MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

3D - PLANES

Solved Examples

1. Find the Cartesian equation of the plane whose vector equation is $\vec{r} . \left(3\hat{i} + 4\hat{j} - 2\hat{k}\right) = 5.$

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2. Find the Cartesian equation of the following plane: $\vec{r} = (\lambda - 2\mu)\hat{i} + (3 - \mu)\hat{j} + (2\lambda + \mu)\hat{k}.$

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3. Find the vector equation of the plane whose Cartesian equation is $2x + 3y - 9z = 4$

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4. Find the vector equation of the plane $x + 7y - 5z + 19 = 0$

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5. Find the equation of the plane which cuts equal intercepts on the axes and passes through the point (2,3,5).

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6. Find the equation of the plane which is parallel to x-axis and cuts intercepts 2 and 5 on y and z-axis respectively.

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7. Find the equation of the plane which is parallel to the plane $x + 5y - 4z + 5 = 0$ and the sum of whose intercepts on the coordinate axes is 15 units.

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8. Find the equation of the plane upon which the length of normal from origin is 10 and direction ratios of this normal are 3,2,6

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9. Find the equation of the plane which is at a distance of 5 units fom the origin and perpendiculat to $2\hat{i} - 3\hat{j} + 6\hat{k}$

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10. Find the equation of the plane through the point $2\hat{i} + 3\hat{j} - \hat{k}$ and perpendicular to vector $3\hat{i} + 3\hat{j} + 7\hat{k}$. Determine the perpendicular distance of this plane from the origin.

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11. Find a normal vector to the plane $x + 2y + 3z - 6 = 0$

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12. What are the direction cosines of the normal to the plane $4x + 12y + 3z = 65$? Also find the lenth of perpendicular from the origin to the plane.

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13. Find the angle between the planes $-x+y+2z=9$ and $x+2y+z=5$

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14. Find the angle between the planes $\vec{r}.\left(\hat{i}+\hat{j}-2\hat{k}\right)=3$ and $\vec{r}.\left(2\hat{i}-2\hat{j}+\hat{k}\right)=2$

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15. Find the angle between the line $\vec{r}=\left(\hat{i}+2\hat{j}-\hat{k}\right)+\lambda\left(\hat{i}-\hat{j}+\hat{k}\right)$ and the plane $\vec{r}.\left(2\hat{i}-\hat{j}+\hat{k}\right)=4$

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16. Find the angle between the plane $x+y-2z+5=0$ and the line whose direction cosines are $\frac{1}{\sqrt{6}},\frac{2}{\sqrt{6}},\frac{1}{\sqrt{6}}$.

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

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18. Find the general equation of plane pasing through the point $(1, 2, -3)$.

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19. Find the vector and the Cartesian equations of the plane passing through the point $(1, 2, 3)$ and perpendicular to the line with direction ratio $2, 3, -4$.

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20. Find the equation of the plane passing through the points $(2, 1, 2)$ and $(1, 3, -2)$ and parallel to the x-axis.

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21. If a plane passes through the point $(-3, -3, 1)$ and is normal to the line joining the points $(2, 6, 1)$ and $(1, 3, 0)$, find its equation.

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22. Find the equation of the plane through $P(1, 4, -2)$ and parallel to the plane $-2x + y - 3z = 0$

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23. Find the equation of the plane through the point (3,4,-1) and parallel to the plane $\vec{r} \cdot \left(2\hat{i} - 3\hat{j} + 5\hat{k}\right) + 7 = 0$

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

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

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26. Find the vector equation to the plane through the point $-\hat{i} + 3\hat{j} + 2\hat{k}$ perpendicular to each of the planes $\vec{r}.\left(\hat{i} + 2\hat{j} + 2\hat{k}\right) = 25$ and $\vec{r}.\left(3\hat{i} + 3\hat{j} + 2\hat{k}\right) = 8.$

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27. Find the equation of the plane which passes through the points $(6, 2, -4)$ and $(3, -4, 1)$ and is parallel to the line joining the points $(1, 0, 3)$ and $(-1, 2, 4)$.

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28. Find the equation of the plane through the point $\hat{i} + 4\hat{j} - 2\hat{k}$ and perpendicular to the line of intersection of the planes $\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 10$ and $\vec{r} \cdot \left(2\hat{i} - \hat{j} + 3\hat{k}\right) = 18$.

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29. Find the equation of the plane passing through the points (0,-1,-1), (4,5,1) and (3,9,4). Also find the vector equation of the plane.

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30. Find the vector equation of the plane passing through the points $(6, -1, 1), (5, 1, 2)$ and $(1, -5, -4)$. Also find the Cartesian equation of the plane.

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31. Show that the points $(0, -1, 0). (2, 1, -1), (1, 1, 1), (3, 3, 0)$ are coplanar.

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32. Can there be a unique equationof the plane passing through the points $(4, 3, 5)(1, 2, 3)$ and $(7, 4, 7)$? Give reason for your answer.

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33. Find the points of intersection of the line $\frac{x-2}{-3}=\frac{y-1}{2}=\frac{z-3}{2}$ and the plane $2x+y-z=3$.

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34. Find the image of the point $P(3,5,7)$ in the plane $2x+y+z=0$.

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35. Find the distance of the point (2,3,4) from the plane $3x+2y+2z+5=0$ measured parallel to the line $\frac{x+3}{3}=\frac{y-2}{6}=\frac{z}{2}$.

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36. Find the vector equationof the line passing through the point (3,1,2) and perpendicular to the plane $\vec{r}.\left(2\hat{i}-\hat{j}+\hat{k}\right)=4$. Find also the

point of intersection of this line and the plane.

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37. Find the equation of a plane containing the line of intersection of the planes $x + y + z - 6 = 0 and 2x + 3y + 4z + 5 = 0$ passing through $(1, 1, 1)$.

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

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39. Find the equation of the plane passing through the line of intersection of the planes 2x + y - Z = 3,5x - 3y + 4z + 9 = 0 and parallel to

the line $\frac{x-1}{2}=\frac{y-3}{4}=\frac{z-5}{5}$

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40. Find the equation of the plane passing through the line intersection of the plane: $2x-y=0$ and $3z-y=0$ and perpendicular to the plane $4x+5y-3z=8$

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41. Find the equation of the plane which is perpendicular to the plane $5x+3y+6z+8=0$ and which contains the line of intersection of the planes $x+2y+3z-4=0$ and $2x+y-z+5=0$

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42. Find the equation of plane(s) passing through the intersection of planes $x+3y+6=0$ and $3x-y-4z=0$ and whose perpendicular

distance from origin is unity.

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43. Find the Cartesian as well as the vector equation of the planes pasing through the intersection of the planes $\vec{r}.\left(2\hat{i}=6\hat{j}\right)+12=0$ and $\vec{r}.\left(3\hat{i}-\hat{j}+4\hat{k}\right)=0$ which are at unit distance from the origin.

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44. The plane $x-y-z=4$ is rotated through 90° about its line of intersection with the plane $x+y+2z=4$. Find its equation in the new position,

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45. Find the equation of the plane through the point (3,4,-5) and parallel to the vectors $3\hat{i}+\hat{j}-\hat{k}$ and $\hat{i}-2\hat{j}+\hat{k}$.

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46. Find the equation of the plane passing through (1,2,0) which contains the line $\frac{x+3}{3}=\frac{y-1}{4}=\frac{z-2}{-2}$

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47. Find the vector and the Cartesian form of the equation of the plane containing two lines: $\vec{r}=\hat{i}+2\hat{j}-\hat{k}+\lambda\left(2\hat{i}+3\hat{j}+6\hat{k}\right)$ and $\vec{r}=3\hat{i}+3\hat{j}-5\hat{k}+\mu\left(-2\hat{i}+$

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48. Find the vector equation of the plane through the points $A(3, -5, -1), B(-1, 5, 7)$ and parallel to the vector $3\hat{i} - \hat{j} + 7\hat{k}$

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49. Find the distance of the point (1,2,0) from the plane $4x + 3y + 12z + 16 = 0$

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50. Show that the distance between planes $2x - 2y + z + 3 = 0$ and $4x - 4y + 2z + 5 = 0 is \frac{1}{6}$

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51. Find the distance of the point (3,4,5) from the plane $\vec{r}.\left(2\hat{i} - 5\hat{j} + 3\hat{k}\right) = 13$

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52. Find the distance of the point (1,2,5) from the plane $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)+17=0$

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53. Find the length of the foot of the perpendicular from the point (1,1,2) to the plane $\vec{r}.\left(2\hat{i}-2\hat{j}+4\hat{k}\right)+5=0$

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54. Find the distance between the parallel planes: $\vec{r}.\left(2\hat{i}-\hat{j}+3\hat{k}\right)=4$ and $\vec{r}.96\hat{i}-3\hat{j}+9\hat{k}\Big)+13=0$

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55. Find the shortest distance between the planes: $x + y - z + 4 = 0$ and $2x - 2y - 2z + 10 = 0$

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56. Find the equation of the line of intersection of the planes $4x + 4y - 5z = 12, 8x + 12y - 13z = 32$ in the symmetric form.

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57. Show that the line represented by equation $x = ay + b, z = cy + d$ in symmetric form is $\frac{x - b}{a} = \frac{y}{1} = \frac{z - d}{c}$

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Exercise

1. Find the Cartesian equations of the following planes whose vector equations are: $\vec{r}.\left(3\hat{i}+3\hat{j}-4\hat{k}\right)=0$

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2. Find the Cartesian equations of the following planes whose vector equations are: $\vec{r}.\left(2\hat{i}-7\hat{j}+4\hat{k}\right)+\ =0$

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3. Find the Cartesian equations of the following planes whose vector equations are: $\vec{r}.\left(\hat{i}+\hat{j}-\hat{k}\right)=2$

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4. Find the Cartesian equations of the following planes whose vector equations are: $\vec{r}.\left[(s-2t)\hat{i}+(3-t)\hat{j}+(2s+t)\hat{k}\right]=15$

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5. Find the vector equation of the following planes whose Cartesian equations are $2x + 3y - z - 1 = 0$

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6. Find the vector equation of the following planes whose Cartesian equations are $x + 2y + 3z + 5 = 0$

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7. Find the equation f the plane with intercepts 2,3, and 4 on the x,y and z-axes respectivelly.

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

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9. Find the euqationof the plane which cuts intercepts 2,3,-4 on the axes.

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10. Find the intercepts of tehplane $3x + 4y - 7z = 84$ on the axes. Also find the length of perpendicular from origin to this plane and direction cosines of this normal.

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

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12. Find the equation of a plane which meets the axes in $A, BandC$, given that the centroid of the triangle ABC is the point (α, β, γ)

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

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14. 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 equations

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15. In each of the following cases,determine the direction cosines of the normal to the plane and its distance from the origin: $2x - 3y + 4z - 6 = 0$

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

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17. In each of the following cases,determine the direction cosines of the normal to the plane ned its distance from the origin: $x + y + z = 1$

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18. In each of the following cases,determine the direction cosines of the normal to the plane ned its distance from the origin: $5y + 8 = 0$

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19. In each of the following cases,determine the direction cosines of the normal to the plane ned its distance from the origin: $z = 2$

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20. Find the direction cosines of the unit vector perpendcular to the plane $\vec{r}.\left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 5$ and $\vec{r}.\left(3\hat{i} - 3\hat{j} + 5\hat{k}\right) = 3$

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21. Find the angle between the plane: $2x - y + z = 6$ and $x + y + 2z = 7$

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22. Find the angle between the plane:

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

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23. Find the angle between the plane:

$3x - 6y + 2z = 7$ and $2x + 2y - 2z = 5$

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24. Find the angle between the plane:

$2x + y - 2z = 5$ and $3x - 6y - 2z = 7$

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25. Determine whether the following pair of planes are parallel or perpendicular and in case they are neither find the angle between them:

$2x - y + 3z - 1 = 0$ and $2x - y + 3z + 3 = 0$

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26. Determine whether the following pair of planes are parallel or perpendicular and in case they are neither find the angle between them:

$2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z - 10$

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27. Determine whether the following pasir of planes are parallel or perpendicular and in case they are neither find the angle between them:

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

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28. Determine whether the following pasir of planes are parallel or perpendicular and in case they are neither find the angle between them:

$4x + 8y + z - 8 = 0$ and $y + z - 4 = 0$

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29. Determine whether the following pair of planes are parallel or perpendicular and in case they are neither find the angle between them:

$3x - 4y + 5z = 0$ and $2x - y - 2z = 5$

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30. Find the angle between the line $\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane $10x + 2y11z = 3$.

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31. Find the equation of the plane that contains the point $(1, 1, 2)$and is perpendicular to each of the planes $2x + 3y2z = 5$and $x + 2y3z = 8$.

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32. Find the equation of the plane passing through the oint $(-1, -1, 2)$ and perpendicular to each of tehpalnes $2x + 3y - 3z = 2$ and $5x - 4y + z = 6$.

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33. 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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34. Find the vector and Cartesian equation 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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35. Find the vector and Cartesian equation of the plane that passes throgh the point (1,0,-2) and the normal vector to the plane is $\hat{i} + \hat{j} - \hat{k}$.

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

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37. Find the equation of the plane through (3,4,-1) which is parallel to the plane $\vec{r}.\left(2\hat{i}-3\hat{j}+5\hat{k}\right)+7=0$

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38. Find the equation of the plane passing through (a,b,c) and paralle toteh plne $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)=2.$

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39. find the equation of the plane passing through the point (3,3,1) and perpendicular to the line joining (3,4,-1) and (2,-1,5).

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40. Find the equation of the plane passing through the point (3,4,1) and (0,1,0) and parallel to the line $\frac{x+3}{2}=\frac{y-3}{7}=\frac{z-2}{5}$

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41. Find the vector and the Cartesian equation of the plane which pases through the point (5,2,-4) and perpendicular to the line with direction ratios (2,3,-1).

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42. Find the equation of the plane through the point (1,4,-2) and parallel to the plane $-2x + y - 3z = 7$.

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43. Find the equation of the plane throughathe points (2,-3,1) and (5,2,-1) and perpendicular to the plane $x - 4y + 5z + 2 = 0$

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

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

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46. Find the equationfo the plane through points (2,1,0),(3,-2,-2), and (3,1,7).

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

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48. Find the vector equation of the plane passing through the points $(2, 5, -3), (-2, -3, 5), (5, 3, -3)$.

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49. Find the vector equation of the plane passing thrugh the points (2,5,-3),(-2,-3,5),(5,3,-3).

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50. Find the coordinates of the point where the line $\frac{x+1}{2} = \frac{y+2}{3} = \frac{z+3}{4} meetsthepla \neq$ x+y+4z=6`.

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

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52. Find the coordinates 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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53. find the coordinates of thepint where the line through $(5, 1, 6)$ and $(3, 4, 1)$ corsses the yz-plane.

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

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55. Find the coordinates of the foot of perpendicular drawn from origin to the planes: $x + y + z = 1$

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56. Find the coordinates of the foot of perpendicular drawn from origin to the planes: $3y + 4z - 6 = 0$

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57. Find the coordinates of the foot of perpendicular drawn from origin to the planes: $5y + 8 = 0$

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58. Find the coordinates of the foot of perpendicular drawn from origin to the planes: $2x + 3y + 4z - 12 = 0$

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

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60. Find the image of the point $(1, 3, 4)$ in the plane $2x - y + z + 3 = 0$.

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

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

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

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

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

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66. 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).

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67. Find the equation of the plane through the line of 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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68. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}.\left(\hat{i} + \hat{j} + \hat{k}\right) = 1$ and $\vec{r}.\left(2\hat{i} + 3\hat{j} - \hat{k}\right) + 4 = 0$ and parallel to x-axis.

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

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70. 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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71. Show that the lines $\frac{x-3}{2}=\frac{y+1}{-3}=\frac{z+2}{1}$ and $\frac{x-7}{-3}=\frac{y}{1}=\frac{z+7}{2}$ are coplanar. Also find the equation of the plane containing them.

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72. Find the distance of each of the following points from the corresponding given plane: $(-6,0,0), 2x-3y+6z-2=0$

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73. Find the distance of each of the following points from the corresponding given plane: $(2, 3, -5), x + 2y - 2z = 9$

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74. Find the distance of each of the following points from the corresponding given plane: $(0, 0, 0), 3x - 4y + 12z = 3$

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75. Find the distance of each of the following points from the corresponding given plane: $(3, -2, 1), (2x - y + 2z + 3 = 0$

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76. Find the distance of a point (2,5,-3) from the plane `vecr.(6hati-3hatj+2hatk)=4.

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77. If a plane has intercepts a,b,c on axes and is at a distance of p units from the origin then prove that $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{1}{p^2}$

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

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79. Find the distance between the planes $2x+3y+4z=4$ and $4+6y+8z=12$.

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80. Find the equation of the line through point (1,2,3) and parallel to line $x - y + 2z5, 3x + y + z = 6.$

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81. the two lines $x = ay + b, z = cy + d$ and $x = a'y + b, z = c'y + d'$ will be perpendicular, if and only if: (A) $aa' + ' = 1 = 0$ (B) $aa' + ' + ' = 1 = 0$ (C) $aa' + ' + ' = 0$ (D) $(a + a') + (b + b') + (c + c') = 0$

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82. Find the vector equation o 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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83. A plane meets the coordinate axes at P, Q and R such that the centroid of the triangle is (3,3,3). The equation of he plane is (A) $x+y+z=9$ (B) $x+y+z=1$ (C) $x+y+z=3$ (D) $3x+3y+3z=1$

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84. The equation $xy=0$ in three dimensional space is represented by (A) a plane (B) two planes at righat angles (C) a pair of parallel planes (D) a pair of straighat lines

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85. The equation $(x-1)(x-2)=0$ in thre dimensional space is represented by (A) a pair of straighat lines (B) a pair of parallel planes (C) a sphere (D) none of these

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86. A plane meets of axes in P,Q and R such that centroid PQR is (1,2,3). The equation of the plane is (A) $6x + 3y + 2z = 6$ (B) $6x + 3y + 2z = 1$ (C) $6x + 3y + 2z = 18$ (D) $x + 2y + 3z = 1$

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87. The distasnce of the plane $2x - 3y + 6z + 14 = 0$ from the origin is (A) 2 (B) 4 (C) 7 (D) 11

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88. The equation of the plane through the origin and parallel to the plane $3x - 4y + 5z - 6 = 0$ is (A) $3x - 4y - 5z - 6 = 0$ (B) $3x - 4y + 5z + 6 = 0$ (C) $3x - 4y_5 z = 0$ (D) $3x + 4y - 5z + 6 = 0$

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89. The equation of the plane containing the line $2x + z - 4 = 0nd2y + z = 0$ and passing through the point (2,1,-1)$is(A)$ x+y-z=4(B)x-y-z=2(C)x+y+z+2=0(D)x+y+z=2`

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90. The eqution $xy + yz = 0$ represents (A) a pair of straighat lines (B) a pair of parallel lines (C) a pair of parallel planes (D) a pair of perpendicular planes

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91. The direction cosines of a normal to the plane $2x - 3y - 6z + 14 = 0$ are (A) $\left(\frac{2}{7}, \frac{-3}{7}, \frac{-6}{7}\right)$ (B) $\left(\frac{-2}{7}, \frac{3}{7}, \frac{6}{7}\right)$ (C) $\left(\frac{-2}{7}, \frac{-3}{3}, \frac{-6}{7}\right)$ (D) none of these

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92. The plane $2x - 3y + 6z - 11 = 0$ makes an angle $\sin^{-1}(\alpha)$ with X-axis. The value of $alpah$ is

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93. The acute angle between the plane $5x - 4y + 7z = 13$ and the y-axis is givne by (A) $\sin^{-1}\left(\frac{5}{\sqrt{90}}\right)$ (B) $\sin^{-1}\left(\frac{-4}{\sqrt{90}}\right)$ (C) $\sin^{-1}\left(\frac{7}{\sqrt{90}}\right)$ (D) $\sin^{-1}\left(\frac{4}{\sqrt{90}}\right)$

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94. The equation of the parallel plane lying midway between the parallel planes $2x - 3y + 6z - 7 = 0$ and $2x - 3y + 6z + 7 = 0$ is (A) $2x - 3y + 6z + 1 = 0$ (B) $2x - 3y + 6z - 1 = 0$ (C) $2x - 3y + 6z = 0$ (D) none of these

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95. The plane $x + y = 0$ (A) is parallel to y-axis (B) is perpendicular to z-axis (C) passes through y-axis (D) none of these

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96. The points $A(1, 1, 0), B(0, 1, 1), C(1, 0, 1)$ and $D\left(\frac{2}{3}, \frac{2}{3}, \frac{2}{3}\right)$ are (A) coplanar (B) nonn coplanar (C) vertices of a parallelograsm (D) none of these

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97. The equation of the plane whose intercepts on the axes are thrice of those made by the plane $2x - 3y + 6z - 11 = 0$ is (A) $6x - 9y + 18z - 11 = 0$ (B) $2x - 3y + 6z - 33 = 0$ (C) $2x - 3y + 6z + 33 = 0$ (D) none of these

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98. The equation of the righat bisecting plane of the segment joiningteh points (a, a, a) and $(-a, -a, -a), a \neq 0$ is (A) $x + y + z = a$ (B) $x + y + z = 3a$ (C) $x + y + z = 0$ (D) $x + y + z + a = 0$

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99. The equation of plane parallel to the plane $x + y + z = 0$ and passing through $(\alpha, \beta, \gamma 0$ is (A) $x + y + z = \alpha + \beta + \gamma$ (B) $x + y + z = \alpha\beta + \beta\gamma + \gamma\alpha$ (C) $x + y + z + \alpha + \beta + \gamma = 0$ (D) none of these

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100. The three planes $x + y = 0, y + z = 0$ and $x + z = 0$ (A) meet in the unique point (B) meet in a line (C) meet taken two at a time i parallel lines (D) none of these

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101. The equation $x^2 - x - 2 = 0$ in three dimensional space is reresented by (A) a pair of parlle planes (B) as pair of straigh lines (C) a pair of perpendicular planes (D) a set contasining two distinct points

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102. The angle between the plane $3x + 4y = 0$ and the line $x^2 + y^2 = 0$ is (A) 0^0 (B) 30^0 (C) 60^0 (D) 90^0

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103. The locus of a first degree equation in x,y and z is a (A) straighat line (B) plane (C) sphere (D) none of these

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104. If the points $(-0, -1, -2), (-3, -4, -5), (-6, -7, -8)$ and (x, x, x) are non coplanar then x is (A) -2 (B) 0 (C) 3 (D) any real number

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105. The points $(3, -2, -1), (-1, 1, 2), (2, 3, -4)$ and $(4, 5, \lambda)$ are coplanar when $\lambda = (A)0(B)$(-146)/17$(C)1(D)$(-17)/9`

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106. The equation of the righat bisector plane of the segment joining (2,3,4) and (6,7,8) is (A) $x + y + z + 15 = 0$ (B) $x + y + z - 15 = 0$ (C) $x - y + z - 15 = 0$ (D) none of these

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107. The equation of the plane through the point (1,2,-3) which is parallel to the plane $3x - 5y + 2z = 11$ is given by (A) $3x - 5y + 2z - 13 = 0$ (B) $5x - 3y + 2z + 13 = 0$ (C) $3x - 2y + 5z + 13 = 0$ (D) $3x - 5y + 2z + 13 = 0$

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108. The distance between the parallel planes $x + 2y - 3z = 2$ and $2x + 4y - 6z + 7 = 0$ is (A) $\frac{1}{\sqrt{14}}$ (B) $\frac{11}{\sqrt{56}}$ (C) $\frac{7}{\sqrt{56}}$ (D) none of these

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109. The angle between the planes $2x - y + z = 6$ and $x + y + 2z = 7$ is (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

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110. Lines OA and OB are drawn from O with directioncosines proportional to (1,-2,-1) and (3,-2,3) respectively. The direction ratios of the normal to the planes AOB are (A) (4,3,2) (B) (4,-3,-2) (C) (-4,3,-2) (D) (4,3,-2)

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111. The equation of the plane through intersectioof planes $x = 2y + 3z = 4$ and $2x + y - z = -5$ and perpendicular to the plane $5x + 3y + 6z + 8 = 0$ is (A) $7x - 2y + 3x + 81 = 0$ (B) $23x + 14y - 9z + 48 = 0$ (C) $51x + 15y + 50z + 173 = 0$ (D) none of these

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112. The distance of the point (2,1,-1) from the plane $x - 2y + 4z = 9$ is (A) $\frac{\sqrt{13}}{21}$ (B) $\frac{13}{21}$ (C) $\frac{13}{\sqrt{21}}$ (D) $\sqrt{\frac{13}{21}}$

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113. The equation of the plane passing through the intersection of the planes $x+2y+3z+4=0adn4x+3y+2z+1=0$ and the origin ils (A) $3x+2y+z+1=0$ (B) $3x+2y+z=0$ (C) $2x+3y+z=0$ (D) $x+y+z=0$

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114. If p is the length of perpendicular from the origin onto the plane whose intercepts on the axes area a,b,c then (A) $a+b+c=p$ (B) $a^{-2}+b^{-2}+c^{-2}=p^{-2}$ (C) $a^{-1}+b^{-1}+c^{-1}=p^{-1}$ (D) `a^(-1)+b^(-1)+c^(-1)=1

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115. Consider the points $P(p,0,0), Q(0,q,0)$ and $R(0,0,r)$ where $pqr\neq 0$ then the equation of the plane PQR is (A) $px+qy+r=1$ (B) $\frac{x}{p}+\frac{y}{q}+\frac{z}{r}=1$ (C) $x+y+z+\frac{1}{p}+\frac{1}{q}+\frac{1}{r}=0$ (D) none of these

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116. The planes x=0 and y=0` (A) are parallel (B) are perpendicular to each other (C) interesect in z-axis (D) none of these

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117. The plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ (A) does not pass through origin (B) is at a distance $\frac{1}{\sqrt{a^{-2}+b^{-2}+c^{-2}}}$ from origin (C) makes intercepts of a,b,c on the coordinates axes (D) all of a,b,c

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118. The distance of the plane $\vec{r}.\left(\frac{2}{7}\hat{i}+\frac{3}{7}\hat{j}-\frac{6}{7}\hat{k}\right)=1$ from the origin is (A) 1 (B) 7 (C) $\frac{1}{7}$ (D) none of these

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119. The planes $\vec{r}.\left(2\hat{i}+3\hat{j}-6\hat{k}\right)=7$ and $\vec{r}.\left(\frac{-2}{7}\hat{i}-\frac{3}{7}\hat{j}+\frac{6}{7}\hat{k}\right)=0$ are (A) parallel (B) at righat angles (C) equidistant from origin (D) none of these

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