MATHS

NCERT - NCERT MATHEMATICS(ENGLISH)

VECTOR ALGEBRA

Solved Examples

1. For any two vectors $\rightarrow a$ and $\rightarrow b$ we always have $\left| \rightarrow a \cdot \rightarrow b \right| \leq | \rightarrow a | | \rightarrow b |$ (Cauchy-Schwartz inequality).

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2. If $\vec{a}$ is a unit vector and $\left(\vec{x} - \vec{a}\right).\left(\vec{x} + \vec{a}\right) = 8$, then find $\left|\vec{x}\right|$

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3. Find $\left|\vec{a}-\vec{b}\right|$, if two vector $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a}\right|=2, \left|\vec{b}\right|=3$ and $\vec{a}\cdot\vec{b}=4$.

A. $\sqrt{5}$

B. 5

C. 2

D. $\sqrt{2}$

Answer: A

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

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5. 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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6. Find angle θbetween the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$.

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

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

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

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

Answer: C

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7. Find the angle between two $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\vec{a} . \vec{b} = 1$.

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8. Show that the points $A\left(2\hat{i} - \hat{j} + \hat{k}\right), B\left(\hat{i} - 3\hat{j} - 5\hat{k}\right), C\left(3\hat{i} - 4\hat{j} - 4\hat{k}\right)$ are the vertices of a right angled triangle.

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9. Consider two points P and Q with position vectors $\rightarrow OP = 3 \rightarrow a - 2 \rightarrow b$ and $\rightarrow OQ = \rightarrow a + \rightarrow b$ Find the

position vector of a point R which divides the line joining P and Q in the ratio 2:1, (i) internally, and (ii) externally.

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10. Find the vector joining the points $P(2, 3, 0)$and $Q(1, 2, 4)$ directed from P to Q.

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

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12. Write the direction ratios of the vector $\vec{a} = \hat{i} + \hat{j} - 2\hat{k}$and hence calculate its direction cosines.

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13. Represent graphically a displacement of 40 km, 30^owest of south.

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14. Classify the following measures as scalars and vectors.(i) 5 seconds (ii) 1000 cm^3

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

(a) Collinear

(b) Equal

(C) Colinitial

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16. Find the values of x, y and z so that the vectors $\vec{a} = x\hat{i} + 2\hat{j} + z\hat{k}$and $\vec{b} = 2\hat{i} + y\hat{j} + \hat{k}$are equal.

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17. Let $\rightarrow a = \hat{i} + 2\hat{j}$and $\rightarrow b = 2\hat{i} + \hat{j}$. Is $|\rightarrow a| = |\rightarrow b|$?

Are the vector $\rightarrow a$and $\rightarrow b$equal?

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

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19. Find a vector in the direction of vector $\overrightarrow{a} = \hat{i} - 2\hat{j}$ `that has magnitude 7 units.

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20. If with reference to the right handed system of mutually perpendicular unit vectors $\hat{i}, \hat{j}$and $\hat{k}$, $\overrightarrow{\alpha} = 3\hat{i} - \hat{j}, \overrightarrow{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$, then express $\overrightarrow{\beta}$ in the from $\overrightarrow{\beta} = \overrightarrow{\beta}_1 + \overrightarrow{\beta}_2$, where $\overrightarrow{\beta}_1$ is parallel to $\overrightarrow{\alpha}$ and $\overrightarrow{\beta}_2$ is perpendicular to $\overrightarrow{\alpha}$

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21. Find $\left|\vec{a} \times \vec{b}\right|$, 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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22. Find a unit vector perpendicular to each of the vectors $\left(\vec{a} + \vec{b}\right)$ and $\left(\vec{a} - \vec{b}\right)$, where $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$.

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23. For any two vectors $\vec{a}$ and $\vec{b}$, prove that $\left|\vec{a} + \vec{b}\right| \leq \left|\vec{a}\right| + \left|\vec{b}\right|$ (ii) $\left|\vec{a} - \vec{b}\right| \leq \left|\vec{a}\right| + \left|\vec{b}\right|$ (iii) $\left|\vec{a} - \vec{b}\right| \geq \left|\vec{a}\right| - \left|\vec{b}\right|$

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24. Show that the points $A\left(-2\hat{i}+3\hat{j}+5\hat{k}\right), B\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ and $C\left(7\hat{i}-\hat{k}\right)$ are collinear.

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25. Write all the unit vectors in $XY-plane$.

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26. If $\hat{i}+\hat{j}+\hat{k}$, $2\hat{i}+5\hat{j}$, $3\hat{i}+2\hat{j}-3\hat{k}$ and $\hat{i}-6\hat{j}-\hat{k}$ are the position vectors of points A, B, C and D respectively, then find the angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$.

Deduce that $\overrightarrow{AB}$and $\overrightarrow{CD}$ are collinear

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27. Find the area of a triangle having the points $A(1, 1, 1)$, $B(1, 2, 3)$ and $C(2, 3, 1)$ as its vertices.

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

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29. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ 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 $\left|\vec{a} + \vec{b} + \vec{c}\right|$.

A. $\sqrt{2}$

B. $2\sqrt{2}$

C. $5\sqrt{2}$

D. $3\sqrt{2}$

Answer: C

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30. Three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ satisfy the condition $\vec{a}+\vec{b}+\vec{c}=\vec{0}$. Evaluate the quantity $\mu=\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$, if $\left|\vec{a}\right|=3, \left|\vec{b}\right|=4$and $\left|\vec{c}\right|=2.$

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31. Find λ if the vectors $\vec{a}=\hat{i}+3\,\hat{j}+\hat{k}, \vec{b}=2\hat{i}-\hat{j}-\hat{k}$ and $\vec{c}=\lambda\hat{i}+7\,\hat{j}+3\hat{k}$ are coplanar.

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32. Prove that $\left[\vec{a}, \vec{b}, \vec{c}+\vec{d}\right]=\left[\vec{a}, \vec{b}, \vec{c}\right]+\left[\vec{a}, \vec{b}, \vec{d}\right]$

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33. Show that the vectors $\rightarrow a=\hat{i}-2\hat{j}+3\hat{k}, \rightarrow b=2\hat{i}+3j-4\hat{k}$ and $c=\hat{i}-3\hat{j}+5\hat{k}$ are coplanar.

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34. Find $\vec{a}.\left(\vec{b}\times\vec{c}\right)$, if $\vec{a}=2\hat{i}+\hat{j}+3\hat{k}, \vec{b}=\hat{i}+2\hat{j}+\hat{k}$ and $c=3\hat{i}+\hat{j}+2\hat{k}$.

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35. Prove that $\left[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}\right]=2\left[\vec{a}, \vec{b}, \vec{c}\right]$.

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36. Show that the four points A, B, C and D with position vectors $4\hat{i}+5\,\hat{j}+\hat{k},\ -\left(\hat{j}+\hat{k}\right), 3\hat{j}+9\,\hat{j}+4\hat{k}$ *and* $4\left(\hat{i}+\hat{j}+\hat{k}\right)$, respectively are coplanar.

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Exercise 10 4

1. Area of a rectangle having vertices A, B, C and D with position vectors $-\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}, \hat{i}+\frac{1}{2}\hat{j}+4\hat{k}, \hat{i}-\frac{1}{2}\hat{j}+4\hat{k}$and $-\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}$respectively is(A) 1/2 (B) 1 (C) 2 (D) 4

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2. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $\left|\vec{a}\right| = 3$and $\left|\vec{b}\right| = \frac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is a unit vector, if the angle between $\vec{a}$ and $\vec{b}$ (A) $\pi/6$ (B) $\pi/4$ (C) $\pi/3$ (D) $\pi/2$

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3. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$.

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4. If either $\vec{a} = 0$and $\vec{b} = 0$then $\vec{a} \times \vec{b} = 0$. Is Is the converse true? Justify your answer with an example.

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5. Find $\left|\vec{a} \times \vec{b}\right|$, if $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$and $\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$

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6. Find λ and μif $\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + \lambda\hat{j} + \mu\hat{k}\right) = \vec{0}$.

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7. Given that $\vec{a}\,\vec{b} = 0$and $\vec{a} \times \vec{b} = 0$. What can you conclude about the vectors $\vec{a}$ and $\vec{b}$.

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8. If $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$, $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$, then verify that $\vec{a} \times \left(\vec{b} + \vec{c}\right) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$

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9. Find a unit vector perpendicular to each of the vector $\rightarrow a + \rightarrow b$and $\rightarrow a - \rightarrow b$where $\rightarrow a = 3\hat{i} + 2\hat{j} + 2\hat{k}$and $\rightarrow b = \hat{i} + 2\hat{j} - 2\hat{k}$

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10. Find the area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C(1, 5, 5).

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Exercise 10 2

1. If $\vec{a}$ and $\vec{b}$ are two collinear vectors, then which of the following are incorrect:(A) $\vec{b} = \lambda \vec{a}$, for some scalar lambda (B) $\vec{a} = \pm \vec{b}$ (C) the respective components of $\vec{a}$ and $\vec{b}$ are proportional(D) both the vectors $\vec{a}$ and $\vec{b}$ have same direction, but different magnitudes.

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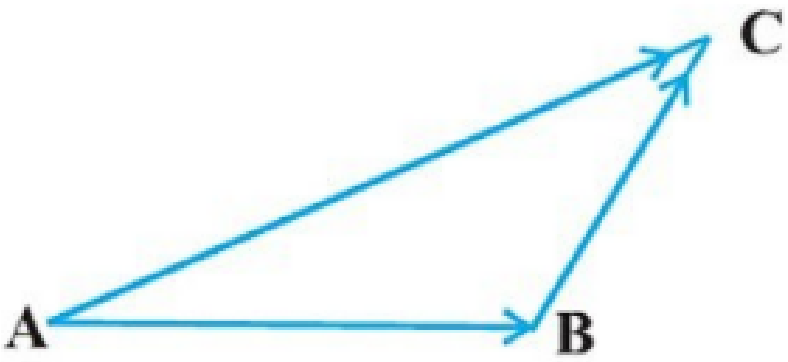
2. In triangle ABC (Figure), which of the following is not true:

$(A)\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$

$(B)\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \vec{0}$

$(C)\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \vec{0}$

$(D)\overrightarrow{AB}+\overrightarrow{CB}+\overrightarrow{CA}=\overrightarrow{0}$



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

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

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5. 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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6. Find the direction cosines of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$.

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

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8. Show that the vector $\hat{i}+\hat{j}+\hat{k}$ is equally inclined to the axes OX, OY and OZ.

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

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10. Find the position vector of the mid point of the vector joining the points P(2, 3, 4) and $Q(4, 1, 2)$.

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

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

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

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

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

Answer: D

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12. For given vectors, $\rightarrow a = 2\hat{i} - \hat{j} + 2\hat{k}$and $\rightarrow b = -\hat{i} + \hat{j} - \hat{k}$find the unit vector in the direction of the vector $\rightarrow a + \rightarrow b$.

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13. Write two different vectors having same magnitude.

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14. Write two different vectors having same direction.

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15. Compute the magnitude of the following vectors:

$\vec{a} = \hat{i} + \hat{j} + \hat{k}$; $\vec{b} = 2\hat{i} - 7\hat{j} - 3\hat{k}$;

$\vec{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$

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16. Find the sum of the vectors $\rightarrow a = \hat{i} - 2\hat{j} + \hat{k}, \rightarrow b = -2\hat{i} + 4\hat{j} + 5\hat{k}$and $\rightarrow c = \hat{i} - 6\hat{j} - 7\hat{k}$

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17. Find the unit vector in the direction of the vector $\overrightarrow{a} = \hat{i} + \hat{j} + 2\hat{k}$

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18. Find the values of x and y so that the vectors $2\hat{i} + 3\hat{j}$and $x\hat{i} + y\hat{j}$are equal.

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

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Miscellaneous Exercise

1. If θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $\left|\vec{a} . \vec{b}\right| = \left|\vec{a} \times \vec{b}\right|$ when θ is equal to(A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π

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2. The two adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$. Find the unit vector parallel to one of its diagonals. Also, find its area.

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3. Show that the direction cosines of a vector equally inclined to the axes OX, OY and OZ are $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$.

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4. Write down a unit vector in XY-plane, making an angle of 30° with the positive direction of x-axis.

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5. A girl walks 4 km towards west, and then she walks 3 km in a direction 30^0 east of north and stops. Determine the girls displacement from her initial point of departure.

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6. Find the scalar components and magnitude of the vector joining the points $P(x_1, y_1, z_1)$and $Q(x_2, y_2, z_2)$

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

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8. Let $\vec{a}=\hat{i}+4\hat{j}+2\hat{k}$, $\vec{b}=3\hat{i}-2\hat{j}+7\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c}\cdot\vec{d}=15$.

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9. The scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$with a unit vector along the sum of vector $2\hat{i}+4\hat{j}-5\hat{k}$and $\lambda\hat{i}+2\hat{j}+3\hat{k}$is equal to one. Find the value of λ.

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10. If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\vec{a}\cdot\vec{b}\geq 0$ only when

$(A)0<\theta<\frac{\pi}{2}$

$(B)0\leq\theta\leq\frac{\pi}{2}$

$(C)0<\theta<\pi$

$(D)0\leq\theta\leq\pi$

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11. Let $\vec{a}$ and $\vec{b}$ be two unit vectors and is the angle between them. Then $\vec{a} + \vec{b}$ is a unit vector if

(A) $\theta = \frac{\pi}{4}$ (B) $\theta = \frac{\pi}{3}$ (C) $\theta = \frac{\pi}{2}$ (D) $\theta = \frac{2\pi}{3}$

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

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13. Prove that $\left(\vec{a} + \vec{b}\right) \cdot \left(\vec{a} + \vec{b}\right) = \left|\vec{a}\right|^2 + \left|\vec{b}\right|^2$, if and only if $\vec{a}$, $\vec{b}$ are perpendicular, given $\vec{a} \neq \vec{0}$, $\vec{b} \neq \vec{0}$

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14. The value of $\hat{i} \cdot \left(\hat{j} \times \hat{k}\right) + \hat{j} \cdot \left(\hat{i} \times \hat{k}\right) + \hat{k} \cdot \left(\hat{i} \times \hat{j}\right)$ is

$(A) 0$

$(B) 1$

$(C) 1$

$(D) 3$

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15. यदि $\vec{a} = \vec{b} + \vec{c}$, तब क्या यह सत्य है कि $\left|\vec{a}\right| = \left|\vec{b}\right| + \left|\vec{c}\right|$? अपने उत्तर की पुष्टि कीजिए।

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16. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are

$\left(2\vec{a}+\vec{b}\right)$ and $(\vec{a}-3\vec{b})$ respectively, externally in the ratio 1:2.Also, show that P is the mid-point of the line segment RQ.

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17. If $\vec{a}=\hat{i}+\hat{j}+\hat{k}, \vec{b}=2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{c}=\hat{i}-2\hat{j}+\hat{k}$find a unit vector parallel to the vector $2\vec{a}-\vec{b}+3\vec{c}$.

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18. Find a vector of magnitude 5 units, and parallel to the resultant of the vectors $\rightarrow a=2\hat{i}+3\hat{j}-\hat{k}$and $\rightarrow b=\hat{i}-2\hat{j}+\hat{k}$.

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19. Show that the points $A(1, -2, -8), B(5, 0, -2)$ and $C(11, 3, 7)$ are collinear, and find the ratio in which B divides AC.

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Exercise 10 3

1. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$and 2 respectively having $\vec{a} \cdot \vec{b} = \sqrt{6}$

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2. Find the projection of the vector $\hat{i} - \hat{j}$on the vector $\hat{i} + \hat{j}$

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3. Find the angle between the vectors $\hat{i} - 2\hat{j} + 3k$and $3\hat{i} - 2\hat{j} + k$

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4. Show that each of the given three vectors is a unit vector: $\frac{1}{7}\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right), \frac{1}{7}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right), \frac{1}{7}\left(6\hat{i} + 2\hat{j} - 3\hat{k}\right)$Also, show that they are mutually perpendicular to each other.

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5. Find the projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$on the vector $7\hat{i} - \hat{j} + 8\hat{k}$

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6. Evaluate the product $\left(3\vec{a} - 5\vec{b}\right).\left(2\vec{a} + 7\vec{b}\right)$

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7. Find $\left|\vec{a}\right|$ and $\left|\vec{b}\right|$, if $\left(\vec{a} + \vec{b}\right)\left(\vec{a} - \vec{b}\right) = 8$ and $\left|\vec{a}\right| = 8\left|\vec{b}\right|$

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8. Find $|\rightarrow x|$, if for a unit vector $\rightarrow a, (\rightarrow x - \rightarrow a) \rightarrow x \dot{+} \rightarrow a = 12.$

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9. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$ having the same magnitude and such that the angle between them is 60^0 and their scalar product is $\frac{1}{2}$.

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10. If $\rightarrow a \dot{\longrightarrow} a = 0$ and $\rightarrow a \dot{\longrightarrow} b = 0$, then what can be concluded about the vector $\rightarrow b$.

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11. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ find the value of $\left(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}\right)$.

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

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13. Show that $\left|\vec{a}\right|\vec{b} + \left|\vec{b}\right|\vec{a}$ is a perpendicular to $\left|\vec{a}\right|\vec{b} - \left|\vec{b}\right|\vec{a}$, for any two non-zero vectors $\vec{a}$ and $\vec{b}$.

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14. Show that the points A(1, 2, 7), B(2, 6, 3) and $C(3, 10, -1)$ are collinear.

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

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16. If either $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$, then $\vec{a} \cdot \vec{b} = 0$But the converse need not be true. Justify your answer with an example.

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17. If the vertices A, B, C of a triangle ABC are $(1, 2, 3), (1, 0, 0), (0, 1, 2)$, respectively, then find $\angle ABC$. [$\angle ABC$ is the angle between the vectors $\overrightarrow{BA}$and $\overrightarrow{BC}$.

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18. If $\vec{a}$ is a nonzero vector of magnitude a and λ a nonzero scalar, then $\lambda\vec{a}$ is unit vector if

(A) $\lambda = 1$

(B) $\lambda = -1$

(C) $a = |\lambda|$

(D) $a = \frac{1}{|\lambda|}$

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Exercise 10 1

1. Classify the following as scalar and vector quantities. (i) time period (ii) distance (iii) force (iv) velocity (v) work done

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2. Classify the following measures as scalars and vectors.(i) 10 kg (ii) 2 meters north-west (iii) 40° (iv) 40 watt (v) 10^19 coulomb (vi)20 m/s^2

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3. Represent graphically a displacement of 40 km, $30o$east of north.

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4. Answer the following as true or false.(i) $\rightarrow a$and $-\rightarrow a$are collinear.(ii) Two collinear vectors are always equal in magnitude. (iii) Two vectors having same magnitude are collinear.(iv) Two collinear vectors having the same magni

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5. In a fig. 23.4 (a square), identify the following vectors: Coinitial ii.

Equal Collinear but not equal

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Exercise 10 5

1. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i}$ and $\vec{c} = c_1\hat{i} + \hat{c}_2 j + c_3\hat{k}$

Then

(a) if $c_1 = 1$ and $c_2 = 2$, find c_3 which makes $\vec{a}$, $\vec{b}$, $\vec{c}$ coplanar

(b) if $c_2 = -1$ and $c_3 = 1$, show that no value of c_1 can makes $\vec{a}$, $\vec{b}$, $\vec{c}$ coplanar.

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2. Show that the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + 3\hat{j} - 4\hat{k} and \vec{c} = \hat{i} - 3\hat{j} + 5\hat{k}$ are coplanar.

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3. Find $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ if $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2i - 3j + k, \vec{c} = 3\hat{i} + \hat{j} - 2\hat{k}$

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4. Find λ if the vectors $\hat{i} - \hat{j} + \hat{k}, 3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + \lambda\hat{j} + \hat{3}k$ are coplanar

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5. Find x such that the four points $A\,(3,\ 2,\ 1),\ B(4, x,\ 5),$ $C\,(4,\ 2,\ 2)$and $D\,(6,\ 5,\ 1)$are coplanar

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6. Show that vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar if $\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}$ are coplanar.

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7. Show that the four points with position vectors $4\hat{i}+8\hat{j}+12\hat{k},\ 2\hat{i}+4\,\hat{j}+6\hat{k}, 3\hat{i}+5\,\hat{j}+4\hat{k}\ and\ 5\hat{i}+8\,\hat{j}+5\hat{k}$ are coplanar.

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