

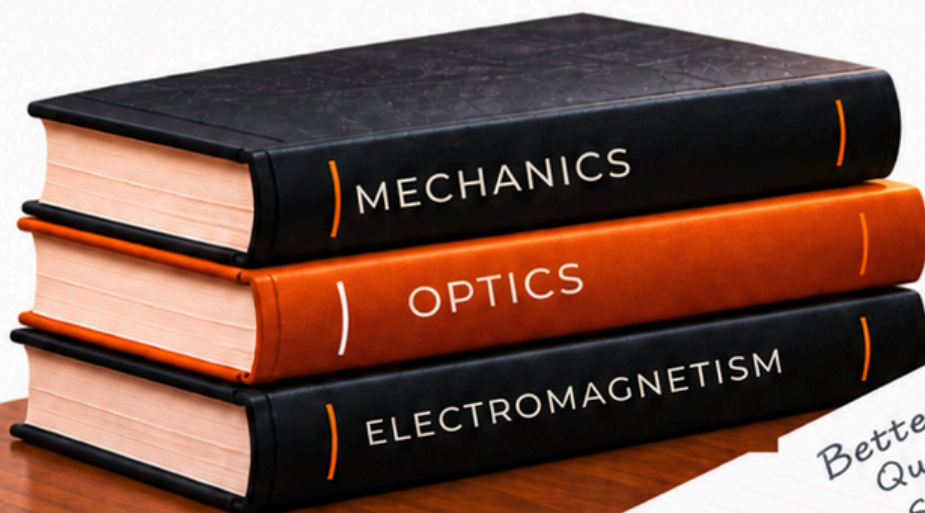
JEE Main Physics

Motion in a plane PYQ

$$F = ma$$



$$v = u + at$$



Motion in a plane JEE Main PYQ



Previous Year Questions - Topic-wise Collection

Subject: Physics

Years: 2026-2002

Total Questions: 55

About this PYQ collection

What is inside

A complete topic-wise set of **55 previous year questions** on **Motion in a plane** from **JEE Main (2026-2017)** and its predecessor **AIEEE (2010-2002)**, across **15 exam years**. **47 questions** are from 2019 onwards, so most of the set reflects the recent NTA pattern.

Questions are arranged to reduce unused page space, with newest-first priority and continuous numbering from 1. Each carries an exam date and shift tag to trace the original paper.

Topic-wise questions

TOPIC	QS	%
Motion in a plane	55	100%

Question types

TYPE	QS	%
Single-correct MCQ	44	80%
Numerical value	11	20%

Numerical-value questions have no options; all 11 are from 2020 onwards.

How these questions help you

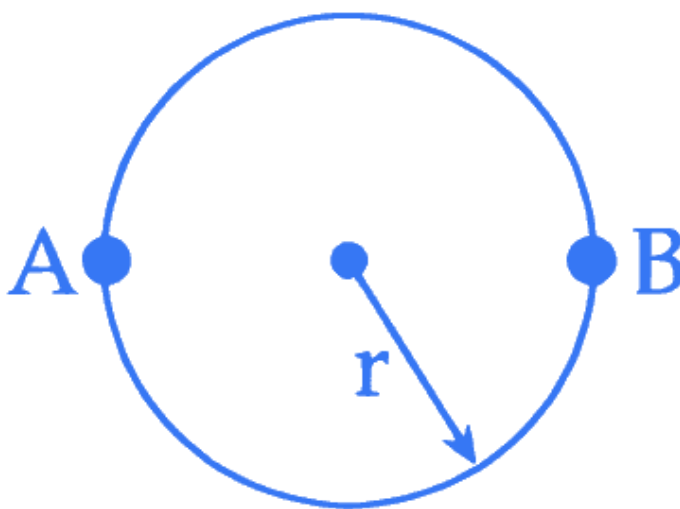
- **Know where the marks are:** motion in a plane make up **55 of 55 questions (about 100%)**.
- **Build speed and accuracy:** practice the concepts and question styles used in previous papers.
- **Learn the patterns:** the same question styles return year after year.
- **Strengthen other chapters:** these concepts support further study in Physics.

Questions – Motion in a plane

1. The velocity of a particle is given as $\vec{v} = -x\hat{i} + 2y\hat{j} - z\hat{k}$ m/s. The magnitude of acceleration at point (1, 2, 4) is _____ m/s². (2 Apr 2026 | Shift 1)

(A) $\sqrt{6}$ (B) 9
(C) $\sqrt{33}$ (D) 0

2. A sportsman runs around a circular track of radius r such that he traverses the path $ABAB$. The distance travelled and displacement, respectively, are



(2 Apr 2025 | Shift 2)

(A) $\pi r, 3r$ (B) $2r, 3\pi r$
(C) $3\pi r, 2r$ (D) $3\pi r, \pi r$

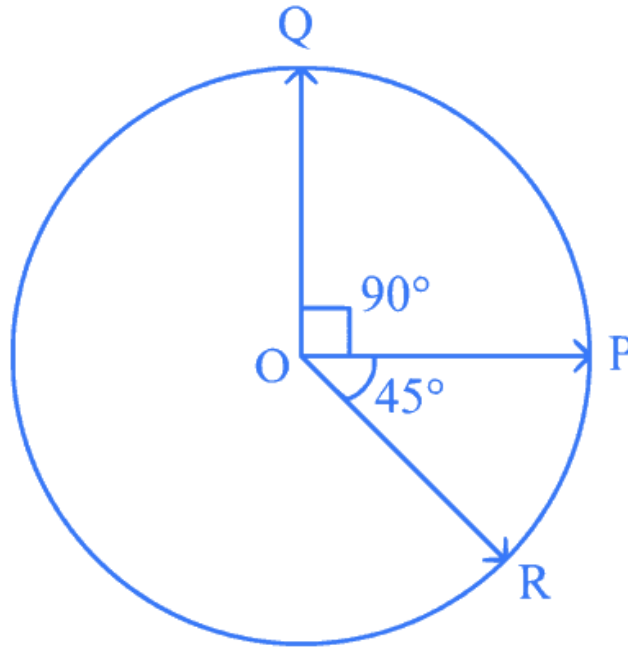
3. The position vector of a moving body at any instant of time is given as $\vec{r} = (5t^2\hat{i} - 5t\hat{j})$ m. The magnitude and direction of velocity at $t = 2$ s is, (24 Jan 2025 | Shift 2)

(A) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis
(B) $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with + ve X axis
(C) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with + ve X axis
(D) $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis

4. If $\vec{a}$ and $\vec{b}$ makes an angle $\cos^{-1}\left(\frac{5}{9}\right)$ with each other, then $|\vec{a} + \vec{b}| = \sqrt{2}|\vec{a} - \vec{b}|$ for $|\vec{a}| = n|\vec{b}|$. The integer value of n is _____. (9 Apr 2024 | Shift 1)

5. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$ and its magnitude is half that of $\vec{B}$. The angle between vectors $\vec{A}$ and $\vec{B}$ is _____. (9 Apr 2024 | Shift 2)

6. Three vectors $\vec{OP}$, $\vec{OQ}$ and $\vec{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____.



(8 Apr 2024 | Shift 1)

7. The angle between vector $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is : (5 Apr 2024 | Shift 1)

- (A) $\tan^{-1}(P/Q)$ (B) 0°
(C) $\tan^{-1} \frac{(2\vec{Q} - 2\vec{P})}{2\vec{Q} + 2\vec{P}}$ (D) $\tan^{-1}(2Q/P)$

8. The co-ordinates of a particle moving in x - y plane are given by :

$$x = 2 + 4t, y = 3t + 8t^2.$$

The motion of the particle is :

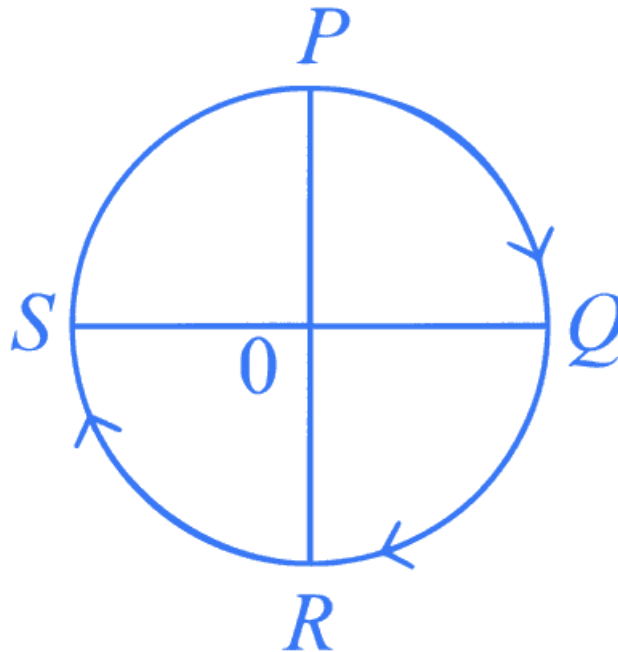
(4 Apr 2024 | Shift 1)

- (A) uniform motion along a straight line. (B) non-uniformly accelerated.
(C) uniformly accelerated having motion along a straight line. (D) uniformly accelerated having motion along a parabolic path.

9. Two forces $\vec{F}_1$ and $\vec{F}_2$ are acting on a body. One force has magnitude thrice that of the other force and the resultant of the two forces is equal to the force of larger magnitude. The angle between $\vec{F}_1$ and $\vec{F}_2$ is $\cos^{-1}\left(\frac{1}{n}\right)$. The value of $|n|$ is ____.

(4 Apr 2024 | Shift 1)

10. A cyclist starts from the point P of a circular ground of radius 2 km and travels along its circumference to the point S . The displacement of a cyclist is:



(4 Apr 2024 | Shift 2)

- (A) $\sqrt{8}$ km (B) 4 km
(C) 6 km (D) 8 km

11. If two vectors $\vec{A}$ and $\vec{B}$ having equal magnitude R are inclined at angle θ , then

(31 Jan 2024 | Shift 2)

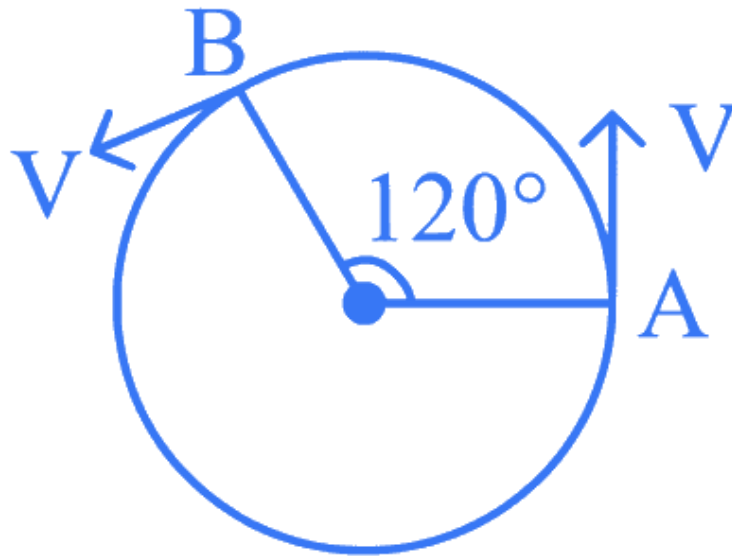
- (A) $|\vec{A} + \vec{B}| = 2R \cos\left(\frac{\theta}{2}\right)$ (B) $|\vec{A} - \vec{B}| = 2R \cos\left(\frac{\theta}{2}\right)$
(C) $|\vec{A} - \vec{B}| = \sqrt{2}R \sin\left(\frac{\theta}{2}\right)$ (D) $|\vec{A} + \vec{B}| = 2R \sin\left(\frac{\theta}{2}\right)$

12. A vector has magnitude same as that of $\vec{A} = 3\hat{i} + 4\hat{j}$ and is parallel to $\vec{B} = 4\hat{i} + 3\hat{j}$. The x and y components of this vector in first quadrant are x and 3 respectively where $x =$ ____.

(30 Jan 2024 | Shift 2)

13. A particle is moving in a circle of radius 50 cm in such a way that at any instant the normal and tangential components of its acceleration are equal. If its speed at $t = 0$ is 4 m/s, the time taken to complete the first revolution will be $\frac{1}{\alpha} [1 - e^{-2\pi}]$ s, where $\alpha =$ _____.
(29 Jan 2024 | Shift 2)
-
14. Position of an ant (S in metres) moving in Y-Z plane is given by $S = 2t^2\hat{j} + 5\hat{k}$ (where t is in second). The magnitude and direction of velocity of the ant at $t = 1$ s will be :
(27 Jan 2024 | Shift 1)
- (A) 16 m/s in y -direction
(B) 4 m/s in x -direction
(C) 9 m/s in z -direction
(D) 4 m/s in y -direction
-
15. A particle starts from origin at $t = 0$ with a velocity $5\hat{i}$ m/s and moves in $x - y$ plane under action of a force which produces a constant acceleration of $(3\hat{i} + 2\hat{j})\text{m/s}^2$. If the x -coordinate of the particle at that instant is 84 m, then the speed of the particle at this time is $\sqrt{\alpha}$ m/s. The value of α is _____.
(27 Jan 2024 | Shift 1)
-
16. A vector in $x - y$ plane makes an angle of 30° with y -axis. The magnitude of y -component of vector is $2\sqrt{3}$. The magnitude of x -component of the vector will be :
(15 Apr 2023 | Shift 1)
- (A) $\sqrt{3}$
(B) 2
(C) 6
(D) $\frac{1}{\sqrt{3}}$
-
17. When vector $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is subtracted from vector $\vec{B}$, it gives a vector equal to $2\hat{j}$. Then the magnitude of vector $\vec{B}$ will be :
(11 Apr 2023 | Shift 2)
- (A) 3
(B) $\sqrt{33}$
(C) $\sqrt{6}$
(D) $\sqrt{5}$
-
18. Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:
(8 Apr 2023 | Shift 1)
- (A) $\frac{5A}{2}$
(B) $\frac{\sqrt{5}A}{4}$
(C) $\frac{\sqrt{5}A}{2}$
(D) $\frac{\sqrt{5}A^2}{2}$
-
19. The sum of two forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$ such that $|\vec{R}| = |\vec{P}|$. The angle θ (in degrees) that the resultant of $2\vec{P}$ and $\vec{Q}$ will make with $\vec{Q}$ is , ...
(7 Jan 2020 | Shift 2)

20. As shown in the figure, a particle is moving with constant speed π m/s. Considering its motion from A to B, the magnitude of the average velocity is :



(6 Apr 2023 | Shift 2)

- (A) π m/s
(B) $1.5\sqrt{3}$ m/s
(C) $\sqrt{3}$ m/s
(D) $2\sqrt{3}$ m/s

21. A body is moving with constant speed, in a circle of radius 10 m. The body completes one revolution in 4 s. At the end of 3rd second, the displacement of body (in m) from its starting point is :

(31 Jan 2023 | Shift 2)

- (A) 15π
(B) 30
(C) $10\sqrt{2}$
(D) 5π

22. A car is moving on a circular path of radius 600 m such that the magnitudes of the tangential acceleration and centripetal acceleration are equal. The time taken by the car to complete first quarter of revolution, if it is moving with an initial speed of 54 km/hr is $t(1 - e^{-\pi/2})$ s. The value of t is _____.

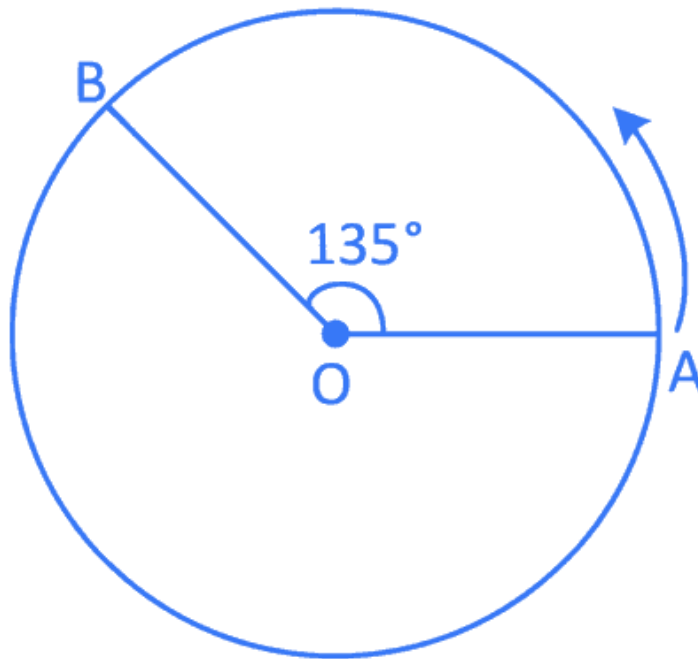
(29 Jan 2023 | Shift 2)

23. At time $t = 0$ a particle starts travelling from a height $7\hat{z}$ cm in a plane keeping z coordinate constant. At any instant of time its position along the $\hat{x}$ and $\hat{y}$ directions are defined as $3t$ and $5t^3$ respectively. At $t = 1$ s acceleration of the particle will be

(28 Jul 2022 | Shift 2)

- (A) $-30\hat{y}$
(B) $30\hat{y}$
(C) $3\hat{x} + 15\hat{y}$
(D) $3\hat{x} + 15\hat{y} + 7\hat{z}$

24. A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60 m, then the magnitude of displacement would be :
(Given $\cos 135^\circ = -0.7$)



(25 Jul 2022 | Shift 1)

- (A) 42 m (B) 47 m
(C) 19 m (D) 40 m

25. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A} + \vec{B}$ is equal to two times the magnitude of $\vec{A} - \vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ will be :

(29 Jun 2022 | Shift 1)

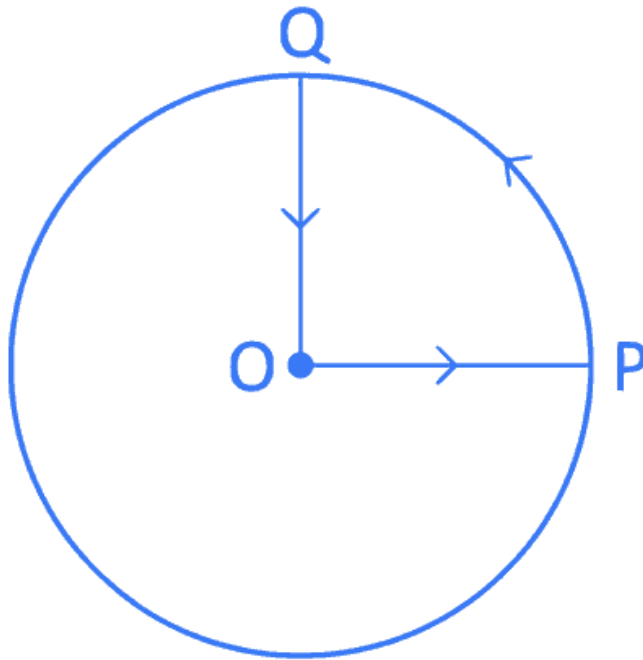
- (A) $\sin^{-1}\left(\frac{3}{5}\right)$ (B) $\sin^{-1}\left(\frac{1}{3}\right)$
(C) $\cos^{-1}\left(\frac{3}{5}\right)$ (D) $\cos^{-1}\left(\frac{1}{3}\right)$

26. Which of the following relations is true for two unit vector $\hat{A}$ and $\hat{B}$ making an angle θ to each other?

(25 Jun 2022 | Shift 1)

- (A) $|\hat{A} + \hat{B}| = |\hat{A} - \hat{B}| \tan \frac{\theta}{2}$ (B) $|\hat{A} - \hat{B}| = |\hat{A} + \hat{B}| \tan \frac{\theta}{2}$
(C) $|\hat{A} + \hat{B}| = |\hat{A} - \hat{B}| \cos \frac{\theta}{2}$ (D) $|\hat{A} - \hat{B}| = |\hat{A} + \hat{B}| \cos \frac{\theta}{2}$

27. A person starts his journey from centre 'O' of the park and comes back to the same position following path OPQO as shown in the figure. The radius of path taken by the person is 200 m and he takes 3 min 58 sec to complete his journey. The average speed of the person is _____ ms^{-1} . (take $\pi = 3.14$)



(30 Jun 2022 | Shift 1)

28. Statement I :
Two forces $(\vec{P} + \vec{Q})$ and $(\vec{P} - \vec{Q})$ where $\vec{P} \perp \vec{Q}$, when act at an angle θ_1 to each other, the magnitude of their resultant is $\sqrt{3(P^2 + Q^2)}$, when they act at an angle θ_2 , the magnitude of their resultant becomes $\sqrt{2(P^2 + Q^2)}$. This is possible only when $\theta_1 < \theta_2$.

Statement II :

In the situation given above.

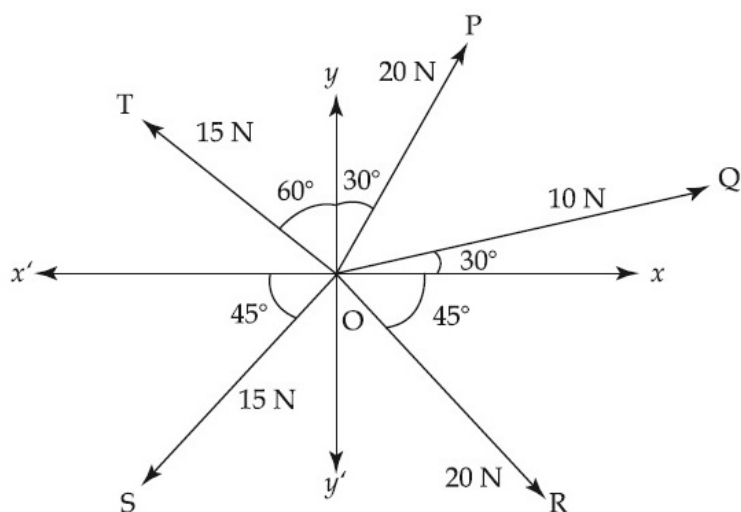
$$\theta_1 = 60^\circ \text{ and } \theta_2 = 90^\circ$$

In the light of the above statements, choose the most appropriate answer from the options given below :-

(31 Aug 2021 | Shift 2)

- | | |
|---|--|
| (A) Statement I is false but Statement II is true | (B) Both Statement I and Statement II are true |
| (C) Statement I is true but Statement II is false | (D) Both Statement I and Statement II are false. |

29. The resultant of these forces $\vec{OP}$, $\vec{OQ}$, $\vec{OR}$, $\vec{OS}$ and $\vec{OT}$ is approximately N.
[Take $\sqrt{3} = 1.7$, $\sqrt{2} = 1.4$ Given $\hat{i}$ and $\hat{j}$ unit vectors along x, y axis]

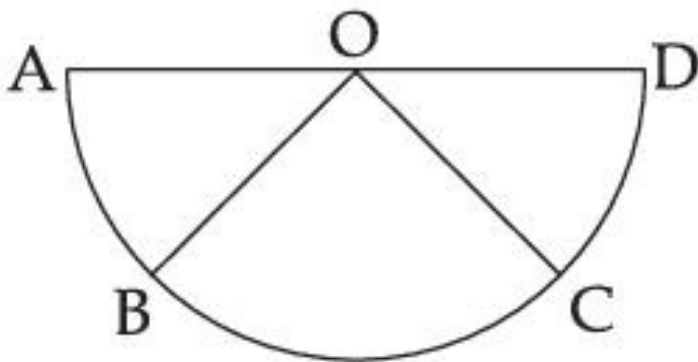


(27 Aug 2021 | Shift 1)

- (A) $9.25\hat{i} + 5\hat{j}$ (B) $3\hat{i} + 15\hat{j}$
(C) $2.5\hat{i} - 14.5\hat{j}$ (D) $-1.5\hat{i} - 15.5\hat{j}$

30. **Assertion A :** If A, B, C, D are four points on a semi-circular arc with centre at 'O' such that $|\vec{AB}| = |\vec{BC}| = |\vec{CD}|$, then $\vec{AB} + \vec{AC} + \vec{AD} = 4\vec{AO} + \vec{OB} + \vec{OC}$

Reason R : Polygon law of vector addition yields $\vec{AB} + \vec{BC} + \vec{CD} + \vec{DA} = 2\vec{AO}$

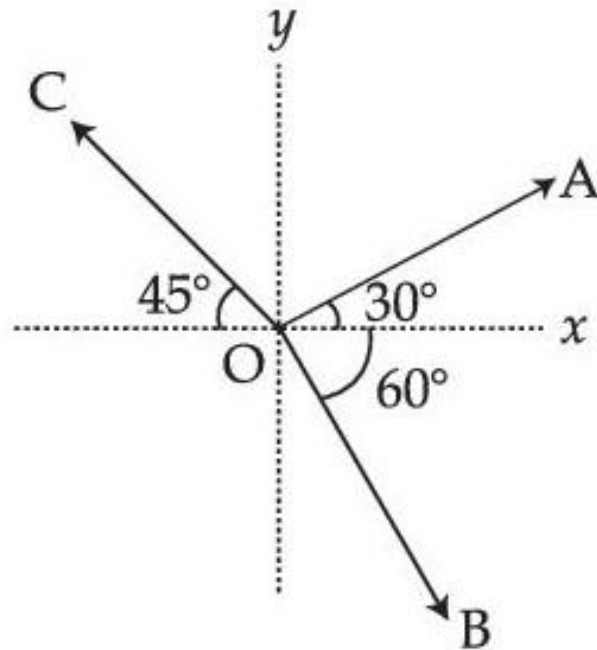


In the light of the above statements, choose the most appropriate answer from the options given below :

(27 Jul 2021 | Shift 1)

- (A) A is correct but R is not correct. (B) A is not correct but R is correct.
(C) Both A and R are correct and R is the correct explanation of A. (D) Both A and R are correct but R is not the correct explanation of A.

31. The magnitude of vectors $\vec{OA}$, $\vec{OB}$ and $\vec{OC}$ in the given figure are equal. The direction of $\vec{OA} + \vec{OB} - \vec{OC}$ with x-axis will be :



(26 Aug 2021 | Shift 1)

- (A) $\tan^{-1} \frac{(1 - \sqrt{3} - \sqrt{2})}{(1 + \sqrt{3} + \sqrt{2})}$ (B) $\tan^{-1} \frac{(\sqrt{3} - 1 + \sqrt{2})}{(1 + \sqrt{3} - \sqrt{2})}$
 (C) $\tan^{-1} \frac{(\sqrt{3} - 1 + \sqrt{2})}{(1 - \sqrt{3} + \sqrt{2})}$ (D) $\tan^{-1} \frac{(1 + \sqrt{3} - \sqrt{2})}{(1 - \sqrt{3} - \sqrt{2})}$

32. Two vectors $\vec{X}$ and $\vec{Y}$ have equal magnitude. The magnitude of $(\vec{X} - \vec{Y})$ is n times the magnitude of $(\vec{X} + \vec{Y})$. The angle between $\vec{X}$ and $\vec{Y}$ is :

(25 Jul 2021 | Shift 2)

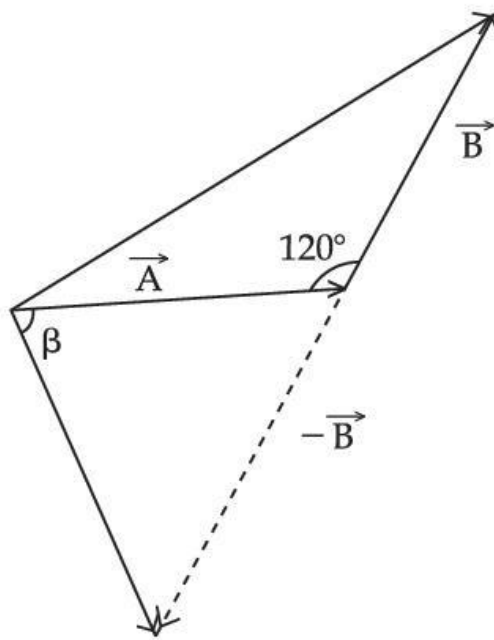
- (A) $\cos^{-1} \left(\frac{-n^2 - 1}{n^2 - 1} \right)$ (B) $\cos^{-1} \left(\frac{n^2 - 1}{-n^2 - 1} \right)$
 (C) $\cos^{-1} \left(\frac{n^2 + 1}{-n^2 - 1} \right)$ (D) $\cos^{-1} \left(\frac{n^2 + 1}{n^2 - 1} \right)$

33. Two vectors $\vec{P}$ and $\vec{Q}$ have equal magnitudes. If the magnitude of $\vec{P} + \vec{Q}$ is n times the magnitude of $\vec{P} - \vec{Q}$, then angle between $\vec{P}$ and $\vec{Q}$ is :

(20 Jul 2021 | Shift 2)

- (A) $\sin^{-1} \left(\frac{n - 1}{n + 1} \right)$ (B) $\cos^{-1} \left(\frac{n - 1}{n + 1} \right)$
 (C) $\sin^{-1} \left(\frac{n^2 - 1}{n^2 + 1} \right)$ (D) $\cos^{-1} \left(\frac{n^2 - 1}{n^2 + 1} \right)$

34. The angle between vector $(\vec{A})$ and $(\vec{A} - \vec{B})$ is :



(26 Aug 2021 | Shift 2)

- (A) $\tan^{-1} \left(\frac{-\frac{B}{2}}{A - B\frac{\sqrt{3}}{2}} \right)$ (B) $\tan^{-1} \left(\frac{A}{0.7B} \right)$
 (C) $\tan^{-1} \left(\frac{\sqrt{3}B}{2A - B} \right)$ (D) $\tan^{-1} \left(\frac{B \cos \theta}{A - B \sin \theta} \right)$

35. A mosquito is moving with a velocity $\vec{v} = 0.5t^2\hat{i} + 3t\hat{j} + 9\hat{k}$ m/s and accelerating in uniform conditions. What will be the direction of mosquito after 2 s?

(16 Mar 2021 | Shift 2)

- (A) $\tan^{-1} \left(\frac{\sqrt{85}}{6} \right)$ from y-axis (B) $\tan^{-1} \left(\frac{5}{2} \right)$ from y-axis
 (C) $\tan^{-1} \left(\frac{2}{3} \right)$ from x-axis (D) $\tan^{-1} \left(\frac{5}{2} \right)$ from x-axis

36. Starting from the origin at time $t = 0$, with initial velocity $5\hat{j}$ ms⁻¹, a particle moves in the x-y plane with a constant acceleration of $(10\hat{i} + 4\hat{j})$ ms⁻². At time t , its coordinates are (20 m, y_0 m). The values of t and y_0 are, respectively:

(4 Sept 2020 | Shift 1)

- (A) 5s and 25 m (B) 2s and 18 m
 (C) 2s and 24 m (D) 4s and 52 m

37. Match List - I with List - II

List I	List II
(a) $\vec{C} - \vec{A} - \vec{B} = 0$	(i)
(b) $\vec{A} - \vec{C} - \vec{B} = 0$	(ii)
(c) $\vec{B} - \vec{A} - \vec{C} = 0$	(iii)
(d) $\vec{A} + \vec{B} = -\vec{C}$	(iv)

Choose the correct answer from the options given below :

(25 Jul 2021 | Shift 1)

- (A) (a) $\rightarrow$ (iv), (b) $\rightarrow$ (i), (c) $\rightarrow$ (iii), (d) $\rightarrow$ (ii)
 (B) (a) $\rightarrow$ (iv), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (i), (d) $\rightarrow$ (ii)
 (C) (a) $\rightarrow$ (iii), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (iv), (d) $\rightarrow$ (i)
 (D) (a) $\rightarrow$ (i), (b) $\rightarrow$ (iv), (c) $\rightarrow$ (ii), (d) $\rightarrow$ (iii)

38. A particle starts from the origin at $t = 0$ with an initial velocity of $3.0 \hat{i}$ m/s and moves in the x-y plane with a constant acceleration $(6\hat{i} + 4\hat{j})$ m/s². The x-coordinate of the particle at the instant when its y-coordinate is 32 m is D meters. The value of D is :-

(9 Jan 2020 | Shift 2)

- (A) 40
 (B) 32
 (C) 50
 (D) 60

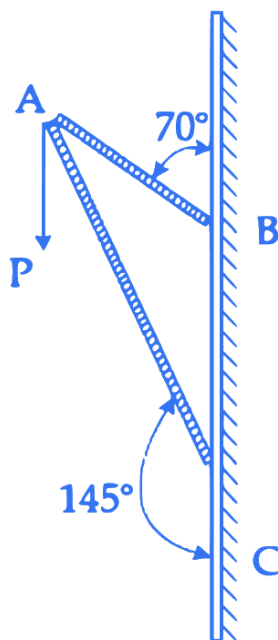
39. The position vector of a particle changes with time according to the relation $\vec{r}(t) = 15t^2\hat{i} + (4 - 20t^2)\hat{j}$

What is the magnitude of the acceleration at $t = 1$?

(9 Apr 2019 | Shift 2)

- (A) 50
 (B) 25
 (C) 40
 (D) 100

40. Consider a frame that is made up of two thin massless rods AB and AC as shown in the figure. A vertical force $\vec{P}$ of magnitude 100 N is applied at point A of the frame.



Suppose the force is $\vec{P}$ resolved parallel to the arms AB and AC of the frame.

The magnitude of the resolved component along the arm AC is xN.

The value of x, to the nearest integer, is _____.

[Given : $\sin(35^\circ) = 0.573$, $\cos(35^\circ) = 0.819$

$\sin(110^\circ) = 0.939$, $\cos(110^\circ) = -0.342$]

(16 Mar 2021 | Shift 1)

41. A particle moves from the point $(2.0\hat{i} + 4.0\hat{j})$ m, at $t = 0$, with an initial velocity $(5.0\hat{i} + 4.0\hat{j})$ ms^{-1} . It is acted upon by a constant force which produces a constant acceleration $(4.0\hat{i} + 4.0\hat{j})$ ms^{-2} . What is the distance of the particle from the origin at time 2 s?

(11 Jan 2019 | Shift 2)

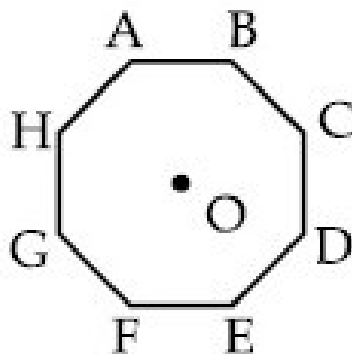
- (A) 15 m (B) $20\sqrt{2}$ m
(C) $10\sqrt{2}$ m (D) 5 m

42. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. The magnitude of $(\vec{A} + \vec{B})$ is 'n' times the magnitude of $(\vec{A} - \vec{B})$. The angle between $\vec{A}$ and $\vec{B}$ is -

(10 Jan 2019 | Shift 2)

- (A) $\sin^{-1} \left[\frac{n-1}{n+1} \right]$ (B) $\sin^{-1} \left[\frac{n^2-1}{n^2+1} \right]$
(C) $\cos^{-1} \left[\frac{n^2-1}{n^2+1} \right]$ (D) $\cos^{-1} \left[\frac{n-1}{n+1} \right]$

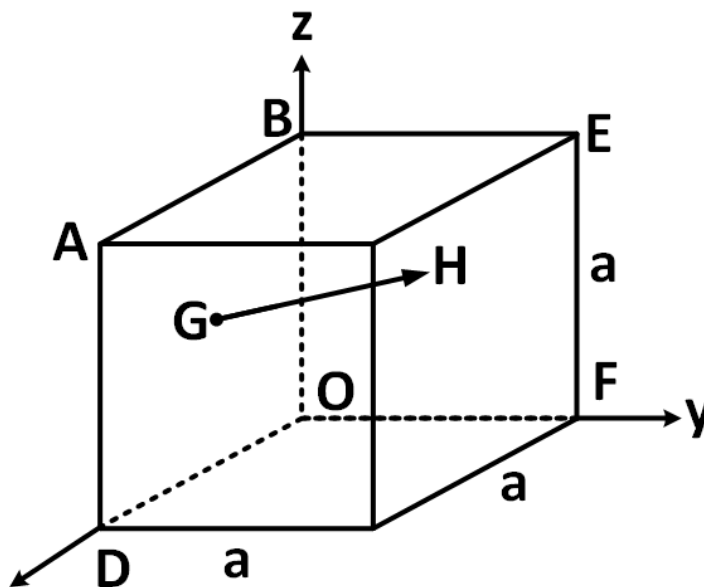
43. In an octagon ABCDEFGH of equal side, what is the sum of $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF} + \overrightarrow{AG} + \overrightarrow{AH}$,
if, $\overrightarrow{AO} = 2\hat{i} + 3\hat{j} - 4\hat{k}$



(25 Feb 2021 | Shift 1)

- (A) $-16\hat{i} - 24\hat{j} + 32\hat{k}$ (B) $16\hat{i} + 24\hat{j} - 32\hat{k}$
(C) $16\hat{i} + 24\hat{j} + 32\hat{k}$ (D) $16\hat{i} - 24\hat{j} + 32\hat{k}$

44. In the cube of side 'a' shown in the figure, the vector from the central point of the face ABOD to the central point of the face BEFO will be -



(10 Jan 2019 | Shift 1)

- (A) $\frac{1}{2}a(\hat{k} - \hat{i})$ (B) $\frac{1}{2}a(\hat{j} - \hat{i})$
(C) $\frac{1}{2}a(\hat{j} - \hat{k})$ (D) $\frac{1}{2}a(\hat{i} - \hat{k})$

45. Two forces P and Q, of magnitude 2F and 3F, respectively, are at an angle θ with each other. If the force Q is doubled, then their resultant also gets doubled. Then, the angle θ is - (10 Jan 2019 | Shift 2)

(A) 90° (B) 60°
(C) 30° (D) 120°

46. A particle is moving with a velocity $\vec{v} = K(y\hat{i} + x\hat{j})$, where K is a constant. The general equation for its path is : (9 Jan 2019 | Shift 1)

(A) $y = x^2 + \text{constant}$ (B) $y^2 = x + \text{constant}$
(C) $y^2 = x^2 + \text{constant}$ (D) $xy = \text{constant}$

47. The position co-ordinates of a particle moving in a 3-D coordinate system is given by
 $x = a \cos \omega t$
 $y = a \sin \omega t$ and
 $z = a \omega t$
The speed of the particle is : (9 Jan 2019 | Shift 2)

(A) $\sqrt{2} a \omega$ (B) $a \omega$
(C) $\sqrt{3} a \omega$ (D) $2 a \omega$

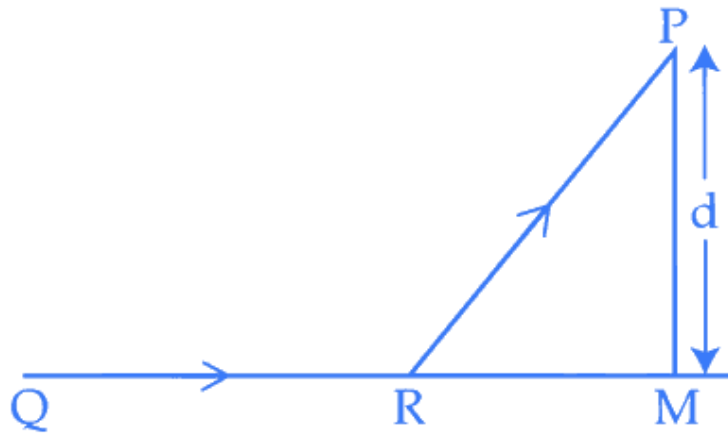
48. A particle is moving with velocity $\vec{v} = k(y\hat{i} + x\hat{j})$, where K is a constant. The general equation for its path is (25 Apr 2010 | Single sitting)

(A) $y = x^2 + \text{constant}$ (B) $y^2 = x + \text{constant}$
(C) $xy = \text{constant}$ (D) $y^2 = x^2 + \text{constant}$

49. A particle has an initial velocity $3\hat{i} + 4\hat{j}$ and an acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after 10 s is: (26 Apr 2009 | Single sitting)

(A) $7\sqrt{2}$ units (B) 7 units
(C) 8.5 units (D) 10 units

50. A man in a car at location Q on a straight highway is moving with speed v . He decides to reach a point P in a field at a distance d from the highway (point M) as shown in the figure. Speed of the car in the field is half to that on the highway. What should be the distance RM, so that the time taken to reach P is minimum ?



(15 Apr 2018 | Shift 2)

- (A) d (B) $\frac{d}{\sqrt{2}}$
 (C) $\frac{d}{2}$ (D) $\frac{d}{\sqrt{3}}$

51. A particle is moving eastwards with a velocity of 5 m/s. In 10 seconds the velocity changes to 5 m/s northwards. The average acceleration in this time is

(8 May 2005 | Single sitting)

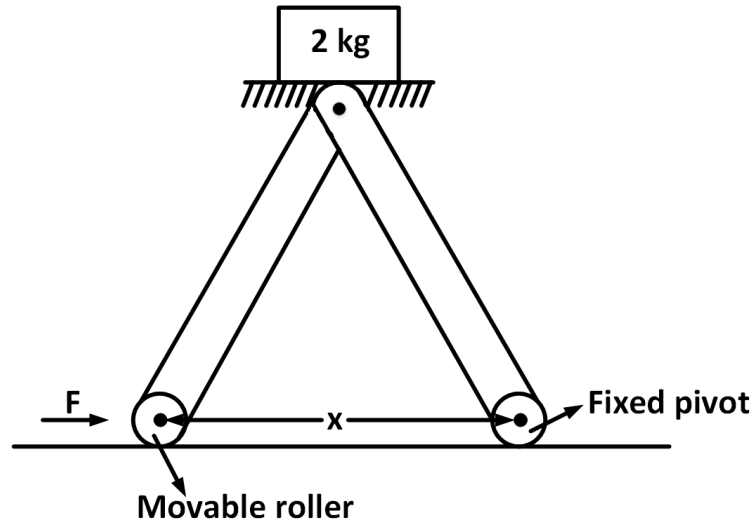
- (A) $\frac{1}{2}ms^{-2}$ towards north (B) $\frac{1}{\sqrt{2}}ms^{-2}$ towards north-east
 (C) $\frac{1}{\sqrt{2}}ms^{-2}$ towards north-west (D) zero

52. The co-ordinates of a moving particle at any time 't' are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time 't' is given by

(26 Apr 2003 | Single sitting)

- (A) $3t\sqrt{\alpha^2 + \beta^2}$ (B) $3t^2\sqrt{\alpha^2 + \beta^2}$
 (C) $t^2\sqrt{\alpha^2 + \beta^2}$ (D) $\sqrt{\alpha^2 + \beta^2}$

53. The machine as shown has 2 rods of length 1 m connected by a pivot at the top. The end of one rod is connected to the floor by a stationary pivot and the end of the other rod has a roller that rolls along the floor in a slot. As the roller goes back and forth, a 2 kg weight moves up and down. If the roller is moving towards right at a constant speed, the weight moves up with a :



(9 Apr 2017 | Shift 1)

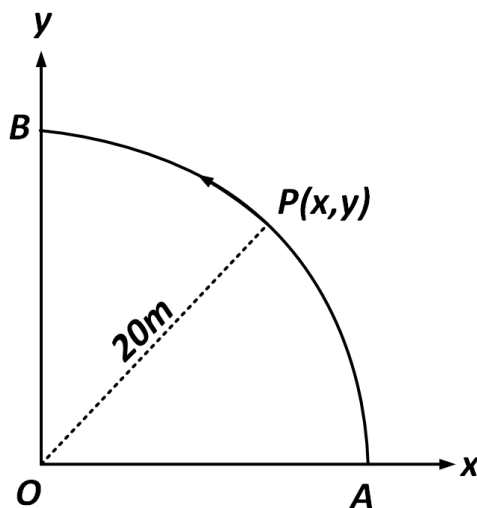
- (A) Constant speed
(B) decreasing speed
(C) increasing speed
(D) speed which is $\frac{3}{4}$ th of that of the roller when the weight is 0.4 m above the ground

54. Two forces are such that the sum of their magnitudes is 18 N and their resultant is 12 N which is perpendicular to the smaller force. Then the magnitudes of the forces are

(19 May 2002 | Single sitting)

- (A) 12N, 6N
(B) 13N, 5N
(C) 10N, 8N
(D) 16N, 2N.

55. A point P moves in counter-clockwise direction on a circular path as shown in the figure. The movement of P is such that it sweeps out a length $s = t^3 + 5$, where s is in metres and t is in seconds. The radius of the path is 20 m . The acceleration of ' P ' when $t = 2\text{ s}$ is nearly.



(25 Apr 2010 | Single sitting)

- (A) 13m/s^2 (B) 12m/s^2
(C) 7.2m/s^2 (D) 14m/s^2