

JEE MAIN VECTOR ALGEBRA — PYQS

Max. Marks: 340

Questions: 85

Section A (MCQ) — 68 questions

- Q.1** Let $\vec{a} = 4\hat{i} - \hat{j} + 3\hat{k}$, $\vec{b} = 10\hat{i} + 2\hat{j} - \hat{k}$ and a vector $\vec{c}$ be such that $2(\vec{a} \times \vec{b}) + 3(\vec{b} \times \vec{c}) = \vec{0}$. If $\vec{a} \cdot \vec{c} = 15$, then $\vec{c} \cdot (\hat{i} + \hat{j} - 3\hat{k})$ is equal to :

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) -6 (2) -5 (3) -4 (4) -3

Scan or tap for the full solution 

- Q.2** Let $\vec{a} = 2\hat{i} + 3\hat{j} + 3\hat{k}$ and $\vec{b} = 6\hat{i} + 3\hat{j} + 3\hat{k}$. Then the square of the area of the triangle with adjacent sides determined by the vectors $(2\vec{a} + 3\vec{b})$ and $(\vec{a} - \vec{b})$ is :

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) 450 (2) 900 (3) 1800 (4) 2400

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- Q.3** Let $\vec{a} = \sqrt{7}\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{j} + 2\hat{k}$. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} + \vec{a} \times \vec{b} = \vec{0}$ and $\vec{r} \cdot \vec{a} = 0$, then $|3\vec{r}|^2$ is equal to:

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) 44 (2) 54 (3) 86 (4) 132

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- Q.4** Let O be the origin, $\vec{OP} = \vec{a}$ and $\vec{OQ} = \vec{b}$. If R is the point on $\vec{OP}$ such that $\vec{OP} = 5\vec{OR}$, and M is the point such that $\vec{OQ} = 5\vec{RM}$, then $\vec{PM}$ is equal to :

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) $\frac{1}{5}(\vec{a} - 4\vec{b})$ (2) $\frac{1}{5}(\vec{b} - 4\vec{a})$
(3) $\frac{1}{5}(-\vec{a} + 4\vec{b})$ (4) $\frac{1}{5}(-\vec{b} + 4\vec{a})$

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- Q.5** Let $\hat{u}$ and $\hat{v}$ be unit vectors inclined at an acute angle such that $\hat{u} \times \hat{v} = \frac{\sqrt{3}}{2}$. If $\vec{A} = \lambda\hat{u} + \hat{v} + (\hat{u} \times \hat{v})$, then λ is equal to :

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) $\frac{4}{3}(\vec{A} \cdot \hat{u}) - \frac{2}{3}(\vec{A} \cdot \hat{v})$ (2) $\frac{2}{3}(\vec{A} \cdot \hat{u}) - \frac{1}{3}(\vec{A} \cdot \hat{v})$

(3) $\frac{4}{3}(\vec{A} \cdot \hat{u}) + \frac{2}{3}(\vec{A} \cdot \hat{v})$ (4) $(\vec{A} \cdot \hat{u}) - \frac{1}{2}(\vec{A} \cdot \hat{v})$

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- Q.6** If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}| = 2$ and $|\vec{b}| = 3$, then the maximum value of $3|(3\vec{a} + 2\vec{b})| + 4|(3\vec{a} - 2\vec{b})|$ is :

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) 30 (2) 36 (3) 60 (4) 72

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- Q.7** Let the vectors $\vec{a} = -\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$. For some $\lambda, \mu \in \mathbb{R}$, let $\vec{c} = \lambda\vec{a} + \mu\vec{b}$.

If $\vec{c} \cdot (3\hat{i} - 6\hat{j} + 2\hat{k}) = 10$ and $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k}) = -2$, then $|\vec{c}|^2$ is equal to :

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 8 (2) 12 (3) 14 (4) 15

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- Q.8** Two adjacent sides of a parallelogram PQRS are given by $\vec{PQ} = \hat{j} + \hat{k}$ and $\vec{PS} = \hat{i} - \hat{j}$. If the side PS is rotated about the point P by an acute angle α in the plane of the parallelogram so that it becomes perpendicular to the side PQ, then

$\sin^2\left(\frac{5\alpha}{2}\right) - \sin^2\left(\frac{\alpha}{2}\right)$ is equal to:

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $\frac{1}{2}$ (2) $\frac{\sqrt{3}}{2}$ (3) $\frac{\sqrt{3}}{4}$ (4) $\frac{2\sqrt{3}}{5}$

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- Q.9** For three unit vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ satisfying $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2 = 9$ and $|2\vec{a} + k\vec{b} + k\vec{c}| = 3$, the positive value of k is :

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) 4 (2) 5 (3) 6 (4) 3

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- Q.10** Let P be a point in the plane of the vectors $\vec{AB} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{AC} = \hat{i} - \hat{j} + 3\hat{k}$ such that P is equidistant from the lines AB and AC. If $|\vec{AP}| = \frac{\sqrt{5}}{2}$, then the area of the triangle ABP is :

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1) $\frac{3}{2}$ (2) $\frac{\sqrt{30}}{4}$ (3) $\frac{\sqrt{26}}{4}$ (4) 2

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- Q.11** Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$, $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \vec{a} \times \vec{b}$. Let $\vec{d}$ be a vector such that $|\vec{d} - \vec{a}| = \sqrt{11}$, $|\vec{c} \times \vec{d}| = 3$ and the angle between $\vec{c}$ and $\vec{d}$ is $\frac{\pi}{4}$. Then $\vec{a} \cdot \vec{d}$ is equal to

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) 0 (2) 1 (3) 3 (4) 11

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- Q.12** Let $\vec{a} = 2\hat{i} - \hat{j} - \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} + \hat{j} + 3\hat{k}$. Let $\vec{v} = \vec{a} + \lambda\vec{b}$, $\lambda \in \mathbb{R}$, be the vector in the plane of the vectors $\vec{a}$ and $\vec{b}$, such that the length of its projection on the vector $\vec{c}$ is $\frac{1}{\sqrt{14}}$. Then $|\vec{v}|$ is equal to

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) $\frac{\sqrt{35}}{2}$ (2) 13 (3) $\frac{\sqrt{21}}{2}$ (4) 7

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- Q.13** Let $\vec{a} = 2\hat{i} - 5\hat{j} + 5\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + 3\hat{k}$. If $\vec{c}$ is a vector such that $2(\vec{a} \times \vec{c}) + 3(\vec{b} \times \vec{c}) = \vec{0}$ and $(\vec{a} - \vec{b}) \cdot \vec{c} = -97$, then $|\vec{c} \times \hat{k}|^2$ is equal to

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) 193 (2) 205 (3) 218 (4) 233

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- Q.14** Let $\vec{a} = -\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} - \hat{j} - 3\hat{k}$, $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{d} = \vec{c} \times \vec{a}$. Then $(\vec{a} - \vec{b}) \cdot \vec{d}$ is equal to :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 2 (2) -2 (3) 4 (4) -4

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- Q.15** Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three vectors such that $\vec{a} \times \vec{b} = 2(\vec{a} \times \vec{c})$. If $|\vec{a}| = 1$, $|\vec{b}| = 4$, $|\vec{c}| = 2$, and the angle between $\vec{b}$ and $\vec{c}$ is 60° , then $|\vec{a} \cdot \vec{c}|$ is equal to

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) 2 (2) 0 (3) 1 (4) 4

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- Q.16** Let $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$, $\vec{c} = \lambda\hat{i} + \hat{j} + \hat{k}$ and $\vec{v} = \vec{a} \times \vec{b}$. If $\vec{v} \cdot \vec{c} = 11$ and the length of the projection of $\vec{b}$ on $\vec{c}$ is p, then $9p^2$ is equal to

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) 9 (2) 6 (3) 4 (4) 12

Scan or tap for the full solution



- Q.17** Let $\vec{AB} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{AD} = \hat{i} + 2\hat{j} + \lambda\hat{k}$, $\lambda \in \mathbb{R}$. Let the projection of the vector $\vec{v} = \hat{i} + \hat{j} + \hat{k}$ on the diagonal $\vec{AC}$ of the parallelogram ABCD be of length one unit. If α, β , where $\alpha > \beta$, be the roots of the equation $\lambda^2 x^2 - 6\lambda x + 5 = 0$, then $2\alpha - \beta$ is equal to

[JEE Main 2026 (Online) 22nd January Morning Shift]

- (1) 3 (2) 6 (3) 4 (4) 1

Scan or tap for the full solution



- Q.18** Let $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \lambda\hat{j} + 2\hat{k}$, $\lambda \in \mathbb{Z}$ be two vectors. Let $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{d}$ be a vector of magnitude 2 in yz-plane. If $|\vec{c}| = \sqrt{53}$, then the maximum possible value of $(\vec{c} \cdot \vec{d})^2$ is equal to :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) 52 (2) 26 (3) 104 (4) 208

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- Q.19** Let $\vec{a} = -\hat{i} + 2\hat{j} + 2\hat{k}$, $\vec{b} = 8\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} \times \vec{c} = \vec{b}$. If $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k}) = 4$, then $|\vec{a} + \vec{c}|^2$ is equal to :

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 30 (2) 33 (3) 27 (4) 35

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- Q.20** Let $\vec{c}$ and $\vec{d}$ be vectors such that $|\vec{c} + \vec{d}| = \sqrt{29}$ and $\vec{c} \times (2\hat{i} + 3\hat{j} + 4\hat{k}) = (2\hat{i} + 3\hat{j} + 4\hat{k}) \times \vec{d}$. If λ_1, λ_2 ($\lambda_1 > \lambda_2$) are the possible values of $(\vec{c} + \vec{d}) \cdot (-7\hat{i} + 2\hat{j} + 3\hat{k})$, then the equation

$K^2 x^2 + (K^2 - 5K + \lambda_1)xy + \left(3K + \frac{\lambda_2}{2}\right)y^2 - 8x + 12y + \lambda_2 = 0$ represents a circle, for K equal to :

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 4 (2) -1 (3) 2 (4) 1

Scan or tap for the full solution



Q.21 For a triangle ABC, let $\vec{p} = \vec{BC}$, $\vec{q} = \vec{CA}$ and $\vec{r} = \vec{BA}$.

If $|\vec{p}| = 2\sqrt{3}$, $|\vec{q}| = 2$ and $\cos \theta = \frac{1}{\sqrt{3}}$, where θ is the

angle between $\vec{p}$ and $\vec{q}$, then $|\vec{p} \times (\vec{q} - 3\vec{r})|^2 + 3|\vec{r}|^2$ is equal to :

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) 200 (2) 220 (3) 410 (4) 340

Scan or tap for the full solution



Q.22 Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$. Let $\vec{c}$ be a unit vector in the plane of the vectors $\vec{a}$ and $\vec{b}$ and be perpendicular to $\vec{a}$. Then such a vector $\vec{c}$ is:

[JEE Main 2025 (Online) 8th April Evening Shift]

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

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Q.23 Let the angle θ , $0 < \theta < \frac{\pi}{2}$ between two unit vectors

$\hat{a}$ and $\hat{b}$ be $\sin^{-1}\left(\frac{\sqrt{65}}{9}\right)$. If the vector

$\vec{c} = 3\hat{a} + 6\hat{b} + 9(\hat{a} \times \hat{b})$, then the value of

$9(\vec{c} \cdot \hat{a}) - 3(\vec{c} \cdot \hat{b})$ is

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) 31 (2) 29 (3) 24 (4) 27

Scan or tap for the full solution



Q.24 Let $\vec{a}$ and $\vec{b}$ be the vectors of the same magnitude

such that $\frac{|\vec{a} + \vec{b}| + |\vec{a} - \vec{b}|}{|\vec{a} + \vec{b}| - |\vec{a} - \vec{b}|} = \sqrt{2} + 1$. Then $\frac{|\vec{a} + \vec{b}|^2}{|\vec{a}|^2}$ is :

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) $2 + \sqrt{2}$ (2) $2 + 4\sqrt{2}$
 (3) $4 + 2\sqrt{2}$ (4) $1 + \sqrt{2}$

Scan or tap for the full solution



Q.25 Consider two vectors $\vec{u} = 3\hat{i} - \hat{j}$ and

$\vec{v} = 2\hat{i} + \hat{j} - \lambda\hat{k}$, $\lambda > 0$. The angle between them is

given by $\cos^{-1}\left(\frac{\sqrt{5}}{2\sqrt{7}}\right)$. Let $\vec{v} = \vec{v}_1 + \vec{v}_2$, where $\vec{v}_1$

is parallel to $\vec{u}$ and $\vec{v}_2$ is perpendicular to $\vec{u}$. Then

the value of $|\vec{v}_1|^2 + |\vec{v}_2|^2$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\frac{23}{2}$ (2) $\frac{25}{2}$ (3) 10 (4) 14

Scan or tap for the full solution



Q.26 Let ABCD be a tetrahedron such that the edges AB, AC and AD are mutually perpendicular. Let the areas of the triangles ABC, ACD and ADB be 5, 6 and 7 square units respectively. Then the area (in square units) of the $\triangle BCD$ is equal to :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) $\sqrt{110}$ (2) 12
 (3) $\sqrt{340}$ (4) $7\sqrt{3}$

Scan or tap for the full solution



Q.27 If $\vec{a}$ is a nonzero vector such that its projections on the vectors $2\hat{i} - \hat{j} + 2\hat{k}$, $\hat{i} + 2\hat{j} - 2\hat{k}$ and $\hat{k}$ are equal, then a unit vector along $\vec{a}$ is :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) $\frac{1}{\sqrt{155}}(-7\hat{i} + 9\hat{j} + 5\hat{k})$
 (2) $\frac{1}{\sqrt{155}}(-7\hat{i} + 9\hat{j} - 5\hat{k})$
 (3) $\frac{1}{\sqrt{155}}(7\hat{i} + 9\hat{j} - 5\hat{k})$
 (4) $\frac{1}{\sqrt{155}}(7\hat{i} + 9\hat{j} + 5\hat{k})$

Scan or tap for the full solution



Q.28 Let $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and a vector $\vec{c}$ be such that $(\vec{a} - \vec{c}) \times \vec{b} = -18\hat{i} - 3\hat{j} + 12\hat{k}$ and $\vec{a} \cdot \vec{c} = 3$. If $\vec{b} \times \vec{c} = \vec{d}$, then $|\vec{a} \cdot \vec{d}|$ is equal to :

[JEE Main 2025 (Online) 2nd April Evening Shift]

- (1) 15 (2) 18 (3) 12 (4) 9

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Q.29 Let $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} - 5\hat{j} + \hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} \times \vec{c} = \vec{c} \times \vec{b}$ and $(\vec{a} + \vec{c}) \cdot (\vec{b} + \vec{c}) = 168$. Then the maximum value of $|\vec{c}|^2$ is :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) 77 (2) 154 (3) 308 (4) 462

Scan or tap for the full solution



- Q.30** Let $\hat{a}$ be a unit vector perpendicular to the vectors $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{c} = 2\hat{i} + 3\hat{j} - \hat{k}$, and $\hat{a}$ makes an angle of $\cos^{-1}\left(-\frac{1}{3}\right)$ with the vector $\hat{i} + \hat{j} + \hat{k}$. If $\hat{a}$ makes an angle of $\frac{\pi}{3}$ with the vector $\hat{i} + \alpha\hat{j} + \hat{k}$, then the value of α is:

[JEE Main 2025 (Online) 29th January Evening Shift]

- (1) $\sqrt{3}$ (2) $\sqrt{6}$ (3) $-\sqrt{6}$ (4) $-\sqrt{3}$

Scan or tap for the full solution



- Q.31** If the components of $\vec{a} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$ along and perpendicular to $\vec{b} = 3\hat{i} + \hat{j} - \hat{k}$ respectively, are $\frac{16}{11}(3\hat{i} + \hat{j} - \hat{k})$ and $\frac{1}{11}(-4\hat{i} - 5\hat{j} - 17\hat{k})$, then $\alpha^2 + \beta^2 + \gamma^2$ is equal to:

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) 16 (2) 23 (3) 26 (4) 18

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- Q.32** Let A, B, C be three points in xy-plane, whose position vectors are given by $\sqrt{3}\hat{i} + \hat{j}$, $\hat{i} + \sqrt{3}\hat{j}$ and $a\hat{i} + (1-a)\hat{j}$ respectively with respect to the origin O. If the distance of the point C from the line bisecting the angle between the vectors $\vec{OA}$ and $\vec{OB}$ is $\frac{9}{\sqrt{2}}$, then the sum of all the possible values of a is:

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) 2 (2) 0 (3) $\frac{9}{2}$ (4) 1

Scan or tap for the full solution



- Q.33** Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{c}$ be three vectors such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}$. If the vector $\vec{c}$ is perpendicular to $\vec{b}$ and $\vec{a} \cdot \vec{c} = 5$, then $|\vec{c}|$ is equal to

[JEE Main 2025 (Online) 24th January Morning Shift]

- (1) $\sqrt{\frac{11}{6}}$ (2) $\frac{1}{3\sqrt{2}}$ (3) 18 (4) 16

Scan or tap for the full solution



- Q.34** Let the position vectors of three vertices of a triangle be $4\vec{p} + \vec{q} - 3\vec{r}$, $-5\vec{p} + \vec{q} + 2\vec{r}$ and $2\vec{p} - \vec{q} + 2\vec{r}$. If the position vectors of the orthocenter and the circumcenter of the triangle are $\frac{\vec{p} + \vec{q} + \vec{r}}{4}$ and $\alpha\vec{p} + \beta\vec{q} + \gamma\vec{r}$ respectively, then $\alpha + 2\beta + 5\gamma$ is equal to:

[JEE Main 2025 (Online) 24th January Evening Shift]

- (1) 4 (2) 3 (3) 1 (4) 6

Scan or tap for the full solution



- Q.35** Let $\vec{a} = 3\hat{i} - \hat{j} + 2\hat{k}$, $\vec{b} = \vec{a} \times (\hat{i} - 2\hat{k})$ and $\vec{c} = \vec{b} \times \hat{k}$. Then the projection of $\vec{c} - 2\hat{j}$ on $\vec{a}$ is:

[JEE Main 2025 (Online) 24th January Evening Shift]

- (1) $2\sqrt{7}$ (2) $3\sqrt{7}$ (3) $\sqrt{14}$ (4) $2\sqrt{14}$

Scan or tap for the full solution



- Q.36** Let the position vectors of the vertices A, B and C of a tetrahedron ABCD be $\hat{i} + 2\hat{j} + \hat{k}$, $\hat{i} + 3\hat{j} - 2\hat{k}$ and $2\hat{i} + \hat{j} - \hat{k}$ respectively. The altitude from the vertex D to the opposite face ABC meets the median line segment through A of the triangle ABC at the point E. If the length of AD is $\frac{\sqrt{110}}{3}$ and the volume of the tetrahedron is $\frac{\sqrt{805}}{6\sqrt{2}}$, then the position vector of E is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\frac{1}{6}(7\hat{i} + 12\hat{j} + \hat{k})$ (2) $\frac{1}{12}(7\hat{i} + 4\hat{j} + 3\hat{k})$
(3) $\frac{1}{6}(12\hat{i} + 12\hat{j} + \hat{k})$ (4) $\frac{1}{2}(\hat{i} + 4\hat{j} + 7\hat{k})$

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- Q.37** Let the arc AC of a circle subtend a right angle at the centre O. If the point B on the arc AC, divides the arc AC such that $\frac{\text{length of arc AB}}{\text{length of arc BC}} = \frac{1}{5}$, and $\vec{OC} = \alpha\vec{OA} + \beta\vec{OB}$, then $\alpha + \sqrt{2}(\sqrt{3} - 1)\beta$ is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $2\sqrt{3}$ (2) $5\sqrt{3}$
(3) $2 + \sqrt{3}$ (4) $2 - \sqrt{3}$

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- Q.38** Let the point A divide the line segment joining the points P(-1, -1, 2) and Q(5, 5, 10) internally in the ratio r:1 ($r > 0$). If O is the origin and $(\vec{OQ} \cdot \vec{OA}) - \frac{1}{5}|\vec{OP} \times \vec{OA}|^2 = 10$, then the value of r is:

[JEE Main 2025 (Online) 23rd January Evening Shift]

- (1) $\sqrt{7}$ (2) 14 (3) 7 (4) 3

Scan or tap for the full solution



Q.39 Let $\vec{a}$ and $\vec{b}$ be two unit vectors such that the angle between them is $\frac{\pi}{3}$. If $\lambda\vec{a} + 2\vec{b}$ and $3\vec{a} - \lambda\vec{b}$ are perpendicular to each other, then the number of values of λ in $[-1, 3]$ is :

[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1) 1 (2) 3 (3) 2 (4) 0

Scan or tap for the full solution 

Q.40 Let three vectors $\vec{a} = \alpha\hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 5\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{c} = x\hat{i} + y\hat{j} + z\hat{k}$ form a triangle such that $\vec{c} = \vec{a} - \vec{b}$ and the area of the triangle is $5\sqrt{6}$. If α is a positive real number, then $|\vec{c}|^2$ is equal to:

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1) 14 (2) 12 (3) 16 (4) 10

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Q.41 Let $\vec{OA} = 2\vec{a}$, $\vec{OB} = 6\vec{a} + 5\vec{b}$ and $\vec{OC} = 3\vec{b}$, where O is the origin. If the area of the parallelogram with adjacent sides $\vec{OA}$ and $\vec{OC}$ is 15 sq. units, then the area (in sq. units) of the quadrilateral OABC is equal to:

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1) 32 (2) 38 (3) 35 (4) 40

Scan or tap for the full solution 

Q.42 Between the following two statements:

Statement-I: Let $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$.

Then the vector $\vec{r}$ satisfying $\vec{a} \times \vec{r} = \vec{a} \times \vec{b}$ and $\vec{a} \cdot \vec{r} = 0$ is of magnitude $\sqrt{10}$.

Statement-II: In a triangle ABC, $\cos 2A + \cos 2B + \cos 2C \geq -\frac{3}{2}$.

[JEE Main 2024 (Online) 9th April Evening Shift]

- (1) Both Statement-I and Statement-II are correct.
(2) Both Statement-I and Statement-II are incorrect.
(3) Statement-I is correct but Statement-II is incorrect.
(4) Statement-I is incorrect but Statement-II is correct.

Scan or tap for the full solution 

Q.43 Let $\vec{a} = 2\hat{i} + \alpha\hat{j} + \hat{k}$, $\vec{b} = -\hat{i} + \hat{k}$, $\vec{c} = \beta\hat{j} - \hat{k}$, where α and β are integers and $\alpha\beta = -6$. Let the values of the ordered pair (α, β) , for which the area of the parallelogram of diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$ is $\frac{\sqrt{21}}{2}$, be (α_1, β_1) and (α_2, β_2) . Then $\alpha_1^2 + \beta_1^2 - \alpha_2\beta_2$ is equal to

[JEE Main 2024 (Online) 9th April Evening Shift]

- (1) 21 (2) 24 (3) 19 (4) 17

Scan or tap for the full solution 

Q.44 The set of all α , for which the vectors $\vec{a} = \alpha\hat{i} + 6\hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} - 2\alpha\hat{k}$ are inclined at an obtuse angle for all $t \in \mathbb{R}$, is

[JEE Main 2024 (Online) 8th April Morning Shift]

- (1) $[0, 1)$ (2) $\left(-\frac{4}{3}, 0\right]$
(3) $(-2, 0]$ (4) $\left(-\frac{4}{3}, 1\right)$

Scan or tap for the full solution 

Q.45 Let $\vec{a} = 4\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = 11\hat{i} - \hat{j} + \hat{k}$ and $\vec{c}$ be a vector such that $(\vec{a} + \vec{b}) \times \vec{c} = \vec{c} \times (-2\vec{a} + 3\vec{b})$. If $(2\vec{a} + 3\vec{b}) \cdot \vec{c} = 1670$, then $|\vec{c}|^2$ is equal to:

[JEE Main 2024 (Online) 8th April Evening Shift]

- (1) 1600 (2) 1618 (3) 1627 (4) 1609

Scan or tap for the full solution 

Q.46 Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + \lambda\hat{k}$ be three vectors. Let $\vec{r}$ be a unit vector along $\vec{b} + \vec{c}$. If $\vec{r} \cdot \vec{a} = 3$, then 3λ is equal to:

[JEE Main 2024 (Online) 8th April Evening Shift]

- (1) 21 (2) 25 (3) 27 (4) 30

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Q.47 If $A(3, 1, -1)$, $B\left(\frac{5}{3}, \frac{7}{3}, \frac{1}{3}\right)$, $C(2, 2, 1)$ and $D\left(\frac{10}{3}, \frac{2}{3}, \frac{-1}{3}\right)$ are the vertices of a quadrilateral ABCD, then its area is

[JEE Main 2024 (Online) 6th April Morning Shift]

- (1) $\frac{4\sqrt{2}}{3}$ (2) $\frac{2\sqrt{2}}{3}$ (3) $\frac{5\sqrt{2}}{3}$ (4) $2\sqrt{2}$

Scan or tap for the full solution 

Q.48 Let $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$, $\vec{b} = ((\vec{a} \times (\hat{i} + \hat{j})) \times \hat{i}) \times \hat{i}$. Then the square of the projection of $\vec{a}$ on $\vec{b}$ is:

[JEE Main 2024 (Online) 6th April Evening Shift]

- (1) $\frac{1}{3}$ (2) $\frac{1}{5}$ (3) 2 (4) $\frac{2}{3}$

Scan or tap for the full solution 

Q.49 Let $\vec{a} = 6\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $|\vec{c}| \geq 6$, $\vec{a} \cdot \vec{c} = 6|\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 60° , then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to:

[JEE Main 2024 (Online) 6th April Evening Shift]

- (1) $\frac{3}{2}\sqrt{6}$ (2) $\frac{9}{2}(6 - \sqrt{6})$
 (3) $\frac{9}{2}(6 + \sqrt{6})$ (4) $\frac{3}{2}\sqrt{3}$

Scan or tap for the
full solution



Q.50 If $A(1, -1, 2)$, $B(5, 7, -6)$, $C(3, 4, -10)$ and $D(-1, -4, -2)$ are the vertices of a quadrilateral ABCD, then its area is :

[JEE Main 2024 (Online) 5th April Morning Shift]

- (1) $24\sqrt{7}$ (2) $48\sqrt{7}$
 (3) $24\sqrt{29}$ (4) $12\sqrt{29}$

Scan or tap for the
full solution



Q.51 Let $\vec{a} = 2\hat{i} + 5\hat{j} - \hat{k}$, $\vec{b} = 2\hat{i} - 2\hat{j} + 2\hat{k}$ and $\vec{c}$ be three vectors such that $(\vec{c} + \hat{i}) \times (\vec{a} + \vec{b} + \hat{i}) = \vec{a} \times (\vec{c} + \hat{i})$. If $\vec{a} \cdot \vec{c} = -29$, then $\vec{c} \cdot (-2\hat{i} + \hat{j} + \hat{k})$ is equal to:

[JEE Main 2024 (Online) 5th April Evening Shift]

- (1) 15 (2) 10 (3) 5 (4) 12

Scan or tap for the
full solution



Q.52 Consider three vectors $\vec{a}$, $\vec{b}$, $\vec{c}$. Let $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a} = \vec{b} \times \vec{c}$. If $\alpha \in [0, \frac{\pi}{3}]$ is the angle between the vectors $\vec{b}$ and $\vec{c}$, then the minimum value of $27|\vec{c} - \vec{a}|^2$ is equal to:

[JEE Main 2024 (Online) 5th April Evening Shift]

- (1) 124 (2) 110 (3) 121 (4) 105

Scan or tap for the
full solution



Q.53 Let a unit vector which makes an angle of 60° with $2\hat{i} + 2\hat{j} - \hat{k}$ and an angle of 45° with $\hat{i} - \hat{k}$ be $\vec{C}$. Then

$$\vec{C} + \left(-\frac{1}{2}\hat{i} + \frac{1}{3\sqrt{2}}\hat{j} - \frac{\sqrt{2}}{3}\hat{k} \right) \text{ is:}$$

[JEE Main 2024 (Online) 4th April Morning Shift]

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

Scan or tap for the
full solution



Q.54 For $\lambda > 0$, let θ be the angle between the vectors $\vec{a} = \hat{i} + \lambda\hat{j} - 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$. If the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are mutually perpendicular, then the value of $(14\cos\theta)^2$ is equal to

[JEE Main 2024 (Online) 4th April Evening Shift]

- (1) 25 (2) 50 (3) 20 (4) 40

Scan or tap for the
full solution



Q.55 Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{c} = x\hat{i} + 2\hat{j} + 3\hat{k}$, $x \in \mathbb{R}$. If $\vec{d}$ is the unit vector in the direction of $\vec{b} + \vec{c}$ such that $\vec{a} \cdot \vec{d} = 1$, then $(\vec{a} \times \vec{b}) \cdot \vec{c}$ is equal to

[JEE Main 2024 (Online) 4th April Evening Shift]

- (1) 3 (2) 9 (3) 11 (4) 6

Scan or tap for the
full solution



Q.56 Let $\vec{a} = -5\hat{i} + \hat{j} - 3\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{c} = ((\vec{a} \times \vec{b}) \times \hat{i}) \times \hat{i}$. Then $\vec{c} \cdot (-\hat{i} + \hat{j} + \hat{k})$ is equal to :

[JEE Main 2024 (Online) 1st February Morning Shift]

- (1) -12 (2) -10 (3) -13 (4) -15

Scan or tap for the
full solution



Q.57 Consider a $\triangle ABC$ where $A(1,3,2)$, $B(-2,8,0)$ and $C(3,6,7)$. If the angle bisector of $\angle BAC$ meets the line BC at D, then the length of the projection of the vector $\vec{AD}$ on the vector $\vec{AC}$ is :

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1) $\frac{37}{2\sqrt{38}}$ (2) $\sqrt{19}$
 (3) $\frac{39}{2\sqrt{38}}$ (4) $\frac{\sqrt{38}}{2}$

Scan or tap for the
full solution



Q.58 Let $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}$, $\vec{b} = 4\hat{i} + \hat{j} + 7\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + 4\hat{k}$ be three vectors. If a vector $\vec{p}$ satisfies $\vec{p} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{p} \cdot \vec{a} = 0$, then $\vec{p} \cdot (\hat{i} - \hat{j} - \hat{k})$ is equal to

[JEE Main 2024 (Online) 31st January Morning Shift]

- (1) 24 (2) 32 (3) 36 (4) 28

Scan or tap for the
full solution



Q.59 Let $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ be two vectors such that $|\vec{a}| = 1$, $\vec{a} \cdot \vec{b} = 2$ and $|\vec{b}| = 4$. If $\vec{c} = 2(\vec{a} \times \vec{b}) - 3\vec{b}$, then the angle between $\vec{b}$ and $\vec{c}$ is equal to:

[JEE Main 2024 (Online) 30th January Morning Shift]

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

$$(3) \cos^{-1}\left(\frac{2}{\sqrt{3}}\right) \quad (4) \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$$

Scan or tap for the full solution



Q.60 Let $A(2,3,5)$ and $C(-3,4,-2)$ be opposite vertices of a parallelogram $ABCD$. If the diagonal $\vec{BD} = \hat{i} + 2\hat{j} + 3\hat{k}$, then the area of the parallelogram is equal to :

[JEE Main 2024 (Online) 30th January Morning Shift]

- (1) $\frac{1}{2}\sqrt{410}$ (2) $\frac{1}{2}\sqrt{306}$
(3) $\frac{1}{2}\sqrt{586}$ (4) $\frac{1}{2}\sqrt{474}$

Scan or tap for the full solution



Q.61 Let $\vec{a} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$, $\alpha, \beta \in \mathbb{R}$. Let a vector $\vec{b}$ be such that the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{4}$ and $|\vec{b}|^2 = 6$. If $\vec{a} \cdot \vec{b} = 3\sqrt{2}$, then the value of $(\alpha^2 + \beta^2)|\vec{a} \times \vec{b}|^2$ is equal to

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) 85 (2) 90 (3) 75 (4) 95

Scan or tap for the full solution



Q.62 Let $\vec{a}$ and $\vec{b}$ be two vectors such that $|\vec{b}| = 1$ and $|\vec{b} \times \vec{a}| = 2$. Then $|(\vec{b} \times \vec{a}) - \vec{b}|^2$ is equal to

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) 1 (2) 3 (3) 5 (4) 4

Scan or tap for the full solution



Q.63 Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non-zero vectors such that $\vec{b}$ and $\vec{c}$ are non-collinear. If $\vec{a} + 5\vec{b}$ is collinear with $\vec{c}$, $\vec{b} + 6\vec{c}$ is collinear with $\vec{a}$ and $\vec{a} + \alpha\vec{b} + \beta\vec{c} = \vec{0}$, then $\alpha + \beta$ is equal to

[JEE Main 2024 (Online) 29th January Morning Shift]

- (1) 30 (2) -30 (3) -25 (4) 35

Scan or tap for the full solution



Q.64 Let O be the origin and the position vectors of A and B be $2\hat{i} + 2\hat{j} + \hat{k}$ and $2\hat{i} + 4\hat{j} + 4\hat{k}$ respectively. If the internal bisector of $\angle AOB$ meets the line AB at C , then the length of OC is

[JEE Main 2024 (Online) 29th January Morning Shift]

- (1) $\frac{3}{2}\sqrt{34}$ (2) $\frac{2}{3}\sqrt{31}$
(3) $\frac{2}{3}\sqrt{34}$ (4) $\frac{3}{2}\sqrt{31}$

Scan or tap for the full solution



Q.65 Let a unit vector $\hat{u} = x\hat{i} + y\hat{j} + z\hat{k}$ make angles $\frac{\pi}{2}$, $\frac{\pi}{3}$ and $\frac{2\pi}{3}$ with the vectors

$$\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{k}, \quad \frac{1}{\sqrt{2}}\hat{j} + \frac{1}{\sqrt{2}}\hat{k} \quad \text{and} \quad \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$$

respectively. If $\vec{v} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j} + \frac{1}{\sqrt{2}}\hat{k}$ then $|\hat{u} - \vec{v}|^2$ is equal to

[JEE Main 2024 (Online) 29th January Evening Shift]

- (1) $\frac{11}{2}$ (2) $\frac{5}{2}$ (3) 7 (4) 9

Scan or tap for the full solution



Q.66 Let $\vec{OA} = \vec{a}$, $\vec{OB} = 12\vec{a} + 4\vec{b}$ and $\vec{OC} = \vec{b}$, where O is the origin. If S is the parallelogram with adjacent sides OA and OC , then $\frac{\text{area of the quadrilateral } OABC}{\text{area of } S}$ is equal to

[JEE Main 2024 (Online) 29th January Evening Shift]

- (1) 7 (2) 6 (3) 8 (4) 10

Scan or tap for the full solution



Q.67 Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$,
 $\vec{b} = 3(\hat{i} - \hat{j} + \hat{k})$.

Let $\vec{c}$ be the vector such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$.

Then $\vec{a} \cdot ((\vec{c} \times \vec{b}) - \vec{b} - \vec{c})$ is equal to :

[JEE Main 2024 (Online) 27th January Morning Shift]

- (1) 32 (2) 36 (3) 24 (4) 20

Scan or tap for the full solution



Q.68 The position vectors of the vertices A , B and C of a triangle are $2\hat{i} - 3\hat{j} + 3\hat{k}$, $2\hat{i} + 2\hat{j} + 3\hat{k}$ and $-\hat{i} + \hat{j} + 3\hat{k}$ respectively. Let l denote the length of the angle bisector AD of $\angle BAC$ where D is on the line segment BC , then $2l^2$ equals :

[JEE Main 2024 (Online) 27th January Evening Shift]

- (1) 45 (2) 50 (3) 42 (4) 49

Scan or tap for the full solution



Section B (Numerical) — 17 questions

Q.69 If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{j} - \hat{k}$ and $\vec{c}$ be three vectors such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$, then $\vec{c} \cdot (\vec{a} - 2\vec{b})$ is equal to _____.

[JEE Main 2026 (Online) 6th April Morning Shift]

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Q.70 Let $\vec{a}_k = (\tan \theta_k)\hat{i} + \hat{j}$ and $\vec{b}_k = \hat{i} - (\cot \theta_k)\hat{j}$, where $\theta_k = \frac{2^{k-1}\pi}{2^n+1}$, for some $n \in \mathbb{N}$, $n > 5$. Then the value of $\frac{\sum_{k=1}^n |\vec{a}_k|^2}{\sum_{k=1}^n |\vec{b}_k|^2}$ is

[JEE Main 2026 (Online) 4th April Morning Shift]

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Q.71 Let PQR be a triangle such that $\vec{PQ} = -2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{PR} = a\hat{i} + b\hat{j} - 4\hat{k}$, $a, b \in \mathbb{Z}$. Let S be the point on QR, which is equidistant from the lines PQ and PR. If $|\vec{PR}| = 9$ and $\vec{PS}$ is parallel to $\hat{i} - 7\hat{j} + 2\hat{k}$, then the value of $3a - 4b$ is _____.

[JEE Main 2026 (Online) 28th January Morning Shift]

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Q.72 Let a vector $\vec{a} = \sqrt{2}\hat{i} - \hat{j} + \lambda\hat{k}$, $\lambda > 0$, make an obtuse angle with the vector $\vec{b} = -\lambda^2\hat{i} + 4\sqrt{2}\hat{j} + 4\sqrt{2}\hat{k}$ and an angle θ , $\frac{\pi}{6} < \theta < \frac{\pi}{2}$, with the positive z-axis. If the set of all possible values of λ is $(\alpha, \beta) - \{\gamma\}$, then $\alpha + \beta + \gamma$ is equal to _____.

[JEE Main 2026 (Online) 22nd January Evening Shift]

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Q.73 Let the three sides of a triangle ABC be given by the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$. Let G be the centroid of the triangle ABC. Then $6(|\vec{AG}|^2 + |\vec{BG}|^2 + |\vec{CG}|^2)$ is equal to _____.

[JEE Main 2025 (Online) 4th April Evening Shift]

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Q.74 Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} + 2\hat{j} - \hat{k}$, $\vec{c} = \lambda\hat{j} + \mu\hat{k}$ and $\hat{d}$ be a unit vector such that $\vec{a} \times \hat{d} = \vec{b} \times \hat{d}$ and $\vec{c} \cdot \hat{d} = 1$. If $\vec{c}$ is perpendicular to $\vec{a}$, then $|3\lambda\hat{d} + \mu\vec{c}|^2$ is equal to _____.

[JEE Main 2025 (Online) 3rd April Morning Shift]

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Q.75 Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} - 3\hat{j} + 3\hat{k}$, $\vec{c} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{d}$ be a vector such that $\vec{b} \times \vec{d} = \vec{c} \times \vec{d}$ and $\vec{a} \cdot \vec{d} = 4$. Then $|(\vec{a} \times \vec{d})|^2$ is equal to _____.

[JEE Main 2025 (Online) 3rd April Evening Shift]

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Q.76 Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{d} = \vec{a} \times \vec{b}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - 2\vec{a}|^2 = 8$ and the angle between $\vec{d}$ and $\vec{c}$ is $\frac{\pi}{4}$, then $|10 - 3\vec{b} \cdot \vec{c}| + |\vec{d} \times \vec{c}|^2$ is equal to _____.

[JEE Main 2025 (Online) 28th January Morning Shift]

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Q.77 Let $\vec{c}$ be the projection vector of $\vec{b} = \lambda\hat{i} + 4\hat{k}$, $\lambda > 0$, on the vector $\vec{a} = \hat{i} + 2\hat{j} + 2\hat{k}$. If $|\vec{a} + \vec{c}| = 7$, then the area of the parallelogram formed by the vectors $\vec{b}$ and $\vec{c}$ is _____.

[JEE Main 2025 (Online) 22nd January Morning Shift]

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Q.78 Let $\vec{a} = 9\hat{i} - 13\hat{j} + 25\hat{k}$, $\vec{b} = 3\hat{i} + 7\hat{j} - 13\hat{k}$ and $\vec{c} = 17\hat{i} - 2\hat{j} + \hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} = (\vec{b} + \vec{c}) \times \vec{a}$ and $\vec{r} \cdot (\vec{b} - \vec{c}) = 0$, then $\frac{|593\vec{r} + 67\vec{a}|^2}{(593)^2}$ is equal to _____.

[JEE Main 2024 (Online) 8th April Morning Shift]

Scan or tap for the full solution



Q.79 Let $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$, $\vec{b} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ and a vector $\vec{c}$ be such that $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times \vec{c} = \hat{i} + 8\hat{j} + 13\hat{k}$. If $\vec{a} \cdot \vec{c} = 13$, then $(24 - \vec{b} \cdot \vec{c})$ is equal to _____.

[JEE Main 2024 (Online) 6th April Morning Shift]

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Q.80 Let $\vec{a} = \hat{i} - 3\hat{j} + 7\hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{c}$ be a vector such that $(\vec{a} + 2\vec{b}) \times \vec{c} = 3(\vec{c} \times \vec{a})$. If $\vec{a} \cdot \vec{c} = 130$, then $\vec{b} \cdot \vec{c}$ is equal to _____.

[JEE Main 2024 (Online) 5th April Morning Shift]

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Q.81 Let ABC be a triangle of area $15\sqrt{2}$ and the vectors $\vec{AB} = \hat{i} + 2\hat{j} - 7\hat{k}$, $\vec{BC} = a\hat{i} + b\hat{j} + c\hat{k}$ and $\vec{AC} = 6\hat{i} + d\hat{j} - 2\hat{k}$, $d > 0$. Then the square of the length of the largest side of the triangle ABC is _____.

[JEE Main 2024 (Online) 4th April Morning Shift]

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- Q.82** Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = -\hat{i} - 8\hat{j} + 2\hat{k}$ and $\vec{c} = 4\hat{i} + c_2\hat{j} + c_3\hat{k}$ be three vectors such that $\vec{b} \times \vec{a} = \vec{c} \times \vec{a}$. If the angle between the vector $\vec{c}$ and the vector $3\hat{i} + 4\hat{j} + \hat{k}$ is θ , then the greatest integer less than or equal to $\tan^2 \theta$ is _____.

[JEE Main 2024 (Online) 1st February Evening Shift]

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- Q.83** Let $\vec{a}$ and $\vec{b}$ be two vectors such that $|\vec{a}| = 1$, $|\vec{b}| = 4$, and $\vec{a} \cdot \vec{b} = 2$. If $\vec{c} = (2\vec{a} \times \vec{b}) - 3\vec{b}$ and the angle between $\vec{b}$ and $\vec{c}$ is α , then $192\sin^2 \alpha$ is equal to _____.

[JEE Main 2024 (Online) 31st January Morning Shift]

Scan or tap for the full solution



- Q.84** Let $\vec{a} = 3\hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{c}$ be a vector such that $(\vec{a} + \vec{b}) \times \vec{c} = 2(\vec{a} \times \vec{b}) + 24\hat{j} - 6\hat{k}$ and $(\vec{a} - \vec{b} + \hat{i}) \cdot \vec{c} = -3$. Then $|\vec{c}|^2$ is equal to _____.

[JEE Main 2024 (Online) 31st January Evening Shift]

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- Q.85** The least positive integral value of α , for which the angle between the vectors $\alpha\hat{i} - 2\hat{j} + 2\hat{k}$ and $\alpha\hat{i} + 2\alpha\hat{j} - 2\hat{k}$ is acute, is _____.

[JEE Main 2024 (Online) 27th January Morning Shift]

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ANSWER KEY

Section A (MCQ) — 68 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	2	3	1	2	1	3	2	2	2	2	1
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	1	3	2	3	4	1	4	3	4	1	1
Ques.	23	24	25	26	27	28	29	30	31	32	33
Ans.	2	1	4	1	4	1	3	3	3	4	1
Ques.	34	35	36	37	38	39	40	41	42	43	44
Ans.	2	4	1	4	3	4	1	3	4	3	2
Ques.	45	46	47	48	49	50	51	52	53	54	55
Ans.	2	2	1	3	3	4	3	1	3	1	3
Ques.	56	57	58	59	60	61	62	63	64	65	66
Ans.	1	1	2	4	4	2	3	4	3	2	3
Ques.	67	68									
Ans.	3	1									

Section B (Numerical) — 17 questions

Ques.	69	70	71	72	73	74	75
Ans.	3	3	37	5	164	5	128
Ques.	76	77	78	79	80	81	82
Ans.	6	16	569	46	30	54	38

Ques.	83	84	85				
Ans.	48	38	5				