MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

VECTOR ALGEBRA -I

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 $\overrightarrow{a}$ and $\overrightarrow{b}$ 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. Verify whether the ratios are direction cosines of some vector or not.

$$\frac{1}{\sqrt{2}}, \frac{1}{2}, \frac{1}{2}$$

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

$$\frac{4}{3}, 0, \frac{3}{4}$$

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4. 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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5. Find the direction cosines and direction ratios for the following vectors.

$3\hat{i} - 4\hat{j} + 8\hat{k}$

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

$3\hat{i} + \hat{j} + \hat{k}$

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

$\hat{j}$

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

$5\hat{i} - 3\hat{j} - 48\hat{k}$

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

$3\hat{i} - 3\hat{k} + 4\hat{j}$

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

$\hat{i} - \hat{k}$

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

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

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15. 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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16. Show that the vectors are coplanar

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

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17. Show that the vectors are coplanar

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

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18. 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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19. 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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20. 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 $3\vec{a} - 2\vec{b} + 5\vec{c}$

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21. 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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22. 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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23. 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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24. 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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25. 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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26. 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

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

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2. Find $\vec{a} \cdot \vec{b}$ when

$$\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k} \quad \text{and} \quad \vec{b} = 6\hat{i} - 3\hat{j} + 2\hat{k}$$

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

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

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

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

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5. 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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6. 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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7. Find the angle between the vectors

$\hat{i} - \hat{j}$ and $\hat{j} - \hat{k}$.

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8. 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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9. 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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10. 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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11. 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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12. Show that the points (2,-1,3), (4,3,1) and (3,1,2) are collinear.

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

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15. If $\vec{a}$, $\vec{b}$ are unit vectors and θ is the angle between them, show that

$$\tan\frac{\theta}{2} = \frac{\left|\vec{a} - \vec{b}\right|}{\left|\vec{a} + \vec{b}\right|}$$

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16. 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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17. 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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18. 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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19. Three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are such that $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 3, \left|\vec{c}\right| = 4$, and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$.

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

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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. $\overrightarrow{AD}$

B. $\overrightarrow{CA}$

C. $\vec{0}$

D. $-\overrightarrow{AD}$

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:

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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: A::B

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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:

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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: A::D

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

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

Answer: A::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. coplanar vectors.

Answer: A::C

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

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

B. $4\overrightarrow{AC}$

C. $4\overrightarrow{BD}$

D. $\overrightarrow{0}$

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

Answer: A::B::C

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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. $\dfrac{2\vec{a} - \vec{b}}{2}$

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

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

Answer: A::B::C

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11. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of three collinear points, then which of the following is true?

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: A::B::C

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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::B::C::D

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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::C

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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::B

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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: A

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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: C

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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: B

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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: C

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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. 60^2

C. 45°

D. 90°

Answer: C

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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: A::B::D

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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: C

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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. 3

C. 5

D. 8

Answer:

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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: B

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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: A::D

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Additional Problems Section A 1 Mark

1. If m $\left(\overrightarrow{2}+\overrightarrow{j}+\overrightarrow{k}\right)$ is a unit vector then the value of m is

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

B. $\pm\frac{1}{\sqrt{5}}$

C. $\pm\frac{1}{\sqrt{6}}$

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

Answer: A

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2. The vectors having initial and terminal points as (2,5,0) and (-3,7,4) respectively is

A. $-\hat{i}+12\hat{j}+4\hat{k}$

B. $5\hat{i}+2\hat{j}-4\hat{k}$

C. $-5\hat{i}+2\hat{j}+4\hat{k}$

D. $\hat{i}+\hat{j}+\hat{k}$

Answer: A::B::D

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3. The value of λ when the vectors $\vec{a}=2\vec{i}+\lambda\vec{j}+\vec{k}$ and $\vec{b}=\vec{i}+2\vec{j}+3\vec{k}$ are othogonal is

A. 0

B. 1

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

D. $-\frac{5}{2}$

Answer: B

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4. The value of λ for which the vectors $3\hat{i} - 6\hat{j} + \hat{k}$ and $2\hat{i} - 4\hat{j} + \lambda\hat{k}$ are parallel is

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

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

C. $\frac{5}{2}$

D. $\frac{2}{5}$

Answer: B::C

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5. Match List -I with List II

ListI			ListII
i.	$\hat{i}.\hat{i}$	(a)	0
i.	$\hat{i}.\hat{j}$	(b)	$\hat{k}$
iiii.	$\hat{i} \times \hat{i}$	(c)	1
iv.	$\hat{i} \times \hat{j}$	(d)	0

A.

(i)	(ii)	(iii)	(iv)
(b)	(c)	(d)	(a)

B. $\begin{matrix} (\text{i}) & (\text{ii}) & (\text{iii}) & (\text{iv}) \\ (c) & (a) & (d) & (b) \end{matrix}$

C. $\begin{matrix} (\text{i}) & (\text{ii}) & (\text{iii}) & (\text{iv}) \\ (d) & (b) & (a) & (c) \end{matrix}$

D. $\begin{matrix} (\text{i}) & (\text{ii}) & (\text{iii}) & (\text{iv}) \\ (d) & (c) & (b) & (a) \end{matrix}$

Answer: A::B::C::D

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6. Assertion (A) : If ABCD is a prallelogram, $\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CB} + \overrightarrow{CD}$ then is equal to zero.

Reason (R): $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are equal in magnitude and opposite in direction. Also $\overrightarrow{AD}$ and $\overrightarrow{CB}$ are equal in magnitude and opposite in direction

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not a correct explanation of A

C. A is true but R is false

D. A is false but R is true

Answer: A::B::C::D

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7. Find the odd one out of the following

A. $\hat{i} + 2\hat{j} + 3\hat{k}$

B. $2\hat{i} + 4\hat{j} + 6\hat{k}$

C. $7\hat{i} + 14\hat{j} + 21\hat{k}$

D. $\hat{i} + 3\hat{j} + 2\hat{k}$

Answer: A::B::C

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8. Assertion (A) : $\vec{a}, \vec{b}, \vec{c}$ are the position vector of three collinear points then $2\vec{a} = \vec{b} + \vec{c}$

Reason (R) : Collinear points, have same direction

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not a correct explanation of A

C. A is true but R is false

D. A is false but R is true

Answer: A::B::C::D

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9. Find the odd one out of the following

A. matrix multiplication

B. vector cross product

C. Subtraction

D. Matris Addition

Answer: A::D

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Additional Problems Section B 2 Mark

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

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2. Write two different vectors having same magnitude.

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3. Find the scalar and vector components of the vector with initial point (2,1) and terminal point (-5,7)

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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. If $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$and $\vec{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$ then find $a \times b$. Verify that $\vec{a}$ and $\vec{a} \times \vec{b}$ are perpendicular to each other.

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Additional Problems Section C 3 Mark

1. Find the unit vector in the direction of the vector

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

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

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3. Find $\left|\vec{x}\right|$ if for a unit vector $\vec{a}$, $\left(\vec{x}-\vec{a}\right)\left(\vec{x}+\vec{a}\right)=12$

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4. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be non-coplanar vectors. Let A,B and C be the points whose position vectors with respect to the origin O are $\vec{a}+2\vec{b}+3\vec{c}$, $-2\vec{a}+3\vec{b}+5\vec{c}$ and $7\vec{a}-\vec{c}$ respectively. Then prove that A, B and C are collinear.

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5. If ABCDE is a pentagon then prove that $\overrightarrow{AB}+\overrightarrow{AE}+\overrightarrow{BC}+\overrightarrow{DC}+\overrightarrow{ED}+\overrightarrow{AC}=3\overrightarrow{AC}$

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Additional Problems Section D 5 Mark

1. Let $\vec{a} = 2\vec{j} + \vec{j} - 2\vec{k}$, $\vec{b} = \vec{i} + \vec{j}$. If $\vec{c}$ is a vector such that $\vec{a}.\vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 30°. Find the value of $\left|\left(\vec{a} \times \vec{b}\right) \times \vec{c}\right|$

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2. Prove that the smaller angle between any two diagonals of a cube is $\cos^{-1}\frac{1}{3}$.

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3. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors such that $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{c}| = \sqrt{24}$ and sum of any two vectors is orthogonal to the third vector

, then find $\left|\vec{a}+\vec{b}+\vec{c}\right|$.

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4. If $\left|\vec{a}\right|=\left|\vec{b}\right|=\left|\vec{a}+\vec{b}\right|=1$ then prove that $\left|\vec{a}-\vec{b}\right|=\sqrt{3}$.

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