# CHAPTER – MOTION IN PLANE

## Multiple Choice Questions:

**1.** In order to describe motion in two or three dimensions, we use
(a) positive sign (b) vectors (c) negative sign (d) Both (b) and (c)

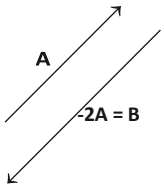
**2.** If length and breadth of a rectangle are 1 m and 0.5 m respectively, then its perimeter will be a
(a) free vector (b) scalar quantity
(c) localised vector (d) Neither (a) nor (b)

**3.** Consider the quantities, pressure, power, energy, impulse, gravitational potential, electrical charge, temperature, area. Out of these, the only vector quantities are
(a) impulse, pressure and area
(b) impulse and area
(c) area and gravitational potential
(d) impulse and pressure

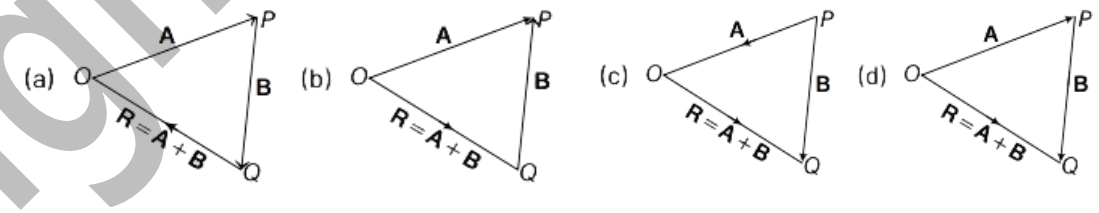
**4.** Suppose an object is at point *P* at time *t* moves to *P'* and then comes back to *P*. Then, displacement is a
(a) unit vector (b) null vector (c) scalar (d) None of these

**5.** The relation between the vectors **A** and $-\lambda\mathbf{A}$ is that,
(a) both have same magnitude (b) both have same direction
(c) they have opposite directions (d) None of the above

**6.** Choose the correct option regarding the given figure.
(a) B = A
(b) B = - A
(c) | B | = | A |
(d) | B | ≠| A |




**7.** *A* and *B* are two inclined vectors. *R* is their sum. Choose the correct figure for the given description.




**8.** Find the correct option about vector subtraction.
(a) A - B= A + B (b) A + B= B- A
(c) A - B= A + (-B) (d) None of these

**9.** A is a vector with magnitude $A$, then the unit vector $\hat{\boldsymbol{a}}$ in the direction of vector A is

(a) $A$A (b) A.A n (c) A × A (d) $\frac{A}{A}$

**10.** Unit vector in the direction of the resultant of vectors $\mathbf{A} = -3\hat{\imath} - 2\hat{\jmath} - 3\hat{k}$ and $\mathbf{B} = 2\hat{\imath} + 4\hat{\jmath} + 6\hat{k}$ is

(a) $\frac{-3\hat{\imath}+2\hat{\jmath}-3\hat{k}}{\sqrt{14}}$ (b) $-\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$

(c) $\frac{-\hat{\imath}+2\hat{\jmath}-3\hat{k}}{\sqrt{14}}$ (d) $-2\hat{\imath} - 4\hat{\jmath} + 8\hat{k}$

**11.** If $\mathbf{A} = \mathbf{B} + \mathbf{C}$ have scalar magnitudes of 5, 4, 3 units respectively, then the angle between A and C is

(a) $\cos^{-1}(3/5)$ (b) $\cos^{-1}(4/5)$ (c) $\pi/2$ (d) $\sin^{-1}(4/5)$

**12.** For two vectors A and B, $|\mathbf{A} + \mathbf{B}| = |\mathbf{A} - \mathbf{B}|$ is always true, when

(a) $|A| = |B| \neq 0$

(b) $|A| = |B| \neq 0$ and A and B are parallel or anti-parallel

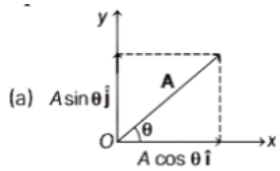
(c) either |A | or | B| is zero

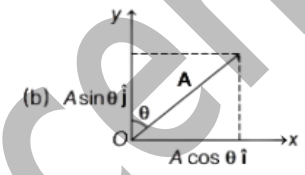
(d) None of the above

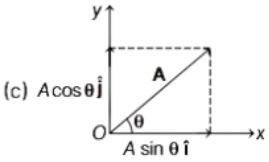
**13.** Two equal vectors have a resultant equal to either of the two. The angle between them is

(a) 90° (b) 60° (c) 120° (d) 0°

**14.** Consider a vector **A** that lies in $xy$- plane. If $A_x$ and $A_y$ are the magnitudes of its $x$ and $y$-components respectively, then the correct representation of **A** can be given by




(d) None of the above

**15.** The component of a vector **r** along $X$-axis will have maximum value if

(a) r is along positive $Y$-axis (b) r is along positive $X$-axis

(c) r makes an angle of 45° with the $X$-axis (d) r is along negative $Y$-axis

**16.** Magnitude of a vector Q is 5 and magnitude of its $y$-component is 4. So, the magnitude of the $x$-component of this vector is

(a) 8 (b) 3 (c) 6 (d) 9

**17.** Three vectors are given as $\mathbf{P} = 3\hat{\imath} - 4\hat{\jmath}$ $\mathbf{Q} = 6\hat{\imath} - 8\hat{\jmath}$ and $\mathbf{R} = (3/4)\hat{\imath} - \hat{\jmath}$, then which of the following is correct?

(a) $P$, $Q$ and $R$ are equal vectors (b) $P$ and $Q$ are parallel but $R$ is not parallel

(c) $P$, $Q$ and $R$ are parallel (d) None of the above

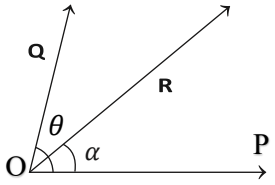
**18.** A vector is inclined at an angle 60° to the horizontal. If its rectangular component in the horizontal direction is 50 N, then its magnitude in the vertical direction is

(a) 25 N (b) 75 N (c) 87 N (d) 100 N

**19.** The angle q between the vector $\mathbf{p} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and unit vector along $X$-axis is

(a) $cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (c) $cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (d) $cos^{-1}\left(\frac{1}{2}\right)$

**20.** Two vectors P and Q are inclined at an angle q and R is their resultant as shown in the figure.




Keeping the magnitude and the angle of the vectors same, if the direction of P and Q is interchanged, then there is a change in which of the following with regard to R?

(a) Magnitude (b) Direction
(c) Both magnitude and direction (d) None of the above

21. It is found that $|A + B|$ A $= |A|$ . This necessarily implies

(a) | B | $=0$ (b) A B, are parallel
(c) A B, are perpendicular (d) A : B $\leq 0$

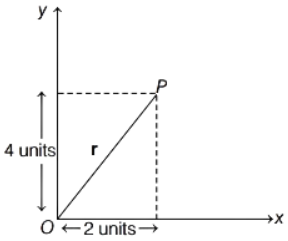
22. The sides of a parallelogram are represented by vectors p $= 5\,\hat{\imath}$ - $4\,\hat{\jmath} + 3\,\hat{k}$ and q $= 3\hat{\imath} + 2\hat{\jmath} - \hat{k}$ Then, the area of the parallelogram is

(a) $\sqrt{684}$ sq. units (b) $\sqrt{72}$ sq. units
(c) $\sqrt{171}$ sq. units (d) $\sqrt{72}$ sq. units

23. If a. b $= |a \times b|$, then the angle $\theta$ between a and b will be

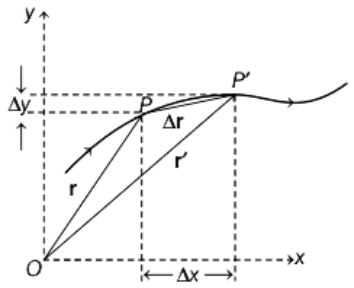
(a) 60° (b) 45° (c) 75° (d) 90°

24. Position vector r of a particle P located in a plane with reference to the origin of an xy-plane as shown in the figure below is given by




(a) $2\hat{\imath} + 4\hat{\jmath}$
(b) $4\hat{\imath} + 2\hat{\jmath}$
(c) $6\,\hat{k}$
(d) $\hat{\imath} + \hat{\jmath} + 4\hat{k}$

25. Suppose a particle moves along a curve shown by the thick line and the positions of particle are represented by P at $t$ and P′ at $t'$. where, coordinates of P is (4, 3) and P′ (7, 6). Net displacement of the particle will be



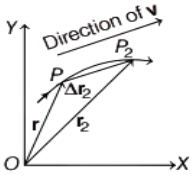

(a) zero
(b) $7\hat{\imath} + 9\hat{\jmath}$
(c) $10\hat{\imath} + 18\hat{\jmath}$
(d) $3\hat{\imath} + 3\hat{\jmath}$

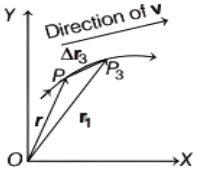
26. A particle moves in xy-plane from positions (2 m, 4m) to (6 m, 8 m) is 2 s. Magnitude and direction of average velocity is

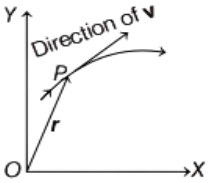
(a) $\sqrt{2}$ $ms^{-1}$ and 45° (b) $2\sqrt{2}$ $ms^{-1}$ and 45°

(c) $4\sqrt{2}$ $ms^{-1}$ and 30° (d) $3\sqrt{2}$ $ms^{-1}$ and 60°

27. The direction of instantaneous velocity is shown by

(a) 


(b) 


(c) 


(d) None of these

28. The position of a particle is given by $r = \hat{\imath} + 2t^2\hat{\jmath} + 5\hat{k}$, then the direction of v (t) at $t = 1s$ in

(a) 45° with X-axis (b) 63° with Y-axis

(c) 30° with Y-axis (d) 53° with X-axis

29. In three-dimensional system, the position coordinates of a particle (in motion) are given below $x = a\cos\omega t \quad y = a\sin\omega t$ The velocity of particle will be

(a) $\sqrt{2}\,a\omega$ (b) $2\,a\omega$ (c) $a\omega$ (d) $\sqrt{3}\,a\omega$

30. The coordinates of a moving particle at any time t are given by, $x = 2t^2$ and $y = 3t^3$. Acceleration of the particle is given by

(a) 468 t (b) $t\sqrt{468}$ (c) $234\ t^2$ (d) $t\sqrt{234}$

31. A particle starts from origin at $t = 0$ with a velocity $5.0\hat{\imath}\ ms^{-1}$ and moves in xy-plane under action of force which produces a constant acceleration of $(3.0\ \hat{\imath} + 2.0\ \hat{\jmath})ms^2$. What is the y-coordinate of the particle at the instant, if x-coordinate is 84 m?

(a) 36 m (b) 24 m (c) 39 m (d) 18 m

32. A car driver is moving towards a fired rocket with a velocity of $8\hat{\imath}\,ms^{-1}$. He observed the rocket to be moving with a speed of 10 $ms^{-1}$. A stationary observer will see the rocket to be moving with a speed of

(a) 5 $ms^{-1}$ (b) 6 $ms^{-1}$ (c) 7 $ms^{-1}$ (d) 8 $ms^{-1}$

33. A man standing on a road has to hold his umbrella at 30° with the vertical to keep the rain away. He throws the umbrella and starts running at 10 $kmh^{-1}$. He finds that raindrops are hitting his head vertically. The actual speed of raindrops is

(a) 20 $kmh^{-1}$ (b) $10\sqrt{3}$ $kmh^{-1}$ (c) $20\sqrt{3}$ $kmh^{-1}$ (d) 10 $kmh^{-1}$

34. A girl can swim with speed 5 $kmh^{-1}$ in still water. She crosses a river 2 km wide, where the river flows steadily at 2 $kmh^{-1}$ and she makes strokes normal to the river current. Find how far down the river she go when she reaches the other bank.

(a) 1 km (b) 2 km (c) 800 m (d) 750 m

35. When a ball is thrown obliquely from the ground level, then the x-component of the velocity

(a) decreases with time (b) increases with time

(c) remains constant (d) zero

36. The motion of an object that is in flight after being projected is a result of two simultaneously occurring components of motion, which are the components in
(a) horizontal direction with constant acceleration
(b) vertical direction with constant acceleration
(c) horizontal direction without acceleration
(d) Both (b) and (c)

37. At the top of the trajectory of a projectile, the directions of its velocity and acceleration are
(a) parallel to each other (b) antiparallel to each other
(c) inclined to each other at an angle of45° (d) perpendicular to each other

38. A projectile is given an initial velocity of $(\hat{\imath} + 2\hat{\jmath})$ $ms^{-1}$, where $\hat{\imath}$ is along the ground and $\hat{\jmath}$ is along vertical. If g is 10 $ms^{-2}$, then the equation of its trajectory is
(a) $y = x - 5x^2$ (b) $y = 2x - 5x^{-2}$ (c) $4y = 2x - 5x^2$ (d) $4y = 2x - 25x^2$

39. The equations of motion of a projectile are given by $x = 18t$ and $2y = 54t - 9.8t^2$. The angle q of projection is
(a) $\tan^{-1}(\frac{2}{3})$ (b) $\tan^{-1}(1.5)$ (c) $\sin^{-1}(\frac{2}{3})$ (d) $\cos^{-1}(\frac{2}{3})$

40. A football player throws a ball with a velocity of 50 $ms^{-1}$ at an angle 30° from the horizontal. The ball remains in the air for (Take, g = 10 $ms^{-2}$ )
(a) 2.5 s (b) 1.25 s (c) 5 s (d) 0.625 s

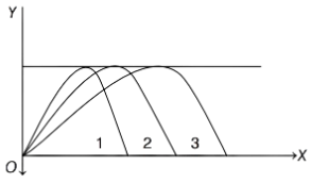
41. The ceiling of a hall is 30 m high. A ball is thrown with 60 $ms^{-1}$ at an angle $\theta$, so that it could reach the ceiling of the hall and come back to the ground. The angle of projection $\theta$ that the ball was projected is given by
(a) $\sin\theta = \frac{1}{\sqrt{8}}$ (b) $\sin\theta = \frac{1}{\sqrt{6}}$ (c) $\sin\theta = \frac{1}{\sqrt{3}}$ (d) None of these

42. Two projectiles A and B are projected with same speed at angles 30° and 60° to be horizontal then, which amongst the following relation between their range, maximum height and time of flight is wrong?
(a) $R_A = R_B$ (b) $H_B = 3\,H_A$ (c) $T_B = \sqrt{3}\,T_A$ (d) None of these

43. A man can throw a stone to a maximum distance of 80 m. The maximum height to which it will rise, is
(a) 30 m (b) 20 m (c) 10 m (d) 40 m

44. Two stones were projected simultaneously in the same vertical plane from same point obliquely, with different speeds and angles with the horizontal. The trajectory of path followed by one, as seen by the other, is
(a) parabola (b) straight line (c) circle (d) hyperbola

45. Given below figure show three paths of a rock with different initial velocities. The correct increasing order for the respective initial horizontal velocity component (ignoring the effect of air resistance) is




(a) 1< 2 < 3
(b) 3 < 2 < 1
(c) 2 < 1 < 3
(d) 3 < 1 < 2

46. What is the centripetal acceleration of a point mass which is moving on a circular path of radius 5m with speed 25 ms $^{-1}$?
(a) 125 ms$^{-2}$ (b) 90 ms$^{-2}$ (c) 60 ms $^{-2}$ (d) None of these

47. The displacement of a particle moving on a circular path, when it makes 60° at the centre is
(a) 2 r (b) r (c) $\sqrt{2}$r (d) None of these

48. If a car is executing a uniform circular motion, then its centripetal acceleration represents
(a) a scalar quantity (b) constant vector
(c) not a constant vector (d) None of these

49. A car revolves uniformly in a circle of diameter 0.80 m and completes 100 rev min -1. Its angular velocity is
(a) 10.467 rads $^{-1}$ (b) 0.6 rads $^{-1}$ (c) 46.26 rads $^{-1}$ (d) 8 rads $^{-1}$

50. If 2 balls are projected at angles 45° and 60° and the maximum heights reached are same, then the ratio of their initial velocities is …… .
(a) $\sqrt{2} : \sqrt{3}$ (b) $\sqrt{3} : \sqrt{2}$ (c) 3 : 2 (d) 2 : 3

51. Two projectiles having different masses $m_1$ and $m_2$ are projected at an angle a and (90° - $\alpha$) with the same speed from some point. The ratio of their maximum heights is …… .
(a) cot $\alpha$: sin $\alpha$ (b) 1: 1 (c) tan $^2$ $\alpha$ : 1 (d) 1: tan $\alpha$

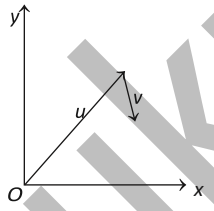
52. A projectile fired with initial velocity u at some angle $\theta$ has a range R. If the initial velocity be doubled at the same angle of projection, then the range will be …… .
(a) 2R (b) R/2 (c) R (d) 4R

53. Two cars of masses $m_1$ and $m_2$ are moving in circles of radii $r_1$ and $r_2$, respectively. Their speeds are such that they make complete circles in the same time t. The ratio of their centripetal accelerations is …… .
(a) $m_1r_1 : m_2 r_2$ (b) $m_1 : m_2$ (c) $r_1 : r_2$ (d) 1: 1.

54. Which one of the following statements is correct?
(a) A scalar quantity is the one that is conserved in a process.
(b) A scalar quantity is the one that can never take negative values.
(c) A scalar quantity is the one that does not vary from one point to another in space.
(d) A scalar quantity has the same value for observers with different orientation of the axes.

55. For two vectors A and B which lie in a plane. Which of the following statement is correct?
(a) If magnitude of A and B vector is 3 and 4 and they add upto give vector having magnitude of 5, then they must be perpendicular vector.
(b) If they add up to give more than 5, then they must be inclined at obtuse angle.
(c) If they add upto give less than 5, then they must be inclined at acute angle.
(d) None of the above

56. Figure shows the orientation of two vectors u and v in the xy-plane. If $u = a\hat{\imath} + b\hat{\jmath}$ and $v = p\hat{\imath} + q\hat{\jmath}$
Which of the following statement is correct?
(a) a and p are positive, while b and q are negative.
(b) a, p and b are positive, while q is negative.
(c) a, q and b are positive, while p is negative.
(d) a, b, p and q are all positive.




57. Match the Column I (example of motion) with Column II (type of motion) and select the correct answer from the codes given below.

| | Column I | | Column II |
|---|---|---|---|
| A. | Free fall | p. | One-dimensional motion |
| B. | Projectile motion | q. | Two-dimensional motion |
| C. | Circular motion | r. | Three-dimensional motion |
| D. | Motion along a straight road | | |

**Codes**

| | A | B | C | D |
|---|---|---|---|---|
| (a) | q | p | r | p |
| (b) | p | q | r | q |
| (c) | p | q | q | p |
| (d) | p | r | q | p |

58. Match the Column I (magnitude of vectors A and B) with Column II (relationship between A and B) and select the correct answer from the codes given below.

| | Column I | | Column II |
|---|---|---|---|
| A. | $\xrightarrow{\lvert\mathbf{A}\rvert = l}$ $\xrightarrow{\lvert\mathbf{B}\rvert = 2l}$ | p. | $\mathbf{A} = -\mathbf{B}$ |
| B. | $\xrightarrow{\lvert\mathbf{A}\rvert = l}$ $\xleftarrow{\lvert\mathbf{B}\rvert = l}$ | q. | $\mathbf{A} = \mathbf{B}$ |
| C. | $\xrightarrow{\lvert\mathbf{A}\rvert = 2l}$ $\xleftarrow{\mathbf{B} = l}$ | r. | $2\mathbf{A} = \mathbf{B}$ |
| D. | $\xrightarrow{\lvert\mathbf{A}\rvert = l}$ $\xrightarrow{\lvert\mathbf{B}\rvert = l}$ | s. | $\mathbf{A} = -2\,\mathbf{B}$ |

Codes

| | A | B | C | D |
|---|---|---|---|---|
| (a) | q | s | p | q |
| (b) | r | p | s | q |
| (c) | r | p | q | s |
| (d) | q | r | s | p |

59. A vector is given by $A = 4\hat{\imath} + 3\hat{\jmath} + 5\hat{k}$, where $\alpha, \beta$ *and* $\gamma$ are the angles made by A with coordinate axes. Then, match the Column I with Column II (respective values) and select the correct option from the codes given below.

| | Column I | | Column II |
|---|---|---|---|
| A. | $\alpha$ | p. | $\cos^{-1}(1/\sqrt{2})$ |
| B. | $\beta$ | q. | $\cos^{-1}(4/5\sqrt{2})$ |
| C. | $\gamma$ | r. | $\cos^{-1}(3/5\sqrt{2})$ |

Codes

| | A | B | C | | A | B | C |
|---|---|---|---|---|---|---|---|
| (a) | p | q | r | (b) | q | r | p |
| (c) | r | q | p | (d) | p | p | q |

**Assertion-Reasoning MCQs For question numbers 60 to 69,**

Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

60. Assertion Magnitude of resultant of two vectors may be less than the magnitude of either vector.

Reason Vector addition is commutative.

61. Assertion Vector addition of two vectors is always greater than their vector subtraction.

Reason At $\theta = 90º$, addition and subtraction of vectors are unequal.

62. Assertion In case of projectile motion, the magnitude of rate of change of velocity is variable.

Reason In projectile motion, magnitude of velocity first increases and then decreases during the motion.

63. Assertion At highest point of a projectile, dot product of velocity and acceleration is zero.

Reason At highest point, velocity and acceleration are mutually perpendicular.

64. Assertion A particle is projected with speed $\vartheta$ at an angle $\theta$ with the horizontal. At any time during motion, speed of particle is v at angle $\alpha$ with the vertical, then v sin $\alpha$ is always constant throughout the motion.

Reason In case of projectile motion, magnitude of radial acceleration at topmost point is minimum.

65. Assertion For projection angle $\tan^{-1}(4)$, the horizontal and maximum height of a projectile are equal.

Reason The maximum range of projectile is directly proportional to square of velocity and inversely proportional to acceleration due to gravity.

66. Assertion The range of a projectile is maximum at 45°.

Reason At = 45°, the value of sin $\theta$ is maximum.

67. Assertion Sum of maximum height for angles a and 90°- $\alpha$ is independent of the angle of projection.

Reason For angles a and 90°- $\alpha$, the horizontal range R is different.

68. Assertion The maximum height of projectile is always 25% of the maximum range.

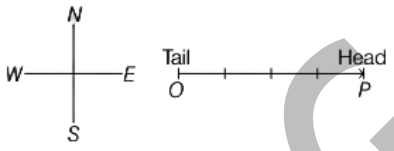
Reason For maximum range, projectile should be projected at 90°.

69. Assertion Uniform circular motion is uniformly accelerated motion.
Reason Kinematic equations for uniform acceleration motion can be applied in the case of uniform circular motion.

## Case Based MCQs.

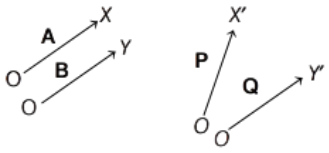
**Vectors**

Vectors are the physical quantities which have both magnitudes and directions and obey the triangle/parallelogram laws of addition and subtraction. It is specified by giving its magnitude by a number and its direction. e.g. Displacement, acceleration, velocity, momentum, force, etc. A vector is represented by a bold face type and also by an arrow placed over a letter, i.e. F, a, b, or $\vec{F}$ $\vec{a}$ $\vec{b}$,.
The length of the line gives the magnitude and the arrowhead gives the direction.
The point P is called head or terminal point and point O is called tail or initial point of the vector OP.




70. Amongst the following quantities, which is not a vector quantity?
(a) Force (b) Acceleration (c) Temperature (d) Velocity

71. Set of vectors A and B, P and Q are as shown below
(a) A and P
(b) P and Q
(c) A and B
(d) B and Q




72. $|\lambda A| = \lambda |A|$, if
(a) $\lambda > 0$ (b) $\lambda < 0$ (c) $\lambda = 0$ (d) $\lambda \neq 0$

73. Among the following properties regarding null vector which is incorrect?
(a) $A + 0 = A$ (b) $\lambda\, 0 = \lambda$ (c) $0A = 0$ (d) $A - A = 0$

74. The x and y components of a position vector P have numerical values 5 and 6, respectively. Direction and magnitude of vector P are
(a) $\tan^{-1}(\frac{6}{5})$ and $\sqrt{61}$ (b) $\tan^{-1}(\frac{5}{6})$ and $\sqrt{61}$
(c) 60° and 8 (d) 30° and 9

**Relative Velocity** Every motion is relative as it has to be observed with respect to an observer. Relative velocity is a measurement of velocity of an object with respect to another observer. It is defined as the time rate of change of relative position of one object with respect to another.

For example, if rain is falling vertically with a velocity $v_r$ and a man is moving horizontally with $v_m$, the man can protect himself from the rain if he holds his umbrella in the direction of relative velocity of rain w.r.t. man.

75. Two bodies are held separated by 98. m vertically one above the other. They are released simultaneously to fall freely under gravity. After 2 s, the relative distance between them is
(a) 4 9. M (b) 19 6. M (c) 9 8. m (d) 39 2. m

76. If two objects P and Q move along parallel straight lines in opposite direction with velocities $v_P$ and $v_Q$ respectively, then relative velocity of P w.r.t. Q,
(a) $V_{PQ} = V_P = Q$ (b) VP - $V_Q$ (c) $V_{P+}V_0$ (d) $V_Q$ - $V_P$

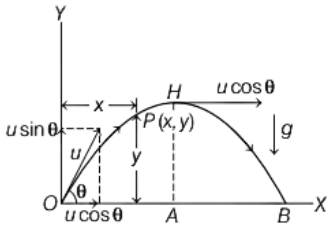
77. A train is moving towards East and a car is along North, both with same speed. The observed direction of car to the passenger in the train is
(a) East-North direction (b) West-North direction
(c) South-East direction (d) None of the above

78. Buses A and B are moving in the same direction with velocities 20 $\hat{\imath}$ $ms^{-1}$ and 15 $^{-1}$ ms $^{-1}$, respectively. Then, relative velocity of A w.r.t. B is
(a) 35 $\hat{\imath}$ $ms^{-1}$ (b) 5 $\hat{\imath}$ $ms^{-1}$ (c) 5 $\hat{\imath}$ $ms^{-1}$ (d) 35 $\hat{\jmath}$ $ms^{-1}$

79. A girl riding a bicycle with a speed of 5 ms $^{-1}$ towards east direction sees raindrops falling vertically downwards. On increasing the speed to 15 ms $^{-1}$, rain appears to fall making an angle of 45° of the vertical. Find the magnitude of velocity of rain.
(a) 5$ms^{-1}$ (b) 5 $\sqrt{5}$ $ms^{-1}$ (c) 25$ms^{-1}$ (d) 10$ms^{-1}$

## Projectile Motion

Projectile motion is a form of motion in which an object or particle is thrown with some initial velocity near the earth's surface and it moves along a curved path under the action of gravity alone. The path followed by a projectile is called its trajectory, which is shown below. When a projectile is projected obliquely, then its trajectory is as shown in the figure below




Here velocity $\vartheta$ is resolved into two components, we get
(a) u cos $\theta$ along OX and
(b) u sin $\theta$ along OY.

80. The example of such type of motion is
(a) motion of car on a banked road (b) motion of boat in sea
(c) a javelin thrown by an athlete (d) motion of ball thrown vertically upward

81. The acceleration of the object in horizontal direction is
(a) constant (b) decreasing (c) increasing (d) zero

82. The vertical component of velocity at point H is
(a) maximum (b) zero
(c) double to that at O (d) equal to horizontal component

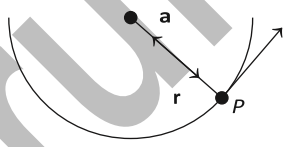
83. A cricket ball is thrown at a speed of 28 m/s in a direction 30° with the horizontal. The time taken by the ball to return to the same level will be

(a) 2.0 s (b) 3.0 s (c) 4.0 s (d) 2.9 s

84. In above case, the distance from the thrower to the point where the ball returns to the same level will be
(a) 39 m (b) 69 m (c) 68 m (d) 72 m

**Uniform Circular Motion**

When an object follows a circular path at a constant speed, the motion of the object is called uniform circular motion. The word uniform refers to the speed which is uniform (constant) throughout the motion. Although the speed does not vary, the particle is accelerating because the velocity changes its direction at every point on the circular track. The figure shows a particle P which moves along a circular track of radius r with a uniform speed u.




85. A circular motion
(a) is one-dimensional motion
(b) is two-dimensional motion
(c) it is represented by combination of two variable vectors
(d) Both (b) and (c)

86. For a particle performing uniform circular motion, choose the incorrect statement from the following.
(a) Magnitude of particle velocity (speed) remains constant.
(b) Particle velocity remains directed perpendicular to radius vector.
(c) Direction of acceleration keeps changing as particle moves.
(d) Angular momentum is constant in magnitude but direction keeps changing.

87. Two cars A and B move along a concentric circular path of radius $r_A$ and $r_B$ with velocities $v_A$ and $v_B$ maintaining constant distance, then $\frac{v_A}{v_B}$ is equal to

(a) $\frac{r_B}{r_A}$ (b) $\frac{r_A}{r_B}$ (c) $\frac{r_A^2}{r_B^2}$ (d) $\frac{r_B^2}{r_A^2}$

88. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 s for every circular lap. The average velocity and average speed for each circular lap, respectively is
(a) 0, 0 (b) 0 10, ms $^{-1}$
(c) 10 ms$^{-1}$, 10 ms $^{-1}$ (d) 10 ms$^{-1}$, 0

89. A particle is revolving at 1200 rpm in a circle of radius 30 cm. Then, its acceleration is
(a) 1600 ms$^{-2}$ (b) 4740 ms$^{-2}$ (c) 2370 ms$^{-2}$ (d) 5055 ms$^{-2}$

90. A body of mass 500 gram is rotating in a vertical circle of radius 1 m. What is the difference in its kinetic energies at the top and the bottom of the circle?
(a) 4.9 J (b) 19.8 J (c) 2.8 J (d) 9.8 J

91. A particle has a displacement of 2 units along the x -axis, 1 unit along the y – axis and 2 units along the z – axis. Then the resultant displacement of the particle is
(a) 3 units (b) 5 units (c) 4 units (d) 1 units

92. A car is moving on a circular path and takes a turn. If $R^1$ and $R^2$ are the reactions on the inner and outer wheels respectively, then
(a) $R^1 => R^2$ (b) $R^1 = R^2$ (c) $R^1 < R^2$ (d) $R^1 > R^2$

93. The angle between centripetal acceleration and tangential acceleration is?
(a) 180° (b) 0° (c) 90° (d) 45°

94. Large angle produces?
(a) high trajectory (b) curve trajectory
(c) flat trajectory (d) straight trajectory

95. He dimensional formula for normal acceleration is
(a) $LT^{-1}$ (b) L2T2 (c) $L3T^{-2}$ (d) $LT^{-2}$

96. A book is pushed with an initial horizontal velocity of 5.0 meters per second off the top of a desk. What is the initial vertical velocity of the book?
(a) 10. m/s (b) 0 m/s (c) 50 m/s (d) 2.5 m/s

97. One radian is defined to be the angle subtended where the arc length S is exactly equal to the?
(a) radius of the circle. (b) diameter of the circle.
(c) circumference of the circle. (d) half of radius of the circle.

98. A body travels along the circumference of a circle of radius 2 m with a linear velocity of 6 m/s. Then its angular velocity is
(a) 6 rad /s (b) 3 rad /s (c) 2 rad / s (d) 4 rad / s

99. One° (1°) is equal to?
(a) 0.1745 rad (b) 0.01745 rad (c) 0.001745 rad (d) 7.1745 rad

100. A body makes a displacement of 4 m due East from a point O and then makes displacement of 3 m due North. Its resultant displacement from O
(a) 7 m (b) 1 m (c) 5 m (d) 1 . 2 m

101. A body is allowed to slide on a frictional less track from rest under-gravity. The track ends in a circular loop of diameter D. What should be the minimum height of the body in terms of D, so that it may successfully complete the loop?
(a) D (b) 4/5 D (c) 5/4 D (d) 2D

102. One radian is equal to?
(a) 57.7° (b) 53.7° (c) 59.3° (d) 57.3°

103. A small body attached at the end of an inextensible string completes a vertical circle, then its
(a) angular momentum remains constant
(b) linear momentum remains constant
(c) angular velocity remains constant

(d) total mechanical energy remains constant

104. A body goes round the circumference of a circle of radius 2 m with an angular velocity of 2 rad/s. Its centripetal acceleration is
(a) 3 $m/s^2$ (b) 1. 5 $m/s^2$ (c) 6 $m/s^2$ (d) 12 $m/s^2$

105. Which is a constant for a freely falling object?
(a) displacement (b) velocity (c) acceleration (d) speed

106. The tangential component and centripetal component of acceleration are?
(a) Similar to each other (b) Parallel to each other.
(c) Equal to each other. (d) Perpendicular to each other.

107. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion takes place in a plane. It follows that
(a) its acceleration is constant (b) its motion is circular
(c) its velocity is constant (d) its motion is linear

# ANSWER

***Multiple Choice Questions***

1. (b) 2. (b) 3. (b) 4. (b) 5. (c) 6. (d) 7. (d) 8. (c) 9. (d) 10. (c)
11. (a) 12. (c) 13. (c) 14. (a) 15. (b) 16. (b) 17. (c) 18. (c) 19. (a) 20. (b)
21. (a) 22. (a) 23. (b) 24. (a) 25. (d) 26. (b) 27. (c) 28. (d) 29. (a) 30. (b)
31. (a) 32. (b) 33. (a) 34. (c) 35. (c) 36. (d) 37. (d) 38. (b) 39. (b) 40. (c)
41. (b) 42. (d) 43. (b) 44. (b) 45. (a) 46. (a) 47. (b) 48. (c) 49. (a) 50. (b)
51. (c) 52. (d) 53. (c) 54. (d) 55. (a) 56. (b) 57. (c) 58. (b) 59. (b)

***Assertion-Reasoning MCQs***

60. (b) 61. (d) 62. (d) 63. (a) 64. (c) 65. (b) 66. (c) 67. (c) 68. (c) 69. (d)

***Case Based MCQs***

70. (c) 71. (c) 72. (a) 73. (b) 74. (a) 75. (c) 76. (c) 77. (b) 78. (b) 79. (b)
80. (c) 81. (d) 82. (b) 83. (d) 84. (b) 85. (d) 86. (c) 87. (b) 88. (b) 89. (b)
90. (d) 91. (a) 92. (c) 93. (c) 94. (a) 95. (d) 96. (b) 97. (a) 98. (b) 99. (b) 100. (c)
101. (c) 102. (d) 103. (d) 104. (d) 105. (c) 106. (d) 107. (b)