

## Vector Algebra — CBSE Pattern Test 1

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

### Test 1 — CBSE Pattern (90 minutes, 40 marks)

Class 12 Maths · Vector Algebra · Narayan Gurukul Academy (ClassApna)

General Instructions: (1) This paper has four sections — Section A ( $1 \times 10$ ), Section B ( $2 \times 4$ ), Section C ( $3 \times 4$ ) and Section D ( $5 \times 2$ ) — 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 vector has
  - (A) magnitude and direction
  - (B) only magnitude
  - (C) only direction
  - (D) neither
2. The magnitude of  $\mathbf{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$  is
  - (A)  $\sqrt{a_1^2 + a_2^2 + a_3^2}$
  - (B)  $a_1 + a_2 + a_3$
  - (C)  $\sqrt{a_1 + a_2 + a_3}$
  - (D)  $a_1a_2a_3$
3. The dot product  $\mathbf{a} \cdot \mathbf{b}$  equals
  - (A)  $|\mathbf{a}||\mathbf{b}| \cos \theta$
  - (B)  $|\mathbf{a}||\mathbf{b}| \sin \theta$
  - (C)  $|\mathbf{a}| + |\mathbf{b}|$
  - (D)  $|\mathbf{a}||\mathbf{b}|$
4. Two non-zero vectors are perpendicular if
  - (A)  $\mathbf{a} \cdot \mathbf{b} = 0$
  - (B)  $\mathbf{a} \cdot \mathbf{b} = 1$
  - (C)  $\mathbf{a} \times \mathbf{b} = 0$
  - (D)  $|\mathbf{a}| = |\mathbf{b}|$
5. The cross product  $\mathbf{a} \times \mathbf{b}$  has magnitude
  - (A)  $|\mathbf{a}||\mathbf{b}| \sin \theta$
  - (B)  $|\mathbf{a}||\mathbf{b}| \cos \theta$
  - (C)  $|\mathbf{a}| + |\mathbf{b}|$
  - (D)  $|\mathbf{a}||\mathbf{b}|$
6. Two non-zero vectors are parallel if
  - (A)  $\mathbf{a} \times \mathbf{b} = 0$
  - (B)  $\mathbf{a} \cdot \mathbf{b} = 0$
  - (C)  $\mathbf{a} \times \mathbf{b} = 1$
  - (D)  $|\mathbf{a}| = |\mathbf{b}|$
7. Three points A, B, C are collinear if
  - (A)  $\mathbf{AB} \times \mathbf{AC} = 0$

- (B)  $AB \cdot AC = 0$   
 (C)  $|AB| = |AC|$   
 (D)  $AB + AC = 0$
8. The scalar triple product  $[a, b, c]$  equals  
 (A)  $a \cdot (b \times c)$   
 (B)  $a \times (b \times c)$   
 (C)  $a \cdot b \cdot c$   
 (D)  $|a||b||c|$
9. Define a vector.
10. Write the formula for the dot product.

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

11. Write the magnitude of  $a = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ .
12. When are two vectors perpendicular?
13. Write the magnitude of  $a \times b$ .
14. When are three vectors coplanar?

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

15. Find the magnitude of  $2\hat{i} + 3\hat{j} + 6\hat{k}$ .
16. Find  $a \cdot b$  if  $a = \hat{i} + 2\hat{j}$  and  $b = 2\hat{i} + \hat{j}$ .
17. Find the area of the parallelogram with adjacent sides  $\hat{i}$  and  $\hat{j}$ .
18. Find  $[a, b, c]$  if  $a = \hat{i}$ ,  $b = \hat{j}$ ,  $c = \hat{k}$ .

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

19. Find the angle between  $a = \hat{i} + \hat{j} + \hat{k}$  and  $b = \hat{i} - \hat{j} + \hat{k}$ .
20. Find the area of the triangle with vertices  $A(1, 1, 1)$ ,  $B(1, 2, 3)$  and  $C(2, 3, 1)$ . Show that the vectors  $a = \hat{i} + \hat{j}$ ,  $b = \hat{j} + \hat{k}$ ,  $c = \hat{k} + \hat{i}$  are coplanar or not.

### Answer Key (Marking Scheme)

- Q1 — (A) magnitude and direction. Q2 — (A)  $\sqrt{a_1^2 + a_2^2 + a_3^2}$ . Q3 — (A)  $|a||b| \cos \theta$ . Q4 — (A)  $a \cdot b = 0$ .  
 Q5 — (A)  $|a||b| \sin \theta$ . Q6 — (A)  $a \times b = 0$ . Q7 — (A)  $AB \times AC = 0$ . Q8 — (A)  $a \cdot (b \times c)$ .  
 Q9 — A quantity with magnitude and direction.  
 Q10 —  $a \cdot b = |a||b| \cos \theta$ .  
 Q11 —  $\sqrt{a_1^2 + a_2^2 + a_3^2}$ .  
 Q12 — When  $a \cdot b = 0$ .  
 Q13 —  $|a||b| \sin \theta$ .  
 Q14 — When  $[a, b, c] = 0$ .  
 Q15 — 7.  
 Q16 — 4.  
 Q17 — 1.  
 Q18 — 1.

Q19 —  $\cos \theta = 1/3$ ,  $\theta = \cos^{-1}(1/3)$ .

Q20 —  $\sqrt{6}/2$ ; not coplanar (triple product = 2).