MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

VECTOR

Example

1. Let $\vec{a}$ and $\vec{b}$ be the position vectors of two given points P and Q respectively. To find the position vector of the point R which divides the line segment $\overline{PQ}$ internally in the ratio m:n.

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Illustrative Examples

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

(i) $\vec{a} + \vec{b}$ and $2\vec{a} - 3\vec{b}$ $(ii)\left|\vec{a} + \vec{b}\right|$ and $\left|\vec{a} - 2\vec{b}\right|$

(iii) a unit vector in the direction $\left(\vec{a} + \vec{b}\right)$

(iv) vector and scalar components of the vector $\left(2\vec{a} - 3\vec{b}\right)$ along the coordinate axes.

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2. If the position vectors of two given points A and B be $8\hat{i} + 3\hat{j} + 2\hat{k}$ and $2\hat{i} - 5\hat{j} + 3\hat{k}$ respectively, find the magnitude and direction of $\overrightarrow{AB}$.

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3. The position vectors of the points A, B and C are $2\hat{i} + 6\hat{j} - \hat{k}$, $\hat{i} + 2\hat{j} + 4\hat{k}$ and $3\hat{i} + 10\hat{j} - 6\hat{k}$ respectively. Show that the points A, B and C are collinear.

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4. Determine the values of p and q for which the vectors $p\hat{i} + 2\hat{j} + 6\hat{k}$ and $3\hat{i} - 3\hat{j} + q\hat{k}$ are parallel.

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

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6. show by vector method that the points (2, -1, 3), (3, -5, 1) and (-1, 11, 9) are collinear.

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7. Using vector method show that the points (7, 9), (3, -7) and (-3, 3) form the sides of a right-angled isosceles triangle.

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8. The position vectors of the points A,B, and C are $2\hat{i}+4\hat{j}-\hat{k}, 4\hat{i}+5\hat{j}+\hat{k}$ and $3\hat{i}+6\hat{j}-3\hat{k}$ respectively. Show that the points form a right-angled triangle.

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9. Write the direction ratios of the vector $2\hat{i}-\hat{j}-2\hat{k}$ and hence find the values of direction cosines of the vector.

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10. Find a vector of magnitude 14 in the direciton of the vector $-3\hat{i}+6\hat{j}-2\hat{k}$.

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11. If $\vec{a}$ and $\vec{b}$ are non-collinear vectors and $\vec{p}=(x+4y)\vec{a}+(2x+y+1)\vec{b}$ and $\vec{q}=(-2x+y+2)\vec{a}+(2x -$

, then find x and y, so that $3\vec{p}=2\vec{q}$.

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12. Prove that the points with position vectors $60\hat{i}+3\hat{j}, 40\hat{i}-8\hat{j}$ and $a\hat{i}-52\hat{j}$ are collinear, if a=-40.

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13. For the vectors $\vec{a}$ and $\vec{b}$ show that

(i) $\left|\vec{a}+\vec{b}\right| \leq \left|\vec{a}\right|+\left|\vec{b}\right|$ (ii) $\left|\left|\vec{a}\right|-\left|\vec{b}\right|\right| \leq \left|\vec{a}-\vec{b}\right|$

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14. (i) If the position vectors of the points A, B, C be $5\hat{i}+3\hat{j}+4\hat{k}, \hat{i}+5\hat{j}+\hat{k}$ and $-3\hat{i}+7\hat{j}-2\hat{k}$ respectively, then show that the points B bisects the line-segment $\overline{AC}$.

(ii) The position vectors of the points P and Q are $5\hat{i}-12\hat{j}+5\hat{k}$ and $-4\hat{i}+3\hat{j}-\hat{k}$ respectively. Find the position vectors of the trisection points of the line-segment $\overline{PQ}$.

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15. If the magnitude of difference of two unit vectors in $\sqrt{3}$, then show that the sum of the vectors is also a unit vector.

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16. ABCDEF is a regular hexagon. If $\overrightarrow{AB} = \overrightarrow{a}$ and $\overrightarrow{BC} = \overrightarrow{b}$, find $\overrightarrow{EF}, \overrightarrow{CD}, \overrightarrow{BF}$ and $\overrightarrow{BD}$ in terms of $\overrightarrow{a}$ and $\overrightarrow{b}$.

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17. Using vector method show that the diagonals of a parallelogram bisect each other.

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18. By vector method prove that the three medians of a triangle are concurrent.

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19. Using vector method show that the line joining the middle points of two sides of a triangle is parallel and half of the third side.

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20. If G be the centroid of the triangle ABC, then prove that $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}=\overrightarrow{0}$.

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21. ABCD is a quadrilateral and E is the point of intersection of the lines joining the mid-points of opposite sides. If O be any point in the plane, then show that $\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}+\overrightarrow{OD}=4\overrightarrow{OE}$.

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22. By vector method prove that the straight line joining the mid-points of the diagonals of a trapezium is parallel ot the parallel sides and half of their difference.

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23. $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 2\hat{k}$ represent two adjacent sides of a parallelogram. Find unit vectors in directions parallel to the diagonals of the parallelogram.

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24. Three non-zero vectors $\vec{a}, \vec{b}, \vec{c}$ are such that no two of them are collinear. If the vector $\left(\vec{a} + \vec{b}\right)$ is collinear with the vector $\vec{c}$ and the vector $\left(\vec{b} + \vec{c}\right)$ is collinear with vector $\vec{a}$, then prove that $\left(\vec{a} + \vec{b} + \vec{c}\right)$ is a null vector.

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Exercise Mcq

1. The unit vector in the direction of a given vector $\vec{a}$ is-`

A. $\frac{\vec{a}}{\vec{a}}$

B. $\frac{\left|\vec{a}\right|}{\left|\vec{a}\right|}$

C. $\frac{\vec{a}}{\left|\vec{a}\right|}$

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

Answer: C

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2. Given

(i) Two vectors are said to be like vectors if they have opposite directions.

(ii) Two unlike vectors have, opposite directions

(iii) Like or unlike vectors are called collinear vectors.

Then -

A. (ii) and (iii) are true

B. (i) and (ii) are true

C. only (iii) is true

D. (i) and (iii) are true.

Answer: A

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3. If $\vec{a} = \overrightarrow{OA}$ and $\vec{b} = \overrightarrow{AB}$, then $\vec{a} + \vec{b}$ is -

A. $\overrightarrow{BO}$

B. $\overrightarrow{OB}$

C. $\overline{OB}$

D. $\overline{BO}$

Answer: B

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4. Let C be the midpoint of the line-segment joining the points A and B , if $\overrightarrow{a}$ and $\overrightarrow{c}$ are the position vectors of the points A and C respetively, then the position vector of the vector of the point B will be -

A. $\overrightarrow{a}+\frac{1}{2}\overrightarrow{c}$

B. $2\overrightarrow{a}-\overrightarrow{c}$

C. $\frac{1}{2}\overrightarrow{a}+\overrightarrow{c}$

D. $2\overrightarrow{c}-\overrightarrow{a}$

Answer: D

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5. If the position vectors of the point P and Q be $\vec{a}$ and $\vec{b}$ respectively, then $\overrightarrow{PQ}$ is -

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

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

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

D. $\dfrac{\vec{a} + \vec{b}}{2}$

Answer: B

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6. Position vector of the point A - position vector of the point B is -

A. $\overrightarrow{BA}$

B. $\left|\overrightarrow{BA}\right|$

C. $\overrightarrow{AB}$

D. $\left|\overrightarrow{AB}\right|$

Answer: A

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7. If $\overrightarrow{r} = x\overrightarrow{a} + y\overrightarrow{b} + z\overrightarrow{c}$, state which of the following is the scalar component of $\overrightarrow{r}$ along $\overrightarrow{a}$?

A. $\left|x\overrightarrow{a}\right|$

B. y

C. $\left|y\overrightarrow{b}\right|$

D. x

Answer: D

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8. If $\overrightarrow{OP} = x\hat{i} + y\hat{j} + z\hat{k}$, state which of the following is the vector component of $\overrightarrow{OP}$ along y-axis ?

A. $x\hat{i}$

B. $y\hat{i}$

C. $\hat{i}$

D. $\hat{j}$

Answer: B

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9. If vectors $\overrightarrow{\alpha} = 2\hat{i} + 3\hat{j} - 6\hat{k}$ and $\overrightarrow{\beta} = p\hat{i} - \hat{j} + 2\hat{k}$ are parallel, then the value of p is -

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

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

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

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

Answer: C

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10. If $\left|m\vec{a}\right| = 1$, then which of the following is true?

A. $m = \frac{1}{\left|\vec{a}\right|}$

B. $m = \pm\frac{1}{\left|\vec{a}\right|}$

C. $m = \frac{1}{\vec{a}}$

D. none of these

Answer: B

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11. If the position vectors of the points P and Q are $2\hat{i}+\hat{k}$ and $-3\hat{i}-4\hat{j}-5\hat{k}$ respectively, then vector $\overrightarrow{OP}$ is -

A. $5\hat{i}+4\hat{j}+4\hat{k}$

B. $5\hat{i}+4\hat{j}+6\hat{k}$

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

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

Answer: B

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12. If $\overrightarrow{OA}=\hat{i}-2\hat{k}$ and $\overrightarrow{OB}=3\hat{i}-2\hat{j}$ then the direction cosines of the vector $\overrightarrow{AB}$ are -

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

B. $2, 2, 2$

C. $-\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

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

Answer: C

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Exercise Very Short Answer Type Questions

1. Define a vector from the geometrical concept.

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2. Write two different vectors having the same magnitude.

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3. Write two different vectors having the same direction.

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4. Define the position vector of a point with respect to an origin. If $\vec{a}$ and $\vec{b}$ are the position vectors of the points P and Q respectively, find the vector $\overrightarrow{PQ}$ in terms of $\vec{a}$ and $\vec{b}$.

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5. Define a vector and a unit vector. Find in terms of vector $\vec{a}$ a unit vector in its direction.

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6. If $\vec{a} = 2\hat{i} - 5\hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} - 4\hat{k}$, find the value of $\left|3\vec{a} + 2\vec{b}\right|$.

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

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8. If $\vec{\alpha} = 2\hat{i} - 5\hat{j} + 4\hat{k}$ and $\vec{\beta} = \hat{i} - 4\hat{j} + 6\hat{k}$, find $\left(2\vec{\alpha} - \vec{\beta}\right)$. Also find a unit vector in the direction of the vector $\left(2\vec{\alpha} - \vec{\beta}\right)$.

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9. Show that the vectors $-\hat{i} + \hat{j}, -4\hat{i} - 6\hat{j}$ and $5\hat{i} + 5\hat{j}$ are the sides of a right-angled triangle.

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10. The position vectors of the points A, B and C are $-5\hat{i} + \hat{j}, 5\hat{i} + 5\hat{j}$ and $10\hat{i} + 7\hat{j}$, show that the points A, B, C are

colinear.

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11. Using vector method show that the points A(-5,7), B(-4,5) and C(1, -5) are collinear.

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12. If $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = 4\hat{i} - \hat{j}$, find a unit vector in the direction of the vector $\left(2\vec{a} - \vec{b}\right)$, also find vector and scalar components of $\left(2\vec{a} - \vec{b}\right)$ along two coordinates axes.

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13. The position vectors of two given points P and Q are $8\hat{i} + 3\hat{j}$ and $2\hat{i} - 5\hat{j}$ respectively, find the magnitude and direction of the vector $\overrightarrow{PQ}$

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14. If $\overrightarrow{a} = 4\overrightarrow{i} - 3\hat{j}$ and $\overrightarrow{b} = -2\hat{i} + 5\hat{j}$ are the position vectors of the points A and B respectively, find

(i) the position vector of the middle point of the line-segment $\overline{AB}$,

(ii) the position vectors of the points of trisection of the line-segment $\overline{AB}$.

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15. Find the vector from the origin to the intersection of the medians of the triangle whose vertices are A(-1, -3), B(5, 7) and C(2, 5).

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16. (i) Determine the value of p for which the vectors $p\hat{i} - 5\hat{j}$ and $2\hat{i} - 3\hat{j}$ are collinear.

(ii) The sides AB and BC of the triangle ABC are represented by the vectors $2\hat{i}-\hat{j}+2\hat{k}$ and $\hat{i}+3\hat{j}+5\hat{k}$ respectively, find the vector representing side CA of the triangle ABC.

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17. The position vectors of the points A and B are $3\hat{i}-\hat{j}+7\hat{k}$ and $4\hat{i}-3\hat{j}-\hat{k}$, find the magnitude and direction cosines of $\overrightarrow{AB}$

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Exercise Short Answer Type Questions

1. If $\overrightarrow{a}=\hat{i}+2\hat{j}-\hat{k}$ and $\overrightarrow{b}=3\hat{i}+\hat{j}-5\hat{k}$, find a unit vector in a direction parallel to vector $\left(\overrightarrow{a}-\overrightarrow{b}\right)$.

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2. Let $\overrightarrow{a} = 4\hat{i} + 3\hat{j} - \hat{k}, \overrightarrow{b} = 5\hat{i} + 2\hat{j} + 2\hat{k}, \overrightarrow{c} = 2\hat{i} - 2\hat{j} - 3\hat{k}$ and $\overrightarrow{d} = 4\hat{i}$

are parallel and find the ratio of their moduli.

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

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4. If the position vectors of the points A, B C are $3\hat{i} - 4\hat{j} - 4\hat{k}, 2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} - 3\hat{j} - 5\hat{k}$ respectively. Show that ABC is right-angled triangle.

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5. If $\vec{a}, \vec{b}, \vec{c}$ are three given vectors, show that the points having vectors $7\vec{a} - \vec{c}$, $\vec{a} + 2\vec{b}$ and $-2\vec{a} + 3\vec{b} + 0.5\vec{c}$ are collinear.

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

(i) a unit vector in the direction of the vector $\left(2\vec{a} - \vec{b}\right)$ and

(ii) vector and scalar components of the vector $\left(2\vec{a} - \vec{b}\right)$ along coordinate axes.

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7. If the position vectors of the points A, B, C are $-2\hat{i} + 2\hat{j} + 2\hat{k}$, $2\hat{i} + 3\hat{j} + 3\hat{k}$ and $-\hat{i} - 2\hat{j} + 3\hat{k}$ respectively, show that ABC is an isosceles triangle.

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8. If the coordinates of the points A, B and C are (2, 6, 3), (1, 2, 7) and (3, 10, -1) respectively, show by vector method that the points A, B and C are collinear.

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9. The position vectors of three points are

(a) $-2\hat{i}+3\hat{j}+5\hat{k}, \hat{i}+2\hat{j}+3\hat{k}, 7\hat{i}-\hat{k}$

(b) $\hat{i}-2\hat{j}+3\hat{k}, 2\hat{i}+3\hat{j}-4\hat{k}, -7\hat{j}+10\hat{k}$

In each case show that the three points are collinear.

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10. If the vectors $p\hat{i}-5\hat{j}+6\hat{k}$ and $2\hat{i}-3\hat{j}-q\hat{k}$ are collinear, find p and q.

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11. If the points having position vectors $\hat{i} + b\hat{j} + c\hat{k}, 7\hat{i} + 2\hat{j} + 6\hat{k}$ and $5\hat{i} + 2\hat{j} + 5\hat{k}$ are collinear, find the values of b and c.

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12. The position vecors of the points A and B are $4\hat{i} - 3\hat{j} + 5\hat{k}$ and $-2\hat{i} + 3\hat{j} + 2\hat{k}$ respectively, find

(i) the position vector of the middle point of the line-segment $\overline{AB}$,

(ii) the position vector of the points of trisection of the line-segment $\overline{AB}$.

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13. If $\overrightarrow{AB} = 2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\overrightarrow{BC} = \hat{i} - 2\hat{j} - 3\hat{k}$ in parallelogram ABCD, find a unit vector in direction parallel to the diagonal $\overrightarrow{AC}$ of the parallelogram.

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14. The position vectors of the points A and B are $2\vec{a}+\vec{b}$ and $\vec{a}-3\vec{b}$. If the point C divides the line-segment $\overline{AB}$ externally in the ratio 1:2, then find the position vector of the point C. Show also that A is the midpoint of the line-segment $\overline{CB}$.

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15. Show that the vector $\hat{i}+\hat{j}+\hat{k}$ makes the same angle with the positive directions of coordinates axes.

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16. Let D, E, F are the midpoints of the sides $\overline{BC}, \overline{CA}$ and $\overline{AB}$ of the triangle ABC. Prove that $\overrightarrow{AD}+\overrightarrow{BE}+\overrightarrow{CF}=\vec{0}$.

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17. If $\overrightarrow{AO}+\overrightarrow{OB}=\overrightarrow{BO}+\overrightarrow{OC}$, show that the points A, B and C are collinear.

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Exercise Long Answer Type Questions

1. If $\vec{a}=2\hat{i}+\hat{j}-3\hat{k}$, $\vec{b}=5\hat{i}+4\hat{j}+2\hat{k}$ and $\vec{c}=3\hat{i}-3\hat{j}-2\hat{k}$, then find the magnitude of the vector $\vec{a}+\vec{b}+2\vec{c}$ and a unit vector in the direction of this vector.

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2. 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 in a direction parallel to vector $\left(2\vec{a}-\vec{b}+3\vec{c}\right)$.

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3. By vector method, show that the four points (7, 2, -3), (6, 1, 4), (-3, -4, -1) and (-2, -3, -8) are the vertices of a parallelogram.

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4. Find a unit vector in direction parallel to the sum of the vectors $\vec{a} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$, find also the direction cosines of this vector.

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5. If $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{c} = -\hat{i} + 2\hat{k}$, then find the magnitude and direction of the vector $\vec{a} - \vec{b} + 2\vec{c}$.

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6. The vectors $\vec{a}$ and $\vec{b}$ are non-collinear. Find for what value of x, the vectors $\vec{c} = (x - 7)\vec{a} + 2\vec{b}$ and $\vec{d} = (2x + 1)\vec{a} - \vec{b}$ are collinear.

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7. Given that the points with position vectors $12\hat{i} - 5\hat{j}, 10\hat{i} + 3\hat{j}$ and $x\hat{i} + 11\hat{j}$ are collinear, find x.

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8. The vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are non-collinear. If $\overrightarrow{p} = (x + 4y)\overrightarrow{a} + (2x + y + 1)\overrightarrow{b}$ and $\overrightarrow{q} = (-2x + y + 2)\overrightarrow{a} + (2x - 3y - 1)\overrightarrow{b}$ satisfy the relation $3\overrightarrow{p} = 2\overrightarrow{q}$, find the values of x and y.

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9. 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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10. ABCDEF is a regular hexagon. If $\overrightarrow{CD}=\vec{a}, \overrightarrow{DE}=\vec{b}$, find $\overrightarrow{AB}, \overrightarrow{BC}, \overrightarrow{BF}, \overrightarrow{CA}, \overrightarrow{AD}$ and $\overrightarrow{BD}$ in terms of $\vec{a}$ and $\vec{b}$.

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11. $\overline{AC}$ and $\overline{BD}$ are the diagonals of the parallelogram ABCD. Prove that,

$\overrightarrow{AC}+\overrightarrow{BD}=2\overrightarrow{BC}$ and $\overrightarrow{AC}-\overrightarrow{BD}=2\overrightarrow{AB}$

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12. By vector method show that the figure formed by joining the mid-points of a quadrilateral is parallelogram.

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13. Defination : Unit vector

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14. ABCD is a parallelogram and P is the midpoint of the side $\overline{BC}$. Prove that $\overline{AC}$ and $\overline{DP}$ meet in a common point of trisection.

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15. ABCD is a parallelogram, P and Q are the mid-points of the sides $\overline{AB}$ and $\overline{DC}$ respectively. Show that $\overline{DP}$ and $\overline{BQ}$ trisect $\overline{AC}$ and are trisected by $\overline{AC}$.

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16. ABCD is a parallelogram and P is the mid-point of $\overline{DC}$. If Q is a point on $\overline{AP}$, such that $\overline{AQ} = \frac{2}{3}\overline{AP}$, show that Q lies on the diagonal

$\overline{BD}$ and $\overline{BQ} = \frac{2}{3}\overline{BD}$.

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17. D, E, F are the midpoints of the sides $\overline{BC}, \overline{CA}$ and $\overline{AB}$ respectively of the triangle ABC. If P is any point in the plane of the triangle, show that $\overrightarrow{PA} + \overrightarrow{PB} + \overrightarrow{PC} = \overrightarrow{PD} + \overrightarrow{PE} + \overrightarrow{PF}$.

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18. C is the midpoint of the line segment $\overline{AB}$ and O is any point outside AB, show that $\overrightarrow{OA} + \overrightarrow{OB} = 2\overrightarrow{OC}$.

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19. G is a point inside the plane of the triangle ABC, if $\overrightarrow{GA} + \overrightarrow{GB} + \overrightarrow{GC} = \overrightarrow{0}$, then show that G is the centroid of the triangle ABC.

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20. The diagonals of the parallelogram ABCD intersect at E. If $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ be the position vectors of its vertices with respect to an arbitary origin O, then show that $\vec{a}+\vec{b}+\vec{c}+\vec{d}=4\overrightarrow{OE}$.

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21. By vector method prove that the straight line joining the midpoints of two non-parallel sides of a trapezium is parallel to the parllel sides and half of their sum.

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Sample Questions For Competitive Examination

1. If

$(x, y, z) \neq (0, 0, 0)$ and $\left(\hat{i}+\hat{j}+3\hat{k}\right)y+\left(-4\hat{i}+5\hat{j}\right)z=a\left(x\hat{i}+y\hat{j}+\right.$

, then the value of a is -

A. 1

B. -1

C. 2

D. 0

Answer: B::D

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2. The sides of a parallelogram are $2\hat{i}+4\hat{j}-5\hat{k}$ and $\hat{i}+2\hat{j}+3\hat{k}$. Then the unit vector parallel to one of the diagonals is -

A. $\frac{1}{7}\left(3\hat{i}+6\hat{j}-2\hat{k}\right)$

B. $\frac{1}{7}\left(3\hat{i}-6j-2\hat{k}\right)$

C. $\frac{1}{\sqrt{69}}\left(-\hat{i}-2\hat{j}+8\hat{k}\right)$

D. $\frac{1}{\sqrt{69}}\left(\hat{i}+2\hat{j}+8\hat{k}\right)$

Answer: A::C

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3. If the resultant of three forces $\overrightarrow{F_1} = p\hat{i} + 3\hat{j} - \hat{k}, \overrightarrow{F_2} = 6\hat{i} - \hat{k}$ and $\overrightarrow{F_3} = -5\hat{i} + \hat{j} + 2\hat{k}$ acting on a particle has a magnitude equal to 5 units, then the value of p is -

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4. Let ABC be a triangle, the position vectors of whose vertices are $7\hat{j} + 10\hat{k}, -\hat{i} + 6\hat{j} + 6\hat{k}$ and $-4\hat{i} + 9\hat{j} + 6\hat{k}$. Then ΔABC is -

A. isosceles

B. equilateral

C. right angled

D. none of these

Answer: A::C

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5. For any two vectors $\vec{a}$ and $\vec{b}$ which of the following is true?

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

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

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

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

Answer: C::D

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6. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors satisfying $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{a}\right|^2=9$, then $\left|2\vec{a}+5\vec{b}+5\vec{c}\right|$ is

-

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7. ABCD is a parallelogram and A_1 and B_1 are the midpoints of sides BC and CD respectively. If $\overrightarrow{AA_1} + \overrightarrow{AB_1} = \frac{\lambda}{2}\overrightarrow{AC}$, then λ is equal to -

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8. ABCD is a quadrilateral. E is the point of intersection of the lines joining the midpoints of the corresponding opposite sides. If O is any point and $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} = x\overrightarrow{OE}$, then x is equal to -

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9. If vectors $\overrightarrow{AB} = -3\hat{i} + 4\hat{k}$ and $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a ΔABC, then the length of the median through A is $k\sqrt{2}$ units, then k is equal to -

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10. In triangle $ABC, \angle A = 30^0, H$ is the orthocenter and D is the midpoint of BC. Segment HD is produced to T such that $HD = DT$. The length AT is equal to a. $2BC$ b. $3BC$ c. $\frac{4}{2}BC$ d. none of these

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11. ABCD is a parallelogram. L is a point on BC which divides BC in the ratio 1:2. AL intersects BD at P. M is a point on DC which divides DC in the ratio 1:2 and AM intersects BD in Q.

Point P divides AL in the ratio -

A. $1:2$

B. $1:3$

C. $3:1$

D. $2:1$

Answer: C

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12. ABCD is a parallelogram. L is a point on BC which divides BC in the ratio 1:2. AL intersects BD at P. M is a point on DC which divides DC in the ratio 1:2 and AM intersects BD in Q.

Point Q divides DB in the ratio -

A. $1:2$

B. $1:3$

C. $3:1$

D. $2:1$

Answer: B

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13. ABCD is a parallelogram. L is a point on BC which divides BC in the ratio 1:2. AL intersects BD at P. M is a point on DC which divides DC in the ratio 1:2 and AM intersects BD in Q.

PQ:DB is equal to -

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

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

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

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

Answer: C

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14. Consider the regular hexagon ABCDEF with centre at O (origin).

$\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}$ is equal to -

A. $2\overrightarrow{AB}$

B. $3\overrightarrow{AB}$

C. $4\overrightarrow{AB}$

D. $6\overrightarrow{AB}$

Answer: C

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15. Consider the regular hexagon ABCDEF with centre at O (origin).

Five forces $\overrightarrow{AB}, \overrightarrow{AC}, \overrightarrow{AD}, \overrightarrow{AE}, \overrightarrow{AF}$ act at the vertex A of a regular hexagon ABCDEF. Then their resultant is -

A. $6\overrightarrow{AO}$

B. $6\overrightarrow{OA}$

C. $4\overrightarrow{AO}$

D. $4\overrightarrow{OA}$

Answer: A

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16. Consider the regular hexagon ABCDEF with centre at O (origin).

$\overrightarrow{AC} + \overrightarrow{DE}$ is equal to -

A. $2\overrightarrow{OA}$

B. $\overrightarrow{AO}$

C. $3\overrightarrow{OA}$

D. $3\overrightarrow{AO}$

Answer: B

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17. Statement - I: $\overrightarrow{a} = 3\hat{i} + p\hat{j} + 3\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + 3\hat{j} + q\hat{k}$ are parallel vectors if $p = \frac{9}{2}$ and $q = 2$

Statement - II: If $\overrightarrow{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\overrightarrow{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ are parallel, then $\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3}$.

A. Statement - I is True, Statement - II is True , Statement - II is a correct explanation for Statement - I

B. Statement - I is True, Statement - II is True , Statement - II is not a correct explanation for Statement - I

C. Statement - I is True, Statement - II is False.

D. Statement - I is False, Statement - II is True.

Answer: a

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18. Statement - I: If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4$ and $\left|\vec{a} + \vec{b}\right| = 5$ then $\left|\vec{a} - \vec{b}\right| = 5.$

Statement - II: The length of the diagonals of a rectangle is same.

A. Statement - I is t=True, Statement - II is True , Statement - II is a correct explanation for Statement - I

B. Statement - I is True, Statement - II is True , Statement - II is not a correct explanation for Statement - I

C. Statement - I is True, Statement - II is False.

D. Statement - I is False, Statement - II is True.

Answer: a

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