

MATHEMATICS · JEE MAIN

Vectors

Chapter-wise previous year questions, with answer key

170

PYQS

2020–2025

PAPERS

6

TOPICS

Vector Triple Product

Dot and Cross Product

Types of Vectors

Scalar Triple Product

Coplanarity and Collinearity

Vector Equation of Line

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: prepwisar.in/learn · No signup needed to browse

Vector Triple Product · 8 PYQs

Q1 JEE Main 2023 · 30 Jan · Shift 1

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) 6

(D) 12

Step-by-step solution ► [prepwiser.in/questions/5A7xYERABu](https://www.prepwiser.in/questions/5A7xYERABu)

Q2 JEE Main 2022 · 29 Jul · Shift 1

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

Step-by-step solution ► [prepwiser.in/questions/BysuD608vs](https://www.prepwiser.in/questions/BysuD608vs)

Q3 JEE Main 2022 · 27 Jul · Shift 1

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

is equal to :

(A) 4

(B) 5

(C) $\sqrt{21}$

(D) $\sqrt{17}$

Step-by-step solution ► [prepwiser.in/questions/uJAhpCw2TH](https://www.prepwiser.in/questions/uJAhpCw2TH)

Q4 JEE Main 2022 · 30 Jun · Shift 1

Let a vector $\vec{c}$ be coplanar with the vectors $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$. If the vector $\vec{c}$ also satisfies the conditions

$$\vec{c} \cdot [(\vec{a} + \vec{b}) \times (\vec{a} \times \vec{b})] = -42$$

and

$$(\vec{c} \times (\vec{a} - \vec{b})) \cdot \hat{k} = 3$$

, then the value of $|\vec{c}|^2$ is equal to :

(A) 24

(B) 29

(C) 35

(D) 42

Step-by-step solution ► [prepwiser.in/questions/P2SQAjXhvm](https://www.prepwiser.in/questions/P2SQAjXhvm)

Q5 JEE Main 2021 · 31 Aug · Shift 2

Let $\vec{a}, \vec{b}, \vec{c}$ three vectors mutually perpendicular to each other and have same magnitude. If a vector $\vec{r}$ satisfies,

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

, then $\vec{r}$ is equal to :

(A) $\frac{1}{3}(\vec{a} + \vec{b} + \vec{c})$

(B) $\frac{1}{3}(2\vec{a} + \vec{b} - \vec{c})$

(C) $\frac{1}{2}(\vec{a} + \vec{b} + \vec{c})$

(D) $\frac{1}{2}(\vec{a} + \vec{b} + 2\vec{c})$

Step-by-step solution ► [prepwisar.in/questions/tG_O-OC10o](https://www.prepwisar.in/questions/tG_O-OC10o)

Q6 JEE Main 2021 · 27 Jul · Shift 1

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

$$(\vec{a} + \vec{b}) \times \left((\vec{a} \times ((\vec{a} - \vec{b}) \times \vec{b})) \times \vec{b} \right)$$

is equal to :

(A) $5(34\hat{i} - 5\hat{j} + 3\hat{k})$

(B) $7(34\hat{i} - 5\hat{j} + 3\hat{k})$

(C) $7(30\hat{i} - 5\hat{j} + 7\hat{k})$

(D) $5(30\hat{i} - 5\hat{j} + 7\hat{k})$

Step-by-step solution ► [prepwisar.in/questions/-6L8UfZASW](https://www.prepwisar.in/questions/-6L8UfZASW)

Q7 JEE Main 2021 · 27 Jul · Shift 2

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a} = \vec{b} \times (\vec{b} \times \vec{c})$. 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 θ ($0 < \theta < \frac{\pi}{2}$), then the value of $1 + \tan\theta$ is equal to :

(A) $\sqrt{3} + 1$

(B) 2

(C) 1

(D) $\frac{\sqrt{3}+1}{\sqrt{3}}$

Step-by-step solution ► [prepwisar.in/questions/jgh6pmsFxf](https://www.prepwisar.in/questions/jgh6pmsFxf)

Q8 JEE Main 2020 · 9 Jan · Shift 2

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

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

is equal to ____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/wclLBSeUaH](https://www.prepwisar.in/questions/wclLBSeUaH)

Dot and Cross Product · 122 PYQs

Q9 JEE Main 2025 · 8 Apr · Shift 2

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

[Step-by-step solution ► prepwisar.in/questions/phJ2z6o7hL](https://www.prepwisar.in/questions/phJ2z6o7hL)

Q10 JEE Main 2025 · 7 Apr · Shift 2

Let $\vec{a}$ and $\vec{b}$ be the vectors of the same magnitude such that

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

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

[Step-by-step solution ► prepwisar.in/questions/u3lOJmh2iG](https://www.prepwisar.in/questions/u3lOJmh2iG)

Q11 JEE Main 2025 · 4 Apr · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/GtsBfM1nX3](https://www.prepwisar.in/questions/GtsBfM1nX3)

Q12 JEE Main 2025 · 4 Apr · Shift 1

Consider two vectors $\vec{u} = 3\hat{i} - \hat{j}$ and $\vec{v} = 2\hat{i} + \hat{j} - \lambda\hat{k}$, $\lambda > 0$. The angle between them is given by $\cos^{-1}\left(\frac{\sqrt{5}}{2\sqrt{7}}\right)$. Let $\vec{v} = \vec{v}_1 + \vec{v}_2$, where $\vec{v}_1$ is parallel to $\vec{u}$ and $\vec{v}_2$ is perpendicular to $\vec{u}$. Then the value $|\vec{v}_1|^2 + |\vec{v}_2|^2$ is equal to

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

Step-by-step solution ► [prepwisar.in/questions/Or8J5KMKEc](https://www.prepwisar.in/questions/Or8J5KMKEc)

Q13 JEE Main 2025 · 3 Apr · Shift 1

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

Numerical answer — enter the value.

Step-by-step solution ► [prepwisar.in/questions/ATPo2Q5vAo](https://www.prepwisar.in/questions/ATPo2Q5vAo)

Q14 JEE Main 2025 · 3 Apr · Shift 2

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 answer — enter the value.

Step-by-step solution ► [prepwisar.in/questions/7qZxv7NmJq](https://www.prepwisar.in/questions/7qZxv7NmJq)

Q15 JEE Main 2025 · 2 Apr · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/CXhUuZ9gaX](https://www.prepwisar.in/questions/CXhUuZ9gaX)

Q16 JEE Main 2025 · 2 Apr · Shift 2

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

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

Step-by-step solution ► [prepwisar.in/questions/FKzBplmRhQ](https://www.prepwisar.in/questions/FKzBplmRhQ)

Q17 JEE Main 2025 · 29 Jan · Shift 1

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 $\vec{a} \times \vec{c} = \vec{a} \times \vec{b} = \vec{c} \times \vec{b}$ and $(\vec{a} + \vec{c}) \cdot (\vec{b} + \vec{c}) = 168$. Then the maximum value of $|\vec{c}|^2$ is :

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

[Step-by-step solution ► prepwiser.in/questions/zyuEPsVSAK](https://www.prepwiser.in/questions/zyuEPsVSAK)

Q18 JEE Main 2025 · 29 Jan · Shift 2

Let $\hat{a}$ be a unit vector perpendicular to the vectors $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{c} = 2\hat{i} + 3\hat{j} - \hat{k}$, and $\hat{a}$ makes an angle of $\cos^{-1}(-\frac{1}{3})$ 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) $\sqrt{3}$
- (B) $\sqrt{6}$
- (C) $-\sqrt{6}$
- (D) $-\sqrt{3}$

[Step-by-step solution ► prepwiser.in/questions/9GAfDE2yRK](https://www.prepwiser.in/questions/9GAfDE2yRK)

Q19 JEE Main 2025 · 28 Jan · Shift 2

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

[Step-by-step solution ► prepwiser.in/questions/YSzbgL-GwF](https://www.prepwiser.in/questions/YSzbgL-GwF)

Q20 JEE Main 2025 · 28 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/WCeULa0NS2](https://www.prepwiser.in/questions/WCeULa0NS2)

Q21 JEE Main 2025 · 28 Jan · Shift 2

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

- (A) 2
- (B) 0
- (C) $\frac{9}{2}$
- (D) 1

[Step-by-step solution ► prepwiser.in/questions/gZcV_RFOsV](https://www.prepwiser.in/questions/gZcV_RFOsV)

Q22 JEE Main 2025 · 24 Jan · Shift 1

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) 18 (D) 16

[Step-by-step solution ► prepwiser.in/questions/UvAjUY-ZsU](https://www.prepwiser.in/questions/UvAjUY-ZsU)

Q23 JEE Main 2025 · 24 Jan · Shift 2

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

[Step-by-step solution ► prepwiser.in/questions/qbFxxnOb3a](https://www.prepwiser.in/questions/qbFxxnOb3a)

Q24 JEE Main 2025 · 23 Jan · Shift 2

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

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

[Step-by-step solution ► prepwiser.in/questions/xbHFqPc9SB](https://www.prepwiser.in/questions/xbHFqPc9SB)

Q25 JEE Main 2025 · 22 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/IK0Hw93mSp](https://www.prepwiser.in/questions/IK0Hw93mSp)

Q26 JEE Main 2025 · 22 Jan · Shift 2

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

[Step-by-step solution ► prepwiser.in/questions/e001oQT10N](https://www.prepwiser.in/questions/e001oQT10N)

Q27 JEE Main 2024 · 9 Apr · Shift 1

Let three vectors ,

$$\vec{a} = \alpha\hat{i} + 4\hat{j} + 2\hat{k}, \vec{b} = 5\hat{i} + 3\hat{j} + 4\hat{k}, \vec{c} = x\hat{i} + y\hat{j} + z\hat{k}$$

form a triangle such that $\vec{c} = \vec{a} - \vec{b}$ and the area of the triangle is $5\sqrt{6}$. If α is a positive real number, then $|\vec{c}|^2$ is equal to:

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

[Step-by-step solution ► prepwiser.in/questions/-ldvvfjNGj](https://www.prepwiser.in/questions/-ldvvfjNGj)

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

Step-by-step solution ► [prepwisar.in/questions/FbU6Wv1KXu](https://www.prepwisar.in/questions/FbU6Wv1KXu)

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

Step-by-step solution ► [prepwisar.in/questions/2YINuTlrg-](https://www.prepwisar.in/questions/2YINuTlrg-)

Let

$$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$$

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

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

Step-by-step solution ► [prepwisar.in/questions/bjztnQKIzg](https://www.prepwisar.in/questions/bjztnQKIzg)

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

Step-by-step solution ► [prepwisar.in/questions/aGfBFbIbvi](https://www.prepwisar.in/questions/aGfBFbIbvi)

Q32 JEE Main 2024 · 8 Apr · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/ReG-zONmIC](https://www.prepwisser.in/questions/ReG-zONmIC)

Q33 JEE Main 2024 · 6 Apr · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/kVW4AsAue4](https://www.prepwisser.in/questions/kVW4AsAue4)

Q34 JEE Main 2024 · 6 Apr · Shift 2

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

$$|\vec{c}| \geq 6, \vec{a} \cdot \vec{c} = 6|\vec{c}|, |\vec{c} - \vec{a}| = 2\sqrt{2}$$

and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 60° , then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to:

(A) $\frac{3}{2}\sqrt{6}$

(B) $\frac{9}{2}(6 - \sqrt{6})$

(C) $\frac{9}{2}(6 + \sqrt{6})$

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

[Step-by-step solution ► prepwisser.in/questions/wJQVVTfydo](https://www.prepwisser.in/questions/wJQVVTfydo)

Q35 JEE Main 2024 · 6 Apr · Shift 2

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) $\frac{1}{5}$

(C) 2

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

[Step-by-step solution ► prepwisser.in/questions/ndQdrjzgQc](https://www.prepwisser.in/questions/ndQdrjzgQc)

Q36 JEE Main 2024 · 6 Apr · Shift 1

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

(A) $\frac{4\sqrt{2}}{3}$

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

(C) $\frac{5\sqrt{2}}{3}$

(D) $2\sqrt{2}$

[Step-by-step solution ► prepwisser.in/questions/tdtSV-1NhI](https://www.prepwisser.in/questions/tdtSV-1NhI)

Q37 JEE Main 2024 · 5 Apr · Shift 2

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) 10

(C) 5

(D) 12

[Step-by-step solution ► prepwisar.in/questions/ioc_2xR4pl](https://www.prepwisar.in/questions/ioc_2xR4pl)

Q38 JEE Main 2024 · 5 Apr · Shift 2

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

(A) 124

(B) 110

(C) 121

(D) 105

[Step-by-step solution ► prepwisar.in/questions/d6swnc003V](https://www.prepwisar.in/questions/d6swnc003V)

Q39 JEE Main 2024 · 5 Apr · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/IQSYdTx1fX](https://www.prepwisar.in/questions/IQSYdTx1fX)

Q40 JEE Main 2024 · 4 Apr · Shift 1

Let ABC be a triangle of area $15\sqrt{2}$ and the vectors

$$\vec{AB} = \hat{i} + 2\hat{j} - 7\hat{k}, \vec{BC} = a\hat{i} + b\hat{j} + c\hat{k}$$

and

$$\vec{AC} = 6\hat{i} + d\hat{j} - 2\hat{k}, d > 0$$

. Then the square of the length of the largest side of the triangle ABC is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/PhAkLRHcKK](https://www.prepwisar.in/questions/PhAkLRHcKK)

Q41 JEE Main 2024 · 4 Apr · Shift 1

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

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

is:

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

(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) $\frac{\sqrt{2}}{3}\hat{i} - \frac{1}{2}\hat{k}$

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

[Step-by-step solution ► prepwiser.in/questions/GUYQy4RVyb](https://www.prepwiser.in/questions/GUYQy4RVyb)

Q42 JEE Main 2024 · 4 Apr · Shift 2

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) 25

(B) 50

(C) 20

(D) 40

[Step-by-step solution ► prepwiser.in/questions/irWfjQa0F2](https://www.prepwiser.in/questions/irWfjQa0F2)

Q43 JEE Main 2024 · 1 Feb · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/75zgIb_uC](https://www.prepwiser.in/questions/75zgIb_uC)

Q44 JEE Main 2024 · 1 Feb · Shift 1

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

[Step-by-step solution ► prepwiser.in/questions/L2U8v2Edti](https://www.prepwiser.in/questions/L2U8v2Edti)

Q45 JEE Main 2024 · 31 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/yIshmepwq_](https://www.prepwiser.in/questions/yIshmepwq_)

Q46 JEE Main 2024 · 31 Jan · Shift 1

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

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

Step-by-step solution ► [prepwisar.in/questions/FWh7OH9Vd6](https://www.prepwisar.in/questions/FWh7OH9Vd6)

Q47 JEE Main 2024 · 31 Jan · Shift 2

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 answer — enter the value.

Step-by-step solution ► [prepwisar.in/questions/tCuY3paCsd](https://www.prepwisar.in/questions/tCuY3paCsd)

Q48 JEE Main 2024 · 30 Jan · Shift 2

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

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

Step-by-step solution ► [prepwisar.in/questions/NZZ9jPCrTc](https://www.prepwisar.in/questions/NZZ9jPCrTc)

Q49 JEE Main 2024 · 30 Jan · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/1rwqmqadm0](https://www.prepwisar.in/questions/1rwqmqadm0)

Q50 JEE Main 2024 · 30 Jan · Shift 2

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

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

Step-by-step solution ► [prepwisar.in/questions/2crz9aiQ68](https://www.prepwisar.in/questions/2crz9aiQ68)

Q51 JEE Main 2024 · 30 Jan · Shift 1

Let

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

and

$$\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$$

be two vectors such that $|\vec{a}| = 1$, $\vec{a} \cdot \vec{b} = 2$ and $|\vec{b}| = 4$. If $\vec{c} = 2(\vec{a} \times \vec{b}) - 3\vec{b}$, then the angle between $\vec{b}$ and $\vec{c}$ is equal to:

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

[Step-by-step solution ► prepwisser.in/questions/0QYD-w4_C](https://www.prepwisser.in/questions/0QYD-w4_C)

Q52 JEE Main 2024 · 27 Jan · Shift 1

Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$,

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

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

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

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

[Step-by-step solution ► prepwisser.in/questions/bmL9psp7WT](https://www.prepwisser.in/questions/bmL9psp7WT)

Q53 JEE Main 2024 · 27 Jan · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/zv9-oEPRKC](https://www.prepwisser.in/questions/zv9-oEPRKC)

Q54 JEE Main 2023 · 13 Apr · Shift 1

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 $|\vec{b}|^2 = 50$, then $|72 - |\vec{b} + \vec{c}|^2|$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/im00qfTtZk](https://www.prepwisser.in/questions/im00qfTtZk)

Q55 JEE Main 2023 · 13 Apr · Shift 1

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 $|\vec{d}|^2$ is equal to :

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

[Step-by-step solution ► prepwisser.in/questions/FFNQKGaYZ](https://www.prepwisser.in/questions/FFNQKGaYZ)

Q56 JEE Main 2023 · 13 Apr · Shift 2

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

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

Step-by-step solution ► [prepwisar.in/questions/p8YRFlbVX6](https://www.prepwisar.in/questions/p8YRFlbVX6)

Q57 JEE Main 2023 · 12 Apr · Shift 1

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

$$(\vec{a} + \vec{b} + \vec{c}) \times \vec{c} = \vec{0}, \vec{a} \cdot \vec{c} = -17$$

and $\vec{b} \cdot \vec{c} = -20$. Then $|\vec{c} \times (\lambda\hat{i} + \hat{j} + \hat{k})|^2$ is equal to :

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

Step-by-step solution ► [prepwisar.in/questions/JA5HYxoT5U](https://www.prepwisar.in/questions/JA5HYxoT5U)

Q58 JEE Main 2023 · 11 Apr · Shift 1

For any vector $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$, with $10|a_i| < 1, i = 1, 2, 3$, 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) Neither (A) nor (B) is true (D) Both (A) and (B) are true

Step-by-step solution ► [prepwisar.in/questions/U5LpWuZiBg](https://www.prepwisar.in/questions/U5LpWuZiBg)

Q59 JEE Main 2023 · 11 Apr · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/cKiKOVUxnH](https://www.prepwisar.in/questions/cKiKOVUxnH)

Q60 JEE Main 2023 · 11 Apr · Shift 2

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 answer — enter the value.

Step-by-step solution ► [prepwisar.in/questions/p8LVA0DT_C](https://www.prepwisar.in/questions/p8LVA0DT_C)

Q61 JEE Main 2023 · 10 Apr · Shift 1

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

Step-by-step solution ► [prepwisser.in/questions/YIhvTkFn8w](https://www.prepwisser.in/questions/YIhvTkFn8w)

Q62 JEE Main 2023 · 10 Apr · Shift 2

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) 42
(C) 44 (D) 48

Step-by-step solution ► [prepwisser.in/questions/VL8nIob2Ng](https://www.prepwisser.in/questions/VL8nIob2Ng)

Q63 JEE Main 2023 · 8 Apr · Shift 1

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

$\vec{a} \cdot \vec{c} = -12$, $\vec{c} \cdot (\hat{i} - 2\hat{j} + \hat{k}) = 5$, then $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k})$ is equal to _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/n-N9_5tbeT](https://www.prepwisser.in/questions/n-N9_5tbeT)

Q64 JEE Main 2023 · 8 Apr · Shift 2

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) $9\sqrt{38}$

Step-by-step solution ► [prepwisser.in/questions/4nIN6r6vi0](https://www.prepwisser.in/questions/4nIN6r6vi0)

Q65 JEE Main 2023 · 6 Apr · Shift 1

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) 680 (B) 720
(C) 760 (D) 640

Step-by-step solution ► [prepwisser.in/questions/oqra2jU3kW](https://www.prepwisser.in/questions/oqra2jU3kW)

Q66 JEE Main 2023 · 1 Feb · Shift 1

A(2, 6, 2), B(-4, 0, λ), C(2, 3, -1) and D(4, 5, 0), $|\lambda| \leq 5$ are the vertices of a quadrilateral ABCD. If its area is 18 square units, then $5 - 6\lambda$ is equal to _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/2yFQFLozCk](https://www.prepwisser.in/questions/2yFQFLozCk)

Q67 JEE Main 2023 · 1 Feb · Shift 2

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

Step-by-step solution ► [prepwisar.in/questions/bwQL9A06YC](https://www.prepwisar.in/questions/bwQL9A06YC)

Q68 JEE Main 2023 · 1 Feb · Shift 2

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) $\frac{11}{7}$ (B) $\frac{11}{5}\sqrt{2}$
(C) $\frac{\sqrt{914}}{7}$ (D) $\frac{11}{7}\sqrt{2}$

Step-by-step solution ► [prepwisar.in/questions/Z00rX6VPSB](https://www.prepwisar.in/questions/Z00rX6VPSB)

Q69 JEE Main 2023 · 31 Jan · Shift 2

Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that

$$|\vec{a}| = \sqrt{31}, 4|\vec{b}| = |\vec{c}| = 2 \text{ and } 2(\vec{a} \times \vec{b}) = 3(\vec{c} \times \vec{a}).$$

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 answer — enter the value.

Step-by-step solution ► [prepwisar.in/questions/npp69xOrxt](https://www.prepwisar.in/questions/npp69xOrxt)

Q70 JEE Main 2023 · 31 Jan · Shift 1

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 statements:

- (A) $|\vec{a} + \lambda\vec{c}| \geq |\vec{a}|$ for all $\lambda \in \mathbb{R}$.
(B) $\vec{a}$ and $\vec{c}$ are always parallel.

Then,

- (A) only (B) is correct (B) both (A) and (B) are correct
(C) only (A) is correct (D) neither (A) nor (B) is correct

Step-by-step solution ► [prepwisar.in/questions/vdGgAl8oaB](https://www.prepwisar.in/questions/vdGgAl8oaB)

Q71 JEE Main 2023 · 31 Jan · Shift 1

Let $\vec{a}$ and $\vec{b}$ be two vectors 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 answer — enter the value.

Step-by-step solution ► [prepwisar.in/questions/xycc5HbiYw](https://www.prepwisar.in/questions/xycc5HbiYw)

Q72 JEE Main 2023 · 31 Jan · Shift 2

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 three vectors. 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) 336 (B) 449
(C) 339 (D) 560

Step-by-step solution ► [prepwisser.in/questions/nOxQjNFFTO](https://www.prepwisser.in/questions/nOxQjNFFTO)

Q73 JEE Main 2023 · 30 Jan · Shift 2

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

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

Step-by-step solution ► [prepwisser.in/questions/qa9YULieW](https://www.prepwisser.in/questions/qa9YULieW)

Q74 JEE Main 2023 · 30 Jan · Shift 2

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 $((\vec{a} + \vec{b}) \times (\vec{a} \times \vec{b})) \times (\vec{a} - \vec{b}) = 8\hat{i} - 40\hat{j} - 24\hat{k}$,

then $|\lambda(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})|^2$ is equal to :

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

Step-by-step solution ► [prepwisser.in/questions/koeG8qCvdu](https://www.prepwisser.in/questions/koeG8qCvdu)

Q75 JEE Main 2023 · 29 Jan · Shift 2

Let $\vec{a} = 4\hat{i} + 3\hat{j}$ and $\vec{b} = 3\hat{i} - 4\hat{j} + 5\hat{k}$. If $\vec{c}$ 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) $\frac{3}{\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$
(C) $\frac{1}{5}$ (D) $\frac{5}{\sqrt{2}}$

Step-by-step solution ► [prepwisser.in/questions/hNzQkG-3Ey](https://www.prepwisser.in/questions/hNzQkG-3Ey)

Q76 JEE Main 2023 · 29 Jan · Shift 2

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) 36 (B) 30
(C) 34 (D) 32

Step-by-step solution ► [prepwisser.in/questions/LQtsfMIPru](https://www.prepwisser.in/questions/LQtsfMIPru)

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

[Step-by-step solution ► prepwisar.in/questions/Uv_BPBU0Ih](https://www.prepwisar.in/questions/Uv_BPBU0Ih)

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

[Step-by-step solution ► prepwisar.in/questions/pDjiUU0aqL](https://www.prepwisar.in/questions/pDjiUU0aqL)

Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non zero vectors such that $\vec{b} \cdot \vec{c} = 0$ and

$$\vec{a} \times (\vec{b} \times \vec{c}) = \frac{\vec{b} - \vec{c}}{2}$$

. If $\vec{d}$ be a vector such that

$$\vec{b} \cdot \vec{d} = \vec{a} \cdot \vec{b}$$

, then

$$(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d})$$

is equal to

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

[Step-by-step solution ► prepwisar.in/questions/Zdcj9yrujr](https://www.prepwisar.in/questions/Zdcj9yrujr)

Let

$$\vec{a} = \hat{i} + 2\hat{j} + \lambda\hat{k}, \vec{b} = 3\hat{i} - 5\hat{j} - \lambda\hat{k}, \vec{a} \cdot \vec{c} = 7, 2\vec{b} \cdot \vec{c} + 43 = 0, \vec{a} \times \vec{c} = \vec{b} \times \vec{c}$$

. Then $|\vec{a} \cdot \vec{b}|$ is equal to :

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/nUym6revMN](https://www.prepwisar.in/questions/nUym6revMN)

Q81 JEE Main 2023 · 24 Jan · Shift 1

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) $-\frac{2}{3}$

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

(C) 2

(D) 1

[Step-by-step solution ► prepwiser.in/questions/ivjue5eS6g](https://www.prepwiser.in/questions/ivjue5eS6g)

Q82 JEE Main 2023 · 24 Jan · Shift 2

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

$$5\vec{\beta}_2 \cdot (\hat{i} + \hat{j} + \hat{k})$$

is :

(A) 9

(B) 7

(C) 6

(D) 11

[Step-by-step solution ► prepwiser.in/questions/BHPb-9qnq1](https://www.prepwiser.in/questions/BHPb-9qnq1)

Q83 JEE Main 2022 · 29 Jul · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/GUsDsBCqQ9](https://www.prepwiser.in/questions/GUsDsBCqQ9)

Q84 JEE Main 2022 · 29 Jul · Shift 1

Let $\hat{a}$ and $\hat{b}$ 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) $54 + 90\sqrt{2}$

[Step-by-step solution ► prepwiser.in/questions/64pDUqU3Zc](https://www.prepwiser.in/questions/64pDUqU3Zc)

Q85 JEE Main 2022 · 28 Jul · Shift 1

Let a vector $\vec{a}$ has magnitude 9. Let a vector $\vec{b}$ be such that for every $(x, y) \in \mathbf{R} \times \mathbf{R} - \{(0, 0)\}$, 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

[Step-by-step solution ► prepwiser.in/questions/PFvOQEvWHP](https://www.prepwiser.in/questions/PFvOQEvWHP)

Q86 JEE Main 2022 · 28 Jul · Shift 2

Let S be the set of all $a \in \mathbb{R}$ 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) $(-\infty, -\frac{4}{3})$

(B) Φ

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

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

[Step-by-step solution ► prepwiser.in/questions/MatNiRZ1-5](https://www.prepwiser.in/questions/MatNiRZ1-5)

Q87 JEE Main 2022 · 27 Jul · Shift 1

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

(A) 2

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

(C) 9

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

[Step-by-step solution ► prepwiser.in/questions/XVltewvGo0](https://www.prepwiser.in/questions/XVltewvGo0)

Q88 JEE Main 2022 · 27 Jul · Shift 2

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

$$|\vec{a}| + |\vec{b}| + |\vec{c}| = \frac{1}{36}$$

, then α is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/dxe3sPS-KX](https://www.prepwiser.in/questions/dxe3sPS-KX)

Q89 JEE Main 2022 · 26 Jul · Shift 2

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) $\frac{5\pi}{6}$

[Step-by-step solution ► prepwiser.in/questions/QV5xXjGXis](https://www.prepwiser.in/questions/QV5xXjGXis)

Q90 JEE Main 2022 · 26 Jul · Shift 1

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

[Step-by-step solution ► prepwiser.in/questions/qOnC1cbHVK](https://www.prepwiser.in/questions/qOnC1cbHVK)

Q91 JEE Main 2022 · 25 Jul · Shift 2

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) $\frac{2}{3}$

Step-by-step solution ► [prepwisser.in/questions/yOa0AmixwS](https://www.prepwisser.in/questions/yOa0AmixwS)

Q92 JEE Main 2022 · 29 Jun · Shift 1

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 $\alpha + \beta$ is equal to :

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

Step-by-step solution ► [prepwisser.in/questions/ZYPpkVG56p](https://www.prepwisser.in/questions/ZYPpkVG56p)

Q93 JEE Main 2022 · 28 Jun · Shift 2

Let $\vec{a}$ be a vector which is perpendicular to the vector $3\hat{i} + \frac{1}{2}\hat{j} + 2\hat{k}$. If

$$\vec{a} \times (2\hat{i} + \hat{k}) = 2\hat{i} - 13\hat{j} - 4\hat{k}$$

, 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) $\frac{7}{3}$

Step-by-step solution ► [prepwisser.in/questions/Z_xhr8t0wY](https://www.prepwisser.in/questions/Z_xhr8t0wY)

Q94 JEE Main 2022 · 28 Jun · Shift 2

Let $\vec{a} = \alpha\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = -2\hat{i} + \alpha\hat{j} + \hat{k}$, where $\alpha \in R$. 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

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

is equal to :

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

Step-by-step solution ► [prepwisser.in/questions/y7vsHTLYxk](https://www.prepwisser.in/questions/y7vsHTLYxk)

Q95 JEE Main 2022 · 27 Jun · Shift 1

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 $|\vec{b}| \in \{1, 2, \dots, 10\}$ is :

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

Step-by-step solution ► [prepwisser.in/questions/FHNAxXr1KY](https://www.prepwisser.in/questions/FHNAxXr1KY)

Q96 JEE Main 2022 · 27 Jun · Shift 2

Let $\vec{a}$ and $\vec{b}$ be the vectors along the diagonals of a parallelogram having area $2\sqrt{2}$. Let the angle between $\vec{a}$ and $\vec{b}$ be acute, $|\vec{a}| = 1$, and

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

. If

$$\vec{c} = 2\sqrt{2}(\vec{a} \times \vec{b}) - 2\vec{b}$$

, then an angle between $\vec{b}$ and $\vec{c}$ is :

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

Step-by-step solution ► [prepwisser.in/questions/Hj76ERkYLI](https://www.prepwisser.in/questions/Hj76ERkYLI)

Q97 JEE Main 2022 · 26 Jun · Shift 2

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 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

Step-by-step solution ► [prepwisser.in/questions/BrjedI0sB3](https://www.prepwisser.in/questions/BrjedI0sB3)

Q98 JEE Main 2022 · 25 Jun · Shift 1

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

Step-by-step solution ► [prepwisser.in/questions/-hIztYLVW5](https://www.prepwisser.in/questions/-hIztYLVW5)

Q99 JEE Main 2022 · 25 Jun · Shift 1

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

$$\left| (\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) \right|^2 + 4(\vec{a} \cdot \vec{b})^2$$

is equal to _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/c_lgcjXW-o](https://www.prepwisser.in/questions/c_lgcjXW-o)

Q100 JEE Main 2022 · 25 Jun · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/TcPBUImS7G](https://www.prepwisser.in/questions/TcPBUImS7G)

Q101 JEE Main 2022 · 24 Jun · Shift 1

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) $6(3 - \sqrt{3})$

(B) $3 + \sqrt{3}$

(C) $6(3 + \sqrt{3})$

(D) $6(\sqrt{3} + 1)$

[Step-by-step solution ► prepwisser.in/questions/dHV6THHMYx](https://www.prepwisser.in/questions/dHV6THHMYx)

Q102 JEE Main 2022 · 24 Jun · Shift 2

Let $\hat{a}$ and $\hat{b}$ be two unit vectors such that $|(\hat{a} + \hat{b}) + 2(\hat{a} \times \hat{b})| = 2$. If $\theta \in (0, \pi)$ is the angle between $\hat{a}$ and $\hat{b}$, then among the statements :

(S1) : $2|\hat{a} \times \hat{b}| = |\hat{a} - \hat{b}|$

(S2) : The projection of $\hat{a}$ on $(\hat{a} + \hat{b})$ 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.

[Step-by-step solution ► prepwisser.in/questions/6QOpj58ZUw](https://www.prepwisser.in/questions/6QOpj58ZUw)

Q103 JEE Main 2021 · 1 Sep · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/oMWabdGIFf](https://www.prepwisser.in/questions/oMWabdGIFf)

Q104 JEE Main 2021 · 31 Aug · Shift 1

Let $\vec{a}$ and $\vec{b}$ be two vectors such that

$$|2\vec{a} + 3\vec{b}| = |3\vec{a} + \vec{b}|$$

and the angle between $\vec{a}$ and $\vec{b}$ is 60° . If $\frac{1}{8}\vec{a}$ is a unit vector, then $|\vec{b}|$ is equal to :

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

[Step-by-step solution ► prepwiser.in/questions/uKc2GIB93F](https://www.prepwiser.in/questions/uKc2GIB93F)

Q105 JEE Main 2021 · 27 Aug · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/G-MfR99bXs](https://www.prepwiser.in/questions/G-MfR99bXs)

Q106 JEE Main 2021 · 26 Aug · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/UFc01vLJr](https://www.prepwiser.in/questions/UFc01vLJr)

Q107 JEE Main 2021 · 27 Jul · Shift 1

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 1, then the value of $3l^2$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/dFOgh5mXTF](https://www.prepwiser.in/questions/dFOgh5mXTF)

Q108 JEE Main 2021 · 25 Jul · Shift 2

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

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

[Step-by-step solution ► prepwiser.in/questions/8cpK82PoBp](https://www.prepwiser.in/questions/8cpK82PoBp)

Q109 JEE Main 2021 · 25 Jul · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/8mGzwj6jri](https://www.prepwiser.in/questions/8mGzwj6jri)

Q110 JEE Main 2021 · 25 Jul · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/zyI4gj_gev](https://www.prepwiser.in/questions/zyI4gj_gev)

Q111 JEE Main 2021 · 22 Jul · Shift 2

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

(B) Projection of $\vec{a}$ on $(\vec{b} \times \vec{c})$ is 2

(C) $\begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix} + \begin{bmatrix} \vec{c} & \vec{a} & \vec{b} \end{bmatrix} = 8$

(D) $|3\vec{a} + \vec{b} - 2\vec{c}|^2 = 51$

[Step-by-step solution ► prepwiser.in/questions/yIy8aQNaOQ](https://www.prepwiser.in/questions/yIy8aQNaOQ)

Q112 JEE Main 2021 · 20 Jul · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/loxCrYM7D1](https://www.prepwiser.in/questions/loxCrYM7D1)

Q113 JEE Main 2021 · 20 Jul · Shift 1

Let P be a plane passing through the points (1, 0, 1), (1, -2, 1) and (0, 1, -2). Let a vector $\vec{a} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$ be such that $\vec{a}$ is parallel to the plane P, perpendicular to $(\hat{i} + 2\hat{j} + 3\hat{k})$ and $\vec{a} \cdot (\hat{i} + \hat{j} + 2\hat{k}) = 2$, then $(\alpha - \beta + \gamma)^2$ equals _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/d17aZlwQom](https://www.prepwiser.in/questions/d17aZlwQom)

Q114 JEE Main 2021 · 20 Jul · Shift 1

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 $(\vec{a} \times \vec{b})$ and $\vec{c}$ is $\frac{\pi}{6}$, then the value of

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

is :

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

(B) 4

(C) 3

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

[Step-by-step solution ► prepwisar.in/questions/W4L6lTWagI](https://www.prepwisar.in/questions/W4L6lTWagI)

Q115 JEE Main 2021 · 18 Mar · Shift 2

Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors perpendicular to each other and $|\vec{a}| = |\vec{b}|$. If $|\vec{a} \times \vec{b}| = |\vec{a}|$, then the angle between the vectors

$$(\vec{a} + \vec{b} + (\vec{a} \times \vec{b}))$$

and $\vec{a}$ is equal to :

(A) $\sin^{-1}\left(\frac{1}{\sqrt{6}}\right)$

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

(C) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

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

[Step-by-step solution ► prepwisar.in/questions/PH05gYm3Ac](https://www.prepwisar.in/questions/PH05gYm3Ac)

Q116 JEE Main 2021 · 17 Mar · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/8GTrCzcEsl](https://www.prepwisar.in/questions/8GTrCzcEsl)

Q117 JEE Main 2021 · 17 Mar · Shift 1

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) 10

(B) 8

(C) 13

(D) 12

[Step-by-step solution ► prepwisar.in/questions/5RzWfd6w5i](https://www.prepwisar.in/questions/5RzWfd6w5i)

Q118 JEE Main 2021 · 16 Mar · Shift 2

Let $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} - 3\hat{j} + 5\hat{k}$. If $\vec{r} \times \vec{a} = \vec{b} \times \vec{r}$,

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

$$\vec{r} \cdot (2\hat{i} + 5\hat{j} - \alpha\hat{k})$$

$= -1, \alpha \in \mathbb{R}$, then the

value of $\alpha + |\vec{r}|^2$ is equal to :

(A) 13

(B) 11

(C) 9

(D) 15

[Step-by-step solution ► prepwiset.in/questions/yv3M2nkQpH](https://www.prepwiset.in/questions/yv3M2nkQpH)

Q119 JEE Main 2021 · 26 Feb · Shift 1

If $\vec{a}$ and $\vec{b}$ are perpendicular, then

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

is equal to :

(A) $\frac{1}{2}|\vec{a}|^4\vec{b}$

(B) $\vec{0}$

(C) $\vec{a} \times \vec{b}$

(D) $|\vec{a}|^4\vec{b}$

[Step-by-step solution ► prepwiset.in/questions/_q-swnIRFL](https://www.prepwiset.in/questions/_q-swnIRFL)

Q120 JEE Main 2021 · 25 Feb · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiset.in/questions/VvTSXxVAIY](https://www.prepwiset.in/questions/VvTSXxVAIY)

Q121 JEE Main 2021 · 25 Feb · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiset.in/questions/GvZvVY4eDy](https://www.prepwiset.in/questions/GvZvVY4eDy)

Q122 JEE Main 2021 · 24 Feb · Shift 1

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

$$2|\vec{a} + \vec{b} + \vec{c}|^2$$

is ____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/uhYYXQWdyY](https://www.prepwiser.in/questions/uhYYXQWdyY)

Q123 JEE Main 2020 · 6 Sep · Shift 1

If $\vec{a}$ and $\vec{b}$ are unit vectors, then the greatest value of

$$\sqrt{3}|\vec{a} + \vec{b}| + |\vec{a} - \vec{b}|$$

is ____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/KcEyoKnsYE](https://www.prepwiser.in/questions/KcEyoKnsYE)

Q124 JEE Main 2020 · 6 Sep · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Cdo5Br0os7](https://www.prepwiser.in/questions/Cdo5Br0os7)

Q125 JEE Main 2020 · 5 Sep · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Cfwj_YZPo2](https://www.prepwiser.in/questions/Cfwj_YZPo2)

Q126 JEE Main 2020 · 4 Sep · Shift 2

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 answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/HUoR2tsuoi](https://www.prepwisser.in/questions/HUoR2tsuoi)

Q127 JEE Main 2020 · 3 Sep · Shift 2

Let $a, b, c \in \mathbb{R}$ 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) $\frac{\pi}{9}$

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

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

[Step-by-step solution ► prepwisser.in/questions/TddpybZwei](https://www.prepwisser.in/questions/TddpybZwei)

Q128 JEE Main 2020 · 8 Jan · Shift 2

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) $-\frac{1}{2}$

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

(C) $\frac{1}{2}$

(D) -1

[Step-by-step solution ► prepwisser.in/questions/H4b1M6eRnk](https://www.prepwisser.in/questions/H4b1M6eRnk)

Q129 JEE Main 2020 · 7 Jan · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/u6b67Hi95z](https://www.prepwisser.in/questions/u6b67Hi95z)

Q130 JEE Main 2020 · 7 Jan · Shift 1

A vector

$$\vec{a} = \alpha \hat{i} + 2\hat{j} + \beta \hat{k} \quad (\alpha, \beta \in R)$$

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

[Step-by-step solution ► prepwisser.in/questions/uyIVBe3b6K](https://www.prepwisser.in/questions/uyIVBe3b6K)

Types of Vectors · 5 PYQs

Q131 JEE Main 2023 · 15 Apr · Shift 1

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

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

[Step-by-step solution ► prepwisser.in/questions/eZcoq8601H](https://www.prepwisser.in/questions/eZcoq8601H)

Q132 JEE Main 2023 · 10 Apr · Shift 2

If the points P and Q are respectively the circumcenter and the orthocentre of a $\triangle ABC$, then

$$\overrightarrow{PA} + \overrightarrow{PB} + \overrightarrow{PC}$$

is equal to :

(A) $\overrightarrow{QP}$

(B) $\overrightarrow{PQ}$

(C) $2\overrightarrow{PQ}$

(D) $2\overrightarrow{QP}$

[Step-by-step solution ► prepwiser.in/questions/1cpEy5cISV](https://www.prepwiser.in/questions/1cpEy5cISV)

Q133 JEE Main 2022 · 29 Jun · Shift 2

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 noncollinear, then the length of the median, in $\triangle ABC$, through A is :

(A) $\frac{\sqrt{82}}{2}$

(B) $\frac{\sqrt{62}}{2}$

(C) $\frac{\sqrt{69}}{2}$

(D) $\frac{\sqrt{66}}{2}$

[Step-by-step solution ► prepwiser.in/questions/fAFM-NbSm6](https://www.prepwiser.in/questions/fAFM-NbSm6)

Q134 JEE Main 2021 · 26 Feb · Shift 2

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

(B) $\frac{1}{\sqrt{2}}(-\hat{j} + \hat{k})$

(C) $\frac{1}{\sqrt{2}}(\hat{i} - \hat{j})$

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

[Step-by-step solution ► prepwiser.in/questions/t7dM8k9eo3](https://www.prepwiser.in/questions/t7dM8k9eo3)

Q135 JEE Main 2020 · 2 Sep · Shift 1

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

Then $|\vec{a} + 2\vec{b}|^2 + |\vec{a} + 2\vec{c}|^2$ is equal to ____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/gqfBKSGz_a](https://www.prepwiser.in/questions/gqfBKSGz_a)

Scalar Triple Product · 17 PYQs

Q136 JEE Main 2024 · 4 Apr · Shift 2

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

Step-by-step solution ► [prepwiser.in/questions/2DtZCq74Fs](https://www.prepwiser.in/questions/2DtZCq74Fs)

Q137 JEE Main 2023 · 11 Apr · Shift 2

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

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

Step-by-step solution ► [prepwiser.in/questions/qNb66BnMKa](https://www.prepwiser.in/questions/qNb66BnMKa)

Q138 JEE Main 2023 · 8 Apr · Shift 2

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) 12 (B) 6
(C) 0 (D) 4

Step-by-step solution ► [prepwiser.in/questions/sAm7vgxiAq](https://www.prepwiser.in/questions/sAm7vgxiAq)

Q139 JEE Main 2023 · 6 Apr · Shift 2

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

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

Step-by-step solution ► [prepwiser.in/questions/jDMsruocci](https://www.prepwiser.in/questions/jDMsruocci)

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 $|\vec{u} \cdot \hat{i}|^2 = \frac{m}{n}$ where m and n are coprime natural numbers, then $m + n$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/tGFpaJdzAX](https://www.prepwisar.in/questions/tGFpaJdzAX)

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

[Step-by-step solution ► prepwisar.in/questions/IAJYpSuJFO](https://www.prepwisar.in/questions/IAJYpSuJFO)

If

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

and $\vec{c} \cdot \vec{a} = 3$, then the value of

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

is :

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

[Step-by-step solution ► prepwisar.in/questions/tuVokV3IU9](https://www.prepwisar.in/questions/tuVokV3IU9)

Q143 JEE Main 2021 · 26 Aug · Shift 1

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

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

[Step-by-step solution ► prepwiser.in/questions/4jRF0FaIWG](https://www.prepwiser.in/questions/4jRF0FaIWG)

Q144 JEE Main 2021 · 27 Jul · Shift 2

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

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

is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/ackzj_aPjr](https://www.prepwiser.in/questions/ackzj_aPjr)

Q145 JEE Main 2021 · 25 Jul · Shift 1

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 $(2 + b)\hat{i} + 2b\hat{j} + (1 - b)\hat{k}$, $a, b, c, \in R$

be co-planar. Then which of the following is true?

- (A) $2b = a + c$ (B) $3c = a + b$
(C) $a = b + 2c$ (D) $2a = b + c$

[Step-by-step solution ► prepwiser.in/questions/mRh-at6SUe](https://www.prepwiser.in/questions/mRh-at6SUe)

Q146 JEE Main 2021 · 22 Jul · Shift 2

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

$$[\vec{a} \ \vec{b} \ \vec{c}] + [\vec{a} \ \vec{b} \ \vec{d}] + [\vec{a} \ \vec{c} \ \vec{d}]$$

is equal to :

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

[Step-by-step solution ► prepwiser.in/questions/uJN-zQssww](https://www.prepwiser.in/questions/uJN-zQssww)

Q147 JEE Main 2021 · 17 Mar · Shift 1

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

$$\frac{1}{3} \left((\vec{a} \times \vec{b}) \cdot \vec{c} \right)$$

is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/KLsVeyoRNG](https://www.prepwisar.in/questions/KLsVeyoRNG)

Q148 JEE Main 2021 · 16 Mar · Shift 2

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 $\vec{c} \cdot (\hat{i} + \hat{j} + 3\hat{k}) = 8$ then the value of

$\vec{c} \cdot (\vec{a} \times \vec{b})$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/emEOndSHFp](https://www.prepwisar.in/questions/emEOndSHFp)

Q149 JEE Main 2020 · 5 Sep · Shift 1

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 cu. units, then :

(A) $n = 7$

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

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

(D) $n = 9$

[Step-by-step solution ► prepwisar.in/questions/21i0gjpHW5](https://www.prepwisar.in/questions/21i0gjpHW5)

Let x_0 be the point of Local maxima of

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

, where

$\vec{a} = x\hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = -2\hat{i} + x\hat{j} - \hat{k}$, $\vec{c} = 7\hat{i} - 2\hat{j} + x\hat{k}$. 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) 14

(B) -30

(C) -4

(D) -22

[Step-by-step solution ► prepwisar.in/questions/o-S5PvOGzk](https://www.prepwisar.in/questions/o-S5PvOGzk)

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

$$\vec{r} = a\hat{i} + a\hat{j} + (a+1)\hat{k} \quad (a \in \mathbb{R})$$

are coplanar and

$$3(\vec{p} \cdot \vec{q})^2 - \lambda |\vec{r} \times \vec{q}|^2 = 0$$

, then the value of λ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/EEhcWzM4JK](https://www.prepwisar.in/questions/EEhcWzM4JK)

Q152 JEE Main 2020 · 8 Jan · Shift 1

Let the volume of a parallelopiped whose coterminous edges are given by

$$\vec{u} = \hat{i} + \hat{j} + \lambda\hat{k}, \vec{v} = \hat{i} + \hat{j} + 3\hat{k} \text{ and}$$

$\vec{w} = 2\hat{i} + \hat{j} + \hat{k}$ be 1 cu. unit. If θ be the angle between the edges $\vec{u}$ and $\vec{w}$, then $\cos\theta$ can be :

(A) $\frac{7}{6\sqrt{3}}$

(B) $\frac{7}{6\sqrt{6}}$

(C) $\frac{5}{7}$

(D) $\frac{5}{3\sqrt{3}}$

[Step-by-step solution ► prepwiser.in/questions/4lKtd15jM3](https://www.prepwiser.in/questions/4lKtd15jM3)

Coplanarity and Collinearity · 16 PYQs

Q153 JEE Main 2024 · 6 Apr · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/G7c5UCXi4l](https://www.prepwiser.in/questions/G7c5UCXi4l)

Q154 JEE Main 2024 · 29 Jan · Shift 1

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) 30

(B) -30

(C) -25

(D) 35

[Step-by-step solution ► prepwiser.in/questions/pMKis4yCdm](https://www.prepwiser.in/questions/pMKis4yCdm)

Q155 JEE Main 2023 · 15 Apr · Shift 1

Let S be the set of all (λ, μ) for which the vectors $\lambda\hat{i} - \hat{j} + \hat{k}, \hat{i} + 2\hat{j} + \mu\hat{k}$ 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) 2370

(B) 2130

(C) 2210

(D) 2290

[Step-by-step solution ► prepwiser.in/questions/83lrNi7f6C](https://www.prepwiser.in/questions/83lrNi7f6C)

Q156 JEE Main 2023 · 12 Apr · Shift 1

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 :

(A) -2

(B) 1

(C) -1

(D) 2

[Step-by-step solution ► prepwiser.in/questions/rMNtWW9S7M](https://www.prepwiser.in/questions/rMNtWW9S7M)

Q157 JEE Main 2023 · 8 Apr · Shift 1

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

[Step-by-step solution ► prepwisser.in/questions/ntzaqvXG8b](https://www.prepwisser.in/questions/ntzaqvXG8b)

Q158 JEE Main 2023 · 6 Apr · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/NVzdFFH7TO](https://www.prepwisser.in/questions/NVzdFFH7TO)

Q159 JEE Main 2023 · 6 Apr · Shift 1

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 $S = \{\lambda \in \mathbb{R} : \text{the points A, B, C and D are coplanar}\}$.

Then $\sum_{\lambda \in S} (\lambda + 2)^2$ is equal to :

- (A) $\frac{37}{2}$ (B) 25
(C) 13 (D) 41

[Step-by-step solution ► prepwisser.in/questions/P0xnEvYgA3](https://www.prepwisser.in/questions/P0xnEvYgA3)

Q160 JEE Main 2023 · 29 Jan · Shift 1

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

[Step-by-step solution ► prepwisser.in/questions/EKsmGBgPmC](https://www.prepwisser.in/questions/EKsmGBgPmC)

Q161 JEE Main 2023 · 29 Jan · Shift 1

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 equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Hf_RwCx2tl](https://www.prepwiser.in/questions/Hf_RwCx2tl)

Q162 JEE Main 2023 · 25 Jan · Shift 2

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) $-\frac{73}{17}$

(C) $-\frac{107}{17}$

(D) $\frac{107}{17}$

[Step-by-step solution ► prepwiser.in/questions/4XLNuB3gE1](https://www.prepwiser.in/questions/4XLNuB3gE1)

Q163 JEE Main 2022 · 29 Jul · Shift 2

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) $\frac{95}{8}$

[Step-by-step solution ► prepwiser.in/questions/R8RR28Ms2e](https://www.prepwiser.in/questions/R8RR28Ms2e)

Q164 JEE Main 2022 · 28 Jul · Shift 1

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 $\vec{c} = t\hat{i} - t\hat{j} + \hat{k}$, $t \in \mathbf{R}$ be such that for

$$\alpha, \beta, \gamma \in \mathbf{R}, \alpha\vec{a} + \beta\vec{b} + \gamma\vec{c} = \vec{0} \Rightarrow \alpha = \beta = \gamma = 0$$

. Then, the set of all values of t is :

(A) a non-empty finite set

(B) equal to $\mathbf{N}$

(C) equal to $\mathbf{R} - \{0\}$

(D) equal to $\mathbf{R}$

[Step-by-step solution ► prepwiser.in/questions/VAI_dr3XVL](https://www.prepwiser.in/questions/VAI_dr3XVL)

Q165 JEE Main 2022 · 28 Jun · Shift 1

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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/S-cDdGXfB8](https://www.prepwiser.in/questions/S-cDdGXfB8)

Q166 JEE Main 2021 · 25 Jul · Shift 2

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) $\sqrt{ab}$

[Step-by-step solution ► prepwisar.in/questions/NrkG8C-NIC](https://www.prepwisar.in/questions/NrkG8C-NIC)

Q167 JEE Main 2021 · 17 Mar · Shift 2

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

(A) 2

(B) 9

(C) 7

(D) 1

[Step-by-step solution ► prepwisar.in/questions/vFHQRHPZ5Z](https://www.prepwisar.in/questions/vFHQRHPZ5Z)

Q168 JEE Main 2021 · 26 Feb · Shift 1

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) $-\frac{39}{5}$

(C) $\frac{44}{5}$

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

[Step-by-step solution ► prepwisar.in/questions/TKYfdYni0u](https://www.prepwisar.in/questions/TKYfdYni0u)

Vector Equation of Line · 2 PYQs

Q169 JEE Main 2024 · 30 Jan · Shift 2

Let

$$L_1 : \vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \lambda(\hat{i} - \hat{j} + 2\hat{k}), \lambda \in \mathbb{R}$$

,

$$L_2 : \vec{r} = (\hat{j} - \hat{k}) + \mu(3\hat{i} + \hat{j} + p\hat{k}), \mu \in \mathbb{R}, \text{ and } L_3 : \vec{r} = \delta(\ell\hat{i} + m\hat{j} + n\hat{k}), \delta \in \mathbb{R}$$

be three lines such that L_1 is perpendicular to L_2 and L_3 is perpendicular to both L_1 and L_2 . Then, the point which lies on L_3 is

(A) $(1, 7, -4)$

(B) $(1, -7, 4)$

(C) $(-1, 7, 4)$

(D) $(-1, -7, 4)$

[Step-by-step solution ► prepwisar.in/questions/VYNpyGPE3T](https://www.prepwisar.in/questions/VYNpyGPE3T)

The lines

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

and

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

- (A) do not intersect for any values of l and m
- (B) intersect for all values of l and m
- (C) intersect when $l = 2$ and $m = \frac{1}{2}$
- (D) intersect when $l = 1$ and $m = 2$

Step-by-step solution ► [prepwisar.in/questions/eBuRv3er04](https://www.prepwisar.in/questions/eBuRv3er04)

Answer key — Vectors

Numbers match the question numbers above. For full working, open the solution link under each question.

1	D	2	A	3	B	4	C	5	C	6	B	7	B	8	30
9	A	10	A	11	164	12	D	13	5	14	128	15	D	16	A
17	C	18	C	19	C	20	6	21	D	22	A	23	D	24	C
25	16	26	D	27	A	28	C	29	B	30	B	31	B	32	569
33	46	34	C	35	C	36	A	37	C	38	A	39	30	40	54
41	C	42	A	43	38	44	A	45	48	46	B	47	38	48	B
49	D	50	C	51	D	52	C	53	5	54	66	55	B	56	D
57	D	58	D	59	D	60	285	61	B	62	C	63	11	64	B
65	B	66	11	67	A	68	D	69	3	70	C	71	36	72	C
73	A	74	B	75	D	76	C	77	A	78	D	79	C	80	8
81	D	82	B	83	14	84	A	85	B	86	B	87	D	88	36
89	A	90	D	91	A	92	A	93	C	94	D	95	A	96	D
97	D	98	B	99	576	100	14	101	C	102	C	103	1494	104	C
105	90	106	5	107	2	108	A	109	3	110	60	111	D	112	4
113	81	114	D	115	D	116	486	117	D	118	D	119	D	120	2
121	12	122	75	123	4	124	1	125	6	126	18	127	D	128	A
129	C	130	B	131	C	132	B	133	A	134	A	135	2	136	C
137	D	138	A	139	D	140	3501	141	C	142	A	143	A	144	9
145	A	146	A	147	2	148	28	149	B	150	D	151	1	152	A
153	55	154	D	155	D	156	B	157	C	158	D	159	D	160	A
161	2	162	A	163	D	164	C	165	150	166	D	167	B	168	C
169	C	170	A												

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