MATHS

BOOKS - MODERN PUBLICATION

VECTORS

Example

1. Classify the following measure as scalar and vector: 40^o

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2. Classify the following measures as scalar and vector quantities : 50 watt.

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3. Classify the following measures as scalar and vector quantities : $10gm/cm^3$.

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4. Classify the following measures as scalar and vector quantities : $20m/\sec$ towards north.

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5. Classify the following measures as scalar and vector quantities : 5 seconds.

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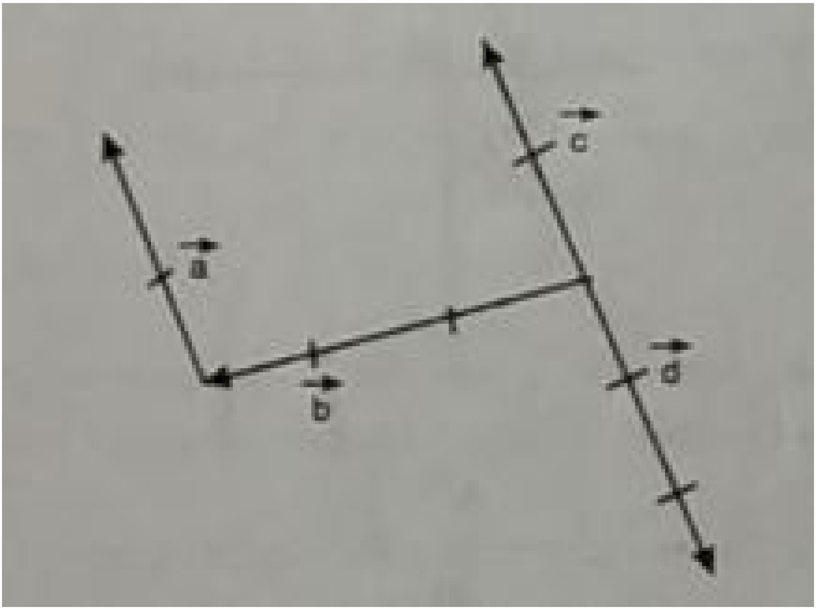
6. In the figure,



which of the vectors are : Collinear.

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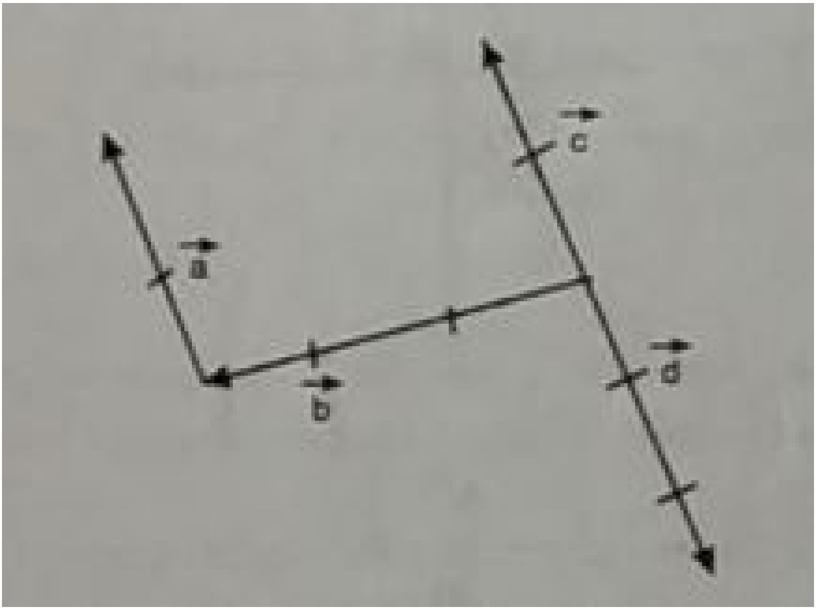
7. In the figure,



which of the vectors are : Equal.

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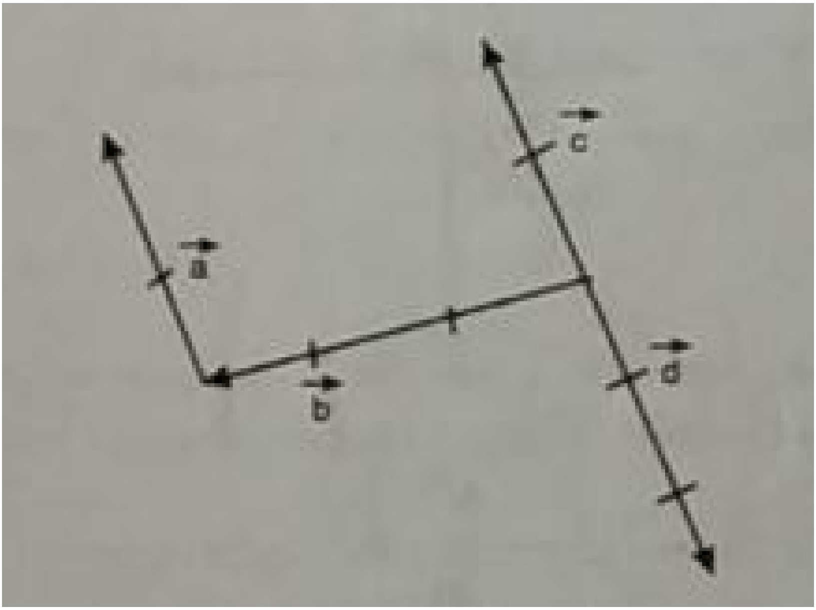
8. In the figure,



which of the vectors are : Co-initial.

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

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10. Given , the edges A, B and C of triangle ABC. Find $\cos\angle BAM$, where M is mid-point of BC.

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11. Show that the sum of three vectors determined by the medians of a triangle directed from the vertics is zero.

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12. In the figure,

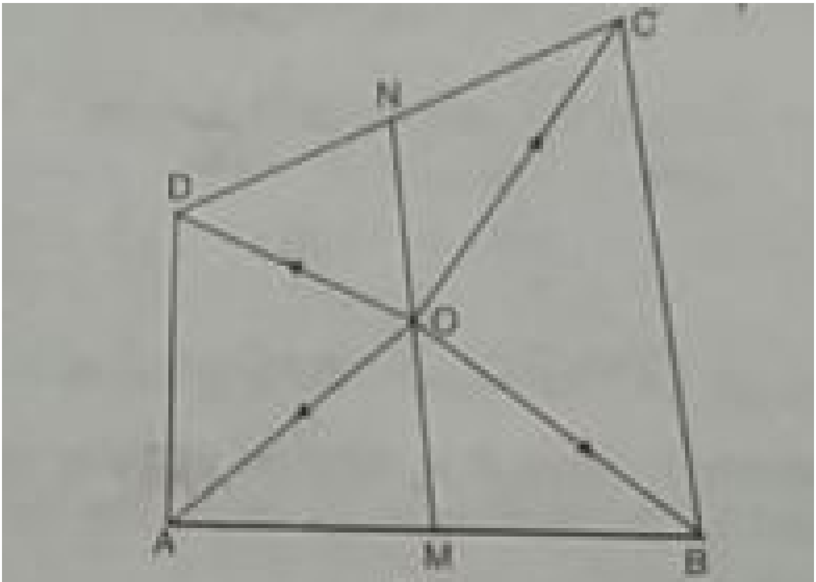

Fig.

M is the mid-point of [AB] and N is the mid-point of [CD] and O is the mid-point of [MN]. Prove that : $\overrightarrow{BC}+\overrightarrow{AD}=2\overrightarrow{MN}$.

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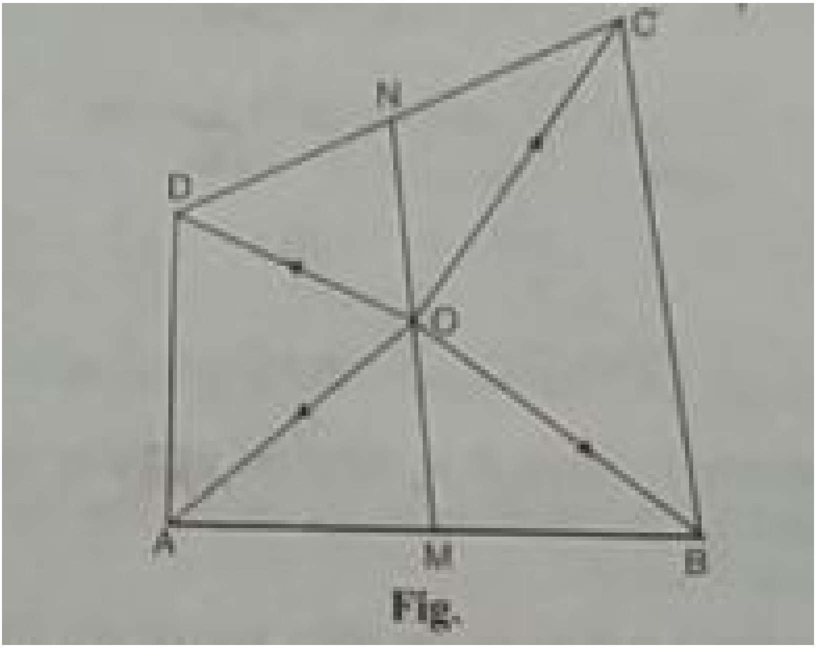
13. In the figure,



M is the mid-point of [AB] and N is the mid-point of [CD] and O is the mid-point of [MN]. Prove that : $\overrightarrow{BC} + \overrightarrow{AD} = 2\overrightarrow{MN}$.

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14. ABCD is a parallelogram and P the intersection of the diagonals, O is any point . Show that $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} = 4\overrightarrow{OP}$.

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15. What is the geometric significance of the relation $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$?

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16. For any two vectors $\vec{a}$ and $\vec{b}$, prove that : $\left|\vec{a}+\vec{b}\right|\leq\left|\vec{a}\right|+\left|\vec{b}\right|$.

Also, write the name of this inequality

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17. If the sum of two unit vectors is a unit vector, show that the magnitude of their difference is $\sqrt{3}$.

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18. Find the position vector of a point, which divides the join of the points with position vectors $\vec{a}-2\vec{b}$ and $2\vec{a}+\vec{b}$ externally in the ratio $2:1$.

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19. The two vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ represent the two sides AB and AC respectively of a $\triangle ABC$. Find the lengthof the median through A

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20. If $\vec{a}=4\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-2\hat{j}+\hat{k}$, then find a unit vector parallel to the vector $\vec{a}+\vec{b}$.

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21. If $\vec{a}=2\hat{i}+\hat{j}-2\hat{k}$, then evaluate $\left|\vec{a}\right|$.

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22. Find the vector joining the points P(2, 3, 0) and Q(– 1, – 2, – 4) directed from P to Q.

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

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24. Write the direction-ratios of the vector $\vec{r} = \hat{i} + \hat{j} - 2\hat{k}$, and hence calculate its direction-cosines.

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25. Write 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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26. Find the unit vector in the direction of the sum of the vectors $\overrightarrow{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\overrightarrow{b} = -\hat{i} + \hat{j} + 3\hat{k}$.

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

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28. Prove that if $\overrightarrow{u} = u_1\hat{i} + u_2\hat{j}$ and $\overrightarrow{v} = v_1\hat{i} + v_2\hat{j}$ are non-zero vectors, then they are parallel if and only if $u_1v_2 - u_2v_1 = 0$.

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29. Find the value of 'p' for which the vector $3\hat{i}+2\hat{j}+9\hat{k}$ and $\hat{i}-2p\hat{j}+3\hat{k}$ are parallel.

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30. Show that the points : $A\left(2\hat{i}-\hat{j}+\hat{k}\right), B\left(\hat{i}-3\hat{j}-\hat{k}\right), C\left(3\hat{i}-4\hat{j}-4\hat{k}\right)$ are the vertices of a right-angled triangle.

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31. Show that the points P(2,6),Q(1,2)and R(3,10) are collinear.

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32. The position vectors of A,B,C are $2\hat{i}+\hat{j}-\hat{k}, 3\hat{i}-2\hat{j}+\hat{k}$ and $\hat{i}+4\hat{j}-3\hat{k}$ respectively. Show that A, B and C are collinear.

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33. Show that the following vectors are coplanar : $2\hat{i}-\hat{j}+\hat{k}, \hat{i}-3\hat{j}-5\hat{k}, 3\hat{i}-4\hat{j}-4\hat{k}.$

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34. Show that the four points A,B,C,D with position vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ respectively, such that $3\vec{a}-2\vec{b}+5\vec{c}-6\vec{d}=\vec{0}$, are collinear. Also find the position vector of the point of intersection of the lines Ac and BD.

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35. D,E,F are the middle points of the sides [BC],[CA],[AB] respectively of a triangle ABC. Show that : FE is parallel to BC and half of its length.

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36. D,E,F are the middle points of the sides [BC],[CA],[AB] respectively of a triangle ABC. Show that : the sum of the vectors $\overrightarrow{AD}, \overrightarrow{BE}, \overrightarrow{CF}$ is zero.

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37. D,E,F are the middle points of the sides [BC],[CA],[AB] respectively of a triangle ABC. Show that : the medians have a common point of trisection i.e. They are concurrent.

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38. Show, by vector method, that the angular bisector of a triangle are concurrent and find its expression for the position vector of the point of concurrency in terms of the position vectors of the vertices.

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39. Prove, by vector method, that the diagonals of a parallelogram bisect each other, conversely, if the diagonals of a quadrilateral bisect each other, it is a parallelogram.

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40. Show that the diagonals of quadrilateral bisect each other if an donly if it is a parallelogram, by using vector method.

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41. Show that the st. Line joining the mid-points of two non-parallel sides of a trapezium is parallel to the bases and is equal to half of the sum of their lengths.

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42. If veca and vecb are perpendicular vectors, $\left|\vec{a}+\vec{b}\right|=13, \left|\vec{a}\right|=5$ then find |vecb|`.

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43. Find the projection of the 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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44. 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 $\vec{b}$.

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45. 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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46. Find λ when the scalar 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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47. For any two vectors $\vec{a}$ and $\vec{b}$, prove that $\left|\vec{a}.\vec{b}\right| \leq \left|\vec{a}\right|\left|\vec{b}\right|$ Also write the name of this inequality.

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48. For two non-zero vectors $\vec{a}$ and $\vec{b}$, write when $\left|\vec{a} + \vec{b}\right| = \left|\vec{a}\right| + \left|\vec{b}\right|$ holds.

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

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

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51. Find $|\vec{a} - \vec{b}|$, if two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 2, |\vec{b}| = 3$ and $\vec{a} \cdot \vec{b} = 4$.

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52. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors of magnitude 3,2,5 respectively. If each one is perpendicular to the sum of other two vectors, prove that :

$\left|\vec{a}+\vec{b}+\vec{c}\right|=\sqrt{38}.$

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53. If veca and vecb are unit vectors inclined at an angle theta then prove that $\cos\left(\frac{\theta}{2}\right)=\frac{1}{2}\left|\vec{a}+\vec{b}\right|$

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54. If $\vec{a}$ is any vector, then show that $\vec{a}=\left(\vec{a}.\hat{i}\right)\hat{j}+\left(\vec{a}.\hat{j}\right)\hat{j}+\left(\vec{a}.\hat{k}\right)\hat{j}.$

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55. 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 $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}.$

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56. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and $|\vec{a}|=3, |\vec{b}|=5,$ and $|\vec{c}|=7,$ find the angle between $\vec{a}$ and $\vec{b}$.

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57. Show that the following vectors are coplanar : $2\hat{i}-\hat{j}+\hat{k}, \hat{i}-3\hat{j}-5\hat{k}, 3\hat{i}-4\hat{j}-4\hat{k}.$

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58. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, show that the angle $'\theta'$ between the vectors $\vec{b}$ and $\vec{c}$ is given by : $\cos\theta=\dfrac{a^2-b^2-c^2}{2|\vec{b}||\vec{c}|}$.

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59. Dot products of a vector with vertices $\hat{i}+\hat{j}-3\hat{k}$, $\hat{i}+3\hat{j}-2\hat{k}$ and $2\hat{i}+\hat{j}+4\hat{k}$ are 0,5 and 8 respectively. Find the vector.

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

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61. If with reference to the right handed system of mutually perpendicular unit vectors $\hat{i}, \hat{j}, \hat{k}$, $\vec{\alpha}=3\hat{i}-\hat{j}$, $\vec{\beta}=2\hat{i}+\hat{j}-3\hat{k}$, then express $\vec{\beta}$ in the form $\vec{\beta}=\vec{\beta}_1+\vec{\beta}_2$ where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.

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62. Prove that in a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

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63. Show that the median to the base of ann isosceles triangle is perpendicular to base.

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64. Prove that the perpendicular from the vertices to the opposite sides (i.e. Altitudes) of a triangle concurrent.

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65. Prove that, in any triangle ABC, $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$.

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66. Use vectors to prove that in $\triangle ABC : a = b\cos C + c\cos B.$

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67. The diagonals of a rhombus are perpendicular to each other .

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68. In a tetrahedron, if two pairs of opposite edges are perpendicular to each other, prove that the third pair is also perpendicular and that the sum of the squares on the two opposite edges is same for each pair.

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69. Using vector method prove that $\cos(A - B) = \cos A \cos B + \sin A \sin B$

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70. Prove that an angle subtended at the circumference of a circle by any diameter is a right-angle.

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71. Find the work done by the force $\overrightarrow{F} = 2\hat{i} + \hat{j} + \hat{k}$ acting on a particle, if the particle is displaced from the point with position vector $2\hat{i} + 2\hat{j} + 2\hat{k}$ to the point with position vector $3\hat{i} + 4\hat{j} + 5\hat{k}$.

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72. Constant forces $2\hat{i} - 5\hat{j} + 6\hat{k}$ and $\hat{i} + 2\hat{j} - \hat{k}$ act on a particle. Determine the work done when the particle is displaced from a point $A(4, -3, -2)$ to the point $B(6, 1, -3)$

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73. forces of magnitudes 5,3,1 units acting in the direction $6\hat{i} + 2\hat{j} + 3\hat{k}, 3\hat{i} - 2\hat{j} + 6\hat{k}, 2\hat{i} - 3\hat{j} - 6\hat{k}$ respectively act on a particle, which is displaced from the point (2,-1,-3) to (5,-1,1). Find the work done by the forces.

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74. Let the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ be such that $\left|\overrightarrow{a}\right| = 3$ and $\left|\overrightarrow{b}\right| = \frac{\sqrt{2}}{3}$, then $\overrightarrow{a} \times \overrightarrow{b}$ is a unit vector, if the angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ is:

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75. Find the value of : $\left(\hat{i} \times \hat{j}\right) \cdot \hat{k} + \hat{i} \cdot \hat{j}$.

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76. Find the value of : $\left(\hat{k} \times \hat{j}\right) \cdot \hat{i} + \hat{j} \cdot \hat{k}$.

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77. Find the value of : $\left(\hat{k} \times \hat{i}\right) \cdot \hat{j} + \hat{i} \cdot \hat{k}$.

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78. Find λ and μ if : $\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + \lambda\hat{j} + \mu\hat{k}\right) = \overrightarrow{0}$.

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79. Find λ and μ if : $\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + \lambda\hat{j} + \mu\hat{k}\right) = \overrightarrow{0}$.

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80. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are two vectors such that $\left|\overrightarrow{a} \cdot \overrightarrow{b}\right| = \left|\overrightarrow{a} \times \overrightarrow{b}\right|$, then what is the angle between $\overrightarrow{a}$ and $\overrightarrow{b}$?

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81. 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 $\vec{a} \cdot \vec{c} = 3$.

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82. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, find : $\left(\vec{r} \times \hat{i}\right) \cdot \left(\vec{r} \times \hat{j}\right) + xy$.

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83. 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 $\vec{b} - \vec{c}$, provided $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$

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84. Find a vector of magnitude 7 , which is perpendicular to both the vectors : $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + \hat{j} - \hat{k}$

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85. Determine the area of a parallelogram whose adjacent sides are represented by the vectors : $\overrightarrow{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 2\hat{i} - 7\hat{j} + \hat{k}$.

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86. Find the area of parallelogram whose adjacent sides are given by the vectors : $\overrightarrow{a} = 3\hat{i} + \hat{j} + 4\hat{k}$ and $\overrightarrow{b} = \hat{i} - \hat{j} + \hat{k}$.

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87. Using vectors, find the area of the triangle having vertices A (1, 1, 1), B (1, 2, 3) and C (2, 3, 1).

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88. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of the vertices A,B,C of a $\triangle ABC$ respectively, find an expression for the area of $\triangle ABC$ and hence deduce the condition for the points A,B,C to be collinear.

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89. If $\vec{a}$ and $\vec{b}$ are any two vectors, prove that $\left(\vec{a} \times \vec{b}\right)^2 = \left|\vec{a}\right|^2 \left|\vec{b}\right|^2 - \left(\vec{a} . \vec{b}\right)^2$ It is known as Largange's indentity.

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90. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, show that $\vec{a} \times \vec{b} = \vec{c} \times \vec{a}$. Interpret the result geometrically.

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91. Show that $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ does not imply $\vec{b} = \vec{c}$. Illustrate geometrically.

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92. Prove that :

$\sin(A + B) = \sin A \cos B + \cos A \sin B$.

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93. If D, E, f are the mid-point of the sides of triangle ABC, prove that : $ar(\triangle DEF) = \frac{1}{4} ar(\triangle ABC)$.

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94. Show that the perpendicular distance of the point $\vec{c}$ from the line joining $\vec{a}$ and $\vec{b}$ is : $\dfrac{\left|\vec{b}\times\vec{c}+\vec{c}\times\vec{a}+\vec{a}\times\vec{b}\right|}{\left|\vec{b}-\vec{a}\right|}$.

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

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96. Let $\vec{a}, \vec{b}, \vec{c}$ represent the vectors $\overrightarrow{BC}, \overrightarrow{CA}$ and $\overrightarrow{AB}$ respectively. Show that $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$ and deduce the rule of sines of the triangle.

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97. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, show that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$.

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98. Find the moment (torque) about the point $\hat{i} + 2\hat{j} + 3\hat{k}$ of a force represented by $\hat{i} + \hat{j} + \hat{k}$ acting through the point $-2\hat{i} + 3\hat{j} + \hat{k}$.

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99. Two unlike forces of equal magnitudes $3\hat{i} + \hat{k}$ and $-3\hat{i} - \widehat{B}2\hat{i} - \hat{j} + 3\hat{k}$ respectively. Find the moment of the couple formed by these forces.

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100. Find the moment of the couple consisting of the force $\vec{F} = 3\hat{i} + 2\hat{j} - \hat{k}$ acting through the point $\hat{i} - \hat{j} + \hat{k}$ and $-\vec{F}$ acting through the point $2\hat{i} - 3\hat{j} - \hat{k}$.

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101. Find the moment about a line through $(0, 0, 0)$ having the direction $2\hat{i} - 2\hat{j} + \hat{k}$ due to a 20 kg force acting at (-4,2,5) in the direction of $12\hat{i} - 4\hat{j} - 3\hat{k}$.

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102. If $\vec{a} \times \vec{b} = \lambda \vec{c}$ for a non-zero scalar $'\lambda'$ and non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$, then find $\vec{a} \cdot \vec{c}$.

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103. Find $\vec{a} . \left(\vec{b} \times \vec{c}\right)$, if $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$

$\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$.

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104. Find the value of λ. such that given vectors $3\hat{i}+\lambda\hat{j}+5\hat{k}$, $\hat{i}+2\hat{j}-3\hat{k}$ and $2\hat{i}-\hat{j}+\hat{k}$ are coplaner.

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105. Using scalar triple product, show that the four points given by position vectors : $2\hat{i}+3\hat{j}+2\hat{k}, 4\hat{i}-5\hat{k}, 3\hat{i}+\hat{j}-2\hat{k}$ and $5\hat{i}+3\hat{j}-4\hat{k}$ are coplanar.

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106. Find $'\lambda'$ so that the four points with position vectors $-\hat{i}+3\hat{j}+2\hat{k}, 3\hat{i}+\lambda\hat{j}+4\hat{k}, 5\hat{i}+7\hat{j}+3\hat{k}$ and $-13\hat{i}+17\hat{j}-\hat{k}$ are coplanar.

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107. Find the volume of the parallelopiped whose sides are given by vectors

$2\hat{i} - 3\hat{j} + 4\hat{k}$, $\hat{i} + 2\hat{j} - \hat{k}$ and $3\hat{i} - \hat{j} + 2\hat{k}$.

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108. The volume of the parallelopiped whose edges are $-12\hat{i} + \lambda\hat{k}$, $3\hat{j} - \hat{k}$ and $2\hat{i} + \hat{j} - 15\hat{k}$ is 546 cubie units. Find the value of $'\lambda'$.

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109. The value of : $\hat{i} \cdot \left(\hat{j} \times \hat{k}\right) + \hat{j} \cdot \left(\hat{k} \times \hat{i}\right) + \hat{k} \cdot \left(\hat{i} \times \hat{j}\right)$ is :

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110. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then show that $\vec{a}+\vec{b}, \vec{b}+\vec{c}$ and $\vec{c}+\vec{a}$ are also coplanar.

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111. Prove that $\vec{a}\cdot\left(\left(\vec{b}+\vec{c}\right)\times\left(\vec{a}+\vec{b}+\vec{c}\right)\right)=0.$

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112. It is given that : $\vec{x}=\dfrac{\vec{b}\times\vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{y}=\dfrac{\vec{c}\times\vec{a}}{\left[\vec{a}\vec{b}\vec{c}\right]}$ and $\vec{z}=\dfrac{\vec{a}\times\vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}$, where $\vec{a}, \vec{b}, \vec{c}$ are ____________ vectors.

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113. 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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114. 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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115. Find a vector of magnitude 11 in the direction opposite to that of $\overrightarrow{PQ}$, where P and Q are the points (1,3,2) and (-1,0,8) respectively.

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116. Find a vector $\vec{r}$ of magnitude $3\sqrt{2}$ units, which makes an angle of $\frac{\pi}{4}$ and $\frac{\pi}{2}$ with y and z-axes respectively.

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

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Exercise

1. Represent graphically a displacement of 40 km, 30^o west of south.

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2. Represent the following graphically a displacement of : $40km, 30^\circ$ east of south.

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3. Represent the following graphically a displacement of : $40km, 30^\circ$ east of south.

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4. Classify the following measure as scalar and vector: $10Kg$

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5. Classify the following measure as scalar and vector: 40^o

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6. Classify the following measure as scalar and vector: $2\ meters$ north-west

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7. Classify the following measure as scalar and vector:40watt

Watch Video Solution

8. Classify the following measure as scalar and vector: 10^(-19)coulomb

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9. Classify the following measure as scalar and vector: $20\frac{m}{s^2}$

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10. Classify the following measures as scalars and vectors: $1000cm^3$

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11. Classify the following measures as scalars and vectors: $10N$

Watch Video Solution

12. Classify the following measures as scalars and vectors: $30k\frac{m}{h}$

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13. Classify the following as scalar and vector quantities: $timeperiod$

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14. Classify the following as scalar and vector quantities: $dis\tan ce$

Watch Video Solution

15. Classify the following as scalar and vector quantities: force

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16. Classify the following as scalar and vector quantities: $velocity$

Watch Video Solution

17. Classify the following as scalar and vector quantities:work done

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18. In the figure

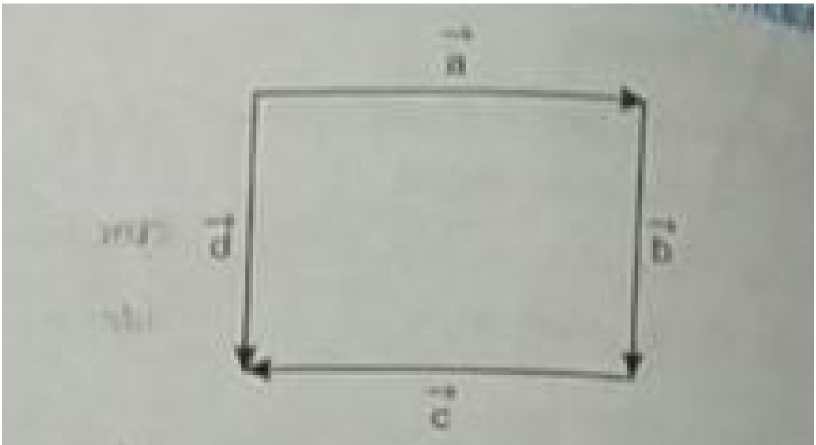

Fig.

identify the following vectors : Co-initial.

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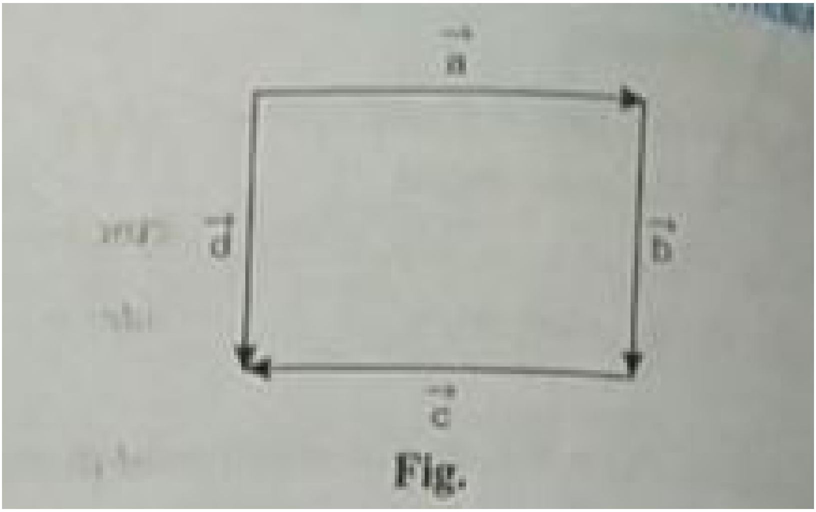
19. In the figure



identify the following vectors : Equal.

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20. A girl walks 4 km towards west, then she walks 3 km in a direction 30^o east of north and stops. Determine the girl's displacement from her initial point of departure.

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21. Answer the following ad true or false : $\vec{a}$ and $-\vec{a}$ are collinear.

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22. Answer the following ad true or false : Two collinear vectors are always equal in mangitude.

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23. Answer the following ad true or false : Two vectors having same magnitude are collinear.

Watch Video Solution

24. Answer the following ad true or false : Two collinear vectors having the same magnitude are equal.

Watch Video Solution

25. Find the sum of the following vectors

$\vec{a} = \hat{i} - 3\hat{k},\ \vec{b} = 2\hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} - 3\hat{j} + 2\hat{k}$

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26. Find the sum of the following vectors

$\vec{a} = \hat{i} - 2\hat{j},\ \vec{b} = 2\hat{i} - 3\hat{j},\ \vec{c} = 2\hat{i} + 3\hat{k}.$

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27. Show that the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $-4\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear.

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28. If $\vec{a} = -\vec{b}$, is it true that $\left|\vec{a}\right| = \left|\vec{b}\right|$?

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29. If $\left|\vec{a}\right| = \left|\vec{b}\right|$, is it true that $\vec{a} = \pm\vec{b}$?

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30. If $\left|\vec{a}\right| = \left|\vec{b}\right|$, is it true that $\vec{a} = \vec{b}$?

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31. $k\vec{a} = \vec{0}$ gives rise to what alternatives for k and $\vec{a}$?

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32. If $\vec{a} = 2\hat{i} + 3\hat{j}$ and $\vec{b} = 3\hat{i} + 4\hat{j}$. Find the magnitude of $\vec{a} + \vec{b}$.

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33. For two non-zero vectors $\overrightarrow{a}$ and $\overrightarrow{b}$, write when $\left|\overrightarrow{a}+\overrightarrow{b}\right|=\left|\overrightarrow{a}\right|+\left|\overrightarrow{b}\right|$ holds.

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34. Vectors drawn from the origin to the point A,B and C are respectively $\overrightarrow{a}, \overrightarrow{b}$ and $4\overrightarrow{a}-3\overrightarrow{b}$. Find $\overrightarrow{A}C$ and $\overrightarrow{B}C$.

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35. Give a condition that the three vectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ form the three sides of a triangle. What are other possibilities ?

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36. D,E,F are mid-points of the sides of the triangle ABC, show that for any point O, the system of concurrent forces represented by $\overrightarrow{OA}, \overrightarrow{OB}, \overrightarrow{OC}$ is equivalent to the system represented by $\overrightarrow{OD}, \overrightarrow{OE}, \overrightarrow{OF}$.

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37. In pentagon ABCDE, prove that : $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} + \overrightarrow{DE} + \overrightarrow{EA} = \overrightarrow{0}$

.

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38. ABCD is a parallelogram and AC, BD are its diagonals. Show that : $\overrightarrow{AC} + \overrightarrow{BD} = 2\overrightarrow{BC}, \overrightarrow{AC} - \overrightarrow{BD} = 2\overrightarrow{AB}$.

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39. ABCDEF is a regular hexagon. Show that : $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} + \overrightarrow{OE} + \overrightarrow{OF} = \overrightarrow{0}$. Where O is the centre of the hexagon.

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40. If ABCDEF is a regular hexagon and AB+AC+AD+AE+AF=λAD, then λ is equal to

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41. ABCDEF is a regular hexagon. Show that : $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF} = 6\overrightarrow{AO}$. Where O is the centre of the hexagon.

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42. Prove that $\left|\overrightarrow{a}\right| - \left|\overrightarrow{b}\right| \leq \left|\overrightarrow{a} - \overrightarrow{b}\right|$.

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43. If $\overrightarrow{a} + 5\overrightarrow{b} = \overrightarrow{c}$ and $\overrightarrow{a} - 7\overrightarrow{b} = 2\overrightarrow{c}$, then show that $\overrightarrow{a}$ has the same direction as that of $\overrightarrow{c}$ and opposite direction to that of $\overrightarrow{b}$.

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44. Write two different vectors having same magnitude.

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45. Write two different vectors having same direction.

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

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47. Find the vector with initial point P(-4,2) and terminal point Q(0,-4).

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48. Find a unit vector in the direction from : P(3,2) towards Q(5,6).

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49. Find a unit vector in the direction from : P(1,2) towards Q(4,5).

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50. Compute the magnitude of the following vectors: $\vec{c}=\left(\frac{1}{\sqrt{3}}\right)\vec{i}+\left(\frac{1}{\sqrt{3}}\right)\vec{j}-\left(\frac{1}{\sqrt{3}}\right)\vec{k}$

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51. Find the magnitude of the vector $\hat{i} - 3\hat{j} + 4\hat{k}$.

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52. Find the value of x for which $x\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector.

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53. Find the unit vector in the direction of the vector $\overrightarrow{a} = \hat{i} + \hat{j} + 2\hat{k}$.

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54. Find the unit vector in the direction of the vector : $\overrightarrow{a} = 2\hat{i} + 3\hat{j} + \hat{k}$.

Watch Video Solution

55. Find the unit vector in the direction of the vector : $\overrightarrow{a} = 3\hat{i} + 2\hat{j} + 6\hat{k}$

.

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56. Find the unit vector in the direction of the vector : $\overrightarrow{b} = 2\hat{i} + \hat{j} + 2\hat{k}$.

Watch Video Solution

57. Find the unit vector in the direction of the vector : $\overrightarrow{a} = 2\hat{i} - 3\hat{j} + 6\hat{k}$

.

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58. Find the unit vector in the direction of vector $\overrightarrow{PQ}$, where P and Q are the points (1,2,3) and (4,5,6) respectively.

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59. Find the values of x and y so that the vectors $2\vec{i}+3\vec{j}$ and $x\vec{i}+y\vec{j}$ are equal.

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60. Find the values of x, y and z so that the vectors : $\vec{a}=x\hat{i}+2\hat{j}+z\hat{k}$ and $\vec{y}=2\hat{i}+y\hat{j}+\hat{k}$ are equal.

Watch Video Solution

61. Let $a.=\hat{i}+2\hat{j}$ and $\vec{b}=2\hat{i}+\hat{j}$. Is $\left|\vec{a}\right|=\left|\vec{b}\right|$? Are the vectors $\vec{a}$ and $\vec{b}$ equal ?

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62. If $\vec{a} = \vec{b} + \vec{c}$, then is it true that $\left|\vec{a}\right| = \left|\vec{b}\right| + \left|\vec{c}\right|$? Justify your answer.

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

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64. Show that the direction cosines of a vector equally inclined to the axes OX, OY and OZ are $\left(\frac{1}{\sqrt{3}}\right), \left(\frac{1}{\sqrt{3}}\right), \left(\frac{1}{\sqrt{3}}\right)$

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65. Show that the vector $\vec{i} + \vec{j} + \vec{k}$ is equally inclined to the axes OX, OY and OZ.

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66. For given vectors, $\overrightarrow{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\overrightarrow{b} = -\hat{i} + \hat{j} - \hat{k}$, find the unit vector in the direction of the vector $\overrightarrow{a} + \overrightarrow{b}$

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67. A and B are two points with position vectors $2\overrightarrow{a} - 3\overrightarrow{b}$ and $6\overrightarrow{b} - \overrightarrow{a}$ respectively. Write the position vector of a point, which divides the line segment AB internally in the ratio 1 : 2.

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68. P and Q are two points with position vectors $2\overrightarrow{a} + 2\overrightarrow{b}$ and $\overrightarrow{a} + \overrightarrow{b}$ respectively. Write the position vector of a point R, which divides the line segment PQ in the ratio 2 : 1 externally.

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

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70. Find the position vector of the mid point of the vector joining the points $P(2, 3, 4), Q(4, 1, -2)$

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

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72. Find a vector in the direction of : $\overrightarrow{a} = 3\hat{i} - \hat{j} + 2\hat{k}$, which has magnitude 6 units.

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73. Find a vector in the direction of : $\hat{i} - 2\hat{j} + 2\hat{k}$, which has magnitude 15 units.

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74. Find a vector in the direction of : $-2\hat{i} + \hat{j} + 2\hat{k}$, which has magnitude 9 units.

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75. Find the scalar components and magnitude of the vector joining the points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$

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76. If $\left|\vec{a}\right| = 3$, what is $\left|5\vec{a}\right|$.

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77. If $\left|\vec{a}\right| = 3$, what is : $\left|-2\vec{a}\right|$.

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78. If $\left|\vec{a}\right| = 3$, what is : $\left|0\vec{a}\right|$?

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79. If $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}$, find $\left|\vec{a} - 2\vec{b}\right|$.

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80. Let $a. \;= \hat{i} + 2\hat{j}$ and $\overrightarrow{b} = 2\hat{i} + \hat{j}$. Is $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right|$? Are the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ equal ?

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81. Find the vector with initial point P(-4,2) and terminal point Q(0,-4).

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82. In the following, find the components of the vector $\overrightarrow{PQ}$ along x and y directions whose magnitude is M, and makes an angle θ with the x-axis : M=15, $\theta = 30^\circ$.

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83. If the position vectors of the point A and B are : $7\hat{i} + 3\hat{j} - \hat{k}$ and $2\hat{i} - 5\hat{j} + 4\hat{k}$ respectively, find the magnitude and direction-cosines of the vector $\overrightarrow{AB}$.

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84. Find the position vector of the centroid of the $\triangle ABC$ when the position vectors of its vertices are A(1,3,0),B(2,1,1) and C(0,-1,0).

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85. Show that the vectors $\overrightarrow{a} = 2\hat{i} + 3\hat{j}$ and $\overrightarrow{b} = 4\hat{i} + 6\hat{j}$ are parallel.

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86. Write unit vector in the direction of the sum of vectors

$\overrightarrow{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + \hat{j} + 3\hat{k}$

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87. IF $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = 6\hat{i} + 2\hat{j} + 3\hat{k}$, find a unit vector parallel to $\vec{a} + \vec{b}$.

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88. Find unit vector in the direction of veca+vecb, where $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and 'vecb=2hati+hatj-3hatk'

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89. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$, $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$.

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90. Find the condition that $\vec{a} = x\hat{i} + y\hat{j}$ and $\vec{b} = y\hat{i} + x\hat{j} (\because x, y \neq 0)$ are parallel.

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91. 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, internally.

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92. 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, externally.

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

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94. Show that the following points are collinear : A(-2,1),B(-5,-1),C(1,3).

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

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96. If $\overrightarrow{a} = -2\hat{i} + 3\hat{j} + 5\hat{k}, \overrightarrow{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\overrightarrow{c} = 7\hat{i} - \hat{k}$ are position vectors of three points A, B, C respectively, prove that A, B, C are collinear.

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97. Show that the following vectors are coplanar : $\hat{i}-\hat{j}+\hat{k}, 6\hat{i}-\hat{k}$ and $4\hat{i}+2\hat{j}-3\hat{k}$.

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98. Show that the following vectors are coplanar : $3\hat{i}-2\hat{j}+4\hat{k}, 6\hat{i}+3\hat{j}+2\hat{k}. 5\hat{i}+7\hat{j}+3\hat{k}. 2\hat{i}+2\hat{j}+5\hat{k}$.

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99. Show that the following vectors are coplanar : $2\hat{i}-\hat{j}+\hat{k}, \hat{i}-3\hat{j}-5\hat{k}, 3\hat{i}-4\hat{j}-4\hat{k}$.

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100. Show that the points A(3,-2,1),B(1,-3,5),C(2,1,-4) do not form a right-angled triangle.

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101. If the position vectors of the vertices of a triangle are : $\vec{A} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{B} = 2\hat{i} + 3\hat{j} + \hat{k}, \vec{C} = 3\hat{i} + \hat{j} + 2\hat{k}$, show that the triangle is an equilateral one.

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102. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, find a unit vector parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$

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103. Show that the four points A,B,C,D with position vectors $\vec{a} \cdot \vec{b} \cdot \vec{c} \cdot \vec{d}$ respectively, are coplanar if and only if $3\vec{a} - 2\vec{b} + \vec{c} - 2\vec{d} = \vec{0}$.

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104. Show that the four points P,Q,R,S with position vectors $\vec{p}, \vec{q}, \vec{r}, \vec{s}$ respectively such that $5\vec{p} - 2\vec{q} + 6\vec{r} - 9\vec{s} = \vec{0}$, are coplanar. Also find the position vector of the point of intersection of the lines PR and QS.

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105. Prove that the necessary and sufficient condition for three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ to be coplanar is that there exist scalars l, m, n (not all zero simultaneously) such that $l\vec{a} + m\vec{b} + n\vec{c} = \vec{0}$.

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106. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ respectively, are position vectors representing the vertices A,B,C,D of a parallelogram, then write $\vec{d}$ in terms of $\vec{a}, \vec{b}$ and $\vec{c}$.

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107. If Q is the point of intersection of the medians of a triangle ABC, prove that $\overrightarrow{QA} + \overrightarrow{QB} + \overrightarrow{QC} = \overrightarrow{0}$.

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108. G is the centroid of a triangle ABC, show that : $\overrightarrow{GA} + \overrightarrow{GB} + \overrightarrow{GC} = \overrightarrow{0}$.

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109. Let $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}, \overrightarrow{d}$ be the position vectors of the four distinct points, P,Q,R,S respectively. If $\overrightarrow{b} - \overrightarrow{a} = \overrightarrow{c} = \overrightarrow{d}$. Show that PQRS is a parallelogram.

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110. Show that the line joining any vertex of a parallelogram to the mid-point of an opposite side divides the opposite diagonal in the ratio 2 : 1.

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111. Prove that the figure formed by joining the mid-points of the pairs of consecutive sides of a quadrilateral is a parallelogram.

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112. Show that if P,A,B are any three points, then $\lambda \overrightarrow{PA} + \mu \overrightarrow{PB} = (\lambda + \mu)\overrightarrow{PC}$, where C divides [AB] in the ratio $\mu : \lambda$.

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113. Obtain the dot product of the vectors : $\overrightarrow{a} = \overrightarrow{i} - \hat{j} + \hat{k}$ and $\overrightarrow{b} = \overrightarrow{i} - \hat{k}$.

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114. Write the magnitude of a vector $\vec{a}$ in terms of dot product.

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115. If $\vec{a} = 7\hat{i} + \hat{j} - 4\hat{k}$ and $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$ find the projection of $\vec{a}$ and $vceb$.

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116. Let $\vec{a} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ and $vceb = \hat{i} + 2\hat{j} + \hat{k}$. Find the projection of $\vec{b}$ and $\vec{a}$.

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117. Find the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$.

Watch Video Solution

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118. Find $\vec{a}\,.\,\vec{b}$ If $\vec{a}=3\hat{i}-\hat{j}+2\hat{k}\text{ and }\vec{b}=2\hat{i}+3\hat{j}+3\hat{k}$

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119. Find $\vec{a}\,.\,\vec{b}$ If $\vec{a}=2\hat{i}-\hat{j}+\hat{k}\text{ and }\vec{b}=2\hat{j}-\hat{k}.$

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120. Evaluate the product $\left(3\widehat{a}-5\hat{b}\right)\cdot\left(2\widehat{a}+7\hat{b}\right)$

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121. If $\vec{a}$ is a unit vector and $\left(\vec{x}-\vec{a}\right)\cdot\left(\vec{x}+\vec{a}\right)=8$, then find $\left|\vec{x}\right|$

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122. If $\vec{a}$ is a unit vcetor and $\left(\vec{x} - \vec{a}\right) \cdot \left(\vec{x} + \vec{a}\right) = 80$, then find $\left|\vec{x}\right|$

.

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123. If $\vec{p}$ is a unit vcetor and $\left(\vec{x} - \vec{p}\right) \cdot \left(\vec{x} + \vec{p}\right) = 80$, then find $\left|\vec{x}\right|$

.

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124. Find $\left|\vec{x}\right|$, if for a unit vector $\vec{a}$, $\left(\vec{x} - \vec{a}\right) \cdot \left(\vec{x} + \vec{a}\right) = 12$

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125. Find the angle between the vectors : $\hat{i} - \hat{j}$ and $\hat{j} - \hat{k}$.

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126. Find the angle between the vectors : $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} + \hat{j} - \hat{k}$.

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127. Find the angle between the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} - \hat{k}$`

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128. 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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129. Find the angle between the vectors : $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} - 3\hat{k}$.

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130. Find the angles between the vectors

$\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}, \vec{b} = 6\hat{i} + 2\hat{j} + 3\hat{k}$

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131. Find the cosine of the acute angle which the vector : $\sqrt{2}\hat{i} + \hat{j} + \hat{k}$ makes with y-axis.

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132. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ such that : $\left|\vec{a}\right| = \sqrt{3}, \left|\vec{b}\right| = 2$ and $\vec{a} \cdot \vec{b} = \sqrt{6}.$

Watch Video Solution

133. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ such that : $\left|\vec{a}\right| = \sqrt{2}, \left|\vec{b}\right| = 2$ and $\vec{a} \cdot \vec{b} = \sqrt{6}.$

Watch Video Solution

134. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\vec{a} \cdot \vec{b} = 1.$

Watch Video Solution

135. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude and such that the angle between them is 60^o and their scalar product is $\frac{1}{2}$.

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136. If either vector $\vec{a} = 0$or $\vec{b} = 0$, then $\vec{a} \cdot \vec{b} = 0$.But the converse need not be true. Justify your answer with an example.

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137. Find the scalar projection of : $\vec{a} = 7\hat{i} + \hat{j} - 4\hat{k}$ on $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$.

Watch Video Solution

138. Find the scalar projection of : $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ on $\vec{b} = \hat{i} - 2\hat{j} - 3\hat{k}$.

Watch Video Solution

139. Find the scalar projection of : $\vec{a} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ on $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$.

Watch Video Solution

140. Find the scalar projection of : $\vec{a} = \hat{i} - \hat{j}$ on $\vec{b} = \hat{i} + \hat{j}$.

Watch Video Solution

141. Find the scalar projection of : $\overrightarrow{a} = \hat{i} + 3\hat{j} + 7\hat{k}$ on $\overrightarrow{b} = 7\hat{i} - \hat{j} + 8\hat{k}$.

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142. Find the scalar projection of $\overrightarrow{b}$ on $\overrightarrow{a}$ where : $\overrightarrow{a} = 2\hat{i} + 2\hat{j} - \hat{k}$ and $\overrightarrow{b} = 2\hat{i} - \hat{j} - 4\hat{k}$

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143. Find the scalar projection of $\overrightarrow{b}$ on $\overrightarrow{a}$ when : $\overrightarrow{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ and $\overrightarrow{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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

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

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146. Find λ when the scalar 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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147. Show that each of the given three vectors are mutually perpendicular unit vector : $\frac{1}{7}\left(2\hat{i}+3\hat{j}+6\hat{k}\right),\frac{1}{7}\left(3\hat{i}-6\hat{j}+2\hat{k}\right),\frac{1}{7}\left(6\hat{i}+2\hat{j}-3\hat{k}\right)$.

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148. If $\overrightarrow{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\overrightarrow{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that the vectors $\left(\overrightarrow{a} + \overrightarrow{b}\right)$ and $\left(\overrightarrow{a} - \overrightarrow{b}\right)$ are perpendicular.

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149. Write the value of $'p'$ for which $\overrightarrow{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ vecb=hati+phatj+3hatk` are parallel.

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150. Find the value of $'\lambda'$ such that the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are perpendicular (orthogonal), where : $\overrightarrow{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}, \overrightarrow{b} = 3\hat{i} + 2\hat{j} - \lambda\hat{k}.$

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151. Find the value of $'\lambda'$ such that the vectors $\vec{a}$ and $\vec{b}$ are perpendicular (orthogonal), where : $\vec{a}=2\hat{i}+\lambda\hat{j}+\hat{k}, \vec{b}=\hat{i}-2\hat{j}+3\hat{k}.$

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152. If $2\hat{i}+\hat{j}-3\hat{k}$ and $m\hat{i}+3\hat{j}-\hat{k}$ are perpendicular to each other, then find $'m'$. Also find the area of the rectangle having these two vectors as sides.

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153. Show that the projection of $\vec{b}$ on $\vec{a}\neq\vec{0}$ is : $\left(\frac{\vec{a}\cdot\vec{b}}{\left|\vec{a}\right|^2}\right)\vec{a}$.

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154. Show that $\left|\vec{a}\right|\vec{b}+\left|\vec{b}\right|\vec{a}$ is perpendicular to $\left|\vec{a}\right|\vec{b}-\left|\vec{b}\right|\vec{a}$ for any two non zero vectors $\vec{a}$ and $\vec{b}$

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155. Find a unit vector perpendicular to each of the vector $\vec{a}+\vec{b}$ 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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156. 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 $\vec{c}$, then find the value of λ.

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

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158. If $\overrightarrow{p} = 5\hat{i} + \lambda\hat{j} - 3\hat{k}$ and $\overrightarrow{q} = \hat{i} + 3\hat{j} - 5\hat{k}$, then find the value of $'\lambda'$, so that $\overrightarrow{p} + \overrightarrow{q}$ and $\overrightarrow{p} - \overrightarrow{q}$ are perpendicular vectors.

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159. If $\overrightarrow{a} = 5\hat{i} - \hat{j} + 7\hat{k}$ and $\overrightarrow{b} = \hat{i} - \hat{j} - \lambda\hat{k}$, then find the value of $'\lambda'$ for which $\left(\overrightarrow{a} + \overrightarrow{b}\right)$ and $\left(\overrightarrow{a} - \overrightarrow{b}\right)$ are orthognal.

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160. Find the scalar product of the following pairs of vectors and the angle between them : $2\hat{i} - 3\hat{j} + 6\hat{k}$ and $2\hat{i} - 3\hat{j} - 5\hat{k}$.

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161. Find the scalar product of the following pairs of vectors and the angle between them : $\hat{i}+3\hat{j}-8\hat{k}$ and $-3\hat{i}-5\hat{j}+4\hat{k}$.

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162. Show that the points : $A\left(2\hat{i}-\hat{j}+\hat{k}\right), B\left(\hat{i}-3\hat{j}-\hat{k}\right), C\left(3\hat{i}-4\hat{j}-4\hat{k}\right)$ are the vertices of a right-angled triangle.

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163. The position vectors of the vertices of $\triangle ABC$ are : $3\hat{i}-4\hat{j}-4\hat{k}, 2\hat{i}-\hat{j}+\hat{k}$ and $\hat{i}-3\hat{j}-5\hat{k}$ respectively. Find $\overrightarrow{AB}, \overrightarrow{BC}$ and $\overrightarrow{CA}$.

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164. Show that the points with position vectors $\vec{a} = 3\hat{i} - 4\hat{j} - 4\hat{k}, \vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} - 5\hat{k}$ respectively form the vertices of a right angled triangle.

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165. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}, |\vec{a}| = 3, |\vec{b}| = 5$ and $|\vec{c}| = 7$, find the angle between $\vec{a}$ and $\vec{b}$.

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166. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then show that $\vec{a}$ and $\vec{b}$ are perpendicular.

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167. If $\vec{a}$ and $\vec{b}$ are perpendicular vectors, show that $\left(\vec{a}+\vec{b}\right)^2=\left(\vec{a}-\vec{b}\right)^2$

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168. Prove that $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}+\vec{b}\right)=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2$, if and only if $\vec{a}, \vec{b}$ are perpendicular, given $\vec{a}\neq\vec{0}, \vec{b}\neq\vec{0}$.

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169. Three vectors $\vec{a}, \vec{b}, \vec{c}$ satisfy the condition $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ Evaluate the quantity $\mu=\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ if $\left|\vec{a}\right|=3, \left|\vec{b}\right|=4, \left|\vec{c}\right|=2$

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170. If the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ satisfy the condition $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and $\left|\vec{a}\right|=2, \left|\vec{b}\right|=4$ and $\left|\vec{c}\right|=3$, then find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$.

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171. 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 $'\lambda'$ and hence find the unit vector along $\vec{b}+\vec{c}$.

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172. If $\left|\vec{a}\right|$=3, $\left|\vec{b}\right|$=4 and $\left|\vec{c}\right|$=5 and each of them is perpendicular to the sum of other two then find the value of $\left|\vec{a}+\vec{b}+\vec{c}\right|$

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173. If $\vec{a}$ and $\vec{b}$ are perpendicular vectors, show that $\left(\vec{a}+\vec{b}\right)^2=\left(\vec{a}-\vec{b}\right)^2$

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174. IF $\vec{a}=3\hat{i}+\hat{j}-4\hat{k}$, $\vec{b}=6\hat{i}+5\hat{j}-2\hat{k}$ and $\left|\vec{c}\right|=3$, find the vector $\vec{c}$, which is perpendicular to both $\vec{a}$ and $\vec{b}$.

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175. If $\vec{a}=\hat{i}+4\hat{j}+2\hat{k}$, $\vec{b}=3\hat{i}-2\hat{j}+7\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$ then find a vector $\vec{d}$ (which is $\perp$ ar to both $\vec{a}$ and $\vec{b}$) and $\vec{c}$. $\vec{d}$ =15.

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176. 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 $\vec{d}$, which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c}\cdot\vec{d}=18$.

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

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178. If $\overrightarrow{a}$=$\hat{i} - \hat{j}$, $\overrightarrow{b}$ = $3\hat{j} - \hat{k}$ and $\overrightarrow{c}$=$7\hat{i} - \hat{k}$. Find a vector $\overrightarrow{d}$ which is perpendicular to both $\overrightarrow{a}$ and $\overrightarrow{b}$ and $\overrightarrow{c}$. $\overrightarrow{d}$ =1.

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179. Consider A(2,3,4),B(4,3,2) and C(5,2,-1) be any three points. Find the projection of $\overrightarrow{BC}$ on $\overrightarrow{AB}$.

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180. Consider A(2,3,4),B(4,3,2) and C(5,2,-1) be any three points. Find the area of triangle ABC.

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181. Dot-product of a vector with vectors $3\hat{i} - 5\hat{k}$, $2\hat{i} + 7\hat{j}$ and $\hat{i} + \hat{j} + \hat{k}$ are respectively -1,6 and 5. find the vector.

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182. If $\hat{i} + \hat{j} + \hat{k}$, $2\hat{i} + 5\hat{j}$, $3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ are the position vectors of points A, B, C and D respectively, then find the angle between AB and CD. Deduce that AB and CD are collinear.

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183. If $\overrightarrow{\alpha} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\overrightarrow{\beta} = 2\hat{i} + \hat{j} - 4\hat{k}$, then express $\overrightarrow{\beta}$ in the form $\overrightarrow{\beta} = \overrightarrow{\beta_1} + \overrightarrow{\beta_2}$, where $\overrightarrow{\beta_1}$ is parallel to $\overrightarrow{\alpha}$ and $\overrightarrow{\beta_2}$ is perpendicular to

$\overrightarrow{\alpha}$.

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184. Prove that the perpendicular from the vertices to the opposite sides (i.e. Altitudes) of a triangle concurrent.

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185. Prove that in a right angled triangle the mid-point of the hypotenuse is equidistant from its vertices.

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186. If two medians of a triangle are equal, prove that the triangle is isosceles.

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187. Which of the following statements are True or False :

If the diagonals of a parallelogram are equal then it is a rectangle.

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188. Prove that sum of squares of the diagonals of a parallelogram is equal to sum of squares of its sides.

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189. In any ΔABC prove by vectors that $a^2 = b^2 + c^2 - 2$ bc $\cos$ A.

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190. In any ΔABC prove by vectors that $b^2 = c^2 + a^2 - 2$ ca $\cos$ B.

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191. In any triangle ABC, then by vectors, prove that : c^2=a^2+b^2-2ab cos C`.

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192. Prove that, in any triangle ABC, $\cos B = \frac{c^2 + a^2 - b^2}{2ca}$.

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193. With the help of vector method, prove that,$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

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194. In any triangle ABC, then by vectors, prove that : $a = b\cos C + c\cos B$.

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195. Use vectors to prove that in $\triangle ABC : b = c\cos A + a\cos C$.

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196. Using vector method prove that

$\cos(A - B) = \cos A \cos B + \sin A \sin B$

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197. In any triangle ABC, show that

$AB^2 + AC^2 = 2(AD^2 + BD^2)$

where, D is the middle point of BC.

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198. Prove that any two edges in a regular tetrahedron are perpendicular.

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199. In each problem, find the work done by a force $\vec{F}$ acting on a particle such that the particle is displaced from a point A to a point B : A: (1,2,0),B(2,-1,3): $\vec{F} = 4\hat{i} + 2\hat{j} + 3\hat{k}$.

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200. In each problem, find the work done by a force $\vec{F}$ acting on a particle such that the particle is displaced from a point A to a point B : A : (1,2,0), B: (0,2,3) , $\vec{F} = 4\hat{i} - 3\hat{k}$.

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201. Find the work done by the force $\vec{F} = \hat{i} + 2\hat{j} + \hat{k}$ acting on a particle, if the particle is displaced from the point with position vector $2\hat{i} + \hat{j} + \hat{k}$ to the point with position vector $3\hat{i} + 2\hat{j} + 4\hat{k}$.

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202. Find the work done in moving an object along the vector $\vec{d} = 3\hat{i} + 2\hat{j} - 5\hat{k}$. If the applied force in $\vec{F} = 2\hat{i} - \hat{j} - \hat{k}$.

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203. A particle acted by constant forces $4\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ is displaced from point $\hat{i} + 2\hat{j} + 3\hat{k}$ to point $5\hat{i} + 4\hat{j} + \hat{k}$. find the total work done by the forces in units.

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204. Constant forces $2\hat{i} - 5\hat{j} + 6\hat{k}$ and $\hat{i} + 2\hat{j} - \hat{k}$ act on a particle. Determine the work done when the particle is displaced from a point $A(4, -3, -2)$ to the point $B(6, 1, -3)$

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205. Forces of magnitudes 5 and 3 units acting in the directions $6\hat{i}+2\hat{j}+3\hat{k}$ and $3\hat{i}-2\hat{j}+6\hat{k}$ respectively act on a particle which is displaced from the point (2,2,-1) to (4,3,1) . The work done by the forces, is

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206. Which is greater: 45 kg or 4500 g?

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207. Find $\vec{a}\times\vec{b}$, if : $\vec{a}=-\hat{i}+3\hat{k}$ and $\vec{b}=\hat{i}+3\hat{j}-2\hat{k}$.

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208. Find $\vec{a}\times\vec{b}$, if : $\vec{a}=\hat{i}-3\hat{j}+4\hat{k}$ and $\vec{b}=2\hat{i}+\hat{j}+\hat{k}$.

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209. The value of : $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}\cdot\left(\hat{k}\times\hat{i}\right)+\hat{k}\cdot\left(\hat{j}\times\hat{i}\right)$ is :

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210. The value of : $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}\cdot\left(\hat{i}\times\hat{k}\right)+\hat{k}\cdot\left(\hat{i}\times\hat{j}\right)$ is :

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211. Find the value of $'p'$ is : $\left(2\hat{i}+6\hat{j}+27\hat{k}\right)\times\left(\hat{i}+3\hat{j}+p\hat{k}\right)=\vec{0}$.

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212. If $\vec{a}=\hat{i}-\hat{j}+2\hat{k}$ and $\vec{b}=2\hat{i}+\hat{j}-\hat{k}$, find : $\left(2\vec{a}-\vec{b}\right)\times\left(\vec{a}+2\vec{b}\right)$.

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213. Find $\overrightarrow{a} \times \overrightarrow{b}$, if $\overrightarrow{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 3\hat{i} + 5\hat{j} - 2\hat{k}$

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214. If $\overrightarrow{a} = 4\hat{i} + 3\hat{j} + \hat{k}$ and $\overrightarrow{b} = \hat{i} - 2\hat{k}$, then find $\left|2\overrightarrow{b} \times \overrightarrow{a}\right|$.

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215. Find the magnitude of the vector $\overrightarrow{a} \times \overrightarrow{b}$ id : $\overrightarrow{a} = 2\hat{i} + \hat{j} + \hat{k}$ and $\overrightarrow{b} = \hat{i} - 2\hat{j} + \hat{k}$.

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216. Find the magnitude of the vector $\overrightarrow{a} \times \overrightarrow{b}$ if : $\overrightarrow{a} = 2\hat{i} + \hat{k}$ and $\overrightarrow{b} = \hat{i} + \hat{j} + \hat{k}$.

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217. Let the vectors $\vec{a}, \vec{b}, \vec{c}$ be given as : $a_1\hat{i} + a_2\hat{j} + a_3\hat{k}, b_1\hat{i} + b_2\hat{j} + b_3\hat{k}, c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then show that $\vec{a} \times \left(\vec{b} + \vec{c}\right) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$.

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218. Prove that $\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$ if : $\vec{a} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + 4\hat{j} - 2\hat{k}$.

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219. Find a vector perpendicular to both : $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 4\hat{j} - \hat{k}$.

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220. If $\overrightarrow{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$, find $\overrightarrow{a} \times \overrightarrow{b}$ and verify that $\overrightarrow{a}$ and $\overrightarrow{a} \times \overrightarrow{b}$ are perpendicular to the vectors : $\hat{i} - 2\hat{j} + 3\hat{k}$, $\hat{i} + 2\hat{j} - \hat{k}$.

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221. If $\overrightarrow{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$, find $\overrightarrow{a} \times \overrightarrow{b}$ and verify that $\overrightarrow{a}$ and $\overrightarrow{a} \times \overrightarrow{b}$ are perpendicular to the vectors : $3\hat{i} - 2\hat{j} + \hat{k}$, $\hat{i} - 2\hat{j} - 3\hat{k}$.

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222. Find a unit vector perpendicular to the plane containing the vectors : $\overrightarrow{a} = 2\hat{i} + \hat{j} + \hat{k}$ and $\overrightarrow{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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223. Find a unit vector in the plane of vectors : $\overrightarrow{a} = \hat{i} + 2\hat{j}$ and $\overrightarrow{b} = \hat{j} + 2\hat{k}$, perpendicular to the vector $\overrightarrow{c} = 2\hat{i} + \hat{j} + 2\hat{k}$.

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224. If $\overrightarrow{a} = 3\hat{i} - \hat{j} + 2\hat{k}$ and $\overrightarrow{b} = -\hat{i} - 2\hat{j} + 4\hat{k}$, find a unit vector along the vector $\left(\overrightarrow{a} + \overrightarrow{b}\right)$.

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225. Find a unit vector perpendicular to each of the vectors $\left(\overrightarrow{a} + \overrightarrow{b}\right)$ and $\left(\overrightarrow{a} - \overrightarrow{b}\right)$, where : $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}$ and $\overrightarrow{b} = \hat{i} + 2\hat{j} + 3\hat{k}$.

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226. Find a unit vector perpendicular to each of the vectors $\left(\overrightarrow{a} + \overrightarrow{b}\right)$ and $\left(\overrightarrow{a} - \overrightarrow{b}\right)$, where : $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}$ and $\overrightarrow{b} = \hat{i} + 2\hat{j} + 3\hat{k}$.

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227. Find a vector of magnitude 9, which is perpendicular to both the vectors : $4\hat{i} - \hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$.

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228. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, show that $\left(\frac{\sin\theta}{2} = \frac{1}{2}\left|\vec{a} - \vec{b}\right|\right.$.

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229. Determine the area of the parallelogram whose adjacent sides are $2\hat{i}$ and $3\hat{j}$.

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230. determine the area of the parallelogram whose adjacent sides are :

$2\hat{i}$ and $3\hat{i} + \hat{j} + 4\hat{k}$.

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231. Find the area of a parallelogram whose adjacent sides are :

$3\hat{i} + \hat{j} + 4\hat{k} \text{ and } \hat{i} - \hat{j} + \hat{k}$

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232. determine the area of the parallelogram whose adjacent sides are :

$\hat{i} - \hat{j} + 3\hat{k}$ and $2\hat{i} - 7\hat{j} + \hat{k}$.

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233. determine the area of the parallelogram whose adjacent sides are :

$\hat{i} + \hat{j} + 3\hat{k}$ and $3\hat{i} + 2\hat{j} + \hat{k}$.

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234. Find the area of the parallelogram whose diagonals are : $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} + \hat{k}$

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235. Find the area of the quadrilateral whose diagonals are given by $3\hat{i} + \hat{j} - 2\hat{k}, \hat{i} - 3\hat{j} + 4\hat{k}$.

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236. Show that the area of the parallelogram with diagonals $\vec{a}$ and $\vec{b}$, is $\frac{1}{2}\left|\vec{a} \times \vec{b}\right|$.

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237. Show that $\left|\vec{a}\times\vec{b}\right|=\sqrt{\vec{a}^2\vec{b}^2-\left(\vec{a}\cdot\vec{b}\right)^2}$.

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238. Prove that $\frac{\left|\vec{a}\times\vec{b}\right|}{\vec{a}\cdot\vec{b}}$= tan theta, $where$theta$is the \angle between$veca and vecb`.

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239. Show that $\left(\vec{a}-\vec{b}\right)\times\left(\vec{a}+\vec{b}\right)=2\left(\vec{a}\times\vec{b}\right)$.

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240. Given that $\vec{a}\cdot\vec{b}=0$ and $\vec{a}\times\vec{b}=\vec{0}$. What can you conclude about the vectors $\vec{a}$ and $\vec{b}$?

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241. Find $\left|\vec{a}\cdot\vec{b}\right|$, if $\left|\vec{a}\right| = 5$, $\left|\vec{b}\right| = 13$ and $\left|\vec{a}\times\vec{b}\right| = 25$.

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242. If $\left|\vec{a}\right| = 13$, $\left|\vec{b}\right| = 5$ and $\vec{a}\cdot\vec{b} = 60$, then find $\left|\vec{a}\times\vec{b}\right|$.

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243. Find λ and μ if : $\left(2\hat{i}+6\hat{j}+27\hat{k}\right)\times\left(\hat{i}+\lambda\hat{j}+\mu\hat{k}\right)=\vec{0}$.

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244. If $\vec{a} = 2\hat{i}+\sqrt{3}\hat{j}+3\hat{k}$ and $\vec{b} = 3\hat{i}+2\hat{j}-2\sqrt{3}\hat{k}$, then : find the direction cosines of $\vec{b}$.

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245. If $\vec{a} = 2\hat{i} + \sqrt{3}\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - 2\sqrt{3}\hat{k}$, then : find a vector in the direction of $\vec{a}$ that has magnitude 7 units.

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246. If $\vec{a} = 2\hat{i} + \sqrt{3}\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - 2\sqrt{3}\hat{k}$, then : find the angle between $\vec{a}$ and $\vec{b}$.

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247. If $\vec{a} = 2\hat{i} + \sqrt{3}\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - 2\sqrt{3}\hat{k}$, then : evaluate $\left(3\vec{a} - 5\vec{b}\right) \times \left(2\vec{a} - \vec{b}\right)$.

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

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249. Prove that the unit vcetor perpendicular to each of the vcetors $2\hat{i}-\hat{j}+\hat{k}$ and $3\hat{i}+4\hat{j}-\hat{k}$ is : $\frac{-3\hat{i}+5\hat{j}+11\hat{k}}{\sqrt{155}}$ and that the sine of the angle between them is $\sqrt{\frac{155}{156}}$.

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250. Show that the three points $\vec{a}-2\vec{b}+3\vec{c}, 2\vec{a}+3\vec{b}-4\vec{c}$ and $-7\vec{b}+10\vec{c}$ are collinear.

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251. With help of vectors find the area of the triangle with vertices $A(2, 3, 5), B(3, 5, 8) \text{ and } C(2, 7, 8)$

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252. Find, with help of vectors, the area of the triangle with vertices : A(1,2,3),B(2,-1,4),C(4,5,-1) with reference to a rectangular system of axes.

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253. Find the area of triangle with vertices

$(1, 2, 4), (3, 1, -2)$ and $(4, 3, 1)$.

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254. Find the value of $'x'$ if the area of triangle is 35 square cm. With vertices (x,4),(2,-6) and (5,4).

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255. If $\vec{a}, \vec{b}, \vec{c}$ are any three vectors then prove that.

$$\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right) = 0$$

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256. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}$, prove that $\vec{a}, \vec{b}, \vec{c}$ are mutually at right angles and $\left|\vec{b}\right| = 1, \left|\vec{c}\right| = \left|\vec{a}\right|$.

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257. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular unit vectors and $\vec{a} \times \vec{b} = \vec{c}$, show that $\vec{b} = \vec{c} \times \vec{a}$ and $\vec{a} = \vec{b} \times \vec{c}$.

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258. If $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$ then find a vector $\vec{d}$ (which is $\perp$ ar to both $\vec{a}$ and $\vec{b}$) and $\vec{c} . \vec{d}$ =15.

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259. If $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} \neq \vec{0}$, show that $\vec{a} + \vec{c} = \overrightarrow{mb}$ m being a scalar.

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260. Prove that

$$\left|\vec{a} \times \vec{b}\right|^2 = \left|\vec{a}\right|^2\left|\vec{b}\right|^2 - \left(\vec{a}\cdot\vec{b}\right)^2 = \left|: \left[\vec{a}\cdot\vec{a}\vec{a}\cdot\vec{b}\right], \left[\vec{a}\cdot\vec{b}\vec{b}\cdot\vec{b}\right.\right.$$

.

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261. If $\vec{a}, \vec{b}, \vec{c}$ are position vectors of non-collinear points A,B and C respectively, show that : $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$ is perpendicular to the plane ABC.

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262. Prove that the normal to the plane containing three point whose position vectors are $\vec{a}, \vec{b}, \vec{c}$ lie in the direction of $\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}$.

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

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264. Prove that : $\sin(A - B) = \sin A \cos B - \cos A \sin B$.

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265. Find the moment about $(1, -1, -1)$ of the force $3\hat{i}+4\hat{j}-5\hat{k}$ acting at $(1, 0, -2)$.

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266. The force represented by $3\hat{i}+2\hat{k}$ is acting through the point $5\hat{i}+4\hat{j}-3\hat{k}$. Find the moment about the point $\hat{i}+3\hat{j}+\hat{k}$.

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267. Find the moment about the point $\hat{i}+2\hat{j}-\hat{k}$ of a force represented by $\hat{i}+2\hat{j}+\hat{k}$ acting through the point $2\hat{i}+3\hat{j}+\hat{k}$.

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268. The force represented by $5\hat{i}+\hat{k}$ is acting through the point $9\hat{i}-\hat{j}+2\hat{k}$. Find the moment about the point $3\hat{i}-2\hat{j}+2\hat{k}$.

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269. A force $\vec{F} = 4\hat{i} + \hat{k}$ acts through point $A(0, 2, 0)$. Find the moment $\vec{m}$ of $\vec{F}$ about the point $B(4, 0, 4)$.

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270. Let $\vec{F} = 2\hat{i} + 4\hat{j} + 3\hat{k}$ at the point P with position vector $\hat{i} - \hat{j} + 3\hat{k}$. Find the moment of $\vec{F}$ about the line through the origin O in the direction of the vector $\vec{a} = \hat{i} + 2\hat{j} + 2\hat{k}$.

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271. A force $\vec{F} = 3\hat{i} + 2\hat{j} - 4\hat{k}$ is applied at the point (1,-1,2).Find the moment of $\vec{F}$ about the point (2,-1,3).

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272. Two unlike forces of equal magnitudes $\hat{j}+2\hat{k}$ and $-\hat{j}-2\hat{k}$ are acting at the points whose position vectors are given by $\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}+3\hat{k}$ respectively. Find the moment of the couple formed by these forces.

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273. A force of 3 units acts through the point (4,-1,7) in the direction of the vector $9\hat{i}+6\hat{j}-2\hat{k}$. Find the moment of the force about the point (1,-3,2) and the moment about the axes, parallel to the co-ordinate axes, which pass through (1,-3,2).

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274. Find the moment about the point (3,4,5) of the force through the point (1,2,-3) having components equal to -2,3,-4. what is the moment of the same force about the line through the origin having direction-ratios

$< 4, \ -2, 5 > \ ?$

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275. The moment of the couple formed by forces $5\hat{i}+\hat{k}$ and $-5\hat{i}-\hat{k}$ acting at the points (9,-1,2) and (3,-2,1) respectively is,

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276. Find the vector moment of the forces : $\hat{i}+2\hat{j}-3\hat{k}:2\hat{i}+3\hat{j}+4\hat{k}$ and $-\hat{i}-\hat{j}+\hat{k}$ acting on a particle at a point P(0,1,2) about the point A(1,-2,0).

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277. Classify the following quantities as vector or scalar : (i) Time period (ii) Distance (iii) Force (iv) Velocity `.

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278. Find $\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)$ if : $\vec{a}=2\hat{i}+\hat{j}+3\hat{k},\ \vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c}=3\hat{i}+\hat{j}+2\hat{k}.$

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279. Show that $\vec{a}\cdot\left(\vec{a}\times\vec{b}\right)=0$ for any pair $\vec{a},\ \vec{b}$ of vectors.

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280. If $\vec{a}=7\hat{i}-2\hat{j}+3\hat{k},\ \vec{b}=\hat{i}-\hat{j}+2\hat{k},\ \vec{c}=2\hat{i}+8\hat{j},$ then find $\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)$ and $\left(\vec{b}\times\vec{c}\right)\cdot\vec{a}.$

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281. Show that the following vectors are coplanar : $\vec{a}=\hat{i}-2\hat{j}+3\hat{k},\ \vec{b}=-2\hat{i}+3\hat{j}-4\hat{k}$ and $\vec{c}=\hat{i}-3\hat{j}+5\hat{k}.$

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282. Show that the following vectors are coplanar :

$-2\hat{i}-2\hat{j}+4\hat{k},\ -2\hat{i}+4\hat{j}-2\hat{k}, 4\hat{i}-2\hat{k}$ and $\hat{i}-\hat{j}+\hat{k}$.

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283. For what value of $'\lambda'$ is the following vectors coplanar ?

$\overrightarrow{a}=\hat{i}+3\hat{j}+\hat{k}, \overrightarrow{b}=2\hat{i}-\hat{j}-\hat{k}$ and $\overrightarrow{c}=\lambda\hat{j}+3\hat{k}$.

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284. For what value of $'\lambda'$ are the following vectors coplanar? :

$\hat{i}-\hat{j}+\hat{k}, 3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}+\lambda\hat{j}-3\hat{k}$.

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285. For what value of $'\lambda'$ is the following vectors coplanar ? $\overrightarrow{a} = 2\hat{i} - 4\hat{j} + 5\hat{k}$, $\hat{i} - \lambda\hat{j} + \hat{k}$ and $3\hat{i} + 2\hat{j} - 5\hat{k}$.

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286. Using scalar triple product, show that the four points given by position vectors $4\hat{i} + 5\hat{j} + \hat{k}$, $-\hat{j} - \hat{k}$, $3\hat{i} + 9\hat{j} + 4\hat{k}$ and $-4\hat{i} + 4\hat{j} + 4\hat{k}$ are coplanar.

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287. Find $'x'$ such that the four points : A(3,2,1),B(4,x,5),C(4,2,-2) and D(6,5,-1) are coplanar.

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288. Show that the four points having position vectors $6\hat{i}-7\hat{j}, 16\hat{i}-19\hat{j}-4\hat{k}, 3\hat{j}-6\hat{k}, 2\hat{i}+5\hat{j}+10\hat{k}$ are not coplanar.

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289. Find the volume of the parallelopiped whose sides are given by the vectors : $11\hat{i}\cdot 2\hat{j}\cdot 13\hat{k}$.

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290. Find the volume of the parallelopiped whose sides are given by the vectors : $3\hat{i}+4\hat{j}\cdot 2\hat{i}+3\hat{j}+4\hat{k}\cdot 5\hat{k}$.

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291. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}, \vec{b}=\hat{i}$ and $\vec{c}=c_1\hat{i}+c_2\hat{j}+c_3\hat{k}$. Then : if $c_1=1$ and $c_2=2$ find c_3 which makes $\vec{a}, \vec{b}, \vec{c}$ coplanar.

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292. Find the volume of the parallelopiped with coteminous edges AB,AC and AD, where A=(3,2,1),B=(4,2,1),C=(0,1,4) and D=(0,0,7).

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293. Prove that for any two vectors $\vec{a}$ and $\vec{b}$, $\vec{a} \cdot \left(\vec{a} \times \vec{b}\right) = 0$. Is $\vec{b} \cdot \left(\vec{a} \times \vec{b}\right) = 0$?

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294. If $\vec{a}, \vec{b}, \vec{c}$ are perpendicular to each other, prove that $\left[\vec{a}.\left(\vec{b} \times \vec{c}\right)\right]^2 = a^2 b^2 c^2$

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295. What can you conclude about four non-zero vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ and $\vec{d}$, given that : $\left[\left(\vec{a}\times\vec{b}\right)\cdot\vec{c}\right]+\left[\left(\vec{b}\times\vec{c}\right)\cdot\vec{d}\right]=0$?

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296. Simplify : $\left(\vec{b}+\vec{c}\right)\cdot\left\{\left(\vec{c}+\vec{a}\right)\times\left(\vec{a}+\vec{b}\right)\right\}.$

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297. Prove that $\left\{\left(\vec{b}+\vec{c}\right)\times\left(\vec{c}+\vec{a}\right)\right\}.\left(\vec{a}+\vec{b}\right)=2\left[\vec{a},\vec{b},\vec{c}\right]$

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298. Prove that $\left\{\left(\vec{b}+\vec{c}\right)\times\left(\vec{c}+\vec{a}\right)\right\}.\left(\vec{a}+\vec{b}\right)=2\left[\vec{a},\vec{b},\vec{c}\right]$

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299. Simplify : $\left\{\left(\vec{b}-\vec{c}\right)\times\left(\vec{c}-\vec{a}\right)\right\}\odot\left(\vec{a}-\vec{b}\right)$

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300. Simplify : $\left[\vec{a}-\vec{b},\vec{b}-\vec{c},\vec{c}-\vec{a}\right]$.

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301. For any three vectors $\vec{a},\vec{b},\vec{c}$ show that $\vec{a}-\vec{b},\vec{b}-\vec{c},\vec{c}-\vec{a}$ are coplanar.

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302. If $\vec{a}\cdot\vec{b}\times\overrightarrow{=}0$ and $\vec{a}'=\dfrac{\vec{b}\times\vec{c}}{\vec{a}\cdot\vec{b}\times\vec{c}},\vec{b}'=\dfrac{\vec{c}\times\vec{a}}{\vec{a}\cdot\vec{b}\times\vec{c}},\vec{c}'=\dfrac{\vec{a}\times\vec{b}}{\vec{a}\cdot\vec{b}\times\vec{c}}$, show that :

$\vec{a} \cdot \vec{a}' + \vec{b} \cdot \vec{b}' + \vec{c} \cdot \vec{c}' = 3.$

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303. If $\vec{a} \cdot \vec{b} \cdot \vec{c} \neg = 0$ and $\vec{a}' = \dfrac{\vec{b} \times \vec{c}}{\vec{a} \cdot \vec{b} \times \vec{c}}, \vec{b}' = \dfrac{\vec{c} \times \vec{a}}{\vec{a} \cdot \vec{b} \times \vec{c}}, \vec{c}' = \dfrac{\vec{a} \times \vec{b}}{\vec{a} \cdot \vec{b} \times \vec{c}}$, show that : $\vec{a}' \cdot \left(\vec{b}' \times \vec{c}'\right) = \dfrac{1}{\vec{a} \cdot \left(\vec{b} \times \vec{c}\right)}.$

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304. If $\vec{a} \cdot \vec{b} \times \vec{c} = 0$ and $\vec{a}' = \dfrac{\vec{b} \times \vec{c}}{\vec{a} \cdot \vec{b} \times \vec{c}}, \vec{b}' = \dfrac{\vec{c} \times \vec{a}}{\vec{a} \cdot \vec{b} \times \vec{c}}, \vec{c}' = \dfrac{\vec{a} \times \vec{b}}{\vec{a} \cdot \vec{b} \times \vec{c}}$, show that : $\vec{a} \cdot \vec{a}' + \vec{b} \cdot \vec{b}' + \vec{c} \cdot \vec{c}' = 3.$

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305. Represent graphically a displacement of 40 km, 30^o east of north.

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306. Classify the following measure as scalar and vector: $10Kg$

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307. Classify the following measures as scalars and vectors : 2 meters north-west.

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308. Classify the following measure as scalar and vector: 40^o

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309. Classify the following measures as scalars and vectors : 40 watt.

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310. Classify the following measures as scalars and vectors : 10^{-19}.

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311. Classify the following measures as scalars and vectors: $20\frac{m}{s}$

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312. Classify the following as scalar and vector quantities: $timeperiod$

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313. Classify the following as scalar and vector quantities: $dis\tan ce$

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314. Classify the following as scalar and vector quantities: force

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315. Classify the following as scalar and vector quantities: $velocity$

Watch Video Solution

316. Classify the following as scalar and vector quantities:work done

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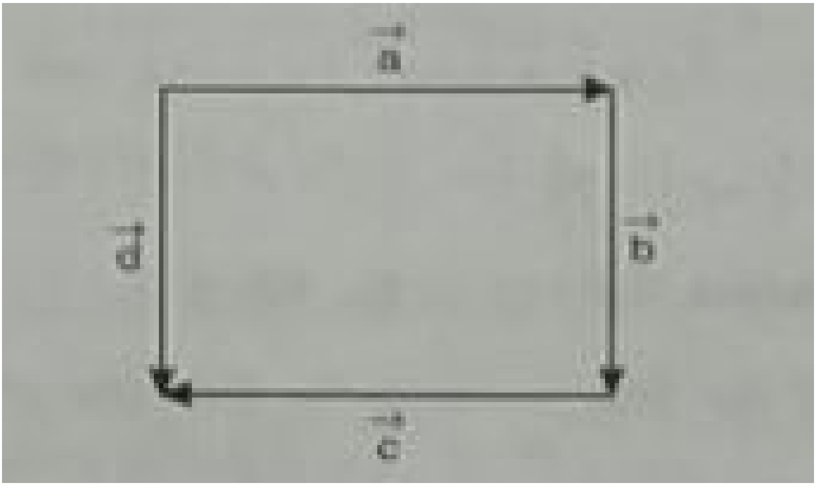
317. In the Fig.,



identify the following vectors : coinitial.

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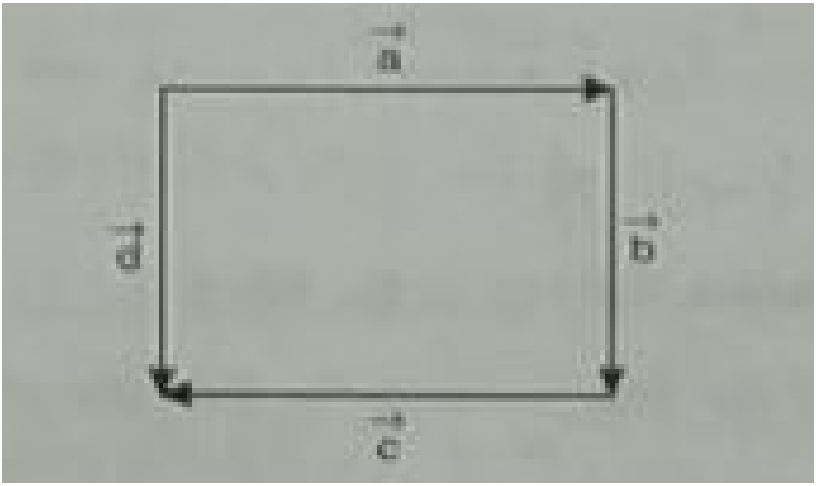
318. In the Fig.,



identify the following vectors : equal.

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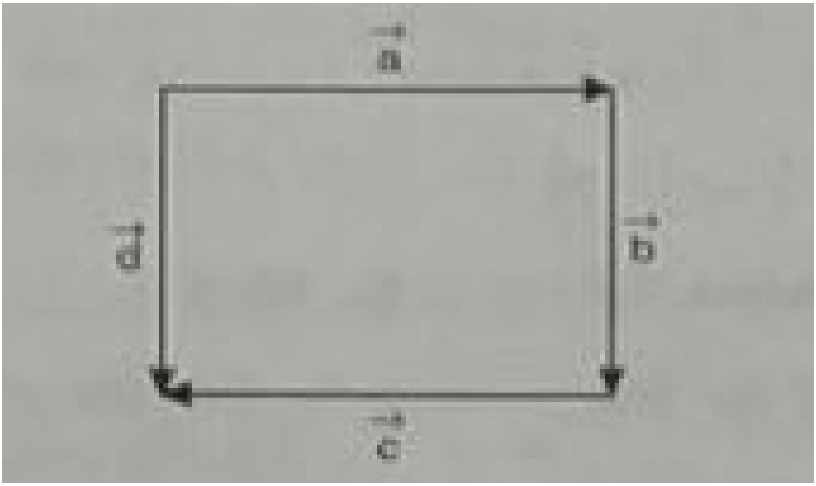
319. In the Fig.,



identify the following vectors : collinear but not equal.

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320. Answer the following ad true or false : $\vec{a}$ and $-\vec{a}$ are collinear.

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321. Answer the following ad true or false : Two collinear vectors are always equal in mangitude.

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322. Answer the following ad true or false : Two vectors having same magnitude are collinear.

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323. Answer the following ad true or false : Two collinear vectors having the same magnitude are equal.

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324. Compute the magnitude of the following vectors :

$\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}, \overrightarrow{b} = 2\hat{i} - 7\hat{j} - 3\hat{k}, \overrightarrow{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$

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325. Write two different vectors having same magnitude.

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326. Write two different vectors having same direction.

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327. Find the values of x and y so that the vectors $2\vec{i} + 3\vec{j}$ and $x\vec{i} + y\vec{j}$ are equal.

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328. Find the scalar and vector components of the vector with initial point (2, 1) and terminal point (– 5, 7).

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

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330. Find the unit vector in the direction of the vector $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$.

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331. For given vectors, $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$, find the unit vector in the direction of the vector $\vec{a} + \vec{b}$

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332. Find a vector in the direction of $5\hat{i} - \hat{j} + 2\hat{k}$, which has magnitude 8 units.

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333. Show that the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $-4\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear.

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

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335. Find the direction cosines of the vector joining the points $A(1, 2, -3)$ and $B(-1, -2, 1)$, directed from A to B.

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336. Show that the vector $\vec{i} + \vec{j} + \vec{k}$ is equally inclined to the axes OX, OY and OZ.

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337. Find the position vector of a point R which divides the line joining two 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 $2:1$ internally

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338. Find the position vector of a point R which divides the line joining two 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.

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

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340. Show that the points with position vectors $\overrightarrow{a} = 3\hat{i} - 4\hat{j} - 4\hat{k}, \overrightarrow{b} = 2\hat{i} - \hat{j} + \hat{k}$ and $\overrightarrow{c} = \hat{i} - 3\hat{j} - 5\hat{k}$ respectively form the vertices of a right angled triangle.

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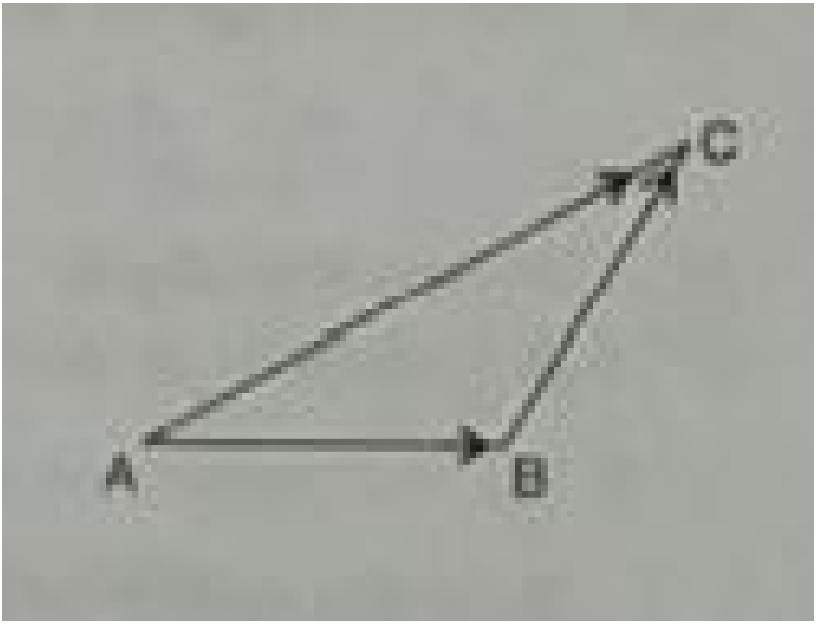
341. In triangle ABC,



which of the following is not true :

A. $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \overrightarrow{0}$

B. $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \overrightarrow{0}$

C. $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \overrightarrow{0}$

D. $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = \overrightarrow{0}$

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342. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are two collinear vectors, then which of the following are incorrect:

A. $\overrightarrow{b} = \lambda \overrightarrow{a}$ for some scalar λ

B. $\overrightarrow{a} = \pm \overrightarrow{b}$

C. the respective component of $\overrightarrow{a}$ and $\overrightarrow{b}$ are proportional

D. both the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ have the same direction, but different magnitudes.

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343. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 2,respectively having $\vec{a} \cdot \vec{b} = \sqrt{6}$

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344. Find the angle between the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} - \hat{k}$`

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345. Find the projection of the vector $\hat{i} + \hat{j}$ on the vector $\hat{i} - \hat{j}$

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346. Find the projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $7\hat{i} - \hat{j} + 8\hat{k}$.

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347. Show that each of the given three vectors is a unit vector : $\frac{1}{7}\left(2\hat{i}+3\hat{j}+6\hat{k}\right), \frac{1}{7}\left(3\hat{i}-6\hat{j}+2\hat{k}\right), \frac{1}{7}\left(6\hat{i}+2\hat{j}-3\hat{k}\right)$. Also, show that they are mutually perpendicular to each other.

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

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349. Evaluate the product $\left(3\hat{a}-5\hat{b}\right)\cdot\left(2\hat{a}+7\hat{b}\right)$

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350. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude and such that the angle between them is 60^{o} and their scalar product is $\frac{1}{2}$.

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351. Find $\left|\vec{x}\right|$, if for a unit vector $\vec{a}$, $\left(\vec{x}-\vec{a}\right)\cdot\left(\vec{x}+\vec{a}\right)=12$

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352. 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 $\vec{c}$, then find the value of λ.

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353. Show that $\left|\vec{a}\right|\vec{b}+\left|\vec{b}\right|\vec{a}$ is perpendicular to $\left|\vec{a}\right|\vec{b}-\left|\vec{b}\right|\vec{a}$ for any two non zero vectors $\vec{a}$ and $\vec{b}$

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

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

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356. If either vector $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$, then $\vec{a} \cdot \vec{b} = \vec{0}$. But the converse need not be true. Justify your answer with an example.

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357. If the vertices A, B, C of a triangle ABC are (1,2,3), (-1,0,0), (0,1,2) respectively, then find $\angle ABC$ [$\angle ABC$ is the angle between the vectors

$\overrightarrow{BA}$ and $\overrightarrow{BC}$]

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

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359. Using vector method, show that the points whose position vectors are , $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$form a right angled triangle.

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360. If $\vec{a}$ is a nonzero vector of magnitude $'a'$ and λ a nonzero scalar, then $\lambda\vec{a}$ is unit vector if:

A. $\lambda = 1$

B. $\lambda = -1$

C. $a = |\lambda|$

D. $a = \frac{1}{|\lambda|}$.

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361. Find $\left|\vec{a} \times \vec{b}\right|$ if $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$ and $vceb = 3\hat{i} - 2\hat{j} + 2\hat{k}$.

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

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

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364. Show that $\left(\vec{a}-\vec{b}\right)\times\left(\vec{a}+\vec{b}\right)=2\left(\vec{a}\times\vec{b}\right)$.

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365. Find λ and μ if : $\left(2\hat{i}+6\hat{j}+27\hat{k}\right)\times\left(\hat{i}+\lambda\hat{j}+\mu\hat{k}\right)=\vec{0}$.

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366. Given that $\vec{a}\cdot\vec{b}=0$ and $\vec{a}\times\vec{b}=\vec{0}$. What can you conclude about the vectors $\vec{a}$ and $\vec{b}$?

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367. Let the vectors $\vec{a}, \vec{b}, \vec{c}$ be given as : $a_1\hat{i} + a_2\hat{j} + a_3\hat{k}, b_1\hat{i} + b_2\hat{j} + b_3\hat{k}, c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then show that $\vec{a} \times \left(\vec{b} + \vec{c}\right) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$.

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368. If either $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$ then $\vec{a} \times \vec{b} = \vec{0}$. Is the converse true? Justify your answer with an example.

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369. Find the area of the triangle with vertices $A(1, 12), B(2, 3, 5), C(1, 5, 5)$

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370. Determine the area of a parallelogram whose adjacent sides are represented by the vectors : $\overrightarrow{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 2\hat{i} - 7\hat{j} + \hat{k}$.

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371. Let the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ be such that $\left|\overrightarrow{a}\right| = 3$ and $\left|\overrightarrow{b}\right| = \frac{\sqrt{2}}{3}$, then $\overrightarrow{a} \times \overrightarrow{b}$ is a unit vector, if the angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ is:

A. $\pi / 6$

B. $\pi / 4$

C. $\pi / 3$

D. $\pi / 2$.

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372. Area of a rectangle having vertices A, B, C and D with position vectors : $-\hat{i}+\left(\frac{1}{2}\right)\hat{j}+4\hat{k},\ \hat{i}+\left(\frac{1}{2}\right)\hat{j}+4\hat{k},\ \hat{i}-\left(\frac{1}{2}\right)\hat{j}+4\hat{k}$ and $-\hat{i}-\left(\frac{1}{2}\right)\hat{j}+4\hat{k}$, respectively is:

A. $\frac{1}{2}$

B. 1

C. 2

D. 4

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373. Write down a unit vector in XY-plane, making an angle of 30^{o} with the positive direction of x-axis.

Watch Video Solution

374. Find the scalar components and magnitude of the vector joining the points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$

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375. A girl walks 4 km towards west, then she walks 3 km in a direction 30^o east of north and stops. Determine the girl's displacement from her initial point of departure.

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376. If $\vec{a} = \vec{b} + \vec{c}$, then is it true that $\left|\vec{a}\right| = \left|\vec{b}\right| + \left|\vec{c}\right|$? Justify your answer.

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377. Find the value of x for which $x\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector.

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

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379. If $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}$, $\overrightarrow{b} = 2\hat{i} - \hat{j} + 3\hat{k}$, $\overrightarrow{c} = \hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector parallel to the vector $2\overrightarrow{a} - \overrightarrow{b} + 3\overrightarrow{c}$.

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380. Show that the points $A(1, -2, -8)$, $B(5, 0, -2)$ and $C(11, 3, 7)$ are collinear.

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

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382. The two adjacent sides of a parallelogram are given by the vectors $2\hat{i}-4\hat{j}+5\hat{k}$ and $\hat{i}-2\hat{j}-3\hat{k}$ Find a unit vector parallel to its diagonal (longer). Also find the area of parallelogram.

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383. Show that the direction cosines of a vector equally inclined to the axes OX, OY and OZ are $\left(\frac{1}{\sqrt{3}}\right),\left(\frac{1}{\sqrt{3}}\right),\left(\frac{1}{\sqrt{3}}\right)$

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

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

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386. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}$is equally inclined to $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$.

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387. Prove that $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}+\vec{b}\right)=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2$, if and only if $\vec{a},\vec{b}$ are perpendicular, given $\vec{a}\neq\vec{0}, \vec{b}\neq\vec{0}$.

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388. If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\vec{a}\cdot\vec{b}\geq 0$ only when:

A. $0<\theta<\frac{\pi}{2}$

B. $0\leq\theta\leq\frac{\pi}{2}$

C. $0<\theta<\pi$

D. $0<\theta<\pi$.

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389. Let $\overrightarrow{a}$ and $\overrightarrow{b}$ be two unit vectors and θ is the angle between them. Then $\overrightarrow{a}+\overrightarrow{b}$ is a unit vector if :

A. $\theta=\frac{\pi}{4}$

B. $\theta=\frac{\pi}{3}$

C. $\theta=\frac{\pi}{2}$

D. $\theta=\frac{2\pi}{3}$.

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390. The value of : $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}\cdot\left(\hat{i}\times\hat{k}\right)+\hat{k}\cdot\left(\hat{i}\times\hat{j}\right)$ is :

A. 0

B. -1

C. 1

D. 3

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391. If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\left|\vec{a}\cdot\vec{b}\right| = \left|\vec{a}\times\vec{b}\right|$ when θ is equal to :

A. 0

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. π.

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392. Using vectors, find the value of $'k'$ such that the points $(k, -10, 3), (1, -1, 3)$ and (3,5,3) are collinear.

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393. If A,B,C,D are the points with position vectors : $\hat{i} + \hat{j} - \hat{k}, 2\hat{i} - \hat{j} + 3\hat{k}, 2\hat{i} - 3\hat{k}, 3\hat{i} - 2\hat{j} + \hat{k}$ respectively, find the projection of $\overrightarrow{AB}$ along CD.

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394. Parallelogram on equal bases and between the same parallels are equal in area.

Watch Video Solution

395. Write all the unit vectors in XY-plane.

Watch Video Solution

396. Write down a unit vector in XY-plane, making an angle of 30^o with the positive direction of x-axis.

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

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398. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$, $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$.

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399. If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} - \hat{k}$, $\vec{c} = -2\hat{i} + \hat{j} - 3\hat{k}$ and $\vec{d} = 3\hat{i} + 2\hat{j} + 5\hat{k}$, find the scalars α, β and γ such that $\vec{d} = \alpha\vec{a} + \beta\vec{b} + \gamma\vec{c}$.

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400. Show that the points $A(1, -2, -8)$, $B(5, 0, -2)$ and $C(11, 3, 7)$ are collinear.

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401. The two adjacent sides of a parallelogram are given by the vectors $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$ Find a unit vector parallel to its diagonal (longer). Also find the area of parallelogram.

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

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403. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}$ and $\vec{c}$.

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404. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors and $\vec{d} \cdot \vec{a} = \vec{d} \cdot \vec{b} = \vec{d} \cdot \vec{c} = 0$, then show that $\vec{d}$ is a zero vector.

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405. If $\vec{c}$ is normal to $\vec{a}$ and $\vec{b}$, show that $\vec{c}$ is normal to $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$.

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406. Show that $\left|\vec{a}\right|\vec{b} + \left|\vec{b}\right|\vec{a}$ is perpendicular to $\left|\vec{a}\right|\vec{b} - \left|\vec{b}\right|\vec{a}$ for any two non zero vectors $\vec{a}$ and $\vec{b}$

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407. Find the area of the parallelogram having diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$, where : $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}, \vec{b} = -\hat{i} + \hat{k}, \vec{c} = 2\hat{j} - \hat{k}$.

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408. Prove that the quadrilateral obtained by joining mid-points of adjacent sides of a rectangle is a rhombus.

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409. Prove that $\frac{1}{2}\overrightarrow{AC} \times \overrightarrow{BD}$ represents the vector area of the plane quadrilateral ABCD.

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410. Given $\vec{a} = \frac{1}{7}\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$, $\vec{b} = \frac{1}{7}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right)$, $\vec{c} = \frac{1}{7}\left(6\hat{i} + 2\hat{j} - 3\hat{k}\right)$, $\hat{i}, \hat{j}, \hat{k}$ being a right handed orthogonal system of unit vectors in space. Show that $\vec{a}, \vec{b}, \vec{c}$ is also another such system.

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411. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then show that $\vec{a} + \vec{b}, \vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are also coplanar.

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412. Are vectors $\vec{a}$ and $-\vec{a}$ collinear ?

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413. Write two different vectors having same magnitude.

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414. What is the unit vector in the direction of $\vec{a} = \vec{i} + \vec{j} + 2\vec{k}$?

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415. What is the position vector of the mid-point of the line segment joining the points A(2,3,4) and B(4,1,-2).

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416. The scalar product of two given vectors $\vec{a}$ and $\vec{b}$ having angle $'\theta'$ between them is defind as $\vec{a} \cdot \vec{b} = \ldots\ldots\ldots$

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417. For mutually perpendicularl unit vectors $\hat{i}, \hat{j}, \hat{k}$, we have : $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k}$.

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418. What is the value of : $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}.\left(\hat{k}\times\hat{i}\right)+\hat{k}.\left(\hat{j}\times\hat{i}\right)$.

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419. If $\left|\vec{a}\cdot\vec{b}\right|=\left|\vec{a}\times\vec{b}\right|$,then angle between $\vec{a}$ and $\vec{b}$ is :

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420. Classify the following as vector as scalar : $\vec{a}\cdot\vec{b},\left[\vec{a}\vec{b}\vec{c}\right],3\vec{a},\vec{a}\times\vec{b}$.

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421. What is $\left[\vec{a}\vec{b}\vec{c}\right]$ when $\vec{a},\vec{b},\vec{c}$ are coplanar ?

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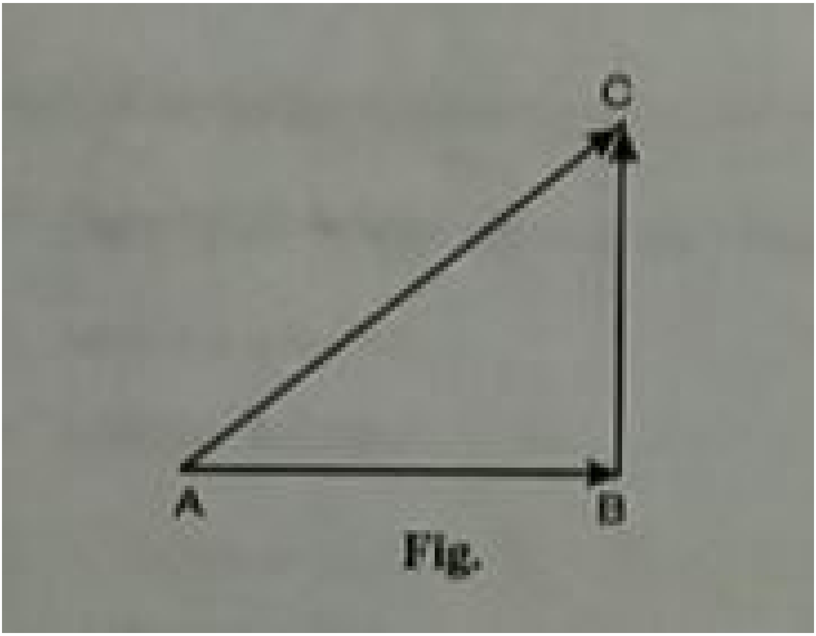
422. In $\triangle ABC$,



which of the following is not true ?

A. $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=\overrightarrow{0}$

B. $\overrightarrow{AB}+\overrightarrow{BC}-\overrightarrow{AC}=\overrightarrow{0}$

C. $\overrightarrow{AB}+\overrightarrow{BC}-\overrightarrow{CA}=\overrightarrow{0}$

D. $\overrightarrow{AB}-\overrightarrow{CB}+\overrightarrow{CA}=\overrightarrow{0}$

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423. If $\vec{a}$ and $\vec{b}$ are two collinear vectors, then which of the following is incorrect ?

A. $\vec{b} = \lambda \vec{a}$ for some scalar λ

B. $\vec{a} = \pm \vec{b}$

C. the respective component of $\vec{a}$ and $\vec{b}$ are proportional

D. both the vectors $\vec{a}$ and $\vec{b}$ have the same direction, but different magnitudes.

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424. If $\vec{a}$ is a nonzero vector of magnitude $'a'$ and λ a nonzero scalar, then $\lambda \vec{a}$ is unit vector if:

A. $\lambda = 1$

B. $\lambda = -1$

C. $a = |\lambda|$

D. $a = \frac{1}{|\lambda|}$.

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425. Let λ be any non-zero scalar. Then for what possible values of x, y and z given below, the vertices $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $x\hat{i} - y\hat{j} - z\hat{k}$ are perpendicular:

A. $x = 2\lambda, y = \lambda, z = \lambda$.

B. $x = \lambda, y = 2\lambda, z = -\lambda$.

C. $x = -\lambda, y = 2\lambda, z = \lambda$.

D. $x = -\lambda, y = -2\lambda, z = \lambda$.

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426. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $\left|\vec{a}\right| = 3$ and $\left|\vec{b}\right| = \frac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is a unit vector if the angle between $\vec{a}$ and $\vec{b}$ is :

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{2}$.

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427. Area of a rectangle having vertices : $A\left(-\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}\right), B\left(\hat{i} + \frac{1}{2}\hat{j} + 4\hat{k}\right), C\left(\hat{i} - \frac{1}{2}\hat{j} + 4\hat{k}\right), D\left(-\hat{i} - \frac{1}{2}\right.$

is :

A. $\frac{1}{2}$ square unit

B. 1 square unit

C. 2 square units

D. 4 square units.

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428. If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\vec{a} \cdot \vec{b} \geq 0$ only when:

A. $0 < \theta < \frac{\pi}{2}$

B. $0 \leq 0 \leq \frac{\pi}{2}$

C. $0 < \theta < \pi$

D. $0 \leq \theta \leq \pi$.

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429. Let $\overrightarrow{a}$ and $\overrightarrow{b}$ be two unit vectors and θ is the angle between them. Then $\overrightarrow{a}+\overrightarrow{b}$ is a unit vector if :

A. $\theta=\frac{\pi}{4}$

B. $\theta=\frac{\pi}{3}$

C. $\theta=\frac{\pi}{2}$

D. $\theta=\frac{2\pi}{3}$.

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430. If $\left(\hat{i},\hat{j},\hat{k}\right)$ are the usual three perpendicular unit vectors, then the value of : $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}\cdot\left(\hat{i}\times\hat{k}\right)+\hat{k}\cdot\left(\hat{i}\times\hat{j}\right)$ is :

A. 0

B. -1

C. 1

D. 3

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431. If θ is the angle between two vectors $\overrightarrow{a}$ and $\overrightarrow{b}$, then $\left|\overrightarrow{a}\cdot\overrightarrow{b}\right| = \left|\overrightarrow{a}\times\overrightarrow{b}\right|$ when θ is equal to :

A. 0

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. π.

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432. The area of the triangle whose adjacent sides are : $\overrightarrow{a} = 3\hat{i} + \hat{j} + 4\hat{k}$ and $\overrightarrow{b} = \hat{i} - \hat{j} + \hat{k}$ is :

A. $\frac{1}{2}\sqrt{42}$

B. 42

C. $\sqrt{42}$

D. $\sqrt{21}$.

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

A. 5

B. 7

C. 12

D. 1

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434. The vector with initial point P(2,-3,5) and terminal point Q(3,-4,7) is :

A. $\hat{i} - \hat{j} + 2\hat{k}$

B. $5\hat{i} - 7\hat{j} + 12\hat{k}$

C. $-\hat{i} + \hat{j} - 2\hat{k}$

D. None of these.

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435. The angle between the vectors $\hat{i} - \hat{j}$ and $\hat{j} - \hat{k}$ is :

A. $\frac{\pi}{3}$

B. $\frac{2\pi}{3}$

C. $-\frac{\pi}{3}$

D. $\frac{5\pi}{6}$.

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436. The value of $'\lambda'$ for which the two vectors : $2\hat{i} - \hat{j} + 2\hat{k}$ and $3\hat{i} + \lambda\hat{j} + \hat{k}$ are perpendicular is :

A. 2

B. 4

C. 6

D. 8

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437. If $\left|\overrightarrow{a}\right| = 8, \left|\overrightarrow{b}\right| = 3$ and $\left|\overrightarrow{a} \times \overrightarrow{b}\right| = 12$, then value of $\overrightarrow{a} \cdot \overrightarrow{b}$ is :

A. $6\sqrt{3}$

B. $8\sqrt{3}$

C. $12\sqrt{3}$

D. None of these.

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438. If $\overrightarrow{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\overrightarrow{b} = -2\hat{i} + \hat{k}$, then the vector in the direction of $\overrightarrow{a} + \overrightarrow{b}$ with magnitude 9 is :

A. $9\hat{k}$

B. $3\hat{k}$

C. $\hat{k}$

D. $6\hat{k}$.

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439. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are two collinear vectors, then which of the following are incorrect:

A. 1) $\vec{b} = \lambda \vec{a}$ for some scalar λ

B. $\vec{a} = \pm \vec{b}$

C. the respective component of $\vec{a}$ and $\vec{b}$ are proportional

D. Both $\vec{a}$ and $\vec{b}$ have same different but different magnitude.

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440. If $\vec{a} \times \vec{b} = |\vec{a}||\vec{b}|\sin\theta\hat{n}$, which one is correct ?

A. $\hat{n}$ is a unit vector perpendicular to both $\vec{a}$ and $\vec{b}$

B. $\hat{n}$ is a unit vector parallel to both $\vec{a}$ and $\vec{b}$

C. $\hat{n}$ is a unit vector neither perpendicular nor parallel to both $\vec{a}$ and $\vec{b}$

D. None of these.

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441. If $\overrightarrow{a} \cdot \overrightarrow{b} = -\left|\overrightarrow{a}\right|\left|\overrightarrow{b}\right|$, then $\theta =$

A. 0

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. π.

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442. The projection of the vector $\overrightarrow{a} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\overrightarrow{b} = \hat{i} + 2\hat{j} + \hat{k}$ is :

A. 1) $\frac{5}{\sqrt{3}}\sqrt{6}$

B. 2) $\frac{2}{3}\sqrt{5}$

C. 3) $\frac{5}{3}\sqrt{6}$

D. 4) $\frac{5}{6}\sqrt{3}$.

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443. The area of triangle having adjacent sides $\vec{a}$ and $\vec{b}$ is :

A. $\frac{1}{2}\left|\vec{a} \times \vec{b}\right|$

B. $\left|\vec{a} \times \vec{b}\right|$

C. $\frac{1}{2}\left|\vec{a} \cdot \vec{b}\right|$

D. None of these.

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444. The magnitude of : $\vec{a} = 3\hat{i} + 2\hat{j}$ is :

A. $\sqrt{5}$

B. $\sqrt{13}$

C. $\sqrt{7}$

D. None of these.

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445. If $\overrightarrow{a} = 3\hat{i} - \hat{j} + 2\hat{k}, \overrightarrow{b} = \hat{i} - 3\hat{k}$, then $\overrightarrow{a} \cdot \overrightarrow{b}$ is :

A. -3

B. 2

C. 9

D. None of these.

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446. If $\overrightarrow{a} = \hat{i} + 2\hat{j} + 5\hat{k}$, $\overrightarrow{b} = 2\hat{i} + 3\hat{j}$, then the value of $\overrightarrow{a} \times \overrightarrow{b}$ is :

A. $15\hat{i} - 10\hat{j} - \hat{k}$

B. $15\hat{i} + 10\hat{j} - \hat{k}$

C. $-15\hat{i} + 10\hat{j} - \hat{k}$

D. None of these.

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447. Let the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ be such that $\left|\overrightarrow{a}\right| = 3$ and $\left|\overrightarrow{b}\right| = \frac{\sqrt{2}}{3}$, then $\overrightarrow{a} \times \overrightarrow{b}$ is a unit vector if the angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ is :

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448. For a unit vector $\overrightarrow{a}$ if $\left(x - \overrightarrow{a}\right) \cdot \left(x + \overrightarrow{a}\right) = 12$, then $|x|$ is equal to :

A. $\sqrt{11}$

B. $\sqrt{13}$

C. $\sqrt{14}$

D. $\sqrt{5}$

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449. Projection of vector $\vec{a}$ on other vector $\vec{b}$ is equal to :

A. 1) $\vec{a} \cdot \vec{b}$

B. 2) $\vec{a} \cdot \left(\frac{\vec{b}}{|\vec{b}|}\right)$

C. 3) $\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$.

D. 4) All of these.

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450. Which of the following is true :

A. 1) $\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 0$

B. 2) $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 0$

C. 3) $\hat{i} + \hat{j} + \hat{k} = 0$

D. 4) None of these.

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451. The angle between the vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ such that $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right| = \sqrt{2}$ and $\overrightarrow{a} \cdot \overrightarrow{b} = 1$ is :

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. 0

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452. If the points A and B are (1,2,-1) and (2,1,-1) respectively, then $\overrightarrow{AB}$ is :

A. $\hat{i} + \hat{j}$

B. $\hat{i} - \hat{j}$

C. $2\hat{i} + \hat{j} - \hat{k}$

D. $\hat{i} + \hat{j} + \hat{k}$.

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453. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are vectors such that $\left|\overrightarrow{a}\right| = 2, \left|\overrightarrow{b}\right| = 3$ and $\overrightarrow{a} \cdot \overrightarrow{b} = 4$, then $\left|\overrightarrow{a} - \overrightarrow{b}\right|$ is equal to :

A. 2

B. 3

C. 4

D. $\sqrt{5}$.

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454. The projection of $\hat{i} - \hat{j} + \hat{k}$ on $\hat{i} - \hat{j}$ is :

A. 0

B. 1

C. $\sqrt{2}$

D. $\frac{1}{\sqrt{2}}$.

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455. The angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ if $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{a} \cdot \overrightarrow{b}$ is :

A. $\frac{\pi}{3}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. $\frac{\pi}{8}$.

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456. The value of $'\lambda'$ for which the vectors : $\overrightarrow{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\overrightarrow{b} = 4\hat{i} + 6\hat{j} + \lambda\hat{k}$ are parallel is :

A. -2

B. 2

C. 1

D. 4

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457. If $p\left(\hat{i}+\hat{j}+\hat{k}\right)$ is a unit vector, then p is equal to :

A. $-\frac{1}{\sqrt{3}}$

B. $\frac{1}{\sqrt{3}}$

C. $+\frac{1}{\sqrt{3}}$

D. None of these.

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458. The value of $'\lambda'$ for which the vectors : $\overrightarrow{a}=3\hat{i}+\hat{j}-2\hat{k}$ and $\overrightarrow{b}=\hat{i}-9\hat{j}+\lambda\hat{k}$ are perpendicular to each other is :

A. -6

B. -3

C. 3

D. 6

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459. If $\vec{a} = 2\hat{i} + 3\hat{j} - 5\hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - \hat{k}$, then $\vec{a} \cdot \vec{b}$ is :

A. 10

B. 0

C. 5

D. 2

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460. Magnitude of the vector $\overrightarrow{PQ}$, joining the points P(2,3,0) and Q(1,-2,-4) is :

A. $\sqrt{34}$

B. $\sqrt{26}$

C. $3\sqrt{2}$

D. $\sqrt{42}$

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461. If $\overrightarrow{a}\cdot\overrightarrow{b}=-\left|\overrightarrow{a}\right|\cdot\left|\overrightarrow{b}\right|$, then $\theta=$,

A. π

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{2}$

D. None of these.

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462. If $\overrightarrow{a}$ is a non-zero vector of magnitude $'a'$ and $'\lambda'$ is a non-zero scalar, such that $\left|\lambda\overrightarrow{a}\right| = 1$, then :

A. 1) $\lambda = 1$

B. 2) $\lambda = -1$

C. 3) $a = |\lambda|$

D. 4) $a = \frac{1}{|\lambda|}$.

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463. The value of $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}\cdot\left(\hat{i}\times\hat{k}\right)+\hat{k}\cdot\left(\hat{i}\times\hat{j}\right)$ is :

A. 0

B. -1

C. 1

D. 3

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464. The projection of $\overrightarrow{a} = 2\hat{i} - \hat{j} + \hat{k}$ on $\overrightarrow{b} = \hat{i} - 2\hat{j} + \hat{k}$ is equal to:

A. 1) $\frac{5\sqrt{6}}{3}$

B. 2) $\frac{5}{\sqrt{6}}$

C. 3) $\frac{6}{\sqrt{14}}$

D. 4) $\frac{\sqrt{6}}{5}$.

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465. If $\left|\vec{a}\cdot\vec{b}\right| = \left|\vec{a}\times\vec{b}\right|$, then the angle between $\vec{a}$ and $\vec{b}$ is :

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. π

D. $\frac{\pi}{6}$.

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466. Let $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$. If $\vec{b}$ be a vector such that : $\vec{a}\cdot\vec{b} = \left|\vec{b}\right|^2$ and $\left|\vec{a} - \vec{b}\right| = \sqrt{7}$, then $\left|\vec{b}\right| =$

A. 7

B. 14

C. $\sqrt{7}$

D. 21

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467. If $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors such that each one of these is perpendicular to the sum of the other two vectors, then the value of $\left|\vec{a}+\vec{b}+\vec{c}\right|^2$ is :

A. 1) $\left|\vec{a}\right|^2+\left|\vec{b}\right|^2+\left|\vec{c}\right|^2$

B. 2) $\left|\vec{a}\right|+\left|\vec{b}\right|+\left|\vec{c}\right|$

C. 3) $2\left(\left|\vec{a}\right|^2+\left|\vec{b}\right|^2+\left|\vec{c}\right|^2\right)$

D. 4) $\frac{1}{2}\left(\left|\vec{a}\right|^2+\left|\vec{b}\right|^2+\left|\vec{c}\right|^2\right)$

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468. If $\vec{a}=\hat{i}+2\hat{j}+2\hat{k}, \left|\vec{b}\right|=5$ and the angle between $\vec{a}$ and $vceb$ is $\frac{\pi}{6}$, then the area of the triangle formed by these two vectors as two sides is :

A. $\frac{15}{4}$

B. $\frac{15}{2}$

C. 15

D. $\frac{15\sqrt{3}}{2}$

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469. If $\overrightarrow{a} \cdot \overrightarrow{b} = 0$ and $\overrightarrow{a} + \overrightarrow{b}$ makes an angle of 60° with $\overrightarrow{a}$, then :

A. 1) $\left|\overrightarrow{a}\right| = 2\left|\overrightarrow{b}\right|$

B. 2) $2\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right|$

C. 3) $\left|\overrightarrow{a}\right| = \frac{1}{\sqrt{3}}\left|\overrightarrow{b}\right|$

D. 4) $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right|$

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470. The area of the parallelogram whose adjacent sides are $\hat{i}+\hat{k}$ and $2\hat{i}+\hat{j}+\hat{k}$ is :

A. 3

B. $\sqrt{2}$

C. 4

D. $\sqrt{3}$

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471. If the projection of $\overrightarrow{b}$ on $\overrightarrow{a}$ is twice the projection of $\overrightarrow{a}$ on $\overrightarrow{b}$, then $\left|\overrightarrow{b}\right|-\left|\overrightarrow{a}\right|$ is equal to :

A. $\left|\overrightarrow{a}-\overrightarrow{b}\right|$

B. $\left|\overrightarrow{a}\right|+\left|\overrightarrow{b}\right|$

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

D. $\left|\vec{a}\right|$

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472. If $\left(\vec{a}\times\vec{b}\right)^2+\left(\vec{a}\cdot\vec{b}\right)^2=144$ and $\left|\vec{a}\right|=4$, then $\left|\vec{b}\right|=$

A. 12

B. 16

C. 8

D. 3

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473. The non-zero vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ are related by $\vec{a} = 8\vec{b}$ and $\vec{c} = -7\vec{b}$. Then the angle between $\vec{a}$ and $\vec{c}$ is :

A. π

B. 0

C. $\frac{\pi}{4}$

D. $\frac{\pi}{2}$.

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474. The edges of a parallelopiped are of unit length and are parallel to non-coplanar unit vectors $\hat{a}, \hat{b}, \hat{c}$ such that $\hat{a} \cdot \hat{b} = \hat{b} \cdot \hat{c} = \hat{c} \cdot \hat{a} = \frac{1}{2}$. Then, the volume of the parallelopiped is

A. $\frac{1}{\sqrt{2}}$

B. $\frac{1}{2\sqrt{2}}$

C. $\frac{\sqrt{3}}{2}$

D. $\frac{1}{\sqrt{3}}$.

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475. If a, b, c and d are the unit vectors such that $(a \times b) \cdot (c \times d) = 1$ and $a \cdot c = \frac{1}{2}$, then

A. $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar

B. $\vec{b}, \vec{c}, \vec{d}$ are non-coplanar

C. $\vec{b}, \vec{d}$ are non-parallel

D. $\vec{a}, \vec{d}$ and parallel and $\vec{b}, \vec{c}$ are parallel.

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476. If $\vec{u}, \vec{v}, \vec{w}$ are non -coplanar vectors and $p, q,$ are real numbers then the equality

$\left[3\vec{u}\,p\vec{v}\,p\vec{w}\right] - \left[p\vec{v}\,\vec{w}\,q\vec{u}\right] - \left[2\vec{w}\,q\vec{v}\,q\vec{u}\right] = 0$ holds for

A. exactly two values of (p, q)

B. more than two but not all values (p, q)

C. all values of (p, q)

D. exactly one value of (p, q).

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477. Let $\vec{a} = \hat{j} - \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$. Then the vector b satisfying $\vec{a} \times \vec{b} + \vec{c} = 0$ and $\vec{a} \cdot \vec{b} = 3,$ is

A. $-\hat{i} + \hat{j} - 2\hat{k}$

B. $2\hat{i} - \hat{j} + 2\hat{k}$

C. $\hat{i}-\hat{j}-2\hat{k}$

D. $\hat{i}+\hat{j}-2\hat{k}$.

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478. If the vectors $\vec{a}=\hat{i}-\hat{j}+2\hat{k}$. $\vec{b}=2\hat{i}+4\hat{j}+\hat{k}$ and $\vec{c}=\lambda\hat{i}+\hat{j}+\mu\hat{k}$ are mutually orthogonal, then (λ, μ)

A. (-3,2)

B. (2,-3)

C. (-2,3)

D. (3,-2).

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479. The vectors $\vec{a}$ and $\vec{b}$ are not perpendicular and $\vec{c}$ and $\vec{d}$ are two vectors satisfying $\vec{b} \times \vec{c} = \vec{b} \times \vec{d}$ and $\vec{a} \cdot \vec{d} = 0$. Then the vector $\vec{d}$ is equal to :

A. $\vec{b} - \left(\dfrac{\vec{b} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right)\vec{c}$

B. $\vec{c} + \left(\dfrac{\vec{a} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right)\vec{b}$.

C. $\vec{b} + \left(\dfrac{\vec{b} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right)\vec{c}$.

D. $\vec{c} - \left(\dfrac{\vec{a} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right)\vec{b}$.

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480. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ be three vectors. A vector $\vec{v}$ in the plane of $\vec{a}$ and $\vec{b}$, whose projection on $\vec{c}$ is $\dfrac{1}{\sqrt{3}}$, is given by :

A. 1) $\hat{i} - 3\hat{j} + 3\hat{k}$

B. 2) $-3\hat{i}-3\hat{j}-\hat{k}$

C. 3) $3\hat{i}-\hat{j}+3\hat{k}$

D. 4) $\hat{i}+3\hat{j}-3\hat{k}.$

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481. If the vectors $p\hat{i}+\hat{j}+\hat{k}, \hat{i}+q\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+r\hat{k}(p\neq q\neq r\neq 1)$ are coplanar, then the value of $pqr-(p+q+r)$ is :

A. 2

B. 0

C. -1

D. $-2.$

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482. Let a,b and c be three non-zero vectors which are pairwise non-collinear. If a+3b is collinear with c and b+2c is collinear with a, then a+3b+6c is

A. $\vec{a}$

B. $\vec{b}$

C. $\vec{0}$

D. $\vec{a}+\vec{c}$.

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483. Let $\vec{a}$ and $\vec{b}$ be two unit vectors. If the vectors : $\vec{c}=\vec{a}+2\vec{b}$ and $\vec{d}=5\vec{a}-4\vec{b}$ are perpendicular to each other, then the angle between $\vec{a}$ and $\vec{b}$ is :

A. 1) $\frac{\pi}{6}$

B. 2) $\frac{\pi}{2}$

C. 3) $\frac{\pi}{3}$

D. 4) $\frac{\pi}{4}$

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484. Let ABCD be a parallelogram such that AB=q, AD=p and $\angle BAD$ be an acute angle. If r the vector that coincides with the altitude directed from the vertex B to the side AD, then r is given by

A. $\vec{r} = 3\vec{q} - \frac{3\left(\vec{p}\cdot\vec{q}\right)}{\vec{p}\cdot\vec{p}}\vec{p}$

B. $\vec{r} = -\vec{q} + \frac{\left(\vec{p}\cdot\vec{q}\right)}{\vec{p}\cdot\vec{p}}\vec{p}$

C. $\vec{r} = \vec{q} - \left(\frac{\left(\vec{p}\cdot\vec{q}\right)}{\vec{p}\cdot\vec{p}}\right)\vec{p}$

D. $\vec{r} = -3\vec{q} + \frac{3\left(\vec{p}\cdot\vec{q}\right)}{\vec{p}\cdot\vec{p}}\vec{p}$

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485. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are vectors such that $\left|\overrightarrow{a}+\overrightarrow{b}\right|=\sqrt{29}$ and $\overrightarrow{a}\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=\left(2\hat{i}+3\hat{j}+4\hat{k}\right)\times\overrightarrow{b}$, then a possible value of $\left(\overrightarrow{a}+\overrightarrow{b}\right).\left(-7\hat{i}+2\hat{j}+3\hat{k}\right)$ is :

A. 0

B. 3

C. 4

D. 8

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486. If the vectors $\overrightarrow{AB}=3\hat{i}+4\hat{k}$ and $\overrightarrow{AC}=5\hat{i}-2\hat{j}-4\hat{k}$ are the sides of a triangle ABC, then the length of the median through A is :

A. $\sqrt{72}$

B. $\sqrt{33}$

C. $\sqrt{45}$

D. $\sqrt{18}$

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487. Let $\overrightarrow{PR} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\overrightarrow{SQ} = \hat{i} - 3\hat{j} - 4\hat{k}$ determine diagonals of a parallelogram PQRS and $\overrightarrow{PT} = \hat{i} + 2\hat{j} + 3\hat{k}$ be another vector. Then the volume of the parallelopiped determined by the vectors $\overrightarrow{PT}, \overrightarrow{PQ}$ and $\overrightarrow{PS}$ is :

A. 1) 5

B. 2) 20

C. 3) 10

D. 4) 30

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488. If $\left[\vec{a}\times\vec{b}\ \vec{b}\times\vec{c}\ \vec{c}\times\vec{a}\right]=\lambda\left[\vec{a}\ \vec{b}\ \vec{c}\right]^2$, then λ is equal to :

A. 3

B. 0

C. 1

D. 2

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489. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non-zero vectors such that no two of them are collinear and $\left(\vec{a}\times\vec{b}\right)\times\vec{c}=\frac{1}{3}\left|\vec{b}\right|\left|\vec{c}\right|\vec{a}$. If '$\theta$' is the angle between the vectors $\vec{b}$ and $\vec{c}$, then a value of $\sin\theta$ is :

A. $\frac{2\sqrt{2}}{3}$

B. $\frac{-\sqrt{2}}{3}$

C. $\frac{2}{3}$

D. $\frac{-2\sqrt{3}}{3}$.

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490. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three unit vectors such that : $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\sqrt{3}}{2}\left(\vec{b} + \vec{c}\right)$. If $\vec{b}$ is not parallel to $\vec{c}$, then angle between $\vec{a}$ and $\vec{b}$ is :

A. $\frac{\pi}{2}$

B. $\frac{2\pi}{3}$

C. $\frac{5\pi}{6}$

D. $\frac{3\pi}{4}$

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491. Find the values of $'x'$ for which $x\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector.

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492. Find the angle between the vectors $\hat{i}-\hat{j}$ and $\hat{j}-\hat{k}$.

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493. Find $\left|\vec{a}\times\vec{b}\right|$ if $\vec{a}=2\hat{i}+\hat{j}+3\hat{k}$ and $vceb=3\hat{i}+5\hat{j}-2\hat{k}$.

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494. Show that the following vectors are collinear : $2\hat{i}-3\hat{j}+4\hat{k}$ and $-4\hat{i}+6\hat{j}-8\hat{k}$.

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495. Show that the vectors : $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $3\hat{i}-4\hat{j}-4\hat{k}$ form the vertices of a right angled triangle.

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496. If $\left|\vec{a}\right| = a$ and $\left|\vec{b}\right| = b$, prove that $\left(\frac{\vec{a}}{a^2} - \frac{\vec{b}}{b^2}\right)^2 = \left(\frac{\vec{a} - \vec{b}}{ab}\right)^2$.

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497. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, find : $\left(\hat{r} \times \hat{i}\right) \cdot \left(\hat{r} \times \hat{j}\right) + xy$.

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498. Find the value of $'\lambda'$ such that the vectors : $3\hat{i} + \lambda\hat{j} + 5\hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $2\hat{i} - \hat{j} + \hat{k}$ are coplanar.

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499. If $\left|\vec{a}\right|$=3, $\left|\vec{b}\right|$=4 and $\left|\vec{c}\right|$=5 and each of them is perpendicular to the sum of other two then find the value of $\left|\vec{a}+\vec{b}+\vec{c}\right|$

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500. Prove that : $\sin(A-B)=\sin A\cos B-\cos A\sin B.$

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