MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

THE PLANE

Solved Examples And Exercises

1. Find the distance of the point $2\hat{i} + \hat{j} - \hat{k}$ from the plane $\vec{r}\ \hat{i} - 2\dot{\hat{j}} + 4\hat{k} = 9$.

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2. Find the distance of the point $(21, 0)$ from the plane $2x + y + 2z + 5 = 0.$

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3. Show that the points $\hat{i}-\hat{j}+3\hat{k} and 3\left(\hat{i}+\hat{j}+\hat{k}\right)$ are equidistant from the plane $\overrightarrow{r}5\hat{i}+\dot{2}\hat{j}+\hat{k}+9=0$

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4. Find the equations of the planes parallel to the plane $x-2y+2z-3=0$ which is at a unit distance from the point $(1, 2, 3)\cdot$

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

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

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

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

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9. Two systems of rectangular axes have the same origin. If a plane cuts them at distances $a, b, canda', b', c'$ respectively, prove that $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{a^{'2}} + \frac{1}{b^{'2}} + \frac{1}{c^{'2}}$

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10. A variable plane is at a constant distance p from the origin and meets the coordinate axes in A, B, C. Show that the locus of the centroid of the tehrahedron $OABCisx^{-2} + y^{-2} + z^{-2} = 16p^{-2}$.

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11. Find the equation of the plane passing through the intersection of the planes $2x - 3y + z - 4 = 0andx - y + z + 1 = 0$ and perpendicular to the plane $x + 2y - 3z + 6 = 0$.

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12. Find the equation of the plane through the line of intersection of $\overrightarrow{r} 2\hat{i} - 3\dot{\hat{j}} + 4\hat{k} = 1 and \overrightarrow{r} \hat{i} \dot{-} \hat{j} + 4 = 0$ and passing through $(2, -1, 1)$

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

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14. Find the equation of a plane through the intersection of the planes $\overrightarrow{r} \hat{i} + 3\dot{\hat{j}} - \hat{k} = 5 and \overrightarrow{r} 2\hat{i} \dot{-} \hat{j} + \hat{k} = 3$ and passing through the point $(1, 1, 1)\cdot$

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15. Find the vector equation of the following planes in non-parametric form: (i) $\vec{r} = \left(2\hat{i} + 2\hat{j} - \hat{k}\right) + \lambda\left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + \mu\left(5\hat{i} - 2\hat{j} + 7\hat{k}\right).$

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16. Find the vector equation of the plane $\vec{r} = (1 + s - t)\hat{i} + (2 - s)\hat{j} + (3 - 2s + 2t)\hat{k}$ in non-parametric form.

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17. Find the Cartesian form the equation of the plane $\vec{r} = (s + t)\hat{i} + (2 + t)\hat{j} + (3s + 2t)\hat{k}.$=15

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18. Find the vector equation of the following plane in scalar product form: $\vec{r} = \left(\hat{i} - \hat{j}\right) + \lambda\left(\hat{i} + \hat{j} + \hat{k}\right) + \mu\left(-4\hat{i} - 2\hat{j} + 3\hat{k}\right).$

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19. The plane $x - 2y + 3z = 0$ is rotated through a right angle about the line of intersection with the plane $2x + 3y - 4z = 0$, find the equation of the plane in its new position.

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20. The plane $lx + my = 0$ is rotated through an angle α about its line of intersection with the $planez = 0$. Prove that the equation of the in its new position if $lx + my \pm \left(\sqrt{l^2 + m^2}\tan\alpha\right)z = 0.$

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

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22. Find the vector equation of the plane passing through the intersection of the planes $x-2y+z=1 and 2x+y+z=8$ and parallel to the line with direction ratios proportional to $1, 2, 1$. Find also the perpendicular distance of $(1, 1, 1)$ from this plane.

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23. If 30 oxen can plough $\frac{1}{7}$th of the field in 4 hrs , in how many hour will 18 oxen take to do the remaining work?

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24. Find the equation 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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25. 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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26. Show that the line whose vector equation is $\vec{r} = \left(2\hat{i} - 2\hat{j} + 3\right) + \lambda\left(\hat{i} - \hat{j} + 4\hat{k}\right)$ is parallel to the plane whose vector equation $\vec{r}\,\hat{i} + 5\dot{\hat{j}} + \hat{k} = 5$. Also, find the distance between them.

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27. Show that the line whose vector equation is $\vec{r} = 2\hat{i} + 5\dot{\hat{j}} - 7\hat{k} + \lambda\left(\hat{i} + 3\hat{j} + 4\hat{k}\right)$ is parallel to the plane whose vector equation is $\vec{r}\,\hat{i} + \dot{\hat{j}} - \hat{k} = 7$. Also find the distance between them.

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28. Find the vector equation of the line passing through the point $(1, -1, 2)$ and perpendicular to the plane $2x - y - 3z - 5 = 0$.

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

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30. Find the plane passing through $(4, -1, 2)$ and parallel to the lines $\frac{x+2}{3} = \frac{y-2}{-1} = \frac{z+1}{2} and \frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{3}$

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31. Find the angle between the lines $\vec{r} \dot{=} \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} + \hat{j} + \hat{k}\right)$ and the plane

$\overrightarrow{r}\left(2\hat{i}-\dot{\hat{j}}+\hat{k}\right)=5.$

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32. Find the angle between the lines $x-2y+z=0=x+2y-2zandx+2y+z=0=3x+9y+5z\cdot$

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33. Find the distance between the parallel planes, $\overrightarrow{r}\left(2\hat{i}-3\dot{\hat{j}}+6\hat{k}\right)=5$ and $\overrightarrow{r}\left(6\hat{i}-9\dot{\hat{j}}+18\hat{k}\right)+20=0.$

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34. Find the distance between the parallel planes $2x-y+2z+3=0and4x-2y+4z+5=0.$

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35. Find the distance between the parallel planes $\vec{r}\,\hat{i} + 2\hat{j} + 3\hat{k} + 7 = 0 and \vec{r}\,2\hat{i} + 4\hat{j} + 6\hat{k} + 7 = 0.$

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

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37. Find the distance of the point $(33, 3)$ from the plane $\vec{r}\,5\hat{i} + 2\hat{j} - 7\hat{k} + 9 = 0$

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38. Find the equations of the planes parallel to the plane $x + 2y - 2z + 8 = 0$ which are at distance of 2 units from the point $(2, 1, 1)$.

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39. Find the distance between the parallel planes $x + y - z + 4 = 0 and x + y - z + 5 = 0.$

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40. Find the equation of the plane through the intersection of the planes $3x - 4y + 5z = 10$ and $2x + 2y - 3z = 4$ and parallel to the line $x = 2y = 3z$.

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41. If the line drawn from $(4, \ -1, 2)$ meets a plane at right angles at the point $(-10, 5, 4)$, find the equation of the plane.

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42. If O is the origin and the coordinates of A are (a, b, c) . Find the direction cosines of OA and the equation of the plane through A at right angles to OA.

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43. Find the vector equation of a lane passing through a point having position vector $2i + 3j - 4k$ and perpendicular to the vector $2i - j + 2k$. Also, reduce it to Cartesian form.

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44. The foot of perpendicular drawn from the origin to the plane is $(4, -2, -5)$. Find the equation of the plane.

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45. If he line drawn from the point $(-2, -1, -3)$ meets a plane at right angle at the point $(1, -3, 3)$, find the equation of the plane.

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46. Find the equation of the plane which bisects the line segment joining the points $A(2, 3, 4) and B(4, 5, 8)$ at right angles.

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47. Find the equation of the plane passing through the point $(1, -1, 2)$ having $2, 3, 2$ as direction ratios of normal to the plane.

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48. Let $\overrightarrow{n}$ be a vector of magnitude $2\sqrt{3}$ such that it makes equal acute angles with the coordinate axes. Find the vector and Cartesian forms of the equation of a plane passing through $(1, -1, 2)$ and normal to $\overrightarrow{n}$.

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49. A vector $\overrightarrow{n}$ of magnitude 8 units is inclined to x-axis at 45^0, y-axis at 60^0 and an acute angle with z-axis. If a plane passes through a point $(\sqrt{2}, -1, 1)$ and is normal to $\overrightarrow{n}$, find its equation in vector form.

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50. A plane passes through the point $(1, -2, 5)$ and is perpendicular to the line joining the origin to the point $3\hat{i} + \hat{j} - \hat{k}$. Find the vector and Cartesian forms of the equation of the plane.

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51. Find the vector and Cartesian equations of the plane containing the two lines

$\vec{r} = 2\hat{i} + \hat{j} - 3\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 5\hat{k}\right) and, \vec{r} = 3\hat{i} + 3\hat{j} + 2\hat{k} + \mu\left(3\hat{i} - 2\hat{j}\right.$

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52. If the lines $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - k$ are coplanar, then $k =$ (a)-4 (2)3 (3)2 (4) 4 (5)1

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53. Equation of plane which passes through the intersection point of the lines $L_1 : \frac{x-1}{3} = \frac{y-2}{1} = \frac{z-3}{2}$ and $L_2 : \frac{x-2}{2} = \frac{y-1}{2} = \frac{z-6}{-1}$ and has the largest distance from origin

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54. Find the coordinates of the point where the line $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{2}$ intersect the plane $x-y+z-5=0$. Also, find the angel between the line and the plane.

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55. Find the shortest distance between the skew-line4s $l_1 : \frac{x-1}{2}=\frac{y+1}{1}=\frac{z-2}{4}$ and $l_2 : \frac{x+2}{4}=\frac{y-0}{-3}=\frac{z+1}{1}$

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56. Find the distance between the line $\vec{r}=\left(-\hat{i}+3\hat{k}\right)+\lambda\left(\hat{i}-2\hat{j}\right)$ and the line passing through $(0,\ -1, 2) and (1,\ -2, 3)$.

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57. Find the image of the point having position vector $\hat{i} + 3\hat{j} + 4\hat{k}$ in the planer. $\vec{r}$. $\left(2\hat{i} - \hat{j} + \hat{k}\right) + 3 = 0$

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58. A plane meets the coordinate axes at $A, BandC$ respectively such that the centroid of triangle ABC is $(1, -2, 3)$. Find the equation of the plane.

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59. 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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60. Show that the four points $(0, -1, -1), (-4, 4, 4), (4, 5, 1) and (3, 9, 4)$ are coplanar. Find the equation of plane containing them.

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61. If from a point $P(a, b, c)$ prpendiculars $PA and PB$ are drawn to $yz and zx - planes,$ find the eqution of th plane OAB.

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62. Find the equation of the plane through the points $A(2, 2, -1), B(3, 4, 2) and C(7, 0, 6.)$

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

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64. A plane meets the coordinate axes in A, B, C such that eh centroid of triangle ABC is the point $(p, q, r)\cdot$ Show that the equation of the plane is $\frac{x}{p}+\frac{y}{q}+\frac{z}{r}=3.$

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65. Write the equation of the plane whose intercepts on the coordinate axes are $-4, 2and3$ respectively.

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66. Show that the four point $(0, -1, -1), (4, 5, 1), (3, 9, 4) and (-4, 4, 4)$ are coplanar and find the equation of the common plane.

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

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68. Find the image of the point with position vector $3\hat{i} + \hat{j} + 2\hat{k}$ in the plane $\overrightarrow{r} 2\hat{i} - \dot{\hat{j}} + \hat{k} = 4.$ Also, find the position vectors of the foot of the perpendicular and the equation of the perpendicular line through $3\hat{i} + \hat{j} + 2\hat{k}.$

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69. Find the length and the foot of perpendicular from the point $(1, 3/2, 2)$ to the plane $2x - 2y + 4z + 5 = 0$.

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70. 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 $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ with the plane $x - y + z = 5$.

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71. Find the equation of the plane through the intersection of the planes $3x - 4y + 5z = 10 and 2x + 2y - 3z = 4$ and parallel to the line $x = 2y = 3z$.

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72. Show that the plane whose vector equation is $\vec{r}\hat{i}+2\hat{j}-\hat{k}=1.$ and the line whose vector equation is $\vec{r}=\left(-\hat{i}+\hat{j}+\hat{k}\right)+\lambda\left(2\hat{i}+\hat{j}+4\hat{k}\right)$ are parallel. Also, find the distance between them.

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73. Prove that the lines $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7} and \frac{x-2}{1}=\frac{y-4}{4}=\frac{z-6}{7}$ are coplanar . Also, find the plane containing these two lines.

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74. 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 coplanar. Also, find the plane containing these two lines.

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75. Find the distance of the point $P(-1, -5, -10)$ from the point of intersection of the line joining the points $A(2, -1, 2) and B(5, 3, 4)$ with the plane $x - y + z = 5$.

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76. Find the distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$ measured parallel to the line whose direction cosines are proportional to $2, 3, -6$.

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

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

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79. Find the equation of the plane passing through the points $(1, -1, 2) and (2, -2, 2)$ and which is perpendicular to the plane $x - 2y + 2z = 9$

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80. Find the equation of the plane passing through the point whose coordinates are $(-1, 1, 1) and (1, -1, 1)$ and perpendicular to the plane $x + 2y + 3z = 5$.

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81. 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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82. 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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83. Find the angle between the planes $x + y + 2z = 9 adn 2x - y + z = 15.$

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84. If the planes Find the angle between the planes $\vec{r}2\hat{i}-\dot{\hat{j}}+\lambda\hat{k}=5and\vec{r}3\hat{i}+2\dot{\hat{j}}+2\hat{k}=4.$ are perpendicular. Find the value of $\lambda\cdot$

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85. Find the vector equation of the plane passing through the points $3\hat{i}+4\hat{j}+2\hat{k}, 2\hat{i}-2\hat{j}-\hat{k}and7\hat{i}+6\hat{k}\cdot$

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86. Find the angle between the planes $\vec{r}2\hat{i}-\dot{\hat{j}}+\hat{k}=6and\vec{r}\hat{i}+\dot{\hat{j}}+2\hat{k}=5.$

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87. Find the vector equation of the plane passing through the points $(1, 1, 0), (1, 2, 1) and (-2, 2, -1)$.

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88. Find the vector equation of the plane passing through the points $A(a, 0, 0), B(0, b, 0) and C(0, 0, c)$. Reduce it to normal form. If plane ABC is at a distance p from the origin, prove that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2}$.

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89. Reduce the equation $\vec{r} \dot{3\hat{i} - 4\hat{j}} + 12\hat{k} = 5$ to normal form and hence find the length of perpendicular from the origin to the plane.

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90. Find the vector equation of a plane which is at a distance of 8 units from the origin and which is normal to the vector $2\hat{i} + \hat{j} + 2\hat{k}$.

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91. Find the direction cosines of perpendicular from the origin to the plane $\overrightarrow{r} 2\hat{i} - 3\dot{\hat{j}} - 6\hat{k} + 5 = 0.$

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92. 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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93. Find the equation of a plane which is at a distance of $3\sqrt{3}$ units from the origin and the normal to which is equally inclined with the coordinate axes.

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94. Find the equation of the plane passing through the point $(-1, 2, 1)$ and perpendicular to the line joining the points $(-3, 1, 2) and (2, 3, 4)$. Find also the perpendicular distance of the origin from this plane.

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95. Find the vector equation of the plane passing through the points $A(2, 2, -1), B(3, 4, 1) and C(7, 0, 6)$. Also, find the Cartesian equation of the plane.

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96. Find the equation of the plane passing through the point $(1, 2, 1)$ and perpendicular to the line joining the points $(1, 4, 2) and (2, 3, 5)$. find also the perpendicular distance of the origin from this plane.

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97. If from a point $P(a, b, c)$ perpendiculars $PAandPB$ are drawn to $YZandZX - planes$ find the vectors equation of the plane OAB.

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98. Find the vector equation of the plane passing through the points having position vectors $\hat{i} + \hat{j} - 2\hat{k}, 2i - \hat{j} + \hat{k} and \hat{i} + 2\hat{j} + \hat{k}$.

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99. Find the equation of the plane through the points $P(1,\ 1,\ 0),\ Q(1,\ 2,\ 1) and\ R(\ -2,\ 2,\ \ -1)$.

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100. Find the equation of the plane passing through the following points:

$(2, 1, 0), (3, -2, -2) and (3, 1, 7)$.

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101. Find the equation of the plane passing through the following points:

$(-5, 0, -6), (-3, 10, -9) and (-2, 6, -6)$.

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102. Find the equation of the plane passing through the following points:

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

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103. Find the equation of the plane passing through the following points:

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

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104. Find the equation of the plane passing through the following points:

$(0, \ -1, \ 0), (3, \ 3, \ 0) and \ (1, \ 1, \ 1).$

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105. Show that the following points are coplanar:

$(0, \ -1, \ 0), \ (2, \ 1, \ -1), \ (1, , 1 , 1) and \ (3, \ , 3 \ 0).$

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106. Show that the following points are coplanar:

$(0, \ 4, \ 3), \ (-1, \ -5, \ -3), \ (-2, \ -2, \ 1) and \ (1, \ 1, \ -1).$

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107. Show that the point (0, -1, -1), (4 5, 1), (3, 9, 4) and (-4, 4, 4) are coplanar and find the equation of the common plane.

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108. Reduce the equation of the plane $2x + 3y - z = 6$ to intercept form and find its intercepts on the coordinate axes.

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109. Write the equation of the plane whose intercepts on the coordinate axes are 2, -3 and 4.

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110. Reduce the equations of the following planes in intercept form and find its intercepts on the coordinate axes: $4x + 3y - 6z - 12 = 0$

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111. Reduce the equation of the plane $2x + 3y - 4 = 12$ to intercept form and find its intercepts on the coordinate axes.

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112. Reduce the equations of the following planes in intercept form and find its intercepts on the coordinate axes: $2x - y + z = 5$

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113. Find the equation of the plane passing through the point (2, 4, 6) and making equal intercepts on the coordinate axes.

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114. Find the equation in Cartesian form of the plane passing through the point $(3, -3, 1)$ and normal to the line joining the points (3, 4, -1) and (2, -1, 5).

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115. Find the vector equation of the plane whose Cartesian form of equals $3x - 4y + 2z = 5$.

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116. Find a normal vector to the plane $2x - y + 2z = 5$. Also, find a unit vector normal to the plane.

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117. Find the angle between the normal to the planes $2x - y + z = 6\, and\, x + y + 2z = 7.$

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118. Find the angles at which the normal vector to the plane $4x + 8y + z = 5$ is inclined to the coordinate axes.

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119. Find the vector equation of a plane passing through a 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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120. Find the Cartesian form of equation of a plane whose vector equation is : $\vec{r} \cdot \left(12\hat{i} - 3\hat{j} + 4\hat{k}\right) + 5 = 0$

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121. Find the Cartesian form of equation of a plane whose vector equation is : $\vec{r}\left(-\hat{i}+\hat{j}+2\hat{k}\right)=9$

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122. Find the vector equations of the coordinates planes.

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123. Find the vector equation of each one of following plane: $2x-y+2z=8$

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124. Find the vector equation of each one of following plane: $x + y - z = 5$

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125. Find the vector equation of each one of following plane: $x + y = 3$

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126. Find the vector and Cartesian equations of a plane passing through the point $(1, -1, 1)$ and normal to theline joining the point $(1, 2, 5)$ and $(-1, 3, 1)$.

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127. If $\vec{n}$ is a vector of magnitude $\sqrt{3}$ and is equally inclined with an acute angle with the coordinate axes. Find the vector and Cartesian forms of the equation of a plane which passes through (2, 1, -1) and is normal to $\vec{n}$

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128. The coordinate of the foot of the perpendicular drawn from the origin to a plane are (12, -4, 3). Find the equation of the plane.

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129. Find the equation of the plane passing through the point $(2, 3, 1)$ having $(5, 3, 2)$ as the direction ratio is of the normal to the plane.

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130. If the axes are rectangular and P is the point (2, 3, -1), find the equation of the plane through P at right angle to OP.

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131. Find the intercepts made on the coordinate axes by the plane $2x + y - 2z = 3$ and find also the direction cosines of the normal to the plane.

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132. Find the equation of the plane that bisects the line segment joining points (1, 2, 3) and (3, 4, 5) and is at right angle to it.

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133. Show that the normal to the following planes are perpendicular to each other. $x - y + z - 2 = 0 \; and \; 3x + 2y - z + 4 = 0$

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134. Show that the normal to the following planes are perpendicular to each other. $\vec{r}\left(2\hat{i}-\hat{j}+3\hat{k}\right)=5$ & $\vec{r}\left(2\hat{i}-2\hat{j}-2\hat{k}\right)=5$

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135. Show that the equation of the planes are perpendicular to each other. $\rightarrow r2\hat{i}-\hat{j}+3\hat{k}=5$

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136. Show that the normal vector to the plane $2x+2y+2z=3$ is equally inclined with the coordinate axes.

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137. Find a vector of magnitude 26 units normal to the plane $12x-3y+4z=1$.

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

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139. 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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140. If O be the origin and the coordinates of P be$(1, \quad 2, \quad 3)$, then find the equation of the plane passing through P and perpendicular to OP.

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141. Find the vector equation of a plane at a distance of 5 units from the origin and has $\hat{i}$ as the unit vector normal to it.

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142. Reduce the equation of the plane $x - 2y - 2z = 12$ to normal form and hence find the length of the perpendicular for the origin to the plane. Also, find the direction cosines of the normal to the plane.

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143. Find the vector equation of a plane which is at a distance of 6 units from the origin and has 2, -1, 2 as the direction ratios of a normal to it. Also, find the coordinates of the foot of the normal drawn from the origin.

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144. Find the vector equation of a plane which is at a distance of 3 units from the origin and has $\hat{k}$ as the unit vector normal to it.

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145. Find the vector equation of a plane which is at a distance of 5 units from the origin and which is normal to the vector $\hat{i} - 2\hat{j} - 2\hat{k}$.

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146. Reduce the equation $2x - 3y - 6z = 14$ to the normal form and hence fine the length of perpendicular from the origin to the plane. Also, find the direction cosines of the normal to the plane.

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147. Write the normal form of the equation of the plane $2x - 3y + 6z + 14 = 0$.

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148. The direction ratios of the perpendicular from the origin to a plane are 12,-3,4 and the length of the perpendicular is 5. Find the equation of the plane.

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

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150. 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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151. Find the distance of the plane $2x - 3y + 4z - 6 = 0$from the origin.

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

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153. Find the vector equation of the plane passing through the points (1, 1, -1), (6, 4, -5) and (-4, -2, 3).

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154. Show that the planes $2x + 6y - 6z = 7 \, and \, 3x + 4y + 5z = 8$ are at right angles.

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155. Find the equation of the plane through the points (2, 1, -1) and (-1, 3, 4) and perpendicular to the plane $x - 2y + 4z = 1$. Also show that the plain thus obtained contains the line $\vec{r} = -\hat{i} + 3\hat{j} + 4\hat{k} + \lambda\left(3\hat{i} - 2\hat{j} - 5\hat{k}\right)$.

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156. Find the angle between the plane: $\vec{r}\left(2\hat{i} - 3\hat{j} + 4\hat{k}\right) = 1 \; and \; \vec{r}\left(-\hat{i} + \hat{j}\right) = 4$.

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157. Find the angle between the plane: $\vec{r}\left(2\hat{i} - \hat{j} + 2\hat{k}\right) = 6 \; and \; \vec{r}\left(3\hat{i} + 6\hat{j} - 2\hat{k}\right) = 9$.

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158. Find the angle between the plane: $\vec{r}\left(2\hat{i}+3\hat{j}-6\hat{k}\right)=5\ and\ \vec{r}\left(\hat{i}-2\hat{j}+2\hat{k}\right)=9.$

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159. Find the angle between the plane: $2x-y+z=4\ and\ x+y+2z=3$

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160. Find the angle between the plane: $x-y+z=5\ and\ x+2y+z=9$

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161. Find the angle between the two planes $2x+y2z=5$and $3x6y2z=7$ using vector method.

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162. Find the angle between the plane:

$x + y - 2z = 3 \; and \; 2x - 2y + z = 5$.

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163. Find the angle between the plane:

$2x - 3y + 4z = 1 \; and - x + y = 4.$

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164. Show that the following planes are at right angle:

$\overrightarrow{r}\left(2\hat{i} - \hat{j} + \hat{k}\right) = 5 \; and \; \overrightarrow{r}\left(-\hat{i} - \hat{j} + \hat{k}\right) = 3.$

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165. Show that the following planes are at right angle: $x - 2y + 4z = 10 \; and \; 18x + 17y + 4z = 49.$

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166. Determine the value of λ for which the following plane are perpendicular to each other. $\overrightarrow{r}\left(\hat{i} + 2\hat{j} + 3\hat{k}\right) = 7 \; and \; \overrightarrow{r}\left(\lambda\hat{i} + 2\hat{j} - 7\hat{k}\right) = 26.$

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167. Determine the value of λ for which the following plane are perpendicular to each other. $2x - 4y + 3z = 5 \; and \; x + 2y + \lambda z = 5$

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168. Determine the value of λ for which the following plane are perpendicular to each other. $3x - 6y - 2z = 7$ and $2x + y - \lambda z = 5$

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

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

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

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

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176. Find the vector equation of the following planes in scalar product form $\left(\vec{r}\dot{\vec{n}} = d\right)$: $\vec{r} = \left(2\hat{i} - \hat{k}\right) + \lambda\hat{i} + \mu\left(\hat{i} - 2\hat{j} - \hat{k}\right)$.

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177. Find the vector equation of the plane $\vec{r} = (1 + s - t)\hat{i} + (2 - s)\hat{j} + (3 - 2s + 2t)\hat{k}$ in non-parametric form.

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178. Find the vector equation of the following planes in scalar product form

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

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179. Find the vector equation of the following planes in scalar product form

$$\left(\to r\dot{\longrightarrow}n=d\right):\to r=\hat{i}-\hat{j}+\lambda\left(\hat{i}+\hat{j}+\hat{k}\right)+\mu\left(4\hat{i}-2\hat{j}+3\hat{k}\right).$$

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

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181. Find the vector equation of the following planes in non parametric form: $\rightarrow r = (\lambda - 2\mu)\hat{i} + (3 - \mu)\hat{j} + (2\lambda + \mu)\hat{k}$

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182. Find the vector equation of the following planes in non parametric form: $\rightarrow r = \left(2\hat{i} + 2\hat{j} - \hat{k}\right) + \lambda\left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + \mu\left(5\hat{i} - 2\hat{j} + 7\hat{k}\right).$

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183. Find the equation of lane passing through the point $\hat{i} + \hat{j} + \hat{k}$ and parallel to the point $\rightarrow r 2\hat{i} - \dot{\hat{j}} + 2\hat{k} = 5.$

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184. 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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185. Direction ratios of the normal to the plane passing through the points $(2, 1, 3)$ and the line of intersectionof the planes $x + 2y + z = 3$ and $2x - y - z = 5$ are (A) 13, 6, 1 (B) 4, 3, 2 (C) 4, 3, 2 (D) none

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

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187. Find the equation of the plane which is parallel to $2x - 3y + z = 0$ and which passes through (1, -1, 2).

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

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189. Find the equation of the plane passing through the line of intersection of the planes $2x - 7y + 4z - 3 = 0, \; 3x - 5y + 4z + 11 = 0$ and the point $(- 2, \; 1, \; 3)$.

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190. Find the equation of the plane through the point $2\hat{i} + \hat{j} - \hat{k}$ and passing through the line of intersection of the plane $\overrightarrow{r}\left(\hat{i} + 3\hat{j} - \hat{k}\right) = 0\ and\ \overrightarrow{r}\left(\hat{j} + 2\hat{k}\right) = 0.$

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

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192. Find the equation of the plane through the line of intersection of the planes $x + 2y + 3z + 4 = 0\ and\ x - y + z + 3 = 0$ and passing through the origin.

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193. Find the vector equation (in scalar product form) of the plane containing the line of intersection of the planes $x - 3y + 2z - 5 = 0 \, and \, 2x - y + 3z - 1 = 0 \, and$ passing through $(1, \ -2, \ 3)$.

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194. Find the equation of the plane which is perpendicular to the plane $5x + 3y + 6z + 8 = 0$ adn which containls the line of intersedtion of the planes $x + 2y + 3z - 4 = 0 and 2x + y - z + 5 = 0.$

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195. Find the equation of the plane through the line of intersection of the planes $\overrightarrow{r}\left(\hat{i} + 3\hat{j}\right) - 6 = 0 \, and \, \overrightarrow{r}\left(3\hat{i} - \hat{j} - 4\hat{k}\right) = 0,$ which is at a unit distance from the origin.

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196. 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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197. 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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198. Prove that if a plane has the 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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199. If the points $(1, 1, \lambda) and (-3, 0, 1)$ be equidistant from the plant $\vec{r} \cdot \left(3\hat{i} + 4\hat{j} - 12\hat{k}\right) + 13 = 0$ find the value of λ.

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

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201. Find the equation of a plane passing through the pint $P(6, 5, 9)$ and parallel to the plane determined by the points $A(3, -1, 2) B(5, 2, 4) and C(-1, -1, 6)$. Also find the distance of this plane from the point A.

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202. A variable plane is at a constant distance p from the origin and meets the coordinate axes in A, B, C . Show that the locus of the centroid of the tehrahedron $OABCisx^{-2} + y^{-2} + z^{-2} = 16p^{-2}$.

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203. A variable plane at a constant distance p from the origin meets the coordinate axes in points A,B and C respectively.Through these points , planes are drawn parallel to the coordinate planes, show that locus of the point of intersection is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$

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204. Find the distance of the point $2\hat{i} - \hat{j} - 4\hat{k}$ from the plane $\vec{r}\cdot\left(3\hat{i} - 4\hat{j} + 12\hat{k}\right) - 9 = 0.$

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

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206. Show that the points (1, 1, 1) and (-3, 0, 1) are equidistant from the plane $3x + 4y - 12z + 13 = 0.$

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207. Find the equations of the plane parallel to the plane $x - 2y + 2z - 3 = 0$ and which are at a unit distance from the point (1, 1, 1).

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208. Find the distance of the point (2, 3, 5) from the xy-plane.

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209. If the product of distances of the point $(1, 1, 1)$ from the origin and plane $x - y + z + \lambda = 0$ be 5 then $\lambda =$

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210. Find the distance between the point $(7, 2, 4)$ and the plane determined by the points $a(2, 5, -3), B(-2, -3, 5)$ and $C(5, 3, -3)\cdot$

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211. Find the distance between the planes $2x - y + 2z = 4$ and $6x - 3y + 6z = 2.$

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212. Prove that the four points having position vectors are non-coplanar:

$\hat{i} + 2\hat{j} + 3\hat{k}, 2\ \hat{i} + \hat{j} + 3\hat{k}\ and\ \hat{i} + \hat{j} + \hat{k}$

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213. Find the equation of the plane mid parallel to the planes $2x - 2y + z + 3 = 0\ and\ 2x - 2y + z + 9 = 0.$

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214. Reduce the equation of line $x - y + 2z = 5adn3x + y + z = 6$ in symmetrical form. Or Find the line of intersection of planes $x - y + 2z = 5and3x + y + z = 6.$

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

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217. Find the equation of the plane passing through the intersection of the planes $4x-y+z=0\,and\,x+y-z=4$ and parallel to the line with direction ratios proportional to 2, 1, 1.

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218. Find the equation of the plane passing through the point $A(1,\ 2,\ 1)$ and perpendicular to the in joining the points $P(1,\ 4,\ 2) and\ Q(2,\ 3, 5)\cdot$

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219. Find an equation or the line that passes through the point $P(2,\ 3,\ 1)$ and is parallel to the line of intersection o the planes $x+2y-3z=4\ and\ x-2y+z=0$.

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220. Find the angle between the line $\rightarrow r=\left(2\hat{i}+3\hat{j}+9\hat{k}\right)+\lambda\left(2\hat{i}+3\hat{j}+4\hat{k}\right)$ and the plane $\rightarrow r\left(\hat{i}+\dot{\hat{j}}+\hat{k}\right)=5.$

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

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222. Find the angle between the line joining the points $(3, \ -4, \ -2) and \ (12, \ 2, \ 0)$ and the plane $3x - y + z = 1$.

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223. The line $\vec{r} = \hat{i} + \lambda\left(2\hat{i} - m\hat{j} - 3\hat{k}\right)$ is parallel to the plane $\vec{r} \cdot \left(m\hat{i} + 3\hat{j} + \hat{k}\right) = 4$. Find m.

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

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225. Find the equation of the plane passes through the point $(2, 3, -4)$ and $(1, -1, 3)$ and parallel to x-axis.

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

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227. Find the vector and Cartesian equations 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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228. Prove that the line of section of the planes $5x + 2y - 4z + 2 = 0 \, and \, 2x + 8y + 2z - 1 = 0$ is parallel to the plane $4x - 2y - 5z - 2 = 0.$

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229. Find the equation of the plane passing through the points $(2, 2, -1)$ and $(3, 4, 2)$ and parallel to the line whose direction ratios are $(7, 0, 6)$

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230. Find the coordinates 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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231. Find the vector and Cartesian forms of the equation of the plane passing through the point $(1, 2, -4)$ and parallel to the lines $\vec{r} = (\hat{i} + 2\hat{j} - 4\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k}) and \vec{r} = (\hat{i} - 3\hat{j} + 5\hat{k}) + \mu(\hat{i} +$ Also find the distance of the point (9, -8, -10) from the plane thus obtained.

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232. 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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233. Find the coordinates 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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234. Find the vector equation of the line passing through (1, 2, 3) and perpendicular to the plane $\rightarrow r\left(\hat{i}+2\dot{\hat{j}}-5\hat{k}\right)=9.$

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235. 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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236. Find the value of λ such that the lines $\dfrac{x-2}{6}=\dfrac{y-1}{\lambda}=\dfrac{z+5}{-4}$ is perpendicular to the plane $3x-y-2z=7.$

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237. Find the equation of the plane passing through the points $(-1,2,0),(2,2,-1)$ and parallel to line $\dfrac{x-1}{1}=\dfrac{2y+1}{2}=\dfrac{z+1}{-1}$

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238. 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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239. Find the coordinate of the point where the line through (5, 1, 6) and (3, 4, 1) crosses the i. yz-plane ii. zx-plane.

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240. 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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241. Find the distance of the point $P(3,\ 4,\ 4)$ from the point where the line joining the points $A(3,\ -4,\ -5) and B(2,\ -3,\ 1)$ intersects the plane $2x+y+z=7$.

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242. 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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243. If $4x+4y-\lambda z=0$ is the equations of the plane through the origin that contains the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$, find the value of λ.

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244. If the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4} and \frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$

intersect, then find the value of k.

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245. Show that the lines

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

are coplanar. Also, find the equation of the plane containing them.

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246. Show that the lines

$\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and $\frac{x}{1} = \frac{y-7}{-3} = \frac{z+7}{2}$ are coplanar.

Also, find the equation of the plane containing them.

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247. Find the equation of the plane which contains two parallel to 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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248. Show that the plane whose vector equation is $\vec{r}\hat{i}+2\dot{\hat{j}}=\hat{k}=3$ contains the line whose vector equation is $\vec{r}\hat{i}\dot{+}\hat{j}+\lambda\left(2\hat{i}+\hat{j}+4\hat{k}\right)$.

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249. Find the vector equation of the plane passing through the points (3, 4, 2) and (7, 0, 6) and perpendicular to the plane $2x-5y-15=0$. Also, show that the plane thus obtained contains the line $\vec{r}=\hat{i}+3\hat{j}-2\hat{k}+\lambda\left(\hat{i}-\hat{j}+\hat{k}\right)$.

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

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251. Find the vector equation of the plane passing through three points with position vectors $\hat{i} + \hat{j} - 2\hat{k}$, $\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$. Also find the coordinates 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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252. Show that the lines $\frac{x5}{4}, \frac{y-7}{4} = \frac{z+3}{-5} \text{ and } \Big)x - 8\frac{)}{7} = \frac{y-4}{1} = \frac{z-5}{3}$ intersect each other

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253. Find the equation of a plane which passes through the point (3, 2, 0) and contains the line $\frac{x-3}{1}=\frac{y-6}{5}=\frac{z-4}{4}$.

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254. Find the shortest distance between the lines $\frac{x-2}{-1}=\frac{y-5}{2}=\frac{z-0}{3}$ and $\frac{x-0}{2}=\frac{y+1}{-1}=\frac{z-1}{2}$.

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255. Find the shortest distance between the lines , $\frac{x-1}{2}=\frac{y-3}{4}=\frac{x+2}{1}$ and $3x-y-2z+4=0=2x+y+z+1$

.

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256. Find the length and the foot of the perpendicular from the point $(7, 14, 5)$ to the plane $2x + 4y - z = 2$. Also, the find image of the point P in the plane.

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257. Find the image of point $(0, 0, 0)$ in the plnae $3x + 4 - 6z + 1 = 0$.

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258. Find the reflection of the point $(1, 2, -1)$ in the plane $3x - 5y + 4z = 5$.

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259. Find the coordinates of the foot of the perpendicular drawn from the point $(5, 4, 2)$ to the line $\frac{x+1}{2} = \frac{y-3}{3} = \frac{z-1}{-1}$. Hence or

otherwise deduce the length of the perpendicular.

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260. Find the coordinates of the foot of the perpendicular from the point (1, 1, 2) to the plane $2x - 2y + 4z + 5 = 0$. Also the find the length of the perpendicular.

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

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262. Find a vector in the direction of $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$, which has magnitude of 6 units.

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

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264. 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 $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + \lambda\left(3\hat{i} + 4\hat{j} + 12\hat{k}\right)$ with the plane $\vec{r} \cdot \left(\hat{i} - \hat{j} + \hat{k}\right) = 5$.

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

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

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

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269. Write the equation of the plane parallel to XOY-plane and passing through the point (2, -3, 5).

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270. Write the equation of the plane parallel to YOZ-plane and passing through (-4, 1, 0).

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271. Write the equation of the plane passing through points $(a, 0, 0), (0, b, 0) and (0, 0, c)$.

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272. Write the general equation of a plane parallel to X-axis.

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273. Write the intercepts made by the plane $2x - 3y + 4z = 12$ on the coordinate axes.

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274. Write the ratio in which the plane $4x + 5y - 3z = 4$ divides the line segment joining points $(-2, 1, 5)$ & $(3, 3, 2)$

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275. Write the plane $\overrightarrow{r}\left(2\hat{i} + 3\hat{j} - 6\hat{k}\right) = 14$ in normal form.

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276. Write the equation of the plane $\overrightarrow{r} = \overrightarrow{a} + \lambda\overrightarrow{b} + \mu\overrightarrow{c}$ in scalar product form.

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277. Write a vector normal to the plane $\vec{r} = l\vec{b} + m\vec{c}$

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278. Write the equation of the plane passing through (2, -1,1) and parallel to the plane $3x + 2y - z = 7$.

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279. Write the equation of the plane containing the lines $\vec{r} = \vec{a} + \lambda\vec{b}$ and $\vec{r} = \vec{a} + \mu\vec{c}$

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280. Write the position vector of the point where the line $\vec{r} = \vec{a} + \lambda \vec{b}$ meets the plane $\vec{r} \cdot \vec{n} = 0$.

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281. Write the value of k for which the line $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{k}$ is perpendicular to the normal to the plane $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) = 4$.

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282. Write the intercept cut off by the plane $2x + y - z = 5$ on x-axis.

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283. Find the length of the perpendicular drawn from the origin to the plane 2x $3y + 6z + 21 = 0$.

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284. Write the vector equation of the line passing through the point (1, -2, -3) and normal to the plane $\vec{r}\left(2\hat{i}+\hat{j}+2\hat{k}\right)=5.$

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

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286. The acute angle between the planes $2x-y+z=6\ and\ x+y+2z=3$ is 45^0 b. 60^0 c. 30^0 d. 75^0

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287. The equation of the plane thrugh the ointersection of lane $x+2y+3z=4$ and 2x+y-z-5 and $perpendic\underline{a}r \rightarrow thepla \ne$ 5x+3y+6z+8=0$is(A)$7x-2y+3z+81=0(B)23x+14y-9z+48=0(C) 51x+15y+50z+173=0` (D) none of these

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288. The distance between the planes $2x+2y-z+2=0 \; and \; 4x+4y-2z+5=0$ is $a.\ \frac{1}{2}$ b. $\frac{1}{4}$, c. $\frac{1}{6}$ d. none of these

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289. The image of the point (1, 3, 4) in the plane $2x-y+z+3=0$ is $(3,\ 5,\ 2)$ b. $(-3, 5,\ 2)$ c.$(3,\ 5,\ -2)$ d. $(3,\ -5,\ 2)$

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

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291. The distance of the line $\overrightarrow{r} = 2\hat{i} - 2\hat{j} + 3\hat{k} + \lambda\left(\hat{i} - \hat{j} + 4\hat{k}\right)$ from the plane $\overrightarrow{r} \cdot \left(\hat{i} + 5\hat{j} + \hat{k}\right) = 5$, is $\frac{5}{3\sqrt{3}}$ b. $\frac{10}{3\sqrt{3}}$ c. $\frac{25}{3\sqrt{3}}$ d. none of these

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292. The equation of the plane through the line $x + y + z + 3 = 0 = 2x - y + 3z + 1$ and parallel to the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ is $a.\, x - 5y + 3 = 7$ b. $x - 5y + 3z = 7$ c. $x + 5y = 3z = 7$ d. $x + 5y + 3z = -7$

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293. The vector equation of the plane containing the line $\vec{r} = \left(-2\hat{i} - 3\hat{j} + 4\hat{k}\right) + \lambda\left(3\hat{i} - 2\hat{j} - \hat{k}\right)$ and the point $\hat{i} + 2\hat{j} + 3\hat{k}$ is $a.$ $\vec{r} \cdot \left(\hat{i} + 3\hat{k}\right) = 10$ b. $\vec{r} \cdot \left(\hat{i} - 3\hat{k}\right) = 10$ c. $\vec{r} \cdot \left(3\hat{i} + \hat{k}\right) = 10$ d. none of these

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294. A plane meets the coordinate axes at $A,\ B,\ C$ such that the centroid of ΔABC is the point $(a,\ b,\ c)$. If the equation of the plane is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = k,\ then\ k =$ 1 b. 2 c. 3 d. none of these

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295. The distance between the point (3,4, 5) and the point where the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ meets the plane $x + y + z = 17,\ is$ 1 b. 2 c. 3 d. none of these

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296. A vector parallel to the line of intersection of the planes $\overrightarrow{r} = 3\hat{i} - \hat{j} + \hat{k} = 1\ and\ \overrightarrow{r}\left(\hat{i} + 4\hat{j} - 2\hat{k}\right) = 2$ is $a.\ -2\hat{i} + 7\hat{j} + 13\hat{k}$

b. $2\hat{i} + 7\hat{j} - 13\hat{k}$ c. $-2i - 7j + 13k$ d. $2i + 7j + 13k$

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297. If plane passes through the point (1, 1,1) and is perpendicular to the line, $\frac{x-1}{3} = \frac{y-1}{0} = \frac{z-1}{4}$, then its perpendicular distance from the origin is

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298. The equation of the plane parallel to the lines $x - 1 = 2y - 5 = 2z$ and $3x = 4y - 11 = 3z - 4$ and passing through the point $(2, 3, 3)$ is

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299. The distance of the point (-1, -5, -10) from the point of intersection of the line $\vec{r} = 2\hat{i} - \hat{j} + 2\hat{k} + \lambda\left(3\hat{i} + 4\hat{j} + 12\hat{k}\right)$ and the plane $\vec{r} \cdot \left(\hat{i} - \hat{j} + \hat{k}\right) = 5$ is a. 9 b. 17 c. 13 d. none of these

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300. The equation of the plane through the intersection of the plane $ax + by + cz + d = 0 \; and \; lx + my + n + p = 0$ and parallel to the line $y = 0, \; z = 0.$ $(A)(bl - am)y + (cl - an)z + dl - ap = 0$ $(B)(am - bl)x + (mc - bn)z + md - bp = 0$ $(c)(na - cl)d + (bn - cm)y + nd - cp = 0$ (D) None of these

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301. The equation of the plane which cuts equal intersects of unit length on the coordinate axes is $x + y + z = 1$ b. $x + y + z = 0$ c. $x + y - z = 1$ d. $x + y + z = 2$

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Others

1. Reduce in symmetrical form the equations of et line $x = ay + b, \ zs = cy + d \cdot$

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2. If the line $\rightarrow r = \left(\hat{i} - 2\hat{j} + \hat{k}\right) + \lambda\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ is parallel to the plane $\rightarrow r3\hat{i} - 2\dot{\hat{j}} + m\hat{k} = 14$, find the value of $m \cdot$

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