PRACTICE PAPER 01 (2026-27)
CHAPTER 10 : VECTOR ALGEBRA

SUBJECT: MATHEMATICS	**MAX. MARKS:** 40
CLASS: XII	**DURATION:** 1½ hrs

General Instructions:

(i) All questions are compulsory.

(ii) This question paper contains 20 questions divided into five Sections A, B, C, D and E.

(iii) Section A comprises 10 MCQs of 1 mark each (Q9 and Q10 are Assertion–Reason questions). Section B comprises 4 questions of 2 marks each. Section C comprises 3 questions of 3 marks each. Section D comprises 1 question of 5 marks with an internal choice. Section E comprises 2 case study based questions of 4 marks each, with internal choice in the last sub-part.

(iv) There is no overall choice. Internal choices have been provided where indicated.

(v) Use of calculators is not permitted.

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. The magnitude of the vector $2\hat{i} - 3\hat{j} + 6\hat{k}$ is

(a) 5 (b) 7 (c) 11 (d) √11

2. The direction cosines of the vector $2\hat{i} + 2\hat{j} - \hat{k}$ are

(a) 2, 2, −1 (b) 1/3, 1/3, −1/3 (c) 2/3, 2/3, −1/3 (d) 2/9, 2/9, −1/9

3. If $|\vec{a}| = 3,\ |\vec{b}| = 4$ and $\vec{a} \cdot \vec{b} = 6$, then the angle between $\vec{a}$ and $\vec{b}$ is

(a) 30° (b) 45° (c) 90° (d) 60°

4. If $|\vec{a}| = 4,\ |\vec{b}| = 3$ and the angle between them is 30°, then $|\vec{a} \times \vec{b}|$ is

(a) 12 (b) 6 (c) 6√3 (d) 12√3

5. The vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $2\hat{i} + \lambda\hat{j} + 6\hat{k}$ are parallel if λ equals

(a) 4 (b) −4 (c) 2 (d) −2

6. The projection of $2\hat{i} + 3\hat{j} + \hat{k}$ on the vector $\hat{i} + 2\hat{j} + 2\hat{k}$ is

(a) 10 (b) 10/9 (c) 10/3 (d) 3

7. The position vector of the point dividing the line segment joining the points with position vectors $\vec{a}$ and $\vec{b}$ in the ratio 1 : 2 internally is

(a) $\frac{\vec{a} + 2\vec{b}}{3}$ (b) $\frac{2\vec{a} + \vec{b}}{3}$

(c) $\frac{\vec{a} + \vec{b}}{3}$ (d) $\frac{\vec{a} + \vec{b}}{2}$

8. The value of $\hat{k} \cdot (\hat{i} \times \hat{j})$ is

(a) 0 (b) −1 (c) 1 (d) 3

For Q9 and Q10, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

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

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

(c) A is true but R is false.

(d) A is false but R is true.

9. Assertion (A): If $\vec{a} \cdot \vec{b} = 0$, then $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$.

Reason (R): The dot product of two non-zero perpendicular vectors is zero.

10. Assertion (A): $(\vec{a} \times \vec{b}) \cdot \vec{a} = 0$ for any two vectors $\vec{a}$ and $\vec{b}$.

Reason (R): $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$, find a unit vector in the direction of $\vec{a} + \vec{b}$.

12. Find the angle between the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$.

13. The position vectors of the points A and B are $\hat{i} + 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$. Find the position vector of the mid-point of AB and the length of AB.

14. Find the value of λ for which the vectors $2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\hat{i} - 2\hat{j} + 3\hat{k}$ are perpendicular to each other.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Find a vector of magnitude 9 which is perpendicular to both the vectors $\vec{a} = \hat{i} + 2\hat{j}$ and $\vec{b} = 2\hat{j} + \hat{k}$.

16. Find the area of the triangle with vertices A(1, 1, 1), B(3, 2, 1) and C(1, 2, 4).

17. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$.

SECTION – D

Question 18 carries 5 marks.

18. The vertices of a triangle ABC are A(1, 0, 2), B(2, 2, 4) and C(3, 1, 0). Find the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{BC}$. Show that the triangle is right-angled at A and find its area.

OR

Show that the points A(−2, 3, 5), B(1, 2, 3) and C(7, 0, −1) are collinear, and find the ratio in which B divides AC.

SECTION – E (Case Study Based Questions)

Questions 19 and 20 carry 4 marks each.

19. A force $\vec{F} = 2\hat{i} + 3\hat{j} + \hat{k}$ newtons acts on a particle and moves it from the point A(1, 1, 1) to the point B(4, 3, 2), where distances are in metres.

Based on the above information, answer the following questions:

(i) Find the displacement vector $\overrightarrow{AB}$. (1)

(ii) Find the magnitude of the displacement. (1)

(iii) Find the work done by the force, given that work done = $\vec{F} \cdot \overrightarrow{AB}$. (2)

OR

(iii) Find the angle between the force and the displacement. (2)

20. The moment (torque) of a force $\vec{F}$ about a point O is given by $\vec{\tau} = \vec{r} \times \vec{F}$, where $\vec{r}$ is the position vector of the point of application of the force. A force $\vec{F} = 2\hat{k}$ newtons acts at the point with position vector $\vec{r} = 3\hat{i} + 4\hat{j}$ metres.

Based on the above information, answer the following questions:

(i) Write $\vec{r} \times \vec{F}$ as a determinant. (1)

(ii) Find the torque vector $\vec{\tau}$. (1)

(iii) Find the magnitude of the torque and a unit vector along the axis of rotation. (2)

OR

(iii) Find the angle between $\vec{r}$ and $\vec{F}$, and verify that $|\vec{\tau}| = |\vec{r}||\vec{F}|\sin\theta$. (2)

— End of Question Paper —