MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

SCALAR OR DOT PRODUCT

Others

1. If the median to the base of a triangle is perpendicular to the base, then triangle is isosceles.

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2. If AD is the median of ABC, using vectors, prove that $AB^2 + AC^2 = 2\left(AD^2 + CD^2\right)$.

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3. In a triangle OAB, $\angle AOB = 90^0$. If P and Q are points of trisection of AB, prove that $OP^2 + OQ^2 = \frac{5}{9}AB^2$

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4. If $\hat{a}$ and $\hat{b}$ are unit vectors inclined at an angle θ, then prove that $\frac{\cos\theta}{2} = \frac{1}{2}\left|\hat{a} + \hat{b}\right|$ $\frac{\tan\theta}{2} = \frac{1}{2}\left|\frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}}\right|$

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5. (Pythagoras's Theorem) Prove by vector method that in a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

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6. Prove that; If the diagonals of a quadrilateral bisect each other at right angles, then it is a rhombus.

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7. prove using vectors: The quadrilateral obtained by joining mid-points of adjacent sides a rectangle is a rhombus.

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8. prove by vector method that the sum of the squares of the diagonals of a parallelogram is equal to the sum of the squares of its sides.

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9. prove that the diagonals of a rectangle are perpendicular if and only if the rectangle is a square.

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10. Using analytical geometry, prove that the diagonals of a rhombus are perpendicular to each other.

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11. If $\left|\vec{a}\right| = a$ and $\left|\vec{b}\right| = b$, prove that $\left(\frac{\vec{a}}{a^2} - \frac{\vec{b}}{b^2}\right)^2 = \left(\frac{\vec{a} - \vec{b}}{ab}\right)^2$.

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

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13. Find the angles which the vector $\vec{a} = \hat{i} - \hat{j} + \sqrt{2}\hat{k}$ makes with the coordinate axes.

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14. Dot product of a vector with $\hat{i}+\hat{j}-3\hat{k}, \hat{i}+3\hat{j}-2\hat{k}$ and $2\hat{i}+\hat{j}+4\hat{k}$ are $0, 5$ and 8 respectively. Find the vector.

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15. Find $\vec{a}\,\vec{b}$, when (i) $\vec{a}=\hat{i}-2\hat{j}+\hat{k}$ and $\vec{b}=4\hat{i}-4\hat{j}+7\hat{k}$ (ii) $\vec{a}=\hat{j}+2\hat{k}$ and $\vec{b}=2\hat{i}+\hat{k}$ (iii) $\vec{a}=\hat{j}-\hat{k}$ and $\vec{b}=2\hat{i}+3\hat{j}-2\hat{k}$

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16. For what value of λ are the vector $\vec{a}$ and $\vec{b}$ perpendicular to each other? where: i, $\vec{a}=\lambda\hat{i}+2\hat{j}+\hat{k}$ and $\vec{b}=4\hat{i}-9\hat{j}+2\hat{k}$ ii, $\vec{a}=\lambda\hat{i}+2\hat{j}+\hat{k}$ and $\vec{b}=5\hat{i}-9\hat{j}+2\hat{k}$ iii, $\vec{a}=2\hat{i}+3\hat{j}+4\hat{k}$ and $\vec{b}=3\hat{i}+2\hat{j}-\lambda\hat{k}$ iv,, $\vec{a}=\lambda\hat{i}+3\hat{j}+2\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+3\hat{k}$

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17. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a}\right| = 4, \left|\vec{b}\right| = 3$ and $\vec{a} . \vec{b} = 6$. Find the angle between $\vec{a}$ and $\vec{b}$.

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18. Find the angles of a triangle whose vertices are $A(0, -1, -2), B(3, 1, 4)$ and C (5,7,1).

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19. Find the projection of $\vec{b} + \vec{c}$ on $\vec{a}$, where $\vec{a}$ = $2\hat{i} - 2\hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$.

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20. Find the values of x and y if the vectors $\vec{a} = 3\hat{i} + x\hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + y\hat{k}$ are mutually perpendicular vectors of equal magnitude.

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21. In a quadrilateral $ABCD$, prove that $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2 + 4PQ^2$, where P and Q are middle points of diagonals AC and BD.

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22. If $\vec{a}$ and $\vec{b}$ are two non-collinear unit vectors such that $\left|\vec{a} + \vec{b}\right| = \sqrt{3}$, find $\left(2\vec{a} - 5\vec{b}\right).\left(3\vec{a} + \vec{b}\right)$.

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

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24. If $\vec{c}$ is perpendicular to both $\vec{a}$ and $\vec{b}$, then prove that it is perpendicular to both $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$.

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25. If $\vec{a}.\vec{a}=0$ and $\vec{a}.\vec{b}=0$, what can you conclude about the vector $\vec{b}$?

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26. If $\vec{a}, \vec{b}, \vec{c}$ are three non coplanar vectors such that $\vec{a}\dot{\vec{a}} = \vec{d}\vec{b} = \ddot{\vec{c}} = 0$, then show that $\vec{d}$ is the null vector.

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27. If a vector $\vec{a}$ is perpendicular to two non-collinear vector $\vec{b}$ and $\vec{c}$, then $\vec{a}$ is perpendicular to every vector in the plane of $\vec{b}$ and $\vec{c}$.

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28. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, show that the angle θ between the vectors $\vec{b}$ and $\vec{c}$ is given by $\cos\theta=\dfrac{\left|\vec{a}\right|^2-|b|^2-\left|\vec{c}\right|^2}{2\left|\vec{b}\right|\left|\vec{c}\right|}$

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29. Let $\vec{u}, \vec{v}$ and $\vec{w}$ be vector such $\vec{u}+\vec{v}+\vec{w}=\vec{0}$. If $\left|\vec{u}\right|=3, \left|\vec{v}\right|=4$ and $\left|\vec{w}\right|=5$, then find $\vec{u}.\vec{v}+\vec{v}.\vec{w}+\vec{w}.\vec{u}$.

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30. Let $\vec{a} = x^2\hat{i} + 2\hat{j} - 2\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = x^2\hat{i} + 5\hat{j} - 4\hat{k}$ be three vectors. Find the values of x for which the angle between $\vec{a}$ and $\vec{b}$ is acute and the angle between $\vec{b}$ and $\vec{c}$ is obtuse.

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31. 12). Show that the vector $\hat{i} + \hat{j} + \hat{k}$ is equally inclined with the coordinate axes. (13)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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32. If $\vec{\alpha} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{\beta} = 2\hat{i} + \hat{j} - 4\hat{k}$, then express $\vec{\beta}$ in the form of $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.

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33. If $\vec{p} = 5\hat{i} + \lambda\hat{j} - 3\hat{k}$ and $\vec{q} = \hat{i} + 3\hat{j} - 5\hat{k}$, then find the value of λ , so that $\vec{p} + \vec{q}$ and $\vec{p} - \vec{q}$ are perpendicular vectors.

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34. For any two vectors $\vec{a}$ and $\vec{b}$, show that : $\left(\vec{a} + \vec{b}\right)\vec{a} - \vec{b} = 0, when\left|\vec{a}\right| = \left|\vec{b}\right|$.

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35. 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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36. Let $\vec{a} = 5\hat{i} - \hat{j} + 7\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \lambda\hat{k}$. Find λ such that $\vec{a} + \vec{b}$ is orthogonal to $\vec{a} - \vec{b}$.

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37. If $\vec{a}$ and $\vec{b}$ are two vectors of the same magnitude inclined at an angle of 30^0 such that $\vec{a}\cdot\vec{b} = 3$, find $\left|\vec{a}\right|, \left|\vec{b}\right|$.

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38. Decompose the vector $6\hat{i} - 3\hat{j} - 6\hat{k}$ into vectors which are parallel and perpendicular to the vector . $\hat{i} + \hat{j} + \hat{k}$ Then the vectors are .

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39. Express $2\hat{i} - \hat{j} + 3\hat{k}$ as the sum of vector parallel and a vector perpendicular to $2\hat{i} + 4\hat{j} - 2\hat{k}$.

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40. Show that the vectors $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + 5\hat{k}$, $\vec{c} = 2\hat{i} + \hat{j} - 4\hat{k}$ form a right angled triangle.

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41. (Projection 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 $a = b\cos C + \text{os}B$ (ii) $b = \text{os}A + a\cos C$ (iii)$c = a\cos B + b\cos A$

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42. Prove using vectors: If two medians of a triangle are equal, then it is isosceles.

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

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44. Find the angle between the vectors $5\hat{i} + 3\hat{j} + 4\hat{k}$ and $6\hat{i} - 8\hat{j} - \hat{k}$.

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45. Find the projection of the vector $7\hat{i} + \hat{j} - 4\hat{k} \in \vec{a} = 2\hat{i} + 6\hat{j} + 3\hat{k}$.

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46. For any vector $\vec{r}$, prove that $\vec{r} = \left(\vec{r} \cdot \hat{i}\right)\hat{i} + \left(\vec{r} \cdot \hat{j}\right)\hat{j} + \left(\vec{r} \cdot \hat{k}\right)\hat{k}$.

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47. Find $\vec{a} \cdot \vec{b}$ when $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k} and \vec{b} = 6\hat{i} - 3\hat{j} + 2\hat{k}$, $\vec{a} = (1, 1, 2) and \vec{b} = (3, 2, -1)$

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48. Find the value of λ so 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 perpendicular to each other.

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49. Find the value of p for which the vectors $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are (i) perpendicular (ii) parallel

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50. Find the values of $'a'$ which the vector $\vec{r} = (a^2 - 4)\hat{i} + 2\hat{j} - (a^2 - 9)\hat{k}$ makes acute angle with the

coordinate axes.

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51. If $\vec{a}, \vec{b}, \vec{c}$ are unit vector, prove that $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{a}\right|^2 \leq 9$.

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52. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular unit vectors, find $\left|2\vec{a}+\vec{b}+\vec{c}\right|$.

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53. Find the value of c for which the vectors $\vec{a}=(c\log_2 x)\hat{i}-6\hat{j}+3\hat{k}$ and $\vec{b}=\left((\log)_2 x\right)\hat{i}+2\hat{j}+\left(2c(\log)_2 x\right)\hat{k}$ make an obtuse angle for any $x \in (0, \infty)$.

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54. 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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55. Dot products of a vector with vectors $3\hat{i} - 5\hat{k}, 2\hat{i} + 7\hat{j} and \vec{a} = \hat{i} + \hat{j} + \hat{k}$ are respectively -1, 6 and 5. Find the vector.

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56. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = 1, |\vec{b}| = 2 and |\vec{c}| = 3$. If the projection of $\vec{b}$ along a is equal to the projection of $\vec{c}$ along $\vec{a} and \vec{b}$, $\vec{c}$ are perpendicular to each other, find $|3\vec{a} - 2\vec{b} + 2\vec{c}|$.

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57. (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 $\cos A \frac{b^2 + c^2 - a^2}{2bc}$ (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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58. Prove that the altitudes of a triangle are concurrent.

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59. Find the components of a unit vector which is perpendicular to the vectors $\hat{i} + 2\hat{j} - \hat{k} and 2\hat{i} - \hat{j} + 2\hat{k}$.

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60. If a unit vector $\vec{a}$ makes angle $\pi/3$ with $\hat{i}$, $\pi/4$ with $\hat{j}$ and an acute angle θ with $\hat{k}$, then find the components of $\vec{a}$ and the angle θ.

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61. If $\hat{a} and \hat{b}$ are unit vectors inclined at an angle θ , then prove that $\frac{\sin\theta}{2} = \frac{1}{2}\left|\hat{a} - \hat{b}\right|$.

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62. If two vectors $\vec{a} and \vec{b}$ are such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 2$ and $\vec{a} . \vec{b} = 6, .,$ Find $\left|\vec{a} + \vec{b}\right| and \left|\vec{a} - \vec{b}\right|$.

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63. Find $\left|\vec{a}\right| and \left|\vec{b}\right|$, if $\left(\vec{a} - \vec{b}\right)\vec{a} + \vec{b} = 27 \text{and} \left|\vec{a}\right| = 2\left|\vec{b}\right|$.

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64. If two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 2, |\vec{b}| = 1$ and $\vec{a} \cdot \vec{b} = 1$, find $\left(3\vec{a} - 5\vec{b}\right) \cdot 2\vec{a} + 7\vec{b}$.

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65. For any two vectors $\vec{a}$ and $\vec{b}$, prove that:

$|\vec{a} + \vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 + 2\vec{a} \cdot \vec{b}$,

$|\vec{a} - \vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 - 2\vec{a} \cdot \vec{b}$,

$|\vec{a} + \vec{b}|^2 + |\vec{a} - \vec{b}|^2 = 2\left(|\vec{a}|^2 + |\vec{b}|^2\right)$ and

$|\vec{a} + \vec{b}|^2 = |\vec{a} - \vec{b}|^2 \Leftrightarrow \vec{a} \perp \vec{b}$. Interpret the result geometrically.

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66. Show that the projection vector $\vec{a}$ and $\vec{b}\left(\neq \vec{0}\right)\left(componen \to f\vec{a}\, aong\, \vec{b}\right) is \left(\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|^2}\right)\vec{b}$.

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67. Using dot product of vectors, prove that a parallelogram, whose diagonals are equal, is a rectangle

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68. For any three vectors $\vec{a}, \vec{b}, \vec{c}$, prove that $\left|\vec{a}+\vec{b}+\vec{c}\right|^2=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2+\left|\vec{c}\right|^2+2\left(\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}\right)$

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69. Show that the angle between two diagonals of a cube is $\cos^{-1}\left(\frac{1}{3}\right)$.

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

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71. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ having the same length $\sqrt{2}$ and their scalar product is -1.

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72. If $\hat{i}+\hat{j}+\hat{k},\ 2\hat{i}+5\hat{j},\ 3\hat{i}+2\hat{j}-3\hat{k}$ and $\hat{i}-6\hat{j}-\hat{k}$ espectively are the position vectors of points $A,\ B,\ C$ and D then find the angle between the straight lines AB and CD. Deduce that AB and CD are collinear.

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73. Let $\vec{a}$ *and* $\vec{b}$ be two vectors of the same magnitude such that the angle between then is 60^0 and $\vec{a}\cdot\vec{b} = 8$. Find $\left|\vec{a}\right|$*and* $\left|\vec{b}\right|$.

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74. Find $\left|\vec{x}\right|$ if for a unit vector $\vec{a}$, $\left(\vec{x}-\vec{a}\right)\cdot\left(\vec{x}+\vec{a}\right) = 15$.

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75. 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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76. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 3$, $\left|\vec{b}\right| = 5$ *and* $\left|\vec{c}\right| = 7$ find the anglebetweeen $\vec{a}$ *and* $\vec{b}$

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77. For any vector $\vec{a}$ *and* $\vec{b}$ prove that $\left|\vec{a}+\vec{b}\right| \leq \left|\vec{a}\right| + \left|\vec{b}\right|$.

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78. For any two vectors $\vec{a}$ and $\vec{b}$ prove that $\left(\vec{a}\cdot\vec{b}\right)^2 \leq \left|\vec{a}\right|^2\left|\vec{b}\right|^2$ and hence show that $\left(a_1b_2+a_2b_2+a_3b_3\right)^2 \leq \left(a_1^2+a_2^2+a_3^2\right)\left(b_1^2+b_2^2+b_3^2\right)$

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79. If $\vec{a}$, $\vec{b}$, 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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80. The scalar product of the vector $\vec{a} = \hat{i}+\hat{j}+\hat{k}$ with a unit vector along the sum of the vectors

$\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ *and* $\vec{c} = \lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to 1. Find the value of λ and hence find the unit vector along $\vec{b} + \vec{\cdot}$

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81. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three vectors such that $\vec{a}\dot{\vec{b}} = \vec{a}\dot{\vec{c}}$ then show that $\vec{a} = 0$ or , $\vec{b} = c$ or $\vec{a} \perp \left(\vec{b} - \vec{c}\right)$.

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82. Show that the vector $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$, $3\hat{i} - 4\hat{j} - 4\hat{k}$ form the sides of a rights angled triangle.

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83. Show that the points A, B, C with position vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ respectively, are the vertices of a right angled triangle. Also, find the remaining angles of the triangle.

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84. If with reference to a right handed system of mutually perpendicular unit vectors $\hat{i}, \hat{j}, \hat{k}$ we have $\vec{\alpha} = 3\hat{i} - \hat{j}, \text{ and } \vec{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$. Express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2, \text{ where } \vec{\beta}_1$ is parallel to $\vec{\alpha} \text{ and } \vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.

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85. Find the value of x for which the angle between the vectors $\vec{a} = 2x^2\hat{i} + 4x\hat{j} + \hat{k} \text{ and } \vec{b} = 7\hat{i} - 2\hat{j} + x\hat{k}$ is obtuse.

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86. If l, m, n are scalars and $\vec{a}, \vec{b}, \vec{c}$ are vectors, prove that $\left|l\vec{a} + m\vec{b} + n\vec{c}\right|^2 = l^2\left|\vec{a}\right|^2 + m^2\left|\vec{b}\right|^2 + n^2\left|\vec{c}\right|^2 + 2\left\{lm\left(\vec{a}.\vec{b}\right) + m$. Also deduce that

$\left|l\vec{a}+m\vec{b}+n\vec{c}\right|^2=l^2\left|\vec{a}\right|^2+m^2\left|\vec{b}\right|^2+n^2\left|\vec{c}\right|^2$ if $\vec{a}$, $\vec{b}$, $\vec{c}$ are mutually perpendicular vectors.

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87. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three mutually perpendicular vectors of equal magniltgude, prove that $\vec{a}+\vec{b}+\vec{c}$ is equally inclined with vectors $\vec{a}$, $\vec{b}$, and $\vec{\cdot}$ also find the angle.

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88. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three vectors of magnitudes 3, 4 and 5 respectively. If each one is perpendicular to the sum of the other two vectors, prove that $\left|\vec{a}+\vec{b}+\vec{c}\right|=5\sqrt{2}$.

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89. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ find the value of `vec adot vec b+ vec bdot vec c+ vec cdot vec adot'

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90. Three vectors $\vec{a}, \vec{b}, \vec{c}$ 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 $\left|\vec{a}\right|=1, \left|\vec{b}\right|=4$ and $\left|\vec{c}\right|=2$.

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91. Find $\vec{a}\cdot\vec{b}$ when: $\vec{a}=\hat{i}-2\hat{j}+\hat{k}$ and $\vec{b}=4\hat{i}-4\hat{j}+7\hat{k}$

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92. Find $\vec{a}\cdot\vec{b}$ when: $\vec{a}=\hat{j}+2\hat{k}$ and $\vec{b}=2\hat{i}+\hat{k}$

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93. Find $\vec{a}\,\vec{b}$ when: $\vec{a} = \hat{j} - \hat{k}\ and\ \vec{b} = 2\hat{i} + 3\hat{j} - 2\hat{k}$

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94. For what value of λ are the vector $\vec{a}\ and\ \vec{b}$ perpendicular to each other? Where; $\vec{a} = \lambda\hat{i} + 2\hat{j} + \hat{k}\ and\ \vec{b} = 4\hat{i} - 9\hat{j} + 2\hat{k}$

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95. For what value of λ are the vector $\vec{a}\ and\ \vec{b}$ perpendicular to each other? Where; $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}\ and\ \vec{b} = 3\hat{i} + 2\hat{j} - \lambda\hat{k}$

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96. For what value of λ are the vector $\vec{a}\ and\ \vec{b}$ perpendicular to each other? Where; $\vec{a} = \lambda\hat{i} + 2\hat{j} + \hat{k}\ and\ \vec{b} = 5\hat{i} - 9\hat{j} + 2\hat{k}$

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97. For what value of λ are the vector $\vec{a}\ and\ \vec{b}$ perpendicular to each other? Where; $\vec{a} = \lambda\hat{i} + 3\hat{j} + 2\hat{k}\ and\ \vec{b} = \hat{i} - \hat{j} + 3\hat{k}$

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98. If $\vec{a}\ and\ \vec{b}$ are two vectors such that $\left|\vec{a}\right| = 4,\ \left|\vec{b}\right| = 3\ and\ \vec{a}\cdot\vec{b} = 6.$ Find the angle between $\vec{a}\ and\ \vec{b}.$

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99. If ` vec a= i- j and vec b=- j+2k ,find (vec a-2 vec b)dot(vec a+ vec b)

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100. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ where: $\vec{a} = \hat{i} - \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$

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101. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ where: $\vec{a} = 3\hat{i} - 2\hat{j} - 6\hat{k}$ and $\vec{b} = 4\hat{i} - \hat{j} + 8\hat{k}$

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102. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ where: $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = 4i + 4\hat{j} - 2\hat{k}$

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103. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ where: $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = 4\hat{i} + 4\hat{j} - 2\hat{k}$

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104. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ where: $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - 2\hat{k}$

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105. Find the angle between the vectors $\vec{a}$ and $\vec{b}$ where: $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$

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106. Find the angles which the vector $\vec{a} = \hat{i} - \hat{j} + \sqrt{2}\hat{k}$ makes with the coordinate axes.

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107. Dot product of a vector with $\hat{i}+\hat{j}-3\hat{k},\ \hat{i}+3\hat{j}-2\hat{k}\ and\ 2\hat{i}+\hat{j}+4\hat{k}$ are 0, 5 and 8 respectively. Find the vector.

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108. Dot products of a vector with vectors $\hat{i}-\hat{j}+\hat{k},\ 2\hat{i}+\hat{j}-3\hat{k}\ and\ \hat{i}+\hat{j}+\hat{k}$ are respectively 4, 0 and 2. Find the vector.

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109. If $\hat{a}\ and\ \hat{b}$ are unit vectors inclined at an angle θ then prove that $\frac{\tan\theta}{2}=\frac{|\hat{a}-\hat{b}|}{|\hat{a}+\hat{b}|}$

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110. If the sum of two unit vectors is a unit vector prove that the magnitude of their difference is $\sqrt{3}$.

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111. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three mutually perpendicular unit vectors, then prove that $\left|\vec{a}+\vec{b}+\vec{c}\right|=\sqrt{3}$

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112. If $\left|\vec{a}+\vec{b}\right|=60$, $\left|\vec{a}-\vec{b}\right|=40$ $\left|\vec{b}\right|=46$, `Then find | vec a|

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113. Show that the vector $\hat{i}+\hat{j}+\hat{k}$ is equally inclined with the coordinate axes.

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

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115. For any tow vectors $a \; and \; b$ show that $\left(\vec{a} + \vec{b}\right)\left(\vec{a} - \vec{b}\right) = 0$ if $\left|\vec{a}\right| = \left|\vec{b}\right|$.

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116. If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + \hat{j} - 2\hat{k} \; and \; \vec{c} = \hat{i} + 3\hat{j} - \hat{k}$, $f \in d\,\lambda$ such that $\vec{a}$ is perpendicular to λ vec b$+ \vec{c}$

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117. If $\vec{p} = 5\hat{i} + \lambda\hat{j} - 3\hat{k}$ *and* $\vec{q} = \hat{i} + 3\hat{j} - 5\hat{k}$, then find the value of λ such that $\vec{p} + \vec{q}$ and $\vec{p} - \vec{q}$ are perpendicular vectors.

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118. If $\vec{\alpha} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ *and* $\vec{\beta} = 2\hat{i} + \hat{j} - 4\hat{k}$, then express $\vec{\beta}$ in the form of $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$ *where* $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ *and* $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.

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

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

angled triangle.

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121. 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 $\vec{a} + \lambda\vec{b}$ perpendiculr to $\vec{c}$, then find the value of λ.

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122. Find the angles of a triangle whose vertices are $A(0, -1, -2)$, $B(3, 1, 4)$ and $C(5, 7, 1)$.

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123. 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 9/2 .

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124. Show that the points whose position vectors are $\vec{a} = 4\hat{i} - 3\hat{j} + k,\ \vec{b} = 2\hat{i} - 4\hat{j} + 5k,\ \vec{c} = \hat{i} - \hat{j}$ form a right triangle.

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125. If $A,\ B,\ C$ have position vectors (0, 1, 1), (3, 1, 5), (0, 3, 3) respectively, show that $\mathrm{Delta}ABC$ is right angled at C.

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126. Find the projection of $\vec{b} + \vec{c}\ on\ \vec{a}\ ,\ where\ \vec{a} = 2\hat{i} - 2\hat{j} + \hat{k},\ \vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}\ and\ \vec{c} = 2\hat{i}$

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127. 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 orthogonal.

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128. A unit vector $\vec{a}$ makes angles $\frac{\pi}{4}$ and $\frac{\pi}{3}$ with $\hat{i}$ and $\hat{j}$ respectively and an acute angle θ with $\hat{k}$. Find the angle θ and components of $\vec{a}$.

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129. If two vectors $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 1$ and $\vec{a}\cdot\vec{b} = 1$, then find rthe value of `(3 vec a-5 vec b)dot'(2 vec a+7 vec b)'dot

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130. If $\vec{a}$ is a unit vector, then find $\left|\vec{x}\right|$ in each of the following: $\left(\vec{x}-\vec{a}\right);\left(\vec{x}+\vec{a}\right)=8$

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131. If $\vec{a}$ is a unit vector, then find $\left|\vec{x}\right|$ in each of the following: $\left(\vec{x}-\vec{a}\right);\left(\vec{x}+\vec{a}\right)=12$

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132. Find $\left|\vec{a}\right| and \left|\vec{b}\right|$, if : $\left(\vec{a}+\vec{b}\right);\left(\vec{a}-\vec{b}\right)=12\, and \left|\vec{a}\right|=2\left|\vec{b}\right|$

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133. 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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134. Find $\left|\vec{a}\right| and \left|\vec{b}\right|$, if : $\left(\vec{a}+\vec{b}\right);\left(\vec{a}-\vec{b}\right)=13 \, and \left|\vec{a}\right|=2\left|\vec{b}\right|$

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135. Find $\left|\vec{a}-\vec{b}\right|$, if : $\left|\vec{a}\right|=2, \left|\vec{b}\right|=5 \, and \, \vec{a}\cdot\vec{b}=8$

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136. Find $\left|\vec{a}-\vec{b}\right|$, if : $\left|\vec{a}\right|=3, \left|\vec{b}\right|=4 \, and \, \vec{a}\cdot\vec{b}=1$

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137. Find $\left|\vec{a}-\vec{b}\right|$, if : $\left|\vec{a}\right|=2, \left|\vec{b}\right|=3 \, and \, \vec{a}\cdot\vec{b}=4$

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138. Find the angle between two vectors $\vec{a}$ and $\vec{b}$, if : $\left|\vec{a}\right| = 3$, $\left|\vec{b}\right| = 3$ and $\vec{a}\cdot\vec{b} = 1$

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139. Express the vector $\vec{a} = 5\hat{i} - 2\hat{j} + 5\hat{k}$ as the sum of two vectors such that one is parallel to the vector $\vec{b} = 3\hat{i} + \hat{k}$ and other is perpendicular to $\vec{b}$.

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140. If $\vec{a}$ and $\vec{b}$ are two vectors of the same magnitude inclined at angle of 30^0 such that $\vec{a}\cdot\vec{b} = 3$, evaluate $\left|\vec{a}\right|$, $\left|\vec{b}\right|$

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141. Express $2\hat{i} - \hat{j} + 3\hat{k}$ as the sum of a vector parallel and a vector perpendicular to $2\hat{i} + 4\hat{j} - 2\hat{k}$.

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142. Decompose the vector $6\hat{i} - 3\hat{j} - 6\hat{k}$ into vectors which are parallel and perpendicular to the vecrtor $\hat{i} + \hat{j} + \hat{k}$.

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143. Let $\vec{a} = 5\hat{i} - \hat{j} + 7\hat{k}$ *and* $\vec{b} = \hat{i} - \hat{j} + \lambda\hat{k}$. Find λ such that $\vec{a} + \vec{b}$ is orthogonal to $\vec{a} - \vec{b}$.

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144. If $\vec{a} \cdot \vec{a} = 0$ *and* $\vec{a} \cdot \vec{b} = 0$ what can you conclude about the vector $\vec{b}$?

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145. If $\vec{c}$ is perpendicular to both $\vec{a}$ and $\vec{b}$, then prove that it is perpendicular to both $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$.

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146. If $\left|\vec{a}\right| = a$ and $\left|\vec{b}\right| = b$, prove that $\left(\frac{\vec{a}}{a^2}-\frac{\vec{b}}{b^2}\right)^2 = \left(\frac{\vec{a}-\vec{b}}{ab}\right)^2$

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147. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three non coplanar vectors such that $\vec{d}\cdot\vec{a} = \vec{d}\cdot\vec{b} = \vec{d}\cdot\vec{c} = 0$, then show that d is the null vector.

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148. If a vector $\vec{a}$ is perpendicular to two non collinear vectors $\vec{b}$ *and* $\vec{c}$, *then* $\vec{a}$ is perpendicular to every vector in the plane of $\vec{b}$ *and* $\vec{c}$

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149. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, show that the angle θ between the vectors $\vec{b}$ *and* $\vec{c}$ ig givne by $\cos\theta=\dfrac{\left|\vec{a}\right|^2-\left|\vec{b}\right|^2-\left|\vec{c}\right|^2}{2\left|\vec{b}\right|\left|\vec{c}\right|}$.

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150. Let $\vec{u}$, $\vec{v}$ *and* $\vec{w}$ be vector such $\vec{u}+\vec{v}+\vec{w}=0$. if $\left|\vec{u}\right|=3$, $\left|\vec{v}\right|=4$ *and* $\left|\vec{w}\right|=5$, then find $\vec{u}\cdot\vec{v}+\vec{v}\cdot\vec{w}+\vec{w}\cdot\vec{u}$.

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151. Let $\vec{a} = x^2\hat{i} + 2\hat{j} - 2\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = x^2\hat{i} + 5\hat{j} - 4\hat{k}$ be three vecrors find the values of x for which the angle between $\vec{a}$ and $\vec{b}$ acute and the angle between $\vec{b}$ and $\vec{c}$ is obtuse.

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152. Find the value of x and y if the vectors $\vec{a} = 3\hat{i} + x\hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + y\hat{k}$ are mutually perpendicular vectors of equal magnitude.

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153. If $\vec{a}$ and $\vec{b}$ are two non collinear unit vectors such that $\left|\vec{a} + \vec{b}\right| = \sqrt{3}$, find $\left(2\vec{a} - 5\vec{b}\right).\left(3\vec{a} + \vec{b}\right)$

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

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155. Prove using vectors: The median to the base of an isosceles triangle is perpendicular to the base.

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156. Show that the diagonals of a rhombus bisect each other at right angles.

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157. Using vector method, prove that the angel in a semi circle is a right angle.

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158. Prove that the cosine formula for triangles is equivalent to the definition of the scalar product.

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159. In a triangle OAB, $\angle AOB = 90^0$. If $P \, and \, Q$ are points of trisection of AB prove that $OP^2 + OQ^2 = \frac{5}{9}AB^2$.

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160. Prove that; If the diagonals of a quadrilateral bisect each other at right angles, then it is a rhombus.

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161. (Pythagoras's Theorem) Prove by vector method that in a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

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162. Prove by vector method that the sum of the square of the diagonals of a parallelogram is equal to the sum of the squares of its sides.

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163. prove using vectors: The quadrilateral obtained by joining mid-points of adjacent sides a rectangle is a rhombus.

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164. Using analytical geometry, prove that the diagonals of a rhombus are perpendicular to each other.

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165. Prove that the diagonals of a rectangle are perpendicular if and only if the rectangle is a square.

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166. In ABC, AD is a median. Prove that $AB^2 + AC^2 = 2\,AD^2 + 2\,DC^2$.

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167. If the median to the base of a triangle is perpendicular to the base then triangle is isosceles.

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168. In a quadrilateral $ABCD$, prove that $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2 + 4PQ^2$, where P and Q are middle points of diagonals AC and BD.

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169. What is the angle between vectors $\vec{a}$ and $\vec{b}$ with magnitudes 2 and 3 respectively ? Given $\vec{a} \cdot \vec{b} = \sqrt{3}$.

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170. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a} \cdot \vec{b} = 6$, $\left|\vec{a}\right| = 3$ and $\left|\vec{b}\right| = 4$. Write the projection of $\vec{a}$ on $\vec{b}$.

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

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172. If the vectors $3\hat{i} + m\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} - 8\hat{k}$ are orthogonal, find m.

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173. If the vectors $3\hat{i} - 2\hat{j} - 4\hat{k}$ and $18\hat{i} - 12\hat{j} - m\hat{k}$ are parallel find the value of m.

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174. If $\vec{a}$ and $\vec{b}$ are vectors of equal magnitude, write the value of $\left(\vec{a} + \vec{b}\right) \cdot \vec{a} - \vec{b}$.

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175. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left(\vec{a}+\vec{b}\right)\vec{a}-\vec{b}=0$ find the relation between the magnitudes of $\vec{a}$ and $\vec{b}$.

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176. For any two vectors $\vec{a}$ and $\vec{b}$ write when $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}\right|+\left|\vec{b}\right|$ holds.

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177. For any two vectors $\vec{a}$ and $\vec{b}$ write then $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}\right|+\left|\vec{b}\right|$ holds.

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178. If $\vec{a}$ and $\vec{b}$ are two vectors of the same magnitude inclined at an angle of 60^0 such that $\vec{a}\cdot\vec{b} = 8$ write the value of their magnitude.

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179. If $\vec{a}\cdot\vec{a} = 0$ and $\vec{a}\cdot\vec{b} = 0$ what can you conclude about the vector $\vec{b}$?

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180. If $\vec{b}$ is a unit vector such that $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}-\vec{b}\right) = 8$, find $\left|\vec{a}\right|$.

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181. If $\hat{a}$, $\hat{b}$ are unit vector such that $\hat{a}+\hat{b}$ is a unit vectors, write the value of $\left|\hat{a}-\hat{b}\right|$.

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

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183. If $\vec{a} = \hat{i} - \hat{j}\ and\ \vec{b} = -\hat{j} + \hat{k}$ find the projection of $\vec{a}\ on\ \vec{b}$.

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184. For any two non zero vectors write the value of

$$\frac{\left|\vec{a} + \vec{b}\right|^2 + \left|\vec{a} - \vec{b}\right|^2}{\left|\vec{a}\right|^2 + \left|\vec{b}\right|^2}$$

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185. Write the the projections of $\vec{r} = 3\hat{i} - 4\hat{j} + 12\hat{k}$ on the coordinate axes.

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186. Writhe the component of $\vec{b}$ along $\vec{a}$.

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187. Writhe the value of $\left(\vec{a}\,\dot{\hat{i}}\right)\hat{i} + \left(\vec{a}\,\dot{\hat{j}}\right)\hat{j} + \left(\vec{a}\,\dot{\hat{k}}\right)\hat{k}\ where\ \vec{a}$ is any vector.

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188. Find the value of $\theta(0, \pi/2)$ for which vectors $\vec{a} = (\sin\theta)\hat{i} + (\cos\theta)\hat{j} and\ \vec{b} = \hat{i} - \sqrt{3}\hat{j} + 2\hat{k}$ are perpendicular.

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189. Write the projection of $\hat{i}+\hat{j}+\hat{k}$ along the vector $\hat{j}$.

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190. Writhe a vector satisfying $\vec{a}\,\hat{i}=\vec{a}\,\hat{i}+\hat{j}=\vec{a}\,\hat{i}+\hat{j}+\hat{k}=1$.

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191. Find $\frac{dy}{dx}$ if $y=e^{3x}$

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192. If $\vec{a}$ and $\vec{b}$ and $\vec{c}$ are mutually perpendicular unit vectors, write the value of $\left|\vec{a}+\vec{b}+\vec{c}\right|$.

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193. If $\vec{a}$ and $\vec{b}$ are mutually perpendicular unit vectors, write the value of $\left|\vec{a}+\vec{b}\right|$.

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

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195. For what value of λ are the vector $\vec{a}=2\hat{i}+\lambda\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+3\hat{k}$ perpendicular to each other?

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196. Write the value of p for which $\vec{a}=3\hat{i}+2\hat{j}+9\hat{k}$ and $\vec{b}=\hat{i}+p\hat{j}+3\hat{k}$ are parallel vectors.

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197. Find the value of λ. If the vectors $2\hat{i}+\lambda\hat{j}+3\hat{k}\ and\ 3\hat{i}+2\hat{j}-4\hat{k}$ are perpendicular to each other.

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198. If $\left|\vec{a}\right|=2,\ \left|\vec{b}\right|=3\ and\ \vec{a}\cdot\vec{b}=3$ find the projection of $\vec{b}\ on\ \vec{a}$.

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199. Writhe the angle between two vectors $\vec{a}\ and\ \vec{b}\ \backslash$ with magnitudes $\sqrt{3}\ and\ 2$ repsectively having $\vec{a}\cdot\vec{b}=\sqrt{6}$.

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200. Write the projection of the vector $\hat{i}+3\hat{j}+7\hat{k}$ on the vector $2\hat{i}-3\hat{j}+6\hat{k}$.

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201. Find λ, when the projection of $\vec{a}=\lambda\hat{i}+\hat{j}+4\hat{k}$ on $\vec{b}=2\hat{i}+6\hat{j}+3\hat{k}$ is 4 units.

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202. For what value of λ are the vectores $\vec{a}=2\hat{i}+\lambda\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+3\hat{k}$ perpendicular to each other?

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203. Writhe the projection of the vector $7\hat{i}+\hat{j}-4\hat{k}$ on the vector $2\hat{i}+6\hat{j}+3\hat{k}$.

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204. Write the value of λ so that the vector $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ are perpendicular to each other.

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205. Write the projection of $\vec{b} + \vec{c}$ on $\vec{a}$, when $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$.

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206. 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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207. 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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208. The vector $\vec{a}$ and $\vec{b}$ satisfy the equation $2\vec{a} + \vec{b} = \vec{p}$ and $\vec{a} + 2\vec{b} = \vec{q}$, where $\vec{p} = \hat{i} + \hat{j}$ and $\vec{q} = \hat{i} - \vec{j}$.

If θ is the angle between $\vec{a}$ and $\vec{b}\backslash$, then

a. $\cos\theta = \frac{4}{5}$ b. $\sin\theta = \frac{1}{\sqrt{2}}$ c. $\cos\theta = -\frac{4}{5}$ d. $\cos\theta = -\frac{3}{5}$

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209. If $\vec{a} . \hat{i} = \vec{a} . \left(\hat{i} + \hat{j}\right) = \vec{a} . \left(\hat{i} + \hat{j} + \hat{k}\right) = 1$, then $\vec{a}$ is equal to

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210. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 3$, $\left|\vec{b}\right| = 5$ and $\left|\vec{c}\right| = 7$ find the anglebetweeen $\vec{a}$ and $\vec{b}$

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211. If $\vec{a}$ and $\vec{b}$ be two unit vectors and θ is the angle between them. Then $\vec{a} + \vec{b}$ is an unit vector, if $\theta =$ $\frac{\pi}{2}$ b. $\frac{2\pi}{3}$ c. $\frac{\pi}{4}$ d. $\frac{\pi}{3}$

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212. The vector $\cos\alpha\cos\beta\hat{i} + \cos\alpha\, s \in \beta\hat{j} + \sin\alpha\hat{k}$ is a $\nu ll\ vec \to r$ b. $nit\ vec \to r$ c. $constant\ vec \to r$ d. none of these

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213. If the position vectors of P and Q are $\hat{i} + 3\hat{j} - 7\hat{k}$ and $5\hat{i} - 2\hat{j} + 4\hat{k}$ them the cosine of the angle between $\vec{P}Q$ and y-axis is $\frac{5}{\sqrt{162}}$ b. $\frac{4}{\sqrt{162}}$ c. $-\frac{5}{\sqrt{162}}$ d. $\frac{11}{\sqrt{162}}$

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214. If $\vec{a}$ and $\vec{b}$ are unit vectors, then which of the following values $\vec{a} \cdot \vec{b}$ is not possible?

a. $\sqrt{3}$

b. $\sqrt{3}/2$

c. $1/\sqrt{2}$

d. $-1/2$

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215. If the vectors $\hat{i} - 2x\hat{j} + 3y\hat{k}$ and $\hat{i} + 2x\hat{j} - y\hat{k}$ are perpendicular, then the locus of (x,y) is

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216. The vector component of $\vec{b}$ perpendicular to $\vec{a}$ is

a. $\left(\vec{b} \cdot \vec{c}\right)\vec{a}$

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

c. $\vec{a} \times \left(\vec{b} \times \vec{a}\right)$

d. none of these

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217. The length of the longer diagonal of the parallelogram constructed on $5\vec{a} + 2\vec{b}$ *and* $\vec{a} - 3\vec{b}$ if it is given that $\left|\vec{a}\right| = 2\sqrt{2}$, $\left|\vec{b}\right| = 3$ and angle between $\vec{a}$ *and* $\vec{b}$ *is* $\pi/4$ is a.15 b. $\sqrt{113}$ c. $\sqrt{593}$ d. $\sqrt{369}$

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218. If $\vec{a}$ is a non zero vector of magnitude 'a' and λ a non zero scalar, then $\lambda\vec{a}$ is unit vector if

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

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220. The value of x for which the angle between $\vec{a} = 2x^2\hat{i} + 4x\hat{j} + \hat{k} and\ \vec{b} = 7\hat{i} - 2\hat{j} + \hat{k}$ is obtuse and the angle between b and the z-axis acute and less than $\pi/6$ is given by

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221. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are any time mutually perpendicular vectors of equal magnitude a, then $\left|\vec{a} + \vec{b} + \vec{c}\right|$ is equal to a b. $\sqrt{2}a$ c. $\sqrt{3}a$ d. $2a$ e. none of these

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222. If the vectors $3\hat{i} + \lambda\hat{j} + \hat{k}\ and\ 2\hat{i} - \hat{j} + 8\hat{k}$ are perpendicular, then λ is equal to -14 b. 7 c. 14 d. $\frac{1}{7}$

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223. The projection of the vector $\hat{i} + \hat{j} + \hat{k}$ along the vector of $\hat{j}$ is 1 b. 0 c. 2 d. -1 e. -2

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224. The vectors $2\hat{i} + 3\hat{j} - 4\hat{k}\ and\ a\hat{i} = b\hat{j} + c\hat{k}$ are perpendicular if $a = 2,\ b = 3,\ c = -4$ $a = 4,\ b = 4,\ c = 5$ $a = 4,\ b = 4,\ c = -5$ $a = -4,\ b = 4,\ c = -5$

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225. If $\left|\vec{a}\right| = \left|\vec{b}\right|$, $then$ $\left(\vec{a} + \vec{b}\right)\vec{a} - \vec{b} =$ a. positive b. negative c. 0 d. none of these

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226. If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle θ then the value of $\left|\vec{a} - \vec{b}\right|$ is a.$2\sin\left(\frac{\theta}{2}\right)$ b. $2\sin\theta$ c. $2\cos\left(\frac{\theta}{2}\right)$ d. $2\cos\theta$

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227. If $\vec{a}$ and $\vec{b}$ are unit vectorts, then the greatest value fo $\sqrt{3}\left|\vec{a} + \vec{b}\right| + \left|\vec{a} - \vec{b}\right|$ is

$(a).2$ $(b).$ $2\sqrt{2}$ $(c).4$ (d). none of these

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228. If the angle between the vectors $x\hat{i}+3\hat{j}-7\hat{k}\ and\ x\hat{i}-x\hat{j}+4\hat{k}$ acute, then x lies in the interval $(-4,7)$ b. $[-4,\ 7]$ c. $R-[-4,7]$ d. $R-(4,7)$

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229. If $\vec{a}\ and\ \vec{b}$ are two unit vectors inclined at an angle θ such that $|a+b|,\ 1,$ then `theta(2pi)/3c. pi/3

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230. Let $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that $\left|\vec{a}+\vec{b}+\vec{c}\right|=1\ and\ \vec{a}$ is perpendicular to $\vec{b}$. If $\vec{c}$ makes angle α and β with $\vec{a}\ and\ \vec{b}$ respectively, then $\cos\alpha+\cos\beta=$ $-\frac{3}{2}$ b. $\frac{3}{2}$ c. 1 d. -1

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231. The orthogonal projection of $\vec{a}$ *on* $\vec{b}$ is a. $\frac{\left(\vec{a}\cdot\vec{b}\right)\vec{a}}{|a|^2}$ b. $\frac{\left(\vec{a}\cdot\vec{b}\right)\vec{b}}{\left|\vec{b}\right|^2}$ c. $\frac{\vec{a}}{\left|\vec{a}\right|}$ d. $\frac{\vec{b}}{\left|\vec{b}\right|}$

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232. If θ is an acute angle and the vector $(\sin\theta)\hat{i}+(\cos\theta)\hat{j}$ is perpendicular to the vector $\hat{i}-\sqrt{3}\hat{j}$, *then* $\theta=$ $\frac{\pi}{6}$ b. $\frac{\pi}{5}$ c. $\frac{\pi}{4}$ d. $\frac{\pi}{3}$

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233. If $\vec{a}$ *and* $\vec{b}$ be two unit vectors and θ is the angle between them. Then $\vec{a}+\vec{b}$ is an unit vector, if $\theta=$ $\frac{\pi}{2}$ b. $\frac{2\pi}{3}$ c. $\frac{\pi}{4}$ d. $\frac{\pi}{3}$

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