sns academy
a fingerprint school
Sincerity, Nobility and Service

XII **VECTOR ALGEBRA**

1. If $\vec{a} = 7\hat{i} + j - 4k$ and $\vec{b} = 2i + 6j + 3k$, then find the projection of $\vec{a}$ and $\vec{b}$.
2. Find λ, if the vectors $\vec{a} = i + 3j + k, \vec{b} = 2i - j - k$ and $\vec{c} = \lambda i + 3k$ are coplanar.
3. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular unit vectors, then find the value of $\left|2\vec{a} + \vec{b} + \vec{c}\right|$
4. Write the unit vector perpendicular to both the vectors $\vec{a} = i + j + k \; and \; \vec{b} = i + j$
5. Find the unit vector in the direction of the sum of the vectors $2i + 3j - k$ and $4i - 3j + 2k$.
6. Find the area of the parallelogram whose adjacent sides are represented by the vectors $2i - 3k \; and \; 4j + 2k$.
7. If $\vec{r} = xi + yj + zk, \; find \; \left(\vec{r} \times \hat{i}\right).\left(\vec{r} \times \vec{j}\right) + xy$.
8. If $\vec{a} = i + 2j + k, \vec{b} = 2i + j \; and \; \vec{c} = 3i - 4j - 5k$, then find the unit vector perpendicular to both of the vectors $\left(\vec{a} - \vec{b}\right) and \left(\vec{c} - \vec{b}\right)$.
9. Two vectors $\vec{j} + k \; and \; 3i - j + 4k$ represent the two side vectors $\overrightarrow{AB} \; and \; \overrightarrow{AC}$ respectively of triangle ABC. Find the length of the median through A.
10. If $\vec{a} \; and \; \vec{b}$ are two unit vectors such that $\vec{a} + \vec{b}$ is also a unit vector, then find the angle between $\vec{a} \; and \; \vec{b}$.
11. If vectors $\vec{a} \; and \; \vec{b}$ are such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = \frac{2}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector, then write the angle between $\vec{a} \; and \; \vec{b}$
12. Find the value of p for which the vectors $3i + 2j + 9k \; and \; i - 2pj + 3k$ are parallel.
13. Find $\vec{a}.(\vec{b} \times \vec{c})$, if $\vec{a} = 2i + j + 3k, \vec{b} = i + 2j + k \; and \; \vec{c} = 3i + j + 2k$.
14. If $\vec{a} \; and \; \vec{b}$ are perpendicular vectors, $\left|\vec{a} + \vec{b}\right| = 13 \; and \left|\vec{a}\right| = 5$, find the value of $\left|\vec{b}\right|$.
15. Find a vector in the direction of $2i - 3j + 6k$ which has magnitude 21 units.
16. Write the value of $\hat{i} \times (j + k) + j \times (k + i) + k \times (i + j)$.
17. Prove: $\left[\vec{a} + \vec{b}, \; \vec{b} + \vec{c}, \; \vec{c} + \vec{a}\right] = 2\left[\vec{a}, \vec{b}, \vec{c}\right]$.
18. Vectors $\vec{a}, \vec{b} \; and \; \vec{c}$ are such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5, \left|\vec{c}\right| = 7$. Find the angle between $\vec{a} \; and \; \vec{b}$.

19. Show that the four points A(4, 5, 1), B(0,-1,-1), C(3, 9, 4) and D (-4,4, 4) are coplanar.
20. The scalar product of the vector $\vec{a} = i + j + k$ with the unit vector along the sum of the vectors $\vec{b} = 2i + 4j - 5k \; and \; \vec{c} = \lambda i + 2j + 3k$ is equal to one. Find the value of λ and hence find the unit vector along $\vec{b} + \vec{c}$.
21. Show that the vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar if and only if $\vec{a} + \vec{b}, \vec{b} + \vec{c}, \vec{c} + \vec{a}$ are coplanar.
22. Find the unit vector perpendicular to both of the vectors $\vec{a} + \vec{b} \; and \; \vec{a} - \vec{b}$ where $\vec{a} = i + j + k; \; \vec{b} = i + 2j + 3k$.
23. If $\vec{a} = xi + 2j - zk \; and \; \vec{b} = 3i - yj = k$ are two equal vectors, then write the value of x + y + z.
24. P and Q are two points with P.V s $3\vec{a} - 2\vec{b} \; and \; \vec{a} + \vec{b}$ respectively. Write the P.V of a point R which divides the line segment PQ in the ratio 2:1 externally.
25. Find $\left|\vec{x}\right|$, if for a unit vector $\vec{a}$, $\left(\vec{x} - \vec{a}\right).\left(\vec{x} + \vec{a}\right) = 15.$
26. A and B are two points with position vectors $2\vec{a} - 3b \; and \; 6\vec{b} - \vec{a}$ respectively. Write the P.V of a point P which divides the line segment AB internally in the ratio 1:2.
27. If $\vec{a}$ is a unit vector $\left(\vec{x} - \vec{a}\right).\left(\vec{x} + \vec{a}\right) = 24$, then find the value of $\left|\vec{x}\right|$
28. For any three vectors $\vec{a}, \vec{b}, \vec{c}$, write the value of the following : $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right).$
29. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a} + \vec{b}\right| = \left|\vec{a}\right|$, then prove that vector $2\vec{a} + \vec{b}$ is perpendicular to $\vec{b}$.
30. If $\vec{a} = i + j + k \; and \; \vec{b} = j - k$, find a vector $\vec{c}$, such that $\vec{a} \times \vec{c} = \vec{b} \; and \; \vec{a}.\vec{c} = 3.$
31. If $\vec{a} = i - j + 7k \; and \; \vec{b} = 5i - j + \lambda k$, then find the value of λ, so that $\vec{a} + \vec{b} \; and \; \vec{a} - \vec{b}$ are perpendicular .
32. The magnitude of the vector product of the vector $i + j + k$ with a unit vector along the sum of vectors $2\dot{i} + 4j - 5k \; and \; \lambda i 2j + 3k$ is equal to $\sqrt{2}$. Find the value of λ.
33. Find a vector of magnitude 6, perpendicular to each of the vectors $\vec{a} + \vec{b} \; and \; \vec{a} - \vec{b}$, where $\vec{a} = i + j + k, \vec{b} = i + 2j + 3k$.

34. If $\vec{a},\vec{b},\vec{c}$ are three vectors such that $\left|\vec{a}\right|=5,\left|\vec{b}\right|=12 and \left|\vec{c}\right|=13,$ and $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, find the value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$.

35. Let $\vec{a}=i+4j+2k,\vec{b}=3i-2j+7k and \vec{c}=2i-j+4k$. Find a vector $\vec{p}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{p}.\vec{c}=18.$

36. Write the direction cosines of the vector $-2i+j-5k$.

37. Write the projection of the vector $\hat{i}-\vec{j}\ on\ \hat{i}+\vec{j}$.

38. Write the angle between two vectors $\vec{a}\ and\ \vec{b}$ with magnitudes $\sqrt{3}$ and 2 respectively having $\vec{a}.\vec{b}=\sqrt{6}$.

39. Write the position vector of the mid-point of the vector joining the points P(2, 3, 4) and Q(4, 1, -2).

40. If $\vec{a}.\vec{b}=0 and \vec{a}.\vec{a}=0$, then what can be concluded about the vector $\vec{b}$?

41. If two vectors $\vec{a}\ and\ \vec{b}$ such that $\left|\vec{a}\right|=2,\left|\vec{b}\right|=1 and\ \vec{a}.\vec{b}=1$ then find the value of $\left(3\vec{a}-5\vec{b}\right).\left(2\vec{a}+7\vec{b}\right)$

42. Find a vector of magnitude 5 units, and parallel to the resultant of the vectors $\vec{a}=2i+3j-k,\vec{b}=i-2j+k$.

43. Using vectors, find the area of the triangle with vertices are A(1,1,2), B(2, 3, 5) and C(1, 5, 5).

44. If vectors $\vec{a}=2i+2j+3k,\vec{b}=-i+2j+k$ and $\vec{c}=3i+j$ are such that $\vec{a}+\lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.

45. If $\vec{a}\times\vec{b}=\vec{c}\times\vec{d}$ and $\vec{a}\times\vec{c}=\vec{b}\times\vec{d}$, show that $\vec{a}-\vec{d}$ is parallel to $\vec{b}-\vec{c}$.