MATHS

BOOKS - ARIHANT PRAKASHAN

THREE DIMENSIONAL GEOMETRY

Topic 1 Practice Questions

1. Write the direction cosines of Z-axis.

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2. If the distance between the points (-1, -1, z) and (1, -1, 1) is 2 then z =_____.

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3. A line makes angles 60° and 45° with the positive direction of X-axis and Y-axis, respectively. What acute angle does it make with the Z-axis?

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4. 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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5. If a line is perpendicular to z-axis and makes an angle measuring 60^0 with x-axis, then the angle it makes with y-axis measures____.

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

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

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8. Find the acute angle between the lines passing through $(-3, -1, 0), (2, -3, 1)$ and $(1, 2, 3), (-1, 4, -2)$ respectively.

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

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10. Find the direction ratios and direction cosines of the line passing through two points (2, -4, 5) and (0, 1, -1).

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11. 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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Topic Test 1

1. 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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2. If a line makes angle $\frac{\pi}{3}$ and $\frac{\pi}{4}$ with X - axis Y - axis respectively, then find the angle made by the line with Z - axis.

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

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

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5. If a line in the space makes angles α, β and γ with the coordinate axes, then find the value of $\cos 2\alpha + \cos 2\beta + \cos 2\gamma + \sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$.

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6. If A, B, C, D are the points $(6, 3, 2), (3, 5, 7), (2, 3, -1)$ and $(3, 5, -3)$ respectively, then find the projection of $\overline{AB}$ on $\overleftrightarrow{CD}$

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7. Prove the angle between the diagonal of one of the faces of the cube and the diagonal of the cube intersecting the diagonal of the face of the cube is $\cos^{-1}\sqrt{\frac{2}{3}}$

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

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Topic 2 Practice Questions

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

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

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

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4. To which coordinate axis is the plane $2x + 3z = 0$ parallel ?

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5. How many independent constants are there in the general equation of a plane $ax + by + cz + d = 0$?

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6. Find the equation of the plane, that passes through the point (-1,3,0) and is perpendicular to the line through the points (1, 1, 1) and (2,-1,-2).

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

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8. Write the equation of the plane passing through the point (3, -6, -9) and parallel to XZ-plane.

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

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

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11. Write the distance between of the point of intersection to the plane $ax + by + cz + d = 0$ meet Z - axis from the origin.

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12. What are the direction cosines of the straight lines normal to plane $2x + y + 2z + 8 = 0$.

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13. The equation of plane perpendicular to z-axis and passing through $(1, -2, 4)$ is____

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14. The distance between the parallel planes $2x - 3y + 6z + 1 = 0$ and $4x - 6y + 12z - 5 = 0$ is____

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15. The plane $y - z + 1 = 0$ is____

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16. What is the angle between the planes $y + x = 0$ and $z = 0$? .

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17. Determine the direction cosines of the normal to the plane and the distance from the origin to the plane 5y + 8 = 0.

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

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19. Find the equation of the plane with intercept 2, 3 and 4 on the X, Y and Z-axes, respectively.

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20. Show that the normals to the planes $\vec{r}.\left(\hat{i}-\hat{j}+\hat{k}\right)=3$and $\vec{r}.\left(3\hat{i}+2\hat{j}-\hat{k}\right)=0$ are perpendicular to each other.

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21. Find the vector equation of a plane which is at a distance of 3 units from the origin , $2\hat{i}+3\hat{j}-6\hat{k}$ being a normal to the plane . Also get its cartesian equation

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22. If the position vectors of two points A ans B are $3\hat{i}+2\hat{j}+\hat{k}$ and $2\hat{i}-5\hat{j}+4\hat{k}$ respectively, what is the magnitude of $\overrightarrow{AB}$?

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

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24. 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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25. 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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26. 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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27. Find the equation of the plane passing through the line $x = y = z$ and the point (3,2,1).

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

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29. Find the equation of a plane biscting the line segment joining $(-1, 4, 3)$ and $(5, -2, -1)$ at right angle.

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

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

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32. Write the equation of the plane $3x - 4y + 6z - 12 = 0$ in intercept from and hence obtain the co-ordinates of the point where it meets the co-ordinate axes.

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33. Find the distance between the following parallel planes.

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

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34. Write the equation of the plane $2x - 3y + 5z + 1 = 0$ in normal from and find its distance from the origin. Find also the distance between from the point (3,1,2).

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35. 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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36. 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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37. Find the equation of the plane Passing through the intersection of the planes $x + 3y - z + 1 = 0$ and $3x - y + 5z + 3 = 0$ and is at a distance $2/3$units from origin.

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38. A variable plane is at a constant distance p from the origin and meets the axes at A,B,C. Through A,B,C plane are drawn parallel to the co-ordinate planes. Show that the locus of their points of intersection is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$.

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Topic Test 2

1. The equation of a plane passing through $(1, 1, 2)$ and parallel to $x + y + z - 1 = 0$ is____

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2. A plane whose normal has direction ratios $< 3, -2, k >$ is parallel to the line joining (-1,1,- 4) and (5,6,-2). Then the value of k =.....[6,-4,-1,0]

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3. Write the equation of the plane $2x - 3y + 5z + 1 = 0$ in normal from and find its distance from the origin. Find also the distance between from the point (3,1,2).

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4. What is the distance of the point (1,1,1)from the plane y=x?

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5. A plane whose normal has direction ratios $< 3, -2, k >$ is parallel to the line joining (-1,1,- 4)

and (5,6,-2). Then the value of k =.....[6,-4,-1,0]

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6. Find the equation of plane passing through the points (2, 1,3), (3, 2, 1) and (1, 0, -1).

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

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8. Find the distance between the parallel planes $2x - 2y + z + 1 = 0$ and $4x - 4y + 2z + 3 = 0$.

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9. Find the equation of the plane passing through the intersection of the plane $x + 2y + 3z - 4 = 0$ and $5x + 3y + 6z + 8 = 0$.

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10. Find the equation of the plane Passing through the intersection of planes

$2x + 3y - 4z + 1 = 0.2x - y + z + 2 = 0$and passing through the point (3,2,1).

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11. 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 perpendicular of the plane $5x + 3y + 6z + 8 = 0.$

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12. Show that plane $ax + by + cz + d = 0$ divides the line segment joining (x_1, y_1, z_1) and (x_2, y_2, z_2) in a

ratio $-\dfrac{ax_1+by_1+cz_1+d}{ax_2+by_2+cz_2+d}$

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Topic 3 Practice Questions

1. Write the value of k such that the line $\dfrac{x-4}{1}=\dfrac{y-2}{1}=\dfrac{z-k}{2}$ lies on the plane $2x-4y+z=7$

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2. Write the equations of the line $2x+z-4=0=2y+z$ in the symmetrical form.

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

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4. Under which conditions the straight line $\frac{x-a}{l}=\frac{y-b}{m}=\frac{z-c}{n}$ intersects the plane $Ax+By+Cz=0$ at a point other than (a,b,c)?

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

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

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7. Proved that the line $\frac{x-1}{2} = \frac{y+2}{-3} = \frac{z-3}{1}$ lies on the plane $7x + 5y + z = 0$

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8. 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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9. Find the point of intersection of the line $2x - 4 = 3y = z$ with plane $x + y + z = 13$.

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10. 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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11. Find the coordinates of the points of intersection of the line $3x - 3 = y + 2 = 3 - 3z$ and the plane $2x + y + z = 9$.

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12. 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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13. If l,m,n be DC.s of a line, then the line is perpendicular to the plaen x - 3y + 2z - 1 = 0 if

[(i) l = 1, m = - 3,n = 2 (ii) $\frac{l}{1} = \frac{m}{-3} = \frac{n}{2}$

(iii) (l - 3m + 2n = 0]`.

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14. Find the equation of a line parallel to Y-axis and passing through the origin.

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15. If the line $\frac{x-3}{2} = \frac{y+k}{-1} = \frac{z+1}{-5}$ lies on the plane 2x-y+z-7 = 0,

then k = -$(2, -1, -2)$

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16. Obtain the equation of the line through the point (1, 2, 3) and parallel to the line $x - y + 2z - 5 = 0, 3x + y + z = -6$

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17. 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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18. 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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19. 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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20. Using the method of elemination find the symmetrical form of equation of the line $6x + 8y + 3z = 10$ and $x + 2y + z = 3$.

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21. Find the value of r, if the line $\frac{x-1}{1} = \frac{y+2}{3} = \frac{z-1}{-1} = r$ rintersects the plane

$2x + y + z = 9.$

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22. 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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23. Determine the symmetric form of the equation to the line of intersection of the plane $y + 2z + 1 = 0$ and $x - 2y - 2 = 0.$

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

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25. Find the intersection of the line passing through the points (3, -2, 1) and (4, 1, 3) with the plane 4x + y - 2z - 11 = 0.

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26. 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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27. Find the equation of the straight line which passes through the point (4, -5, 6) and parallel to the join of the points of (5, -3, 2) and (4, 9, 1)`.

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28. Find the angle between the pair of lines

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

and

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

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29. Find the shortest distance between the lines $\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$ and $\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$.

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

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31. Find the equation of the plane through (6,3,1) and $(8,-5,3)$ parallel to x-axls.

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

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33. Show that the line joining the points $(0, 2, -4)$ and $(-1, 1-2)$ and the lines joining the points $(-2, 3, 3)$ and $(-3, -2, 1)$ are co-plannr. Find their point of intersection.

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

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35. Find a symmetric form of the equation to the lines $x + 2y - z - 2 = 0$ and $2x - y + 3z - 4 = 0$.

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36. Find the coordinates of the foot of perpendicular drawn from the point A(1, 8, 4) to the line joining the points B(0, -1, 3) and C(2, -3, 1)

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37. Find the coordinate of the point, where the line trough (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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Topic Test 3

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

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2. The equation of straight line equally inclined to the axes and equidistant from the point (1,−2) and (3,4) is

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3. Find the equation of lines joining the points. (a,a,a) and (a,0,a)

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4. Find the symmetric form of equation of the lines x + 2y + z - 3 = 0 = 6x + 8y + 3z - 10.

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

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

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7. Find the acute angle between the lines passing through $(-3, -1, 0), (2, -3, 1)$ and $(1, 2, 3), (-1, 4, -2)$ respectively.

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8. Prove that the lines $x = az + b, y = cz + d$ and $x = a_1z + b_1, y = c_1z + d_1$ are perpendicular if $aa_1 + cc_1 + 1 = 0$.

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9. Find the angle between the lines $\frac{x-3}{1}=\frac{y-2}{2}=\frac{z+4}{2}$ and $\frac{x-5}{3}=\frac{y+2}{2}=\frac{z}{6}$.

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10. For what value of k lines $\frac{x+2}{-k}=\frac{y-3}{2}=\frac{z+4}{k}$ and $\frac{x-4}{5}=\frac{y-3}{k}=\frac{z+1}{2}$ are perpendicular to each other?

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11. Show that the lines $\frac{x-5}{4}=\frac{y-7}{4}=\frac{z+3}{-5}$ and $\frac{x-8}{7}=\frac{y-4}{1}=\frac{z-5}{3}$

intersect each other.

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

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13. 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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14. Find the length and the foot of perpendicular drawn from the point (2, -1, 5) to the line

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

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15. Find the vector and cartesian equations of line passing through the point (1, 2 - 4) and perpendicular to two lines

$$\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$$

and

$$\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}.$$

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16. Cartesian equation of line AB is $\frac{2x-1}{2} = \frac{4-y}{7} = \frac{z+1}{2}$. Write the direction ratios of a line parallel to AB.

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17. Find the co-ordinates of the point where the line joining $(3, 4, -5)$ and $(2, -3, 1)$ meets the plane $2x + y + z - 7 = 0$.

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18. Find the distance of the point $(1, -1, -10)$ from the line $\frac{x-4}{1} = \frac{y+3}{-4} = \frac{z+1}{7}$ measured parallelto the line $\frac{x+2}{2} = \frac{y-3}{-3} = \frac{z-4}{8}$

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19. Find equation of a plane through $(2, -3, 1)$ and perpendlcular to the line joining the points $(3, 4, -1)$ and (2,-1,5)`.

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20. Find the equation of the plane containg the line x + 2 = 2y - 1 = 3z and parallel to the line x = 1 - 5y. = 2z - 7. Also find the shortest distance between the two lines.

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Chapter Test

1. If a line makes angles $90^\circ, 135^\circ, 45^\circ$ with the X, Y and Z-axes, respectively. Find its direction cosines.

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2. Find the direction cosines of the line segment joining the points A(7, -5,9) and B (5,-3,8).

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

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4. If the x-coordinate of a point P on the join of Q(2,2,1) and R(3,8,11) are colinear.

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5. Find the equation of a line parallel to X - axis and passing through the origin.

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6. Find the equation of a plane that cuts the coordinate axes at $(a, 0, 0)$, (0,b,0) and (0, 0,c).

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7. Find the distance of the point whose position vector is $\left(2\hat{i} + \hat{j} - \hat{k}\right)$ from the plane r. $\left(\hat{i} - 2\hat{j} + 4\hat{k}\right) = 9$.

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8. Find the ratio in which the line segment through (2,4,5),(3,5,-4) is divided by xy-plane.

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9. State true or False .The planes $2x + 4y - z + 1 = 0$ and $x - 2y - 6z + 3 = 0$ are perpendicular to each other.

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10. Find the equation of the plane .Passing through the point $(2, 3 - 1)$ and parallel to the plane $3x - 4y + 7z = 0$.

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11. State which of the following statements are true (T) or false(F)

The line $\frac{x-1}{2} = \frac{y-1}{2} = \frac{z-1}{2}$ pass though the origin.

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12. Find the coordinates of the point, where the line passing through (5, 1, 6) and (3, 4, 1) cross YZ-plane.

13. A plane meets the coordinate axes at A, B and C respectivély. If the centroid of the triangle ABC is (-1, 2, 5) then find the equation of the plane.

14. Find the perpendicular distance of point (1,0,0) in from the lines $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z-10}{8}$ and `(x

coordinate of foot of perpendicular and equation of perpendicular.

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15. Show that the shortest distance between the lines $x + a = 2y = -12z$ and $x = y + 2a = 6z - 6a$ is 2a .

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16. Find the equation of two planes through the origin, parallel to the line $\frac{x-1}{2} = \frac{y+3}{-1} = \frac{z+1}{-2}$ and at a distance $\frac{5}{3}$ from it.

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17. If a line makes angles α, β and γ with the positive direction of coordinate axes, then write the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

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18. Find the angle between the lines whose dcs. L, m, n are connected by the relation, $3l + m + 5n = 0$ and $6mn - 2nl + 5lm = 0$

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

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20. 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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21. 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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22. Find the distance of the point (-1, 5, -10) form the point of intersection of the line $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + \gamma\left(3\hat{i} + 4\hat{j} + 2\hat{k}\right)$ and the plane $\vec{r}.\left(\hat{i} - \hat{j} + \hat{k}\right) = 5.$

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23. Find the equation of the straight line perpendicular to the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-6}{7}$ and lyinng in the plane x - 2y + 4z - 51 = 0.

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24. Find the distance of the point (3,-4,5)from the plane 2x+5y-6z-19=0 measured parallel to the line $\frac{x-1}{2}=\frac{y}{1}=\frac{z+3}{-2}$.

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