MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

VECTOR OR CROSS PRODUCT

Solved Examples And Exercises

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 $\left|\vec{a}\right| = 2, |b| = 5$ 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 $\vec{a} x \vec{b}$ and prove that $\left|\vec{a} x \vec{b}\right| = \left(\vec{a}\dot{\vec{b}} \tan\theta,\right.$ 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 $\vec{a} \times \vec{b}$. Verify that $\vec{a}$ and $\vec{a} \times \vec{b}$ 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 the area of the parallelogram determined by the vectors: $2\hat{i} and 3\hat{j}$ $2\hat{i}+\hat{j}+3\hat{k} and \hat{i}-\hat{j}$ $3\hat{i}+\hat{j}-2\hat{k} and \hat{i}-3\hat{j}+4\hat{k}$ $\hat{i}-3\hat{j}+\hat{k} and \hat{i}+\hat{j}+\hat{k}$

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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 $\overrightarrow{O}A = \overrightarrow{a}, \overrightarrow{O}B = 10\overrightarrow{a} + 2\overrightarrow{b}, and\overrightarrow{O}C = bwhereO$ 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 $\overrightarrow{A}B = \overrightarrow{b}, \overrightarrow{A}D = \overrightarrow{d}, \overrightarrow{A}C = m\overrightarrow{b} + p\overrightarrow{\cdot\cdot}$ Show that he area of the quadrilateral $ABCDis\frac{1}{2}|m+p|\left|\overrightarrow{b} \times \overrightarrow{d}\right|\cdot$

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

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

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34. 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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35. 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 righ angles such that $\left|\vec{b}\right| = 1 and \left|\vec{c}\right| = \left|\vec{a}\right|.$

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36. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ and $\vec{a}\ x\ \vec{b} = \vec{a}\ x\ \vec{c}, \vec{a} \ne 0$, then show that $\vec{b} = \vec{c}$.

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37. 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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38. 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 $\vec{r} \times \vec{b} = \vec{c} \times \vec{b} and \vec{r}.\vec{a} = 0.$

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

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

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41. Prove by vector method that $\sin(A-B)=\sin A\cos B-\cos A\sin B$ and $\sin(A+B)=\sin A\cos B+\cos A\sin B$

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42. 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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43. 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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44. If $A(0,1,1),B(2,3,-2),C(22,19,-5)andD(1,-12,1)$ are the vertices of a quadrailateral $ABCD$, find its area.

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45. 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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46. 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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47. 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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48. 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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49. 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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50. 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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51. 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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52. 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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53. If $\overrightarrow{r}=x\hat{i}+y\hat{j}+z\hat{i}$, find the value of $\left(\overrightarrow{r}\times\hat{i}\right)\dot{\overrightarrow{r}}\times\hat{j}+xy$.

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

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

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56. 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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57. 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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58. 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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59. 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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60. If $\vec{a}=\hat{i}+\hat{j}+\hat{k},\ \vec{c}=\hat{j}-\hat{k}$ are given vectors, then find $\vec{a}$ vector $\vec{b}$ satisying the equation $\vec{a}\times\vec{b}=\vec{c}\ and\ \vec{a}\dot{\vec{b}}=3.$

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

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

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64. 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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65. Find a unit vector perpendicular to the lane containing the vectors $\vec{a} = 2\hat{i} + \hat{j} + \hat{k} \ and \ \vec{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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

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68. If $\overrightarrow{a} = 3\hat{i} - \hat{j} - 2\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + 3\hat{j} + \hat{k},\ f \in d\left(\overrightarrow{a} + 2\overrightarrow{b}\right) \times \left(2\overrightarrow{a} - \overrightarrow{b}\right.$

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69. 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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70. 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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71. Find the area of the parallelogram determined by the vectors: $2\hat{i}\ and\ 3\hat{j}$

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72. 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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73. 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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74. Find the area of the parallelogram determined by the vectors: $\hat{i} - 3\hat{j} + \hat{k}\ and\ \hat{i} + \hat{j} + \hat{k}\cdot$

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75. 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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76. 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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77. 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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78. 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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79. 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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80. Given $a = \frac{1}{7}\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right), \vec{b} = \frac{1}{7}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right), \vec{c} = \frac{1}{7}\left(6\hat{i} + 2\hat{j} - 3\hat{k}\right), \hat{i}$ being a right handed orthogonal system of unit vectors in space, show that $\vec{a}, \vec{b}$ and $\vec{c}$ is also another system.

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81. If $\left|\vec{a}\right| = 13, \left|\vec{b}\right| = 5$ and $\vec{a}\dot{\vec{b}} = 60$, then find $\left|\vec{a} \times \vec{b}\right|$.

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82. 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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83. 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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84. 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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85. What inference can you draw if $\vec{a} \times \vec{b} = \vec{0}$ and $\vec{a} \dot{\vec{b}} = 0.$

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86. 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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87. 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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88. 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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89. 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 $\vec{a} \times \vec{b} \cdot$ verify that $\vec{a} \ and \ \vec{a} \times \vec{b}$ are perpendicular to each other.

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90. 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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91. 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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92. If $\left|\vec{a}\right|=\sqrt{26},\ \left|\vec{b}\right|=7\ and\ \left|\vec{a}\times\vec{b}\right|=35,\ f\in d\ \vec{a}\dot{\vec{b}}$.

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93. 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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94. 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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95. 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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96. 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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97. 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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98. 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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99. If either $\rightarrow a = \rightarrow 0$ and $\rightarrow b = \rightarrow 0$ then $\rightarrow a \times \rightarrow b = \rightarrow 0$. Is Is the converse true? Justify your answer with an example.

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100. 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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101. 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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102. 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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103. Define vector product of two vectors.

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

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105. Write the value of $\hat{i}\hat{j}\dot{\times}\hat{k}+\hat{j}\hat{k}\dot{\times}\hat{i}+\hat{k}\hat{j}\dot{\times}\hat{i}$.

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106. Write the value of $\hat{i}\hat{j}\dot{\times}\hat{k}+\hat{j}\hat{k}\dot{\times}\hat{i}+\hat{k}\hat{i}\dot{\times}\hat{j}$.

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

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

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109. 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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110. 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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111. If $\left|\vec{a}\right| = 10$, $\left|\vec{b}\right| = 2$ *and* $\left|\vec{a} \times \vec{b}\right| = 16$ find $\vec{a} \cdot \vec{b}$.

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

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113. 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.

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

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

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

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

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

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

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

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121. 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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122. 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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123. If a is a unit vector such that $\vec{a} \times \hat{i} = \hat{j}$ find $\vec{a} . \hat{i}$.

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124. 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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125. 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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126. 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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127. 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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128. Find a vector of magnitude $\sqrt{171}$ which is perpendicular to both of the vectors $\vec{a}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{b}=3\hat{i}-\hat{j}+2\hat{k}$.

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129. If $\vec{a}$ is any vector, then $\left(\vec{a}\times\hat{i}\right)^2+\left(\vec{a}\times\hat{j}\right)^2+\left(\vec{a}\times\hat{k}\right)^2=$ $\vec{a}^2$ b. $2\vec{a}^2$ c. $3\vec{a}^2$ d. $4\vec{a}^2$

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130. 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 $\vec{b}=\vec{c}$ b. $\vec{b}=0$ c. $\vec{b}+\vec{c}=0$ d. none of these

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131. 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 $\vec{a}\cdot$ 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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132. 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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133. 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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134. Vectors $\vec{a}\ and\ \vec{b}$ are inclined at angel $\theta=120^0$. If $\left|\vec{a}\right|=1,\ \left|\vec{b}\right|=2,$ then $\left[\left(\vec{a}+3\vec{b}\right)\times\left(3\vec{a}-\vec{b}\right)\right]^2$ is equal to 300 b. 235 c. 275 d. 225

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135. 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 $\hat{i}$ b. $\hat{j}$ c. $\hat{k}$ d. none of these

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136. 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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137. 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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138. 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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139. 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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140. If $\left|\vec{a} \times \vec{b}\right| = 4,\ \left|\vec{a}\dot{\vec{b}}\right| = 2,\ then \left|\vec{a}\right|^2\left|\vec{b}\right|^2 = 6$ b. 2 c. 20 d. 8

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

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

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