

Vector Algebra — CBSE Pattern Test 2

Class 12 Maths · 90 minutes · 40 marks · Sections A–D with answer key · Narayan Gurukul Academy

Test 2 — CBSE Pattern (90 minutes, 40 marks)

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General Instructions: (1) This paper has four sections — Section A (1×10), Section B (2×4), Section C (3×4) and Section D (5×2) — total 40 marks. Time allowed: 90 minutes.
 (2) All questions are compulsory. No overall choice is given; internal choice, where allowed, is clearly marked.
 (3) For MCQ questions choose the single correct option; for VSA answers write a single line.
 (4) Take $g = 10 \text{ m/s}^2$. All symbols carry their usual meaning. Use of a calculator is not permitted.

Section A — MCQ & VSA ($10 \times 1 = 10$ marks)

1. A unit vector in the direction of $\mathbf{a}$ is
 - (A) $\mathbf{a}/|\mathbf{a}|$
 - (B) $\mathbf{a}|\mathbf{a}|$
 - (C) $|\mathbf{a}|/\mathbf{a}$
 - (D) $\mathbf{a} + |\mathbf{a}|$
2. The position vector of point (x, y, z) is
 - (A) $x\hat{i} + y\hat{j} + z\hat{k}$
 - (B) $x + y + z$
 - (C) $xy\hat{j} + z\hat{k}$
 - (D) $x\hat{i} - y\hat{j} + z\hat{k}$
3. $\hat{i} \cdot \hat{i}$ equals
 - (A) 1
 - (B) 0
 - (C) $\hat{i}$
 - (D) -1
4. The projection of $\mathbf{a}$ on $\mathbf{b}$ is
 - (A) $(\mathbf{a} \cdot \mathbf{b})/|\mathbf{b}|$
 - (B) $(\mathbf{a} \cdot \mathbf{b})|\mathbf{b}|$
 - (C) $\mathbf{a} \cdot \mathbf{b}$
 - (D) $|\mathbf{a}|$
5. $\hat{i} \times \hat{j}$ equals
 - (A) $\hat{k}$
 - (B) $-\hat{k}$
 - (C) $\hat{i}$
 - (D) 0
6. The area of a parallelogram with adjacent sides $\mathbf{a}$ and $\mathbf{b}$ is
 - (A) $|\mathbf{a} \times \mathbf{b}|$
 - (B) $\mathbf{a} \cdot \mathbf{b}$
 - (C) $\frac{1}{2}|\mathbf{a} \times \mathbf{b}|$
 - (D) $|\mathbf{a}||\mathbf{b}|$
7. Four points are coplanar if
 - (A) the scalar triple product of three vectors is 0

- (B) their dot products are equal
 (C) their magnitudes are equal
 (D) they lie on a line
8. Vectors a , b , c are coplanar if
 (A) $[a, b, c] = 0$
 (B) $[a, b, c] = 1$
 (C) $a \cdot b = 0$
 (D) $a \times b = 0$
9. Write the value of $\hat{i} \cdot \hat{j}$.
10. When are two vectors parallel?

Section B — Short Answer I ($4 \times 2 = 8$ marks)

11. Find the unit vector in the direction of $3\hat{i} + 4\hat{j}$.
12. Write the value of $\hat{i} \times \hat{j}$.
13. State the condition for three points to be collinear.
14. Write the scalar triple product of a , b , c .

Section C — Short Answer II ($4 \times 3 = 12$ marks)

15. Find a unit vector in the direction of $\hat{i} + \hat{j} + \hat{k}$.
16. Find the angle between $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$.
17. Find $a \times b$ if $a = \hat{i} + \hat{j}$ and $b = \hat{j} + \hat{k}$.
18. Show that the points $(1, 1)$, $(2, 2)$, $(3, 3)$ are collinear using vectors.

Section D — Long Answers ($2 \times 5 = 10$ marks)

19. Find a vector of magnitude 6 in the direction of $2\hat{i} - \hat{j} + 2\hat{k}$. Find the projection of $a = 2\hat{i} + 3\hat{j}$ on $b = \hat{i} + \hat{j}$.
20. Find a unit vector perpendicular to both $a = \hat{i} + \hat{j}$ and $b = \hat{j} + \hat{k}$. Show that the points $A(1, 0, 0)$, $B(0, 1, 0)$, $C(0, 0, 1)$ and $D(1, 1, 1)$ are coplanar.

Answer Key (Marking Scheme)

- Q1 — (A) $a/|a|$. Q2 — (A) $x\hat{i} + y\hat{j} + z\hat{k}$. Q3 — (A) 1. Q4 — (A) $(a \cdot b)/|b|$.
- Q5 — (A) $\hat{k}$. Q6 — (A) $|a \times b|$. Q7 — (A) scalar triple product = 0. Q8 — (A) $[a, b, c] = 0$.
- Q9 — 0.
- Q10 — When $a \times b = 0$.
- Q11 — $(3\hat{i} + 4\hat{j})/5$.
- Q12 — $\hat{k}$.
- Q13 — $AB \times AC = 0$.
- Q14 — $a \cdot (b \times c)$.
- Q15 — $(\hat{i} + \hat{j} + \hat{k})/\sqrt{3}$.
- Q16 — 90° .
- Q17 — $\hat{i} - \hat{j} + \hat{k}$.
- Q18 — $AB \times AC = 0$.

Q19 — $2(2\hat{i} - \hat{j} + 2\hat{k})$; $5/\sqrt{2}$.

Q20 — $(\hat{i} - \hat{j} + \hat{k})/\sqrt{3}$; coplanar (triple product = 0).