



MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

VECTOR AND THEIR PROPERTIES

Solved Examples

1. Classify the following measures as scalars and vectors :

(i) 40 seconds , (ii) $100m^2$, (iii) $30gm / cm^3$

(iv) $60km / hr$, (v) $56m / s$ towards south



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2. Represent graphically a displacement of $50km$, 60° west to north.



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3. Let $\vec{a} = a_1\hat{i} + 3\hat{j} + a_3\hat{k}$ and

$\vec{b} = 2\hat{i} + b_2\hat{j} + \hat{k}$. If $\vec{a} = \vec{b}$, find the values

of a_1 , b_2 and a_3 .



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4. Let $\vec{a} = 3\hat{i} + 2\hat{j}$ and $\vec{b} = 2\hat{i} + 3\hat{j}$. Is $|\vec{a}| = |\vec{b}|$? Is $\vec{a} = \vec{b}$?



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



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6. Write a vector of magnitude 15 units in the direction of the vector

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



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7. Find a unit vector parallel to the sum of the vector $(\hat{i} + \hat{j} + \hat{k})$ and $(2\hat{i} - 3\hat{j} + 5\hat{k})$.



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



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



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10. For what value of a , the vector s
 $(2\hat{i} - 3\hat{j} + 4\hat{k})$ and $(a\hat{i} + 6\hat{j} - 8\hat{k})$
collinear ?

A. -4

B. -5

C. -6

D. -7

Answer: A



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11. Show that the three points $-2\hat{i} + 3\hat{j} + 5\hat{k}$, $\hat{i} + 2\hat{j} + 3\hat{k}$, $7\hat{i} - \hat{k}$ are collinear



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12. Write the direction cosines of the vectors $(-2\hat{i} + \hat{j} - 5\hat{k})$.



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13. 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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14. Find the values of x for which $x(\hat{i} + \hat{j} + \hat{k})$ is a unit vector



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15. If $A(1, 2, -3)$ and $B(-1, -2, 1)$ are the two given points in space then find (i) the direction ratios of \overrightarrow{AB} and (ii) the direction cosines of \overrightarrow{AB} . Express \overrightarrow{AB} in terms of \hat{i} , \hat{j} and \hat{k} .



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16. Find the scalar and scalar components of the vector with initial points $A(-3, -1, 2)$ and terminal point $B(-5, 4, 3)$.





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17. Write two different vectors having same magnitude.



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18. Write the different vectors having same magnitude.



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19. Prove that the points

$$2\hat{i} - \hat{j} + \hat{k}, \hat{i} - 3\hat{j} - 5\hat{k} \text{ and } 3\hat{i} - 4\hat{j} - 4\hat{k}$$

are the vertices of a right angled triangle. Also find the remaining angles of the triangle.



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



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21. P and Q are two points with position vectors $3\vec{a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ respectively.

Write the position vector of a point R which divides the line segment PQ in the ratio $2:1$ externally.



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22. Find the position vector of a point R which divides the line segment joining the points

$A(2, -3, 4)$ and $B(3, 1, -2)$ externally in the ratio 3:2.



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23. 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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24. 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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Exercise 22

1. Write down the magnitude of each of the following vectors :

$$(i) \vec{a} = \hat{i} + 2\hat{j} + 5\hat{k}, (ii) \vec{b} = 5\hat{i} - 4\hat{j} - 3\hat{k}$$

$$(iii) \vec{c} = \left(\frac{1}{\sqrt{3}}\hat{i} - \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k} \right), (iv)$$

$$\vec{d} = \left(\sqrt{2}\hat{i} + \sqrt{3}\hat{j} - \sqrt{5}\hat{k} \right)$$



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2. Find a unit vector in the direction of the vector.

$$(i) \left(3\hat{i} + 4\hat{j} - 5\hat{k} \right), (ii) \left(3\hat{i} - 2\hat{j} + 6\hat{k} \right)$$

$$(iii) \left(\hat{i} + \hat{k} \right), (iv) \left(2\hat{i} + \hat{j} + 2\hat{k} \right)$$



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3. If $\vec{a} = (2\hat{i} - 4\hat{j} + 5\hat{k})$ then find the value of λ so that $\lambda \vec{a}$ may be a unit vector.



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4. If $\vec{a} = (-\hat{i} + \hat{j} - \hat{k})$ and $\vec{b} = (2\hat{i} - 2\hat{j} + 2\hat{k})$ then find the unit vector in the direction of $(\vec{a} + \vec{b})$.



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5. If $\vec{a} = (3\hat{i} + \hat{j} - 5\hat{k})$ and $\vec{b} = (\hat{i} + 2\hat{j} - \hat{k})$ then find a unit vector in the direction of $(\vec{a} - \vec{b})$.



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



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7. Find a vector of magnitude 9 units in the direction of the vector $(-2\hat{i} + \hat{j} + 2\hat{k})$.



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8. Find a vector of magnitude 8 units in the direction of the vector $(5\hat{i} - \hat{j} + 2\hat{k})$.



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



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10. If $\vec{a} = (\hat{i} - 2\hat{j})$, $\vec{b} = (2\hat{i} - 3\hat{j})$ and $\vec{c} = (2\hat{i} + 3\hat{k})$, find $(\vec{a} + \vec{b} + \vec{c})$.



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11. If $A(-2, 1, 2)$ and $B(2, -1, 6)$ are two given points, find a unit vector in the direction of \overrightarrow{AB} .



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12. Find the direction ratios and direction cosines of the vector $\vec{a} = (5\hat{i} - 3\hat{j} + 4\hat{k})$.



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13. Find the direction ratios and the direction cosines of the vector joining the points $A(2, 1, -2)$ and $B(3, 5, -4)$.



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14. Show that the points A, B and C having position vectors

$(\hat{i} + 2\hat{j} + 7\hat{k}), (2\hat{i} + 6\hat{j} + 3\hat{k}),$ and $(3\hat{i} + 10\hat{j} - 3\hat{k})$ respectively, are collinear.



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



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16. If the position vector of the vertices A, B and C of a $\triangle ABC$ be $(\hat{i} + 2\hat{j} + 3\hat{k})$, $(2\hat{i} + 3\hat{j} + \hat{k})$ and

$(3\hat{i} + \hat{j} + 2\hat{k})$ respectively, prove that ΔABC is equilateral.



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17. Show that the points A, B and C having position vectors

$(3\hat{i} - 4\hat{j} - 4\hat{k}), (2\hat{i} - \hat{j} + \hat{k})$ and $(\hat{i} - 3\hat{j} - 5\hat{k})$ respectively, from the vertices of a right-angled triangle.



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18. Using vector method, show that the points $A(1, -1, 0)$, $B(4, -3, 1)$ and $C(2, -4, 5)$ are the vertices of a right -angled triangle.



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19. Find the position vector of the point which divides the join of the points $\left(2\vec{a} - 3\vec{b}\right)$ and $\left(3\vec{a} - 2\vec{b}\right)$ (i) internally and (ii) externally in the ratio 2:3 .



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



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21. Find the position vector of a point R which divides the line joining $A(-2, 1, 3)$ and

$B(3, 5, -2)$ in the ratio $2:1$ (i) internally (ii) externally.



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22. Find the position vector of the mid-point of the vector joining the points

$$A(3\hat{i} + 2\hat{j} + 6\hat{k}) \text{ and } B(\hat{i} + 4\hat{j} - 2\hat{k})$$



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23. If $\overrightarrow{AB} = (2\hat{i} + \hat{j} - 3\hat{k})$ and $A(1, 2, -1)$ is the given point, find the coordinates of B.



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



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