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MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

APPLICATIONS OF VECTOR ALGEBRA

Example Questions Solved

1. With usual notations, in any triangle ABC, prove the following by vector method .

(i) $a^2 = b^2 + c^2 - 2bc \cos A$

(ii) $b^2 = c^2 + a^2 - 2bc \cos B$

(iii) $c^2 = a^2 + b^2 - 2bc \cos C$

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2. Projection formula:

Prove that $a = b\cos C + c\cos B$.

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3. By vector method, prove that cos $(\alpha + B\eta) = \cos\alpha\cos B\eta - \sin\alpha\sin B\eta$.

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4. Sine formula:

With usual notation in a ΔABC

Prove that $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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5. By vector method, Prove that $\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$

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6. (Apollonius theorem): If D is the midpoint of the side BC of a triangle ABC, then show by vector method that

$$\left|\overrightarrow{AB}\right|^2 + \left|\overrightarrow{AC}\right|^2 = 2\left(\left|\overrightarrow{AD}\right|^2 + \left|\overrightarrow{BD}\right|^2\right).$$

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7. Prove by vector method that the perpendiculars (altitudes) from the vertices to the sides of a triangle are concurrent.

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8. In trigle ABC, the points D, E, F are the midpoints of the sides BC,CA, and AB respee. Tively. Using vector methed ,show that the area of Δ DEF is equal to $\frac{1}{4}$ (area of ABC).

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9. A particale acted upon by constant forces $2\hat{i} + 5\hat{j} + 6\hat{k}$ and $-\hat{i} - 2\hat{j} - \hat{k}$ is displaced from the piont (4,-3,-2) to the point (6,1,-3). Find the total wrok done by the forces.

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10. A particale acted upon by constant forces $3\hat{i} + 2\hat{j} + 2\hat{k}$ and $2\hat{k} - \hat{j} - \hat{k}$ is displaced from the piont (1,3,-1) to the point (4,-1, λ). If the wrok done by the forces is 16 units , find the value of λ

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11. Find the magnitude and the direction cosines of the torque about the point (2,0,-1) of a force $2\hat{i} + \hat{j} - \hat{k}$, whose line of action passes through the origin.

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12. If $\vec{a} = -3\hat{i} - \hat{j} + 5\hat{k}$, $\vec{b} = \hat{i} - 2\hat{j} + \widehat{K}$, $\vec{c} = 4\hat{j} - 5\hat{k}$, find $\vec{a}.\left(\vec{b} \times \vec{c}\right)$.

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13. Find the volume of the parallelepiped whose coterminus edges are given by the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$, $\hat{i} + 2\hat{j} - \hat{k}$ and $3\hat{i} - \hat{j} + 2\hat{k}$.

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14. Show that the vectors $\hat{i} + 2\hat{j} - 3\hat{k}$, $2\hat{i} - \hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ are coplanar.

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15. If $2\hat{i} - \hat{j} + 3\hat{k}, 3\hat{i} + 2\hat{j} + \hat{k}, \hat{i} + m\hat{j} + 4\hat{k}$ are coplanar, find the value of m.

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16. Show that the four points (6,-7,0),(16,-19,-4),(0,3,-6),(2,-5,10) lie on a same plane.

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17. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three vectors, prove that $\left[\vec{a}+\vec{c}, \vec{a}+\vec{b}, \vec{a}+\vec{b}+\vec{c}\right]=-\left[\vec{a}, \vec{b}, \vec{c}\right]$

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18. 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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19. Prove that $\left(\vec{a}.\left(\vec{b}\times\vec{c}\right)\right)\vec{a}=\left(\vec{a}\times\vec{b}\right)\times\left(\vec{a}\times\vec{c}\right)$.

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20. For any four vectors $\vec{a}$, $\vec{b}$, $\vec{c}$, $\vec{d}$ we have $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \left[\vec{a}, \vec{b}, \vec{d}\right]\vec{c} - \left[\vec{a}, \vec{b}, \vec{c}\right]\vec{d} = \left[\vec{a}, \vec{c}, \vec{d}\right.$

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21. If $\vec{a} = -2\hat{i} + 3\hat{j} - 2\hat{k}$, $\vec{b} = 3\hat{i} - \hat{j} + 3\hat{k}$, $\vec{c} = 2\hat{i} - 5\hat{j} + \hat{k}$ find $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ and $\vec{a} \times \left(\vec{b} \times \vec{c}\right)$. State whether they are equal.

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22. If $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = \hat{i} - \hat{j} - 4\hat{k}$, $\vec{c} = 3\hat{j} - \hat{k}$ and $\vec{d} = 2\hat{i} + 5\hat{j} + \hat{k}$

, verify that

(i) $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \left[\vec{a}, \vec{b}, \vec{d}\right]\vec{c} - \left[\vec{a}, \vec{b}, \vec{c}\right]\vec{d}$

(ii) $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \left[\vec{a}, \vec{c}, \vec{d}\right]\vec{b} - \left[\vec{b}, \vec{c}, \vec{d}\right]\vec{a}$

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23. A straight line passes through the point (1, 2, -3) and parallel to $4\hat{i}+5\hat{j}-7\hat{k}$. What vector equation in parametric form (ii) vector equation in non-parametric form (iii) Cartesian equations of the straight line.

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24. The vector equation in parametric form of a line is $\vec{r}=\left(3\hat{i}-2\hat{j}+6\hat{k}\right)+t\left(2\hat{i}-\hat{j}+3\hat{k}\right)$. Find (i) the direction cosines of the straight line (ii) vector equation in non-parametric form of the line (iii) Cartesian equations of the line.

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25. Find the vector equation in parametric form and Cartesian equations of the line passo through (-4, 2,-3) and is parallel to the line

$$\frac{-x-2}{4}=\frac{y+3}{-2}=\frac{2z-6}{3}$$

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26. Find the vector equation in parametric form and Cartesian equations of a through the points (-3, 7, -4) and (13,-5, 2). Find the point where the straight line crosses the xy -plane.

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27. Find the angle between the straight line $\frac{x-1}{2}=\frac{y-3}{2}=z$ with co-ordinates axes.

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28. Find the acute angle between the lines $\vec{r}=\left(\hat{i}+2\hat{j}+4\hat{k}\right)+t\left(2\hat{i}+2\hat{j}+\hat{k}\right)$ and the straight passing through the points (5, 1, 4) and (9,2, 12).

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29. Find the acute angle between the straight lines $\frac{x-4}{2}=\frac{y}{1}=\frac{z+1}{-2}$ and $\frac{x-1}{4}=\frac{y+1}{-4}=\frac{z-2}{2}$ state whether they are parallel or perpendicular.

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30. show that the straight line passing through the points A (6,7,5) and B (8,10,6) is perpendicular to the straight line passing through the points C (10, 2,-5) and D (8,3,-4).

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31. Show that the lines $\frac{x-1}{4}=\frac{2-y}{6}=\frac{z-4}{12}$ and $\frac{x-3}{-2}=\frac{y-3}{-2}=\frac{5-z}{6}$ are parallel.

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32. Find the point of intersection of the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z$.

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33. Find the parametric form of vector equation of a straight line passing through the point of intersection of the straight lines $\vec{r} = \left(\hat{i} + 3\hat{j} - \hat{k}\right) + t\left(2\hat{i} + 3\hat{j} + 2\hat{k}\right)$ and $\frac{x-2}{1} = \frac{y-4}{2} = \frac{z+3}{4}$ and perpendicular to both straight lines.

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34. Determine whether the pair of straight lines

$\vec{r} = \left(2\hat{i} + 6\hat{j} + 3\hat{k}\right) + t\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right), \vec{r} = \left(2\hat{j} - 3\hat{k}\right) + s\left(\hat{i} + 2\hat{j} + 3\right.$

are parallel. Find the shortest distance between them.

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35. Find the shortest distance between the two given straight lines $\vec{r} = \left(2\hat{i} + 3\hat{j} + \hat{k}\right) + t\left(-2\hat{i} + \hat{j} + 2\hat{k}\right)$ and $\frac{x-3}{2} = \frac{y}{-1} = \frac{z+2}{2}$

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36. Find the coordinates of the foot of the perpendicular drawn from the point (-1,2,3) the straight line $\vec{r} = \left(\hat{i} - 4\hat{j} + 3\hat{k}\right) + t\left(2\hat{i} + 3\hat{j} + \hat{k}\right)$

Also, find the shortest distance from point to the straight line.

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37. Find the vector and Cartesian form of the equations of a plane which is at a distance of 12 units from the origin and perpendicular to $6\hat{i} + 2\hat{j} - 3\hat{k}$.

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38. If the Cartesian equation of a plane is 3x - 4y + 32 -8, find the vector equation of the plane in the standard form.

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39. Find the direction cosines of the normal to the plane and length of the perpendicular from the origin to the plane $\overrightarrow{r}.\left(3\hat{i}-4\hat{j}+12\hat{k}\right)=5$.

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40. Find the vector and Cartesian equations of the plane passing through the point with position vector $4\hat{\imath}+2\hat{j}-3\hat{k}$ and normal to vector $2\hat{i}-\hat{j}+\hat{k}$.

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41. A variable plane moves in such a way that the sum of the reciprocals of its intercepts on the coordinate axes is a constant. Show that the plane passes through a fixed point.

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42. Find the non-parametric form of vector equation, and Cartesian equation vector equation, and Cartesian equation of the plane passing through the point (0, 1,-5) and parallel to the straight lines $\vec{r} = \left(\hat{i} = 2\hat{j} - 4\hat{k}\right) + s\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$ and $\vec{r} = \left(\hat{i} = 3\hat{j} - 4\hat{k}\right) + t\left(\hat{i} + \hat{j} + \hat{k}\right)$

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43. Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points (-1, 2, 0), (2, 2, -1) and parallel to the straight line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$

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44. Verify whether the line $\frac{x-3}{-4}=\frac{y-4}{-7}=\frac{z+3}{12}$ lies in the plane 5x – y +z = 8.

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45. Find the acute angle between the planes $\vec{r}.\left(2\hat{\imath}+2\hat{j}+2\hat{k}\right)=11$ and 4x-2y + 2z =15

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46. Find the angle between the straight line $\vec{r}=\left(2\hat{i}+3\hat{j}+\hat{k}\right)+k+t\left(\hat{i}-\hat{j}+\hat{k}\right)$ and the plane 2x-y+z=5

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47. Find the distance of a point (2,5,-3) from the plane $\overrightarrow{r}.\left(6\hat{i}-3\hat{j}+2\hat{k}\right)=5$

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48. Find the distance of the point (5,-5, -10) from the point of intersection of a straight line passing through the points A(4, 1, 2) and B(7, 5, 4) with the plane x-y+z=5.

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49. Find the distance between the parallel planes x +2y-2z +1= 0 and 2x + 4y - 4z+5=0.

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50. Find the distance between the parallel planes $\vec{r}.\left(2\hat{i}-\hat{j}-2\hat{k}\right)=6$ and $\vec{r}.\left(6\hat{i}-3\hat{j}-6\hat{k}\right)=27$

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51. Find the equation of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i}+\hat{j}+k\right)=0$ and $\vec{r}\left(2\hat{i}-3\hat{j}+5\hat{k}\right)=2$ and the point (-1, 2, 1).

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52. Find the image of the point whose position vector is $\hat{i}+2\hat{j}+3\hat{k}$ in the plane $\vec{r}.\left(\hat{i}+2\hat{j}+4\hat{k}\right)=38.$

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53. Find the coordinates of the points where the straight line $\vec{r} = \left(\hat{i} - 2\hat{j} - 2\hat{k}\right) + t\left(4\hat{i} + 3\hat{j} + 2\hat{k}\right)$ intersects the plane $x - 2y + 3z + 9 = 0.$

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Exercise 6 1

1. Prove by vertor metord thtat if a line is drawn frome the centre of a circle of a circle to the midpoint of a chord then the line is perpendicular to the chord

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2. Prove by vector method that median to the base of an isoscels triangle is perpendicular to the base.

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3. Prove by vector method that an angle in a semi-circle is a right angle.

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4. Prove by vector method that the diagonals of a rhombus bisect each other at right angles.

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5. Using vector method, prove that if the diagonals of a parallelogram are equal, then it is a rectangle.

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6. Prove by vector method that the area of the quadrilateral ABCD having diagonals AC and is $\frac{1}{2}\left|\overline{AC} \times \overline{BD}\right|$

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

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8. If G is the centroid of a ΔABC, Prove that $(\text{ area of } \Delta GAB) = (\text{ area of } \Delta GBC) = (\text{are}$

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9. Using vector method, prove $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$.

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10. Prove by vector method that $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$.

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11. A particle acted on by constant forces$8\hat{i}+2\hat{j}-6\hat{k}$ and $6\hat{i}+2\hat{j}-2\hat{k}$ is displaced from the point $(1, 2, 3)$ to the point $(5, 4, 1)$.

Find the total work done by the forces.

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12. Forces of magnitude $5\sqrt{2}$ and $10\sqrt{2}$ units acting in the directions $3\hat{i}+4\hat{j}+5k$ and $10\hat{j}+6\hat{j}-8\hat{k}$, respectively, act on a particle which is displaced from the point with position vector $4\hat{i}-3\hat{j}-2\hat{k}$ to the with position vector $6\hat{i}+\hat{j}-3\hat{k}$. Find the work done by the forces.

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13. Find the magnidude and direction cosines of the torque of a force represented by $3\hat{i}+4\hat{j}-5\hat{k}$ about the point with position vector $2\hat{i}-3\hat{j}+4\hat{k}$ acting through a point whose position vector is $4\hat{i}+2\hat{j}-3\hat{k}$.

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14. Find the torque of the resultant of the three forces represented by $-3\hat{i}+6\hat{j}-3\hat{k}, 4\hat{i}-10\hat{j}+12\hat{k}$ and $4\hat{i}+7\hat{j}$ acting at the point with position vector $8\hat{i}-6\hat{j}-4\hat{k}$, about the point with position vector $18\hat{i}+3\hat{j}-9\hat{k}$.

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Exercise 6 2

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

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2. Find the volume of the parallelepiped whose coterminous edges are represented by the vector $-6\hat{i}+14\hat{j}+10\hat{k}, 14\hat{i}-10\hat{j}-6\hat{k}, \text{ and } 2\hat{i}+4\hat{j}-2\hat{k}.$

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3. The volume of the parallelepiped whose coterminus edges are $7\hat{i}+\lambda\hat{j}-3\hat{k}, \hat{i}+2\hat{j}-\hat{k}-3\hat{i}+7\hat{j}+5\hat{k}$ is 90 cubic units. Find the value of λ.

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4. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors represented by concurrent edges of a parallelepiped of volume 4 cubic units, find the value of $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{b}\times\vec{c}\right)+\left(\vec{b}+\vec{c}\right)\cdot\left(\vec{c}\times\vec{a}\right)+\left(\vec{c}+\vec{a}\right)\cdot\left(\vec{a}\times$

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5. Find the altitude of a parallelepiped determined by the vectors $\vec{a} = -2\hat{i} + 5\hat{j} + 3\hat{k}$ $\vec{b} = \hat{i} + 3\hat{j} - 2\hat{k}$ and $\vec{c} = -3\hat{i} + \hat{j} + 4\hat{k}$ if the base is taken as the parallelogram determined by $\vec{b}$ and $\vec{c}$.

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6. Determine whether the three vectors $2\hat{i} + 3\hat{j} + \hat{k}, \hat{i} - 2\hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} + 3\hat{k}$ are coplanar.

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7. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. " If "c_(1)=1 and c_(2)=2" find "c_(3)" such that "vec(a), vec(b) and vec(c)" are coplanar. "`

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8. If $\vec{a} = \hat{i} - \hat{k}, \vec{b} = x\hat{i} + \hat{j} + (1 - x)\hat{k}, \vec{c} = y\hat{i} + x\hat{j} + (1 + x - y)\hat{k}$

show that $\left[\vec{a}, \vec{b}, \vec{c}\right]$ depends on neither .x nor y.

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9. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}, \hat{i} + \hat{j}$andchat(i)+chat(j)+bhat(k)` are coplanar, prove that c is the geometric mean of a and b .

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10. Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors such that $\vec{c}$ is a unit vector perpendicular to both $\vec{a}$ and $\vec{c}$. If the angle between $\vec{a}$ and $\vec{c}$ is $\frac{\pi}{6}$, show that $\left[\vec{a}, \vec{b}, \vec{c}\right]^2 = \frac{1}{4}\left|\vec{a}\right|^2\left|\vec{b}\right|^2$.

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Exercise 6 3

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

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2. For any vector $\vec{a}$ prove that $\hat{i} \times \left(\vec{a} \times \hat{i}\right) + \hat{j} \times \left(\vec{a} \times \hat{j}\right) + \hat{k} \times \left(\vec{a} \times \hat{k}\right) = 2\vec{a}$

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3. Prove that $\left[\vec{a} - \vec{b}, \vec{b} - \vec{c}, \vec{c} - \vec{a}\right] = 0$

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4. If $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}, \vec{b} = 3\hat{i} + 5\hat{j} + 2\hat{k}, \vec{c} = -\hat{i} - 2\hat{j} + 3\hat{k}$, verify that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \left(\vec{a} \cdot \vec{c}\right)\vec{b} - \left(\vec{b} \cdot \vec{c}\right)\vec{a}$

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5. If $\overrightarrow{a} = 2\hat{i} + 3\hat{j} - \hat{k}, \overrightarrow{b} = -\hat{i} + 2\hat{j} - 4\hat{k}, \overrightarrow{c} = \hat{i} + \hat{j} + \hat{k}$, then find the value of $\left(\overrightarrow{a} \times \overrightarrow{b}\right) \cdot \left(\overrightarrow{a} \times \overrightarrow{c}\right)$.

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

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

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8. If $\hat{a}, \hat{b}, \hat{c}$ are three unit vectors such that $\hat{b}$ and $\hat{c}$ are non-parallel and $\hat{a} \times \left(\hat{b} \times \hat{c}\right) = \frac{1}{2}\hat{b}$, find the angle between $\vec{a}$ and $\vec{c}$.

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Exercise 6 4

1. Find the non-parametric form of vector equation and Cartesian equations of the straight line passing through the point with position vector $4\hat{i} + 3\hat{j} - 7\hat{k}$ and parallel to the vector $2\hat{i} - 6\hat{j} + 7\hat{k}$.

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2. Find the parametric form of vector equation and Cartesian equtions of the straight line passing through the point $(-2, 3, 4)$ and parallel to the straight line $\frac{x-1}{-4} = \frac{y+3}{5} = \frac{8-z}{-6}$

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3. Find the point where the straight line passes through $(6, 7, 4)$ and $(8, 4, 9)$ cut the xz and yz planes.

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4. Find the direction cosines of the straight line passing through the points $(5, 6, 7)$ and $(7, 9, 13)$. Also, find the parametric form of vector equation and Cartesian equtions of the straight line passing through two given points.

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5. Find the angle between the following lines.

$$\vec{r} = \left(4\hat{i} - \hat{j}\right) + t\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$$

$$\vec{r} = \left(\hat{i} - 2\hat{j} + 4\hat{k}\right) + s\left(-\hat{i} - 2\hat{j} + 2\hat{k}\right)$$

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6. The vertices of AABC are A(7, 2, 1), B(6, 0, 3), and C(4, 2, 4). Find $\angle ABC$

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7. If the straight line joining the points $(2, 1, 4)$ and $(a-1, 4, -1)$ is parallel to the line joining the points $(0, 2, b-1)$ and $(5, 3, -2)$, find the values of a and b.

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8. If the straight lines $\frac{x-5}{5m} = \frac{2-y}{5} = \frac{1-z}{-1}$ and $x = \frac{2y+1}{4m} = \frac{1-z}{-3}$ are perpendicular to each other, find the value of m.

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9. Show that the points $(2, 3, 4), (-1, 4, 5)$ and $(8, 1, 2)$ are collinear.

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Exercise 6 5

1. Find the parametric form of vector equation and Cartesian equations of a straight line passing through $(5, 2, 8)$and is perpendicular to the straight lines

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2. Show that the lines $\vec{r} = \left(6\hat{i} + \hat{j} + 2\hat{k}\right) + s\left(\hat{i} + 2\hat{j} - 3\hat{k}\right)$ and $\vec{r} = \left(3\hat{i} + 2\hat{j} - 2\hat{k}\right) + t\left(2\hat{i}\right.$ are skew lines and hence find the shortest distance between them.

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3. If the two lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-m}{2} = z$ intersect at a point, find the value of m.

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4. Show that the lines $\frac{x-3}{3}=\frac{y-3}{-1}, z-1=0 \text{ and } \frac{x-6}{2}=\frac{z-1}{3}, y-2=0$ intersect. Also find the point of intersection.'

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5. Show that the straight lines $x+1=2y=-12z \text{ and } x=y+2=6z-6$ are skew and hence find the shortest distance between them.

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6. Find the parametric form of vector eqution of the straight line passing through $(-1, 2, 1)$ and paralle to the straight line

$\vec{r} = \left(2\hat{i} + 3\hat{j} - \hat{k}\right) + t\left(\hat{i} - 2\hat{j} + \hat{k}\right)$ and lines find the shortest distance between the lines.

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7. Find the foot of the perpendicular drawn from the point $(5, 4, 2)$ to the line $\frac{x+1}{2} = \frac{y-3}{3} = \frac{z-1}{-1}$. Also, find the eqution of the perpendicular.

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Exercise 6 6

1. Find a parametric form of vector equation of a plane which is at a distance of 7 units from the origin having3,-4,5 as direction ratios of a normal to it .

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2. Find the direction cosines of the normal to the plane 12x + 3y - 4z = 65. Also, find the non-parametric form of vector equation of a plane and the length of the perpendicular to the plane from the origin.

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3. Find the vector and Cartesian equations of the plane passing through the point with position vector $2\hat{i} + 6\hat{j} + 3\hat{k}$ and normal to the vector $\hat{i} + 3\hat{j} + 5\hat{k}$.

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4. A plane passes through the point $(1, 1, 2)$ - and the normal to the plane of magnitude $3\sqrt{3}$ makes equal acute angles with the coordinate axes. Find the equation of the plane.

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5. Find the intercept cut off by the plane $\vec{r} = \left(6\hat{i} + 4\hat{j} - 3\hat{k}\right) = 12$ on the coordinate axes.

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6. If a plane meets the coordinate axes at A,B,C such that the centroid of the triangle ABC is the point (u, v, w), find the eqution of the plane.

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Exercise 6 7

1. Find the non-parametric form of vector equation, and Cartesian eqution of the plane passing through the point $(2, 3, 6)$ and parallel to the straight lines

$$\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-3}{1} \text{ and } \frac{x+3}{2} = \frac{y-3}{-5} = \frac{z+1}{-3}.$$

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2. Find the parametric form of vector equation, and Cartesian equations of the plane passing through the points $(2, 2, 1), (9, 3, 6)$ and perpendicular to the plane 2x + 6y + 6z = 9.

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3. Find the parametric form vector eqution and Cartesian equations of the plane passing through the points $(2, 2, 1), (1, -2, 3)$ and parallel to the straight line passing through the points $(2, 1, -3)$ and $(-1, 5, -8)$.

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4. Find the non-parametric form of vector equation and Cartesian equation of the plane passing through the point $(1, -2, 4)$ and perpendicular to the plane x + 2y - 3z = 11 and parallel to the line $\frac{x+7}{3} = \frac{y+3}{-1} = \frac{z}{1}$.

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5. Find the angle between the line $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + t\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$ and the plane $\vec{r} \cdot \left(6\hat{i} + 3\hat{j} + 2\hat{k}\right) = 8.$

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6. Find the parametric vector, non-parametric vector and Cartesian form of the equations of the plane passing through the three non-collinear points `(3,6,-2),(-1,-2,6)and(6,4,-2).

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7. Find the non-parametric form of vector equation, and Cartesian equations of the plane $\vec{r} = \left(6\hat{i} - \hat{j} + \hat{k}\right) + s\left(-\hat{i} + 2\hat{j} + \hat{k}\right) + t\left(-5\hat{j} - 4\hat{j} - 5\hat{k}\right)$

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Exercise 6 8

1. Show that the straight lines $\vec{r} = \left(5\hat{i} + 7\hat{j} - 3\hat{k}\right) + s\left(4\hat{i} + 4\hat{j} - 5\hat{k}\right)$ and $\vec{r} = \left(8\hat{i} + 4\hat{j} + 5\hat{k}\right) + t\left(\right.$

are coplanar. Find the vector equation of the plane in which they lie.

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2. Show that the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{3}$ and $\frac{x-1}{-3} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar. Also, find the plane containing these lines.

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3. If the straight lines $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{m^2}$ and $\frac{x-3}{1} = \frac{y-2}{m^2} = \frac{z-1}{2}$ are

coplanar, find the distinct real values of m.

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4. If the straight lines $\frac{x-1}{2}=\frac{y+1}{\lambda}=\frac{z}{2}$ and $\frac{x+1}{5}=\frac{y+1}{2}=\frac{z}{\lambda}$ are coplanar, find λ and equations of the planes containing theses two lines.

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Exercise 6 9

1. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}\cdot\left(2\hat{i}-7\hat{j}+4\hat{k}\right)=3$ and $3x-5y+4z+11=0$, and the point $(-$

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2. Find the equation of the plane passing thruough the line of intersection of the planes x +2y + 3z = 2 and x - y + z= 3 , and at a distance $\frac{2}{\sqrt{3}}$ from point $(3, 1, -1)$.

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3. Find the angle between the line $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + t\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$ and the plane $\vec{r} \cdot \left(6\hat{i} + 3\hat{j} + 2\hat{k}\right) = 8.$

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4. Find the angle between the planes $\vec{r} \cdot \left(\hat{i} + \hat{j} - 2\hat{k}\right) = 3 \text{ and } 2x - 2y + z = 2$

A. $\left[\overline{\alpha}, \bar{\beta}, \bar{\gamma}\right] = 1$

B. $\left[\overline{\alpha}, \bar{\beta}, \bar{\gamma}\right] = -1$

C. $[\overline{\alpha}, \bar{\beta}, \bar{\gamma}] = 0$

D. $[\overline{\alpha}, \bar{\beta}, \bar{\gamma}] = 2$

Answer:

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5. Find the equation of the plane which passes through the point $(3, 4, -1)$ and is parallel to the plane 2x - 3y + 5z + 7 = 0. Also, find the distance between the two planes.

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6. Find the length of the perpendicular from the point $(1, -2, 3)$ to the plane x - y + z = 5.

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7. Find the point intersection of the line $x-1=\frac{y}{2}=z+1$ with the plane $2x-y+2z=2$. Also, find the angle between the line and the plane.

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8. Find the coordinates of the foot of the perpendicular and length of the perpendicular from the point $(4, 3, 2)$ to the plane x + 2y + 3z = 2.

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Exercise 6 10 M C Q

1. If $\vec{a}$ and $\vec{b}$ are parallel vectors, then $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is equal to

A. 2

B. -1

C. 1

D. 0

Answer: d

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2. If a vector $\overrightarrow{\alpha}$ lies in the plane of $\overrightarrow{\beta}$ and $\overrightarrow{\gamma}$, then

A. $\left[\overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma}\right] = 1$

B. $\left[\overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma}\right] = -1$

C. $\left[\overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma}\right] = 0$

D. $\left[\overrightarrow{\alpha}, \overrightarrow{\beta}, \overrightarrow{\gamma}\right] = 2$

Answer: c

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3. If $\vec{a}.\vec{b}=\vec{b}.\vec{c}=\vec{c}.\vec{a}=0$,then the value of $\begin{vmatrix}\vec{a} & \vec{b} & \vec{c}\end{vmatrix}$ is________

A. $|\vec{a}||\vec{b}||\vec{C}|$

B. $\frac{1}{3}|\vec{a}||\vec{b}||\vec{C}|$

C. 1

D. -1

Answer: a

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4. If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a}$ is perpendicular to $\vec{b}$, and is parallel to $\vec{c}$ then $\vec{a}\times\left(\vec{b}\times\vec{c}\right)$ is equal to

A. $\vec{a}$

B. $\vec{b}$

C. $\vec{c}$

D. $\vec{0}$

Answer: b

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5. If $\left[\vec{a}, \vec{b}, \vec{c}\right] = 1$ then the value of

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

A. 1

B. -1

C. 2

D. 3

Answer: a

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6. The volume of the parallelepiped with its edges represented by the vectors $\hat{i}+\hat{j}, \hat{i}+2\hat{j}, \hat{i}+\hat{j}+\pi\hat{k}$ is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. (π)

D. $\frac{\pi}{4}$

Answer: c

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

A. $(i)\frac{\pi}{6}\ (ii)\frac{\pi}{4}\ (ii)\frac{\pi}{3}\ (iv)\frac{\pi}{2}$

B.

C.

D.

Answer: a

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8. If $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}, \overrightarrow{b} = \hat{i} + \hat{j}, \overrightarrow{c} = \overrightarrow{i}$ and $\left(\overrightarrow{a} \times \overrightarrow{b}\right)\Big) \times \overrightarrow{c} = \lambda \overrightarrow{a} + \mu \overrightarrow{b}$ then the value of $\lambda + \mu$ is.______

A. 0

B. 1

C. 6

D. 3

Answer: a

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9. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b} + \vec{c}}{\sqrt{2}}$ then the angle between $\vec{a}$ and $\vec{b}$ is

________.

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. $\frac{3\pi}{4}$

Answer: a

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10. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{b + c}{\sqrt{2}}$, then the angle between $\vec{a}$ and $\vec{b}$ is

A. $\frac{\pi}{2}$

B. $\frac{3\pi}{4}$

C. $\frac{\pi}{4}$

D. (π)

Answer: b

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11. If the volume of the parallelpiped with $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{c} \times \vec{a}$ as coterminous edges is 8 cubic units, then the volume of the parallelepiped with $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{b} \times \vec{c}\right), \left(\vec{b} \times \vec{c}\right) \times \left(\vec{c} \times \vec{a}\right)$ and $\left(\vec{c} \times \vec{a}\right) \times \left(\vec{a}\right.$ as coterminous edges is,

A. 64 cubic units

B. 512cubic units

C. 64cubic units

D. 24cubic units

Answer: c

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12. Consider the vectors, $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ 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 the planes determined by the pairs of vectors, $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$ respectively. Then the angle between P_1 and P_2 is

A. 0°

B. 45°

C. 60°

D. 90°

Answer: a

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13. if $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right)$ where $\vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{b} . \vec{c} \neq 0$ and $\vec{a} . \vec{b} \neq 0$ then $\vec{a}$ and $\vec{c}$ are______

A. perpendicular

B. parallel

C. inclined at an angle $\frac{\pi}{3}$

D. inclined at an angle $\frac{\pi}{6}$

Answer: b

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14. If $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - 5\hat{k}, \vec{c} = 3\hat{i} + 5\hat{j} - \hat{k},$ then a vector perpendicular to $\vec{a}$ and lies in the plane containing $\vec{b}$ and $\vec{c}$ is

A. $-17\hat{i} + 21\hat{j} - 97\hat{k}$

B. $-17\hat{i} + 21\hat{j} - 123\hat{k}$

C. $-17\hat{i} - 21\hat{j} + 97\hat{k}$

D. $-17\hat{i} - 21\hat{j} - 97\hat{k}$

Answer: d

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15. The angle between the lines $\frac{x-2}{3} = \frac{y+1}{-2}, z = 2$ and $\frac{x-1}{1} = \frac{2y+3}{3}, \frac{z+5}{2}$ is

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{2}$

Answer: d

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16. If the line $\frac{x-2}{3}=\frac{y-1}{-5}=\frac{z+2}{2}$ lies in the plane $x+3y-az+\beta=0$ then (

is

A. $(-5, 5)$

B. $(-6, 7)$

C. $(5, -5)$

D. $(6, -7)$

Answer: b

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17. The angle between the line $\vec{r}=\left(\hat{i}+2\hat{j}-3\hat{k}\right)+t\left(2\hat{i}+\hat{j}-2\hat{k}\right)$ and the plane $\vec{r}\cdot\left(\hat{i}+\hat{j}\right)+4=0$ is :

A. 0°

B. 30°

C. 45°

D. 90°

Answer: c

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18. The coordinates of the point where the line $\vec{r} = \left(6\hat{i} - \hat{j} - 3\hat{k}\right) + t\left(-\hat{i} + 4\hat{k}\right)$ meets the planeb $\vec{r}.\left(\hat{i} + \hat{j} - \hat{k}\right) = 3$ are ________

A. $(2, 1, 0)$

B. $(7, -1, -7)$

C. $(1, 2, -6)$

D. $(5, -1, 1)$

Answer: d

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19. Distance from the origin to the plane $3x - 6y + 2z + 7 = 0$ is

A. 0

B. 1

C. 2

D. 3

Answer: b

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20. The distance between the planes $x + 2y + 3z + 7 = 0$ and $2x + 4y + 6z + 7 = 0$ is

A. $\frac{\sqrt{7}}{2\sqrt{2}}$

B. $\frac{7}{2}$

C. $\frac{\sqrt{7}}{2}$

D. $\frac{7}{2\sqrt{2}}$

Answer: a

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21. If direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}, \quad \text{then.}$

A. $c = \ \pm 3$

B. $c \pm \sqrt{3}$

C. cgt0

D. $0 < c < 1$

Answer: b

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22. The vector equation $\overrightarrow{r} = \left(\hat{i} - 2\hat{j} - \hat{k}\right) + t\left(6\hat{j} - \hat{k}\right)$ represents a straight line passing through the points

A. $(0, 6, -1)$ and $(1, -2, -1)$

B. $(0, 6, -1)$ and $(-1, 4, -2)$

C. $(1, -2, -1)$ and $(1, 4, -2)$

D. $(1, -2, -1)$ and $(0, -6, 1)$

Answer: c

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23. If the distance of the point $(1, 1, 1)$ from the origin is half of its distance from the plane x + y + z + k = 0, then the value of k are

A. ± 3

B. ± 6

C. $-3, 9$

D. $3, \ -9$

Answer: d

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24. If the planes $\overrightarrow{r}\cdot\left(2\hat{i}-\lambda\hat{j}+\hat{k}\right)=3 \text{ and } \overrightarrow{r}\left(4\hat{i}+\hat{j}-\mu\hat{k}\right)=5$ are parallel, then the value of $\lambda \text{ and } \mu$ are

A. $\frac{1}{2}, \ -2$

B. $\frac{-1}{2}, 2$

C. $\frac{-1}{2}, \ -2$

D. $\frac{1}{2}, 2$

Answer: c

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25. If the length of the perpendicular from the origin to the plane $2x+3y+\lambda z=1, \lambda>0$ is $\frac{1}{5}$ then the value of is λ is

A. $2\sqrt{3}$

B. $3\sqrt{2}$

C. 0

D. 1

Answer: a

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Additional Questions Solved

1. The work done by the force $\overrightarrow{F}=a\hat{i}+\hat{j}+\hat{k}$ in moving the point of application from (1.1.1) 1 (2. 2. 2) along a straight line is given to be 5 units. Find the value of a.

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2. If the position vectors of three points A, B and Care respectively $\vec{i}+\vec{j}+3\vec{k}$, $4\vec{i}+\vec{j}+5\vec{k}$ and $7\left(\vec{i}+\vec{k}\right)$. Find $\overrightarrow{AB}\times\overrightarrow{AC}$ ..

Interpret the result geometrically.

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3. A force given by and $3\vec{i}+2\vec{j}-4\vec{k}$ is applied at the point (1,-1,2).

Find the moment of the force about the point (2,-1,3).

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4. Show that the area of a parallelogram having diagonals $3\vec{i}+\vec{j}-2\vec{k}$ and $\vec{i}+3\vec{j}+4\vec{k}$ is $5\sqrt{3}$.

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5. If the edges $\vec{a} = -3\vec{i} + 7\vec{j} + 5\vec{k}$, $\vec{b} = -5\vec{i} + 7\vec{j} - 3\vec{k}$, $\vec{c} = -7\vec{i} - 5\vec{j} - 3\vec{k}$ meet a vertex, find the volume of the parallelepiped.

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6. If $\vec{x}.\vec{a} = 0$, $\vec{x}.\vec{b} = 0$, $\vec{x}.\vec{c} = 0$ and $\vec{x} \neq \vec{0}$ then show yhat $\vec{a}$, $\vec{b}$, $\vec{c}$ are coplanar .

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7. The volume of the parallelepiped whose edges are represented by $-12\hat{i} + \lambda\hat{k}, 3\hat{j} - \hat{k}, 2\hat{I} + \hat{j} - 15\hat{k}$ is 546 cubic units. Find the value of λ

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8. Prove that $\left|\vec{a}\ \vec{b}\ \vec{c}\right| = abc$ if and only if $\vec{a}$, $\vec{b}$, $\vec{c}$ are mutually perpendicular.

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9. Show that the points (1, 3, 1), (1, 1,-1), (-1, 1, 1), (2,2, -1) are lying on the same plane.

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10. If $\vec{a} = 2\vec{i} + 3\vec{j} - 5\vec{k}$, $\vec{b} = -\vec{i} - \vec{j} + 2\vec{k}$ and $\vec{c} = 4\vec{i} - 2\vec{j} + 2\vec{k}$ Show that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} \neq \vec{a} \times \left(\vec{b} \times \vec{c}\right)$.

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11. If $\vec{a} = 3\vec{i} + 2\vec{j} - 4\vec{k}$, $\vec{b} = 5\vec{i} - 3\vec{j} + 6\vec{k}$, $\vec{c} = 5\vec{i} + \vec{j} + 2\vec{k}$,fin(i) $\vec{a} \times \left(\vec{b} \times \vec{c}\right)$ (ii) $\left(\vec{a} \times \vec{b}\right) \times \vec{c}$ and show that they are not equal.

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12. If $\vec{a}=2\vec{i}+3\vec{j}-\vec{k}, \vec{b}=2\vec{i}+5\vec{k}, \vec{c}=\vec{j}-3\vec{k}$, verify that $\vec{a}\times\left(\vec{b}\times\vec{c}\right)=\left(\vec{a}.\vec{c}\right)\vec{b}-\left(\vec{a}.\vec{b}\right)\vec{c}$.

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13. Find the vector and cartesian equations of the straight line passing through the point A with position vector $3\vec{i}-\vec{j}+4\vec{k}$ and parallel to the vector $-5\vec{i}+7\vec{j}+3\vec{k}$.

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14. Find the vector and cartesian equations of the straight line passing through (-5, 2, 3) and (4, -3, 6).

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15. Find the angle between the following lines $\vec{r} = 3\vec{i} + 2\vec{j} - \vec{k} + t\left(\vec{i} + 2\vec{j} + 2\vec{k}\right)$ and $\vec{r} = 5\vec{j} + 2\vec{k} + s\left(3\vec{i} + 2\vec{j} + 6\vec{k}\right)$

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16. Find the angle between the following lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-4}{6}$ and x+1= $\frac{y+2}{2} = \frac{z-4}{2}$.

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17. Find the distance between the parallel lines $\vec{r} = \left(\hat{i} - \hat{j}\right) + t\left(2\hat{i} - \hat{j} + \hat{k}\right)$ and $\vec{r} = \left(2\hat{i} + \hat{j} - \hat{k}\right) + s\left(2\hat{i} - \hat{j} + \hat{k}\right)$

.

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18. Show that the lines $\vec{r} = (\hat{i} - \hat{j}) + t(2\hat{i} + \hat{k})$ and $\vec{r} = (2\hat{i} - \hat{j}) + s(\hat{i} + \hat{j} - \hat{k})$ are skew lines and find the distance between them .

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19. Show that the lines $\frac{x-1}{3} = \frac{y-1}{-1} = \frac{z+1}{0}$ and $\frac{x-4}{2} = \frac{y}{0} = \frac{z+1}{3}$ intersect and hence find the point of intersection.

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20. find the shortest distance between the skew lines. $\vec{r} = \left(\vec{i} - \vec{j}\right) + \lambda\left(2\vec{i} + \vec{j} + \vec{k}\right)$ and $\vec{r} = \left(\vec{i} + \vec{j} - \vec{k}\right) + \mu\left(2\vec{i} - \vec{j} - \vec{k}\right)$

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21. find the shortest distance between the skew lines. $\vec{r} = \left(2\vec{i} - \vec{j} - \vec{k}\right) + t\left(\vec{i} - 2\vec{j} + 3\vec{k}\right)$ and $\vec{r} = \left(\vec{i} - 2\vec{j} - \vec{k}\right) + s\left(2\vec{i} - 2\vec{j} - 3\vec{k}\right)$

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22. Find the vector and cartesian equations of a plane which is at a distance of 18 units from the origin and which is normal to the vector $2\vec{i} + 7\vec{j} + 8\vec{k}$.

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23. The unit normal vector to the plane 2x - y + 2z = 5 are ....

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24. Find the length of the perpendicular from the origin to the plane

$\vec{r}.\left(3\vec{i}+4\vec{j}+12\vec{k}\right)=26$

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25. The foot of the perpendicular drawn from the origin to a plane is 18 ,

equation of the plane.

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26. Find the Cartesian equation of the plane through the point with position vector $2\hat{i}-\hat{j}+\hat{k}$ and perpendicular to the vector $4\hat{i}+2\hat{j}-3\hat{k}$

.

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27. Find the vector and cartesian equations of the plane passing through the point (2,-1, 4) and parallel to the plane $\vec{r}.\left(4\vec{i}-12\vec{j}-3\vec{k}\right)=7$

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28. Find the Vector and Cartesian equation of the plane containing the line $\frac{x-2}{2}=\frac{y-2}{3}=\frac{z-1}{3}$ and parallel to the line $\frac{x+1}{3}=\frac{y-1}{2}=\frac{z+1}{1}$

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29. Find the vector and cartesian equation of the plane passing through the point (1, 3, 2) and parallel to the lines * $\frac{x+1}{2}=\frac{y+2}{-1}=\frac{z+3}{3}$ and $\frac{x-2}{1}=\frac{y+1}{2}=\frac{z+2}{2}$.

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30. Find the vector and cartesian equations of the plane passing through the point (-1,3,2) and perpendicular to the planes.x + 2y + 2=5 and 3x+y+2z=8.

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31. Find the vector and cartesian equations of the plane passing through the points A(1, -2, 3) and B(-1,2,-1) and is parallel to the line $\frac{x-2}{2} = \frac{y+1}{3} = \frac{z-1}{4}$.

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32. Find the vector and certesian equation of the plane through the points (1, 2, 3) and (2, 3, 1) and perpendicular to the plane $\vec{r} \cdot \left(3\hat{i} - 2\hat{j} + 4\hat{k}\right) = 5$.

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33. Find the vector and cartesian equations of the plane containing the line $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-1}{-2}$ and passing through the point (-1, 1,-1).

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34. Derive the equation of the plane in the intercept form.

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35. Find the Cartesian form of the equation of the plane $\vec{r} = (s-2t)\hat{i} + (3-t)\hat{j}(2s+t)\hat{k}$

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36. Show that the straigh lines $\vec{r} = \left(\vec{i} + \vec{j} - \vec{k}\right) + \lambda\left(3\vec{i} - \vec{j}\right)$ $\vec{r} = \left(4\vec{i} - \vec{k}\right) + \mu\left(2\vec{i} + 3\vec{k}\right)$ are coplanar . Find the vector equation of the which they lie.

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37. If the straight lines $\frac{x-1}{2}=\frac{y+1}{\lambda}=\frac{z}{2}$ and $\frac{x+1}{5}=\frac{y+1}{2}=\frac{z}{\lambda}$ are coplanar, find λ and equations of the planes containing theses two lines.

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38. If the lines $\frac{x-2}{1}=\frac{y-3}{1}=\frac{z-4}{-k}$ and $\frac{x-1}{k}=\frac{y-4}{2}=\frac{z-5}{1}$ are coplanar, then find the value of k.

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39. Show that the lines $\frac{x+3}{-3}=\frac{y-1}{1}=\frac{z-5}{5}$ and $\frac{x+1}{-1}=\frac{y-2}{2}=\frac{z-5}{5}$ are coplanar .Al,so find the equation of the plane containing these two lines.

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40. Find the point of intersection of the line passing through the two points (1, 1, -1), (-1, 0, 1) and the xy-plane.

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41. Find the coordinates of the point where the line $\vec{r} = \left(\hat{i} + 2\hat{j} - 5\hat{k}\right) + t\left(2\hat{i} - 3\hat{j} + 4\hat{k}\right)$ meets the plane $\vec{r} \cdot \left(2\vec{i} + 4\vec{j} - \vec{k}\right) = 3.$

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42. Find the point of intersection of the line $\vec{r} = \left(\vec{j} - \vec{k}\right) + s\left(2\vec{i} - \vec{j} + \vec{k}\right)$ and Xz-plane

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43. Find the meeting point of the line $\vec{r} = \left(2\vec{i} + \vec{j} - 3\vec{k}\right) + t\left(2\vec{i} - \vec{j} - \vec{k}\right)$ and the x - 2y +3z + 7 =0.

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44. Show that the following planes are at right angles:

$\vec{r}.\left(2\vec{i} + \vec{j} + \vec{k}\right) = 15$ and $\vec{r}.\left(\vec{i} + \vec{j} - 3\vec{k}\right) = 3$.

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45. The planes $\vec{r}.\left(2\overrightarrow{+}\lambda\vec{j} - 3\vec{k}\right) = 10$ and $\vec{r}.\left(\lambda\overrightarrow{+}3\vec{j} + \vec{k}\right) = 5$ are perpendicular. Find λ

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46. Find the angle between the line $\frac{x-2}{3} = \frac{y-1}{-1} = \frac{z-3}{2}$ and the plane $3x + 4y + z + 5 = 0$.

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47. Find the angle between the line $\vec{r} = \vec{i} + \vec{j} + 3\vec{k} + \lambda\left(2\vec{i} + \vec{j} - \vec{k}\right)$ and the plane $\vec{r}.\left(\vec{i} + \vec{j}\right) = 1$

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

A. 6

B. 10

C. 12

D. 24

Answer: (c)

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49. If

$\overrightarrow{a} = \hat{i} - \hat{k}, \overrightarrow{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}, \overrightarrow{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$

show that $\left[\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}\right]$ depends on neither .x nor y.

A. onlyx

B. onlyy

C. Neither x or y

D. Both x and y

Answer: c

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50. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are three non-coplanar vector and $\overrightarrow{p}, \overrightarrow{q} \overrightarrow{r}$ are defind

by the relations $\overrightarrow{p} = \dfrac{\overrightarrow{b} \times \overrightarrow{c}}{\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right]}, \overrightarrow{q} = \dfrac{\overrightarrow{c} \times \overrightarrow{a}}{\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right]}, \overrightarrow{r} = \dfrac{\overrightarrow{a} \times \overrightarrow{b}}{\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right]},$

then $\overrightarrow{p}.\left(\overrightarrow{a}+\overrightarrow{b}\right)+\overrightarrow{q}.\left(\overrightarrow{b}+\overrightarrow{c}\right)+\overrightarrow{r}.\left(\overrightarrow{c}+\overrightarrow{a}\right)$ =............

A. 0

B. 1

C. 2

D. 3

Answer: d

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51. The value of $\hat{i}.\left(\hat{j}\times\hat{k}\right)+\hat{j}.\left(\hat{k}\times\hat{i}\right)+\hat{k}.\left(\hat{j}\times\hat{i}\right)$ =.........

A. 1

B. 3

C. -3

D. 0

Answer: A

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

A. the A.M of a and b

B. the G.M of a and b

C. the H.M of a and b

D. equal to zero

Answer: b

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53. The value of $\hat{i}.\left(\hat{j} \times \hat{k}\right) + \left(\hat{i} \times \hat{k}\right).\hat{j}$ ....

A. 1

B. -1

C. 0

D. $\hat{j}$

Answer: c

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54. The value of $\left[\hat{i} - \hat{j}, \hat{j} - \hat{k}, \hat{k} - \hat{i}\right]$ is :

A. 0

B. 1

C. 2

D. 3

Answer: a

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

A. $\vec{u}$ is a unit vector

B. $\vec{u} = \vec{a} + \vec{b} + \vec{c}$

C. $\vec{u} = \vec{0}$

D. $\vec{u} \neq \vec{0}$

Answer: c

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56. The area of the parallelogram having diagonals $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} + 4k$ is

A. $10\sqrt{3}$

B. $6\sqrt{30}$

C. $\frac{3}{2}\sqrt{30}$

D. $3\sqrt{30}$

Answer: d

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57. Show that $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times (\vec{a} + \vec{b}) = \vec{0}$.

A. $\vec{x} = \vec{0}$

B. $\vec{y} = \vec{0}$

C. $\vec{x}$ and $\vec{y}$ are parallel

D. $\vec{x} = \vec{x}$ or $\vec{y} = \vec{0}$ or $\vec{x}$ and $\vec{y}$ are parallel

Answer: d

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58. If $\overline{PR} = 2\hat{i} + \hat{j} + \hat{k}, \overline{QS} = \hat{i} + 3\hat{j} + 2\hat{k},$ then the area of the quadrilateral PQRS is

A. $5\sqrt{3}$

B. $10\sqrt{3}$

C. $\frac{5\sqrt{3}}{2}$

D. $\frac{3}{2}$

Answer: c

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59. if $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right)$ where $\vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{b}.\vec{c} \neq 0$ and $\vec{a}.\vec{b} \neq 0$ then $\vec{a}$ and $\vec{c}$ are______

A. $\vec{a}$ parellel to $\vec{b}$

B. $\vec{b}$ parellel to $\vec{c}$

C. $\overrightarrow{c}$ parellel to $\overrightarrow{a}$

D. $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}$

Answer: c

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