MATHS

BOOKS - SHARAM PUBLICATION

THREE DIMENSIONAL GEOMETRY

Example

1. Write the vector equation ofthe plane whose cartesian equation is $x + y + 2z = 1$.

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

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

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4. Write the distance between parallel planes $2x-y+3z=4$ and $2x-y+3z=18.$

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5. What is the equation of x-axis in symmetric form.

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6. What is the direction cosines of the line passing through (0, 0, 0) and (1, 2, 3) ?

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7. How many straight lines in space through the origin are equally inclined to the coordinate axes?

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8. Write the equation of the plane perpendicular to y-axis at the point (0,-2, 0).

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9. Fill in the blanks in the length of the projection of the line segment joining (1,3,-1) and (3,2,4)on z-axis is _____.

$[1, 3, 4, 5]$

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10. If α, β, γ be direction angles of a line, what is the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

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11. If the distance between the points (-1, -1, k) and (1,-1,1) is 2 then what is the value of k ?

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12. Write theequationofthelinepassing through the point (4, —6,1) and parallel to the line $x - \frac{1}{1} = y + \frac{2}{3} = z - \frac{1}{-1}$.

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13. What is the image of the point (—2, 3, —5) respect to the zx-plane ?

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14. What is the distance of the point (x, y, z) from x-axis?

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15. What is the distance of the point (1, 2, -3) from xy-plane ?

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16. What is the angle between the lines $\frac{x}{1} = \frac{y}{-2} = \frac{z}{1}$ and $\frac{x}{4} = \frac{y}{1} = \frac{z}{-2}$.

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17. What is the number of independent constants that occur in the general equation of a plane.

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18. A plane has x-intercept and y-intercept 2 and 3 respectively and passes through (1, 1, 1). Find the z-

intercept .

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19. What is the distance of the point (x, y, z) from x-axis?

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20. What is the angle between the lines $\frac{x+2}{-4}=\frac{y+3}{5}=\frac{z-1}{3}$ and $\frac{1-x}{-4}=\frac{y-1}{5}=\frac{2-z}{3}$.

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21. Write the equation of the plane passing through the point(1,-2,3)and perpendicular to the y-axis.

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22. To which coordinate axis is, the plane $2x + 3y = 0$ parallel and why ?

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23. What is the image of the point (6, 3, -4) with respect to yz- plane ? '

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24. Find the value of k for which the line $\frac{x-2}{3} = \frac{1-y}{k} = \frac{z-1}{4}$ is parallel to the plane 2x + 6y + 3z - 4 = 0.

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25. If the d.cs of a straight line be $\left\langle \frac{2}{7}, \frac{3}{7}, \frac{k}{7} \right\rangle$, then what is the value of k ?

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26. If a line makes an angle90° with x-axis, 60° with y-axis and what angle it makes with z-axis?

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27. What is the distance between the planes x- 2y+ 3z + 1= 0 and 2x - 4y + 6z + 3 = 0?

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28. Write the equation of the plane with intercepts on axes 1, -1, 3. .

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29. What are the direction consines of the normal to the plane 3x - 2y - 2z + 1 = 0?

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30. Write the ratio in which the line joining the points (2,3,4) and $(-3, 5, -4)$ is divided by yz-plane.

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31. Write the angle between the planes 3x -5y + 2z-8 = 0 and 2x + 4y + 7z + 16 = 0.

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32. Write the equation of the line passing through (-3, 1, 2) and perpendicular to the plane 2y - z=3.

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33. Write the direction cosines of Z-axis.

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34. What is the distance of the point (4, 5, -3) from y-axis ?

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35. Write the equation of the plane passes through y-axis and z-axis.

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36. Fill in the blanks in the length of the projection of the line segment joining (1,3,-1) and (3,2,4)on z-axis is _____.

$[1, 3, 4, 5]$

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37. What are the d.cs of the line through (1,-1, 1)and (2, -5,-3)?

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38. Show that the point (3, -2, 4), (1, 1, 1) and (-1, 4,-2)are collinear.

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39. What is the equation of x-axis in symmetric form.

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40. What are the d.cs of the line x = y = z.

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41. Write down the d.rs of the line 2x = 3y = 4z.

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

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

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44. Show that lines $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + \lambda\left(3\hat{i} - \hat{j}\right)$ and $\vec{r} = \left(4\hat{i} - \hat{k}\right) + \mu\left(2\hat{i} + 3\hat{k}\right)$ intersect each other. Find their point of intersection.

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

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46. Find the area of the triangle ABC with vertices A(1,2,4), B(3,1,-2) and C(4,3,1) by vector method.

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47. Show that $\left[\vec{a}+\vec{b}\,\vec{b}+\vec{c}\,\vec{c}+\vec{a}\right]=2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

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48. If the sum of two unit vectors is a unit vector, show that the magnitude of their difference is $\sqrt{3}$.

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49. Find the shortest distance between the following lines $\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and $\vec{r} = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

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50. Find the shortest distance between the lines $\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$.

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51. Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line

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

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52. The projection of a line segment $\overline{OP}$, through origin O, on the co-ordinate axes are 6, 2, 3. Find the length of the line segment OP and its direction cosines.

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

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54. Prove that the lines $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$ are co-planar.

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55. Find the locus of points which are equidistant from the points (1,2,3) and (3,2,-1).

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56. Find the equation of the plane through the points (1, 2, -3), (2,3, -4) and perpendicular to the plane x + y + z + 1

= 0.

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57. Find the perpendicular distance of the point $(-1, 3, 9)$ from the line $\frac{x-13}{5} = \frac{y+8}{-8} = \frac{z-31}{1}$

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

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59. If P $(1, y, z)$ lies on the line through $(3, 2, -1)$ and $(-4, 6, 3)$ find y & z.

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60. Find the equation of the plane passing through the foot of the perpendiculars drawn from P(a,b,c) on the co-ordinate planes.

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61. Find the equation of the plane passing 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 points of intersection of the line $\frac{x-1}{1}=\frac{y+2}{3}=\frac{z-1}{-1}$ and the plane $2x+y+z=9$.

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63. Find the ratio in which the line segment through (1,3,-1) and (2,6,-2) is divided by zx-plane.

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64. Find the co-ordinates of the point where the perpendicular from the origin meets the line joining the points $(-9, 4, 5)$ and $(11, 0, -1)$.

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65. Find the image of the point $(2, -1, 3)$ in the plane $3x - 2y + z - 9 = 0$

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66. Find the image of the point (-2,0,3) with respect to the plane y = 3.

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67. If A (1,0,-1), B (-2,4,-2) and C(1,5,10) be the vertices of a triangle and the bisector of the angle BAC, meets BC at D, then find the coordinates of the point D.

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

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

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70. Find the equation of the plane passing through the line x = y = z and the point (3,2,1).

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71. Find the equation of the plane which passes through (1, 1, 2) and parallel to the plane x + 2y - z = 5.

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72. Bisecting the line segment joining $(-1, 4, 3)$ and $(5, -2, -1)$ at right angles.

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73. Find the distance between the parallel planes 3x - 2y + 6z - 7 = 0 and 3x- 2y + 6z + 14 = 0.

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74. Find the number of points (x, y, z) in space other than the point (1,-2, 3), such that |x| = 1, |y| = 2 and |z|= 3.

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75. Write the equation of the plane passing through (3,-6,-9) and parallel to xy-plane.

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76. Find the equation of the plane passing through the points (-2, 3, 5), (7,-7,-5) and (-2, 5, -3).

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77. Find the equation of the plane Paralel to the plane $2x - y + 3z + 1 = 0$ and at a distance 3 units away

from it.

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78. Passing throughthe point $(2, -3, 1)$ and $(-1, 1-7)$ and perpendicular to the plane $x - 2y + 5z + 1 = 0$.

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79. Write the axis to which the plane by+cz+d=0 is parallal.

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80. Find the shortest distance between the lines

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

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81. 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 planer $\vec{r}.\left(5\hat{i}-6\hat{k}\right)+8=0$

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82. Prove that the lines $\frac{x+3}{2}=\frac{y+5}{3}=\frac{z-7}{-3}$ and $\frac{x+1}{4}=\frac{y+1}{5}=\frac{z+1}{-1}$ are coplanar.

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83. Prove that the four points (0, 4, 3), (-1, -5, -3), (-2, -2, 1) and (1, 1, -1) lie in one plane. Find the equation of the plane.

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84. Find the distance from the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{1}$ to the point (4, 5, 2).

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85. A variable plane is at a constant distance 3r from the origin and meets the axes in A, B and C. Show that the locus of the centroid of the ΔABC is $x^{-2} + y^{-2} + z^{-2} = r^{-2}$.

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86. If the edges of a rectangular parallelopiped are of lengths a, b, c, then the angle between four diagonals

are $\cos^{-1}\left(\frac{\pm a^2 \pm b^2 \pm c^2}{a^2+b^2+c^2}\right)$.

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87. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines show that the d.cs. Of the line perpendicular to both of them are $m_1n_2 - n_1m_2, n_1l_2 - l_1n_2, l_1m_2 - m_1l_2$

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88. Find the image of the point (2, 3, 4) with respect to the plane x - y + 2z = 4. Obtain the foot of the

perpendicular from P on the plane and the corresponding perpendicular distance.

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89. Prove that the two lines whose direction cosines are connected by the equations $l + 2m + 3n = 0, 3lm - 4\ln + mn = 0$ are perpendicular to each other.

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90. 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 = 0.

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91. How far is the point (4, 1, 1) from the line of intersection of the planes x + y + z = 4, x - 2y - z = 4.

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

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93. Find 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.

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94. Prove that the line joining $(1,2,3),(2,1,-1)$ intersects the line joining $(-1,3,1)$ and $(3,1,5)$.

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95. Find the equation of the line through the point (1, -2, 1) and parallel to the line $\frac{x}{2}=\frac{y-1}{-1}=\frac{z+2}{3}$.

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96. Find the shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y-7}{2}=\frac{z-6}{4}$ Find also the equation of the line of shortest distance.

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