MATHS

BOOKS - OSWAAL PUBLICATION MATHS (KANNADA ENGLISH)

VECTOR ALGEBRA

Topic 1 Very Short Answer Type Questions

1. If the vectors $2\hat{i}+3\hat{j}-6\hat{k}$ and $4\hat{i}-m\hat{j}-12\hat{k}$ are parallel find m.

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2. Write the vector joining the points A(2,3,0) and B(1,2,4).

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3. Define collinear vectors.

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4. Define negative of a vector.

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5. Find the direction cosines of vector, $2\hat{i}+\hat{j}+3\hat{k}$.

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6. Define unit vector.

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7. If $\overrightarrow{AB}=3\hat{i}+2\hat{j}+6\hat{k}$, $\overrightarrow{OA}=\hat{i}-\hat{j}-3\hat{k}$, find the value of $\overrightarrow{OB}$.

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

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9. Write a vector in the direction of the vector $\hat{i} - 2\hat{j} + 2\hat{k}$ that has magnitude 9 units.

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10. Write the value of cosine of the angle which the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ makes with y-axis.

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11. Write a unit vector in the direction of the sum of vectors $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 7\hat{k}$.

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12. Write the value of p for which the vectors $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} - 2p\hat{j} + 3\hat{k}$ are parallel vectors.

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13. Find a vector $\vec{a}$ of a magnitude $5\sqrt{2}$ making an angle of $\frac{\pi}{4}$ with x-axis , $\frac{\pi}{2}$ with y-axis and an acute angle θ with z-axis.

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14. Find a vector in the direction of vector $2\hat{i} - 3\hat{j} + 6\hat{k}$ which has magnitude 21 units.

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15. If $\vec{a} = x\hat{i} + 2\hat{j} - z\hat{k}$ and $\vec{b} = 3\hat{i} - y\hat{j} + \hat{k}$ are two equal vectors, then write the value of x+y+z.

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16. If a unit vector $\vec{a}$ makes an angle $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ with $\hat{j}$ and a acute angle θ with $\hat{k}$, then find the value of θ.

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17. Write a unit vector in the direction of the sum of vectors $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} + 3\hat{k}$.

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18. Consider two points P and Q with position vectors $\overrightarrow{OP} = 3\vec{a} - 2\vec{b}$ and $\overrightarrow{OQ} = \vec{a} + \vec{b}$. Find the position vector of a point R which divides the line joining P and Q in the ratio $2:1$, (i) intermally, and (ii) externally.

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19. L and M are two points with position vectors $2\vec{a} - \vec{b}$ and $\vec{a} + 2\vec{b}$ respectively. Write the position vectors of a point N which divides the line segment LM in the ratio 2 : 1 externally.

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20. Find a unit vector in the direction of $\vec{A} = 3\hat{i} - 2\hat{j} + 6\hat{k}$.

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21. Find the sum of vectos $a = \hat{i} - 2\hat{j} + \hat{k}, b = -2\hat{i} + 4\hat{j} + 5\hat{k}$ and $c = \hat{i} - 6\hat{j} - 7\hat{k}$.

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22. Find the scalar and vector components of the vector with initial point $(2, 1)$ and terminal point $(-5, 7)$.

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23. If a line has direction ratios 2,-1,-2 then determine its direction cosines.

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24. If A, B and C are the vertices of a triangle ABC, then what is the value of $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA}$?

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25. Find the magnitude of the vector $\vec{a} = 3\hat{i} + 2\hat{j} + 6\hat{k}$.

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26. Find the magnitude of the vector $\left(2\hat{i} - 3\hat{j} - 6\hat{k}\right) + \left(-\hat{i} + \hat{j} + 4\hat{k}\right)$.

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27. Write the direction cosines of the line joining the points (1,0,0) and (0,1,1).

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28. For what value of 'a' the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $a\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear ?

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29. Write the direction cosines of the vector $2\hat{i}+\hat{j}-5\hat{k}$.

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30. Find the position vector of the mid point of the line segment joining the points $A\left(5\hat{i}+3\hat{j}\right)$ and $B\left(3\hat{i}-\hat{j}\right)$.

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31. If $\vec{a}=2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=\left(6\hat{i}+\lambda\hat{j}+9\hat{k}\right)$ and $\vec{a}$ is parallel to $\vec{b}$, find the value of λ.

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32. In a triangle ABC, the sides AB and BC are represented by vectors $2\hat{i}-\hat{j}+2\hat{k}$, $\hat{i}+3\hat{j}+5\hat{k}$ respectively. Find the vector representing CA.

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33. Find the position vector of the mid point of the line-segment AB, where A is the point (3, 4, -2) and B is the point (1,2,4).

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34. Write a vector of magnitude 15 units in the direction of vector $\hat{i} - 2\hat{j} + 2\hat{k}$.

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Topic 1 Short Answer Type Questions I

1. If the position vectors of the points A and B respectively are i+2j-3k and j-k find the direction cosines of AB

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2. Find a vector of magnitue 8 units in the direction of the vector, $\vec{a} = 5\hat{i} - \hat{j} + 2\hat{k}$

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3. Find λ if the vectors $\vec{a} = \hat{i} + 3\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} + 7\hat{j} + 3\hat{k}$ are coplanar

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4. Find $\left|\vec{b}\right|$, if $\left(\vec{a} + \vec{b}\right).\left(\vec{a} - \vec{b}\right) = 8$ and $\left|\vec{a}\right| = 8\left|\vec{b}\right|$

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5. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$.

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6. Find a vector of magnitude 11 in the direction on opposite to that of $\overline{PQ}$. Where P and Q are the points (1,3,2) and (-1,0,8), respectively.

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7. If the points (-1,-1,2), (2,m,5) and (3,11,6) are collinear, find the value of m.

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8. Obtain the projection of the vector $\vec{a} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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Topic 1 Short Answer Type Questions Ii

1. Show that the position vector of the point P, which divides the line joining the points A and B having position vectors $\vec{a}$ and $\vec{b}$ internally in ratio m:n is $\frac{m\vec{b}+n\vec{a}}{m+n}$

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

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3. Show that the points $A(1,2,7), B(2,6,3)$ and $C(3,10,-10)$ are collinear.

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4. Find all vectors of magnitude $10\sqrt{3}$ that are perpendicular to the plane of $\hat{i}+2\hat{j}+\hat{k}$ and $-\hat{i}+3\hat{j}+\hat{k}$.

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5. Find the direction cosines of the vector $\hat{i}+2\hat{j}+3\hat{k}$

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6. 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 $2\vec{a}-\vec{b}+3\vec{c}$.

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Topic 2 Short Answer Type Questions I

1. If $\vec{a}$ is a unit vector such that $\left(\vec{x}-\vec{a}\right).\left(\vec{x}+\vec{a}\right)=8$ find $\left|\vec{x}\right|$.

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2. If $\vec{a}$ and $\vec{b}$ are unit vectors, then find the angle between $\vec{a}$ and $\vec{b}$, given that $\left(\sqrt{3}\vec{a}-\vec{b}\right)$ is a unit vector.

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3. Find the projection of vector $\hat{i}+3\hat{j}+7\hat{k}$ on the vector $2\hat{i}-3\hat{j}+6\hat{k}$.

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4. 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 $\left|\vec{b}\right|$

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5. Write the projection of the vector $\hat{i}+\hat{j}+\hat{k}$ along the vector $\hat{j}$.

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6. Write the value of λ so that the vectors $\vec{a}=2\hat{i}+\lambda\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+3\hat{k}$ are perpendicular to each other ?

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7. Write the projection of the vector $7\hat{i}+\hat{j}-4\hat{k}$ on the vector $2\hat{i}+6\hat{j}+3\hat{k}$.

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8. Write the projection of $\vec{b}+\vec{c}$ on $\vec{a}$, where $\vec{a}=2\hat{i}-2\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}-2\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$.

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9. Find $\left|\vec{x}\right|$, if for a unit vector $\vec{a}$, $\left(\vec{x}+\vec{a}\right)\left(\vec{x}-\vec{a}\right)=15$.

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10. Find $'\lambda'$ when the projection of $\vec{a}=\lambda\hat{i}+\hat{j}+4\hat{k}$ on $\vec{b}=2\hat{i}+6\hat{j}+3\hat{k}$ is 4 units.

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11. If $\left|\vec{a}\right|=\sqrt{3}, \left|\vec{b}\right|=2$ and angle between $\vec{a}$ and $\vec{b}$ is 60°, find $\vec{a}.\vec{b}$.

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

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

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14. Find the value of λ if the vectors $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \lambda\hat{j} - 3\hat{k}$ are perpendicular to each other.

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Topic 2 Short Answer Type Questions Ii

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

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2. If two vectors $\vec{a}$ and $\vec{b}$ such that $\left|\vec{a}\right| = 2\left|\vec{b}\right| = 3$ and $\vec{a}.\vec{b} = 6$, find $\left|\vec{a} - \vec{b}\right|$.

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3. If $\vec{a} = \hat{i} - \hat{j} + 7\hat{k}$ and $\vec{b} = 5\hat{i} - \hat{j} + \lambda\hat{k}$, then find the value of λ so that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular vectors.

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4. If $\vec{a}, \vec{b}, \vec{c}$ are three mutually perpendicular vectors of equal magnitude, then the angle θ which $\vec{a} + \vec{b} + \vec{c}$ makes with any one of three given vectors is given by

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5. Vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $|\vec{a}| = 3, |\vec{b}| = 5$ and $|\vec{c}| = 7$. Find the angle between $\vec{a}$ and $\vec{b}$.

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6. The scalar product of the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vectors $\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{c} = \lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ and hence find the unit vector along $\vec{b} + \vec{c}$.

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7. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a} + \vec{b}| = |\vec{a}|$, then prove tat $2\vec{a} + \vec{b}$ is perpendicular to $\vec{b}$.

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8. If the sum of the unit vectors $\hat{a}$ and $\vec{b}$ is a unit vector. Show that the magnitude of their difference is $\sqrt{3}$.

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9. 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 $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$.

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

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11. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors such that $\left|\vec{a}\right| = 3$, $\left|\vec{b}\right| = 4$ and $\left|\vec{c}\right| = 3$ and each one of them is perpendicular to the sum of the other two, then find $\left|\vec{a} + \vec{b} + \vec{c}\right|$.

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12. The dot product of a vector with the vectors $\hat{i} - 3\hat{k}$, $\hat{i} - 2\hat{k}$ and $\hat{i} + \hat{j} + 4\hat{k}$ are 0, 5 and 8 respectively. Find the vector.

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Topic 3

1. If $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = -\hat{i} + \hat{k}$, $\vec{c} = 2\hat{j} - \hat{k}$ are three vectors, find the area of the parallelogram having diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$.

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2. Find the unit vector perpendicular to both the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$.

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3. If $\vec{a}=3\hat{i}-\hat{j}$ and $\vec{b}=2\hat{i}+\hat{j}-3\hat{k}$ then express $\vec{b}$ in the form of $\vec{b}=\vec{b_1}+\vec{b_2}$ where $\vec{b_1}\ ||\ \vec{a}$ and $\vec{b_2}$ perpendicular to $\vec{a}$.

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4. If $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{j}-\hat{k}$, find a vector $\vec{c}$, such that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}.\vec{c}=3$.

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5. Using vectors, find the area of the triangle with vertices are A(1,2,3), B(2, -1, 4) and C(4,5,-1).

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6. Find the unit vector perpendicular to the plane of ΔABC whose vertices are

A(3,-1,2), B(1,-1,-3) and C(4,-3,1)

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

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8. Find the area of the triangle with vertices A(1,1,2), B(2,3,5) and C(1,5,5).

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9. Find the unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ where $\vec{a}=3\hat{i}+2\hat{j}+2\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}-2\hat{k}$

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10. Find the vector $\vec{p}$ which is perpendicular to both $\vec{\alpha}=4\hat{i}+5\hat{j}-\hat{k}$ and $\vec{\beta}=\hat{i}-4\hat{j}+5\hat{k}$ and $\vec{p}.\vec{q}=21$, where $\vec{q}=3\hat{i}+\hat{j}-\hat{k}$.

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11. Find the unit vector perpendicular to the plane ABC where the position vectors A, B and C are $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+\hat{j}+2\hat{k}$ and $2\hat{i}+3\hat{k}$.

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12. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a} . \vec{b} = \vec{a} . \vec{c} = 0$ and angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$, prove that $\vec{a} = \pm 2\left(\vec{b} \times \vec{c}\right)$.

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

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Topic 4 Short Answer Type Questions Ii

1. Prove that $\left[\vec{a} + \vec{b}, \vec{b} + \vec{c}, \vec{c} + \vec{a}\right] = 2\left[\vec{a}, \vec{b}, \vec{c}\right]$.

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2. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{O}$, find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$.

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3. Prove that $\left[\vec{a}, \vec{b}, \vec{c} + \vec{d}\right] = \left[\vec{a}, \vec{b}, \vec{c}\right] + \left[\vec{a}, \vec{b}, \vec{d}\right]$.

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4. If the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar, prove that the vectors $\vec{a} + \vec{b}, \vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are also coplanar.

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5. Show that the four points A, B, C and D with position vectors $4\hat{i} + 5\hat{j} + \hat{k} - \hat{j} - \hat{k}, 3\hat{i} + 9\hat{j} + 4\hat{k}$ and $4\left(-\hat{i} + \hat{j} + \hat{k}\right)$ respectively are coplanar.

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6. Find the value of λ, if the point with position vectors $3\hat{i}-2\hat{j}-\hat{k}, 2\hat{i}+3\hat{j}-4\hat{k}, -\hat{i}+\hat{j}+2\hat{k}$ and $4\hat{i}+5\hat{j}+\lambda\hat{k}$ are coplanar.

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7. If $\vec{a}=2\hat{i}-3\hat{j}+4\hat{k}, \vec{b}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{c}=3\hat{i}+4\hat{j}-\hat{k}$, then find $\vec{a}.\left(\vec{b}\times\vec{c}\right)$ and $\left(\vec{a}\times\vec{b}\right).\vec{c}$. Is, $\vec{a}.\left(\vec{b}\times\vec{c}\right)=\left(\vec{a}\times\vec{b}\right).\vec{c}$?

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