MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

ALGEBRA OF VECTORS

Solved Examples And Exercises

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

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2. Prove that the following vectors are non-coplanar: $3\hat{i}+\hat{j}-\hat{k}, 2\hat{i}-\hat{j}+7\hat{k}$ and $7\hat{i}-\hat{j}+23\hat{k}$ $\hat{i}+2\hat{j}+3\hat{k}, 2\hat{i}+\hat{j}+3$ and $\hat{i}+\hat{j}+\hat{k}$

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3. Using vectors show that the points $A(-2, 3, 5), B(7, 0, -1)C(-3, -2, -5)$ and $D(3, 4, 7)$ are such that AB and CD intersect at the point $P(1, 2, 3)\cdot$

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4. Prove that 1,1,1 cannot be direction cosines of a straight line.

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5. A vector $\overrightarrow{r}$ is inclined at equal acute angles of $x - a\xi s, \ y - a\xi s$ and $z - a\xi s$. if $\left|\overrightarrow{r}\right| = 6$ units, find $\overrightarrow{r}$.

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6. Find the angles at which the following vectors are inclined to each of the coordinate axes: $\hat{i} - \hat{j} + \hat{k}$ $\hat{j} - \hat{k}$ $4\hat{i} + 8\hat{j} + \hat{k}$

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7. Find the direction cosines of the following vectors: $2\hat{i} + 2\hat{j} - \hat{k}$ $6\hat{i} - 2\hat{j} - 3\hat{k}$ $3\hat{i} - 4\hat{k}$

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8. Prove that the sum of three vectors determined by the medians of a triangle directed from the vertices is zero.

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9. If P is a point and $ABCD$ is a quadrilateral and $\vec{A}P + \vec{P}B + \vec{P}D = \vec{P}C$, show that $ABCD$ is a parallelogram.

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10. If $\vec{a}$ is a vector and m is a scalar such that $m\vec{a} = \vec{0}$, then what are the alternatives for m and $\vec{a}$?

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11. If $\vec{a}, \vec{b}$ are two vectors, then write the truth value of the following statements: $\vec{a} = -\vec{b} \left|\vec{a}\right| = \left|\vec{b}\right|$ $\left|\vec{a}\right| = \left|\vec{b}\right| \vec{a} = \pm \vec{b}$ $\left|\vec{a}\right| = \left|\vec{b}\right| \vec{a} = \vec{b}$

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12. $ABCD$ is a quadrilateral. Find the sum the vectors $\vec{B}A$, $\vec{B}C$, and $\vec{D}A$.

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13. $ABCDE$ is pentagon, prove that $\vec{A}B$ + $\vec{B}C$ + $\vec{C}D$ + $\vec{D}E + \vec{E}A$ = $\vec{0}$ $\vec{A}B + \vec{A}E + \vec{B}C + \vec{D}C + \vec{E}D + \vec{A}C = 3\vec{A}C$

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14. If P, Q and R are three collinear points such that $\overrightarrow{PQ} = \overrightarrow{a}$ and $\overrightarrow{QR} = \overrightarrow{b}$. Find the vector $\overrightarrow{PR}$.

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

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16. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are two non-collinear vectors having the same initial point. What are the vectors represented by $\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{a} - \overrightarrow{b}$.

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

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18. Find the unit vector in the direction of $3\hat{i} + 4\hat{j} - 12\hat{k}$.

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19. The vertices A, B, C of triangle ABC have respectively position vectors $\vec{a}, \vec{b}, \vec{c}$ with respect to a given origin O. Show that the point D where the bisector of $\angle A$ meets BC has position vector $\vec{d} = \dfrac{\beta\vec{b} + \gamma\vec{c}}{\beta + \gamma}$, where $\beta = \left|\vec{c} - \vec{a}\right|$ and, $\gamma = \left|\vec{a} - \vec{b}\right|$. Hence, deduce that incentre I has position vector $\dfrac{\alpha\vec{a} + \beta\vec{b} + \gamma\vec{c}}{\alpha + \beta + \gamma}$ where $\alpha = \left|\vec{b} - \vec{c}\right|$

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20. Find a unit vector parallel to the vector $\hat{i} + \sqrt{3}\hat{j}$

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21. Show that the found points A, B, C, D with position vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ respectively such that 3 $\vec{a} - 2\vec{b} + 5\vec{c} - 6\vec{d} = \vec{0}$, are coplanar. Also, find the position vector of the point of intersection of the line segments AC and BD.

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22. If $\vec{a}, \vec{b}$ are the position vectors of A, B respectively, find the position vector of a point C in AB produced such that $AC = 3AB$ and that a point D in BA produced such that $BD = 2BA$.

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23. Let $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ be the position vectors of the four distinct points A, B, C, D. If $\vec{b} - \vec{a} = \vec{a} - \vec{d}$, then show that $ABCD$ is parallelogram.

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24. 6). If $\vec{P}Q = 3\hat{i} + 2\hat{j} - \hat{k}$ and the coordinates of P are $(1, -1, 2)$, find the coordinates of Q. (7). prove that the points $\hat{i} - \hat{j}, 4\hat{i} - 3\hat{j} + \hat{k}, 2\hat{i} - 4\hat{j} + 5\hat{k}$ are the vertices of a right angled triangle.

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25. Prove that the points $\hat{i} - \hat{j}, 4\hat{i} - 3\hat{j} + \hat{k}$ and $2\hat{i} - 4\hat{j} + 5\hat{k}$ are the vertices of a right angled triangle.

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26. Find the position vector from the origin O to the centroid of the triangle whose vertices are $(1, -1, 2)$, $(2, 1, 3)$ and $-1, 2, -1)$.

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27. 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 coplanar.

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

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29. Can a vector have direction angles $45^0, 60^0, 120^0$

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30. A vector makes an angle of $\frac{\pi}{4}$ with each of x-axis and y-axis Find the angle made by it with the z-axis.

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31. Show that the point A, B, C with position vectors $\vec{a} - 2\vec{b} + 3\vec{c}, 2\vec{a} + 3\vec{b} - 4\vec{c}$ and $-7\vec{b} + 10\vec{c}$ are collinear.

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32. If $\vec{A}O + \vec{O}B = \vec{B}O + \vec{O}C$, prove that A, B, C are collinear points.

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33. If $\vec{a}, \vec{b}$ are two non-collinear vectors, prove that the points with position vectors $\vec{a} + \vec{b}, \vec{a} - \vec{b}$ and $\vec{a} + \lambda \vec{b}$ are collinear for all real values of $\lambda\cdot$

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34. If the points with position vectors $10\hat{i} + 3\hat{j}, 12\hat{i} - 5\hat{j}$ and $a\hat{i} + 11\hat{j}$ are collinear, find the value of $a\cdot$

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

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

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37. Five forces $\vec{A}B$, $\vec{A}C$, $\vec{A}D$, $\vec{A}E$ and $\vec{A}F$ act at the vertex of a regular hexagon $ABCDEF$. Prove that the resultant is $6\vec{A}O$, where O is the centre of heaagon.

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38. 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

$2\vec{a} - \vec{b} + 3\vec{\cdot}$

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39. Answer the following as true or flase: $\vec{a}$ and $\vec{b}$ are collinear. Two collinear vectors are always equal in magnitude. Zero vector is unique. Two vectors having same magnitude are collinear. Two collinear vectors having the same magnitude are equal.

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40. In Fig. $ABCD$ is a regular hexagon, which vectors are: Collinear Equal Coinitial Collinear but not equal

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41. Find the coordinates of the tip of the position vector which is equivalent to $\overrightarrow{A}B$, where the coordinates of A and B are $(-1, 3)$ and $(-2, 1)$ respectively.

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42. Express $\overrightarrow{A}B$ in terms of unit vectors $\hat{i}$ and $\hat{j}$, when the points are: i)$A(4, -1), B(1, 3)$ ii)$A(-6, 3), B(-2, -5)$ Find $\left|\overrightarrow{A}B\right|$ in each case.

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43. If the position vectors of the points $A(3, 4), B(5, -6)$ and $(4, -1)$ are $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ respectively compute $\overrightarrow{a} + 2\overrightarrow{b} - 3\overrightarrow{\cdot}$

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44. $ABCD$ is parallelogram. If the coordinates of A, B, C are $(-2, -1), (3, 0)$ and $(1, -2)$ respectively, find the coordinates of D.

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45. If the position vector of a point $(-4, -3)$ be $\vec{a}$, find $|a|$.

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46. Find a vector of magnitude 4 units which is parallel to the vector $\sqrt{3}\hat{i} + \hat{j}$.

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47. If the position vector $\vec{a}$ of a point $(12, n)$ is such that $\left|\vec{a}\right| = 13$, find the value (s) of n.

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

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49. $ABCD$ is parallelogram and P is the point of intersection of its diagonals. If O is the origin of reference, show that $\vec{O}A + \vec{O}B + \vec{O}C + \vec{O}D = 4\vec{O}P$.

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50. If O is a point in space, ABC is a triangle and D, E, F are the mid-points of the sides BC, CA and AB respectively of the triangle, prove that $\vec{O}A + \vec{O}B + \vec{O}C = \vec{O}D + \vec{O}E + \vec{O}F$.

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51. Show that the point $2\hat{i}, -\hat{i} - 4\hat{j}$ and $-\hat{i} + 4\hat{j}$ from an isosceles triangle.

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52. If $\vec{a}$ be the position vector whose tip is $(5, -3)$, find the coordinates of a point B such that $\overrightarrow{AB} = \vec{a}$, the coordinates of A being $(4, -1)$.

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53. Show that the line segments joining the mid-points of opposite sides of a quadrilateral bisects each other.

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54. $ABCD$ are four points in a plane and Q is the point of intersection of the lines joining the mid-points of AB and CD; BC and AD. Show that $\overrightarrow{P}A + \overrightarrow{P}B + \overrightarrow{P}C + \overrightarrow{P}D = 4\overrightarrow{P}Q$, where P is any point.

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55. If $\overrightarrow{a}\, and\, \overrightarrow{b}$ are non-collinear vectors, find the value of x for which the vectors $\overrightarrow{\alpha} = (2x+1)\overrightarrow{a} - \overrightarrow{b}\, and\, \overrightarrow{\beta} = (x-2)\overrightarrow{a} + \overrightarrow{b}$ are collinear.

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56. The projection of a vector on the coordinate axes are $6, \ -3, 2.$

Find its length and direction cosines.

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57. If $\vec{a}, \vec{b}, \vec{c}$ are three non- null vectors such that any two of them are non-collinear. If $\vec{a}+\vec{b}$ is collinear with $\vec{c}$ and $\vec{b}+\vec{c}$ is collinear with $\vec{a}$, then find $\vec{a}+\vec{b}+\vec{c}$

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58. Show that the vectors $2\vec{a}-\vec{b}+3\vec{c}, \vec{a}+\vec{b}-2\vec{c}$ and $\vec{a}+\vec{b}-3\vec{c}$ are non-coplanar vectors (where $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors)

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59. Show that the points A, B, C with position vectors $-2\vec{a}+3\vec{b}+5\vec{c}, \vec{a}+2\vec{b}+3\vec{c} and 7\vec{a}-\vec{c}$ respectively, are collinear.

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60. Prove that the line joining the mid-points of the diagonals of a trapezium is parallel to the parallel sides of trapezium and is half of their difference.

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61. Prove that the segment joining the middle points of two non-parallel sides of a trapezium is parallel to the parallel sides and half of their sum.

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62. Using vector method, prove that the line segments joining the mid-points of the adjacent sides of a quadrilateral taken in order form a parallelogram.

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63. If the points with position vectors $60\hat{i} + 2\hat{j}, 40\hat{i} - 8\hat{j}$ and $a\hat{i} - 52\hat{j}$ are collinear, find the value of a.

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64. If $ABCD$ is quadrilateral and $EandF$ are the mid-points of $ACandBD$ respectively, prove that $\overrightarrow{A}B + \overrightarrow{A}D$ $+\overrightarrow{C}B$ $+\overrightarrow{C}D$ =4 $\overrightarrow{E}F$.

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65. If $D and E$ are the mid-points of sides $AB and AC$ of a triangle ABC respectively, show that $\vec{B}E + \vec{D}C = \frac{3}{2}\vec{B}C$.

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66. If G is the centroid of a triangle ABC, prove that $\vec{G}A + \vec{G}B + \vec{G}C = \vec{0}$.

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67. Prove using vectors: Medians of a triangle are concurrent.

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68. Points L, M, N divide the sides BC, CA, AB of ABC in the ratio 1:4, 3:2, 3:7 respectively. Prove thatAL + BM + CŃ is a vector parallel to CK where K divides AB in the ratio 1: 3.

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69. Prove using vectors: The diagonals of a quadrilateral bisect each other iff it is a parallelogram.

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70. Prove that the sum of the vectors directed from the vertices to the mid-points of opposite sides of a triangle is zero.

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71. Prove that the line segment joining the mid points of two side of a triangle is parallel to the third side and equal to half of it.

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72. If $ABCandA'B'C$ are two triangles and G, G' be their centriods, prove that $\overrightarrow{\forall}' + \overrightarrow{B}B' + \overrightarrow{\mathbb{C}}' = 3\overrightarrow{G}G'$

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73. A vector $\overrightarrow{r}$ is inclined at equal to $OX, OYandOZ$. If the magnitude of $\overrightarrow{r}$ is 6 units, find $\overrightarrow{r}$.

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74. A vector $\overrightarrow{r}$ has length 21 and its direction ratios are proportional to $2, -3, 6.$ Find the direction cosines and components of $\overrightarrow{r}$, is given that $\overrightarrow{r}$ Makes an acute angle with $x-$ axis.

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75. Show plane whose vector equation is $\overrightarrow{r}\cdot\left(\hat{i}+2\hat{j}-\hat{k}\right)=3$ contains the line $\overrightarrow{r}=\hat{i}+j+\lambda\left(2\hat{i}+\hat{j}+4\hat{k}\right)$

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76. Find the angle between line $\dfrac{x+1}{2}=\dfrac{y}{3}=\dfrac{z-3}{6}$ and the plane $10x+2y-11z-3=0.$

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77. If a, b, c are non-coplanar vectors such that $x_1\overrightarrow{a}+y_1\overrightarrow{b}+z_1\overrightarrow{c}=x_2\overrightarrow{a}+y_2\overrightarrow{b}+z_2\overrightarrow{c}$, prove that $x_1=x_2, y+1=y+2andz_1=z_2.$

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78. Show that the vectors a, b, c given by $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k} and \vec{c} = \hat{i} + \hat{j} + \hat{k}$ are non-coplanar. Express vector $\vec{d} = 2\hat{i} - 3\hat{k}$ as a liner combination of the vectors $\vec{a}, \vec{b}, and \vec{c}$.

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79. A vector $\vec{O}P$ is inclined to $OXat45^0 andOYat60^0$. Find the angle at which $\vec{O}P$ is inclined to OZ.

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80. If a vector makes angles $\alpha, \beta, \gamma withOX, OYandOZ$ respectively, prove that $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2.$

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81. $ABCD$ is a parallelogram. If $LandM$ are the mid-points of $BCandDC$ respectively, then express $\overrightarrow{A}LandA\overrightarrow{}M$ in terms of $\overrightarrow{A}BandA\overrightarrow{}D$. Also, prove that $\overrightarrow{A}L+\overrightarrow{A}M=\frac{3}{2}\overrightarrow{A}C$.

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82. Find a unit vector in the direction of the resultant of the vectors $\hat{i}-\hat{j}+3\hat{k}, 2\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}+2\hat{j}-2\hat{k}$.

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83. Find the position vector of the mid-point of the vector joining the points $P\left(2\hat{i}-3\hat{j}+4\hat{k}\right)and\mathrm{Q}\left(4\hat{i}+\hat{j}-2\hat{k}\right)$.

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84. Show that the line joining one vertex of a parallelogram to the mid-point of an opposite side trisects the diagonal and is trisected there at.

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85. Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors such that any two of them are non-collinear. If $\vec{a} + 2\vec{b}$ is collinear with $\vec{c}$ and $\vec{b} + 3\vec{c}$ is collinear with $\vec{a}$ then prove that $\vec{a} + 2\vec{b} + 6\vec{c} = \vec{0}$

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86. If $\vec{a}, \vec{b}$ are the position vectors of the points $(1, -1), (-2, m)$, find the value of m for which $\vec{a}$ and $\vec{b}$ are collinear.

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87. Find the position vector of a point A in space such that $\overrightarrow{O}A$ is inclined at $60^0 \rightarrow OX$ and at $45^0 \rightarrow OY and \left|\overrightarrow{O}A\right| = 10units\cdot$

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88. Show that the points $A(6, -7, 0), B(16, -19, -4), C(0, 3, -6) and \quad D(2, -5, 10)$ are such that AB and CD intersect at the point $P(1, -1, 2)\cdot$

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89. The lines joining the vertices of a tetrahedron to the centroids of opposite faces are concurrent.

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

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91. 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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92. Three vectors of magnitude $a, 2a, 3a$ meet in a point and their directions are along the diagonals of the adjacent faces of a cube. Determine their resultant.

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93. Show that the vectors $\vec{a}-2\vec{b}+3\vec{c}, \vec{a}-3\vec{b}+5\vec{c} and -2\vec{a}+3\vec{b}-4\vec{c}$ are coplanar, where $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar.

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94. Find the angles at which the vector $2\hat{i}-\hat{j}+2\hat{k}$ is inclined to each of the coordinate axes.

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95. Prove that four points $2\vec{a}+3\vec{b}-\vec{c}, \vec{a}-2\vec{b}+3\vec{c}, 3\vec{a}+4\vec{b}-2\vec{c} and \vec{a}-6\vec{b}+6\vec{c}$ are coplanar.

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

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97. If $\vec{a} \, and \, \vec{b}$ are two non-collinear vectors, show that points $l_1 \vec{a} + m_1 \vec{b}, l_2 \vec{a} + m_2 \vec{b}$ and $l_3 \vec{a} + m_3 \vec{b}$ are collinear if $|l_1 l_2 l_3 m_1 m_2 m_3 111| = 0.$

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98. If the position vector $\vec{a}$ of a point $(12, n)$ is such that $\left|\vec{a}\right| = 13,$ find the value of n.

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99. If $A=(0,1)B=(1,0), C=(1,2), D=(2,1)$, prove that $\vec{A}B=\vec{C}D$.

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100. 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 be $\vec{a}, \vec{b}, \vec{\cdot}$

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

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102. If D is the mid-point of the side BC of a triangle ABC, prove that $\vec{A}B+\vec{A}C=2\vec{A}D$.

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103. Show that the found points A, B, C, D with position vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ respectively such that 3 $\vec{a}-2\vec{b}+5\vec{c}-6\vec{d}=\vec{0}$, are coplanar. Also, find the position vector of the point of intersection of the line segments AC and BD.

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104. Let $\vec{a}, \vec{b}, \vec{c}$ be the position vectors of three distinct points A, B, C. If there exist scalars x, y, z (not all zero) such that $x\vec{a}+y\vec{b}+z\vec{c}=0andx+y+z=0,$ then show that $A, BandC$ lie on a line.

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105. If $\vec{a}\,and\,\vec{b}$ are position vectors of points $AandB$ respectively, then find the position vector of points of trisection of AB .

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106. If $\vec{a}\,and\,\vec{b}$ are position vectors of $AandB$ respectively, find the position vector of a point $ConBA$ produced such that $BC = 1.5BA$.

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107. If $\vec{c} = 3\vec{a} + 4\vec{b}$ and $2\vec{c} = \vec{a} - 3\vec{b}$, show that (i) $\vec{c}$ and $\vec{a}$ have the same direction and $\left|\vec{c}\right| > \left|\vec{a}\right|$(ii) $\vec{b}$ and $\vec{c}$ have opposite direction and $\left|\vec{c}\right| > \left|\vec{b}\right|$

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108. Find the position vectors of the points which divide the join of the points $2\vec{a}-3\vec{b}and3\vec{a}-2\vec{b}$ internally and externally in the ratio $2:3$.

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109. Let O be the centre of a regular hexagon $ABCDEF$. Find the sum of the vectors $\vec{O}A, \vec{O}B, \vec{O}C, \vec{O}D, \vec{O}Eand\vec{O}F$.

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

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111. IF P_1, P_2, P_3, P_4 are points in a plane or space and O is the origin of vectors, show that P_4 coincides with $O \Leftrightarrow \left(\vec{O}P\right)_1 + \vec{P}_1P_2 + \vec{P}_2P_3 + \vec{P}_3P_4 = \vec{0}$.

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112. Using vectors, find the value of λ such that the points $(\lambda, -10, 3), (1, -1, 3) and (3, 5, 3)$ are collinear.

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113. If $\vec{a}, \vec{b}$ are any two vectors, then give the geometrical interpretation of g relation $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$

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114. If $\vec{P}O + \vec{O}Q = \vec{Q}O + \vec{O}R$, show that the point, P, Q, R are collinear.

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

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116. If $\vec{a}\, and\, \vec{b}$ are the vectors determined by two adjacent sides of a regular hexagon, what are the vectors determined by the other sides taken in order?

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117. Vectors drawn the origin O to the points $A, BandC$ are respectively $\vec{a}, \vec{b}$ and $\vec{4}a - \vec{3}b$. find $\vec{A}C$ and $\vec{B}C$.

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118. If $\vec{a}$ and $\vec{b}$ represent two adjacent sides $\vec{A}B$ and $\vec{B}C$ respectively of a parallelogram $ABCD$, then show that its diagonals $\vec{A}C$ and $\vec{D}B$ are equal to $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ respectively.

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119. Let $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ be the position vectors of the four distinct points A, B, C, D. If $\vec{b} - \vec{a} = \vec{a} - \vec{d}$, then show that $ABCD$ is parallelogram.

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

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

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122. If $\vec{a}$ is a position vector whose tip is $(1, -3)\cdot$ Find the coordinates of the point B such that $\vec{A}B = \vec{a}$, if A has coordinates $(-1, 5)\cdot$

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123. Find the coordinates of the tip of the position vector which is equivalent to $\vec{A}B$, where the coordinates of $AandBare(3, 1)and(5, 0)$ respectively.

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124. Write all the unit vectors in $XY - plane$.

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125. Find a unit vector parallel to the vector $3\hat{i} + 4\hat{j}$.

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126. If A, B, C have position vectors $(2, 0, 0), (0, 1, 0), (0, 0, 2)$, show that ABC is isosceles.

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

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

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129. If the position vectors of the points $A, B, C, D are 2\hat{i} + 4\hat{k}, 5\hat{i} + 3\sqrt{3}\hat{j} + 4\hat{k}, -2\sqrt{3}\hat{j} + \hat{k} and 2\hat{i} + \hat{k}$ respectively, prove that CD is parallel to $AB and CD = \frac{2}{3}AB$.

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130. Represent graphically

i. a displacement of 40 km, 30^0 west of south ii 60 km, 40^0 east of north iii.50 km south east.

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131. Classify the following measures as scalars and vectors

a.10 kg b.10 meters north –west c.10 Newton

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132. Classify the following measures as scalars and vectors

a.30 km / hr b.50 m/ sec towards north c.10^{-19} coloumb

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133. In a fig 23.4 (a square), identify the following vectors: i.Coinitial ii.Equal iii.Collinear but not equal

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134. In fig 23.3, which of the vectors are: i.Collinear ii. Equal iii. Co-initial

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135. Represent the following graphically:

i.A displacement of 40 km, 30^0 east of north ii.A displacement of 50 km south east iii.A displacement of 70 km, 40^0 north of west

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136. Classify the following measures as scalars and vectors: a.15 kg b. 520 kg weight c. 45^0 d.10 meters south east e. 50 $m/\sec^2$

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137. Classify the following as scalars and vector quantities: a.Time period b. Distance c. Displacement d.Force e. Work f. Velocity g.Acceleration

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138. In Fig. $ABCD$ is a regular hexagon, which vectors are: Collinear Equal Coinitial Collinear but not equal

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139. Answer the following as true or flase: $\vec{a}$ and $\vec{b}$ are collinear. Two collinear vectors are always equal in magnitude. Zero vector is unique. Two vectors having same magnitude are collinear. Two collinear vectors having the same magnitude are equal.

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140. If $\vec{a}$, $\vec{b}$, $\vec{c}$ be the vectors represented by the sides of a triangle, taken in order, then prove that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$.

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141. If P, Q and R are three collinear points such that $\vec{P}Q = \vec{a}$ and $\vec{Q}R$ = $\vec{b}$. Find the vector $\vec{P}R$.

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

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143. If $\vec{a}$ and $\vec{b}$ are two non-collinear vectors having the same initial point. What are the vectors represented by $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$.

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144. If $\vec{a}$ is a vector and m is a scalar such that $m\vec{a} = \vec{0}$, then what are the alternatives for m and $\vec{a}$?

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145. If $\vec{a}, \vec{b}$ are two vectors, then write the truth value of the following statements: $\vec{a} = -\vec{b}\left|\vec{a}\right| = \left|\vec{b}\right|$ $\left|\vec{a}\right| = \left|\vec{b}\right|\vec{a} = \pm\vec{b}\left|\vec{a}\right| = \left|\vec{b}\right|\vec{a} = \vec{b}$

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146. If $\vec{a}, \vec{b}$ are two vectors, then write the truth value of the following statements: $\vec{a} = -\vec{b}\left|\vec{a}\right| = \left|\vec{b}\right|$ $\left|\vec{a}\right| = \left|\vec{b}\right|\vec{a} = \pm\vec{b}\left|\vec{a}\right| = \left|\vec{b}\right|\vec{a} = \vec{b}$

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147. If $\vec{a}, \vec{b}$ are two vectors, then write the truth value of the following statements: $\vec{a} = -\vec{b}\left|\vec{a}\right| = \left|\vec{b}\right|$ $\left|\vec{a}\right| = \left|\vec{b}\right|\vec{a} = \pm\vec{b}\left|\vec{a}\right| = \left|\vec{b}\right|\vec{a} = \vec{b}$

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148. $ABCD$ is a quadrilateral. Find the sum the vectors $\vec{B}A$, $\vec{B}C$, and $\vec{D}A$.

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149. $ABCDE$ is pentagon, prove that $\vec{A}B + \vec{B}C + \vec{C}D + \vec{D}E + \vec{E}A = \vec{0}$ $\vec{A}B + \vec{A}E + \vec{B}C + \vec{D}C + \vec{E}D + \vec{A}C = 3\vec{A}C$

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150. $ABCDE$ is pentagon, prove that $\vec{A}B + \vec{B}C + \vec{C}D + \vec{D}E + \vec{E}A = \vec{0}$ $\vec{A}B + \vec{A}E + \vec{B}C + \vec{D}C + \vec{E}D + \vec{A}C = 3\vec{A}C$

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151. Prove that the sum of all vectors drawn from the centre of a regular octagon to its vertices is the zero vector.

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152. If P is a point and $ABCD$ is a quadrilateral and $\vec{A}P + \vec{P}B + \vec{P}D = \vec{P}C$, show that $ABCD$ is a parallelogram.

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153. Five forces $\vec{A}B$, $\vec{A}C$, $\vec{A}D$, $\vec{A}E$ and $\vec{A}F$ act at the vertex of a regular hexagon $ABCDEF$. Prove that the resultant is $6\vec{A}O$, where O is the centre of heaagon.

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154. The position vectors of A, B,C and D are $\vec{a}$, $\vec{b}$, $2\vec{a}+3\vec{b}$ and $\vec{a}-2\vec{b}$ respectively show that $\vec{DB}=3\vec{b}-\vec{a}$ and $\vec{AC}=\vec{a}+3\vec{b}$

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155. Let ABCD be as parallelogram. If $\vec{a}$, $\vec{b}$, $\vec{c}$ be the position vectors $of\ A,\ B,\ C$ respectively with reference to the origin O, find the position vector of D reference to O.

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156. Find the position vector of a point R which divides the line segment joining P and Q whose position vectors are $2\vec{a}+\vec{b}\ and\ \vec{a}-4\vec{b}$, externally in the ratio 1:2, also show that P is the midpoint of the line segment RQ.

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157. Let $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ be the position vectors of the four distinct points A, B, C, D. If $\vec{b}-\vec{a}=\vec{a}-\vec{d}$, then show that $ABCD$ is parallelogram.

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158. If $\vec{a}, \vec{b}$ are the position vectors of A, B respectively, find the position vector of a point C in AB produced such that $AC=3AB$ and that a point D in BA produced such that $BD=2BA$.

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159. Show that the found points A, B, C, D with position vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ respectively such that 3 $\vec{a}-2\vec{b}+5\vec{c}-6\vec{d}=\vec{0}$,

are coplanar. Also, find the position vector of the point of intersection of the line segments AC and BD.

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

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161. The vertices A, B, C of triangle ABC have respectively position vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ with respect to a given origin O. Show that the point D where the bisector of $\angle A$ meets BC has position vector $\vec{d}=\dfrac{\beta\vec{b}+\gamma\vec{c}}{\beta+\gamma}$, where $\beta=\left|\vec{c}-\vec{a}\right|$ and, $\gamma=\left|\vec{a}-\vec{b}\right|$.

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162. If $P \, and \, Q$ are the mid points of the sides AB and CD of a parallelogram ABCD, prove that DP and BQ cut the diagonal AC in its points of trisection which are also the points of trisection of DP and BQ respectively.

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163. If O is a point in space, ABC is a triangle and D, E, F are the mid-points of the sides BC, CA and AB respectively of the triangle, prove that $\vec{O}A + \vec{O}B + \vec{O}C = \vec{O}D + \vec{O}E + \vec{O}F$.

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

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165. $ABCD$ is parallelogram and P is the point of intersection of its diagonals. If O is the origin of reference, show that $\vec{O}A + \vec{O}B + \vec{O}C + \vec{O}D = 4\vec{O}P$.

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166. Show that the line segments joining the mid-points of opposite sides of a quadrilateral bisects each other.

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167. $ABCD$ are four points in a plane and Q is the point of intersection of the lines joining the mid-points of AB and CD; BC

and AD. Show that $\vec{P}A + \vec{P}B + \vec{P}C + \vec{P}D = 4\vec{P}Q$, where P is any point.

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168. Prove that the internal bisectors of the angles of a triangle are concurrent

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169. 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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170. ABCD is a parallelogram. If the coordinates of $A, B, C \, are \, (2, 3), (1, 4) and \, (0, -2)$ respectively, find the coordinates of D.

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171. Find the vector of magnitude 5 units which is parallel to the vector $2\hat{i} - 4\hat{j}$.

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172. Find the components along the coordinates axes of the position vector of each of the following points: $P(5, 4)$

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173. Find the components along the coordinates axes of the position vector of each of the following points: $Q(-4, 3)$

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174. Find the components along the coordinates axes of the position vector of each of the following points: $R\,(5,\ -7)$

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175. Find the components along the coordinates axes of the position vector of each of the following points: $S(-4,\ -5)$

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

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

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

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179. If the position vector of a point $(-4, -3) be \vec{a}$, find $\left|\vec{a}\right|$.

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180. If the position vector $\overrightarrow{a}$ of a point $(12, n)$ is such that $\left|\overrightarrow{a}\right| = 13,$ find the value of $n\cdot$

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181. Find a vector of magnitude 4 units which is parallel to the vector $\sqrt{3}\hat{i} + \hat{j}\cdot$

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182. Express $\overrightarrow{A}B$ in terms of unit vectors $\hat{i}$ and $\hat{j},$ when the points are: i)$A(4, -1), B(1, 3)$ ii)$A(-6, 3), B(-2, -5)$ Find $\left|\overrightarrow{A}B\right|$ in each case.

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183. Find the coordinates of the tip of the position vector which is equivalent to $\overrightarrow{A}B$, where the coordinates of A and B are $(-1, 3)$ and $(-2, 1)$ respectively.

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184. $ABCD$ is parallelogram. If the coordinates of A, B, C are $(-2, -1), (3, 0)$ and $(1, -2)$ respectively, find the coordinates of D.

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185. If the position vectors of the points $A(3, 4), B(5, -6)$ and $(4, -1)$ are $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ respectively compute $\overrightarrow{a} + 2\overrightarrow{b} - 3\overrightarrow{\cdot}$

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186. If $\overrightarrow{a}$ be the position vector whose tip is $(5, -3)$, find the coordinates of a point B such that $\overrightarrow{AB} = \overrightarrow{a}$, the coordinates of A being $(4, -1)$.

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187. Show that the point $2\hat{i}, -\hat{i}-4\hat{j}$ and $-\hat{i}+4\hat{j}$ from an isosceles triangle.

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188. Find a unit vector parallel to the vector $\hat{i}+\sqrt{3}\hat{j}$

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189. Find the components along the coordinate axes of the position vector of each of the following points: $P(3, 2)$

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190. Find the components along the coordinate axes of the position vector of each of the following points: $(-5, 1)$

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191. Find the components along the coordinate axes of the position vector of each of the following points: $R(-11, -9)$

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192. Find the components along the coordinate axes of the position vector of each of the following points: $S(4, -3)$

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

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194. Find the sum of 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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195. Find the distance between the points $A(2, 3, 1) and\ B(-1, 2, -3)$, using vector method.

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196. Show that the points $A, B\ and\ C$ with position vectos $\vec{a} = 3\hat{i} - 4\hat{j} - 4\hat{k},\ \vec{b} = 2\hat{i} - \hat{j} + \hat{k}\ and\ \vec{c} = \hat{i} - 3\hat{j} - 5\hat{k}$ represent, form the vertices of a right angled triangle.

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

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

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199. Find the magnitude of the vectors $\overrightarrow{a} = 2\hat{i} + 3\hat{j} - 6\hat{k}$.

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200. Find the unit vector in the direction of $3\hat{i} + 4\hat{j} - 12\hat{k}$.

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201. The adjacent sides of a parallelogram are represented by the vectors $\overrightarrow{a} = \hat{i} + \hat{j} - \hat{k} \, and \, \overrightarrow{b} = -2\hat{i} + \hat{j} + 2\hat{k}$. Find unit vectors parallel to the diagonals of the parallelogram.

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202. If

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

find $\left|3\vec{a} - 2\vec{b} + 4\vec{c}\right|.$

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203. 6). If $\vec{P}Q = 3\hat{i} + 2\hat{j} - \hat{k}$ and the coordinates of P are $(1, -1, 2)$, find the coordinates of $Q.$ (7). prove that the points $\hat{i} - \hat{j}, 4\hat{i} - 3\hat{j} + \hat{k}, 2\hat{i} - 4\hat{j} + 5\hat{k}$ are the vertices of a right angled triangle.

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204. Prove that the points $\hat{i}-\hat{j}, 4\hat{i}-3\hat{j}+\hat{k}$ and $2\hat{i}-4\hat{j}+5\hat{k}$ are the vertices of a right angled triangle.

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205. If the vertices $A,\ B,\ C$ of a triangle ABC are the point with position vectors $a_1\hat{i}+a_2\hat{j}+a_3\hat{k},\ b_1\hat{i}+b_2\hat{j}+b_3\hat{k},\ c_1\hat{i}+c_2\hat{j}+c_3\hat{k}$ respectively, what are the vectors determined by its sides? Find the length of these vectors.

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206. Find the position vector from the origin O to the centroid of the triangle whose vertices are $(1,\ -1, 2), (2, 1, 3)$ and $-1, 2,\ -1)$.

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

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

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

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

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212. 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 $2\vec{a}-\vec{b}+3\vec{\cdot}$

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213. 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 $2\vec{a} - \vec{b} + 3\vec{\cdot}$

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214. Two vectors $\hat{j} + \hat{k}$ and $3\hat{i} - \hat{j} + 4\hat{k}$ represents the two side vectors $\vec{A}B$ and $\vec{A}C$ respectively of ΔABC Find the length of median from A.

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

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216. If $a \text{ and } b$ ar non collinear vector such that $x_1 \vec{a} + y_1 \vec{b} = x_2 \vec{a} + y_2 \vec{b}$, then prove that $x_1 = x_2 \text{and } y_1 = y_2.$

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217. Show that the points with position vectors $\vec{a} - 2\vec{b} + 3\vec{c}, \ -2\vec{a} + 3\vec{b} - \vec{c} \text{ and } 4\vec{a} - 7\vec{b} + 7\vec{c}$ are collinear.

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218. Show that the three points $A(-2, 3, 5); B(1, 2, 3)$ and $C(7, 0, -1)$ are collinear.

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219. The position vectors of the points P, Q, R are $\hat{i} + 2\hat{j} + 3\hat{k}, \ -2\hat{i} + 3\hat{j} + 5\hat{k} \ and \ 7\hat{i} - \hat{k}$ respectively. Prove that $P, \ Q \ and \ R$ are collinear points.

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220. Show that the point A, B, C with position vectors $\vec{a} - 2\vec{b} + 3\vec{c}, 2\vec{a} + 3\vec{b} - 4\vec{c}$ and $-7\vec{b} + 10\vec{c}$ are collinear.

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221. If $a, \ b, \ c$ are non coplanar vectors prove that the points having the following position vectors are collinear: $\vec{a}, \ \vec{b}, \ 3\vec{a} - 2\vec{b}$

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222. If $a, \ b, \ c$ are non coplanar vectors prove that the points having the following position vectors are collinear: $\vec{a} + \vec{b} + \vec{c}, \ 4\vec{a} + 3\vec{b}, \ 10\vec{a} + 7\vec{b} - 2\vec{c} \cdot$

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223. Prove that the points having position vectors $\hat{i} + 2\hat{j} + 3\hat{k}, \ 3\hat{i} + 4\hat{j} + 7\hat{k}, \ -3\hat{i} - 2\hat{j} - 5\hat{k}$ are collinear.

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224. If the points with position vectors $10\hat{i} + 3\hat{j}, 12\hat{i} - 5\hat{j}$ and $a\hat{i} + 11\hat{j}$ are collinear, find the value of $a \cdot$

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225. If $\overrightarrow{a}, \overrightarrow{b}$ are two non-collinear vectors, prove that the points with position vectors $\overrightarrow{a}+\overrightarrow{b}, \overrightarrow{a}-\overrightarrow{b}$ and $\overrightarrow{a}+\lambda\overrightarrow{b}$ are collinear for all real values of $\lambda\cdot$

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226. If $\overrightarrow{AO}+\overrightarrow{OB}=\overrightarrow{BO}+\overrightarrow{OC}$, prove that A, B, C are collinear points.

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227. If the points $A(m, -1), \ B(2, 1) and \ C(4, 5)$ are collinear find the value of $m\cdot$

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228. 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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229. Show that the points (3,4), (-5, 16), (5,1) are collinear.

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230. If the vectors $\vec{a} = 2\hat{i} - 3\hat{j} \; and \; \vec{b} = -6\hat{i} + m\hat{j}$ are collinear, find the value of m

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231. 8. 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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232. Using vectors show that the points $A(-2, 3, 5), B(7, 0, -1) C(-3, -2, -5)$ and $D(3, 4, 7)$ are such that AB and CD intersect at the point $P(1, 2, 3)$.

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233. Show that the points whose position vectors are as given below are collinear: $2\hat{i} + \hat{j} - \hat{k},\ 3\hat{i} - 2\hat{j} + \hat{k}\ and\ \hat{i} + 4\hat{j} - 3\hat{k}$

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234. Using vector method, prove that the following points are collinear:

A(6,-7,-1) B(2,-3,1) C(4,-5,0)

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235. Using vector method, prove that the following points are collinear:

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

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236. Using vector method, prove that the following points are collinear:

A(1,2,7) B(2,6,3) C(3,10,-1)

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237. Using vector method, prove that the following points are collinear: A(-3,-2-5),B(1,2,3)and C(3,4,7)

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238. If a, b, c are non zero non coplanar vectors, prove that the following vectors are coplanar. $5\vec{a}+6\vec{b}+7\vec{c},\ 7\vec{a}-8\vec{b}+9\vec{c}\ and\ 3\vec{a}+20\vec{b}+5\vec{c}$

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239. Let $\vec{a},\ \vec{b}\ and\ \vec{c},$ be non-zero non-coplanar vectors. Prove that: $\vec{a}-2\vec{b}+3\vec{c},\ -2\vec{a}+3\vec{b}-4\vec{c}\ and\ \vec{c}-3\vec{b}+5\vec{c}$ are coplanar vectors. $2\vec{a}-\vec{b}+3\vec{c},\ \vec{a}+\vec{b}-2\vec{c}\ and\ \vec{a}+\vec{b}-3\vec{c}$ are non-coplanar vectors.

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240. 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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241. Prove that the following vectors are coplanar: $2\hat{i}-\hat{j}+\hat{k},\ \hat{i}-3\hat{j}-5\hat{k}\ and\ 3\hat{i}-4\hat{j}-4\hat{k}$

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242. Prove that the following vectors are coplanar: $\hat{i}+\hat{j}+\hat{k},\ 2\hat{i}+3\hat{j}-\hat{k}\ and\ -\hat{i}-2\hat{j}+2\hat{k}$

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243. Prove that the following vectors are non coplanar: $3\hat{i}+\hat{j}-\hat{k},\ 2\hat{i}-\hat{j}+7\hat{k}\ and\ 7\hat{i}-\hat{j}+23\hat{k}$

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244. Prove that the following vectors are non-coplanar: $\hat{i}+2\hat{j}+3\hat{k},\ 2\hat{i}+\hat{j}+3\hat{k}\ and\ \hat{i}+\hat{j}+\hat{k}$

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245. If $\overrightarrow{a},\ \overrightarrow{b},\ \overrightarrow{c}$ are non coplanar vectors, prove that the following vectors are non coplanar: $2\overrightarrow{a}-\overrightarrow{b}+3\overrightarrow{c},\ \overrightarrow{a}+\overrightarrow{b}-2\overrightarrow{c}\ and\ \overrightarrow{a}+\overrightarrow{b}-3\overrightarrow{c}$

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246. If $\vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors, prove that the following vectors are non coplanar: $\vec{a} + 2\vec{b} + 3\vec{c}, 2\vec{a} + \vec{b} + 3\vec{c}$ and $\vec{a} + \vec{b} + \vec{c}$

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

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

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249. The direction cosines of a vector $\vec{r}$, which is equally inclined to OX, OY and OZ If $\left|\vec{r}\right|$ is given, the total number of such vectors is given by

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250. Can a vector have direction angles $45^0, 60^0, 120^0$

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251. Prove that 1,1,1 cannot be direction cosines of a straight line.

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252. A vector makes an angle of $\frac{\pi}{4}$ with each of x-axis and y-axis Find the angle made by it with the z-axis.

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253. The vector $\overrightarrow{r}$ is inclined at equal acute angles of x-axis,y axis, and z-axis. If $\left|\overrightarrow{r}\right| = 6$ units, find $\overrightarrow{r}$.

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254. A vector $\overrightarrow{r}$ is inclined to x-axis at 45^0 and y-axis at 60^0. If $\left|\overrightarrow{r}\right| = 8$ units, find $\overrightarrow{r}$.

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255. Find the direction cosines of the following vectors: $2\hat{i} + 2\hat{j} - \hat{k}$

$6\hat{i} - 2\hat{j} - 3\hat{k}\ 3\hat{i} - 4\hat{k}$

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256. Find the direction cosines of the following vectors: $2\hat{i} + 2\hat{j} - \hat{k}$

$6\hat{i} - 2\hat{j} - 3\hat{k}\ 3\hat{i} - 4\hat{k}$

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257. Find the direction cosines of the following vectors: $2\hat{i} + 2\hat{j} - \hat{k}$

$6\hat{i} - 2\hat{j} - 3\hat{k}\ 3\hat{i} - 4\hat{k}$

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258. Find the angles at which the following vectors are inclined to each of the coordinate axes: $\hat{i} - \hat{j} + \hat{k}$

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259. Find the angles at which the following vectors are inclined to each of the coordinate axes: $\hat{j} - \hat{k}$

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260. Find the angles at which the following vectors are inclined to each of the coordinate axes: $4\hat{i} + 8\hat{j} + \hat{k}$

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261. Show that the vector $i + j + k$ is equally inclined with the axes $OX, \ OY \ and \ OZ$.

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

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

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264. 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-axis respectively.

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

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266. Define zero vector.

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267. Define unit vector.

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268. Define position vector of point.

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269. Write $\vec{P}Q + \vec{R}P + \vec{Q}R$ in the simplified form.

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270. If $\vec{a}\ and\ \vec{b}$ represent two adjacent sides of a parallel then write vectors representing its diagonals.

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271. If $\vec{a}, \vec{b}, \vec{c}$ represent the sides of a triangle taken in order, then write the value of $\vec{a} + \vec{b} + \vec{c}$

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272. If $\vec{a}, \vec{b}, \vec{c}$ are position vectors of the vertices $A, B \, and \, C$ respectively, of a triangle ABC, write the value of $\vec{A}B + \vec{B}C + \vec{C}A$.

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273. If $\vec{a}, \vec{b}, \vec{c}$ are position vectors of the vertices of a triangle, then write the position vector of its centroid.

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274. If $\vec{a}, \vec{b}, \vec{c}$ are position vectors o the point $A, B, and \, C$ respectively, write the value of $\vec{A}B + \vec{B}C + \vec{A}C$.

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275. If G denotes the centroid of $\text{Delta } ABC$, then write the value

o $\overrightarrow{G}A + \overrightarrow{G}B + \overrightarrow{G}C$.

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276. If D is the mid point of side BC of a triangle ABC such that $\overrightarrow{A}B + \overrightarrow{A}C = \lambda \overrightarrow{A}D$, write the value of λ.

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277. If D, E, F are the mid points of the side BC, CA and AB respectively of a triangle ABC, write the value of $\overrightarrow{A}D + \overrightarrow{B}E + \overrightarrow{C}F$.

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278. If $\overrightarrow{a}$ is a non zero vecrtor iof modulus a and m is a non zero scalar such that ma is a unit vector, write the value of m.

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279. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are the position vectors of the vertices of an equilateral triangle whose orthocentre is the origin, then write the value of $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}$

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280. Write a unit vector making equal acute angle with the coordinates axes.

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281. If a vector makes angle α, β, γ with OX, OY and OZ respectively, then write the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

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282. Write a vector of magnitude 12 units which makes 45^0 angle with X-axis 60^0 angle with Y-axis and an obtuse angle with Z-axis.

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283. Write the length (magnitude) of a vector whose project on the coordinate axes are 12,3 and 4 units.

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284. Write the position vector of a point dividing the line segment joining points A and B with position vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ externally in the ration 1:4 where $\overrightarrow{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\overrightarrow{b} = -\hat{i} + \hat{j} + \hat{k}$.

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285. Write the direction cosines of the vector $\overrightarrow{r} = 6\hat{i} - 2\hat{j} + 3\hat{k}$.

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286. If $\overrightarrow{a} = i + j$, $\overrightarrow{b} = j + k$ and $\overrightarrow{c} = k + i$, write unit vectors parallel to $\overrightarrow{a} + \overrightarrow{b} - 2\overrightarrow{c}$.

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287. If $\vec{a} = \hat{i} + \hat{j},\ \vec{b} = \hat{j} + \hat{k}\ and\ \vec{c} = \hat{k} + \hat{i},$ where unit vectors parallel to $\vec{a} + \vec{b} - 2\vec{c}$.

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288. If $\vec{a} = \hat{i} + 2\hat{j},\ \vec{b} = \hat{j} + 2\hat{k},$ write a unitvector along the vector $3\vec{a} - 2\vec{b}$.

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289. Write the position vector of a point dividing the line segment joining points having position vectors $\hat{i} + \hat{j} - 2\hat{k}\ and\ 2\hat{i} - \hat{j} + 3\hat{k}$ externally in the ratio 2:3.

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290. If $\overrightarrow{a} = \hat{i} + \hat{j}, \overrightarrow{b} = \hat{j} + \hat{k}, \overrightarrow{c} = \hat{k} + \hat{i}$ find the unit vector in the direction of $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}$

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291. If

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

find $\left|3\overrightarrow{a} - 2\overrightarrow{b} + 4\overrightarrow{c}\right|.$

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292. A unit vector $\overrightarrow{r}$ makes angle $\frac{\pi}{3} \; and \; \frac{\pi}{2}$ with $\hat{j} and \; \hat{k}$ respectively and an acute angle $\theta \; with \; i,$ Find $\theta.$

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

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294. If $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}\ and\ \vec{b} = 2\hat{i} + 4\hat{j} + 9\hat{k}$ find a unit vector parallel to $\vec{a} + \vec{b}$.

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

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

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

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

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299. Write two different vectors having same magnitude.

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300. Write two different vectors having same direction.

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301. Write a vector in the direction of vector $5\hat{i} - \hat{j} + 2\hat{k}$ which has magnitude of 8 unit.

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

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

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

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305. Writhe the direction cosines of the vectors $-2\hat{i} + \hat{j} - 5\hat{k}$.

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306. Find the sum of the following vectors $\vec{a} = \hat{i} - 2\hat{j},\ \vec{b} = 2\hat{i} - 3\hat{j},\ \vec{c} = 2\hat{i} + 3\hat{k}$.

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

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

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

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

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

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312. Write a unit vector in the direction of $\overrightarrow{PQ}$ where PQ are the points $(1, 3, 0)$ and $(4, 5, 6)$ respectively.

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

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314. It $\left|\vec{a}\right| = 4$ and $-3 \leq \lambda \leq 2,$ then write the range of $\lambda\left|\vec{a}\right|$

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315. In a triangle ΔOAC, if B is the mid point of side AC and $\overrightarrow{OA} = \overrightarrow{a}, \overrightarrow{OB} = \overrightarrow{b}$, then what is $\overrightarrow{OC}$?

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316. If in a $\Delta ABC, \ A = (0, 0), \ B = (3, 3\sqrt{3}), C \equiv (-3\sqrt{3}, 3)$ then the vector of magnitude $\sqrt{2}$ $units$ directed along $AO, \ where\ O$ is the circumcentre of ABC is

A. a) $(1-\sqrt{3})\hat{i} + (1+\sqrt{3})\hat{j}$

B. b) $(1+\sqrt{3})\hat{i} + (1-\sqrt{3})\hat{j}$

C. c) $(1+\sqrt{3})\hat{i} + (\sqrt{3}-1)\hat{j}$

D. d) None of these

Answer: null

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317. If $\overrightarrow{a}, \overrightarrow{b}$ are the vectors forming consecutive sides of a regular of a regular hexagon $ABCDEF$, then the vector representing side CD is

A. a) $\overrightarrow{a} + \overrightarrow{b}$

B. b) $\overrightarrow{a} - \overrightarrow{b}$

C. c) $\overrightarrow{b} - \overrightarrow{a}$

D. d) $-\left(\overrightarrow{a} + \overrightarrow{b}\right)$

Answer: c) $\overrightarrow{b} - \overrightarrow{a}$

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318. Forces $3\overrightarrow{OA}$, $5\overrightarrow{OB}$ act along $OA\, and\, OB$ If their resultant passes through C on AB, then C is a

A. a) mid point of AB

B. b) C divides AB in the ratio $2:1$

C. c) $3AC = 5CB$

D. d) $2AC = 3CB$

Answer: null

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319. If $\overrightarrow{a}$, $\overrightarrow{b}$, $\overrightarrow{c}$ are three non-zero vectors, no two which are collinear and the vector $\overrightarrow{a} + \overrightarrow{b}$ is collinear with $\overrightarrow{c}$, $\overrightarrow{b} + \overrightarrow{c}$ is collinear with $\overrightarrow{a}$ then, $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} =$

A. a) $\overrightarrow{a}$

B. b) $\vec{b}$

C. c) $\vec{c}$

D. d) None of these

Answer: d) None of these

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320. If points $A\left(60\hat{i}+3\hat{j}\right)$, $B\left(40\hat{i}-8\hat{j}\right)$ and $C\left(a\hat{i}-52\hat{j}\right)$ are collinear, then a is equal to

A. a) 40

B. b) -40

C. c) 20

D. d) -20

Answer: b) -40

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321. If G is the intersection of diagonals of a parallelogram $ABCD$ and O is any point then $\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}+\overrightarrow{OD}=$

A. a) $2\overrightarrow{OG}$

B. b) $4\overrightarrow{OG}$

C. c) $5\overrightarrow{OG}$

D. d) $3\overrightarrow{OG}$

Answer: null

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322. The vector $\cos\alpha\cos\beta\hat{i}+\cos\alpha\sin\beta\hat{j}+\sin\alpha\hat{k}$ is a

A. a) null vector

B. b) unit vector

C. c) constant vector

D. d) none of these

Answer: b) unit vector

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323. In a regular hexagon $ABCDEF$, $\overrightarrow{AB} = a$, $\overrightarrow{BC} = \vec{b}$, $\overrightarrow{CD} = c$ Then\ $\vec{A}\ E =$

A. a) $\vec{a} + \vec{b} + \vec{c}$

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

C. c) $\vec{b} + \vec{c}$

D. d) $\vec{a} + 2\vec{b} + 2\vec{c}$

Answer: null

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324. The vector equation of the plane passing through $\vec{a}, \vec{b}, \vec{c}$ is $\vec{r} = \alpha\vec{a} + \beta\vec{b} + \gamma\vec{c}$ provided that

A. a) $\alpha + \beta + \gamma = 0$

B. b) $\alpha + \beta + \gamma = 1$

C. c) $\alpha + \beta = \gamma$

D. d) $\alpha^2 + \beta^2 + \gamma^2 = 1$

Answer: b) $\alpha + \beta + \gamma = 1$

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325. If $O \, and \, O'$ are circumcentre and orthocentre of $ABC, \; then \, \vec{O}A + \vec{O}B + \vec{O}C$ equals a.$2\overrightarrow{O}O'$ b. $\overrightarrow{O}O'$ c. $\overrightarrow{O}'O$ d. $2\overrightarrow{O}'O$

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326. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ and $\overrightarrow{d}$ are the position vectors of points A, B, C, D such that no three of them are collinear and $\overrightarrow{a}+\overrightarrow{c}=\overrightarrow{b}+\overrightarrow{d}$, then $ABCD$ is a

A. a) rhombus

B. b) rectangle

C. c) square

D. d) parallelogram

Answer: d) parallelogram

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327. Let G be the centroid of ABC. If $\vec{A}B = \vec{a}$, $\vec{A}C = \vec{b}$, then the bisector $\vec{A}G$, in terms of $\vec{a}\ and\ \vec{b}$ is $\frac{2}{3}\left(\vec{a} + \vec{b}\right)$ b. $\frac{1}{6}\left(\vec{a} + \vec{b}\right)$ c. $\frac{1}{3}\left(\vec{a} + \vec{b}\right)$ d. $\frac{1}{2}\left(\vec{a} + \vec{b}\right)1$

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328. If $ABCDEF$ is a regular hexagon, them $\overrightarrow{AD} + \overrightarrow{EB} + \overrightarrow{FC}$ equals

A. a) $2\overrightarrow{AB}$

B. b) $\vec{0}$

C. c) $3\overrightarrow{AB}$

D. d) $4\overrightarrow{AB}$

Answer: d) $4\overrightarrow{AB}$

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329. The position vectors of the points A, B, C are $2\hat{i}+\hat{j}-\hat{k},\ 3\hat{i}-2\hat{j}+\hat{k}$ and $\hat{i}+4\hat{j}-\hat{k}$ respectively. These points

A. a) Form an isosceles triangle

B. b) Form a right triangle

C. c) Are collinear

D. d) Form a scalene triangle

Answer: a) Form an isosceles triangle

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330. If three points A, B and C have position vectors $\hat{i}+x\hat{j}+3\hat{k},\ 3\hat{i}+4\hat{j}+7\hat{k}$ and $y\hat{i}-2\hat{j}-5\hat{k}$ respectively are collinear, them $(x, y)=$

A. a) $(2, -3)$

B. b) $(-2, 3)$

C. c) $(-2, -3)$

D. d) $(2, 3)$

Answer: c) $(-2, -3)$

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331. $ABCD$ is a parallelogram with AC and BD as diagonals. Then, $\overrightarrow{AC} - \overrightarrow{BD} =$

A. a) $4\overrightarrow{AB}$

B. b) $3\overrightarrow{AB}$

C. c) $2\overrightarrow{AB}$

D. d) $\overrightarrow{AB}$

Answer: c) $2\overrightarrow{AB}$

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Others

1. If O is the circumcentre adn O' the orthocentre of a triangle ABC, prove that $\overrightarrow{S}A+\overrightarrow{S}B+SC=3\overrightarrow{S}G$, is any point in the plane of triangle ABC whose centroid is at G. $\overrightarrow{O}A+\overrightarrow{O}B+\overrightarrow{O}C=\overrightarrow{O}O'$ $\overrightarrow{O}'A+\overrightarrow{O}'B+\overrightarrow{O}'C=2\overrightarrow{O}'O$ $\overrightarrow{A}P'+\overrightarrow{O}'B+\overrightarrow{O}'C+\ =\overrightarrow{A}P, where\overrightarrow{A}P$ is the diameter of the circumcircle.

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