CBSE CLASS 12 MATHS · CHAPTER 10 · 2026-27

Vector Algebra Class 12 Important Questions

10 questions · 27 marks · no calculator · step-marked answers

Name _____ Date _____ Score / 27

- Original questions in the board paper's question types, from 1-mark MCQs to a case study. Try every question before you look at the answers.
- No calculator: as in the CBSE board exam, everything works by hand.
- Worked answers with step marks for 5 questions start after the questions. The other 5 open free on the chapter page with a free account (no card): the link is next to each one.
- Online, with more practice: cbsemathrevision.com/class-12/vector-algebra

Section A · Multiple choice and assertion–reason (1 mark each)

1. **1 mark · Scalar (dot) product**

Vectors $\vec{a}$ and $\vec{b}$ have $|\vec{a}| = 2$, $|\vec{b}| = 5$ and $\vec{a} \cdot \vec{b} = 5\sqrt{3}$. What is the angle between them?

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

2. **1 mark · Vectors, magnitude and direction**

The unit vector in the direction of $2\hat{i} - 3\hat{j} + 6\hat{k}$ is

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

(b) $\frac{2\hat{i} - 3\hat{j} + 6\hat{k}}{49}$

(c) $\frac{2\hat{i} - 3\hat{j} + 6\hat{k}}{5}$

(d) $2\hat{i} - 3\hat{j} + 6\hat{k}$

3. 1 mark · Vector (cross) product

In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

Assertion (A): $\hat{i} \times \hat{j} = \hat{k}$.

Reason (R): $\hat{i} \cdot \hat{j} = 0$.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

Section B · Short answer (2 marks each)

4. 2 marks · Scalar (dot) product

Find λ if $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ are perpendicular.

5. 2 marks · Vector (cross) product

Find the area of the parallelogram whose adjacent sides are $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$.

Section C · Short answer (3 marks each)

6. 3 marks · Scalar (dot) product

Find the projection of $\vec{a} = 3\hat{i} - \hat{j} + 4\hat{k}$ on $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$.

7. 3 marks · Vectors, magnitude and direction

Find a vector of magnitude 9 in the direction of $2\hat{i} - \hat{j} + 2\hat{k}$, and the direction cosines of that direction.

Section D · Long answer (5 marks each)

8. 5 marks · Vector (cross) product

$A(1, 0, 2)$, $B(3, 1, 4)$ and $C(2, 3, 1)$ are the vertices of a triangle. Find (a) $\overrightarrow{AB}$ and $\overrightarrow{AC}$, (b) the area of $\triangle ABC$, (c) $\cos A$.

9. 5 marks · Vector (cross) product

For $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - 2\hat{k}$: (a) find $\vec{a} \cdot \vec{b}$ and the cosine of the angle between them; (b) find $\vec{a} \times \vec{b}$ and a unit vector perpendicular to both; (c) check that $\vec{a} \times \vec{b}$ is perpendicular to $\vec{a}$.

Section E · Case study (4 marks)

10. **4 marks · Vectors, magnitude and direction**

Drone flight. A drone flies in a straight line from $P(1, 2, 0)$ to $Q(4, 6, 0)$, then straight up to $R(4, 6, 5)$ (units: metres).

i. Write $\overrightarrow{PQ}$ and find its length. *[1 mark]*

ii. Find the straight-line distance from P to R. *[1 mark]*

iii. Find the angle between $\overrightarrow{PQ}$ and $\overrightarrow{PR}$. *[2 marks]*

Answers and worked solutions

Question 1

1 mark

$\cos\theta = \dfrac{5\sqrt{3}}{2\times 5} = \dfrac{\sqrt{3}}{2} \Rightarrow \theta = \dfrac{\pi}{6}$ **A1**

Correct option: (a) $\dfrac{\pi}{6}$

Question 2

1 mark

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/vector-algebra#iq-2

Question 3

1 mark

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/vector-algebra#iq-3

Question 4

2 marks

Answer: $\lambda = \dfrac{5}{2}$

$\vec{a}\cdot\vec{b} = 2 - 2\lambda + 3 = 0$ **M1**

$\lambda = \dfrac{5}{2}$ **A1**

Question 5

2 marks

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/vector-algebra#iq-5

Question 6

3 marks

Answer: 3

$\vec{a}\cdot\vec{b} = 3 - 2 + 8 = 9$ **M1**

$|\vec{b}| = \sqrt{1+4+4} = 3$ **A1**

Projection $= \dfrac{\vec{a}\cdot\vec{b}}{|\vec{b}|} = 3$ **A1**

Question 7

3 marks

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/vector-algebra#iq-7

Question 8

5 marks

Answer: Area $\dfrac{3\sqrt{10}}{2}$; $\cos A = \dfrac{1}{\sqrt{11}}$

(a) $\overrightarrow{AB} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\overrightarrow{AC} = \hat{i} + 3\hat{j} - \hat{k}$ **A1**

(b) $\overrightarrow{AB}\times\overrightarrow{AC} = -7\hat{i} + 4\hat{j} + 5\hat{k}$ **M1**

$|\overrightarrow{AB}\times\overrightarrow{AC}| = \sqrt{49+16+25} = \sqrt{90} = 3\sqrt{10}$ **A1**

Area $= \dfrac{1}{2}\times 3\sqrt{10} = \dfrac{3\sqrt{10}}{2}$ square units **A1**

(c) $\cos A = \dfrac{\overrightarrow{AB}\cdot\overrightarrow{AC}}{|\overrightarrow{AB}||\overrightarrow{AC}|} = \dfrac{2+3-2}{3\sqrt{11}} = \dfrac{1}{\sqrt{11}}$ **A1**

Question 9

5 marks

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/vector-algebra#iq-9

Question 10

4 marks

i. $\overrightarrow{PQ} = 3\hat{i} + 4\hat{j}$, length $5\,m$ **A1**

ii. $\overrightarrow{PR} = 3\hat{i} + 4\hat{j} + 5\hat{k}$,
$|\overrightarrow{PR}| = \sqrt{50} = 5\sqrt{2}\,m$ **A1**

iii. $\cos\theta = \dfrac{9+16+0}{5\times 5\sqrt{2}} = \dfrac{1}{\sqrt{2}}$ **M1**
$\theta = \dfrac{\pi}{4}$ **A1**

More on this chapter, free: revision notes, a Route to 95 and practice with instant feedback at cbsemathrevision.com/class-12/vector-algebra

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