an oblique projectile motion if the velocity of projection is increased by 2%, the percentage increase in horizontal range will be

1. 1%
2. 2%
3. 3%
4. 4%

$R \propto u^2$

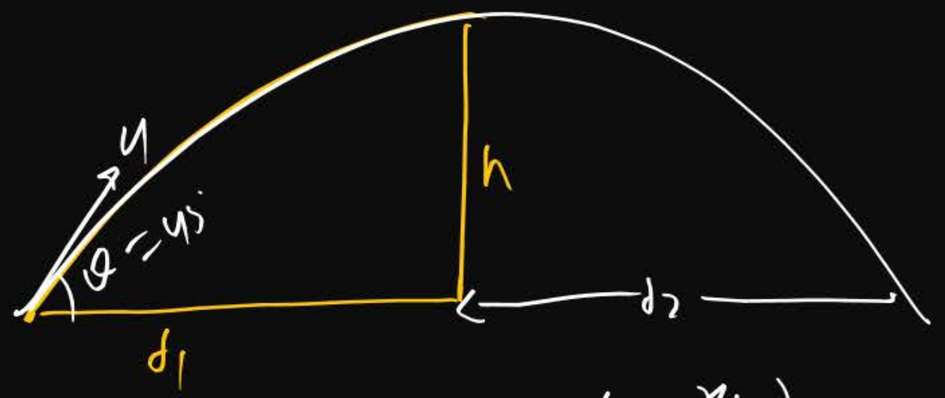
$\frac{\Delta R}{R} = 2\left(\frac{\Delta u}{u} \times 100\right)$

$= 2 \times 2 = 4\%$

Question

A ball is projected at an angle 45° with horizontal. It passes through a wall of height h at horizontal distance d_1 from the point of projection and strikes the ground at a horizontal distance $(d_1 + d_2)$ from the point of projection, then

1. $h = \dfrac{2d_1d_2}{d_1 + d_2}$
2. $h = \dfrac{d_1d_2}{d_1 + d_2}$
3. $h = \dfrac{\sqrt{2}d_1d_2}{d_1 + d_2}$
4. $h = \dfrac{d_1d_2}{2(d_1 + d_2)}$



$$y = x\tan\theta\left(1 - x/R\right)$$

$$h = d_1 \cdot \tan 45^\circ\left(1 - \frac{d_1}{d_1+d_2}\right)$$

$$= d_1\left(\frac{d_2}{d_1+d_2}\right) = \frac{d_1d_2}{d_1+d_2}$$

THANK YOU