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MATHEMATICS · JEE MAIN

Vector Algebra

Previous Year Questions with answers

286 questions · **189** papers · **2002–2026** · newest paper first

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What is in this PDF: every Vector Algebra question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

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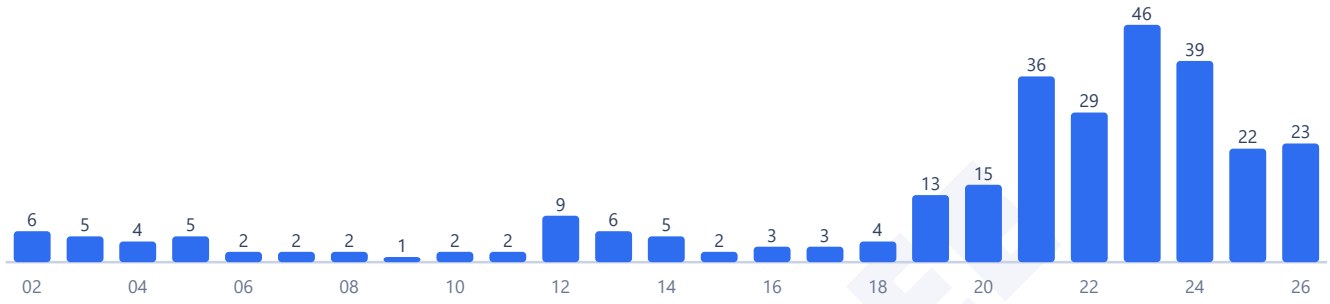
Chapter at a glance

4.9%	286	153 of 162	232 / 54
of Mathematics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Steady: 1.4 questions per paper in 2024–2026 against 1.3 in 2019–2023.

Questions per year



Counts are the questions we hold: 286 in 189 papers. 2 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Vector algebra provides algebraic tools for geometric problem solving under Unit 12: Vector Algebra in the Class 12 curriculum, securing rank 6 among the 29 chapters in the subject. Across the 162 examination papers administered between 2019 and 2026, this chapter contributed 223 questions, capturing 4.9 percent of all mathematics questions. It appeared in 153 of those 162 papers and has been featured every year since 2019. Over the recent 2024 to 2026 examination cycles, it delivered 84 questions across 58 papers, averaging 1.4 questions per paper with an increased subject share of 5.4 percent. Comparing the earlier 2002 to 2018 share of 4.8 percent against the 2024 to 2026 level shows that its long-term share is up, and comparing 2019 to 2026 with 2024 to 2026 also shows it is up. Over the full 2002 to 2026 archive spanning 200 papers, 286 questions appeared in 189 papers, with 54 questions featured in the numerical answer format between 2019 and 2026.

In the 2024, 2025, and 2026 testing sessions, the question numbers were 39, 22, and 23 questions respectively.

Vector algebra works in close partnership with three-dimensional geometry. While spatial lines are categorized under coordinate geometry, vector equations, vector projections, and vector triple products provide the underlying algebraic mechanics used to resolve these spatial relationships.

Most-asked topics

Questions in this chapter organize across four well-defined subtopics:

1. **Cross Product (73 questions, 2019-2026; 85 total, last asked 2026)** The most frequent single topic. Involves cross-product equations such as a cross c equals b, finding unit vectors perpendicular to two given directions, triangle and parallelogram areas, and resolving vector equations using dot constraints.

2. **Triple Products (72 questions, 2019-2026; 94 total, last asked 2026)** Encompasses scalar triple products representing parallelepiped volumes and coplanarity criteria, alongside vector triple products expanded using the standard BAC minus CAB expansion rule. Note that while formal vector triple products were de-emphasised in recent NTA syllabi, basic triple product manipulations still appear.

3. **Dot Product (54 questions, 2019-2026; 72 total, last asked 2026)** Covers scalar products, lengths of vector projections, angles between vectors, work-like energy identities, orthogonality conditions, and expanding squared magnitudes of vector sums and differences.

4. **Basics (24 questions, 2019-2026; 35 total, last asked 2026)** Deals with collinearity, linear independence, section formulas, unit vectors, position vectors of triangle centres, and angle bisector vector formulations.

What the questions look like

Vector questions set in recent examination shifts showcase distinct analytical patterns:

- **Vector Equation with Cross Product and Dot Constraint**: You are given a vector equation of the form a cross c equals b, where a and b are known vectors, together with a scalar condition such as a dot c equals a known constant. Candidates solve for c or compute the magnitude squared of a plus c.
- **Vector Triple Product Expansion**: An expression involves a vector crossed with the cross product of two other vectors. Applying the standard expansion identity turns the expression into a linear combination of the inner vectors.
- **Projection on a Vector or Line**: Finding the orthogonal projection of a vector v onto another vector u, and using the resulting scalar length to solve for an unknown coordinate parameter.
- **Coplanar Vectors and Parallelepiped Volume**: Enforcing that three vectors are coplanar by setting their scalar triple product determinant to zero, or calculating the volume of a parallelepiped formed by coterminous edges.

How to practise it

Mastering vectors requires switching between coordinate components and vector identities:

- **Solve cross-product equations methodically**: When given a cross c equals b, take the cross product of both sides with a. Expanding the left side via the vector triple product converts the cross product into scalar multiples of a and c, enabling you to isolate c directly using the given value of a dot c.
- **Remember the projection formula**: The scalar projection of vector a on vector b is the dot product of a and b divided by the magnitude of b. The vector projection multiplies this scalar by the unit vector in the direction of b.
- **Use the BAC-CAB identity**: Memorise that a cross (b cross c) equals b multiplied by (a dot c) minus c multiplied by (a dot b). Keep the order strictly intact to avoid inadvertent sign errors.
- **Square vector equations**: If a problem involves magnitudes of vector sums such as the magnitude of a plus b plus c, square the entire expression to expand it into individual magnitude squares plus pairwise dot products.

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

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 $2\left(\vec{a} \times \vec{b}\right) + 3\left(\vec{b} \times \vec{c}\right) = \vec{0}$.

If $\vec{a} \cdot \vec{c} = 15$, then $\vec{c} \cdot \left(\hat{i} + \hat{j} - 3\hat{k}\right)$ is equal to :

(A) -6
(B) -5
(C) -4
(D) -3

Answer: (B) -5 · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 1 Numerical

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 $\vec{c} \cdot \left(\vec{a} - 2\vec{b}\right)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 3. · Official NTA final key

Q3 JEE Main 2026 · 6 Apr · Shift 2 MCQ

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 $\left(2\vec{a} + 3\vec{b}\right)$ and $\left(\vec{a} - \vec{b}\right)$ is :

(A) 450
(B) 900
(C) 1800
(D) 2400

Answer: (C) 1800 · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 1 MCQ

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:

(A) 44
(B) 54
(C) 86
(D) 132

Answer: (A) 44 · Official NTA final key

Q5 JEE Main 2026 · 5 Apr · Shift 2 MCQ

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 :

(A) $\frac{1}{5}\left(\vec{a} - 4\vec{b}\right)$
(B) $\frac{1}{5}\left(\vec{b} - 4\vec{a}\right)$
(C) $\frac{1}{5}\left(-\vec{a} + 4\vec{b}\right)$
(D) $\frac{1}{5}\left(-\vec{b} + 4\vec{a}\right)$

Answer: (B) $\frac{1}{5}\left(\vec{b} - 4\vec{a}\right)$ · Official NTA final key

Q6 JEE Main 2026 · 4 Apr · Shift 2 MCQ

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:

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

Answer: (A) $\frac{4}{3}(\vec{A} \cdot \hat{u}) - \frac{2}{3}(\vec{A} \cdot \hat{v})$ · Official NTA final key

Q7 JEE Main 2026 · 2 Apr · Shift 1 MCQ

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

(A) 30
(B) 36
(C) 60
(D) 72

Answer: (C) 60 · Official NTA final key

Q8 JEE Main 2026 · 2 Apr · Shift 2 MCQ

Let the vectors $\vec{a} = -\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$. For some $\lambda, \mu \in \mathbf{R}$, let $\vec{c} = \lambda\vec{a} + \mu\vec{b}$. If $\vec{c} \cdot \left(3\hat{i} - 6\hat{j} + 2\hat{k}\right) = 10$ and $\vec{c} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = -2$, then $|\vec{c}|^2$ is equal to :

(A) 8
(B) 12
(C) 14
(D) 15

Answer: (B) 12 · Official NTA final key

Q9 JEE Main 2026 · 2 Apr · Shift 2 MCQ

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 :

(A) $\frac{1}{2}$
(B) $\frac{\sqrt{3}}{2}$
(C) $\frac{\sqrt{3}}{4}$
(D) $\frac{2\sqrt{3}}{5}$

Answer: (B) $\frac{\sqrt{3}}{2}$ · Official NTA final key

Q10 JEE Main 2026 · 28 Jan · Shift 1 MCQ

For three unit vectors $\vec{a}, \vec{b}, \vec{c}$ satisfying

$\left|\vec{a} - \vec{b}\right|^2 + \left|\vec{b} - \vec{c}\right|^2 + |\vec{c} - \vec{a}|^2 = 9$ and $\left|2\vec{a} + k\vec{b} + k\vec{c}\right| = 3$,

the positive value of k is

(A) 3
(B) 6
(C) 4
(D) 5

Answer: (D) 5 · Official NTA final key

Q11 JEE Main 2026 · 28 Jan · Shift 1 Numerical

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

Numerical value type: the answer is a number.

Dropped by NTA. Full marks to everyone. · Official NTA final key

Q12 JEE Main 2026 · 28 Jan · Shift 2 MCQ

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 $\left|\overrightarrow{AP}\right| = \frac{\sqrt{5}}{2}$, then the area of the triangle ABP is :

(A) 2
(B) $\frac{3}{2}$
(C) $\frac{\sqrt{26}}{4}$
(D) $\frac{\sqrt{30}}{4}$

Answer: (D) $\frac{\sqrt{30}}{4}$ · Official NTA final key

Q13 JEE Main 2026 · 24 Jan · Shift 1 MCQ

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 $\left|\vec{d} - \vec{a}\right| = \sqrt{11}$, $\left|\vec{c} \times \vec{d}\right| = 3$ and the angle between $\vec{c}$ and $\vec{d}$ is $\frac{\pi}{4}$. Then $\vec{a} \cdot \vec{d}$ is equal to

(A) 1
(B) 3
(C) 11
(D) 0

Answer: (D) 0 · Official NTA final key

Q14 JEE Main 2026 · 24 Jan · Shift 2 MCQ

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 $\vec{v}$ 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

(A) $\frac{\sqrt{35}}{2}$
(B) $\frac{\sqrt{21}}{2}$
(C) 7
(D) 13

Options (3) or (4) or (2) or (1) were accepted. More than one answer was accepted. · Official NTA final key

Q15 JEE Main 2026 · 24 Jan · Shift 2 MCQ

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 $\left|\vec{c} \times \hat{k}\right|^2$ is equal to

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(A) 193
(B) 218
(C) 205
(D) 233

Answer: (B) 218 · Official NTA final key

Q16 JEE Main 2026 · 23 Jan · Shift 1 MCQ

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 $\left(\vec{a} - \vec{b}\right) \cdot \vec{d}$ is equal to :

(A) -4
(B) 4
(C) -2
(D) 2

Answer: (C) -2 · Official NTA final key

Q17 JEE Main 2026 · 23 Jan · Shift 2 MCQ

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

(A) 4
(B) 2
(C) 0
(D) 1

Answer: (D) 1 · Official NTA final key

Q18 JEE Main 2026 · 23 Jan · Shift 2 MCQ

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

(A) 12
(B) 4
(C) 9
(D) 6

Answer: (A) 12 · Official NTA final key

Q19 JEE Main 2026 · 22 Jan · Shift 1 MCQ

Let $\overrightarrow{AB} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\overrightarrow{AD} = \hat{i} + 2\hat{j} + \lambda\hat{k}$, $\lambda \in \mathbb{R}$. 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 $\alpha > \beta$, be the roots of the equation $\lambda^2 x^2 - 6\lambda x + 5 = 0$, then $2\alpha - \beta$ is equal to

(A) 4
(B) 6
(C) 3
(D) 1

Answer: (C) 3 · Official NTA final key

Q20 JEE Main 2026 · 22 Jan · Shift 2 MCQ

Let $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \lambda\hat{j} + 2\hat{k}$, $\lambda \in \mathbf{Z}$ 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 $\left(\vec{c} \cdot \vec{d}\right)^2$ is equal to :

(A) 26
(B) 208
(C) 104
(D) 52

Answer: (B) 208 · Official NTA final key

Q21 JEE Main 2026 · 22 Jan · Shift 2 Numerical

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 _____.

Numerical value type: the answer is a number.

Answer: 5. · Official NTA final key

Q22 JEE Main 2026 · 21 Jan · Shift 1 MCQ

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 :

(A) 33
(B) 35
(C) 27
(D) 30

Answer: (C) 27 · Official NTA final key

Q23 JEE Main 2026 · 21 Jan · Shift 2 MCQ

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

(A) 340
(B) 220
(C) 200
(D) 410

Answer: (C) 200 · Official NTA final key

Q24 JEE Main 2025 · 8 Apr · Shift 2 MCQ

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 :

(A) $\frac{1}{\sqrt{5}}(\hat{j} - 2\hat{k})$
(B) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$
(C) $\frac{1}{\sqrt{3}}(-\hat{i} + \hat{j} - \hat{k})$
(D) $\frac{1}{\sqrt{2}}(-\hat{i} + \hat{k})$

Answer: (D) $\frac{1}{\sqrt{2}}(-\hat{i} + \hat{k})$ · Key from source paper

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Q25 JEE Main 2025 · 7 Apr · Shift 1 MCQ

Let the angle $\theta, 0 < \theta < \frac{\pi}{2}$ 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

(A) 29
(B) 24
(C) 27
(D) 31

Answer: (A) 29 · Key from source paper

Q26 JEE Main 2025 · 7 Apr · Shift 2 MCQ

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 :

(A) $2 + 4\sqrt{2}$
(B) $4 + 2\sqrt{2}$
(C) $2 + \sqrt{2}$
(D) $1 + \sqrt{2}$

Answer: (C) $2 + \sqrt{2}$ · Key from source paper

Q27 JEE Main 2025 · 4 Apr · Shift 1 MCQ

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 $\overrightarrow{v_2}$ is perpendicular to $\vec{u}$. Then the value $\left|\overrightarrow{v_1}\right|^2 + \left|\overrightarrow{v_2}\right|^2$ is equal to

(A) 14
(B) 10
(C) $\frac{25}{2}$
(D) $\frac{23}{2}$

Answer: (A) 14 · Key from source paper

Q28 JEE Main 2025 · 4 Apr · Shift 2 Numerical

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 $6\left(\left|\overrightarrow{AG}\right|^2 + \left|\overrightarrow{BG}\right|^2 + \left|\overrightarrow{CG}\right|^2\right)$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 164. · Key from source paper

Q29 JEE Main 2025 · 3 Apr · Shift 1 Numerical

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 $\left|3\lambda\hat{d} + \mu\vec{c}\right|^2$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q30 JEE Main 2025 · 3 Apr · Shift 2 Numerical

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 _____

Numerical value type: the answer is a number.

Answer: 128. · Key from source paper

Q31 JEE Main 2025 · 2 Apr · Shift 1 MCQ

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 :

(A) $\frac{1}{\sqrt{155}}\left(-7\hat{i}+9\hat{j}+5\hat{k}\right)$
(B) $\frac{1}{\sqrt{155}}\left(7\hat{i}+9\hat{j}+5\hat{k}\right)$
(C) $\frac{1}{\sqrt{155}}\left(7\hat{i}+9\hat{j}-5\hat{k}\right)$
(D) $\frac{1}{\sqrt{155}}\left(-7\hat{i}+9\hat{j}-5\hat{k}\right)$

Answer: (B) $\frac{1}{\sqrt{155}}\left(7\hat{i}+9\hat{j}+5\hat{k}\right)$ · Key from source paper

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Q32 JEE Main 2025 · 2 Apr · Shift 1 MCQ

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 ΔBCD is equal to :

(A) $\sqrt{110}$
(B) $\sqrt{340}$
(C) 12
(D) $7\sqrt{3}$

Answer: (A) $\sqrt{110}$ · Key from source paper

Q33 JEE Main 2025 · 2 Apr · Shift 2 MCQ

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

(A) 18
(B) 9
(C) 12
(D) 15

Answer: (D) 15 · Key from source paper

Q34 JEE Main 2025 · 29 Jan · Shift 1 MCQ

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 :

(A) 462
(B) 77
(C) 154
(D) 308

Answer: (D) 308 · Key from source paper

Q35 JEE Main 2025 · 29 Jan · Shift 2 MCQ

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 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 :

(A) $\sqrt{6}$
(B) $-\sqrt{6}$
(C) $-\sqrt{3}$
(D) $\sqrt{3}$

Answer: (B) $-\sqrt{6}$ · Key from source paper

Q36 JEE Main 2025 · 28 Jan · Shift 1 Numerical

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 _____ .

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q37 JEE Main 2025 · 28 Jan · Shift 2 MCQ

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 :

(A) 26
(B) 18
(C) 23
(D) 16

Answer: (A) 26 · Key from source paper

Q38 JEE Main 2025 · 24 Jan · Shift 1 MCQ

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

(A) $\sqrt{\frac{11}{6}}$
(B) $\frac{1}{3\sqrt{2}}$
(C) 16
(D) 18

Answer: (A) $\sqrt{\frac{11}{6}}$ · Key from source paper

Q39 JEE Main 2025 · 24 Jan · Shift 2 MCQ

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 :

(A) 3
(B) 4
(C) 1
(D) 6

Answer: (A) 3 · Key from source paper

Q40 JEE Main 2025 · 24 Jan · Shift 2 MCQ

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 :

(A) $2\sqrt{14}$
(B) $\sqrt{14}$
(C) $3\sqrt{7}$
(D) $2\sqrt{7}$

Answer: (A) $2\sqrt{14}$ · Key from source paper

Q41 JEE Main 2025 · 23 Jan · Shift 1 MCQ

Let the position vectors of the vertices A, B and C of a tetrahedron $ABCD$ be $\hat{\mathbf{i}}+2\hat{\mathbf{j}}+\hat{\mathbf{k}}$, $\hat{\mathbf{i}}+3\hat{\mathbf{j}}-2\hat{\mathbf{k}}$ and $2\hat{\mathbf{i}}+\hat{\mathbf{j}}-\hat{\mathbf{k}}$ 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

(A) $\frac{1}{12}(7\hat{\mathbf{i}}+4\hat{\mathbf{j}}+3\hat{\mathbf{k}})$
(B) $\frac{1}{2}(\hat{\mathbf{i}}+4\hat{\mathbf{j}}+7\hat{\mathbf{k}})$
(C) $\frac{1}{6}(12\hat{\mathbf{i}}+12\hat{\mathbf{j}}+\hat{\mathbf{k}})$
(D) $\frac{1}{6}(7\hat{\mathbf{i}}+12\hat{\mathbf{j}}+\hat{\mathbf{k}})$

Answer: (D) $\frac{1}{6}(7\hat{\mathbf{i}}+12\hat{\mathbf{j}}+\hat{\mathbf{k}})$ · Key from source paper

Q42 JEE Main 2025 · 23 Jan · Shift 1 MCQ

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 $\overrightarrow{OC}=\alpha\overrightarrow{OA}+\beta\overrightarrow{OB}$, then $\alpha+\sqrt{2}(\sqrt{3}-1)\beta$ is equal to

(A) $2\sqrt{3}$
(B) $2-\sqrt{3}$
(C) $5\sqrt{3}$
(D) $2+\sqrt{3}$

Answer: (B) $2-\sqrt{3}$ · Key from source paper

Q43 JEE Main 2025 · 23 Jan · Shift 2 MCQ

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 $\left(\overrightarrow{OQ}\cdot\overrightarrow{OA}\right)-\frac{1}{5}\left|\overrightarrow{OP}\times\overrightarrow{OA}\right|^2=10$, then the value of r is :

(A) $\sqrt{7}$
(B) 14
(C) 3
(D) 7

Answer: (D) 7 · Key from source paper

Q44 JEE Main 2025 · 22 Jan · Shift 1 Numerical

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 _____

Numerical value type: the answer is a number.

Answer: 16. · Key from source paper

Q45 JEE Main 2025 · 22 Jan · Shift 2 MCQ

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 :

(A) 2
(B) 1
(C) 0
(D) 3

Answer: (C) 0 · Key from source paper

Q46 JEE Main 2024 · 9 Apr · Shift 1 MCQ

Let three vectors $\overrightarrow{a}=\alpha\hat{i}+4\hat{j}+2\hat{k}$, $\overrightarrow{b}=5\hat{i}+3\hat{j}+4\hat{k}$, $\overrightarrow{c}=x\hat{i}+y\hat{j}+z\hat{k}$ 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:

(A) 16
(B) 14
(C) 12
(D) 10

Answer: (B) 14 · Key from source paper

Q47 JEE Main 2024 · 9 Apr · Shift 1 MCQ

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

(A) 32
(B) 40
(C) 38
(D) 35

Answer: (D) 35 · Key from source paper

Q48 JEE Main 2024 · 9 Apr · Shift 2 MCQ

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, $\cos 2A + \cos 2B + \cos 2C \geq -\frac{3}{2}$.

(A) Statement I is incorrect but Statement II is correct.
(B) Both Statement I and Statement II are correct.
(C) Statement I is correct but Statement II is incorrect.
(D) Both Statement I and Statement II are incorrect.

Answer: (A) Statement I is incorrect but Statement II is correct. · Key from source paper

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Q49 JEE Main 2024 · 9 Apr · Shift 2 MCQ

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

(A) 19
(B) 17
(C) 24
(D) 21

Answer: (A) 19 · Key from source paper

Q50 JEE Main 2024 · 8 Apr · Shift 1 MCQ

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

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

Answer: (C) $\left(-\frac{4}{3}, 0\right]$ · Key from source paper

Q51 JEE Main 2024 · 8 Apr · Shift 1 Numerical

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 _____

Numerical value type: the answer is a number.

Answer: 569. · Key from source paper

Q52 JEE Main 2024 · 8 Apr · Shift 2 MCQ

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 :

(A) 1609
(B) 1618
(C) 1600
(D) 1627

Answer: (B) 1618 · Key from source paper

Q53 JEE Main 2024 · 8 Apr · Shift 2 MCQ

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

(A) 21
(B) 30
(C) 25
(D) 27

Answer: (C) 25 · Key from source paper

Q54 JEE Main 2024 · 6 Apr · Shift 1 MCQ

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

(A) $\frac{2\sqrt{2}}{3}$
(B) $\frac{5\sqrt{2}}{3}$
(C) $2\sqrt{2}$
(D) $\frac{4\sqrt{2}}{3}$

Answer: (D) $\frac{4\sqrt{2}}{3}$ · Key from source paper

Q55 JEE Main 2024 · 6 Apr · Shift 1 · Numerical

Let $\alpha\beta\gamma = 45$; $\alpha, \beta, \gamma \in \mathbb{R}$. If $x(\alpha, 1, 2) + y(1, \beta, 2) + z(2, 3, \gamma) = (0, 0, 0)$ for some $x, y, z \in \mathbb{R}$, $xyz \neq 0$, then $6\alpha + 4\beta + \gamma$ is equal to _____

Numerical value type: the answer is a number.

Answer: 55. · Key from source paper

Q56 JEE Main 2024 · 6 Apr · Shift 1 · Numerical

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 _____

Numerical value type: the answer is a number.

Answer: 46. · Key from source paper

Q57 JEE Main 2024 · 6 Apr · Shift 2 · MCQ

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 :

(A) $\frac{1}{3}$
(B) $\frac{2}{3}$
(C) 2
(D) $\frac{1}{5}$

Answer: (C) 2 · Key from source paper

Q58 JEE Main 2024 · 6 Apr · Shift 2 · MCQ

Let $\vec{a} = 6\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a is 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:

(A) $\frac{9}{2}(6 - \sqrt{6})$
(B) $\frac{3}{2}\sqrt{6}$
(C) $\frac{9}{2}(6 + \sqrt{6})$
(D) $\frac{3}{2}\sqrt{3}$

Answer: (C) $\frac{9}{2}(6 + \sqrt{6})$ · Key from source paper

Q59 JEE Main 2024 · 5 Apr · Shift 1 MCQ

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 :

(A) $48\sqrt{7}$
(B) $12\sqrt{29}$
(C) $24\sqrt{7}$
(D) $24\sqrt{29}$

Answer: (B) $12\sqrt{29}$ · Key from source paper

Q60 JEE Main 2024 · 5 Apr · Shift 1 Numerical

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 _____

Numerical value type: the answer is a number.

Answer: 30. · Key from source paper

Q61 JEE Main 2024 · 5 Apr · Shift 2 MCQ

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 $\alpha\in\left[0,\frac{\pi}{3}\right]$ 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:

(A) 110
(B) 124
(C) 121
(D) 105

Answer: (B) 124 · Key from source paper

Q62 JEE Main 2024 · 5 Apr · Shift 2 MCQ

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:

(A) 15
(B) 12
(C) 10
(D) 5

Answer: (D) 5 · Key from source paper

Q63 JEE Main 2024 · 4 Apr · Shift 1 MCQ

Let a unit vector which makes an angle of 60° with $2\hat{i}+2\hat{j}-\hat{k}$ and angle 45° with $\hat{i}-\hat{k}$ be $\vec{C}$. Then $\vec{C}+\left(-\frac{1}{2}\hat{i}+\frac{1}{3\sqrt{2}}\hat{j}-\frac{\sqrt{2}}{3}\hat{k}\right)$ is :

(A) $\frac{\sqrt{2}}{3}\hat{i}-\frac{1}{2}\hat{k}$
(B) $\left(\frac{1}{\sqrt{3}}+\frac{1}{2}\right)\hat{i}+\left(\frac{1}{\sqrt{3}}-\frac{1}{3\sqrt{2}}\right)\hat{j}+\left(\frac{1}{\sqrt{3}}+\frac{\sqrt{2}}{3}\right)\hat{k}$
(C) $\frac{\sqrt{2}}{3}\hat{i}+\frac{1}{3\sqrt{2}}\hat{j}-\frac{1}{2}\hat{k}$
(D) $-\frac{\sqrt{2}}{3}\hat{i}+\frac{\sqrt{2}}{3}\hat{j}+\left(\frac{1}{2}+\frac{2\sqrt{2}}{3}\right)\hat{k}$

Answer: (A) $\frac{\sqrt{2}}{3}\hat{i}-\frac{1}{2}\hat{k}$ · Key from source paper

Q64 JEE Main 2024 · 4 Apr · Shift 1 Numerical

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

Numerical value type: the answer is a number.

Answer: 54. · Key from source paper

Q65 JEE Main 2024 · 4 Apr · Shift 2 MCQ

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

(A) 11
(B) 3
(C) 9
(D) 6

Answer: (A) 11 · Key from source paper

Q66 JEE Main 2024 · 4 Apr · Shift 2 MCQ

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

(A) 50
(B) 40
(C) 25
(D) 20

Answer: (C) 25 · Key from source paper

Q67 JEE Main 2024 · 1 Feb · Shift 1 MCQ

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

(A) -12
(B) -10
(C) -13
(D) -15

Answer: (A) -12 · Key from source paper

Q68 JEE Main 2024 · 1 Feb · Shift 2 MCQ

Consider a $\triangle ABC$ where $A1, 3, 2$, $B-2, 8, 0$ and $C3, 6, 7$. If the angle bisector of $\angle BAC$ meets the line BC at D, then the length of the projection of the vector $\overrightarrow{AD}$ on the vector $\overrightarrow{AC}$ is:

(A) $\frac{37}{2\sqrt{38}}$
(B) $\frac{\sqrt{38}}{2}$
(C) $\frac{39}{2\sqrt{38}}$
(D) $\sqrt{19}$

Answer: (A) $\frac{37}{2\sqrt{38}}$ · Key from source paper

Q69 JEE Main 2024 · 1 Feb · Shift 2 Numerical

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:

Numerical value type: the answer is a number.

Answer: 38. · Key from source paper

Q70 JEE Main 2024 · 31 Jan · Shift 1 MCQ

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 vectors $\vec{p}$ 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

(A) 24
(B) 36
(C) 28
(D) 32

Answer: (D) 32 · Key from source paper

Q71 JEE Main 2024 · 31 Jan · Shift 1 Numerical

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 _____.

Numerical value type: the answer is a number.

Answer: 48. · Key from source paper

Q72 JEE Main 2024 · 31 Jan · Shift 2 Numerical

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 _____.

Numerical value type: the answer is a number.

Answer: 38. · Key from source paper

Q73 JEE Main 2024 · 30 Jan · Shift 1 MCQ

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

(A) $\frac{1}{2}\sqrt{410}$
(B) $\frac{1}{2}\sqrt{474}$
(C) $\frac{1}{2}\sqrt{586}$
(D) $\frac{1}{2}\sqrt{306}$

Answer: (B) $\frac{1}{2}\sqrt{474}$ · Key from source paper

Q74 JEE Main 2024 · 30 Jan · Shift 1 MCQ

Let $\vec{a}=a_i\hat{i}+a_2\hat{j}+a_3\hat{k}$ 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 $\vec{c}=2\left(\vec{a}\times\vec{b}\right)-3\vec{b}$, then the angle between $\vec{b}$ and $\vec{c}$ is equal to :

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

Answer: (C) $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ · Key from source paper

Q75 JEE Main 2024 · 30 Jan · Shift 2 MCQ

Let $\vec{a}=\hat{i}+\alpha\hat{j}+\beta\hat{k}$, $\alpha,\beta\in R$. 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 $\left(\alpha^2+\beta^2\right)\mid\vec{a}\times\vec{b}\mid^2$ is equal to

(A) 90
(B) 75
(C) 95
(D) 85

Answer: (A) 90 · Key from source paper

Q76 JEE Main 2024 · 30 Jan · Shift 2 MCQ

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

(A) 3
(B) 5
(C) 1
(D) 4

Answer: (B) 5 · Key from source paper

Q77 JEE Main 2024 · 29 Jan · Shift 1 MCQ

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

(A) 35
(B) 30
(C) -30
(D) -25

Answer: (A) 35 · Key from source paper

Q78 JEE Main 2024 · 29 Jan · Shift 1 MCQ

Let O be the origin and the position vector 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

(A) $\frac{2}{3}\sqrt{31}$
(B) $\frac{2}{3}\sqrt{34}$
(C) $\frac{3}{4}\sqrt{34}$
(D) $\frac{3}{2}\sqrt{31}$

Answer: (B) $\frac{2}{3}\sqrt{34}$ · Key from source paper

Q79 JEE Main 2024 · 29 Jan · Shift 2 MCQ

Let $\overrightarrow{OA}=\vec{a}, \overrightarrow{OB}=12\vec{a}+4\vec{b}$ and $\overrightarrow{OC}=\vec{b}$, 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 _____.

(A) 6
(B) 10
(C) 7
(D) 8

Answer: (D) 8 · Key from source paper

Q80 JEE Main 2024 · 29 Jan · Shift 2 MCQ

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

(A) $\frac{11}{2}$
(B) $\frac{5}{2}$
(C) 9
(D) 7

Answer: (B) $\frac{5}{2}$ · Key from source paper

Q81 JEE Main 2024 · 27 Jan · Shift 1 MCQ

If $\vec{a}=\hat{i}+2\hat{j}+\hat{k}, \vec{b}=3\left(\hat{i}-\hat{j}+\hat{k}\right)$ and $\vec{c}$ be the vector such that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}\cdot\vec{c}=3$, then $\vec{a}\cdot\left(\left(\vec{c}\times\vec{b}\right)-\vec{b}-\vec{c}\right)$ is equal to

(A) 32
(B) 24
(C) 20
(D) 36

Answer: (B) 24 · Key from source paper

Q82 JEE Main 2024 · 27 Jan · Shift 1 Numerical

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 _____.

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q83 JEE Main 2024 · 27 Jan · Shift 2 MCQ

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 denotes the length of the angle bisector AD of $\angle BAC$ where D is on the line segment BC, then $2l^2$ equals :

(A) 49
(B) 42
(C) 50
(D) 45

Answer: (D) 45 · Key from source paper

Q84 JEE Main 2024 · 27 Jan · Shift 2 MCQ

Let the position vectors of the vertices A, B and C of a triangle be $2\hat{i}+2\hat{j}+\hat{k}$, $\hat{i}+2\hat{j}+2\hat{k}$ and $2\hat{i}+\hat{j}+2\hat{k}$ respectively. Let l_1, l_2 and l_3 be the lengths of perpendiculars drawn from the ortho centre of the triangle on the sides AB, BC and CA respectively, then $l_1^2+l_2^2+l_3^2$ equals :

(A) $\frac{1}{5}$
(B) $\frac{1}{2}$
(C) $\frac{1}{4}$
(D) $\frac{1}{3}$

Answer: (B) $\frac{1}{2}$ · Key from source paper

Q85 JEE Main 2023 · 15 Apr · Shift 1 MCQ

Let S be the set of all (λ, μ) for which the vectors $\lambda\hat{i} - \hat{j} + \hat{k}$, $\hat{j} + 2\hat{j} + \mu\hat{k}$ and $3\hat{i} - 4\hat{j} + 5\hat{k}$, where $\lambda - \mu = 5$, are coplanar, then $\sum_{(\lambda,\mu)\in S} 80(\lambda^2 + \mu^2)$ is equal to

(A) 2210
(B) 2130
(C) 2290
(D) 2370

Answer: (C) 2290 · Key from source paper

Q86 JEE Main 2023 · 15 Apr · Shift 1 MCQ

Let $ABCD$ be a quadrilateral. If E and F are the mid points of the diagonals AC and BD respectively and $\left(\overrightarrow{AB} - \overrightarrow{BC}\right) + \left(\overrightarrow{AD} - \overrightarrow{DC}\right) = k\,\overrightarrow{FE}$, then k is equal to

(A) 4
(B) -2
(C) 2
(D) -4

Answer: (D) -4 · Key from source paper

Q87 JEE Main 2023 · 13 Apr · Shift 1 MCQ

Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. If a vector $\vec{d}$ satisfies $\vec{d} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{d} \cdot \vec{a} = 24$, then $\left|\vec{d}\right|^2$ is equal to

(A) 323
(B) 423
(C) 313
(D) 413

Answer: (D) 413 · Key from source paper

Q88 JEE Main 2023 · 13 Apr · Shift 1 · Numerical

Let $\vec{a} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} - 3\hat{j} + 3\hat{k}$. If $\vec{b}$ is a vector such that $\vec{a} = \vec{b} \times \vec{c}$ and $\left|\vec{b}\right|^2 = 50$, then $\left|72 - \left|\vec{b} + \vec{c}\right|^2\right|$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 66. · Key from source paper

Q89 JEE Main 2023 · 13 Apr · Shift 2 · MCQ

Let $|\vec{a}| = 2$, $\left|\vec{b}\right| = 3$ and the angle between the vectors $\vec{a}$ and $\vec{b}$ be $\frac{\pi}{4}$. Then $\left|\left(\vec{a} + 2\vec{b}\right) \times \left(2\vec{a} - 3\vec{b}\right)\right|^2$ is equal to

(A) 441
(B) 482
(C) 841
(D) 882

Answer: (D) 882 · Key from source paper

Q90 JEE Main 2023 · 13 Apr · Shift 2 · MCQ

Let for a triangle ABC
$\overrightarrow{AB} = -2\hat{i} + \hat{j} + 3\hat{k}$
$\overrightarrow{CB} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$
$\overrightarrow{CA} = 4\hat{i} + 3\hat{j} + \delta\hat{k}$
If $\delta > 0$ and the area of the triangle ABC is $5\sqrt{6}$ then $\overrightarrow{CB} \cdot \overrightarrow{CA}$ is equal to

(A) 60
(B) 54
(C) 108
(D) 120

Answer: (A) 60 · Key from source paper

Q91 JEE Main 2023 · 12 Apr · Shift 1 · MCQ

Let a, b, c be three distinct real numbers, none equal to one. If the vectors $a\hat{i} + \hat{j} + \hat{k}$, $\hat{i} + b\hat{j} + \hat{k}$ and $\hat{i} + \hat{j} + c\hat{k}$ are coplanar, then $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is equal to

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(A) 2
(B) -1
(C) -2
(D) 1

Answer: (D) 1 · Key from source paper

Q92 JEE Main 2023 · 12 Apr · Shift 1 MCQ

Let $\lambda \in \mathbb{Z}$, $\vec{a} = \lambda\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$. Let $\vec{c}$ be a vector such that $\left(\vec{a} + \vec{b} + \vec{c}\right) \times \vec{c} = \vec{0}$, $\vec{a} \cdot \vec{c} = -17$ and $\vec{b} \cdot \vec{c} = -20$. Then $\left|\vec{c} \times \left(\lambda\hat{i} + \hat{j} + \hat{k}\right)\right|^2$ is equal to

(A) 46
(B) 53
(C) 62
(D) 49

Answer: (A) 46 · Key from source paper

Q93 JEE Main 2023 · 11 Apr · Shift 1 MCQ

For any vector $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$, with $10a_i < 1$, $i = 1, 2, 3$, consider the following statements:
$A : \max a_1, a_2, a_3 \leq \vec{a}$
$B : |\vec{a}| \leq 3 \max a_1, a_2, a_3$

(A) Only B is true
(B) Only A is true
(C) Both A and B are true
(D) Neither A nor B is true

Answer: (C) Both A and B are true · Key from source paper

Q94 JEE Main 2023 · 11 Apr · Shift 1 MCQ

Let $\vec{a}$ be a non-zero vector parallel to the line of intersection of the two planes described by $\hat{i} + \hat{j}, \hat{i} + \hat{k}$ and $\hat{i} - \hat{j}, \hat{j} - \hat{k}$. If θ is the angle between the vector $\vec{a}$ and the vector $\vec{b} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{a} \cdot \vec{b} = 6$, then the ordered pair $\theta, |\vec{a} \times \vec{b}|$ is equal to

(A) $\frac{\pi}{3}, 3\sqrt{6}$
(B) $\frac{\pi}{4}, 3\sqrt{6}$
(C) $\frac{\pi}{3}, 6$
(D) $\frac{\pi}{4}, 6$

Answer: (D) $\frac{\pi}{4}, 6$ · Key from source paper

Q95 JEE Main 2023 · 11 Apr · Shift 2 MCQ

If four distinct points with position vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are coplanar, then $\left[\vec{a}\vec{b}\vec{c}\right]$ is equal to

(A) $\left[\vec{d}\,\vec{b}\,\vec{a}\right] + \left[\vec{a}\,\vec{c}\,\vec{d}\right] + \left[\vec{d}\vec{b}\,\vec{c}\right]$
(B) $\left[\vec{a}\,\vec{d}\,\vec{b}\right] + \left[\vec{d}\,\vec{c}\,\vec{a}\right] + \left[\vec{d}\,\vec{b}\,\vec{c}\right]$
(C) $\left[\vec{d}\,\vec{c}\,\vec{a}\right] + \left[\vec{b}\,\vec{d}\,\vec{a}\right] + \left[\vec{c}\,\vec{d}\,\vec{b}\right]$
(D) $\left[\vec{b}\,\vec{c}\,\vec{d}\right] + \left[\vec{d}\,\vec{a}\,\vec{c}\right] + \left[\vec{d}\,\vec{b}\,\vec{a}\right]$

Answer: (C) $\left[\vec{d}\,\vec{c}\,\vec{a}\right] + \left[\vec{b}\,\vec{d}\,\vec{a}\right] + \left[\vec{c}\,\vec{d}\,\vec{b}\right]$ · Key from source paper

Q96 JEE Main 2023 · 11 Apr · Shift 2 Numerical

Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - \hat{k}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = 11$, $\vec{b} \cdot (\vec{a} \times \vec{c}) = 27$ and $\vec{b} \cdot \vec{c} = -\sqrt{3}|\vec{b}|$, then $|\vec{a} \times \vec{c}|^2$ is equal to

Numerical value type: the answer is a number.

Answer: 285. · Key from source paper

Q97 JEE Main 2023 · 10 Apr · Shift 1 MCQ

An arc PQ of a circle subtends a right angle at its centre O. The mid point of the arc PQ is R. If $\overrightarrow{OP} = \vec{u}$, $\overrightarrow{OR} = \vec{v}$ and $\overrightarrow{OQ} = \alpha\vec{u} + \beta\vec{v}$, then α, β^2, are the roots of the equation

(A) $x^2 + x - 2 = 0$
(B) $x^2 - x - 2 = 0$
(C) $3x^2 - 2x - 1 = 0$
(D) $3x^2 + 2x - 1 = 0$

Answer: (B) $x^2 - x - 2 = 0$ · Key from source paper

Q98 JEE Main 2023 · 10 Apr · Shift 1 MCQ

Let O be the origin and the position vector of the point P be $-\hat{i} - 2\hat{j} + 3\hat{k}$. If the position vectors of the points A, B and C are $-2\hat{i} + \hat{j} - 3\hat{k}$, $2\hat{i} + 4\hat{j} - 2\hat{k}$ and $-4\hat{i} + 2\hat{j} - \hat{k}$ respectively, then the projection of the vector $\overrightarrow{OP}$ on a vector perpendicular to the vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$ is

(A) 3
(B) $\frac{8}{3}$
(C) $\frac{7}{3}$
(D) $\frac{10}{3}$

Answer: (A) 3 · Key from source paper

Q99 JEE Main 2023 · 10 Apr · Shift 2 MCQ

Let $\vec{a}=2\hat{i}+7\hat{j}-\hat{k}$, $\vec{b}=3\hat{i}+5\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}+2\hat{k}$ Let $\vec{d}$ be a vector which is perpendicular to both $\vec{a}$ and $\vec{b}$, and $\vec{c}\cdot\vec{d}=12$. Then $\hat{i}+\hat{j}-\hat{k}\cdot\vec{c}\times\vec{d}$ is equal to

(A) 24
(B) 44
(C) 42
(D) 48

Answer: (B) 44 · Key from source paper

Q100 JEE Main 2023 · 10 Apr · Shift 2 MCQ

If the points P and Q are respectively the circumcenter and the orthocentre of a ΔABC, then $\overrightarrow{PA}+\overrightarrow{PB}+\overrightarrow{PC}$ is equal to _____

(A) $2\overrightarrow{QP}$
(B) $2\overrightarrow{PQ}$
(C) $\overrightarrow{PQ}$
(D) $\overrightarrow{QP}$

Answer: (C) $\overrightarrow{PQ}$ · Key from source paper

Q101 JEE Main 2023 · 8 Apr · Shift 1 MCQ

If the points with position vectors $\alpha\hat{i}+10\hat{j}+13\hat{k}$, $6\hat{i}+11\hat{j}+11\hat{k}$, $\frac{9}{2}\hat{i}+\beta\hat{j}-8\hat{k}$ are collinear, then $(19\alpha-6\beta)^2$ is equal to

(A) 36
(B) 25
(C) 49
(D) 16

Answer: (A) 36 · Key from source paper

Q102 JEE Main 2023 · 8 Apr · Shift 1 Numerical

Let $\vec{a}=6\hat{i}+9\hat{j}+12\hat{k}$, $\vec{b}=\alpha\hat{i}+11\hat{j}-2\hat{k}$ and $\vec{c}$ be vectors such that $\vec{a}\times\vec{c}=\vec{a}\times\vec{b}$ If $\vec{a}\cdot\vec{c}=-12$, and $\vec{c}\cdot(\hat{i}-2\hat{j}+\hat{k})=5$ then $\vec{c}\cdot(\hat{i}+\hat{j}+\hat{k})$ is equal to _____

Numerical value type: the answer is a number.

Answer: 11. · Key from source paper

Q103 JEE Main 2023 · 8 Apr · Shift 2 MCQ

Let the vectors $\vec{u_1}=\hat{i}+\hat{j}+a\hat{k}$, $\vec{u_2}=\hat{i}+b\hat{j}+\hat{k}$, and $\vec{u_3}=c\hat{i}+\hat{j}+\hat{k}$ be coplanar. If the vectors $\vec{v_1}=(a+b)\hat{i}+c\hat{j}+c\hat{k}$, $\vec{v_2}=a\hat{i}+(b+c)\hat{j}+a\hat{k}$ and $\vec{v_3}=b\hat{i}+b\hat{j}+(c+a)\hat{k}$ are also coplanar, then $6(a+$

$b + c)$ is equal to

(A) 0

(B) 4

(C) 12

(D) 6

Answer: (C) 12 · Key from source paper

Q104 JEE Main 2023 · 8 Apr · Shift 2 MCQ

The area of the quadrilateral $ABCD$ with vertices $A(2, 1, 1)$, $B(1, 2, 5)$, $C(-2, -3, 5)$ and $D(1, -6, -7)$ is equal to

(A) 48

(B) $8\sqrt{38}$

(C) 54

(D) $9\sqrt{38}$

Answer: (B) $8\sqrt{38}$ · Key from source paper

Q105 JEE Main 2023 · 6 Apr · Shift 1 MCQ

Let the position vectors of the points A, B, C and D be $5\hat{i} + 5\hat{j} + 2\lambda\hat{k}$, $\hat{i} + 2\hat{j} + 3\hat{k}$, $-2\hat{i} + \lambda\hat{j} + 4\hat{k}$ and $-\hat{i} + 5\hat{j} + 6\hat{k}$. Let the set $S = \{\lambda \in \mathbb{R}$: the points A, B, C and D are coplanar$\}$. The $\sum_{\lambda \in S}(\lambda + 2)^2$ is equal to

(A) 25

(B) $\frac{37}{2}$

(C) 14

(D) 41

Answer: (D) 41 · Key from source paper

Q106 JEE Main 2023 · 6 Apr · Shift 1 MCQ

Let $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{b} = \hat{i} - 2\hat{j} - 2\hat{k}$ and $\vec{c} = -\hat{i} + 4\hat{j} + 3\hat{k}$. If $\vec{d}$ is a vector perpendicular to both $\vec{b}$ and $\vec{c}$, and $\vec{a} \cdot \vec{d} = 18$, then $|\vec{a} \times \vec{d}|^2$ is equal to

(A) 640

(B) 680

(C) 720

(D) 760

Answer: (C) 720 · Key from source paper

Q107 JEE Main 2023 · 6 Apr · Shift 2 MCQ

Let the vectors $\vec{a}, \vec{b}, \vec{c}$ represent three coterminous edges of a parallelopiped of volume V. Then the volume of the parallelopiped, whose coterminous edges are represented by $\vec{a}$, $\vec{b}+\vec{c}$ and $\vec{a}+2\vec{b}+3\vec{c}$ is equal to

(A) $2V$
(B) $6V$
(C) V
(D) $3V$

Answer: (C) V · Key from source paper

Q108 JEE Main 2023 · 6 Apr · Shift 2 MCQ

The sum of all values of α, for which the points whose position vectors are $\hat{i}-2\hat{j}+3\hat{k}$, $2\hat{i}-3\hat{j}+4\hat{k}$, $(\alpha+1)\hat{i}+2\hat{k}$ and $9\hat{i}+(\alpha-8)\hat{j}+6\hat{k}$ are coplanar, is equal to

(A) -2
(B) 2
(C) 6
(D) 4

Answer: (B) 2 · Key from source paper

Q109 JEE Main 2023 · 1 Feb · Shift 1 Numerical

Let $\vec{v}=\alpha\hat{i}+2\hat{j}-3\hat{k}$, $\vec{w}=2\alpha\hat{i}+\hat{j}-\hat{k}$, and $\vec{u}$ be a vector such that $\vec{u}=\alpha>0$. If the minimum value of the scalar triple product $\vec{u}\,\vec{v}\,\vec{w}$ is $-\alpha\sqrt{3401}$, and $\vec{u}.\hat{i}^2=\frac{m}{n}$ where m and n are coprime natural numbers, then $m+n$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 3501. · Key from source paper

Q110 JEE Main 2023 · 1 Feb · Shift 1 Numerical

$A2,6,2, B-4,0,\lambda, C2,3,-1$ and $D4,5,0,\ \lambda\leq 5$ are the vertices of a quadrilateral $ABCD$. If its area is 18 square units, then 5 - 6λ is equal to _____.

Numerical value type: the answer is a number.

Answer: 11. · Key from source paper

Q111 JEE Main 2023 · 1 Feb · Shift 2 MCQ

Let $\vec{a}=5\hat{i}-\hat{j}-3\hat{k}$ and $\vec{b}=\hat{i}+3\hat{j}+5\hat{k}$ be two vectors. Then which one of the following statements is TRUE?

(A) Projection of $\vec{a}$ on $\vec{b}$ is $\frac{-13}{\sqrt{35}}$ and the direction of the projection vector is opposite to the direction of $\vec{b}$

(B) Projection of $\vec{a}$ on $\vec{b}$ is $\frac{-17}{\sqrt{35}}$ and the direction of the projection vector is opposite to the direction of $\vec{b}$

(C) Projection of $\vec{a}$ on $\vec{b}$ is $\frac{17}{\sqrt{35}}$ and the direction of the projection vector is opposite to the direction of $\vec{b}$

(D) Projection of $\vec{a}$ on $\vec{b}$ is $\frac{13}{\sqrt{35}}$ and the direction of the projection vector is opposite to the direction of $\vec{a}$

Answer: (A) Projection of $\vec{a}$ on $\vec{b}$ is $\frac{-13}{\sqrt{35}}$ and the direction of the projection vector is opposite to the direction of $\vec{b}$ · Key from source paper

Q112 JEE Main 2023 · 1 Feb · Shift 2 MCQ

Let $\vec{a} = 2\hat{i} - 7\hat{j} + 5\hat{k}$, $\vec{b} = \hat{i} + \hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 3\hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} = \vec{c} \times \vec{a}$ and $\vec{r} \cdot \vec{b} = 0$, then $|\vec{r}|$ is equal to:

(A) $\frac{11}{7}\sqrt{2}$

(B) $\frac{11}{7}$

(C) $\frac{11}{5}\sqrt{2}$

(D) $\frac{\sqrt{914}}{7}$

Answer: (A) $\frac{11}{7}\sqrt{2}$ · Key from source paper

Q113 JEE Main 2023 · 31 Jan · Shift 1 MCQ

Let $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}$, and $\vec{b}$ and $\vec{c}$ be two nonzero vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{a} + \vec{b} - \vec{c}$ and $\vec{b} \cdot \vec{c} = 0$.
Consider the following two statement:
A $\vec{a} + \lambda\vec{c} \geq \vec{a}$ for all $\lambda \in \mathbb{R}$.
B $\vec{a}$ and $\vec{c}$ are always parallel

(A) only (B) is correct

(B) neither (A) nor (B) is correct

(C) only (A) is correct

(D) both (A) and (B) are correct.

Answer: (C) only (A) is correct · Key from source paper

Q114 JEE Main 2023 · 31 Jan · Shift 1 Numerical

Let $\vec{a}$ and $\vec{b}$ be two vector such that $\vec{a} = \sqrt{14}$, $\vec{b} = \sqrt{6}$ and $\vec{a} \times \vec{b} = \sqrt{48}$. Then $\vec{a} \cdot \vec{b}^2$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 36. · Key from source paper

Q115 JEE Main 2023 · 31 Jan · Shift 2 MCQ

Let $\vec{a}=\hat{i}+2\hat{j}+3\hat{k}, \vec{b}=\hat{i}-\hat{j}+2\hat{k}$ and $\vec{c}=5\hat{i}-3\hat{j}+3\hat{k}$, be there(three) vector. If $\vec{r}$ is a vector such that, $\vec{r}\times\vec{b}=\vec{c}\times\vec{b}$ and $\vec{r}\cdot\vec{a}=0$, then $25\,|\vec{r}|^2$ is equal to

(A) 560
(B) 339
(C) 449
(D) 336

Answer: (B) 339 · Key from source paper

Q116 JEE Main 2023 · 31 Jan · Shift 2 Numerical

Let $\vec{a},\vec{b},\vec{c}$ be three vectors such that $|\vec{a}|=\sqrt{31}$, $4\left|\vec{b}\right|=|\vec{c}|=2$ and $2\left(\vec{a}\times\vec{b}\right)=3\left(\vec{c}\times\vec{a}\right)$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$, then $\left(\frac{\vec{a}\times\vec{c}}{\vec{a}\cdot\vec{b}}\right)^2$ is equal to _____ .

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q117 JEE Main 2023 · 30 Jan · Shift 1 MCQ

If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three non-zero vectors and $\hat{n}$ is a unit vector perpendicular to $\vec{c}$ such that $\vec{a}=\alpha\vec{b}-\hat{n}$, $\alpha\neq 0$ and $\vec{b}\cdot\vec{c}$ = 12, then $\vec{c}\times\vec{a}\times\vec{b}$ is equal to:

(A) 15
(B) 9
(C) 12
(D) 6

Answer: (C) 12 · Key from source paper

Q118 JEE Main 2023 · 30 Jan · Shift 2 MCQ

Let $\lambda\in\mathbb{R}, \vec{a}=\lambda\hat{i}+2\hat{j}-3\hat{k}, \vec{b}=\hat{i}-\lambda\hat{j}+2\hat{k}$. If $\left(\left(\vec{a}+\vec{b}\right)\times\left(\vec{a}\times\vec{b}\right)\right)\times\left(\vec{a}-\vec{b}\right)=8\hat{i}-40\hat{j}-24\hat{k}$ then $\left|\lambda\left(\vec{a}+\vec{b}\right)\times\left(\vec{a}-\vec{b}\right)\right|^2$ is equal to

(A) 140
(B) 132
(C) 144
(D) 136

Answer: (A) 140 · Key from source paper

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Q119 JEE Main 2023 · 30 Jan · Shift 2 MCQ

Let $\vec{a}$ and $\vec{b}$ be two vectors. Let $|\vec{a}| = 1$, $|\vec{b}| = 4$ and $\vec{a} \cdot \vec{b} = 2$. If $\vec{c} = \left(2\vec{a} \times \vec{b}\right) - 3\vec{b}$, then the value of $\vec{b} \cdot \vec{c}$ is

(A) -24
(B) -48
(C) -84
(D) -60

Answer: (B) -48 · Key from source paper

Q120 JEE Main 2023 · 29 Jan · Shift 1 MCQ

If the vectors $\vec{a} = \lambda\hat{i} + \mu\hat{j} + 4\hat{k}$, $\vec{b} = -2\hat{i} + 4\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} + 3\hat{j} + \hat{k}$ are coplanar and the projection of $\vec{a}$ on the vector $\vec{b}$ is $\sqrt{54}$ units, then the sum of all possible values of $\lambda + \mu$ is equal to

(A) 0
(B) 6
(C) 24
(D) 18

Answer: (C) 24 · Key from source paper

Q121 JEE Main 2023 · 29 Jan · Shift 1 Numerical

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-zero non-coplanar vectors. Let the position vectors of four points A, B, C and D be $\vec{a} - \vec{b} + \vec{c}$, $\lambda\vec{a} - 3\vec{b} + 4\vec{c}$, $-\vec{a} + 2\vec{b} - 3\vec{c}$ and $2\vec{a} - 4\vec{b} + 6\vec{c}$ respectively. If $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{AD}$ are coplanar, then λ is :

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q122 JEE Main 2023 · 29 Jan · Shift 2 MCQ

If $\vec{a} = \hat{i} + 2\hat{k}$, $\vec{b} = \hat{i} + \hat{j} + \hat{k}$, $\vec{c} = 7\hat{i} - 3\hat{j} + 4\hat{k}$, $\vec{r} \times \vec{b} + \vec{b} \times \vec{c} = \vec{0}$ and $\vec{r} \cdot \vec{a} = 0$ then $\vec{r} \cdot \vec{c}$ is equal to:

(A) 34
(B) 12
(C) 36
(D) 30

Answer: (A) 34 · Key from source paper

Q123 JEE Main 2023 · 29 Jan · Shift 2 MCQ

Let $\vec{a} = 4\hat{i} + 3\hat{j}$ and $\vec{b} = 3\hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c}$ is a vector such that $\vec{c} \cdot (\vec{a} \times \vec{b}) + 25 = 0$, $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k}) = 4$ and projection of $\vec{c}$ on $\vec{a}$ is 1 , then the projection of $\vec{c}$ on $\vec{b}$ equals:

(A) $\frac{5}{\sqrt{2}}$
(B) $\frac{1}{5}$
(C) $\frac{1}{\sqrt{2}}$
(D) $\frac{3}{\sqrt{2}}$

Answer: (A) $\frac{5}{\sqrt{2}}$ · Key from source paper

Q124 JEE Main 2023 · 25 Jan · Shift 1 MCQ

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non zero vectors such that $\vec{b} \cdot \vec{c} = 0$ and $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b}-\vec{c}}{2}$. If $\vec{d}$ be a vector such that $\vec{b} \cdot \vec{d} = \vec{a} \cdot \vec{b}$, then $\left(\vec{a} \times \vec{b}\right) \cdot \left(\vec{c} \times \vec{d}\right)$ is equal to

(A) $\frac{3}{4}$
(B) $\frac{1}{2}$
(C) $-\frac{1}{4}$
(D) $\frac{1}{4}$

Answer: (D) $\frac{1}{4}$ · Key from source paper

Q125 JEE Main 2023 · 25 Jan · Shift 1 MCQ

The vector $\vec{a} = -\hat{i} + 2\hat{j} + \hat{k}$ is rotated through a right angle, passing through the y-axis in its way and the resulting vector is $\vec{b}$. Then the projection of $3\vec{a} + \sqrt{2}\vec{b}$ on $\vec{c} = 5\hat{i} + 4\hat{j} + 3\hat{k}$ is

(A) $3\sqrt{2}$
(B) 1
(C) $\sqrt{6}$
(D) $2\sqrt{3}$

Answer: (A) $3\sqrt{2}$ · Key from source paper

Q126 JEE Main 2023 · 25 Jan · Shift 2 MCQ

If the four points, whose position vectors are $3\hat{i} - 4\hat{j} + 2\hat{k}$, $\hat{i} + 2\hat{j} - \hat{k}$, $-2\hat{i} - \hat{j} + 3\hat{k}$ and $5\hat{i} - 2\alpha\hat{j} + 4\hat{k}$ are coplanar, then α is equal to

(A) $\frac{73}{17}$
(B) $-\frac{107}{17}$
(C) $-\frac{73}{17}$
(D) $\frac{107}{17}$

Answer: (A) $\frac{73}{17}$ · Key from source paper

Q127 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Let $\vec{a} = -\hat{i} - \hat{j} + \hat{k}$, $\vec{a} \cdot \vec{b} = 1$ and $\vec{a} \times \vec{b} = \hat{i} - \hat{j}$. Then $\vec{a} - 6\vec{b}$ is equal to

(A) $3\left(\hat{i}-\hat{j}-\hat{k}\right)$
(B) $3\left(\hat{i}+\hat{j}+\hat{k}\right)$
(C) $3\left(\hat{i}-\hat{j}+\hat{k}\right)$
(D) $3\left(\hat{i}+\hat{j}-\hat{k}\right)$

Answer: (B) $3\left(\hat{i}+\hat{j}+\hat{k}\right)$ · Key from source paper

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Q128 JEE Main 2023 · 24 Jan · Shift 1 MCQ

Let $\vec{u}=\hat{i}-\hat{j}-2\hat{k}$, $\vec{v}=2\hat{i}+\hat{j}-\hat{k}$, $\vec{v}\cdot\vec{w}=2$ and $\vec{v}\times\vec{w}=\vec{u}+\lambda\vec{v}$, then $\vec{u}\cdot\vec{w}$ is equal to

(A) 1
(B) $\frac{3}{2}$
(C) 2
(D) $-\frac{2}{3}$

Answer: (A) 1 · Key from source paper

Q129 JEE Main 2023 · 24 Jan · Shift 2 MCQ

Let $\vec{\alpha}=4\hat{i}+3\hat{j}+5\hat{k}$ and $\vec{\beta}=\hat{i}+2\hat{j}-4\hat{k}$. Let $\vec{\beta}_1$ be parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ be perpendicular to $\vec{\alpha}$. If $\vec{\beta}=\vec{\beta}_1+\vec{\beta}_2$, then the value of $5\vec{\beta}_2\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)$ is

(A) 6
(B) 11
(C) 7
(D) 9

Answer: (C) 7 · Key from source paper

Q130 JEE Main 2023 · 24 Jan · Shift 2 Numerical

Let $\vec{a}=\hat{i}+2\hat{j}+\lambda\hat{k}$, $\vec{b}=3\hat{i}-5\hat{j}-\lambda\hat{k}$, $\vec{a}\cdot\vec{c}=7$, $2\left(\vec{b}\cdot\vec{c}\right)+43=0$, $\vec{a}\times\vec{c}=\vec{b}\times\vec{c}$, then $\vec{a}\cdot\vec{b}$ is equal to

Numerical value type: the answer is a number.

Answer: -8. · Checked by our team

Q131 JEE Main 2022 · 29 Jul · Shift 1 MCQ

Let $\vec{a}=3\hat{i}+\hat{j}$ and $\vec{b}=\hat{i}+2\hat{j}+\hat{k}$. Let $\vec{c}$ be a vector satisfying $\vec{a}\times(\vec{b}\times\vec{c})=\vec{b}+\lambda\vec{c}$. If $\vec{b}$ and $\vec{c}$ are non-parallel, then the value of λ is

(A) -5
(B) 5
(C) 1
(D) -1

Answer: (A) -5 · Key from source paper

Q132 JEE Main 2022 · 29 Jul · Shift 1 MCQ

Let $\hat{a}$ and b be two unit vectors such that the angle between them is $\frac{\pi}{4}$. If θ is the angle between the vectors $(\hat{a}+\hat{b})$ and $(\hat{a}+2\hat{b}+2(\hat{a}\times\hat{b}))$ then the value of $164\cos^2\theta$ is equal to

(A) $90+27\sqrt{2}$
(B) $45+18\sqrt{2}$
(C) $90+3\sqrt{2}$
(D) $54+90\sqrt{2}$

Answer: (A) $90+27\sqrt{2}$ · Key from source paper

Q133 JEE Main 2022 · 29 Jul · Shift 2 MCQ

If $2,3,9,5,2,1,1,\lambda,8$ and $\lambda,2,3$ are coplanar, then the product of all possible values of λ is

(A) $\frac{21}{2}$
(B) $\frac{59}{8}$
(C) $\frac{57}{8}$
(D) $\frac{95}{8}$

Answer: (D) $\frac{95}{8}$ · Key from source paper

Q134 JEE Main 2022 · 29 Jul · Shift 2 MCQ

Let $\vec{a},\vec{b},\vec{c}$ be three coplanar concurrent vectors such that angles between any two of them is same. If the product of their magnitudes is 14 and $\vec{a}\times\vec{b}\cdot\vec{b}\times\vec{c}+\vec{b}\times\vec{c}\cdot\vec{c}\times\vec{a}+\vec{c}\times\vec{a}\cdot\vec{a}\times\vec{b}=168$ then $\vec{a}+\vec{b}+\vec{c}$ is equal to

(A) 10
(B) 14
(C) 16
(D) 18

Answer: (C) 16 · Key from source paper

Q135 JEE Main 2022 · 29 Jul · Shift 2 Numerical

Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\vec{a}+\vec{b}^2=\vec{a}^2+2\vec{b}^2$, $\vec{a}\cdot\vec{b}=3$ and $\vec{a}\times\vec{b}^2=75$. Then $\vec{a}^2$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 14. · Key from source paper

Q136 JEE Main 2022 · 28 Jul · Shift 1 MCQ

Let the vectors $\vec{a} = 1 + t\hat{i} + 1 - t\hat{j} + \hat{k}, \vec{b} = 1 - t\hat{i} + 1 + t\hat{j} + 2\hat{k}$ and $\vec{c} = t\hat{i} - t\hat{j} + \hat{k},\ t \in R$ be such that for $\alpha, \beta, \gamma \in R,\ \alpha\vec{a} + \beta\vec{b} + \gamma\vec{c} = \vec{0} \Rightarrow \alpha = \beta = \gamma = 0$. Then, the set of all values of t is

(A) a non-empty finite set

(B) equal to N

(C) equal to $R - 0$

(D) equal to R

Answer: (C) equal to $R - 0$ · Key from source paper

Q137 JEE Main 2022 · 28 Jul · Shift 1 MCQ

Let a vector $\vec{a}$ has a magnitude 9. Let a vector $\vec{b}$ be such that for every $x, y \in R \times R - 0, 0$, the vector $x\vec{a} + y\vec{b}$ is perpendicular to the vector $6y\vec{a} - 18x\vec{b}$. Then the value of $\vec{a} \times \vec{b}$ is equal to

(A) $9\sqrt{3}$

(B) $27\sqrt{3}$

(C) 9

(D) 81

Answer: (B) $27\sqrt{3}$ · Key from source paper

Q138 JEE Main 2022 · 28 Jul · Shift 2 MCQ

Let S be the set of all $a \in R$ for which the angle between the vectors $\vec{u} = a(\log_e b)\hat{i} - 6\hat{j} + 3\hat{k}$ and $\vec{v} = (\log_e b)\hat{i} + 2\hat{j} + 2a(\log_e b)\hat{k}, (b > 1)$ is acute. Then S is equal to

(A) $\left(-\infty, -\frac{4}{3}\right)$

(B) Φ

(C) $\left(-\frac{4}{3}, 0\right)$

(D) $\left(\frac{12}{7}, \infty\right)$

Answer: (B) Φ · Key from source paper

Q139 JEE Main 2022 · 27 Jul · Shift 1 MCQ

Let $\overrightarrow{a} = \alpha\hat{i} + \hat{j} + \beta\hat{k}$ and $\overrightarrow{b} = 3\hat{i} - 5\hat{j} + 4\hat{k}$ be two vectors, such that $\overrightarrow{a} \times \overrightarrow{b} = -\hat{i} + 9\hat{j} + 12\hat{k}$. Then the projection of $\overrightarrow{b} - 2\overrightarrow{a}$ on $\overrightarrow{b} + \overrightarrow{a}$ is equal to

(A) 2

(B) $\frac{39}{5}$

(C) 9

(D) $\frac{46}{5}$

Answer: (D) $\frac{46}{5}$ · Key from source paper

Q140 JEE Main 2022 · 27 Jul · Shift 1 · MCQ

Let $\vec{a} = 2\hat{i} - \hat{j} + 5\hat{k}$ and $\vec{b} = \alpha\hat{i} + \beta\hat{j} + 2\hat{k}$. If $\left(\left(\vec{a} \times \vec{b}\right) \times \hat{i}\right) \cdot \hat{k} = \frac{23}{2}$, then $\left|\vec{b} \times 2\hat{j}\right|$ is equal to

(A) 4

(B) 5

(C) $\sqrt{21}$

(D) $\sqrt{17}$

Answer: (B) 5 · Key from source paper

Q141 JEE Main 2022 · 27 Jul · Shift 2 · Numerical

Let $\vec{a}, \vec{b}, \vec{c}$ be three non-coplanar vectors such that $\vec{a} \times \vec{b} = 4\vec{c}$, $\vec{b} \times \vec{c} = 9\vec{a}$ and $\vec{c} \times \vec{a} = \alpha\vec{b}$, $\alpha > 0$. If $\left|\vec{a}\right| + \left|\vec{b}\right| + \left|\vec{c}\right| = 36$, then α is equal to _____ .

Numerical value type: the answer is a number.

Answer: 36. · Key from source paper

Q142 JEE Main 2022 · 26 Jul · Shift 1 · MCQ

Let $\vec{a} = \alpha\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \alpha\hat{k}$, $\alpha > 0$. If the projection of $\vec{a} \times \vec{b}$ on the vector $-\hat{i} + 2\hat{j} - 2\hat{k}$ is 30, then α is equal to

(A) $\frac{15}{2}$

(B) 8

(C) $\frac{13}{2}$

(D) 7

Answer: (D) 7 · Key from source paper

Q143 JEE Main 2022 · 26 Jul · Shift 2 · MCQ

A vector $\vec{a}$ is parallel to the line of intersection of the plane determined by the vectors $\hat{i}, \hat{i} + \hat{j}$ and the plane determined by the vectors $\hat{i} - \hat{j}, \hat{i} + \hat{k}$. The obtuse angle between $\vec{a}$ and the vector $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$ is

(A) $\frac{3\pi}{4}$
(B) $\frac{2\pi}{3}$
(C) $\frac{4\pi}{5}$
(D) $\frac{5\pi}{6}$

Answer: (A) $\frac{3\pi}{4}$ · Key from source paper

Q144 JEE Main 2022 · 25 Jul · Shift 1 MCQ

Let ABC be a triangle such that $\overrightarrow{BC} = \vec{a}, \overrightarrow{CA} = \vec{b}, \overrightarrow{AB} = \vec{c}, \vec{a} = 6\sqrt{2}, \vec{b} = 2\sqrt{3}$ and $\vec{b} \cdot \vec{c} = 12$ Consider the statements :
$S1$: $\vec{a} \times \vec{b} + \vec{c} \times \vec{b} - \vec{c} = 62\sqrt{2} - 1$
$S2$: $\angle ABC = \cos^{-1}\sqrt{\frac{2}{3}}$. Then

(A) both $S1$ and $S2$are true
(B) only $S1$ is true
(C) only $S2$ is true
(D) both $S1$ and $S2$ are false

Answer: (D) both $S1$ and $S2$ are false · Checked by our team

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Q145 JEE Main 2022 · 25 Jul · Shift 2 MCQ

Let $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ and let $\vec{b}$ be a vector such that $\vec{a} \times \vec{b} = 2\hat{i} - \hat{k}$ and $\vec{a} \cdot \vec{b} = 3$. Then the projection of $\vec{b}$ on the vector $\vec{a} - \vec{b}$ is:

(A) $\frac{2}{\sqrt{21}}$
(B) $2\sqrt{\frac{3}{7}}$
(C) $\frac{2}{3}\sqrt{\frac{7}{3}}$
(D) $\frac{2}{3}$

Answer: (A) $\frac{2}{\sqrt{21}}$ · Key from source paper

Q146 JEE Main 2022 · 29 Jun · Shift 1 MCQ

Let $\vec{a} = \alpha\hat{i} + 3\hat{j} - \hat{k}, \vec{b} = 3\hat{i} - \beta\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 2\hat{k}$ where $\alpha, \beta \in R$ be three vectors. If the projection of $\vec{a}$ on $\vec{c}$ is $\frac{10}{3}$ and $\vec{b} \times \vec{c} = -6\hat{i} + 10\hat{j} + 7\hat{k}$, then the value of $\alpha + \beta$ equal to

(A) 3
(B) 4
(C) 5
(D) 6

Answer: (A) 3 · Key from source paper

Q147 JEE Main 2022 · 29 Jun · Shift 2 MCQ

Let $A,\ B,\ C$ be three points whose position vectors respectively are:
$\vec{a} = \hat{i} + 4\hat{j} + 3\hat{k}$
$\vec{b} = 2\hat{i} + \alpha\hat{j} + 4\hat{k},\ \alpha \in R$
$\vec{c} = 3\hat{i} - 2\hat{j} + 5\hat{k}$
If α is the smallest positive integer for which $\vec{a},\ \vec{b},\ \vec{c}$ are non-collinear, then the length of the median, $\triangle ABC$, through A is:

(A) $\frac{\sqrt{82}}{2}$
(B) $\frac{\sqrt{62}}{2}$
(C) $\frac{\sqrt{69}}{2}$
(D) $\frac{\sqrt{66}}{2}$

Answer: (A) $\frac{\sqrt{82}}{2}$ · Key from source paper

Q148 JEE Main 2022 · 28 Jun · Shift 1 Numerical

If $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ are coplanar vectors and $\vec{a} \cdot \vec{c} = 5$, $\vec{b} \perp \vec{c}$, then $122(c_1 + c_2 + c_3)$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 150. · Key from source paper

Q149 JEE Main 2022 · 28 Jun · Shift 2 MCQ

Let $\vec{a} = \alpha\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = -2\hat{i} + \alpha\hat{j} + \hat{k}$, where $\alpha \in \mathbf{R}$. If the area of the parallelogram whose adjacent sides are represented by the vectors $\vec{a}$ and $\vec{b}$ is $\sqrt{15(\alpha^2 + 4)}$, then the value of $2\left|\vec{a}\right|^2 + \left(\vec{a} \cdot \vec{b}\right)\left|\vec{b}\right|^2$ is equal to

(A) 10
(B) 7
(C) 9
(D) 14

Answer: (D) 14 · Key from source paper

Q150 JEE Main 2022 · 28 Jun · Shift 2 MCQ

Let $\vec{a}$ be a vector which is perpendicular to the vector $3\hat{i} + \frac{1}{2}\hat{j} + 2\hat{k}$. If $\vec{a} \times \left(2\hat{i} + \hat{k}\right) = 2\hat{i} - 13\hat{j} - 4\hat{k}$, then the projection of the vector $\vec{a}$ on the vector $2\hat{i} + 2\hat{j} + \hat{k}$ is

(A) $\frac{1}{3}$
(B) 1
(C) $\frac{5}{3}$
(D) $\frac{7}{3}$

Answer: (C) $\frac{5}{3}$ · Key from source paper

Q151 JEE Main 2022 · 27 Jun · Shift 1 MCQ

Let $\vec{a}=\hat{i}+\hat{j}-\hat{k}$ and $\vec{c}=2\hat{i}-3\hat{j}+2\hat{k}$. Then the number of vectors $\vec{b}$ such that $\vec{b}\times\vec{c}=\vec{a}$ and $|\vec{b}|\in\{1,2,\ldots,10\}$ is

(A) 0
(B) 1
(C) 2
(D) 3

Answer: (A) 0 · Key from source paper

Q152 JEE Main 2022 · 27 Jun · Shift 2 MCQ

Let $\vec{a}$ and $\vec{b}$ be the vectors along the diagonal of a parallelogram having area $2\sqrt{2}$. Let the angle between $\vec{a}$ and $\vec{b}$ be acute. $|\vec{a}|=1$ and $|\vec{a}.\vec{b}|=|\vec{a}\times\vec{b}|$. If $\vec{c}=2\sqrt{2}\left(\vec{a}\times\vec{b}\right)-2\vec{b}$, then an angle between $\vec{b}$ and $\vec{c}$ is

(A) $\frac{-\pi}{4}$
(B) $\frac{5\pi}{6}$
(C) $\frac{\pi}{3}$
(D) $\frac{3\pi}{4}$

Answer: (D) $\frac{3\pi}{4}$ · Key from source paper

Q153 JEE Main 2022 · 26 Jun · Shift 1 MCQ

If $\vec{a}\cdot\vec{b}=1,\vec{b}\cdot\vec{c}=2$ and $\vec{c}\cdot\vec{a}=3$, then the value of $\left[\vec{a}\times(\vec{b}\times\vec{c})\ \ \vec{b}\times(\vec{c}\times\vec{a})\ \ \vec{c}\times(\vec{b}\times\vec{a})\right]$ is

(A) 0
(B) $-6\vec{a}\cdot(\vec{b}\times\vec{c})$
(C) $12\vec{c}\cdot(\vec{a}\times\vec{b})$
(D) $-12\vec{b}\cdot(\vec{c}\times\vec{a})$

Answer: (A) 0 · Key from source paper

Q154 JEE Main 2022 · 26 Jun · Shift 2 MCQ

Let $\vec{a}=\hat{i}+\hat{j}+2\hat{k},\vec{b}=2\hat{i}-3\hat{j}+\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}+\hat{k}$ be the three given vectors. Let $\vec{v}$ be a vector in the plane of $\vec{a}$ and $\vec{b}$ whose projection on $\vec{c}$ is $\frac{2}{\sqrt{3}}$. If $\vec{v}\cdot\hat{j}=7$, then $\vec{v}\cdot(\hat{i}+\hat{k})$ is equal to

(A) 6
(B) 7
(C) 8
(D) 9

Answer: (D) 9 · Key from source paper

Q155 JEE Main 2022 · 25 Jun · Shift 1 MCQ

Let $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$, $a_i > 0$, $i = 1, 2, 3$ be a vector which makes equal angles with the coordinate axes OX, OY and OZ. Also, let the projection of $\vec{a}$ on the vector $3\hat{i} + 4\hat{j}$ be 7. Let $\vec{b}$ be a vector obtained by rotating $\vec{a}$ with 90°. If $\vec{a}, \vec{b}$ and x-axis are coplanar, then projection of a vector $\vec{b}$ on $3\hat{i} + 4\hat{j}$ is equal to

(A) $\sqrt{7}$
(B) $\sqrt{2}$
(C) 2
(D) 7

Answer: (B) $\sqrt{2}$ · Key from source paper

Q156 JEE Main 2022 · 25 Jun · Shift 1 Numerical

Let θ be the angle between the vectors $\vec{a}$ and $\vec{b}$, where $\vec{a} = 4, \vec{b} = 3$ and $\theta \in \frac{\pi}{4}, \frac{\pi}{3}$. Then $\vec{a} - \vec{b} \times \vec{a} + \vec{b}^2 + 4\vec{a} \cdot \vec{b}^2$ is equal to _____

Numerical value type: the answer is a number.

Answer: 576. · Key from source paper

Q157 JEE Main 2022 · 25 Jun · Shift 2 Numerical

Let $\vec{b} = \hat{i} + \hat{j} + \lambda\hat{k}$, $\lambda \in \mathbb{R}$. If $\vec{a}$ is a vector such that $\vec{a} \times \vec{b} = 13\hat{i} - \hat{j} - 4\hat{k}$ and $\vec{a} \cdot \vec{b} + 21 = 0$, then $\vec{b} - \vec{a} \cdot \hat{k} - \hat{j} + \vec{b} + \vec{a} \cdot \hat{i} - \hat{k}$ is equal to _____

Numerical value type: the answer is a number.

Answer: 14. · Key from source paper

Q158 JEE Main 2022 · 24 Jun · Shift 1 MCQ

Let $\hat{a}, \hat{b}$ be unit vectors. If $\vec{c}$ be a vector such that the angle between $\hat{a}$ and $\vec{c}$ is $\frac{\pi}{12}$, and $\hat{b} = \vec{c} + 2(\vec{c} \times \hat{a})$, then $|6\vec{c}|^2$ is equal to:

(A) $6\left(3-\sqrt{3}\right)$
(B) $6\left(3+\sqrt{3}\right)$
(C) $3+\sqrt{3}$
(D) $6\left(\sqrt{3}+1\right)$

Answer: (B) $6\left(3+\sqrt{3}\right)$ · Key from source paper

Q159 JEE Main 2022 · 24 Jun · Shift 2 MCQ

Let a and b be two unit vectors such that $|(a+b)+2(a\times b)|=2$. If $\theta\in(0,\pi)$ is the angle between $\hat{a}$ and b, then among the statements:
$(S1):2\left|\hat{a}\times\hat{b}\right|=\left|\hat{a}-\hat{b}\right|$
$(S2)$: The projection of $\hat{a}$ on $\left(\hat{a}+\hat{b}\right)$ is $\frac{1}{2}$

(A) Only $(S1)$ is true.
(B) Only $(S2)$ is true.
(C) Both $(S1)$ and $(S2)$ are true.
(D) Both $(S1)$ and $(S2)$ are false.

Answer: (C) Both $(S1)$ and $(S2)$ are true. · Key from source paper

Q160 JEE Main 2021 · 1 Sep · Shift 2 Numerical

Let $\vec{a}=2\hat{i}-\hat{j}+2\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}-\hat{k}$. Let a vector $\vec{v}$ be in the plane containing $\vec{a}$ and $\vec{b}$. If $\vec{v}$ is perpendicular to the vector $3\hat{i}+2\hat{j}-\hat{k}$ and its projection on $\vec{a}$ is 19 units, then $|2\vec{v}|^2$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 1494. · Key from source paper

Q161 JEE Main 2021 · 31 Aug · Shift 1 MCQ

Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\left|2\vec{a}+3\vec{b}\right|=\left|3\vec{a}+\vec{b}\right|$ and the angle between $\vec{a}$ and $\vec{b}$ is 60°. If $\frac{1}{8}\vec{a}$ is a unit vector, then $\left|\vec{b}\right|$ is equal to :

(A) 8
(B) 4
(C) 6
(D) 5

Answer: (D) 5 · Key from source paper

Q162 JEE Main 2021 · 31 Aug · Shift 2 MCQ

Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three vectors mutually perpendicular to each other and have same magnitude. If a vector $\vec{r}$ satisfies $\vec{a}\times\left\{\left(\vec{r}-\vec{b}\right)\times\vec{a}\right\}+\vec{b}\times\left\{(\vec{r}-\vec{c})\times\vec{b}\right\}+\vec{c}\times\{(\vec{r}-\vec{a})\times\vec{c}\}=\vec{0}$, then $\vec{r}$ is equal to:

(A) $\frac{1}{3}\left(\vec{a}+\vec{b}+\vec{c}\right)$
(B) $\frac{1}{3}\left(2\vec{a}+\vec{b}-\vec{c}\right)$
(C) $\frac{1}{2}\left(\vec{a}+\vec{b}+\vec{c}\right)$
(D) $\frac{1}{2}\left(\vec{a}+\vec{b}+2\vec{c}\right)$

Answer: (C) $\frac{1}{2}\left(\vec{a}+\vec{b}+\vec{c}\right)$ · Key from source paper

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Q163 JEE Main 2021 · 27 Aug · Shift 1 · Numerical

Let $\vec{a}=\hat{i}+5\hat{j}+\alpha\hat{k}$, $\vec{b}=\hat{i}+3\hat{j}+\beta\hat{k}$ and $\vec{c}=-\hat{i}+2\hat{j}-3\hat{k}$ be three vectors such that, $|\vec{b}\times\vec{c}|=5\sqrt{3}$ and $\vec{a}$ is perpendicular to $\vec{b}$. Then the greatest amongst the values of $|\vec{a}|^2$ is _____.

Numerical value type: the answer is a number.

Answer: 90. · Key from source paper

Q164 JEE Main 2021 · 26 Aug · Shift 1 · MCQ

Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{j}-\hat{k}$. If $\vec{c}$ is a vector such that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}\cdot\vec{c}=3$, then $\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)$ is equal to:

(A) 6
(B) -2
(C) 2
(D) -6

Answer: (B) -2 · Key from source paper

Q165 JEE Main 2021 · 26 Aug · Shift 2 · Numerical

If the projection of the vector $\hat{i}+2\hat{j}+\hat{k}$ on the sum of the two vectors $2\hat{i}+4\hat{j}-5\hat{k}$ and $-\lambda\hat{i}+2\hat{j}+3\hat{k}$ is 1, then λ is equal to _____.

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q166 JEE Main 2021 · 27 Jul · Shift 1 · MCQ

Let $\vec{a}=\hat{i}+\hat{j}+2\hat{k}$ and $\vec{b}=-\hat{i}+2\hat{j}+3\hat{k}$. Then the vector product $\left(\vec{a}+\vec{b}\right)\times\left(\left(\vec{a}\times\left(\left(\vec{a}-\vec{b}\right)\times\vec{b}\right)\right)\times\vec{b}\right)$ is equal to :

(A) $5\left(34\hat{i}-5\hat{j}+3\hat{k}\right)$
(B) $7\left(34\hat{i}-5\hat{j}+3\hat{k}\right)$
(C) $7\left(30\hat{i}-5\hat{j}+7\hat{k}\right)$
(D) $5\left(30\hat{i}-5\hat{j}+7\hat{k}\right)$

Answer: (B) $7\left(34\hat{i}-5\hat{j}+3\hat{k}\right)$ · Key from source paper

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Q167 JEE Main 2021 · 27 Jul · Shift 1 Numerical

Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}$ and $\vec{c}=\hat{j}-\hat{k}$ be three vectors such that $\vec{a}\times\vec{b}=\vec{c}$ and $\vec{a}\cdot\vec{b}=1$. If the length of projection vector of the vector $\vec{b}$ on the vector $\vec{a}\times\vec{c}$ is l, then the value of $3l^2$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q168 JEE Main 2021 · 27 Jul · Shift 2 MCQ

Let $\vec{a},\vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a}=\vec{b}\times\left(\vec{b}\times\vec{c}\right)$. If magnitudes of the vectors $\vec{a},\vec{b}$ and $\vec{c}$ are $\sqrt{2}$, 1 and 2 respectively and the angle between $\vec{b}$ and $\vec{c}$ is $\theta\left(0<\theta<\frac{\pi}{2}\right)$, then the value of $1+\tan\theta$ is equal to :

(A) $\sqrt{3}+1$
(B) 2
(C) 1
(D) $\frac{\sqrt{3}+1}{\sqrt{3}}$

Answer: (B) 2 · Key from source paper

Q169 JEE Main 2021 · 27 Jul · Shift 2 Numerical

Let $\vec{a}=\hat{i}-\alpha\hat{j}+\beta\hat{k},\vec{b}=3\hat{i}+\beta\hat{j}-\alpha\hat{k}$ and $\vec{c}=-\alpha\hat{i}-2\hat{j}+\hat{k}$, where α and β are integers. If $\vec{a}\cdot\vec{b}=-1$ and $\vec{b}\cdot\vec{c}=10$, then $\left(\vec{a}\times\vec{b}\right)\cdot\vec{c}$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

Q170 JEE Main 2021 · 25 Jul · Shift 1 MCQ

Let the vectors $2+a+b\hat{i}+a+2b+c\hat{j}-b+c\hat{k}$, $1+b\hat{i}+2b\hat{j}-b\hat{k}$ and $2+b\hat{i}+2b\hat{j}+1-b\hat{k}$, $\forall a,b,c\in R$ be co-planar. Then which of the following is true?

(A) $2b = a + c$

(B) $3c = a + b$

(C) $a = b + 2c$

(D) $2a = b + c$

Answer: (A) $2b = a + c$ · Key from source paper

Q171 JEE Main 2021 · 25 Jul · Shift 1 Numerical

Let $\vec{p} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{q} = \hat{i} + 2\hat{j} + \hat{k}$ be two vectors. If a vector $\vec{r} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$ is perpendicular to each of the vectors $(\vec{p} + \vec{q})$ and $(\vec{p} - \vec{q})$, and $|\vec{r}| = \sqrt{3}$, then $|\alpha| + |\beta| + |\gamma|$ is equal to _____

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q172 JEE Main 2021 · 25 Jul · Shift 2 MCQ

Let a, b and c be distinct positive numbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ are co-planar, then c is equal to:

(A) $\frac{2}{\frac{1}{a}+\frac{1}{b}}$

(B) $\frac{a+b}{2}$

(C) $\frac{1}{a} + \frac{1}{b}$

(D) $\sqrt{ab}$

Answer: (D) $\sqrt{ab}$ · Key from source paper

Q173 JEE Main 2021 · 25 Jul · Shift 2 MCQ

If $|\vec{a}| = 2$, $\left|\vec{b}\right| = 5$ and $\left|\vec{a} \times \vec{b}\right| = 8$, then $\left|\vec{a} \cdot \vec{b}\right|$ is equal to:

(A) 6

(B) 4

(C) 3

(D) 5

Answer: (A) 6 · Key from source paper

Q174 JEE Main 2021 · 25 Jul · Shift 2 Numerical

If $\vec{a}$ and $\vec{b}$ are unit vectors and $\left(\vec{a} + 3\vec{b}\right)$ is perpendicular to $\left(7\vec{a} - 5\vec{b}\right)$ and $\left(\vec{a} - 4\vec{b}\right)$ is perpendicular to $\left(7\vec{a} - 2\vec{b}\right)$, then the angle between $\vec{a}$ and $\vec{b}$ (in degrees) is _____.

Numerical value type: the answer is a number.

Answer: 60. · Key from source paper

EdLoop JEE

Q175 JEE Main 2021 · 22 Jul · Shift 1 MCQ

Let a vector $\vec{a}$ be coplanar with vectors $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} + \hat{k}$. If $\vec{a}$ is perpendicular to $\vec{d} = 3\hat{i} + 2\hat{j} + 6\hat{k}$, and $|\vec{a}| = \sqrt{10}$. Then a possible value of $\left[\vec{a}\,\vec{b}\,\vec{c}\right] + \left[\vec{a}\,\vec{b}\,\vec{d}\right] + \left[\vec{a}\,\vec{c}\,\vec{d}\right]$ is equal to:

(A) -42
(B) -40
(C) -29
(D) -38

Answer: (A) -42 · Key from source paper

Q176 JEE Main 2021 · 22 Jul · Shift 1 MCQ

Let three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be such that $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}$ and $|\vec{a}| = 2$. Then which one of the following is not true?

(A) $\vec{a} \times \left(\left(\vec{b} + \vec{c}\right) \times \left(\vec{b} - \vec{c}\right)\right) = \vec{0}$
(B) Projection of $\vec{a}$ on $\left(\vec{b} \times \vec{c}\right)$ is 2
(C) $\left[\vec{a}\,\vec{b}\,\vec{c}\right] + \left[\vec{c}\,\vec{a}\,\vec{b}\right] = 8$
(D) $\left|3\vec{a} + \vec{b} - 2\vec{c}\right|^2 = 51$

Answer: (D) $\left|3\vec{a} + \vec{b} - 2\vec{c}\right|^2 = 51$ · Key from source paper

Q177 JEE Main 2021 · 20 Jul · Shift 1 MCQ

Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\left(\vec{a} \times \vec{b}\right)$ and $\vec{c}$ is $\frac{\pi}{6}$, then the value of $\left|\left(\vec{a} \times \vec{b}\right) \times \vec{c}\right|$ is:

(A) $\frac{2}{3}$
(B) 4
(C) 3
(D) $\frac{3}{2}$

Answer: (D) $\frac{3}{2}$ · Key from source paper

Q178 JEE Main 2021 · 20 Jul · Shift 1 Numerical

Let $\vec{a}, \vec{b}, \vec{c}$ be three mutually perpendicular vectors of the same magnitude and equally inclined at an angle θ, with the vector $\vec{a} + \vec{b} + \vec{c}$. Then $36\cos^2 2\theta$ is equal to

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q179 JEE Main 2021 · 20 Jul · Shift 2 MCQ

In a triangle ABC, if $\left|\overrightarrow{BC}\right| = 3$, $\left|\overrightarrow{CA}\right| = 5$ and $\left|\overrightarrow{BA}\right| = 7$, then the projection of the vector $\overrightarrow{BA}$ on $\overrightarrow{BC}$ is equal to

(A) $\frac{19}{2}$
(B) $\frac{13}{2}$
(C) $\frac{11}{2}$
(D) $\frac{15}{2}$

Answer: (C) $\frac{11}{2}$ · Key from source paper

Q180 JEE Main 2021 · 20 Jul · Shift 2 Numerical

For $p > 0$, a vector $\overrightarrow{v_2} = 2\hat{i} + (p+1)\hat{j}$ is obtained by rotating the vector $\overrightarrow{v_1} = \sqrt{3}p\hat{i} + \hat{j}$ by an angle θ about origin in counter clockwise direction. If $\tan\theta = \frac{(\alpha\sqrt{3}-2)}{(4\sqrt{3}+3)}$, then the value of α is equal to _____ .

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q181 JEE Main 2021 · 18 Mar · Shift 2 MCQ

In a triangle ABC, if $\left|\overrightarrow{BC}\right| = 8$, $\left|\overrightarrow{CA}\right| = 7$, $\left|\overrightarrow{AB}\right| = 10$, then the projection of the vector $\overrightarrow{AB}$ on $\overrightarrow{AC}$ is equal to :

(A) $\frac{25}{4}$
(B) $\frac{85}{14}$
(C) $\frac{127}{20}$
(D) $\frac{115}{16}$

Answer: (B) $\frac{85}{14}$ · Key from source paper

Q182 JEE Main 2021 · 18 Mar · Shift 2 MCQ

Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors perpendicular to each other and $\left|\vec{a}\right| = \left|\vec{b}\right|$, If $\left|\vec{a} \times \vec{b}\right| = \left|\vec{a}\right|$, then the angle between the vectors $\left(\vec{a} + \vec{b} + \left(\vec{a} \times \vec{b}\right)\right)$ and $\vec{a}$ is equal to :

(A) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(B) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(C) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$
(D) $\sin^{-1}\left(\frac{1}{\sqrt{6}}\right)$

Answer: (B) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ · Key from source paper

Q183 JEE Main 2021 · 17 Mar · Shift 1 MCQ

Let $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\vec{b} = 7\hat{i} + \hat{j} - 6\hat{k}$ If $\vec{r} \times \vec{a} = \vec{r} \times \vec{b}, \vec{r} \cdot (\hat{i} + 2\hat{j} + \hat{k}) = -3$, then $\vec{r} \cdot (2\hat{i} - 3\hat{j} + \hat{k})$ is equal to:

(A) 12
(B) 8
(C) 13
(D) 10

Answer: (A) 12 · Key from source paper

Q184 JEE Main 2021 · 17 Mar · Shift 1 Numerical

If $\vec{a} = \alpha\hat{i} + \beta\hat{j} + 3\hat{k}, \vec{b} = -\beta\hat{i} - \alpha\hat{j} - \hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} - \hat{k}$ such that $\vec{a} \cdot \vec{b} = 1$ and $\vec{b} \cdot \vec{c} = -3$, then $\frac{1}{3}((\vec{a} \times \vec{b}) \cdot \vec{c})$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q185 JEE Main 2021 · 17 Mar · Shift 2 MCQ

Let O be the origin. Let $\overrightarrow{OP} = x\hat{i} + y\hat{j} - \hat{k}$ and $\overrightarrow{OQ} = -\hat{i} + 2\hat{j} + 3x\hat{k}, x, y \in R, x > 0$, be such that $|\overrightarrow{PQ}| = \sqrt{20}$ and the vector $\overrightarrow{OP}$ is perpendicular to $\overrightarrow{OQ}$. If $\overrightarrow{OR} = 3\hat{i} + z\hat{j} - 7\hat{k}, z \in R$, is coplanar with $\overrightarrow{OP}$ and $\overrightarrow{OQ}$, then the value of $x^2 + y^2 + z^2$ is equal to

(A) 7
(B) 9
(C) 2
(D) 1

Answer: (B) 9 · Key from source paper

Q186 JEE Main 2021 · 17 Mar · Shift 2 Numerical

Let $\vec{x}$ be a vector in the plane containing vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$. If the vector $\vec{x}$ is perpendicular to $(3\hat{i} + 2\hat{j} - \hat{k})$ and its projection on $\vec{a}$ is $\frac{17\sqrt{6}}{2}$, then the value of $|\vec{x}|^2$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 486. · Key from source paper

Q187 JEE Main 2021 · 16 Mar · Shift 1 MCQ

Let a vector $\alpha\hat{i} + \beta\hat{j}$ be obtained by rotating the vector $\sqrt{3}\hat{i} + \hat{j}$ by an angle 45° about the origin in counterclockwise direction in the first quadrant. Then the area (in sq. units) of triangle having vertices $(\alpha, \beta), (0, \beta)$ and $(0, 0)$ is equal to

(A) $\frac{1}{2}$
(B) 1
(C) $\frac{1}{\sqrt{2}}$
(D) $2\sqrt{2}$

Answer: (A) $\frac{1}{2}$ · Key from source paper

Q188 JEE Main 2021 · 16 Mar · Shift 2 MCQ

Let $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} - 3\hat{j} + 5\hat{k}$. If $\vec{r} \times \vec{a} = \vec{b} \times \vec{r}$, $\vec{r} \cdot \left(\alpha\hat{i} + 2\hat{j} + \hat{k}\right) = 3$ and $\vec{r} \cdot \left(2\hat{i} + 5\hat{j} - \alpha\hat{k}\right) = -1$, $\alpha \in R$, then the value of $\alpha + |\vec{r}|^2$ is equal to :

(A) 9
(B) 15
(C) 13
(D) 11

Answer: (B) 15 · Key from source paper

Q189 JEE Main 2021 · 16 Mar · Shift 2 Numerical

Let $\vec{c}$ be a vector perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$. If $\vec{c} \cdot \left(\hat{i} + \hat{j} + 3\hat{k}\right) = 8$, then the value of $\vec{c} \cdot \left(\vec{a} \times \vec{b}\right)$ is equal to

Numerical value type: the answer is a number.

Answer: 28. · Key from source paper

Q190 JEE Main 2021 · 26 Feb · Shift 1 MCQ

If $\vec{a}$ and $\vec{b}$ are perpendicular, then $\vec{a} \times \left(\vec{a} \times \left(\vec{a} \times \left(\vec{a} \times \vec{b}\right)\right)\right)$ is equal to:

(A) $|\vec{a}|^4 \vec{b}$
(B) $\vec{0}$
(C) $\vec{a} \times \vec{b}$
(D) $\frac{1}{2}|\vec{a}|^4 \vec{b}$

Answer: (A) $|\vec{a}|^4 \vec{b}$ · Key from source paper

Q191 JEE Main 2021 · 26 Feb · Shift 1 MCQ

If $(1, 5, 35)$, $(7, 5, 5)$, $(1, \lambda, 7)$ and $(2\lambda, 1, 2)$ are coplanar, then the sum of all possible values of λ is:

(A) $\frac{44}{5}$
(B) $-\frac{44}{5}$
(C) $\frac{39}{5}$
(D) $-\frac{39}{5}$

Answer: (A) $\frac{44}{5}$ · Key from source paper

Q192 JEE Main 2021 · 26 Feb · Shift 2 MCQ

If vectors $\vec{a}_1 = x\hat{i} - \hat{j} + \hat{k}$ and $\vec{a}_2 = \hat{i} + y\hat{j} + z\hat{k}$ are collinear, then a possible unit vector parallel to the vector $x\hat{i} + y\hat{j} + z\hat{k}$ is:

(A) $\frac{1}{\sqrt{2}}\left(-\hat{j} + \hat{k}\right)$
(B) $\frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$
(C) $\frac{1}{\sqrt{2}}\left(\hat{i} - \hat{j}\right)$
(D) $\frac{1}{\sqrt{3}}\left(\hat{i} - \hat{j} + \hat{k}\right)$

Answer: (D) $\frac{1}{\sqrt{3}}\left(\hat{i} - \hat{j} + \hat{k}\right)$ · Key from source paper

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Q193 JEE Main 2021 · 25 Feb · Shift 1 Numerical

Let $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} = \vec{c} \times \vec{a}$ and $\vec{r} \cdot \vec{b} = 0$, then $\vec{r} \cdot \vec{a}$ is equal to

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q194 JEE Main 2021 · 25 Feb · Shift 2 Numerical

Let $\vec{a} = \hat{i} + \alpha\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - \alpha\hat{j} + \hat{k}$. If the area of the parallelogram whose adjacent sides are represented by the vectors $\vec{a}$ and $\vec{b}$ is $8\sqrt{3}$ square units, then $\vec{a} \cdot \vec{b}$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q195 JEE Main 2021 · 24 Feb · Shift 1 Numerical

Let three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}$, $\vec{a} \cdot \vec{c} = 7$ and $\vec{b}$ is perpendicular to $\vec{c}$, where $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{k}$, then the value of $2\left|\vec{a} + \vec{b} + \vec{c}\right|^2$ is _____

Numerical value type: the answer is a number.

Answer: 75. · Key from source paper

Q196 JEE Main 2020 · 6 Sep · Shift 1 Numerical

If $\vec{a}$ and $\vec{b}$ are unit vectors, then the greatest value of $\sqrt{3}\left|\vec{a} + \vec{b}\right| + \left|\vec{a} - \vec{b}\right|$ is _____

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q197 JEE Main 2020 · 6 Sep · Shift 2 Numerical

If $\vec{x}$ and $\vec{y}$ be two non-zero vectors such that $|\vec{x}+\vec{y}|=|\vec{x}|$ and $2\vec{x}+\lambda\vec{y}$ is perpendicular to $\vec{y}$, then the value of λ is _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q198 JEE Main 2020 · 5 Sep · Shift 1 MCQ

If the volume of a parallelopiped, whose coterminus edges are given by the vectors $\vec{a}=\hat{i}+\hat{j}+n\hat{k}$, $\vec{b}=2\hat{i}+4\hat{j}-n\hat{k}$ and$\vec{c}=\hat{i}+n\hat{j}+3\hat{k}$ $(n\geq 0)$ is 158 cubic units, then :

(A) $\vec{a}\cdot\vec{c}=17$

(B) $\vec{b}\cdot\vec{c}=10$

(C) $n=7$

(D) $n=9$

Answer: (B) $\vec{b}\cdot\vec{c}=10$ · Key from source paper

Q199 JEE Main 2020 · 5 Sep · Shift 2 Numerical

Let the vectors $\vec{a},\vec{b},\vec{c}$ be such that $|\vec{a}|=2$, $|\vec{b}|=4$ and $|\vec{c}|=4$. If the projection of $\vec{b}$ on $\vec{a}$ is equal to the projection of $\vec{c}$ on $\vec{a}$ and $\vec{b}$ is perpendicular to $\vec{c}$, then the value of $|\vec{a}+\vec{b}-\vec{c}|$ is _____

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q200 JEE Main 2020 · 4 Sep · Shift 1 MCQ

Let x_0 be the point of local maxima of $f(x)=\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)$, where$\vec{a}=x\hat{i}-2\hat{j}+3\hat{k}$, $\vec{b}=-2\hat{i}+x\hat{j}-\hat{k}$ and $\vec{c}=7\hat{i}-2\hat{j}+x\hat{k}$. Then the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ at $x=x_0$ is:

(A) -4

(B) -30

(C) 14

(D) -22

Answer: (D) -22 · Key from source paper

Q201 JEE Main 2020 · 4 Sep · Shift 2 Numerical

If $\vec{a}=2\hat{i}+\hat{j}+2\hat{k}$, then, the value of $\left|\hat{i}\times(\vec{a}\times\hat{i})\right|^2+\left|\hat{j}\times(\vec{a}\times\hat{j})\right|^2+\left|\hat{k}\times(\vec{a}\times\hat{k})\right|^2$, is equal to :

Numerical value type: the answer is a number.

Answer: 18. · Key from source paper

Q202 JEE Main 2020 · 3 Sep · Shift 2 MCQ

Let $a,\ b,\ c \in R$ be such that $a^2+b^2+c^2=1$. If $a\cos\theta = b\cos\left(\theta+\frac{2\pi}{3}\right) = c\cos\left(\theta+\frac{4\pi}{3}\right)$,where $\theta=\frac{\pi}{9}$, then the angle between the vectors $a\hat{i}+b\hat{j}+c\hat{k}$ and $b\hat{i}+c\hat{j}+a\hat{k}$ is:

(A) 0

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

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

(D) $\frac{\pi}{9}$

Answer: (C) $\frac{\pi}{2}$ · Key from source paper

Q203 JEE Main 2020 · 2 Sep · Shift 1 Numerical

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three unit vectors such that $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{a}-\vec{c}\right|^2=8$. Then $\left|\vec{a}+2\vec{b}\right|^2+\left|\vec{a}+2\vec{c}\right|^2$ is equal to

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q204 JEE Main 2020 · 2 Sep · Shift 2 Numerical

Let the position vectors of points 'A' and 'B' be $\hat{i}+\hat{j}+\hat{k}$ and $2\hat{i}+\hat{j}+3\hat{k}$, respectively. A point 'P' divides the line segment AB internally in the ratio $\lambda:1(\lambda>0)$. If O is the origin and $\overrightarrow{OB}\cdot\overrightarrow{OP}-3\left|\overrightarrow{OA}\times\overrightarrow{OP}\right|^2=6$ then λ is equal to

Numerical value type: the answer is a number.

Answer: 0.8. · Key from source paper

Q205 JEE Main 2020 · 9 Jan · Shift 1 Numerical

If the vectors, $\vec{p}=(a+1)\hat{i}+a\hat{j}+a\hat{k}$, $\vec{q}=a\hat{i}+(a+1)\hat{j}+a\hat{k}$ and $\vec{r}=a\hat{i}+a\hat{j}+(a+1)\hat{k}(a\in R)$ are coplanar and $3\left(\vec{p}.\vec{q}\right)^2-\lambda\left|\vec{r}\times\vec{q}\right|^2=0$, then the value of λ is _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q206 JEE Main 2020 · 9 Jan · Shift 2 Numerical

Let $\vec{a},\vec{b}$ and $\vec{c}$ be three vectors such that $|\vec{a}|=\sqrt{3}$, $|\vec{b}|=5$, $\vec{b}\cdot\vec{c}=10$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$. If $\vec{a}$ is perpendicular to the vector $\vec{b}\times\vec{c}$, then $\left|\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right|$ is equal to _____.

Numerical value type: the answer is a number.

Answer: 30. · Key from source paper

Q207 JEE Main 2020 · 8 Jan · Shift 1 MCQ

Let the volume of a parallelepiped whose coterminous edges are given by $\vec{u} = \hat{i} + \hat{j} + \lambda\hat{k}$, $\vec{v} = \hat{i} + \hat{j} + 3\hat{k}$ and $\vec{w} = 2\hat{i} + \hat{j} + \hat{k}$ be 1 cu. unit. If θ be the angle between the edges $\vec{u}$ and $\vec{w}$, then the value of $\cos\theta$ can be

(A) $\frac{7}{6\sqrt{6}}$
(B) $\frac{7}{6\sqrt{3}}$
(C) $\frac{5}{7}$
(D) $\frac{5}{3\sqrt{3}}$

Answer: (B) $\frac{7}{6\sqrt{3}}$ · Key from source paper

Q208 JEE Main 2020 · 8 Jan · Shift 2 MCQ

Let $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$, be two vectors. If $\vec{c}$, is a vector such that $\vec{b} \times \vec{c} = \vec{b} \times \vec{a}$ and $\vec{c} \cdot \vec{a} = 0$, then $\vec{c} \cdot \vec{b}$, is equal to.

(A) $-\frac{3}{2}$
(B) $\frac{1}{2}$
(C) $-\frac{1}{2}$
(D) -1

Answer: (C) $-\frac{1}{2}$ · Key from source paper

Q209 JEE Main 2020 · 7 Jan · Shift 1 MCQ

A vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}(\alpha, \beta \in R)$ lies in the plane of the vectors, $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$. If $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then

(A) $\vec{a} \cdot \hat{i} + 3 = 0$
(B) $\vec{a} \cdot \hat{i} + 1 = 0$
(C) $\vec{a} \cdot \hat{k} + 2 = 0$
(D) $\vec{a} \cdot \hat{k} + 4 = 0$

Answer: (C) $\vec{a} \cdot \hat{k} + 2 = 0$ · Key from source paper

Q210 JEE Main 2020 · 7 Jan · Shift 2 MCQ

Let $\vec{a}, \vec{b}$ and $\vec{c}$, be three unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$. If $\lambda = \vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ and $\vec{d} = \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$, then the order pair, $(\lambda, \vec{d})$, is equal to.

(A) $\left(\frac{3}{2}, 3\vec{a} \times \vec{c}\right)$
(B) $\left(-\frac{3}{2}, 3\vec{c} \times \vec{b}\right)$
(C) $\left(\frac{3}{2}, 3\vec{b} \times \vec{c}\right)$
(D) $\left(-\frac{3}{2}, 3\vec{a} \times \vec{b}\right)$

Answer: (D) $\left(-\frac{3}{2}, 3\vec{a} \times \vec{b}\right)$ · Key from source paper

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Q211 JEE Main 2019 · 12 Apr · Shift 1 MCQ

If the volume of parallelepiped formed by the vectors $\hat{i} + \lambda\hat{j} + \hat{k}, \hat{j} + \lambda\hat{k}$ and $\lambda\hat{i} + \hat{k}$ is minimum, then λ is equal to:

(A) $-\frac{1}{\sqrt{3}}$
(B) $-\sqrt{3}$
(C) $\sqrt{3}$
(D) $\frac{1}{\sqrt{3}}$

Answer: (D) $\frac{1}{\sqrt{3}}$ · Key from source paper

Q212 JEE Main 2019 · 12 Apr · Shift 1 MCQ

Let $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ be two vectors. If a vector perpendicular to both the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ has the magnitude 12 then one such vector is:

(A) $4\left(2\hat{i} + 2\hat{j} + \hat{k}\right)$
(B) $4\left(2\hat{i} - 2\hat{j} - \hat{k}\right)$
(C) $4\left(-2\hat{i} - 2\hat{j} + \hat{k}\right)$
(D) $4\left(2\hat{i} + 2\hat{j} - \hat{k}\right)$

Answer: (B) $4\left(2\hat{i} - 2\hat{j} - \hat{k}\right)$ · Key from source paper

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Q213 JEE Main 2019 · 12 Apr · Shift 2 MCQ

Let $\alpha \in R$ and the three vectors $\vec{a} = \alpha\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} - \alpha\hat{k}$ and $\vec{c} = \alpha\hat{i} - 2\hat{j} + 3\hat{k}$. Then the set $S = \{\alpha : \vec{a}, \vec{b}$ and $\vec{c}$ are coplanar$\}$

(A) is singleton
(B) contains exactly two positive numbers
(C) is empty
(D) contains exactly two numbers only one of which is positive

Answer: (C) is empty · Key from source paper

Q214 JEE Main 2019 · 9 Apr · Shift 1 MCQ

Let $\vec{\alpha} = 3\hat{i} + \hat{j}$ and $\vec{\beta} = 2\hat{i} - \hat{j} + 3\hat{k}$. If $\vec{\beta} = \vec{\beta}_1 - \vec{\beta}_2$, where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$, then $\vec{\beta}_1 \times \vec{\beta}_2$ is equal to:

(A) $\frac{1}{2}\left(-3\hat{i} + 9\hat{j} + 5\hat{k}\right)$

(B) $3\hat{i} - 9\hat{j} - 5\hat{k}$

(C) $-3\hat{i} + 9\hat{j} + 5\hat{k}$

(D) $\frac{1}{2}\left(3\hat{i} - 9\hat{j} + 5\hat{k}\right)$

Answer: (A) $\frac{1}{2}\left(-3\hat{i} + 9\hat{j} + 5\hat{k}\right)$ · Key from source paper

Q215 JEE Main 2019 · 8 Apr · Shift 1 MCQ

The magnitude of the projection of the vector $2\hat{i} + 3\hat{j} + \hat{k}$ on the vector perpendicular to the plane containing the vectors $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$, is:

(A) $3\sqrt{6}$

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

(C) $\sqrt{6}$

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

Answer: (B) $\sqrt{\frac{3}{2}}$ · Key from source paper

Q216 JEE Main 2019 · 8 Apr · Shift 2 MCQ

Let $\vec{a} = 3\hat{i} + 2\hat{j} + x\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$, for some real x. Then the condition for $\vec{a} \times \vec{b} = r$ to follow

(A) $0 < r \leq \sqrt{\frac{3}{2}}$

(B) $r \geq 5\sqrt{\frac{3}{2}}$

(C) $\sqrt{\frac{3}{2}} < r \leq 3\sqrt{\frac{3}{2}}$

(D) $3\sqrt{\frac{3}{2}} < \mathrm{r} < 5\sqrt{\frac{3}{2}}$

Answer: (B) $r \geq 5\sqrt{\frac{3}{2}}$ · Key from source paper

Q217 JEE Main 2019 · 12 Jan · Shift 1 MCQ

The sum of the distinct real values of μ for which the vectors $\mu\hat{i} + \hat{j} + \hat{k}$, $\hat{i} + \mu\hat{j} + \hat{k}$, $\hat{i} + \hat{j} + \mu\hat{k}$ are co-planar, is

(A) 0
(B) -1
(C) 1
(D) 2

Answer: (B) -1 · Key from source paper

Q218 JEE Main 2019 · 12 Jan · Shift 2 MCQ

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three unit vectors, out of which vectors $\vec{b}$ and $\vec{c}$ are non-parallel. If α and β are the angles which vector $\vec{a}$ makes with vectors $\vec{b}$ and $\vec{c}$ respectively and $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{1}{2}\vec{b}$, then $|\alpha - \beta|$ is equal to :

(A) 90°
(B) 60°
(C) 45°
(D) 30°

Answer: (D) 30° · Key from source paper

Q219 JEE Main 2019 · 11 Jan · Shift 1 MCQ

Let $\vec{a} = \hat{i} + 2\hat{j} + 4\hat{k}, \vec{b} = \hat{i} + \lambda\hat{j} + 4\hat{k}$ and $\vec{c} = 2\hat{i} + 4\hat{j} + \left(\lambda^2 - 1\right)\hat{k}$ be coplanar vectors. Then the non-zero vector $\vec{a} \times \vec{c}$ is:

(A) $-10\hat{i} - 5\hat{j}$
(B) $-14\hat{i} - 5\hat{j}$
(C) $-14\hat{i} + 5\hat{j}$
(D) $-10\hat{i} + 5\hat{j}$

Answer: (D) $-10\hat{i} + 5\hat{j}$ · Key from source paper

Q220 JEE Main 2019 · 10 Jan · Shift 1 MCQ

Let $\vec{a} = 2\hat{i} + \lambda_1\hat{j} + 3\hat{k}, \vec{b} = 4\hat{i} + (3 - \lambda_2)\hat{j} + 6\hat{k}$ and $\vec{c} = 3\hat{i} + 6\hat{j} + (\lambda_3 - 1)\hat{k}$ be three vectors such that $\vec{b} = 2\vec{a}$ and $\vec{a}$ is perpendicular to $\vec{c}$. Then a possible value of $(\lambda_1,\ \lambda_2,\ \lambda_3)$ is

(A) $\left(-\frac{1}{2},\ 4,\ 0\right)$
(B) $(1, 5, 1)$
(C) $\left(\frac{1}{2},\ 4,\ -2\right)$
(D) $(1, 3, 1)$

Answer: (A) $\left(-\frac{1}{2},\ 4,\ 0\right)$ · Key from source paper

Q221 JEE Main 2019 · 10 Jan · Shift 2 MCQ

Let $\vec{\alpha} = (\lambda - 2)\vec{a} + \vec{b}$ and $\vec{\beta} = (4\lambda - 2)\vec{a} + 3\vec{b}$, be two given vectors where vectors $\vec{a}$ and $\vec{b}$ are non-collinear. The value of λ for which vectors $\vec{\alpha}$ and $\vec{\beta}$ are collinear, is:

(A) -4
(B) -3
(C) 4
(D) 3

Answer: (A) -4 · Key from source paper

Q222 JEE Main 2019 · 9 Jan · Shift 1 MCQ

Let $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} \times \vec{c} + \vec{b} = \vec{0}$ and $\vec{a} \cdot \vec{c} = 4$, then $\left|\vec{c}\right|^2$ is equal to:

(A) $\frac{19}{2}$
(B) 9
(C) $\frac{17}{2}$
(D) 8

Answer: (A) $\frac{19}{2}$ · Key from source paper

Q223 JEE Main 2019 · 9 Jan · Shift 2 MCQ

Let $\vec{a} = \hat{i} + \hat{j} + \sqrt{2}\hat{k}$, $\vec{b} = b_1\hat{i} + b_2\hat{j} + \sqrt{2}\hat{k}$ and $\vec{c} = 5\hat{i} + \hat{j} + \sqrt{2}\hat{k}$ be three vectors such that the projection vector of $\vec{b}$ on $\vec{a}$ is $\left|\vec{a}\right|$. If $\vec{a} + \vec{b}$ is perpendicular to $\vec{c}$, then $\left|\vec{b}\right|$ is equal to:

(A) $\sqrt{22}$
(B) $\sqrt{32}$
(C) 6
(D) 4

Answer: (C) 6 · Key from source paper

Q224 JEE Main 2018 · 16 Apr · Online MCQ

Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{c} = \hat{j} - \hat{k}$ and a vector $\vec{b}$ be such that $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a} \cdot \vec{b} = 3$. Then $\left|\vec{b}\right|$ equals

(A) $\frac{11}{3}$
(B) $\frac{11}{\sqrt{3}}$
(C) $\sqrt{\frac{11}{3}}$
(D) $\frac{\sqrt{11}}{3}$

Answer: (C) $\sqrt{\frac{11}{3}}$ · Key from source paper

Q225 JEE Main 2018 · 15 Apr · Shift 1 MCQ

If $\vec{a}, \vec{b}$, and $\vec{c}$ are unit vectors such that $\vec{a} + 2\vec{b} + 2\vec{c} = \vec{0}$, then $|\vec{a} \times \vec{c}|$ is equal to

(A) $\frac{1}{4}$
(B) $\frac{\sqrt{15}}{4}$
(C) $\frac{15}{16}$
(D) $\frac{\sqrt{15}}{16}$

Answer: (B) $\frac{\sqrt{15}}{4}$ · Key from source paper

Q226 JEE Main 2018 · 15 Apr · Shift 2 MCQ

If the position vectors of the vertices A, B and C of a $\triangle$ABC are respectively $4\hat{i} + 7\hat{j} + 8\hat{k}, 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $2\hat{i} + 5\hat{j} + 7\hat{k}$, then the position vector of the point, where the bisector of $\angle A$ meets BC is

(A) $\frac{1}{2}(4\hat{i} + 8\hat{j} + 11\hat{k})$
(B) $\frac{1}{3}(6\hat{i} + 13\hat{j} + 18\hat{k})$
(C) $\frac{1}{4}(8\hat{i} + 14\hat{j} + 9\hat{k})$
(D) $\frac{1}{3}(6\hat{i} + 11\hat{j} + 15\hat{k})$

Answer: (B) $\frac{1}{3}(6\hat{i} + 13\hat{j} + 18\hat{k})$ · Key from source paper

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Q227 JEE Main 2018 · 8 Apr · Offline MCQ

Let $\vec{u}$ be a vector coplanar with the vectors $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{j} + \hat{k}$. If $\vec{u}$ is perpendicular to $\vec{a}$ and $\vec{u} \cdot \vec{b} = 24$, then $|\vec{u}|^2$ is equal to:

(A) 84
(B) 336
(C) 315
(D) 256

Answer: (B) 336 · Key from source paper

Q228 JEE Main 2017 · 9 Apr · Online MCQ

If the vector $\overrightarrow{b} = 3\hat{j} + 4\hat{k}$ is written as the sum of a vector $\overrightarrow{b_1}$, parallel to $\overrightarrow{a} = \hat{i} + \hat{j}$ and a vector $\overrightarrow{b_2}$, perpendicular to $\overrightarrow{a}$, then $\overrightarrow{b_1} \times \overrightarrow{b_2}$ is equal to :

(A) $6\hat{i} - 6\hat{j} + \frac{9}{2}\hat{k}$
(B) $-3\hat{i} + 3\hat{j} - 9\hat{k}$
(C) $-6\hat{i} + 6\hat{j} - \frac{9}{2}\hat{k}$
(D) $3\hat{i} - 3\hat{j} + 9\hat{k}$

Answer: (A) $6\hat{i} - 6\hat{j} + \frac{9}{2}\hat{k}$ · Key from source paper

Q229 JEE Main 2017 · 8 Apr · Online MCQ

The area (in sq. units) of the parallelogram whose diagonals are along the vectors $8\hat{i} - 6\hat{j}$ and $3\hat{i} + 4\hat{j} - 12\hat{k}$, is:

(A) 20
(B) 65
(C) 52
(D) 26

Answer: (B) 65 · Key from source paper

Q230 JEE Main 2017 · 2 Apr · Offline MCQ

Given, $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. Let $\vec{c}$ be a vector such that $|\vec{c} - \vec{a}| = 3$, $\left|(\vec{a} \times \vec{b}) \times \vec{c}\right| = 3$ and the angle between $\vec{c}$ and $\vec{a} \times \vec{b}$ be 30°. Then $\vec{a} \cdot \vec{c}$ is equal to:

(A) $\frac{25}{8}$
(B) 2
(C) 5
(D) $\frac{1}{8}$

Answer: (B) 2 · Key from source paper

Q231 JEE Main 2016 · 10 Apr · Online MCQ

Let ABC be a triangle whose circumcentre is at P. If the position vectors A, B, C and P are $\vec{a}, \vec{b}, \vec{c}$ and $\frac{\vec{a}+\vec{b}+\vec{c}}{4}$ respectively, then the position vector of the orthocentre of this triangle, is :

(A) $-\left(\frac{\vec{a}+\vec{b}+\vec{c}}{2}\right)$
(B) $\vec{a}+\vec{b}+\vec{c}$
(C) $\frac{\left(\vec{a}+\vec{b}+\vec{c}\right)}{2}$
(D) $\vec{0}$

Answer: (C) $\frac{\left(\vec{a}+\vec{b}+\vec{c}\right)}{2}$ · Key from source paper

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Q232 JEE Main 2016 · 9 Apr · Online MCQ

In a triangle ABC, right angle at vertex A, if the position vectors of A, B and C are respectively $3\hat{i}+\hat{j}-\hat{k}$, $-\hat{i}+3\hat{j}+p\hat{k}$ and $5\hat{i}+q\hat{j}-4\hat{k}$, then the point (p, q) lies on a line:

(A) Making an obtuse angle with the positive direction of $x-axis$
(B) Parallel to $x-axis$
(C) Parallel to $y-axis$
(D) Making an acute angle with the positive direction of $x-axis$

Answer: (D) Making an acute angle with the positive direction of $x-axis$ · Key from source paper

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Q233 JEE Main 2016 · 3 Apr · Offline MCQ

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three unit vectors such that $\vec{a}\times\left(\vec{b}\times\vec{c}\right)=\frac{\sqrt{3}}{2}\left(\vec{b}+\vec{c}\right)$. If $\vec{b}$ is not parallel to $\vec{c}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{2\pi}{3}$
(B) $\frac{5\pi}{6}$
(C) $\frac{3\pi}{4}$
(D) $\frac{\pi}{2}$

Answer: (B) $\frac{5\pi}{6}$ · Key from source paper

Q234 JEE Main 2015 · 10 Apr · Online MCQ

Let $\vec{a}$ and $\vec{b}$ be two unit vectors such that $\left|\vec{a}+\vec{b}\right|=\sqrt{3}$. If $\vec{c}=\vec{a}+2\vec{b}+3\left(\vec{a}\times\vec{b}\right)$, then $2\left|\vec{c}\right|$ is equal to:

(A) $\sqrt{51}$
(B) $\sqrt{37}$
(C) $\sqrt{43}$
(D) $\sqrt{55}$

Answer: (D) $\sqrt{55}$ · Key from source paper

Q235 JEE Main 2015 · 4 Apr · Offline MCQ

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non - zero vectors such that no two of them are collinear and $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \frac{1}{3}|\vec{b}||\vec{c}|\vec{a}$. If θ is the angle between vectors $\vec{b}$ and $\vec{c}$, then a value of $\sin\theta$ is

(A) $\frac{-2\sqrt{3}}{3}$

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

(C) $\frac{-\sqrt{2}}{3}$

(D) $\frac{2}{3}$

Answer: (B) $\frac{2\sqrt{2}}{3}$ · Key from source paper

Q236 JEE Main 2014 · 19 Apr · Online MCQ

If $\overrightarrow{x} = 3\hat{i} - 6\hat{j} - \hat{k}$, $\overrightarrow{y} = \hat{i} + 4\hat{j} - 3\hat{k}$ and $\overrightarrow{z} = 3\hat{i} - 4\hat{j} - 12\hat{k}$, then the magnitude of the projection of $\overrightarrow{x} \times \overrightarrow{y}$ on $\overrightarrow{z}$ is

(A) 14

(B) 12

(C) 15

(D) 10

Answer: (A) 14 · Key from source paper

Q237 JEE Main 2014 · 12 Apr · Online MCQ

If $\hat{x}$, $\hat{y}$ and $\hat{z}$ are three unit vectors in threedimensional space, then the minimum value of $|\hat{x} + \hat{y}|^2 + |\hat{y} + \hat{z}|^2 + |\hat{z} + \hat{x}|^2$

(A) $\frac{3}{2}$

(B) 3

(C) $3\sqrt{3}$

(D) 6

Answer: (B) 3 · Key from source paper

Q238 JEE Main 2014 · 11 Apr · Online MCQ

If $|\vec{c}|^2 = 60$ and $\vec{c} \times (\hat{i} + 2\hat{j} + 5\hat{k}) = \vec{0}$, then a value of $\vec{c} \cdot (-7\hat{i} + 2\hat{j} + 3\hat{k})$ is:

(A) $4\sqrt{2}$
(B) 12
(C) 24
(D) $12\sqrt{2}$

Answer: (D) $12\sqrt{2}$ · Key from source paper

Q239 JEE Main 2014 · 9 Apr · Online MCQ

If $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $|2\vec{a} - \vec{b}| = 5$, then $|2\vec{a} + \vec{b}|$ equals :

(A) 5
(B) 7
(C) 17
(D) 1

Answer: (A) 5 · Key from source paper

Q240 JEE Main 2014 · 6 Apr · Offline MCQ

If $\left[\vec{a} \times \vec{b} \;\; \vec{b} \times \vec{c} \;\; \vec{c} \times \vec{a}\right] = \lambda \left[\vec{a} \;\; \vec{b} \;\; \vec{c}\right]^2$ then λ is equal to

(A) 0
(B) 1
(C) 2
(D) 3

Answer: (B) 1 · Key from source paper

Q241 JEE Main 2013 · 25 Apr · Online MCQ

Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}, \vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|, |\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 30°, then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ equals:

(A) $\frac{1}{2}$
(B) $\frac{3\sqrt{3}}{2}$
(C) 3
(D) $\frac{3}{2}$

Answer: (D) $\frac{3}{2}$ · Key from source paper

Q242 JEE Main 2013 · 23 Apr · Online MCQ

If $\vec{a}$ and $\vec{b}$ are non-collinear vectors, then the value of α for which the vectors $\vec{u} = (\alpha - 2)\vec{a} + \vec{b}$ and $\vec{v} = (2 + 3\alpha)\vec{a} - 3\vec{b}$ are collinear is :

(A) $\frac{3}{2}$
(B) $\frac{2}{3}$
(C) $-\frac{3}{2}$
(D) $-\frac{2}{3}$

Answer: (B) $\frac{2}{3}$ · Key from source paper

Q243 JEE Main 2013 · 22 Apr · Online MCQ

If $\hat{a}, \hat{b}$ and $\hat{c}$ are unit vectors satisfying $\hat{a} - \sqrt{3}\hat{b} + \hat{c} = \vec{0}$, then the angle between the vectors $\hat{a}$ and $\hat{c}$ is :

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{3}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{2}$

Answer: (B) $\frac{\pi}{3}$ · Key from source paper

Q244 JEE Main 2013 · 9 Apr · Online MCQ

Let $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - 2\hat{k}$ be three vectors. A vector of the type $\vec{b} + \lambda\vec{c}$ for some scalar λ, whose projection on $\vec{a}$ is of magnitude $\sqrt{\frac{2}{3}}$ is :

(A) $2\hat{i} + \hat{j} + 5\hat{k}$
(B) $2\hat{i} + 3\hat{j} - 3\hat{k}$
(C) $2\hat{i} - \hat{j} + 5\hat{k}$
(D) $2\hat{i} + 3\hat{j} + 3\hat{k}$

Answer: (B) $2\hat{i} + 3\hat{j} - 3\hat{k}$ · Key from source paper

Q245 JEE Main 2013 · 9 Apr · Online MCQ

The vector $(\hat{i} \times \vec{a} \cdot \vec{b})\hat{i} + (\hat{j} \times \vec{a}\vec{b})\hat{j} + (\hat{k} \times \vec{a} \cdot \vec{b})\hat{k}$ is equal to:

(A) $\vec{b} \times \vec{a}$
(B) $\vec{a}$
(C) $\vec{a} \times \vec{b}$
(D) $\vec{b}$

Answer: (C) $\vec{a} \times \vec{b}$ · Key from source paper

Q246 JEE Main 2013 · 7 Apr · Offline MCQ

If the vectors $\overrightarrow{AB} = 3\hat{i} + 4\hat{k}$ and $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a triangle ABC, then the length of the median through A is:

(A) $\sqrt{33}$
(B) $\sqrt{45}$
(C) $\sqrt{18}$
(D) $\sqrt{72}$

Answer: (A) $\sqrt{33}$ · Key from source paper

Q247 AIEEE 2012 · 19 May · Online MCQ

If $\vec{a}+\vec{b}+\vec{c}=0, |\vec{a}|=3, |\vec{b}|=5$ and $|\vec{c}|=7$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{2}$

Answer: (A) $\frac{\pi}{3}$ · Key from source paper

Q248 AIEEE 2012 · 19 May · Online MCQ

If $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}, \vec{b}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{c}=r\hat{i}+\hat{j}+(2r-1)\hat{k}$ are three vectors such that $\vec{c}$ is parallel to the plane of $\vec{a}$ and $\vec{b}$, then r is equal to

(A) 1
(B) -1
(C) 0
(D) 2

Answer: (C) 0 · Key from source paper

Q249 AIEEE 2012 · 12 May · Online MCQ

If $\vec{u}=\hat{j}+4\hat{k}, \vec{v}=\hat{i}+3\hat{k}$ and $\vec{w}=\cos\theta\,\hat{i}+\sin\theta\,\hat{j}$ are vectors in 3-dimensional space, then the maximum possible value of $|\vec{u}\times\vec{v}\cdot\vec{w}|$ is

(A) $\sqrt{3}$
(B) 5
(C) $\sqrt{14}$
(D) 7

Answer: (B) 5 · Key from source paper

Q250 AIEEE 2012 · 12 May · Online MCQ

Statement 1: If the points $(1,2,2), (2,1,2)$ and $(2,2,z)$ and $(1,1,1)$ are coplanar, then $z=2$.
Statement 2: If the 4 points P, Q, R and S are coplanar, then the volume of the tetrahedron $PQRS$ is 0.

(A) Statement 1 is false,, Statement 2 is true.
(B) Statement 1 is true, Statement 2 is false.
(C) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.
(D) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

Answer: (A) Statement 1 is false,, Statement 2 is true. · Key from source paper

Q251 AIEEE 2012 · 12 May · Online MCQ

A unit vector which is perpendicular to the vector $2i - j + 2k$ and is coplanar with the vectors $i + j - k$ and $2\hat{i} + 2\hat{j} - \hat{k}$ is

(A) $\frac{2\hat{j} + \hat{k}}{\sqrt{5}}$
(B) $\frac{3\hat{i} + 2\hat{j} - 2\hat{k}}{\sqrt{17}}$
(C) $\frac{3\hat{i} + 2\hat{j} + 2\hat{k}}{\sqrt{17}}$
(D) $\frac{2\hat{i} + 2\hat{j} - \hat{k}}{3}$

Answer: (D) $\frac{2\hat{i} + 2\hat{j} - \hat{k}}{3}$ · Key from source paper

Q252 AIEEE 2012 · 7 May · Online MCQ

$ABCD$ is parallelogram. The position vectors of A and C are respectively, $3\hat{i} + 3\hat{j} + 5\hat{k}$ and $\hat{i} - 5\hat{j} - 5\hat{k}$. If M is the midpoint of the diagonal DB, then the magnitude of the projection of $\overrightarrow{OM}$ on $\overrightarrow{OC}$, where O is the origin, is

(A) $7\sqrt{51}$
(B) $\frac{7}{\sqrt{50}}$
(C) $7\sqrt{50}$
(D) $\frac{7}{\sqrt{51}}$

Answer: (D) $\frac{7}{\sqrt{51}}$ · Key from source paper

Q253 AIEEE 2012 · 7 May · Online MCQ

If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} + \hat{j} + (2\lambda - 1\hat{k})$ are coplanar vectors, then λ is equal to

(A) 0
(B) -1
(C) 2
(D) 1

Answer: (A) 0 · Key from source paper

Q254 AIEEE 2012 · Offline MCQ

Let $\hat{a}$ and $\hat{b}$ be two unit vectors. If the vectors $\vec{c} = \hat{a} + 2\hat{b}$ and $\vec{d} = 5\hat{a} - 4\hat{b}$ are perpendicular to each other, then the angle between $\hat{a}$ and $\hat{b}$ is

(A) $\frac{\pi}{6}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{4}$

Answer: (C) $\frac{\pi}{3}$ · Key from source paper

Q255 AIEEE 2012 · Offline MCQ

Let $ABCD$ be a parallelogram such that $\overrightarrow{AB} = \vec{q}$, $\overrightarrow{AD} = \vec{p}$ and $\angle BAD$ be an acute angle. If $\vec{r}$ is the vector that coincides with the altitude directed from the vertex B to the side AD, then $\vec{r}$ is given by

(A) $\vec{r} = 3\vec{q} - \frac{3(\vec{p}\cdot\vec{q})}{(\vec{p}\cdot\vec{p})}\vec{p}$
(B) $\vec{r} = -\vec{q} + \left(\frac{\vec{p}\cdot\vec{q}}{\vec{p}\cdot\vec{p}}\right)\vec{p}$
(C) $\vec{r} = \vec{q} - \left(\frac{\vec{p}\cdot\vec{q}}{\vec{p}\cdot\vec{p}}\right)\vec{p}$
(D) $\vec{r} = -3\vec{q} + \frac{3(\vec{p}\cdot\vec{q})}{(\vec{p}\cdot\vec{p})}\vec{p}$

Answer: (B) $\vec{r} = -\vec{q} + \left(\frac{\vec{p}\cdot\vec{q}}{\vec{p}\cdot\vec{p}}\right)\vec{p}$ · Key from source paper

Q256 AIEEE 2011 MCQ

If $\overrightarrow{a} = \frac{1}{\sqrt{10}}(3\hat{i} + \hat{k})$ and $\overrightarrow{b} = \frac{1}{7}(2\hat{i} + 3\hat{j} - 6\hat{k})$, then the value of $(2\overrightarrow{a} - \overrightarrow{b}) \cdot [(\overrightarrow{a} \times \overrightarrow{b}) \times (\overrightarrow{a} + 2\overrightarrow{b})]$ is

(A) -3
(B) 5
(C) 3
(D) -5

Answer: (D) -5 · Key from source paper

Q257 AIEEE 2011 MCQ

The vector $\vec{a}$ and $\vec{b}$ are not perpendicular and $\vec{c}$ and $\vec{d}$ are two vectors satisfying: $\vec{b} \times \vec{c} = \vec{b} \times \vec{d}$ and $\vec{a} \cdot \vec{d} = 0$. Then the vector $\vec{d}$ is equal to

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(A) $\vec{c}+\left(\frac{\vec{a}\cdot\vec{c}}{\vec{a}\cdot\vec{b}}\right)\vec{b}$
(B) $\vec{b}+\left(\frac{\vec{b}\cdot\vec{c}}{\vec{a}\cdot\vec{b}}\right)\vec{c}$
(C) $\vec{c}-\left(\frac{\vec{a}\cdot\vec{c}}{\vec{a}\cdot\vec{b}}\right)\vec{b}$
(D) $\vec{b}-\left(\frac{\vec{b}\cdot\vec{c}}{\vec{a}\cdot\vec{b}}\right)\vec{c}$

Answer: (C) $\vec{c}-\left(\frac{\vec{a}\cdot\vec{c}}{\vec{a}\cdot\vec{b}}\right)\vec{b}$ · Key from source paper

Q258 AIEEE 2010 MCQ

Let $\vec{a}=\hat{j}-\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}-\hat{k}$. Then vector $\vec{b}$ satisfying $\vec{a}\times\vec{b}+\vec{c}=\vec{0}$ and $\vec{a}\cdot\vec{b}=3$ is

(A) $2\hat{i}-\hat{j}+2\hat{k}$
(B) $\hat{i}-\hat{j}-2\hat{k}$
(C) $\hat{i}+\hat{j}-2\hat{k}$
(D) $-\hat{i}+\hat{j}-2\hat{k}$

Answer: (D) $-\hat{i}+\hat{j}-2\hat{k}$ · Key from source paper

Q259 AIEEE 2010 MCQ

If the vectors $\vec{a}=\hat{i}-\hat{j}+2\hat{k}$, $\vec{b}=2\hat{i}+4\hat{j}+\hat{k}$ and $\vec{c}=\lambda\hat{i}+\hat{j}+\mu\hat{k}$ are mutually orthogonal, then $(\lambda,\mu)=$

(A) $(2,-3)$
(B) $(-2,3)$
(C) $(3,-2)$
(D) $(-3,2)$

Answer: (D) $(-3,2)$ · Key from source paper

Q260 AIEEE 2009 MCQ

If $\vec{u},\vec{v},\vec{w}$ are non-coplanar vectors and p,q are real numbers, then the equality $[3\vec{u}\ \ p\vec{v}\ \ p\vec{w}]-[p\vec{v}\ \ \vec{w}\ \ q\vec{u}]-[2\vec{w}\ \ q\vec{v}\ \ q\vec{u}]=0$ holds for

(A) exactly one value of (p,q)
(B) exactly two values of (p,q)
(C) more than two but not all values of (p,q)
(D) all values of (p,q)

Answer: (A) exactly one value of (p,q) · Key from source paper

Q261 AIEEE 2008 MCQ

The non-zero verctors $\vec{a},\vec{b}$ and $\vec{c}$ are related by $\vec{a}=8\vec{b}$ and $\vec{c}=-7\vec{b}$. Then the angle between $\vec{a}$ and $\vec{c}$ is

(A) 0
(B) $\pi/4$
(C) $\pi/2$
(D) π

Answer: (D) π · Key from source paper

Q262 AIEEE 2008 MCQ

The vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of the vectors $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{j} + \hat{k}$ and bisects the angle between $\vec{b}$ and $\vec{c}$. Then which one of the following gives possible values of α and β ?

(A) $\alpha = 2, \beta = 2$
(B) $\alpha = 1, \beta = 2$
(C) $\alpha = 2, \beta = 1$
(D) $\alpha = 1, \beta = 1$

Answer: (D) $\alpha = 1, \beta = 1$ · Key from source paper

Q263 AIEEE 2007 MCQ

If $\hat{u}$ and $\hat{v}$ are unit vectors and θ is the acute angle between them, then $2\hat{u} \times 3\hat{v}$ is a unit vector for

(A) exactly two values of θ
(B) more than two values of θ
(C) no value of θ
(D) exactly one value of θ

Answer: (D) exactly one value of θ · Key from source paper

Q264 AIEEE 2007 MCQ

Let $\bar{a} = \mathrm{i} + \mathrm{j} + \mathrm{k}, \mathrm{b} = \mathrm{i} - \mathrm{j} + 2\mathrm{k}$ and $\bar{c} = x\mathrm{i} + (\mathrm{x} - 2)\mathrm{j} - \mathrm{k}$. If the vector $\bar{c}$ lies in the plane of $\bar{a}$ and b, then x equals

(A) 0
(B) 1
(C) -4
(D) -2

Answer: (D) -2 · Key from source paper

Q265 AIEEE 2006 MCQ

If $(\mathrm{a} \times \mathrm{b}) \times \bar{c} = \bar{a} \times (\mathrm{b} \times \bar{c})$, where $\bar{a}$, b and $\bar{c}$ are any three vectors such that $\bar{a} \cdot \mathrm{b} \neq 0$, $\mathrm{b} \cdot \bar{c} \neq 0$, then a and c are

(A) inclined at an angle of $\pi/3$ between them
(B) inclined at an angle of $\pi/6$ between them
(C) perpendicular
(D) parallel

Answer: (D) parallel · Key from source paper

Q266 AIEEE 2006 MCQ

The values of a, for which the points A, B, C with position vectors $2i - j + k$, $i - 3j - 5k$ and $ai - 3j + k$ respectively are the vertices of a right-angled triangle with $C = \frac{\pi}{2}$ are

(A) 2 and 1
(B) -2 and -1
(C) -2 and 1
(D) 2 and -1

Answer: (A) 2 and 1 · Key from source paper

Q267 AIEEE 2005 MCQ

If C is the mid point of AB and P is any point outside AB, then

(A) $\overrightarrow{PA} + \overrightarrow{PB} = 2\overrightarrow{PC}$
(B) $\overrightarrow{PA} + \overrightarrow{PB} + 2\overrightarrow{PC} = 0$
(C) $\overrightarrow{PA} + \overrightarrow{PB} + \overrightarrow{PC} = 0$
(D) None of these

Answer: (A) $\overrightarrow{PA} + \overrightarrow{PB} = 2\overrightarrow{PC}$ · Key from source paper

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Q268 AIEEE 2005 MCQ

For any vectora a the value of $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2$ is equal to

(A) $3\vec{a}^2$
(B) $\vec{a}^2$
(C) $2\vec{a}^2$
(D) $4\vec{a}^2$

Answer: (C) $2\vec{a}^2$ · Key from source paper

Q269 AIEEE 2005 MCQ

If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors and λ is a real number then $\left[\lambda(\vec{a} + \vec{b})\ \lambda^2\vec{b}\ \lambda\vec{c}\right] = \left[\vec{a}\ \vec{b} + \vec{c}\ \vec{b}\right]$ for

(A) exactly one value of λ
(B) no value of λ
(C) exactly three values of λ
(D) exactly two values of λ

Answer: (B) no value of λ · Key from source paper

Q270 AIEEE 2005 MCQ

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

(A) only y
(B) only x
(C) both x and y
(D) neither x nor y

Answer: (D) neither x nor y · Key from source paper

Q271 AIEEE 2005 MCQ

Let a, b and c be distinct non-negative numbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is

(A) the Geometric Mean of a and b
(B) the Arithmetic Mean of a and b
(C) equal to zero
(D) the Harmonic Mean of a and b

Answer: (A) the Geometric Mean of a and b · Key from source paper

Q272 AIEEE 2004 MCQ

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-zero vectors such that no two of these are collinear. If the vector $\vec{a} + 2\vec{b}$ is collinear with $\vec{c}$ and $\vec{b} + 3\vec{c}$ is collinear with $\vec{a}$ (λ being some non-zero scalar) then $\vec{a} + 2\vec{b} + 6\vec{c}$ equals

(A) $\lambda\vec{a}$
(B) $\lambda\vec{b}$
(C) $\lambda\vec{c}$
(D) 0

Answer: (D) 0 · Key from source paper

Q273 AIEEE 2004 MCQ

If $\bar{a}, b, \bar{c}$ are non-coplanar vectors and λ is a real number, then the vectors $\bar{a} + 2\mathrm{b} + 3\bar{c}$, $\lambda\mathrm{b} + 4\bar{c}$ and $(2\lambda - 1)\bar{c}$ are non-coplanar for

(A) all values of λ
(B) all except one value of λ
(C) all except two values of λ
(D) no value of λ

Answer: (C) all except two values of λ · Key from source paper

Q274 AIEEE 2004 MCQ

Let $\bar{a}$, b and $\bar{c}$ be non-zero vectors such that $(\bar{a} \times b) \times \bar{c} = \frac{1}{3}|b||c|\bar{a}$. If θ is the acute angle between the vectors $\bar{b}$ and $\bar{c}$, then $\sin\theta$ equals

(A) $\frac{1}{3}$
(B) $\frac{\sqrt{2}}{3}$
(C) $\frac{2}{3}$
(D) $\frac{2\sqrt{2}}{3}$

Answer: (D) $\frac{2\sqrt{2}}{3}$ · Key from source paper

Q275 AIEEE 2004 MCQ

Let $\bar{u}, \bar{v}, \bar{w}$ be such that $|\bar{u}| = 1, |\bar{v}| = 2, |\bar{w}| = 3$. If the projection $\bar{v}$ along $\bar{u}$ is equal to that of $\bar{w}$ along $\bar{u}$ and $\bar{v}, \bar{w}$ are perpendicular to each other then $|\bar{u} - \bar{v} + \bar{w}|$ equals

(A) 2
(B) $\sqrt{7}$
(C) $\sqrt{14}$
(D) 14

Answer: (C) $\sqrt{14}$ · Key from source paper

Q276 AIEEE 2003 MCQ

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) $\sqrt{33}$

Answer: (D) $\sqrt{33}$ · Key from source paper

Q277 AIEEE 2003 MCQ

Let $\overrightarrow{u} = \hat{i} + \hat{j}$, $\overrightarrow{v} = \hat{i} - \hat{j}$ and $\overrightarrow{w} = \hat{i} + 2\hat{j} + 3\hat{k}$. If $\hat{n}$ is a unit vector such that $\vec{u} \cdot \hat{n} = 0$ and $\vec{v} \cdot \hat{n} = 0$, then $|\overrightarrow{w} \cdot \hat{n}|$ is equal to

(A) 3
(B) 0
(C) 1
(D) 2

Answer: (A) 3 · Key from source paper

Q278 AIEEE 2003 MCQ

$\vec{a}, \vec{b}, \vec{c}$ are 3 vectors, such that $\vec{a}+\vec{b}+\vec{c}=0$, $|\vec{a}|=1$, $|\vec{b}|=2$, $|\vec{c}|=3$, then $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ is equal to

(A) 1
(B) 0
(C) -7
(D) 7

Answer: (C) -7 · Key from source paper

Q279 AIEEE 2003 MCQ

Consider points A, B, C and D with position vectors $7i-4j+7k, i-6j+10k, -i-3j+4k$ and $5i-j+k$ respectively. Then ABCD is a

(A) parallelogram but not a rhombus
(B) square
(C) rhombus
(D) rectangle

Answer: (C) rhombus · Key from source paper

Q280 AIEEE 2003 MCQ

If $\bar{u}, \bar{v}$ and $\bar{w}$ are three non-coplanar vectors, then $(\bar{u}+\bar{v}-\bar{w}).(\bar{u}-\bar{v})\times(\bar{v}-\bar{w})$ equals

(A) $3\bar{u}.\bar{v}\times\bar{w}$
(B) 0
(C) $\overrightarrow{u}.\overrightarrow{v}\times\overrightarrow{w}$
(D) $\overrightarrow{u}.\overrightarrow{w}\times\overrightarrow{v}$

Answer: (C) $\overrightarrow{u}.\overrightarrow{v}\times\overrightarrow{w}$ · Key from source paper

Q281 AIEEE 2002 MCQ

If $|\vec{a}|=4, |\vec{b}|=2$ and the angle between $\vec{a}$ and $\vec{b}$ is $\pi/6$ then $(\vec{a}\times\vec{b})^2=2$ is equal to

(A) 48
(B) 16
(C) $\vec{a}$
(D) none of these

Answer: (B) 16 · Key from source paper

Q282 AIEEE 2002 MCQ

If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $|\vec{a}\vec{b}\vec{c}| = 4$ then $\left|\vec{a} \times \vec{b}\ \ \vec{b} \times \vec{c}\ \ \vec{c} \times \vec{a}\right| =$

(A) 16
(B) 64
(C) 4
(D) 8

Answer: (A) 16 · Key from source paper

Q283 AIEEE 2002 MCQ

If $\vec{a}, b, \vec{c}$ are vectors such that $\vec{a} + b + \vec{c} = 0$ and $|\vec{a}| = 7, |b| = 5, |\vec{c}| = 3$ then angle between vector b and $\vec{c}$ is

(A) 60°
(B) 30°
(C) 45°
(D) 90°

Answer: (A) 60° · Key from source paper

Q284 AIEEE 2002 MCQ

If $|a| = 5, |b| = 4, |c| = 3$ thus what will be the value of $|a \cdot b + b.c + c.a|$, given that $\vec{a} + \vec{b} + \vec{c} = 0$

(A) 25
(B) 50
(C) -25
(D) -50

Answer: (A) 25 · Key from source paper

Q285 AIEEE 2002 MCQ

$\vec{a} = 3\hat{i} - 5\hat{j}$ and $\vec{b} = 6\hat{i} + 3\hat{j}$ are two vectors and $\vec{c}$ is a vector such that $\vec{c} = \vec{a} \times \vec{b}$ then

$|\vec{a}| : |\vec{b}| : |\vec{c}|$

(A) $\sqrt{34} : \sqrt{45} : \sqrt{39}$
(B) $\sqrt{34} : \sqrt{45} : 39$
(C) 34 : 39 : 45
(D) 39 : 35 : 34

Answer: (B) $\sqrt{34} : \sqrt{45} : 39$ · Key from source paper

Q286 AIEEE 2002 MCQ

If $\vec{a} \times b = b \times \vec{c} = \vec{c} \times \vec{a}$ then $\vec{a} + b + \vec{c} =$

(A) abc
(B) -1
(C) 0
(D) 2

Answer: (C) 0 · Key from source paper

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