MATHS

BOOKS - MODERN PUBLICATION

VECTOR

Exercise

1. Find the unit vector in the direction of the vector $2\hat{i} - 3\hat{j} + 4\hat{k}$.

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2. What is the projection of $\hat{i} + \hat{j} - \hat{k}$ upon the vector $\hat{i}$?

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3. Correct the error if any : A null vector has no direction.

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4. Is $\left(\vec{a} . \vec{b}\right)\vec{c}$ a vector quantity.

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5. If $\vec{a} = 2\hat{i} + \hat{j}$, $\vec{b} = \hat{k}$ what is $\vec{a} . \vec{b}$?

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6. If $\vec{a} = 2\hat{i} + \hat{j}$, $\vec{b} = \hat{k}$ what is $\vec{a} . \vec{b}$?

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7. In each of the problems given below, find the work done by a force $\vec{F}$ acting on a particle, such that the particle is displaced from a point A to a point B. $\vec{F} = 4\hat{i} + 2\hat{j} + 3\hat{k}$

A(1,2,0), B(2,-1,3).

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8. If $\left|k\vec{a}\right| = 1$ then the value of k = ___.

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9. If $\vec{a} \times \vec{b} = \hat{n}$ then what is the angle between $\vec{a}$ and $\vec{b}$?

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10. Can dot product of two non-zero vectors be zero?

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11. What is the value of $[i + j] along [3i + 4j]$.

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12. If $\vec{a} = 2i + 3j - 6k$ and $\vec{b} = \propto \hat{i} - \hat{j} + 2k\hat{}$ are parallel then $\propto$ = ____.

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13. If $2i - j + k$ and $i - 3j - 5k$ and $3i - 4j - 4k$ form a triangle, what type of triangle is it ?

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14. If $(-3, \tau, 1) \perp (1, 0, 3)$ then τ = ____.

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15. If on action of force $f = 2i + j - k$, a prticle displaced from A (0,1,2) to B (-2,3,0) then what is the work done by the force?

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16. If $\left(\vec{a} + \vec{b}\right).\left(\vec{a} - \vec{b}\right) = 0$ then what is the relation between $\vec{a}$ and $\vec{b}$?

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17. A vector perpendicular to the vectors $\hat{i} + \hat{j}$ and $\hat{i} + \hat{k}$ is ____

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18. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors and $\vec{a} + \vec{b} + \vec{c} = 0$ then the evaluate $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$.

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19. Are three points with position vectors $\vec{a} + \vec{b}, \vec{a} - \vec{b}$ and $\vec{a}\tau + \vec{b}$ are collinear for all $\tau \in R$? Give reasons.

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20. Find the unit vector perpendicular to $i + j$ and $i + k$.

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21. If $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} \neq 0$, Prove that $\vec{a} + \vec{c} = m\vec{b}$, m is a scalar.

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22. Let $\vec{a}$ is any vector than what is the value of $\left(\vec{a} \cdot \hat{i}\right)\hat{i} + \left(\vec{a} \cdot \hat{j}\right) + \left(\vec{a} \cdot \hat{k}\right)\hat{k}$?

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23. What is the value of $\left(\hat{i} + \hat{j}\right) \times \left(\hat{j} + \hat{k}\right) \cdot \left(\hat{k} + \hat{i}\right)$?

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24. If $\overrightarrow{AC}$ and $\overrightarrow{BD}$ are the diagonals of the parallelogram $ABCD$, show that $\overrightarrow{AC} + \overrightarrow{BD} = 2\overrightarrow{BC}$.

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

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26. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a} + \vec{b}\right| = \left|\vec{a}\right|$, then prove that $2\vec{a} + \vec{b}$ is perpendicular to $\vec{b}$.

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27. Determine the area of parallelogram whose adjacent sides are the vector $2\hat{i}+\hat{j}+3\hat{k}, \hat{i}-\hat{j}$

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28. Prove that $\left(\vec{a}\times\vec{b}\right)^2 = a^2b^2 - \left(\vec{a}.\vec{b}\right)^2$.

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29. Prove that $\left(\vec{a}\times\vec{b}\right).\left(\vec{c}\times\vec{d}\right) = \begin{bmatrix} \vec{a}.\vec{c} & \vec{a}.\vec{d} \\ \vec{b}.\vec{c} & \vec{b}.\vec{d} \end{bmatrix}$.

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30. Find a unit vector in direction of $\vec{a} - \vec{b}$, when $\vec{a} = 4\hat{i} + 7\hat{j} + \hat{k}$ and $\vec{b} = 3\hat{j} - 11\hat{k}$.

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31. If $\vec{a}$ and $\vec{b}$ be perpendicular vectors, then prove that $\left(\vec{a} + \vec{b}\right)^2 = \left(\vec{a} - \vec{b}\right)^2$.

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32. Find the value of λ so that the three vectors are co-planar. (2,-1,1), (1,2,-3) and (3,λ,5)

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33. Determine k such that a vector $\vec{r}$ is at right angles to each of the vectors $\vec{a} = k\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} - k\hat{k}$ and $\vec{c} = -2\hat{i} + k\hat{j} + 3\hat{k}$.

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34. Find the scalar and vector projection of $\vec{a}$ on $\vec{b}$. $\vec{a}$ = $\hat{i} + \hat{j}$, $\vec{b}$ = $\hat{j} + \hat{k}$

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35. Calculate the area of the triangle ABC (by vector method) where A(1,2,4), B(3,1,-2), C(4,3,1)

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36. Prove that : $\left|\vec{a}+\vec{b}\right| \leq \left|\vec{a}\right| + \left|\vec{b}\right|$.

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

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38. If $\vec{a}$ and $\vec{b}$ are unit vectors, then what is the angle between $\vec{a}$ and $\vec{b}$ so that $\sqrt{2}\vec{a} - \vec{b}$ is a unit vector ?

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39. Prove by vector method that the diagonals of a parallelogram bisect each other.

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40. Prove by vector method that in a parallelogram, the line joining a vertex to the midpoint of an oppositeside trisects the other diagonal.

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41. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitude, show that $\vec{a} + \vec{b} + \vec{c}$ is equally

inclined to $\vec{a}$. $\vec{b}$. $\vec{c}$.

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42. Prove the following by vector method. Median to the base of an isosceles triangle is perpendicular to the base.

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43. Prove the following by vector method. The diagonals of a rhombus are at right angles.

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44. Prove the following by vector method. An angle inscribed in a semi-circle is a right angle.

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45. Prove the following by vector method. In a triangle AOB, $m\angle AOB = 90^\circ$. If P and Q are the points of trisection of AB, prove that

$$OP^2 + OQ^2 = \frac{5}{9}AB^2$$

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46. Show that $\left(\vec{a} - \vec{b}\right) \times \left(\vec{a} + \vec{b}\right) = 2\left(\vec{a} \times \vec{b}\right)$. Interpret this result geometrically.

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