MATHS

JEE (MAIN AND ADVANCED MATHEMATICS) FOR BOARD AND COMPETITIVE EXAMS

VECTOR ALGEBRA

Example

1. Represent graphically

(a) A displacement of 50 km, 30° south of west

(b) A displacement of 40 km, 60° north of east

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2. Classify the following measures as scalars and vectors.

(a) 25 kg (b) 25 newton along North

(c) 45 km/hr (d) 25 ampere

(e) 50 mile/hr towards East

(f) 50 joule.

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3. In the given figure, which of the vectors are :

(a) Collinear

(b) Equal

(C) Colinitial

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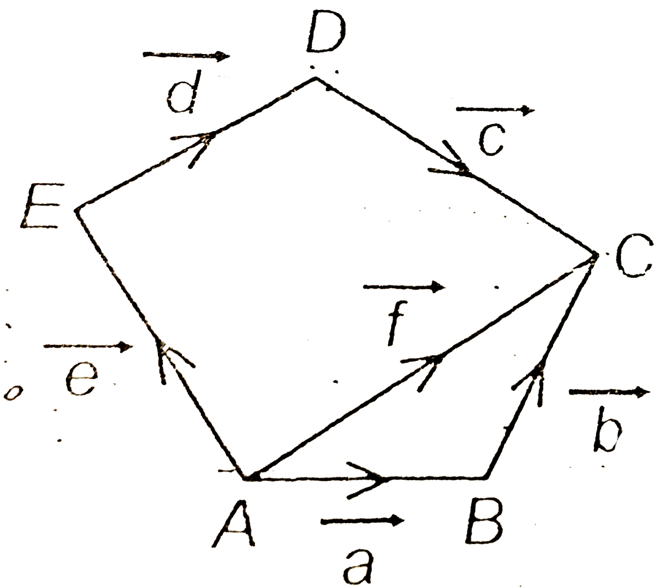
4. In the given figure, which of the following vector are

(a) collinear and equal (if ABCD are regular pentagon)

(b) coinitial vectors.



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5. Prove that when the sides of a triagle are taken in order, it leads to zero resultant.

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6. If $\vec{a}\,and\,\vec{b}$ are the vectors determined by two adjacent sides of a regular hexagon, what are the vectors determined by the other sides taken in order?

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7. Find the values of x and y so that the vector $3\hat{i} + 4\hat{j}$ and $x\hat{i} + y\hat{j}$ are equal.

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8. Let O be the origin and let A(-8,3) be a point in xy plane. Express $\overrightarrow{OA}$ in terms of vector $\vec{\hat{i}}$ and $\hat{j}$, Also, find $\left|\overrightarrow{OA}\right|$

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9. The position vector $\vec{a}$ of a point (m,12) is such that $|\vec{a}|$=13, find the value of m.

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10. ABCD is a parallelogram. If the coordinates of $A, B, C\ are\ (2,3), (1,4) and\ (0,-2)$ respectively, find the coordinates of D.

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11. Find the values of x,y and z so that vectors $\vec{a}=x\hat{i}+4\hat{j}+z\hat{k}$ and $\vec{b}=3\hat{i}+y\hat{j}+\hat{k}$ are equal.

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

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13. Find the unit vector in the direction of the difference of vector $\left(\vec{a}-\vec{b}\right)$, $\vec{a}=4\hat{i}+5\hat{j}+6\hat{k}$ and $\vec{b}=2\hat{i}+3\hat{j}+4\hat{k}$.

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14. Write the direction ratio's of the vector $\vec{a}=4\hat{i}-2\hat{j}+\hat{k}$ and hence calculate its direction cosines.

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15. Find the distance between the points A(3,2,1), B(-1,2,-3).

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16. The position vector of A,B,C are $\left(\hat{i}+2\hat{j}+3\hat{k}\right), \left(-2\hat{i}+3\hat{j}+5\hat{k}\right)$ and $(7\hat{i}-\hat{k})$ respectively. Prove that A,B and C are collinear.

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17. Find the position vector of the points which divide the join of the points $5\vec{a}-4\vec{b}$ and $4\vec{a}-5\vec{b}$ internally and externally in the ratio 4:3 respectively.

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

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

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20. Find the position vector of centroid of a triangle having position vector of its vertices as `2i+3j-4k, -2i+3j+4k and -6j

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21. If A,B and C are the vertices of a triangle with position vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively and G is the centroid of ΔABC, then $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}$ is equal to

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22. Show that the points A,B and C with position vectors $a=3\hat{j}-4\hat{j}-4\hat{k}, b=2\hat{i}-\hat{j}+\hat{k} \text{ and } c=\hat{i}-3\hat{j}-5\hat{k}$ respectively, form the vertices of a right angled triangle.

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23. Find the angle between two vectors $\vec{p}$ and $\vec{q}$ are 4,3 with respectively and when $\vec{p} . \vec{q}$ =5`.

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24. Find the angle $'\theta'$ between the vector $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + 4\hat{k}$.

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25. If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular.

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26. Find the projection of the vector $\vec{a} = 3\hat{i} + 2\hat{j} - 4\hat{k}$ on the vector $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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27. Find $\left|\vec{a}-\vec{b}\right|$, if two vector $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a}\right|=4, \left|\vec{b}\right|=5$ and $\vec{a}.\vec{b}=3$

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28. If $\vec{p}$ is a unti vector and $\left(\vec{y}-\vec{p}\right).\left(\vec{y}+\vec{p}\right)=8$, then find $\left|\vec{y}\right|$

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29. For any two vectors $\vec{p}$ and $\vec{q}$, show that $\left|\vec{p}.\vec{q}\right|\leq\left|\vec{p}\right|\left|\vec{q}\right|$.

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30. For any two vectors $\vec{a}$ and $\vec{b}$ prove that $\left|\vec{a}+\vec{b}\right|<+\left|\vec{a}\right|+\left|\vec{b}\right|$

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31. Show that the points A, B and C with position vectors $-2\hat{i}+3\hat{j}+5\hat{k}$, $\hat{i}+2\hat{j}+3\hat{k}$ and $7\hat{i}-\hat{k}$ respectively are collinear

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32. Prove that the area of the parallelogram with diagonal $\vec{a}$ and $\vec{b}$ is $\frac{1}{2}\left|\vec{a}\times\vec{b}\right|$

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33. Show that the area of a parallelogram having diagonals $3\hat{i}+\hat{j}-2\hat{k}\ and\ \hat{i}-3\hat{j}+4\hat{k}$ is $5\sqrt{3}$ square units.

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34. If $\vec{a}$ and $\vec{b}$ are any two vectors , then prove that $\left|\vec{a} \times \vec{b}\right|^2 = \left|\vec{a}\right|^2\left|\vec{b}\right|^2 - \left(\vec{a} \,.\, \vec{b}\right)^2 = \begin{vmatrix} \vec{a} \,.\, \vec{a} & \vec{a} \,.\, \vec{b} \\ \vec{a} \,.\, \vec{b} & \vec{b} \,.\, \vec{b} \end{vmatrix}$ or $\left|\vec{a} \times \vec{b}\right|^2 + \left(\vec{a} \,.\, \vec{b}\right)^2 = \left|\vec{a}\right|^2\left|\vec{b}\right|^2$ (This is also known as Lagrange identily)

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35. Find $\vec{a} \times \vec{b}$ if $\vec{a} = i + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$.

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36. Find a unit vector perpendicular to both the vectors $\hat{i} - 2\hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$.

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37. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar vectors then find value of $\left[\vec{a} - \vec{b} + \vec{2} c \vec{b} - \vec{c} + 2\vec{a}\vec{a} + 2\vec{b} - \vec{c}\right]$

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38. The edges of a parallelopiped are of unit length and a parallel to non-coplanar unit vectors $\hat{a}, \hat{b}, \hat{c}$ such that $\hat{a}.\ \hat{b} = \hat{b}.\ \hat{c} = \hat{c}.\ \vec{a} = 1/2$. Then the volume of the parallelopiped in cubic units is

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39. Solve for $\vec{x}, \vec{x} \times \vec{b} = \vec{a}$, where $\vec{a}, \vec{b}$ are two given vectors such that $\vec{a}$ is perpendicular to $\vec{b}$.

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40. VECTOR ALGEBRA | LINEAR COMBINATION LINEAR INDEPENDENCE AND LINEAR DEPENDENCE | Definition and physical interpretation: Linear Combination, Linear Combination: Linear Independence And Linear Dependence, Linearly Independent, Linearly Dependent, Theorem 1: If $\vec{a}$ and $\vec{b}$ are two non collinear vectors; then every vector $\vec{r}$ coplanar with $\vec{a}$ and $\vec{b}$ can be expressed in one and only one way as a linear combination: x$\vec{a}$+y$\vec{b}$., Theorem 2: If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are non coplanar vectors; then any vector $\vec{r}$ can be expressed as linear combination: x$\vec{a}$ +y$\vec{b}$+z$\vec{c}$, Theorem 3:If vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ are coplanar then det($\vec{a}$ $\vec{b}$ $\vec{c}$) = 0, Examples: Prove that the segment joining the middle points of two non parallel sides of a trapezium is parallel to the parallel sides and half of their sum., Components of a vector in terms of coordinates of its end points

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41. If $\vec{a}$, $\vec{b}$, $\vec{c}$, $\vec{d}$ are the position vectors of the verticles of a cyclic quadrilateral ABCd prove that

$$\frac{\left|\vec{a}\times\vec{b}+\vec{b}\times\vec{d}+\vec{d}\times\vec{a}\right|}{\left(\vec{b}-\vec{a}\right).\left(\vec{d}-\vec{a}\right)}+\frac{\left|\vec{b}\times\vec{c}+\vec{c}\times\vec{d}+\vec{d}\times\vec{b}\right|}{\left(\vec{b}-\vec{c}\right).\left(\vec{d}-\vec{c}\right)}=0$$

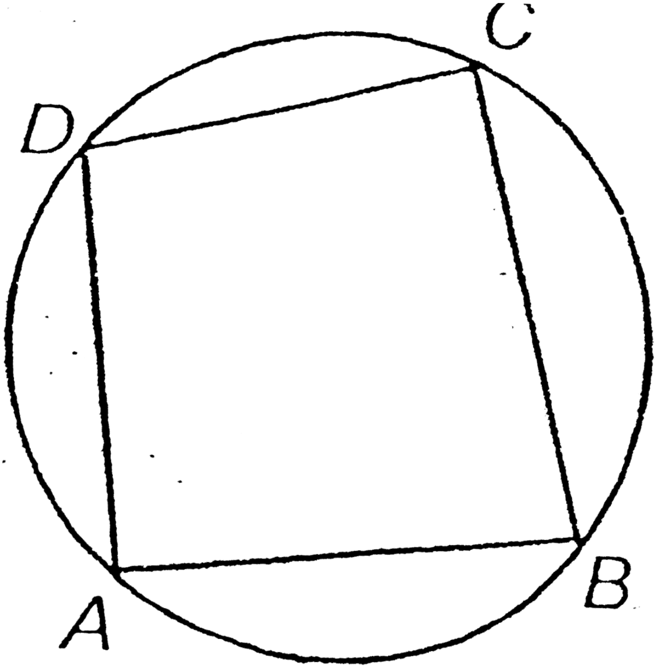

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Illustration

1. about to only mathematics

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Try Yourself

1. Classify the following as scalars and vectors :

Time

Distance

Displacement

Force

Work

Torque

Velocity

Speed

Acceleration

Mass

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2. Represent the following graphically :

A displacement of 70 km, 60° North of West.

A force of 70 N, 30° East of South.

A velocity of 15 km/hr in 45° North-west direction.

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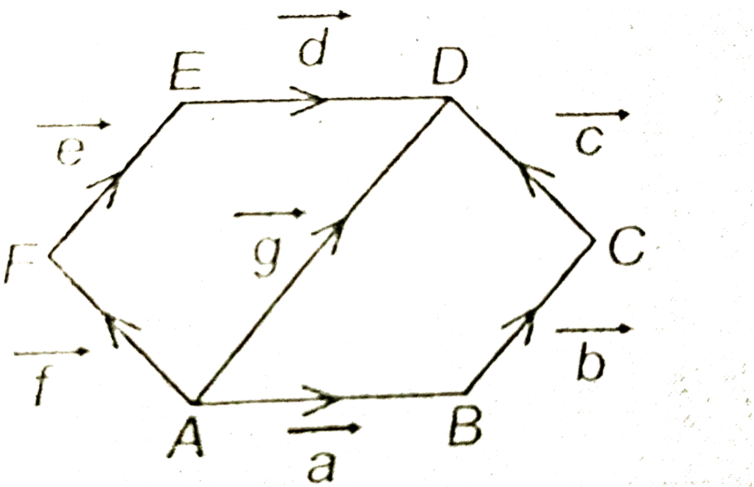
3. In the given figure, vectors which are

Collinear

Equal

Collinear but not equal.



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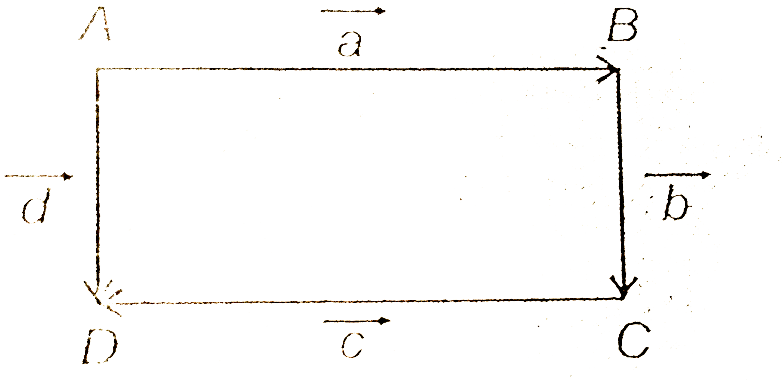
4. In the given figure, identify the following vectors :



Coinitial

Equal

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

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6. If $\overrightarrow{PO} + \overrightarrow{OQ} = \overrightarrow{QO} + \overrightarrow{OR}$, show that the point, P, Q, R are collinear.

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

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8. If the position vector $\overrightarrow{a}$ of a point (m,5) is such that $\left|\overrightarrow{a}\right| = 13$, find the value of m.

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9. (i) Find the sum of vectors $\overrightarrow{a} = \hat{i} - 2\hat{j} + \hat{k}$, $\overrightarrow{b} = -2\hat{i} + 4\hat{j} + 5\hat{k}$, and $\overrightarrow{c} = \hat{i} - \hat{j} - 7\hat{k}$ (ii) Find the magnitude of the vector $\overrightarrow{a} = 3\hat{i} - 2\hat{j} + 6\hat{k}$.

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10. (i) Find the unit vector in the direction of $\vec{a}+\vec{b}$ if $\vec{a}=2\hat{i}-\hat{j}+2\hat{k}$, and $\vec{b}=-\hat{i}+\hat{j}-\hat{k}$ (ii) 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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11. Find the distance between points A(2,5,7), B(1,3,5), by using vector method.

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

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13. Find the mid point of the line segment joining the points $P\left(2\hat{i}+3\hat{j}+3\hat{k}\right)$ and $Q\left(4\hat{i}+\hat{j}-2\hat{k}\right)$

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14. 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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15. Find the angle between the vectors $\vec{a}$ and $\vec{b}$

if $\left|\vec{a}\right|=2\left|\vec{b}\right|=3$ and $\vec{a}.\vec{b}=1$

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

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16. Find the projection of vector $\vec{a}=5\hat{i}-\hat{j}-3\hat{k}$ on the vector $\vec{b}=\hat{i}+\hat{j}+\hat{k}$.

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

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18. Let $\vec{a}$ and $\vec{b}$ be two vectors of the same magnitude such that the angle between them is 60° and $\vec{a}.\vec{b}$ =8. Find $\left|\vec{a}\right|$ and $\left|\vec{b}\right|$.

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19. Find the magnitude of a given by $\vec{a}=\left(\hat{i}+3\hat{j}+\hat{k}\right)\times\left(-\hat{i}+3\hat{k}\right)$

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20. 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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Assignment Section A

1. What is the maximum number of rectangular components into which a vector can be split in space?

A. Two

B. Three

C. Four

D. More than four

Answer: 1

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2. Which of the following is a vector ?

A. Electric charge

B. Work

C. Electric current

D. Momentum

Answer: 4

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3. The minimum number of vectors of equal magnitude needed to produce zero resultant is

A. 2

B. 3

C. 4

D. More than 4

Answer: 1

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4. What is the maximum number of rectangular components into which a vector can be split in space?

A. Two

B. Three

C. Four

D. Any number of component

Answer: 4

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5. Which of the following operations between the two vectors can result a vector perpendicular to either of them ?

A. Addition

B. Subtraction

C. Product

D. Division

Answer: 3

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6. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is

A. 1

B. $\sqrt{2}$

C. $\sqrt{5}$

D. $\sqrt{3}$

Answer: 4

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7. Let O be the centre of a regular hexagon $ABCDEF$. Find the sum of the vectors $\vec{O}A, \vec{O}B, \vec{O}C, \vec{O}D, \vec{O}EandO\vec{F}$.

A. $\sqrt{3}$

B. 0

C. 2

D. 1

Answer: 2

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8. For any two vectors $\vec{a}$ and $\vec{b}$, which one of the following is not true ?

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

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

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

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

Answer: 3

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

A. $\frac{1}{\sqrt{14}}\hat{i} + \frac{2}{\sqrt{14}}\hat{j} + \frac{3}{\sqrt{14}}\hat{k}$

B. $\frac{2}{\sqrt{14}}\hat{i} + \frac{1}{\sqrt{14}}\hat{j} + \frac{3}{\sqrt{14}}\hat{k}$

C. $\frac{1}{\sqrt{14}}\hat{i} + \frac{3}{\sqrt{14}}\hat{j} + \frac{2}{\sqrt{14}}\hat{k}$

D. $\frac{3}{\sqrt{14}}\hat{i} + \frac{1}{\sqrt{14}}\hat{j} + \frac{2}{\sqrt{14}}\hat{k}$

Answer: 1

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10. Prove that the vectgors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ form a righat angled triangle.

A. Equilateral triangle

B. Isosceles triangle

C. Right triangle

D. Right Isosceles triangle

Answer: 3

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11. The magnitude of the sum of two vectors is equal to the difference in their magnitudes. What is the angle between vectors?

A. 0°

B. 45°

C. 90^2

D. 180^2

Answer: 4

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12. What is the angle between $\vec{a}$ and the resultant of $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$?

A. 0

B. $\tan^{-1}\frac{a}{b}$

C. $\tan^{-1}\frac{b}{a}$

D. $\tan^{-1}\frac{(a-b)}{(a+b)}$

Answer: 1

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13. What is the magnitude of the scalar product of the following vectors ?

$\overrightarrow{a} = \hat{i} + \hat{j}, \overrightarrow{b} = \hat{i} + \hat{k}$

A. 1

B. 2

C. $\sqrt{2}$

D. 3

Answer: 1

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14. Given that $0.4\hat{i} + 0.8\hat{j} + b\hat{k}$ is a unit vector . What is the value of b ?

A. 0.2

B. $\sqrt{0.2}$

C. 0.8

D. $\sqrt{0.8}$

Answer: 2

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15. $ABCD$ is parallelogram. If L and M are the middle points of BC and CD, then $\overline{AL} + \overline{AM}$ equals

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

B. $\frac{2}{3}\overrightarrow{A}C$

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

D. $\frac{3}{4}\overrightarrow{A}C$

Answer: 3

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16. If $\overrightarrow{a} = \hat{i} + \hat{j}, \overrightarrow{b} = \hat{j} + \hat{k}, \overrightarrow{c}\hat{k} + \hat{i}$, a unit vector parallel to $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c}$.

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

B. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$

C. $\dfrac{\left(\hat{i} + \hat{j} + \hat{k}\right)}{2\sqrt{8}}$

D. $\dfrac{\vec{a} + \vec{b} + \vec{c}}{\sqrt{3}}$

Answer: 2

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17. $p_1\hat{i} + p_2\hat{j}$ is a unit vector perpendicular to $4\hat{i} - 3\hat{j}$ if

A. $p_1 = 0.6, p_2 = 0.8$

B. $p_1 = 3, p_2 = 4$

C. $p_1 = 0.8, p_2 = 0.6$

D. $p_1 = 4, p_2 = 3$

Answer: 1

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18. If $\vec{O}A = \vec{a}, \vec{O}B = \vec{b}, \vec{O}C = 2\vec{a} + 3\vec{b}, \vec{O}D = \vec{a} - 2\vec{b},$ the length of $\vec{O}A$ is three times the length of $\vec{O}B$ and $\vec{O}A$ is perpendicular to $\vec{D}B$, then $\left(\vec{B}D \times \vec{A}C\right).\left(\vec{O}D \times \vec{O}C\right)$ is

A. $7\vec{a} \times \vec{b}\Big|^2$

B. $42\left|\vec{a} \times \vec{b}\right|^2$

C. 0

D. 1

Answer: 3

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19. Let $\vec{a} = 3\hat{i} - \hat{j}, \vec{b} = \hat{i} - 2\hat{j}, \vec{c} = -\hat{i} + 7\hat{j}$ and $\vec{p} = \vec{a} + \vec{b} + \vec{c}$. Then $\vec{P}$ in terms of $\vec{a}$ and $\vec{b}$ is

A. $2\vec{a} + 3\vec{b}$

B. $-2\vec{a} - 3\vec{b}$

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

D. $2\vec{a} - 3\hat{b}$

Answer: 4

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20. If $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \vec{a} \neq 0$, then

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

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

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

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

Answer: 1

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21. Given two vectors

$\overrightarrow{a} = 2\hat{i} - 3\hat{j} + 6\hat{k}, \overrightarrow{b} = -2\hat{i} + 2\hat{j} - \hat{k}$ and

$\lambda = \dfrac{\text{the projection of } \overrightarrow{a} \, on \, \overrightarrow{b}}{\text{the projection of } \overrightarrow{b} \, on \, \overrightarrow{a}}$, then the value of λ is

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

B. 7

C. 3

D. $\dfrac{7}{3}$

Answer: 4

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22. The area of parallelogram whose diagonals coincide with the following pair of vectors is $5\sqrt{3}$. The vectors are

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

B. $\dfrac{3\hat{i}}{2} - \dfrac{\hat{j}}{2} - \hat{k}, 2\hat{i} - 6\hat{j} + 8\hat{k}$

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

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

Answer: 4

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23. Let $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ be three non-zero vectors such that $\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}=\overrightarrow{0}$ and $\lambda\overrightarrow{b}\times\overrightarrow{a}+\overrightarrow{b}\times\overrightarrow{c}+\overrightarrow{c}\times\overrightarrow{a}=\overrightarrow{0}$ then find the value of λ.

A. 1

B. 2

C. -1

D. -2

Answer: 2

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24. If $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c}, \overrightarrow{b} \times \overrightarrow{c} = \overrightarrow{a}$, where $\overrightarrow{c} \neq \overrightarrow{0}$, then

A. $\left|\overrightarrow{a}\right| = \left|\overrightarrow{c}\right|, \left|\overrightarrow{b}\right| = 1$

B. $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right|, \left|\overrightarrow{\ }\right| = 1$

C. $\left|\overrightarrow{b}\right| = \left|\overrightarrow{c}\right|, \left|\overrightarrow{a}\right| = 1$

D. $\left|\overrightarrow{a}\right| \neq \left|\overrightarrow{c}\right|$

Answer: 1

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25. ABCDEF is a regular hexagon where centre O is the origin, if the position vector of A is $\hat{i} - \hat{j} + 2\hat{k}$, then $\overline{BC}$ is equal to

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

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

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

D. Both (1) & (2)

Answer: 2

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26. The value of the following expression

$\hat{i}.\left(\hat{j}\times\hat{k}\right)+j.\left(\hat{i}\times\hat{k}\right)+\hat{k}.\left(\hat{j}\times\hat{i}\right)$is

A. 3

B. 0

C. -3

D. 1

Answer: 4

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27. For any vector $\vec{a}$ the value of $\left(\vec{a} \times \hat{i}\right)^2 + \left(\vec{a} \times \hat{j}\right)^2 + \left(\vec{a} \times \hat{k}\right)^2$ is equal to

A. $\left|\vec{a}\right|^2$

B. $2\left|\vec{a}\right|^2$

C. $3\left|\vec{a}\right|^2$

D. $4\left|\vec{a}\right|^2$

Answer: 2

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28. If $\left|\vec{a} \times \vec{b}\right| = 2, \left|\vec{a} . \vec{b}\right| = 2$, then $\left|\vec{a}\right|^2\left|\vec{b}\right|^2$ is equal to

A. 6

B. 2

C. 8

D. 20

Answer: 3

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29. $\left|\left(\vec{a} \times \vec{b}\right)\right|^2$ is eqaul to

A. $\left|\vec{a}\right|^2\left|\vec{b}\right|^2 - \left(\vec{a}\,.\,\vec{b}\right)^2$

B. $\left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 - 3\left(\vec{a}\,.\,\vec{b}\right)^2$

C. $\left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 - 2\left(\vec{a}\,.\,\vec{b}\right)$

D. $\left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 - \vec{a}\,.\,\vec{b}$

Answer: 1

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30. If $\overrightarrow{a}$ and $\overrightarrow{b}$ are unit vectors, then which of the following values of $\overrightarrow{a}\,.\,\overrightarrow{b}$ is not possible ?

A. $\sqrt{3}$

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

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

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

Answer: 1

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31. If $\overrightarrow{a}\,.\,\overrightarrow{i}=\overrightarrow{a}\,.\left(\hat{i}+\hat{j}\right)=\overrightarrow{a}\,.\left(\hat{i}+\hat{j}+\hat{k}\right)$. Then find the unit vector $\overrightarrow{a}$.

A. $\overrightarrow{0}$

B. $\hat{i}$

C. $\hat{j}$

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

Answer: 2

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32. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $|\vec{c}| = 7$, then the angle between $\vec{a}$ and $\vec{b}$ is

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

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

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

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

Answer: 4

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33. The vector $\cos\alpha.\cos\beta\hat{i}+\cos\alpha.\sin\beta\hat{j}+\sin\alpha\hat{k}$ is a/an

A. Null vector

B. Unit vector

C. Constant vector

D. Vector of magnitude 3

Answer: 2

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34. If $\left|\overrightarrow{a}\right|=\left|\overrightarrow{b}\right|$, then $\left(\overrightarrow{a}+\overrightarrow{b}\right).\left(\overrightarrow{a}-\overrightarrow{b}\right)$ is equal to

A. Positive

B. Negative

C. Zero

D. None of these

Answer: 3

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35. If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle θ, then the value of $\left|\vec{a}-\vec{b}\right|$ is

A. $2\frac{\sin(\theta)}{2}$

B. $2\sin\theta$

C. $2\cos\theta\frac{\theta}{2}$

D. $2\cos\theta$

Answer: 1

Watch Video Solution

36. The projection of the vector $\hat{i}+\hat{j}+\hat{k}$ along the vector of $\hat{j}$ is

A. 1

B. 0

C. 2

D. -1

Answer: 1

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37. If OACB is a parallelogram with $\vec{O}C = \vec{a}$ and $\vec{A}B = \vec{b}$, then $\vec{O}A$ is equal to

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

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

C. $\frac{1}{2}\left(\vec{b} - \vec{a}\right)$

D. $\frac{1}{2}\left(\vec{a} - \vec{b}\right)$

Answer: 4

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38. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are the position vectors of points A, B, C and D, respectively referred to the same origin O such that no three of these points are collinear and $\vec{a} + \vec{c} = \vec{b} + \vec{d}$, then prove that quadrilateral $ABCD$ is a parallelogram.

A. Rhombus

B. Rectangle

C. Square

D. Parallelogram

Answer: 4

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39. If the vectors $3\hat{i} + \lambda\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + 8\hat{k}$ are perpendicular, then λ is equal to

A. -14

B. 7

C. 14

D. $\frac{1}{7}$

Answer: 3

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40. The vectors $2\hat{i} + \hat{j} - 4\hat{k}$ and $a\hat{i} + b\hat{j} + c\hat{k}$ are perpendicular, if

A. a=2, b=3, c=-4

B. a=4, b=4, c=5

C. a=4, b=4, c=-5

D. a=-4, b=4, c=-5

Answer: 2

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41. Let $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that $\left|\vec{a} + \vec{b} + \vec{c}\right| = 1$ and $\vec{a} \perp \vec{b}$, if $\vec{c}$ makes angles $\delta\beta$ with $\vec{a}, \vec{b}$ respectively, then $\cos\delta + \cos\beta$ is equal to

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

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

C. 1

D. -1

Answer: 4

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42. If θ is the angle between the vectors $2\hat{i} - 2\hat{j} + 4\hat{k}$ and $3\hat{i} + \hat{j} + 2\hat{k}$, then $\sin\theta$ is equal to

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

B. $\frac{2}{\sqrt{7}}$

C. $\frac{\sqrt{2}}{7}$

D. $\sqrt{\frac{2}{7}}$

Answer: 2

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43. If $\overrightarrow{a} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\overrightarrow{b} = \hat{i} + 4\hat{j} - 2\hat{k}$, then $\overrightarrow{a} \times \overrightarrow{b}$ is

A. $10\hat{i} + 2\hat{j} + 11\hat{k}$

B. $10\hat{i} + 3\hat{j} + 11\hat{k}$

C. $10\hat{i} - 3\hat{j} + 11\hat{k}$

D. $10\hat{i} - 3\hat{j} - 10\hat{k}$

Answer: 2

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44. If $\vec{a}, \vec{b}$ represent the diagonals of a rhombus, then

A. $\vec{a} \times \vec{b} = 0$

B. $\vec{a} . \vec{b} = 0$

C. $\vec{a} . \vec{b} = 1$

D. $\vec{a} \times \vec{b} = \vec{a}$

Answer: 2

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45. If $\vec{u} = \vec{a} - \vec{b}, \vec{v} = \vec{a} + \vec{b}$ and $\left|\vec{a}\right| = \left|\vec{b}\right| = 2$, then $\left|\vec{u} \times \vec{v}\right|$ is equal to

A. $2\sqrt{16 - \left(\vec{a} . \vec{b}\right)^2}$

B. $\sqrt{\left[16 - \left(\vec{a} . \vec{b}\right)^2\right]}$

C. $2\sqrt{\left[4 - \left(\vec{a} . \vec{b}\right)^2\right]}$

D. $\left[4-\left(\vec{a}.\vec{b}\right)^{2}\right]$

Answer: 1

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46. If $\vec{p}=2\vec{a}-3\vec{b}, \vec{q}=\vec{a}-2b+\vec{c}, \vec{r}=-3\vec{a}+\vec{b}+2\vec{c}, \vec{a}, \vec{b}, \vec{c}$ being non-zero, non-coplanar vectors, then $-2\vec{a}+\vec{b}-\vec{c}$ is equal to

A. $\vec{p}-4\vec{q}$

B. $\dfrac{\left(-7\vec{q}+\vec{r}\right)}{5}$

C. $2\vec{p}-3\vec{q}+\vec{r}$

D. $4\vec{p}-2\vec{r}$

Answer: 3

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47. A vector $\overrightarrow{c}$ of magnitude $\sqrt{7}$ which is perpendicular to the vector $\overrightarrow{a} = 2\hat{j} - \hat{k}$ and $\overrightarrow{b} = -\hat{i} + 2\hat{j} - 3\hat{k}$ and makes an obtuse angle with the y-axis is given by

A. (a) $\left(\frac{-4}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-2}{\sqrt{3}}\right)$

B. (b) $\left(\frac{-4}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{2}{\sqrt{3}}\right)$

C. (c) $\left(\frac{4}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{2}{\sqrt{3}}\right)$

D. (d)Both (2) & (3)

Answer: 3

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48. If $\overrightarrow{a} = \hat{i} + \hat{j}, \overrightarrow{b} = \hat{i} - \hat{j}$, then $\overrightarrow{a} . \overrightarrow{b} =$

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

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

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

D. 0

Answer: 4

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49. The vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + \lambda\hat{k}$ are coplanar if the value of λ is

A. 1

B. 2

C. 3

D. 5

Answer: 4

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50. The volume of the parallelepiped whose edges are

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

A. -2 cubic unit

B. 2 cubic unit

C. 1 cubic unit

D. 4 cubic unit

Answer: 2

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Assignment Section B

1. Let $ABCD$ be a parallelogram whose diagonals intersect at P and let O be the origin. Then prove that $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} = 4\overrightarrow{OP}$.

A. $\overrightarrow{O}P$

B. $2\overrightarrow{O}P$

C. $3veOP$

D. $4\overrightarrow{O}P$

Answer: 4

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2. If a and b are position vectors of A and B respectively the position vector of a point C on AB produced such that $\overrightarrow{AC} = 3\overrightarrow{AB}$ is

A. $3\overrightarrow{b} - 2\overrightarrow{a}$

B. $2\overrightarrow{a} - 3\overrightarrow{b}$

C. $2\overrightarrow{a} + 3\overrightarrow{b}$

D. $3\overrightarrow{a} - 2\overrightarrow{b}$

Answer: 1

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3. The points with position vectors $60\hat{i}+3\hat{j}, 40\hat{i}-8\hat{j}, a\hat{i}-52\hat{j}$ are collinear if (A) $a=-40$ (B) $a=40$ (C) $a=20$ (D) none of these

A. -20

B. 40

C. -40

D. 20

Answer: 3

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4. $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are three non-coplanar such that $\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}=\alpha\overrightarrow{d}$ and $\overrightarrow{b}+\overrightarrow{c}+\overrightarrow{d}=\beta\overrightarrow{a}$, then $\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}+\overrightarrow{d}$ is equal to:

A. $\alpha\overrightarrow{a}$

B. $\beta\overrightarrow{b}$

C. 0

D. $(\alpha + \beta)\vec{c}$

Answer: 3

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5. The position vector of three points are $2\vec{a} - \vec{b} + 3\vec{c}$, $\vec{a} - 2\vec{b} + \lambda\vec{c}$ and $\mu\vec{a} - 5\vec{b}$ where $\vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors. The points are collinear when

A. $\lambda = -2, \mu = \frac{9}{4}$

B. $\lambda = \frac{-9}{4}, \mu = 2$

C. $\lambda = \frac{9}{4}, \mu = -2$

D. $\lambda = 2, \mu = -2$

Answer: 3

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6. Let a,b,c be three distinct positive real numbers. If $\overrightarrow{p}, \overrightarrow{q}, \overrightarrow{r}$ lie in a plane, where $\overrightarrow{p} = a\hat{i} - a\hat{j} + b\hat{k}$, $\overrightarrow{q} = \hat{i} + \hat{k}$ and $\overrightarrow{r} = c\hat{i} + c\hat{j} + b\hat{k}$, then b is

A. The A.M. of a,c

B. The G.M. of a, c

C. The H.M. of a, c

D. Equal to 0

Answer: 3

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7. Let $\overrightarrow{a}$ and $\overrightarrow{b}$ are unit vectors inclined at an angle α to each other , if $\left|\overrightarrow{a} + \overrightarrow{b}\right| < 1$ then

A. $\alpha = \frac{\pi}{2}$

B. $\alpha < \frac{\pi}{3}$

C. $\alpha > \frac{2\pi}{3}$

D. $\frac{\pi}{3} < \alpha < \frac{2\pi}{3}$

Answer: 3

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8. A unit vector in the xy-plane that makes an angle of $\frac{\pi}{4}$ with the vector $\hat{i} + \hat{j}$ and an angle of 'pi/3' with the vector $3\hat{i} - 4\hat{j}$ is

A. $\hat{i}$

B. $\frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j}\right)$

C. $\frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

D. Not in existence

Answer: 4

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9. The vectors $2\hat{i} - \lambda\hat{j} + 3\lambda\hat{k}$ and $(1+\lambda)\hat{i} - 2\lambda\hat{j} + \hat{k}$ include an acute angle for (A) all values of λ(B) $\lambda < -2$and $\lambda > -\frac{1}{2}$ (C) $\lambda = -\frac{1}{2}$ (D) $\lambda\varepsilon\left[-2, -\frac{1}{2}\right]$

A. All real m

B. $m < -2 \text{ or } m > -\frac{1}{2}$

C. $m = -\frac{1}{2}$

D. $m \in \left[-2, -\frac{1}{2}\right]$

Answer: 2

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10. Let $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 3, \left|\vec{c}\right| = 2, \left|\vec{a} + \vec{b} + \vec{c}\right| = 4$ and $\vec{a}$ is perpendicular to $\vec{b}, \vec{c}$ makes angle θ and ϕ with $\vec{a}$ and $\vec{b}$ respectively, then $\cos\theta + \cos\theta =$

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

B. $-\frac{3}{4}$

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

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

Answer: 4

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11. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $\left|\vec{c}\right| = \sqrt{3}$ then:

A. $\alpha = 1, \beta = -1$

B. $\alpha = 1, \beta \pm 1$

C. $\alpha = -1, \beta = \pm 1$

D. $\alpha = \pm 1, \beta = 1$

Answer: 4

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12. $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}, \vec{b} = \hat{j} + 2\hat{j} - \hat{k}, \vec{c} = \hat{i} + \hat{j} - 2\hat{k}$. A vector coplanar with $\vec{b}$ and $\vec{c}$. Whose projection on $\vec{a}$ is magnitude $\sqrt{\frac{2}{3}}$ is

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

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

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

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

Answer: 1

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13. find the area of a parallelogram whose diagonals are $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} + 4\hat{k}$.

A. $10\sqrt{3}$

B. $5\sqrt{3}$

C. 8

D. 4

Answer: 2

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14. If a and b are unit vectors, then the vector defined as $V = (a + b) \times (a + b)$ is collinear to the vector

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

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

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

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

Answer: 1

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15. Let $\overrightarrow{a} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\overrightarrow{c}$ is a vector such that $\left|\overrightarrow{a} \times \overrightarrow{c}\right|^2 + \left(\overrightarrow{a} . \overrightarrow{c}\right)^2 = 144$ then $\left|\overrightarrow{c}\right|$ is equal to

A. 16

B. 4

C. 3

D. 9

Answer: 2

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16. ABCD is a quadrilateral with $\overrightarrow{AB} = \overrightarrow{a}, \overrightarrow{AD} = \overrightarrow{b}$ and $\overrightarrow{AC} = 2\overrightarrow{a} + 3\overrightarrow{b}$. If its area is α times the area of the parallelogram with AB and AD as adjacent sides, then $\alpha =$

A. 5

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

C. 1

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

Answer: 2

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17. A unit vector perpendicular to the plane passing through the points whose position vectors are $\hat{i} - \hat{j} + 2\hat{k}, 2\hat{i} - \hat{k}$ and $2\hat{i} + \hat{k}$ is

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

B. $\frac{1}{\sqrt{6}}\left(\hat{i} + 2\hat{j} + \hat{k}\right)$

C. $\pm\left(\frac{\hat{i} - \hat{j}}{\sqrt{2}}\right)$

D. $\frac{1}{\sqrt{6}}\left(3\hat{i} + 4\hat{j} - \hat{k}\right)$

Answer: 3

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18. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of the vertices. A,B,C of a triangle ABC. Then the area of triangle ABC is

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

B. $\frac{1}{2}\left(\vec{a} \times \vec{b}\right).\vec{c}$

C. $\frac{1}{2}\left|\vec{a} \times \vec{b}\right|$

D. $\frac{1}{2}\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|$

Answer: 4

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19. If $\vec{p} \times \vec{q} = \vec{r}$ and $\vec{p}.\vec{q} = c$, then $\vec{q}$ is

A. $\dfrac{c\vec{p} - \vec{p} \times \vec{r}}{\left|\vec{p}\right|^2}$

B. $\dfrac{c\vec{p} + \vec{p} \times \vec{r}}{\left|\vec{p}\right|^2}$

C. $\dfrac{c\vec{r} - \vec{p} \times \vec{r}}{\left|\vec{p}\right|^2}$

D. $\dfrac{c\vec{r} + \vec{p} \times \vec{r}}{\left|\vec{p}\right|^2}$

Answer: 1

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20. If $\vec{a} = \left(\hat{i} + \hat{j} + \hat{k}\right), \vec{a}\,.\,\vec{b} = 1 \text{ and } \vec{a} \times \vec{b} = \hat{j} - \hat{k}, \text{ then } \vec{b}$ is

(a) $\hat{i} - \hat{j} + \hat{k}$ (b) $2\hat{i} - \hat{k}$ (c) $\hat{i}$ (d) $2\hat{i}$

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

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

C. $\hat{i}$

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

Answer: 3

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21. If $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = 4$ then $\left[\vec{a} \times \vec{b}\ \vec{b} \times \vec{c}\ \vec{c} \times \vec{a}\right]$ is equal to

A. 8

B. 64

C. 4

D. 16

Answer: 4

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22. If $\vec{r} = x\left(\vec{a} \times \vec{b}\right) + y\left(\vec{b} \times \vec{c}\right) + z\left(\vec{c} \times \vec{a}\right)$ and $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = \frac{1}{3}$, then x+y+z is equal to

A. $7\vec{r}.\left(\vec{a} + \vec{b} + \vec{c}\right)$

B. $\vec{r}.\left(\vec{a} + \vec{b} + \vec{c}\right)$

C. $5\overrightarrow{r}.\left(\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}\right)$

D. $3\overrightarrow{r}.\left(\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}\right)$

Answer: 4

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23. If the verticles of a tetrahedron have the position vectors $\overrightarrow{0}, \hat{i}+\hat{j}, 2\hat{j}-\hat{k}$ and $\hat{i}+\hat{k}$ then the volume of the tetrahedron is

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

B. 1

C. 2

D. 3

Answer: 1

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24. If $\left[\left(2\vec{a}+\vec{b}\right)\vec{c}\,\vec{d}\right]=\lambda\left[\vec{a}\,\vec{c}\,\vec{d}\right]+\mu\left[\vec{b}\,\vec{c}\,\vec{d}\right]$ then $\lambda+\mu$ is equal to

A. -6

B. 3

C. 2

D. -2

Answer: 2

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25. Unit vectors $\vec{a}$ and $\vec{b}$ ar perpendicular , and unit vector $\vec{c}$ is inclined at an angle θ to both $\vec{a}$ and $\vec{b}$. $If \alpha\vec{a}+\beta\vec{b}+\gamma\left(\vec{a}\times\vec{b}\right)$ then.

A. $x=\cos\theta, y=\sin\theta, z=\cos 2\theta$

B. $x=\sin\theta, y=\cos\theta, z=\cos 2\theta$

C. $x = y = \cos\theta, z^2 = \cos 2\theta$

D. $x = y = \cos\theta, z^2 = -\cos 2\theta$

Answer: 4

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26. The position vectors of the sides of triangle are $3\hat{i} + 4\hat{j} + 5\hat{k}$, $\hat{i} + 7\hat{k}$ and $5\hat{i} + 5\hat{k}$. The distance between the circumcentre and the ortho centre is

A. 0

B. $\dfrac{3\sqrt{274}}{\sqrt{11}}$

C. $\sqrt{306}$

D. $\dfrac{3}{2}\sqrt{306}$

Answer: 2

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27. $\vec{b}$ and $\vec{c}$ are non- collinear if *[Math Processing Error]* then

A. $\alpha = \frac{\pi}{2}, \beta = -1$

B. $\alpha = \frac{\pi}{3}, \beta = -1$

C. $\alpha = \frac{\pi}{3}, \beta = 1$

D. $\alpha = \frac{\pi}{2}, \beta = 1$

Answer: 4

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28. Let $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}$, and $\vec{b} = \hat{i} + \hat{j}$ if c is a vector such that $\vec{a} . \vec{c} = \left|\vec{c}\right|, \left|\vec{c} - \vec{a}\right| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{i} s30^\circ$, then $\left|\left(\vec{a} \times \vec{b}\right)\right| \times \vec{c}\right|$ is equal to

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

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

C. 2

D. 3

Answer: 2

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29.

$\overrightarrow{r} = 3\hat{i} + 2\hat{j} - 5\hat{k}, \overrightarrow{a} = 2\hat{i} - \hat{j} + \hat{k}, \overrightarrow{b} = \hat{i} + 3\hat{j} - 2\hat{k}, \overrightarrow{c} = -2\hat{i} + \hat{j} -$

such that $\overrightarrow{r} = \lambda\overrightarrow{a} + \mu\overrightarrow{b} + \gamma\overrightarrow{c}$, then

A. $\mu, \frac{\lambda}{2}, \gamma$ are in A.P.

B. λ, μ, γ are in A.P.

C. $\frac{\lambda}{2}, \gamma$ are in G.P.

D. $\mu, \frac{\lambda}{2}, \gamma$ are in G.P.

Answer: 1

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30. let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors having magnitudes 1, 1 and 2, respectively, if $\vec{a} \times \left(\vec{a} \times \vec{c}\right) + \vec{b} = \vec{0}$, then the acute angle between $\vec{a}$ and $\vec{c}$ is ______

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

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

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

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

Answer: 1

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31. If $\vec{a} \perp \vec{b}$ then vector $\vec{v}$ in terms of $\vec{a}$ and $\vec{b}$ satisfying the equations $\vec{v}.Veca = 0nad\vec{v}.Vecb = 1$ and $\left[\vec{a}\vec{a}\vec{b}\right] = 1$ is

A. $\frac{\vec{b}}{\left|\vec{b}\right|} + \frac{\vec{a} \times \vec{b}}{\left|\vec{a} \times \vec{b}\right|^2}$

B. $\dfrac{\vec{b}}{\left|\vec{b}\right|^2} + \dfrac{\vec{a} \times \vec{b}}{\left|\vec{a} \times \vec{b}\right|^2}$

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

D. $\dfrac{\vec{b}}{\left|\vec{b}\right|} + \dfrac{\vec{a} \times \vec{b}}{\left|\vec{a} \times \vec{b}\right|}$

Answer: 2

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32. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}$ is perpendicular to the plane of $\vec{b}, \vec{c}$ and the angle between $\vec{b}, \vec{c}$ is $\dfrac{\pi}{3}$, then $\left|\vec{a} + \vec{b} + \vec{c}\right| =$

A. 4

B. 2

C. 9

D. 3

Answer: 2

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Assignment Section C

1. Let $\alpha = a\hat{i} + b\hat{j} + c\hat{k}, \overrightarrow{\beta} = b\hat{i} + c\hat{j} + a\hat{k}$ and $\overrightarrow{\gamma} = c\hat{i} + a\hat{j} + b\hat{k}$ be three coplanar vectors with $a \neq b$ and $\overrightarrow{v} = \hat{i} + \hat{j} + \hat{k}$. Then $\overrightarrow{v}$ is perpendicular to

A. $\overrightarrow{\alpha} + \overrightarrow{\beta}$

B. $\overrightarrow{\beta} + \overrightarrow{\gamma}$

C. $\overrightarrow{\gamma} + \overrightarrow{\alpha}$

D. $\overrightarrow{\alpha} + \overrightarrow{\beta} + \overrightarrow{\gamma}$

Answer: 1,2,3,4

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2. If $\vec{a} + 2\vec{b} + 3\vec{c} = 0$, then $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} =$

A. (a) $6\left(\vec{b} \times \vec{c}\right)$

B. (b) $2\left(\vec{a} \times \vec{b}\right)$

C. (c) $3\left(\vec{c} \times \vec{a}\right)$

D. (d) 0

Answer: 1,2,3

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3. The vector $\left(\vec{a} \,.\, \vec{b}\right)\vec{c} - \left(\vec{a} \,.\, \vec{c}\right)\vec{b}$ is perpendicular to

A. $\vec{b}$

B. $\vec{a}$

C. $\vec{c}$

D. $\vec{b} \times \vec{c}$

Answer: 2,4

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4. Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors such that $\left[\vec{a}\vec{b}\vec{c}\right] = \left|\vec{a}\right|\left|\vec{b}\right|\left|\vec{c}\right|$ then

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

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

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

D. $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a} \times \vec{b}\right) \times \vec{c}$

Answer: 1,2,3,4

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5. Which of the following expressions are meaningful? $\vec{u}.\left(\vec{v} \times \vec{w}\right)$ b. $\left(\vec{u}.\vec{v}\right).\vec{w}$ c. $\left(\vec{u}.\vec{v}\right).\vec{w}$ d. $\vec{u} \times \left(\vec{v}.\vec{w}\right)$

A. $\vec{u} \times \left(\vec{v} \times \vec{w}\right)$

B. $\left(\vec{u} \,.\, \vec{v}\right) . \vec{w}$

C. $\left(\vec{u} \,.\, \vec{v}\right)\vec{w}$

D. $\vec{u} \times \left(\vec{v} \,.\, \vec{w}\right)$

Answer: 1,3

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6. If $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + \hat{j} + \hat{k}, \vec{c} = 10\hat{j} - \hat{k}$ and $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = u\vec{a} + v\vec{b} + w\vec{v}$, then

A. w=0

B. w=-3

C. u=0

D. v=17

Answer: 2,3,4

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Assignment Section D Comprehesion I

1. Comprehesion-I

Let k be the length of any edge of a regular tetrahedron (all edges are equal in length). The angle between a line and a plane is equal to the complement of the angle between the line and the normal to the plane whereas the angle between two plane is equal to the angle between the normals. Let O be the origin and A,B and C vertices with position vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively of the regular tetrahedron.

The angle between any edge and a face not containing the edge is

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

B. B) $\cos^{-1}\left(\frac{1}{4}\right)$

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

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

Answer: 3

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2. Comprehesion-I

Let k be the length of any edge of a regular tetrahedron (all edges are equal in length). The angle between a line and a plane is equal to the complement of the angle between the line and the normal to the plane whereas the angle between two plane is equal to the angle between the normals. Let O be the origin and A,B and C vertices with position vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively of the regular tetrahedron.

The angle between any two faces is

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

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

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

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

Answer: 4

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3. Comprehesion-I

Let k be the length of any edge of a regular tetrahedron (all edges are equal in length). The angle between a line and a plane is equal to the complement of the angle between the line and the normal to the plane whereas the angle between two plane is equal to the angle between the normals. Let O be the origin and A,B and C vertices with position vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively of the regular tetrahedron.

The value of $\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2$ is

A. (a)k^6

B. (b)$\frac{1}{2}k^6$

C. (c)$\frac{1}{3}k^6$

D. (d)$\frac{1}{4}k^6$

Answer: 2

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Assignment Section D Comprehesion Ii

1. If $\vec{b} \neq 0$, then every vector $\vec{a}$ can be written in a unique manner as the sum of a vector $\vec{a}_p$ parallel to $\vec{b}$ and a vector $\vec{a}_q$ perpendicular to $\vec{b}$. If $\vec{a}$ is parallel to $\vec{b}$ then $\vec{a}_q$=0 and $\vec{a}_q = \vec{a}$. The vector $\vec{a}_p$ is called the projection of $\vec{a}$ on $\vec{b}$ and is denoted by proj $\vec{b}\left(\vec{a}\right)$. Since proj $\vec{b}\left(\vec{a}\right)$ is parallel to $\vec{b}$, it is a scalar multiple of the vector in the direction of $\vec{b}$ i.e.,

$$\text{proj } \vec{b}\left(\vec{a}\right) = \lambda \vec{U}\vec{b} \qquad \left(\vec{U}\vec{b} = \frac{\vec{b}}{\left|\vec{b}\right|}\right)$$

The scalar λ is called the componennt of $\vec{a}$ in the direction of $\vec{b}$ and is denoted by comp $\vec{b}\left(\vec{a}\right)$. In fact proj $\vec{b}\left(\vec{a}\right) = \left(\vec{a}.\vec{U}\vec{b}\right)\vec{U}\vec{b}$ and comp $\vec{b}\left(\vec{a}\right) = \vec{a}.\vec{U}\vec{b}$.

If $\vec{a} = -2\hat{j} + \hat{j} + \hat{k}$ and $\vec{b} = 4\hat{i} - 3\hat{j} + \hat{k}$ then proj $\vec{b}\left(\vec{a}\right)$ is

A. (a)$4\hat{i}+3\hat{j}+2\hat{k}$

B. (b)$-\frac{5}{13}\left(4\hat{i}-\hat{j}+2\hat{k}\right)$

C. (c)$\frac{5}{13}\left(4hai-3\hat{j}+\hat{k}\right)$

D. (d)$-\frac{4}{11}\left(4\hat{i}-3\hat{j}+2\hat{k}\right)$

Answer: 2

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2. If $\vec{b}\neq 0$, then every vector $\vec{a}$ can be written in a unique manner as the sum of a vector $\vec{a}_p$ parallel to $\vec{b}$ and a vector $\vec{a}_q$ perpendicular to $\vec{b}$. If $\vec{a}$ is parallel to $\vec{b}$ then $\vec{a}_q$=0 and $\vec{a}_q=\vec{a}$. The vector $\vec{a}_p$ is called the projection of $\vec{a}$ on $\vec{b}$ and is denoted by proj $\vec{b}\left(\vec{a}\right)$. Since proj $\vec{b}\left(\vec{a}\right)$ is parallel to $\vec{b}$, it is a scalar multiple of the vector in the direction of $\vec{b}$ i.e.,

proj $\vec{b}\left(\vec{a}\right)=\lambda\vec{U}\vec{b}$ $\qquad\left(\vec{U}\vec{b}=\frac{\vec{b}}{\left|\vec{b}\right|}\right)$

The scalar λ is called the componennt of $\vec{a}$ in the direction of $\vec{b}$ and is denoted by comp $\vec{b}\left(\vec{a}\right)$. In fact proj $\vec{b}\left(\vec{a}\right)=\left(\vec{a}.\vec{U}\vec{b}\right)\vec{U}\vec{b}$ and comp $\vec{b}\left(\vec{a}\right)=\vec{a}.\vec{U}\vec{b}$.

If $\vec{a}=-2\hat{j}+\hat{j}+\hat{k}$ and $\vec{b}=4\hat{i}-3\hat{j}+\hat{k}$ then proj $\vec{b}\left(\vec{a}\right)$ is

A. $\frac{1}{13}\left(-3\hat{i}+\hat{j}+9\hat{k}\right)$

B. $\frac{1}{13}\left(-3\hat{i}-\hat{j}+4\hat{k}\right)$

C. $\frac{2}{13}\left(-3\hat{i}+\hat{j}+9\hat{k}\right)$

D. $-\frac{2}{13}\left(3\hat{i}+\hat{j}-9\hat{k}\right)$

Answer: 3

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3. If $\vec{b}\neq 0$, then every vector $\vec{a}$ can be written in a unique manner as the sum of a vector $\vec{a}_p$ parallel to $\vec{b}$ and a vector $\vec{a}_q$ perpendicular to $\vec{b}$. If $\vec{a}$ is parallel to $\vec{b}$ then $\vec{a}_q$=0 and $\vec{a}_q=\vec{a}$. The vector $\vec{a}_p$ is called the projection of $\vec{a}$ on $\vec{b}$ and is denoted by proj $\vec{b}\left(\vec{a}\right)$. Since proj $\vec{b}\left(\vec{a}\right)$ is parallel to $\vec{b}$, it is a scalar multiple of the vector in the direction of $\vec{b}$ i.e., proj $\vec{b}\left(\vec{a}\right) = \lambda \vec{U}\vec{b}$ $\left(\vec{U}\vec{b} = \frac{\vec{b}}{\left|\vec{b}\right|}\right)$

The scalar λ is called the componennt of $\vec{a}$ in the direction of $\vec{b}$ and is denoted by comp $\vec{b}\left(\vec{a}\right)$. In fact proj $\vec{b}\left(\vec{a}\right) = \left(\vec{a}.\vec{U}\vec{b}\right)\vec{U}\vec{b}$ and comp $\vec{b}\left(\vec{a}\right) = \vec{a}.\vec{U}\vec{b}$.

If $\vec{a} = -2\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 4\hat{i} - 3\hat{j} + \hat{k}$ then proj $\vec{b}\left(\vec{a}\right)$ is

A. a. $4\hat{i} + 2\hat{j} + 3\hat{k}$

B. b. $\frac{-5}{13}4\hat{i} - 3\hat{j} + \hat{k}$

C. c. $2\hat{j} + \hat{j} + \hat{k}$

D. d. $\frac{-4}{11}4\hat{i} - 3\hat{j} + \hat{k}$

Answer: 1

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Assignment Section E Assertion Reason Type Question

1. STATEMENT-1 Let $\overrightarrow{a}, \overrightarrow{b}$ bo two vectors such that $\overrightarrow{a} . \overrightarrow{b} = 0$, then $\overrightarrow{a}$ and $\overrightarrow{b}$ are perpendicular. And

STATEMENT-2 Two non-zero vectors are perpendicular if and only if their dot product is zero.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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2. STATEMENT-1 : Let $P\left(\vec{a}\right), Q\left(\vec{b}\right)$ and $R\left(\vec{c}\right)$ be three points such that $2\vec{a}+3\vec{b}+5\vec{c}=0$. Then the vector area of the ΔPQR is a null vector.

And

STATEMENT-2 : Three collinear points from a triangle with zero area.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-2

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-2

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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3. STATEMENT-1 : The vector $\hat{i}$ bisects the angle between the vectors $\hat{i}-2\hat{j}-2\hat{k}$ and $\hat{i}+2\hat{j}+2\hat{k}$.

And

STATEMENT-2 : The vector along the angle bisector of the vector $\vec{a}$ and $\vec{b}$ is given by $\pm\left(\frac{\vec{a}}{|\vec{a}|}\pm\frac{\vec{b}}{|\vec{b}|}\right)$ where $|\vec{a}|.|\vec{b}|\neq 0$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-3

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 3

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4. STATEMENT-1 : $\left|\vec{u} \, . \, \vec{v}\right| = \cos\theta.$

and

STATEMENT-2 : $\left|\vec{u} \times \vec{v}\right| = \sin\theta$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 2

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5. STATEMENT-1: If $\vec{a}, \vec{b}, \vec{c}$, are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $\vec{a} \, . \, \vec{b} + \vec{b} \, . \, \vec{c} + \vec{c} \, . \, \vec{a} = -\frac{3}{2}.$

STATEMENT-2 : $\left(\vec{x} + \vec{y}\right)^2 = \left|\vec{x}\right|^2 + \left|\vec{y}\right|^2 + 2\left(\vec{x} \, . \, \vec{y}\right).$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-5

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-5

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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6. STATEMENT-1 : If $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c} \times \overrightarrow{d}$ and $\overrightarrow{a} \times \overrightarrow{c} = \overrightarrow{b} \times \overrightarrow{d}$, then $\overrightarrow{a} - \overrightarrow{d}$ is perpendicular to $\overrightarrow{b} - \overrightarrow{c}$.

And

STATEMENT-2 : If $\overrightarrow{P}$ and $\overrightarrow{Q}$ are perpendicular then $\overrightarrow{P} . \overrightarrow{Q} = 0.$

A. (a)Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-6

B. (b)Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-6

C. (c)Statement-1 is True, Statement-2 is False

D. (d)Statement-1 is False, Statement-2 is True

Answer: 4

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Section F Matrix Match Type Questions

1. Match the area/volume of column-I and column-II

Column-I	Column-II
(A) Triangle with vertices $(-\hat{i}+2\hat{j}+3\hat{k})$, $(2\hat{i}-\hat{j}-\hat{k})$, $(\hat{i}+\hat{j}-\hat{k})$	(p) $\frac{\sqrt{3}}{2}$
(B) Tetrahedron with vertices (0, 0, 0), (1, 1, −1) (1, −1, 1), (−1, 1, 1)	(q) $\frac{2}{3}$
(C) Tetrahedron with vertices (−1, 0, 1), (2, −1, 0) (1, 2, 5), (1, 2, 1)	(r) $\frac{\sqrt{89}}{2}$
(D) Triangle with vertices (1, 0, 0), (0, 1, 0), (1,1;1)	(s) $\frac{16}{3}$

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2. It $\vec{a}$, $\vec{b}$, $\vec{c}$ be any three then match the following

Column-I	Column-II
(A) Triangle with vertices $(-\hat{i}+2\hat{j}+3\hat{k})$, $(2\hat{i}-\hat{j}-\hat{k})$, $(\hat{i}+\hat{j}-\hat{k})$	(p) $\frac{\sqrt{3}}{2}$
(B) Tetrahedron with vertices (0, 0, 0), (1, 1, −1) (1, −1, 1), (−1, 1, 1)	(q) $\frac{2}{3}$
(C) Tetrahedron with vertices (−1, 0, 1), (2, −1, 0) (1, 2, 5), (1, 2, 1)	(r) $\frac{\sqrt{89}}{2}$
(D) Triangle with vertices (1, 0, 0), (0, 1, 0), (1,1,1)	(s) $\frac{16}{3}$

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3. Match the following

Column-I	Column-II
$\vec{a}\times(\vec{b}+\vec{c})+\vec{b}\times(\vec{c}+\vec{a})$	(p) $[\vec{c}\ \vec{b}\ \vec{a}]\vec{a}$
$\vec{a}\times(\vec{b}\times\vec{c})+\vec{b}\times(\vec{c}\times\vec{a})$	(q) $[\vec{c}\ \vec{b}\ \vec{a}]\vec{b}$
$(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{b})$	(r) $(\vec{a}\times\vec{b})\times\vec{c}$
$(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{a})$	(s) $(\vec{a}+\vec{b})\times\vec{c}$

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Section G Integer Answer Type Questions

1. If $\overrightarrow{x}_1, \overrightarrow{x}_2, \overrightarrow{x}_3$ are two sets of non-coplanar vectors such that $\overrightarrow{x}_r . \overrightarrow{y}_s = \begin{cases} 0, & \text{if } r \neq s \\ 2 & \text{if } r = s \end{cases}$ where r,s =1,2,3 what is the value of $\left[\overrightarrow{x}_1 \overrightarrow{x}_2 \overrightarrow{x}_3\right]\left[\overrightarrow{y}_1 \overrightarrow{y}_2 \overrightarrow{y}_3\right]$?

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2. Let $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are three vectors of which every pair is non collinear , and the vectors $\overrightarrow{a} + 3\overrightarrow{b}$ and $2\overrightarrow{b} + \overrightarrow{c}$ are collinear with $\overrightarrow{c}$ are $\overrightarrow{a}$ respectively. If $\overrightarrow{b} . \overrightarrow{b} = 1$, then find $\left|2\overrightarrow{a} + 3\overrightarrow{c}\right|$.

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Section H Multiple True Flase Type Questions

1. STATEMENT-1 : If $\vec{a}$ and $\vec{b}$ be two given non zero vectors then any vector $\vec{r}$ coplanar with $\vec{a}$ and $\vec{b}$ can be represented as $\vec{r} = x\vec{a} + y\vec{b}$ where x &yare some scalars.

STATEMENT-2 : If $\vec{a}, \vec{b}\vec{c}$ are three non-coplanar vectors, then any vector $\vec{r}$ in space can be expressed as $\vec{r} = x\vec{a} + y\vec{b} + z\vec{c}$, where x,y,z are some scalars.

STATEMENT-3 : If vectors $\vec{a} \& \vec{b}$ represent two sides of a triangle, then $\lambda\left(\vec{a} + \vec{b}\right)$ (where $\lambda \neq 1$) can represent the vector along third side.

A. F T T

B. T T F

C. F T F

D. T T T

Answer: 2

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Section I Subjective Type Questions

1. If $\vec{a} = \hat{j} - \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} + \hat{k}$ are given vectors, and $\vec{b}$ is such that $\vec{a} . \vec{b} = 3$ and $\vec{a} \times \vec{b} + \vec{c} = 0$ than $\left|\vec{b}\right|^2$ is equal to ....

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2. If $\vec{d} = \lambda\left(\vec{a} \times \vec{b}\right) + \mu\left(\vec{b} \times \vec{c}\right) + t\left(\vec{c} \times \vec{a}\right)$. $\left[\vec{a}, \vec{b}\,\vec{c}\right] = \frac{1}{8}$ and $\vec{d} . \left(\vec{a} + \vec{b} + \vec{c}\right) = 8$ then $\lambda + \mu + t$ equals ....

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3. If $\left[\vec{b}\,\vec{c}\,\vec{d}\right] = 24$ and $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) + \left(\vec{a} \times \vec{c}\right) \times \left(\vec{d} \times \vec{b}\right) + \left(\vec{a} \times \vec{d}\right) \times \left(\vec{b}\right.$

then k is equal to ....

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4. If $\left(\vec{a}\times\vec{b}\right).\left[\left(\vec{b}\times\vec{c}\right)\times\left(\vec{c}\times\vec{a}\right)\right]=\left(\vec{a}.\left(\vec{b}\times\vec{c}\right)\right)^{k}$ find k.

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5. A plane passes through the point (1,1,1) and is parallel to the vectors $\vec{b}=(1,0,-1)$ and $\vec{c}=(-1,1,0)$. If π meets the axes in A, B, and C, find the volume of the tetrahedron OABC.

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Section J Aakash Challengers Questions

1. Sholve the simultasneous vector equations for $\vec{x}$ and $\vec{y}:\vec{x}+\vec{c}\times\vec{y}=\vec{a}$ and $\vec{y}+\vec{c}\times\vec{x}=\vec{b},\vec{c}\neq 0$

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2. Let

$\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$, $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$

be three non-zero vectors such that $\vec{c}$ is a unit vector perpendicular to both $\vec{a}$ and $\vec{b}$. If the angle between $\vec{a}$ and $\vec{b}$ $is \pi/6$ then the value of

$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ is

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3. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors and $\vec{u}$ and $\vec{v}$ are any two vectors. Prove that $\vec{u} \times \vec{v} = \dfrac{1}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}\begin{vmatrix} \vec{u}.\vec{a} & \vec{v}.\vec{a} & \vec{a} \\ \vec{u}.\vec{b} & \vec{v}.\vec{b} & \vec{b} \\ \vec{u}.\vec{c} & \vec{v}.\vec{c} & \vec{c} \end{vmatrix}$

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4. If $\begin{vmatrix} p & p^2 & 1+p^3 \\ q & p^2 & 1+q^3 \\ r & r^2 & 1+r^3 \end{vmatrix} = 0$ and the volume of parallelopiped formed by the vectors $\vec{a} = \hat{i} + p\hat{j} + p^2\hat{k}$, $\vec{b} = \hat{i} + q\hat{j} + q^2\hat{k}$ and $\vec{c} = \hat{i} + r\hat{j} + r^2\hat{k}$ is 5, find pqr.

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5. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}$ and $\vec{c}$.

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