MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

VECTOR ALGEBRA-I

Solved Examples

1. Represent graphically the displacement at

(i) 30 km 60° west of north

(ii) 60 km 50° south of east

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2. If P and Q are two points with position vectors $4\vec{i} - 3\vec{j}$ and $2\vec{i} + 5\vec{j}$. Find the position vectors of the points which divide the line

joining the points. P and Q in the ration 2:3internally and externally.

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3. Find a unit vector along the directions of the vector $5\hat{i} - 3\hat{j} + 4\hat{k}$?

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4. Find the direction ratio and direction cosines of the following vectors.

(i) $3\hat{i} + 4\hat{j} - 6\hat{k}$ (ii) $3\hat{i} - 4\hat{k}$.

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5. Show that the points vectors are $2\hat{i} + 3\hat{j} - 5\hat{k}, 3\hat{i} + \hat{j} - 2\hat{k}$ and $6\hat{i} - 5\hat{j} + 7\hat{k}$ are collinear.

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6. Find a point whose positions vector has magnitude 5 and parallel to the vector $4\hat{i} - 3\hat{j} + 10\hat{k}$.

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7. Prove that the points whose position vectors $2\hat{i} + 4\hat{j} + 3\hat{k}, 4\hat{i} + \hat{j} + 9\hat{k}$ and $10\hat{i} - \hat{j} + 6\hat{k}$ form a right angled triangle.

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8. Show that the vectors $5\hat{i} + 6\hat{j} + 7\hat{k}, 7\hat{i} - 8\hat{j} + 9\hat{k}, 3\hat{i} + 20\hat{j} + 5\hat{k}$ are coplanar.

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9. Find $\vec{a}.\ \vec{b}$ when

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

(ii) $\vec{a}$ and $\vec{b}$ represent the point (2,3,-1) and (-1,2,3).

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10. Find $\left(\vec{a} + 3\vec{b}\right).\left(2\vec{a} - \vec{b}\right)$ if $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\hat{b} = 3\hat{i} + \hat{j} - \hat{k}$

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

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

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13. For any vector $\vec{r}$ prove that $\vec{r} = \left(\vec{r}.\hat{i}\right)\hat{i} + \left(\vec{r}.\hat{j}\right)\hat{j} + \left(\vec{r}.\hat{k}\right)\hat{k}$.

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14. Find the angle between the vectors $5\hat{i} + 3\hat{j} + 4\hat{k}$ and $6\hat{i} + 4\hat{k}$

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15. find the projection of $\overline{AB}$ on $\overline{CD}$ where A,B,C,D are the points (4,-3,0), (7,-5,-1),(-2,1,3)(0,2,5)`.

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16. If $\hat{a}$, $\hat{b}$ and $\hat{c}$ are three unit vectors satisfying $\hat{a} - \sqrt{3}\hat{b} + \hat{c} = \hat{0}$ then find the angle between $\hat{a}$ and $\hat{c}$.

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17. Show that the points (4,-3,1)(2,-4,5) and (1,-1,0) form a right angled triangle.

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18. Find $\left|\hat{a} \times \hat{b}\right|$, where $\hat{a} = 3\hat{i} + 4\hat{j}$ and $\hat{b} = \hat{\hat{i}} + \hat{j} + \hat{k}$

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19. If $\overrightarrow{a} = -3\hat{i} + \hat{j} - 7\hat{k}$ and $\overrightarrow{b} = 6\hat{i} + 2\hat{j} - 3\hat{k}$, verify

(i) $\overrightarrow{a}$ and $\hat{a} \times \hat{b}$ are perpendicular to each other.

(ii) $\overrightarrow{b}$ and $\overrightarrow{a} \times \overrightarrow{b}$ are perpendicular to each other.

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20. Find the vectors of magnitude 6 which are perpendicular to both vectors $\vec{a} = 4\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = -2\hat{i} + \hat{j} - 2\hat{k}$

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

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

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23. for any two vectors $\vec{a}$ and $\vec{b}$, prove that $\left|\vec{a} \times \vec{b}\right|^2 + \left(\vec{a} . \vec{b}\right)^2 = \left|\vec{a}\right|^2 \left|\vec{b}\right|^2$.

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24. Find the area of a triangle having the points A(1,0,0),B(0,1,0) and C(0,0,1) as its vertices.

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Exercise 8 1

1. Represent graphically the displacement of (i) 45 km 30° north of east. (ii) 80 km, 60° south of west

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2. Prove that the relation R defined on the set V of all vectors by $\vec{a} R \vec{b}$ if $\vec{a} = \vec{b}$, is an equivalence relation on V.

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3. Let $\vec{a}$ and $\vec{b}$ be the position vectors of the points A and B. Prove that the position vectors of the points which trisects the line segment AB are $\frac{\vec{a}+2\vec{b}}{3}$ and $\frac{\vec{b}+2\vec{a}}{3}$.

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4. If D and E, are the midpoints of the sides AB and AC of a triangle ABC, prove that $\overrightarrow{BE}+\overrightarrow{DC}=\frac{3}{2}\overrightarrow{BC}$.

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5. Prove that line segment joining the midpoints of two sides of a triangle is parallel to the third side whose length is half of the length of the third side.

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6. Prove that the line segments joining the midpoints of the adjacent sides of a quadrilateral form a parallelogram.

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7. If $\vec{a}$ and $\vec{b}$ represent a side and a diagonal of a parallelogram, find the other sides and the other diagonal.

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8. If $\overrightarrow{PO} + \overrightarrow{OQ} = \overrightarrow{QO} + \overrightarrow{OR}$, prove that the points P, Q,R, are collinear.

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9. If D is the midpoint of the side BC of a triangle ABC, prove that vec(AB)+vec(AC)=2vec(AD)

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10. If G is the centroid of a triangle ABC, prove that $\overrightarrow{GA} + \overrightarrow{GB} + \overrightarrow{GC} = \overrightarrow{0}$.

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11. Let A, B, and C be the vertices of a triangle. Let D, E, and F be the midpoints of the sides BC, CA, and AB respectively. Show that $\overrightarrow{AD} + \overrightarrow{BE} + \overrightarrow{CF} = \overrightarrow{0}$.

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12. If ABCD is a quadrilateral and E and F are the midpoints of AC and BD respectively, then prove that $\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CB} + \overrightarrow{CD} = 4\overrightarrow{EF}$.

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Exercise 8 2

1. Verify whether the ratios are direction cosines of some vector or not.

$\frac{1}{5}, \frac{3}{5}, \frac{4}{5}$

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2. Find the direction cosines of a vector whose direction ratios are (i) 1,2,3, (ii) 3,-1,3 (iii) 0,0,7

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3. Find the direction cosines and direction ratios for the following vectors.

$\hat{j}$

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4. A triangle is formed by joining the points (1,0,0), (0,1,0) and (0,0,1). Find the direction cosines of the medians.

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5. If $\frac{1}{2}, \frac{1}{\sqrt{2}}$ a are the direction cosines of some vector, then find a.

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6. If (a,a+b,a+b+c) is one set of direction ratios of the line joining (1,0,0) and (0,1,0), then find a set of values of a,b,c.

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7. Show that the vectors $-\hat{i}-2\hat{j}-6\hat{k}, 2\hat{i}-\hat{j}+\hat{k}$ and $-\hat{i}+3\hat{j}+5\hat{k},$ form a right angled triangle.

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8. Find the value of λ for which the vectors $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + \lambda\hat{j} + 3\hat{k}$ are parallel.

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9. Show that the following vectors are coplaner.

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

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

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10. Show that the points whose position vectors $4\hat{i} + 5\hat{j} + \hat{k}, \ -\hat{j} - \hat{k}, 3\hat{i} + 9\hat{j} + 4\hat{k}$ and $-4\hat{i} + 4\hat{j} + 4\hat{k}$ are coplanar.

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11. If $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$, $\vec{b} = 3\hat{i} - 4\hat{j} - 5\hat{k}$, and $\vec{c} = -3\hat{i} + 2\hat{j} + 3\hat{k}$, find the magnitude and direction cosines of $\vec{a} + \vec{b} + \vec{c}$

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12. The position vectors of the vertices of a triangle are $\hat{i} + 2\hat{j} + 3\hat{k}, 3\hat{i} - 4\hat{j} + 5\hat{k}$ and $-2\hat{i} + 3\hat{j} - 7\hat{k}$. Find the perimeter of the triangle

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13. Find the unit vector parallel to $3\vec{a} - 2\vec{b} + 4\vec{c}$, if $\vec{a} = 3\hat{i} - \hat{j} - 4\hat{k}$, $\vec{b} = -2\hat{i} + 4\hat{j} - 3\hat{k}$, $\vec{c} = \hat{i} + 2$

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14. The position vectors $\vec{a}, \vec{b}, \vec{c}$ of three points satisfy the relation $2\vec{a} - 7\vec{b} + 5\vec{c} = \vec{0}$. Are these points collinear?

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15. The position vectors of the points P,Q,R,S are $\hat{i} + \hat{j} + \hat{k}, 2\hat{i} + 5\hat{j}, 3\hat{k} + 2\hat{j} - 3\hat{k}$, and $\hat{i} - 6\hat{j} - \hat{k}$ respectively. Prove that the line PQ and RS are parallel.

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16. Find the value or values of m for which m $\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector.

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17. Show that the points A (1,1,1), B (1,2,3) and C (2,-1,1) are vertices of an isosceles triangle.

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Exercise 8 3

1. Find $\vec{a} . \vec{b}$ when

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

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2. Find the value λ for which the vectors $\vec{a}$ and $\vec{b}$ are perpendicular, where

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

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

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4. Find the angle between the vectors

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

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5. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a}+2\vec{b}+\vec{c}=\vec{0}$ and $\left|\vec{a}\right|=3, \left|\vec{b}\right|=4, \left|\vec{c}\right|=7$, find the angle between $\vec{a}$ and $\vec{b}$.

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6. Show that the vectors $\vec{a}=2\hat{i}+3\hat{j}+6\hat{k}, \vec{b}=6\hat{i}+2\hat{j}-3\hat{k}$, and $\vec{c}=3\hat{i}-6\hat{j}+2\hat{k}$, are mutually orthogonal.

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7. Show that the vectors $-\hat{i}-2\hat{j}-6\hat{k}, 2\hat{i}-\hat{j}+\hat{k}$ and $-\hat{i}+3\hat{j}+5\hat{k}$, form a right angled triangle.

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8. If $\left|\vec{a}\right|=5, \left|\vec{b}\right|=6, \left|\vec{c}\right|=7$ and $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, find $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$.

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9. Show that the points (2,-1,3), (4,3,1) and (3,1,2) are collinear.

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10. If $\vec{a}, \vec{b}$ are unit vectors and θ is the angle between them, show that $\sin\frac{\theta}{2}=\frac{1}{2}\left|\vec{a}-\vec{b}\right|$

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

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

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13. Find λ, when the projection of $\vec{a} = \lambda\hat{i} + \hat{j} + 4\hat{k}$ on $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$ is 4 units.

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14. Three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are such that $|\vec{a}| = 2, |\vec{b}| = 3, |\vec{c}| = 4$, and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$.

Find $4\vec{a} \cdot \vec{b} + 3\vec{b} \cdot \vec{c} + 3\vec{c} \cdot \vec{a}$.

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Exercise 8 4

1. Find the magnitude of $\vec{a} \times \vec{b}$ if $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 5\hat{j} - 2\hat{k}$.

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2. Show that $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right) = \vec{0}$.

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3. Find the vectors of magnitude $10\sqrt{3}$ that are perpendicular to the plane which contains $\hat{i}+2\hat{j}+\hat{k}$ and $\hat{i}+3\hat{j}+4\hat{k}$

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

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5. Find the area of the parallelogram whose two adjacent sides are determined by the vectors $\hat{i}+2\hat{j}+3\hat{k}$ and $3\hat{i}-2\hat{j}+\hat{k}$.

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6. Find the area of the triangle whose vertices are A (3,-1,2), B(1,-1,-3) and C(4,-3,1).

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7. If $\vec{a}, \vec{b}, \vec{c}$ are position vectors of the vertices A,B,C of a triangle ABC, show that the area of the triangle ABC is $\frac{1}{2}\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|$. Also deduce the condition for collinearity of the points A,B and C.

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8. For any vector $\vec{a}$ prove that $\left|\vec{a} \times \hat{i}\right|^2 + \left|\vec{a} \times \hat{j}\right|^2 + \left|\vec{a} \times \hat{k}\right|^2 = 2\left|\vec{a}\right|^2$.

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9. Let $\vec{a}, \vec{b}, \vec{c}$ be unit vectors such that $\vec{a} . \vec{b} = \vec{a} . \vec{c} = 0$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$. Prove that $\vec{a} = \pm \frac{2}{\sqrt{3}}\left(\vec{b} \times \vec{c}\right)$.

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10. Find the angle between the vectors $2\hat{i}+\hat{j}-\hat{k}$ and $\hat{i}+2\hat{j}+\hat{k}$ using vector product.

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Exercise 8 5

1. The value of $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{DA}+\overrightarrow{CD}$is

A. $\overline{AD}$

B. $\overline{CA}$

C. $\bar{0}$

D. $-\overline{AD}$

Answer: C

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2. If $\vec{a} + 2\vec{b}$ and $3\vec{a} + m\vec{b}$ are parallel, then the value of m is

A. 3

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

C. 6

D. $\frac{1}{6}$

Answer: C

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3. The unit vector parallel to the resultant of the vectors $\hat{i} + \hat{j} - \hat{k}$ and $\hat{i} - 2\hat{j} + \hat{k}$is

A. $\frac{\hat{i} - \hat{j} + \hat{k}}{\sqrt{5}}$

B. $\frac{2\hat{i} + \hat{j}}{\sqrt{5}}$

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

D. $\frac{2\hat{i} - \hat{j}}{\sqrt{5}}$

Answer: D

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4. A vector $\overrightarrow{OP}$ makes 60° and 45° with the positive direction of the x and y axes respectively. Then the angle between $\overrightarrow{OP}$ and the z-axis is

A. 45°

B. 60°

C. 90°

D. 30°

Answer: B

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5. If $\overrightarrow{BA} = 3\hat{i} + 2\hat{j} + \hat{k}$ and the position vector of B is $\hat{i} + 3\hat{j} - \hat{k}$ then the position vector A is

A. $4\hat{i}+2\hat{j}+\hat{k}$

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

C. $4\hat{i}$

D. $-4\hat{i}$

Answer: B

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6. A vector makes equal angle with the positive direction of the coordinate axes. Then each angle is equal to

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\cos^{-1}\left(\frac{2}{3}\right)$

C. $cs^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D. $\cos^{-1}\left(\frac{2}{\sqrt{3}}\right)$

Answer: C

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7. The vectors $\vec{a} - \vec{b}, \vec{b} - \vec{c}, \vec{c} - \vec{a}$ are

A. parallel to each other

B. unit vectors

C. mutually perpendicular vectors

D. coplaner vectors

Answer: D

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8. If ABCD is a parallelogram, then $\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CB} + \overrightarrow{CD}$ is equal to

A. $2\left(\overline{AB} + \overline{AD}\right)$

B. $4\overline{AC}$

C. $4\overline{BD}$

D. $\bar{0}$

Answer: D

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9. One of the diagonals of parallelogram ABCD with $\vec{a}$ and $\vec{b}$ as adjacent sides is $\vec{a} + \vec{b}$. The other diagonal $\overrightarrow{BD}$ is

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

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

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

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

Answer: B

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10. If $\vec{a}, \vec{b}$ are the position vectors A and B then which one of the following points whose position vector lies on AB, is

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

B. $\frac{2\vec{a} - \vec{b}}{2}$

C. $\frac{2\vec{a} - \vec{b}}{3}$

D. $\frac{\vec{a} - \vec{b}}{3}$

Answer: C

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11. If $\vec{a}, \vec{b}$ are the position vectors A and B then which one of the following points whose position vector lies on AB, is

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

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

C. $\vec{b} = \vec{c} + \vec{a}$

D. $4\vec{a} + \vec{b} + \vec{c} = \vec{0}$

Answer: B

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12. If $\vec{r} = \frac{9\vec{a} + 7\vec{b}}{16}$ then the point P whose position vector $\vec{r}$ divides the line joining the points with position vectors $\vec{a}$ and $\vec{b}$ in the ratio

A. 7 : 9 internally

B. 9 : 7 internally

C. 9 : 7 externally

D. 7 : 9 externally

Answer: A

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13. If $\lambda\hat{i} + 2\lambda\hat{j} + 2\lambda\hat{k}$ is a unit vector,then the value of λ is

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

B. $\frac{1}{4}$

C. $\frac{1}{9}$

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

Answer: A

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14. Two vertices of a triangle have position vectors $3\hat{i} + 4\hat{j} - 4\hat{k}$ and $2\hat{i} + 3\hat{j} + 4\hat{k}$. If the position vector of the centroid is $\hat{i} + 2\hat{j} + 3\hat{k}$, then the position vector of the third vertex is

A. $-2\hat{i} - \hat{j} + 9\hat{k}$

B. $-2\hat{i} - \hat{j} - 6\hat{k}$

C. $2\hat{i}\hat{j} + 6\hat{k}$

D. $-2\hat{i}+\hat{j}+6\hat{k}$

Answer: A

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15. If $\left|\vec{a}+\vec{b}\right|=60, \left|\vec{a}-\vec{b}\right|=40$ and $\left|\vec{b}\right|=46$, then $\left|\vec{a}\right|$ is

A. 42

B. 12

C. 22

D. 32

Answer: C

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16. If $\vec{a}$ and $\vec{b}$ having same magnitude and angle between them is 60° and their scalar product is $\frac{1}{2}$ then $\left|\vec{a}\right|$ is

A. 2

B. 3

C. 7

D. 1

Answer: D

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17. The value of $\theta \in \left(0, \frac{\pi}{2}\right)$ for which the vectors $\vec{a} = (\sin\theta)\hat{i} + (\cos\theta)\hat{j}$ and $\hat{b} = \hat{i} - \sqrt{3}\hat{j} + 2\hat{k}$ are perpendicular, is equal to

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

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

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

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

Answer: A

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18. If $\left|\vec{a}\right| = 13, \left|\vec{b}\right| = 5$ and $\vec{a}.\vec{b} = 60$then $\left|\vec{a} \times \vec{b}\right|$ is

A. 15

B. 35

C. 45

D. 25

Answer: D

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19. Vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle $\theta = 120^\circ$. If $\left|\vec{a}\right| = 1, \left|\vec{b}\right| = 2$, then $\left[\left(\vec{a} + 3\vec{b}\right) \times \left(3\vec{a} - \vec{b}\right)\right]^2$ is equal to

A. 225

B. 275

C. 325

D. 300

Answer: D

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20. If $\vec{a}$ and $\vec{b}$ are two vectors of magnitude 2 and inclined at an angle 60°, then the angle between $\vec{a}$ and $\vec{a} + \vec{b}$ is

A. 30°

B. 60°

C. 45°

D. 90°

Answer: A

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21. If the projection of $5\hat{i} - \hat{j} - 3\hat{k}$ on the vector $\hat{i} + 3\hat{j} + \lambda\hat{k}$ is same as the projection of $\hat{i} + 3\hat{j} + \lambda\hat{k}$ on $5\hat{i} - \hat{j} - 3\hat{k}$ then $\lambda$is equal to.

A. ± 4

B. ± 3

C. ± 5

D. ± 1

Answer: C

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22. If (1,2,4) and (2,-3λ, -3) are the initial and terminal points of the vector $\hat{i}+5\hat{j}-7\hat{k}$, then value of λ is equal to

A. $\frac{7}{3}$

B. $-\frac{7}{3}$

C. $-\frac{5}{3}$

D. $\frac{5}{3}$

Answer: B

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23. If the points whose position vectors $10\hat{i}+3\hat{j}$, $12\hat{i}-5\hat{j}$ and $a\hat{i}+11\hat{j}$ are collinear then a is equal to

A. 6

B. 2

C. 5

D. 8

Answer: D

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24. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 2\hat{i} + x\hat{j} + \hat{k}, \vec{c} = \hat{i} - \hat{j} + 4\hat{k}$ and $\vec{a} . \left(\vec{b} \times \vec{c} \right) = 70$, then x is equal to

A. 5

B. 7

C. 26

D. 10

Answer: C

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25. If $\vec{a} = \hat{i} + 2\hat{j} + 2\hat{k}$, $\left|\vec{b}\right|$ =5 and the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$, then the area of the triangle formed by these two vectors as two sides is

A. $\frac{7}{4}$

B. $\frac{15}{4}$

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

D. $\frac{17}{4}$

Answer: B

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Additional Problems

1. Shown that the points with position vectors $\vec{a} - 2\vec{b} + 3\vec{c}$, $-2\vec{a} + 3\vec{b} + 2\vec{c}$ and $-8\vec{a} + 13\vec{b}$ are collinear.

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2. If ABC and A'B'C' are two triangles and G, G' be their corresponding centroids, prove that $\overline{AA'} + \overline{BB'} + \overline{CC'} = 3\overline{GG'}$.

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3. Prove using vectors the mid-points of two opposite sides of a quadrilateral and the mid-points of the diagonals are the vertices of a parallelogram.

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

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5. Find the unit vectors parallel to the sum of $3\hat{i} - 5\hat{j} + 8\hat{k}$ and $-2\hat{j} - 2\hat{k}$.

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6. Show that the points whose position vectors are $4\vec{i} + 5\vec{j} + 6\vec{k}$, $5\vec{i} + 6\vec{j} + 4\vec{k}$, and $6\vec{i} + 4\vec{j} + 5\vec{k}$ form an equilateral triangle.

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7. Prove that the points $2\hat{i} + 3\hat{j} + 4\hat{k}, 3\hat{i} + 4\hat{j} + 2\hat{k}, 4\hat{i} + 2\hat{j} + 3\hat{k}$ from an equilateral triangle.

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8. Examine whether the vectors $\hat{i} + 3\hat{j} + \hat{k}, 2\hat{i} - \hat{j} - \hat{k}$ and $7\hat{j} + 5\hat{k}$ are coplanar.

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9. Find λ so that the vectors $2\hat{i}+\lambda\hat{j}+\hat{k}$ and $\hat{i}-2\hat{j}+\hat{k}$ are perpendicular to each other.

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10. If $\left|\vec{a}+\vec{b}\right|=60, \left|\vec{a}-\vec{b}\right|=40$ and $\left|\vec{b}\right|=46$, then $\left|\vec{a}\right|$ is

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

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13. Find the projection of :

(i) $\hat{i}-\hat{j}$ on Z-axis (ii) $\hat{i}+2\hat{j}-2\hat{k}$ on $2\hat{i}-\hat{j}+5\hat{k}$ (iii) $3\hat{i}+\hat{j}-\hat{k}$ on $4\hat{i}-\hat{j}+2\hat{k}$

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14. Show that the vector $\hat{i}+\hat{j}+\hat{k}$ is equally inclined with the coordinate axes.

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15. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three mutually perpendicular unit vectors, then prove that $\left|\vec{a}+\vec{b}+\vec{c}\right|=\sqrt{3}$

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16. Show that the points whose positions vectors $4\hat{i} - 3\hat{j} + \hat{k}, 2\hat{i} - 4\hat{j} + 5\hat{k}, \hat{i} - \hat{j}$ from a right angled triangle.

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17. Let $\vec{u}, \vec{v}, \vec{w}$ be vectors such that $\vec{u} + \vec{v} + \vec{w} = \vec{0}$. If abvec(u)=3,absve is .....

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18. If $\vec{p} = -3\vec{i} + 4\vec{j} - 7\vec{k}$ ans $\vec{q} = 6\vec{i} + 2\vec{j} - 3\vec{k}$ then find $\vec{p} \times \vec{q}$. Verify that $\vec{p}$ and $\vec{p} \times \vec{q}$ are perpendicular to each other and also verify that $\vec{q}$ and $\vec{p} \times \vec{q}$ are perpendicular to each other.

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19. If $\vec{a}.\vec{b}$ are say two vectors, then prove that $\left|\vec{a}\times\vec{b}\right|^2+\left(\vec{a}.\vec{b}\right)^2=\left|\vec{a}\right|^2\left|\vec{b}\right|^2$

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20. Find the angle between the vectors $2\hat{i}+\hat{j}-\hat{k}$ and $\hat{i}+2\hat{j}+\hat{k}$ using vector product.

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21. Find the vectors of magnitude 6 which are perpendicular to both the vectors $4\vec{i}-\vec{j}+3\vec{k}$ and $-2\vec{i}+\vec{j}-2\vec{k}$.

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

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23. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$ show that $\vec{a} - \vec{d}$ and $\vec{b} - \vec{c}$ are parallel.

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24. Find the angle between two vectors $\vec{a}$ nd $\vec{b}$ if $\left|\vec{a} \times \vec{b}\right| = \vec{a}.\vec{b}$.

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25. If $\vec{a}, \vec{b}, \vec{c}$ be unit vectors such that $\vec{a}.\vec{b} = \vec{a}.\vec{c} = 0$ and the angle between $\vec{b}$ and $\vec{c}$ is $\pi/6$. Prove that $\vec{a} = \pm 2\left(\vec{b} \times \vec{c}\right)$

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26. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 7$ and $\vec{a} \times \vec{b} = 3\hat{i} - 2\hat{j} + 6\hat{k}$ find the angle between $\vec{a}$ and $\vec{b}$.

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