MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

VECTOR OR CROSS PRODUCT

Others

1. If $\vec{a}=2\hat{i}-3\hat{j}+\hat{k}, \hat{b}=-\hat{i}+\hat{k}, \vec{c}=2\hat{j}-\hat{k}$ are three vectors, find the area of the parallelogram having diagonals $\left(\vec{a}+\vec{b}\right)$ and $\left(\vec{b}+\vec{c}\right)$.

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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. If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}, \vec{c} \times \vec{a} = \vec{b}$. Show that $\vec{a}, \vec{b}, \vec{c}$ from an orthonormal right handed triad of unit vectors.

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4. Find a unit vector perpendicular to the plane ABC, where the coordinates of A, B and C are $A(3, -1, 2), B(1, -1, -3)$ and $C(4, -3, 1)$.

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5. Find the angle between two vectors $\vec{a}$ and $\vec{b}$, if $\left|\vec{a} \times \vec{b}\right| = \vec{a}.\vec{b}$.

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6. If $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} \neq 0$, then show that $\vec{a} + \vec{c} = m\vec{b}$, where m is any scalar.

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7. If $|a| = 2, |b| = 7$ and $\vec{a}\, x\, \vec{b} = 3\hat{i} + 2\hat{j} + 6\hat{k},$ find the angle between $\vec{a}$ and $\vec{b}$.

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8. If $\vec{a} = 2\hat{i} + 5\hat{j} = 7\hat{k}, \vec{b} = -3\hat{j} + \hat{k}\text{and}\,\vec{c} = \hat{i} - 2\hat{j} - 3\hat{k},$ compute $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ and $\vec{a} \times \left(\vec{b} \times \vec{c}\right)$ and verify that these are not equal.

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9. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 5$ and $\left|\vec{a} \times \vec{b}\right| = 8$, find $\vec{a} . \vec{b}$.

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10. If $\left|\vec{a}\right| = \sqrt{26,} \left|\vec{b}\right| = 7$ and $\left|\vec{a} \times \vec{b}\right| = 35$, find $\vec{a} \dot{\vec{b}}$.

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11. Define $\vec{a} \times \vec{b}$ and prove that $\left|\vec{a} \times \vec{b}\right| = \left(\vec{a} . \vec{b} \tan\theta,\right.$ where θ is the angle between $\vec{a}$ and $\vec{b}$).

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12. Find the area of the triangle formed by O, A, B when $\vec{O}A = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{O}B = -3\hat{i} - 2\hat{j} + \hat{k}$.

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

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14. If a, b, c are the lengths of sides, BC, CA and AB of a triangle ABC, prove that $\vec{B}C + \vec{C}A + \vec{A}B = \vec{O}$ and deduce that $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.

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15. (22) if $\vec{p}$ and $\vec{q}$ are unit vectors forming an angle of 30°; find the area of the parallelogram having $\vec{a} = \vec{p} + 2\vec{q}$ and $\vec{b} = 2\vec{p} + \vec{q}$ as its diagonals. (23) For any two vectors $\vec{a}$ and $\vec{b}$, prove that $\left|\vec{a} \times \vec{b}\right|^2 = \begin{vmatrix} \vec{a} \cdot \vec{a} & \vec{a} \cdot \vec{b} \\ \vec{b} \cdot \vec{a} & \vec{b} \cdot \vec{b} \end{vmatrix}$.

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16. If $\overrightarrow{p}$ and $\overrightarrow{q}$ are unit vectors forming an angle of 30^{0}; find the area of the parallelogram having $\overrightarrow{a} = \overrightarrow{p} + 2\overrightarrow{q}$ and $\overrightarrow{b} = 2\overrightarrow{p} + \overrightarrow{q}$ is its diagonals.

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

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18. Find the area of the parallelogram whose diagonals are : $4\hat{i} - \hat{j} - 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$

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19. Find Find the area of the parallelogram determined by the vectors: 2 ^ i + ^ j + 3 ^ k a n d ^ i − ^ j `3

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20. Find a vector of magnitude 49, which is perpendicular to both the vectors $2\hat{i} + 3\hat{j} + 6\hat{k}$ and $3\hat{i} - 6\hat{j} + 2\hat{k}$. Find a vector whose length is 3 and which is perpendicular to the vector $\vec{a} = 3\hat{i} + \hat{j} - 4\hat{k}$ and $\vec{b} = 6\hat{i} + 5\hat{j} - 2\hat{k}$.

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21. If $\vec{a} = 3\hat{i} - \hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} + \hat{k},$ find $\left(\vec{a} + 2\vec{b}\right) \times \left(2\vec{a} - \vec{b}\right).$

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22. If $\overrightarrow{a} = 3\hat{i} - 2\hat{k}$ and $\overrightarrow{b} = -\hat{i} + 3\hat{k}$, find $\left|\overrightarrow{a} \times \overrightarrow{b}\right|$

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23. Using vectors: Prove that if a,b,care the lengths of three sides of a triangle then its area Δ is given by $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ where 2s=a+b+c

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24. Prove by vector method that the parallelogram on the same base and between the same parallels are equal in area.

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25. If D, E, F are the mid-points of the sides $BC, CAandAB$ respectively of a triangle ABC, prove by vector method that

$AreaofDEF = \frac{1}{4}(areaofABC)\cdot$

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26. Let $\vec{O}A = \vec{a}, \vec{O}B = 10\vec{a} + 2\vec{b}, and\vec{O}C = bwhereO$ is origin. Let p denote the area of th quadrilateral $OABCandq$ denote the area of teh parallelogram with $OAandOC$ as adjacent sides. Prove that $p = 6q\cdot$

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27. $ABCD$ is quadrilateral such that $\vec{A}B = \vec{b}, \vec{A}D = \vec{d}, \vec{A}C = m\vec{b} + p\vec{..}$ Show that he area of the quadrilateral $ABCDis\frac{1}{2}|m+p|\left|\vec{b} \times \vec{d}\right|\cdot$

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28. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then prove that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

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29. Prove that the normal to the plane containing three points whose position vectors are $\vec{a}, \vec{b}, \vec{c}$ lies in the direction $\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}$.

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30. If $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \vec{a} \neq \vec{0}\, and\, \vec{b} \neq \vec{c}$, show that $\vec{b} = \vec{c} + t\vec{a}$ for some scalar t.

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31. For any two vectors $\vec{a}\, and\, \vec{b}$, show that $\left(1 + \left|\vec{a}\right|^2\right)\left(1 + \left|\vec{b}\right|^2\right) = \left\{(1 + \vec{a}.\vec{b})^2 \left|\vec{a} + \vec{b} + \left(\vec{a} \times \vec{b}\right)\right|^2\right.$

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32. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of the vertices A, B, C of a triangle ABC, show that the area triangle $ABC is \frac{1}{2}\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|.$ Deduce the condition for points $\vec{a}, \vec{b}, \vec{c}$ to be collinear.

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33. For any three vectors $\vec{a}, \vec{b}, \vec{c}$ show that $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right) = \vec{0}$

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34. Show that perpendicular distance of the point $\vec{c}$ from the line joining $\vec{a} \, and \, \vec{b}$ is $\frac{\left|\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}\right|}{\left|\vec{b} - \vec{a}\right|}$

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35. Prove that the points $A, BandC$ with position vectors $\vec{a}, \vec{b}\, and\, \vec{c}$ respectively are collinear if and only if $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \vec{0}$.

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36. Let $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors such that $\vec{a} \times \vec{b} = \vec{c}\, and\, \vec{b} \times \vec{c} = \vec{a}$; prove that $\vec{a}, \vec{b}, \vec{c}$ are mutually at right angles such that $\left|\vec{b}\right| = 1 and \left|\vec{c}\right| = \left|\vec{a}\right|$.

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37. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \vec{a} \neq 0$, then show that $\vec{b} = \vec{c}$.

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38. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\left|\vec{a}+\vec{b}+\vec{c}\right|=1, \vec{c}=\lambda\left(\vec{a}\times\vec{b}\right) and \left|\vec{a}\right|=\frac{1}{\sqrt{2}}, \left|\vec{b}\right|=\frac{1}{\sqrt{3}}, \left|\vec{c}\right|=$, find the angle between $\vec{a}\ and\ \vec{b}$.

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39. Let $\vec{a}=2\hat{i}+\hat{k}, \vec{b}=\hat{i}+\hat{j}+\hat{k} and \vec{c}=4\hat{i}-3\hat{j}+7\hat{k}$ be three vectors. Find vector $\vec{r}$ which satisfies $\vec{r}\times\vec{b}=\vec{c}\times\vec{b}\ and\ \vec{r}\cdot\vec{a}=0.$

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40. A triangle OAB is determined by the vectors $\vec{a}\ and\ \vec{b}$ as shown if fig. Show that the triangle has the area given by $\frac{1}{2}\sqrt{|a|^2|b|^2-(a.\ b)^2}$.

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41. If A, B, C, D be any four points in space, prove that $\left|\overrightarrow{A}B \times \overrightarrow{C}D + \overrightarrow{B}C \times \overrightarrow{A}D + \overrightarrow{C}A \times \overrightarrow{B}D\right| = 4$ (Area of triangle ABC)

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42. If $\overrightarrow{a}, \overrightarrow{b} and \overrightarrow{c}$ are three non coplanar vectors, then prove that $\overrightarrow{d} = \frac{\overrightarrow{a}.\overrightarrow{d}}{\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right]}\left(\overrightarrow{b} \times \overrightarrow{c}\right) + \frac{\overrightarrow{b}.\overrightarrow{d}}{\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right]}\left(\overrightarrow{c} \times \overrightarrow{a}\right) + \frac{\overrightarrow{c}.\overrightarrow{d}}{\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right]}\left(\overrightarrow{a} \times \overrightarrow{b}\right.$

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43. Let $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ be unit vectors such that $\overrightarrow{a}\dot{\overrightarrow{b}} = \overrightarrow{a}\dot{\overrightarrow{c}} = 0$ and the angle between $\overrightarrow{b} and \overrightarrow{c}$ is $\frac{\pi}{6}, showthat \overrightarrow{a} = \pm 2\left(\overrightarrow{b} \times \overrightarrow{c}\right)$.

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44. Prove by vector method that sin(A-B)=sinAcosB-cosAsinB and sin(A+B)=sinAcosB+cosAsinB

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45. In a triangle ABC, prove by vector method that $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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46. Show that $\left(\vec{a} \times \vec{b}\right)^2 = \left|\vec{a}\right|^2\left|\vec{b}\right|^2 - \left(\vec{a}\dot{\vec{b}}\right)^2 = \begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} \\ \vec{a}.\vec{b} & \vec{b}.\vec{b} \end{vmatrix}$

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47. Given $\left|\vec{a}\right| = 10, \left|\vec{b}\right| = 2 \text{and} \vec{a}\dot{\vec{b}} = 12, \text{find} \left|\vec{a} \times \vec{b}\right|$.

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48. If $A(0, 1, 1), B(2, 3, \ -2), C(22, 19, \ -5) and D(1, \ -12, 1)$ are the vertices of a quadrailateral $ABCD,$ find its area.

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49. Find the area of the parallelogram determined by the vectors $\hat{i} + 2\hat{j} + 3\hat{k} and 3\hat{i} - 2\hat{j} + \hat{k}.$

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50. Find a unit vector perpendicular to the plane $ABC,$ where the coordinates of A, B and C are $A(3, \ -1, 2), B(1, \ -1, \ -3)$ and $C(4, \ -3, 1).$

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51. Find a vector of magnitude 9, which is perpendicular to both vectors $4\hat{i}-\hat{j}+3\hat{k} and -2\hat{i}+\hat{j}-2\hat{k}$.

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52. Find a unit vector perpendicular to both the vectors $\hat{i}-2\hat{j}+3\hat{k} and \hat{i}+2\hat{j}-\hat{k}$.

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53. For any vector $\vec{a}$, prove that $\left|\vec{a}\times\hat{i}\right|^2+\left|\vec{a}\times\hat{j}\right|^2+\left|\vec{a}\times\hat{k}\right|^2=2\left|\vec{a}\right|^2$

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54. Find the magnitude of $\vec{a}$ give by $\vec{a}=\left(\hat{i}+2\hat{j}-2\hat{k}\right)\times\left(-\hat{i}+3\hat{k}\right)$

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55. Find $\vec{a} \times \vec{b}$, if $\vec{a} = 2\hat{i} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$.

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

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57. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, find the value of $\left(\vec{r} \times \hat{i}\right) \cdot \left(\vec{r} \times \hat{j}\right) + xy$.

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58. 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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59. Let $\vec{a} = \hat{i} - \hat{j}, \ \vec{b} = 3\hat{j} - \hat{k} \, and \, \vec{c} = 7\hat{i} - \hat{k}\cdot$ Find a vector $\vec{d}$ which is perpendicular to both $\vec{a} \ and \ \vec{b}, \ and \ \vec{c} \dot{\vec{d}} = 1.$

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60. 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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61. Find the area of the triangle whose vertices are $A(3, \ -1, 2), \ B(1, \ -1, \ -3) and \ C(4, \ -3, 1)\cdot$

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62. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, show that $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$, where $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$

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63. Prove that $\left(\vec{a} - \vec{b}\right) \times \left(\vec{a} + \vec{b}\right) = 2\left(\vec{a} \times \vec{b}\right)$ and interpret it geometrically.

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64. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{c} = \hat{j} - \hat{k}$ are given vectors, then find vector $\vec{b}$ satisying the equation $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a} \dot{\vec{b}} = 3$.

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65. If $\vec{a} = \hat{i} + 3\hat{j} - 2\hat{k}$ and $\vec{b} = -\hat{i} + 3\hat{k}$, find $\left|\vec{a} \times \vec{b}\right|$.

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66. If $\overrightarrow{a} = 3\hat{i} + 4\hat{j}\ and\ \overrightarrow{b} = \hat{i} + \hat{j} + \hat{k},$ find the value of $\left|\overrightarrow{a} \times \overrightarrow{b}\right|$.

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67. If $\overrightarrow{a} = 2\hat{i} + \hat{k},\ \overrightarrow{b} = \hat{i} + \hat{j} + \hat{k},$ find the magnitude of $\overrightarrow{a} \times \overrightarrow{b}$.

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68. Find a unit vector perpendicular to both the vectors $4\hat{i} - \hat{j} + 3\hat{k}\ and - 2\hat{i} + \hat{j} - 2\hat{k}$.

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69. Find a unit vector perpendicular to the plane containing the vectors $\overrightarrow{a} = 2\hat{i} + \hat{j} + \hat{k}\ and\ \overrightarrow{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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70. Find the magnitude of vector $\vec{a} = \left(3\hat{k} + 4\hat{j}\right) \times \left(\hat{i} + \hat{j} - \hat{k}\right).$

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71. If $\vec{a} = 4\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{k}$ then $f \in d \left|2\vec{b} \times \vec{a}\right|.$

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72. If $\vec{a} = 3\hat{i} - \hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} + \hat{k}$,find $\left(\vec{a} + 2\vec{b}\right) \times \left(2\vec{a} - \vec{b}\right).$

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73. Find a vector of magnitude 49, which is perpendicular to both the vectors $2\hat{i} + 3\hat{j} + 6\hat{k}$ and $3\hat{i} - 6\hat{j} + 2\hat{k}.$

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74. Find a vector whose length is 3 and which is perpendicular to the vector $\overrightarrow{a} = 3\hat{i} + \hat{j} - 4\hat{k} \; and \; \overrightarrow{b} = 6\hat{i} + 5\hat{j} - 2\hat{k}$.

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75. Find the area of the parallelogram determined by the vectors: $2\hat{i} \; and \; 3\hat{j}$

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76. Find the area of the parallelogram determined by the vectors: $2\hat{i} + \hat{j} + 3\hat{k} \; and \; \hat{i} - \hat{j}$

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77. Find the area of the parallelogram determined by the vectors: $3\hat{i} + \hat{j} - 2\hat{k} \, and \, \hat{i} - 3\hat{j} + 4\hat{k}$

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78. Find the area of the parallelogram determined by the vectors: $\hat{i} - 3\hat{j} + \hat{k} \, and \, \hat{i} + \hat{j} + \hat{k}.$

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79. Find the area of the parallelogram whose diagonals are: $4\hat{i} - \hat{j} - 3\hat{k} \, and - 2\hat{i} + \hat{j} - 2\hat{k}$

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80. Find the area of the parallelogram whose diagonals are: $2\hat{i} + \hat{k} \, and \, \hat{i} + \hat{j} + \hat{k}$

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81. Find the area of the parallelogram whose diagonals are: $3\hat{i} + 4\hat{j}\ and\ \hat{i} + \hat{j} + \hat{k}$

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82. If $a = 2i + 5j - 7k,\ b = -3i + 4j + k\ and\ c = i - 2j - 3k,$ compute $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ and $a \times (b \times c)$ and verify that these are not equal.

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83. If $\left|\vec{a}\right| = 2,\ \left|\vec{b}\right| = 5\ and\ \left|\vec{a} \times \vec{b}\right| = 8,$ find $\vec{a}\ .\ \vec{b}$

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84. Show that the vectors $\vec{a}=\frac{1}{7}\left(2\hat{i}+3\hat{j}+6\hat{k}\right), \vec{b}=\frac{1}{7}\left(3\hat{i}-6\hat{j}+2\hat{k}\right), \vec{c}=\frac{1}{7}\left(6\hat{i}+2\hat{j}-3\hat{k}\right)$ are mutually perpendicular unit vectors.

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85. If $\left|\vec{a}\right|=13, \left|\vec{b}\right|=5\ and\ \vec{a}\dot{\vec{b}}=60$, t h e n find $\left|\vec{a}\times\vec{b}\right|$.

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86. If $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}\neq 0,$ then show that $\vec{a}+\vec{c}=m\vec{b},\ where\ m$ is any scalar.

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87. Find the angle between two vectors $\vec{a}\ and\ \vec{b}$, if $\left|\vec{a}\times\vec{b}\right|=\vec{a}\dot{\vec{b}}$.

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88. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 7 \, and \, \vec{a} \times \vec{b} = 3\hat{i} + 2\hat{j} + 6\hat{k},$ find the angle between $\vec{a} \, and \, \vec{b}$.

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89. What inference can you draw if $\vec{a} \times \vec{b} = \vec{0} \, and \, \vec{a} \dot{\vec{b}} = 0.$

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90. If $\vec{a}, \vec{b}, \vec{c}$ are three unit vecrtors such that $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}, \vec{c} \times \vec{a} = \vec{b}$ Show that $\vec{a}, \vec{b}, \vec{c}$ form an orthonormal right handed triad of unit vectors.

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91. Find a unit vector perpendicular to the plane ABC, where the coordinates of $A,\ B,\ and\ C$ are $A(3,\ -1,\ 2),\ B(1,\ -1,\ -3) and\ C(4,\ -3,\ 1)\cdot$

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92. If a, b, c are the lengths of sides, BC, CA and AB of a triangle $ABC,$ prove that $\overrightarrow{B}C+\overrightarrow{C}A+\overrightarrow{A}B=\overrightarrow{O}$ and deduce that $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}.$

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

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94. For any two vectors $\vec{a}$ and $\vec{b}$ prove that $\left|\vec{a} \times \vec{b}\right|^2 = \begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} \end{vmatrix}$

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95. prove that $\left|\vec{a} \times \vec{b}\right| = \left(\vec{a} \dot{\vec{b}}\right) tan\theta, \ where\ \theta$ is the angle between $\vec{a}$ and $\vec{b}$.

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96. If $\left|\vec{a}\right| = \sqrt{26}, \ \left|\vec{b}\right| = 7\ and \left|\vec{a} \times \vec{b}\right| = 35$,find $\vec{a} \dot{\vec{b}}$.

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97. Find the area of the triangle formed by $O, \ A, \ B\ when\ OA = \hat{i} + 2\hat{j} + 3\hat{k}, \ OB = -3\hat{i} - 2\hat{j} + \hat{k}$.

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98. 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 $\vec{c}\vec{d} = 15$.

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

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100. Using vectors, find the area of triangle with vertices $A(2, 3, 5), B(3, 5, 8)$ and $C(2, 7, 8)$.

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101. If $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}, \ \vec{b} = -\hat{i} + \hat{k}, \ \vec{c} = 2\hat{j} - \hat{k}$ are three vectors find the area of the parallelogram having diagonals $\left(\vec{a} + \vec{b}\right)$ and $\left(\vec{b} + \vec{c}\right)$.

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

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104. 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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105. Using vectors, 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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106. Find all vectors of magnitude $10\sqrt{3}$ that are perpendicular to the plane $\hat{i} + 2\hat{j} + \hat{k}\ and - \hat{i} + 3\hat{j} + 4\hat{k}.$

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107. Define vector product of two vectors.

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108. Write the value $\left(\hat{i} \times \hat{j}\right)\dot{\hat{k}} + \hat{i}\dot{\hat{j}}\cdot$

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109. Write the value of $\hat{i}.\ \left(\hat{j} \times \hat{k}\right) + \hat{j}.\ \left(\hat{k} \times \hat{i}\right) + \hat{k}.\ \left(\hat{j} \times \hat{i}\right)\cdot$

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110. Write the value of $\hat{i}.\ \left(\hat{j} \times \hat{k}\right) + \hat{j}.\ \left(\hat{k} \times \hat{i}\right) + \hat{k}.\ \left(\hat{i} \times \hat{j}\right)\cdot$

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111. Write the value of $\hat{i} \times \left(\hat{j} + \hat{k}\right) + \hat{j} \times \left(\hat{k} + \hat{i}\right) + \hat{k} \times \left(\hat{i} + \hat{j}\right)\cdot$

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112. Write the expression for the area of the parallelogram having $\vec{a}$ and $\vec{b}$ as its diagonals.

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113. If $\vec{a}$ and $\vec{b}$ are unit vectors then write the value of $\left|\vec{a}\times\vec{b}\right|^2+\left(\vec{a}\dot{\vec{b}}\right)^2$.

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114. If $\vec{a}$ and $\vec{b}$ are two vectors of magnitudes 3 and $\frac{\sqrt{2}}{3}$ respectively such that $\vec{a}\times\vec{b}$ is a unit vector. Write the angle between $\vec{a}$ and $\vec{b}$.

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115. If $\left|\vec{a}\right|=10, \left|\vec{b}\right|=2$ and $\left|\vec{a}\times\vec{b}\right|=16$ find $\vec{a}\dot{\vec{b}}$.

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116. For any two vectors $\vec{a}$ and $\vec{b}$, find $\vec{a}.\left(\vec{b} \times \vec{a}\right)$.

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117. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a} \times \vec{b}\right| = 3$ and $\vec{a}\dot{\vec{b}} = 1$, find the angle between $\vec{a}$ and $\vec{b}$.

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118. For any three vectors a, b and c write the value of $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right)$.

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119. For any two vectors $\vec{a}$ and $\vec{b}$, fin d\ $\left(\vec{a} \times \vec{b}\right).\vec{b}$.

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120. Write the value of $\hat{i}\left(\hat{j}\times\hat{k}\right)\cdot$

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121. If $\overrightarrow{a}=3\hat{i}-\hat{j}+2\hat{k}\ and\ \overrightarrow{b}=2\hat{i}+\hat{j}-\hat{k}\ then$ find $\left(\overrightarrow{a}\times\overrightarrow{b}\right)\overrightarrow{a}\cdot$

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122. Write a unit vector perpendicular to $\hat{i}+\hat{j}\ and\ \hat{j}+\hat{k}\cdot$

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123. If $\left|\overrightarrow{a}\times\overrightarrow{b}\right|^2=\left(\overrightarrow{a}\cdot\overrightarrow{b}\right)^2=144\ and\ \left|\overrightarrow{a}\right|=4$, find $\overrightarrow{b}\cdot$

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124. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then write the value of $\left|\vec{r} \times \hat{i}\right|^2$.

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125. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $\vec{a} \times \vec{b}$ is also a unit vector, find the angle between $\vec{a}$ and $\vec{b}$.

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126. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a}\right| = \left|\vec{a} \times \vec{b}\right|$, write the angle between $\vec{a}$ and $\vec{b}$.

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127. If $\vec{a}$ and $\vec{b}$ are unit vectors then write the value of $\left|\vec{a} \times \vec{b}\right|^2 + \left(\vec{a} \cdot \vec{b}\right)^2$.

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128. If a is a unit vector such that $\vec{a} \times \hat{i} = \hat{j}$ find $\vec{a} . \hat{i}$.

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129. If $\vec{c}$ is a unit vector perpendicular to the vectors $\vec{a}$ and $\vec{b}$ write another unit vector perpendicular $\vec{a}$ and $\vec{b}$.

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130. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\left|\vec{a} \times \vec{b}\right| = \sqrt{3}$.

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131. Vectors $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a}\right| = 3$, $\left|\vec{b}\right| = \frac{2}{3}$ and $\left(\vec{a} \times \vec{b}\right)$ is a unit vector. Write the angle between $\vec{a}$ and $\vec{b}$.

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132. Find λ, if $\left(2\hat{i}+6\hat{j}+14\hat{k}\right)\times\left(\hat{i}-\lambda\hat{j}+7\hat{k}\right)=\overrightarrow{0}$.

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133. Write the value of $\left(\hat{i}\times\hat{j}\right)\dot{\hat{k}}+\left(\hat{j}\times\hat{k}\right)\dot{\hat{j}}$.

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134. Find a vector of magnitude $\sqrt{171}$ which is perpendicular to both of the vectors $\overrightarrow{a}=\hat{i}+2\hat{j}-3\hat{k}\ and\ \overrightarrow{b}=3\hat{i}-\hat{j}+2\hat{k}$.

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135. If $\overrightarrow{a}$ is any vector, then $\left(\overrightarrow{a}\times\hat{i}\right)^2+\left(\overrightarrow{a}\times\hat{j}\right)^2+\left(\overrightarrow{a}\times\hat{k}\right)^2=$

A. (a) $\vec{a}^2$

B. (b) $2\vec{a}^2$

C. (c) $3\vec{a}^2$

D. (d) $4\vec{a}^2$

Answer: null

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

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

B. $\vec{b} = 0$

C. $\vec{b} + \vec{c} = 0$

D. none of these

Answer: null

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137. The vector $\vec{b} = 3\hat{i} + 4\hat{k}$ is to be written as the sum of a vector $\vec{\alpha}$ parallel to $\vec{a} = \hat{i} + \hat{j}$ and a vector $\vec{\beta}$ perpendicular to $\vec{a}$. Then $\vec{\alpha} = \frac{3}{2}\left(\hat{i} + \hat{j}\right)$ b. $\frac{2}{3}\left(\hat{i} + \hat{j}\right)$ c. $\frac{1}{2}\left(\hat{i} + \hat{j}\right)$ d. $\frac{1}{3}\left(\hat{i} + \hat{j}\right)$

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138. The unit vector perpendicular to the plane passing through point $P\left(\hat{i} - \hat{j} + 2\hat{k}\right),\ Q\left(2\hat{i} - \hat{k}\right) and\ R\left(2\hat{j} + \hat{k}\right) is$ a).$2\hat{i} + \hat{j} + \hat{k}\backslash$ b. $\sqrt{6}\left(2\hat{i} + \hat{j} + \hat{k}\right)$ c. $\frac{1}{\sqrt{6}}\left(2\hat{i} + \hat{j} + \hat{k}\right)$ d. $\frac{1}{6}\left(2\hat{i} + \hat{j} + \hat{k}\right)$

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139. If $a,\ b$ represent the diagonals of a rhombus, then $\vec{a} \times \vec{b} = \vec{0}$ b. $\vec{a}\dot{\vec{b}} = 0$ c. $\vec{a}\dot{\vec{b}} = 1$ d. $\vec{a} \times \vec{b} = \vec{a}$

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140. Vectors $\overrightarrow{a}$ *and* $\overrightarrow{b}$ are inclined at angel $\theta = 120^0$. If $\left|\overrightarrow{a}\right| = 1, \left|\overrightarrow{b}\right| = 2,$ then $\left[\left(\overrightarrow{a} + 3\overrightarrow{b}\right) \times \left(3\overrightarrow{a} - \overrightarrow{b}\right)\right]^2$ is equal to 300

b. 235 c. 275 d. 225

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141. If $\overrightarrow{a} = \hat{i} + \hat{j} - \hat{k}, \overrightarrow{b} = -\hat{i} + 2\hat{j} + 2\hat{k}$ *and* $\overrightarrow{c} = -\hat{i} + 2\hat{j} - \hat{k},$

then a unit vector normal to the vectors $a + b$ *and* $b - c$ is

A. a. $\hat{i}$

B. b. $\hat{j}$

C. c. $\hat{k}$

D. d. none of these

Answer: null

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142. A unit vector perpendicular to both $\hat{i}+\hat{j}$ *and* $\hat{j}+\hat{k}$ is $\hat{i}-\hat{j}+\hat{k}$ b. $\hat{i}+\hat{j}+\hat{k}$ c. $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$ d. $\frac{1}{\sqrt{3}}\left(\hat{i}-\hat{j}+\hat{k}\right)$

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

$a.\ 10\hat{i}+2\hat{j}+11\hat{k}$ b. $10\hat{i}+3\hat{j}+11\hat{k}$ c. $10\hat{i}-3\hat{j}+11\hat{k}$ d. $10\hat{i}-2\hat{j}-10\hat{k}$

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144. If $\hat{i},\ \hat{j},\ \hat{k}$ are unit vectors, then $\hat{i}\dot{\hat{j}}=1$ b. $\hat{i}\dot{\hat{i}}=1$ c. $\hat{i}\times\hat{j}=1$ d. $\hat{i}\times\left(\hat{j}\times\hat{k}\right)=1$

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145. 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 $\sin\theta=\frac{2}{3}$ b. $\frac{2}{\sqrt{7}}$ c. $\frac{\sqrt{2}}{7}$ d. $\sqrt{\frac{2}{7}}$

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146. If $\left|\vec{a} \times \vec{b}\right| = 4,\ \vec{a}\dot{\vec{b}} = 2,\ then \left|\vec{a}\right|^2 \left|\vec{b}\right|^2 = $ 6 b. 2 c. 20 d. 8

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147. The value of $\hat{i}.\left(\hat{j} \times \hat{k}\right) + \hat{j}.\left(\hat{i} + \hat{k}\right) + \hat{k}.\left(\hat{i} \times \hat{j}\right)$ is(A) 0 (B) 1 (C) 1 (D) 3

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

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