

MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

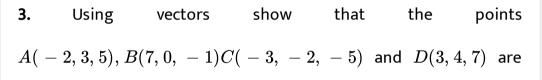
ALGEBRA OF VECTORS

Solved Examples And Exercises

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

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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such that AB and CD intersect at the point P(1, 2, 3).



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



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} .



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

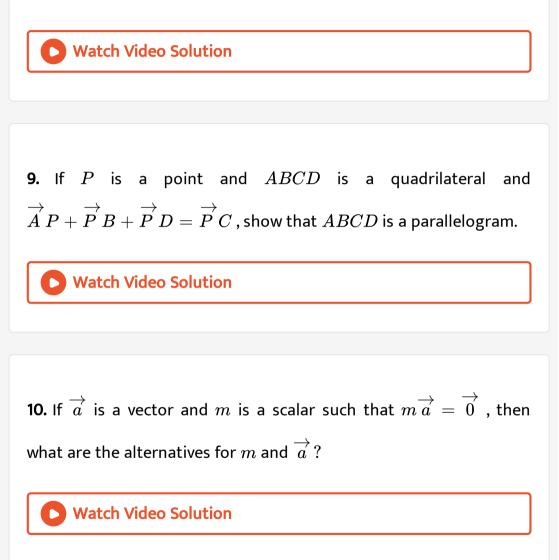
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7. Find the direction cosines of the following vectors: $2\hat{i}+2\hat{j}-\hat{k}$

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

8. Prove that the sum of three vectors determined by the medians of

a triangle directed from the vertices is zero.



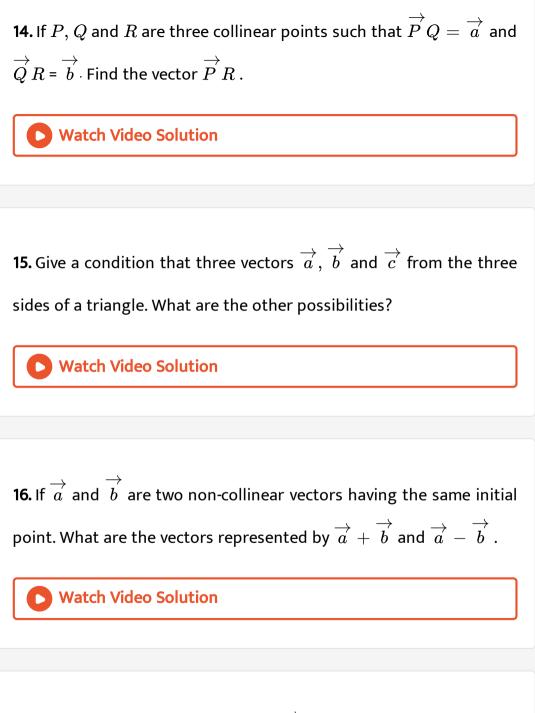
11. If \overrightarrow{a} , \overrightarrow{b} are two vectors, then write the truth value of the following statements: $\overrightarrow{a} = -\overrightarrow{b} |\overrightarrow{a}| = |\overrightarrow{b}|$

$$\left| \overrightarrow{a} \right| = \left| \overrightarrow{b} \right| \overrightarrow{a} = \pm \overrightarrow{b} \left| \overrightarrow{a} \right| = \left| \overrightarrow{b} \right| \overrightarrow{a} = \overrightarrow{b}$$

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

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



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

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

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

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

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

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

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24. 6). If $\overrightarrow{P}Q = 3\hat{i} + 2\hat{j} - \hat{k}$ 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.

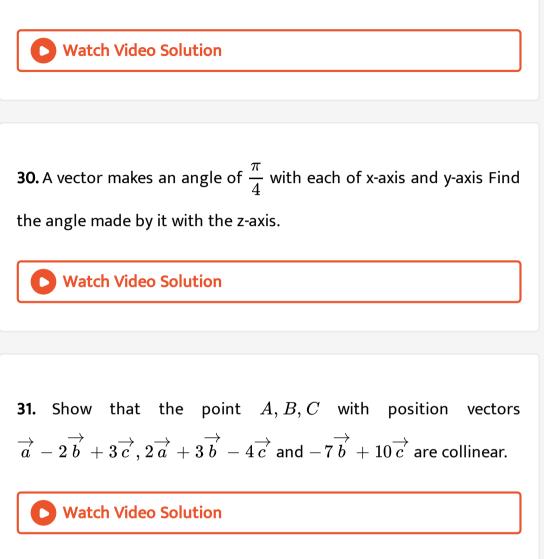
26. Find the position vector from the origin O to the centroid of the triangle whose vertices are (1, -1, 2), (2, 1, 3) and -1, 2, -1).

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

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



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

points.

33. 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 λ .

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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.

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



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

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

find a vector of magnitude 6 units which is parallel to the vector

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

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39. Answer the following as true or flase: \overrightarrow{a} and \overrightarrow{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

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.

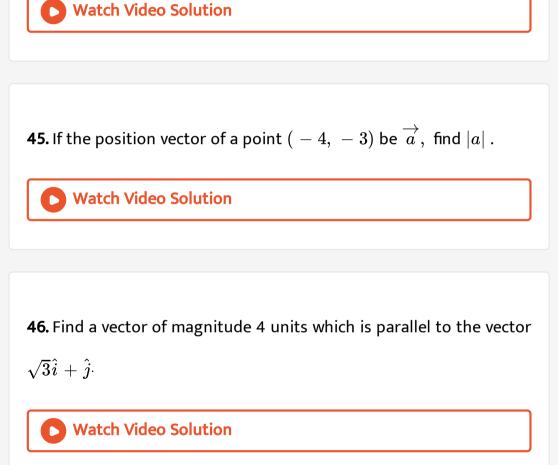


42. Express $\overrightarrow{A}B$ in terms of unit vectors \hat{i} and \hat{j} , when the points are: i)A(4, -1), B(1, 3) ii)A(-6, 3), B(-2, -5) Find $\left|\overrightarrow{A}B\right|$ in each case.

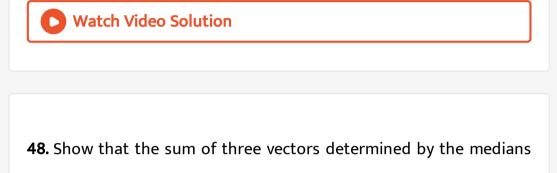
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43. If the position vectors of the points A(3, 4), B(5, -6) and (4, -1) are $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ respectively compute $\overrightarrow{a} + 2\overrightarrow{b} - 3\overrightarrow{\cdot}$

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.



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



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 $\overrightarrow{O}A + \overrightarrow{O}B + \overrightarrow{O}C + \overrightarrow{O}D = 4\overrightarrow{O}P$.

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 $\overrightarrow{O}A + \overrightarrow{O}B + \overrightarrow{O}C = \overrightarrow{O}D + \overrightarrow{O}E + \overrightarrow{O}F$.

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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 \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).

53. Show that the line segments joining the mid-points of opposite

sides of a quadrilateral bisects each other.



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.

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

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

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

collinear.



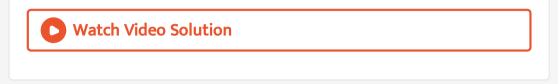
60. Prove that the line joining the mid-points of the diagonals of a trapezium is parallel to the parallel sides of trapezium and is half of their difference.



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



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.



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 $\overrightarrow{A}B + \overrightarrow{A}D + \overrightarrow{C}B + \overrightarrow{C}D = 4$ $\overrightarrow{E}F$.

65. If DandE are the mid-points of sides ABandAC of a triangle

$$ABC$$
 respectively, show that $\overrightarrow{B}E+\overrightarrow{D}C=rac{3}{2}\overrightarrow{B}C$.

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

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



68. Points L, M, N divide the sides BC, CA, AB of ABC in the ratio 1:4,

3:2, 3:7 respectively. Prove that AL + BM + CŃ is a vector parallel to CK

where K divides AB in the ratio 1: 3.



69. Prove using vectors: The diagonals of a quadrilateral bisect each

other iff it is a parallelogram.



70. Prove that the sum of the vectors directed from the vertices to

the mid-points of opposite sides of a triangle is zero.



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.

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, OY and OZ. 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.

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
$$\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$$
 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 $x_1 = x_2, y + 1 = y + 2andz_1 = z_2$.

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 noncoplanar. 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 $\overrightarrow{O}P$ is inclined to $OXat45^0 and OYat60^0$. Find the angle at which $\overrightarrow{O}P$ is inclined to OZ.

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

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



82. Find a unit vector in the direction of the resultant of the vectors

 $\hat{i} - \hat{j} + 3\hat{k}, 2\hat{i} + \hat{j} - 2\hat{k} ~~ ext{and}~~~ \hat{i} + 2\hat{j} - 2\hat{k} \cdot$

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83. Find the position vector of the mid-point of the vector joining

the points
$$Pig(2\hat{i}-3\hat{j}+4\hat{k}ig) and {
m Q}ig(4\hat{i}+\hat{j}-2\hat{k}ig)$$
 .

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.

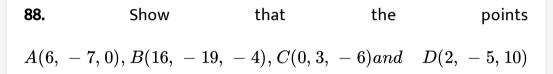
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85. Let \overrightarrow{a} , \overrightarrow{b} , \overrightarrow{c} be three non-zero vectors such that any two of them are non-collinear. If $\overrightarrow{a} + 2\overrightarrow{b}$ is collinear with \overrightarrow{c} and $\overrightarrow{b} +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

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

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 $\left|\overrightarrow{O}A\right| = 10$ units.



are such that AB and CD intersect at the point P(1, -1, 2).

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89. The lines joining the vertices of a tetrahedron to the centroids of

opposite faces are concurrent.



90. Find a vector \overrightarrow{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.

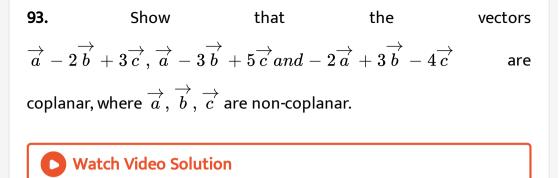
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91. Let
$$\overrightarrow{a} = \hat{i} + 2\hat{j}and\overrightarrow{b} = 2\hat{i} + \hat{j}\dot{i}s|\overrightarrow{a}| = |\overrightarrow{b}|$$
? Are the vectors $\overrightarrow{a}and\overrightarrow{b}$ equal?

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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.





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

95. Prove that four points

 $2\overrightarrow{a} + 3\overrightarrow{b} - \overrightarrow{c}, \overrightarrow{a} - 2\overrightarrow{b} + 3\overrightarrow{c}, 3\overrightarrow{a} + 4\overrightarrow{b} - 2\overrightarrow{c}$ and $\overrightarrow{a} - 6\overrightarrow{b} + 6\overrightarrow{c}$

are coplanar.

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

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97. If \overrightarrow{a} and \overrightarrow{b} are two non-collinear vectors, show that points $l_1\overrightarrow{a} + m_1\overrightarrow{b}, l_2\overrightarrow{a} + m_2\overrightarrow{b}$ and $l_3\overrightarrow{a} + m_3\overrightarrow{b}$ are collinear if $|l_1l_2l_3m_1m_2m_3111| = 0.$

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

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

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

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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 $\overrightarrow{OP} = 2\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{OQ} = \overrightarrow{a} - 2\overrightarrow{b}$, respectively in the ratio 1:2

internally and externally.

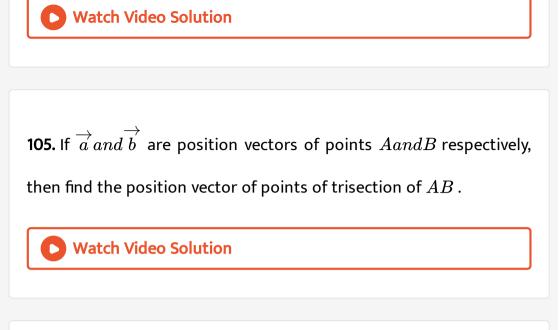
102. If D is the mid-point of the side BC of a triangle ABC, prove that $\overrightarrow{A}B + \overrightarrow{A}C = 2\overrightarrow{A}D$.

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103. Show that the found points A, B, C, D with position vectors $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}, \overrightarrow{d}$ respectively such that $3 \overrightarrow{a} - 2 \overrightarrow{b} + 5 \overrightarrow{c} - 6 \overrightarrow{d} = \overrightarrow{0}$, 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 \overrightarrow{a} , \overrightarrow{b} , \overrightarrow{c} be the position vectors of three distinct points A, B, C. If there exist scalars x, y, z (not all zero) such that $x\overrightarrow{a} + y\overrightarrow{b} + z\overrightarrow{c} = 0$ and x + y + z = 0, then show that A, BandC lie on a line.



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

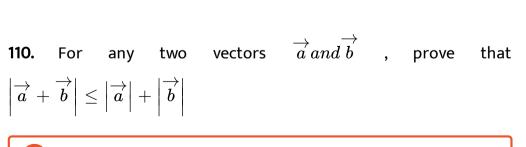
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107. If $\overrightarrow{c} = 3\overrightarrow{a} + 4\overrightarrow{b}$ and $2\overrightarrow{c} = \overrightarrow{a} - 3\overrightarrow{b}$, show that (i) \overrightarrow{c} and \overrightarrow{a} have the same direction and $|\overrightarrow{c}|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

108. Find the position vectors of the points which divide the join of the points $2\overrightarrow{a} - 3\overrightarrow{b}and3\overrightarrow{a} - 2\overrightarrow{b}$ 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 $\overrightarrow{O}A$, $\overrightarrow{O}B$, $\overrightarrow{O}C$, $\overrightarrow{O}D$, $\overrightarrow{O}Eand\overrightarrow{O}F$.



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 $O \Leftrightarrow \left(\overrightarrow{O}P\right)_1 + \overrightarrow{P}_1P_2 + \overrightarrow{P}_2P_3 + \overrightarrow{P}_3P_4 = \overrightarrow{0}$.

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

114. If
$$\overrightarrow{P}O + \overrightarrow{O}Q = \overrightarrow{Q}O + \overrightarrow{O}R$$
, 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 \overrightarrow{a} and \overrightarrow{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?

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

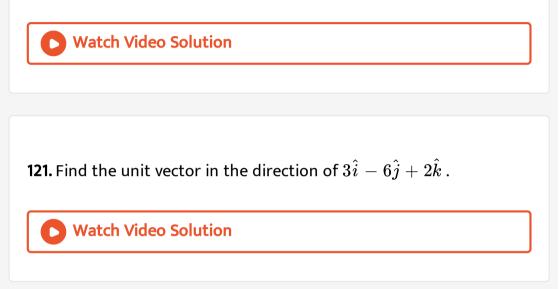
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118. If
$$\overrightarrow{a}$$
 and \overrightarrow{b} represent two adjacent sides \overrightarrow{A} Band \overrightarrow{B} C respectively of a parallelogram ABCD, then show that its diagonals \overrightarrow{A} Cand \overrightarrow{D} B are equal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

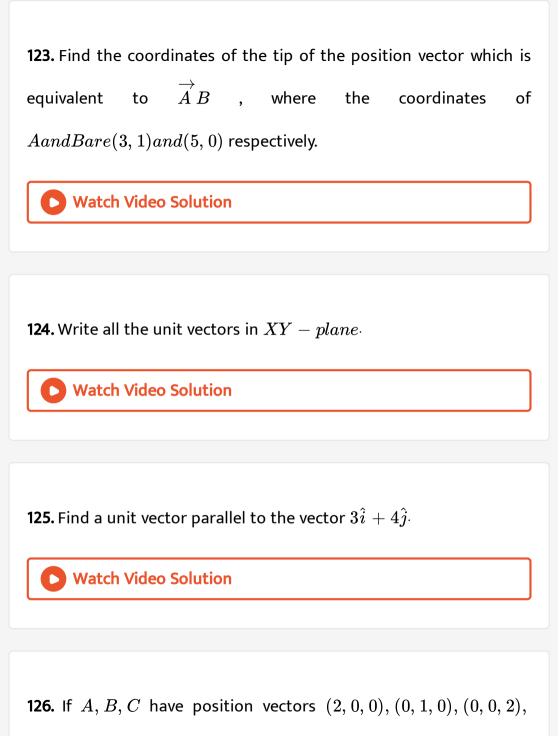
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119. Let $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}, \overrightarrow{d}$ be the position vectors of the four distinct points A, B, C, D. If $\overrightarrow{b} - \overrightarrow{a} = \overrightarrow{a} - \overrightarrow{d}$, then show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

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



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



show that ABC is isosceles.

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

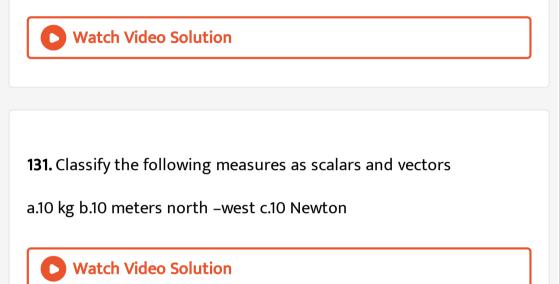
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129. If the position vectors of the points $A, B, C, Dare2\hat{i} + 4\hat{k}, 5\hat{i} + 3\sqrt{3}\hat{j} + 4\hat{k}, -2\sqrt{3}\hat{j} + \hat{k}and2\hat{i} + \hat{k}$ respectively, prove that CD is parallel to $ABandCD = rac{2}{3}AB$.

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.

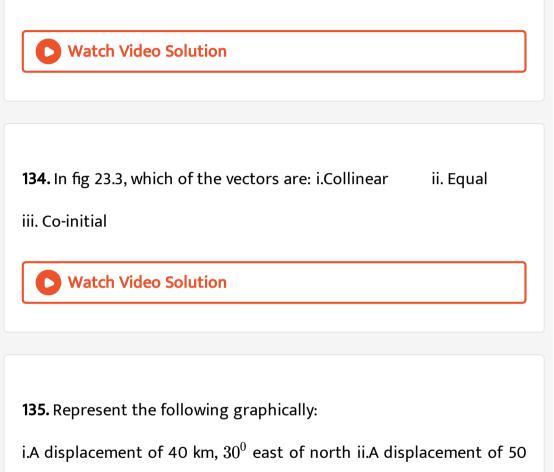


132. Classify the following measures as scalars and vectors

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

133. In a fig 23.4 (a square), identify the following vectors: i.Coinitial

ii.Equal iii.Collinear but not equal



km south east iii. A displacement of 70 km, 40^0 north of west

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



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

Velocity g.Acceleration



138. In Fig. ABCD is a regular hexagon, which vectors are: Collinear

Equal Coinitial Collinear but not equal

139. Answer the following as true or flase: \overrightarrow{a} and \overrightarrow{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 \overrightarrow{a} , \overrightarrow{b} , \overrightarrow{c} be the vectors represented by the sides of a triangle, taken in order, then prove that $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}$.

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

142. 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?



143. 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 $\overrightarrow{a} - \overrightarrow{b}$.



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

145. If $\overrightarrow{a}, \overrightarrow{b}$ are two vectors, then write the truth value of the

following statements:
$$\overrightarrow{a} = -\overrightarrow{b} |\overrightarrow{a}| = |\overrightarrow{b}|$$

 $|\overrightarrow{a}| = |\overrightarrow{b}| \overrightarrow{a} = \pm \overrightarrow{b} |\overrightarrow{a}| = |\overrightarrow{b}| \overrightarrow{a} = \overrightarrow{b}$

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

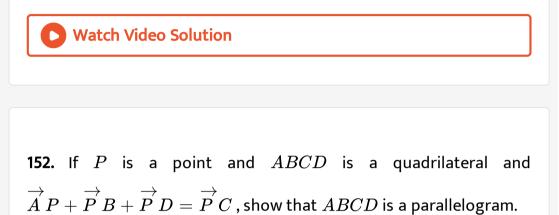
148. ABCD is a quadrilateral. Find the sum the vectors $\overrightarrow{B}A$, $\overrightarrow{B}C$, and $\overrightarrow{D}A$.

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

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

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

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

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155. Let ABCD be as parallelogram. If \overrightarrow{a} , \overrightarrow{b} , \overrightarrow{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 $2\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{a} - 4\overrightarrow{b}$, externally in the ratio 1:2, also show that P is the midpoint of the line segment RQ.



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

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158. If \overrightarrow{a} , \overrightarrow{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 $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}, \overrightarrow{d}$ respectively such that 3 $\overrightarrow{a} - 2\overrightarrow{b} + 5\overrightarrow{c} - 6\overrightarrow{d} = \overrightarrow{0}$,

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 \overrightarrow{p} , \overrightarrow{q} , \overrightarrow{r} , \overrightarrow{s} respectively such that $5\overrightarrow{p} - 2\overrightarrow{q} + 6\overrightarrow{r} - 9\overrightarrow{s} = \overrightarrow{0}$, 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 $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ with respect to a given origin O. Show that the point D where the bisector of $\angle A$ meets BC has position vector

$$\overrightarrow{d} = rac{eta \, \overrightarrow{b} + \gamma \, \overrightarrow{c}}{eta + \gamma}, ext{ where } eta = \left| \overrightarrow{c} - \overrightarrow{a}
ight| ext{ and, } \gamma = \left| \overrightarrow{a} - \overrightarrow{b}
ight|.$$

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.



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 $\overrightarrow{O}A + \overrightarrow{O}B + \overrightarrow{O}C = \overrightarrow{O}D + \overrightarrow{O}E + \overrightarrow{O}F$.

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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.

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

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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 $\overrightarrow{P}A + \overrightarrow{P}B + \overrightarrow{P}C + \overrightarrow{P}D = 4\overrightarrow{P}Q,\,\,$ where P

is any point.

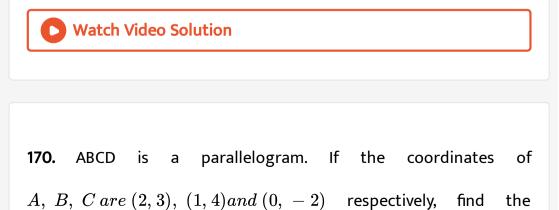
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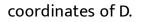
168. Prove that the internal bisectors of the angles of a triangle are

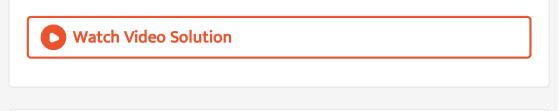
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169. Find the values of x and y so that the vectors $2\hat{i} + 3\hat{j}$ and $x\hat{i} + y\hat{j}$ are equal.







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

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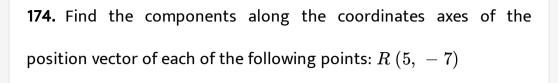
172. Find the components along the coordinates axes of the position

vector of each of the following points: P(5, 4)



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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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).

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



178. A girl walks 4 km towards west, then she walks 3 km in a direction 30*o*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 $(-4, -3)be \overrightarrow{a}$, find $|\overrightarrow{a}|$.

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.



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

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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 $\begin{vmatrix} \overrightarrow{A}B \end{vmatrix}$ in each case.

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.

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

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

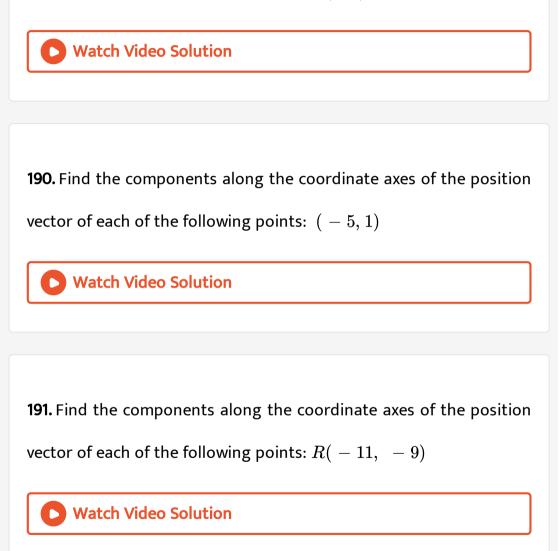
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188. Find a unit vector parallel to the vector $\hat{i}+\sqrt{3}\hat{j}$

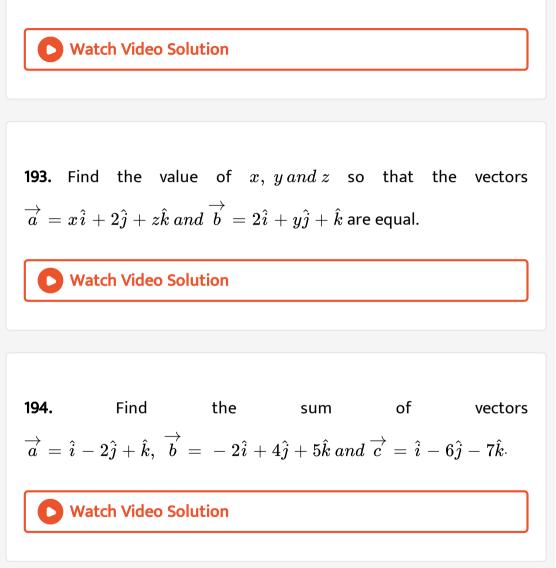


189. Find the components along the coordinate axes of the position

vector of each of the following points: P(3, 2)



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



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

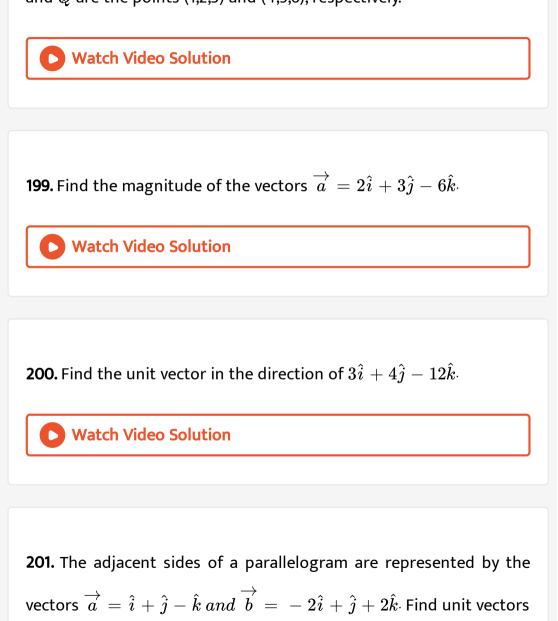
196. Show that the points A, B and C with position vectos $\vec{a} = 3\hat{i} - 4\hat{j} - 4\hat{k}, \ \vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} - 5\hat{k}$

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 $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$.

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.



parallel to the diagonals of the parallelogram.

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202. If

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

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

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203. 6). If $\overrightarrow{P}Q = 3\hat{i} + 2\hat{j} - \hat{k}$ 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.

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.

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).

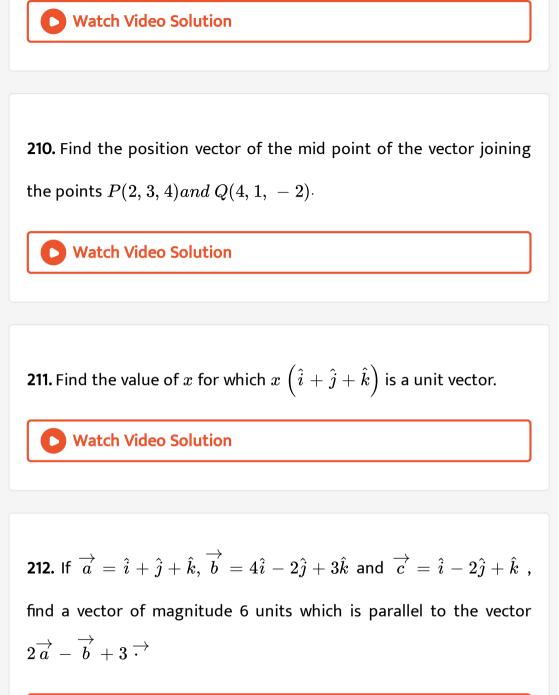
207. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively, in the ratio 2 : 1 (i) internally (ii) externally



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.

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

vertices of a right angled triangle.



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

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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 $\overrightarrow{A}B$ and $\overrightarrow{A}C$ 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 $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$.

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

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

collinear.

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



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 $\overrightarrow{a} - 2\overrightarrow{b} + 3\overrightarrow{c}, 2\overrightarrow{a} + 3\overrightarrow{b} - 4\overrightarrow{c}$ and $-7\overrightarrow{b} + 10\overrightarrow{c}$ 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: $\overrightarrow{a}, \overrightarrow{b}, 3\overrightarrow{a} - 2\overrightarrow{b}$

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

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.

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 λ .

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

points.

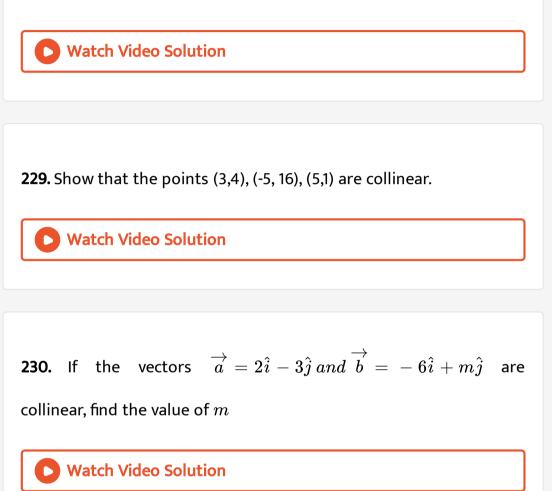
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227. If the points A(m, -1), B(2, 1) and C(4, 5) are collinear find

the value of m_{\cdot}

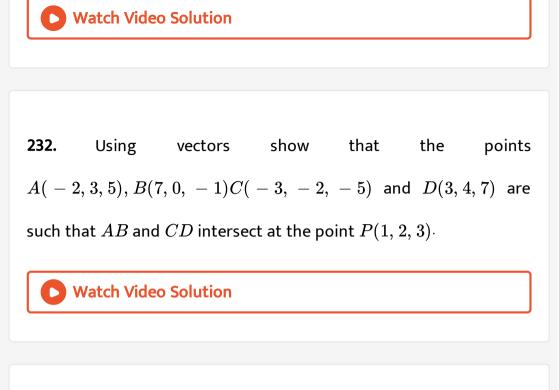
228. Show that the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $-4\hat{i} + 6\hat{j} - 8\hat{k}$ are

collinear.



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.



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)



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)



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

238. If a, b, c are non zero non coplanar vectors, prove that the

following vectors are coplanar. $5\overrightarrow{a} + 6\overrightarrow{b} + 7\overrightarrow{c}, \ 7\overrightarrow{a} - 8\overrightarrow{b} + 9\overrightarrow{c} \ and \ 3\overrightarrow{a} + 20\overrightarrow{b} + 5\overrightarrow{c}$

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

coplanar vectors.

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.



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

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: $2\overrightarrow{a} - \overrightarrow{b} + 3\overrightarrow{c}, \ \overrightarrow{a} + \overrightarrow{b} - 2\overrightarrow{c} \ and \ \overrightarrow{a} + \overrightarrow{b} - 3\overrightarrow{c}$

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

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

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

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

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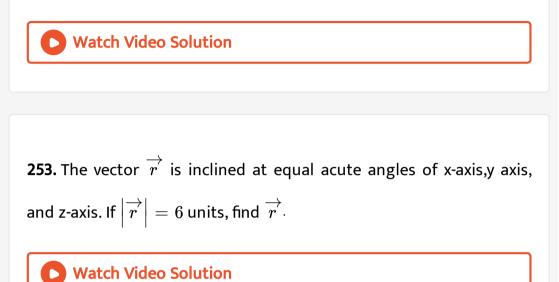
250. Can a vector have direction angles $45^0,\,60^0,\,120^0$



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

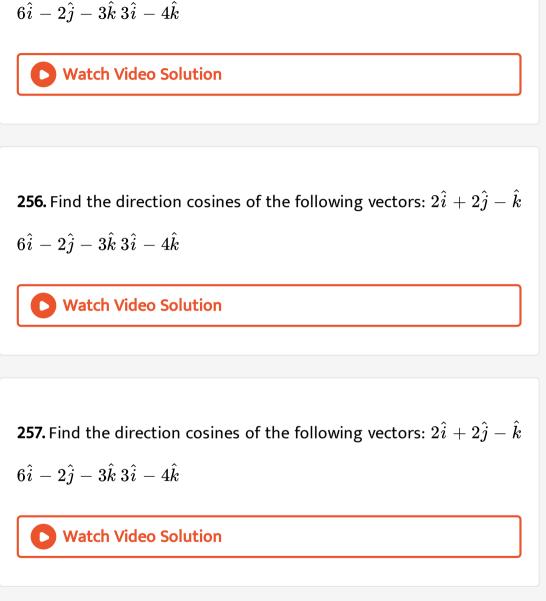


252. A vector makes an angle of $\frac{\pi}{4}$ with each of x-axis and y-axis Find the angle made by it with the z-axis.

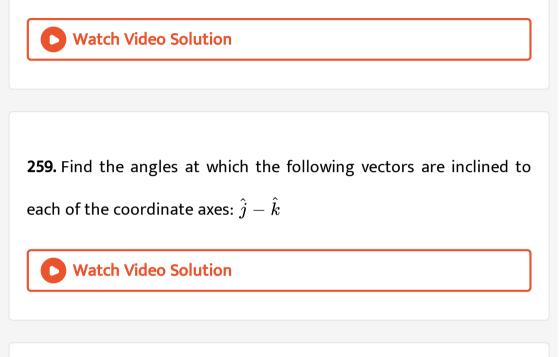


254. A vector
$$\overrightarrow{r}$$
 is inclined to x-axis at 45^0 and y-axis at 60^0 . If $\left|\overrightarrow{r}\right| = 8$ units, find \overrightarrow{r} .

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



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



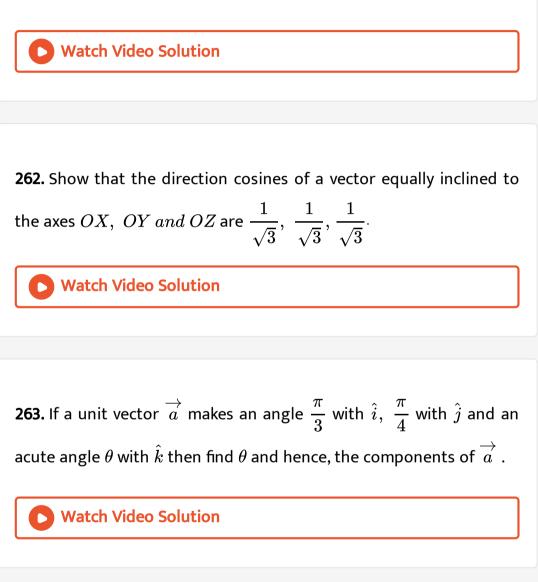
260. Find the angles at which the following vectors are inclined to

each of the coordinate axes: $4\hat{i}+8\hat{j}+\hat{k}$



261. Show that the vector i + j + k is equally inclined with the axes

OX, OY and OZ.



264. Find a vector \overrightarrow{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.



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

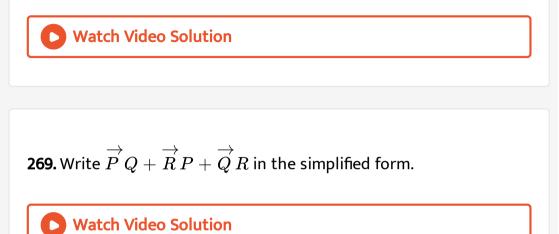
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266. Define zero vector.



267. Define unit vector.

268. Define position vector of point.



270. If \overrightarrow{a} and \overrightarrow{b} represent two adjacent sides of a parallel then

write vectors representing its diagonals.

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

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

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

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

275. If G denotes the centroid of 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 $\overrightarrow{A}D + \overrightarrow{B}E + \overrightarrow{C}F$.

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.

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.



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



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.



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

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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 $\overrightarrow{a} + \overrightarrow{b} - 2\overrightarrow{c}$.

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

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

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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.

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

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

find $|3\vec{a} - 2\vec{b} + 4\vec{c}|$.
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292. A unit vector \vec{r} makes angle $\frac{\pi}{3}$ and $\frac{\pi}{2}$ with \hat{j} and \hat{k}

respectively and an acute angle heta with $i,\,$ Find $heta \cdot$

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



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

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

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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).

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

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298. What is the cosine of the angle which the vector $\sqrt{2}\hat{i} + \hat{j} + \hat{k}$

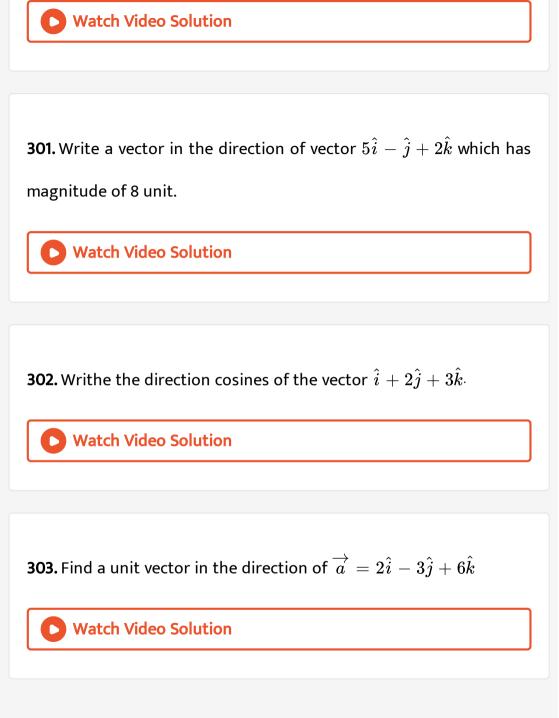
makes with y-axis?

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299. Write two different vectors having same magnitude.

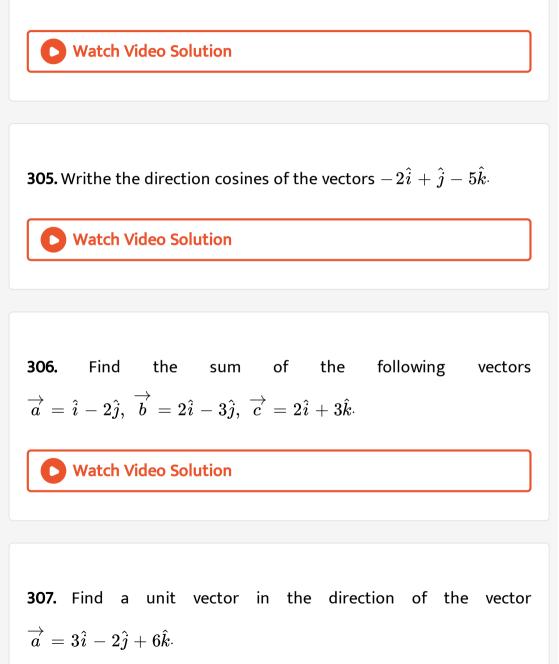
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300. Write two different vectors having same direction.



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?



308. If
$$\overrightarrow{a} = x\hat{i} + 2\hat{j} - z\hat{k}$$
 and $\overrightarrow{b} = 3\hat{i} - y\hat{j} + \hat{k}$ are two equal

vectors, then write the value of x + y + z.

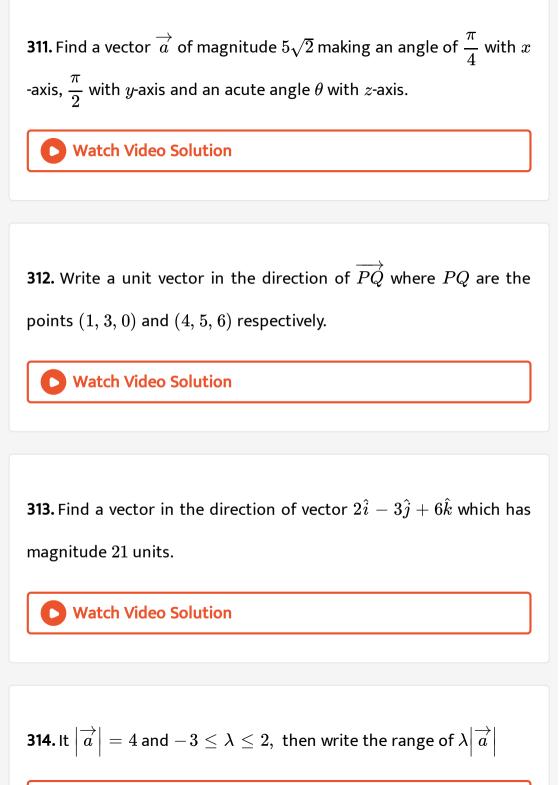
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309. Write a unit vector in the direction of the sum of the vectors

$$\stackrel{
ightarrow}{a}=2\hat{i}+2\hat{j}-5\hat{k}$$
 and $\stackrel{
ightarrow}{b}=2\hat{i}+\hat{j}-7\hat{k}$

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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.



315. In a triangle $\triangle OAC$, 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 $\triangle ABC$, 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

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

318. Forces $3O\overrightarrow{A}$, $5O\overrightarrow{B}$ 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)
$$\stackrel{
ightarrow}{a}$$

B. b) $\stackrel{
ightarrow}{b}$

C. c) \overrightarrow{c}

D. d) None of these

Answer: d) None of these

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320. If points
$$A\Big(60\hat{i}+3\hat{j}\Big),\;B\Big(40\hat{i}-8\hat{j}\Big)$$
 and $C\Big(a\hat{i}-52\hat{j}\Big)$ are

collinear, then a is equal to

A. a) 40

B.b) -40

C. c) 20

 ${\sf D.d})-20$

Answer: b) -40

321. If G is the intersection of diagonals of a parallelogram ABCDand 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



322. The vector $\coslpha\,\coseta\,\hat{i}\,+\,\coslpha\,\sineta\,\hat{j}\,+\,\sinlpha\hat{k}$ is a

A. a) null vector

B. b) unit vector

C. c) constant vector

D. d) none of these

Answer: b) unit vector

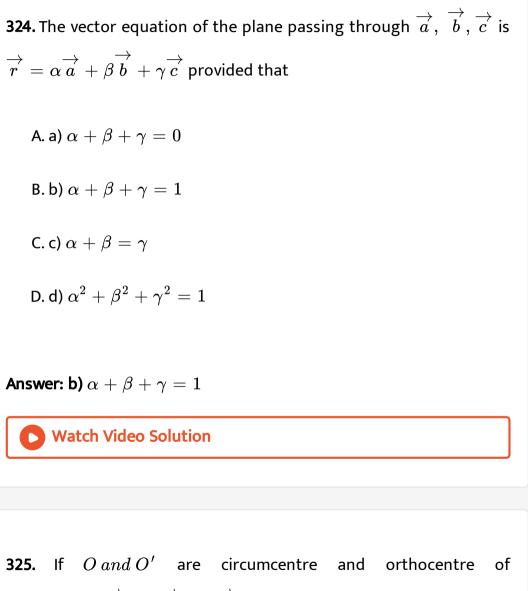
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323. In a regular hexagon $ABCDEF, \ \overrightarrow{AB} = a, \ \overrightarrow{BC} = \overrightarrow{b}$, $\overrightarrow{CD} = c \, \text{Then} \setminus \overrightarrow{AE} =$

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

B. b) $2\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}$
C. c) $\overrightarrow{b} + \overrightarrow{c}$
D. d) $\overrightarrow{a} + 2\overrightarrow{b} + 2\overrightarrow{c}$

Answer: null



 $ABC, \ then \overrightarrow{O}A + \overrightarrow{O}B + \overrightarrow{O}C$ 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



327. Let G be the centroid of ABC. If $\overrightarrow{A}B = \overrightarrow{a}$, $\overrightarrow{A}C = \overrightarrow{b}$, then the bisector $\overrightarrow{A}G$, in terms of \overrightarrow{a} and \overrightarrow{b} is $\frac{2}{3}\left(\overrightarrow{a} + \overrightarrow{b}\right)$ b. $\frac{1}{6}\left(\overrightarrow{a} + \overrightarrow{b}\right)$ c. $\frac{1}{3}\left(\overrightarrow{a} + \overrightarrow{b}\right)$ d. $\frac{1}{2}\left(\overrightarrow{a} + \overrightarrow{b}\right)$ 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) $\overrightarrow{0}$ C. c) $3\overrightarrow{AB}$ D. d) $4\overrightarrow{AB}$

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

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) =

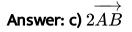
A. a) (2, -3)B. b) (-2, 3)C. c) (-2, -3)D. d) (2, 3)

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) \overrightarrow{AB} B. b) \overrightarrow{AB} C. c) $\overrightarrow{2AB}$ D. d) \overrightarrow{AB}





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

circumcircle.

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