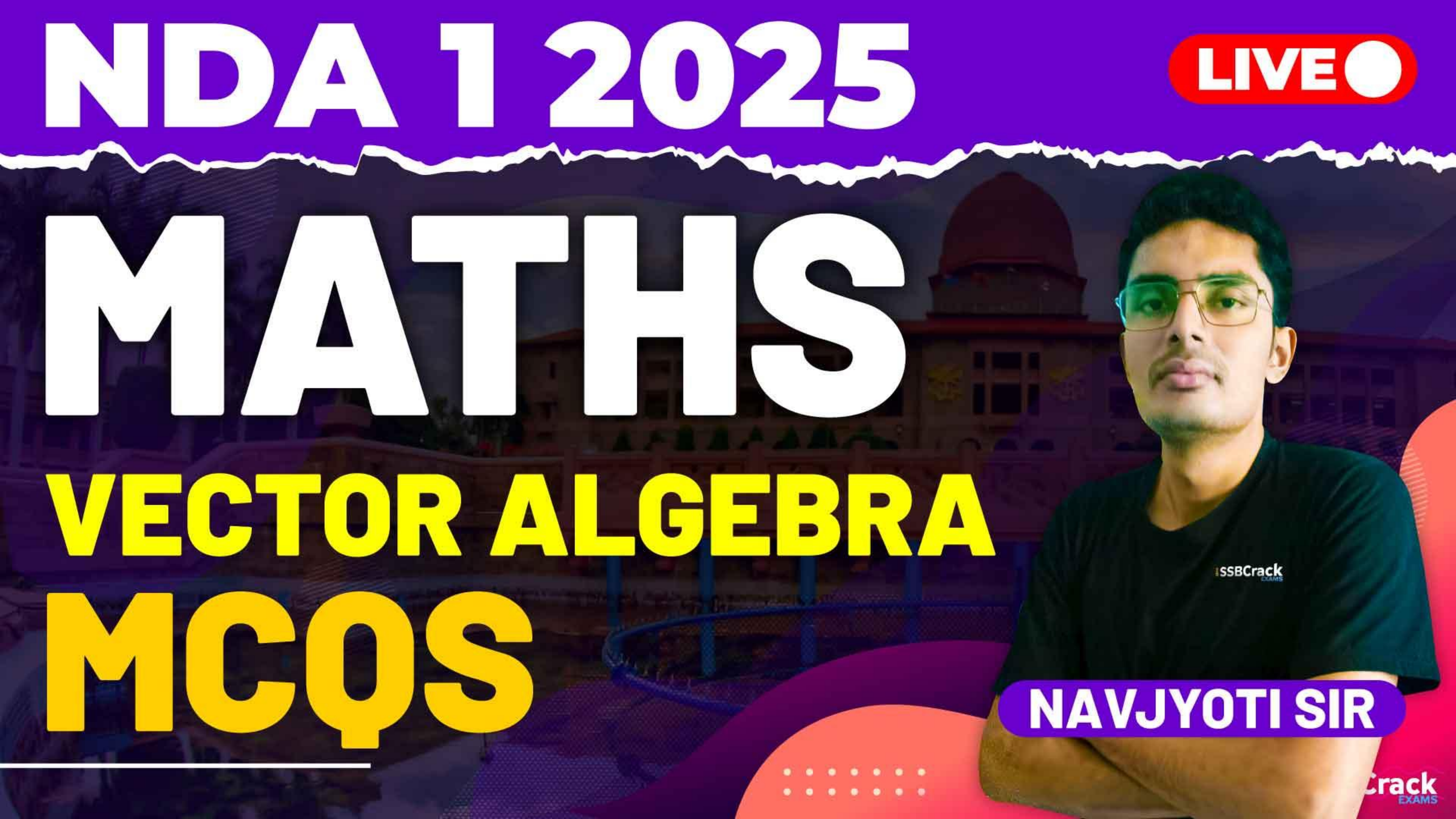

NDA 1 2025
LIVE
MATHS
VECTOR ALGEBRA
MCQS
SSBCrack EXAMS
NAVJYOTI SIR
Crack EXAMS

31 Jan 2025 Live Classes Schedule

9:00AM	31 JANUARY 2025 DAILY DEFENCE UPDATES	DIVYANSHU SIR
10:00AM	31 JANUARY 2025 DAILY CURRENT AFFAIRS	RUBY MA'AM

AFCAT 1 2025 LIVE CLASSES

12:30PM	REASONING - SYLLOGISM	RUBY MA'AM
3:00PM	STATIC GK - IMPORTANT INTERNATIONAL GROUPS	DIVYANSHU SIR
4:30PM	ENGLISH - ANTONYMS - CLASS 3	ANURADHA MA'AM
5:30PM	MATHS - NUMBER SYSTEM - CLASS 2	NAVJYOTI SIR

NDA 1 2025 LIVE CLASSES

10:00AM	MATHS - VECTOR ALGEBRA	NAVJYOTI SIR
11:30AM	MODERN HISTORY - CLASS 3	RUBY MA'AM
1:00PM	PHYSICS - ROTATIONAL MOTION	NAVJYOTI SIR
4:30PM	ENGLISH - ANTONYMS - CLASS 3	ANURADHA MA'AM

CDS 1 2025 LIVE CLASSES

11:30AM	MODERN HISTORY - CLASS 3	RUBY MA'AM
1:00PM	PHYSICS - ROTATIONAL MOTION	NAVJYOTI SIR
4:30PM	ENGLISH - ANTONYMS - CLASS 3	ANURADHA MA'AM
5:30PM	MATHS - NUMBER SYSTEM - CLASS 2	NAVJYOTI SIR

Consider the following in respect of moment of a force :

1. The moment of force about a point is independent of point of application of force. ✗
2. The moment of a force about a line is a vector quantity. ✗

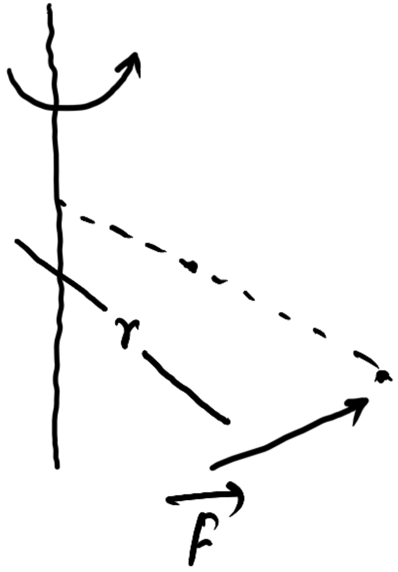
Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2



Moment of force $= \vec{r} \times \vec{F}$

Moment of force about a line $= (\vec{r} \times \vec{F}) \cdot \hat{a}$

$\hat{a}$: unit vector along direction of line

not a vector quantity

Ans. (d)

For any vector $\vec{r}$, what is

$(\vec{r}\cdot\hat{i})(\vec{r}\times\hat{i})+(\vec{r}\cdot\hat{j})(\vec{r}\times\hat{j})+(\vec{r}\cdot\hat{k})(\vec{r}\times\hat{k})$

equal to ?

(a) $\vec{0}$

(b) $\vec{r}$

(c) $2\vec{r}$

(d) $3\vec{r}$

$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

$(\vec{r}\cdot\hat{i}) = x$

$(\vec{r}\cdot\hat{j}) = y$

$(\vec{r}\cdot\hat{k}) = z$

$$\vec{r}\times\hat{i} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x & y & z \\ 1 & 0 & 0 \end{vmatrix} = (-\hat{j})(z) + (-y)\hat{k}$$

$= -z\hat{j} - y\hat{k}$

$$\vec{r}\times\hat{j} = \begin{vmatrix} i & j & k \\ x & y & z \\ 0 & 1 & 0 \end{vmatrix}$$

$= \hat{i}(-z) + \hat{k}(x)$

$$\vec{r}\times\hat{k} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x & y & z \\ 0 & 0 & 1 \end{vmatrix}$$

$= \hat{i}(y) - \hat{j}(-x)$

NDA 1 2025 REVISION - MATHS – VECTOR ALGEBRA

$$(\vec{r}\cdot\hat{i})(\vec{r}\times\hat{i}) + (\vec{r}\cdot\hat{j})(\vec{r}\times\hat{j}) + (\vec{r}\cdot\hat{k})(\vec{r}\times\hat{k})$$

$$= x(-z\hat{j} - y\hat{k}) + y(-z\hat{i} + x\hat{k}) + z(y\hat{i} + x\hat{j})$$

$$= -xz\hat{j} - yx\hat{k} - yz\hat{i} + xy\hat{k} + zy\hat{i} + xz\hat{j}$$

$$= 0 = \vec{0}$$

If a vector of magnitude 2 units makes an angle $\frac{\pi}{3}$ with $2\hat{i}$, $\frac{\pi}{4}$ with $3\hat{j}$ and an acute angle θ with $4\hat{k}$, then what are the components of the vector?

(PYQ – 2024 – I)

(a) $(1, \sqrt{2}, 1)$

(b) $(1, -\sqrt{2}, 1)$

(c) $(1, -\sqrt{2}, -1)$

(d) $(1, \sqrt{2}, -1)$

$2\hat{i}$ $3\hat{j}$ $4\hat{k}$ —— positive direction

$\frac{\pi}{3}$ $\frac{\pi}{4}$ θ (acute angle) — first quadrant

So, all components will be positive.

Ans. (a)

(PYQ – 2024 – I)

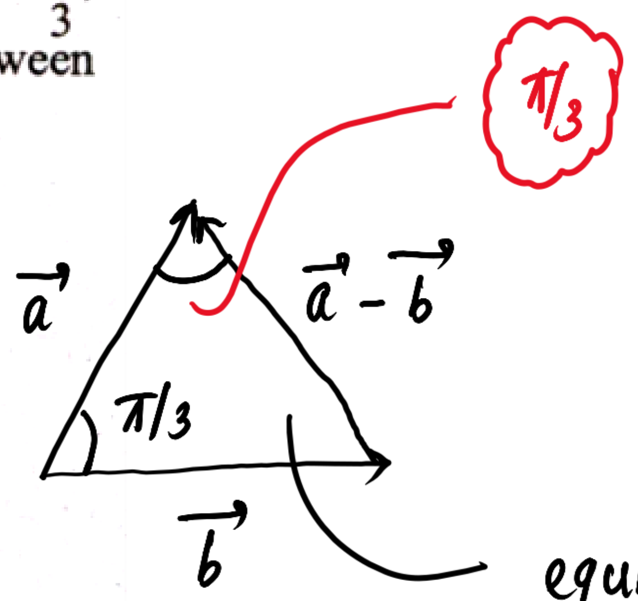
Let $\vec{a}$ and $\vec{b}$ are two vectors of magnitude 4 inclined at an angle $\frac{\pi}{3}$, then what is the angle between $\vec{a}$ and $\vec{a}-\vec{b}$?

(a) $\frac{\pi}{2}$

(b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$

(d) $\frac{\pi}{6}$



$|\vec{a}| = |\vec{b}| = |\vec{a}-\vec{b}| = 4$

equilateral triangle

SSBCrack EXAMS

Let θ be the angle between two unit vectors $\vec{a}$ and $\vec{b}$. If $\vec{a}+2\vec{b}$ is perpendicular to $5\vec{a}-4\vec{b}$, then what is $\cos\theta+\cos 2\theta$ equal to? **(PYQ – 2024 – II)**

(a) 0

(b) 1/2

(c) 1

(d) $\frac{\sqrt{3}+1}{2}$

$\vec{a}+2\vec{b} \perp 5\vec{a}-4\vec{b}$

$(\vec{a}+2\vec{b})\cdot(5\vec{a}-4\vec{b})=0$

$5(\vec{a}\cdot\vec{a})-4(\vec{a}\cdot\vec{b})+10(\vec{b}\cdot\vec{a})-8(\vec{b}\cdot\vec{b})=0$

$5a^2+6\vec{a}\cdot\vec{b}-8b^2=0 \quad =0$

$(\vec{a}\cdot\vec{b}=\vec{b}\cdot\vec{a})$

$-3+6ab\cos\theta=0$

$a=|\vec{a}| \quad b=|\vec{b}|$

$-3+6(1)(1)\cos\theta=0$

$a=b=1$

$$-3 + 6\cos\theta = 0$$

$$\cos\theta = \frac{3}{6} = \frac{1}{2}$$

$$\theta = 60^\circ$$

$$\cos\theta + \cos 2\theta = \cos\theta + \underline{2\cos^2\theta - 1}$$

$$= \frac{1}{2} + 2\left(\frac{1}{2}\right)^2 - 1$$

$$= \frac{-1}{2} + \frac{1}{2} = \boxed{0}$$

Let $ABCDEF$ be a regular hexagon. If $\overrightarrow{AD} = m\,\overrightarrow{BC}$ and $\overrightarrow{CF} = n\,\overrightarrow{AB}$, then what is mn equal to?

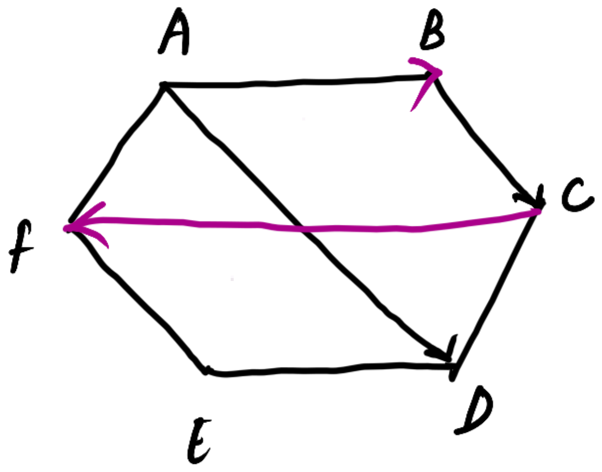
(PYQ – 2024 – II)

(a) –4

(b) –2

(c) 2

(d) 4



$\overrightarrow{AD} = 2\overrightarrow{BC} \Rightarrow m = 2$

$\overrightarrow{CF} = -2\overrightarrow{AB} \Rightarrow n = -2$

$mn = 2 \times -2 = -4$

What is $3\alpha + 2\beta$ equal to if

$$(2\hat{i} + 6\hat{j} + 27\hat{k}) \times (\hat{i} + \alpha\hat{j} + \beta\hat{k})$$

is a null vector?

(a) 36

(b) 33

(c) 30

(d) 27

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 6 & 27 \\ 1 & \alpha & \beta \end{vmatrix} = \hat{i}(6\beta - 27\alpha) - \hat{j}(2\beta - 27) + \hat{k}(2\alpha - 6)$$

$$= 0\hat{i} + 0\hat{j} + 0\hat{k} \text{ (null vector)}$$

$2\beta - 27 = 0$

$\beta = \frac{27}{2}$

$2\alpha - 6 = 0$

$\alpha = 3$

$3\alpha + 2\beta$

$= 9 + 27$

$= 36$

Q) If $\vec{r}_1 = \lambda\hat{i} + 2\hat{j} + \hat{k}$, $\vec{r}_2 = \hat{i} + (2-\lambda)\hat{j} + 2\hat{k}$ are such that $|\vec{r}_1| > |\vec{r}_2|$, then λ satisfies which one of the following?

(a) $\lambda = 0$ only (b) $\lambda = 1$

(c) $\lambda < 1$ (d) $\lambda > 1$

$$|\vec{r}_1| > |\vec{r}_2|$$

$$|\vec{r}_1|^2 > |\vec{r}_2|^2$$

$$\lambda^2 + 2^2 + 1^2 > 1^2 + (2-\lambda)^2 + 2^2$$

$$\lambda^2 > 4 + \lambda^2 - 4\lambda$$

$$0 > 4 - 4\lambda$$

$$4\lambda > 4$$

$$\boxed{\lambda > 1}$$

For a vector,

$$\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$$

$$|\vec{a}| = \sqrt{a_1^2 + a_2^2 + a_3^2}$$

$$|\vec{a}|^2 = a_1^2 + a_2^2 + a_3^2$$

Q) If $\vec{r}_1 = \lambda\hat{i} + 2\hat{j} + \hat{k}$, $\vec{r}_2 = \hat{i} + (2-\lambda)\hat{j} + 2\hat{k}$ are such that $|\vec{r}_1| > |\vec{r}_2|$, then λ satisfies which one of the following?

(a) $\lambda = 0$ only

(b) $\lambda = 1$

(c) $\lambda < 1$

(d) $\lambda > 1$

Ans: (D)

Q) If $|\vec{a}| = 2, |\vec{b}| = 5$ and $|\vec{a} \times \vec{b}| = 8$, then what is the value of $\vec{a} \cdot \vec{b}$?

(a) 4 (b) 6

(c) 8 (d) 10

$|\vec{a}| = a$

$|\vec{b}| = b$

$|\vec{a} \times \vec{b}| = 8$

$ab \sin\theta = 8$

$(2 \times 5) \sin\theta = 8$

$\sin\theta = \frac{8}{10} = \frac{4}{5} \Rightarrow \cos\theta = \frac{3}{5}$

$\vec{a} \cdot \vec{b} = ab\cos\theta$

$= 2 \times 5 \left(\frac{3}{5}\right)$

$= 6$

Q) If $|\vec{a}| = 2, |\vec{b}| = 5$ and $|\vec{a} \times \vec{b}| = 8$, then what is the value of $\vec{a} \cdot \vec{b}$?

(a) 4 (b) 6

(c) 8 (d) 10

Ans: (B)

Q) Let $\vec{a}$ and $\vec{b}$ be two unit vectors and α be the angle between them. If $(\vec{a}+\vec{b})$ is also the unit vectors, then what is the value of α?

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{3}$

(c) $\frac{2\pi}{3}$

(d) $\frac{\pi}{2}$

$$|\vec{a}+\vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 + 2(\vec{a}\cdot\vec{b})$$

$$1^2 = 1^2 + 1^2 + 2(ab\cos\alpha)$$

$$-\frac{1}{2} = 1 \times 1 \times \cos\alpha$$

$$\cos\alpha = -\frac{1}{2}$$

$$\alpha = \pi - \frac{\pi}{3} = \frac{2\pi}{3}$$

Q) Let $\vec{a}$ and $\vec{b}$ be two unit vectors and α be the angle between them. If $(\vec{a}+\vec{b})$ is also the unit vectors, then what is the value of α?

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{3}$

(c) $\frac{2\pi}{3}$

(d) $\frac{\pi}{2}$

Ans: (C)

Q) Which one of the following is the unit vector perpendicular to the vectors $4\hat{i}+2\hat{j}$ and $-3\hat{i}+2\hat{j}$?

(a) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$

(b) $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$

(c) $\hat{k}$

(d) $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$

Let the required unit vector be $x\hat{i}+y\hat{j}+z\hat{k}$.

$(x\hat{i}+y\hat{j}+z\hat{k})\cdot(4\hat{i}+2\hat{j})=0$

$4x+2y=0$ — (1)

$(x\hat{i}+y\hat{j}+z\hat{k})\cdot(-3\hat{i}+2\hat{j})=0$

$-3x+2y=0$ — (2)

$x=0$; $y=0$

As $x\hat{i} + y\hat{j} + z\hat{k}$ is a unit vector,

$$\sqrt{x^2 + y^2 + z^2} = 1$$

$$x^2 + y^2 + z^2 = 1$$

$$0^2 + 0^2 + z^2 = 1$$

$$z = 1 \text{ or } -1$$

Required unit vector is $\hat{k}$ or $-\hat{k}$.

Q) Which one of the following is the unit vector perpendicular to the vectors $4\hat{i}+2\hat{j}$ and $-3\hat{i}+2\hat{j}$?

(a) $\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}$

(b) $\dfrac{\hat{i}-\hat{j}}{\sqrt{2}}$

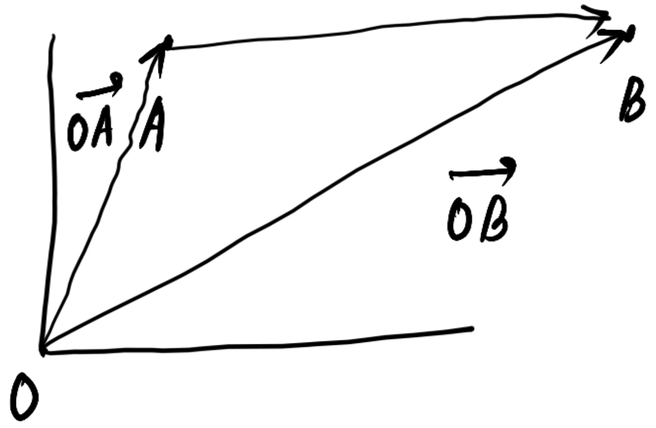
(c) $\hat{k}$

(d) $\dfrac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$

Ans: (C)

Q) A force $\vec{F} = \hat{i} + 3\hat{j} + 2\hat{k}$ acts on a particle to displace it from the point $A(\hat{i} + 2\hat{j} - 3\hat{k})$ to the point $B(3\hat{i} - \hat{j} + 5\hat{k})$. The work done by the force will be

(a) 5 units (b) 7 units (c) 9 units (d) 10 units



Displacement vector, $\vec{d} = \vec{AB} = \vec{OB} - \vec{OA}$

$= (3\hat{i} - \hat{j} + 5\hat{k}) - (\hat{i} + 2\hat{j} - 3\hat{k})$

$= 2\hat{i} - 3\hat{j} + 8\hat{k}$

work done $= \vec{F} \cdot \vec{d}$

$= (\hat{i} + 3\hat{j} + 2\hat{k}) \cdot (2\hat{i} - 3\hat{j} + 8\hat{k}) = 2 - 9 + 16 = 9$

Q) A force $\vec{F} = \hat{i} + 3\hat{j} + 2\hat{k}$ acts on a particle to displace it from the point $A(\hat{i} + 2\hat{j} - 3\hat{k})$ to the point $B(3\hat{i} - \hat{j} + 5\hat{k})$. The work done by the force will be

(a) 5 units (b) 7 units (c) 9 units (d) 10 units

Ans: (c)

Q) If $|\vec{\mathbf{a}}| = 3$, $|\vec{\mathbf{b}}| = 4$ and $|\vec{\mathbf{a}} - \vec{\mathbf{b}}| = 5$, then what is the value of $|\vec{\mathbf{a}} + \vec{\mathbf{b}}|$?

(a) 8 (b) 6 (c) $5\sqrt{2}$ (d) 5

$$|\vec a - \vec b|^2 = |\vec a|^2 + |\vec b|^2 - 2(\vec a \cdot \vec b)$$

$$5^2 = 3^2 + 4^2 - 2(\vec a \cdot \vec b) \Rightarrow -2(\vec a \cdot \vec b) = 0 \text{ or } \vec a \cdot \vec b = 0$$

$$|\vec a + \vec b|^2 = |\vec a|^2 + |\vec b| + 2(\vec a \cdot \vec b)$$

$$|\vec a + \vec b|^2 = 3^2 + 4^2 + 2(0) \Rightarrow |\vec a + \vec b|^2 = 25 \Rightarrow |\vec a + \vec b| = 5$$

Q) If $|\vec{\mathbf{a}}| = 3$, $|\vec{\mathbf{b}}| = 4$ and $|\vec{\mathbf{a}} - \vec{\mathbf{b}}| = 5$, then what is the value of $|\vec{\mathbf{a}} + \vec{\mathbf{b}}|$?

(a) 8 (b) 6 (c) $5\sqrt{2}$ (d) 5

Ans: (d)

Q) If the magnitude of the sum of two non-zero vectors is equal to the magnitude of their difference, then which one of the following is correct?

(a) The vectors are parallel
(b) The vectors are perpendicular ✓
(c) The vectors are anti-parallel
(d) The vectors must be unit vectors

$$|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$$

$$|\vec{a} + \vec{b}|^2 = |\vec{a} - \vec{b}|^2$$

$$a^2 + b^2 + 2(\vec{a} \cdot \vec{b}) = a^2 + b^2 - 2(\vec{a} \cdot \vec{b})$$

$$4(\vec{a} \cdot \vec{b}) = 0$$

$$\vec{a} \cdot \vec{b} = 0 \Rightarrow \vec{a} \perp \vec{b}$$

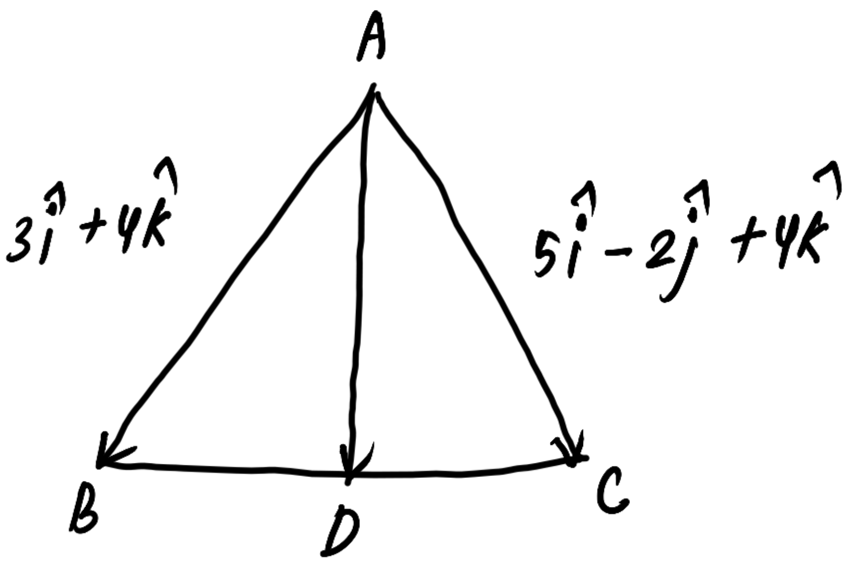
Q) If the magnitude of the sum of two non-zero vectors is equal to the magnitude of their difference, then which one of the following is correct?

(a) The vectors are parallel
(b) The vectors are perpendicular
(c) The vectors are anti-parallel
(d) The vectors must be unit vectors

Ans: (b)

Q) The vectors $\overrightarrow{AB} = 3\hat{i} + 4\hat{k}$ & $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a triangle ABC. The length of the median through A is

(a) $\sqrt{288}$ (b) $\sqrt{18}$ (c) $\sqrt{72}$ (d) $\sqrt{33}$



$$\overrightarrow{AD} = \frac{1}{2}\left(\overrightarrow{AB} + \overrightarrow{AC}\right)$$

$$= \frac{1}{2}\left(3\hat{i} + 4\hat{k} + 5\hat{i} - 2\hat{j} + 4\hat{k}\right)$$

$$= \frac{1}{2}\left(8\hat{i} - 2\hat{j} + 8\hat{k}\right) = 4\hat{i} - \hat{j} + 4\hat{k}$$

$$\overrightarrow{AD} = 4\hat{i} - \hat{j} + 4\hat{k}$$

$$|\overrightarrow{AD}| = \sqrt{4^2 + (-1)^2 + 4^2}$$

$$= \sqrt{33}$$

Q) The vectors $\overrightarrow{AB} = 3\hat{i} + 4\hat{k}$ & $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a triangle ABC. The length of the median through A is

(a) $\sqrt{288}$ (b) $\sqrt{18}$ (c) $\sqrt{72}$ (d) $\sqrt{33}$

Ans: (d)

SSBCrack EXAMS

Q) The volume of the parallelopiped whose sides are given by

$\overrightarrow{OA} = 2i - 2j$, $\overrightarrow{OB} = i + j - k$, $\overrightarrow{OC} = 3i - k$, is

(a) $\frac{4}{13}$ (b) 4

(c) $\frac{2}{7}$ (d) none of these

3 sides of parallelopiped,

$x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$

$x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$

$x_3\hat{i} + y_3\hat{j} + z_3\hat{k}$

$$\text{Volume} = \begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix}$$

$$\begin{vmatrix} 2 & -2 & 0 \\ 1 & 1 & -1 \\ 3 & 0 & -1 \end{vmatrix}$$

$$\begin{vmatrix} 2 & -2 & 0 \\ 1 & 1 & -1 \\ 3 & 0 & -1 \end{vmatrix} = 2(-1) + 2(-1+3) + 0(\;)$$

$$= -2 + 2(2)$$

$$= 2 \text{ cubic units}$$

Q) The volume of the parallelopiped whose sides are given by

$\overrightarrow{OA} = 2i - 2j,\ \overrightarrow{OB} = i + j - k,\ \overrightarrow{OC} = 3i - k,$ is

(a) $\frac{4}{13}$ (b) 4

(c) $\frac{2}{7}$ (d) none of these

Ans: (d)

Q) If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a}+2\vec{b}$ and $5\vec{a}-4\vec{b}$ are perpendicular to each other then the angle between $\vec{a}$ and $\vec{b}$ is

(a) $45°$ (b) $60°$

(c) $\cos^{-1}\left(\frac{1}{3}\right)$ (d) $\cos^{-1}\left(\frac{2}{7}\right)$

(HW)

Q) If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a}+2\vec{b}$ and $5\vec{a}-4\vec{b}$ are perpendicular to each other then the angle between $\vec{a}$ and $\vec{b}$ is

(a) 45°

(b) 60°

(c) $\cos^{-1}\left(\frac{1}{3}\right)$

(d) $\cos^{-1}\left(\frac{2}{7}\right)$

Ans: (b)

Q) Let $\vec{u}, \vec{v}$ and $\vec{w}$ be vectors such that $\vec{u}+\vec{v}+\vec{w}=0$. If $|\vec{u}|=3, |\vec{v}|=4$ and $|\vec{w}|=5$, then $\vec{u}.\vec{v}+\vec{v}.\vec{w}+\vec{w}.\vec{u}$ is

(a) 47 (b) -25 (c) 0 (d) 25

$$|\vec{u}+\vec{v}+\vec{w}|^2 = |\vec{u}|^2+|\vec{v}|^2+|\vec{w}|^2+2(\underbrace{\vec{u}\cdot\vec{v}+\vec{v}\cdot\vec{w}+\vec{w}\cdot\vec{u}}_{A})$$

$$0^2 = 3^2 + 4^2 + 5^2 + 2A$$

$$A = -\frac{50}{2} = -25$$

Q) Let $\vec{u}, \vec{v}$ and $\vec{w}$ be vectors such that $\vec{u} + \vec{v} + \vec{w} = 0$. If $|\vec{u}| = 3, |\vec{v}| = 4$ and $|\vec{w}| = 5$, then $\vec{u}.\vec{v} + \vec{v}.\vec{w} + \vec{w}.\vec{u}$ is

(a) 47 (b) -25 (c) 0 (d) 25

Ans: (b)

Q) If **a** and **b** are unit vectors and θ is the angle between them, then what is $\sin^2\left(\frac{\theta}{2}\right)$ equal to?

(a) $\frac{|a+b|^2}{4}$ (b) $\frac{|a-b|^2}{4}$

(c) $\frac{|a+b|^2}{2}$ (d) $\frac{|a-b|^2}{2}$

$1-\cos\theta = 2\sin^2\frac{\theta}{2}$

$|\vec{a}-\vec{b}|^2 = a^2+b^2-2(\vec{a}\cdot\vec{b})$

$= 1^2+1^2-2(1)(1)\cos\theta$

$|\vec{a}-\vec{b}|^2 = 2(1-\cos\theta)$

$\frac{|\vec{a}-\vec{b}|^2}{2} = 2\sin^2\frac{\theta}{2}$

$\frac{|\vec{a}-\vec{b}|^2}{4} = \sin^2\frac{\theta}{2}$

Q) If **a** and **b** are unit vectors and θ is the angle between them, then what is $\sin^2\left(\frac{\theta}{2}\right)$ equal to?

(a) $\frac{|a + b|^2}{4}$

(b) $\frac{|a - b|^2}{4}$

(c) $\frac{|a + b|^2}{2}$

(d) $\frac{|a - b|^2}{2}$

Ans: (b)

SSBCrack EXAMS

Q) The scalar $\vec{A}.(\vec{B}+\vec{C})\times(\vec{A}+\vec{B}+\vec{C})$ equals :

(a) 0

(b) $[\vec{A}\ \vec{B}\ \vec{C}]+[\vec{B}\ \vec{C}\ \vec{A}]$

(c) $[\vec{A}\ \vec{B}\ \vec{C}]$

(d) None of these

$$\vec{A}\cdot(\vec{B}+\vec{C})\times(\vec{A}+\vec{B}+\vec{C})$$

$$\vec{A}\cdot(\vec{B}\times\vec{A}+\vec{B}\times\vec{B}+\vec{B}\times\vec{C}+\vec{C}\times\vec{A}+\vec{C}\times\vec{B}+\vec{C}\times\vec{C})$$

$$\vec{A}\cdot(\vec{B}\times\vec{A}+0+\vec{B}\times\vec{C}+\vec{C}\times\vec{A}+\vec{C}\times\vec{B}+0)$$

$$\vec{A}\cdot\left(\vec{B}\times\vec{A} + 0 + \vec{B}\times\vec{C} + \vec{C}\times\vec{A} + \vec{C}\times\vec{B} + 0\right)$$

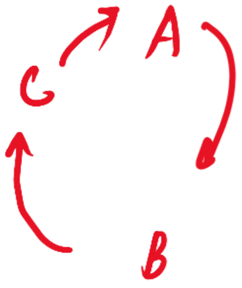
$$\underline{\vec{A}\cdot(\vec{B}\times\vec{A})} + \vec{A}\cdot(\vec{B}\times\vec{C}) + \underline{\vec{A}}\cdot(\vec{C}\times\underline{\vec{A}}) + \vec{A}\cdot(\vec{C}\times\vec{B})$$

$$= 0 + \vec{A}\cdot(\vec{B}\times\vec{C}) + 0 + \vec{A}\cdot(\vec{C}\times\vec{B})$$

$$= \vec{A}\cdot(\vec{B}\times\vec{C}) + \vec{A}\cdot(\vec{C}\times\vec{B})$$

$$= \vec{A}\cdot(\vec{B}\times\vec{C}) - \vec{A}\cdot(\vec{B}\times\vec{C})$$

$$= \boxed{0}$$



$$\left.\begin{array}{l}\vec{A}\cdot(\vec{C}\times\vec{B})\\ \vec{B}\cdot(\vec{A}\times\vec{C})\\ \vec{C}\cdot(\vec{B}\times\vec{A})\end{array}\right] = -\vec{A}\cdot(\vec{B}\times\vec{C})$$

$$\vec{A}\cdot(\vec{B}\times\vec{C})$$

if $\vec{A}=\vec{B}$, or $\vec{B}=\vec{C}$

then $\vec{A}\cdot(\vec{B}\times\vec{C}) = 0$

Q) The scalar $\vec{A}.(\vec{B}+\vec{C})\times(\vec{A}+\vec{B}+\vec{C})$ equals :

(a) 0

(b) $[\vec{A}\ \vec{B}\ \vec{C}]+[\vec{B}\ \vec{C}\ \vec{A}]$

(c) $[\vec{A}\ \vec{B}\ \vec{C}]$

(d) None of these

Ans: (a)

Q) What is the moment about the point $\hat{i}+2\hat{j}+3\hat{k}$, of a force represented by $\hat{i}+\hat{j}+\hat{k}$, acting through the point $-2\hat{i}+3\hat{j}+\hat{k}$?

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

(b) $\hat{i}-\hat{j}+3\hat{k}$

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

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

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(b) $\hat{i}-\hat{j}+3\hat{k}$

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

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

Ans: (d)

Q) If the vectors $-\hat{i}-2x\hat{j}-3y\hat{k}$ and $\hat{i}-3x\hat{j}-2y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y)?

(a) a straight line
(b) an ellipse
(c) a parabola
(d) a circle

Q) If the vectors $-\hat{i}-2x\hat{j}-3y\hat{k}$ and $\hat{i}-3x\hat{j}-2y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y)?

(a) a straight line
(b) an ellipse
(c) a parabola
(d) a circle

Ans: (d)

Q) If the magnitude of $\vec{a} \times \vec{b}$ equals to $\vec{a} . \vec{b}$, then which one of the following is correct?

(a) $\vec{a} = \vec{b}$

(b) The angle between $\vec{a}$ and $\vec{b}$ is 45°

(c) $\vec{a}$ is parallel to $\vec{b}$

(d) $\vec{a}$ is perpendicular to $\vec{b}$

Q) If the magnitude of $\vec{a} \times \vec{b}$ equals to $\vec{a} . \vec{b}$, then which one of the following is correct?

(a) $\vec{a} = \vec{b}$

(b) The angle between $\vec{a}$ and $\vec{b}$ is 45°

(c) $\vec{a}$ is parallel to $\vec{b}$

(d) $\vec{a}$ is perpendicular to $\vec{b}$

Ans: (b)

Q) A force $\vec{F} = 3\hat{i} + 4\hat{j} - 3\hat{k}$ is applied at the point P, whose position vector is $\vec{r} = 2\hat{i} - 2\hat{j} - 3\hat{k}$. What is the magnitude of the moment of the force about the origin?

(a) 23 units
(b) 19 units
(c) 18 units
(d) 21 units

Q) A force $\vec{F} = 3\hat{i} + 4\hat{j} - 3\hat{k}$ is applied at the point P, whose position vector is $\vec{r} = 2\hat{i} - 2\hat{j} - 3\hat{k}$. What is the magnitude of the moment of the force about the origin?

(a) 23 units
(b) 19 units
(c) 18 units
(d) 21 units

Ans: (a)

Q) If two unit vectors $\vec{p}$ and $\vec{q}$ make an angle $\frac{\pi}{3}$ with each other, what is the magnitude of $\vec{p}-\frac{1}{2}\vec{q}$?

(a) 0

(b) $\frac{\sqrt{3}}{2}$

(c) 1

(d) $\frac{1}{\sqrt{2}}$

Q) If two unit vectors $\vec{p}$ and $\vec{q}$ make an angle $\frac{\pi}{3}$ with each other, what is the magnitude of $\vec{p}-\frac{1}{2}\vec{q}$?

(a) 0

(b) $\frac{\sqrt{3}}{2}$

(c) 1

(d) $\frac{1}{\sqrt{2}}$

Ans: (b)

Q) Let $\overline{p}$ and $\vec{q}$ be the position vectors of P and Q respectively, with respect to O and $|\overline{p}| = p, |\overline{q}| = q$. The points R and S divide PQ internally and externally in the ratio 2 : 3 respectively. If OR and OS are perpendicular then

(a) $9q^2 = 4q^2$ (b) $4p^2 = 9q^2$

(c) $9p = 4q$ (d) $4p = 9q$

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Q) Let $\vec{p}$ and $\vec{q}$ be the position vectors of P and Q respectively, with respect to O and $|\vec{p}| = p$, $|\vec{q}| = q$. The points R and S divide PQ internally and externally in the ratio 2 : 3 respectively. If OR and OS are perpendicular then

(a) $9q^2 = 4q^2$ (b) $4p^2 = 9q^2$

(c) $9p = 4q$ (d) $4p = 9q$

Ans: (a)

Q) Let α, β, γ be distinct real numbers. The points with position vectors $\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$, $\beta\hat{i} + \gamma\hat{j} + \alpha\hat{k}$, $\gamma\hat{i} + \alpha\hat{j} + \beta\hat{k}$

(a) are collinear

(b) form an equilateral triangle

(c) form a scalene triangle

(d) form a right angled triangle

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(a) are collinear
(b) form an equilateral triangle
(c) form a scalene triangle
(d) form a right angled triangle

Ans: (b)

Q) What are the values of x for which the two vectors $(x^2-1)\hat{i}+(x+2)\hat{j}+x^2\hat{k}$ and $2\hat{i}-x\hat{j}+3\hat{k}$ are orthogonal?

(a) No real value of x

(b) $x=\frac{1}{2}$ and $x=-1$

(c) $x=-\frac{1}{2}$ and $x=1$

(d) $x=-1$ and $x=2$

Q) What are the values of x for which the two vectors $(x^2-1)\hat{i}+(x+2)\hat{j}+x^2\hat{k}$ and $2\hat{i}-x\hat{j}+3\hat{k}$ are orthogonal?

(a) No real value of x

(b) $x=\frac{1}{2}$ and $x=-1$

(c) $x=-\frac{1}{2}$ and $x=1$

(d) $x=-1$ and $x=2$

Ans: (c)

Q) If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three non coplanar vectors, then

$(\vec{a} + \vec{b} + \vec{c}).\ [(\vec{a} + \vec{b}) \times (\vec{a} + \vec{c})]$ equals

(a) 0

(b) $[\vec{a}\ \vec{b}\ \vec{c}]$

(c) $2\,[\vec{a}\ \vec{b}\ \vec{c}]$

(d) $-[\vec{a}\ \vec{b}\ \vec{c}]$

Q) If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three non coplanar vectors, then

$(\vec{a} + \vec{b} + \vec{c}).\ [(\vec{a} + \vec{b}) \times (\vec{a} + \vec{c})]$ equals

(a) 0

(b) $[\vec{a}\ \vec{b}\ \vec{c}]$

(c) $2\,[\vec{a}\ \vec{b}\ \vec{c}]$

(d) $-[\vec{a}\ \vec{b}\ \vec{c}]$

Ans: (d)

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Q) If the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ form the sides BC, CA and AB respectively of a triangle ABC, then

(a) $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}=0$

(b) $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$

(c) $\vec{a}.\vec{b}=\vec{b}.\vec{c}=\vec{c}.\vec{a}$

(d) $\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}=\vec{0}$

Q) If the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ form the sides BC, CA and AB respectively of a triangle ABC, then

(a) $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} = 0$

(b) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

(c) $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{c} = \vec{c} \cdot \vec{a}$

(d) $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \vec{0}$

Ans: (b)

Q) Let $\vec{a} = \vec{i} - \vec{k}$, $\vec{b} = x\vec{i} + \vec{j} + (1-x)\vec{k}$ and $\vec{c} = y\vec{i} + x\vec{j} + (1+x-y)\vec{k}$. Then $[\vec{a}\,\vec{b}\,\vec{c}]$ depends on

(a) only x

(b) only y

(c) Neither x Nor y

(d) both x and y

Q) Let $\vec{a} = \vec{i} - \vec{k}$, $\vec{b} = x\vec{i} + \vec{j} + (1-x)\vec{k}$ and $\vec{c} = y\vec{i} + x\vec{j} + (1+x-y)\vec{k}$. Then $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ depends on

(a) only x (b) only y

(c) Neither x Nor y (d) both x and y

Ans: (c)

Q) If $\vec{a} = (\hat{i} + \hat{j} + \hat{k}), \vec{a}.\vec{b} = 1$ and $\vec{a} \times \vec{b} = \hat{j} - \hat{k}$, then $\vec{b}$ is

(a) $\hat{i} - \hat{j} + \hat{k}$

(b) $2\hat{j} - \hat{k}$

(c) $\hat{i}$

(d) $2\hat{i}$

Q) If $\vec{a} = (\hat{i} + \hat{j} + \hat{k}), \vec{a}.\vec{b} = 1$ and $\vec{a} \times \vec{b} = \hat{j} - \hat{k}$, then $\vec{b}$ is

(a) $\hat{i} - \hat{j} + \hat{k}$

(b) $2\hat{j} - \hat{k}$

(c) $\hat{i}$

(d) $2\hat{i}$

Ans: (c)

Q) If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle of $30°$ to each other, then which one of the following is correct ?

(a) $|\vec{a}+\vec{b}| > 1$

(b) $1 < |\vec{a}+\vec{b}| < 2$

(c) $|\vec{a}+\vec{b}| = 2$

(d) $|\vec{a}+\vec{b}| > 2$

Q) If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle of $30°$ to each other, then which one of the following is correct ?

(a) $|\vec{a}+\vec{b}| > 1$

(b) $1 < |\vec{a}+\vec{b}| < 2$

(c) $|\vec{a}+\vec{b}| = 2$

(d) $|\vec{a}+\vec{b}| > 2$

Ans: (b)

Q) If $\vec{a}$ is a position vector of a point $(1, -3)$ and A is another point $(-1, 5)$, then what are the coordinates of the point B such that $\overrightarrow{AB} = \vec{a}$?

(a) $(2, 0)$ (b) $(0, 2)$

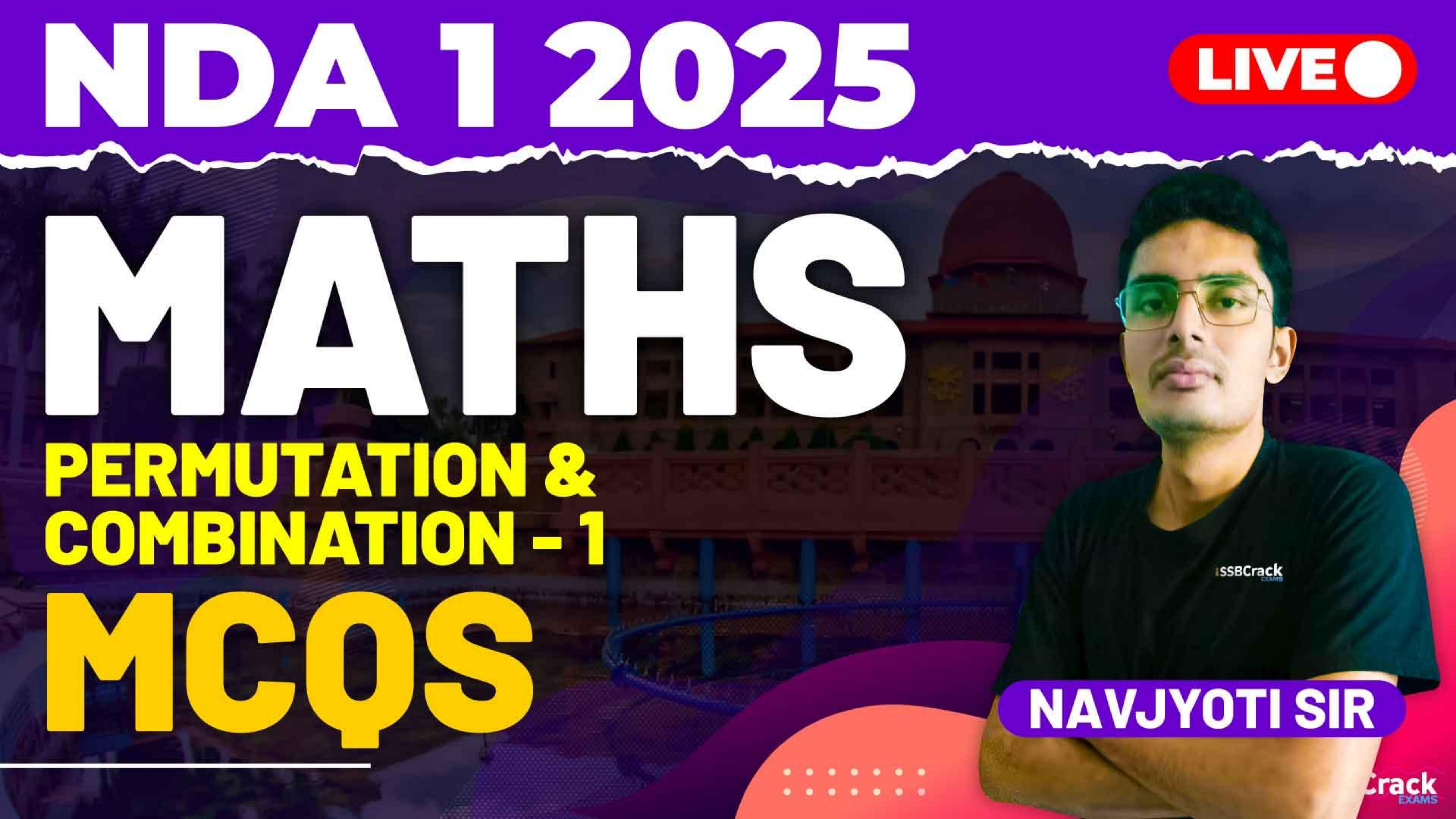
(c) $(-2, 0)$ (d) $(0, -2)$

Q) If $\vec{a}$ is a position vector of a point $(1, -3)$ and A is another point $(-1, 5)$, then what are the coordinates of the point B such that $\overrightarrow{AB} = \vec{a}$?

(a) $(2, 0)$ (b) $(0, 2)$

(c) $(-2, 0)$ (d) $(0, -2)$

Ans: (b)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