JEE Mains PYQs Motion in Plane (Physics Master Academy)
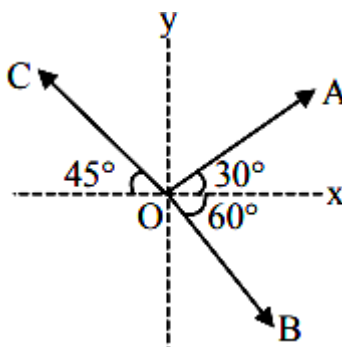
QUESTIONS

SECTIONS

1. Section A - 25 Questions

Section 1 : Section A - 25 Questions

SECTION INSTRUCTIONS

Thjis section contains 25 MCQs. +4 for every correct anser. -1 for every incorrect answer

1   The magnitude of vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ in the given kgure are equal. The direction of $\overrightarrow{OA}$, + $\overrightarrow{OB}$ − $\overrightarrow{OC}$ with x axis will be

○ $\tan^{-1} \dfrac{(1-\sqrt{3}-\sqrt{2})}{(1+\sqrt{3}+\sqrt{2})}$

○ $\tan^{-1} \dfrac{\left(\sqrt{3}-1+\sqrt{2}\right)}{\left(1+\sqrt{3}-\sqrt{2}\right)}$

$$\bigcirc \quad \tan^{-1} \frac{\left(\sqrt{3} - 1 + \sqrt{2}\right)}{\left(1 - \sqrt{3} + \sqrt{2}\right)}$$

$$\bigcirc \quad \tan^{-1} \frac{\left(1 + \sqrt{3} - \sqrt{2}\right)}{\left(1 - \sqrt{3} - \sqrt{2}\right)}$$

2 What will be the projection of vector $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ on vector $\vec{B} = \hat{i} + \hat{j}$?

$\bigcirc \quad \sqrt{2}(\hat{i} + \hat{j} + \hat{k})$

$\bigcirc \quad 2(\hat{i} + \hat{j} + \hat{k})$
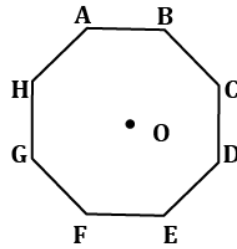
$\bigcirc \quad \sqrt{2}(\hat{i} + \hat{j})$

$\bigcirc \quad (\hat{i} + \hat{j})$

3 In an octagon ABCDEFGH of equal side, what is the sum of $\vec{AB} + \vec{AC} + \vec{AD} + \vec{AE} + \vec{AF} + \vec{AG} + \vec{AH}$, if $\vec{AO} = 2\hat{i}$

$+ 3\hat{j} - 4\hat{k}$.

○ $-16\hat{i} - 24\hat{j} + 32\hat{k}$

○ $16\hat{i} + 24\hat{j} + 32\hat{k}$

○ $16\hat{i} + 24\hat{j} - 32\hat{k}$

○ $16\hat{i} - 24\hat{j} + 32\hat{k}$

Correct: +4 · Incorrect: -1

4 If $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$, the angle between $\vec{P}$ and $\vec{Q}$ is θ (0° < 30°<360°). The value of θ will be___°.
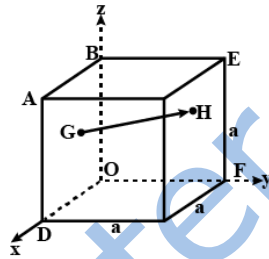
○ 0

○ 45

○ 90

○ 180

Correct: +4 · Incorrect: -1

5 Let $|\vec{A_1}| = 3$, $|\vec{A_2}| = 5$ and $|\vec{A_1} + \vec{A_2}| = 5$. The value of (2

$\vec{A_1} + 3$
$\vec{A_2}$
$).(3$
$\vec{A_1}$
$- 2$
$\vec{A_2}$
$)$ is

○ -106.5

○ -99.5

○ -112.5

○ -118.5

6   In the cube of side 'a' shown in kgure, the vector from the central point of the face ABOD to the central point of the face BEFO will be

○ $\frac{1}{2}a(\hat{k}-\hat{i})$

○ $\frac{1}{2}a(\hat{i}-\hat{k})$

○ $\frac{1}{2}a(\hat{j}-\hat{i})$

○ $\frac{1}{2}a(\hat{j}-\hat{k})$

7   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 angel θ is

○ 120°

○ 60°

○ 90°

○ 30°

8 A helicopter is flying horizontally with a speed 'v' at an altitude 'h' has to drop a food packet for a man on the ground. What is the distance of helicopter from the man when the food packet is dropped?

○ $\sqrt{\dfrac{2ghv^2+1}{h^2}}$

○ $\sqrt{2ghv^2+h^2}$

○ $\sqrt{\dfrac{2v^2h}{g}+h^2}$

○ $\sqrt{\dfrac{2gh}{v^2}+h^2}$

9 A bomb is dropped by kghter plane flying horizontally. To an observer sitting in the plane. The trajectory of the bomb is a

○ hyperbola

○ parabola in the direction of motion of plane

○ straight line vertically down the plane

○ parabola in a direction opposite to the motion of plane

10 A mosquito is moving wit ah velocity $\vec{v}$ = 0.5t^2

$\hat{i}$

+ 3t

$\hat{j}$

+ 9

$\hat{k}$

m/s and accelerating in uniform motion. What will be the direction of mosquito after 2s?

○ $\tan^{-1}(2/3)$ from y axis

○ $\tan^{-1}(5/2)$ from y axis

○ $\tan^{-1}(5/2)$ from x axis

○ none of these

11 A balloon is moving up u in air vertically above a point A on the ground. When it is at a height h_1, a girl standing at a distance d (point B) from A (see kgure) sees it at an angle 45° with respect to the vertical. When the balloon climbs up a further height h_2 it is seen at an angle 60° with respect to the vertical if the girl moves further by a distance 2.464d (point C). Then the height h_2 is (give $\tan 30° = 0.5774$)
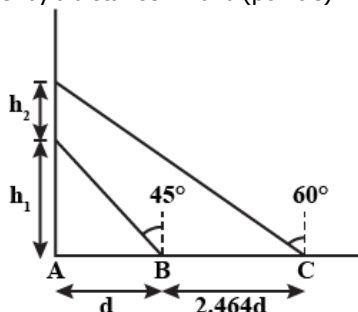
○ 1.464d

○ 0.732d

○ 0.464d

○ d

12 Starting from the origin at time t = 0 with initial velocity $5\hat{j}$ m/s 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 $(20m, y_0 m)$. The values of t and y_0 are respectively

○ 4s and 52m

○ 2s and 18m

○ 2s and 24m

○ 5s and 25m

13 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?

○ 40

○ 25

○ 100

○ 50

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

○ 15m

○ $20\sqrt{2}$ m

○ 5m

○ $10\sqrt{2}$ m

15 A particle moving with a velocity of $\vec{v} = K(y\hat{i} + x\hat{j})$ where K is a constant. The general equation for its path is

○ $y = x^2$ + constant

○ $y^2 = x$ + constant

○ $y^2 = x^2$ + constant

○ xy = constant

16 A particle has an initial velocity of $3\hat{i} + 4\hat{j}$ and acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after 10s is

○ $7\sqrt{2}$ units

○ 7 units

○ 8.5 units

○ 10 units

17 The coordinates of a moving particle at anytime 't' are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time t is given by

○ $3t\sqrt{\alpha^2+\beta^2}$

○ $3t^2\sqrt{\alpha^2+\beta^2}$

○ $t^2\sqrt{\alpha^2+\beta^2}$

○ $\sqrt{\alpha^2+\beta^2}$

18 The ranges and heights for two projectiles projected with the same initial velocity at angles 42° and 48° with the horizontal are R_1, R_2 and H_1 and H_2 respectively, Choose the correct option:

○ $R_1 > R_2$ and $H_1 = H_2$

○ $R_1 = R_2$ and $H_1 < H_2$

○ $R_1 < R_2$ and $H_1 < H_2$

○ $R_1 = R_2$ and $H_1 = H_2$

The initial velocity of the particle is $5\sqrt{2}$ m/s and the air resistance is assumed to be negligible. The magnitude of the change in momentum between the points A and B is $x \times 10^{-2}$ kgm/s. The value of x, to the nearest integer is ____

○ 2

○ 3

○ 4

○ 5

20 A shell is kred from a kxed artillery gun with an initial speed u such that it hits the target on the ground at a distance R from it. if t_1 and t_2 are the values of the time taken by it to hit the target in two possible ways, the product t_1t_2 is

○ R/4g,

○ R/g

○ R/2g

○ 2R/g

21 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?

○ $R^2 = 4h_1h_2$

○ $R^2 = 16h_1h_2$

○ $R^2 = 2h_1h_2$

○ $R^2 = h_1h_2$

22 A body is projected at t = 0 with a velocity of 10m/s at an angle of 60° with the horizontal. The radius of curvature of its trajectory at t = 1s is R, neglecting air resistance and taking acceleration due to gravity g =- 10m/s², the value of R is

○ 10.3m

○ 2.8m

○ 2.5m

○ 5.1m

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

○ 1:16

○ 1:2

○ 1:4

○ 1:8

24 A person is swimming with a speed of 10m/s at an angle of 120° with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is x m/s. The value x to the nearest integer is ___

○ 5

○ 10

○ 15

○ 20

25 When a car is at rest, its driver sees raindrops falling on it vertically. When driving the car with speed v, he sees that raindrops are coming at an angle 60° from the horizontal. On further increasing the speed of the car to $(1+\beta)v$, this angle changes to 45°. The value of β is close to

○ 0.73

○ 0.41

○ 0.37

○ 0.50

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ANSWERS

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1 | $\tan^{-1}\dfrac{(1-\sqrt{3}-\sqrt{2})}{(1+\sqrt{3}+\sqrt{2})}$

2 $(\hat{i}+\hat{j})$

3 $16\hat{i}+24\hat{j}-32\hat{k}$

4 180

5 -118.5

6 $\dfrac{1}{2}a(\hat{j}-\hat{i})$

7 120°

8 $\sqrt{\dfrac{2v^2h}{g}+h^2}$

9 straight line vertically down the plane

10 none of these

11 d

12 4s and 52m

13 50

14 $20\sqrt{2}$ m

15 $y^2 = x^2 +$ constant

16 $7\sqrt{2}$ units

17 $3t^2\sqrt{\alpha^2+\beta^2}$

18 $R_1 = R_2$ and $H_1 < H_2$

19 5

20 2R/g

21 $R^2 = 16h_1h_2$

22 2.8m

23 1:16

24 5

25 0.73

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