MATHS

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Three Dimensional Geometry

Example

1. If a line makes angles of $90^\circ, 60^\circ$ and 30° with the positive x, y and z axis respectively, find its direction-cosines.

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2. If a line has direction ratios $< -2, -1, 2 >$ then its direction - cosines are

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3. If a line has direction cosine : $\leftarrow \frac{9}{11}, \frac{6}{11}, -\frac{2}{11} >$, then what are its direction ratios?

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4. Show that the points $A(1, -2, -8), B(5, 0, -2)$ and $C(11, 3, 7)$ are collinear.

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5. Find the acute angle between the lines whose direction ratios are : $< 1, 1, 2 > \text{ and } \leftarrow 3, -4, 1 >$

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6. Find the angle between the lines whose direction cosines are given by the equations $3l + m + 5n = 0, 6mn - 2nl + 5lm = 0$

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7. Find the length of the projection of the line segment joining the points $P(3, -1, 2)$ and $Q(2, 4 - 1)$ on the line with direction ratios $< 1, 2, -2 >$

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8. Find the area of the triangle ABC whose vertices are : $A(1, 2, 4), B(-2, 1, 2)$ and $C(2, 4, -3)$

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9. A line makes angles $\alpha, \beta, \gamma, \delta$ with the diagonals of a cube, prove that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$

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10. If the cartesian equations of a line are : $\frac{3-x}{5} = \frac{y+4}{7} = \frac{2z-6}{4}$, write the vector equation for the line.

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11. Find the direction cosines of the line : $\frac{2x+5}{2} = \frac{3-2y}{3} = \frac{3z+1}{4}$

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12. Write the cartesian equation of the straight line through the point (1,2,3) and along the vector $3\hat{i} + \hat{j} + 2\hat{k}$

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13. Find the vector equation of the line through $(4, 3, -1)$ and parallel to the line: $\vec{r} = \left(2\hat{i} - \hat{j} + 3\hat{k}\right) + \lambda\left(3\hat{i} - \hat{j} + 4\hat{k}\right)$

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14. Find the angle between the following pair of lines : $\vec{r} = \hat{i} + \hat{j} - \hat{k} + \lambda\left(\hat{i} - 3\hat{j} + 2\hat{k}\right), \vec{r} = 2\hat{i} - \hat{j} + \hat{k} + \mu\left(3\hat{i} + \hat{j} - 2\hat{k}\right)$

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15. Find the angle between the followig pair of lines : $\frac{-x+2}{-2} = \frac{y-1}{7} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{2y-8}{4} = \frac{z-5}{4}$ and check whether the lines are parallel or perpendicuar.

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16. Find the point on the line $\frac{x+2}{3}=\frac{y+1}{2}=\frac{z-3}{2}$ at a distance of $3\sqrt{2}$ from the point $(1, 2, 3)$.

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17. Find the equation of the line passing through the point (-1,3,-2) and perpendicular to the lines : $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}$.

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18. Find the vectoer and cartesian equations of the line through the point (1,2,-4) and perpendicualr of the lines: $\overrightarrow{r}=\left(8\hat{i}-19\hat{j}+10\hat{k}\right)+\lambda\left(3\hat{i}-16\hat{j}+7\hat{k}\right)$ and $\overrightarrow{r}=\left(15\hat{i}+29\hat{j}+5\hat{k}\right)$

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19. Show that, if the axes are rectangular, the equations of the line through (x_1, y_1, z_1) at right angles to the lines: $\frac{x}{l_1} = \frac{y}{m_1} = \frac{z}{n_1}, \frac{x}{l_2} = \frac{y}{m_2} = \frac{z}{n_2}$ are $\frac{x - x_1}{m_1 n_2 - m_2 n_1} = \frac{y - y_1}{n_1 l_2 - n_2 l_1} = \frac{z - z_1}{l_1 m_2 - l_2 m_1}$

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20. Find the length of perpendicular drawn from the point (3,4,5) on the line $\frac{x - 2}{2} = \frac{y - 3}{5} = \frac{z - 1}{3}$

Also find the foot of perpendicular.

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21. Find the co-ordinates of the foot of the perpendicualr drawn from the point A(1,8,4) to the joining B(0,-1,3) and C(2,-3,-1).

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22. Find the vector equation of the line parallel to the line : $\frac{x-1}{5}=\frac{3-y}{2}=\frac{z+1}{4}$ and passing through (3,0,-4). Also find the distance between these two lines.

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23. Find the equation of the perpendicular drawn from the point P(2,4,-1) to the line : $\frac{x+5}{1}=\frac{y+3}{4}=\frac{z-6}{-9}$. Also write down the co ordinates of the foot of the perpendicualr from P to the line.

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24. Find the image of the point (1,6,3) in the line : $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$.

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25. Slope of the line joining (3,1) and (4,5) is :

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26. Find the co ordinates of the foot of perpendicular and the length of the perpendicular drawn from the point P(5,4,2) to the line : $\overrightarrow{r} = -\hat{i} + 3\hat{j} + \hat{k} + \lambda\left(2\hat{i} + 3\hat{j} - \hat{k}\right)$. Also find the image of P in this line.

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27. Find the shortest distance between the lines whose equations are : $\overrightarrow{r} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ and $\overrightarrow{r} = \left(2\hat{i} + 4\hat{j} + 5\hat{k}\right) + \mu\left(3\hat{i} + 4\hat{j} + 5\hat{k}\right)$.

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28. Find the distance between the lines l_1 and l_2 given by : $\overrightarrow{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$ and $\overrightarrow{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + \mu\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)C\widetilde{O}$

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29. Show that the two lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$ intersect each other . Find also the point of intersection.

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30. 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.

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31. Find whether the lines: $\overrightarrow{r}=\left(\hat{i}-\hat{j}-\hat{k}\right)+\lambda\left(2\hat{i}+\hat{j}\right)$ and $\overrightarrow{r}=\left(2\hat{i}-\hat{j}\right)+\mu\left(\hat{i}+\hat{j}-\hat{k}\right)$ intersect or not. If itersecting, find their point of intersection..

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32. Find the shortest distance and the vector equation of the line of shortest distance between the lines given by : $\vec{r} = \left(3\hat{i} + 8\hat{j} + 3\hat{k}\right) + \lambda\left(3\hat{i} - \hat{j} + \hat{k}\right)$ and $\vec{r} = \left(-3\hat{i} - 7\hat{j} + 6\hat{k}\right) + \mu$

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33. Write the sum of intercepts cut off by the plane $\vec{r} \cdot \left(2\hat{i} + \hat{j} - \hat{k}\right) - 5 = 0$ on the three axes.

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34. Find the distance of the plane: $x - y + 4z - 9 = 0$ from the origin.

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35. Find the distance of the plane 3x-4y+12z=3 from the origin.

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36. Find the equation of the plane with interceots 2, 3 and 4 on the x, y and z axis respectively.

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37. Find the co-ordinates of the point where the line through the points A(3,4,1) and B(5,1,6) crosses the xy-plane.

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38. Find the vector equation of a plane passing through the point having 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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39. Find the vector equation of the plane which is at a distance of $\frac{6}{\sqrt{29}}$ from the origin and its normal vector from the origin is $2\hat{i} - 3\hat{j} + 4\hat{k}$. Also find its cartesian form.

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40. Find the direction cosines of the unit vector perpendicular to the plane $\vec{r} \cdot \left(6\hat{i} - 3\hat{j} - 2\hat{k}\right) + 1 = 0$ passing through the origin.

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41. Find the vector equation of a plane, which is at a distance of 7 uits from the origin and which is normal to the vector $3\hat{i} + 5\hat{j} - 6\hat{k}$.

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42. Find the angle between the two planes $2x + y - 2z = 5$ and $3x - 6y - 2z = 7$ using vector method.

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43. Find the equation of the plane through the point (1,-1,2) and (2,-2,2) and perpendicular to the plane $6x - 2y + 2z = 9$.

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44. Find equation of a plane passing through the points $(2, 1, 0)$,(3,-2,-2) and (3,1,7)`

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45. Find the equation of the plane determined by the points A(3,-1,2), B(5,2,4) and C(-1,-1,6) and hence find the distance between the plane and the point P(6,5,9).

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46. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=1$ and $\vec{r}\cdot\left(2\hat{i}+3\hat{j}-\hat{k}\right)+4=0$ and parallel to x-axis.

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47. Find the equation of the plane which contains the line of intersection of the planes $\vec{r}\cdot\left(\hat{i}+2\hat{j}+3\hat{k}\right)-4=0$ and $\vec{r}\cdot\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ and which is perpendicular to the plane $\vec{r}\cdot\left(5\hat{i}+3\hat{j}-6\hat{k}\right)+8=0$

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48. Find the equation of the plane which contains the line of intersection of the planes $\vec{r}\cdot\left(\hat{i}+2\hat{j}+3\hat{k}\right)-4=0$ and $\vec{r}\cdot\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ and which is perpendicular to the plane $\vec{r}\cdot\left(5\hat{i}+3\hat{j}-6\hat{k}\right)+8=0$

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49. If the lines: $\frac{x-1}{-3}=\frac{y-2}{-2k}=\frac{z-3}{2}$ and $\frac{x-1}{k}=\frac{y-2}{1}=\frac{z-3}{5}$ are perpendicular, find the values of k and hence find the equation of plane containing these lines.

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50. Find the vector equation of the line passing through (1, 2, 3) and parallel to the planes $\vec{r}.\left(\hat{i}-\hat{j}+2\hat{k}\right)=5 \text{ and } \vec{r}.\left(3\hat{i}+\hat{j}+\hat{k}\right)=6.$

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51. From the point P(1,2,4), a perpendicular is drawn on the plane $2x+y-2z+3=0$. Find the equations, the length and co-ordinates of the foot of the perpendicular.

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52. Find the co-ordinates of the point P, where the line through A(3,-4,-5) and B(2,-3,1) crosses the plane passing through three points L(2,2,1), M(3,0,1) and N(4,-1,0). Also, find the ratio in which P divides the line segment AB.

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53. Find the distance of the point (1,-2,3) from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$.

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54. Find the co-ordinates of the foot of the perpendicular and the perpendicualr distance of the point (1,3,4) from the plane $2x - y + z + 3 = 0$. Find also, the image of the point in the plane.

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55. Find the equation of the plane, which meets the axes in A,B,C given that centroid of the triangle ABC is the point (α, β, γ).

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56. Find the equation of the plane bisectiing the angles between the planes: $x + 2y + 2z - 3 = 0, 3x + 4y + 12z + 1 = 0$ and specify the plane, which bisects the acute angle.

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57. Show that the plane whose vector equation is $\vec{r}.\left(\hat{i} + 2\hat{j} - \hat{k}\right) = 3$ contains the line whose vector equation is $\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} + \hat{j} + 4\hat{k}\right)$.

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58. Find the angle between the line : $\vec{r} = (\hat{i} - \hat{j} + \hat{k}) + \lambda(2\hat{i} - \hat{j} + 3\hat{k})$ and the plane $\vec{r} \cdot (2\hat{i} + \hat{j} - \hat{k}) = 4$. Also find whether the line is parallel to the plane or not.

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59. Find the point of intersection of the line : $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ and the plane $\vec{r} \cdot (2\hat{i} - 6\hat{j} + 3\hat{k}) + 5 = 0$.

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60. Show that the line , $\vec{r} = \hat{i} + \hat{j} + \lambda(2\hat{i} + \hat{j} + 4\hat{k})$ lies in the plane $\vec{r} \cdot (\hat{i} + 2\hat{j} - \hat{k}) = 3$.

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61. Find the distance from the point (3,4,5) of the plane, where the line : $\frac{x-3}{1}=\frac{y-4}{2}=\frac{z-5}{2}$ meets the plane $x+y+z=2$.

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62. 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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63. State when the line $\vec{r}=\vec{a}+\lambda\vec{b}$ is parallel to the plane $\vec{r}\cdot\vec{n}=d$. Show that the line $\vec{r}=\hat{i}+\hat{j}+\lambda\left(2\hat{i}+\hat{k}+4\hat{k}\right)$ is parallel to the plane $\vec{r}\cdot\left(-2\hat{i}+\hat{k}\right)=5$. Also, find the distance between the line and the plane.

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64. Find the equation to the plane through the line $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\gamma}{n}$ and parallel to the line $\frac{x}{l'}=\frac{y}{m'}=\frac{z}{n'}$

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65. If the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect, then k is equal to

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66. Find the equation of the plane parallel to the line $\frac{x-2}{1}=\frac{y-1}{3}=\frac{z-3}{2}$, which contains the point (5,2,-1) and passes through the origin.

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67. Find the equation of the plane containing the line : $\frac{x-1}{2}=\frac{y-2}{-1}=\frac{z-3}{4}$ and perpendicular to the plane x + 2y + z - 2 = 0.

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68. Find the equation of the plane containingg the lines: $\vec{r}=\hat{i}+\hat{j}+\lambda\left(\hat{i}+2\hat{j}-\hat{k}\right)$ and $\vec{r}=\hat{i}+\hat{j}+\mu\left(-\hat{i}+\hat{j}-2\hat{k}\right)$.

Find the distance of this plane from origin and also from the point (1,1,1).

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69. Find cartesian equations of the plane containing the lines: $\vec{r}=2\hat{i}+\hat{j}-3\hat{k}+\lambda\left(\hat{i}+2\hat{j}+5\hat{k}\right)$ and $\vec{r}=3\hat{i}+3\hat{j}-7\hat{k}+\mu\left(3\hat{i}-2\hat{j}+5\hat{k}\right)$

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Exercise

1. Find the distance of the point (2,3,4) from the x axis.

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2. If a line makes angles of $90^\circ, 60^\circ$ and θ with the x, y and z axis respectively,where θ is acute, find its θ

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3. If a line has direction cosines $< \frac{2}{3}, -\frac{1}{3}, -\frac{2}{3} >$, then find the direction ratios.

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4. If a line has direction ratios $< 2, -1, -2 >$, then what are its direction cosines?

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5. Find the direction cosines of a line passing through the points (1,0,0) and (0,1,1).

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6. Find the direction cosines of the lines joining the points: (-1,-1,-1) and (2,3,4)

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7. Find the direction ratios and direction cosines of the vector joining the points (4,7,2) and (5,11,-4).

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8. Write the direction cosines of the vector : $-2\hat{i} + \hat{j} - 5\hat{k}$

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9. Write the direction cosines of the vector : $\hat{i} + 2\hat{j} + 3\hat{k}$

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10. Find the length of the projection of the line segment joining (3,4,5) and (4,6,3) on the straight line : $\frac{x-4}{2} = \frac{y-5}{3} = \frac{z-6}{6}$

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11. Show that the following points are collinear : (1,2,3) , (2,6,3) , (3,10,-1)

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12. Find the acute angle between two lines whose direction ratios are $< 2, 3, 6 >$ and $< 1, 2, -2 >$

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13. Find the obtuse angle between two lines whose direction ratios are : $< 3, -6, 2 >$ and $< 1, -2, -2 >$

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14. Find the angle between the lines whose direction ratios are : a, b, c and $b - c, c - a, a - b$

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15. Find the direction cosines of the sides of the triangle whose vertices are (3, 5, – 4), (– 1, 1, 2) and (– 5, – 5, – 2).

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16. Show that the three lines with direction cosines $\frac{12}{13}, -\frac{3}{13}, -\frac{4}{13}, \frac{4}{13}, \frac{12}{13}, \frac{3}{13}, \frac{3}{13}, -\frac{4}{13}, \frac{12}{13}$ are mutually perpendicular.

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17. The angle between the lines whose direction cosines are given by the equatios $l^2 + m^2 - n^2 = 0, m + n + l = 0$ is

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18. Find the angle between the lines whose direction cosines are given by $: 2l - m + 2n = 0, mn + nl + lm = 0.$

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19. Find the area of the triangle ABC whose vertices are : $A(1, 2, 4), B(-2, 1, 2)$ and $C(2, 4, -3)$

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20. Show that the line through the points (4, 7, 8), (2, 3, 4) is parallel to the line through the points (– 1, – 2, 1), (1, 2, 5).

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21. Show that the line joining the origin to the point (2, 1, 1) is perpendicular to the line determined by the points (3, 5, – 1), (4, 3, – 1).

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22. Determine the value of k so that the lie joining the points $A(k, 1, -1), B(2, 0, 2k)$ is perpendicular to the line joining the points $C(4, 2k, 1)$ and $D(2, 3, 2)$

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23. Prove that the angle between any two diagonals of a cube is $\cos^{-1}\frac{1}{3}$

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24. Find the projection of the line segment joining the points: (2,-3,0), (0,4,5) on the line with direction cosines $< \frac{2}{7}, \frac{3}{7}, -\frac{6}{7} >$

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25. Find the projection of the line segment joining the points (1,2,3), (4,3,1) on the line with direction ratios $< 3, -6, 2 >$.

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26. If the edges of a rectangular parallelopiped are a, b and c, show that the angles between the four diagonals are given by $\cos^{-1}\frac{a^2 \pm b^2 \pm c^2}{a^2 + b^2 + c^2}$

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27. write the vectoe equation of the line : $\frac{x-5}{-3} = \frac{y+4}{7} = \frac{6-z}{2}$.

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28. show that the three lines with direction cosines $< \frac{12}{13}, -\frac{3}{13}, -\frac{4}{13} >, < \frac{4}{13}, \frac{12}{13}, \frac{3}{13} >, < \frac{3}{13}, -\frac{4}{13}, \frac{12}{13} >$ are mutually perpendicular.

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29. express the following equations of the lines into vector form: $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$.

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30. Find the cartesian equation of the line which passes through the point (– 2, 4, – 5) and parallel to the line given by $\frac{x+3}{3}=\frac{y-4}{5}=\frac{z+8}{6}$

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31. Find the cartesian as well as the vector equation of the line passing through : $(0, -1, 4)$ and parallel to the straight line : $\frac{-x-2}{1}=\frac{y+3}{7}=\frac{2z-6}{3}$

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32. Find the cartesian as well as the vector equation of the line passing through : (-1,2,3) and parallel to the line: (x-3)/2=(y+1)/3=(z-1)/6

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33. The cartesian equations of a line are : $\frac{x-5}{3}=\frac{y+4}{7}=\frac{z-6}{2}$ and $\frac{x+3}{2}=\frac{y-5}{4}=\frac{z+6}{2}$. find the vector equation of the lines.

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34. Find the equation of a line parallel to x-axis and passing through the origin.

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35. Find the direction cosines of a line parallel to the line : $\frac{x-5}{6}=\frac{y+4}{2}=\frac{7-z}{6}$

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36. Write the direction cosine of a line parallel to the line : $\frac{3-x}{3}=\frac{y+2}{-2}=\frac{z+2}{6}$

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37. Find the vector and the Cartesian equations of the line through the point (5, 2, – 4) and which is parallel to the vector $3\hat{i} + 2\hat{j} - 8\hat{k}$

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38. Find the equation of the line passing through the point (2, -1, 3) and perpendicular to the lines : $\vec{r} = \left(\hat{i} - \hat{j} + \hat{k}\right) + \lambda\left(2\hat{i} + \hat{j} - 3\hat{k}\right)$ and $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + \mu\left(\hat{i} + \hat{j} + \hat{k}\right)$

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39. Find the equation of the line in vector and in cartesian form that passes through the point with position vector $2\hat{i} - \hat{j} + 4\hat{k}$ and is in the direction $\hat{i} + 2\hat{j} - \hat{k}$

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40. Find the vector equation for the line through the points : $(1, 2, 2)$ and $(6, 4, 6)$.

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41. Find the vector and the cartesian equations of the lines that passes through the origin and (5, – 2, 3).

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42. Find the vector and cartesian equations of the line that passes through : the points (1,2,3) and (2,-1,4).

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43. Find the equation of a st line through (-1,2,3) and equally inclined to the axes.

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44. Find the equation of a line parallel to x-axis and passing through the origin.

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45. Find the angle between the pairs of lines with direction ratios: $< 5, 12, 1 >$, $< 2, 4, 6 >$

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46. Find the angle between the pairs of lines with direction ratios:<a, b, c >, <$b - c, c - a, a - b$>

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47. The angle between a line with direction ratios proportional to $2, 2, 1$ and a line joining $(3, 1, 4)$ and $(7, 2, 12)$ is

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48. Find the angle between the following pairs of lines : $\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$, $\vec{r} = 5\hat{j} - 2\hat{k} + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$

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49. Find the angle between the following pair of lines: $\vec{r} = 3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right)$ and $\vec{r} = 2\hat{i} - \hat{j} - 56\hat{k} + \mu\left(3\hat{i} - 5\hat{j} - 4\hat{k}\right)$

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50. Find the angle between the following pairs of lines : $\frac{x-2}{2}=\frac{y-1}{5}=\frac{z+3}{-3}$ and $\frac{x+2}{-1}=\frac{y-4}{8}=\frac{z-5}{4}$

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51. Find the angle between the following pairs of lines : $\frac{5-x}{3}=\frac{y+3}{-4}, z=7$ and $x=\frac{1-y}{2}=\frac{z-6}{2}$

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52. Find the angle between the following lines $\frac{x+1}{1}=\frac{y-4}{1}=\frac{z-5}{2}$ and $\frac{x+3}{3}=\frac{y-2}{5}=\frac{z+5}{4}$

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53. Find the angle between the pair of lines $\frac{x+3}{3}=\frac{y-1}{5}=\frac{z+3}{4}$ and $\frac{x+1}{1}=\frac{y-4}{1}=\frac{z-5}{2}$

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54. Show that the lines $\frac{x-5}{7}=\frac{y+2}{-5}=\frac{z}{1}$ and $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ are perpendicular to each other

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55. Show that the lines : $\frac{x-3}{2}=\frac{y+1}{-3}=\frac{z-2}{4}$ and $\frac{x+2}{2}=\frac{y-4}{4}=\frac{z+5}{2}$ are perpendicular to each other.

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56. Find the value of p so that the lines : $l_1: \frac{1-x}{3}=\frac{7y-14}{2p}=\frac{z-3}{2}$ and $l_2: \frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$ are at right angles. also find the equations of the line passing through (3,2,-4) and parallel to line l_1.

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57. Find k so that the lines : $\frac{x-3}{2}=\frac{y+1}{3}=\frac{z-2}{2k}$ and $\frac{x+2}{1}=\frac{4-y}{k}=\frac{z+5}{1}$ are perpendicular to each other.

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58. Show that the line through the points (1, – 1, 2), (3, 4, – 2) is perpendicular to the line through the points (0, 3, 2) and (3, 5, 6).

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59. Show that the line through the points : (4,7,8), (2,3,4) is parallel to the line through the points (-1,-2,1) and (1,2,5).

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60. The cartesian equations of a line are $3x + 1 = 6y - 2 = 1 - z$. Find the fixed point through which it passes, its direction-ratios and also its vector equation.

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61. The points $A(4, 5, 10), B(2, 3, 4) \text{ and } C(1, 2, -1)$ are three vertices of a parallelogram ABCD. Find the vector equations of side AB and BC and also find the coordinates of point D .

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62. Write the equation of a line, parallel to the line $\frac{x-2}{-3} = \frac{y+3}{2} = \frac{z+3}{6}$ and passing through the point (1,2,3).

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63. Find the equation of the line perpendicular to the lines : $\vec{r} = \left(3\hat{i} + 2\hat{j} - 4\hat{k}\right) + \lambda\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$ and $\vec{r} = \left(5\hat{j} - 2\hat{k}\right) + \mu\left(3\hat{i} + 2\right.$

and passing through the point (1,1,1)

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64. Find the equations of the straight line passing through the point (2, 3, -1) and is perpendicular to the lines : $\frac{x-2}{2} = \frac{y+1}{1} = \frac{z-3}{3}$ and $\frac{x-3}{1} = \frac{y+2}{1} = \frac{z-1}{1}$.

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65. Find the equations of the straight line passing through the point (1, 2, - 4) and is perpendicular to the lines : $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$.

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66. Find the vector and cartesian equations of the line passing through the point (2,1,3) and perpendicualr to thelines : $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x}{-3}=\frac{y}{2}=\frac{z}{5}$

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67. Find the equation in vector anf cartesian form of the line passing through the point : (2,-1,3) and perpendicular to the lines $\vec{r}=\left(\hat{i}+\hat{j}-\hat{k}\right)+\lambda\left(2\hat{i}-2\hat{j}+\hat{k}\right)$ and $\vec{r}=\left(2\hat{i}-\hat{j}-3\hat{k}\right)+\mu\left(\hat{i}+2$

.

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68. Find the equation of the line passing through the point (2, -1, 3) and perpendicular to the lines : $\vec{r}=\left(\hat{i}-\hat{j}+\hat{k}\right)+\lambda\left(2\hat{i}+\hat{j}-3\hat{k}\right)$ and $\vec{r}=\left(\hat{i}+\hat{j}-\hat{k}\right)+\mu\left(\hat{i}+\hat{j}+\hat{k}\right)$

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69. Prove that the points (1,2,3),(4,0,4),(-2,4,2) and (7,-2,5) are collinear.

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70. Show that the following points whose psitions vectors are given are collinear : $5\hat{i}+5\hat{k}, 2\hat{i}+\hat{j}+3\hat{k} \text{ and } -4\hat{i}+3\hat{j}-\hat{k}$

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71. Show that the following points whose psitions vectors are given are collinear : $-2\hat{i}+3\hat{j}+5\hat{k}, \hat{i}+2\hat{j}+3\hat{k} \text{ and } 7\hat{i}-\hat{k}$

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72. Find the points on the line through the points A(1,2,3) and B(5,8, 15) at a distance of 14 units from the mid point of AB.

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73. Find the equations of the perpendicular from the point (3,-1,11,) to the line : $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$

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74. Show that the line joining the origin to the point (2, 1, 1) is perpendicular to the line determined by the points (3, 5, – 1), (4, 3, – 1).

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75. Find the vector equation of a line passing through a point with position vector $2\hat{i} - \hat{j} + \hat{k}$ and parallel t the line joining the points with position vectors $-\hat{i} + 4\hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 2\hat{k}$. Also, find the cartesian equivalent of the equation.

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76. Find the vector equation of a line passing through the point with position vector $\hat{i}-2\hat{j}-3\hat{k}$ and parallel to the line joining the points with position vectors $\hat{i}-\hat{j}+4\hat{k}$ and $2\hat{i}+\hat{j}+2\hat{k}$. Also find the cartesian form of the equation.

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77. Find the distance of the point (1,2,3) from the line joining the points (-1,2,5) and (2,3,4).

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78. Find the distance of the point (1,2,3) from the co ordinate axes.

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79. Find the distance of (-1,2,5) from the plane passing through the point (3,4,5) whose direction ratios are $< 2, \ -3, 6 >$.

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80. Find the perpendicular distance of the point (1,0,0) from the line : $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$. Also find the co ordinates of the foot of the perpendicular.

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81. Find the length of the perpendicular from the point (1,2,3) to the line : $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$

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82. Find the perpendicular distance from the point (1,2,3) to the line :

$\vec{r} = 6\hat{i} + 7\hat{j} + 7\hat{k} + \lambda\left(3\hat{i} + 2\hat{j} - 2\hat{k}\right)$

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83. Find the image of the point (2,-1,5) in the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$. Also find the equation of the line joining the given point and its. Also the length of that line segment .

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84. Find the foot of the perpendicular from the point (0,2,3) on the line : $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$. Also find the length of the perpendicular.

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85. Find the coordinates of the foot of the perpendicular drawn from point $A(1, 0, 3)$ to the join of points $B(4, 7, 1)$ and $C(3, 5, 3)$.

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86. A(1,0,4), B(0,-11,3), C(2,-3,1) are three points and D is the foot of the perpandicular from A on BC. Find the coodinates of D.

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87. The perpendicular distance of a corner of a unit cube from a diagonal not passing through it is

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88. Find the image of the point (2,0,1) in the line

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

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89. Find the image of the point $(1, 2, 3)$ in the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$.

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90. Find the image of the point A(-1,8,4) in the line joining the points B(0,-1,3) and C(2,-3,-1).

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91. Let the point P(5,9,3) lie on the top of Qutub Minar, Delhi.Find the image of the point on the line: $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. do you think that conversation of monuments is important and why?

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92. Find the foot and hence the length of the perpendicular from the point (5,7,3) to the line $\frac{x-15}{3}=\frac{y-29}{8}=\frac{5-z}{5}$. find also the equations of the perpendicular.

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93. Find the length and foot of perpendicular drawn from the point (2,-1,3) to the line

$$\frac{x-11}{10}=\frac{y+2}{-4}=\frac{z+8}{-11}$$

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94. Find the equations of the perpendicular drawn from the point (2,4,-1) to the line : $\frac{x+5}{1}=\frac{y+3}{4}=\frac{z-6}{-9}$

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95. Find the length of perpendicular from point $(2, 3, 4)$ to the $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$.

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96. Find the equations of the perpendicular from the point (3,-1,11,) to the line : $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$

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97. A line passing through the point A with position vector $\vec{a} = 4\hat{i} + 2\hat{j} + 2\hat{k}$ is parllel to the vector $\vec{b} = 2\hat{i} + 3\hat{j} + 6\hat{k}$.Find the length of the perpendicular drawn on this line from a point P with position vector $\vec{r}_1 = \hat{i} + 2\hat{j} + 3\hat{k}$.

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98. 1 Find the shortest distance between the lines l_1 and l_2 whose vector equations are: $\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} - \hat{j} + \hat{k}\right)$, and $\vec{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu\left(3\hat{i} - 5\hat{j} + 2\hat{k}\right)$

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99. Find the shortest distance between two lines whose vector equations are : $\vec{r} = 3\hat{i} + 8\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} - \hat{j} + \hat{k}\right)$ and $\vec{r} = -3\hat{i} - 7\hat{j} + 6\hat{k} + \mu\left(-3\hat{i} + 2\hat{j} + 4\hat{k}\right)$

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100. Find the shortest distance between the following lines whose vector equations are : $\vec{r} = \left(\hat{i} - \hat{j} + 2\hat{k}\right) + \lambda\left(-2\hat{i} + \hat{j} + 3\hat{k}\right)$ and $\vec{r} = \left(2\hat{i} + 3\hat{j} - \hat{k}\right) + \mu\left(3\hat{i} - 2\hat{j} + 2\hat{k}\right)$

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101. Find the shortest distance between the following lines whose vector equations are :

$\overrightarrow{r} = 6\hat{i} + 2\hat{j} + 2\hat{k} + \lambda\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$ and $\overrightarrow{r} = -4\hat{i} - \hat{k} + \mu\left(3\hat{i} - 2\hat{j} -$

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102. Find the shortest distance between the following lines whose vector equations are :

$\overrightarrow{r} = \left(4\hat{i} - \hat{j}\right) + \lambda\left(\hat{i} + 2\hat{j} - 3\hat{k}\right)$ and $\overrightarrow{r} = \left(\hat{i} - \hat{j} + 2\hat{k}\right) + \mu\left(2\hat{i} + 4\hat{j} -$

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103. Find the shortest distance between the following lines whose vector equations are :

$\overrightarrow{r} = \left(\hat{i} + 2\hat{j} - 4\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$ and $\overrightarrow{r} = \left(3\hat{i} + 3\hat{j} + 5\hat{k}\right) + \mu($

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104. Find the shortest distance between the following lines whose vector equations are : $\vec{r} = \left(\hat{i} + 2\hat{j} - 4\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$ and $\vec{r} = \left(3\hat{i} + 3\hat{j} - 5\hat{k}\right) + \mu\left(2\right.$

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105. Find the shortest distance between the following lines whose vector equations are : $\vec{r} = (\lambda - 1)\hat{i} + (\lambda - 1)\hat{j} - (1 + \lambda)\hat{k}$ and $\vec{r} = (1 - \mu)\hat{i} + (2\mu - 1)\hat{j} + (\mu + 2)\hat{k}$

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106. Find the shortest distance between the following lines whose vector equations are : $\vec{r} = (1 + \lambda)\hat{i} + (2 - \lambda)\hat{j} + (1 + \lambda)\hat{k}$ and $\vec{r} = 2(1 + \mu)\hat{i} - (1 - \mu)\hat{j} + ($

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107. Consider the equation of the straight lines given by :

$L_1 : \vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ If

$\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k}, \ \vec{b}_1 = \hat{i} - \hat{j} + \hat{k}, \ \vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k}, \ \vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

, then find : $\vec{a}_2 - \vec{a}_1$

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108. Consider the equation of the straight lines given by :

$L_1 : \vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ If

$\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k}, \ \vec{b}_1 = \hat{i} - \hat{j} + \hat{k}, \ \vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k}, \ \vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

, then find : $\vec{b}_2 - \vec{b}_1$

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109. Consider the equation of the straight lines given by :

$L_1 : \vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ If $\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k},\ \vec{b}_1 = \hat{i} - \hat{j} + \hat{k},\ \vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k},\ \vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

, then find : $\vec{b}_1 \times \vec{b}_2$

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110. Consider the equation of the straight lines given by :

$L_1 : \vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ If $\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k},\ \vec{b}_1 = \hat{i} - \hat{j} + \hat{k},\ \vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k},\ \vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

, then find : $\vec{a}_1 \times \vec{a}_2$

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111. Consider the equation of the straight lines given by :

$L_1 : \vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ If

$\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k},\ \vec{b}_1 = \hat{i} - \hat{j} + \hat{k},\ \vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k},\ \vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

, then find : $\left(\vec{b}_1 \times \vec{b}_2\right) \cdot \left(\vec{a}_2 - \vec{a}_1\right)$

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112. Consider the equation of the straight lines given by :

$L_1 : \vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ If

$\vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k},\ \vec{b}_1 = \hat{i} - \hat{j} + \hat{k},\ \vec{a}_2 = 2\hat{i} - \hat{j} - \hat{k},\ \vec{b}_2 = 2\hat{i} + \hat{j} + 2\hat{k}$

, then find : the shortest distance between L_1 and L_2.

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113. Find the shortest distance between the following lines whose vector equations are :

$\vec{r} = (1 - t)\hat{i} + (t - 2)\hat{j} + (3 - 2t)\hat{k}$ and $\vec{r} = (s + 1)\hat{i} + (2s - 1)\hat{j} - ($

where t and s are scalars.

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114. Find the shortest distance between the following lines whose vector equations are :

$\overrightarrow{r}=(3-t)\hat{i}+(4+2t)\hat{j}+(t-2)\hat{k}$ and $\overrightarrow{r}=(1+s)\hat{i}+(3s-7)\hat{j}+($

where t and s are scalars.

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115. Find the shortest distance between the following lines whose vector equations are : $\overrightarrow{r}=(8+3\lambda)\hat{i}-(9+16\lambda)\hat{j}+(10+7\lambda)\hat{k}$ and $\overrightarrow{r}=15\hat{i}+29\hat{j}+5\hat{k}+\mu\left(3\hat{i}+8\hat{j}-5\hat{k}\right)$

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116. Find the shortest distance between the following lines whose vector equations are :

$\overrightarrow{r}=3\hat{i}-15\hat{j}+9\hat{k}+\lambda\left(2\hat{i}-7\hat{j}+5\hat{k}\right)$ and $\overrightarrow{r}=(2\mu-1)\hat{i}+(1+\mu)\hat{j}$

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117. Find the S.D. between the lines : $\frac{x}{2}=\frac{y}{-3}=\frac{z}{1}$ and $\frac{x-2}{3}=\frac{y-1}{-5}=\frac{z+2}{2}$

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118. Find the shortest distance between given lines. $\frac{x-1}{1}=\frac{y-2}{-1}=\frac{z-1}{1}$ and $\frac{x-2}{2}=\frac{y+1}{1}=\frac{z+1}{2}$.

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119. Find the S.D. between the lines : $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{2}$ and $\frac{x+1}{3}=\frac{y-1}{2}=\frac{z-1}{5}$

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120. Find the angle between the lines

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4} \text{ and } \frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$$

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121. Find the S.D. between the lines :

$$\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1} \text{ and } \frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$$

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122. Determine whether or not the following pairs of lines intersect :

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

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

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123. Determine whether or not the following pairs of lines intersect :

$\overrightarrow{r} = (2\lambda + 1)\hat{i} - (\lambda + 1)\hat{j} + (\lambda + 1)\hat{k}$ and

$\overrightarrow{r} = (3\mu + 2)\hat{i} - (5\mu + 5)\hat{j} + (2\mu - 1)\hat{k}$

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124. Determine whether or not the following pairs of lines intersect :

$\frac{x-1}{2} = \frac{y+1}{3} = z, \frac{x+1}{5} = \frac{y-2}{1} = \frac{z-2}{0}$

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125. Prove that the lines : $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar.

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126. Find the shortest distance and the equation of the shortest distance between the following two lines: $\vec{r} = \left(-\hat{i} + \hat{j} + 9\hat{k}\right) + \lambda\left(2\hat{i} + \hat{j} - 3\hat{k}\right)$ and $\vec{r} = \left(3\hat{i} - 15\hat{j} + 9\hat{k}\right) + \mu$

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127. Find the shortest distance and the vector equation of the line of shortest distance between the lines given by : $\vec{r} = \left(-4\hat{i} + 4\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} + \hat{j} - \hat{k}\right)$ and $\vec{r} = \left(-3\hat{i} - 8\hat{j} - 3\hat{k}\right) + \mu$

.

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128. How many cubic feet are there in a room measuring 5m x 10m x 2m?

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129. Write the vector equation of the following lines and hence find distance between them

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z+4}{6}, \frac{x-3}{4}=\frac{y-3}{6}=\frac{z+5}{12}$$

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130. Show that the lines : $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ intersect each other. Also find their point of intersection.

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131. Show that the lines : $\vec{r}=3\hat{i}+2\hat{j}-4\hat{k}+\lambda\left(\hat{i}+2\hat{j}+2\hat{k}\right)$ and $\vec{r}=5\hat{i}-2\hat{j}+\mu\left(3\hat{i}+2\hat{j}+6\right.$

are intersecting. Hence, find their point of intersection.

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132. Show that the lines: $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + \lambda\left(3\hat{i} - \hat{j}\right)$ and $\vec{r} = \left(4\hat{i} - \hat{k}\right) + \mu\left(2\hat{i} + 3\hat{k}\right)$ are intersecting. Hence find their point of intersection.

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133. Show that the lines: $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-1}{5}$ and $\frac{x-2}{4} = \frac{y-1}{3} = \frac{z+1}{-2}$ do not intersect.

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134. Show that the lines: $\vec{r} = \left(\hat{i} + \hat{j}\right) + \lambda\left(2\hat{i} - \hat{k}\right)$ and $\vec{r} = \left(2\hat{i} - \hat{j}\right) + \mu\left(\hat{i} + \hat{k} - \hat{k}\right)$ do not intersect.

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135. Find shortest distance between lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$

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136. Show that the following lines are coplanar $\frac{5-x}{-4}=\frac{y-7}{-4}=\frac{z+3}{-5}$ and $\frac{x-8}{7}=\frac{2y-8}{2}=\frac{z-5}{3}$

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137. 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. Also find the equation of the plane containing the lines.

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138. Show that the lines $\frac{x-a+d}{\alpha-\delta}=\frac{y-a}{\alpha}=\frac{z-a-d}{\alpha+\delta}$ and $\frac{x-b+c}{\beta-\gamma}=\frac{y-b}{\beta}=\frac{z-b-c}{\beta+\gamma}$ are coplanar.

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139. Find the equations the lines joining the following pair of vertices :

(0,0,0), (1,0,2)

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140. Find the equations the lines joining the following pair of vertices:

(1,3,0),(0,3,0)

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141. Find the shortest distance between the lines $\left(\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}\text{ and }\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}\right)$

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142. Show that the lines: $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + \lambda\left(3\hat{i} - \hat{j}\right)$ and $\vec{r} = \left(4\hat{i} - \hat{k}\right) + \mu\left(2\hat{i} + 3\hat{k}\right)$ are intersecting. Hence find their point of intersection.

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143. Find the equation of the plane with the intercept 5 on the y axis and parallel to ZOX plane.

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144. Find the equation of the plane with intercept 4 on the z axis and parallel to XOY plane.

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145. Find the vector equation of a plane, which is at a distance of 7 uits from the origin and which is normal to the vector $3\hat{i} + 5\hat{j} - 6\hat{k}$.

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146. Find the vector equation of a plane, which is at a distance of 5 units from the origin and its normal vector is $2\hat{i} - 3\hat{j} + 6\hat{k}$.

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147. Find the vector equation of the plane whose cartesian form of equation is : $4x - 6y + z = 5$

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148. Find the vector equation of the plane whose cartesian form of equation is : $7x - 6y + 4z + 9 = 0$

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149. Find the cartesian equations of the following planes: $\vec{r}\cdot\left(3\hat{i}+3\hat{j}-2\hat{k}\right)=3$

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150. Find the cartesian equations of the following planes: $\vec{r}\cdot\left(2\hat{i}+3\hat{j}-4\hat{k}\right)=1$

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151. Find the Cartesian equation of the following plane: $\vec{r}\cdot\left[(s-2t)\hat{i}+(3-t)\hat{j}+(2s+t)\hat{k}\right]=15$

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152. What are the direction cosines of the normal to the plane $3x + 2y - 3z = 8$?

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153. Find the direction cosine of the perpendicular from origin to plane $\overrightarrow{r} \cdot \left(\hat{i} + 2\hat{j} - 2\hat{k}\right) = 18$

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154. Find the vector equation of the line through the origin, which is perpendicular to the plane $\overrightarrow{r} \cdot \left(\hat{i} - 2\hat{j} + \hat{k}\right) = 3$.

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155. Find the distance of the points (2,3,4) from the plane $\overrightarrow{R} \cdot \left(3\hat{i} - 6\hat{j} + 2\hat{k}\right) = -11$.

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156. Find the distance of a point (2,5,-3) from the plane $\vec{R} \cdot \left(6\hat{i} - 3\hat{j} + 2\hat{k}\right) = 4$

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157. Find the distance from (1,2,3) to the plane $2x + 3y - z + 2 = 0$

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158. Find the length of the perpendicular drawn from the origin to the plane $4x - y + 7z + 2 = 0$

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159. Find a unit vector normal to the plane : $\vec{r} \cdot \left(2\hat{i} - 3\hat{j} + 6\hat{k}\right) + 14 = 0.$

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160. Find the angle between the two planes $3x - 6y + 2z = 7$ and $2x + 2y - 2z = 5$

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161. Find the angle between the planes : $4x + 8y + z = 8$ and $y + z = 4$

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162. Find the angle between the following planes

$2x - y - z = 6$ and $x + y + 2z = 7$

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163. Find the angle between the planes : $\overrightarrow{r} \cdot \left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 5 \text{ and } \overrightarrow{r} \cdot \left(3\hat{i} - 3\hat{j} + 5\hat{k}\right) = 3$

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164. Find the angle between the planes : $\overrightarrow{r} \cdot \left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 5 \text{ and } \overrightarrow{r} \cdot \left(3\hat{i} - 3\hat{j} + 5\hat{k}\right) = 3$

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165. Find the value of k for whicj the planes: $3x - 6y - 2z = 7 \text{ and } 2x + y - kz = 5$ are perpendicular to each other.

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166. The position vectors of two points A and B are $3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-2\hat{j}-4\hat{k}$ respectively. Find the equation of the plane passing through B and perpendicular to $\overrightarrow{AB}$

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167. Find the vector equation of the plane through the point (2,0,-1) and perpendicular to the line joining the two pints (1,2,3) and (3,-1,6).

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168. Find the equation of the plane passing through the points (1,2,1) and perpendicular to the line joining the points (1,4,2) and (2,3,5), Also, find the perpendicular distance of the plane from the origin.

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169. Find the vector and cartesian equations of the plane which passes through the point (5, 2, – 4) and perpendicular to the line with direction ratios 2, 3, – 1.

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170. Find the vector and cartesian equations of the plane that passes through the point (1, 0, – 2) and the normal to the plane is $\hat{i}+\hat{j}-\hat{k}$

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171. Find the vector and cartesian equations of the plane that passes through the point (1,4, 6) and the normal vector to the plane is $\hat{i}-2\hat{j}+\hat{k}$

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172. Find the length of the perpendicular from the point(2,3,7) to the plane $3x - y - z = 7$. Also find the co-ordinates of the foot of the perpendicular.

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173. In the following , find the distance of each of the given points from the correspnding given planes: (0,0,0) $2x - y + 2z + 1 = 0$

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174. In the following , find the distance of each of the given points from the correspnding given planes: (3,-2,1) $2x - y + 2z + 3 = 0$

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175. In the following case, find the distance of each of the given point from the corresponding given plane: Point (-6,0,0) Plane $2x - 3y + 6z - 2 = 0$

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176. In the following case, find the distance of each of the given point from the corresponding given plane:Point (2,3,-5) Plane $x + 2y - 2z = 9$

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177. In the following, determine the direction cosines of the normal to the plane and the distance from the origin : $z = 2$

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178. In the following, determine the direction cosines of the normal to the plane and the distance from the origin : $5y + 8 = 0$

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179. If the points $(1, 1, p)$ and $(-3, 0, 1)$ be equidistant from the plane $\vec{r} \cdot \left(3\hat{i} + 4\hat{j} - 12\hat{k}\right) + 13 = 0$, then find the value of p.

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180. In the following case, find the coordinates of the foot of the perpendicular drawn from the origin: $2x + 3y + 4z - 12 = 0$

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181. In the following case, find the coordinates of the foot of the perpendicular drawn from the origin: $3y + 4z - 6 = 0$

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182. In the following cases, find the co-ordinates of the foot of the perpendicular drawn from the origin : $x + y + z = 1$

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183. In the following case, find the coordinates of the foot of the perpendicular drawn from the origin: $5y + 8 = 0$

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184. Find the length and the foot of the perpendicular from the point $(7, 14, 5)$ to the plane $2x + 4y - z = 2$.

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185. Find the vector equation of the line passing through (1, 2, 3) and parallel to the planes $\vec{r}.\left(\hat{i}-\hat{j}+2\hat{k}\right)=5$ and $\vec{r}.\left(3\hat{i}+\hat{j}+\hat{k}\right)=6.$

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186. Find the vector equation of the line passing through (1, 2, 3) and perpendicular to the plane $\vec{r}\cdot\left(\hat{i}+2\hat{j}-5\hat{k}\right)+9=0$

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187. Find the equation of the plane passing through (a, b, c) and parallel to the plane $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=2$

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188. Find cartesian equations of the plane containing the lines: $\overrightarrow{r} = 2\hat{i} + \hat{j} - 3\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 5\hat{k}\right)$ and $\overrightarrow{r} = 3\hat{i} + 3\hat{j} - 7\hat{k} + \mu\left(3\hat{i} - 2\hat{j} + 5\hat{k}\right)$

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189. Find the angle between the lines: $x - 2y + z = 0 = x + 2y - 2z$ and $x + 2y + z = 0 = 3x + 9y + 5z.$

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190. Show that the lines : $3x - 2y + 5 = 0, y + 3z - 15 = 0$ and $\frac{x-1}{5} = \frac{y+5}{-3} = \frac{z}{1}$ are perpendicular to each other.

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191. Find the equations of the line passing through the point (1,-2,-3) and parallel to the planes: $x - y + 2z = 5$ and $3x + 2y - z = 6$

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192. Find the equation of the plane, which bisects the line joining the points (-1,2,3) and (3,-5,6) ate right angles.

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193. Find the equation of the plane throught he intersection of the planes : $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ at the point (2,2,1).

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194. Find the vector equation of the plane through the planes : $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 6$ and $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) = -5$ at the point

(1,1,1).

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195. Find the vector equation of the following plane in scalar product form: $\overrightarrow{r} = \hat{i} - \hat{j} + \lambda\left(\hat{i} + \hat{j} + \hat{k}\right) + \mu\left(\hat{i} - 2\hat{j} + 3\hat{k}\right)$

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196. Find the Cartesian equation of the plane passing through three non-collinear points :(0, - 1, - 1) , (4, 5, 1) and (3, 9, 4)

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197. Find the equations of the plane that passes through three points : (1,1,0), (1,2,1), (-2,2,-1)

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198. Find the equations of the planes passing through the following points

$(2, 5, -3), (-2, -3, 5), (5, 3, -3)$

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199. Find the equation of the plane through three non-collinear points (0, -1 , 0) , (1 , 1, 1)and (3, 3, 0).

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200. Find the equation of the plane passing through the points : (3, -1, 2), (5, 2, 4), (-1, -1, 6)

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201. Find the equation of the plane through three non-collinear points: (2,2,-1),(3,4,2), (7,0,6)

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202. Find the equation of the plane through three non-collinear points: (2,1,-1), (6,5,0),(2,-1,5)

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203. Find the equation of the plane throught he points (3,-2,4), (-13,17,-1), (-6,3,2). Show that it passes through (5,7,3).

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204. Find the equations of the planes passing through the following points

$(-3, 5, 1), (4, -1, 2), (2, 3, 4)$

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205. Find the vector equations of the plane passing through the points $R(2, 5, -3), S(-2, -3, 5), T(5, 3, -3)$

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206. Find the distance between the points : (2,1,0), (1,1,2).

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207. Find the distance between the point $P(6, 5, 9)$ and the plane determined by the points $A(3, -1, 2), B(5, 2, 4), C(-1, -1, 6)$

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208. Find the distance between the point (7,2,4) and the plane determined by the points: A(2,5,-3),(B(-2,-3,5), C(5,3,-3).

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209. Find the equation of the plane through the points (2,-3,-1) and (5,2,-1) and perpendicular to the plane $x-2y+4z=10$.

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210. Find the vector equation of the plane throught the points (2,1,-1) and (-1,3,4) and perpendicular to the plane $x-2y+4z=10$.

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211. Find the equation of the plane through the point (0,0,0) and (3,-1,2) and parallel of the line $\frac{x-4}{1}=\frac{y+3}{-4}=\frac{z+1}{7}$

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212. Show that the following four points are coplanar : (4,5,1),(0,-1,-1),(3,9,4),(-4,4,4)

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213. Show that the following four points are coplanar :(0,-1,0),(2,1,-1),(1,1,1),(3,3,0)

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214. Show that the four points : (0,-1,1),(4,5,1),(3,9,4),(-4,4,4) are coplanar. Also find the equation of the plane containing them.

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215. The foot of the perpendicular drawn from the origin to the plane is : (2,-3,-4). Find the equation of the plane.

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216. Find the foot and length of the perpendicular from the point (3,4,5) to the plane: $2x - 5y + 3z = 39.$

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217. Find the length and the foot of the perpendicular from the point $(7, 14, 5)$ to the plane $2x + 4y - z = 2.$

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218. Find the co-ordinates of the points where the line through the points (3,-4,-5) and (2,-3,1) crosses the plane $2x + y + z = 7$

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219. Find the distance between two parallel planes : $2x + 3y + 4z = 4$ and $4x + 6y + 8z = 12$.

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220. Find the equation passing throught the intersection of the planes : $2x - 7y + 4z = 3$ and $3x - 5y + 4z + 11 = 0$ and the point (-2,1,3).

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221. Find the equation of the plane throught he intersection of the planes : $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ at the point (2,2,1).

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222. Find the vector equation of the plane through the intersection of the planes $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 6$ and $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) = -5$ and the point (1,1,1).

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223. Find the equation of the plane passing through the intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and the point (1,1,1)

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224. Find the equation of the plane through the intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to the plane $x - y + z = 0$

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225. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=1$ and $\vec{r}\cdot\left(2\hat{i}+3\hat{j}-\hat{k}\right)+4=0$ and parallel to x-axis.

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226. Find the equation of the plane through the intersection of the planes $\vec{r}\cdot\left(2\hat{i}+\hat{j}+3\hat{k}\right)=7$ and $\vec{r}\cdot\left(2\hat{i}+3\hat{j}+3\hat{k}\right)=9$ and passing through the point (2,1,3).

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227. Find the equation of the plane passing through the line of intersection of the planes : $\vec{r}\cdot\left(\hat{i}+3\hat{j}\right)-6=0$ and $\vec{r}\cdot\left(3\hat{i}-\hat{j}-4\hat{k}\right)=0$, whose perpendicular distance form origin is unity.

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228. Find the equation of the plane passing through the line of intersection of the planes $2x+y-z=3$ and $5x-3y+4z=9$ and parallel to the lines $\frac{x-1}{2}=\frac{y-3}{4}=\frac{z-5}{5}$

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229. Find the equation of the plane through the line of intersection of the planes: $x+3y-z+1=0$ and $x+y-2z+3=0$ and perpendicular to the plane $3x-y-2z-4=0$

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230. Find the vector equation of the plane passing through the intersection of the planes : $\vec{r}\cdot\left(2\hat{i}-\hat{j}+2\hat{k}\right)=2$ and $\vec{r}\cdot\left(3\hat{i}+\hat{j}-2\hat{k}\right)=-2$ and perpendicular to the $\vec{a}=5\hat{i}-2\hat{j}+3\hat{k}$.

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

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

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233. Find the equation of the plane passing through the point (1,1,-1) and perpendicular to each of the planes : $x + 2y + 3z - 7 = 0$ and $2x - 3y + 4z = 0$

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234. Find the equation of the plane through the point (-1, -1, 2) and perpendicular to the planes 3x + 2y - 3z = 1 and 5x -4y + z = 5.

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235. The distance of the point $P(-2, 3, -4)$ from the line $\frac{x+2}{3} = \frac{2y+3}{4} = \frac{3z+4}{5}$ measured parallel to the plane $4x + 12y - 3z + 1 = 0$ is d, then find the value of $(2d-8)$, is........

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236. Find the ratio in which the line segment joining : (2,1,5) and (3,4,3) is divided by the plane $x + y - z = \frac{1}{2}$

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237. Find the ratio in which the line segment joining : (1,2,3) and (-3,4,-5) is divided by the xy-plane.

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238. Find the equation of the plane passing through the points (1,2,1) and perpendicular to the line joining the points (1,4,2) and (2,3,5), Also, find the perpendicular distance of the plane from the origin.

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239. Find the image of the point : (3,-2,1) in the plane $3x - y + 4z = 2$

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240. Find the image of the point : (1,2,3) in the plane $3x + 2y + z = 24$

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241. Find the image of the point : (2,-1,3) in the plane $3x - 2y - z = 9$

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242. Find the co-ordinates of the foot of perpendicular drawn from the point (2, 3, 5) on the plane given by the equation : $2x - 3y + 4z + 10 = 0$

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243. The foot of the perpendicular drwan from origin to a plane is (4,-2,5) : How far is the plane from the origin?

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244. The foot of the perpendicular drwan from origin to a plane is (4,-2,5) : How far is the plane from the origin?

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245. The foot of the perpendicular drwan from origin to a plane is (4,-2,5) : Obtain the equation of the plane in general form.

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246. Find the co-ordinates of the foot of the perpendicular distance of the point P(3,2,1) from the plane $2x - y + z + 1 = 0$. Find also , the image of the point in the plane.

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247. Find the length and the foot of the perpendicular from the point $(7, 14, 5)$ to the plane $2x + 4y - z = 2$.

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248. Find the distance of the point P(1,2,3) from its image in the plane $x + 2y + 4z = 38$.

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249. Find the co-ordinates of the point P, where the line through A(3,-4,-5) and B(2,-3,1) crosses the plane passing through three points L(2,2,1), M(3,0,1) and N(4,-1,0). Also, find the ratio in which P divides the line segment AB.

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250. A variable plane which remains at a constant distance 3p from the origin cuts the coordinate axes at A,B,C. Show that locus of the O centroid of the triangle ABC is

$$\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}.$$

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251. A variable plane which remains at a constant distance 3p from the origin cuts the coordinate axes at A,B,C. Show that locus of the O centroid of the triangle ABC is

$$\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}.$$

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252. A variable plane is at a constant distance $4p$ from the origin and cuts axes in A, B, C respectively. Show that the centroid of the tetrahedron OABC lies on : $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}$

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253. A variable plane which remains at a constant distance p from the origin cuts the co-ordinate axes at A, B, C. Through A,B,C planes are drawn parallel to the co-ordinate planes. Show that locus of the point of intersection is : $x^{-2} + y^{-2} + z^{-2} = p^{-2}$

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254. A variable plane passes through a fixed point a,b,c and meet the co-ordinates axes in A,B,C. Show that the locus of the point common to the planes through A,B,C parallel to the co-ordinate planes is $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 1$

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255. A variable plane moves so that the sum of reciprocals of its intercepts on the three coordinate axes is constant, show that it passes through a fixed point.

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256. Show that the sum of the reciprocals of the intercepts on rectangular axes made by a fixed plane is same for all systems of rectangular axes, with a given origin.

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257. Find the equations of the bisector planes of the angle between the planes : $3x-2y+6z+8=0$ and $2x-y+2z+3=0$

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258. In the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angles between them:$7x+5y+6z+30=0$and $3x-y-10z+4=0$

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259. In the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angles between them: $2x + y + 3z - 2 = 0$ and $x - 2y + 5 = 0$

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260. In the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angles between them: $2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z - 1 = 0$

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261. પIn the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angles between them: $2x - y + 3z - 1 = 0$ and $2x - y + 3z + 3 = 0$

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262. In the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angles between them: $4x + 8y + z - 8 = 0$ and $y + z - 4 = 0$

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263. What is the point of intersection of the line $x = y = z$ with the plane $x + 2y + 3z = 6$?

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264. Find the angle between the lines in which the planes: $3x - 7y - 5z = 1, 5x - 13y + 3z + 2 = 0$ cut the plane $8x - 11y + 2z = 0$.

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265. Show that the line , $\vec{r} = 2\hat{i} - 3\hat{j} + 5\hat{k} + \lambda\left(\hat{i} - \hat{j} + 2\hat{k}\right)$ lies in the plane $\vec{r} \cdot \left(3\hat{i} + \hat{j} - \hat{k}\right) + 2 = 0.$

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266. Show that the line , $\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} + \hat{j} + 4\hat{k}\right)$ lies in the plane $\vec{r} \cdot \left(\hat{i} + 2\hat{j} - \hat{k}\right) = 3.$

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267. Find the vector equation of the line passing through the point (3,1,2) and perpendicular to the plane $\vec{r} \cdot 2\hat{i} - \hat{j} + \hat{k}\Big) = 4.$ Also find the point of intersection of this line and the plane.

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268. Find the point where the line $\frac{x+1}{2} = \frac{y+2}{3} = \frac{z+3}{4}$ meets the plane $x + y + 4z = 6$.

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269. Find the angle between the line : $\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ and the plane : $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 5$.

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270. Find the angle between the line joing (3,-4,-2) and(12, 2, 0) and the plane $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 4$

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271. Find the angle between the line : $\frac{x+1}{2}=\frac{y}{3}=\frac{z-3}{6}$ and the plane $10x+2y-11z=3.$

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272. Find the angle between the line $\frac{x+1}{2}=\frac{y}{3}=\frac{z-3}{6}$ and the plane $10x+2y-11z=3$

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273. Find the distance of the point (-1, -5, -10) from the point of intersection of the $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{12}$ and the plane x-y + z= 5.

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274. Find the distance of the point (-1 , -5 , -10) from the point of intersection of the line $\vec{r}=2\hat{i}-\hat{j}+2\hat{k}+\lambda\left(3\hat{i}+4\hat{j}+2\hat{k}\right)$ and the plane $\vec{r}\,.\left(\hat{i}-\hat{j}+\hat{k}\right)$=5.

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275. Find the distance of the point with position vector $-\hat{i}-5\hat{j}-10\hat{k}$ from the point of intersection of the line $\vec{r}=\left(2\hat{i}-\hat{j}+2\hat{k}\right)+\lambda\left(3\hat{i}+4\hat{j}+12\hat{k}\right)$ and the plane $\vec{r}\cdot\left(\hat{i}-\hat{j}+\hat{k}\right)=5.$

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276. Find the distance of the point (2,12,5) from the point of intersection of the line: $\vec{r}=2\hat{i}-4\hat{j}+2\hat{k}+\lambda\left(3\hat{i}+4\hat{j}+2\hat{k}\right)$ and the plane $\vec{r}\cdot\left(\hat{i}-2\hat{j}+\hat{k}\right)=0.$

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277. Find the distance between the point with position vector $-\hat{i}-5\hat{j}-10\hat{k}$ and the point of intersection of the line $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-12}{12}$ with the plane $x-y+z=5$.

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278. Find the vector equation of the line passing through (1, 2, 3) and parallel to the planes $\vec{r}.\left(\hat{i}-\hat{j}+2\hat{k}\right)=5 \text{ and } \vec{r}.\left(3\hat{i}+\hat{j}+\hat{k}\right)=6.$

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279. Find the vector equation of the line passing through (1, 2, 3) and perpendicular to the plane $\vec{r}\cdot\left(\hat{i}+2\hat{j}-5\hat{k}\right)+9=0$

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280. Find the equation of the plane which is parallel to the line $\frac{x-4}{1}=\frac{y+3}{-4}=\frac{z+1}{7}$ and passes through the point (0,0,0) and (3,-1,2).

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281. Find the equations of the plane through the points (1,0,-1), (3,2,2) and parallel to the line $\frac{x-1}{1}=\frac{y-1}{-2}=\frac{z-2}{3}$

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282. Find the equation of the plane containing the line $\frac{x+2}{2}=\frac{y+3}{3}=\frac{z-4}{-2}$ and the point (0,6,0).

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283. Find the equation of the plane, which contains two lines: $\frac{x-4}{1}=\frac{y-3}{-4}=\frac{z-2}{5}$ and $\frac{x-3}{1}=\frac{y+2}{-4}=\frac{z}{5}$.

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284. Find the vector and cartesian equations of the plane containing the lines: $\vec{r}=\hat{i}+2\hat{j}-4\hat{k}+\lambda\left(2\hat{i}+3\hat{j}+6\hat{k}\right)$ and $\vec{r}=3\hat{i}+3\hat{j}-5\hat{k}+\mu\left(-2\hat{i}+3\hat{j}+8\hat{k}\right)$.

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285. Find the equation of the plane through the point (1,1,1) and perpendicular to the plane $x-2y+z=3$, $4x+3y-z=5$.

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286. If the line drawn from (4,-1,2) to the point (-3,2,3) meets a plane at right angles, at the point (-10,5,4), then find the equation of the plane.

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287. Find the length and the foot of the perpendicular from: P(1,1,2) to the plane $2x - 2y + 4z + 5 = 0$

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288. Find the coordinates of the foot of the perpendicular drawn from the origin to the plane $2x - 3y + 4z - 6 = 0$

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289. Find the co-ordinates of the foot of the perpendicular from the point(2,3,7) to the plane $3x - y - z = 7$. Also find the length of the perpendicular.

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290. Find the equation of the plane containing the line : $\frac{x-1}{3}=\frac{y+2}{1}=\frac{z-3}{2}$ and perpendicular to the plane 2x - y + 2z -3= 0.

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291. Show that the line L whose vector equation is $\overrightarrow{r}=2\hat{i}-2\hat{j}+3\hat{k}+\lambda\left(\hat{i}-\hat{j}+4\hat{k}\right)$ is parallel to the plane π whose vector equation is $\overrightarrow{r}\cdot\left(\hat{i}+5\hat{j}+\hat{k}\right)=5$ and find the distance between them.

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292. State when the line $\vec{r} = \vec{a} + \lambda \vec{b}$ is parallel to the plane $\vec{r} \cdot \vec{n} = d$. Show that the line $\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} + \hat{k} + 4\hat{k}\right)$ is parallel to the plane $\vec{r} \cdot \left(-2\hat{i} + \hat{k}\right) = 5$. Also, find the distance between the line and the plane.

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293. Find the equations of the line through (-1,3,2) and perpendicular to the plane $x + 2y + 2z = 3$, the length of the perpendicular and co-ordeinates of its foot.

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294. Find the vector equation of the line passing through the point (3,1,2) and perpendicular to the plane $\vec{r} \cdot 2\hat{i} - \hat{j} + \hat{k}\big) = 4$. Also find the point of intersection of this line and the plane.

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295. Find the vector equation of a line passing through the point with position vector $\left(2\hat{i} - 3\hat{j} - 5\hat{k}\right)$ and perpendicular to the plane $\vec{r} \cdot \left(6\hat{i} - 3\hat{j} - 5\hat{k}\right) + 2 = 0$. Also, find the point of intersection of this line and the plane.

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296. Find the co-ordinates of the point, where the line: $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{2}$ intersects the plane $x - y + z - 5 = 0$. Also find the angle between the line and the plane.

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297. Find the length of the perpendicular from the point (1,2,3) to the line $: \frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$

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298. Find the point, where the line joining the points (1,3,4) and (-3,5,2) intersects the plane $\vec{r} \cdot \left(2\hat{i} + \hat{j} + \hat{k}\right) + 3 = 0.$ Is the point equaidistant from the gien points?

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299. Find the co-ordinates of the point where the line joining the points (1,-2,3) and (2,-1,5) cuts the plane $x - 2y + 3z = 19.$ Hence, find the distance of this point from the point (5,4,1).

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300. Find the equation of the plane passing through the point (1,1,1) and containing the line: $\vec{r} = \left(-3\hat{i} + \hat{j} + 5\hat{k}\right) + \lambda\left(3\hat{i} - \hat{j} + 5\hat{k}\right).$ Also, show that the plane contains the line: $\vec{r} = \left(-\hat{i} + 2\hat{j} + 5\hat{k}\right) + \lambda\left(\hat{i} - 2\hat{j} - 5\hat{k}\right).$

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301. Find the equation of the plane passing through the points (1,2,1) and perpendicular to the line joining the points (1,4,2) and (2,3,5), Also, find the perpendicular distance of the plane from the origin.

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302. Find the vector equation of the plane passing through three points with position vectors $\hat{i} + \hat{j} - 2\hat{k}, 2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$. Also find the co-ordinates of the point of intersection of this plane and the line $\vec{r} = 3\hat{i} - \hat{j} - \hat{k} + \lambda\left(2\hat{i} - 2\hat{j} + \hat{k}\right)$.

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303. A line makes $90^\circ, 135^\circ, 45^\circ$ with x, y and z axes respectively than its direction cosines are

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304. Find the direction cosine of a line which makes equal angles with the co-ordinate axes.

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305. If a line has the direction ratios –18, 12, – 4, then what are its direction cosines ?

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306. Show that the points (2, 3, 4), (– 1, – 2, 1), (5, 8, 7) are collinear.

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307. Find the direction cosines of the sides of the triangle whose vertices are (3, 5, – 4), (– 1, 1, 2) and (– 5, – 5, – 2).

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308. show that the three lines with direction cosines

$$< \frac{12}{13}, -\frac{3}{13}, -\frac{4}{13} >, < \frac{4}{13}, \frac{12}{13}, \frac{3}{13} >, < \frac{3}{13}, -\frac{4}{13}, \frac{12}{13} >$$

are mutually perpendicular.

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309. Show that the line through the points (1, – 1, 2), (3, 4, – 2) is perpendicular to the line through the points (0, 3, 2) and (3, 5, 6).

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310. Show that the line through the points : (4,7,8), (2,3,4) is parallel to the line through the points (-1,-2,1) and (1,2,5).

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311. Find the equation of the line which passes through the point (1, 2, 3) and is parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$

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312. Find the equation of the line in vector and in cartesian form that passes through the point with position vector $2\hat{i} - \hat{j} + 4\hat{k}$ and is in the direction $\hat{i} + 2\hat{j} - \hat{k}$

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313. Find the cartesian equation of the line which passes through the point (– 2, 4, – 5) and parallel to the line given by $\frac{x+3}{3} = \frac{y-4}{5} = \frac{z+8}{6}$

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314. The cartesian equation of a line is $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$. Write its vector form.

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315. Find the vector and the cartesian equations of the lines that passes through the origin and (5, – 2, 3).

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316. Find the vector and the cartesian equations of the line that passes through the points (3, – 2, – 5), (3, – 2, 6).

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317. Find the angle between the following pair of lines: $\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and

$\overrightarrow{r} = 7\hat{i} - 6\hat{j} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

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318. Find the angle between the following pair of lines: $\overrightarrow{r} = 3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right)$ and $\overrightarrow{r} = 2\hat{i} - \hat{j} - 56\hat{k} + \mu\left(3\hat{i} - 5\hat{j} - 4\hat{k}\right)$

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319. Find the angle between the following pairs of lines : $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$

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320. Find the angle between the lines $\frac{x}{2} = \frac{y}{2} = \frac{z}{1}$ and $\frac{x-5}{4} = \frac{y-2}{1} = \frac{z-3}{8}$

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321. Find the value of p so that the lines : $l_1 : \frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $l_2 : \frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles. also find the equations of the line passing through (3,2,-4) and parallel to line l_1.

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322. Show that the lines $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ are perpendicular to each other

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

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324. Find the shortest distance between the lines $\left(\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}\text{ and }\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}\right)$

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325. Find the shortest distance between the lines whose vector equations are $\vec{r}=\left(\hat{i}+2\hat{j}+3\hat{k}\right)+\lambda\left(\hat{i}-3\hat{j}+2\hat{k}\right)$ and $\vec{r}=4\hat{i}+5\hat{j}+6\hat{k}+\mu\left(2\hat{i}+3\hat{j}+\hat{k}\right)$

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326. Find the shortest distance between the following lines whose vector equations are :

$\vec{r}=(1-t)\hat{i}+(t-2)\hat{j}+(3-2t)\hat{k}$ and $\vec{r}=(s+1)\hat{i}+(2s-1)\hat{j}-($

where t and s are scalars.

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327. In the following case, determine the direction cosines of the normal to the plane and the distance from the origin: $z = 2$

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328. In the following case, determine the direction cosines of the normal to the plane and the distance from the origin: $x + y + z = 1$

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329. In each of the following cases, determine the direction cosines of the normal to the plane and the distance from the origin. : $2x + 3y - z = 5$

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330. In the following case, determine the direction cosines of the normal to the plane and the distance from the origin: $5y + 8 = 0$

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331. Find the vector equation of a plane, which is at a distance of 7 units from the origin and which is normal to the vector $3\hat{i} + 5\hat{j} - 6\hat{k}$.

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332. Find the cartesian equations of the following planes: $\vec{r} \cdot \left(4\hat{i} + 8\hat{j} - 7\hat{k}\right) = 2$

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333. Find the cartesian equations of the following planes: $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right) = 1$

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334. Find the cartesian equations of the following planes: $\vec{r} \cdot [(s - 2t)\hat{i} + (3 - t)\hat{j} + (2s + t)\hat{k}] = 15$

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335. In the following case, find the coordinates of the foot of the perpendicular drawn from the origin: $2x + 3y + 4z - 12 = 0$

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336. In the following case, find the coordinates of the foot of the perpendicular drawn from the origin: $3y + 4z - 6 = 0$

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337. In the following cases, find the co-ordinates of the foot of the perpendicular drawn from the origin : $x + y + z = 1$

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338. In the following case, find the coordinates of the foot of the perpendicular drawn from the origin: $5y + 8 = 0$

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339. Find the vector and cartesian equations of the plane that passes through the point (1, 0, – 2) and the normal to the plane is $\hat{i} + \hat{j} - \hat{k}$

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340. Find the vector and cartesian equations of the plane that passes through the point (1,4, 6) and the normal vector to the plane is $\hat{i} - 2\hat{j} + \hat{k}$

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341. Find the equations of the plane that passes through three points : (1,1,-1), (6,4,-5), (-4,-2,3)

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342. Find the equations of the plane that passes through three points : (1,1,0), (1,2,1), (-2,2,-1)

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343. Find the intercepts cut off by the plane $2x + y - z = 5$

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344. Find the equation of the plane with intercept 3 on the y-axis and parallel to ZOX plane.

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345. Find the equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point (2, 2, 1).I

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346. Find the vector equation of the plane passing through the intersection of the planes $\vec{r} \cdot \left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 7, \vec{r} \cdot \left(2\hat{i} + 5\hat{j} + 3\hat{k}\right) = 9$ and through the point (2, 1, 3)

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347. Find the equation of the plane through the intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to the plane $x - y + z = 0$

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348. Find the angle between the planes whose vector equations are $\vec{r}\cdot\left(2\hat{i}+2\hat{j}-3\hat{k}\right)=5$ and $\vec{r}\cdot\left(3\hat{i}-3\hat{j}+5\hat{k}\right)=3$

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349. In the following determine whether the given planes are parallel or perpendicular and in case they are neither, find the angles between them:

$7x+5y+6z+30=0$ and $3x-y-10z+4=0$

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350. In the following determine whether the given planes are parallel or perpendicular and in case they are neither, find the angles between them:

$2x+y+3z-2=0$ and $x-2y+5=0$

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351. In the following determine whether the given planes are parallel or perpendicular and in case they are neither, find the angles between them: $2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z - 1 = 0$

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352. In the following determine whether the given planes are parallel or perpendicular and in case they are neither, find the angles between them: $2x - y + 3z - 1 = 0$ and $2x - y + 3z + 3 = 0$

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353. In the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angles between them: $4x + 8y + z - 8 = 0$ and $y + z - 4 = 0$

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354. In the following case, find the distance of each of the given point from the corresponding given plane: Point (0,0,0) Plane $3x - 4y + 12z = 3$

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355. In the following , find the distance of each of the given points from the correspnding given planes: (3,-2,1) $2x - y + 2z + 3 = 0$

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356. In the following , find the distance of each of the given points from the correspnding given planes: (2,3,-5)

$x + 2y - 2z = 9$

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357. In the following case, find the distance of each of the given point from the corresponding given plane: Point (-6,0,0) Plane $2x - 3y + 6z - 2 = 0$

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358. Show that the line joining the origin to the point (2, 1, 1) is perpendicular to the line determined by the points (3, 5, – 1), (4, 3, – 1).

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359. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines, show that the direction cosines of the line perpendicular to both of these are $m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2 - m_1$

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360. Find the angle between the lines whose direction ratios are : a, b, c and $b - c, c - a, a - b$

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361. Find the equation of a line parallel to x-axis and passing through the origin.

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362. If the coordinates of the points A, B, C, D be (1, 2, 3), (4, 5, 7), (– 4, 3, – 6) and (2, 9, 2) respectively, then find the angle between the lines AB and CD.

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363. If the lines: $\frac{x-1}{3k} = \frac{y-2}{2} = \frac{z+3}{1}$ and $\frac{x-1}{2} = \frac{y-1}{k} = \frac{z-6}{-5}$ are perpendicular, find the values of k.

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364. Find the vector equation of the line passing through (1, 2, 3) and perpendicular to the plane $\vec{r}\cdot\left(\hat{i}+2\hat{j}-5\hat{k}\right)+9=0$

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365. Find the equation of the plane passing through (a, b, c) and parallel to the plane $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=2$

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366. Find the shortest distance between the following lines whose vector equations are :

$\vec{r}=6\hat{i}+2\hat{j}+2\hat{k}+\lambda\left(\hat{i}-2\hat{j}+2\hat{k}\right)$ and $\vec{r}=-4\hat{i}-\hat{k}+\mu\left(3\hat{i}-2\hat{j}-$

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367. Find the coordinates of the points where the line through (5,1,6) and (3,4,1) crosses YZ-plane.

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368. Find the coordinates of the point where the line through (5,1,6) and (3,4,1) crosses the ZX-plane.

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369. Find the coordinates of the point where the line through (3, – 4, – 5) and (2, – 3, 1) crosses the plane $2x + y + z = 7$

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370. Find the equation of the plane passing through the point (-1, 3, 2) and perpendicular to each of the planes : $x+2y+3z=5$ and $3x+3y+z=0$.

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371. If the points (1, 1, p) and (– 3, 0, 1) be equidistant from the plane $\vec{r}\cdot\left(3\hat{i}+4\hat{j}-12\hat{k}\right)+13=0$ then find the value of p.

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372. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=1$ and $\vec{r}\cdot\left(2\hat{i}+3\hat{j}-\hat{k}\right)+4=0$ and parallel to x-axis.

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373. If O be the origin and the coordinates of P be (1, 2, – 3), then find the equation of the plane passing through P and perpendicular to OP.

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374. Find the equation of the plane which contains the line of intersection of the planes $\overrightarrow{r}\cdot\left(\hat{i}+2\hat{j}+3\hat{k}\right)-4=0$ and $\overrightarrow{r}\cdot\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ and which is perpendicular to the plane $\overrightarrow{r}\cdot\left(5\hat{i}+3\hat{j}-6\hat{k}\right)+8=0$

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375. Find the distance of the point (-1 , -5 , -10) from the point of intersection of the line $\overrightarrow{r}=2\hat{i}-\hat{j}+2\hat{k}+\lambda\left(3\hat{i}+4\hat{j}+2\hat{k}\right)$ and the plane $\overrightarrow{r}.\left(\hat{i}-\hat{j}+\hat{k}\right)$=5.

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376. Find the vector equation of the line passing through (1, 2, 3) and parallel to the planes $\vec{r}.\left(\hat{i}-\hat{j}+2\hat{k}\right)=5$ and $\vec{r}.\left(3\hat{i}+\hat{j}+\hat{k}\right)=6.$

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377. Find the vector equation of the line passing through the point (1,2,-4) and perpendicular to the lines $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-15}{3}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$

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378. Prove that if a plane has intercepts a,b,c and is at a distance of p units from the origin, then $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{1}{p^2}.$

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379. Find the Distance between the two planes $2x + 3y + 4z = 4$ and \`4x+6y+8z=12

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380. The planes $2x - y + 4z = 5$ and $5x - 2.5y + 10z = 6$ are :

A. perpendicular

B. parallel

C. intersect y axis

D. passes through $\left(0, 0, \frac{5}{4}\right)$

Answer:

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381. The x, co-ordinate of a point on the line joining the points Q (2, 2, 1) and R (5, 1, - 2) is 4. Find its z-co-ordinate

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382. Find the distance of the point (-1 , -5 , -10) from the point of intersection of the line $\vec{r} = 2\hat{i} - \hat{j} + 2\hat{k} + \lambda\left(3\hat{i} + 4\hat{j} + 2\hat{k}\right)$ and the plane $\vec{r}.\left(\hat{i} - \hat{j} + \hat{k}\right)$=5.

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383. Find the equation of a plane which is at a distance $3\sqrt{3}$ units from origin and the normal to which is equally inclined to co-ordinate axes.

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384. Find the equation of the two lines through the origin which intersect the line $\frac{x-3}{2} = \frac{y-3}{1} = \frac{z}{1}$ at angle of $\frac{\pi}{3}$ each.

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385. The plane $ax + by = 0$ is rotated through an angle α about its line of intersection with the plane $z = 0$. Show that the equation to the plane in new position is $ax + by \pm z\sqrt{a^2 + b^2}\tan\alpha = 0$.

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386. Show that the sequence t n defined by t n = 3 n + 1 is an AP.

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387. Prove that the lines, whose direction cosines are given by $al + bm + cn = 0, fmn + gnl + hlm = 0$ are: perpendicular if $\frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$

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388. Prove that the lines, whose direction cosines are given by $al + bm + cn = 0, fmn + gnl + hlm = 0$ are: perpendicular if

$$\frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$$

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389. Using converse of Basic Proportionality theorem prove that the line joining the mid-points of any two sides of a triangle is parallel to the third side. (Recall that you have done it in Class IX).

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390. Verify that $< \frac{l_1 + l_2 + l_3}{\sqrt{3}}, \frac{m_1 + m_2 + m_3}{\sqrt{3}}, \frac{n_1 + n_2 + n_3}{\sqrt{3}} >$ can be taken as the direction cosines of a line L equally inclined to three mutually perpendicular lines with direction cosines: `, , `

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391. Find the vector equation of the line passing through (1, 2, 3) and perpendicular to the plane $\vec{r} \cdot \left(\hat{i} + 2\hat{j} - 5\hat{k}\right) + 9 = 0$

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392. The two lines $x = ay + b, z = cy + d$ and $x = a'y + b', z = c'y + d'$ are perpendicular to each other, if

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393. Prove that the line joining the points $6\vec{a} - 4\vec{b} + 4\vec{c}$ and $-4\vec{c}$ and the line joining the points $-\vec{a} - 2\vec{b} - 3\vec{c}, \vec{a} + 2\vec{b} - 5\vec{c}$ intersect at $-4\vec{c}$

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394. Find the vector equation of the line passing through (1, 2, 3) and parallel to the planes $\vec{r}.\left(\hat{i} - \hat{j} + 2\hat{k}\right) = 5$ and $\vec{r}.\left(3\hat{i} + \hat{j} + \hat{k}\right) = 6.$

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395. Find the vector equation of the line passing through the point (1,2,-4) and perpendicular to the lines

$\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-15}{3}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$

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396. Find the co-ordinates of the points where the line through the points (3,-4,-5) and (2,-3,1) crosses the plane $2x+y+z=7$

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397. Show that the equation of the plane passing through a point having position vector $\vec{a}$ and parallel to $\vec{b}$ and $\vec{c}$ is $\vec{r}=\vec{a}+\lambda\vec{b}+\mu\vec{c}$

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398. Find the distance of the point $(2, 1, 0)$ from the plane $2x + y + 2z + 5 = 0.$

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399. Find the distance of the point with position vector $-\hat{i} - 5\hat{j} - 10\hat{k}$ from the point of intersection of the line $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + \lambda\left(3\hat{i} + 4\hat{j} + 12\hat{k}\right)$ and the plane $\vec{r} \cdot \left(\hat{i} - \hat{j} + \hat{k}\right) = 5.$

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400. Find the point, where the line joining the points (1,3,4) and (-3,5,2) intersects the plane $\vec{r} \cdot \left(2\hat{i} + \hat{j} + \hat{k}\right) + 3 = 0.$ Is the point equaidistant from the gien points?

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401. Find the equation of the plane passing through the line of intersection of the planes $2x + y - z = 3$ and $5x - 3y + 4z = 9$ and parallel to the lines $\frac{x-1}{2} = \frac{y-3}{4} = \frac{z-5}{5}$

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402. If from a point P(a,b,c) perpendicular PA and PB are drawn to yz and zx-planes, find the vector equation of the plane OAB.

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403. If O be the origin and the coordinates of P be (1, 2, – 3), then find the equation of the plane passing through P and perpendicular to OP.

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404. Find the equation of the plane which contains the line of intersection of the planes $\vec{r} \cdot \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) - 4 = 0$ and

$\overrightarrow{r}\cdot\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ and which is perpendicular to the plane $\overrightarrow{r}\cdot\left(5\hat{i}+3\hat{j}-6\hat{k}\right)+8=0$

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405. Prove that the S.D. between a diagonal of a rectangular parallelopiped and its edges not meeting it are: $\frac{bc}{\sqrt{b^2+c^2}}, \frac{ca}{\sqrt{c^2+a^2}}, \frac{ab}{\sqrt{a^2+b^2}}$ where a,b,c are lengths of the edges.

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406. What is the equation of the xy-plane?

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407. If a line makes an angle α, β, γ with x axis, y axis and z axis , then : $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=\ldots\ldots$

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408. Write the direction cosines of the vector : $2\hat{i} + 2\hat{j} + 3\hat{k}$

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409. Find the vector equation of the line $\frac{x+4}{3} = \frac{y+3}{7} = \frac{z-5}{2}$

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410. Find the equation of a st line through (3,1,-5) and equally inclined to the axes.

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411. The distance of the point (2,3,-5) from the plane $x + 2y - 2z - 9 = 0$ is ....

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412. Find the distance of the plane $x - 3y + 2z - 8 = 0$ from the origin.

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413. Find the intercepts cut off by the plane $x + 4y - 2z = 8$ with the axes.

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414. Find the equation of the plane with intercept 9 on the y axis and parallel to ZOX plane.

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415. What is the point of intersection of the line $x = y = z$ with the plane $x + 2y + 3z = 6$?

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416. Distance between the two planes: $2x + 3y + 4z = 4$ and $4x + 6y + 8z = 12$ is:

A. 2

B. 4

C. 8

D. $\frac{1}{\sqrt{29}}$ units

Answer:

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417. The planes $2x - y + 4z = 5$ and $5x - 2.5y + 10z = 6$ are :

A. perpendicular

B. parallel

C. intersect y axis

D. passes through $\left(0, 0, \frac{5}{4}\right)$

Answer:

Watch Video Solution

418. The co-ordinates of foot of the perpendicular drawn from the point (2,5,7) on the x axis are given by:

A. (2,0,0)

B. (0,5,0)

C. (0,0,7)

D. (0,5,7)

Answer:

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419. If α, β, γ are the angles that a line makes with the positive direction of x, y, z axis repectively, then the direction cosines of the line are:

A. $< \sin\alpha, \sin\beta, \sin\gamma >$

B. $< \cos\alpha, \cos\beta, \cos\gamma >$

C. $< \tan\alpha, \tan\beta, \tan\gamma >$

D. $< \cos^2\alpha, \cos^2\beta, \cos^2\gamma >$

Answer:

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420. The distance of a point P(a,b,c) from x axis is:

A. $\sqrt{a^2 + c^2}$

B. $\sqrt{a^2 + b^2}$

C. $\sqrt{b^2 + c^2}$

D. $b^2 + c^2$

Answer:

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421. If the direction cosine of a line are < k,k,k >, then,

A. 1) $k > 0$

B. 2) $0 < k < 1$

C. 3) $k = 1$

D. 4) $k = \frac{1}{\sqrt{3}} \text{ or } -\frac{1}{\sqrt{3}}$

Answer:

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422. The reflection of the point (α, β, γ) in the xy-plane is:

A. $(\alpha, \beta, 0)$

B. $(0, 0, \gamma)$

C. $(-\alpha, -\beta, \gamma)$

D. $(\alpha, \beta, -\gamma)$

Answer:

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423. Distance between the point (0,1,7) and the plane $3x + 4y + 1 = 0$ is:

A. 1 unit

B. 2 units

C. 3 units

D. 4 units

Answer:

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424. If a line makes angles of 90°, 60° and 30° with the positive x, y and z axis respectively, find its direction-cosines.

A. $< 0, \frac{1}{2}, \frac{\sqrt{3}}{2} >$

B. $< 1, \frac{1}{2}, \frac{\sqrt{3}}{2} >$

C. $< 0, -\frac{1}{2}, \frac{\sqrt{3}}{2} >$

D. none of these

Answer:

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425. If a line passes through two points (-2,4,-5) and (1,2,3), then its direction cosines will be:

A. $< \frac{3}{\sqrt{77}}, -\frac{2}{\sqrt{77}}, \frac{8}{\sqrt{77}} >$

B. $\leftarrow \frac{2}{\sqrt{77}}, \frac{3}{\sqrt{77}}, \frac{8}{\sqrt{77}} >$

C. $< \frac{3}{\sqrt{77}}, \frac{2}{\sqrt{77}}, \frac{8}{\sqrt{77}} >$

D. none of these

Answer:

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426. The direction cosines of the line whose direction ratios are $6, \ -2, 3$

:

A. 1) $\frac{6}{7}, \frac{2}{7}, \ -\frac{3}{7}$

B. 2) $\frac{6}{7}, \ -\frac{2}{7}, \frac{3}{7}$

C. 3) $\frac{6}{7}, \frac{2}{7}, \frac{3}{7}$

D. 4) none of these

Answer:

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427. The direction cosines of the line joining the points (-2,1,-8) and (4,3,-5) is :

A. 6/7,-2/7,3/7

B. 6/7,2/7,-3/7

C. 6/7,2/7,3/7

D. none of these

Answer:

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428. The equation of line passing through the point: (2,-1,4) and in the direction of $\hat{i} + \hat{j} - 2\hat{k}$ in cartesian form is :

A. 1) $\dfrac{x-2}{1} = \dfrac{y+1}{1} = \dfrac{z-4}{-2}$

B. 2) $\dfrac{x-2}{1} = \dfrac{y+1}{1} = \dfrac{z+4}{-2}$

C. 3) $\dfrac{x+2}{1} = \dfrac{y-1}{1} = \dfrac{z-4}{-2}$

D. 4) none of these

Answer:

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429. Find the cartesian equation of the line which passes through the point (– 2, 4, – 5) and parallel to the line given by $\frac{x+3}{3}=\frac{y-4}{5}=\frac{z+8}{6}$

A. $\frac{x+2}{3}=\frac{y-4}{5}=\frac{z+5}{6}$

B. $\frac{x-2}{3}=\frac{y+4}{5}=\frac{z-5}{6}$

C. $\frac{x-2}{3}=\frac{y+4}{5}=\frac{y+5}{6}$

D. none of these

Answer:

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430. Find the angle between the following pair of lines : $\vec{r} = \hat{i} + \hat{j} - \hat{k} + \lambda\left(\hat{i} - 3\hat{j} + 2\hat{k}\right), \vec{r} = 2\hat{i} - \hat{j} + \hat{k} + \mu\left(3\hat{i} + \hat{j} - 2\hat{k}\right)$

A. 0°

B. 30°

C. 60°

D. none of these

Answer:

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431. The direction ratios of a line normal to the plane $x + 2y - 3z + 4 = 0$ are

A. 1,-2,3

B. 1,-2,-3

C. 1,2,-3

D. none of these

Answer:

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432. Find the equation of the plane with interceots 2, 3 and 4 on the x, y and z axis respectively.

A. $2x + 3y + 4z = 1$

B. $2x + 3y + 4z = 12$

C. $6x + 4y + 3z = 1$

D. $6x + 4y + 3z = 12$

Answer:

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433. The distance of the point (2,1,-1) from the plane $x-2y+4z=9$ is :

A. $-\frac{13}{\sqrt{21}}$

B. $\frac{9}{\sqrt{6}}$

C. $\frac{13}{\sqrt{21}}$

D. $-\frac{9}{\sqrt{6}}$

Answer:

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434. If the line $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2}$ lies exactly on the plane $2x-4y+z=7$, the value of k is

A. -7

B. -4

C. 7

D. 4

Answer:

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435. The point which lies in the plane given by the equations $2x + y - 3z = 10$ is :

A. (0,0,0)

B. (1,1,1)

C. (1,10,1)

D. (1,11,1)

Answer:

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436. The angle between two planes : $3x - 6y + 2z = 7$ and $2x + 2y - 2z = 5$ is :

A. $\sin^{-1}\left(\frac{5\sqrt{3}}{21}\right)$

B. $\sin^{-1}\left(\frac{-5\sqrt{3}}{21}\right)$

C. $\sin^{-1}\left(\frac{21}{\sqrt{75}}\right)$

D. none of these

Answer:

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437. Direction cosines of the normal to the plane: $2x - 3y + 4z - 6 = 0$ are :

A. 2,-3,4

B. $\frac{2}{6}, -\frac{3}{6}, \frac{4}{6}$

C. $\frac{2}{\sqrt{29}}, -\frac{3}{\sqrt{29}}, \frac{4}{\sqrt{29}}$

D. none of these

Answer:

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438. If a vector makes angles α, β, γ with x, y and z axes respectively, then $\cos \alpha, \cos \beta, \cos \gamma$ are known as:

A. direction ratios

B. direction cosines

C. direction angles

D. cosines angles

Answer:

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439. If a line makes angles of $90^\circ, 60^\circ$ and 30° with the positive x, y and z axis respectively, find its direction-cosines.

A. $< 1, \frac{\sqrt{3}}{2}, \frac{1}{2} >$

B. $< undef \in ed, \sqrt{3}, \frac{1}{\sqrt{3}} >$

C. $< 0, \frac{1}{2}, \frac{\sqrt{3}}{2} >$

D. $< 0, 1, 1 >$

Answer:

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440. The direction cosines of the line joining the points (-2, 4, -5) and (1, 2, 3) is :

A. $\leftarrow \frac{2}{\sqrt{77}}, \frac{8}{\sqrt{77}}, \frac{3}{\sqrt{77}} >$

B. $\leftarrow 3, 2, 8 >$

C. $< \frac{3}{\sqrt{77}}, -\frac{2}{\sqrt{77}}, \frac{8}{\sqrt{77}} >$

D. $< 3, -2, 8 >$

Answer:

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441. Distance between plane defined by $3x + 4y + 5 = 0$ and the point (5, 0, 7) is

A. 3 units

B. 4 units

C. 5 units

D. 6 units

Answer:

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442. Vector equation of the line $\frac{x+1}{2} = \frac{y-4}{4} = \frac{z+6}{3}$

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

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

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

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

Answer:

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443. The value of lambda for which the plane $\vec{r} \cdot \left(2\hat{i} - 2\hat{j} + 4\hat{k}\right) = 5$ is perpendicular to $\vec{r} \cdot \left(3\hat{i} - 3\hat{j} + \lambda\hat{k}\right) = 7$ is :

A. 4

B. 3

C. -3

D. -4

Answer:

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444. Direction casines of z-axis are

A. $< 0, 0, 1 >$

B. $< 1, 0, 0 >$

C. $< 0, 0, 0 >$

D. $< 0, 1, 0 >$

Answer:

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445. If a line has direction ratios $< 2, \ -1, \ -2 >$, then what are its direction cosines?

A. $< \frac{2}{3}, \ -\frac{1}{3}, \ -\frac{2}{3} >$

B. $\leftarrow \frac{2}{3}, \ -\frac{1}{3}, \frac{2}{3} >$

C. $\leftarrow \frac{2}{3}, \ -\frac{1}{3}, \ -\frac{2}{3} >$

D. none of these

Answer:

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446. A line makes angles 45° and 60° with the positive direction of the axis of x and y makes with the positive direction of z axis, an angle of:

A. 60°

B. 120°

C. 60° and 120°

D. none of these

Answer:

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447. Equation of line passing through the point (2,3,1) and parallel to the line of intersection of the planes:

$x - 2y - z + 5 = 0$ and $x + y + 3z = 6$ is:

A. 1) $\frac{x-2}{5} = \frac{y-3}{-4} = \frac{z-1}{5}$

B. 2) $\frac{x-2}{-5} = \frac{y-3}{-4} = \frac{z-1}{3}$

C. 3) $\frac{x-2}{5} = \frac{y-3}{4} = \frac{z-1}{3}$

D. 4) $\frac{x-2}{4} = \frac{y-3}{3} = \frac{z-1}{2}$

Answer:

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448. If the direction cosines of a vector of magnitude 3 are $< \frac{2}{3}, -\frac{a}{3}, \frac{2}{3} >$, $a > 0$, then the vector is :

A. $2\hat{i} + \hat{j} + 2\hat{k}$

B. $2\hat{i} - \hat{j} + 2\hat{k}$

C. $\hat{i} - 2\hat{j} + 2\hat{k}$

D. $\hat{i} + 2\hat{j} + 2\hat{k}$

Answer:

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449. Equation of line passing through the point (2,3,1) and parallel to the line of intersection of the planes: $x - 2y - z + 5 = 0$ and $x + y + 3z = 6$ is:

A. $\dfrac{x-2}{-5} = \dfrac{y-3}{-4} = \dfrac{z-1}{3}$

B. $\dfrac{x-2}{5} = \dfrac{y-3}{-4} = \dfrac{z-1}{3}$

C. $\dfrac{x-2}{5} = \dfrac{y-3}{4} = \dfrac{z-1}{3}$

D. $\dfrac{x-2}{4} = \dfrac{y-3}{3} = \dfrac{z-1}{2}$

Answer:

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450. A unit vector parallel to the straight line: $\frac{x-2}{3} = \frac{3+y}{-1} = \frac{z-2}{-4}$ is:

A. $\frac{1}{\sqrt{26}}\left(3\hat{i} - \hat{j} + 4\hat{k}\right)$

B. $\frac{1}{\sqrt{26}}\left(\hat{i} + 3\hat{j} - \hat{k}\right)$

C. $\frac{1}{\sqrt{26}}\left(3\hat{i} - \hat{j} - 4\hat{k}\right)$

D. $\frac{1}{\sqrt{26}}\left(3\hat{i} + \hat{j} + 4\hat{k}\right)$

Answer:

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451. The angle between a normal to the plane : $2x - y + 2z - 1 = 0$ and the z axis is:

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\sin^{-1}\left(\frac{2}{3}\right)$

C. $\cos^{-1}\left(\frac{2}{3}\right)$

D. $\sin^{-1}\left(\frac{1}{3}\right)$

Answer:

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452. Find the coordinates of the Foot of the perpendicular drawn from the origin to the plane $2x - 3y + 4z = 29$ is:

A. (5,-1,4)

B. (7,-1,3)

C. (5,-2,3)

D. (2,-3,4)

Answer:

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453. The distance between the x axis and the point (3,12,5) is :

A. 3

B. 13

C. 14

D. 12

Answer:

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454. The shortest distance of the point (a,b,c) from the x-axis is

A. $\sqrt{a^2 + b^2}$

B. $\sqrt{b^2 + c^2}$

C. a

D. $\sqrt{a^2 + c^2}$

Answer:

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455. Equation of the plane perpendicular to the line $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and passing through the point (2,3,4) is :

A. $2x+3y+z=17$

B. $x+2y+3z=9$

C. $3x+2y+z=16$

D. $x+2y+3z=20$

Answer:

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456. The line $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is parallel to the plane:

A. $2x + 3y + 4z = 0$

B. $3x + 4y + 5z = 7$

C. $2x + y - 2z = 0$

D. $x + y + z = 2$

Answer:

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457. Prove that the angle between any two diagonals of a cube is $\cos^{-1}\frac{1}{3}$

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. 30°

C. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D. 45°

Answer:

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458. The line passing through the points $(5, 1, a)$ and $(3, b, 1)$ crosses the YZ-plane at the point $\left(0, \frac{17}{2}, -\frac{13}{2}\right)$. Then,

A. $a = 8, b = 2$

B. $a = 2, b = 8$

C. $a = 4, b = 6$

D. $a = 6, b = 4$

Answer:

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459. If the straight lines : $\frac{x-1}{k} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x-2}{3} = \frac{y-3}{k} = \frac{z-1}{2}$ intersect at a point, then the integer k is equal to:

A. -2

B. -5

C. 5

D. 2

Answer:

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

A. $\frac{1}{4}$

B. $-\frac{1}{4}$

C. $\frac{1}{8}$

D. $-\frac{1}{8}$

Answer:

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461. A line with positive direction cosines passes through the pint P(2,-1,2) and makes the plane $2x + y + z = 9$ at point Q. The length of the line segment PQ equals:

A. 1

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer:

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462. Let the line $\frac{x-2}{3}=\frac{y-1}{-5}=\frac{z+2}{2}$ lies in the plane $x+3y-\alpha z+\beta=0$. Then, (α, β) equals

A. (-6,-17)

B. (5,-15)

C. (-5,5)

D. (6,-17)

Answer:

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463. The projection of a vector on the three coordinate axes are $6, -3, 2$, respectively. The direction cosines of the vector are

A. $\frac{6}{5}, -\frac{3}{5}, \frac{2}{5}$

B. $\frac{6}{7}, -\frac{3}{7}, \frac{2}{7}$

C. $-\frac{6}{7}, -\frac{3}{7}, \frac{2}{7}$

D. $6, \ -3, 2$

Answer:

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464. A line AB in three-dimensional space makes angles 45° and 120° with the positive X-axis and The positive Y-axis, respectively. If AB makes an acute angle θ with the positive Z-axis, then θ equals

A. 30°

B. 45°

C. 60°

D. 75°

Answer:

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465. Equation of the plane containing the straight line $\frac{x}{2} = \frac{y}{3} = \frac{z}{4}$ and perpendicular to the plane containing the straight lines $\frac{x}{3} = \frac{y}{4} = \frac{z}{2}$ and $\frac{x}{4} = \frac{y}{2} = \frac{z}{3}$ is :

A. 1) $x + 2y - 2z = 0$

B. 2) $3x + 2y - 2z = 0$

C. 3) $x - 2y + z = 0$

D. 4) $5x + 2y - 4z = 0$

Answer:

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466. If the distance of the point P(1,-2,1) from the plane $x + 2y - 2z = \alpha$, where $\alpha > 0$, is 5, then the foot of the perpendicular from P to the plane is:

A. $\left(\frac{8}{3}, \frac{4}{3}, -\frac{7}{3}\right)$

B. $\left(\frac{4}{3}, -\frac{4}{3}, \frac{1}{3}\right)$

C. $\left(\frac{1}{3}, \frac{2}{3}, \frac{10}{3}\right)$

D. $\left(\frac{2}{3}, -\frac{1}{3}, \frac{5}{2}\right)$

Answer:

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467. If the angle between the line $x = \frac{y-1}{2} = (z-3)(\lambda)$ and the plane $x + 2y + 3z = 4 is \cos^{-1}\left(\sqrt{\frac{5}{14}}\right)$, then λ equals

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

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

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

D. $\frac{5}{3}$

Answer:

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468. The length of the perpendicular drawn from the point $(3, -1, 11)$ to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is

A. $\sqrt{29}$

B. $\sqrt{33}$

C. $\sqrt{53}$

D. $\sqrt{65}$

Answer:

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469. The distance of the point (1,-5, 9) fromthe plane $x - y + z = 5$, measured along a straight line: $x = y = z$ is

A. $10\sqrt{3}$

B. $5\sqrt{3}$

C. $3\sqrt{10}$

D. $3\sqrt{5}$

Answer:

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470. If the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect, then k is equal to

A. -1

B. $\frac{2}{9}$

C. $\frac{9}{2}$

D. 0

Answer:

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471. An equation of a plane parallel to the plane $x - 2y + 2z - 5 = 0$ and at a unit distance from the origin is

A. $x - 2y + 2z - 3 = 0$

B. $x - 2y + 2z + 1 = 0$

C. $x - 2y + 2z - 1 = 0$

D. $x - 2y + 2z + 5 = 0$

Answer:

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

A. $5x - 11y + z = 17$

B. $\sqrt{2}x + y = 3\sqrt{2} - 1$

C. $x + y + z = \sqrt{3}$

D. $x - \sqrt{2}y = 1 - \sqrt{2}$

Answer:

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473. The point P is the intersection of the straight line joining the points Q(2,3,5) and R(1,-1,4) with the plane $5x - 4y - z = 1$. If S is the foot of the perpendicular drawn from the point T(2,1,4) to QR, then the length of the line segment PS is:

A. $\frac{1}{\sqrt{2}}$

B. $\sqrt{2}$

C. 2

D. $2\sqrt{2}$

Answer:

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474. 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 k can have

A. exactly one value

B. exactly two values

C. exactly three values

D. any value

Answer:

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475. Distance between two parallel planes $2x+y+2z=8$ and $4x+2y+4z+5=0$ is

A. $\frac{5}{2}$

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

C. $\frac{9}{2}$

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

Answer:

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476. The image of the line $\frac{x-1}{3}=\frac{y-3}{1}=\frac{z-4}{-5}$ in the plane $2x-y+z+3=0$ is the line

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

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

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

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

Answer:

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477. The angle between the lines whose direction cosines satisfy the equations $l+m+n=0$ and $l^2=m^2+n^2$ is

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

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

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

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

Answer:

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478. The distance of the point (1,0,2) from the poitn of intersection of the line $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{12}$ and the plane $x-y+z=16$ is :

A. $2\sqrt{14}$

B. 8

C. `3sqrt21

D. 13

Answer:

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479. The equation of the plane containing the line $2x - 5y + z = 3, x + y + 4z = 5$ and parallel to the plane $x + 3y + 6z = 1$, is

A. $2x + 6y + 12z = 13$

B. $x + 3y + 6z = -7$

C. $x + 3y + 6z = 7$

D. $2x + 6y - 12z = -13$

Answer:

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480. If the line, $\frac{x-3}{2}=\frac{y+2}{-1}=\frac{z+4}{3}$ lies in the place, $lx+my-z=9$, then l^2+m^2 is equal to:

A. 18

B. 5

C. 2

D. 26

Answer:

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481. The distance of the point $(1, -5, 9)$ from the plane $x-y+z=5$ measured along the line $x=y=z$ is

A. $10\sqrt{3}$

B. $\frac{10}{\sqrt{3}}$

C. $\frac{20}{3}$

D. $3\sqrt{10}$

Answer:

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482. If a line has direction ratios $< 2, \ -1, \ -2 >$, then what are its direction cosines?

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483. Find the Cartesian equation of the following plane: $\vec{r} \cdot \left(\hat{i} + \hat{j} - \hat{k}\right) = 2$

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484. Show that the line , $\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} + \hat{j} + 4\hat{k}\right)$ lies in the plane $\vec{r} \cdot \left(\hat{i} + 2\hat{j} - \hat{k}\right) = 3.$

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485. Find the area of the triangle whose vertices are : $A(1, 2, 3), B(2, -1, 4)$ and $C(4, 5, -1)$

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486. Find the equations of the straight line passing through the point (2, 3, -1) and is perpendicular to the lines : $\frac{x-2}{2} = \frac{y+1}{1} = \frac{z-3}{3}$ and $\frac{x-3}{1} = \frac{y+2}{1} = \frac{z-1}{1}$.

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487. Find the image of the point (1,6,3) in the line : $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

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488. Find the equation of the plane passing through the point(-1, 3, 2) and perpendicular to the planes x + 2y + 3z = 5 and 3x + 3y + z = 0.

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489. Prove that if a plane has intercepts a,b,c and is at a distance of p units from the origin, then $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{1}{p^2}$.

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490. A line makes angles $\alpha, \beta, \gamma, \delta$ with the diagonals of a cube, prove that $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta=\frac{4}{3}$

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491. Show that the lines $\frac{x-a+d}{\alpha-\delta}=\frac{y-a}{\alpha}=\frac{z-a-d}{\alpha+\delta}$ and $\frac{x-b+c}{\beta-\gamma}=\frac{y-b}{\beta}=\frac{z-b-c}{\beta+\gamma}$ are coplanar.

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