

1. A body in one dimensional motion has zero speed at an instant. At that instant, it must have
- (1) Zero velocity
 - (2) Zero acceleration
 - (3) Non zero velocity
 - (4) Non zero acceleration
2. A particle is moving along a circle such that it completes one revolution in 40 seconds.

In 2 minutes 20 seconds, the ratio $\frac{\text{displacement}}{\text{distance}}$ is

- (1) 0
- (2) $\frac{1}{7}$
- (3) $\frac{2}{7}$
- (4) $\frac{1}{11}$

3. Consider the motion of the tip of the second's hand of a clock. In one minute (R be the length of second hand), its

- (1) Displacement is $2\pi R$
- (2) Distance covered is $2R$
- (3) Displacement is zero
- (4) Distance covered is zero

4. At any instant, the velocity and acceleration of a particle moving along a straight line are v and a . The speed of the particle is increasing if

- (1) $v > 0, a > 0$
- (2) $v < 0, a > 0$
- (3) $v > 0, a < 0$
- (4) $v > 0, a = 0$

5. A person travels along a straight road for the first $\frac{t}{3}$ time with a velocity v_1 and for next $\frac{2t}{3}$ time with a velocity v_2 . Then the mean velocity v is given by

$$(1) v = \frac{v_1 + 2v_2}{3} \quad (2) \frac{1}{v} = \frac{1}{3v_1} + \frac{2}{3v_2}$$

$$(3) v = \frac{1}{3} \sqrt{2v_1 v_2} \quad (4) v = \sqrt{\frac{3v_2}{2v_1}}$$

6. A particle moves along x-axis with speed 6 m/s for the first half distance of a journey and the second half distance with a speed 3 m/s. The average speed in the total journey is

- (1) 5 m/s
- (2) 4.5 m/s
- (3) 4 m/s
- (4) 2 m/s

7. A train of 150 m length is going towards North at a speed of 10 m/s. A bird is flying at 5 m/s parallel to the track towards South. The time taken by the bird to cross the train is

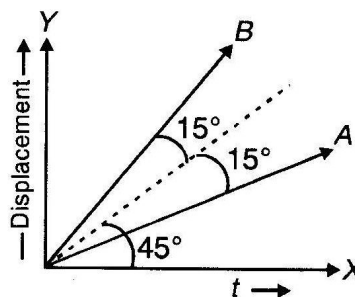
- (1) 10 s
- (2) 15 s
- (3) 30 s
- (4) 12 s

8. If magnitude of average speed and average velocity over a time interval are same, then

- (1) The particle must move with zero acceleration
- (2) The particle must move with non-zero acceleration
- (3) The particle must be at rest
- (4) The particle must move in a straight line without turning back

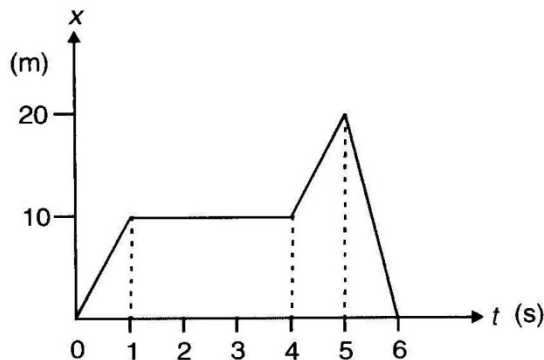
9. The displacement-time graph for two particles A

and B is as follows. The ratio $\frac{v_A}{v_B}$ is



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

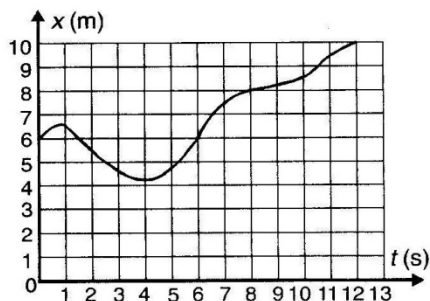
10. Figure shows the graph of x -coordinate of a particle moving along x -axis as a function of time. Average velocity during $t = 0$ to 6 s and instantaneous velocity at $t = 3$ sec respectively, will be



- (1) 10 m/s, 0 (2) 60 m/s, 0
 (3) 0, 0 (4) 0, 10 m/s
11. A boat covers certain distance between two spots in a river taking t_1 hrs going downstream and t_2 hrs going upstream. What time will be taken by boat to cover same distance in still water?

- (1) $\frac{t_1 + t_2}{2}$
 (2) $2(t_2 - t_1)$
 (3) $\frac{2t_1 t_2}{t_1 + t_2}$
 (4) $\sqrt{t_1 t_2}$

12. Position-time graph for a particle is shown in figure. Starting from $t = 0$, at what time t , the average velocity is zero?

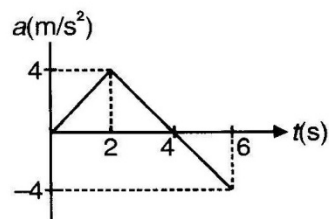


- (1) 1 s (2) 3 s
 (3) 6 s (4) 7 s

13. If the displacement of a particle varies with time as $\sqrt{x} = t + 7$, then

- (1) Velocity of the particle is inversely proportional to t
 (2) Velocity of the particle is proportional to t^2
 (3) Velocity of the particle is proportional to \sqrt{t}
 (4) The particle moves with constant acceleration

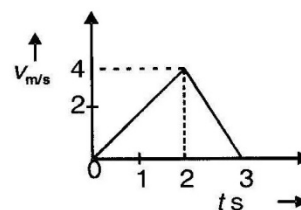
14. For the acceleration-time (a - t) graph shown in figure, the change in velocity of particle from $t = 0$ to $t = 6$ s is



- (1) 10 m/s (2) 4 m/s
 (3) 12 m/s (4) 8 m/s
15. The initial velocity of a particle is u (at $t = 0$) and the acceleration a is given by $\alpha t^{3/2}$. Which of the following relations is valid?

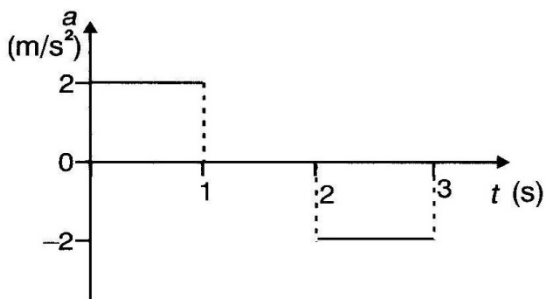
- (1) $v = u + \alpha t^{3/2}$
 (2) $v = u + \frac{3\alpha t^3}{2}$
 (3) $v = u + \frac{2}{5} \alpha t^{5/2}$
 (4) $v = u + \alpha t^{6/2}$

16. The velocity versus time graph of a body moving in a straight line is as shown in the figure below



- (1) The distance covered by the body in 0 to 2s is 8m
 (2) The acceleration of the body in 0 to 2s is 4 ms^{-2}
 (3) The acceleration of the body in 2 to 3s is 4 ms^{-2}
 (4) The distance moved by the body during 0 to 3 s is 6 m

17. Acceleration-time graph for a particle is given in figure. If it starts motion at $t = 0$, distance travelled in 3 s will be



- (1) 4 m (2) 2 m
(3) 0 (4) 6 m
18. A car travelling at a speed of 30 km/h is brought to rest in a distance of 8 m by applying brakes. If the same car is moving at a speed of 60 km/hr then it can be brought to rest with same brakes in
- (1) 64 m (2) 32 m
(3) 16 m (4) 4 m
19. A particle is thrown with any velocity vertically upward, the distance travelled by the particle in last second of its ascent is

- (1) g (2) $\frac{g}{2}$
(3) $\frac{g}{4}$ (4) Cannot be calculated

20. The two ends of a train moving with constant acceleration pass a certain point with velocities u and $3u$. The velocity with which the middle point of the train passes the same point is

- (1) $2u$ (2) $\frac{3}{2}u$
(3) $\sqrt{5}u$ (4) $\sqrt{10}u$

21. A ball is dropped from a bridge of 122.5 metre above a river. After the ball has been falling for two seconds, a second ball is thrown straight down after it. Initial velocity of second ball so that both hit the water at the same time is

- (1) 49 m/s (2) 55.5 m/s
(3) 26.1 m/s (4) 9.8 m/s

22. A particle starts moving with acceleration 2 m/s^2 . Distance travelled by it in 5th half second is

- (1) 1.25 m (2) 2.25 m
(3) 6.25 m (4) 30.25 m

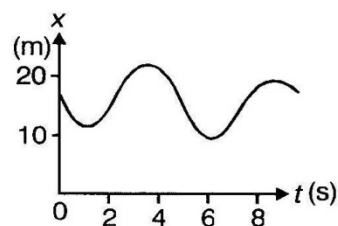
23. A balloon starts rising from ground from rest with an upward acceleration 2 m/s^2 . Just after 1 s, a stone is dropped from it. The time taken by stone to strike the ground is nearly

- (1) 0.3 s (2) 0.7 s
(3) 1 s (4) 1.4 s

24. 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/s^2 . There will be no collision when

- (1) $d < 2.5 \text{ m}$ (2) $d > 125 \text{ m}$
(3) $d > 25 \text{ m}$ (4) $d < 125 \text{ m}$

25. Figure shows the position of a particle moving on the x-axis as a function of time



- (1) The particle has come to rest 4 times
(2) The velocity at $t = 8 \text{ s}$ is negative
(3) The velocity remains positive for $t = 2 \text{ s}$ to $t = 6 \text{ s}$
(4) The particle moves with a constant velocity

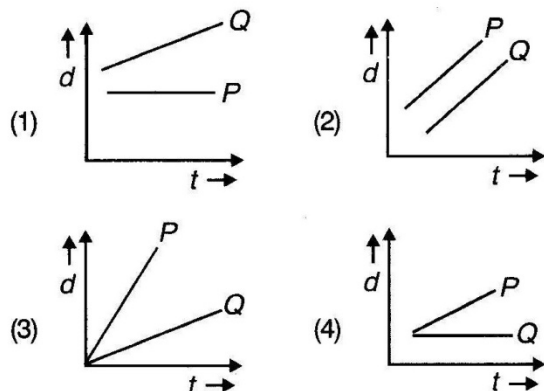
26. Two cars are moving in the same direction with a speed of 30 km/h. They are separated from each other by 5 km. Third car moving in the opposite direction meets the two cars after an interval of 4 minutes. The speed of the third car is

- (1) 30 km/h (2) 25 km/h
(3) 40 km/h (4) 45 km/h

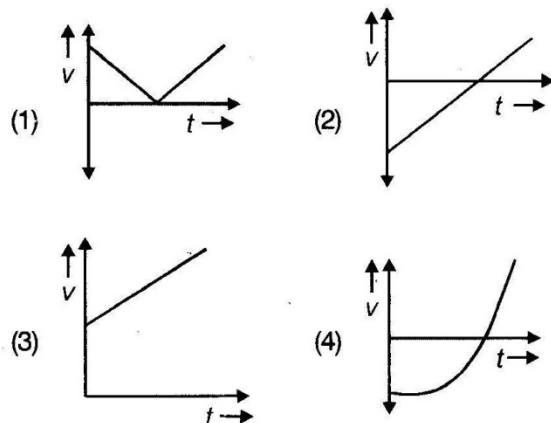
27. A body is thrown vertically upwards and takes 5 seconds to reach maximum height. The distance travelled by the body will be same in

- (1) 1st and 10th second
(2) 2nd and 8th second
(3) 4th and 6th second
(4) Both (2) & (3)

28. Which one of the following time displacement graph represents two moving objects P and Q with zero relative velocity?



29. A particle moves along x -axis in such a way that its x -co-ordinate varies with time according to the equation $x = 8 - 4t + t^2$. The speed of the particle will vary with time as



30. A particle moves along x -axis in such a way that its coordinate x varies with time t according to expression $x = 2 - 5t + 6t^2$. The initial velocity of the particle is

- (1) -5 m/s (2) -3 m/s
 (3) 3 m/s (4) 6 m/s

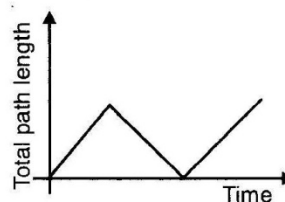
31. The position of a particle moving along x -axis is given by $x = (-2t^3 + 3t^2 + 5)\text{m}$. The acceleration of particle at the instant its velocity becomes zero is

- (1) 12 ms^{-2} (2) -12 ms^{-2}
 (3) -6 ms^{-2} (4) Zero

INSTRUCTIONS FOR Q. NO. 32 TO 36

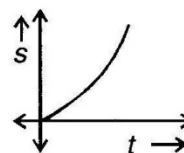
In the following questions (32 to 36), a statement of assertion (A) is followed by a statement of reason (R)

- (1) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark **(1)**.
 (2) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark **(2)**.
 (3) If Assertion is true statement but Reason is false, then mark **(3)**.
 (4) If both Assertion and Reason are false statements, then mark **(4)**.
32. A : In the presence of air friction, if the ball is thrown vertically upwards then time of ascent is less than the time of descent.
 R : Force due to air friction always acts opposite to the motion of the body.
33. A : The following graph can't exist actually.



R : Total path travelled never decreases with time.

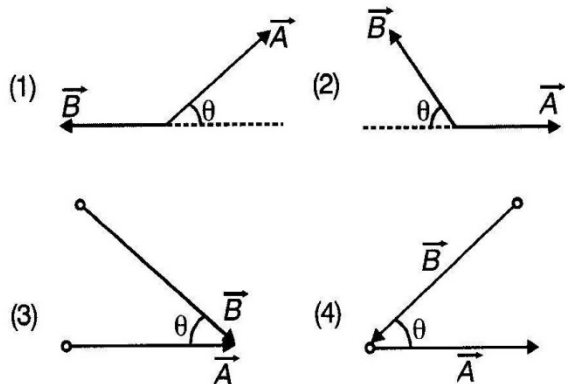
34. A : The displacement time graph shown in the figure represents an accelerated motion.



R : Slope of the graph increases with time.

35. A : Average velocity can be zero, but average speed of a moving body cannot be zero in any finite time interval.
 R : For a moving body displacement can be zero but distance can never be zero.
36. A : At an instant a body can have zero velocity but nonzero acceleration.
 R : At the highest point of the projectile fired vertically upward velocity is zero but acceleration is non-zero.

1. Let θ be the angle between vectors \vec{A} and \vec{B} . Which of the following figures correctly represents the angle θ ?



2. \vec{A} is a vector of magnitude 2.7 units due east. What is the magnitude and direction of vector $4\vec{A}$?

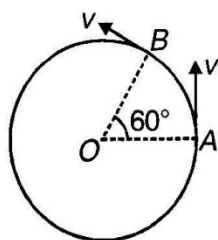
- (1) 4 units due east (2) 4 units due west
(3) 2.7 units due east (4) 10.8 units due east

3. Two forces of magnitude 8 N and 15 N respectively act at a point. If the resultant force is 17 N, the angle between the forces has to be

- (1) 60° (2) 45°
(3) 90° (4) 30°

4. A particle is moving in a circle of radius r having centre at O , with a constant speed v . The magnitude of change in velocity in moving from A to B is

- (1) $2v$
(2) 0
(3) $\sqrt{3}v$
(4) v



5. Two forces of 10 N and 6 N act upon a body. The direction of the forces are unknown. The resultant force on the body may be

- (1) 15 N (2) 3 N
(3) 17 N (4) 2 N

6. The vector \vec{OA} where O is origin is given by $\vec{OA} = 2\hat{i} + 2\hat{j}$. Now it is rotated by 45° anticlockwise about O . What will be the new vector?

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

7. A car moves towards north at a speed of 54 km/h for 1 h. Then it moves eastward with same speed for same duration. The average speed and velocity of car for complete journey is

- (1) 54 km/h, 0 (2) 15 m/s, $\frac{15}{\sqrt{2}}$ m/s
(3) 0, 0 (4) 0, $\frac{54}{\sqrt{2}}$ km/h

8. If the sum of two unit vectors is also a unit vector, then magnitude of their difference and angle between the two given unit vectors is

- (1) $\sqrt{3}, 60^\circ$ (2) $\sqrt{3}, 120^\circ$
(3) $\sqrt{2}, 60^\circ$ (4) $\sqrt{2}, 120^\circ$

9. A vector, \vec{A} points vertically upwards and \vec{B} towards north. The vector product $\vec{A} \times \vec{B}$ is

- (1) Zero (2) Along east
(3) Along west (4) Vertically downward

10. If vectors $\vec{A} = 2\hat{i} + 3\hat{j} + p\hat{k}$ and $\vec{B} = 3\hat{i} - 8\hat{j} + 2\hat{k}$ are perpendicular to each other, then value of p is

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

11. If $\vec{A} = \hat{i} + 2\hat{k}$ and $\vec{B} = \hat{i} + \hat{j} - \hat{k}$ then $\vec{A} \times \vec{B}$ is equal to

- (1) $2\hat{i} - \hat{j} - \hat{k}$ (2) $-2\hat{i} + \hat{j} + \hat{k}$
(3) $-2\hat{i} + 3\hat{j} + \hat{k}$ (4) $-\hat{i} + \hat{j} + \hat{k}$

12. A particle projected from origin moves in x - y plane with a velocity $\vec{v} = 3\hat{i} + 6x\hat{j}$, where \hat{i} and \hat{j} are the unit vectors along x and y axis. Find the equation of path followed by the particle

- (1) $y = x^2$ (2) $y = \frac{1}{x^2}$
 (3) $y = 2x^2$ (4) $y = \frac{1}{x}$

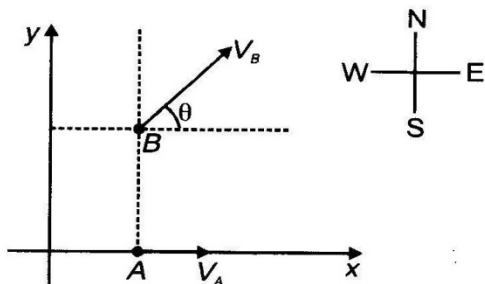
13. Ram moves in east direction at a speed of 6 m/s and Shyam moves 30° east of north at a speed of 6 m/s. The magnitude of their relative velocity is

- (1) 3 m/s (2) 6 m/s
 (3) $6\sqrt{3}$ m/s (4) $6\sqrt{2}$ m/s

14. A train is running at a constant speed of 90 km/h on a straight track. A person standing at the top of a boggy moves in the direction of motion of the train such that he covers 1 meters on the train each second. The speed of the person with respect to ground is

- (1) 25 m/s (2) 91 km/h
 (3) 26 km/h (4) 26 m/s

15. Figure shows two ships moving in x - y plane with velocities V_A and V_B . The ships move such that B always remains north of A. The ratio $\frac{V_A}{V_B}$ is equal to



- (1) $\cos\theta$ (2) $\sin\theta$
 (3) $\sec\theta$ (4) $\operatorname{cosec}\theta$

16. Four persons P, Q, R and S are initially at the four 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

17. A person, reaches a point directly opposite on the other bank of a flowing river, while swimming at a speed of 5 m/s at an angle of 120° with the flow. The speed of the flow must be

- (1) 2.5 m/s (2) 3 m/s
 (3) 4 m/s (4) 1.5 m/s

18. A body of mass 1 kg is projected from ground at an angle 30° with horizontal on a level ground at a speed 50 m/s. The magnitude of change in momentum of the body during its flight is ($g = 10 \text{ m/s}^2$)

- (1) 50 kg ms^{-1} (2) 100 kg ms^{-1}
 (3) 25 kg ms^{-1} (4) Zero

19. A boat which has a speed of 5 km/hr in still water crosses a river of width 1 km along the shortest possible path in 15 minutes. The velocity of the river water (in km/hr) is

- (1) 1 (2) 3
 (3) 4 (4) 40

20. A car with a 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/sec. The angle at which rain drops strike the windshield is

- (1) $\tan^{-1}\frac{5}{9}$ (2) $\tan^{-1}\frac{9}{5}$
 (3) $\tan^{-1}\frac{3}{2}$ (4) $\tan^{-1}\frac{2}{3}$

21. Two projectiles are projected at angles $\left(\frac{\pi}{4} + \theta\right)$ and $\left(\frac{\pi}{4} - \theta\right)$ where $\theta < \frac{\pi}{4}$, with same speed. The ratio of horizontal ranges described by them is

- (1) $\tan\theta : 1$ (2) $1 : \tan^2\theta$
 (3) $1 : 1$ (4) $1 : \sqrt{3}$

22. A shell is fired vertically upwards with a velocity v_1 from a trolley moving horizontally with velocity v_2 . A person on the ground observes the motion of the shell as a parabola, whose horizontal range is

- (1) $\frac{2v_1^2 v_2}{g}$ (2) $\frac{2v_1^2}{g}$
 (3) $\frac{2v_2^2}{g}$ (4) $\frac{2v_1 v_2}{g}$

23. The velocity at the maximum height of a projectile is $\frac{\sqrt{3}}{2}$ times its initial velocity of projection (u). Its range on the horizontal plane is

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

24. A projectile is thrown into space so as to have a maximum possible horizontal range of 400 metres. Taking the point of projection as the origin, the co-ordinates of the point where the velocity of the projectile is minimum are

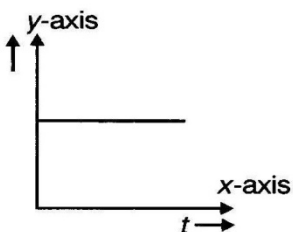
- (1) (400, 100) (2) (200, 100)
 (3) (400, 200) (4) (200, 200)

25. If the time of flight of a bullet over a horizontal range R is T , then the angle of projection with horizontal is

- (1) $\tan^{-1}\left(\frac{gT^2}{2R}\right)$ (2) $\tan^{-1}\left(\frac{2R^2}{gT}\right)$
 (3) $\tan^{-1}\left(\frac{2R}{g^2T}\right)$ (4) $\tan^{-1}\left(\frac{2R}{gT}\right)$

26. In the graph shown in figure, which quantity associated with projectile motion is plotted along y-axis

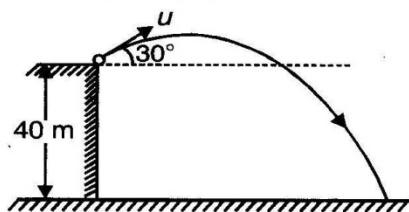
- (1) Kinetic energy
 (2) Momentum
 (3) Horizontal velocity
 (4) None of these



27. The equation of a projectile is $y = ax - bx^2$. Its horizontal range is

- (1) $\frac{a}{b}$ (2) $\frac{b}{a}$
 (3) $a + b$ (4) $b - a$

28. Figure shows a projectile thrown with speed $u = 20$ m/s at an angle 30° with horizontal from the top of a building 40 m high. Then the horizontal range of projectile is



- (1) $20\sqrt{3}$ m (2) $40\sqrt{3}$ m
 (3) 40 m (4) 20 m

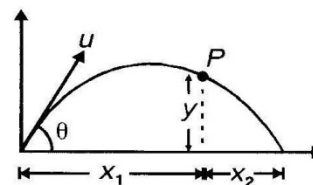
29. When a particle is projected at some angle to the horizontal, it has a range R and time of flight t_1 . If the same particle is projected with the same speed at some other angle to have the same range, its time of flight is t_2 , then

- (1) $t_1 + t_2 = \frac{2R}{g}$ (2) $t_1 - t_2 = \frac{R}{g}$
 (3) $t_1 t_2 = \frac{2R}{g}$ (4) $t_1 t_2 = \frac{R}{g}$

30. A projectile is thrown with velocity v at an angle θ with horizontal. When the projectile is at a height equal to half of the maximum height, the vertical component of the velocity of projectile is

- (1) $v \sin \theta \times 3$ (2) $\frac{v \sin \theta}{3}$
 (3) $\frac{v \sin \theta}{\sqrt{2}}$ (4) $\frac{v \sin \theta}{\sqrt{3}}$

31. In the given figure for a projectile



- (1) $y = \left[\frac{x_1 x_2}{x_1 - x_2} \right] \tan \theta$ (2) $y = \left[\frac{x_1 x_2}{x_1 + x_2} \right] \tan \theta$
 (3) $y = \left[\frac{2x_1 x_2}{x_1 + x_2} \right] \cos \theta$ (4) $y = \left[\frac{2x_1 x_2}{x_1 + x_2} \right] \tan \theta$

32. Two paper screens A and B are separated by distance 100 m. A bullet penetrates A and B , at points P & Q respectively, where Q is 10 cm below P . If bullet is travelling horizontally at the time of hitting A , the velocity of bullet at A is nearly

- (1) 100 m/s (2) 200 m/s
 (3) 600 m/s (4) 700 m/s

33. A car is going round a circle of radius R_1 with constant speed. Another car is going round a circle of radius R_2 with constant speed. If both of them take same time to complete the circles, the ratio of their angular speeds and linear speeds will be

- (1) $\sqrt{\frac{R_1}{R_2}}, \frac{R_1}{R_2}$ (2) 1, 1
 (3) $1, \frac{R_1}{R_2}$ (4) $\frac{R_1}{R_2}, 1$

34. A particle moves in a circle of radius 25 cm at two revolutions per second. The acceleration of the particle is (in m/s^2)

- (1) π^2 (2) $8\pi^2$
 (3) $4\pi^2$ (4) $2\pi^2$

35. A particle is revolving in a circular path of radius 25 m with constant angular speed 12 rev/min. Then the angular acceleration of particle is

- (1) $2\pi^2 \text{ rad/s}^2$ (2) $4\pi^2 \text{ rad/s}^2$
 (3) $\pi^2 \text{ rad/s}^2$ (4) Zero

36. Two particles are moving in circular paths of radii r_1 and r_2 with same angular speeds. Then the ratio of their centripetal acceleration is

- (1) 1 : 1 (2) $r_1 : r_2$
 (3) $r_2 : r_1$ (4) $r_2^2 : r_1^2$

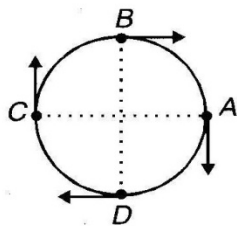
37. A particle P is moving in a circle of radius r with uniform speed v . C is the centre of the circle and AB is diameter. The angular velocity of P about A and C is in the ratio

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

38. A car is moving at a speed of 40 m/s on a circular track of radius 400 m. This speed is increasing at the rate of 3 m/s^2 . The acceleration of car is

- (1) 4 m/s^2 (2) 7 m/s^2
 (3) 5 m/s^2 (4) 3 m/s^2

39. Four particles A , B , C and D are moving with constant speed v each. At the instant shown relative velocity of A with respect to B , C and D are in directions



- (1) (2)
 (3) (4)

40. The ratio of angular speeds of minute hand and hour hand of a watch is

- (1) 6 : 1 (2) 12 : 1
 (3) 60 : 1 (4) 1 : 60

INSTRUCTIONS FOR Q. NO. 41 TO 45

In the following questions (41 to 45), a statement of assertion (A) is followed by a statement of reason (R)

- (1) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark **(1)**.
 (2) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark **(2)**.
 (3) If Assertion is true statement but Reason is false, then mark **(3)**.
 (4) If both Assertion and Reason are false statements, then mark **(4)**.

41. A : Uniform circular motion is accelerated motion still speed remains unchanged.

R : Instantaneous velocity is always normal to instantaneous acceleration in uniform circular motion.

42. A : When a body moves on a curved path with increasing speed, then angle between instantaneous velocity and acceleration is acute angle.

R : When the speed is increasing, its tangential acceleration is in the direction of instantaneous velocity.

43. A : Path of a projectile with respect to another projectile is straight line.

R : Acceleration of a projectile with respect to another projectile is zero.

44. A : In the case of ground to ground projection of a projectile from ground the angle of projection with horizontal is $\theta = 30^\circ$. There is no point on its path such that instantaneous velocity is normal to the initial velocity.

R : Maximum deviation of the projectile is $2\theta = 60^\circ$.

45. A : Three vectors having magnitudes 10, 10 and 25 cannot produce zero resultant.

R : If three vectors are producing zero resultant, then sum of magnitude of any two is more than or equal to magnitude of third and difference is less than or equal to the magnitude of third.