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MATHS

BOOKS - PRADEEP PUBLICATION

VECTORS

Example

1. If $\vec{c} = 3\vec{a} + 4\vec{b}$ and $2\vec{c} = \vec{a} - 3\vec{b}$ then show that $\vec{c}$ and $\vec{a}$ are like vectors and $|\vec{c}| > |\vec{a}|$.

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

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3. If a,b,c and d be the position vectors of the points A,B,C and D respectively, referred to same origin O such that no three of these points are collinear and a+c=b+d, then quadrilateral ABCD is a

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4. ABCD is a quadrilateral. E is the point of intersection of the line joining the mid-points of the opposite sides. If O is any point and OA+OB+OC+OD=xOE, then x is equal to

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5. 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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6. Solve for $\vec{x}$, the equation:

$\vec{A}C + \vec{x} = \vec{0}$

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7. Solve for $\vec{x}$, the equation:

$\vec{D}E + \vec{x} = \vec{D}C$

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8. Solve for $\vec{x}$, the equation: ,br>$\vec{A}E + \vec{x} = \vec{A}C$

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9. Solve for $\vec{x}$, the equation:

$\vec{B}E + \vec{x} + \vec{E}D = \vec{B}D$, where ABCD is a quadilateral whose diagonals intersects in E.

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10. ABCD is a quadilateral in which [BC] is parallel to [AD] and the ratio of the lengths $BC : AD : : 4 : 7$. Taking $\overrightarrow{A}B$ and $\overrightarrow{A}D$ as represseentatives of vectors $\overrightarrow{v}$ and $7\overrightarrow{u}$ respectively, find the vectors represented by $\overrightarrow{B}C$

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11. differentiate the following

$y = \sin 9x + \cos ec2x$

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12. Differentiate the following

$y = \log(e^x) + x^3$

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13. If A,B and C are the vertices of a triangle whose position vectors are a,b and c and G is the centroid of the ΔABC, then $GA + GB + GC$ is

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14. Differentiate the following

$y = \cos(\log(e^x))$

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15. 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, internally.

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16. 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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17. If the mid-points of the consecutives sides of any quadrilateral are connected by straight lines, prove that the resulting quadilateral is a paralellogram.

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18. Write each of the statements in the form if then

A quadrilateral is a paralleogram if its diagonals bisect each other.

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19. Show that the points with position vectors $\vec{a}-2\vec{b}+3\vec{c}$, $-2\vec{a}+3\vec{b}+2\vec{c}$ and $-8\vec{a}+13\vec{b}$ are collinear, whatever $\vec{a}, \vec{b}$ and $\vec{c}$ may be.

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20. 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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21. Four points P,Q,R and S with respective position vectors $\vec{p}, \vec{q}, \vec{r}$ and $\vec{s}$ are such that $5\vec{p} - 2\vec{q} + 6\vec{r} - 9\vec{s} = \vec{0}$. Show that the four points are coplanar and find the P.V. of the point in which the lines PQ and RS intersect.

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22. If O and H be the circumcentre and orthocentre respectively of triangle ABC, prove that $\vec{O}A + \vec{O}B + \vec{O}C = \vec{O}H$.

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23. If S and O be the circumcentre and orthocentre respectively of triangle ABC, prove that $\overrightarrow{S}A + \overrightarrow{S}B + \overrightarrow{S}C = \overrightarrow{S}O$.

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24. If A (2,4) and B (-5,-3) are respectively the initial and final points of a vector $\overrightarrow{v}$, find components of $\overrightarrow{v}$ and the magnitude of $\overrightarrow{v}$.

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25. If A is the point (1,2) and the vector $\overrightarrow{A}B$ has components 2 and 6, find the point B.

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26. Let $\vec{a} = \hat{i} + 2\hat{j}$ 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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27. Find the vector in the direction of the vector $\hat{i} - 2\hat{j}$ that has magnitude 7 units.

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

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29. Find the components of a vector $\vec{v}$ whose magnitude is $5\sqrt{3}$ and which makes an angle of 120 with positive direction of X- axis.

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30. Using vectors, prove that the point A(1,2), B(3,8) and (-3,-10) are collinear.

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31. A(5,4),B(3,8),C(-1,6) and D are coplanar points. Find the coordinates of D so that $\vec{A}B = \vec{D}C$.

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32. If $\vec{v}_1 = (2, -3), \vec{v}_2 = (0, 1)$ and $\vec{v}_3 = (-1, 6)$, find a unit vector parallel to $\vec{v}_1 + 2\vec{v}_2 - \vec{v}_3$.

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33. If $\vec{v}_1 = (2, -3), \vec{v}_2 = (0, 1)$ and $\vec{v}_3 = (-1, 6)$, find a unit vector parallel to $\vec{v}_1 + 2\vec{v}_2 - \vec{v}_3$.

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34. Find the co-ordinates of the points A,B,C and D in the given figure.

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35. Find the components and magnitude of the vector $\vec{P}Q$ where P and Q are the points (-1,-2,4) and (2,0,-2) respectively.

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36. The vector $\vec{v} = \vec{A}B$ has components 3,-4 and 5 and the point A has the coordinates(2,-3,1). Find the point B.

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37. Find the values of x,y and z so that the vectors $\overrightarrow{a} = x\hat{i} + 2\hat{j} + z\hat{k}$ and $\overrightarrow{b} = 2\hat{I} + y\hat{j} + \hat{k}$ are equal.

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38. Find the unit vector in the direction of vector vec PQ ,P(1,2,3) and Q(5,6,7)

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

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

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41. Find a unit vector in the direction of the sum of the vectors:

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

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42. Show that the points A(3,5,1), B(-1,0,8) and C(7,10,-6) are collinear.

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43. 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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44. Prove that the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ are coplanar.

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45. Show that the points (1,0,1),(1,1,0),(0,1,1) and (0,0,2) are coplanar.

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46. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, find a vector of magnitude 6 units which is parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$.

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47. Show that the points $A\left(2\hat{i} - \hat{j} + \hat{k}\right)$, $B\left(\hat{i} - 3\hat{j} - 5\hat{k}\right)$ and $C\left(3\hat{i} - 4\hat{j} - 4\hat{k}\right)$ are the vertices of a right angled triangle.

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48. Vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are given by $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j}$, $\vec{c} = 3\hat{i} + 5\hat{j} - 2\hat{k}$ and $\vec{d} = -\hat{j} + \hat{k}$. Show that the vectors $\vec{b} - \vec{a}$ and $\vec{d} - \vec{c}$ are parallel and find the ratio of their lengths.

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49. Find the values of x and y if the points (x,-1,3), (3,y,1) and (-1, 11,9) are collinear.

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50. Show that the vectors $\vec{a} = \hat{i} - 3\hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} - 4\hat{j} - 4\hat{k}$ and $\vec{c} = 3\hat{i} + 2\hat{j} - 3\hat{k}$ are linearly independent.

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51. Find $\vec{v}_1 \cdot \vec{v}_2$ when $\vec{v}_1 = 4\hat{i} + 12\hat{j} - 3\hat{k}$, $\vec{v}_2 = -2\hat{i} + 6\hat{j} + 9\hat{k}$.

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52. Find $\vec{v}_1 . \vec{v}_2$ when $\vec{v}_1 = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{v}_2 = -2\hat{j} + 4\hat{k}$.

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53. Find $\vec{v}_1 . \vec{v}_2$ when $\vec{v}_1 = (2, 3, -1)$, $\vec{v}_2 = (-1, 2, 3)$.

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54. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}| = 10, |\vec{b}| = 15$ and $\vec{a} . \vec{b} = 75\sqrt{2}$, find the angle between $\vec{a}$ and $\vec{b}$.

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

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56. Find the angle between the vectors (1,-1,1) and (2,3,6).

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57. Find the angle between the vectors $3\hat{i} - 2\hat{j} - 6\hat{k}$ and $4\hat{i} - \hat{j} - 8\hat{k}$.

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

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

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60. Prove that the three vectors $3\hat{i} + \hat{j} + 2\hat{k}$, $\hat{i} - \hat{j} - \hat{k}$ and $\hat{i} + 5\hat{j} - 4\hat{k}$ are at right angle to one another.

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61. If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that the vecctors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular.

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62. Find λ if the vectors $\vec{a} = \hat{i} - \lambda\hat{j} + 3\hat{k}$ and $\vec{b} = 4\hat{i} - 5\hat{j} + 2\hat{k}$ are perpendicular to each other.

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63. If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ be such that $\vec{a} + \lambda\vec{b}$ is at right angles to $\vec{c}$, then find λ.

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64. Show hat the vectors $\vec{a} = \frac{1}{7}\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$, $\vec{b} = \frac{1}{7}\left(6\hat{i} + 2\hat{j} - 3\hat{k}\right)$ and $\vec{c} = \frac{1}{7}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right)$ are mutually orthogonal unit vectors.

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65. Find λ if the vector $\lambda\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector.

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66. Show that the vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}, \vec{b} = \hat{i} - 3\hat{j} - 5\hat{k}$, $\vec{c} = 3\hat{i} - 4\hat{j} - 4\hat{k}$ form a right angled triangle.

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67. Find the angles of the triangle whose vertices are (0,-1,-2), B(3,1,4) and C(5,7,1).

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68. 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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69. If $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$, prove that $\vec{a}$ and $\vec{b}$ are perpendicular.

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

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71. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 1$ 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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72. Find two vectors of unit length which make angles of $\angle 45$ with (1,0,0) and are at right angles to (0,0,1).

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73. 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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74. Show that the projection of $\vec{a}$ on $\vec{b} \neq \vec{0}$ is $\left[\frac{\vec{a}.\vec{b}}{|\vec{b}|2}\right]\vec{b}$. Hence find the projection of $\vec{P}Q$ on $\vec{A}B$ where P,Q,A,B are the points (-2,1,3),(3,2,5), (4,-3,5),(7,-5,-1) respectively

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75. In any triangle ABC, prove that $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$.

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76. Show that the diagonals of a rhombus bisect each other at right angles.

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77. Prove that angle in a semi-circle is right angle.

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78. Prove analytically that the altitudes of a triangle are concurrent.

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

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80. Determine the lengths of the diagonals of a parallelogram whose adjacent sides are $\vec{a} = 2\vec{m} + \vec{n}$ and $\vec{b} = \vec{m} - 2\vec{n}$ where $\vec{m}$ and $\vec{n}$ are unit vectors inclined at an angle of $\angle 60$.

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81. If $\vec{a} = 2\hat{i} - 3\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} - 4\hat{k}$, find $\vec{a} + \vec{b}$.

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82. The vector $-\hat{i} + \hat{j} - \hat{k}$ bisects the angle between the vector $\vec{c}$ and $3\hat{i} + 4\hat{j}$. Determine the unit vector along $\vec{c}$.

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83. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar vectors, prove that

$$\begin{vmatrix} \vec{a} & \vec{b} & \vec{c} \\ \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \end{vmatrix} = \vec{0}.$$

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84. In a parallelogram ABCD, the bisector of $\angle A$ also bisects BC at X. Prove that AD = 2AB.

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85. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, $|\vec{a}|=1, |\vec{b}|=4$ and $|\vec{c}|=2$, then find the value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$.

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

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87. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}|=3, |\vec{b}|=4$ and $|\vec{c}|=5$ and one of them being perpendicular to the sum of the other two, find $|\vec{a}+\vec{b}+\vec{c}|$.

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88. Constant forces $2\hat{i} - 5\hat{j} + 6\hat{k}$ and $-\hat{i} + 2\hat{j} - \hat{k}$ act on the particle. Determine the work done when the particle is displaced from a point A with position vector $4\hat{i} - 3\hat{j} - 2\hat{k}$ to a point B with position vector $6\hat{i} + \hat{j} - 3\hat{k}$.

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89. Find the magnitude of $\overrightarrow{v} =_1 \left(3\hat{k} + 4\hat{j}\right) \cdot \left(\hat{i} + \hat{j} - \hat{k}\right)$.

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90. If $\overrightarrow{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 3\hat{i} + 5\hat{j} - 2\hat{k}$, find $|\overrightarrow{a} \cdot \overrightarrow{b}|$.

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91. Integrate the following

$\int \log(3x)dx$

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92. Taking $\vec{v}_1 = \hat{i} + 2\hat{j} - \hat{k}$, $\vec{v}_2 = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{v}_3 = \hat{i} + \hat{j} + \hat{k}$ verify that $\left(\vec{v}_1 \cdot \vec{v}_2\right)\vec{v}_3 \neq \vec{v}_1\left(\vec{v}_2 \cdot \vec{v}_3\right)$.

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93. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, find ($\vec{r} \cdot \hat{i}$).($\vec{r} \cdot \hat{j}$) +xy.

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94. Find a unit vector 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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95. Find all vectors of magnitude 10 sqrt 3 that are perpendicular to the plane of vectors $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{b} = -\hat{i} + 3\hat{j} + 4\hat{k}$.

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

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97. If $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j}$ and $\vec{c} = 3\hat{i} - 4\hat{j} - 5\hat{k}$, then find a unit vector perpendicular to both of the vectors $\vec{a} - \vec{b}$ and $\vec{c} - \vec{b}$.

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98. Find the cosine and the sine of the angle between the vectors $\overrightarrow{v}_1 = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\overrightarrow{v}_2 = 4\hat{i} - 2\hat{j} + 2\hat{k}$.

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99. The vectors from the origin O to the points P and Q are respectively $2\hat{i} - 6\hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} + 2\hat{k}$. Determine the area of the parallelogram formed by $\overrightarrow{O}P$ and $\overrightarrow{O}Q$ as adjacent sides.

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

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

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

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103. Prove that $\left(\vec{a} - \vec{b}\right) \times \left(\vec{a} + \vec{b}\right) = 2\left(\vec{a} \times \vec{b}\right)$ give a geometrical interpretation to it. Hence find the area of the parallelogram whose diagonals are the vectors $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} + 4\hat{k}$.

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104. If $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} \neq \vec{0}$, then show that $\vec{a} + \vec{c} = k\vec{b}$ where k is a scalar.

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105. Let $\vec{A}, \vec{B}, \vec{C}$ be unit vectors. Suppose that $\vec{A} \cdot \vec{B} = \vec{A} \cdot \vec{C} = 0$ and the angle between $\vec{B}$ and $\vec{C}$ is $\frac{\pi}{6}$. Prove that $\vec{A} = \pm 2\left(\vec{B} \times \vec{C}\right)$.

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106. Let $a = \hat{i} + 4\hat{j} + 2\hat{k}, b = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $c = 2\hat{i} - \hat{j} + 4\hat{k}$ Find a vector d which is perpendicular to both a and b and c.d=15.

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107. If a,b,c are the lengths of the sides [BC],[CA] and [AB] of triangle ABC, prove that $\vec{B}C + \vec{C}A + \vec{A}B = \vec{0}$ and deduce that

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

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108. If $\vec{a}$ and $\vec{b}$ are any two vectors, show that $\left|\vec{a} \times \vec{b}\right|^2 = \begin{bmatrix} \vec{a}\cdot\vec{a} & \vec{a}\cdot\vec{b} \\ \vec{a}\cdot\vec{b} & \vec{b}\cdot\vec{b} \end{bmatrix}.$

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109. Find the vector whose length is 3 and which is perpendicular to the vectors $\vec{a} = 3\hat{i} + \hat{j} - 4\hat{k}, \vec{b} = 6\hat{i} + 5\hat{j} - 2\hat{k}.$

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110. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three proper vectors such that $\vec{a}\cdot\vec{b} = \vec{c}$, $\vec{b}\cdot\vec{c} = \vec{a}$. Prove that $\vec{a}, \vec{b}, \vec{c}$ are mutually at right angles and $\left|\vec{b}\right| = 1$,|quad vec c|=|quad vec a|.

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111. If $\overrightarrow{A} = (1, 1, 1), \overrightarrow{C} = (0, 1, -1)$ are two given vectors, then find a vector $\overrightarrow{B}$ satisfying the equations $\overrightarrow{A} \times \overrightarrow{B} = \overrightarrow{C}$ and $\overrightarrow{A} \cdot \overrightarrow{B} = 3$.

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112. If A,B,C and D are any four points in space prove that $\left|\overrightarrow{AB} \times \overrightarrow{CD} + \overrightarrow{BC} \times \overrightarrow{AD} + \overrightarrow{CA} \times \overrightarrow{BD}\right| = 4(areaof\Delta ABC)$.

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113. If $\overrightarrow{\alpha} = 3\hat{i} - \hat{j}$ and $\beta = 2\hat{i} + \hat{j} - 3\hat{k}$, express $\overrightarrow{\beta}$ in the form $\overrightarrow{\beta} = \overrightarrow{\beta}_1 + \overrightarrow{\beta}_2$ where β_1 is parallel to $\overrightarrow{\alpha}$ and $\overrightarrow{\beta}_2$ is perpendicular to $\overrightarrow{\alpha}$.

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114. Using vectors, prove that $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$.

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115. integrate the following

$$\int \frac{dx}{\sqrt{16 - x^2 - 6x}}$$

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116. integrate the following

$$\int \frac{dx}{\sqrt{11 - x^2 - 10x}}$$

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Exercise

1. Classify the following physical quantities into scalars and vectors:

$9gm$

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2. Classify the following physical quantities into scalars and vectors:

5 seconds

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3. Classify the following physical quantities into scalars and vectors:

$1000cm^3$

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4. Classify the following physical quantities into scalars and vectors:

2 radians

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5. Classify the following physical quantities into scalars and vectors:

30 m/s

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6. Classify the following physical quantities into scalars and vectors:

20 m/s towards north

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7. Classify the following physical quantities into scalars and vectors:

10 Newton

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8. Classify the following physical quantities into scalars and vectors:

10 gm/cm^3

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9. Classify the following physical quantities into scalars and vectors:

$981\frac{m}{s^2}$ towards the centre of earth

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10. Find $\lambda \in R$ such that $\left|\lambda \vec{a}\right| = 1, \vec{a}$ being a non-zero vector.

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11. If $\left|\vec{a}\right| = 2$, find $\left|4\vec{a}\right|, \left|10\vec{a}\right|$ and $\left|(-5)\vec{a}\right|$.

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12. Is it possible that $\left|\vec{a} + \vec{b}\right| = \left|\vec{a}\right| + \left|\vec{b}\right|$? If yes, when?

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

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14. Does $|\vec{a}| = |\vec{b}|$ imply $\vec{a} = \vec{b}$?

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15. If A,B,C,D are the points with position vectors $\vec{a}, \vec{b}, 3\vec{a} + 2\vec{b}$ and $\vec{a} - 2\vec{b}$ respectively , show that $\vec{AC} = 2\vec{a} + 2\vec{b}$ and $\vec{DB} = 3\vec{b} - a$.

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16. If $\vec{c} = 3\vec{a} + 4\vec{b}$ and $2\vec{c} = \vec{a} - 3\vec{b}$, show that $\vec{c}$ and $\vec{b}$ have opposite directions and $|\vec{c}| > 2|\vec{b}|$.

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17. If the position vector of a point A is $\vec{a} + 2\vec{b}$ and $\vec{a}$ divides AB in the ratio $2:3$, then the position vector of B, is

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18. If ABC is triangle and D is the mid-point of [BC], prove that $\vec{A}B + \vec{A}C = 2\vec{A}D$.

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19. If $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find $\vec{a} - 2\vec{b}$.

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20. If $\vec{a} = 5\hat{i} - \hat{j} - 2\hat{k}$ and $\vec{b} = 5\hat{i} + \hat{j} - 2\hat{k}$, find $3\vec{a} - \vec{b}$.

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21. If ABCD is a parallelogram and $\vec{A}B = \vec{a}, \vec{B}C = \vec{b}$ then show that $\vec{A}C = \vec{a} + \vec{b}$ and $\vec{B}D = \vec{b} - \vec{a}$.

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22. If ABCD is a parallelogram and $\vec{A}B = \vec{a}, \vec{B}C = \vec{b}$ then give geometrical significance of $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$.

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23. ABC is any triangle and D,E,F are the mid-points of sides $\overrightarrow{BC}, \overrightarrow{CA}$ and $\overrightarrow{AB}$respectively. Express the $\overrightarrow{BE}$ and $\overrightarrow{CF}$ as linear combination of vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$.

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24. ABCD is a parallelogram and [AC], [BD]are its diagonals. Express $\vec{A}C$ and $\vec{B}D$ in terms of $\vec{A}B$ and $\vec{A}D$.

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25. ABCD is a parallelogram and [AC], [BD]are its diagonals. Express $\vec{A}B$ and $\vec{A}D$ in terms of $\vec{A}C$ and $\vec{B}D$.

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26. Evaluate $\int \frac{dx}{x^2 + 10x + 34}$

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27. 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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28. Apply vectors to prove that if a pair of opposite sides of quadrilateral are equal and parallel, then the figure is a parallelogram.

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29. P is a point on the side BC of ΔABC and Q is a point such that PQ is the resultant of AP,PB and PC. Then, ABQC is a

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30. Evaluate $\int \frac{dx}{x^2 + 8x + 25}$

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31. If $\overrightarrow{a}$ is a vectors of magnitude 3 pointing eastwards and $\overrightarrow{b}$ is vector of magnitude 7 pointing westwards find the magnitude and direction of

$\vec{a} - \vec{b}$.

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32. Evaluate $\int \frac{dx}{x^2 + 12x + 37}$

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33. integrate the following

$$\int \frac{dx}{x^2 + 10x + 16}$$

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34. integrate the following

$$\int \frac{dx}{x^2 + 8x + 12}$$

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35. integrate the following

$$\int \frac{dx}{\sqrt{x^2 + 6x + 13}}$$

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36. Show that the mid-points o ftwo opposite sides of quadilateral and the mid-points of the diagonals are the vertices of parallelogram.

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37. ABCD is a quadrilateral and O is point in its plane. Show that if $\vec{O}A + \vec{O}B + \vec{O}C + \vec{O}D = \vec{0}$, then O is the point of the interection of the lines joining the mid-points of the opposite sides of ABCD.

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38. ABCD is a parallelogram . If P and Q are the mid-points of [BC] and [CD] respectively, show that $\overrightarrow{A}P + \overrightarrow{A}Q =$

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39. Evaluate

$$\int \frac{dx}{3x^2 + 6x + 5}$$

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40. A,B,C and D are four points with position vectors $\overrightarrow{a}$, $\overrightarrow{b}$, $\overrightarrow{c}$ and $\overrightarrow{d}$ respectively such that $5\overrightarrow{a} - 2\overrightarrow{b} + 6\overrightarrow{c} - 9\overrightarrow{d} = \overrightarrow{0}$. Show that the point A,B,C,D are coplanar and find find the P.V. of the point in which the lines AC and BD intersects.

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41. ABCDEF is a regular hexagon. Express the vectors $\overrightarrow{CD}, \overrightarrow{DE}, \overrightarrow{EF}, \overrightarrow{FA}, \overrightarrow{CE}$ in terms of $\overrightarrow{AB}$ and $\overrightarrow{BC}$.

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42. Express the vector $a = 5\hat{i} - 2\hat{j} + 5\hat{k}$ as sum of two vectors such that one is parallel to the vector $b = 3\hat{i} + \hat{k}$ and the other is perpendicular to b.

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43. Find the component of vector $\overrightarrow{P}Q$ where:

P(2,3), Q(5,-3). Also, find the magnitude of $\overrightarrow{P}Q$.

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44. Find the component of vector $\overrightarrow{P}Q$ where:

P(-1,-3), Q(4,5).Also, find the magnitude of $\overrightarrow{P}Q$.

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45. Find the component of vector $\overrightarrow{PQ}$ where:

P(0,2), Q(-5,-6).Also, find the magnitude of $\overrightarrow{PQ}$.

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46. Find the component of vector $\overrightarrow{PQ}$ where:

P(2,4), Q(5,3).Also, find the magnitude of $\overrightarrow{PQ}$.

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47. In each of the following problems, components of $\overrightarrow{A}B$ along X-axis and Y-axis are respectively a_1 and a_2. Find the point B when:

$a_1 = 2, a_2 = 3, A(2, -3)$.

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48. In each of the following problems, components of $\vec{A}B$ along X-axis and Y-axis are respectively a_1 and a_2. Find the point B when:

$a_1 = -2, a_2 = -4, A(-1, -2)$.

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49. In each of the following problems, components of $\vec{A}B$ along X-axis and Y-axis are respectively a_1 and a_2. Find the point B when:

$a_1 = -5, a_2 = 4, A(7, 8)$.

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50. Find the components of vector $\vec{v}$ making an angle α with positive direction of X-axis, when:

$\left|\vec{v}\right| = 3\sqrt{2}, \alpha = \angle 45.$

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51. Find the components of vector $\vec{v}$ making an angle α with positive direction of X-axis, when:

$\left|\vec{v}\right| = 10, \alpha = \angle 30.$

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52. Find the components of vector $\vec{v}$ making an angle α with positive direction of X-axis, when:

$\left|\vec{v}\right| = \sqrt{3}, \alpha = \angle 60.$

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53. Find the components of vector $\vec{v}$ making an angle α with positive direction of X-axis, when:

$\left|\vec{v}\right| = 5, \alpha = \angle 180.$

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54. Find the components of vector $\vec{v}$ making an angle α with positive direction of X-axis, when:

$\left|\vec{v}\right| = 20, \alpha = \angle 240.$

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55. Find the components of vector $\vec{v}$ making an angle α with positive direction of X-axis, when:

$\left|\vec{v}\right| = 3\sqrt{2}, \alpha = \angle 45.$

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56. Find the corordinates of the terminal point of the position vector which is equivalent to $\vec{P}Q$ where P(2,6), Q(-1,2).

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57. 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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58. If $\vec{a} = 2\hat{I} - 3\hat{j}, \vec{b} = 3\hat{i} + 2\hat{j}$ and $\vec{c} = \hat{i} + \hat{j}$, find the components of vector $\vec{a} - 2\vec{b} + \vec{c}$.

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59. Let $A(2, -1), B(-1, 2), C(3, 1)$ and $D(0, 4)$. Show that $\overrightarrow{AB} = \overrightarrow{CD}$.

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60. Given four points $A(2, 2), B(2, 4), C(1, 2)$ and $D(-1, 3)$. Find the point P that $\overrightarrow{AP} = \overrightarrow{AB} + \overrightarrow{CD}$.

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61. Let $\vec{a}$ and $\vec{b}$ be the position vectors of the points (3,-5) and (m,4) respectively. Find m if the vectors $\vec{a}$ and $\vec{b}$ are collinear.

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62. ABCD is a parallelogram. If the points A , B and C are respectively : (0,0), (2,2),(1,3) Find the coordinates of the point D.

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63. ABCD is a parallelogram. If the points A , B and C are respectively : (2,3), (1,4),(1,-2) Find the coordinates of the point D.

Watch Video Solution

64. ABCD is a parallelogram. If the points A , B and C are respectively : (2,3), (1,4),(1,-2) Find the coordinates of the point D.

Watch Video Solution

65. ABCD is a parallelogram. If the points A , B and C are respectively : (-2,-1), (3,0),(0,-2) Find the coordinates of the point D.

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

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67. Using vectors, prove that the following point are collinear:

$(1, 2), (3, 8), (7, 20)$

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68. Using vectors, prove that the following point are collinear:

(-2,3,5),(1,2,3),(7,0,-1)

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69. Using vectors, prove that the following point are collinear:

(7,9),(-1,1),(-5,-3)

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70. Using vectors, prove that the following point are collinear:

(-1,2),(0,0),(2,-4)

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71. Find the unknown x if the points (2,4), (7,x) and (-1,1) are collinear.

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72. If $\vec{\alpha}$ and $\vec{\beta}$ are non-collinear vectors and $\vec{a}=(x+4y)\vec{\alpha}+(2x+y+1)\vec{\beta}$ and $\vec{b}=(y-2x+2)\vec{\alpha}+(2x-3y-1)\beta$, find x and y so that $3\vec{a}=2\vec{b}$.

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73. If the position vectors of the vertices A,B and C of $\triangle ABC$ are respectively $\vec{0}$, $-20\hat{i}+15\hat{j}$ and $36\hat{I}+15\hat{j}$. Find the P.V. of the incentre of the triangle.

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74. Find the length of the vector $3\hat{i} + 4\hat{j} - 12\hat{k}$.

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75. Find the components o fteh vector $\overrightarrow{A}B$ where A and B are the points(2,0,3) and (-1,2,-3) respectively. Also , find the length of this vector.

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76. Find the coordinates of the final point of vector $\overrightarrow{v}$ whose components are 2,3,-4 and whose initial point is (3,-6,2). Also find $\left|\overrightarrow{v}\right|$.

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77. Find the unit vector in the direction of $3\hat{i} - 6\hat{j} - 2\hat{k}$.

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78. Find the unit vector in the direction of $12\hat{i} - 5\hat{k}$.

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79. Find a unit vector parallel to the sum of the vector $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}$, $\overrightarrow{b} = 3\hat{i} + \hat{j} - 4\hat{k}$ and $\overrightarrow{c} = -2\hat{i} - \hat{j} - \hat{k}$.

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80. Show that the points A,B and C whose position vectors are repectively $2\hat{i} + \hat{j} - \hat{k}, 3\hat{i} - 2\hat{j} + \hat{k}$ and $\hat{i} + 4\hat{j} - 3\hat{k}$ are collinear.

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81. Find the unit vector in the direction of sum of vectors $-2\hat{i} - 3\hat{j} + 2\hat{k}$, $3\hat{i} + 4\hat{j} - 2\hat{k}$ and $\hat{i} + 2\hat{j} + 6\hat{k}$.

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82. If $\overrightarrow{A}B = a\hat{i}_1 + a\hat{j}_2 + a_{\hat{k}}$ and A has the cordinates (b1,b2,b3), find the cordinates of B.

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83. Find a unit vector in the direction of $\overrightarrow{a} - 2\overrightarrow{b} + 3\overrightarrow{c}$ if $\overrightarrow{a} = \hat{i} + \hat{j}$, $\overrightarrow{b} = \hat{j} + \hat{k}$ and $\overrightarrow{c} = \overrightarrow{i} + \overrightarrow{k}$.

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84. Find the points of trisection of [PQ] if the position vectors of P and Q are respectively $3\hat{i} + 2\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$.

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85. Show that the point A,B,C and D whose position vectors are respectively $2\hat{i}+4\hat{j}+2\hat{k}$, $\hat{i}+2\hat{j}+\hat{k}$, $3\hat{i}+\hat{j}-3\hat{k}$ and $4\hat{i}+3\hat{j}-2\hat{k}$ are the vertices of a paralleogram (use vector method).

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86. The position vectors of the points A, B, C and D are respectively $4\hat{i}+3\hat{j}-\hat{k}$,$5\hat{i}+\hat{j}+2\hat{k}$, $2\hat{i}-3\hat{k}$ and $4\hat{i}-4\hat{j}+3\hat{k}$. Show that AB and CD are parallel.

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87. Find the magnitude and components of the vector 2(-1,0,3) + 3(1,1,2)-(-2,3,0).

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88. Prove that the points A (1,2,3), B(2,3,1) and C(3,1,2) are the vertices of an equilateral triangle.

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89. Prove that the points (1,1,1),(-2,4,1),(-1,5,5) and (2,2,5) taken in order ,are the vertices of a square. Find the area of square.

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

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91. 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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92. The sides of a parallelogram represent the vectors $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$. Find the unit vectors parallel to its diagonals.

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93. Let $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{c} = -\hat{i} + 2\hat{k}$. Find the vector in the direction of $\vec{b} - \vec{a} - 2\vec{c}$ and having length $2\sqrt{30}$.

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94. Prove that the points whose position vectors are $\hat{i} - \hat{j} + \hat{k}$, $2\hat{i} + 3\hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} + 3\hat{k}$, $-2\hat{j} + 3\hat{k}$ lie in the same plane.

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95. Prove that the vectors $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = -2\hat{i} + \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - 2\hat{k}$ are coplanar.

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96. Show that the points (1,1,1),(2,-1,2),(-1,2,2) and (2,2,-1) are coplanar.

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97. Show that the points A(4,5,1), B(0,-1,-1), C(3,9,4) and D(-4,4,4) are coplanar.

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98. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are non-coplanar (independent) vectors, prove that the vectors $\vec{a} - 2\vec{b} + 3\vec{c}$, $-2\vec{a} + 3\vec{b} - 4\vec{c}$ and $\vec{a} - \vec{b} + 2\vec{c}$ are also linearly independent.

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99. Find $\vec{v}_1 \cdot \vec{v}_2$ when $\vec{v}_1 = 4\hat{i} + 12\hat{j} - 3\hat{k}$, $\vec{v}_2 = -2\hat{i} + 6\hat{j} + 9\hat{k}$.

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100. Find $\vec{v}_1 \cdot \vec{v}_2$ when $\vec{v}_1 = (1, 3, 5)$, $\vec{v}_2 = (5, -7, 9)$.

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101. Find the angle between the vectors:

$\vec{v}_1 = \hat{i} - 2\hat{j} - 2\hat{k}$ and $\vec{v}_2 = 2\hat{i} + 3\hat{j} - 6\hat{k}$.

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102. Find the angle between the vectors:

$\vec{v}_1 = (3, 5, 4)$ and $\vec{v}_2 = (2, -2, 1)$.

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

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104. If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + \hat{j} - 2\hat{k}$ and $\vec{c} = \hat{i} + 3\hat{j} - \hat{k}$, find lambda if $\vec{a}$ is at right angles to $\lambda\vec{b} + \vec{c}$.

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105. Find the value of a for which the vector $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} + a\hat{j} + 3\hat{k}$ are perpendicular.

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106. Find the value of a for which the vector $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} + a\hat{j} + 3\hat{k}$ are parallel.

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107. If $\left(\vec{a}\right)^2 = \left(\vec{b}\right)^2$, is it necessary that $\vec{a} = \vec{b}$?

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108. Find the angles which the vector $3\hat{i} - 6\hat{j} + 2\hat{k}$ makes the co-ordinates axes.

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

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

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

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112. If the vertices A,B,C of $\triangle ABC$ have position vectors (1,2,3), (-1,0,0), (0,1,2) respectively what is the magnitude of the angle ABC?

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113. 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 $\vec{A}B$ and $\vec{C}D$. Are $\vec{A}B$ and $\vec{C}D$ collinear?

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114. If $\vec{a}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{b}=3\hat{i}-\hat{j}+2\hat{k}$, show that the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are at right angles.

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

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116. Find the projection (vector) of the vector $7\hat{i} + \hat{j} - 4\hat{k}$ on $7\hat{i} + \hat{j} - 3\hat{k}$

.

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117. Find the projection of $\vec{A}B$ on $\vec{P}Q$ where P,Q,A,B are the points (-2,1,3),(0,2,5),(4,-3,0),(7,-5,-1) respectively.

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118. 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 $\vec{A}B$ along $\vec{C}D$.

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

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

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121. Prove that the vectors $\vec{a}=\hat{i}-3\hat{j}-5\hat{k}$, $\vec{b}=2\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}=\hat{i}+2\hat{j}+6\hat{k}$ from of a right angled triangle.

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122. If A,B,C have position vectors (0,1,1),(3,1,5),(0,3,3) respectively, prove that $\triangle ABC$ is right angled at C.

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123. Prove Cauchy- Schwarz inequality $\left|\vec{a}\cdot\vec{b}\right| < |\vec{a}||\vec{b}|$.

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124. For any two vectors $\vec{a}$ and $\vec{b}$, prove that $\left(\vec{a}\cdot\vec{b}\right)^2 \le |\vec{a}|^2|\vec{b}|^2$

.

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125. If $|\vec{a}| = 1$, $|\vec{b}| = 1$ and $|\vec{a}+\vec{b}| = 1$, prove that $\left|\vec{a}-\vec{b}\right| = \sqrt{3}$.

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126. If $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$, prove that $\vec{a}$ and $\vec{b}$ are perpendicular.

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127. If $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}-\vec{b}\right)=0$, show that $\left|\vec{a}\right|=\left|\vec{b}\right|$.

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128. If $\vec{a}$ and $\vec{b}$ are any two vectors, then prove that $\left|\vec{a}+\vec{b}\right|^2+\left|\vec{a}-\vec{b}\right|^2=2\left|\vec{a}\right|^2+2\left|\vec{b}\right|^2$.

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129. Prove that two proper vectors $\vec{a}$ and $\vec{b}$ are the right angles iff $\left|\vec{a}+\vec{b}\right|^2=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2$.

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130. 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 zero vector.

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131. Find a vector $\vec{c}$ such that $\vec{c}\cdot\left(\hat{i}+\hat{j}\right)=2$, $\vec{c}\cdot\left(\hat{i}-\hat{j}\right)=3$ and $\vec{c}\cdot\hat{k}=0$.

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132. Find a vector $\vec{c}$ such that $\vec{c}.\hat{i}=\vec{c}.\hat{j}=\vec{c}.\hat{k}$ and $\left|\vec{c}\right|=100$.

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133. 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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134. 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 if $\vec{a}+\vec{b}+\vec{c}=0$, find the value of

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

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135. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular unit vectors , then find the value of $\left| 2\vec{a} + \vec{b} + \vec{c} \right|$.

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

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137. If $\vec{a} + \vec{b} + \vec{c} = 0$, show that the angle$\theta$ between $\vec{a}$ and $\vec{b}$ is given by $\cos \theta$= $c^2 - a^2 - b^2 / 2ab$.

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138. Using vector method, prove that in a triangle, $a = b\cos C + c\cos B$ (projection formula)

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

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140. 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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141. 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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142. Prove that in a right angled triangle the mid-point of the hypotenuse is equidistant from its vertices.

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143. In a triangle OAB, $\angle AOB = 90^\circ$. If P and Q are the points of trisection of AB, prove that $OP^2 + OQ^2 = \frac{5}{9}AB^2$.

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

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146. Prove that if the diagonals of a quadrilateral bisect each other at right angles, then the quadrilateral is a rhombus.

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147. Using vector method, prove that the altitudes of a triangle are concurrent.

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

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149. Prove by vectors that :

$\cos(\alpha+\beta)=\cos\alpha\cos\beta-\sin\alpha\sin\beta.$

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150. Prove by vectors that :

$\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta.$

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151. In each of the following , find the work done by a force $\overrightarrow{F}$ acting on a particle such that the particle is :

$P(-2,3,0), Q(0,1,2), \overrightarrow{F}=2\hat{i}+\hat{j}-\hat{k}.$

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152. In each of the following , find the work done by a force $\vec{F}$ acting on a particle such that the particle is :

$P(-3, 4, 1), Q(-1, -1, 2), \vec{F} = 3\hat{i} + \hat{j} - 2\hat{k}.$

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153. A particle acted on by two forces $4\hat{i} + 3\hat{j}$ and $3\hat{i} + 2\hat{j}$ is displaced from the point $\hat{i} + 2\hat{j}$ to $5\hat{i} + 4\hat{j}$. Find the totral work done by these forces.

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154. A particle is acted upon by constant forces $4\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ which displace it from a point $\hat{i} + 2\hat{j} + 3\hat{k}$ to the point $5\hat{i} + 4\hat{j} + \hat{k}$. Find the work done by the forces in standard units

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155. Find $\overrightarrow{v}_1 \cdot \overrightarrow{v}_2$ if $\overrightarrow{v}_1$=$3\hat{i} + \hat{j} + 2\hat{k}$, '$\overrightarrow{v}_2 = 2\hat{i} - 2\hat{j} + 4\hat{k}$.

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156. Find $\overrightarrow{a} \cdot \overrightarrow{b}$ if $\overrightarrow{a} = 2\hat{i} + \hat{k}$ and $\overrightarrow{b} = \hat{i} + \hat{j} + \hat{k}$

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157. If $\overrightarrow{a} = 4\hat{i} + 3\hat{j} + \hat{k}$ and $\overrightarrow{b} = \hat{i} - 2\hat{k}$, find | vec a *vec b|`.

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158. Evaluate the following products: $\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right) \cdot \left(2\hat{i} + \hat{j} - 2\hat{k}\right)$.

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159. Evaluate the following products: $\left(2\hat{i} + 3\hat{j}\right) \cdot \left(- \hat{i} + 3\hat{j} + \hat{k}\right)$.

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160. Evaluate the following products: $(2, -1, 1)\cdot(3, 4, -1)$.

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161. Taking $\vec{a}=2\hat{i}-3\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+4\hat{j}-2\hat{k}$, verify that $\vec{a}\cdot\vec{b}=\vec{b}\cdot\vec{a}$.

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162. If $\vec{a}=3\hat{i}+4\hat{j}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$, find the value of $\left|\vec{a}\cdot\vec{b}\right|$.

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163. Find the magnitude of $\vec{a}=\left(\hat{i}+3\hat{j}-2\hat{k}\right)\cdot\left(-\hat{i}+3\hat{k}\right)$.

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164. Given $\left|\vec{a}\right| = 10, \left|\vec{b}\right| = 2$and $\vec{a} \cdot \vec{b} = 12$, find $\left|\vec{a}\text{ cross }\vec{b}\right|$.

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165. Define $\vec{a} \cdot \vec{b}$ where $\vec{a}$ and $\vec{b}$ are any two vectors. Find $\vec{a} \cdot \vec{b}$ if $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 5$.

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

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167. Find a unit vector perpendicular to both the planes of $\vec{a}$ and $\vec{b}$, where $\vec{a} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} + \hat{k}$.

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168. Find a unit vector perpendicular to the plane of two vectors $a = \hat{i} - \hat{j} + 2\hat{k}$ and $b = 2\hat{i} + 3\hat{j} - \hat{k}$.

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169. Find the equation of a plane through the points (3,-1,2), (1,-1,-3) and (4,-3,1)

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170. Find a unit vector perpendicular to each of the vectors $\hat{i} + 2\hat{j} + 3\hat{k}$ and $-3\hat{i} - 2\hat{j} + \hat{k}$. Also find the area of the parallelogram determined by these vectors.

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171. Find the sine of the angle between the vectors :

(3,0,3) and (1,2,-7)

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172. Find the sine of the angle between the vectors :

$2\hat{i} + 4\hat{j} + 4\hat{k}$ and $2\hat{i} - 7\hat{j} + \hat{k}$.

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173. Determine the area of the parallelogram whose adjacent sides are the vectors $\hat{i} - 3\hat{j} + \hat{k}$ and $\hat{i} + \hat{j} + \hat{k}$.

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174. Find the area of the parallelogram having two adjacent sides OA and OB where O is the origin and the position vectors of A and B are respectively $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = -3\hat{i} - 2\hat{j} + \hat{k}$.

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175. Find the area of $\triangle PQR$ where P,Q,R have respectively coordinates (1,3,2),(2,-1,1),(-1,2,3) with reference to rectangular system of co-ordinates.

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176. Find the area of the triangle formed by O,A,B where :

$\vec{O}A = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{O}B = -3\hat{i} - 2\hat{j} + \hat{k}$

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177. Find the area of the triangle formed by O,A,B where :

$\vec{O}A = 3\hat{i} + 2\hat{j} + \hat{k}, \vec{O}B = -\hat{i} - 3\hat{j} + \hat{k}$

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178. 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 $\vec{b} - \vec{c}$ where $\vec{a} \neq \vec{d}, \vec{b} \neq \vec{c}$.

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179. Find the area of the triangle ABC where A,B,C are the points (a,0,0), (0,b,0),(0,0,c)respectively, where $abc \neq 0$.

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180. Find the area of the triangle having the points A(1,1,1), B(1,2,3) and C(2,3,1) as vertices.

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181. If $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}, \vec{b} = -\hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{c} = \hat{i} + \hat{j} + \hat{k}$, find $\left(\vec{a} \cdot \vec{b}\right) \cdot \left(\vec{a} \cdot \vec{c}\right)$.

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182. Calculate the product $\left(\left(\hat{i}-2\hat{j}+3\hat{k}\right)cross\left(2\hat{i}+\hat{j}-3\hat{k}\right)\right)\cdot\left(-3\hat{i}+\hat{j}+2\hat{k}\right)$.

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183. If $\overrightarrow{a}=\hat{i}-2\hat{j}+\hat{k}$, $\overrightarrow{b}=2\hat{i}-\hat{j}+\hat{k}$ and $\overrightarrow{c}=\hat{i}+\hat{j}-2\hat{k}$, compute $\left(\overrightarrow{a}\text{ cross }\overrightarrow{b}\right)\cdot\overrightarrow{c}$.

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184. Define the vector product of two vectors $\overrightarrow{a}$ and $\overrightarrow{b}$. If $\overrightarrow{a}=2\hat{i}-\hat{j}+\hat{k}$ and $\overrightarrow{c}=2\hat{i}+3\hat{j}$, then find $\left(\overrightarrow{a}+\overrightarrow{b}\right)\cdot\overrightarrow{c}$ and $\overrightarrow{a}\cdot\left(\overrightarrow{b}+\overrightarrow{c}\right)$.

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185. If $\overrightarrow{a} = 2\hat{i} + 5\hat{j} - 7\hat{k}, \overrightarrow{b} = -3\hat{I} + 4\hat{j} + \hat{k}$ and $\overrightarrow{c} = \hat{i} - 2\hat{j} - 3\hat{k}$, compute $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \cdot \overrightarrow{c}$ and $\overrightarrow{a} \cdot \left(\overrightarrow{b} \times \overrightarrow{c}\right)$ and verify that these are same.

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186. If G is the centroid of $\triangle ABC$, prove that area $\triangle AGB = \frac{1}{3} area \triangle ABC$.

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187. 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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188. Using vectors prove that $\sin(\alpha - \beta)$= $\sin\alpha\cos\beta - \cos\alpha\sin\beta$.

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189. If $\vec{a} = 2\hat{i} + 3\hat{j} + 6\hat{k}$, $\vec{b} = 3\hat{i} - 6\hat{j} + 2\hat{k}$ and $\vec{c} = 6\hat{i} + 2\hat{j} - 3\hat{k}$ then compute $\vec{b} \cdot \vec{c}$ and $\vec{a} \cdot \vec{b}$. Hence evaluate $\vec{a} \cdot \left(\vec{b} \cdot \vec{c}\right)$ and also $\left(\vec{a} \cdot \vec{b}\right) \cdot \vec{c}$.

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

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191. Integrate the following

$$\int x \sin(2x) dx$$

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192. Prove the following : $\vec{a} \cdot \left(\vec{a} \times \vec{b}\right) = 0$, where are $\vec{a}$ and $\vec{b}$ are any two vectors.

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193. Integrate the following

$$\int \frac{dx}{1 + \cos ecx}$$

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194. Integrate the following

$$\int \frac{dx}{1 - \cos ecx}$$

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195. Find the volume of the parallelopied whose co-terminus edges are represented by the vectors

$\overrightarrow{1} = 2\hat{i} + \hat{j} - \hat{k}, \overrightarrow{2}, = \hat{i} + \hat{2}j + 3\hat{k}$ and $\overrightarrow{3} = 3\hat{i} - \hat{j} + 2\hat{k}$

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

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197. Find λ such that the vectors $\overrightarrow{v}_1 = 2\hat{i} - \hat{j} + \hat{k}, \overrightarrow{v}_2 = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\overrightarrow{v}_3 = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar.

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

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199. Prove that the points whose position vectors are $6\hat{i} - 7\hat{j}, 16\hat{i} - 29\hat{j} - 4\hat{k}, 3\hat{j} - 6\hat{k}$ and $2\hat{i} + 5\hat{j} + 10\hat{k}$ are coplanar.

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200. Find x such that the four points A (4, 1, 2), B (5, x, 6), C (5, 1,-1) and D (7, 4, 0) are coplanar

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

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

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204. Prove that $\left[\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}\right]=0$

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205. Integrate the following

$$\int(\cos x)\frac{dx}{1+\sin^2 x}$$

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206. Prove that if $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are any four vectors, then $\left(\vec{a} \times \vec{b}\right) \cdot \left(\vec{c} \times \vec{d}\right) = \begin{bmatrix} \vec{a} \cdot \vec{c} & \vec{b} \cdot \vec{c} \\ \vec{a} \cdot \vec{d} & \vec{b} \cdot \vec{d} \end{bmatrix}$

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207. Compute $\left[\vec{a}\vec{b}\vec{c}\right]$ where $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = \hat{j} + \hat{k}$.

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208. Compute $\left[\vec{a}\vec{b}\vec{c}\right]$ where $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = \hat{j} + \hat{k}$.

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209. Find the volume of the Parallelopiped whose coterminous edges are represented by the vectors

$\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}, \vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$.

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210. Find the volume of the Parallelopiped whose coterminous edges are represented by the vectors $\vec{a} = -3\hat{i} + 7\hat{j} + 5\hat{k}, \vec{b} = -5\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{c} = 7\hat{i} - 5\hat{j} - 3\hat{k}$.

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211. Find the volume of the Parallelopiped whose coterminous edges are represented by the 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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212. If $\vec{\alpha}$ and $\vec{\beta}$ are any vectors, prove that $\vec{\beta} \cdot \left(\vec{\alpha} \times \vec{\beta}\right) = 0$.

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213. If $\vec{a} = -2\hat{i} - 2\hat{j} + 4\hat{k}$, $\vec{b} = -2\hat{i} + 4\hat{j} - 2\hat{k}$ and $\vec{c} = 4\hat{i} - 2\hat{j} - 2\hat{k}$.

prove that $\vec{a}$, $\vec{b}$, $\vec{c}$ are coplanar

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214. Show that the vectors $\vec{a} = 10\hat{i} - 12\hat{j} - 4\hat{k}$, $\vec{b} = -16\hat{i} + 22\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - 8\hat{j} + 16\hat{k}$ are coplanar.

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215. If $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} + 2\hat{j} - 7\hat{k}$ and $\vec{c} = 5\hat{i} + 6\hat{j} - 5\hat{k}$.

show that $\vec{a}$, $\vec{b}$ and $\vec{c}$ are coplanar.

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216. Integrate the following

$\int x e^{3x} dx$

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

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

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219. Prove that the four points $4\hat{i}+5\hat{j}+\hat{k},\ -\left(\hat{j}+\hat{k}\right), 3\hat{i}+9\hat{j}+4\hat{k}$ and $4\left(-\hat{i}+\hat{j}+\hat{k}\right)$ are coplanar.

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220. Integrate the following

$$\int (2x+6)\frac{dx}{x^2+6x+49}$$

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221. 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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222. Integrate the following

$$\int x \log 3x dx$$

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223. If $\vec{a} = 3\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = -\hat{i} + \hat{j} + 3\hat{k}$, state which of the following is meaningful and evaluate those that are meaningful : $\left(\vec{a} \cdot \vec{b}\right) \times \vec{c}, \vec{a} \times \left(\vec{b} \times \vec{c}\right), \left(\vec{a} \times \vec{b}\right) \cdot \vec{c}$

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224. Integrate the following

$$\int \frac{dx}{x^2 + 10x + 9}$$

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225. If $\vec{a}, \vec{b}, \vec{c}$ are any three vectors, prove that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) + \vec{b} \times \left(\vec{c} \times \vec{a}\right) + \vec{c} \times \left(\vec{a} \times \vec{b}\right) = \vec{0}$

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226. For any vector $\vec{a}$, prove that $\hat{i} \times \left(\vec{a} \times \hat{i}\right) + \hat{j} \times \left(\vec{a} \times \hat{j}\right) + \hat{k} \times \left(\vec{a} \times \hat{k}\right) = 2\vec{a}$

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227. If a,b and c are three non-zero vectors such that $a \cdot (b \times c) = 0$ and b and c are not parallel vectors, prove that $a = \lambda b + \mu c$ where λ and μ are scalar.

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228. Integrate the following

$$\int x \cos 5x dx$$

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229. What is the magnitude of a unit vector ?

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230. If $\overrightarrow{a} = x\hat{i} + 2\hat{j} - z\hat{k}$ and $\overrightarrow{b} = 3\hat{i} - y\hat{j} + \hat{k}$ equal vectors, then find the value of x + y +z.

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231. Does $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right|$ imply $\overrightarrow{a} = \overrightarrow{b}$?

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232. State whether the vectors $\hat{i}, \hat{j}$ and $\hat{k}$ are coplanar or non-coplanar.

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233. Integrate the following

$$\int \frac{dx}{1 - \sec x}$$

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234. What is the cosine of the angle which the vector $\sqrt{2}\hat{i} + \hat{j} + \hat{k}$ makes with the Y-axis ?

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235. Find p if the vectors $2\hat{i} + 3\hat{j} + 6\hat{k}$ and $p\hat{i} + 2\hat{j} - 3\hat{k}$ are perpendicular.

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236. Find λ if the vector $\lambda\left(\hat{i}+\hat{j}+\hat{k}\right)$ is a unit vector.

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237. If $\vec{a}$ and $\vec{b}$ are non-zero vectors and the angle θ between them is given by $\cos\theta = \frac{k}{\left|\vec{a}\right|\left|\vec{b}\right|}$ then write the value of k.

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

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239. If θ is the angle between two non-zero vectors $\vec{a}$ and $\vec{b}$, then write down the value of $\sin\theta$.

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240. If the vectors $3\hat{i}+2\hat{j}+9\hat{k}$ and $\hat{i}-2p\hat{j}+3\hat{k}$ are parallel, find p.

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241. If for any two vectors $\vec{a}$ and $\vec{b}$, $\left(\vec{a}+\vec{b}\right)^2+\left(\vec{a}-\vec{b}\right)^2=\lambda\left\{\left(\vec{a}\right)^2+\left(\vec{b}\right)^2\right\}, thenwritethevalueof$ λ`.

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

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

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244. If $\overrightarrow{PQ} = 3\hat{i} + 3\hat{j} + 6\hat{k}$and Q is the point (4, 5, 6), find the point P.

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245. Find $\overrightarrow{a} \cdot \overrightarrow{b}$ if $\overrightarrow{a} = 3\hat{i} + 4\hat{j} - 2\hat{k}$ and $\overrightarrow{b} = -2\hat{i} + 2\hat{j} + \hat{k}$

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246. If $\left(\overrightarrow{a} + \overrightarrow{b}\right) \cdot \left(\overrightarrow{a} - \overrightarrow{b}\right) = 0$ and $\left|\overrightarrow{a}\right| = 5$, find $\left|\overrightarrow{b}\right|$.

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247. If $\left(\vec{a}\right)^2 = \left(\vec{b}\right)^2$, is it necessary that $\vec{a} = \vec{b}$?

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248. What is the angle between two unlike parallel vectors ?

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249. If vectors $\vec{a}$ and $\vec{b}$, are such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = \frac{2}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector, then find the angle between $\vec{a}$ and $\vec{b}$.

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250. Find the sum of vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{j} + \hat{k}$.

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251. If $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find $\vec{a} + \vec{b}$.

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252. If $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find $2\vec{a} - \vec{b}$.

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253. Find a unit vector in the direction of $\overrightarrow{PQ}$. where P and Q have coordinates (5, 0, 8) and (3, 3, 2) respectively.

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254. Find the angle between the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} + 4\hat{j} - \hat{k}$

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255. 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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256. Find the position vector of the point R which divides the line (segment) joining the two points P and Q with position vectors $\overrightarrow{OP} = 2\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{OQ} = \overrightarrow{a} - 2\overrightarrow{b}$ respectively, in the ratio 1: 2. (i) internally (ii) externally. ‘

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257. if $\overrightarrow{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\overrightarrow{b} = \hat{i} + \hat{j} - 2\hat{k}$ and $\overrightarrow{c} = \hat{i} + 3\hat{j} - \hat{k}$, find λ such that $\overrightarrow{a}$ is perpendicular to $\lambda\overrightarrow{b} + \overrightarrow{c}$

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258. Find the magnitude of a vector, whose components are 3, 4 and -12

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259. Consider the points P (- 1, 0 2) and Q (3, -2 1), Write down vector $\overrightarrow{PQ}$.

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260. If $\overrightarrow{a} = 2\hat{i} - \hat{j} + 3\hat{k} \text{ and } \overrightarrow{b} = 4\hat{i} + \hat{j} - 3\hat{k}$, find $\overrightarrow{a} + \overrightarrow{b}$.

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261. For any two vectors $\overrightarrow{a}$ and $\overrightarrow{b}$, prove that $\left(\overrightarrow{a} \cdot \overrightarrow{b}\right)^2 \leq \left|\overrightarrow{a}\right|^2 \left|\overrightarrow{b}\right|^2$

.

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262. If for a vector $\vec{a}$, $\vec{a}\cdot\hat{i}=\vec{a}\cdot\hat{j}=\vec{a}\cdot\hat{k}=0$, then find $|\vec{a}|$.

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263. If $|\vec{a}|=10, \text{ and } |\vec{b}|=2$ and $\vec{a}\cdot\vec{b}=12$, find angle between the two vectors

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264. What is the area of a triangle, two of whose sides are along the vectors $\hat{i} \text{ and } \hat{j}$.

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265. If $\vec{a} \text{ and } \vec{b}$ are the position vectors of A and B respectively, find the position vector of a Point C in BA produced such that BC = 1.5 BA.

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266. Evaluate

$$\int \sin 2x \frac{dx}{1 - \sin x}$$

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267. Find the sine of the angle between the vectors $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + 4\hat{k}$.

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268. Find a vector of magnitude 6 units which is at right angles to both the vectors $2\hat{i} - \hat{j} + 2\hat{k}$ and $4\hat{i} - \hat{j} + 3\hat{k}$

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269. A vector $\vec{r}$ is inclined at equal angles to the three axes. If the magnitude of $\vec{r}$ is $2\sqrt{3}$ units, find $\vec{r}$.

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270. If $\vec{a} = 6\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} - 2\hat{k}$, find $\vec{a} - \vec{b}$.

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271. What is the value of $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ if $\vec{a}, \vec{b}, \vec{c}$ are non-zero coplanar vectors ?

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272. If a and b are two unit vectors such that a+2b and 5a−4b are perpendicular to each other, then the angle between a and b is

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

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274. What is the value of $\left|\hat{a} + \hat{b} + \hat{c}\right|$ if $\hat{a}, \hat{b}$ and $\hat{c}$ are mutually orthogonal unit vectors.

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275. 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 $\vec{a} + \vec{b}$.

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276. Find λ and μ if $\left(\hat{i} + 3\hat{j} + 9\hat{k}\right) \times \left(3\hat{i} - \lambda\hat{j} + \mu\hat{k}\right) = \vec{0}$.

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277. If $\vec{a} = 2\hat{i} - 3\hat{j} + 3\hat{k} \text{ and } \vec{b} = 3\hat{i} - \hat{j} - 4\hat{k}$, find $\vec{a} + \vec{b}$.

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278. Classify the following measures as scalars and vectors, 10 g

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

Watch Video Solution

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

Watch Video Solution

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

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

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

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

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

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

Watch Video Solution

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

Watch Video Solution

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

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293. Compute the magnitude of the following vectors : $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 2\hat{i} - 7\hat{j} - 3\hat{k}, \vec{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$

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294. Write two different vectors having same magnitude.

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295. Write two different vectors having same direction.

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

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

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

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300. 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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301. 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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302. Find a vector in the direction of vector $5\vec{i} - \vec{j} + 2\vec{k}$ which has magnitude 8 units.

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

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

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307. Find the position vector of a point R which divides the line joining two points P and Q whose Position Vector, are $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively, in the ratio 2 : 1 (i) internally,

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308. Find the position vector of a point R which divides the line joining two points P and Q whose Position Vector, 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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309. 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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310. Show that the points A, B and C 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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311. If $\vec{a}$ and $\vec{b}$ are two collinear vectors then which of the following are incorrect :

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

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

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

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

Answer:

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312. 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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313. Find the angle between the vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$.

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

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315. 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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316. 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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317. 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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318. Evaluate the product $\left(3\vec{a}-5\vec{b}\right)\cdot\left(2\vec{a}+7\vec{b}\right)$.

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319. 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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320. If $\vec{a}=2\hat{i}+2\hat{j}+3\hat{k},\ \vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ then $\vec{a}+\vec{b}$ is

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321. Show that $\left|\vec{a}\right|\vec{b}+\left|\vec{b}\right|\vec{a}$ 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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322. If $|a|=5, |a-b|=8$ and $|a+b|=10$, then |b| is equal to

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

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324. 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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325. 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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326. Show that the points A(1,2,7), B(2,6,3) and C(3,10,-1) are collinear.

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327. Show that the points $A\left(2\hat{i}-\hat{j}+\hat{k}\right)$, $B\left(\hat{i}-3\hat{j}-5\hat{k}\right)$ and $C\left(3\hat{i}-4\hat{j}-4\hat{k}\right)$ are the vertices of a right angled triangle.

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328. If $\vec{a}$ is a non-zero vector of magnitude 'a' and λ a non-zero scalar, then $\lambda \vec{a}$ is unit vector if $\lambda = 1$

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329. If $\vec{a}$ is a non-zero vector of magnitude 'a' and λ a non-zero scalar, then $\lambda \vec{a}$ is unit vector if $\lambda = -1$

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330. If $\vec{a}$ is a non-zero vector of magnitude 'a' and λ a non-zero scalar, then $\lambda \vec{a}$ is unit vector if $a = |\lambda|$

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331. If $\vec{a}$ is a non-zero vector of magnitude 'a' and λ a non-zero scalar, then $\lambda \vec{a}$ is unit vector if $a = \frac{1}{|\lambda|}$

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

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

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

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335. Show that $(a - b) \times (a + b) = 2(a \times b)$

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336. 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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337. 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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338. Let the vectors $\vec{a}, \vec{b}, \vec{c}$ be given as $a_1\hat{i}+a_2\hat{j}+a_3\hat{k}, b_1\hat{i}+b_2\hat{j}+b_3\hat{k}$ and $c_1\hat{i}+c_2\hat{j}+c_3\hat{k}$, 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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339. 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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340. Find the area of the triangle with vertices A (1, 1, 2), B (2, 3, 5) and C (1, 5, 5).

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

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342. Let the vectors $\overrightarrow{\text{and}}\vec{b}$ 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. $\frac{\pi}{2}$

Answer:

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343. Area of a rectangle having vertices $A\left[-\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}\right], B\left[\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}\right], C\left[\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}\right]$ and $D\left[-\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}\right]$ is

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

B. 1

C. 2

D. 4

Answer:

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344. Find $\left[\vec{a}, \vec{b}, \vec{c}\right]$ if $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} - 2\hat{k}$.

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

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346. Find λ if the vectors $\hat{i} - \hat{j} + \hat{k}, 3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + \lambda\hat{j} - 3\hat{k}$ are coplanar.

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347. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then

(a) if $c_1 = 1$ and $c_2 = 2$, find c_3, which makes $\vec{a}$, $\vec{b}$ and $\vec{c}$ coplanar.

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348. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then if $c_2 = -1$ and $c_3 = 1$, show that no value of c_1, can makes $\vec{a}$, $\vec{b}$ and $\vec{c}$ coplanar.

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349. Show that the four points with position vectors $4\hat{i} + 8\hat{j} + 12\hat{k}$, $2\hat{i} + 4\hat{j} + 6\hat{k}$, $3\hat{i} + 5\hat{j} + 4\hat{k}$ and $5\hat{i} + 8\hat{j} + 5\hat{k}$ are coplanar.

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350. 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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351. If a,b and c are coplanar show $[\text{a+b b+c c+a}]$ are coplanar.

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352. 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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353. 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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354. A girl walks 4 km towards west, then she walks 3 km in a direction 30° east of north and stops. Determine the girl's displacement from her initial point of departure.

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

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357. 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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358. 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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359. Show that the points A (1, - 2, - 8), B (5, 0,- 2) and C (11, 3, 7) are collinear, and find the ratio in which B divides AC.

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

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361. The two adjacent sides of a parallelogram are $2\hat{i}-4\hat{j}+5\hat{k}$ and $\hat{i}-2\hat{j}-3\hat{k}$. Find the unit vector Parallel to its diagonal. Also, find its area.

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362. 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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363. Let $a=\hat{i}+4\hat{j}+2\hat{k}, b=3\hat{i}-2\hat{j}+7\hat{k}$ and $c=2\hat{i}-\hat{j}+4\hat{k}$ Find a vector d which is perpendicular to both a and b and c.d=15.

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364. 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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365. 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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366. 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.

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367. 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. $0 \leq \theta \leq \pi$

Answer:

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

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

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

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

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

Answer:

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369. 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

Answer:

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

A. 0

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

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

D. π

Answer:

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371. If $\vec{a}$ is a non-zero vector, then $\left(\frac{1}{\left|\vec{a}\right|}\right)\vec{a}$ is a..........

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372. If $\vec{a}$, $\vec{b}$ are non-collinear vectors, then $\vec{a}$, $\vec{b}$ and $\vec{a} + \vec{b}$ are...........

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373. The vector $\vec{a} + \vec{b}$ bisects the angle between the non collinear vectors $\vec{a}$ and $\vec{b}$ if ....

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374. If $\vec{r} \cdot \vec{a} = 0 = \vec{r} \cdot \vec{b}$,where $\vec{a}$ and $\vec{b}$ are non-coplanar vectors then

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375. If $\vec{r} \cdot \vec{a} = 0 = \vec{r} \cdot \vec{b} = 0$ and also $\vec{r} \cdot \vec{c} = 0$ for some non-zero vector $\vec{r}$, then the value of $\vec{a} \cdot \left(\vec{b} \times \vec{c}\right)$ is........

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376. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are any two vectors, then $\left(\overrightarrow{a} \times \overrightarrow{b}\right)^2 + \left(\overrightarrow{a} \cdot \overrightarrow{b}\right)^2$ =.......

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377. If $\overrightarrow{a}$ is any non-zero vector, then $\left(\overrightarrow{a} \cdot \hat{i}\right)\hat{i} + \left(\overrightarrow{a} \cdot \hat{j}\right)\hat{j} + \left(\overrightarrow{a} \cdot \hat{k}\right)\hat{k}$ is equal to......

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378. If a is any vector, then

$\left(a \times \hat{i}\right)^2 + \left(a \times \hat{j}\right)^2 + \left(a \times \hat{k}\right)^2$ is equal to

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379. If $(a \times b)^2 + (a \cdot b)^2 = 144$ and $|a| = 4$, then find the value of |b|.

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380. If a non-zero vector $\overrightarrow{a}$ makes an angle α with positive direction of x-axis, then $\cos\alpha$ =.........

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381. The values of k, for which $\left|k\overrightarrow{a}\right| < \left|\overrightarrow{a}\right|$ and $k\overrightarrow{a} = \frac{1}{2}\overrightarrow{a}$ is parallel to $\overrightarrow{a}$ hold true, lie in...

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382. The vectors $\overrightarrow{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\overrightarrow{b} = -\hat{i} + 2\hat{k}$ are the adjacent sides of a parallelogram. The acute angle between its diagonals is.............

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383. If $\vec{a}$ and $\vec{b}$ are any two vectors, then $\left(\vec{a}+\vec{b}\right)^2+\left(\vec{a}-\vec{b}\right)^2$ =............

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

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385. If $\vec{a}$ is a non-zero vector and λ is a real number st. $\left|\lambda\vec{a}\right|=1$, then $|\lambda|$ is equal to......

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386. If the vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar then $\left(\vec{a}\times\vec{b}\right)\cdot\vec{c}=\left(\vec{b}\times\vec{c}\right)\cdot\vec{a}$ =..........

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

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

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389. In case of each of the following statements, state whether it is true or false : If $\left|\vec{a}\right| = \left|\vec{b}\right|$ then necessarily it implies that $\left|\vec{a}\right| = \pm\left|\vec{b}\right|$

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390. Incase of each of the following statements, state whether it is true or false : For any two vectors $\vec{a}, \vec{b}$: $\left|\vec{a} \cdot \vec{b}\right| \leq \left|\vec{a}\right|\left|\vec{b}\right|$

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391. Incase of each of the following statements, state whether it is true or false : If $\vec{a}$ and $\vec{b}$ are the adjacent sides of a parallelogram, then $\vec{a}\cdot\vec{b}=0$

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392. Incase of each of the following statements, state whether it is true or false : If $\vec{a}$ and $\vec{b}$ are the adjacent sides of a rhomus, then $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}-\vec{b}\right)\neq 0.$

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393. Incase of each of the following statements, state whether it is true or false : If $\vec{a}$ and $\vec{b}$ are the adjacent sides of a rhombus, then $\vec{a}\cdot\vec{b}=0$

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394. Incase of each of the following statements, state whether it is true or false : If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$ then the vectors $\vec{a}$ and $\vec{b}$ are orthogonal.

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395. Incase of each of the following statements, state whether it is true or false : For any two non-zero vectors $\vec{a}$ and $\vec{b}$, $\left(\vec{a}-\vec{b}\right)^2=\left(\vec{a}\right)^2+\left(\vec{b}\right)^2-2\vec{a}\cdot\vec{b}$

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396. Incase of each of the following statements, state whether it is true or false For any two non-zero vectors $\vec{a}$ and $\vec{b}$, $\left(\vec{a}+\vec{b}\right)^2=\left(\vec{a}\right)^2+\left(\vec{b}\right)^2+2\vec{a}.\vec{b}$

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397. Position vector of a point P is vectors whose initial point is origin.

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398. Incase of each of the following statements, state whether it is true or false : If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$ then the vectors $\vec{a}$ and $\vec{b}$ are orthogonal.

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399. Incase of each of the following statements, state whether it is true or false : For any vector $\vec{a}$, $\left(\vec{a}\cdot\hat{i}\right)^2+\left(\vec{a}\cdot\hat{j}\right)^2+\left(\vec{a}\cdot\hat{k}\right)^2=\left(\vec{a}\right)^2$

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400. Incase of each of the following statements, state whether it is true or false : For any vector $\vec{a}$, $(\vec{a}\cdot\hat{i})\hat{i}+(\vec{a}\cdot\hat{j})\hat{j}+(\vec{a}\cdot\hat{k})\hat{k}=\vec{a}$

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401. Incase of each of the following statements, state whether it is true or false : Direction cosines of a non-zero vector $\vec{a}$ are the components of a unit vector in the direction of $\vec{a}$.

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402. Incase of each of the following statements, state whether it is true or false : $(\hat{i}\times\hat{j})\cdot\hat{k}=1=\hat{i}\cdot(\hat{j}\times\hat{k})$

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403. If a is any vector, then

$\left(a\times\hat{i}\right)^2+\left(a\times\hat{j}\right)^2+\left(a\times\hat{k}\right)^2$ is equal to

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404. Incase of each of the following statements, state whether it is true or false : For any vector $\vec{a}$, $\left(\vec{a}\times\hat{i}\right)\hat{i}+\left(\vec{a}\times\hat{j}\right)\hat{j}+\left(\vec{a}\times\hat{k}\right)\hat{k}=\vec{a}$

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405. Which of the following is not a vector quantity?

A. force

B. mass

C. weight

D. velocity

Answer:

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406. A vector with magnitude zero is called a

A. free vector

B. localized vector

C. position vector

D. null vector

Answer:

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407. The magnitude of a vector can never be

A. negative

B. zero

C. positive

D. none of these.

Answer:

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

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

B. $\frac{1}{3}\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$

C. $3\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$

D. $9\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$

Answer:

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409. The position vector of the point which divides the join of points $2\vec{a} - 3\vec{b}$ and $\vec{a} + \vec{b}$ in the ratio 3: 1 is

A. $\dfrac{3\vec{a} - 2\vec{b}}{2}$

B. $\dfrac{7\vec{a} - 8\vec{b}}{4}$

C. $\dfrac{3\vec{a}}{4}$

D. $\dfrac{5\vec{a}}{4}$

Answer:

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

A. 5

B. 7

C. 12

D. 11

Answer:

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411. The position vector of the point which divides the join of points with position vectors $\vec{a} + \vec{b}$ and $2\vec{a} - \vec{b}$ inthe ratio 1: 2 is

A. $\frac{1}{3}\left(3\vec{a} + 2\vec{b}\right)$

B. $\vec{a}$

C. $\frac{1}{3}\left(5\vec{a} - \vec{b}\right)$

D. $\frac{4\vec{a} + \vec{b}}{3}$

Answer:

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412. The value of λ for which the vectors $3\hat{i} - 6\hat{j} + \hat{k}$ and $2\hat{i} - 4\hat{j} + \lambda\hat{k}$ are parallel is

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

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

C. $\frac{5}{2}$

D. $\frac{2}{5}$

Answer:

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413. If $\vec{a}$ and $\vec{b}$ are non-collinear proper vectors then number of unit vectors at right angles to both $\vec{a}$ and $\vec{b}$ is........

A. 1

B. 2

C. 4

D. infinitely many

Answer:

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414. If θ is the angle between two proper vectors $\vec{a}$ and $\vec{b}$, then $\vec{a}\cdot\vec{b}<0$ then

A. $0\leq\theta\leq\pi$

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

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

D. none of these

Answer:

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415. If $\overrightarrow{a}$ is any vector, then $\overrightarrow{a} \cdot \overrightarrow{a}$

A. 0

B. $\overrightarrow{0}$

C. $\neq 0$

D. $\left|\overrightarrow{a}\right|^2$

Answer:

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416. For any vector, $\overrightarrow{a}$, $\overrightarrow{a} \times \overrightarrow{a}$

A. $\overrightarrow{0}$

B. 0

C. $\left|\overrightarrow{a}\right|^2$

D. none of these

Answer:

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417. The vector having initial and terminal points as (2,5,0) and (-3,7,4) respectively is

A. $-\hat{i}+12\hat{j}+4\hat{k}$

B. $5\hat{i}+2\hat{j}-4\hat{k}$

C. $-5\hat{i}+2\hat{j}+4\hat{k}$

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

Answer:

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418. The angle between two vectors $\vec{a}$ and $\vec{b}$ with Magnitudes $\sqrt{3}$ and 4 respectively and $\vec{a}\cdot\vec{b}=2\sqrt{3}$ is

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

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

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

D. $5\frac{\pi}{12}$

Answer:

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419. The value of λ for which the vectors $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ are orthogonal is

A. 0

B. 1

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

D. $-\frac{5}{2}$

Answer:

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

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

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

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

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

Answer:

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421. 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

Answer:

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422. If $\overrightarrow{a} \cdot \overrightarrow{a} = 0$ then $\overrightarrow{a}$ is a

A. A) proper vector

B. B) free vector

C. C) null vector

D. D) none of these

Answer:

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423. If $\vec{a}$ and $\vec{b}$ are proper vectors such that $\vec{b} = \lambda \vec{a}$ for some realλ then $\vec{a}$ and $\vec{b}$ are

A. non-collinear

B. linearly independent

C. linearly dependent

D. none of these

Answer:

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424. For any two vectors $\vec{a}$ and $\vec{b}$, which of the following is not true ?

A. $\left|\vec{a} + \vec{b}\right| \leq \left|\vec{a}\right| + \left|\vec{b}\right|$

B. $\left|\vec{a} - \vec{b}\right| \leq \left|\vec{a}\right| + \left|\vec{b}\right|$

C. $\left|\vec{a} - \vec{b}\right| \geq \left|\left|\vec{a}\right| - \left|\vec{b}\right|\right|$

D. none of these

Answer:

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

A. $\sqrt{2}$

B. $\sqrt{3}$

C. 3

D. 4

Answer:

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426. If the vectors from the origin to the points A and B are . $\overrightarrow{a} = a\hat{i} - 3\hat{j} + 2\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + 3\hat{j} + \hat{k}$ respectively, then the area of

$\triangle\, OAB$ Is

A. 340

B. $\sqrt{125}$

C. $\sqrt{229}$

D. $\frac{1}{2}\sqrt{229}$

Answer:

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427. Given $\left|\vec{a}\right| = 10, \left|\vec{b}\right| = 2$and $\vec{a} \cdot \vec{b} = 12$, find $\left|\vec{a}\right.$ cross $\left.\vec{b}\right|$.

A. 5

B. 10

C. 14

D. 16

Answer:

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428. Direction cosines of $\hat{i}$ are '

A. a) $<, 0, 1, 1>$

B. b) $<1, 0, 0>$

C. c) $<, -1, 0, 0>$

D. d) none of these

Answer:

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429. The vectors $-2\hat{i}+\hat{j}+2\hat{k}, \hat{i}+\lambda\hat{j}-\hat{k}, 2\hat{i}-\hat{j}+\lambda\hat{k}$, are coplanar if λ =.........

A. 1) -2

B. 2) 0

C. 3) 1

D. 4) -1

Answer:

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430. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, then the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ is equal to

A. 1

B. 3

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

D. none of these

Answer:

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431. If $\left|\vec{a}\right| = 8, \left|\vec{b}\right| = 3$ and $\left|\vec{a} \times \vec{b}\right| = 12$, then the value of $\vec{a} . \vec{b}$ is

A. $6\sqrt{3} \text{ or } -6\sqrt{3}$

B. $8\sqrt{3} \text{ or } -8\sqrt{3}$

C. $12\sqrt{3} \text{ or } -12\sqrt{3}$

D. none of these

Answer:

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432. If the vectors $2\hat{j} + \hat{k}$ and $3\hat{i} - \hat{j} + 4\hat{k}$ represent the two sides AB and AC respectively of a $\triangle ABC$, then the length of the median through A is,

A. $\frac{1}{2}\sqrt{35}$

B. $2\sqrt{3}$

C. $3\sqrt{2}$

D. none of these

Answer:

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433. $\left(\hat{i}+\hat{j}\right)\times\left(\hat{j}+\hat{k}\right)\cdot\left(\hat{k}+\hat{i}\right)$ is equal to

A. A) 0

B. B) 1

C. C) 2

D. D) none of these

Answer:

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434. If $\vec{a}$, $\vec{b}$ and $\sqrt{3}\vec{a} - \vec{b}$ are Unit Vectors, then the angle between $\vec{a}$ and $\vec{b}$ is ....

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

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

C. `pi/6

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

Answer:

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435. If $\left|\vec{a}\right| = 8, \left|\vec{b}\right| = 3$ and $\left|\vec{a} \times \vec{b}\right| = 12$, then the value of $\vec{a} \cdot \vec{b}$ is

A. [0,8]

B. [-12,8]

C. [0, 12]

D. [8, 12]

Answer:

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436. If ABC is any triangle and D is the midpoint of side [BC], then $\overrightarrow{AB} + \overrightarrow{AC}$

A. $\overrightarrow{AD}$

B. $2\overrightarrow{AD}$

C. $3\overrightarrow{AD}$

D. none of these

Answer:

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437. If $\vec{b}$ is a non-zero vector, then projection of $\vec{a}$ on $\vec{b}$ is

A. $\vec{a} \cdot \hat{b}$

B. $\left(\vec{a}\right.$ · vecb)/|vec b|^2`

C. $\vec{a} \cdot \vec{b}$

D. none of these

Answer:

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438. If $\vec{a}$ is a unit vector Perpendicular to the vectors $\vec{b} = \hat{i} - \hat{j}$ and $\vec{c} = \hat{i} + \hat{j}$ such that $\vec{a}, \vec{b}, \vec{c}$ form a right hand triad, then $\vec{a}$ is equal to

A. $\hat{k}$

B. $-\hat{k}$

C. $\frac{1}{\sqrt{2}}\left(\hat{i} - \hat{j}\right)$

D. $\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

Answer:

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