MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

THE PLANE

Solved Examples

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

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2. Show that the four points $A(1, -1, 1), B(2, 3, 1), C(1, 2, 3)$ and $D(0, -2, 3)$ are coplanar. Find the equation of the plane containing them.

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3. Find the equation of the plane which cuts off intercepts 3,6 and -4 from the axes of coordinates.

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

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

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6. 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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7. Find the vector equation of a plane which is at a distance of 6 units from the origin and which is normal to the vector $\left(\hat{i}+2\hat{j}-2\hat{k}\right)$.

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8. Find the vector equation of a plane which is at a distance of 6 units from the origin and which is normal to the vector $\left(\hat{i}+2\hat{j}-2\hat{k}\right)$.

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9. Find the vector equation of a plane passing through a point having position vector $\left(2\hat{i}-\hat{j}+\hat{k}\right)$ and perpendicular to the vector $\left(4\hat{i}+2\hat{j}-3\hat{k}\right)$. Also, reduce it to Cartesian form.

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

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

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

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13. Find the vectors equation of a plane whose Cartesian equation is $2x - 3y + 4z + 6 = 0$. Find the direction cosines of the normal to the plane and its distance from the origin.

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14. Find the vector equation of the plane whose Cartesian equation is $5y + 8 = 0$. Find the direction cosines of the normal to the plane and its distance from the origin.

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15. Find the Cartesian from the equation of the plane

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

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

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17. The foot of the perpendicular drawn from the origin to a plane is $(4, -2, -5)$. Find the equation of the plane in (i) vector form, ii) Cartesian form.

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

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

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

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22. Find the coordinates of the point where the line through $(3, -4, -5)$ and (2,-3,1) crosses the plane passing through the points (2,2,1),(3,0,1) and (4,-1,0).

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

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24. Find the distance of the point (3,4,5) from the plane $x + y + z = 2$, measured parallel to the line $2x = y = z$.

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25. Find the distance of the point $(-2, 3, \ -4)$ from the line $\frac{x+2}{3} = \frac{2y+3}{4} = \frac{3z+4}{5}$ measured parallel to the plane $4x + 12y - 3z + 1 = 0$.

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

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27. Find the image of the point $(1, \ 2, \ 3)$ in the plane $x+2y+4z=38$

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

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29. Find the distance of the point (2,3,4) from the plane $\vec{r}.\left(3\hat{i}-6\hat{j}+2\hat{k}\right)+11=0.$

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

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31. 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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32. 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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33. Find the distance between the parallel planes $2x - y + 3z + 40$ and $6x - 3y + 9z - 3 = 0.$

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

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35. Find the equations of the planes parallel to the plane $x - 2y + 2z - 3 = 0$ which is at a unit

distance from the point $(1, 2, 3)$.

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36. Find the equation of the plane passing through the point $(2, -3, 5)$ and parallel to the points $3x - 7y - 2z = 5$. Also, the find the distance between the two planes.

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37. The equation of the plane through the intersection of the planes $\vec{r}.\left(2\hat{i} + 6\hat{j}\right) + 12 = 0$

and $\vec{r}.\left(3\hat{i}-\hat{j}+4\hat{k}\right)=0$ and at a unit distance from the origin, is

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

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39. 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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40. A variable plane which remains at a constant distance 3p from the origin cuts the coordinate axes at A, B, C. Show that the locus of the centroid of triangle ABC is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$.

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41. 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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42. Find the vector equation of a plane which is parallel to the plane $\vec{r}.\left(2\hat{i} - \hat{j} + 2\hat{k}\right) = 5$ and passes through the point whose position vector is $\left(\hat{i} + \hat{j} + \hat{k}\right)$.

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43. Find the vector equation of plane which is paralel to the plane $\vec{r}.\left(2\hat{i}-3\hat{j}+5\hat{k}\right)+2=0$ and passes through the point (3,4,-1).

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44. Find the equation of the plane which is parallel to the plane $2x-3y+z+8=0$ and which passes through the point (-1,1,2).

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45. Find the distance between the parallel planes $2x - y + 3z + 40$ and $6x - 3y + 9z - 3 = 0$.

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

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47. 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 $x - y + z = 0$. Also find the distance of the plane so obtained from the origin.

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48. 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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49. 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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50. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}.\left(\hat{i}+3\hat{j}\right)-6=0$ and $\vec{r}.\left(3\hat{i}-\hat{j}-4\hat{k}\right)=0$, whose perpendicular distance from the origin is unity.

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51. Find the vector 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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52. 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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53. Find the vector equation of the plane passing thrugh the points (2,5,-3),(-2,-3,5),(5,3,-3).

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54. Find the vector equation of the plane passing through the points $(1, 1, 1), (1, -1, 1) and (-7, -3, -5)$.

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55. Find the angle between the planes.

$\vec{r}.\left(\hat{i}+\hat{j}+2\hat{k}\right)=5$ and $\vec{r}.\left(2\hat{i}-\hat{j}+\hat{k}\right)=8.$

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

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57. Find the value of λ for which the planes.

$\vec{r}.\left(\hat{i}+2\hat{j}+3\hat{k}\right)=13$ and

$\vec{r}.\left(\lambda\hat{i}+2\hat{j}-7\hat{k}\right)=9$, are perpendicular to each other.

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58. Find the angle between the plane: $7x+5y+6z+30=0$ and $3x-y-10z+4=0$

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59. Find the value of λ for which the planes $2x-4y+3z=7$ and $x+2y+\lambda z=18$ are perpendicular to each other.

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

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62. Find the equation of the plane passing through the point (1,3,2) and parallel to the plane is $3x - 2y + 2z + 33 = 0.$

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63. The angle between the line $\vec{r}.\left(\hat{i} + \hat{j} - 3\hat{k}\right) + \lambda\left(2\hat{i} + 2\hat{j} + \hat{k}\right)$ and the plane $\vec{r}.\left(6\hat{i} - 3\hat{j} + 2\hat{k}\right) = 5$, is

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64. Find the value of m for which the line $\vec{r}.=\left(\hat{i}+2\hat{j}-\hat{k}\right)+\lambda\left(2\hat{i}+\hat{j}+2\hat{k}\right)$ is parallel to the plane $\vec{r}.\left(3\hat{i}-2\hat{j}+m\hat{k}\right)=12$

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65. Show that the line $\vec{r}=\left(2\hat{i}-2\hat{j}+3\hat{k}\right)+\lambda\left(\hat{i}-\hat{j}+4\hat{k}\right)$ is parallel to the plane $\vec{r}.\left(\hat{i}+5\hat{j}+\hat{k}\right)=5.$

Also, find the distance between the given line and the given plane.

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

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

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68. Find the equations of the line passing through the point $(3, 0, 1)$ parallel to the planes $x + 2y = 0$ and $3y - z = 0$.

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69. Find the equation of the plane through the pont A(1,2,1) and perpendicular to the line joining the points P(1,4,2) and Q(2,3,5). Also find the distance of this plane from the line $\frac{x+3}{2} = \frac{y-5}{-1} = \frac{z-7}{-1}$

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70. 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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71. The plane passing through the point (4, -1, 2) and perallel to the lines $\frac{x+2}{3} = \frac{y-2}{-1} = \frac{z+1}{2}$ and $\frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{3}$ also passes through the point

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72. 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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73. Find ten 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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74. 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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75. Show that the equation by $by + cz + d = 0$ represents a plane parallel to the x-axis. Find the equation of a plane which is parallel to the x-axis and passes through the points A(2,3,1) and B(4,-5,3).

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76. Find the vector and Cartesian equations of the plane passing through the point (1,2,-4) and parallel to the lines

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

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

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77. Find the Cartesian and vector equation of the plane passing through the point (2,0,-1) and parallel to to the lines.

$\frac{x}{-3} = \frac{y-2}{4} = z + 1$ and $x - 4 = \frac{1-y}{2} = 2z.$

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78. Show that the line

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

$\vec{r} = \left(4\hat{i} - \hat{k}\right) + \mu\left(2\hat{i} + 3\hat{k}\right)$ are coplanar. Also find the equation of plane in which these lines lie.

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79. Show that the lines

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

are coplanar. Also find the equation of the plane containing the lines.

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80. 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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81. Find the equation of the plane passing through the parallel through lines $\frac{x-3}{3}=\frac{y+4}{2}=\frac{z-1}{1}$ and $\frac{x+1}{3}=\frac{y-2}{2}=\frac{z}{1}$.

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Exercise 28 A

1. Find the equationof the plane passing through each group of points.

i) A(2,2,-1), B(3,4,2) and C(7,0,6)

ii) A(0,-1,-1), B(4,5,1) and C(3,9,4)

iii) A(-2,6,-6), B(-3,10,-9) and C(-5,0,-6).

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2. Show that the four points A(3,2,-5, B(-1,4,-3), C(-3,8,-5) and D(-3,2,1) are coplanar. Find the equation

of the plane containing them.

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3. Show that the four points A(0,-1,0), B(2,1,-1), C(1,1,1) and D(3,3,0) are coplanar. Find the equation of the plane containing them.

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4. Write the equation of the plane whose intercepts on the coordinate axes are 2,-4 and 5 respectively.

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5. Reduce the equation of the plane $4x - 3y + 2z = 12$ to the intercept form, and hence find the intercepts made by the plane with the coordinate axes.

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6. Find the equation of the plane which passes through the point (2,-3,7) and makes equal intercepts on the coordinate axes.

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7. 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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8. Find the vector and the Casrtesian equations o the lane passing through the point (1,2,30 and perpendicular to the line with direction ratio 2,3,-4.

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9. 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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Exercise 28 B

1. Find the vector and Cartesian equations of a plane which is at a distance of 5 units from the origin and which has $\hat{k}$ as the unit vector normal to it.

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2. Find the vector and Cartesian equations of a plane which is at a distance of 7 units from the origin and whose normal vector from the origin is $\left(3\hat{i}+5\hat{j}-6\hat{k}\right)$.

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3. 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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4. Find the vector and Cartesian equations of a plane which is at a distance of 6 units from the origin and which has a normal with direction ratios 2,-1,-2.

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5. 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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6. Find the length of perpendicular from the origin to the plane $\vec{r}.\left(3\hat{i}-12\hat{j}-4\hat{k}\right)+39=0$. Also write the unit normal vector from the origin to the plane.

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7. Find the Cartesian equation of the plane whose vector equation is $\vec{r}.\left(3\hat{i}+5\hat{j}-9\hat{k}\right)=8$.

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8. Find the vector equation of a plane whose Cartesian equation is $5x - 7y + 2z + 4 = 0$.

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9. Find a unit vector normal to the plane is $x - 2y + 2z = 6$.

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10. Find the direction cosines of the normal to the plane is $(3x - 6y + 2z = 7$.

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11. For each of the following planes, find the direction cosines of the normal to the plane and the distance of the plane from the origin:

i) $2x + 3y - z = 5$, ii) z=3 , iii) $3y + 5 = 0$.

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12. Find the vector and Cartesian equations of the plane passing throgh the point (2,-1,1) and perpendicular to the line having direction ratios 4,2,-3.

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13. Find the coordinates of the foot of the perpendicular drawn from the origin to the plane i) $2x + 3y + 4z - 12 = 0$, ii) $5y + 8 = 0$.

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14. 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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15. 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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16. 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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17. Find the coordinates of the foot of the perpendicular and the perpendicular distance from the point P(3,2,1) to the plane $2x - y + z + 1 = 0$.

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

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

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20. 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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21. 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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22. Find the distance of the point $(0, -3, 2)$ from the plane $3x + 2y + 2z + 5 = 0$, measured parallel to the line $\frac{x+1}{3} = \frac{y+1}{2} = \frac{z}{3}$.

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23. Find the equation of the line passing through the point $\mathrm{P}(4, 6, 2)$ and the point of intersection of the line $\frac{\mathrm{x}-1}{3} = \frac{\mathrm{y}}{2} = \frac{\mathrm{z}+1}{7}$ and the plane $\mathrm{x}+\mathrm{y}-\mathrm{z} = 8$.

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24. Show that the distance of the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $(x-y+z=5)$ from the point $(-1, -5, -10)$ is 13 units.

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

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26. Prove tht the normals to the planes $4x + 11y + 2z + 3 = 0$ and $3x - 2y + 5z = 8$ are perpendicular to each other.

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27. Show that the line $\vec{r} = \left(2\hat{i} - 2\hat{j} + 3\hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + 4\hat{k}\right)$ is parallel to the plane $\vec{r}.\left(\hat{i} + 5\hat{j} + \hat{k}\right) = 7$.

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

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29. A vector $\vec{n}$ f 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 $\vec{n}$, find its equation in vector form.

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

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Exercise 28 C

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

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2. 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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3. 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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4. Find the distance of the point (1,1,2) from the plane $\vec{r}.\left(2\hat{i}-2\hat{j}+4\hat{k}\right)+5=0.$

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

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6. Find the distance of the point $(2, 1, -1)$ is equidistant from the plane $x - 2y + 4z = 9$.

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7. Show that the point $(1, 2, 1)$ is equidistant from the planes $\vec{r} \cdot \left(\hat{i} + 2\hat{j} - 2\hat{k}\right) = 5$ and $\vec{r} \cdot \left(2\hat{i} - 2\hat{j} + \hat{k}\right) + 3 = 0$.

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

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9. Distance between the two planes: $2x + 3y + 4z = 4$and $4x + 6y + 8z = 12$is(A) 2 units (B) 4 units (C) 8 units (D) $\frac{2}{\sqrt{29}}$units

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10. Find the distance between the parallel planes $x + 2y - 2z + 4 = 0$ and $x + 2y - 2z - 8 = 0$.

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

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12. 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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13. Find the equation of the plane mid-parallel to the planes $2x - 3y + 6z + 21 = 0$ and $2x - 3y + 6z - 14 = 0$.

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14. Show that the planes $2x - y + 6z = 5$ and $5x - 2.5y + 15z = 12$ are parallel.

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

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16. 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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17. Find the vector equation of a plane which is parallel to the plane $\vec{r}.\left(2\hat{i}-\hat{j}+2\hat{k}\right)=5$ and passes through the point whose position vector is $\left(\hat{i}+\hat{j}+\hat{k}\right)$.

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18. 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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19. Find the equation of the plane passing through the origin and parallel to the plane $5x - 3y + 7z + 13 = 0.$

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20. Find the equation of the plane passing through the point $(-1, 0, 7)$ and parallel to the plane $3x - 5y + 4z = 11.$

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

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22. Find the distance between the planes $x + 2y + 3z + 7 = 0$ and $2x + 4y + 6z + 7 = 0$.

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23. 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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24. Find the equation of the plane through the line of intersection of the planes $x-3y+z+6=0$ and $x+2y+3z+5=0$, and passing through the origin.

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25. 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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26. Find the equation of the plane passing through the line of intersection of the planes $2x - y = 0$ and $3z - y = 0$, and perpendicular to the plane $4x + 5y - 3z = 9$.

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27. 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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28. Find the equation of the plane passing through the lineof intersection of the planes $x + 2y + 3z - 5 = 0$ and $3x - 2y - z + 1 = 0$ and cutting off equal intercepts on the x-axis and z-axis.

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

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

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32. Find the equation of a plane passing through the intersection of the planes $\vec{r}.\left(2\hat{i}-7\hat{j}+4\hat{k}\right)=3$ and

$\vec{r}.\left(3\hat{i}-5\hat{j}+4\hat{k}\right)+11-0$ and passes through the point $\left(-2\hat{i}+\hat{j}+3\hat{k}\right)$.

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33. Find the equation of the plane through the line of intersection of the planes $\vec{r}.\left(2\hat{i}-3\hat{j}+4\hat{k}\right)=1$ and $\vec{r}.\left(\hat{i}-\hat{j}\right)+4=0$ and perpendicular to the plane $\vec{r}.\left(2\hat{i}-\hat{j}+\hat{k}\right)+8=0.$

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

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Exercise 28 F

1. Find the acute angle between the following planes: i) $\vec{r}.\left(\hat{i}+\hat{j}-2\hat{k}\right)=5$ and $\vec{r}.\left(2\hat{i}+2\hat{j}-\hat{k}\right)=9$ ii) $\vec{r}.\left(\hat{i}+2\hat{j}-\hat{k}\right)=6$ and $\vec{r}.\left(2\hat{i}-\hat{j}-\hat{k}\right)+3=0$

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2. Show that the following planes are right angles:

i) $\vec{r}.\left(4\hat{i}-7\hat{j}-8\hat{k}\right)=5$ and $\vec{r}.\left(3\hat{i}-4\hat{j}+5\hat{k}\right)+10=0$

ii) $\vec{r}.\left(2\hat{i}+6\hat{j}+6\hat{k}\right)=13$ and $\vec{r}.\left(3\hat{i}+4\hat{j}-5\hat{k}\right)+7=0$

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3. Find the value of λ for which the given planes are perpendicular to the each other:

i) $\vec{r}.\left(2\hat{i}-\hat{j}-\lambda k\right)=7$ and

$\vec{r}.\left(3\hat{i}+2\hat{j}+2\hat{k}\right)=9$

ii) $\vec{r}.\left(\lambda\hat{i}+2\hat{j}+3\hat{k}\right)=5$ and $\vec{r}.\left(\hat{i}+2\hat{j}-7\hat{k}\right)+11=0$

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4. Find the acute angle between the following planes: $2x-y+z=5$ and $x+y+2z=7$ ii) $x+2y+2z=3$ and $2x-3y+6z=8$

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5. Show that each of the following pairs of planes are at right angles:

i) $3x + 4y - 5z = 7$ and $2x + 6y + 6z + 7 = 0$

ii) $x - 2y + 4z = 10$ and $18x + 17y + 4z = 49$

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6. Prove that the plane $2x + 3y - 4z = 9$ is perpendicular to each of the planes $x + 2y + 2z - 7 = 0$ and $5x + 6y + 7z = 23$.

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7. Show that the planes $2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z - 1 = 0$ are parallel.

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8. Find the value of λ for which the planes $x - 4y + \lambda z + 3 = 0$ and $2x + 2y + 3z = 5$ are perpendicular to each other.

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9. Write the equation of the plane passing through the origin and parallel to the plane

$5x - 3y + 7z + 11 = 0.$

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

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11. Find the equation of the plane passing through the point $(1, -2, 7)$ and parallel to the plane $5x + 4y - 11z = 6.$

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12. 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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13. Find the equation of a plane passes through the point $(0, 0, 0)$ and perpendicular to each to the planes $x + 2y - z = 1$ and $3x - 4y + z = 5.$

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14. Find the equation of the plane that contains the point A(1,-1,2) and is perpendicular to both the planes $2x + 3y - 2z = 5$ and $x + 2y - 3z = 8$. Hence, find the distance of the point $P(-2, 5, 5)$ from the plane obtained above

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

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16. 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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17. Find the equation of the plane through the points A(3,4,2) and B(7,0,6) and perpendicular to the plane $2x - 5y = 15$.

Hint: The given plane is $2x - 5y + 0z = 15$.

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18. Find the equation of the plane through the points $A(2, 1, -1)$ and $B(-1, 3, 4)$ and perpendicular to the plane $x - 2y + 4z = 10$. Also, show that the plane thus obtained contains the line $\vec{r} = \left(-\hat{i} + 3\hat{j} + 4\hat{k}\right) + \lambda\left(3\hat{i} - 2\hat{j} - 5\hat{k}\right)$.

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Exercise 28 G

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

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

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

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

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5. 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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6. Find the anlge between the line joining the points A(3,-4,-2) and B(12,2,0) and the plane $3x - y + z = 1$.

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7. If the plane $2x - 3y - 6z = 13$ makes an angle $\sin^{-1}$ with the x-axis, then the find the value of λ.

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

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9. Find the value of m for which the line $\vec{r}. = \left(\hat{i} + 2\hat{k}\right) + \lambda\left(2\hat{i} - m\hat{j} - 3\hat{k}\right)$ is parallel to the plane $\vec{r}.\left(m\hat{i} + 3\hat{j} + \hat{k}\right) = 4$.

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10. Find the vector equation of a lie passing through the origin perpendicular to the plane $\vec{r}.\left(\hat{i}+2\hat{j}+3\hat{k}\right)=3.$

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11. Find the vector equation of the line passing through the point with position vector $\left(\hat{i}-2\hat{j}+5\hat{k}\right)$ and perpendicular to the plane $\vec{r}.\left(2\hat{i}-3\hat{j}-\hat{k}\right)=0.$

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12. Show that the equation $ax + by + d = 0$ represents a plane parallel to the z-axis. Hence, find the equation of a plane which is parallel to the z-axis. Hence, find the equation of a plane which is parallel to the z-axis nd passes through the points $A(2, -3, -1)$ and $B(-4, 7, 6)$.

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

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14. Find the equation of a plane passing through the point (2,-1,5), perpendicular to the plane $x + 2y - 3z = 7$ and parallel to the linne $\frac{x+5}{3} = \frac{y+1}{-1} = \frac{z-2}{1}$.

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15. Find the equation of the plane passing through the intersection of the planes $4x - y + z = 0$ and $x + y - z = 0$ and parallel to the line which direction ratios 2,1,1. Find also the perpendicular distance of (1,1,1) from this plane.

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16. Find the vector and Cartesian equations of the plane passing through the origin and parallel to the vectors $\left(\hat{i}+\hat{j}-\hat{k}\right)$ and $\left(3\hat{i}-\hat{k}\right)$.

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17. Find the vector and Cartesian quations of the plane passing through the point (3,-1,2) and parallel to the lines $\overrightarrow{r}=\left(-\hat{j}+3\hat{k}\right)+\lambda\left(2\hat{i}-5\hat{j}-\hat{k}\right)$ and $\overrightarrow{r}.\left(\hat{i}-3\hat{j}+\hat{k}\right)+\mu\left(-5\hat{i}+4\hat{j}\right)$.

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18. Find the vector equation of a plane passing through the point (1,2,3) and parallel to the lines whose direction ratos are $(1, -1, -2)$ and $(-1, 0, 2)$.

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19. Find the Cartesian and vector eqauations of a plane passing through the point (1,2,-4) and parallel to the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z+1}{6}$ and $\frac{x-1}{1} = \frac{y+3}{1} = \frac{z}{-1}$.

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20. Find the vector equation of the plane passing through the point $\left(3\hat{i}+4\hat{j}+2\hat{k}\right)$ and parallel to the vectors $\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ and $\left(\hat{i}-\hat{j}+\hat{k}\right)$.

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Exercise 28 I

1. Show that the lines

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

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

are coplanar. Also the find the equation of the plane passing through these lines.

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2. Find the vector and Cartesian forms of the equationi of the plane containing the two lines.

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

$\vec{r} = \left(9\hat{i} + 5\hat{j} - \hat{k}\right) + \mu\left(-2\hat{i} + 3\hat{j} + 8\hat{k}\right).$

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

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

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

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

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

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6. Show that the lines $\frac{5-x}{-4}=\frac{y-7}{4}=\frac{z+3}{-5}$ and $\frac{x-8}{7}=\frac{2y-8}{2}=\frac{z-5}{3}$ are coplaner. Find the equation of the plane containing these lines.

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7. 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. Find the equation of the plane containing these lines.

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

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9. Find the equation of the plane which contains two parallel lines given by

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

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

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Exercise 28 J

1. Find the direction ratios of the normal to the plane $x+2y-3z=5$.

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2. Find the direction cosines of the normal to the plane $2x + 3y - z = 4$.

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3. Find the direction cosines of the normal to the plane $y = 3$.

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4. Find the direction cosines of the normal to the plane $3x + 4 = 0$.

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5. Write the equation of the plane parallel to XY-plane and passing through the point (4,-2,3).

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6. Write the equation of the plane parallel to YZ-plane and passing through the point (-3,2,0).

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7. The equation of a plane parallel to x-axis is

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8. Write the intercept cut off by the plane $2x + y - z = 5$ on $x - a\xi s\cdot$

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

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10. Reduce the equation $2x - 3y + 5z + 4 = 0$ to intercept form and find the intercepts made by it on the coordinate axes.

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11. Find the equation of a plane passing through the points A(a,0,0), B(0,b,0) and C(0,0,c)`.

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12. Write the value of k for which the planes $2x - 5y + kz = 4$ and $x + 2y - z = 6$ are perpendicular to each other.

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

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14. Find the angle between the planes $\vec{r}.\left(\hat{i}+\hat{j}\right)=1$ and $\vec{r}.\left(\hat{i}+\hat{k}\right)=3.$

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15. Find the angle between the planes $\vec{r}.\left(3\hat{i}-4\hat{j}+5\hat{k}\right)=0$ and $\vec{r}.\left(2\hat{i}-\hat{j}-2\hat{k}\right)=7.$

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

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18. Find the value of λ such that the line $\frac{x-2}{6}=\frac{y-1}{\lambda}=\frac{z+5}{4}$ is perpendicular to the planes $3x-y+2z=7$.

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

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

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22. Show that the line $\vec{r} = \left(4\hat{i} - 7\hat{k}\right) + \lambda\left(4\hat{i} - 2\hat{j} + 3\hat{k}\right)$ is parallel to the plane $\vec{r} \cdot \left(5\hat{i} + 4\hat{j} - 4\hat{k}\right) = 7$.

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23. Find the length of perpendicular from the origin to the plane $\vec{r} \cdot \left(2\hat{i} - 3\hat{j} + 6\hat{k}\right) + 14 = 0$.

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24. Find the value of λ for which the line $\frac{x-1}{2}=\frac{y-1}{3}=\frac{z-1}{\lambda}$ is parallel to the plane $\vec{r}.\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=4.$

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

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26. Write the equation of a plane passing through the point (2,-1,0) and parallel to the plane $3x + 2y - z = 7$

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Objective Questions

1. The direction cosines of the perpendicular from the origin to the plane $\vec{r}.\left(6\hat{i} - 3\hat{j} - 2\hat{k}\right) + 1 = 0$ are

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

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

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

D. none of these

Answer: c

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2. The direction cosines of the normal to the plane $5y + 4 = 0$ are

A. $0, -\frac{4}{5}, 0$

B. $0, 1, 0$

C. $0, \ -1, 0$

D. none of these

Answer: c

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3. The length of perpendicular from the origin to the plane $\vec{r}.\left(-3\hat{i}-4\hat{j}-12\hat{k}\right)+39=0$ is

A. 3 units

B. $\frac{13}{5}$ units

C. $\frac{5}{3}$ units

D. none of these

Answer: A

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4. The equation of a plane passing through the point A(2,-3,7) and making equal intercepts on the axes,is

A. $x + y + z = 3$

B. $x + y + z = 6$

C. $x + y + z = 9$

D. $x + y + z = 4$

Answer: b

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5. A plane cuts off intercepts $3, -4, 6$ on the coordinate axes. The length of perpendicular from the origin to this plane is

A. $\frac{5}{\sqrt{29}}$ units

B. $\frac{8}{\sqrt{29}}$ units

C. $\frac{6}{\sqrt{29}}$ units

D. $\frac{12}{\sqrt{29}}$ units

Answer: d

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6. If the line $\frac{x+1}{3} = \frac{y-2}{4} = \frac{z+6}{5}$ is parallel to the planes $2x - 3y + kz = 0$, then the value of k is

A. $\frac{5}{6}$

B. $\frac{6}{5}$

C. $\frac{3}{4}$

D. $\frac{4}{5}$

Answer: b

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7. यदि O मूल बिंदु तथा P के निर्देशांक $(1, 2, -3)$ है तो बिंदु P से जाने वाले तथा OP के "लंबवत " तल का समीकरण ज्ञात कीजिए।

A. $x + 2y - 3z = 14$

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

C. $x - 2y - 3z = 14$

D. none of these

Answer: a

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8. The line $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ lies exactly on the plane $2x = 4y + z = 7$ then the value of k is (A) 7 (B) -7 (C) 1 (D) none of these

A. -7

B. 7

C. 4

D. -4

Answer: b

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9. The plane $2x + 3y + 4z = 12$ meets the coordinate axes in A,B and C. The centroid of $\triangle ABC$ is

A. `(2,3,4)

B. (6,4,3)

C. $\left(2, \frac{4}{3}, 1\right)$

D. none of these

Answer: c

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10. If a plane meets the coordinate axes in A,B and C such that the centroid of $\triangle ABC$is (1,2,4), then the equation of the plane is

A. $x + 2y + 4z = 6$

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

C. $x + 2y + 4z = 7$

D. $4x + 2y + z = 7$

Answer: b

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11. The equation of a plane through the point A(1,0,-1) and perpendicular to the line $\frac{x+1}{2} = \frac{y+3}{4} = \frac{z+7}{-3}$ is

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

B. $2x - 4y + 3z = 5$

C. $2x + 4y - 3z = 5$

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

Answer: c

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12. The line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ meets the plane $2x + 3y - z = 14$ in the point

A. (2,5,7)

B. (3,5,7)

C. (5,7,3)

D. (6,5,3)

Answer: b

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13. Find the equation of the plane through the points (2,2,1) and (9,3,6) and $perpendicar \to thepla \neq$ 2x+6y+6z=1`

A. $x + 2y - 3z + 5 = 0$

B. $2x - 5y + 4z - 8 = 0$

C. $4x + 5y - 6z + 3 = 0$

D. $3x + 4y - 5z - 9 = 0$

Answer: d

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14. 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 $(2, 2, 1)$.

A. $7x + 5y - 4z - 8 = 0$

B. $7x - 5y + 4z - 8 = 0$

C. $5x - 7y + 4z - 8 = 0$

D. $5x + 7y - 4z + 8 = 0$

Answer: B

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15. The equation of the plane passing through the points A(0,-1,0), B(2,1,-1) and C(1,1,1) is given by

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

B. $4x - 3y + 2z + 3 = 0$

C. $4x - 3y + 2z - 3 = 0$

D. none of these

Answer: c

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16. If the plane $2x - y + z = 0$ is parallel to the line $\frac{2x-1}{2} = \frac{2-y}{2} = \frac{z+1}{a}$, then the value of a is

A. -4

B. -2

C. 4

D. 2

Answer: a

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17. The angle between the line $\frac{x+1}{1} = \frac{y}{2} = \frac{z-1}{1}$ and a normal to the plane $x - y + z = 0$ is

A. 0°

B. 30°

C. 45°

D. 90°

Answer: d

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18. The point of intersection of the line $\frac{x-1}{3}=\frac{y+2}{4}=\frac{z-3}{-2}$ and the plane $2x-y+3z-1=0$, is

A. $(-10, 10, 3)$

B. $(10, 10, -3)$

C. $(10, -10, 3)$

D. $(10, -10, -3)$

Answer: b

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19. The equation of a plane passing throgh the points $A(a, 0, 0), B(0, b, 0)$ and C(0,0,c) is given by

A. $ax + by + cz = 0$

B. $ax + by + cz = 1$

C. $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 0$

D. $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$

Answer: d

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20. If θ is the angle between the planes $2x - y + 2z = 3$ and $6x - 2y + 3z = 5$, then $\cos\theta = ?$

A. $\frac{11}{20}$

B. $\frac{12}{23}$

C. $\frac{17}{25}$

D. $\frac{20}{21}$

Answer: d

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21. The angle between the planes $2x - y + z = 6$ and $x + y + 2z = 7$, is

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

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

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

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

Answer: c

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22. The angles between the planes $\vec{r}.\left(3\hat{i}-6\hat{j}+2\hat{k}\right)=4$ and $\vec{r}.\left(2\hat{i}-\hat{j}+2\hat{k}\right)=3$, is

A. $\cos^{-1}\left(\frac{16}{21}\right)$

B. $\cos^{-1}\left(\frac{4}{21}\right)$

C. $\cos^{-1}\left(\frac{3}{4}\right)$

D. $\cos^{-1}\left(\frac{1}{4}\right)$

Answer: a

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23. The equation of a plane through the point $(2, 3, 1)$ and $(4, -5, 3)$ and parallel to x-axis

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

B. $y + 4z = 7$

C. $y + 3z = 6$

D. $x + 5y - 3z = 4$

Answer: b

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24. A variable plane moves so that the sum of the reciprocals of its intercepts on the coordinate axes is $(1/2)$. Then, the plane passes through the point

A. $(0, 0, 0)$

B. (1,1,1)

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

D. $(2, 2, 2)$

Answer: d

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25. The equation of a plane which is perpendicular to $\left(2\hat{i}-3\hat{j}+\hat{k}\right)$ and at a distance of 5 units from the origin is

A. $2x-3y+z=5$

B. $2x-3y+z=5\sqrt{14}$

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

D. $\frac{x}{2}-\frac{y}{3}+\frac{z}{1}=\frac{5}{\sqrt{14}}$

Answer: b

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26. The equation of the plane passing through the point A(2,3,4) and parallel to the plane $5x - 6y + 7z = 3$, is

A. $5x - 6y + 7z = 20$

B. $7x - 6y + 5z = 72$

C. $20x - 18y + 14z = 11$

D. $10x - 18y + 28z = 13$

Answer: a

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27. The foot of the perpendicular from the point A(7,14,5) to the plane $2x + 4y - z = 2$ is

A. (3,1,8)

B. (1,2,8)

C. (3,-3,5)

D. (5,-3,-4)

Answer: b

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28. The equation of the plane which makes with coordinate axes, a triangle witih centroid (α, β, γ) is given by

A. $\alpha x + \beta y + \gamma z = 1$

B. $\alpha x + \beta y + \gamma z = 3$

C. $\frac{x}{\alpha} + \frac{y}{\beta} = \frac{z}{\gamma} = 1$

D. $\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} = 3$

Answer: d

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29. The intercepts made by the plane $\vec{r}.\left(2\hat{i}-3\hat{j}+4\hat{k}\right)=12$ are

A. 2,-3,4

B. 2,-3,-6

C. $-6,\ -4,3$

D. $-6,4,3$

Answer:

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30. The angle between the line $\frac{x-2}{1}=\frac{y+3}{-2}=\frac{z+4}{-3}$ and the plane $2x-3y+z=5$ is

A. $\cos^{-1}\left(\frac{5}{14}\right)$

B. $\sin^{-1}\left(\frac{5}{14}\right)$

C. $\cos^{-1}\left(\frac{3}{7}\right)$

D. $\sin^{-1}\left(\frac{3}{7}\right)$

Answer: b

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31. The angle between the line $\vec{r} = \left(\hat{i} + \hat{j} - 3\hat{k}\right) + \lambda\left(2\hat{i} + 2\hat{j} + \hat{k}\right)$ and the plane $\vec{r}.\left(6\hat{i} - 3\hat{j} + 2\hat{k}\right) = 5$, is

A. $\cos^{-1}\left(\frac{5}{14}\right)$

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

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

D. $\sin^{-1}\left(\frac{8}{21}\right)$

Answer: d

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

A. $\frac{25}{\sqrt{2}}$ units

B. $\frac{25}{\sqrt{3}}$ units

C. $25\sqrt{2}$ units

D. $25\sqrt{3}$ units

Answer: b

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33. The distance between the parallel planes $2x - 3y + 6z = 5$ and $6x - 9y + 18z + 20 = 0$, is

A. $\frac{5}{3}$ units

B. $5\sqrt{3}$ units

C. $\frac{8}{5}$ units

D. $8\sqrt{5}$ units

Answer: a

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34. The distance between the planes $x + 2y - 2z + 1 = 0$ and $2x + 4y - 4z + 5 = 0$, is

A. 4 units

B. 2 units

C. $\frac{1}{2}$ units

D. $\frac{1}{4}$ units

Answer: C

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35. 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. $(3,\ -5,\ 2)$

A. (3,-5,2)

B. (3,5,-2)

C. (3,5,2)

D. (-3,5,2)

Answer: d

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