YAKEEN NEET 2.0

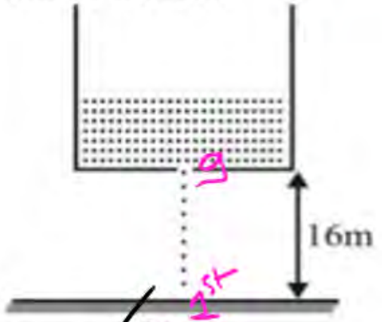
2026

Motion in a plane

Physics | Assignment Solution 01

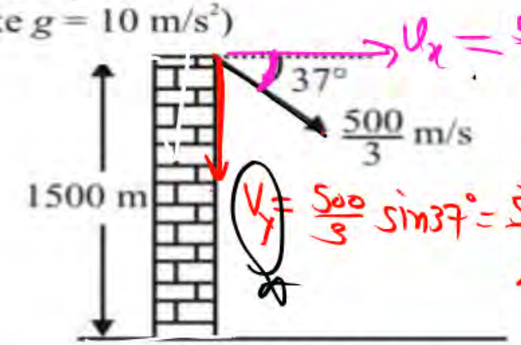
By- Manish Raj (MR Sir)

1. Water drops fall with negligible velocity at regular intervals from a hole at the bottom of a vessel placed 16m from the ground. The ninth drop is about to fall when the first drop just falls on the floor. Find the distance between the third and fifth drop at this instant in meters.

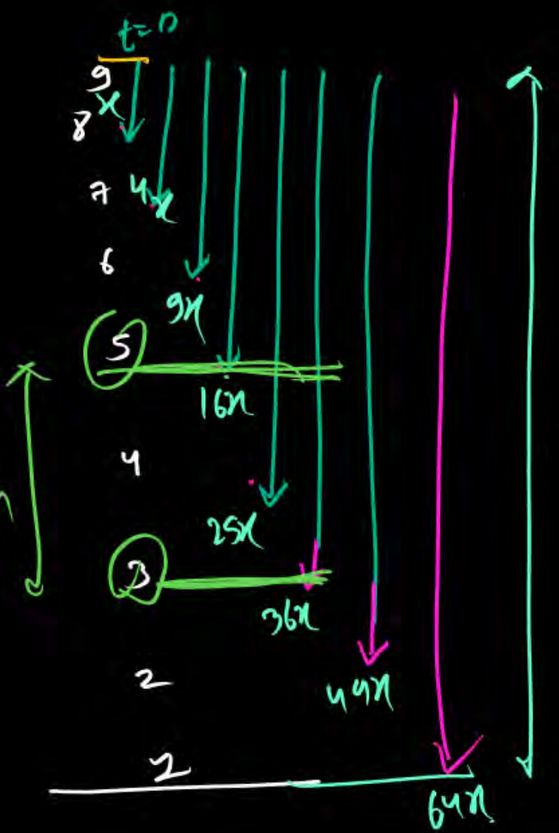


(1) 2 (2) 5
(3) 8 (4) 9

2. A particle is projected from a tower as shown in figure, then the distance from the foot of the tower where it will strike the ground will be:
(take $g = 10\ m/s^2$)



(1) 4000/3 m (2) 5000/3 m
(3) 2000 m (4) 3000 m



$64x = 16$

$x = \frac{1}{4}\ m$

$h = 36x - 16x = 20x$

$= 20 \times \frac{1}{4}$

$= 5$

$u_x = \frac{500}{3}\cos 37 = \frac{500}{3} \times \frac{4}{5} = \frac{400}{3}$

$u = 100$, $a = g = 10$, $s = 1500\ m$, $v_f = ?$

$v_f^2 = u^2 + 2as$

$= 1000 + 2 \times 10 \times 1500$

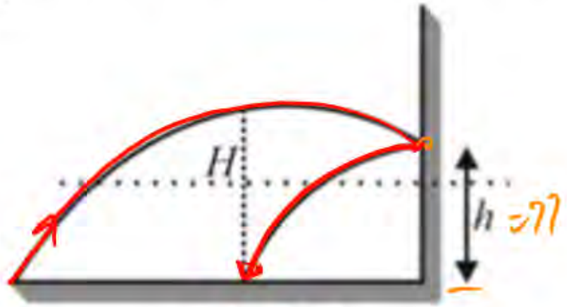
$v_f = \sqrt{400000} = \sqrt{4 \times 10^4} = 2 \times 100 = 200$

$v_f = 200$

$t_f = 10s$, $R = u_x T_f = \frac{400}{3} \times 10 = \frac{4000}{3}$

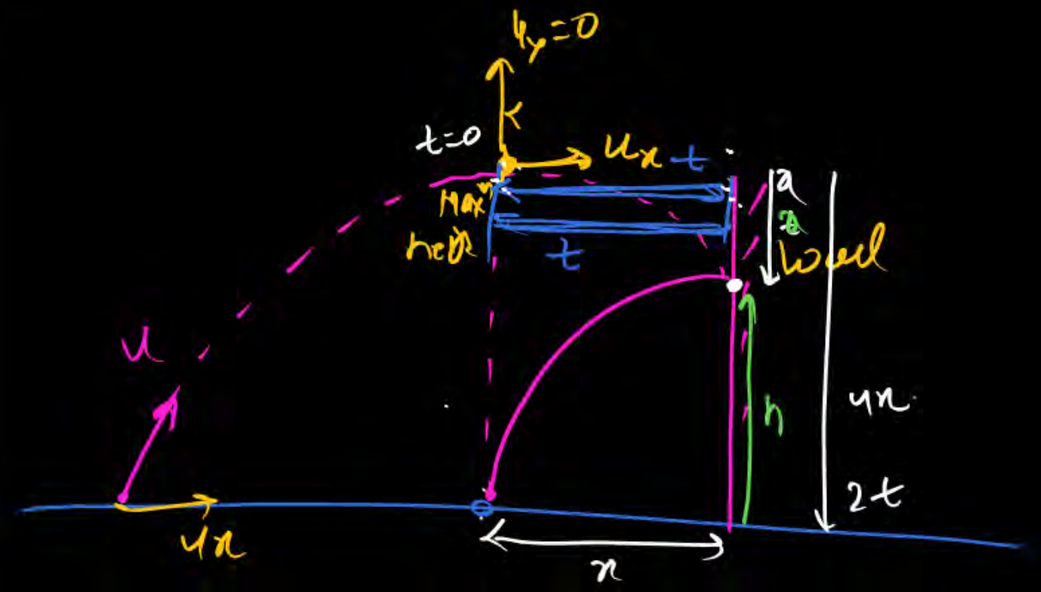
$v_y = \frac{500}{3}\sin 37° = \frac{500}{3} \times \frac{3}{5} = 100\ m/s$

3. A stone is projected form a horizontal plane. It attains maximum height 'H' and strikes a stationary smooth wall and falls on the ground vertically below the maximum height. Assume the collision to be elastic, the height of the point on the wall where ball will strike is:



Key-Concept →
Consid Motⁿ in x-axis & y-axis separately.

(1) H/2
(2) H/4
✓(3) 3H/4
(4) None of these

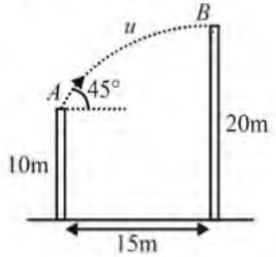


$u_x = H$

$x = \frac{H}{4}$

$h = 3x = 3\left(\frac{H}{4}\right)$

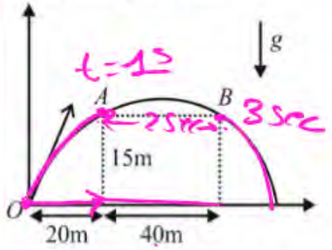
4. Find the value of 'u' so that the ball reaches at point B. (Take $g = 10\ m/s^2$)



(1) 20 m/s (2) 40 m/s

(3) $15\sqrt{2}$ m/s (4) 50 m/s

5. In the projectile motion shown in figure, given $t_{AB} = 2$ sec, then (take, $g = 10\ ms^{-2}$)



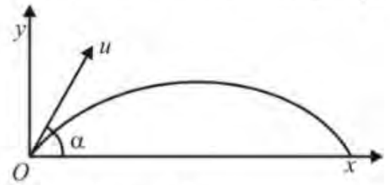
(1) Particle is at point 'B' at 3 sec

(2) Maximum height of projectile is 20 m

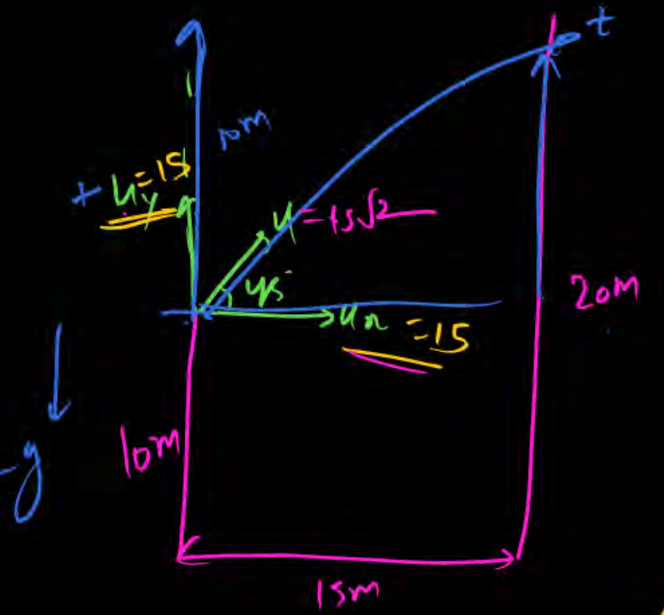
(3) Initial vertical component of velocity is 20 ms^{-1}

(4) Horizontal component of velocity is 20 ms^{-1}

6. The trajectory of projectile is $y = x(1 - x)$, where 'y' and 'x' are in metres. Choose the correct option(s).



(1) Horizontal range is 1m



$u_x = u_y = 15$

$15 = u_x t$ — (1)

$10 = u_y t - \frac{1}{2} g t^2$

$10 = 15 - 5t^2$

$5t^2 = 5$

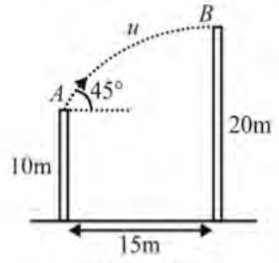
$t = 1$

~~20~~ $~~y_0~~ = u_x \times ~~2~~$

$u_x = 20\ m/s$

$a_x = 0$

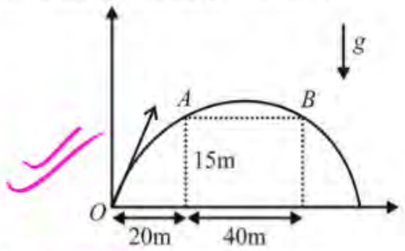
$T_f = 4\ sec\ (t_{up} = 2\ sec) = \frac{u_y}{g}$ $u_y = 20\ m/s$



(1) 20 m/s (2) 40 m/s

(3) $15\sqrt{2}$ m/s (4) 50 m/s

5. In the projectile motion shown in figure, given $t_{AB} = 2$ sec, then (take, $g = 10\ ms^{-2}$)



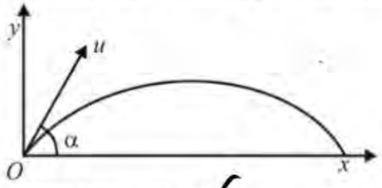
(1) Particle is at point 'B' at 3 sec

(2) Maximum height of projectile is 20 m

(3) Initial vertical component of velocity is 20 ms^{-1}

(4) Horizontal component of velocity is 20 ms^{-1}

6. The trajectory of projectile is $y = x(1 - x)$, where 'y' and 'x' are in metres. Choose the correct option(s).

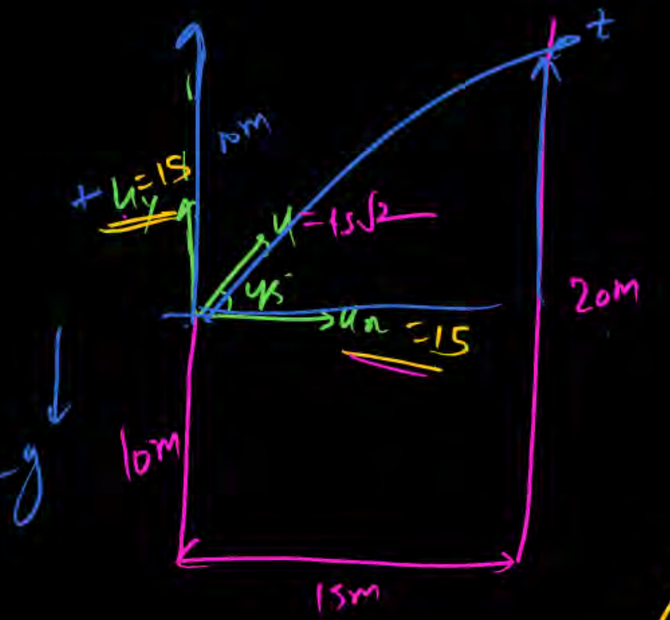


(1) Horizontal range is 1m ✓

(2) The angle of projection is 45° ✓

(3) The horizontal range is 2m

(4) The horizontal range is 30° ✗



$u_x = u_y = 15$

$15 = u_x t$ — (1)

$10 = u_y t - \frac{1}{2} g t^2$

$10 = 15 - 5t^2$

$5t^2 = 5$

$t = 1$

$y = x - x^2$

$R = 1m$

$t_{AB} = 1$

$$y = x(1-x)$$

$$y = x - x^2$$

$\tan\theta = 1$

$y = 0$

$x = x^2$

$x = 1$

$R = 1$

7. A particle is projected from ground at a height of 15 m from ground velocity of a projectile is $v=\left(10\hat{i}+10\hat{j}\right)$. Here, $\hat{j}$ is vertically upwards and $\hat{i}$ is along horizontal direction, then
(Take, $g=10\ \text{ms}^{-2}$)

(1) Particle was projected at an angle of 45° with horizontal.

(2) Time of flight of projectile is 4 sec

(3) Horizontal range of projectile is 100 m

(4) Maximum height of projectile from ground is 20 m.

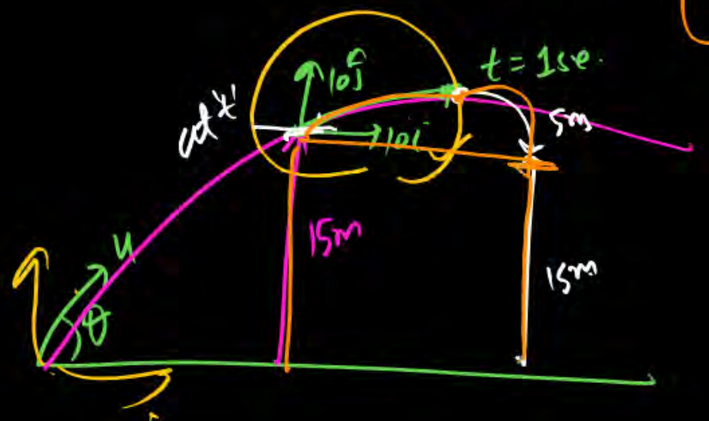
Ans (2) & (4)

$t_{up} = 2\text{sec}$ ✓

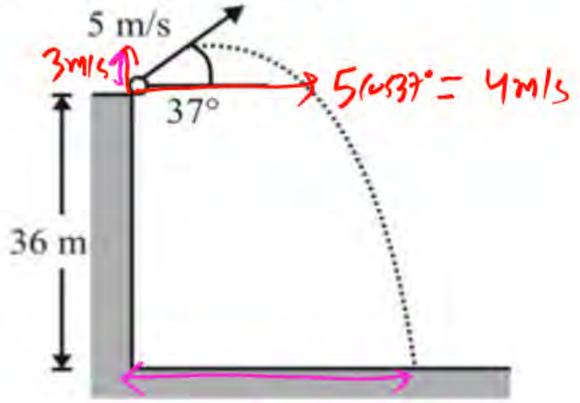
$T_{tot} = 4\text{sec}$

$t_{up} = \frac{u_y}{g}$

$2 \times 10 = u_y$



8. A ball is thrown from the top of 36 m high tower with velocity 5 m/s at an angle 37° above the horizontal as shown. Its horizontal distance on the ground is closest to [$g = 10\ m/s^2$]

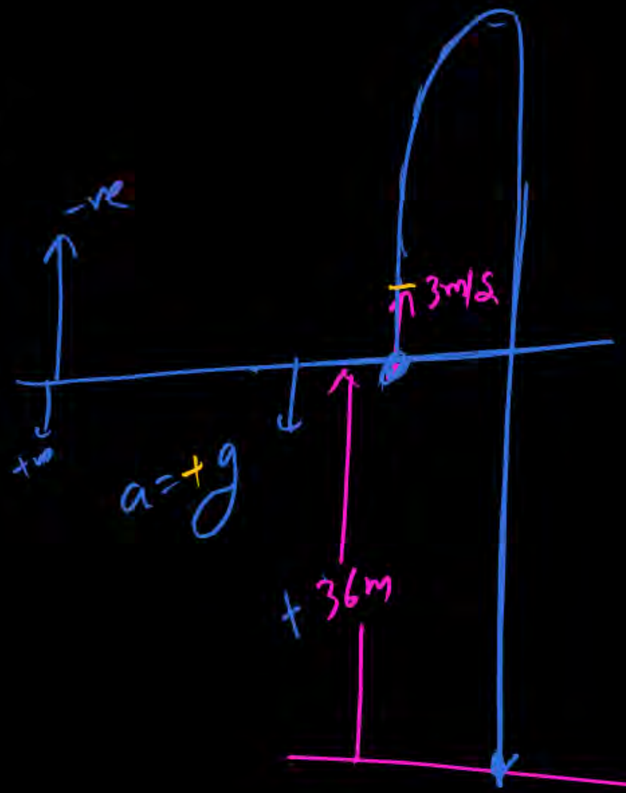


(1) 190 m
(2) 130 m
(3) 150 m
(4) 170 m

MP^r

$t_{up} = \frac{3}{10} = 0.3s$

$(t_{flight}) = 2.5 = 3s$



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

$36 = -3t + \frac{1}{2}(10)t^2$

$5t^2 - 3t - 36 = 0$

$t = \frac{3 \pm \sqrt{9 + 4 \times 5 \times 36}}{2 \times 5}$

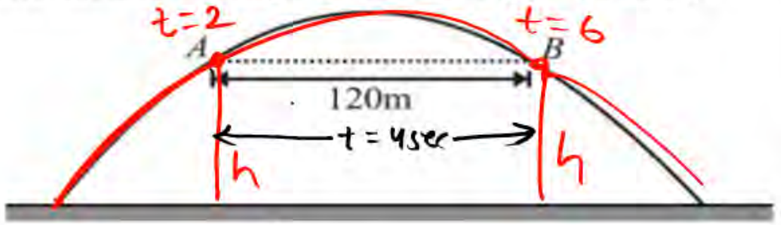
$= \frac{3 \pm \sqrt{729}}{10}$ ✓

$= \frac{3 + 26.83}{10}$

$= \frac{30}{10} = 3s$

36
20
00
72

9. A projectile passes two points A and B at same height after 2s and 6s of its projection. Horizontal separation between the points A and B is 120 m. The horizontal range is closest to [$g = 10\ m/s^2$]



(1) 180 m
(2) 200 m
~~(3)~~ 240 m
(4) 260 m

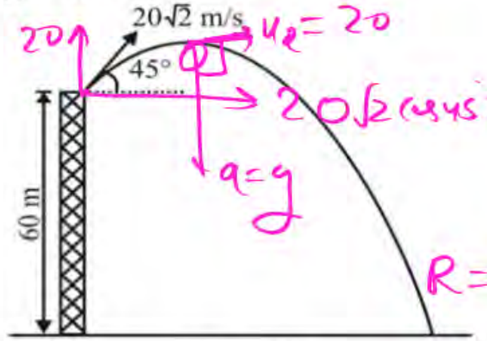
$120 = u_x \times 4$ (30)

$T_f = 8\ sec$

$u_x = 30\ m$

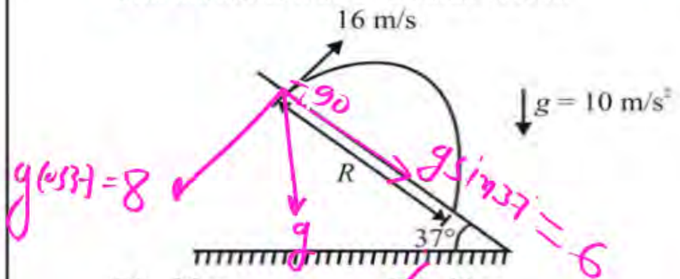
$R = u_x T_f = 30 \times 8 = 240$

10. A ball is thrown from the top of a 60 m high tower with velocity $20\sqrt{2}$ m/s at 45° elevation as shown in figure. Find radius of curvature of path at highest point. ($g = 10$ m/s^2)



(1) 10 m (2) 20 m
(3) 40 m (4) 200 m

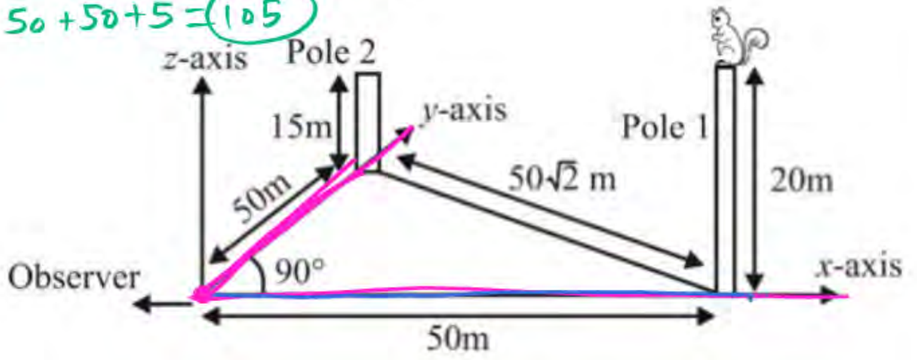
11. A projectile is launched with a velocity of 16 m/s at right angles to the slope which is inclined at 37° with the horizontal. The value of R is:

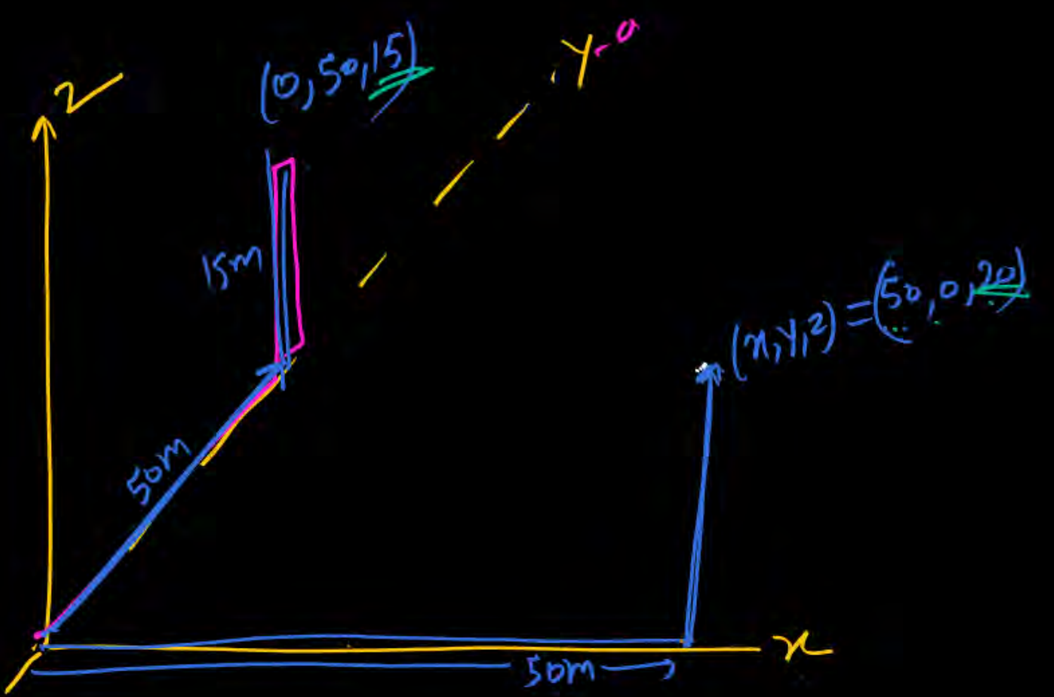


(1) 96 m (2) 48 m
(3) 72 m (4) None of these

12. A small squirrel jumps from pole 1 to pole 2 in horizontal direction. Squirrels is observed by a very small observer at origin. What is average velocity vector of squirrel? If average velocity vector is expressed as $v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$, express your answer as sum of magnitudes of its components $|v_x| + |v_y| + |v_z|$ in unit m/s.

50 + 50 + 5 = 105

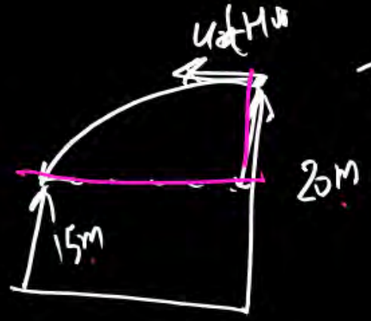




$V_x = \frac{x(\text{Total})}{t}$

$|V_y| = \frac{50}{1} = 50 = \frac{50}{1} = 50$

$V_2 = \frac{5}{1} = 5$



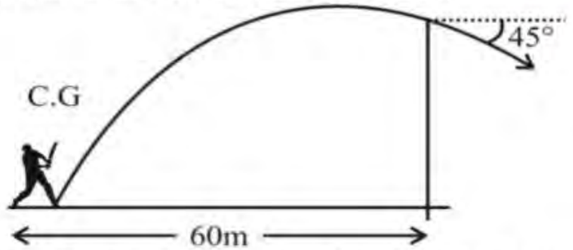
$T = \sqrt{\frac{2H}{g}}$

$T = \sqrt{\frac{2\times5}{10}} = \sqrt{\frac{10}{10}}$

$= 2s$

Paragraph for Questions 13 and 14:

In an IPL "Chris Gayle" of RCB hit a six which lands on the roof of Stadium situated at a distance of 60 m from Gayle. If time of flight of ball is 4 sec and ball hits the stadium roof at an angle of 45° with horizontal in downward direction then:



13. Height of roof of stadium where ball hits from the ground is:

(1) 60 m (2) 40 m

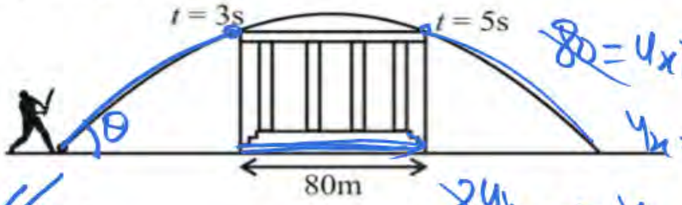
(3) 20 m (4) None

14. Initial speed of the ball when Gayle hit the ball was:

(1) $\sqrt{150}$ m/s (2) $\sqrt{1250}$ m/s

(3) $\sqrt{850}$ m/s (4) $\sqrt{1050}$ m/s

15. The six hit by CHRIS GAYLE in IPL just misses a building of length 80 m as shown in figure. The angle of projection with horizontal is:

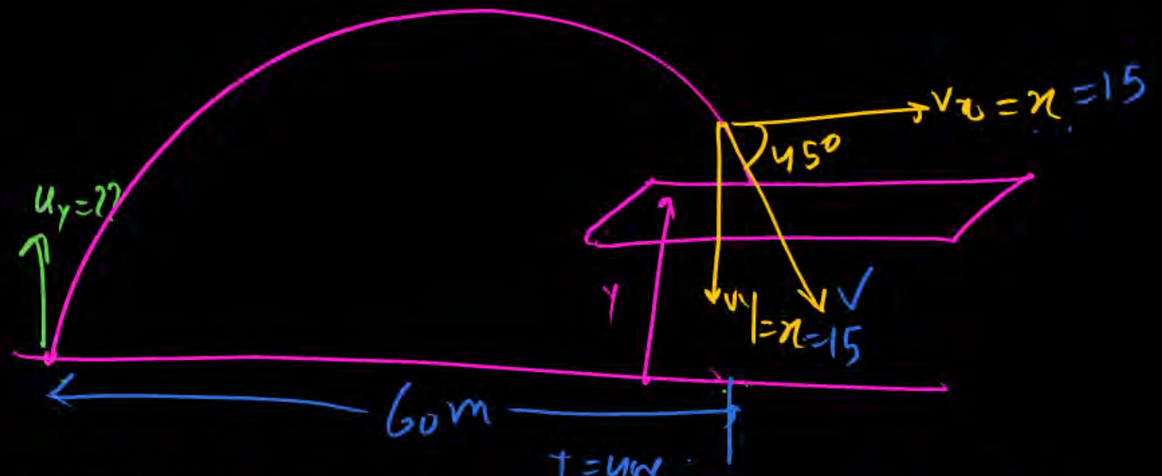


(1) 45° (2) 30°

(3) 60° (4) 15°

17.

18.



Consider Motion in y-dir.

$v_f = u_i + at$

$-15 = u_y - 10 \times 4$

$40 - 15 = u_y$

$u_y = 25 m/s$

$y = u_y t - \frac{1}{2} g t^2$

$= 25 \times 4 - \frac{1}{2} \times 10 \times 4^2$

$= 100 - 5 \times 16$

$= 100 - 80 = 20 m.$

$v_x = \frac{60}{4} = 15 m/s$

$a_x = 0$

16. A particle is projected with velocity u so that its horizontal range is three times the maximum height attained by it. The horizontal range of the projectile is given as $\frac{nu^2}{25g}$, where value of n is: (given 'g' is the acceleration due to gravity) **[JEE Main 2025]**

(1) 6 (2) 18

(3) 12 (4) 24

$R = 3H$ $\quad \frac{H}{R} = \frac{\tan\theta}{4}$

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

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

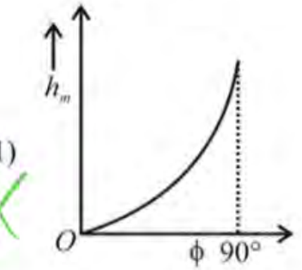
$\theta = 53^\circ$

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

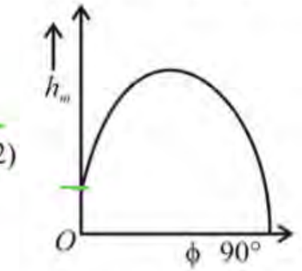
$R = \frac{u^2}{g} 2 \times \frac{4}{5} \times \frac{3}{5} = \frac{24u^2}{25g}$

17. The angles of projection of a particle is measured from the vertical axis as ϕ and the maximum height reached by the particle is h_m. Here h_m as ϕ can be presented as **[JEE Main 2025]**

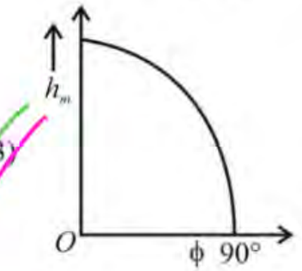
(1)



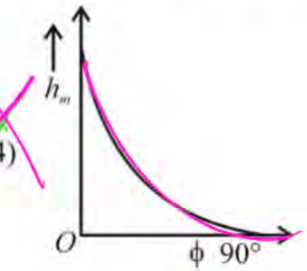
(2)



(3)



(4)



$$h = \frac{u_y^2}{2g} = \frac{u^2\cos^2\phi}{2g}$$

$h \propto \cos^2\phi$

18. Two balls with same mass and initial velocity, are projected at different angles in such a way that maximum height reached by first ball is 8 times higher than that of the second ball. T_1 and T_2 are the total flying times of first and second ball, respectively, then the ratio of T_1 and T_2 is:

[JEE Main 2025]

(1) $2\sqrt{2}:1$

(2) $2:1$

(3) $\sqrt{2}:1$

(4) $4:1$

$$\frac{H_1}{H_2} = \frac{u_{y_1}^2}{u_{y_2}^2} = \frac{8}{1}$$

$$\frac{u_{y_1}}{u_{y_2}} = \sqrt{\frac{8}{1}} = \frac{2\sqrt{2}}{1}$$

$$\frac{T_1}{T_2} = \frac{\frac{2u_{y_1}}{g}}{\frac{2u_{y_2}}{g}} = \frac{u_{y_1}}{u_{y_2}} =$$

19. Projectiles A and B are thrown at angles of 45° and 60° with vertical respectively from top of a 400 m high tower. If their ranges and times of flight are same, the ratio of their speeds of projection v_A:

[JEE Main 2024]

(1) $1 : \sqrt{3}$ (2) $\sqrt{2} : 1$

(3) $1 : 2$ (4) $1 : \sqrt{2}$

20. The maximum height reached by a projectile is 64m. If the initial velocity is halved, the new maximum height of the projectile is ____ m. **[JEE Main 2024]**

21. The angle of projection for a projectile to have same horizontal range and maximum height is:

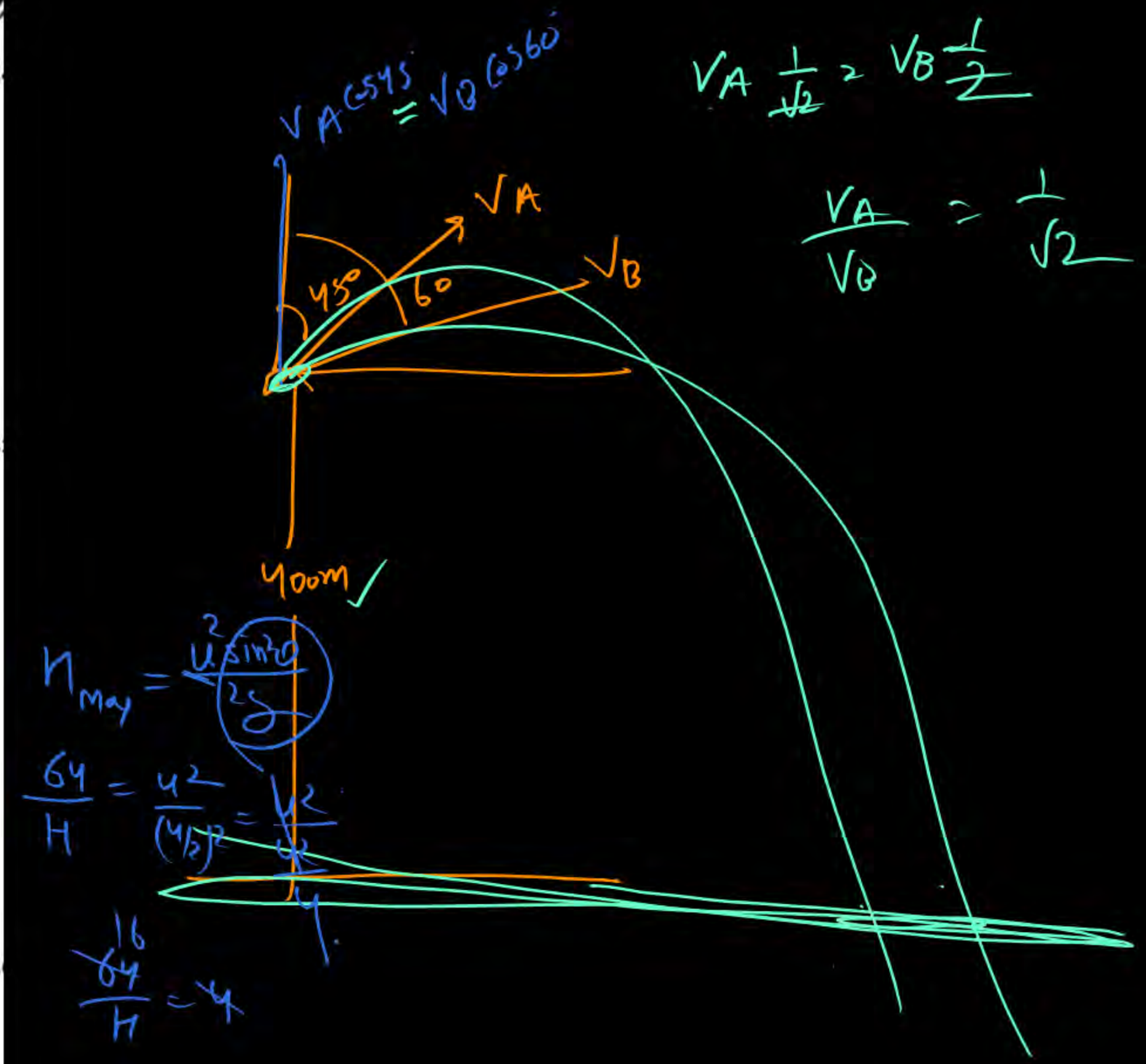
[JEE Main 2024]

(1) $\tan^{-1}(2)$

(2) $\tan^{-1}(4)$

(3) $\tan^{-1}\left(\frac{1}{4}\right)$

(4) $\tan^{-1}\left(\frac{1}{2}\right)$



22. The range of the projectile projected at an angle of 15° with horizontal is 50 m. If the projectile is projected with same velocity at an angle of 45° with horizontal, then its range will be: **[JEE Main 2023]**

(1) 50 m (2) $50\sqrt{2}$ m

(3) 100 m (4) $100\sqrt{2}$ m

23. The initial speed of a projectile fired from ground is u. At the highest point during its motion, the speed of projectile is $\frac{\sqrt{3}}{2}u$. The time of flight of the projectile is:

(1) $\frac{u}{2g}$ (2) $\frac{u}{g}$

(3) $\frac{2u}{g}$ (4) $\frac{\sqrt{3}u}{g}$

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

$50 = \frac{u^2}{g} \sin 30° \quad — (1)$

$R' = \frac{u^2}{g} \sin 90 \quad — (1)$

$\frac{50}{R'} = \frac{1}{2 \times 1}$

$R' = 100m$

$T = \frac{2u \sin\theta}{g}$

$= \frac{2u \sin 30}{g}$

$= \frac{u}{g}$

$u\cos\theta = \frac{\sqrt{3}}{2}u$

$\cos\theta = \frac{\sqrt{3}}{2}$

$\theta = 30$

24. The trajectory of projectile, projected from the ground is given by $y = x - \frac{x^2}{20}$. Where x and y are measured in meter. The maximum height attained by the projectile will be: **[JEE Main 2023]**

(1) 5 m (2) $10\sqrt{2}$ m

(3) 200 m (4) 10 m

25. For a body projected at an angle with the horizontal from the ground choose the correct statement **[JEE Main 2023]**

(1) Gravitational potential energy is maximum at the highest point.

(2) The horizontal component of velocity is zero at highest point.

(3) The vertical component of velocity is zero at highest point.

(4) The kinetic energy (K.E.) is zero at the highest point of projectile motion.

Ans (2) & (3)

26. A projectile is projected at 30° from horizontal with initial velocity 40 ms^{-1}. The velocity of the projectile at $t = 2s$ from the starts will be:

(Given $g = 10\ m/s^2$) **[JEE Main 2023]**

(1) $20\sqrt{3}$ ms^{-1} (2) $40\sqrt{3}$ ms^{-1}

(3) 20 ms^{-1} (4) Zero

$y = x - \frac{x^2}{20}$

$y = 0$

$R = \frac{R^2}{20}$ R

$R = 20$

$H = \frac{R \tan\theta}{4}$

$= \frac{20 \times 1}{4} = 5$

$\tan\theta = 1$

$V_y = 40\sin 30 = 40 \times \frac{1}{2} = 20$

$V_y = 0$

40 m/s, 30°

$40\cos 30 = 40 \times \frac{\sqrt{3}}{2} = 20\sqrt{3}$ — (1)

27. Two objects are projected with the same velocity 'u' however at different angles α and β with the horizontal. If $\alpha + \beta = 90°$, the ratio of horizontal range of the first object to the 2nd object will be:

[JEE Main 2023]

(1) 4 : 1 (2) 2 : 1

(3) 1 : 2 (4) 1 : 1

28. Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:

[JEE Main 2023]

(1) 2 : $\sqrt{3}$ (2) $\sqrt{3}$: 1

(3) 1 : 3 (4) 1 : $\sqrt{3}$

$\frac{H_1}{H_2} = \frac{u^2\sin^2 30}{u^2\sin^2 60} = \left(\frac{\sin 30}{\sin 60}\right)^2 = \left(\frac{1}{\sqrt{3}}\right)^2$

960 − 480 cut-off

340 (Bio)

140 (Phy)

480

40

520

330

140

470

80

550+

29. A projectile fired at 30° to the ground is observed to be at same height at time 3s and 5s after projection, during its flight. The speed of projection of the projectile is _____ ms^{-1} (Given $g = 10\ ms^{-2}$)

[JEE Main 2023]

30. A ball is projected from the ground with a speed 15 ms^{-1} at an angle θ with horizontal so that its range and maximum height are equal. Then 'tan θ' will be equal to:

[JEE Main 2022]

(1) 1/4 (2) 1/2

(3) 2 (4) 4

31. A person can throw a ball upto a maximum range of 100 m. How high above the ground he can throw the same ball?

[JEE Main 2022]

(1) 25 m (2) 50 m

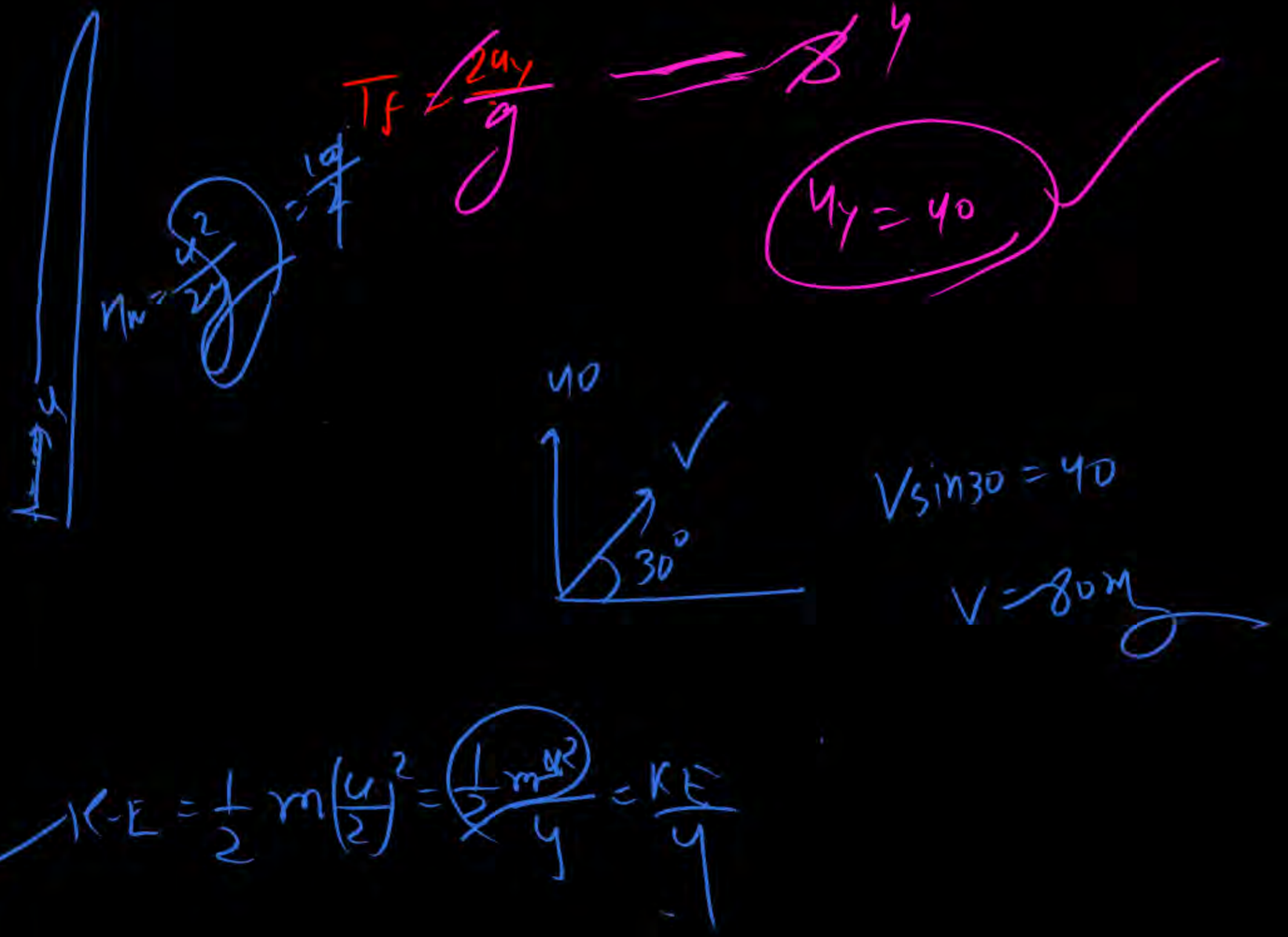
(3) 100 m (4) 200 m

32. A ball is projected with kinetic energy E, at an angle of 60° to the horizontal. The kinetic energy of this ball at the highest point of its flight will become:

[JEE Main 2022]

(1) Zero (2) $E/2$

(3) $E/4$ (4) E



33. Two projectile thrown at 30° and 45° with the horizontal respectively, reach the maximum height in same time. The ratio of their initial velocities is

[JEE Main 2022]

(1) $1 : \sqrt{2}$ (2) $2 : 1$

(3) $\sqrt{2} : 1$ (4) $1 : 2$

34. Two guns A and B can fire bullets at speed 1 km/s and 2 km/s respectively. From a point on a horizontal ground, they are fired in all possible directions. The ratio of maximum areas covered by the bullets fired by the two guns, on the ground is:

[JEE Main 2019]

(1) $1 : 16$ (2) $1 : 2$

(3) $1 : 4$ (4) $1 : 8$

35. Two particles are projected from the same point with the same speed u such that they have the same range R, but different maximum heights, h_1 and h_2. Which of the following is correct? **[JEE Main 2019]**

(1) $R^2 = 2h_1 h_2$ (2) $R^2 = 16h_1 h_2$

(3) $R^2 = 4h_1 h_2$ (4) $R^2 = h_1 h_2$

$v_A \sin 30 = v_A \sin 45$

$\text{Area} = \pi R_{max}^2 \propto u^4$

THANK YOU