MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

VECTOR ALGEBRA: COMPETITION

Solved Examples

1. Let $\vec{r}_1, \vec{r}_2, \ldots\ldots \vec{r}_n$ be the position of points $P_1, P_2, \ldots\ldots\ldots, P_n$ respectively relative to an origin O. Show that if the vector equation $a_1\vec{r}_1 + a_2\vec{r}_2 + \ldots + a_n\vec{r}_n = \vec{0}$ holds, then a similar equation will also hold good wilth respect to any other origin if $a_1 + a_2 + \ldots\ldots + a_n = 0$

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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 $p + q + r + . = 0, where p, q, r\ldots\ldots..$ are scalars.

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3. A vector a has components a_1, a_2, a_3 in a right handed rectangular cartesian coordinate system $OXYZ$ the coordinate axis is rotated about z axis through an angle $\frac{\pi}{2}$. The 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 thast $\overrightarrow{A_1A_2} + \overrightarrow{B_1B_2} + \overrightarrow{C_1C_2} = 3\overrightarrow{G_1G_2}$

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

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7. If the vectors $a\vec{i} + \vec{j} + \vec{k}, \vec{i} + b\vec{j} + \vec{k}, \vec{i} + \vec{j} + c\vec{k}$ are coplanar find the value of $\frac{1}{1-a} + \frac{1}{a-b} + \frac{1}{1-c}$

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8. If $\vec{a}, \vec{b}$ be two non zero non parallel vectors then show that the points whose position vectors are $p_1\vec{a} + q_1\vec{b}, p_2\vec{a} + q_2\vec{b}, p_3\vec{a} + q_3\vec{b}$ 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 $\vec{i} - 3\vec{j} + 2\vec{k}, 2\vec{i} - 4\vec{j} - \vec{k}$ and $3\vec{i} + 2\vec{j} - \vec{k}$ are linearly independent.

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10. 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 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. If f is the centre of a circle inscribed in a triangle ABC, then

$$\left|\overrightarrow{BC}\right|\overrightarrow{IA}+\left|\overrightarrow{CA}\right|\overrightarrow{IB}+\left|\overrightarrow{AB}\right|\overrightarrow{IC}$$ is

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15. Let $OACB$ be a parallelogram with O at the origin andOC a diagonal. Let D be the midpoint of $\dot{OA}$ using vector methods prove that $BDandCO$ intersect 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 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 $C\left(-5\vec{i} + \overrightarrow{6k}\right)$

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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 points $A(1, 0, 1)$ to the ine thorugh the points $B(2, 3, 4)$ and $C(-1, 1, -2)$.

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23. If vector $\vec{a}, \vec{b}, \vec{c}$ are coplanar show that $\begin{vmatrix} \vec{a} & \vec{b} & \vec{c} \\ \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \end{vmatrix}$

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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. If D is the mid-point of BC, E the foot of the perpendicular drawn from D to AC, F is the mid-point of DE. Prove that AF is perpendicular to BE.

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27. Let ABC and PQR be any two triangles in the same plane. Assume that the perpendiculars from the points A, B, C to the sides QR, RP, PQ respectively are concurrent. Using vector methods or otherwise,prove that the perpendiculars from $P, Q, R \rightarrow BC, CA, AB$ respectively are also concurrent.

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28. P and Q re tow interior points on te side BC of $\triangle ABC$such that , $BP \mid \mid BQ$ and $BC.PQ = BP.CQ$ and AQ bisects $\angle PAC$ using vector method prove that AQ and AB are mutually perpendicular

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29. 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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30. 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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31. 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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32. A particle acted on by constant forces $4\vec{i} + \vec{j} - 3\vec{k}$ and $3\vec{i} + \vec{j} - \vec{k}$ is displaced from the point $\vec{i} + 2\vec{j} + 3\vec{k}$ to the point $5\vec{i} + 4\vec{j} + \vec{k}$. Find the total work done by the forces

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33. $A_1, A_2, \dots, A_n$ are the vertices of a regular plane polygon with n sides and O as its centre. Show that $\sum_{i=1}^{n} \overrightarrow{OA_i} \times \overrightarrow{OA_{i+1}} = (1 - n)\left(\overrightarrow{OA_2} \times \overrightarrow{OA_1}\right)$

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

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35. 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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36. $A, B, CandD$ are any four points in the space, then prove that $\left|\vec{A}B \times \vec{C}D + \vec{B}C \times \vec{A}D + \vec{C}A \times \vec{B}D\right| = 4$ (area of ABC .)

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37. 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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38. Let

$A(t) = f_1(t)\vec{i} + f_2(t)\vec{j}$ and $\vec{B}(t) = g_1(t)\vec{i} + g_2(t)\vec{j}, t\varepsilon[0, 1] where f_1, f_2, g_1, g_2$ are continuous functions. If $\vec{A}(t)$ and $\vec{B}(t)$ are non zero for all $t\varepsilon[0, 1]$ and $\vec{A}(0) = 2\vec{i} + 3\vec{j}, \vec{A}(1) = 6\vec{i} = 2\vec{j}, \vec{B}(0) = 3\vec{i} + 2\vec{j}$ and $\vec{B}(1) = 2\vec{i} + 6\vec{j}$

prove that $\vec{A}(t)$ and $\vec{B}(t)$ are parallel for some $t\varepsilon(0, 1)$

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39. Given that $\vec{A}, \vec{B}, \vec{C}$ form triangle such that $\vec{A} = \vec{B} + \vec{C}$. Find a,b,c,d such that area of the triangle is $5\sqrt{6}$ where $\vec{A} = a\vec{i} + b\vec{i} + c\vec{k}. \vec{B} = d\vec{i} + 3\vec{j} + 4\vec{k}$ and $\vec{C} = 3\vec{i} + \vec{j} - 2\vec{k}$.

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40. Position vectors of two points A and C re $9\vec{i} - \vec{j} + 7\vec{i} - 2\vec{j} + 7\vec{k}$ respectively THE point intersection of vectors

$\overrightarrow{AB} = 4\vec{i} - \vec{j} + 3\vec{k}$ and $\overrightarrow{CD} = 2\vec{i} - \vec{j} + 2\vec{k}$ 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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41. A,B,C,D are four pints such that $\overrightarrow{AB} = m\left(2\vec{i}6\vec{j} + 2\vec{k}\right), \overrightarrow{BC} = \vec{i} + 2\vec{j}$ and $\overrightarrow{CD} = n\left(-6\vec{i} + 15\vec{j} - 3\vec{k}\right)$. Find the conditions on the scalar m and n so that CD interesects aB at some point H.Also find the area of $\triangle BCH$

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42. 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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43. 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 positfons

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44. 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 $\vec{a}\times\vec{c}=\vec{b}\times ecd$ then prove that $\vec{a}.\vec{b}+\vec{c}.\vec{d}\neq\vec{a}.\vec{c}+\vec{b}.\vec{d}$

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45. If $\vec{A}=(1, 1, 1)$ and $\vec{C}=(0, 1, -1)$ are given vectors then find a vector $\vec{B}$ satisfying equations $\vec{A}\times\vec{B}=\vec{C}$ and $\vec{A}.\vec{B}=3$

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46. $\vec{A} = \left(2\vec{i} + \vec{k}\right), \vec{B} = \left(\vec{i} + \vec{j} + \vec{k}\right)$ and $\vec{C} = 4\vec{i} - \vec{3}j + 7\vec{k}$ determine a vector $verR$ satisfying $\vec{R} \times \vec{B} = \vec{C} \times \vec{B}$ and $\vec{R}.\vec{A} = 0$

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47. For any two vectors $\vec{u}$ and $\vec{v}$ prove that $\left(1 + \left|\vec{u}\right|^2\left(1 + \left|\vec{v}\right|^{20} = \left(1 - \vec{u}.\vec{c}\right)^2 + \ |\ \vec{u} + \vec{v} + \vec{u} \times \vec{|}\right.\right.^2$

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48. 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 $\vec{r}_3 = 2\vec{i} + \vec{j} - 2\vec{k}$ relative to an origin O. Find the distance of P from the plane OQR.

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49. A non zero vector $\vec{a}$ is parallel to the line of intersection of the plane determined by the vectors $\vec{i}, \vec{i}+\vec{j}$ and the plane determined by the vectors $\vec{i}-\vec{j}, \vec{i}+\vec{k}$ find the angle between $\vec{a}$ and the vector $\vec{i}-2\vec{j}+2\vec{k}$.

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50. The position ector 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 sequidsictnat form the lines OP, OQ and OR find a unit vector along $\overrightarrow{OAwhereO}$ is the origin.

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

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

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54. 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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55. 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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56. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar, show that $\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}$ are also coplanar.

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57. 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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58. 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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59. 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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60. 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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61. Vector $\vec{OA} = \hat{i} + 2\hat{j} + 2\hat{k}$ turns through a right angle passing through the positive x-axis on the way. Show that the vector in its new position is $\dfrac{4\hat{i} - \hat{j} - \hat{k}\cdot}{\sqrt{2}}$

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62. If is given that $\vec{x} = \frac{\vec{b} \times \vec{c}}{\vec{a}\ \ \vec{b}\ \ \vec{c}}, \vec{y} = \frac{\vec{c} \times \vec{a}}{\vec{a}\ \ \vec{b}\ \ \vec{c}}, \vec{z} = \frac{\vec{a} \times \vec{b}}{\vec{a}\ \ \vec{b}\ \ \vec{c}} where \vec{a}, \vec{b}, \vec{c}$ 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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63. 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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64. 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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65. If $\vec{x}.\vec{a}=0\vec{x}.\vec{b}=0$ and $\vec{x}.\vec{c}=0$ for some non zero vector $\vec{x}$ then show that $\left[\vec{a}\vec{b}\vec{c}\right]=0$

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66. 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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67. 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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68. 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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69. 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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70. Given that vectors $\vec{a}$ and $\vec{b}$ asre perpendicular to each other, find vector $\vec{v}$ in erms of $\vec{a}$ and $\vec{b}$ satisfying the equations $\vec{v}.\vec{a}=0, \vec{c}.\vec{b}=1$ and $\left[\vec{v}\vec{a}\vec{b}\right]=1$

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

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72. 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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73. 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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74. 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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75. Prove that : $\vec{i} \times \left(\vec{a} \times \vec{i}\right) + \vec{j} \times \left(\vec{a} \times \vec{j}\right) + \vec{k} \times \left(\vec{a} \times \vec{k}\right) = \overrightarrow{2a}$

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76. If $\vec{a}, \vec{b}, \vec{c}$ are non zero vectors and $\vec{b}$ is not parallel to $\left(\vec{a} \times \vec{c}\right)$ 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.

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77. Prove that: $\left[\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}\right] = \left[\vec{a}\vec{b}\vec{c}\right]^2$

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

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80. If $\hat{u}, \hat{v}, \hat{w}$ be three non-coplanar unit vectors with angles between $\hat{u} \& \hat{v}$ is α between $\hat{v} \& \hat{w}$ is β and between $\hat{w} \& \hat{u}$ is γ. If $\vec{a}, \vec{b}, \vec{c}$ are the unit vectors along angle bisectors of α, β, γ respectively, then prove that $\left[\vec{a} x \vec{b} \vec{b} x \vec{c} \vec{c} x \vec{a}\right] = \frac{1}{16}[\hat{u}\hat{v}\hat{w}]^2 \sec^2\left(\frac{\alpha}{2}\right)\sec^2\left(\frac{\beta}{2}\right)\sec^2\left(\frac{\gamma}{2}\right)$

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81. Let $\hat{a}$ be a unit vector and $\hat{b}$ a non zero vector non parallel to $\vec{a}$. Find the angles of the triangle tow sides of which are represented by the vectors. $\sqrt{3}\left(\hat{a} \times \vec{b}\right)$ and $\vec{b}$ - $\left(\hat{a}.\vec{b}\right)\hat{a}$

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82. 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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83. 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 $\vec{a}, \vec{b}$ and $\vec{c}$.

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84. Let $\vec{x}, \vec{y}$ and $\vec{z}$ be unit vectors such that $\vec{x}+\vec{y}+\vec{z}=\vec{a}, \vec{x}\times(\vec{y}\times\vec{z})=\vec{b}, (\vec{x}\times\vec{y})\times\vec{z}=\vec{c}, \vec{a}.\vec{x}=\frac{3}{2}, \vec{a}.\vec{y}=\frac{7}{4}$ and $|\vec{a}|=$

. Find $\vec{x}, \vec{y}, \vec{z}$ in terms of $\vec{a}, \vec{b}, \vec{c}$. `

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85. Solve the following siultaneous 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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86. Find the scaslars α and β if $\vec{a}\times(\vec{b}\times\vec{c})+(\vec{a}.\vec{b})\vec{b}=(\vec{4}-2\beta-\sin\alpha)\vec{b}+(\beta^2-1)\vec{c}$ and $(\vec{c}.\vec{c})\vec{a}=\vec{c}$

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

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87. Find the set of vectors reciprocal to the set of vectors $2\vec{i} + 3\vec{j} - \vec{k}, \vec{i} - \vec{j} - \vec{k}, -\vec{i} + 2\vec{j} + 2\vec{k}$

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88. Prove that: $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) + \left(\vec{a} \times \vec{c}\right) \times \left(\vec{d} \times \vec{b}\right) + \left(\vec{a} \times \vec{d}\right) \times \left(\vec{b} \times \vec{c}\right) = 2\left[\vec{b}\vec{c}\vec{d}\right]\vec{a}$

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

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90. Find vector $\vec{r}$ if $\vec{r}.\vec{a} = m$ and $\vec{r} \times \vec{b} = \vec{c}, where \vec{a}.\vec{b} \neq 0$

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

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92. Solve: $\vec{r} \times \vec{b} = \vec{a}, where\vec{a}$ and $\vec{b}$ are given vectors such that $\vec{a}.\vec{b} = 0$.

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93. Solve $\vec{a}.\vec{r} = x, \vec{b}.\vec{r} = y, \vec{c}.\vec{r} = z$, where $\vec{a}, \vec{b}, \vec{c}$ are given non coplanar vectors.

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94. Solve the following simultaneous equation for $\vec{x}$ and $\vec{y}$:

$\vec{x} + \vec{y} = \vec{a}, \vec{x} \times \vec{y} = \vec{b}$ and $\vec{x}.\vec{a} = 1$

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

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96. Solved $\lambda\vec{r} + (\vec{a}.\vec{r})\vec{b} = \vec{c}, \lambda \neq 0$

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

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98. If $\vec{a}, \vec{b}, \vec{c}$ asre three vectors such that $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}$ then (A) $|\vec{b}| = 1, |\vec{c}| = |\vec{a}|$ (B) $|\vec{c}| = 1, |\vec{a}| = |\vec{b}|$ (C) $|\vec{b}| = 2, |\vec{c}| = 2|\vec{a}|$ (D)

$\left|\vec{a}\right| = 1, \left|\vec{c}b\right| = \left|\vec{c}\right|$

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99. If $\hat{a}.\hat{b} = 0$ where $\hat{a}$ and $\hat{b}$ are unit vectors and the unit vectors $\vec{c}$ is inclined at angle θ to both $\hat{a}$ and $\hat{b}. If\hat{c} = m\hat{a} + n\hat{b} + p\left(\hat{a} \times \hat{b}\right), (m, n, p\varepsilon R)$ then (A) - $\frac{\pi}{4} \leq \theta \leq \frac{\pi}{4}$ (B) $\frac{\pi}{4} \leq \theta \leq \frac{3\pi}{4}$ (C) $0 \leq \theta \leq \frac{\pi}{4}$ (D) $0 \leq \theta \leq \frac{3\pi}{4}$

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100. The edges of a parallelopiped are of unit length and are parallel to non coplanar unit vectors $\hat{a}, \hat{b}, \hat{c}$ such that $\hat{a}.\hat{b} = \hat{b}.\hat{c} = \hat{c}.\hat{a} = \frac{1}{2}$ Then the volume of the parallelopiped is (A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{2\sqrt{2}}$ (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{1}{\sqrt{3}}$

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101. The number of distinct real values of λ 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 (A) zero (B) one (C) two (D) three

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102. Lelt two non collinear unit vectors $\hat{a}$ and $\hat{b}$ form and acute angle. A point P moves so that at any time t the position vector $\overrightarrow{OP}$ (where O is the origin) is given by $\hat{a}\cos t + \hat{b}\sin t.$ When P is farthest from origin O, let M be the length of $\overrightarrow{OP}$ and $\hat{u}$ be the unit vector along $\overrightarrow{OP}$ Then (A) $\hat{u} = \frac{\hat{a} + \hat{b}}{\left|\hat{a} + \hat{b}\right|}$ and $M = \left(1 + \hat{a}.\hat{b}\right)^{\frac{1}{2}}$ (B) $\hat{u} = \frac{\hat{a} - \hat{b}}{\left|\hat{a} - \hat{b}\right|}$ and $M = \left(1 + \hat{a}.\hat{b}\right)^{\frac{1}{2}}$ (C) $\hat{u} = \frac{\hat{a} + \hat{b}}{\left|\hat{a} + \hat{b}\right|}$ and $M = \left(1 + 2\hat{a}.\hat{b}\right)^{\frac{1}{2}}$ (D) $\hat{u} = \frac{\hat{a} - \hat{b}}{\left|\hat{a} - \hat{b}\right|}$ and $M = \left(1 + 2\hat{a}.\hat{b}\right)^{\frac{1}{2}}$

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103. Let $\vec{a}, \vec{b}, \vec{c}$ be unit such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$. Which one of the following is correct? (A) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a} = \vec{0}$ (B) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a} \neq \vec{0}$ (C) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \ \times \vec{c} \neq \vec{0}$ (D) $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}$ are mutually perpendicular

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104. Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}, \ \vec{=} \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - \hat{k}$. A vector in the plane of $\vec{a}$ and $\vec{b}$ whose projection on $\vec{c} is \frac{1}{\sqrt{3}}$ is (A) $4\hat{i} - \hat{j} + 4\hat{k}$ (B) $\hat{i} + \hat{j} - 3\hat{k}$ (C) $2\hat{i} + \hat{j} - 2\hat{k}$ (D) $4\hat{i} + \hat{j} - 4\hat{k}$

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

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106. The non zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are related by $\vec{a} = (8)\vec{b}$ and $\vec{c} = -7\vec{b}$. Then angle between $\vec{a}$ and $\vec{c}$ is $(A)\frac{\pi}{2}$ (B) pi $(C)0(D)\frac{\pi}{4}$

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107. The vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of vectors $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{j} + \hat{k}$ and bisects the angle between $\vec{b}$ and $\vec{c}$. Then which one of the following gives possible values o α and β? (A) $\alpha = 2, \beta = 1$ (B) $\alpha = 1, \beta = 1$ (C) $\alpha = 2, \beta = 1$ (D) $\alpha = 1, \beta = 2$

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108. If $\vec{a}, \vec{b}, \vec{c}$ be three that unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{1}{2}\vec{b}, \vec{b}$ and $\vec{c}$ veing non parallel. If θ_1 is the angle between $\vec{a}$ and $\vec{b}$ and θ_2 is the angle between $\vec{a}$ and $\vec{b}$ then (A) $\theta_1 = \frac{\pi}{6}, \theta_2 = \frac{\pi}{3}$ (B) $\theta_1 = \frac{\pi}{3}, \theta_2 = \frac{\pi}{6}$ (C) $\theta_1 = \frac{\pi}{2}, \theta_2 = \frac{\pi}{3}$ (D) $\theta_1 = \frac{\pi}{3}, \theta_2 = \frac{\pi}{2}$

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109. The equation $\vec{r} - 2\vec{r}.\vec{c} + h = 0, \left|\vec{c}\right| > \sqrt{h}$ represents (A) circle (B) ellipse (C) cone (D) sphere

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110. $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} + 4\hat{i} + 3\hat{k}$ 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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111. 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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112. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors, then $\left|\vec{a} - \vec{b}\right|^2 + \left|\vec{b} - \vec{c}\right|^2 + \left|\vec{c} - \vec{a}\right|^2$ does not exceed $(A)4(B)9(C)8(D)6$

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113. 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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114. 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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115. If $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are unit vectors such that $(\vec{a} \times \vec{b}).(\vec{c} \times \vec{d}) = 1$ and $\vec{a}.\vec{c} = \frac{1}{2}$ then (A) $\vec{a}, \vec{b}, \vec{c}$ are non coplanar (B) $\vec{b}, \vec{c}, \vec{d}$ are non coplanar (C) $\vec{b}, \vec{d}$ are non paralel (D) $\vec{a}, \vec{d}$ are paralel and $\vec{b}, \vec{c}$ are parallel

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116. Let $P(3, 2, 6)$ be a point in space and Q be a point on line $\vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(-3\hat{i} + \hat{j} + 5\hat{k})^{.}$ Then the value of μ for which the vector $\vec{PQ}$ is parallel to the plane $x - 4y + 3z = 1$ is a. 1/4 b. -1/4 c. 1/8 d. -1/8

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117. 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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118. 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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119. Let $\vec{A}$ be a vector parallel to the of intersection of planes P_1 and P_2 through origin. P_1 is parallel to the vectors $2\hat{j} + 3\hat{k}$ and $3\hat{j}$ - $3\hat{k}$ and P_2 is parallel to $\hat{j}$ - $\hat{k}$ and $3\hat{i} + 3\hat{j}$ then the angle between the vectors $\vec{A}$ and $2\hat{i} + \hat{j}$ - $2\hat{k}$ is (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{6}$ (D) $\frac{3\pi}{4}$

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120. Assertion: $\overrightarrow{PQ} \times \left(\overrightarrow{RS} + \overrightarrow{ST}\right) \neq 0,$ Reason : $\overrightarrow{PQ} \times \overrightarrow{RS} = \vec{0}$ and $\overrightarrow{PQ} \times \overrightarrow{ST} \neq \vec{0}$ (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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121. 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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122. Consider $\triangle ABC. LetIbethe \in centre$ and $a, b, cbethesidesofthe \triangle opposite \rightarrow \angle sA, B, Cr$

/_\ABC

$with \in the \triangle . AO, BO$ and $COmeetthesidesBC, CA$ and $AB \in D, E$ and $Frespe$

(OD)/(AD)+(OE)/(BE)+(O)/(CF)=(A)3/8(B)1(C)3/2` (D) none of these

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123. 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, D are any four points, prove that $\vec{AB}\cdot\vec{CD} + \vec{BC}\cdot\vec{AD} + \vec{CA}\cdot\vec{BD} = 0$.

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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 $3\vec{i} + 2\vec{j} - 2\vec{j}$. Determine the perpendicular distance of this plane from the origin.

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5. The position vector of two points A and B are $3\vec{i}+\vec{j}+2\vec{k}$ and $\vec{i}-2\vec{j}-4\vec{k}$ respectively. Find the equation of the plane through B and perpendicular to AB.

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6. Find the cosine of the angel 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 ABCbe a triangle. Points D,E,F are taken on the sides AB,BC and CA respectively such that $\frac{AD}{AB}=\frac{BE}{BC}/=\frac{CF}{CA}=\alpha$ Prove that the vectors AE, B and CD form a triangle also find alpha for which the area of the triangle formed by these is least.

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8. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors oif three non collinear points AS,B,C respectively, show that eperpendicular distance of C ferom the line through A and B is $\dfrac{\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|}{\left|\vec{b} - \vec{a}\right|}$

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

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10. Prove that the shortest distance between two lines AB and CD is $\dfrac{\left|\left(\vec{c} - \vec{a}\right). \left(\vec{b} - \vec{a}\right) \times \left(\vec{d} - \vec{c}\right)\right|}{\left|\left(\vec{b} - \vec{a}\right) \times \overrightarrow{d - \vec{c}}\right|}$ 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 $\frac{1}{2} | \left(xy\ | \left|\vec{a} \times \vec{b}\right|\right.$

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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 practicle 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 $\vec{a} = -2\overrightarrow{i} - 2\overrightarrow{j} + 4\overrightarrow{k}, \vec{b} = -2\overrightarrow{i} + 4\overrightarrow{j} - 2\overrightarrow{k}$ and $\vec{c} = 4\overrightarrow{i} - 2\overrightarrow{j} - 2\overrightarrow{k}$ 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 $2\overrightarrow{i} + 3\overrightarrow{j} + \vec{k}, \vec{i} - \vec{j} + \vec{k}, 2\overrightarrow{i} + \vec{j} - \vec{k}$.

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

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

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

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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. Prove that $\vec{a}, \vec{b}, \vec{c}$ are coplanar iff $\vec{a}\times\vec{b}, \vec{b}\times\vec{c}, \vec{c}\times\vec{a}$ are coplanar

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21. If $\vec{a}, \vec{b}, \vec{c}$ be three non coplanar vectors show that $\vec{b}\times\vec{c}, \vec{c}\times\vec{a}, \vec{a}\times\vec{b}$ are non coplanar.

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22. If $\vec{A} = \frac{\vec{b} \times \vec{c}}{\left[\vec{b}\vec{c}\vec{c}\right]}, \vec{B} = \frac{\vec{c} \times \vec{a}}{\left[\vec{c}\vec{a}\vec{b}\right)}, \vec{C} = \frac{\vec{a} \times \vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right)}$ 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 $\vec{\ }, \vec{b}, \vec{c}$ are non coplanar express $\vec{\ }, \vec{b}, \vec{c}$ 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. Show 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 $\vec{c} = c_1\vec{l} + v_2\vec{m} + c_3\vec{n} where \vec{l}, \vec{m}$ 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 angel between any edge and a face not containing the edge is $\cos^{-1}\left(1/\sqrt{3}\right)$.

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28. If a,b,c be the pth, qth and rth term respectively of H.P. show that the vectors $bc\vec{i}+p\vec{j}+\vec{k}, ca\vec{i}+q\vec{j}+\vec{k}$ and $ab\vec{i}+r\vec{j}+\vec{k}$ are coplanar.

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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 $a\vec{i}+2c\vec{j}-3a\vec{k}, (2a+1)\vec{i}+(2a+3)\vec{j}+(a+1)\vec{k}$ and $(3a+5)\vec{i}+(a+5)\vec{j}+(a+$

are non coplanar

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

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

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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 $\vec{a}=\vec{i}+\overrightarrow{2j}-\vec{k}, \vec{b}=\overrightarrow{2i}+\vec{j}+\overrightarrow{3k}, \vec{c}=\vec{i}-\vec{j}+\vec{k}$ and $\vec{d}=\overrightarrow{3i}\vec{j}+\overrightarrow{2k}$ then evaluate $\left(\vec{a}\times\vec{b}\right).\left(\vec{c}\times\vec{d}\right)$

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40. If $\vec{a}=\vec{i}+\overrightarrow{2j}-\vec{k}, \vec{b}=\overrightarrow{2i}+\vec{j}+\overrightarrow{3k}, \vec{c}=\vec{i}-\vec{j}+\vec{k}$ and $\vec{d}=\overrightarrow{3i}\vec{j}+\overrightarrow{2k}$ then evaluate $\left(\vec{a}\times\vec{b}\right)\times\left(\vec{c}\times\vec{d}\right)$

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41. Prove that $\vec{a}\times\left\{\vec{b}\times\left(\vec{c}\times\vec{d}\right)\right\}=\left(\vec{b}.\vec{d}\right)\left(\vec{a}\times\vec{c}\right)-\left(\vec{b}.\vec{c}\right)\left(\vec{a}\times\vec{d}\right)$

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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 $\dfrac{\left(\vec{a}.\vec{b}\right)\vec{a}}{\vec{a}^2}$ and $\left(\left(\vec{a} \times \vec{b}\right)\vec{a}\right)\dfrac{)}{a^2}$ 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: $\vec{d} = \vec{a} - \dfrac{\left(\vec{a}.\vec{b}\right)\vec{b}}{b^2}, \vec{c} = \dfrac{\left(\vec{a}.\vec{b}\right)\vec{b}}{b^2}$

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

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47. Prove that $\vec{a}' \times \vec{b}' + \vec{b}' \times \vec{c}' + \vec{c}' \times \vec{a}' = \dfrac{\vec{a} + \vec{b} + \vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}$

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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. Solve $\vec{r} \times \vec{a} = \vec{b}$ and $\vec{r} \times \vec{c} = \vec{d}$.

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50. Solve $\vec{a}.\vec{r}=x, \vec{b}.\vec{r}=y, \vec{c}.\vec{r}=z where \vec{a}, \vec{b}, \vec{c}$ are given non coplasnar vectors.

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51. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors each of magnitude 3 then $|\vec{a}+\vec{b}+\vec{|}$ 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 $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ 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 $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that $3\vec{a} + 4\vec{b} + 5\vec{c} = \vec{0}$. Then which of the following statements is true? (A) $\vec{a}$ is parrallel to vecb(B)veca $isperpendic\underline{a}r \rightarrow \vec{b}$ (C) $\vec{a}$ is neither parralel nor perpendicular to $\vec{b}$ (D) $\vec{a}, \vec{b}, \vec{c}$ are copalanar

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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) $\vec{a}.\vec{b}\times\vec{=}$ - 1 (B) $\vec{a}.\vec{b}\times\vec{c}=0$ (C) $\vec{a}.\vec{b}\times\vec{=}1$ (D) $\vec{a}.\vec{b}\times\vec{c}=2$

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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 $\vec{b}, \vec{a}, \vec{b} = |\vec{a}||\vec{b}|$ then (A) $\vec{a}$ | | $\vec{b}$ (B) $\vec{a} \perp \vec{b}$ (C) $\vec{a} = \vec{b}$ (D) none of these

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60. Unit vector in the xyplane that makes and angle of 45^0 with the vector $\hat{i} + \hat{j}$ and an angle of 60^0 with the vector $3\hat{i} - 4\hat{j}$ is (A) $\hat{i}$ (B) $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ (C) $\frac{\hat{i} - \hat{j}}{\sqrt{2}}$ (D) none of these

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61. If$\vec{a}, \vec{b}, \vec{c}$ are three mutually perpendicular vectors, then the vector which is equally inclined to these vectors is (A) $\vec{a} + \vec{b} + \vec{c}$ (B) $\frac{\vec{a}}{|\vec{a}|} + \frac{\vec{b}}{|\vec{b}|} + \vec{l}|\vec{c}|$ (C) $\frac{\vec{a}}{|\vec{a}|^2} + \frac{\vec{b}}{|\vec{b}|^2} + \frac{\vec{c}}{|\vec{c}|^2}$ (D) $|\vec{a}|\vec{a} - |\vec{b}|\vec{b} + |\vec{c}|\vec{c}$

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62. If $\vec{a} + \vec{b} + \vec{c} = 0, \left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5, \left|\vec{c}\right| = 7,$ then angle between $\vec{a}$ and $\vec{b}$ is (A) $\frac{\pi}{6}$ (B) $\frac{2\pi}{3}$ (C) $\frac{5\pi}{3}$ (D) $\frac{\pi}{3}$

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63. If the sides of an angle ar given by vectors $\vec{a} = \hat{i} - 2\hat{j} + 2\hat{k}$ and vecb $2\hat{i} + \hat{j} + 2\hat{k},$ then the internasl bisector for the angle is (A) $3\hat{i} - \hat{j} + 3\hat{k}$ (B) $\frac{1}{3}\left(3\hat{i} - \hat{j} + 4\hat{k}\right)$ (C) $\frac{1}{3}\left(-\hat{i} - 3\hat{j}\right)$ (D) $3\hat{i} - \hat{j} - 4\hat{k}$

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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 the $\triangle ABC$ is (A) isosceles (B) equilateral (C) righat angled (D) none of these

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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 $\overrightarrow{PQ} on \overrightarrow{RS}$ 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 betweenteh unit vectors $\vec{a}$ and $\vec{b}$ is vec60^0$then$|veca-vecb|` is (A) 0 (B) 1 (C) 2 (D) 4

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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 (A) $\dfrac{\beta\vec{a} - \vec{a} \times \vec{c}}{|\vec{a}|^2}$ (B) $\dfrac{\beta\vec{a} + \vec{a} \times \vec{c}}{|\vec{a}|^2}$ (C) $\dfrac{\beta\vec{c} - \vec{a} \times \vec{c}}{|\vec{a}|^2}$ (D) $\dfrac{\beta\vec{c} + \vec{a} \times \vec{c}}{|\vec{a}|^2}$

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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 gamma is equal to (A) $\dfrac{\left[\vec{a}\vec{b}\vec{c}\right]}{\left[\vec{b}\vec{a}\vec{c}\right]}$ (B) $\dfrac{\left[\vec{b}\vec{c}\vec{d}\right]}{\left[\vec{b}\vec{c}\vec{a}\right]}$ (C) $\dfrac{\left[\vec{b}\vec{d}\vec{c}\right]}{\left[\vec{a}\vec{b}\vec{c}\right]}$ (D) $\dfrac{\left[\vec{c}\vec{b}\vec{d}\right]}{\left[\vec{a}\vec{b}\vec{c}\right]}$

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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 $\vec{b}$ lies in the interval (A) $\left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right)$ (B) $(0, \pi 0)$ (C) $\left(\dfrac{\pi}{2}, \dfrac{3\pi}{2}\right)$ (D) (0,2pi)`

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71. If $a\left(\vec{\alpha}\times\vec{\beta}\right)=b\left(\vec{\beta}\times\vec{\gamma}\right)+c\left(\vec{\gamma}\times\vec{\alpha}\right)=\vec{0}$ and at least one of a,b and c is non zero then vectors $\vec{\alpha},\vec{\beta},\vec{\gamma}$ are (A) parallel (B) coplanar (C) mutually perpendicular (D) none of these

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72. If $\vec{a},\vec{b},\vec{c}$ are mutually perpendicular vector 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 $\left[\vec{a}\vec{b}\vec{c}\right]=1 then \vec{\alpha}+\vec{\beta}+\vec{\gamma}=$ (A) $|\vec{a}|^2$ (B) - $|\vec{a}|^2$ (C) 0 (D) none of these

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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 $\vec{a} = \hat{i} - 3\hat{j}, \vec{b} = 2\hat{i} - t\hat{j}$ 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 $\vec{a}$ and $\vec{b}$ are two adjacent sides of parallelograsm then the vector representing the altitude of the parallelogram which is perpendicular to $\vec{a}$ is (A) $\vec{b} + \frac{\vec{b} \times \vec{a}}{|\vec{a}|^2}$ (B) $\frac{\vec{a}.\vec{b}}{\vec{b}|^2}$ (C) $\vec{b}$ - $\left.\frac{\vec{b}.\vec{a}}{(|\vec{a}|)^2}\right)$ (D) $\frac{\vec{a} \times (\vec{b} \times \vec{a})}{\vec{b}|^{20}}$

78. If A,B,C,D are four points in space, then $\left|\vec{AB}x\vec{CD} + \vec{BC} \times \vec{AD} + \vec{CA} \times \vec{BD}\right| = k(areof \triangle ABC)wherek =$ (A) 5 (B) 4 (C) 2 (D) none of these

79. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non coplnar and non zero vectors and $\vec{r}$ is any vector in space then $\left[\vec{c}\,\vec{r}\,\vec{b}\right]\vec{a} + p\vec{a}\,\vec{r}\,\vec{c}\,\big]\vec{b} + \left[\vec{b}\,\vec{r}\,\vec{a}\right]c =$ (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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80. If $\vec{u}, \vec{v}$ and $\vec{w}$ are vectors such that $\vec{u} + \vec{v} + \vec{w} = \vec{0}$ then $\left[\vec{u} + \vec{v}\vec{v} + \vec{w}\vec{w} + \vec{u}\,\right]\big) =$ (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 $\vec{a}\vec{b}$ be any two mutually perpendiculr vectors and $\vec{\alpha}$ be any vector

then $\left|\vec{a} \times \vec{b}\right|^2 \frac{\left(\vec{a}.\vec{\alpha}\right)\vec{a}}{\vec{a}|^2} + \left|\vec{a}x\vec{b}\right|^2 \frac{\left(\vec{b}.\vec{\alpha}\right)\vec{b}}{\left|\vec{b}\right|^2} - \left|\vec{a} \times \vec{b}\right|^2 \vec{\alpha} =$ (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 $\vec{d} = \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$ is a on zero vector and $\left|\left(\vec{d}.\vec{c}\right)\left(\vec{a} \times \vec{b}\right) + \left(\vec{d}.\vec{a}\right)\left(\vec{b} \times \vec{c}\right) + \left(\vec{d}.\vec{b}\right)\left(\vec{c} \times \vec{a}\right)\right| = 0$ then (A) $\left|\vec{a}\right| + \left|\vec{b}\right| + \left|\vec{c}\right| = \left|\vec{d}\right|$ (B) $\left|\vec{a}\right| = \left|\vec{b}\right| = \left|\vec{c}\right|$ (C) $\vec{a}, \vec{b}, \vec{c}$ are coplanar (D) $\vec{a} + \vec{c} = 2\vec{b}$

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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 (A) $\vec{a}, \vec{b}, \vec{c}$ are non coplanar (B) $\left|\vec{a}\right| = \left|\vec{b}\right| = \left|\vec{c}\right|$ (C) $\vec{a}.\vec{c} = \vec{b}.\vec{c}$ (D) $\lambda\left(\vec{b} \times \vec{c}\right) + \mu\left(\vec{c} \times \vec{a}\right) = \vec{c}$

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91. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $|\vec{b}| = |\vec{c}|$ then

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

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92. A parallelogram is constructed on $3\vec{a}+\vec{b}$ and $\vec{a}-4\vec{b}, where|\vec{a}|=6$ and $|\vec{b}|=8$ and $\vec{a}$ and $\vec{b}$ are anti parallel then the length of the longer diagonal is (A) 40 (B) 64 (C) 32 (D) 48

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

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94. If $\left(\vec{a}\times\vec{b}\right)\times\left(\vec{b}\times\vec{c}\right)=\vec{b}, where \vec{a}, \vec{b}$ and $\vec{c}$ are non zero vectors then (A) $\vec{a}, \vec{b}$ and $\vec{c} can be coplanar$ (B) $\vec{a}, \vec{b}$ and $\vec{c}$ must be coplanar (C) $\vec{a}, \vec{b}$ and $\vec{c}$cannot be coplanar (D) none of these

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95. If $\vec{a}$ is any then $\left|\vec{a}.\hat{i}\right|^2+\left|\vec{a}.\hat{i}\right|^2+\left|\vec{a}.\hat{k}\right|^2=$ (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. If $\vec{a}, \vec{b}$ and $\vec{c}$ are vectors such that $\left|\vec{a}\right|=3, \left|\vec{b}\right|=4$ and $|\vec{l}=5$ and $\left(\vec{a}+\vec{b}\right)$ is perpendicular to $\vec{c}, \left(\vec{b}+\vec{c}\right)$ is perpendicular to $\vec{a}$ and $\left(\vec{c}+\vec{a}\right)$ is perpendicular to $\vec{b}$ then $\left|\vec{a}+\vec{b}+\vec{c}\right|=$ (A) $4\sqrt{3}$ (B) $5\sqrt{2}$ (C) 2 (D) 12

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97. If $\left|\vec{a}\right| =$ and $\left|\vec{b}\right| = 3$ and $\vec{a}.\vec{b} = 0, then\left(\vec{a}\left(\vec{x}\left(\vec{a} \times \left(\vec{a} \times \right)\right)\right)\right) =$ (A) $48\hat{b}$ (B) $-48\hat{b}$ (C) $48\hat{a}$ (D) $-48\hat{a}$

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98. If $\left|\vec{a}.\vec{b}\right| = \sqrt{3}\left|\vec{a} \times \vec{b}\right|$ 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 $\hat{a}$ and $\hat{b}$ are two unit vectors and θ is the angle between them then vector $2\hat{b} + \hat{a}$ 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 $\vec{r}.\vec{a} = \vec{r}.\vec{b} = \vec{r}.\vec{c} = \frac{1}{2}$ 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

$A(\vec{a}), B(\vec{b})$ and $C(\vec{c}0$ is (A) $\left|\left[\vec{a}\vec{b}\vec{c}\right]\right|$ (B) $|\vec{r}|$ (C) $\left|\left[\vec{a}\vec{b}\vec{r}\right]\vec{r}\right|$ (D) none of these

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101. If $\alpha + \beta + \gamma = a\vec{\delta}$ and $\vec{\beta} + \vec{\gamma} + \vec{\delta} = b\vec{\alpha}$ and $\alpha, \vec{\beta}, \vec{\gamma}$ are non coplanar and $\vec{\alpha}$ is not parallel to $\vec{\delta}$ 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) $(-3, -1, -10$

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103. If the non zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other then the solution the equation $\vec{r} \times \vec{a} = \vec{b}$ is (A) $\vec{r} \alpha \vec{b}$ - $\frac{1}{|\vec{b}|^2}(\vec{a} \times \vec{b})$ (B) $\vec{r} \alpha \vec{b} + \frac{1}{|\vec{a}|^2}(\vec{a} \times \vec{b})$ (C) $\vec{r} \alpha \vec{b} + \frac{1}{|\vec{b}|^2}(\vec{a} \times \vec{b})$ (D) none of these

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104. If $\vec{\alpha} \mid \mid (\vec{b} \times \vec{\gamma}), then (\vec{\alpha} \times \vec{\beta}).(\vec{\alpha} \times \vec{\gamma}) =$ (A) $|\vec{\alpha}|^2(\vec{\beta}.\vec{\gamma})$ (B) $|\vec{\beta}|^2(\vec{\gamma}.\vec{\alpha})$ (C) $|\vec{\gamma}|^2(\vec{\alpha}.\vec{\beta})$ (D) $|\vec{\alpha}||\vec{\beta}||\vec{\gamma}|$

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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

$(\vec{a} \times \vec{b}) \times (\vec{r} \times \vec{c}) + (\vec{b} \times \vec{c}) \times (\vec{r} \times \vec{a}) + (\vec{c} \times \vec{a}) \times (\vec{r} \times \vec{b}) =$ (A) $[\vec{a}\vec{b}\vec{c}]$ (B) $2[\vec{a}\vec{b}\vec{c}]\vec{r}$ (C) $3[\vec{a}\vec{b}\vec{c}]\vec{r}$ (D) $4[\vec{a}\vec{b}\vec{c}]\vec{r}$

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106. Let $\overrightarrow{OA} = \vec{a}s, \overrightarrow{OB} = 10\vec{a} + 2\vec{b}$ and $\overrightarrow{OC} = \vec{b} whereO$ A and C are non collinear points. Let p denote the area of the quadrilaterial OABCand q denote the area of the parallelogram with OA and OC as adjacent sides. Then $\frac{p}{q}$ = (A) 2 (B) 6 (C) 1 (D) $\frac{1}{2} \mid \vec{a} + \vec{b} + \vec{c}\Big]$

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107. If $\vec{A} = \lambda(\vec{u} \times \vec{v}) + \mu(\vec{v} \times \vec{w}) + v(\vec{w} \times \vec{u})$ and $[\vec{u}\vec{v}\vec{w}] = \frac{1}{5} then \lambda + \mu + v =$ (A) 5 (B) 10 (C) 15 (D) none of these

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108. If $|\vec{c}| = 2, |\vec{a}| = |\vec{b}| = 1$ and $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = \vec{0}$ 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 $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b} + \vec{c}}{\sqrt{2}}$ 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 of intersetion of the planes $\vec{r}.\vec{n} = q, \vec{r}.\vec{n}' = q'$ and pasing through the point $\vec{a}$ is (A)

$\vec{r} = \vec{a} + \lambda(\vec{n} - \vec{n}')$ (B) $\vec{r} = \vec{a} + \lambda(\vec{n} \times \vec{n}')$ (C) $\vec{r} = \vec{a} + \lambda(\vec{n} + \vec{n}')$ (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 $\vec{r}.\vec{n} = q$ is (A) $\vec{a} + \frac{\vec{q} - \vec{a}.\vec{n}}{|\vec{n}|}$

(B) $\vec{a} + 2\left(\frac{\vec{q} - \vec{a}.\vec{n}}{|\vec{n}|^2}\right)\vec{n}$ (C) $\vec{a} + \frac{2(\vec{q} + \vec{a}.\vec{n})}{|\vec{n}|}$ (D) none of these

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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) $\left[\vec{r}\,\vec{a}\,s\vec{b}\right] = 0$ (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 $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}. If\vec{c}$ is a vector such that $\vec{a}.\,\vec{c} = \left|\vec{c}\right|, \left|\vec{c} - \vec{a}\right| = 2\sqrt{2}$ and the angle between $\left(\vec{a} \times \vec{b}\right)$ and $\vec{c}$ is $\frac{\pi}{6}$ then $|\left(\vec{a} \times \vec{b}\right)x\,\vec{|}$ = (A) 2/3(B)1/2(C)3/2` (D) 1

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116. If $\vec{A}, \vec{B}, \vec{C}$ 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 $\vec{R}$ which satisfies the relations $\vec{R} \times \vec{B} = \vec{C} \times \vec{B}$ and $\vec{R}.\,\vec{A} = 0$ 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 spiing about a fixed piont (3,-2,-1) with angular veclocity of 4 radd/sec, the axis of rotation being the direction of (1,2,-2) then the velocity of the particle at the point (4,1,1) is (A) $\frac{4}{3}(1,\ -4, 10)$ (B) $\frac{4}{3}(4,\ -10, 1)$ (C) $\frac{4}{3}(10,\ -4, 1)$ (D) $\frac{4}{3}(10, 4, 1)$

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

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119. If the area of triangle ABC having vertices $A(\vec{a}), B(\vec{b}), C(\vec{c})$ 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 $\triangle ABCareA(\vec{a}), B(\vec{b})$ and $C(\vec{c})$ 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 $O(0, 0, 0), A(1, 2, 1), B(2, 1, 3), andC(-1, 1, 2),$ then angle between face $OABandABC$ will be a. $\cos^{-1}\left(\frac{17}{31}\right)$ b. 30^0 c. 90^0 d. $\cos^{-1}\left(\frac{19}{35}\right)$

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124. The value of the a so that the volume of the paralellopied formed by vectors $\hat{i}a\hat{j} + \hat{k}, \hat{j} + a\hat{k}, a\hat{i} + \hat{k}$ becomes minimum is (A) $\sqrt{3}$ (B) 2 (C) $\frac{1}{\sqrt{3}}$ (D) 3

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125. If $a = \left(\hat{i} \times \hat{j}\hat{k}\right), \hat{a}.\hat{b} = 1$ and $\hat{a}.\hat{b} = 1$ and $\hat{a} \times \hat{b} - \left(\hat{i} - \hat{k}\right)$ then 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 $2\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is (A) $\frac{2\hat{i} - 6\hat{j} + \hat{k}}{\sqrt{41}}$ (B) $\frac{2\hat{i} - 3\hat{j}}{\sqrt{3}}$ (C) $3\hat{j} - \hat{k}\frac{)}{\sqrt{10}}$ (D) $\frac{4\hat{i} + 3\hat{j} - 3\hat{k}}{\sqrt{34}}$

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

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128. A vector $\vec{v}$ 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) $\vec{v} = \frac{4}{\sqrt{3}}\left(\hat{i} - \hat{j} - \hat{k}\right)$ (B) $\vec{v} = \frac{4}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}0\right.$ (C) $\vec{v} = \frac{4}{\sqrt{3}}\left(\hat{i} + \hat{j} + \hat{k}0\right.$ (D) vecv=4(hati+hatj+hatk)`

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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 is acted upon by the following forces $2\hat{i}+3\hat{j}+t\hat{k}$, $-5\hat{i}+4\hat{j}3\hat{k}$ and $3\hat{i}-7\hat{k}$. In which plane does it move? (A) $xy-pla\ne$ (B) $yz-pla\ne$ (C) $zx-pla\ne$ (D) any arbitrary plane

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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 $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \hat{b}4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $|\vec{c}| = \sqrt{3}$ then (A) $\alpha = 1, \beta = -1$ (B) $\alpha = 1, \beta = \pm 1$ (C) $\alpha - 1, \beta = \pm 1$ (D) $\alpha = \pm 1, \beta = 1$

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133. A vector $\vec{a} = t\hat{+}t^2\hat{j}$ 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 $\vec{AO} + \vec{OB} = \vec{BO} + \vec{OC}$ 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 $2\hat{i} + 4\hat{} - 5\hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$. The unit vector parallel to one of the diagonal is (A) $\frac{1}{\sqrt{69}}\left(\hat{i} + 2\hat{j} - 8\hat{k}\right)$ (B) $\frac{1}{\sqrt{69}}\left(-\hat{i} + 2\hat{j} + 8\hat{k}\right)$ (C) $\frac{1}{\sqrt{69}}\left(-\hat{i} - 2\hat{j} - 8\hat{k}\right)$ (D) $\frac{1}{\sqrt{69}}\left(\hat{i} + 2\hat{j} + 8\hat{k}\right)$

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

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137. If D,E and F and are respectively the mid points of AB,AC and BC in $\triangle ABC, then$vec(BE)+vec(AF)=(A)vec(DC)(B)1/2vec(BF)(C)2vec(BF)(D) 3/2vec(BF)`

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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) $\overrightarrow{PA} + \overrightarrow{PB} + 2\overrightarrow{PC} = \vec{0}$ (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 and D with position vectors $7\hat{i} - 4\hat{j} + 7\hat{k}, \hat{i} - 6\hat{j} + 10\hat{k}, \hat{i} - 3\hat{j} + 4\hat{k}$ and $5\hat{i} - \hat{j} + 5\hat{k}$ respectively. Then ABCD is a (A) square (B) rhombus (C) rectangle (D) parallelogram but not a rhombus

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140. The 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 triangle ABC. The length of the median through A is (A) $\sqrt{72}$ (B) $\sqrt{33}$ (C) $\sqrt{2880}$ (D) $\sqrt{18}$

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141. If $\vec{a}, \vec{b}, \vec{c}$ are noncoplanar vectors and λ is a real number, then the vectors $\vec{a} + 2\vec{b} + 3\vec{c}, \lambda\vec{b} + 4\vec{c}$ and $(2\lambda - 1)\vec{c}$ are non coplanar of (A) all values of lamda (B) all except one values of lamda (C) all except two values of lamda (D) no value of lamda

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142. Let $\vec{a}, \vec{b},$ and $\vec{c}$ be three non zero vector such that no two of these are collinear. If the vector $\vec{a} + 2\vec{b}$ is collinear with $\vec{c}$ and $\vec{b} + 3\vec{c}$ is colinear with $\vec{a}(\lambda$ being some non zero scalar) then $\vec{a} + 2\vec{b} + 6\vec{c}$ equals (A) $\lambda\vec{a}$ (B) $\lambda\vec{b}$ (C) $\lambda\vec{c}$ (D) 0

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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 $\overrightarrow{|a|} = 3, \left|\vec{b}\right| = 4, \text{ and } \left|\vec{a} = \vec{b}\right| = 5, then \left|\vec{a} - \vec{b}\right|$ is equal to (A) 6 (B) 5 (C) 4 (D) 3

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145. Let $\vec{u}, \vec{v}, \vec{w}$ be such that $\left|\vec{u}\right| = 1, \left|\vec{v}\right| = 2, \left|\vec{w}\right|3.$ If the projection of $\vec{v} along \vec{u}$ is equal to that of $\vec{w} along \vec{v}, \vec{w}$ are perpendicular to each other then $|\vec{u} - \vec{v} + \vec{w}|$ equals (A) 2 (B) $\sqrt{7}$ (C) $\sqrt{14}$ (D) 14

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146. If $\vec{a}, \vec{b}, \vec{c}$ are perpendicular to $\vec{b} + \vec{c}, \vec{c} + \vec{a}$ and $\vec{a} + \vec{b}$ respectively and if $|\vec{a} + \vec{b}| = 6, |\vec{b} + \vec{c}| = 8$ and $|\vec{c} + \vec{a}| = 10, then |\vec{a} + \vec{b} + \vec{c}|$ (A) $5\sqrt{2}$ (B) 50 (C) $10\sqrt{2}$ (D) 10

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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 perpendicular to each othre, then the angle beween $\vec{a}$ and $\vec{b}$ is (A) 45^0 (B) 60^0 (C) $\cos^{-1}\left(\frac{1}{30}\right)$ (D) $\cos^{-1}\left(\frac{2}{7}\right)$

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148. A unit vector in xy-plane that makes an angle of 45^0 with the vector $\hat{i}+\hat{j}$ and angle of 60^0 with the vector $3\hat{i}-4\hat{j}$ is (A) $\hat{i}$ (B) $\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}$ (C) $\dfrac{\hat{i}-\hat{j}}{\sqrt{2}}$ (D) none of these

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149. The position vector of the pont where the line $\vec{r}=\hat{i}-h*j+\hat{k}+t\left(\hat{i}+\hat{j}-\hat{k}\right)$ 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 distance between the line $\vec{r}=2\hat{i}-2\hat{j}+3\hat{+}\lambda\left(\vec{i}-\vec{j}+4\vec{k}\right)$ and the plane $\vec{r}.\left(\vec{i}+5\vec{j}+\vec{k}\right)=5$ is $(A)\dfrac{10}{3}\sqrt{3}$ (B) $\dfrac{10}{9}$ (C) $\dfrac{10}{3}$ (D) $\dfrac{3}{10}$

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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) $\left(4 + 2\sqrt{2}\right)\hat{i} + \left(4 - 2\sqrt{2}\right)\hat{j}$ (B) $\left(4\hat{i} + 3\sqrt{2}\hat{j}\right)$ (C) $\left(4\sqrt{2}\hat{i} + 4\hat{j}\right)$ (D) $\left(4 + 2\sqrt{2}\right)\left(\hat{i} + \hat{j}\right)$

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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 the vectors $\vec{a}, \vec{b}, \vec{c}$ 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 pairs of vectors $\vec{a}, \vec{b}$and vecc,vecd respectively. Then the angle between P_1 and P_2 is (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

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156. Let $\vec{a} = \hat{i} - \hat{k}, \vec{b} = x\hat{i} + \hat{j} + (1 - x)\hat{k}$ and $\vec{c} = y\hat{i} + x\hat{j} + (1 + x - y)\hat{k}. Then$ $\left[\vec{a}\vec{b}\vec{c}\right]$ depends on (A) only x (B) only y (C) neither x nor y (D) both x and y

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157. The number of vectors of unit length perpendicular to vectors $\vec{a} = (1, 1, 0) and \vec{b} = (0, 1, 1)$ is a. one b. two c. three d. infinite

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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 (A) 45^0 (B) 60^0 (C) $\cos^{-1}\left(\frac{1}{3}\right)$ (D) $\cos^{-1}\left(\frac{2}{7}\right)$

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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 (A) -1 (B) $\sqrt{10} + \sqrt{6}$ (C) $\sqrt{59}$ (D) $\sqrt{60}$

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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 than $\left[2\vec{a} - \vec{b}, 2\vec{b} - \vec{c}, 2\vec{c} - \vec{a}\right] =$ (A) 1 (B) 0 (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 $veda, \vec{b}, \vec{c}$ be three noncolanar vectors and $\vec{p}, \vec{q}, \vec{r}$ are vectors defined by the relations $\vec{p} = \frac{\vec{b} \times \vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{q} = \frac{\vec{c} \times \vec{c}a}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{r} = \frac{\vec{a} \times \vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}$ 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 $\vec{p} = \dfrac{\vec{b} \times \vec{c}}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{q} = \dfrac{\vec{c} \times \vec{q}}{\left[\vec{a}\vec{b}\vec{c}\right]}, \vec{r} = \dfrac{\vec{a} \times \vec{b}}{\left[\vec{a}\vec{b}\vec{c}\right]}.$ 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 $\vec{a} = \hat{i} - \hat{k}, \vec{b} = x\hat{i} + \hat{j} + (1 - x)\hat{k}$ and $\vec{c} = y\hat{i} + x\hat{j} + (1 + x - y)\hat{k}. Then$ $\left[\vec{a}\vec{b}\vec{c}\right]$ depends on (A) `only x (B) only y (C) neither x nor y (D) both x and y

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169. Let a, b, c be distinct non-negative numbers. If the vectors $ai + aj + ck, i + k$ and $ci + cj + bk$ lie in a plane, then c is the

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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 coplanat then the value of $\frac{1}{1 - a} + \frac{1}{1 - b} + \frac{1}{1 - c}$ is (A) 0 (B) 1 (C) -1 (D) 2

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171. If $\begin{vmatrix} a & a^2 & 1 + a^3 \\ b & b^2 & 1 + b^3 \\ c & c^2 & 1 + c^2 \end{vmatrix} = 0$ and vectors $\left(1, a, a^2\right), \left(1, b, b^2\right)$ and $\left(1, c, c^2\right)$ are hon coplanar then the product abc equals (A) 2 (B) -1 (C) 1 (D) 0

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172. If $\vec{u}, \vec{v}$ and $\vec{w}$ are three non coplanar vectors then $\left(\vec{u} + \vec{v} - \vec{w}\right). \left(\vec{u} - \vec{c}\right) \times \left(\vec{v} - \vec{w}\right)$ equals (A) $\vec{u}. \vec{v} \times \vec{w}$ (B) $\vec{u}. \vec{w} \times \vec{v}$ (C) $3\vec{u}. \vec{u} \times \vec{w}$ (D) 0

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173. Let $\vec{u} = hai + \hat{j}, \vec{v} = \hat{i} - \hat{j}$ and $\vec{w} = \hat{i} + 2\hat{j} + 3\hat{k}$. If $\hat{n}$ isa unit vector such that $\vec{u}.\hat{n} = 0$ and $\vec{v}.\hat{n} = 0, \left|\vec{w}.\hat{n}\right|$ 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 $\vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors and λ is a real number, then $\left[\lambda\left(\vec{a} + \vec{b}\right) \quad \lambda^2\vec{b} \quad \lambda\vec{c}\right] = \left[\vec{a} \quad \vec{b} + \vec{c} \quad \vec{b}\right]$ for

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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 $\vec{V}.\left(\vec{a} + \vec{b} + \vec{c}\right) = x + y + z.$ 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 $\vec{A}.\left(\vec{B} + \vec{C}\right) \times \left(\vec{A} + \vec{B} + \vec{C}\right)$ equals (A) 0 (B) $\left[\vec{A}\vec{B}\vec{C}\right] + \left[\vec{B}\vec{C}\vec{A}\right]$ (C) $\left[\vec{A}\vec{B}\vec{C}\right]$ (D) none of these

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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. The value of a so thast the volume of parallelpiped formed by vectors $\hat{i} + a\hat{j} + \hat{k}, \hat{j} + a\hat{k}, a\hat{i} + \hat{k}$ becomes minimum is (A) $\sqrt{93}$) (B) 2 (C) $\frac{1}{\sqrt{3}}$ (D) 3

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180. For non zero vectors $\vec{a}, \vec{b}, \vec{c}\left|\left(\vec{a} \times \vec{b}\right). \vec{c}\right| = |\vec{a}|\left|\vec{b}\right| \mid \vec{\mid}$ holds if and only if (A) $\vec{a}. \vec{b} = 0, \vec{b}. \vec{c} = 0$ (B) $\vec{b}. \vec{c} = 0, \vec{c}. \vec{a} = 0$ (C) $\vec{c}. \vec{a} = 0, \vec{a}. \vec{b} = 0$ (D) $\vec{a}. \vec{b} = \vec{b}. \vec{c} = \vec{c}. \vec{a} = 0$

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181. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non coplanar and unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b} + \vec{c}}{\sqrt{92}}\Bigg)$ 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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182. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be the non zero vectors such that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \frac{1}{3}\left|\vec{b}\right|\left|\vec{c}\right|\vec{a}$. if theta is the acute angle between the vectors $\vec{b}$ and $\vec{a}$ then theta equals (A) $\frac{1}{3}$ (B) $\frac{\sqrt{2}}{3}$ (C) $\frac{2}{3}$ (D) $2\frac{\sqrt{2}}{3}$

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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 $\left[\vec{A}\vec{B}\vec{C}\right] \neq 0 then \vec{A} \times \left(\vec{B} \times \vec{C}\right)$ 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 $\hat{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \hat{b} = \hat{i} \times \left(\vec{a} \times \hat{i}\right) + \hat{j} \times \left(\vec{a} \times \hat{j}\right) + \hat{k} \times \left(veda \times \hat{k}\right)$ then length of $\vec{b}$ is equal to (A) $\sqrt{12}$ (B) $2\sqrt{12}$ (C) $2\sqrt{14}$ (D) $3\sqrt{12}$

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185. Let $\vec{a} = \hat{i} - \hat{j}, \vec{b} = \hat{j} - \hat{k}, \vec{c} = \hat{k} - \hat{i}. If \hat{d}$ is a unit vector such that $\vec{a}. \hat{d} = 0 = \left[\vec{b}, \vec{c}, \vec{d}\right] then \hat{d}$ equals (A) $\pm \frac{\hat{i} + \hat{j} - 2\hat{k}}{\sqrt{6}}$ (B) $\pm \frac{\hat{i} + \hat{j} - \hat{k}}{\sqrt{3}}$ (C) $\pm \frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$ (D) $\pm \hat{k}$

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186. If $\vec{a}s = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} + \hat{j}, \vec{c} = \hat{i}$ and $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \lambda \vec{a} = \mu \vec{b}, then \lambda + \mu = ?$

(A) 0 (B) 1 (C) 2 (D) 3

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187. Given $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} x \vec{d}\right) = 5\vec{c} + 6\vec{d}$ then the value of $\vec{a}. \vec{b} \times \left(\vec{a} + \vec{c} + 2\vec{d}\right)$ 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 vecb but veca and vecb` are non collinear

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189. If $\left(vca \times \vec{b}\right)x\vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right), where\vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{a}. \vec{b} \neq 0, \vec{b}. \vec{c} \neq 0then\vec{a}$ 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 $\vec{a}$ form a triangle then $\vec{a}$ may be (A) -$\hat{i}$ - $\hat{k}$ (B) $\hat{i}$ - $2\hat{j}$ - $\hat{k}$ (C) $2\hat{i} + \hat{j} + \hat{j}k$ (D) hati+hatk`

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191. If vectors $\vec{a}$ and $\vec{b}$ are non collinear then $\frac{\vec{a}}{|\vec{a}|} + \frac{\vec{b}}{|\vec{b}|}$ is (A) a unit vector in the plane of $\vec{a}$ and $\vec{b}$ (B) in the plane of $\vec{a}$ and $\vec{b}$ (C) equally inclined ot vecas and vecb(D)perpendiculat to $\vec{a} \times \vec{b}$

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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 (A) $\hat{i} + \hat{k}$ (B) $2\hat{i} + \hat{j} + \hat{k}$ (C) $3\hat{i} + 2\hat{j} + \hat{k}$ (D) $-4\hat{i} - 2\hat{j} - 2\hat{k}$

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193. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. Then values of x are (A) $-\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) 2

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194. If the sides $\overrightarrow{AB}$ of an equilateral triangle ABC lying in the xy-plane is $3\hat{i}$ then the side $\overrightarrow{CB}$ can be (A) $-\frac{3}{2}\left(\hat{i} - \sqrt{3}\right)$ (B) $\frac{3}{2}\left(\hat{i} - \sqrt{3}\right)$ (C) $-\frac{3}{2}\left(\hat{i} + \sqrt{3}\right)$ (D) $\frac{3}{2}\left(\hat{i} + \sqrt{3}\right)$

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195. If vectors $\vec{A} = 2\hat{i} + 3\hat{j} + 4\hat{k}, \vec{B} = \hat{i} + \hat{j} + 5\hat{k}$ and $\vec{C}$ form a left handed system then $\vec{C}$ is (A) $11\hat{i} - 6\hat{j} - \hat{k}$ (B) $-11\hat{i} + 6\hat{j} + \hat{k}$ (C) $-11\hat{i} + 6\hat{j} - \hat{k}$ (D) $-11\hat{i} + 6\hat{j} - \hat{k}$

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196. If $\vec{a} + 2\vec{b} = 3\vec{b} = 0, then \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} =$ (A) $2\left(\vec{a} \times \vec{b}\right)$ (B) $6\left(\vec{b} \times \vec{c}\right)$ (C) $3\left(\vec{c} \times \vec{a}\right)$ (D) 0

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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 $\vec{v} = \vec{a} \times \vec{b}$ then $\left|\vec{v}\right|$ is (A) $\left|\vec{u}\right|$ (B) $\left|\vec{u}\right| + \left|\vec{u}.\vec{b}\right|$ (C) $\left|\vec{u}\right| + \left|\vec{u}.\vec{a}\right|$ (D) none of these

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200. A linepasses through the points whose positions vectors $\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 3\hat{j} + \hat{k}$. The position vector of a point on it at a unit distance from the first point is (A) $\hat{i} - \hat{j} + 3\hat{j}k$ (B) $\frac{1}{5}\left(4\hat{i} + 9\hat{j} - 13\hat{k}0\right.$ (C) $\frac{1}{5}\left(6\hat{i} + \hat{j} - 7\hat{k}\right)$ (D) none of these

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201. A vector of magnitude 2 along a bisector of the angle between the two vectors $2\hat{i} - 2\hat{j} + \hat{k}a$ 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 $\vec{b} = 4\hat{i} + 3\hat{j}$. Let $\vec{c}$ be a vector perpendicular to $\vec{b}$ and it lies in the xy-plane. A vector in the xy-plane having projection 1 and 2 along $\vec{b}$ and $\vec{c}$ is (A) $\hat{i} - 2\hat{j}$ (B) $2\hat{i} - \hat{j}$ (C) $\frac{1}{5}\left(- 2\hat{i} + 11\hat{j}0\right.$ (D) none of these

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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 $\left[\vec{c}\vec{r}\vec{b}\right]\vec{a} + p\vec{a}\vec{r}\vec{c}\,\Big]\vec{b} + \left[\vec{b}\vec{r}\vec{a}\right]c =$ (A) $\left[\vec{a}\vec{b}\vec{c}\right]$ (B) $\left[\vec{a}\vec{b}\vec{c}\right]\vec{r}$ (C) $\frac{\vec{r}}{\left[\vec{a}\vec{b}\vec{c}\right]}$ (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 vectors such that $\vec{b} \times \vec{c} = \vec{a}, \vec{a} \times \vec{b} = \vec{c} a \neq d\vec{c} \times \vec{a} = \vec{b}$ then (A) $|\vec{a}| + |\vec{b}| + |\vec{c}| = 3$ (B) $|\vec{b}| = 1$ (C) $|\vec{a}| = 1$ (D) none of these

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207. If $\vec{a}, \vec{b}, \vec{c}$ be non coplanar vectors and $\vec{p} = \frac{\vec{b} \times \vec{c}}{\vec{a}\vec{b}\vec{c}}$, vecq=(veccxxveca)/[veca vecb vecc], $\vec{r} = \frac{\vec{a} \times \vec{b}}{\vec{a}\vec{b}\vec{c}}$ 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 $\vec{\times} xvedcb = \vec{c} \times \vec{b}$ and $\vec{x} \perp \vec{a} then \vec{x}$ is equal to (A) $\dfrac{\left(\vec{b} \times \vec{c}\right) \vec{\times} \vec{a}}{\vec{b}.\vec{a}}$ (B)

$\left(\vec{b} \times \dfrac{\vec{a} \times \vec{c}}{\vec{b}.\vec{c}}\right.$ (C) $\left(\vec{a} \times \dfrac{\vec{c} \times \vec{b}}{\vec{a}.\vec{b}}\right.$ (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) $\vec{\lambda} = \frac{\left(\vec{a}.\vec{b}\right).\vec{a}}{\vec{a}^2}$ (B) $\vec{\lambda} = \frac{\left(\vec{a}.\vec{b}\right).\vec{b}}{\vec{b}^2}$ (C) $\vec{\mu} = \left(\frac{\vec{b}.\vec{b}0\vec{a} - \left(\vec{a}.\vec{b}\right)\vec{b}}{\vec{b}^2}\right.$ (D) $\vec{\mu} = \frac{\vec{b} \times \left(\vec{a} \times \vec{b}\right)}{\vec{b}^2}$

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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 $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a}x\left(\vec{b} \times \vec{c}0\right.$ 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 $\vec{b} = \left(tan\alpha, -12\sqrt{\sin\alpha/2}\right) and \vec{c} = \left(tan\alpha, tan\alpha - \frac{3}{\sqrt{\sin\alpha/2}}\right)$ are orthogonal and vector $\vec{a} = (13, \sin2\alpha)$ makes an obtuse angle with the z-axis, then the value of α is $\alpha = (4n+1)\pi + \tan^{-1}2$ b. $\alpha = (4n+1)\pi - \tan^{-1}2$ c. $\alpha = (4n+2)\pi + \tan^{-1}2$ d. $\alpha = (4n+2)\pi - \tan^{-1}2$

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215. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j}$ then the vector $\left(\vec{a}.\hat{i}\right)\hat{i} + \left(\vec{a}.\hat{j}\right)\hat{j} + \left(\vec{a}.\hat{k}\right)\hat{k}, \left(\vec{b}.\hat{i}\right)\hat{i} + \left(\vec{b}.\hat{j}\right)\hat{j} + \left(\vec{b}.\hat{k}\right)\hat{k}$ and $\hat{i} + \hat{j} - 2\hat{k}$ (A) are mutually perpendicular (B) are coplanasr (C) form a parallelopiped of volume 6 units (D) form as parallelopiped of volume 3 units

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216. If unit vectors $\hat{i}$ and $\hat{j}$ are at righat angle to each other and $\vec{p} = 3\hat{i} + 3\hat{j}, \vec{q} = 5\hat{i}, 4\vec{r} = \vec{p} + \vec{q}, then 2\vec{s} = \vec{p} - \vec{q}$ (A) $\left|\vec{r} + kves\right| = \left|\vec{r} - k\vec{s}\right|$ for all real k (B) $\vec{r}$ is perpendicular to $\vec{s}$ (C) $\vec{r} + \vec{s}$ is perpendicular to $\vec{r} - \vec{s}$ (D) $\left|\vec{r}\right| = \left|\vec{s}\right| = \left|\vec{p}\right| = \vec{q}\,|$

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217. If vectors $\vec{a}$ and $\vec{b}$ are non collinear then $\dfrac{\vec{a}}{\left|\vec{a}\right|} + \dfrac{\vec{b}}{\left|\vec{b}\right|}$ is (A) a unit vector $\in thepla \ne of$veca and vecb$(B) \in thepla \ne of$veca and vecb $(C)equally \in cl \in edot\vec{a}s$ and $\vec{b}$ (D) $perpendic\underline{a}t \rightarrow$ veca xx vecb\`

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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 $\vec{A} = 3\hat{i} - \hat{j} + \hat{k}$ passes through point P and vector $\vec{B} = -3\hat{i} + 2\hat{j} + 4\hat{k}$ 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 $\overrightarrow{AB} = 3\hat{i} + 2\hat{+} 2\hat{k}$ and $\overrightarrow{BC} = -\hat{i} - 2\hat{k}$ are the adjacent sides of parallelogram. The angle between its diagonal is (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) (2pi)/3`

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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) $\{0\}$ (B) $(0, \infty)$ (C) (-oo,1)(D)(1,oo)`

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221. The volume of the tetrahedronwhose vertices are the points with position vectors $\hat{i} - 5\hat{j} + 10\hat{k}$, $-\hat{i} - 3\hat{j} + 7\hat{k}$, $5\hat{i} - \hat{j} + \lambda\hat{k}$ and $7\hat{i} - 4\hat{j} + 7\hat{k}$ is 11 cubic units then the value of λ is (A) 7 (B) 1 (C) -7 (D) -1

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222. If a vector $\vec{r}$e satisfies the equation $\vec{r} \times \left(\hat{i} + 2\hat{j} + \hat{k}\right) = \hat{i} - \hat{k} then \vec{r}$e is equal to (A) $\hat{i} + 3\hat{j} + \hat{k}$ (B) $3\hat{i} + 7\hat{j} + 3\hat{k}$ (C) $\hat{i} + (t+3)\hat{i} + \hat{k}\Big)$, where t is any scalar (D) $\hat{j} + t\left(\hat{i} + 2\hat{j} + \hat{k}\right)$ where t is any scalar.

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223. If $\overrightarrow{DA} = \vec{a}, \overrightarrow{AB} = \vec{b}$ and $\overrightarrow{CB} = k\vec{a} where k > 0$ 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 $\left|\vec{b}\right| = 4$with$\vec{a} \times \vec{b} = 2\left(\vec{a} \times \vec{c}\right)$. The angle between $\vec{a}$ and $\vec{c}$ is $\cos^{-1}\left(\frac{1}{4}\right)$. Then $\vec{b} - 2\vec{c} = \lambda\vec{a}$, if λ is (A) 3 (B) $-4(C)4(D)$-1/4`

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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 (A) $\lambda_1 = \vec{a}.\vec{c}$ (B) $\lambda_2 = \left|\vec{b} \times \vec{c}\right|$ (C) $\lambda_3 = \left|\left(\vec{a} \times \vec{b}\right) \times \vec{c}\right|$ (D) $\lambda_1 + \lambda_2 + \lambda_3 = \left(\vec{a} + \vec{b} + \vec{a} \times \vec{b}\right).\vec{c}$

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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 the 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 theta lies in the intervasl. (A) [0,pi/6] $(B)\left(5\frac{\pi}{6}, \pi\right]$ (C) [pi/2,5pi/6](D)[pi/6,pi/2]`

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231. The vectors $2\hat{i} - \lambda\hat{j} + 3\lambda\hat{k}$ and $(1 + \lambda)\hat{i} - 2\lambda\hat{j} + \hat{k}$ include an acute angle for (A) all values of m (B) $\lambda \leftarrow 2$ (C) lamdagt-12(D)lamdaepsilon [-2,-1/2]`

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232. The vectors $\vec{a} = x\hat{i} - 2\hat{j} + 5\hat{j}$ and $\vec{b} = \hat{i} + y\hat{j} - z\hat{k}$ 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. Let $\vec{a} = 2\hat{i} = \hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - 2\hat{k}$ be three vectors . A vector in the pland of $\vec{b}$ and $\vec{c}$ whose projection on $\vec{a}$ is of magnitude $\sqrt{\left(\frac{2}{3}\right)}$is (A) $2\hat{i} + 3\hat{j} + 3\hat{k}$ (B) $2\hat{i} + 3\hat{j} - 3\hat{k}$ (C) $-2\hat{i} - \hat{j} + 5\hat{k}$ (D) $2\hat{i} + \hat{j} + 5\hat{k}$

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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 $\vec{r}_1 = \vec{a} - \vec{b} + \vec{c}, \vec{r}_2 = \vec{b} + \vec{c} - \vec{a}, \vec{r}_3 = \vec{c} + \vec{a} + \vec{b}, \vec{r} = 2\vec{a} - 3\vec{b} + 3\vec{c}$ if $\vec{r} = \lambda_1\vec{r}_1$ - 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 (A) $4\sqrt{5}$ (B) $4\sqrt{3}$ (C) 4sqrt(7)` (D) none of these

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237. The vector $\vec{a} + \vec{b}$ bisects the angle between the vectors $\hat{a}$ and $\hat{b}$ if (A) $\left|\vec{a}\right| + \left|\vec{b}\right| = 0$ (B) angle between $\vec{a}$ and $\vec{b}$ is zero (C) $\left|\vec{a}\right| = \left|\vec{b}\right| = 0$ (D) none of these

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238. Assertion:Points A,B,C are collinear, Reason: $\overset{\rightarrow}{AB} \times \overset{\rightarrow}{AC} = 0$ (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: Angle between $\vec{a}$ and $\vec{b}$ is $\frac{2\pi}{3}$, Reason: $\left|\vec{a} + \vec{b}\right|^2 = \left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 + 2\left|\vec{a}.\vec{b}\right|$ (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: $|\vec{a}| + |\vec{b}| = |\vec{a} + \vec{b}|$ (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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242. Assertion : Suppose $\hat{a}, \hat{b}, \hat{c}$ are unit vectors such that $\hat{a}, \hat{b} = \hat{a}.\hat{c} = 0$ and the angle between hatb and hatc is pi/6$thanhe \vec{\rightarrow} r$hata $canberepresentedas$hata=+-2(hatbxxhatc),$Reason:$ hata=+-(hatbxxhatc)/(hatbxxhatc|)` (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 $\hat{a}, \hat{b}, \hat{c}$ are mutually perpendicular unit vectors, then $\left[\hat{a}\hat{b}\hat{c}\right]=1$ (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 $\overrightarrow{AB}=\vec{a}, \overrightarrow{BC}=\vec{b}$ and $\overrightarrow{CD}=\vec{c}, then\overrightarrow{EA}$ is equal to $-\left(\vec{b}+\vec{c}\right)$, 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 : $If vecA$, vecB,vec$Careanythreenoncoplanar \vec{} rsthen$ (vecA.vecBxxvecC)/(vecCxxvecA.vecB)+ (vecB.vecAxxvecc)/(vecC.vecAxxvecB)=0, $Reason$: [veca vecb vecc]!=[vecb vecc veca]` (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 $\vec{a}$ vecrxxveca=vecbrarrvecr=(vecaxxvecb)/(veca.veca), $Reason$: vecr.veca=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 $\vec{r} = l\left(\vec{a} \times \vec{b}\right) = m\left(\vec{b} \times \vec{c}\right) + n\left(\vec{c}x\vec{a}\right), wherel, m, n$ are scalars and $\left[\vec{a}\vec{b}\vec{c}\right] = \frac{1}{2}. l + m + n = 2\vec{r}. \left(\vec{a} + \vec{b} + \rightarrow\right)$. 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 $\vec{x}d \perp \vec{a}then\vec{x} = \dfrac{\left(\vec{b} \times \vec{c}\right) \times \vec{a}}{\vec{a}. \vec{b}}$, 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 $\overrightarrow{AC} = \hat{i} - 2\hat{j} + \hat{k}, then$|vec(AM)|=sqrt(6) $Reason,$ vec(AB)+vec(AC)=2vec(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: $\left|\vec{a} + \vec{b}\right| < \left|\vec{-} \vec{b}\right|$, Reason: $\left|\vec{a} + \vec{b}\right|^2 = a^2 + b^2 + 2\vec{a}.\vec{b}.$ (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 $ig \in , thentheposition \vec{\ } rofcentroidof/$_\ABC

$is\left(\vec{O}A\right) + \overrightarrow{OB} + \overrightarrow{OC}\frac{)}{3}$ (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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254. Assertion: $\vec{a} = \hat{i} + p\hat{j} + 2\hat{k}$ and $\hat{b} = 2\hat{i} + 3\hat{j} + q\hat{k}$ are parallel vectors if $p = \frac{3}{2}, q = 4$, Reason: If $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ 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 $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} - \hat{k}$ be two vectors. Angle between $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b} = 90^0$ Reason: Projection of $\vec{a} + \vec{b} on \vec{a} - \vec{b}$ 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: $\vec{c}4\vec{a} - \vec{b}$ and $\vec{a}, veb, \vec{c}$ are coplanar. Reason Vector $\vec{a}, \vec{b}, \vec{c}$ 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: $|\vec{a}| = |\vec{b}|$ does not imply that $\vec{a} = \vec{b}$, Reason: If $\vec{a} = \vec{b}, then|\vec{a}| = |\vec{b}|$ (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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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 $(\vec{x} + \vec{y})^2 = |\vec{x}|^2 + |\vec{y}|^2 + 2(\vec{x}.\vec{y})$ (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 $\overrightarrow{AB} \times \overrightarrow{AC} = \vec{0}$ (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 monent of force $\vec{F}$ about P(veca) is vecFxxvecr, where vecr=vec(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. Assertion: The nine point centre wil be $\frac{\vec{a}+\vec{b}+\vec{c}}{2}$, Reason: Centroid of $\triangle ABCis$(veca+vecb+vecc)/3)` 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 $\vec{F}$ and displacement $\vec{r}$ 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 $\overrightarrow{AB} = \vec{a}, \vec{)} BC \Big) = \vec{b}$ then $\vec{C} = \vec{a} + \vec{b}$ (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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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 hatj+ahatk $is \max i\mu m. Reason. Thevolumeotheparal \leq lo\pi pedhav \in gthethreecoter \min ouse$ veca.vecb and vecc=|[veca vecb vecc]|` (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 $\vec{b}, then \vec{a} \times \left(\vec{b} \times \vec{c}\right) = 0$

Reason: If $\vec{b}$ is perpendicular to vec$c then$vecbxxvecc=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 $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 3\left|2\vec{a} - \vec{b}\right| = 5, then \mid 2\vec{a} + \vec{\mid} = 5, Reason:$ |vecp-vecq|=|vecp+vecq|` (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. Assertion : $If \in a \triangle ABC, \overrightarrow{BC} = \frac{\vec{p}}{\left|\vec{p}\right|} - \frac{\vec{q}}{\left|\vec{q}\right|}$ and vec(AC)= (2vecp)/|vecp|,|vecp|!=|veq|$then the value of$cos2A+cos2B+cos2C

$is - 1.$, $Reason : If \in$ /_\ABC, /_C=90^0 then cos2A+cos2B+cos2C=-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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268. Assertion: If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d} the \left(\vec{a} - \vec{d}\right)$ is perpendicular to $\left(\vec{b} - \vec{c}\right)$., Reason : If $\vec{p}$ is perpendicular to vecq then vecp.vecq=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 $\vec{r}.\vec{a} = 0, \vec{r}.\vec{b} = 0, \vec{r}.\vec{c} = 0$ for some non zero vector $\vec{r}$e then $\vec{a}, \vec{b}, \vec{c}$ are coplanar vectors. Reason : Ifveca,vecb,vecc$arecoplanarthen$ veca+vecb+vecc=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 $|\vec{a}||\vec{b}|=1$, 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 $\left(\vec{a}\times\hat{i}\right).\left(\vec{b}\times\hat{i}\right)+\left(\vec{a}\times\hat{j}\right).\left(\vec{}\times\hat{j}\right)+\left(\vec{a}\times\hat{k}\right).\left(\vec{b}\times\hat{k}\right)=2\vec{a}.\vec{b}.,Reason:\left(\vec{a}.\hat{i}\right)($

(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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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,$|\vec{a}|^2 = \vec{a}.\vec{a}$ 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. 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 $\vec{a}$, $|\vec{a}|^2 = \vec{a}.\vec{a}$ 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 vecc$isasunit \overset{\wedge}{\vec{\rightarrow}} rsucht$ veca.vecb=veca.vecc=0 and theta= (pi/6) then veca=(A)+-1/2(vecbxxvecc)(B)+-(vecbxxvecc)(C) +-2(vecbxxvecc)` (D) none of these

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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 veca,|veca|^2=veca.vecaIf veca_|_vecb and veca_|_vecc then veca||vecbxxveccIfveca||vecb, then veca=tvecb$Now answer the follow \in g question: If$|vecc|=4, theta cos^-1(1/4) and vecc-2vecb=tvecas, 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 $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right) = \left(\vec{a}.\vec{c}\right)\left(\vec{b}.\right.$

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

Now answer the following question: $\left(\vec{a} \times \vec{b}\right).\left(\vec{\times}\vec{d}\right)$ is equal to (A) $\left(\vec{a} \times \vec{d}\right).\left(\vec{b} \times \vec{c}\right)$ (B) $\left(\vec{b} \times \vec{a}\right).\left(\vec{c} \times \vec{d}\right)$ (C) $\left(\overrightarrow{dxx\vec{c}}\right).\left(\vec{b} \times \vec{a}0\right.$ (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 $\left(\vec{a} \times \vec{b}\right).\left(\vec{c} \times \vec{d}\right) = \left(\vec{a}.\vec{c}\right)\left(\vec{b}.\right.$

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

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280. Unit vector along $\vec{a}$ is denoted by $\hat{a}\left(\text{ if } \left|\vec{a}\right| = 1, \vec{a}\right.$ 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 $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2}\vec{b}\left[\vec{p} \times (\vec{\ } \times \vec{r})\right.$ is a vector triple product and $\vec{p} \times (\vec{q} \times \vec{r}) = (\vec{p}.\vec{r}.\vec{q}) - (\vec{p}.\vec{q})\vec{r}\left.\right]$. 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 $\hat{a}($ if $|\vec{a}| = 1, \vec{a}$ is called a unit vector). Also $\frac{\vec{a}}{|\vec{a}|} = \hat{a}$ and $\vec{a} = |\vec{a}|\hat{a}$. Suppose $\vec{a}, \vec{b}, \vec{c}$ are three non parallel unit vectors such that $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2}\vec{b}\left[\vec{p} \times (\vec{\ } \times \vec{r})\right.$ is a vector triple product and $\vec{p} \times (\vec{q} \times \vec{r}) = (\vec{p}.\vec{r}.\vec{q}) - (\vec{p}.\vec{q})\vec{r}\left.\right]$. 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 $\hat{a}($ if $|\vec{a}| = 1, \vec{a}$ is called a unit vector). Also $\frac{\vec{a}}{|\vec{a}|} = \hat{a}$ and $\vec{a} = |\vec{a}|\hat{a}$. Suppose $\vec{a}, \vec{b}, \vec{c}$ are three non parallel unit vectors such that $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2}\vec{b}\left[\vec{p} \times (\vec{\ } \times \vec{r})\right.$ is a vector triple product and $\vec{p} \times (\vec{q} \times \vec{r}) = (\vec{p}.\vec{r}.\vec{q}) - (\vec{p}.\vec{q})\vec{r}]$. $|\vec{a} \times \vec{c}|$ is equal to (A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{3}{4}$ (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 $(\vec{a} \times \vec{b}) \times \vec{c}$ or $(\vec{b} \times \vec{c}) \times \vec{a}$ 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. $(\vec{a} \times (\vec{b} \times \vec{c})) \times \vec{d}$ or $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})$. Now answer the following question: $(\vec{a} \times \vec{b})x(\vec{c} \times \vec{d})$ would be a vector (A) perpendicular to $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ (B) $paral \leq l \rightarrow$ veca and vecc(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 $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)$. (vecaxxvecb)xx(veccxxvecd0

$isa \vec{\rightarrow} r(A)alongthel \in eoff\int ersectionoftwopla \neq sconta \in \ \in g$veca,vecb

and vecc,vecd$(B)perpendic\underline{a}r \rightarrow pla \neq conta \in \ \in g$veca,vecb and

vecc,vecd$(C)paral \leq l \rightarrow thepla \neq conta \in \ \in g$veca,vecb and vecc,vecd`

(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 $\overrightarrow{AB} \times \overrightarrow{AC} = \vec{0}$ Let the points A,B, and C having position vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be collinear Now answer the following queston: The exists scalars x,y,z such that (A) $x\vec{a} + y\vec{b} + zc\vec{c} = 0$ and $x + y + z \neq 0$ (B) $x\vec{a} + y\vec{b} + zc\vec{c} \neq 0$ and $x + y + z \neq 0$ (C) $x\vec{a} + y\vec{b} + zc\vec{c} = 0$ 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 $\overrightarrow{AB} \times \overrightarrow{AC} = \vec{0}$ Let the points A,B, and C having position vectors $\vec{a}, \vec{b}$ and $\vec{c}$ be collinear Now answer the following queston: (A) veca.vecb=veca.vecc(B)vecaxxvecb=vecc(C) vecaxxvecb+vecbxxvecc+veccxxveca=vec0` (D) none of these

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289. $\vec{a}.\left(\vec{b}\times\vec{c}\right)$ 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. $\left[\vec{a}+\vec{b}\vec{b}+\vec{c}\vec{c}+\vec{a}\right]$ is equal to (A) $2\left[\vec{a}\vec{b}\vec{c}\right]$ (B) $3\left[\vec{a}, \vec{b}, \vec{c}\right]$ (C) $\left[\vec{a}, \vec{b}, \vec{c}\right]$ (D) 0

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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 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. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar then $\left[\vec{b}+\vec{c}\vec{c}+\vec{a}\vec{a}+\vec{b}=\right]$ (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 $\vec{a}$ 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 Positon vector of Q for position vector of R in (1) is (A) $\frac{2\vec{a}+3\vec{c}}{5}$ (B) $\frac{3\vec{a}+2\vec{c}}{5}$ (C) $\frac{\vec{a}+2\vec{c}}{5}$ (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 $\vec{a}$ 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: ((PQ)/(QR)).((AQ)/(QC))$isequal \rightarrow (B)\frac{1}{10}$ (C) $\frac{2}{5}$ (D) $\frac{3}{5}$

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295. Let ABCbe a triangle. Points D,E,F are taken on the sides AB,BC and CA respectively such that $\frac{AD}{AB}=\frac{BE}{BC}/=\frac{CF}{CA}=\alpha$ Prove that the vectors AE, B and CD form a triangle also find alpha for which the area of the triangle formed by these is least.

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296. Let ABCbe a triangle. Points D,E,F are taken on the sides AB,BC and CA respectively such that $\frac{AD}{AB} = \frac{BE}{BC}/ = \frac{CF}{CA} = \alpha$ Prove that the vectors AE, B and CD form a triangle also find alpha for which the area of the triangle formed by these is least.

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297. 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 pasrallelopiped whose adjacent edges are represented by the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ is (A) $24\sqrt{2}$ (B) $24\sqrt{3}$ (C) $32\sqrt{92}$)

(D) 32

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298. 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 heighat of the parallelopiped whose adjacent edges are represented by the ectors $\vec{a}, \vec{b}$ and $\vec{c}$ 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 veca\',vecb\' 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 $\left[\vec{a}'\vec{b}'\vec{c}'\right]^{-1}$ 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 veca\',vecb\' and vecc\'$whichsatiies$

veca.veca\'=vecb.vecb\'=vecc.vecc\'=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 $\left(\vec{a} \times \vec{a}'\right) + \left(\vec{b} \times \vec{b}\right) + \left(\vec{} \times \vec{}'\right)$ is (A) $\vec{a} + \vec{b} + \vec{}$ (B) $\vec{a}' + \vec{b}' + \vec{}'$ (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 veca\',vecb\' 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 $\vec{c}.$ $\left[\vec{a}, \vec{b}, \vec{c}\right] - \left(\vec{a}' \times \vec{b}'\right) + \left(\vec{b}' \times \vec{}'\right) + \left(\vec{c}' \times \vec{a}'\right) =$ (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 $\vec{r}.\left(4\hat{i} - 12\hat{j} - 3\hat{k}\right) - 7 = 0$, is

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