

Board – CBSE

Class – 12

Topic – Vector Algebra

(i) Vector and scalars, Direction ratio and direction cosines & Unit vector**LEVEL I**

1. If $\vec{a} = \hat{i} + \hat{j} - 5\hat{k}$ and $\vec{b} = \hat{i} - 4\hat{j} + 3\hat{k}$ find a unit vector parallel to $\vec{a} + \vec{b}$
2. Write a vector of magnitude 15 units in the direction of vector $\hat{i} - 2\hat{j} + 2\hat{k}$
3. If $\vec{a} = \hat{i} + \hat{j} - \hat{k}$; $\vec{b} = \hat{i} - \hat{j} + \hat{k}$; $\vec{c} = -\hat{i} + \hat{j} + \hat{k}$ find a unit vector in the direction of $\vec{a} + \vec{b} + \vec{c}$
4. Find a unit vector in the direction of the vector $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ [CBSE 2011]
5. Find a vector in the direction of vector $\vec{a} = \hat{i} - 2\hat{j}$, whose magnitude is 7

LEVEL II

6. Find a vector of magnitude 5 units, perpendicular to each of the vectors $(\vec{a} + \vec{b})$, $(\vec{a} - \vec{b})$ where $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$
7. If the sum of two unit vectors is a unit vector, show that the magnitude of their difference is $\sqrt{3}$.
8. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, find a vector of magnitude 6 units which is parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$

LEVEL – III

9. If a line make α, β, γ with the X - axis , Y- axis and Z - axis respectively, then find the value of $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$
10. For what value of p, is $(\hat{i} + \hat{j} + \hat{k})p$ a unit vector?
11. What is the cosine of the angle which the vector $\sqrt{2}\hat{i} + \hat{j} + \hat{k}$ makes with Y - axis
12. Write the value of p for which $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors.

(ii) Position vector of a point and collinear vectors**LEVEL – I**

13. Find the position vector of the midpoint of the line segment joining the points A($5\hat{i} + 3\hat{j}$) and B($3\hat{i} - \hat{j}$)
14. In a triangle ABC, the sides AB and BC are represents by vectors $2\hat{i} - \hat{j} + 2\hat{k}$, $\hat{i} + 3\hat{j} + 5\hat{k}$ respectively. Find the vector representing CA.
15. Show that the points (1,0), (6,0), (0,0) are collinear.

LEVEL – II

16. Write the position vector of a point R which divides the line joining the points P and Q whose position vectors are $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively in the ratio 2 : 1 externally
17. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $(2\vec{a} + \vec{b})$ and $(\vec{a} - 3\vec{b})$ respectively, externally in the ratio 1:2. Also, show that P is the mid-point of the line segment RQ

(iii) Dot product of two vectors

LEVEL – I

18. Find $\vec{a} \cdot \vec{b}$ if $\vec{a} = 3\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} + 3\hat{k}$.
19. If $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = \sqrt{6}$. Then find the angle between \vec{a} and \vec{b} .
20. Write the angle between two vectors \vec{a} and \vec{b} with magnitudes $\sqrt{3}$ and 2 respectively having $\vec{a} \cdot \vec{b} = \sqrt{6}$ [CBSE 2011]

LEVEL – II

21. The dot products of a vector with the vectors $\hat{i} - 3\hat{j}$, $\hat{i} - 2\hat{j}$ and $\hat{i} + \hat{j} + 4\hat{k}$ are 0, 5 and 8 respectively. Find the vectors.
22. If \vec{a} and \vec{b} are two vectors such that $|\vec{a} \cdot \vec{b}| = |\vec{a} \times \vec{b}|$, then what is the angle between \vec{a} and \vec{b} .
23. If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to \vec{c} , find the value of λ .

LEVEL – III

24. If \vec{a} & \vec{b} are unit vectors inclined at an angle θ , prove that $\sin \frac{\theta}{2} = \frac{1}{2} |\vec{a} - \vec{b}|$.
25. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$, then find the angle between \vec{a} and \vec{b} .