NDA 1 2025

LIVE ●

MATHS

VECTOR ALGEBRA

CLASS 3

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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? $\rightarrow 0\hat{i} + 0\hat{j} + 0\hat{k}$

(a) 36 ✓

(b) 33

(c) 30

(d) 27

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

$2\alpha - 6 = 0$

$2\beta - 27 = 0$

$\underline{\alpha = 3}$

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

$$3\alpha + 2\beta = 3(3) + 2\left(\frac{27}{2}\right) = 9 + 27 = \boxed{36}$$

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) $\lambda > 1$ ✓

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

$$|\vec{a}| = \sqrt{x^2+y^2+z^2}$$

$$|\vec{r_1}| > |\vec{r_2}|$$

$$\sqrt{\lambda^2+2^2+1^2} > \sqrt{1^2+(2-\lambda)^2+2^2}$$

$$\sqrt{\lambda^2+5} > \sqrt{9+\lambda^2-4\lambda}$$

$$\lambda^2+5 > \lambda^2-4\lambda+9$$

$$5 > -4\lambda+9$$

$$4\lambda > 4 \longrightarrow \boxed{\lambda > 1}$$

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

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

$$|\vec{a}||\vec{b}| \sin\theta = 8$$

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

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

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

$$= 2 \times 5 \times \frac{3}{5} = \textcircled{6}$$

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

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

$$1^2 = 1^2 + 1^2 + 2\,\vec{a}\cdot\vec{b}$$

$$0 = 1 + 2\,|\vec{a}|\,|\vec{b}|\cos\alpha$$

$$0 = 1 + 2(1)(1)\cos\alpha$$

$$\cos\alpha = \frac{-1}{2} \Rightarrow \alpha = \pi - \frac{\pi}{3} = \underbrace{\frac{2\pi}{3}}$$

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 $\underline{4\hat{i}}+2\hat{j}$ and $\underline{-3\hat{i}}+2\hat{j}$?

(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 $\underline{x\hat{i}+y\hat{j}+z\hat{k}}$

$$\sqrt{x^2+y^2+z^2} = 1 \text{ ——— } ③$$

$$(x\hat{i}+y\hat{j}+z\hat{k}).(4\hat{i}+2\hat{j}) = 4x+2y = 0 \text{ ——— } ①$$

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

$$\left.\begin{aligned} 4x + 2y &= 0 \\ -3x + 2y &= 0 \end{aligned}\right\} \quad x = 0,\ y = 0$$

$$x^2 + y^2 + z^2 = 1 \longrightarrow z^2 = 1 \Rightarrow \boxed{z = \pm 1}$$

Reqd. unit vector $\Rightarrow 0\hat{i} + 0\hat{j} \pm \hat{k} = \underline{\hat{k}}$ or $\underline{-\hat{k}}$

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

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

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

(c) $\hat{\mathbf{k}}$

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

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

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

final − initial

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

$$\text{Work done} = \vec{F}\cdot\vec{d} = (\hat{i} + 3\hat{j} + 2\hat{k})\cdot(2\hat{i} - 3\hat{j} + 8\hat{k})$$

$$= 2 + (3 \times -3) + (2 \times 8) = 2 - 9 + 16 = \boxed{9 \text{ units}}$$

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

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

$$5^2 = 3^2 + 4^2 - 2\,\vec{a}\cdot\vec{b}$$

$$\boxed{\vec{a}\cdot\vec{b} = 0}$$

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

$$= 3^2 + 4^2 = 5^2 = \boxed{25}$$

$$\boxed{|\vec{a} + \vec{b}| = 5}$$

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

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

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

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

$$4\vec{a}\cdot\vec{b} = 0 \Rightarrow \boxed{\vec{a}\cdot\vec{b} = 0} \longrightarrow$$

$\vec{a}$ & $\vec{b}$ are perpendicular

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) $\sqrt{33}$

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

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

$$\sqrt{4^2 + (-1)^2 + (4)^2} = \underbrace{\sqrt{33}}$$

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)

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]

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

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

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

$$[\vec{a}\ \vec{b}\ \vec{c}] = \begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix}$$

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

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 $\overset{\vec{A}}{\underline{\vec{a}+2\vec{b}}}$ and $\underset{\vec{B}}{\underline{5\vec{a}-4\vec{b}}}$ 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) $\cos^{-1}\left(\frac{2}{7}\right)$

$$\vec{A} \perp \vec{B} \Rightarrow \vec{A}\cdot\vec{B} = 0$$

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

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

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

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

$$5a^2 + 10\,\underline{\vec{a}\cdot\vec{b}} - 4\,\vec{a}\cdot\vec{b} - 8b^2 = 0$$

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

$$5(1) - 8(1) + 6ab\cos\theta = 0$$

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

$$\cos\theta = \frac{3}{6} = \frac{1}{2} \Rightarrow \boxed{\theta = 60^\circ}$$

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 $\underline{\vec{u}+\vec{v}+\vec{w}=0}$. 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 $\longrightarrow$ $|\vec{u}+\vec{v}+\vec{w}|=0$

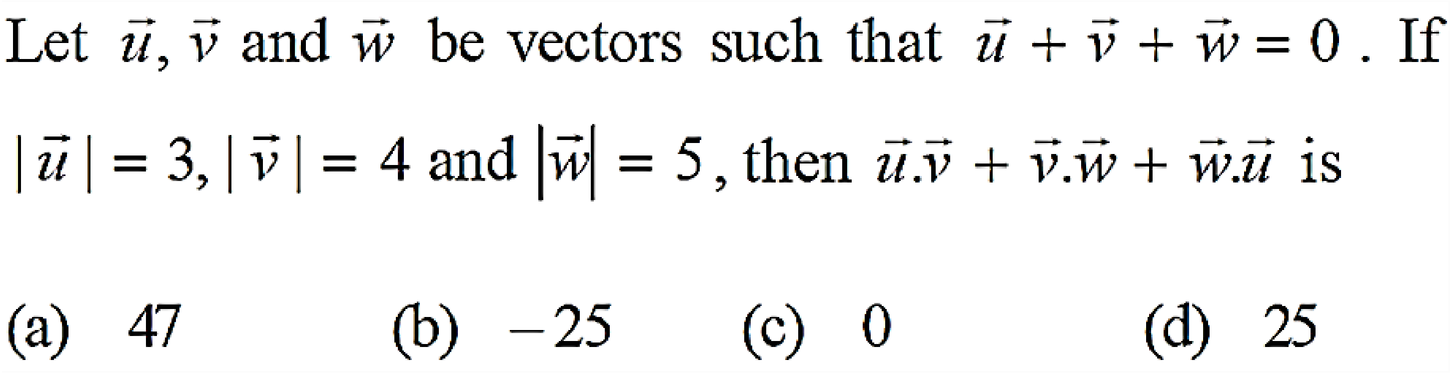
(a) 47 (b) −25 (c) 0 (d) 25

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

$$0^2 = 3^2+4^2+5^2+2(\vec{A})$$

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

$$\boxed{A = -25}$$

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

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

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

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

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

$$= 2\left(2\sin^2\frac{\theta}{2}\right)$$

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

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

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)

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

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

$$\vec{A}\cdot\left[(\vec{B}\times\vec{A})+\underline{(\vec{B}\times\vec{B})}+(\vec{B}\times\vec{C})+(\vec{C}\times\vec{A})+(\vec{C}\times\vec{B})+(\underline{\vec{C}\times\vec{C}})\right]$$

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

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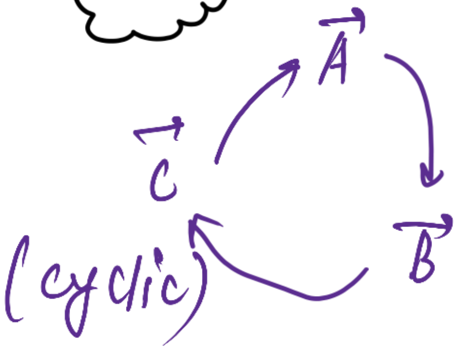
$$= \underline{\vec{A}\cdot(\vec{B}\times\vec{A})} + \vec{A}\cdot(\vec{B}\times\vec{C}) + \underline{\vec{A}\cdot(\vec{C}\times\vec{A})} + \vec{A}\cdot(\vec{C}\times\vec{B})$$

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

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

$$= \boxed{0}$$



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

Two vectors are the same in $\vec{A}\cdot(\vec{B}\times\vec{C})$, 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) $2\hat{i}+\hat{j}+2\hat{k}$

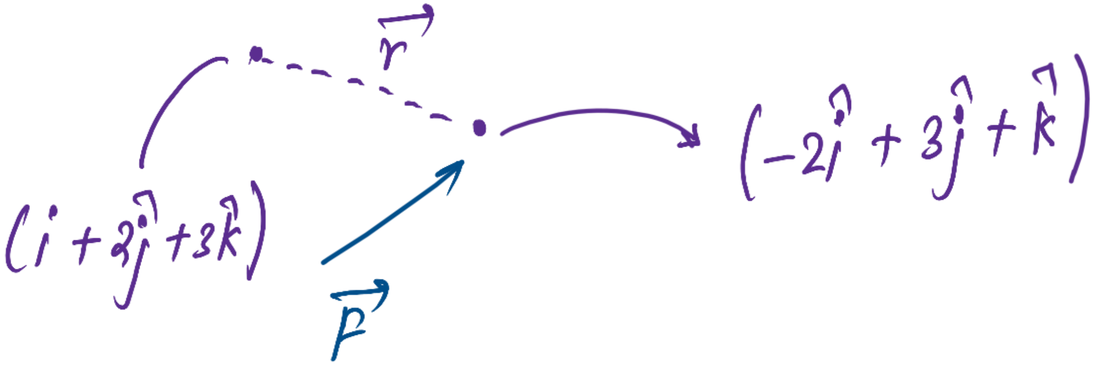
(b) $\hat{i}-\hat{j}+3\hat{k}$

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

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

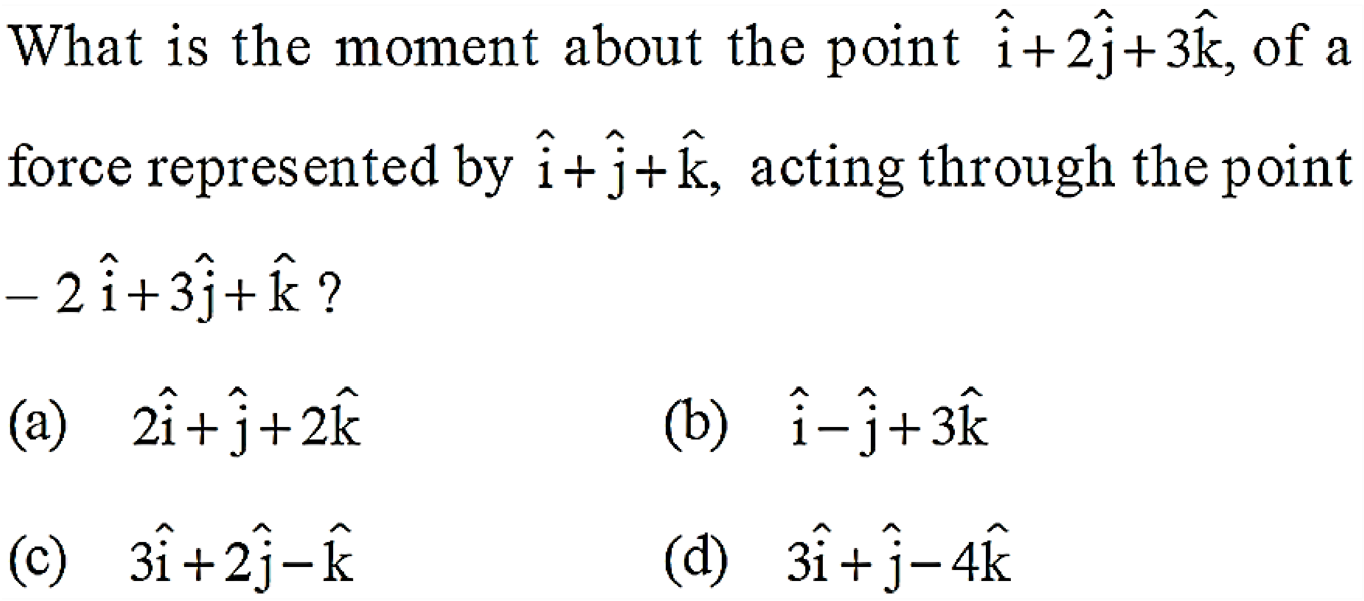
$$\vec{r} = (-2\hat{i}+3\hat{j}+\hat{k}) - (\hat{i}+2\hat{j}+3\hat{k})$$

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



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

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



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

Ans: (d)

Q) If the vectors $\overset{\vec{a}}{-\hat{i}-2x\hat{j}-3y\hat{k}}$ and $\overset{\vec{b}}{\hat{i}-3x\hat{j}-2y\hat{k}}$ 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

Orthogonal $\Rightarrow \boxed{\vec{a}\cdot\vec{b}=0}$

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

$$-1+6x^2+6y^2=0$$

$$\boxed{x^2+y^2=\frac{1}{6}}$$

of form, $\underbrace{(x-0)^2+(y-0)^2=r^2}$ (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 $\vec{b}$

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

$$ab \sin\theta = ab \cos\theta$$

$$\tan\theta = 1$$

$$\boxed{\theta = 45^\circ}$$

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 $\vec{r} = \widehat{2i} - 2\hat{j} - 3\hat{k}$. 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 $\vec{r} = \widehat{2i} - 2\hat{j} - 3\hat{k}$. 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) $\frac{1}{\sqrt{2}}$

$$\left|\vec{p} - \frac{1}{2}\vec{q}\right|^2 = p^2 + \frac{1}{4}q^2 - 2(\vec{p})\cdot\left(\frac{1}{2}\vec{q}\right)$$

$$= 1 + \frac{1}{4} - \frac{2}{2}(1)(1)\cos\frac{\pi}{3}$$

$$= \frac{5}{4} - \frac{1}{2} = \frac{3}{4}$$

$$\left|p - \frac{1}{2}\vec{q}\right| = \frac{\sqrt{3}}{2}$$

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 $\overrightarrow{p}$ and $\vec{q}$ be the position vectors of P and Q respectively, with respect to O and $|\overrightarrow{p}| = p, |\overrightarrow{q}| = q$. 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) $4p = 9q$

Q) Let $\overline{p}$ 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

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

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 $x=2$

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

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

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

Ans: (d)

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

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

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

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

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

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

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

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

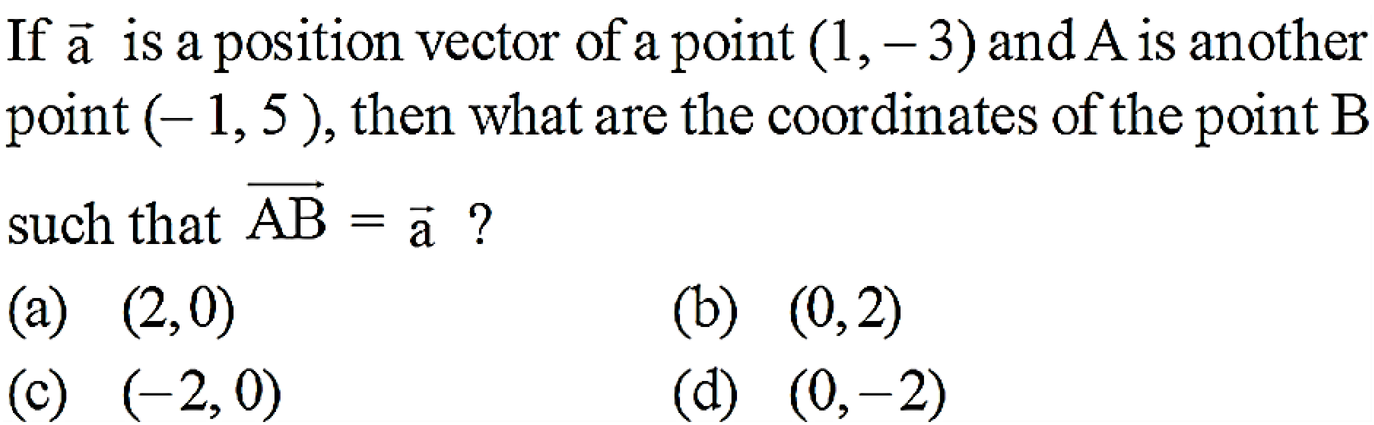
(b) $1<|\vec{a}+\vec{b}|<2$

(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) $(0, -2)$

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(a) $(2, 0)$

(b) $(0, 2)$

(c) $(-2, 0)$

(d) $(0, -2)$

Ans: (b)

NDA 1 2025

LIVE

MATHS

BINOMIAL THEOREM

CLASS 1

NAVJYOTI SIR