MATHS

BOOKS - KC SINHA ENGLISH

VECTOR ALGEBRA: COMPETITION

Solved Examples

1. Let $\overrightarrow{r}_1, \overrightarrow{r}_2, \overrightarrow{r}_3, , \overrightarrow{r}_n$ be the position vectors of points P_1, P_2, P_3, P_n relative to the origin O. If the vector equation $a_1\overrightarrow{r}_1 + a_2\overrightarrow{r}_2 + \; + a_n\overrightarrow{r}_n = 0$ hold, then a similar equation will also hold w.r.t. to any other origin provided a. $a_1 + a_2 + \dot{+} a_n = n$ b. $a_1 + a_2 + \dot{+} a_n = 1$ c. $a_1 + a_2 + \dot{+} a_n = 0$ d. $a_1 = a_2 = a_3 \dot{+} a_n = 0$

2. Prove that the vector relation $p\vec{a}+q\vec{b}+r\vec{c}+\ldots.=0$ will be inependent of the orign if and only if $p+q+r+.\;=0, wherep, q, r.........$ are scalars.

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3. A vector a has components a_1, a_2 and a_3 in a right handed rectangular cartesian system OXYZ. The coordinate system is rotated about Z-axis through angle $\frac{\pi}{2}$. Find components of a in the new system.

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4. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ be the position vectors of points A,B,C,D respectively and $\vec{b}-\vec{a}=2\left(\vec{d}-\vec{c}\right)$ show that the pointf intersection of the straighat lines AD and BC divides these line segments in the ratio 2:1.

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5. If G_1 is the mean centre of A_1, B_1, C_1 and G_2 that of A_2, B_2, C_2 then show that $\overrightarrow{A_1A_2} + \overrightarrow{B_1B_2} + \overrightarrow{C_1C_2} = 3\overrightarrow{G_1G_2}$

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6. The position vectors of the points A,B,C,D are $\overrightarrow{3i} - \overrightarrow{2j} - \overrightarrow{k}, \overrightarrow{2i} + \overrightarrow{3j} - \overrightarrow{4k} - \overrightarrow{i} + \overrightarrow{j} + \overrightarrow{2k} \text{ and } \overrightarrow{4j} + \overrightarrow{5j} + \overrightarrow{\lambda k}$ respectively Find λ if A,B,C,D are coplanar.

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7. If the vectors $\overrightarrow{\alpha} = a\hat{i} + \hat{j} + \hat{k}, \overrightarrow{\beta} = \hat{i} + b\hat{j} + \hat{k} and \overrightarrow{\gamma} = \hat{i} + \hat{j} + c\hat{k}$ are coplanar, then prove that $\frac{1}{1-a} + \frac{1}{1+b} + \frac{1}{1-c} = 1, wherea \neq 1, b \neq 1 andc \neq 1.$

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8. If $\overrightarrow{a}, \overrightarrow{b}$ be two non zero non parallel vectors then show that the points whose position vectors are $p_1\overrightarrow{a} + q_1\overrightarrow{b}, p_2\overrightarrow{a} + q_2\overrightarrow{b}, p_3\overrightarrow{a} + q_3\overrightarrow{b}$ are collinear if $\begin{vmatrix} 1 & p_1 & q_1 \\ 1 & p_2 & q_2 \\ 1 & p_3 & q_3 \end{vmatrix} = 0$

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9. Show that the vectors

$\hat{i} - 3\hat{i} + 2\hat{k}, 2\hat{i} - 4\hat{j} - \hat{k}$ and $3\hat{i} + 2\hat{j} - \hat{k}$ and linearly independent.

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10. if $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are non coplanar and non zero vectors such that $\overrightarrow{b} \times \overrightarrow{c} = \overrightarrow{a}, \overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c}$ and $\overrightarrow{c} \times \overrightarrow{a} = \overrightarrow{b}$ then 1

$(a)|a| = 1(b)|a| = 2(c)|a| = 3(d)|a| = 4$

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11. if $\vec{a}, \vec{b}, \vec{c}$ are non coplanar and non zero vectors such that $\vec{b} \times \vec{c} = \vec{a}, \vec{a} \times \vec{b} = \vec{c}$ and $\vec{c} \times \vec{a} = \vec{b}$ then 2. $(a)|a| - |b| + |c| = 4(b)|a| - |b| + |c| = \frac{2}{3}(c)|a| - |b| + |c| = 1(d)$ none of these`

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12. if $\vec{a}, \vec{b}, \vec{c}$ are non coplanar and non zero vectors such that $\vec{b} \times \vec{c} = \vec{a}, \vec{a} \times \vec{b} = \vec{c}$ and $\vec{c} \times \vec{a} = \vec{b}$ then 3. $(a)|a| + |b| + |c| = 0(b)|a| + |b| + |c| = 2(c)|a| + |b| + |c| = 3$ (d) none of these`

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13. Prove that the internal bisectors of the angles of a triangle are concurrent

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14. Assertion: If I is the incentre of $\triangle ABC, then$

|vec(BC)|vec(IA)+|vec(CA)|vec(IB)+|vec(AB)|vec(IC)=0

$Reason: If O is the$ or $ig \in$, $then the position \xrightarrow{} r of centroid of$

/_\ABC$is \dfrac{\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC}}{3}$

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15. Let OACB be a parallelogram with O at the origin and OC a diagonal. Let D be the mid-point of OA. Using vector methods prove that BD and CO intersects in the same ratio. Determine this ratio.

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16. In a $\triangle OAB$,E is the mid point of OB and D is the point on AB such that $AD : DB = 2 : 1$ If OD and AE intersect at P then determine the ratio of $OP : PD$ using vector methods

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17. Find the vector equation of the line through the points $2\vec{i} + \vec{j} - 3\vec{k}$ and parallel to vector $\vec{i} + 2\vec{j} + \vec{k}$

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18. Find the vector equation of the line through the points $(1, -2, 1)$ and $(0, -2, 3)$.

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19. Find the equation of the plane passing through three given points $A\left(-2\vec{i} + 6\vec{j} - 6\vec{k}\right), B\left(-3\vec{i} + 10\vec{j} - 9\vec{k}\right)$ and $C\left(-5\vec{i} + \vec{6k}\right)$

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20. Find the equation of the plane through the origin and the points $4\vec{j}$ and $2\vec{i}+\vec{k}$. Find also the point in which this plane is cut by the line joining points $\vec{i}-2\vec{j}+\vec{k}$ and $3\vec{k}-2\vec{j}$.

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21. O is any point in the plane of the triangle ABC,AO,BO and CO meet the sides BC,CA nd AB in D,E,F respectively show that $\frac{OD}{AD}+\frac{OE}{BE}+\frac{OF}{CF}=1.$

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22. Find the perpendicular distance of the point A(1,0,1) to the line through the points B(2,3,4) and C(-1,1,-2)

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23. If vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar, show that

$$\begin{vmatrix} \vec{a} & \vec{b} & \vec{c} \\ \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \end{vmatrix} = \vec{0}$$

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24. If vector $\vec{a}, \vec{b}, \vec{c}$ are coplanar then find the value of $\vec{c}$ in terms of $\vec{a}$ and $\vec{b}$

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25. If n be integer gt1, then prove that $\sum_{r=1}^{n-1} \frac{\cos(2r\pi)}{n} = -1$

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26. Let ABC be a triangle with $AB = AC\cdot$ If D is the midpoint of BC, E is the foot of the perpendicular drawn from D to $AC, and F$ is the midpoint of $DE,$ then prove that AF is perpendicular to BE.

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27. Two triangles ABC and PQR are such that the perpendiculars from A to QR ,B to RP and C to PQ are concurrent .Show that the perpendicular from P to BC ,Q to CA and R to AB are also concurrent .

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28. Find the equation of the plane through the point $2\vec{i} - \vec{j} + \vec{k}$ and perpendiulr to the vector $4\vec{i} + 2\vec{j} - 3\vec{k}$. Determine the perpendicular distance of this plane from the origin.

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29. Find the equation of a plane passing throug the piont $A(3, -2, 1)$ and perpendicular to the vector $4\vec{i} + 7\vec{j} - 4\vec{k}$. If PM be perpendicular from the point $P(1, 2, -1)$ to this plane find its length.

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30. Find the projection of the line $\vec{r} = \vec{a} + t\vec{b}$ on the plane given by $\vec{r}.\vec{n} = q$.

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31. A particle acted by costant forces $4\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ is displaced from point $\hat{i} + 2\hat{j} + 3\hat{k}\text{to point}5\hat{i} + 4\hat{j} + \hat{k}$ find the total work done by the forces in units.

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33. Let $\overrightarrow{O}A = \overrightarrow{a}, \hat{O}B = 10\overrightarrow{a} + 2\overrightarrow{b} and \overrightarrow{O}C = \overrightarrow{b}, where O, A and C$ are non-collinear points. Let p denotes the areaof quadrilateral $OACB$, and let q denote the area of parallelogram with $OA and OC$ as adjacent sides. If $p = kq,$ then find$k$.

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34. If A,B,C,D are any four points in space prove that $\overrightarrow{AB} \times \overrightarrow{CD} + \overrightarrow{BC} x \overrightarrow{AD} + \overrightarrow{CA} \times \overrightarrow{BD} = 2\overrightarrow{AB} \times \overrightarrow{CA}$

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35. $A, B, C and D$ are any four points in the space, then 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 ABC .)

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36. Show that the equation of as line perpendicular to the two vectors $\vec{b}$ and $\vec{c}$ and passing through point $\vec{a}$ is $\vec{r} = \vec{a} + t\left(\vec{b} \times \vec{c}\right)$ where t is a scalar.

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37. Let $\vec{A}(t) = f_1(t)\hat{i} + f_2(t)\hat{j}$ and $\vec{B}(t) = g(t)\hat{i} + g_2(t)\hat{j}, t \in [0, 1], f_1, f_2, g_1 g_2$ are continuous functions. If $\vec{A}(t)$ and $\vec{B}(t)$ are non-zero vectors for all t and $\vec{A}(0) = 2\hat{i} + 3\hat{j}, \vec{A}(1) = 6\hat{i} + 2\hat{j}, \vec{B}(0) = 3\hat{i} + 2\hat{i}$ and $\vec{B}(1) = 2\hat{i}$ Then,show that $\vec{A}(t)$ and $\vec{B}(t)$ are parallel for some t.

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38. Given that vectors $\vec{A}, \vec{B}$ and $\vec{C}$ from a triangle such that $\vec{A} = \vec{B} + \vec{C}$. Find a, b,c and d such that the area of the triangle is $5\sqrt{16}$ where.

$\vec{A} = a\hat{i} + b\vec{j} + c\hat{k}$

$\overrightarrow{B} = d\hat{i} + 3\hat{j} + 4\hat{k}$

$\overrightarrow{C} = 3\hat{i} + \hat{j} - 2\hat{k}$

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39. Position vectors of two points A and C re $9\overrightarrow{i} - \overrightarrow{j} + 7\overrightarrow{i} - 2\overrightarrow{j} + 7\overrightarrow{k}$ respectively THE point intersection of vectors $\overrightarrow{AB} = 4\overrightarrow{i} - \overrightarrow{j} + 3\overrightarrow{k}$ and $\overrightarrow{CD} = 2\overrightarrow{i} - \overrightarrow{j} + 2\overrightarrow{k}$ is P. If vector $\overrightarrow{PQ}$ is perpendicular to $\overrightarrow{AB}$ and $\overrightarrow{CD}$ and PQ=15 units find the position vector of Q.

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40. $A, B, CandD$ are four points such that $\overrightarrow{A}B = m\left(2\hat{i} - 6\hat{j} + 2\hat{k}\right), \overrightarrow{B}C = \left(\hat{i} - 2\hat{j}\right)and\overrightarrow{C}D = n\left(-6\hat{i} + 15\hat{j} - 3\hat{k}\right.$ If CD intersects AB at some point $E,$ then a. $m \geq 1/2$ b.$n \geq 1/3$ c. $m = n$ d. $m < n$

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41. In a $\triangle ABC$points D,E,F are taken on the sides BC,CA and AB respectively such that $\frac{BD}{DC}=\frac{CE}{EA}=\frac{AF}{FB}=n$ prove that $\triangle DEF=\frac{n^2-n+1}{(n+1)^2}\triangle ABC$

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42. The position vectors of the vertices A, B and C of a tetrahedron ABCD are $\hat{i}+\hat{j}+\hat{k}$, $\hat{k}$, $\hat{i}$ and $\hat{3}i$,respectively. The altitude from vertex D to the opposite face ABC meets the median line through Aof triangle ABC at a point E. If the length of the side AD is 4 and the volume of the tetrahedron is2√2/3, find the position vectors of the point E for all its possible positions

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43. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are four distinct vectors satisfying the conditions $\vec{a}\times\vec{b}=\vec{c}\times\vec{d}$ and $\vec{a}\times\vec{c}=\vec{b}\times d$ then prove that

$\vec{a} \cdot \vec{b} + \vec{c} \cdot \vec{d} \neq \vec{a} \cdot \vec{c} + \vec{b} \cdot \vec{d}$

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44. If $\vec{A} = (1, 1, 1)$ and $\vec{C} = (0, 1, -1)$ are given vectors the vector $\vec{B}$ satisfying the equations $\vec{A} \times \vec{B} = \vec{C}$ and $\vec{A} \cdot \vec{B} = 3$ is ______.

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45.

$\vec{A} = \left(2\vec{i} + \vec{k}\right), \vec{B} = \left(\vec{i} + \vec{j} + \vec{k}\right)$ and $\vec{C} = 4\vec{i} - \vec{3}j + 7\vec{k}$

determine a $\vec{R}$ satisfying $\vec{R} \times \vec{B} = \vec{C} \times \vec{B}$ and $\vec{R} \cdot \vec{A} = 0$

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46. For any two vectors $\vec{u}$ and $\vec{v}$ prove that

$\left(1 + \left|\vec{u}\right|^2\right)\left(1 + \left|\vec{v}\right|^2\right) = \left(1 - \vec{u} \cdot \vec{v}\right)^2 + \left|\vec{u} + \vec{v} + \left(\vec{u} \times \vec{v}\right)\right|^2$

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47. Let points P,Q, and R hasve positon vectors $\vec{r}_1 = 3\vec{i} - 2\vec{j} - \vec{k}, \vec{r}_2 = \vec{i} + 3\vec{j} + 4verck$ and $\vec{r}_3 = 2\vec{i} + \vec{j} - 2$ relative to an origin O. Find the distance of P from the plane OQR.

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48. A non vector $\vec{a}$ is parallel to the line of intersection of the plane determined by the vectors $\vec{i}, \vec{i} + \vec{j}$ and thepane determined by the vectors $\vec{i} - \vec{j}, \vec{i} + \vec{k}$ then angle between $\vec{a}$ and $\vec{i} - 2\vec{j} + 2\vec{k}$ is = (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{4}$

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49. The position vector sof points P,Q,R are $3\vec{i} + 4\vec{j} + 5\vec{k}, 7\vec{i} - \vec{k}$ and $5\vec{i} + 5\vec{j}$ respectivley. If A is a point

equidistant form the lines OP, OQ and OR find a unit vector along $\overrightarrow{OA} where O$ is the origin.

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50. A force of 15 units act iln the direction of the vector $\overrightarrow{i} - \overrightarrow{j} + 2\overrightarrow{k}$ and passes through a point $2\overrightarrow{i} - 2\overrightarrow{j} + 2\overrightarrow{k}$. Find the moment of the force about the point $\overrightarrow{i} + \overrightarrow{j} + \overrightarrow{k}$.

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51. A rigid body is spinning about a fixed point (3,-2,-1) with an angular velocity of 4 rad/s, the axis of rotation being in the direction of (1,2,-2). Find the velocity of the particle at point (4,1,1).

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52. Find the volume of the parallelopiped whose edges are represented by $\vec{a}=2\hat{i}-3\hat{j}+4\hat{k},\ \vec{b}=\hat{i}+2\hat{j}-\hat{k},\ \vec{c}=3\hat{i}-\hat{j}+2\hat{k}$

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53. Prove that the four points $4\vec{i}+5\vec{i}+\vec{k},\ -\left(\vec{j}+\vec{k}\right), 3\vec{i}+9\vec{j}+4\vec{k}$ and $4\left(-\vec{i}+\vec{j}+\vec{k}\right)$ are coplanar

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54. Prove that $\left[\vec{a}+\vec{b}\vec{b}+\vec{c}\vec{c}+\vec{a}\right]=2\left[\vec{a}\vec{b}\vec{c}\right]$

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55. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then show that $\vec{a}\times\vec{b}, \vec{b}\times\vec{c}$ and $\vec{c}\times\vec{a}$ are also coplanar.

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56. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of A,B,C respectively prove that $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$ is a vector perpendicular to the plane ABC.

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57. Examine whether the vectors $\vec{a} = 2\vec{i} + 3\vec{j} + 2\vec{k}, \vec{b} = \vec{i} - \vec{j} + 2\vec{k}$ and $\vec{c} = 3\vec{i} + 2\vec{j} - 4\vec{k}$ form a left handed or a righat handed system.

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58. If $\vec{l}, \vec{m}, \vec{n}$ are three non coplanar vectors prove that

$$\left[\vec{l}\,\vec{m}\,\vec{n}\right]\left(\vec{a} \times \vec{b}\right) = \begin{vmatrix} \vec{1}.\vec{a} & \vec{1}.\vec{b} & \vec{1} \\ \vec{m}.\vec{a} & \vec{m}.\vec{b} & \vec{m} \\ \vec{n}.\vec{a} & \vec{n}.\vec{b} & \vec{n} \end{vmatrix}$$

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59. Show that $\left[\vec{a}\ \vec{b}\ \vec{c}\right]^2 = \begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \\ \vec{c}.\vec{a} & \vec{c}.\vec{b} & \vec{c}.\vec{c} \end{vmatrix}$

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60. vecctor $\overrightarrow{OA} = \hat{i} + 2\hat{j} + 2\hat{k}$ turns through a right angle passing through the positive x-axis on the way. Show that the vector in its new postion is $\frac{4\hat{i} - \hat{j} - \hat{k}}{\sqrt{2}}$

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61. If is given that $\vec{x} = \frac{\vec{b} \times \vec{c}}{\left[\vec{a}\ \vec{b}\ \vec{c}\right]}, \vec{y} = \frac{\vec{c} \times \vec{a}}{\left[\vec{a}\ \vec{b}\ \vec{c}\right]}, \vec{z} = \frac{\vec{a} \times \vec{b}}{\left[\vec{a}\ \vec{b}\ \vec{c}\right]} where \vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors. Find the value of $\vec{x}.\left(\vec{a} + \vec{b}\right) + \vec{y}.\left(\vec{c} + \vec{b}\right) + \vec{z}\left(\vec{c} + \vec{a}\right)$

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62. If $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{b} \times \vec{c} = \vec{a}$, show that $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs. Also show that $\left|\vec{c}\right| = \left|\vec{a}\right|$ and $\left|\vec{b}\right| = 1$

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63. If is given that $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}, \vec{r}.\vec{a} = 0$ and $\vec{a}.\vec{b} \neq 0$. What is the geometrical meaning of these equation separately? If the abvoe three statements hold good simultaneously, determine the vector $\vec{r}$ in terms of $\vec{a}, \vec{b}$ and $\vec{c}$.

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64. If $\vec{X}.\vec{A} = 0, \vec{X}.\vec{B} = 0$ and $\vec{X}.\vec{C} = 0$ for some non-zero vector $\vec{x}1, then$[vecA vecB vecC] =0`

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65. Express $\vec{a}, \vec{b}, \vec{c}$ in terms of $\vec{b} \times \vec{c}, \vec{c} \times \vec{a}$ and $\vec{a} \times \vec{b}$.

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66. find $x, y,$ and z if $x\vec{a} + y\vec{b} + z\vec{c} = \vec{d}$ and $\vec{a}, \vec{b}, \vec{c}$ are non coplanar.

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67. OABC is a tetrahedron where O is the origin and A,B,C have position vectors $\vec{a}, \vec{b}, \vec{c}$ respectively prove that circumcentre of tetrahedron OABC is $\dfrac{a^2\left(\vec{b} \times \vec{c}\right) + b^2\left(\vec{c} \times \vec{a}\right) + c^2\left(\vec{a} \times \vec{b}\right)}{2\left[\vec{a}\,\vec{b}\,\vec{c}\right]}$

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68. Let $\vec{u}$ and $\vec{v}$ be unit vectors. If $\vec{w}$ is a vector such that $\vec{w} + \vec{w} \times \vec{u} = \vec{v}$, then prove that $\left|\left(\vec{u} \times \vec{v}\right). \vec{w}\right| \leq \frac{1}{2}$ and that the equality holds if and only if $\vec{u}$ is perpendicular to $\vec{v}$.

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69. If $\vec{a} \perp \vec{b}$ then vector $\vec{v}$ in terms of $\vec{a}$ and $\vec{b}$ satisfying the equations $\vec{v}. Veca = 0nad\vec{v}. Vecb = 1$ and $\left[\vec{a}\vec{a}\vec{b}\right] = 1$ is

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70. $\vec{a}, \vec{b}, \vec{c}$ are three non coplanat unit vectors wuch that angle between any two is alpha. If $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} = \vec{la} + m\vec{b} + n\vec{c}$ then determine l,m,n in terms of α.

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71. Prove that the formula for the volume V of a tetrahedron, in terms of the lengths of three coterminous edges and their mutul inclinations is

$$V^2 = \frac{a^2b^2c^2}{36}\begin{vmatrix} 1 & \cos\phi & \cos\psi \\ \cos\phi & 1 & \cos\theta \\ \cos\psi & \cos\theta & 1 \end{vmatrix}$$

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72. Findthe value of $\vec{\alpha} \times \left(\vec{\beta} \times \vec{\gamma}\right)$, where, $\vec{\alpha} = 2\vec{i} - 10\vec{j} + 2\vec{k}, \vec{\beta} = 3\vec{i} + \vec{j} + 2\vec{k}, \vec{\gamma} = 2\vec{i} + \vec{j} + 3\vec{k}$

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

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74. Prove that $\hat{i} \times \left(\vec{a} \times \vec{i}\right) + \hat{j} \times \left(\vec{a} \times \vec{j}\right) + \hat{k} \times \left(\vec{a} \times \vec{k}\right) = 2\vec{a}$

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75. show that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right)$ if and only if $\vec{a}$ and $\vec{c}$ are collinear or $\left(\vec{a} \times \vec{c}\right) \times \vec{b} = \vec{0}$

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76. Let $vea, \vec{b}$ and $\vec{c}$ be any three vectors, then prove that $\left[\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}\right] = \left[\vec{a}\,\vec{b}\,\vec{c}\right]^2$

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77. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then show that $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}$ and $\vec{c} \times \vec{a}$ are also coplanar.

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78. Show that the vectors $\vec{a} \times \left(b \overrightarrow{\times} \vec{c}\right), \vec{b}\left(\vec{c} \times \vec{a}\right)$ and $\vec{c} \times \left(\vec{a} \times \vec{b}\right)$ are coplanar.

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79. $\vec{u}$, $\vec{v}$ and $\vec{w}$ are three non-coplanar unit vecrtors and α, β and γ are the angles between $\vec{u}$ and $\vec{v}$, $\vec{v}$ and $\vec{w}$, $and \vec{w}$ and $\vec{u}$, respectively, and $\vec{x}$, $\vec{y}$ and $\vec{z}$ are unit vectors along the bisectors of the angles α, $\beta and \gamma$, respectively. Prove that $\left[\vec{x} \times \vec{y} \vec{y} \times \vec{z} \vec{z} \times \vec{x}\right] = \frac{1}{16}\left[\vec{u} \vec{v} \vec{w}\right]^2 \sec^2\left(\frac{\alpha}{2}\right)\sec^2\left(\frac{\beta}{2}\right)\sec^2\left(\frac{\gamma}{2}\right)$.

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80. The angles of a triangle , two of whose sides are respresented by vectors $\sqrt{3}\left(\widehat{a}\times\vec{b}\right)$ and $\hat{b}-(\widehat{a}.\,Vecb)\widehat{a}$ where $\vec{b}$ is a non - zero vector and $\vec{a}$ is a unit vector in the direction of $\vec{a}$. Are

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81. If $\vec{x}\times\vec{y}=\vec{a},\vec{y}\times\vec{z}=\vec{b},\vec{x}.\vec{b}=\gamma,\vec{x}.\vec{y}=1$ and $\vec{y}.\vec{z}=1$ then find x,y,z in terms of $\vec{a},\ \vec{b}$ and γ.

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82. Vectors $\vec{x},\vec{y},\vec{z}$ each of magnitude $\sqrt{2}$ make angles of 60^0 with each other. If $\vec{x}\times\left(\vec{y}\times\vec{z}\right)=\vec{a},\vec{y}\times\left(\vec{z}\times\vec{x}\right)=\vec{b}$ and $\vec{x}\times\vec{y}=\vec{c}$. Find $\vec{x},\vec{y},\vec{z}$ in terms of $\vec{a},\vec{b},\vec{c}$.

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83. Let $\vec{u}, \vec{v}$ and $\vec{w}$ be three unit vectors such that $\vec{u}+\vec{v}+\vec{w}=\vec{a}, \vec{u}\times\left(\vec{v}\times\vec{w}\right)=\vec{b}, \left(\vec{u}\times\vec{v}\right)\times\vec{w}=\vec{c}, \vec{a}.\vec{u}=$

Vector $\vec{u}$ is

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84. Solve the following simultaneous equation for vectors $\vec{x}$ and $\vec{y}$, if $\vec{x}+\vec{y}=\vec{a}, \vec{x}\times\vec{y}=\vec{b}, \vec{x}.\vec{a}=1$

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85. Find the scaslars α and β if $\vec{a}\times\left(\vec{b}\times\vec{c}\right)+\left(\vec{a}.\vec{b}\right)\vec{b}=\left(\vec{4}-2\beta-\sin\alpha\right)\vec{b}+\left(\beta^2-1\right)\vec{c}$ and

where $\vec{b}$ and $\vec{c}$ are non collinear and α, β are scalars

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86. Find the set of vector reciprocal to the set off vectors $2\hat{i}+3\hat{j}-\hat{k}, \hat{i}-\hat{j}-2\hat{k}, -\hat{i}+2\hat{j}+2\hat{k}.$

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87. Prove that: $\left(\vec{a}\times\vec{b}\right)\times\left(\vec{c}\times\vec{d}\right)+\left(\vec{a}\times\vec{c}\right)\times\left(\vec{d}\times\vec{b}\right)+\left(\vec{a}\times\vec{d}\right)\times\left(\vec{b}\right.$

= $-2\left[\vec{b}\,\vec{c}\,\vec{d}\right]\vec{a}$

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88. For any four vectors prove that

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

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89. Find vector $\vec{r}$ if $\vec{r}.\vec{a}=m$ and $\vec{r}\times\vec{b}=\vec{c}$, where $\vec{a}.\vec{b}\neq0$

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90. Find $\vec{r}$ such that $t\vec{r}+\vec{r}+\vec{a}=\vec{b}$.

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91. Solve $r \times b = a$, where a and b are given vectors such that $a \cdot b = 0$.

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92. Solve $a \cdot r = x, b \cdot r = y, c \cdot r = z$, where a,b,c are givenn non-coplanar vectors.

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93. Vectors $\vec{A}$ and $\vec{B}$ satisfying the vector equation $\vec{A}+\vec{B}=\vec{a}, \vec{A}\times\vec{B}=\vec{b}$ and $\vec{A}.\vec{a}=1$. where veca and $\vec{b}$ are given vectosrs, are

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94. Sholve the simultasneous vector equations for $\overrightarrow{x}$ and $\overrightarrow{y}$: $\overrightarrow{x} + \overrightarrow{c} \times \overrightarrow{y} = \overrightarrow{a}$ and $\overrightarrow{y} + \overrightarrow{c} \times \overrightarrow{x} = \overrightarrow{b}, \overrightarrow{c} \neq 0$

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95. Solved $\lambda \overrightarrow{r} + \left(\overrightarrow{a}.\overrightarrow{r}\right)\overrightarrow{b} = \overrightarrow{c}, \lambda \neq 0$

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96. $\overrightarrow{u}$ and $\overrightarrow{n}$ are unit vectors and t is a scalar. If $\overrightarrow{n}.\overrightarrow{a} \neq 0$ solve the equation $\overrightarrow{r} \times \overrightarrow{a} = \overrightarrow{u}, \overrightarrow{r}.\overrightarrow{n} = t$

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97. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{a}.\vec{b}=0$ and $\vec{a}+\vec{b}=\vec{c}$ then:

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98. Let $\vec{a}.\vec{b}=0$ where $\vec{a}$ and $\vec{b}$ are unit vectors and the vector $\vec{c}$ is inclined an anlge θ to both $\vec{a}$ and $\vec{b}.If\vec{c}=m\vec{a}+n\vec{b}+p\left(\vec{a}\times\vec{b}\right), (m, n, p \in R)$ then

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99. The edges of parallelopiped are of unit length and are parallel to non-coplanar unit vectors $\widehat{a}, \hat{b}, \hat{c}$ such that $\widehat{a}.\vec{b}=\vec{b}.\vec{c}\vec{c}.\vec{a}=\frac{1}{2}$ then find volume of parallelopiped.

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100. The number of distinct real values of α, for which the vectors $-\lambda^2\hat{i}+\hat{j}+\hat{k}$, $\hat{i}-\lambda^2\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}-\lambda^2\hat{k}$ are coplanar is

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101. Let two non-collinear unit vectors $\vec{a}$ and $\vec{b}$ form an acute angle. A point P moves so that at any time t, time position vector, $\overrightarrow{OP}$ (where O is the origin) is given by $\widehat{a}\cot t+\hat{b}\sin t$. When p is farthest fro origing o, let M be the length of $\overrightarrow{OP}$ and $\widehat{u}$ be the unit vector along $\overrightarrow{OP}$ .then

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102. Let a, b, c be unit vectors such that a+b+c=0. Which one of the following is correct?

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103. Let $\overrightarrow{a} = \hat{i} + 2\hat{j} + \hat{k}, \overrightarrow{b} = \hat{i} - \hat{j} + \hat{k}$ and $\overrightarrow{c} = \hat{\hat{j}} - \hat{k}$ A vector in the plane of $\overrightarrow{a}$ and $\overrightarrow{b}$ whose projections on $\overrightarrow{c} is 1/\sqrt{3}$ is

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104. If $\alpha + \beta + \gamma = 2$ and $\overrightarrow{a} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}, \hat{k} \times \left(\hat{k} \times \overrightarrow{a}\right) = \overrightarrow{0}$,then γ= (A) 1 (B) -1 (C) 2 (D) none of these

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105. The non-zero vectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ are related by $\overrightarrow{a} = 8\overrightarrow{b}$ and $\overrightarrow{c} = -7\overrightarrow{b}$ angle between $\overrightarrow{a}$ and $\overrightarrow{c}$ is

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106. The vector $\overrightarrow{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of the vectors $\overrightarrow{b} = \hat{\text{i}} + \hat{j}$ and $\overrightarrow{c} = \hat{j} + \hat{k}$ and bisects the angle between $\overrightarrow{b}$ and $\overrightarrow{c}$.

Then which one of the following gives possible values of $\alpha \text{and} \beta$? (1) $\alpha = 2, \beta = 2$ (2) $\alpha = 1, \beta = 2$ (3) $\alpha = 2, \beta = 1$ (4) $\alpha = 1, \beta = 1$

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107. If $\vec{a}, \vec{b}, and \leftrightarrow c$ are three unit vecrtors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{1}{1}\vec{b}, then\left(\vec{b}\, and\, \vec{c}\right.$ being non-parallel) angle between $\vec{a}\, and\, \vec{b}$ is$\pi/3$ b.$a n g l e b e t w e e n \vec{a}\, and\, \vec{c}\, i s \pi/3$ c. a. angle between $\vec{a}\, and\, \vec{b}$ is$\pi/2$ d. a. angle between $\vec{a}\, and\, \vec{c}$ is$\pi/2$

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108. The equation $\vec{r}^2 - 2\vec{r}.\vec{c} + h = 0, \left|\vec{c}\right| > \sqrt{h}$ represents

(A) circle

(B) ellipse

(C) cone

(D) sphere

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109. $\overrightarrow{a}=\hat{i}-\hat{j}+\hat{k}$ and $\overrightarrow{b}=2\hat{i}+4\hat{i}+3\hat{k}$ are one of the sides and medians respectively of a triangle through the same vertex, then area of the triangle is (A) $\frac{1}{2}\sqrt{83}$ (B) $\sqrt{83}$ (C) $\frac{1}{2}\sqrt{85}$ (D) $\sqrt{86}$

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110. The values of a for which the points A,B,C with position vectors $2\hat{i}+\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $a\hat{i}-3\hat{j}+\hat{k}$ respectively are the vertices of a righat angled triangle at C are (A) 2 and 1 (B) -2 and -1 (C) -2 and 1 (D) 2 and -1

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111. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are unit vectors, then $\left|\overrightarrow{a}-\overrightarrow{b}\right|^2+\left|\overrightarrow{b}-\overrightarrow{c}\right|^2+\left|\overrightarrow{c}-\overrightarrow{a}\right|^2$ does not exceed $(A)4(B)9(C)8(D)6$

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112. If $\vec{u}, \vec{v}, \vec{w}$ are noncoplanar vectors and p, q are real numbers, then the equality $\left[3\vec{u}, p\vec{v}, p\vec{w}\right] - \left[p\vec{v}, \vec{w}, q\vec{u}\right] - \left[2\vec{w}, q\vec{v}, q\vec{u}\right] = 0$ holds for (1) exactly one value of (p, q) (2) exactly two values of (p, q) (3) more than two but not all values of (p, q) (4) all values of (p, q)

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113. The projections of a vector on the three coordinate axis are 6, 3 , 2 respectively. The direction cosines of the vector are (1) $6, -3, 2$ (2) $\frac{6}{5}, \frac{-3}{5}, \frac{2}{5}$ (3) $\frac{6}{7}, \frac{-3}{7}, \frac{2}{7}$ (4) $\frac{-6}{7}, \frac{-3}{7}, \frac{2}{7}$

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114. If $\vec{a}, \vec{c}, \vec{c}$ and $\vec{d}$ are unit vectors such that $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right) = 1$ and $\vec{a}.\vec{b} = \frac{1}{2}$ then

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115. Let $P(3, 2, 6)$ be a point in space and Q be a point on line $\vec{r} = \left(\hat{i} - \hat{j} + 2\hat{k}\right) + \mu\left(-3\hat{i} + \hat{j} + 5\hat{k}\right)$. Then the value of μ for which the vector $\overrightarrow{PQ}$ is parallel to the plane $x - 4y + 3z = 1$ is

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116. If θ is the angle between unit vectors $\vec{a}$ and $\vec{b}$ then $\sin\left(\frac{\theta}{2}\right)$ is (A) $\frac{1}{2}\left|\vec{a} - \vec{b}\right|$ (B) $\frac{1}{2}\left|\vec{a} + \vec{b}\right|$ (C) $\frac{1}{2}\left|\vec{a} \times \vec{b}\right|$ (D) $\frac{1}{\sqrt{2}}\sqrt{1 - \vec{a}.\vec{b}}$

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117. Let $\vec{u}, \vec{v}, \vec{w}$ be three unit vectors such that $\vec{u} + \vec{v} + \vec{w} = \vec{a}, \vec{a}.\vec{u} = \frac{3}{2}, \vec{a}.\vec{v} = \frac{7}{4}\left|\vec{a}\right| = 2,$ then (A) $\vec{u}.\vec{v} = \frac{3}{2}$ (B) $\vec{u}.\vec{w} = 0$ (C) $\vec{u}.\vec{w} = -\frac{1}{4}$ (D) none of these

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118. Let $\overrightarrow{A}$ be a vector parallel to the line of intersection of the planes P_1 and P_2. The plane P_1 is parallel to vectors $2\hat{j} + 3\hat{k}$ and $4\hat{j} - 3\hat{k}$ while plane P_2 is parallel to the vectors $\hat{j} - \hat{k}$ and $\hat{i} + \hat{j}$. The acute angle between $\overrightarrow{A}$ and $2\hat{i} + \hat{j} - 2\hat{k}$ is

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119. Assertion: $\overrightarrow{PQ} \times \left(\overrightarrow{RS} + \overrightarrow{ST}\right) \neq 0$, Reason : $\overrightarrow{PQ} \times \overrightarrow{RS} = \overrightarrow{0}$ and $\overrightarrow{PQ} \times \overrightarrow{ST} \neq \overrightarrow{0}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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120. Consider $\triangle ABC$. Let I bet he incentre and a,b,c be the sides of the triangle opposite to angles A,B,C respectively. Let O be any point in the plane of $\triangle ABC$ within the triangle. AO,BO and CO meet the sides BC, CA and AB in D,E and F respectively. $a\overrightarrow{IA} = b\overrightarrow{IB} + c\overrightarrow{IC} =$ (A) $-1(B)0(C)1(D)3$

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121. Consider $\triangle ABC$ Let I be the incentre and a,b c be the sides of the triangle opposite to the angle A,B,C respectively. Let O be any point in the plane of $\triangle ABC$ within the triangle . AO ,BO ,CO meet the sides BC, CA and AB in D, E and F respectively then $\dfrac{OD}{AD} + \dfrac{OE}{BE} + \dfrac{OF}{CF} =$

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122. Consider $\triangle ABC$. Let I bet he incentre and a,b,c be the sides of the triangle opposite to angles A,B,C respectively. Let O be any point in the plane of $\triangle ABC$ within the triangle. AO,BO and CO meet the sides BC, CA and AB in D,E and F respectively. If $3\overrightarrow{BD} = 2\overrightarrow{DC}$ and $4\overrightarrow{CE} = \overrightarrow{EA}$ then the ratio in which divides $\overrightarrow{AB}$ is(A)3:4(B)3:2(C)4:1(D)6:1`

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Exercise

1. If $\lambda\vec{a} + \mu\vec{b} + \gamma\vec{c} = 0, where\,\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular and λ, μ, γ are scalars prove that $\lambda = \mu = \gamma = 0$

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2. A,B,C and d are any four points prove that $\overrightarrow{AB}.\overrightarrow{CD} + \overrightarrow{BC}.\overrightarrow{AD} + \overrightarrow{CA}.\overrightarrow{BD} = 0$

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3. Find the equation of the plane through the point $2\vec{i} + 3\vec{j} - \vec{k}$ and perpendicular to the vector $3\vec{i} - 4\vec{j} + 7\vec{k}$.

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4. Find the equation of the plane through the $2\vec{i}+3\vec{j}-\vec{k}$ and perpendicular to the vector $3\vec{i}+2\vec{j}-2\vec{k}$. Determine the perpendicular distance of this plane from the origin.

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5. If the position vectors of the point A and B are $3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-2\hat{j}-4\hat{k}$ respectively. Then the eqaution of the plane through B and perpendicular to AB is

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6. Find the cosine of the angle between the planes $\vec{r}.\left(2\vec{i}-3\vec{j}-6\vec{k}\right)=7$ and $\vec{r}.\left(6\vec{i}+2\vec{j}-9\vec{k}\right)=5$

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7. Let A, B, C represent the vertices of a triangle, where A is the origin and B and C have position b and c respectively.* Points M, N and P are taken on sides AB, BC and CA respectively, such that $\frac{AM}{AB} = \frac{BN}{BC} = \frac{CP}{CA} = \alpha$. If $\triangle$ represent the area enclosed by the three vectors AN, BP and CM, then the value of α, for which $\triangle$ is least

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8. If $\vec{a}, \vec{b}$ and $\vec{c}$ are the position vectors of the vertices A,B and C. respectively of $\triangle ABC$. Prove that the perpendicualar distance of the vertex A from the base BC of the triangle ABC is

$$\frac{\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|}{\left|\vec{c} - \vec{b}\right|}$$

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9. Show that the perpendicular distance of any point $\vec{a}$ from the line $\vec{r} = \vec{b} + t\vec{c} is \left(\mid \left(\vec{b} - \vec{a} \right) \times \vec{c} \right) \frac{\mid}{\left| \vec{c} \right|}$

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10. Prove that the shortest distance between two lines AB and CD is $\frac{\left| \left(\vec{c} - \vec{a} \right) . \left(\vec{b} - \vec{a} \right) \times \left(\vec{d} - \vec{c} \right) \right|}{\left| \left(\vec{b} - \vec{a} \right) \times \overrightarrow{d - c} \right|}$ where $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are the position vectors of points A,B,C,D respectively.

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11. If PQRS is a quadrilteral such that $\overrightarrow{PQ} = \vec{a}, \overrightarrow{PS} = \vec{b}$ and $\overrightarrow{PR} = x\vec{a} + y\vec{b}$ show that the area of the quadrilateral PQRS is $\frac{1}{2} \mid \left(xy \mid \left| \vec{a} \times \vec{b} \right| \right.$

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12. A rigid body is rotating at 5 radians per second about an axis AB where A and B are the pont $2\vec{i}+\vec{j}+\vec{k}$ and $8\vec{i}-2\vec{j}+3\vec{k}$ respectively. Find the veclocity of the parcticle P of the body at the points $5\vec{i}-\vec{j}+\vec{k}$.

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13. If $\vec{a}=\vec{i}-2\vec{j}+\vec{k}, \vec{b}=\vec{i}+\vec{j}+\vec{k}$ and $\vec{c}=\vec{i}+2\vec{j}+\vec{k}$ then show that $\vec{a}.\left(\vec{b}\times\vec{c}\right)=\left(\vec{a}\times\vec{b}\right).\vec{c}$.

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14. If $\vec{a}=-\vec{2i}-\vec{2j}+\vec{4k}, \vec{b}=-\vec{2i}+\vec{4j}-\vec{2k}$ and $\vec{c}=\vec{4i}-\vec{2j}-\vec{2k}$

Calculate the value of $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ and interpret the result.

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15. Find the volume of the parallelopiped whose thre coterminus edges asre represented by $\overrightarrow{2i} + \overrightarrow{3j} + \overrightarrow{k}, \overrightarrow{i} - \overrightarrow{j} + \overrightarrow{k}, \overrightarrow{2i} + \overrightarrow{j} - \overrightarrow{k}$.

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16. Find the volume of the parallelopiped, whose three coterminous edges are represented by the vectors $\hat{i} + \hat{j} + \hat{k}, \hat{i} - \hat{j} + \hat{k}, \hat{i} + 2\hat{j} - \hat{k}$.

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17. Find the value of the constant λ so that vectors $\overrightarrow{a} = \overrightarrow{2i} - \overrightarrow{j} + \overrightarrow{k}, \overrightarrow{b} = \overrightarrow{i} + \overrightarrow{2j} - \overrightarrow{3j}$, and $\overrightarrow{c} = \overrightarrow{3i} + \overrightarrow{\lambda j} + \overrightarrow{5k}$ are coplanar.

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18. Show that: $\left(\overrightarrow{a} + \overrightarrow{b}\right). \left\{\left(\overrightarrow{b} + \overrightarrow{c}\right) \times \left(\overrightarrow{c} + \overrightarrow{a}\right) \mid = 2\left\{\overrightarrow{a}. \left(\overrightarrow{b} \times \overrightarrow{c}\right)\right\}\right.$

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19. Show that the plane through the points $\vec{a}, \vec{b}, \vec{c}$ has the equation $\left[\vec{r}\,\vec{b}\,\vec{c}\right]+\left[\vec{r}\,\vec{c}\,\vec{a}\right]+\left[\vec{r}\,\vec{a}\,\vec{b}\right]=\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

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20. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then show that $\vec{a}\times\vec{b}, \vec{b}\times\vec{c}$ and $\vec{c}\times\vec{a}$ are also coplanar.

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21. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then show that $\vec{a}\times\vec{b}, \vec{b}\times\vec{c}$ and $\vec{c}\times\vec{a}$ are also coplanar.

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22. If $\vec{A} = \dfrac{\vec{b} \times \vec{c}}{\left[\vec{b}\,\vec{c}\,\vec{a}\right]}, \vec{B} = \dfrac{\vec{c} \times \vec{a}}{\left[\vec{c}\,\vec{a}\,\vec{b}\right]}, \vec{C} = \dfrac{\vec{a} \times \vec{b}}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}$ find $\left[\vec{A}\,\vec{B}\,\vec{C}\right]$

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23. If the three vectors $\vec{a}, \vec{b}, \vec{c}$ are non coplanar express each of $\vec{b} \times \vec{c}, \vec{c} \times \vec{a}, \vec{a} \times \vec{b}$ in terms of $\vec{a}, \vec{b}, \vec{c}$.

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24. If the three vectors $\overrightarrow{,}\ \vec{b}, \vec{c}$ are non coplanar express $\overrightarrow{,}\ \vec{b}, \vec{c}$ each in terms of the vectors $\vec{b} \times \vec{c}, \vec{c} \times \vec{a}, \vec{a} \times \vec{b}$

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25. Prove that $\left[\vec{l}\,\vec{m}\,\vec{n}\right]\left[\vec{a}\,\vec{b}\,\vec{c}\right] = \begin{vmatrix} \vec{l}.\vec{a} & \vec{l}.\vec{b} & \vec{l}.\vec{c} \\ \vec{m}.\vec{a} & \vec{m}.\vec{b} & \vec{m}.\vec{c} \\ \vec{n}.\vec{a} & \vec{n}.\vec{b} & \vec{n}.\vec{c} \end{vmatrix}$

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26. If $\vec{a} = a_1 \vec{l} + a_2 \vec{m} + a_3 \vec{n}, \vec{b} = b_1 \vec{l} + b_2 \vec{m} + b_3 \vec{n}$ and $\vec{c} = c_1 \vec{l} + v_2 \vec{m}$

are three non coplnar vectors then show that

$$\left[\vec{a}\vec{b}\vec{c}\right] = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix} \left[\vec{l}\vec{m}\vec{n}\right]$$

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27. Let k be the length of any edge of a regular tetrahedron (a tetrahedron whose edges are equal in length is called a regular tetrahedron). Show that the angle between any edge and a face not containing the egge is $\cos^{-1}(1/\sqrt{3})$

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28. If a, b, c be the pth, qth and rth terms respectively of a HP, show that the points (bc, p), (ca, q) and (ab, r) are collinear.

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29. Prove that

$$\begin{vmatrix} \cos(A-P) & \cos(A-Q) & \cos(A-R) \\ \cos(B-P) & \cos(B-Q) & \cos(B-R) \\ \cos(C-P) & \cos(C-Q) & \cos(C-R) \end{vmatrix} = 0.$$

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30. Prove that for any nonzero scalar a the vectors $a\vec{i}+2a\vec{j}-3a\vec{k}$, $(2a+1)\vec{i}+(2a+3)\vec{j}+(a+1)\vec{k}$ and $(3a+5)\vec{i}$

are non coplanar

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31. If vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar, show that
$$\begin{vmatrix} \vec{a} & \vec{b} & \vec{c} \\ \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \end{vmatrix} = \vec{0}$$

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32. Show that the points whose position vectors are $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ will be coplanar if $\left[\vec{a}\vec{b}\vec{c}\right] - \left[\vec{a}\vec{b}\vec{d}\right] + \left[\vec{a}\vec{c}\vec{d}\right] - \left[\vec{b}\vec{c}\vec{d}\right] = 0$

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33. Prove that $\vec{i} \times \left(\vec{j} \times \vec{k}\right) = \vec{0}$

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34. Find the value of
$\left(\vec{i} - 2j + \vec{k}\right) \times \left[\left(2\vec{i} + \vec{j} + \vec{k}\right) \times \left(\vec{i} + 2\vec{j} - \vec{k}\right)\right]$

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35. If $\vec{A} = 2\vec{i} + \vec{j} - 3\vec{k}\vec{B} = \vec{i} - 2\vec{j} + \vec{k}$ and $\vec{C} = -\vec{i} + \vec{j} - \vec{4}k$ find $\vec{A} \times \left(\vec{B} \times \vec{C}\right)$

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36. Prove that $\left(\vec{b} \times \vec{c}\right) \times \left(\vec{c} \times \vec{a}\right) = \left[\vec{a}\vec{b}\vec{c}\right]\vec{c}$

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37. Prove that $\left(\vec{b} \times \vec{c}\right) \times \left(\vec{c} \times \vec{a}\right) = \left[\vec{a}\vec{b}\vec{c}\right]\vec{c}$

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38. Prove that: $\left[\left(\vec{a} \times \vec{b}\right) \times \left(\vec{a} \times \vec{c}\right)\right].\vec{d} = \left[\vec{a}\vec{b}\vec{c}\right]\left(\vec{a}.\vec{d}\right)$

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39. If $\overrightarrow{a}=\overrightarrow{i}+\overrightarrow{2j}-\overrightarrow{k}, \overrightarrow{b}=\overrightarrow{2i}+\overrightarrow{j}+\overrightarrow{3k}, \overrightarrow{c}=\overrightarrow{i}-\overrightarrow{j}+\overrightarrow{k} \text{ and } \overrightarrow{d}=\overrightarrow{3i}$

then evaluate $\left(\overrightarrow{a}\times\overrightarrow{b}\right).\left(\overrightarrow{c}\times\overrightarrow{d}\right)$

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40. If $\overrightarrow{a}=\overrightarrow{i}+\overrightarrow{2j}-\overrightarrow{k}, \overrightarrow{b}=\overrightarrow{2i}+\overrightarrow{j}+\overrightarrow{3k}, \overrightarrow{c}=\overrightarrow{i}-\overrightarrow{j}+\overrightarrow{k} \text{ and } \overrightarrow{d}=\overrightarrow{3i}$

then evaluate $\left(\overrightarrow{a}\times\overrightarrow{b}\right)\times\left(\overrightarrow{c}\times\overrightarrow{d}\right)$

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41. Prove that

$\overrightarrow{a}\times\left\{\overrightarrow{b}\times\left(\overrightarrow{c}\times\overrightarrow{d}\right)\right\}=\left(\overrightarrow{b}.\overrightarrow{d}\right)\left(\overrightarrow{a}\times\overrightarrow{c}\right)-\left(\overrightarrow{b}.\overrightarrow{c}\right)\left(\overrightarrow{a}\times\overrightarrow{d}\right)$

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42. Prove that: $\vec{a} \times \left[\vec{b} \times \left(\vec{c} \times \vec{a}\right)\right] = \left(\vec{a}.\vec{b}\right)\left(\vec{a} \times \vec{c}\right)$

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43. If the vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are coplanar show that $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \vec{0}$

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44. Show that the components of $\vec{b}$ parallel to $\vec{a}$ and perpendicular to it are $\frac{\left(\vec{a}.\vec{b}\right)\vec{a}}{\vec{a}^2}$ and $\left(\left(\vec{a} \times \vec{b}\right)\vec{a}\right)\frac{)}{a^2}$ respectively.

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45. If $\vec{a}$ and $\vec{b}$ be two non collinear vectors such that $\vec{a} = \vec{c} + \vec{d}$, where $\vec{c}$ is parallel to $\vec{b}$ and $\vec{d}$ is perpendicular to $\vec{b}$ obtain expression for $\vec{c}$ and $\vec{d}$ in terms of $\vec{a}$ and $\vec{b}$ as: $\vec{d} = \vec{a} - \frac{\left(\vec{a}\,.\,\vec{b}\right)\vec{b}}{b^2}, \vec{c} = \frac{\left(\vec{a}\,.\,\vec{b}\right)\vec{b}}{b^2}$

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46. If $\vec{a}, \vec{b}, \vec{c}$ and $\vec{a}', \vec{b}', \vec{c}'$ are reciprocal system of vectors prove that $\vec{a} \times \vec{a}' + \vec{b} \times \vec{b}' + \vec{c} \times \vec{c}' = \vec{0}$

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47. If $\vec{a}, \vec{b}, \vec{c}$ and $\vec{a}', \vec{b}', \vec{c}'$ are reciprocal system of vectors, then prove that $\vec{a}' \times \vec{b}' \times \vec{b}, \times \vec{c}' + \vec{c}' \times \vec{a}' = \frac{\vec{a} + \vec{b} + \vec{c}}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}$

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48. Prove that $\vec{a}'.\left(\vec{b}+\vec{c}\right)+\vec{b}'.\left(\vec{c}+\vec{a}\right)+\vec{c}'.\left(\vec{a}+\vec{b}\right)=0$

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49. The condition for equations $\vec{r}\times\vec{a}=\vec{b}$ and $\vec{r}\times\vec{c}=\vec{d}$ to be consistent is

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50. Solve $a\cdot r=x, b\cdot r=y, c\cdot r=z,$ where a,b,c are givenn non-coplanar vectors.

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51. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors each of magnitude 3 then $\left|\vec{a}+\vec{b}+\vec{}\right|$ is equal (A) 3 (B) 9 (C) $3\sqrt{3}$ (D) none of these

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52. Let the vectors $\vec{a}, \vec{b}, \vec{c}$ be the position vectors of the vertices P,Q,R respectively of a triangle. Which of the following represents the area of the triangle? (A) $\frac{1}{2}\left|\vec{a} \times \vec{b}\right|$ (B) $\frac{1}{2}\left|\vec{b} \times \vec{c}\right|$ (C) $\frac{1}{2}\left|\vec{c} \times \vec{a}\right|$ (D) $\frac{1}{2}\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|$

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53. If the vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - \widehat{3k}$ and $\vec{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar the value of λ is (A) -1 (B) 3 (C) -4 (D) $-\frac{1}{4}$

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54. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three units vectors such that $3\vec{a} + 4\vec{b} + 5\vec{c} = 0$. Then which of the following statements is true ?

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55. If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0, then \vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$ is equal to (A) -1 (B) 3 (C) 0 (D) $-\frac{3}{2}$

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56. If vector $\vec{a}$ lies in the plane of vectors $\vec{b}$ and $\vec{c}$ which of the following is correct? (A) $\vec{a} . \left(\vec{b} \times \vec{c}\right) = -1$ (B) $\vec{a} . \left(\vec{b} \times \vec{c}\right) = 0$ (C) $\vec{a} . \left(\vec{b} \times \vec{c}\right) = 1$ (D) $\vec{a} . \left(\vec{b} \times \vec{c}\right) = 2$

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57. The value of λ so that unit vectors $\frac{2\hat{i} + \lambda\hat{j} + \hat{k}}{\sqrt{5 + \lambda^2}}$ and $\frac{\hat{i} - 2\hat{j} + 3\hat{k}}{\sqrt{14}}$ are orthogonl (A) $\frac{3}{7}$ (B) $\frac{5}{2}$ (C) $\frac{2}{5}$ (D) $\frac{2}{7}$

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58. The vector $\left(\vec{a}-\vec{b}\right)\times\left(\vec{a}+\vec{b}\right)$ is equal to (A) $\frac{1}{2}\left(\vec{a}\times\vec{b}\right)$ (B) $\vec{a}\times\vec{b}$ (C) $2\left(\vec{a}+\vec{b}\right)$ (D) $2\left(\vec{a}\times\vec{b}\right)$

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59. For two vectors $\vec{a}$ and $\vec{b}$, $\vec{a}, \vec{b} = \left|\vec{a}\right|\left|\vec{b}\right|$ then (A) $\vec{a} \mid \mid \vec{b}$ (B) $\vec{a} \perp \vec{b}$ (C) $\vec{a} = \vec{b}$ (D) none of these

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60. A unit vector in the xy-plane that makes an angle of $\frac{\pi}{4}$ with the vector $\hat{i}+\hat{j}$ and an angle of 'pi/3' with the vector $3\hat{i}-4\hat{j}$ is

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61. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three mutually perpendicular vectors, then the vector which is equally inclined to these vectors is

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

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63. If the sides of an angle are given by vectors $\vec{a}=\hat{i}-2\hat{j}+2\hat{k}$ and $\vec{b}=2\hat{i}+\hat{j}+2\hat{k}$, then find the internal bisector of the angle.

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64. Let ABC be a triangle, the position vectors of whose vertices are respectively $\hat{i}+2\hat{j}+4\hat{k}, -2\hat{i}+2\hat{j}+\hat{k}$ and $2\hat{i}+4\hat{j}-3\hat{k}$. Then ΔABC is

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65. $P(1, 0, -1), Q(2, 0, -3), R(-1, 2, 0)$ and $S(3, -2, -1)$ are four points and d is the projection of $\overrightarrow{PQ on RS}$ then which of the following is (are) true? (A) $d = \frac{6}{\sqrt{165}}$ (B) $d = \frac{6}{\sqrt{33}}$ (C) $\frac{8}{\sqrt{33}}$ (D) $d = \frac{6}{\sqrt{5}}$

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66. If the angle between unit vectors $\vec{a}$ and $\vec{b}$ is 60°. Then find the value of $\left|\vec{a} - \vec{b}\right|$.

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67. The vector (s) equally inclined to the vectors $\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + \hat{j} - \hat{k}$ in the plane containing them is (are_ (A) $\frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$ (B) $\hat{i}$ (C) $\hat{i} + \hat{k}$ (D) $\hat{i} - \hat{k}$

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68. If $\vec{a}.\vec{b}=\beta$ and $\vec{a}\times\vec{b}=\vec{c}$, then $\vec{b}$ is

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69. If $\vec{a}, \vec{b}, \vec{c}$ are unity vectors such that $\vec{d}=\lambda\vec{a}+\mu\vec{b}+\gamma\vec{c}$ then λ is equal to (A) $\frac{\left[\vec{a}\vec{b}\vec{c}\right]}{\left[\vec{b}\vec{a}\vec{c}\right]}$ (B) $\frac{\left[\vec{b}\vec{c}\vec{d}\right]}{\left[\vec{b}\vec{c}\vec{a}\right]}$ (C) $\frac{\left[\vec{b}\vec{d}\vec{c}\right]}{\left[\vec{a}\vec{b}\vec{c}\right]}$ (D) $\frac{\left[\vec{c}\vec{b}\vec{d}\right]}{\left[\vec{a}\vec{b}\vec{c}\right]}$

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70. If $\left|\vec{a}+\vec{b}\right|<\left|\vec{a}-\vec{b}\right|$, then the angle between $\vec{a}$ and $\vec{b}$ can lie in the interval

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71. If $a\left(\vec{\alpha}\times\vec{\beta}\right)\times\left(\vec{\beta}\times\vec{\gamma}\right)+c\left(\vec{\gamma}\times\vec{\alpha}\right)=0$ and at leasy one of a,b and c is non-zerp , then vector $\vec{\alpha}, \vec{\beta}$ and γ are

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72. If $\vec{a}, \vec{b}$ and $\vec{c}$ are , mutually perpendicular vcetors and $\vec{a} = \alpha\left(\vec{a} \times \vec{b}\right) + \beta\left(\vec{b} \times \vec{c}\right) + \gamma\left(\vec{c} \times \vec{a}\right)$ and $\left[\vec{a}\,\vec{b}\,\vec{c}\right] = 1$, then find the value of $\alpha + \beta + \gamma$

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73. If the vectors $a\hat{i} + b\hat{j} + c\hat{k}, b\hat{i} + c\hat{j} + a\hat{k}$ and $c\hat{i} + a\hat{j} + b\hat{k}$ are coplanar and a,b,c are distinct then (A) $a^3 + b^3 + c^3 = 1$ (B) $a + b + c = 1$ (C) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 1$ (D) a+b+c=0`

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74. Given three vectors $\vec{a} = 6\hat{i} - 3\hat{j}, \vec{b} = 2\hat{i} - 6\hat{j}$ and $\vec{c} = -2\hat{i} + 21\hat{j}$ such that $\vec{\alpha} = \vec{a} + \vec{b} + \vec{c}$. Then the resolution of te vector $\vec{\alpha}$ into components with respect to $\vec{a}$ and $\vec{b}$ is given by (A) $3\vec{a}-2\vec{b}$ (B) $2\vec{a}-3\vec{b}$ (C) $3\vec{b}-2\vec{a}$ (D) none of these

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75. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that veca is perpendicular to $\vec{b}$ and $\vec{c}$ and $\left|\vec{a}+\vec{b}+\vec{c}\right|=1$ then the angle between $\vec{b}$ and $\vec{c}$ is (A) $\frac{\pi}{2}(B)$pi(C)0(D)(2pi)/3`

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76. If $\vec{a}=(3,1)$ and $\vec{b}=(1,2)$ represent the sides of a parallelogram then the angle θ between the diagonals of the paralelogram is given by (A) $\theta=\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$ (B) $\theta=\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ (C) $\theta=\cos^{-1}\left(\frac{1}{2\sqrt{5}}\right)$ (D) $\theta=\frac{\pi}{2}$

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77. If vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are two adjecent sides of a paralleogram, then the vector representing the altitude of the parallelogram which is perpendicular to $\overrightarrow{a}$ is

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78. 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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79. Let $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ be three non- coplanar vectors and $\overrightarrow{r}$ be any arbitrary vector. Then $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{r} \times \overrightarrow{c}\right) + \left(\overrightarrow{b} \times \overrightarrow{c}\right) \times \left(\overrightarrow{r} \times \overrightarrow{a}\right) + \left(\overrightarrow{c} \times \overrightarrow{a}\right)\left(\overrightarrow{r} \times$

is always equal to

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80. If $\vec{u}, \vec{v}$ and $\vec{w}$ are vectors such that $\vec{u}+\vec{v}+\vec{w}=\vec{0}$ then $\left[\vec{u}+\vec{v}\vec{v}+\vec{w}\vec{w}+\vec{u}\right])=$ (A) 1 (B) $\left[\vec{u}\,\vec{v}\,\vec{w}\right]$ (C) 0 (D) -1

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81. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three mutually perpendicular unit vectors then $\left(\vec{r}.\vec{a}\right)\vec{a}+\left(\vec{r}.\vec{b}\right)\vec{b}+\left(\vec{r}.\vec{c}\right)\vec{c}=$ (A) $\dfrac{\left[\vec{a}\,\vec{b}\,\vec{c}\right]\vec{r}}{2}$ (B) $\vec{r}$ (C) $2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ (D) none of these

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82. If $\vec{a}$ and $\vec{b}$ be any two mutually perpendiculr vectors and $\vec{\alpha}$ be any vector then

$\left|\vec{a}\times\vec{b}\right|^2\dfrac{\left(\vec{a}.\vec{\alpha}\right)\vec{a}}{\left|\vec{a}\right|^2}+\left|\vec{a}\times\vec{b}\right|^2\dfrac{\left(\vec{b}.\vec{\alpha}\right)\vec{b}}{\left|\vec{b}\right|^2}-\left|\vec{a}\times\vec{b}\right|^2\vec{\alpha}=$ (A) $\left|\left(\vec{a}.\vec{b}\right)\vec{\alpha}\right|\left(\vec{a}\times\vec{b}\right)$ (B) $\left[\vec{a}\,\vec{b}\,\vec{\alpha}\right]\left(\vec{b}\times\vec{a}\right)$ (C) $\left[\vec{a}\,\vec{b}\,\vec{\alpha}\right]\left(\vec{a}\times\vec{b}\right)$ (D) none of these

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83. If $\vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors then $\frac{\left[\vec{a} + 2\vec{b}\vec{b} + 2c\vec{c}\vec{c} + 2\vec{a}\right]}{\left[\vec{a}\vec{b}\vec{c}\right]} =$ (A) 3 (B) 9 (C) 8 (D) 6

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84. The vector $\vec{a} = \frac{1}{4}\left(2\hat{i} - 2\hat{j} + \hat{k}\right)$ (A) is a unit vector (B) makes an angle of $\frac{\pi}{3}$ with the vector $\left(\hat{i} + \frac{1}{2}\hat{j} - \hat{k}\right)$ (C) is parallel to the vector $\frac{7}{4}\hat{i} - \frac{7}{4}\hat{j} + \frac{7}{8}\hat{k}$ (D) none of these

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85. The vector $\vec{a} \times \left(\vec{b} \times \vec{c}\right)$ can be represented in the form (A) $\alpha\vec{a}$ (B) $\alpha\vec{b}$ (C) $alha\vec{c}$ (D) $\alpha\vec{b} + \beta\vec{c}$

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86. The points $A \equiv (3, 10), B \equiv (12, -5)$ and $C \equiv (\lambda, 10)$ are collinear then $\lambda =$ (A) 3 (B) 4 (C) 5 (D) none of these

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87. Two vectors $\vec{\alpha} = 3\hat{i} + 4\hat{j}$ and $\vec{\beta} = 5\hat{i} + 2\hat{j} - 14\hat{k}$ have the same initial point then their angulr bisector having magnitude $\frac{7}{3}$ be (A) $\frac{7}{3\sqrt{6}}\left(2\hat{i} + \hat{j} - \hat{k}\right)$ (B) $\frac{7}{3\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$ (C) $\frac{7}{3\sqrt{3}}\left(\hat{i} - \hat{j} + \hat{k}\right)$ (D) $\frac{7}{3\sqrt{3}}\left(\hat{i} - \hat{j} - \hat{k}\right)$

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88. If $\vec{d} = \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} + \vec{c} \times \vec{a}$ is a non- zero vector and $\left|\left(\vec{d}.\vec{c}\right)\left(\vec{a} \times \vec{b}\right) + \left(\vec{d}.\vec{a}\right)\left(\vec{b} \times \vec{c}\right) + \left(\vec{d}.\vec{b}\right)\left(\vec{c} \times \vec{a}\right) = 0\right.$ then

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89. If $\vec{a}, \vec{b}, \vec{c}$ are three coplanar unit vector such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = -\frac{\vec{b}}{2}$ then the angle betweeen $\vec{b}$ and $\vec{c}$ can be

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{6}$ (C) π (D) $\frac{2\pi}{3}$

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90. The two lines $\vec{r} = \vec{a} + \vec{\lambda}\left(\vec{b} \times \vec{c}\right)$ and $\vec{r} = \vec{b} + \mu\left(\vec{c} \times \vec{a}\right)$ intersect at a point where $\vec{\lambda}$ and μ are scalars then

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91. If $\vec{A}, \vec{B}$ and $\vec{C}$ are vectors such that $\left|\vec{B}\right| = \left|\vec{C}\right|$ prove that $\left[\left(\vec{A} + \vec{B}\right) \times \left(\vec{A} + \vec{C}\right)\right] \times \left(\vec{B} + \vec{C}\right).\left(\vec{B} + \vec{C}\right) = 0$

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92. A parallelogram is construted on $3\overrightarrow{a}+\overrightarrow{b}$ and $\overrightarrow{a}-4\overrightarrow{b}$, where $\left|\overrightarrow{a}\right|=6$ and $\left|\overrightarrow{b}\right|=8$ and $\overrightarrow{a}$ and $\overrightarrow{b}$ are anti-parallel . Then the length of the longer diagonal is

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93. If $\overrightarrow{a}$ is any vector and $\hat{i}, \hat{j}$ and $\hat{k}$ are unit vectors along the x,y and z directions then $\hat{i}\times\left(\overrightarrow{a}\times\hat{i}\right)+\hat{j}\times\left(\overrightarrow{a}\times\hat{j}\right)+\hat{k}\times\left(\overrightarrow{a}\times\overrightarrow{k}\right)=$ (A) $\overrightarrow{a}\,(B)$-veca(C)2veca(D)0

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94. if $\left(\overrightarrow{a}\times\overrightarrow{b}\right)\times\left(\overrightarrow{b}\times\overrightarrow{c}\right)=\overrightarrow{b},$ where $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ are non-zero vectors, then

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95. If $\vec{a}$ is any then $\left|\vec{a}\,.\,\hat{i}\right|^2 + \left|\vec{a}\,.\,\hat{j}\right|^2 + \left|\vec{a}\,.\,\hat{k}\right|^2 =$

(A) $\left|\vec{a}\right|^2$ (B) $\left|\vec{a}\right|$ (C) $2\left|\vec{\alpha}\right|$ (D) none of these

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96. Let $\vec{a}, \vec{b}$ and $\vec{c}$ are vectors such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4 \text{ and } \left|\vec{c}\right| = 5, \text{ and } \left(\vec{a} + \vec{b}\right)$ is perpendicular to $\vec{c}, \left(\vec{b} + \vec{c}\right)$ is perpendiculatr to $\vec{a}$ and $\left(\vec{c} + \vec{a}\right)$ is perpendicular to $\vec{b}$. Then find the value of $\left|\vec{a} + \vec{b} + \vec{c}\right|$.

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97. If $\left|\vec{a}\right| = 2 \text{ and } \left|\vec{b}\right| = 3 \text{ and } \vec{a}\,.\,\vec{b} = 0, \text{ then } \left(\vec{a} \times \left(\vec{a} \times \left(\vec{a} \times \left(\vec{a} \times\right.\right.\right.\right.$ is equal to the given diagonal is $\vec{c} = 4\hat{k} = 8\hat{k}$ then , the volume of a parallelpiped is

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98. If $\left|\vec{a}\cdot\vec{b}\right| = \sqrt{3}\left|\vec{a}\times\vec{b}\right|$ then the angle between $\vec{a}$ and $\vec{b}$ is (A) $\frac{\pi}{6}$

(B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

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99. If $\widehat{a}$ and $\hat{b}$ are two unit vectors and θ is the angle between them then vector $2\hat{b}+\widehat{a}$ is a unit vector if

(A) $\theta = \frac{\pi}{3}$ (B) $\theta = \frac{\pi}{6}$ (C) $\theta = \frac{\pi}{2}$ (D) $\theta = \pi$

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100. If $\vec{r}\cdot\vec{a} = \vec{r}\cdot\vec{b} = \vec{r}\cdot\vec{c} = \frac{1}{2}$ for some non zero vector $\vec{r}$ and $\vec{a}, \vec{b}, \vec{c}$ are non coplanar, then the area of the triangle whose vertices are $A\left(\vec{a}\right), B\left(\vec{b}\right)$ and $C\left(\vec{c}\right)$ is

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101. If $\vec{\alpha} + \vec{\beta} + \vec{\gamma} = a\vec{\delta}$ and $\vec{\beta} + \vec{\gamma} + \vec{\delta} = b\vec{\alpha}$, $\vec{\alpha}$ and $\vec{\delta}$ are non-colliner, then $\vec{\alpha} + \vec{\beta} + \vec{\gamma} + \vec{\delta}$ equals a. $a\vec{\alpha}$ b. $b\vec{\delta}$ c. 0 d. $(a+b)\vec{\gamma}$

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102. Let $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = 2\hat{i} - \hat{k}$. Then the point of intersection of the lines $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}$ and $\vec{r} \times \vec{b} = \vec{a} \times \vec{b}$ is (A) $(3, -1, 10$ (B) $(3, 1, -1)$ (C) $(-3, 1, 1)$ (D) $(-3, -1, -1)$

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103. If non-zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other, then the solution of the equation $\vec{r} \times \vec{a} = \vec{b}$ is given by

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104. if $\vec{\alpha} \mid \mid \left(\vec{\beta} \times \vec{\gamma}\right)$, then $\left(\vec{\alpha} \times \vec{\gamma}\right)$ equal to

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105. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three non coplanar vectors and $\vec{r}$ is any vector in space, then $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{r} \times \vec{c}\right) + \left(\vec{b} \times \vec{c}\right) \times \left(\vec{r} \times \vec{a}\right) + \left(\vec{c} \times \vec{a}\right) \times \left(\vec{r}\right.$

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106. 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 $p = 6q$.

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107. Let $\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = 10\vec{a} + 2\vec{b}$ and $\overrightarrow{OC} = \vec{b}$ where , O, A and C are non-collinear points. Let p denote that area of the quadrilateral OABC. And let q denote the area of the parallelogram with OA and OC as adjacent sides. If p=kq, then k= ________

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108. If $\left|\vec{c}\right| = 2, \left|\vec{a}\right| = \left|\vec{b}\right| = 1$ and $\vec{a} \times \left(\vec{a} \times \vec{c}\right) + \vec{b} = \vec{0}$ then the acute angle between $\vec{a}$ and $\vec{c}$ is (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{2\pi}{3}$

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109. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non coplanar and unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b} + \vec{c}}{\sqrt{2}}\Bigg)$ then the angle between vea and $\vec{b}$ is (A) $\frac{3\pi}{4}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π

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110. If $\vec{b}$ and $\vec{c}$ are any two mutually perpendicular unit vectors and $\vec{a}$ is any vector, then

$\left(\vec{a}.\vec{b}\right)\vec{b}+\left(\vec{a}.\vec{c}\right)\vec{c}+\frac{\vec{a}.\left(\vec{b}\times\vec{c}\right)}{\left|\vec{b}\times\vec{c}\right|^2}\left(\vec{b}\times\vec{c}\right)=$ (A) 0 (B) $\vec{a}\,(C)$veca /2(D)2veca`

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111. The equation of the line throgh the point $\vec{a}$ parallel to the plane $\vec{r}.\vec{n}$=q and perpendicular to the line $\vec{r}=\vec{b}+t\vec{c}$ is (A) $\vec{r}=\vec{a}+\lambda\left(\vec{n}\times\vec{c}\right)$ (B) $\left(\vec{r}-\vec{a}\right)\times\left(\vec{n}\times\vec{c}\right)=0$ (C) $\vec{r}=\vec{b}+\lambda\left(\vec{n}\times\vec{c}\right)$ (D) none of these

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112. $\vec{P}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{R}=\hat{j}-\hat{k}$ are given vectors then a vector $\vec{Q}$ satisfying the equation $\vec{P}\times\vec{Q}=\vec{R}$ and $\vec{P}.\vec{Q}=3$ is (A) $\left(\frac{5}{3},\frac{2}{3},\frac{1}{3}\right)$ (B) $\left(\frac{2}{3},\frac{5}{3},\frac{2}{3}\right)$ (C) $\left(\frac{5}{3},\frac{2}{3},\frac{2}{3}\right)$ (D) $\left(\frac{2}{3},\frac{2}{3},\frac{5}{3}\right)$

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113. The reflection of the point $\vec{a}$ in the plane $\vec{r}\cdot\vec{n}=q$ is

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114. The plane containing the two straight lines $\vec{r}=\vec{a}+\lambda\vec{b}$ and $\vec{r}=\vec{b}+\mu\vec{a}$ is (A) $\left[\vec{r}\,\vec{a}\,\vec{b}\right]=0$ (B) $\left[\vec{r}\,\vec{a}\,\vec{a}\times\vec{b}\right]=0$ (C) $\left[\vec{r}\,\vec{b}\,\vec{a}\times\vec{b}\right]=0$ (D) $\left[\vec{r}\,\vec{a}+\vec{b}\,\vec{a}\times\vec{b}\right]=0$

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115. Let $\vec{a}=2\hat{i}+\hat{j}+\hat{k}$, and $\vec{b}=\hat{i}+\hat{j}$ if c is a vector such that $\vec{a}\cdot\vec{c}=\left|\vec{c}\right|, \left|\vec{c}-\vec{a}\right|=2\sqrt{2}$ and the angle between $\vec{a}\times\vec{b}$ and $\vec{i}\,s30^\circ$, then $\left|\left(\vec{a}\times\vec{b}\right)\right|\times\vec{c}\,\right|$ is equal to

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116. If $\overrightarrow{A}, \overrightarrow{B}, \overrightarrow{C}$ are three vectors respectively given by $2\hat{i} + \hat{k}, \hat{i} + \hat{j} + \hat{k}$ and $4\hat{i} - 3\hat{j} + 7\hat{k}$, then the vector $\overrightarrow{R}$ which satisfies the relations $\overrightarrow{R} \times \overrightarrow{B} = \overrightarrow{C} \times \overrightarrow{B}$ and $\overrightarrow{R} . \overrightarrow{A} = 0$ is (A) $2\hat{i} - 8\hat{j} + 2\hat{k}$ (B) $\hat{i} - 4\hat{j} + 2\hat{k}$ (C) $-\hat{i} - 8\hat{j} + 2\hat{k}$ (D) none of these

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117. A rigid body is spinning about a fixed point (3,-2-1) with an anglar velocity of 4 rad/s, the axis of rotation being in the direction of (1,2,-2) . Find the velocity of the particle at point (4,1,1)/

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118. A particle has an angular speed of 3 rad/s and the axis of rotation passes through the points $(1, 1, 2) and (1, 2, -2)$. Find the velocity of the particle at point $P(3, 6, 4)$.

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119. If the area of triangle ABC having vertices $A\left(\vec{a}\right), B\left(\vec{b}\right), C\left(\vec{c}\right)$ is $t\left|\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}+\vec{c}\times\vec{a}\right| thent[=$ (A) 2 (B) $\frac{1}{2}$ (C) 1 (D) none of these

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120. The vector $\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}$ is (A) parallel to plane of $\triangle ABC$ (B) perpendicular to plane of $\triangle ABC$ (C) is neighater parallel nor perpendicular to the plane of $\triangle ABC$ (D) the vector area of $\triangle ABC$

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121. If vertices of $\triangle ABCareA\left(\vec{a}\right), B\left(\vec{b}\right)$ and $C\left(\vec{c}\right)$ then length of perpendicular from C to AB is (A) $\frac{\left|\vec{b}\times\vec{c}+\vec{c}\times\vec{a}+\vec{a}\times\vec{b}\right|}{\left|\vec{a}-\vec{b}\right|}$ (B)

$\frac{\left|\vec{b}\times\vec{c}+\vec{c}\times\vec{a}+\vec{a}\times\vec{b}\right|}{\left|\vec{a}+\vec{b}\right|}$ (C) $\frac{\left|\vec{b}\times\vec{c}\right|+\left|\vec{c}\times\vec{a}\right|+\left|\vec{a}\times\vec{b}\right|}{\left|\vec{a}-\vec{b}\right|}$

(D) none of these

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122. If $\hat{u}$ and $\hat{v}$ are unit vectors and θ is the acute angle between them, then $2\hat{u}\times 3\hat{v}$ is a unit vector for (1) exactly two values of θ (2) more than two values of θ (3) no value of θ (4) exactly one value of θ

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123. A tetrahedron has vertices O (0,0,0), A(1,2,1,), B(2,1,3) and C(-1,1,2), the angle between faces OAB and ABC will be

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124. Find the value of a so that the volume of the parallelopiped formed by vectors $\hat{i} + a\hat{j} + \hat{k}, \hat{j} + a\hat{k}$ and $a\hat{i} + \hat{k}$ becomes minimum.

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125. If $\vec{a} = \left(\hat{i} + \hat{j} + \hat{k}\right)$, and $\vec{a}.\vec{b} = 1$ and $\vec{a} \times \vec{b} = -\left(\hat{i} - \hat{k}\right) then \vec{b}$ is

(A) $\hat{i} - \hat{j} + \hat{k}$ (B) $2\hat{j} - \hat{k}$ (C) $\hat{j}$ (D) $2\hat{i}$

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126. The unit vector which is orthogonal to the vector $3\hat{i} + 2\hat{j} + 6\hat{k}$ and is coplanar with the vectors $2\hat{i} + 2\hat{j} + \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is

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127. The points with position vectors $60\hat{i}+3\hat{j}, 40\hat{i}-8\hat{j}, a\hat{i}-52\hat{j}$ are collinear if (A) $a=-40$ (B) $a=40$ (C) $a=20$ (D) none of these

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128. A vector $\overrightarrow{v}$ or magnitude 4 units is equally inclined to the vectors $\hat{i}+\hat{j}, \hat{j}+\hat{k}, \hat{k}+\hat{i},$ which of the following is correct? (A) $\overrightarrow{v}=\frac{4}{\sqrt{3}}\left(\hat{i}-\hat{j}-\hat{k}\right)$ (B) $\overrightarrow{v}=\frac{4}{\sqrt{3}}\left(\hat{i}+\hat{j}-\hat{k}\right)$ (C) $\overrightarrow{v}=\frac{4}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$ (D) $\overrightarrow{v}=4\left(\hat{i}+\hat{j}+\hat{k}\right)$

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129. The position verctors of the points A and B with respect of O are $2\hat{i}+2\hat{j}+\hat{k}$ and $2\hat{i}+4\hat{j}+4\hat{k}$, the length of the internal bisector of $\angle BOA$ of ΔAOB is

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130. A particle acted upon by constant forces $4\hat{i}+\hat{j}-3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ is displaced from the point $\hat{i}+2\hat{j}+3\hat{k}$ to point $5\hat{i}+4\hat{j}+\hat{k}$. The total work done by the forces in SI unit is

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131. If n forces $\overrightarrow{PA}_1.....\overrightarrow{PA}_n$ divege from point P and other forces $\overrightarrow{A_1Q}, \overrightarrow{A_2Q}, .., \overrightarrow{A_nQ}$ vonverge to point Q , then the resultant of the 2n forces is represent in magnitude and directed by (A) $n\overrightarrow{PQ}$ (B) $n\overrightarrow{QP}$ (C) $2n\overrightarrow{PQ}$ (D) $n^2\overrightarrow{PQ}$

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132. If $\overrightarrow{a}=\hat{i}+\hat{j}+\hat{k}, \overrightarrow{b}=4\hat{i}+3\hat{j}+4\hat{k}$ and $\overrightarrow{c}=\hat{i}+\alpha\hat{j}+\beta\hat{k}$ are linearly dependent vectors and $\left|\overrightarrow{c}\right|=\sqrt{3}$ then:

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133. A vector $\overrightarrow{a} = t\hat{i} + t^2\hat{j}$ is rotated through a righat angle passing through the x-axis. What is the vector in its new position $(t > 0)$? (A) $t^2\hat{i} - t\hat{j}$ (B) $\sqrt{t}\hat{i} - \frac{1}{\sqrt{t}}\hat{j}$ (C) $-t^2\hat{i} + t\hat{j}$ (D) $\frac{t^2\hat{i} - t\hat{j}}{t\sqrt{t^2+1}}$

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134. If $\overrightarrow{AO} + \overrightarrow{OB} = \overrightarrow{BO} + \overrightarrow{OC}$ then A,B,C,D form a/an (A) equilaterla triangle (B) righat angled triangle (C) isosceles triangle (D) straighat line

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135. The sides of a parallelogram are $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$. The unit vector parallel to one of the diagonals is

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136. $\overrightarrow{a}$ and $\overrightarrow{b}$ are two non collinear vectors then $x\overrightarrow{a}+y\overrightarrow{b}$ (where x and y are scalars) represents a vector which is (A) parallel to $\overrightarrow{b}$ (B) parallel to $\overrightarrow{a}$ (C) coplanar with $\overrightarrow{a}$ and $\overrightarrow{b}$ (D) none of these

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137. If D,E and F are respectively, the mid-points of AB,AC and BC in ΔABC, then BE+AF is equal to

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138. If C is the mid point of AB and P is any point outside AB then (A) $\overrightarrow{PA}+\overrightarrow{PB}+\overrightarrow{PC}=0$ (B) $\overrightarrow{PA}+\overrightarrow{PB}+2\overrightarrow{PC}=\overrightarrow{0}$ (C) $\overrightarrow{PA}+\overrightarrow{PB}=\overrightarrow{PC}$ (D) $\overrightarrow{PA}+\overrightarrow{PB}=2\overrightarrow{PC}$

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139. Consider points A,B,C annd D with position vectors $7\hat{i}-4\hat{j}+7\hat{k}, \hat{i}-6\hat{j}+10\hat{k}, -1\hat{i}-3\hat{j}+4\hat{k}$ and $5\hat{i}-\hat{j}+5\hat{k}$, respectively. Then, ABCD is

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140. If vectors $\overrightarrow{AB} = -3\hat{i}+4\hat{k}$ and $\overrightarrow{AC}=5\hat{i}-2\hat{j}+4\hat{k}$ are the sides of a ΔABC, then the length of the median throught A is

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141. If $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{}$ are non-coplanar vectors and λ is a real number, then the vectors $\overrightarrow{a}+2\overrightarrow{b}+3\overrightarrow{c}, \lambda\overrightarrow{b}+\mu\overrightarrow{c}$ and $(2\lambda-1)\overrightarrow{c}$ are coplanar when

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142. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non-zero vectors which are positive non-collinear. If $\vec{a}+3\vec{b}$ is collinear with $\vec{c}$ and $\vec{b}+2\vec{c}$ is collinear with $\vec{a}$ then $\vec{a}$ then $\vec{a}+3\vec{b}+6\vec{c}$ is:

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143. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors of which every pair is non colinear. If the vector $\vec{a}+\vec{b}$ and $\vec{b}+\vec{c}$ are collinear with the vector $\vec{c}$ and $\vec{a}$ respectively then which one of the following is correct? (A) $\vec{a}+\vec{b}+\vec{c}$ is a nul vector (B) $\vec{a}+\vec{b}+\vec{c}$ is a unit vector (C) $\vec{a}+\vec{b}+\vec{c}$ is a vector of magnitude 2 units (D) $\vec{a}+\vec{b}+\vec{c}$ is a vector of magnitude 3 units

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144. If $\overrightarrow{|a|}=3, \left|\vec{b}\right|=4,$ and $\left|\vec{a}+\vec{b}\right|=5, then\left|\vec{a}-\vec{b}\right|$ is equal to

(A) 6 (B) 5 (C) 4 (D) 3

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145. Let $\vec{u}, \vec{v}$ and $\vec{w}$ be such that $|\vec{u}| = 1, |\vec{v}| = 2$ and $|\vec{w}| = 3$ if the projection of $\vec{v}$ along $h\vec{u}$ is equal to that of $\vec{w}$ along $\vec{u}$ and vectors $\vec{v}$ and $\vec{w}$ are perpendicular to each other then $|\vec{u} - \vec{v} + \vec{w}|$ equals

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146. Let the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are perpendicular to $\vec{b} + \vec{c}, \vec{c} + \vec{a}$ and $\vec{a} + \vec{b}$ respectively. If $|\vec{a} + \vec{b}| = 6, |\vec{b} + \vec{c}| = 8$ and $|\vec{c} + \vec{a}| = 10$, then the value of $|\vec{a} + \vec{b} + \vec{c}|$ is equal to

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147. If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a} + 2\vec{b}$ and $5\vec{a} - 4\vec{b}$ are perpendicualar to each other, then the angle between $\vec{a}$ and $\vec{b}$ is

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148. A unit vector in the xy-plane that makes an angle of $\frac{\pi}{4}$ with the vector $\hat{i}+\hat{j}$ and an angle of 'pi/3' with the vector $3\hat{i}-4\hat{j}$ is

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149. The position vector of the pont where the line $\vec{r}=\hat{i}-j+\hat{k}+t\left(\hat{i}+\hat{j}-\hat{k}\right)$ meets plane $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)=5$ is (A) $5\hat{i}+\hat{j}-\hat{k}$ (B) $5\hat{i}+3\hat{j}-3\hat{k}$ (C) $5\hat{i}+\hat{j}+\hat{k}$ (D) $4\hat{i}+2\hat{j}-2\hat{k}$

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150. The perpendicular distance between the line $\vec{r}=2\hat{i}-2\hat{j}+3\hat{k}+\lambda\left(\hat{i}-\hat{j}+4\hat{k}\right)$ and the plane $\vec{r}.\left(\hat{i}+5\hat{j}+\hat{k}\right)=5$ is :

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151. A unit vector int eh plane of the vectors $2\hat{i}+\hat{j}+\hat{k}$, $\hat{i}-\hat{j}+\hat{k}$ and orthogonal to $5\hat{i}+2\hat{j}-6\hat{k}$ is (A) $\frac{6\hat{i}-5\hat{k}}{\sqrt{6}}$ (B) $\frac{3\hat{j}-\hat{k}}{\sqrt{10}}$ (C) $\frac{\hat{i}-5\hat{j}}{\sqrt{29}}$ (D) $\frac{2\hat{i}+\hat{j}-2\hat{k}}{3}$

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152. The work done by the forces $\vec{F}=2\hat{i}-3\hat{j}+2\hat{k}$ in moving a particle from (3,4,5) to (1,2,3) is (A) 0 (B) $\frac{3}{2}$ (C) -4 (D) -2

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153. If the work done by a force $\vec{F}=\hat{i}+\hat{j}-8\hat{k}$ along a givne vector in the xy-plane is 8 units and the magnitude of the given vector is $4\sqrt{3}$ then the given vector is represented as (A) $(4+2\sqrt{2})\hat{i}+(4-2\sqrt{2})\hat{j}$ (B) $\left(4\hat{i}+3\sqrt{2}\hat{j}\right)$ (C) $\left(4\sqrt{2}\hat{i}+4\hat{j}\right)$ (D) $(4+2\sqrt{2})\left(\hat{i}+\hat{j}\right)$

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154. If $\vec{a}, \vec{b}, \vec{c}$ are unit coplanar vectors then the scalar triple product $\left[2\vec{a} - \vec{b}, 2\vec{b} - c, \vec{2}\, c - \vec{a}\right]$ is equal to (A) 0 (B) 1 (C) $-\sqrt{3}$ (D) $\sqrt{3}$

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155. Let vectors $\vec{a}, \vec{b}\, \vec{a}$ and $\vec{d}$ be such that $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \vec{0}$. Let P_1 and P_2 be planes determined by the pairs of vectors $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$, respectively. Then the angle between P_1 and P_2 is

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156. Let $\vec{a} = \vec{i} - \vec{k}, \vec{b} = x\vec{i} + \vec{j} + (1 - x)\vec{k}$ and $\vec{c} = y\vec{i} + x\vec{j} + (1 + x - y)\vec{k}$. Then $\left[\vec{a}\, \vec{b}\, \vec{c}\right]$ depends on

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157. Then number of vectors of unit length perpendicular to vectors $\vec{a} = (1, 1, 0)$ and $\vec{b} = (0, 1, 1)$ is

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158. If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a} + 2\vec{b}$ and $5\vec{a} - 4\vec{b}$ are perpendicular to each other, then the angle between $\vec{a}$ and $\vec{b}$ is

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159. The point of intersection of $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}$ and $\vec{r} \times \vec{b} = \vec{a} \times \vec{b}$ where $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = 2\hat{i} - \hat{k}$ is (A) $3\hat{i} + \hat{j} - \hat{k}$ (B) $3\hat{i} - \hat{k}$ (C) $3\hat{i} + 2\hat{j} + \hat{k}$ (D) none of these

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160. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a} \neq 0, \left|\vec{a}\right| = \left|\vec{c}\right| = 1, \left|\vec{b}\right| = 4$ and $\left|\vec{b} \times \vec{c}\right| = \sqrt{15}.$ If $\vec{b} - 2\vec{c} = \lambda \vec{a}$ then find the value of λ .

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161. $\left|\vec{a} \times \hat{i}\right|^2 + \left|\vec{a} \times \hat{j}\right|^2 + \left|\vec{a} \times \hat{k}\right|^2 =$ (A) $\left|\vec{a}\right|^2$ (B) $2\left|\vec{a}\right|^2$ (C) $3\left|\vec{a}\right|^2$ (D) $4\left|\vec{a}\right|^2$

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162. Let $\vec{V} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{W} = \hat{i} + 3\hat{k}.$ if $\vec{U}$ is a unit vector, then the maximum value of the scalar triple product $\left[\vec{U}\vec{V}\vec{W}\right]$ is

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163. If $\vec{a} s \times \vec{b} = 0$ and $\vec{a} . \vec{b} = 0$ then (A) $\vec{a} \perp \vec{b}$ (B) $\vec{a} \mid \mid \vec{b}$ (C) $\vec{a} = 0$ and $\vec{b} = 0$ (D) $\vec{a} = 0$ or $\vec{b} = 0$

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164. If $\vec{a}, \vec{b}, \vec{c}$ are unit coplanar vectors then the scalar triple product $\left[2\vec{a} - \vec{b}, 2\vec{b} - c, \vec{2}c - \vec{a}\right]$ is equal to (A) 0 (B) 1 (C) $-\sqrt{3}$ (D) $\sqrt{3}$

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165. Which of the followind expression are meanigful ? (A) $\vec{u}.\left(\vec{v} \times \vec{w}\right)$ (B) $\left(\vec{u}.\vec{v}\right) \times \vec{w}$ (C) $\left(\vec{u}.\vec{v}\right).\vec{w}$ (D) $\vec{u} \times \left(\vec{v}.\vec{w}\right)$

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166. Let $\vec{a}, \vec{b}, \vec{c}$ be three noncolanar vectors and $\vec{p}, \vec{q}, \vec{r}$ are vectors defined by the relations $\vec{p} = \frac{\vec{b} \times \vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{q} = \frac{\vec{c} \times \vec{a}}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{r} = \frac{\vec{a} \times \vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}$ then the value of the expression $\left(\vec{a}+\vec{b}\right).\vec{p}+\left(\vec{b}+\vec{c}\right).\vec{q}+\left(\vec{c}+\vec{a}\right).\vec{r}.$ is equal to (A) 0 (B) 1 (C) 2 (D) 3

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167. Let $\vec{a},\vec{b},\vec{c}$ be non coplanar vectors and $\vec{p}=\frac{\vec{b}\times\vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]},\vec{q}=\frac{\vec{c}\times\vec{a}}{\left[\vec{a}\vec{b}\vec{c}\right]},\vec{r}=\frac{\vec{a}\times\vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}$. What is the vaue of $\left(\vec{a}-\vec{b}-\vec{c}\right).\vec{p}+\left(\vec{b}-\vec{c}-\vec{a}\right).\vec{q}+\left(\vec{c}-\vec{a}-\vec{b}\right).\vec{r}$?

(A) 0 (B) -3 (C) 3 (D) -9

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168. Let $\vec{a}=\vec{i}-\vec{k},\vec{b}=x\vec{i}+\vec{j}+(1-x)\vec{k}$ and $\vec{c}=y\vec{i}+x\vec{j}+(1+x-y)\vec{k}$. Then $\left[\vec{a}\vec{b}\vec{c}\right]$ depends on

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169. Let a,b and c be distinct non-negative numbers. If the vectors $a\hat{i}+a\hat{j}+c\hat{k}$, $\hat{i}+\hat{k}$ and $c\hat{i}+c\hat{j}+c\hat{k}$ lie in a plane,then c is:

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170. If the vectors $a\hat{i}+\hat{j}+\hat{k}, \hat{i}+b\hat{j}+\hat{k}, \hat{i}+\hat{j}+c\hat{k}(a\neq 1, b\neq 1, c\neq 1)$ are coplanar then the value of $\dfrac{1}{1-a}+\dfrac{1}{1-b}+\dfrac{1}{1-c}$ is (A) 0 (B) 1 (C) -1 (D) 2

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171. If $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix}=0$ and vectors $(1, a, a^2), (1, b, b^2)$ and $(1, c, c^2)$ are non-coplanar, then the product abc equal to:

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172. If $\vec{u}, \vec{v}$ and $\vec{w}$ are three non coplanar vectors then $\left(\vec{u}+\vec{v}-\vec{w}\right).\left(\vec{u}-\vec{v}\right)\times\left(\vec{v}-\vec{w}\right)$ equals (A) $\vec{u}.\left(\vec{v}\times\vec{w}\right)$ (B) $\vec{u}.\vec{w}\times\vec{v}$ (C) $2\vec{u}.\left(\vec{v}\times\vec{w}\right)$ (D) 0

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173. Let $\vec{u}=\hat{i}+\hat{j}, \vec{v}=\hat{i}-\hat{j}$ and $\vec{w}=\hat{i}+2\hat{j}+3\hat{k}$. If $\widehat{n}$ is a unit vector such that $\vec{u}.\widehat{n}=0$ and $\vec{v}.\widehat{n}=0, \left|\vec{w}.\widehat{n}\right|$ is equal to (A) 0 (B) 1 (C) 2 (D) 3

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174. If $\vec{a}$ is perpendicuar to $\vec{b}$ and $\vec{c}$ $\left|\vec{a}\right|=2, \left|\vec{b}\right|=3, \left|\vec{c}\right|=4$ and the angle between $\vec{b}$ and $\vec{c} is \frac{2\pi}{3}, then \left[\vec{a}\,\vec{b}\,\vec{c}\right]$ is equal to

(A) $4\sqrt{3}$

(B) $6\sqrt{3}$

(C) $12\sqrt{3}$

(D) $18\sqrt{3}$

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175. If a,b and c are non-coplanar vectors and λ is a real number, then

$\left[\lambda(a+b)\middle|\lambda^2 b\middle|\lambda c \mid \lambda c\right] = [a \quad a+c \quad b]$ fforr

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176. If

$\vec{V} = x\left(\vec{a} \times \vec{b}\right) + y\left(\vec{b} \times \vec{c}\right) + z\left(\vec{c} \times \vec{a}\right)$ and $\vec{V} \cdot \left(\vec{a} + \vec{b} + \vec{c}\right)$

The valueof $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ if $x+y+z \neq 0$ ils (A) 0 (B) 1 (C) -1 (D) 2

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177. The scalar $\vec{A} \cdot \left(\vec{B} \cdot \vec{C}\right) \times \left(\vec{A} + \vec{B} + \vec{C}\right)$ equals

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178. If $\vec{A}, \vec{B}$ and $\vec{C}$ are three non coplanar then $\left(\vec{A}+\vec{B}+\vec{C}\right).\left\{\left(\vec{A}+\vec{B}\right)\times\left(\vec{A}+\vec{C}\right)\right\}$ equals: (A) 0 (B) $\left[\vec{A}\vec{B}\vec{C}\right]$ (C) $2\left[\vec{A}\vec{B}\vec{C}\right]$ (D) $-\left[\vec{A}\vec{B}\vec{C}\right]$

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179. Find the value of a so that the volume of the parallelopiped formed by vectors $\hat{i}+a\hat{j}+\hat{k}, \hat{j}+a\hat{k}$ and $a\hat{i}+\hat{k}$ becomes minimum.

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180. For non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$, $\left|\left(\vec{a}\times\vec{b}\right).\vec{c}\right|=\left|\vec{a}\right|\left|\vec{b}\right|\left|\vec{c}\right|$ holds if and only if

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181. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non coplanar and unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b} + \vec{c}}{\sqrt{2}}$ then the angle between $\vec{a}$ and $\vec{b}$ is (A) $\frac{3\pi}{4}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π

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182. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be non-zero vectors such that no two are collinear and $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \frac{1}{3}\left|\vec{b}\right|\left|\vec{c}\right|\vec{a}$ if θ is the acute angle between vectors $\vec{b}$ and $\vec{c}$ then find value of $\sin\theta$.

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183. If $\vec{A} \times \left(\vec{B} \times \vec{C}\right) = \vec{B} \times \left(\vec{C} \times \vec{A}\right)$ and $\left[\vec{A}\vec{B}\vec{C}\right] \neq 0 then \vec{A}.\left(\vec{B} \times \vec{C}\right.$ is equal to (A) 0 (B) $\vec{A} \times \vec{B}$ (C) $\vec{B} \times \vec{C}$ (D) $\vec{C} \times \vec{A}$

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184. If $\widehat{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \hat{b} = \hat{i} \times \left(\overrightarrow{a} \times \hat{i}\right) + \hat{j} \times \left(\overrightarrow{a} \times \hat{j}\right) + \hat{k} \times \left(\overrightarrow{a} \times \hat{k}\right)$ then length of $\overrightarrow{b}$ is equal to (A) $\sqrt{12}$ (B) $2\sqrt{12}$ (C) $2\sqrt{14}$ (D) $3\sqrt{12}$

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185. Let $\overrightarrow{a} = \hat{i} - \hat{j}, \overrightarrow{b} = \hat{j} - \hat{k}, \overrightarrow{c} = \hat{k} - \hat{i}. If \hat{d}$ is a unit vector such that $\overrightarrow{a} . \hat{d} = 0 = \left[\overrightarrow{b} \overrightarrow{c} \overrightarrow{d}\right]$ then $\hat{d}$ equals

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186. If $a = \hat{i} + \hat{j} + \hat{k}, b = \hat{i} + \hat{j}, c = \hat{i}$ and $(a \times b) \times c = \lambda a + \mu b,$ then $\lambda + \mu$ is equal to

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187. Given $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = 5\vec{c} + 6\vec{d}$ then the value of $\vec{a} . \left(\vec{b} \times \left(\vec{a} + \vec{c} + 2\vec{d}\right)\right)$ is (A) 7 (B) 16 (C) -1 (D) 4

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188. If $\vec{a} \times \left[\vec{a} \times \left\{\vec{a} \times \left(\vec{a} \times \vec{b}\right)\right\}\right] = \left|\vec{a}\right|^4 \vec{b}$ how are $\vec{a}$ and $\vec{b}$ related? (A) $\vec{a}$ and $\vec{b}$ are coplanar (B) $\vec{a}$ and $\vec{b}$ are collinear (C) $\vec{a}$ is perpendicular to $\vec{b}$ (D) $\vec{a}$ is parallel to $\vec{b}$ but $\vec{a}$ and $\vec{b}$ are non collinear

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189. If $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right), where \vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{a} . \vec{b} \neq 0, \vec{b} . \vec{c} \neq 0, then \vec{a}$ and $\vec{c}$ are (A) inclined at an angle $\frac{\pi}{3}$ to each other (B) inclined at an angle of $\frac{\pi}{6}$ to each other (C) perpendicular (D) parallel

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190. If the vectors $\hat{i} - \hat{j}, \hat{j} + \hat{k}$ and a form a triangle, then a may be

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191. If vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are non collinear then $\frac{\overrightarrow{a}}{\left|\overrightarrow{a}\right|} + \frac{\overrightarrow{b}}{\left|\overrightarrow{b}\right|}$ is (A) a unit vector (B) in the plane of $\overrightarrow{a}$ and $\overrightarrow{b}$ (C) equally inclined to $\overrightarrow{a}$ and $\overrightarrow{b}$ (D) perpendicular to $\overrightarrow{a} \times \overrightarrow{b}$

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192. Vectors Perpendicular to $\hat{i} - \hat{j} - \hat{k}$ and in the plane of $\hat{i} + \hat{j} + \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ are

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193. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and is doubled in magnitude. It now becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The values of x are

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194. if side $\overrightarrow{AB}$ of an equilateral triangle ABC lying in the x-y plane is $3\hat{i}$. Then side $\overrightarrow{CB}$ can be

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195. if vectors $\overrightarrow{A} = 2\hat{i} + 3\hat{j} + 4\hat{k}, \overrightarrow{B} = \hat{i} + \hat{j} + 5\hat{k}$ and $\overrightarrow{C}$ from a left - handed system, then $\overrightarrow{C}$ is

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196. If $\overrightarrow{a} + 2\overrightarrow{b} + 3\overrightarrow{c} = 0$, then $\overrightarrow{a} \times \overrightarrow{b} + \overrightarrow{b} \times \overrightarrow{c} + \overrightarrow{c} \times \overrightarrow{a} =$

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197. Unit vectors $\vec{a}$ and $\vec{b}$ are perpendicular, and unit vector $\vec{c}$ is inclined at angle θ to both $\vec{a}$ and $\vec{b}$. If $\vec{c} = \alpha\vec{a} + \beta\vec{b} + \gamma\left(\vec{a} \times \vec{b}\right)$, then $a = \beta$ b. $\gamma^1 = 1 - 2\alpha^2$ c. $\gamma^2 = -\cos 2\theta$ d. $\beta^2 = \dfrac{1 + \cos 2\theta}{2}$

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198. The equation of the line throgh the point $\vec{a}$ parallel to the plane $\vec{r}.\vec{n}$=q and perpendicular to the line $\vec{r} = \vec{b} + t\vec{c}$ is (A) $\vec{r} = \vec{a} + \lambda\left(\vec{n} \times \vec{c}\right)$ (B) $\left(\vec{r} - \vec{a}\right) \times \left(\vec{n} \times \vec{c}\right) = 0$ (C) $\vec{r} = \vec{b} + \lambda\left(\vec{n} \times \vec{c}\right)$ (D) none of these

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199. If $\vec{a}$ and $\vec{b}$ are two non collinear vectors and $\vec{u} = \vec{a} - \left(\vec{a}.\vec{b}\right).\vec{b}$ and $\vec{v} = \vec{a}x\vec{b}$ then $\vec{v}$ is

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200. A line passes through the points whose position vectors are $\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+\hat{k}$. The position vector of a point on it at unit distance from the first point is

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201. A vector of magnitude 2 along a bisector of the angle between the two vectors $2\hat{i}-2\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}-2\hat{k}$ is (A) $\frac{2}{\sqrt{10}}\left(3\hat{i}-\hat{k}\right)$ (B) $\frac{2}{\sqrt{23}}\left(\hat{i}-3\hat{j}+3\hat{k}\right)$ (C) $\frac{1}{\sqrt{26}}\left(\hat{i}-4\hat{j}+3\hat{k}\right)$ (D) none of these

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202. A unit vector which is equally inclined to the vector $\hat{i}, \frac{-2\hat{i}+\hat{j}+2\hat{k}}{3}$ and $\frac{-4\hat{j}-3\hat{k}}{5}$ (A) $\frac{1}{\sqrt{51}}\left(-\hat{i}+5\hat{j}-5\hat{k}\right)$ (B) $\frac{1}{\sqrt{51}}\left(\hat{i}-5\hat{j}+5\hat{k}\right)$ (C) $\frac{1}{\sqrt{51}}\left(\hat{i}+5\hat{j}-5\hat{k}\right)$ (D) $\frac{1}{\sqrt{51}}\left(\hat{i}+5\hat{j}+5\hat{k}\right)$

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203. Three points whose position vectors are $\vec{a}, \vec{b}, \vec{c}$ will be collinear if

(A) $\lambda\vec{a}+\mu\vec{b}=(\lambda+\mu)\vec{c}$ (B) $\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}=0$ (C) $\left[\vec{a}\vec{b}\vec{c}\right]=0$ (D) none of these

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204. Let $\vec{b}=4\hat{i}+3\hat{j}$ and $\vec{c}$ be two vectors perpendicular to each other in the xy- plane. All vectors in the sme plane having projections 1 and 2 along $\vec{b}$ and $\vec{c}$., respectively, are given by _______

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205. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non coplnar and non zero vectors and $\vec{r}$ is any vector in space then $\left[\vec{c}\vec{r}\vec{b}\right]\vec{a}+\left[\vec{a}\vec{r}\vec{c}\right]\vec{b}+\left[\vec{b}\vec{r}\vec{a}\right]c=$ (A) $\left[\vec{a}\vec{b}\vec{c}\right]$ (B) $\left[\vec{a}\vec{b}\vec{c}\right]\vec{r}$ (C) $\dfrac{\vec{r}}{\left[\vec{a}\vec{b}\vec{c}\right]}$ (D) $\vec{r}.\left(\vec{a}+\vec{b}+\vec{c}\right)$

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206. if $\vec{a}, \vec{b}, \vec{c}$ are non coplanar non-zero vectors such that $\vec{b} \times \vec{c} = \vec{a} \times \vec{b} = \vec{c}$ and $\vec{c} \times \vec{a} = \vec{b}$ then $|\vec{a}| + |\vec{b}| + |\vec{c}|$ is equal to

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207. If $\vec{a}, \vec{b}, \vec{c}$ be non coplanar vectors and $\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a}\,\vec{b}\,\vec{c}]}$, $\vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a}\,\vec{b}\,\vec{c}]}$, $\vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a}\,\vec{b}\,\vec{c}]}$ then (A) $\vec{p}.\vec{a} = 1$ (B) $\vec{p}.\vec{a} + \vec{q}.\vec{b} + \vec{r}.\vec{c} = 3$ (C) $\vec{p}.\vec{a} + \vec{q}.\vec{b} + \vec{r}.\vec{c} = 0$ (D) none of these

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208. If $\vec{a}, \vec{b}, \vec{c}$ are any thre vectors then $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ is a vector (A) perpendicular to $\vec{a} \times \vec{b}$ (B) coplanar with $\vec{a}$ and $\vec{b}$ (C) parallel to $\vec{c}$ (D) parallel to either $\vec{a}$ or $\vec{b}$

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209. If $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{b} = \vec{c} \times \vec{a}$ then (A) $\vec{a} . \vec{b} = \vec{c}^2$ (B) $\vec{c} . \vec{a} . = \vec{b}^2$ (C) $\vec{a} \perp \vec{b}$ (D) $\vec{a} \mid \mid \vec{b} \times \vec{c}$

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210. If $\vec{x} X \vec{b} = \vec{c} \times \vec{b}$ and $\vec{x} \perp \vec{a} \, then \, \vec{x}$ is equal to (A) $\dfrac{\left(\vec{b} \times \vec{c}\right) \times \vec{a}}{\vec{b} . \vec{a}}$ (B) $\left(\dfrac{\vec{b} \times \left(\vec{a} \times \vec{c}\right)}{\vec{b} . \vec{c}}\right)$ (C) $\left(\dfrac{\vec{a} \times \left(\vec{c} \times \vec{b}\right)}{\vec{a} . \vec{b}}\right)$

(D) none of these

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211. The resolved part of the vector $\vec{a}$ along the vector $\vec{b}\, is\, \vec{\lambda}$ and that perpendicular to $\vec{b}\, is\, \vec{\mu}$. Then (A) $\vec{\lambda} = \dfrac{\left(\vec{a}\,.\,\vec{b}\right).\,\vec{a}}{\vec{a}^2}$ (B) $\vec{\lambda} = \dfrac{\left(\vec{a}\,.\,\vec{b}\right).\,\vec{b}}{\vec{b}^2}$ (C) $\vec{\mu} = \dfrac{\left(\vec{b}\,.\,\vec{b}\right)\vec{a} - \left(\vec{a}\,.\,\vec{b}\right)\vec{b}}{\vec{b}^2}$ (D) $\vec{\mu} = \dfrac{\vec{b} \times \left(\vec{a} \times \vec{b}\right)}{\vec{b}^2}$

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212. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are any for vectors then $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)$ is a vector (A) perpendicular to $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ (B) along the the line intersection of two planes, one containing $\vec{a}, \vec{b}$ and the other containing $\vec{c}, \vec{d}$. (C) equally inclined both $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$ (D) none of these

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213. If $\left(\vec{a}\times\vec{b}\right)\times\vec{c}=\vec{a}\,x\left(\vec{b}\times\vec{c}\right)$ then (A) $\left(\vec{c}\times\vec{a}\right)\times\vec{b}=0$ (B) $\vec{b}\times\left(\vec{c}\times\vec{a}\right)=0$ (C) $\vec{c}\times\left(\vec{a}\times\vec{b}\right)=0$ (D) none of these

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214. If vector $\vec{b}=\left(tan\alpha,\ -1,2\sqrt{\sin\alpha/2}\right)and\,\vec{c}=\left(tan\alpha,tan\alpha,\ -\frac{3}{\sqrt{\sin\alpha/2}}\right)$ are orthogonal and vector $\vec{a}=(1,3,\sin 2\alpha)$ makes an obtuse angle with the z-axis, then the value of α is

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215. If $a=\hat{i}+\hat{j}+\hat{k}$ and $b=\hat{i}-\hat{j}$, then vectors $\left(\left(a\cdot\hat{i}\right)\hat{i}+\left(a\cdot\hat{j}\right)\hat{j}+\left(a\cdot\hat{k}\right)\hat{k}\right),\left\{\left(b\cdot\hat{i}\right)\hat{i}+\left(b\hat{j}\right)\hat{j}+\left(b\cdot\hat{k}\right)\hat{k}\right\}$ and $(\hat{i}$

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216. If unit vectors $\hat{i}$ and $\hat{j}$ are at right angles to each other and $p = 3\hat{i} + 4\hat{j}, q = 5\hat{i}, 4r = p + q$ and $2s = p - q$, then

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217. If vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are non collinear then $\frac{\overrightarrow{a}}{\left|\overrightarrow{a}\right|} + \frac{\overrightarrow{b}}{\left|\overrightarrow{b}\right|}$ is (A) a unit vector (B) in the plane of $\overrightarrow{a}$ and $\overrightarrow{b}$ (C) equally inclined to $\overrightarrow{a}$ and $\overrightarrow{b}$ (D) perpendicular to $\overrightarrow{a} \times \overrightarrow{b}$

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218. The position vectors of the points P and Q are $5\hat{i} + 7\hat{j} - 2\hat{k}$ and $-3\hat{i} + 3\hat{j} + 6\hat{k}$, respectively. Vector $\overrightarrow{A} = 3\hat{i} - \hat{j} + \hat{k}$ passes through point P and vector $\overrightarrow{B} = -3\hat{i} + 2\hat{j} + 4\hat{k}$ passes through point Q. A third vector $2\hat{i} + 7\hat{j} - 5\hat{k}$ intersects vectors A and B. Find the position vectors of points of intersection.

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219. The vectors $\vec{a} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} - 2\hat{k}$ are the adjacent sides of a paralleogram. The angle between its diagonals is....... .

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220. The vectors $a\hat{i} + 2a\hat{j} - 3a\hat{k}, (2a+1)\hat{i} + (2a+3)\hat{j} + (a+1)\hat{k}$ and $(3a+5)\hat{i} + (a+5)\hat{j} + (a+2)\hat{k}$ are non coplanasr for a belonging to the set (A) R - $\{0\}$ (B) $(0, \infty)$ (C) (-oo,1)(D)(1,oo)`

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221. The volume of the tetrahedron whose vertices are the points with positon vectors $\hat{i} - 6\hat{j} + 10\hat{k}, -\hat{i} - 3\hat{j} + 7\hat{k}, 5\hat{i} - \hat{j} + \lambda\hat{k}$ and $7\hat{i} - 4\hat{j} + 7\hat{k}$ is 11 cubic units if the value of λ is

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222. If $\vec{a}$ satisfies $\vec{a} \times \left(\hat{i} + 2\hat{j} + \hat{k}\right) = \hat{i} - \hat{k}$ then $\vec{a}$ is equal to

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223. If $\overrightarrow{DA} = \vec{a}, \overrightarrow{AB} = \vec{b}$ and $\overrightarrow{CB} = k\vec{a} wherek > 0$ and X,Y are the midpoint of DB and AC respectively such that $\left|\vec{a}\right| = 17$ and $\left|\overrightarrow{XY}\right| = 4$, then k is equal to (A) $\frac{9}{17}$ (B) $\frac{8}{17}$ (C) $\frac{25}{17}$ (D) $\frac{4}{17}$

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224. $\vec{a}$ and $\vec{c}$ are unit vectors and $\left|\vec{b}\right| = 4$ the angle between $\vec{a}$ and $\vec{b} is \cos^{-1}(1/4)$ and $\vec{b} - 2\vec{c} = \lambda\vec{a}$ the value of λ is

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225. If the resultant of three forces $\vec{F}_1 = p\hat{i} + 3\hat{j} - \hat{k}, \vec{F}_2 = 6\hat{i} - \hat{k} and \vec{F}_3 = -5\hat{i} + \hat{j} + 2\hat{k}$ acting on a parricle has magnitude equal to 5 units, then the value of p is a. -6 b. -4

c. 2 d. 4

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226. If $\vec{a}$ and $\vec{b}$ are two unit vectors perpendicular to each other and $\vec{c}=\lambda_1\vec{a}+\lambda_2\vec{b}+\lambda_3\left(\vec{a}\times\vec{b}\right)$ then the following is (are) true

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227. If $\vec{a}\times\vec{b}=\vec{c}\times\vec{d}$ and $\vec{a}\times\vec{c}=\vec{b}\times\vec{d}$ then (A) $\left(\vec{a}-\vec{d}\right)=\lambda\left(\vec{b}-\vec{c}\right)$ (B) $\vec{a}+\vec{d}=\lambda\left(\vec{b}+\vec{c}\right)$ (C) $\left(\vec{a}-\vec{b}\right)=\lambda\left(\vec{c}+\vec{d}\right)$ (D) none of these

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228. If A,B,C are three points with position vectors $\vec{i}+\vec{j}$, $\vec{i}-\hat{j}$ and $p\vec{i}+q\vec{j}+r\vec{k}$ respectiey then the points are collinear if (A) $p=q=r=0$ (B) $p=qr=1$ (C) $p=q, r=0$ (D) $p=1, q=2, r=0$

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229. If $\left|\vec{a}\right|=4, \left|\vec{b}\right|=2$ and angle between $\vec{a}$ and $\vec{b}\,is\frac{\pi}{6}then\left(\vec{a}\times\vec{b}\right)^2$ is (A) 48 (B) $\left(\vec{a}\right)^2$ (C) 16 (D) 32

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230. If unit vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle 2θ such that $\left|\vec{a}-\vec{b}\right|<1$ and $0\leq\theta\leq\pi$, then θ lies in the interval

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231. The vectors $2\hat{i}-m\hat{j}+3\hat{k}$ and $(1+m)\hat{i}-2m\hat{j}+\hat{k}$ include an acute angle for

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232. The vectors $\overrightarrow{a} = x\hat{i} - 2\hat{j} + 5\hat{j}$ and $\overrightarrow{b} = \hat{i} + y\hat{j} - z\hat{k}$ are collinear if (A) $x = 1, y = -2, z = -5$ (B) $x = \frac{1}{2}, y = -4, z = -10$ (C) $x = -\frac{1}{2}, y = 4, z = 10$ (D) none of these

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233. $\overrightarrow{a} = 2\hat{i} - \hat{j} + \hat{k}, \overrightarrow{b} = \hat{j} + 2\hat{j} - \hat{k}, \overrightarrow{c} = \hat{i} + \hat{j} - 2\hat{k}$. A vector coplanar with $\overrightarrow{b}$ and $\overrightarrow{c}$. Whose projection on $\overrightarrow{a}$ is magnitude $\sqrt{\frac{2}{3}}$ is

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234. The vectors $(x, x+1, x+2), (x+3, x+3, x+5)$ and $(x+6, x+7, x+8)$ are coplanar for (A) all values of x (B) $x < 0$ (C) $x > 0$ (D) none of these

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235. If $\vec{a}, \vec{b}, \vec{c}$ are three non coplanar vectors such that $\vec{r}_1 = \vec{a} - \vec{b} + \vec{c}, \vec{r}_2 = \vec{b} + \vec{c} - \vec{a}, \vec{r}_3 = \vec{c} + \vec{a} + \vec{b}, \vec{r} = 2\vec{a}$ -

then

(A) $\lambda_1 = \frac{7}{2}$

(B) $\lambda_1 + \lambda_2 = 3$

(C) $\lambda_2 + \lambda_3 = 2$

(D) $\lambda_1 + \lambda_2 + \lambda_3 = 4$

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236. A parallelogram is constructed on the vectors $\vec{a} = 3\vec{\alpha} - \vec{\beta}, \vec{b} = \vec{\alpha} + 3\vec{\beta}. If \left|\vec{\alpha}\right| = \left|\vec{\beta}\right| = 2$ and angle between $\vec{\alpha}$ and $\vec{\beta} is \frac{\pi}{3}$ then the length of a diagonal of the parallelogram is

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237. If vector $\vec{a} + \vec{b}$ bisects the angle between $\vec{a}$ and $\vec{b}$, then prove that $\left|\vec{a}\right| = \left|\vec{b}\right|$.

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238. Assertion:Points A,B,C are collinear, Reason: $\overrightarrow{AB} \times \overrightarrow{AC} = 0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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239. Assetion: $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \left[\vec{a}\,\vec{c}\,\vec{d}\right]\vec{b} - \left[\vec{b}\,\vec{c}\,\vec{d}\right]\vec{a}$ Reason: $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \left(\vec{a}\,.\,\vec{c}\right)\vec{b} - \left(\vec{b}\,.\,\vec{c}\right)\vec{a}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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240. Assertion: If $\left|\vec{a}\right| = \left|\vec{b}\right| = \left|\vec{a} + \vec{b}\right|$=1, then angle between $\vec{a}$ and $\vec{b} \, is \dfrac{2\pi}{3}$, Reason: $\left|\vec{a} + \vec{b}\right|^2 = \left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 + 2\left(\vec{a} \,.\, \vec{b}\right)\Big|$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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241. Assertion: If the magnitude of the sum of two unit vectors is a unit vector, then magnitude of their differnce is $\sqrt{3}$ Reason: $\left|\vec{a}\right| + \left|\vec{b}\right| = \left|\vec{a} + \vec{b}\right|$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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242. Assertion : Suppose $\widehat{a}, \hat{b}, \hat{c}$ are unit vectors such that $\widehat{a}, \hat{b} = \widehat{a}. \hat{c} = 0$ and the angle between $\hat{b}$ and $\hat{c} is \dfrac{\pi}{6}$ than he vector $\widehat{a}$ can be represented as $\widehat{a} = \pm 2\left(\hat{b} \times \hat{c}\right)$, Reason: $\widehat{a} = \pm \dfrac{\hat{b} \times \hat{c}}{\left|\hat{b} \times \hat{c}\right|}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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243. Assertion: Thevalue of expression $\hat{i}.\left(\hat{j} \times \hat{k}\right) + \hat{j}.\left(\hat{k} \times \hat{i}\right) + \hat{k}.\left(\hat{i} \times \hat{j}\right)$ is equal to 3, Reason: If $\widehat{a}, \hat{b}, \hat{c}$ are mutually perpendicular unit vectors, then $\left[\widehat{a}\hat{b}\hat{c}\right] = 1$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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244. Assertion ABCDEF is a regular hexagon and $\overrightarrow{AB} = \overrightarrow{a}, \overrightarrow{BC} = \overrightarrow{b}$ and $\overrightarrow{CD} = \overrightarrow{c}, then\overrightarrow{EA}$ is equal to $-\left(\overrightarrow{b} + \overrightarrow{c}\right)$, Reason: $\overrightarrow{AE} = \overrightarrow{BD} = \overrightarrow{BC} + \overrightarrow{CD}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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245. Assertion : If $\vec{A}, \vec{B}, \vec{C}$ are any three non coplanar vectors then $\dfrac{\vec{A}.\left(\vec{B} \times \vec{C}\right)}{\left(\vec{C} \times \vec{A}\right).\vec{B}} + \dfrac{\vec{B}.\left(\vec{A} \times \vec{c}\right)}{\vec{C}.\left(\vec{A} \times \vec{B}\right)} = 0,$ Reason: $\left[\vec{a}\vec{b}\vec{c}\right] \neq \left[\vec{b}\vec{c}\vec{a}\right]$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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246. Assertion: $\vec{p}, \vec{q}$ and $\vec{r}$ are coplanar. Reason: Vectros $\vec{p}, \vec{q}, \vec{r}$ are linearly independent. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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247. Assertion: $\vec{r}.\vec{a}$ and $\vec{b}$ are thre vectors such that $\vec{r}$ is perpendicular to $\vec{a}$. If $\vec{r}\times\vec{a}=\vec{b}$ then $\vec{r}=\frac{\vec{a}\times\vec{b}}{\vec{a}.\vec{a}}$, Reason: $\vec{r}.\vec{a}=0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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248. Assertion: Let $\vec{r}=l\left(\vec{a}\times\vec{b}\right)+m\left(\vec{b}\times\vec{c}\right)+n\left(\vec{c}\times\vec{a}\right), wherel, m, n$ are scalars and $\left[\vec{a}\vec{b}\vec{c}\right]=\frac{1}{2}, thenl+m+n=2\vec{r}.\left(\vec{a}+\vec{b}+\vec{c}\right)$. Reason: $\vec{a},\vec{b},\vec{c}$ are coplanar (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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249. Assertion: If $\vec{x} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{x} \perp \vec{a}\, then\, \vec{x} = \frac{\left(\vec{b} \times \vec{c}\right) \times \vec{a}}{\vec{a} \,.\, \vec{b}}$, Reason: $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a} \,.\, \vec{c}\right)\vec{b} - \left(\vec{a} \,.\, \vec{b}\right)\vec{c}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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250. Assertion: If $\overrightarrow{AB} = 3\hat{i} - 3\hat{k}$ and $\overrightarrow{AC} = \hat{i} - 2\hat{j} + \hat{k}, then' \left|\overrightarrow{AM}\right| = \sqrt{6}$ Reason, $\overrightarrow{AB} + \overrightarrow{AC} = 2\overrightarrow{AM}$

(A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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251. Assertion: $\left|\vec{a}+\vec{b}\right|<\left|\vec{a}-\vec{b}\right|$, Reason: $\left|\vec{a}+\vec{b}\right|^2=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2+2\vec{a}.\vec{b}.$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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252. Assertion: In $\triangle ABC, \overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=0$ Reason: If $\overrightarrow{OA}=\vec{a}, \overrightarrow{OB}=\vec{b} the \overrightarrow{AB}=\vec{a}+\vec{b}$ (triangle law of addition) (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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253. Assertion: If I is the incentre of $\triangle ABC, then$

|vec(BC)|vec(IA)+|vec(CA)|vec(IB)+|vec(AB)|vec(IC)=0

$Reason: IfOisthe$ or $ig \in$, $thentheposition \overrightarrow{\longrightarrow} rofcentroidof$

/_\ABC$is \frac{\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC}}{3}$

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254. Assertion: $\overrightarrow{a} = \hat{i} + p\hat{j} + 2\hat{k}$ and $\hat{b} = 2\hat{i} + 3\hat{j} + q\hat{k}$ are parallel vectors if $p = \frac{3}{2}, q = 4,$ Reason: If $\overrightarrow{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\overrightarrow{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ are parallel then a_1/b_1=a_2/b_2=a_3/b_3`. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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255. Assertion: Let $\overrightarrow{a} = \hat{i} + \hat{j}$ and $\overrightarrow{b} = \hat{j} - \hat{k}$ be two vectors. Angle between $\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{a} - \overrightarrow{b} = 90^0$

Reason: Projection of $\overrightarrow{a} + \overrightarrow{b}\, on\, \overrightarrow{a} - \overrightarrow{b}$ is zero

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true R is not te correct explanation of A

(C) A is true but R is false.

(D) A is false but R is true.

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256. Assertion: $\overrightarrow{c}, 4\overrightarrow{a} - \overrightarrow{b},$ and $\overrightarrow{a}, \overrightarrow{c}$ are coplanar.

Reason Vector $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are linearly dependent.

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true R is not te correct explanation of A

(C) A is true but R is false.

(D) A is false but R is true.

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257. Assertion: $\left|\vec{a}\right| = \left|\vec{b}\right|$ does not imply that $\vec{a} = \vec{b}$, Reason: If $\vec{a} = \vec{b}, then\left|\vec{a}\right| = \left|\vec{b}\right|$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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258. Assertion: If $\vec{a}, \vec{b}, \vec{c}$ are unit such that $\vec{a} + \vec{b} + \vec{c} = 0$ then $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a} = -\frac{3}{2}$, Reason $\left(\vec{x} + \vec{y}\right)^2 = \left|\vec{x}\right|^2 + \left|\vec{y}\right|^2 + 2\left(\vec{x} . \vec{y}\right)$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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259. Assertion: Three points with position vectors $\vec{a}s, \vec{b}, \vec{c}$ are collinear if $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = 0$ Reason: Three points A,B,C are collinear Iff $\overrightarrow{AB} \times \overrightarrow{AC} = \overrightarrow{0}$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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260. Assertion: If as force $\vec{F}$ passes through $Q\left(\vec{b}\right)$ then moment of force $\vec{F}$ about P($\vec{a}$) is $\vec{F} \times \vec{r}$, where $\vec{r} = \overrightarrow{PQ}$, Reason Moment is a vector. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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261. Let A($\vec{a}$), B ($\vec{b}$) and C($\vec{c}$) be the vertices of the triangle with circumcenter at origin. Assertion: The nine point centre wil be $\left(\frac{\vec{a} + \vec{b} + \vec{c}}{2}\right)$, Reason: Centroid of $\triangle ABC$ is $\left(\frac{\vec{a} + \vec{b} + \vec{c}}{3}\right)$ and nine point centre is the middle point of the line segment joining circumcentre and orthocentre. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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262. Assertion: The scalar product of a force $\overrightarrow{F}$ and displacement $\overrightarrow{r}$ is equal to the work done.

Reason: Work done is not a scalar

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true R is not te correct explanation of A

(C) A is true but R is false.

(D) A is false but R is true.

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263. Assertion: In a $\triangle ABC, \overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = 0,$ Reason: If $\overrightarrow{AB} = \overrightarrow{a}, \overrightarrow{\big)BC\big)} = \overrightarrow{b}$ then $\overrightarrow{C} = \overrightarrow{a} + \overrightarrow{b}$ (triangle law of addition) (A)

Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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264. Assertion: For $a = -\frac{1}{\sqrt{3}}$ the volume of the parallelopiped formed by vectors $\hat{i} + a\hat{j}, a\hat{i} + \hat{j} + \hat{k}$ and $\hat{j} + a\hat{k}$ is maximum. Reason. The volume o the parallelopiped having the three coterminous edges $\vec{a} . \vec{b}$ and $\vec{c} = \left|\left[\vec{a}\vec{b}\vec{c}\right]\right|$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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265. Assertion: If $\vec{a}$ is a perpendicular to $\vec{b}$ and $\vec{c}, then \vec{a} \times \left(\vec{b} \times \vec{c}\right) = 0$ Reason: If $\vec{b}$ is perpendicular to $\vec{c}$ then $\vec{b} \times \vec{c} = 0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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266. Assertion : If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 3\left|2\vec{a} - \vec{b}\right| = 5, then\left|2\vec{a} + \vec{b}\right| = 5,$ Reason: $\left|\vec{p} - \vec{q}\right| = \left|\vec{p} + \vec{q}\right|$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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267. Statement I: If in a $\Delta ABC, BC = \frac{p}{|p|} - \frac{q}{|q|}$ and $C = \frac{2p}{|p|}, |p| \neq |q|$, then the value of $\cos 2A + \cos 2B + \cos 2C$ is -1.

Statement II: If in $\Delta ABC, \angle C - 90^\circ$, then

$\cos 2A + \cos 2B + \cos 2C = -1$

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268. Assertion: If $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c} \times \overrightarrow{d}$ and $\overrightarrow{a} \times \overrightarrow{c} = \overrightarrow{b} \times \overrightarrow{d}\, the \left(\overrightarrow{a} - \overrightarrow{d}\right)$ is perpendicular to $\left(\overrightarrow{b} - \overrightarrow{c}\right)$., Reason : If $\overrightarrow{p}$ is perpendicular to $\overrightarrow{q}\, then\, \overrightarrow{p} . \overrightarrow{q} = 0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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269. Assertion: If $\overrightarrow{r} . \overrightarrow{a} = 0, \overrightarrow{r} . \overrightarrow{b} = 0, \overrightarrow{r} . \overrightarrow{c} = 0$ for some non zero vector $\overrightarrow{r}$ e then $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are coplanar vectors. Reason : If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are coplanar then $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = 0$ (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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270. Assertion: If $\vec{a}$ and $\vec{b}$ re reciprocal vectors, then $\vec{a}.\vec{b} = 1$, Reason: If $\vec{a} = \lambda \vec{b}$, $\lambda \varepsilon R^+$ and $\left|\vec{a}\right|\left|\vec{b}\right| = 1$, then $\vec{a}$ and $\vec{b}$ are reciprocal. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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271. Assertion: Let $\vec{a}$ and $\vec{b}$ be any two vectors $\left(\vec{a} \times \hat{i}\right).\left(\vec{b} \times \hat{i}\right) + \left(\vec{a} \times \hat{j}\right).\left(\vec{b} \times \hat{j}\right) + \left(\vec{a} \times \hat{k}\right).\left(\vec{b} \times \hat{k}\right) = 2\vec{a}$

(A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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272. Assertion: The vector product of a force $\vec{F}$ and displacement $\vec{r}$ is equal to the work done. Reason: Work is not a vector. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.

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273. Consider three vectors $\vec{a}, \vec{b}$ and $\vec{c}$. Vectors $\vec{a}$ and $\vec{b}$ are unit vectors having an angle θ between them For vector veca,$\left|\vec{a}\right|^2 = \vec{a}.\vec{a}$ If $\vec{a} \perp \vec{b}$ and $\vec{a} \perp \vec{c}\, then\, \vec{a} \mid\mid \vec{b} \times \vec{c}$ If $\vec{a} \mid\mid \vec{b}, then\, \vec{a} = t\,\vec{b}$ Now answer the following question: The value of $\sin\left(\frac{\theta}{2}\right)$ is (A) $\frac{1}{2}\left|\vec{a} - \vec{b}\right|$ (B) $\frac{1}{2}\left|\vec{a} + \vec{b}\right|$ (C) $\left|\vec{a} - \vec{b}\right|$ (D) $\left|\vec{a} + \vec{b}\right|$

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274. Consider three vectors $\vec{a}, \vec{b}$ and $\vec{c}$. Vectors $\vec{a}$ and $\vec{b}$ are unit vectors having an angle θ between them For vector veca,$\left|\vec{a}\right|^2 = \vec{a}.\vec{a}$ If $\vec{a} \perp \vec{b}$ and $\vec{a} \perp \vec{c}\, then\, \vec{a} \mid\mid \vec{b} \times \vec{c}$ If $\vec{a} \mid\mid \vec{b}, then\, \vec{a} = t\,\vec{b}$ Now answer the following question: If $\vec{c}$ is a unit vector and equal to the sum of $\vec{a}$ and $\vec{b}$ the magnitude of difference between $\vec{a}$ and $\vec{b}$ is (A) 1 (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) $\frac{1}{\sqrt{2}}$

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275. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be unit vectors such that $\vec{a}.\vec{b} = 0 = \vec{a}.\vec{c}$. It the angle between $\vec{b}$ and $\vec{c} is \frac{\pi}{6}$ then find $\vec{a}$.

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276. Consider three vectors $\vec{a}, \vec{b}$ and $\vec{c}$. Vectors $\vec{a}$ and $\vec{b}$ are unit vectors having an angle θ between them For vector $\vec{a}, \left|\vec{a}\right|^2 = \vec{a}.\vec{a}$ If $\vec{a} \perp \vec{b}$ and $\vec{a} \perp \vec{c} then \vec{a} \mid \mid \vec{b} \times \vec{c}$ If $\vec{a} \mid \mid \vec{b}, then \vec{a} = t\vec{b}$ Now answer the following question: If $\left|\vec{c}\right| = 4, \theta = \cos^{-1}\left(\frac{1}{4}\right)$ and $\vec{c} = 2\vec{b} + t\vec{a}, then t =$ (A) $3, -4$ (B) $-3, 4$ (C) $3, 4$ (D) $-3, -4$

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277. For vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a}.\vec{c}\right)\vec{b} - \left(\vec{a}.\vec{b}\right)\vec{c}$ and $\left(\vec{a} \times \vec{b}\right.$

Now answer the following question: $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right)$ is equal to

(A) $\vec{a}.\left(\vec{b} \times \left(\vec{c} \times \vec{d}\right)\right)$ (B) $\left|\vec{a}\right|\left(\vec{b}.\left(\vec{c} \times \vec{d}\right)\right)$ (C) $\left|\vec{a} \times \vec{b}\right|.\left|\vec{c} \times \vec{d}\right|$ (D) none of these

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278. For vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a}.\vec{c}\right)\vec{b} - \left(\vec{a}.\vec{b}\right)\vec{c}$ and $\left(\vec{a} \times \vec{b}\right.$

Now answer the following question: $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right)$ is equal to

(A) $\vec{a}.\left(\vec{b} \times \left(\vec{c} \times \vec{d}\right)\right)$ (B) $\left|\vec{a}\right|\left(\vec{b}.\left(\vec{c} \times \vec{d}\right)\right)$ (C) $\left|\vec{a} \times \vec{b}\right|.\left|\vec{c} \times \vec{d}\right|$ (D) none of these

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279. For vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a}.\vec{c}\right)\vec{b} - \left(\vec{a}.\vec{b}\right)\vec{c}$ and $\left(\vec{a} \times \vec{b}\right.$

Now answer the following question: $\left\{\left(\vec{a} \times \vec{b}\right). \times \vec{c}\right\}.\vec{d}$ would be equal to (A) $\vec{a}.\left(\vec{b} \times \left(\vec{c} \times \vec{d}\right)\right)$ (B) $\left(\left(\vec{a} \times \vec{c}\right) \times \vec{b}\right).\vec{d}$ (C) $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right)$ (D) none of these

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280. Unit vector along $\vec{a}$ is denoted by $\hat{a}\Big($ if $\left|\vec{a}\right| = 1, \vec{a}$ is called a unit vector). Also $\frac{\vec{a}}{\left|\vec{a}\right|} = \hat{a}$ and $\vec{a} = \left|\vec{a}\right|\hat{a}$. Suppose $\vec{a}, \vec{b}, \vec{c}$ are three non parallel unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{1}{2}\vec{b}$ and $\vec{p} \times \left(\vec{q} \times \vec{r}\right) = \left(\vec{p}.\vec{r}.\vec{q}\right) - \left(\vec{p}.\vec{q}\right)\vec{r}\Big]$. Angle between $\vec{a}$ and $\vec{b}$ is (A) 90^0 (B) 30^0 (C) 60^0 (D) none of these

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281. Unit vector along $\vec{a}$ is denoted by $\hat{a}\Big($ if $\left|\vec{a}\right| = 1, \vec{a}$ is called a unit vector). Also $\dfrac{\vec{a}}{\left|\vec{a}\right|} = \hat{a}$ and $\vec{a} = \left|\vec{a}\right|\hat{a}$. Suppose $\vec{a}, \vec{b}, \vec{c}$ are three non parallel unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \dfrac{1}{2}\vec{b}$ and $\vec{p} \times \left(\vec{q} \times \vec{r}\right) = \left(\vec{p}\,.\,\vec{r}\,.\,\vec{q}\right) - \left(\vec{p}\,.\,\vec{q}\right)\vec{r}\Big]$. Angle between $\vec{a}$ and $\vec{c}$ is (A) 120^0 (B) 60^0 (C) 30^0 (D) none of these

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282. Unit vector along $\vec{a}$ is denoted by $\hat{a}\Big($ if $\left|\vec{a}\right| = 1, \vec{a}$ is called a unit vector). Also $\dfrac{\vec{a}}{\left|\vec{a}\right|} = \hat{a}$ and $\vec{a} = \left|\vec{a}\right|\hat{a}$. Suppose $\vec{a}, \vec{b}, \vec{c}$ are three non parallel unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \dfrac{1}{2}\vec{b}$ and $\vec{p} \times \left(\vec{q} \times \vec{r}\right) = \left(\vec{p}\,.\,\vec{r}\right)\vec{q} - \left(\vec{p}\,.\,\vec{q}\right)\vec{r}$. $\left|\vec{a} \times \vec{c}\right|$ is equal to (A) $\dfrac{1}{2}$ (B) $\dfrac{\sqrt{3}}{2}$ (C) $\dfrac{3}{4}$ (D) none of these

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283. For any three vectors $\vec{a}, \vec{b}, \vec{c}$ their product would be a vector if one cross product is folowed by other cross product i.e $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ or $\left(\vec{b} \times \vec{c}\right) \times \vec{a}$ etc. For any four vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ the product would be a vector with the help of sequential cross product or by cross product of two vectors obtained by corss product of two pair i.e. $\left(\vec{a} \times \left(\vec{b} \times \vec{c}\right)\right) \times \vec{d}$ or $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)$. Now answer the following question: $\left(\vec{a} \times \vec{b}\right)x\left(\vec{c} \times \vec{d}\right)$ would be a vector (A) perpendicular to $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ (B) parallel to $\vec{a}$ and $\vec{c}$ (C) paralel to $\vec{b}$ and $\vec{d}$ (D) none of these

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284. For any three vectors $\vec{a}, \vec{b}, \vec{c}$ their product would be a vector if one cross product is folowed by other cross product i.e $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ or $\left(\vec{b} \times \vec{c}\right) \times \vec{a}$ etc. For any four vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ the product would be a vector with the help of sequential cross product or by cross product of two vectors obtained by corss product of two pair i.e. $\left(\vec{a} \times \left(\vec{b} \times \vec{c}\right)\right) \times \vec{d}$ or $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)$. $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)$ would be a (A) equally inclined with $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ (B) perpendicular with $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ and $\vec{c}$ (C) equally inclined with $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$ (D) none of these

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285. For any three vectors $\vec{a}, \vec{b}, \vec{c}$ their product would be a vector if one cross product is folowed by other cross product i.e $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ or $\left(\vec{b} \times \vec{c}\right) \times \vec{a}$ etc. For any four vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ the product would be a vector with the help of sequential cross product or by cross product of two vectors obtained by corss product of two pair i.e. $\left(\vec{a} \times \left(\vec{b} \times \vec{c}\right)\right) \times \vec{d}$ or $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)$. Now answer the following question: $\left(\vec{a} \times \vec{b}\right) x \left(\vec{c} \times \vec{d}\right)$ would be a (A) equally inclined with $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ (B) perpendicular with

$\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ and $\vec{c}$ (C) equally inclined with $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$

(D) none of these

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286. If O be the origin the vector $\overrightarrow{OP}$ is called the position vector of point P. Also $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$. Three points are said to be collinear if they lie on the same stasighat line.Points A,B,C are collinear if one of them divides the line segment joining the others two in some ratio. Also points A,B,C are collinear if and only if $\overrightarrow{AB} \times \overrightarrow{AC} = \vec{0}$ Let the points A,B, and C having position vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be collinear Now answer the following queston: $t\vec{a} + s\vec{b} = (t+s)\vec{c}$ where t and s are scalar (A) $t\vec{a} + s\vec{b} = (t+s)\vec{c}$ where t and s are scalar (B) $\vec{a} = \vec{b}$ (C) $\vec{b} = \vec{c}$

(D) none of these

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287. If O be the origin the vector $\overrightarrow{OP}$ is called the position vector of point P. Also $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$. Three points are said to be collinear if they lie on the same stasighat line.Points A,B,C are collinear if one of them divides the line segment joining the others two in some ratio. Also points A,B,C are collinear if and only if $\overrightarrow{AB} \times \overrightarrow{AC} = \overrightarrow{0}$ Let the points A,B, and C having position vectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ be collinear Now answer the following queston: The exists scalars x,y,z such that (A) $x\overrightarrow{a} + y\overrightarrow{b} + zc\overrightarrow{c} = 0$ and $x + y + z \neq 0$ (B) $x\overrightarrow{a} + y\overrightarrow{b} + zc\overrightarrow{c} \neq 0$ and $x + y + z \neq 0$ (C) $x\overrightarrow{a} + y\overrightarrow{b} + z\overrightarrow{c} = 0$ and $x + y + z = 0$ (D) none of these

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288. If O be the origin the vector $\overrightarrow{OP}$ is called the position vector of point P. Also $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$. Three points are said to be collinear if they lie on the same stasighat line.Points A,B,C are collinear if one of them divides the line segment joining the others two in some ratio. Also points A,B,C are collinear if and only if $\overrightarrow{AB} \times \overrightarrow{AC} = \overrightarrow{0}$ Let the points A,B, and C having position vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be collinear Now answer the following queston: (A) $\vec{a}.\vec{b} = \vec{a}.\vec{c}$ (B) $\vec{a} \times \vec{b} = \vec{c}$ (C) $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \vec{0}$ (D) none of these

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289. Prove that $\left[\vec{a} + \vec{b}\vec{b} + \vec{c}\vec{c} + \vec{a}\right] = 2\left[\vec{a}\vec{b}\vec{c}\right]$

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290. $\vec{a}.\left(\vec{b} \times \vec{c}\right)$ is called the scalar triple product of $\vec{a}, \vec{b}, \vec{c}$ and is denoted by $\left[\vec{a}\vec{b}\vec{c}\right]$. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then $\left[\vec{a} + \vec{b}\vec{b} + \vec{c}\vec{c} + \vec{a}\right]$ = (A) 1 (B) -1 (C) 0 (D) none of these

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291. $\vec{a}.\left(\vec{b}\times\vec{c}\right)$ is called the scalar triple product of $\vec{a}, \vec{b}, \vec{c}$ and is denoted by $\left[\vec{a}\vec{b}\vec{c}\right]. If \vec{a}, \vec{b}, \vec{c}$ are cyclically permuted the vaslue of the scalar triple product remasin the same. In a scalar triple product, interchange of two vectors changes the sign of scalar triple product but not the magnitude. in scalar triple product the the position of the dot and cross can be interchanged privided the cyclic order of vectors is preserved. Also the scaslar triple product is ZERO if any two vectors are equal or parallel. (A) [vecb-vecc vecc-veca veca-vecb](B)[veca vecb vecc]` (C) 0 (D) none of these

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292. Let A,B,C be vertices of a triangle ABC in which B is taken as origin of reference and position vectors of A and C are $\vec{a}$ and $\vec{c}$ respectively. A line AR parallel to BC is drawn from A PR (P is the mid point of AB) meets AC and Q and area of triangle ACR is 2 times area of triangle ABC Position vector of R in terms $\vec{a}$ and $\vec{c}$ is (A) $\vec{a}+2\vec{c}$ (B) $\vec{a}+3\vec{c}$ (C) $\vec{a}+\vec{c}$ (D) $\vec{a}+4\vec{c}$

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293. Let A,B,C be vertices of a triangle ABC in which B is taken as origin of reference and position vectors of A and C are $\overrightarrow{a}$ and $\overrightarrow{c}$ respectively. A line AR parallel to BC is drawn from A PR (P is the mid point of AB) meets AC and Q and area of triangle ACR is 2 times area of triangle ABC Positon vector of Q for position vector of R in (1) is (A) $\frac{2\overrightarrow{a}+3\overrightarrow{c}}{5}$ (B) $\frac{3\overrightarrow{a}+2\overrightarrow{c}}{5}$ (C) $\frac{\overrightarrow{a}+2\overrightarrow{c}}{5}$ (D) none of these

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294. Let A,B,C be vertices of a triangle ABC in which B is taken as origin of reference and position vectors of A and C are $\overrightarrow{a}$ and $\overrightarrow{c}$ respectively. A line AR parallel to BC is drawn from A PR (P is the mid point of AB) meets AC and Q and area of triangle ACR is 2 times area of triangle ABC: ((PQ)/(QR)).((AQ)/(QC))$isequal \rightarrow (B)\frac{1}{10}$ (C) $\frac{2}{5}$ (D) $\frac{3}{5}$

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295. Let A, B, C represent the vertices of a triangle, where A is the origin and B and C have position b and c respectively.* Points M, N and P are taken on sides AB, BC and CA respectively, such that $\frac{AM}{AB} = \frac{BN}{BC} = \frac{CP}{CA} = \alpha$. If $\triangle$ represent the area enclosed by the three vectors AN, BP and CM, then the value of α, for which $\triangle$ is least

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296. Let A, B, C represent the vertices of a triangle, where A is the origin and B and C have position b and c respectively.* Points M, N and P are taken on sides AB, BC and CA respectively, such that $\frac{AM}{AB} = \frac{BN}{BC} = \frac{CP}{CA} = \alpha$. If $\triangle$ represent the area enclosed by the three vectors AN, BP and CM, then the value of α, for which $\triangle$ is least

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297. Let $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ be three vectors such that $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right| = \left|\overrightarrow{c}\right| = 4$ and angle between $\overrightarrow{a}$ and $\overrightarrow{b} is \frac{\pi}{3}$ angle between $\overrightarrow{b}$ and $\overrightarrow{c}$ is $\frac{\pi}{3}$ and angle between $\overrightarrow{c}$ and $\overrightarrow{a}$ is $\frac{\pi}{3}$. The volume of the parallelopiped whose adjacent edges are represented by the vectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ is (A) $24\sqrt{2}$ (B) $24\sqrt{3}$ (C) $32\sqrt{92}$) (D) $32\sqrt{}$

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298. Let $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ be three vectors such that $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right| = \left|\overrightarrow{c}\right| = 4$ and angle between $\overrightarrow{a}$ and $\overrightarrow{b} is \frac{\pi}{3}$ angle between $\overrightarrow{b}$ and $\overrightarrow{c}$ is $\frac{\pi}{3}$ and angle between $\overrightarrow{c}$ and $\overrightarrow{a}$ is $\frac{\pi}{3}$. The heighat of the parallelopiped whose adjacent edges are represented by the ectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ is (A) $4\sqrt{\frac{2}{3}}$ (B) $3\sqrt{\frac{2}{3}}$ (C) $4\sqrt{\frac{3}{2}}$ (D) $3\sqrt{\frac{3}{2}}$

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299. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = |\vec{b}| = |\vec{c}| = 4$ and angle between $\vec{a}$ and $\vec{b}\, is \frac{\pi}{3}$ angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$ and angle between $\vec{c}$ and $\vec{a}$ is $\frac{\pi}{3}$. The volume of the tetrhedron whose adjacent edges are represented by the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ is (A) $\frac{4\sqrt{3}}{2}$ (B) $\frac{8\sqrt{2}}{3}$ (C) $\frac{16}{\sqrt{3}}$ (D) $\frac{16\sqrt{2}}{3}$

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300. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = |\vec{b}| = |\vec{c}| = 4$ and angle between $\vec{a}$ and $\vec{b}\, is \frac{\pi}{3}$ angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$ and angle between $\vec{c}$ and $\vec{a}$ is $\frac{\pi}{3}$. The volume of the triangular prism whose adjacent edges are represented by the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ is (A) $12\sqrt{12}$ (B) $12\sqrt{3}$ (C) $16\sqrt{2}$ (D) $16\sqrt{3}$

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301. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ be any three non coplanar vectors. Then the system of vectors $\vec{a}'$, $\vec{b}'$ and $\vec{c}'$ which satisfies $\vec{a}.\vec{a}' = \vec{b}.\vec{b}' = \vec{c}.\vec{c}' = 1$ and $\vec{a}.\vec{b}' = \vec{a}.\vec{c}' = \vec{b}.\vec{a}' = \vec{b}.\vec{c}$ is called the reciprocal system to the vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$. The value of $\left[\vec{a}',\vec{b}',\vec{c}'\right]^{-1}$ is (A) $2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ (B) $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ (C) $3\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ (D) 0

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302. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ be any three non coplanar vectors. Then the system of vectors $\vec{a}'$, $\vec{b}'$ and $\vec{c}'$ which satisfies $\vec{a}.\vec{a}' = \vec{b}.\vec{b}' = \vec{c}.\vec{c}' = 1$ $\vec{a}.\vec{b}' = \vec{a}.\vec{a}' = \vec{b}.\vec{a}' = \vec{b}.\vec{c}' = \vec{c}.\vec{a}' = \vec{c}.\vec{b}' = 0$ is called the reciprocal system to the vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$. The value of $\left(\vec{a}\times\vec{a}'\right) + \left(\vec{b}\times\vec{b}'\right) + \left(\vec{c}\times\vec{c}'\right)$ is (A) $\vec{a}+\vec{b}+\vec{c}$ (B) $\vec{a}'+\vec{b}'+\vec{c}'$ (C) 0 (D) none of these

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303. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ be any three non coplanar vectors. Then the system of vectors $\vec{a}'$, $\vec{b}'$ and $\vec{c}'$ which satisfies $\vec{a}.\vec{a}' = \vec{b}.\vec{b}' = \vec{c}.\vec{c}' = 1\vec{a}.\vec{b}' = \vec{a}.\vec{b}' = \vec{b}.\vec{a}' = \vec{b}.\vec{c}' =$ is called the reciprocal system to the vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$. $\left[\vec{a}, \vec{b}, \vec{c}\right]\left(\left(\vec{a}' \times \vec{b}'\right) + \left(\vec{b}' \times \vec{c}'\right) + \left(\vec{c}' \times \vec{a}'\right)\right) =$ (A) $\vec{a} + \vec{b} + \vec{c}$ (B) $\vec{a} + \vec{b} - \vec{c}$ (C) $2\left(\vec{a} + \vec{b} + \vec{c}\right)$ (D) $3\left(\vec{a}' + \vec{b}' + \vec{c}'\right)$

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304. The vector equation of the plane through the point $2\hat{i} - \hat{j} - 4\hat{k}$ and parallel to the plane $r \cdot \left(4\hat{i} - 12\hat{j} - 3\hat{k}\right) - 7 = 0$ is

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