MATHS

BOOKS - NCERT MATHS (ENGLISH)

VECTOR ALGEBRA

Short Answer Type Questions

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

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2. If $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, then find the unit vector in the direction of

(i) $6\vec{b}$ (ii) $2\vec{a} - \vec{b}$

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3. Find a unit vector in the direction of $\overrightarrow{PQ}$, where P and Q have coordinates (5, 0, 8) and (3, 3, 2) respectively.

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4. If $\vec{a}\, and\, \vec{b}$ are position vectors of $AandB$ respectively, find the position vector of a point $ConBA$ produced such that $BC = 1.5BA$.

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5. Using vectors, find the value of λ such that the points $(\lambda, -10), (1, -1, 3) and (3, 5, 3)$ are collinear.

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6. A vector $\vec{r}$ is inclined at equal angles to the three axes. If the magnitude of $\vec{r}$ is $2\sqrt{3}$ units, then find the value of $\vec{r}$.

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7. A vector $\vec{r}$ has length 21 and its direction ratios are proportional to $2, -3, 6$. Find the direction cosines and components of $\vec{r}$, is given that $\vec{r}$ Makes an acute angle with $x - a\xi s$.

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8. Find a vector of magnitude 6, which is perpendicular to both the vectors $2\hat{i} - \hat{j} + 2\hat{k}$ and $4\hat{i} - \hat{j} + 3\hat{k}$.

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9. Find the angle between the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} + 4\hat{j} - \hat{k}$.

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10. If $\vec{a} + \vec{b} + \vec{c} = 0$, then show that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$. Interpret the result

geometrically.

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

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

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13. Using vectors, find the area of the ΔABC with vertices A(1, 2, 3), B(2, -1, 4) and C(4, 5, -1)

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14. Using vectors, prove that the parallelogram on the same base and between the same parallels are equal in area.

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Long Answer Type Questions

1. (Cosine Formulae) if a, b, c are the lengths of the sides opposite respectively to the angles A, B, C of a triangle ABC, show that (I) $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ (ii) $\cos B = \frac{c^2 + a^2 - b^2}{2ac}$ (iii) (i) $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

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2. If $\vec{a}, \vec{b}$ and $\vec{c}$ determine the vertices of a triangle, show that $\frac{1}{2}\left[\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}\right]$ givens the vector area of the triangle. Hence, deduce the condition that the three points $\vec{a}, \vec{b}$ and $\vec{c}$ are collinera. Also,

find the unit vector normal to the plane of the triangle.

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3. Show that area of the parallelogram whose diagonals are given by $\vec{a}$ and $\vec{b}$ is $\frac{\left|\vec{a} \times \vec{b}\right|}{2}$ Also, find the area of the parallelogram whose diagonals are $2i - j + k$ and $i + 3j - k$.

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4. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$ find a vector $\vec{c}$ such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} . \vec{c} = 3$.

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Objective Tpye Questions

1. The vector in the direction of the vector $\hat{i} - 2\hat{j} + 2\hat{k}$ that has magnitude 9 is

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

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

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

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

Answer: C

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2. The position vector of the point which divides the join of points $2\vec{a}-3\vec{b}$ and $\vec{a}+\vec{b}$ in the ratio 3:1, is

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

B. $\frac{7\vec{a}-8\vec{b}}{7}$

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

D. $\frac{5\vec{a}}{4}$

Answer: D

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3. The vector 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:

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4. The angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 4, respectively and $\vec{a} . \vec{b} = 2\sqrt{3}$ is

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

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

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

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

Answer: B

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5. Find the value of λ such that the vectors $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ are orthogonal.

A. 0

B. 1

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

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

Answer: D

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

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

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

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

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

Answer: A

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7. Find the area of triangle formed by the vectors from origin to the points A and B are $\vec{a} = 2\hat{i} - 3\hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} + \hat{k}$

A. 340

B. $\sqrt{25}$

C. $\sqrt{229}$

D. $\frac{1}{2}\sqrt{229}$

Answer:

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8. 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. $\vec{a}^2$

B. $3\vec{a}^2$

C. $4\vec{a}^2$

D. $2\vec{a}^2$

Answer: D

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9. If $\left|\vec{a}\right| = 10, \left|\vec{b}\right| = 2$ and $\vec{a} . \vec{b} = 12$, then the value of $\left|\vec{a} \times \vec{b}\right|$ is

A. 5

B. 10

C. 14

D. 16

Answer: D

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10. The vectors $\lambda\hat{i}+\hat{j}+2\hat{k}, \hat{i}+\lambda\hat{j}-\hat{k}$ and $2\hat{i}-\hat{j}+\lambda\hat{k}$ are coplanar, if

A. $\lambda = -2$

B. $\lambda = 0$

C. $\lambda = 1$

D. $\lambda = -1$

Answer:

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11. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$, then the value of $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$ is

A. 1

B. 3

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

D. None of these

Answer:

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12. The projection vector of $\vec{a}$ on $\vec{b}$ is

A. $\left(\frac{\vec{a}.\vec{b}}{|\vec{b}|}\right)\vec{b}$

B. $\frac{\vec{a}.\vec{b}}{|\vec{b}|}$

C. $\frac{\vec{a}.\vec{b}}{|\vec{a}|}$

D. $\left(\frac{\vec{a}.\vec{b}}{|\vec{b}|^2}\right)\hat{b}$

Answer: D

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13. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 3$ and $\left|\vec{c}\right| = 5$, then the value of $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$ is

A. 0

B. 1

C. -19

D. 38

Answer: C

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14. If $\left|\overrightarrow{a}\right| = 4$ and $-3 \leq \lambda \leq 2$, then the range of $\left|\lambda \overrightarrow{a}\right|$ is

A. [8,0]

B. [-12,8]

C. [0,12]

D. [8,12]

Answer:

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15. The number of vectors of unit length perpendicular to the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{j} + \hat{k}$ is

A. one

B. two

C. three

D. infinite

Answer:

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16. The vector $\vec{a} + \vec{b}$ bisects the angle between the non-collinear vectors $\vec{a}$ and $\vec{b}$, if.....

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17. If $\vec{r} . \vec{a} = 0, \vec{r} . \vec{b} = 0$ and $\vec{r} . \vec{c} = 0$ for some non-zero vector $\vec{r}$, then the value of $\vec{a} . \left(\vec{b} \times \vec{c} \right)$ is..... .

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18. The vectors $\vec{a} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} - 2\hat{k}$ are the

adjacent sides of a paralleogram. The angle between its diagonals is..... .

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19. The values of k, for which $\left|k \quad \vec{a}\right| < \left|\vec{a}\right|$ and $k\vec{a} + \frac{1}{2}\vec{a}$ is parallel to $\vec{a}$ holds true are.....

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20. The value of the expression $\left|\vec{a} \times \vec{b}\right|^2 + \left(\vec{a} . \vec{b}\right)^2$ is..... .

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21. If $\left|\vec{a} \times \vec{b}\right|^2 + \left|\vec{a} . \vec{b}\right|^2 = 144$ and $\left|\vec{a}\right| = 4$, then $\left|\vec{b}\right|$ is equal to .....

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22. If $\vec{a}$ is any non-zero vector, then $\left(\vec{a} . \hat{i}\right)\hat{i} + \left(\vec{a} . \hat{j}\right)\hat{j} + \left(\vec{a} . \vec{k}\right)\hat{k}$ is equal to .....

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23. State true or false: If $\left|\vec{a}\right| = \left|\vec{b}\right|$, then necessarily it implies $\vec{a} = \pm \vec{b}$.

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24. State true or false: Position vector of a point $\vec{P}$ is a vector whose initial point is origin.

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25. State true or false: If $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$, then the vectors $\vec{a}$ and $\vec{b}$ are orthogonal

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26. The formula $\left(\vec{a}+\vec{b}\right)^2=\vec{a^2}+\vec{b^2}+2\vec{a}\times\vec{b}$ is valid for non-zero vectors $\vec{a}$ and $\vec{b}$.

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27. State true or false: If $\vec{a}$ and $\vec{b}$ are adjacent sides of a rhombus, then $\vec{a}.\vec{b}=0$.

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