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JEE MAIN VECTOR ALGEBRA — PYQS

Max. Marks: 192 **Questions:** 48

Section A (MCQ) — 39 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, $\overrightarrow{OP}=\vec{a}$ and $\overrightarrow{OQ}=\vec{b}$. If R is the point on $\overrightarrow{OP}$ such that $\overrightarrow{OP}=5\overrightarrow{OR}$, and M is the point such that $\overrightarrow{OQ}=5\overrightarrow{RM}$, then $\overrightarrow{PM}$ 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 λ, μ ∈ 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 $\overrightarrow{PQ}=\hat{j}+\hat{k}$ and $\overrightarrow{PS}=\hat{i}-\hat{j}$. 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 $\overrightarrow{AB}=3\hat{i}+\hat{j}-\hat{k}$ and $\overrightarrow{AC}=\hat{i}-\hat{j}+3\hat{k}$ such that P is equidistant from the lines AB and AC. If $|\overrightarrow{AP}|=\frac{\sqrt{5}}{2}$, 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 $\vec{v}=\vec{a}+\lambda\vec{b}$, $\lambda\in R$, 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

Scan or tap for the full solution

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

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

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

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

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Q.18 Let $\vec{a}=2\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=\lambda\hat{j}+2\hat{k}$, $\lambda\in Z$ 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

$$K^2x^2+(K^2-5K+\lambda_1)xy+\left(3K+\frac{\lambda_2}{2}\right)y^2-8x+12y+\lambda_2=0$$

represents a circle, for K equal to :

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

(1) 4 (2) −1 (3) 2 (4) 1

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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

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Q.22 Let $\vec{a}=\hat{i}+2\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}+\hat{j}-\hat{k}$. Let $\hat{c}$ 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 $\hat{c}$ 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) $\frac{1}{\sqrt{3}}(-\hat{i}+\hat{j}-\hat{k})$

Scan or tap for the full solution

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

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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

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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

Scan or tap for the full solution

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

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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 α + 2β + 5γ 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) $2\sqrt{14}$

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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) $2-\sqrt{3}$

Scan or tap for the full solution

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

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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

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Section B (Numerical) — 9 questions

Q.40 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.41 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 $n\in N$, $n>5$. 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.42 Let PQR be a triangle such that $\vec{PQ}=-2\hat{i}-\hat{j}+2\hat{k}$ and $\vec{PR}=a\hat{i}+b\hat{j}-4\hat{k}$, $a,b\in Z$. 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.43 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.44 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 $6\left(|\vec{AG}|^2+|\vec{BG}|^2+|\vec{CG}|^2\right)$ is equal to _____.

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

Scan or tap for the full solution

Q.45 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.46 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.47 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.48 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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ANSWER KEY

Section A (MCQ) — 39 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					
Ans.	2	4	1	4	3	4					

Section B (Numerical) — 9 questions

Ques.	40	41	42	43	44	45	46
Ans.	**3**	**3**	**37**	**5**	**164**	**5**	**128**
Ques.	47	48					
Ans.	**6**	**16**					