

## TOPIC: "3D GEOMETRY, LINE & PLANE"

### 3D Geometry:

Page | 1

- Find the direction cosines of the line perpendicular to the line perpendicular to the lines whose Direction ratios are  $-2, 1, -1$  and  $-3, -4, 1$ .
- A line makes angles  $60^\circ$  and  $45^\circ$  with the positive directions of Y and Z axis respectively. Find the Angle made by the line with positive direction of x-axis.
- Direction cosines of the line passing through the points A(-4, 2, 3) and B(1, 3, -2) are .....  
(a)  $\pm \frac{1}{\sqrt{51}}, \pm \frac{5}{\sqrt{51}}, \pm \frac{1}{\sqrt{51}}$       (b)  $\pm \frac{5}{\sqrt{51}}, \pm \frac{1}{\sqrt{51}}, \pm \frac{-5}{\sqrt{51}}$   
(c)  $\pm 5, \pm 1, \pm 5$       (d)  $\pm \sqrt{51}, \pm \sqrt{51}, \pm \sqrt{51}$
- Which of the following represents direction cosines of the line  
(a)  $0, \frac{1}{\sqrt{2}}, \frac{1}{2}$       (b)  $0, \frac{-\sqrt{3}}{2}, \frac{1}{\sqrt{2}}$   
(c)  $0, \frac{-\sqrt{3}}{2}, \frac{1}{2}$       (d)  $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$
- Find the direction ratios of a vector perpendicular to the two lines whose direction ratio are  $-2, 1, -1$  and  $-3, -4, 1$ .

### Line:

- Find vector equation of line passing through the point whose position vector is  $3\hat{j} - 4\hat{j} + \hat{k}$  and parallel to the vector  $2\hat{j} + \hat{j} - 3\hat{k}$ . Also write the equation in Cartesian form.
- The Cartesian equation of a line is  $\frac{x+6}{2} = \frac{y+4}{7} = \frac{z-5}{3}$ , find its vector equation.

8. If a line is inclined at  $60^\circ$  and  $30^\circ$  with the X and y- axes respectively ,then the angle which it  
Makes with Z-axis is

- (a) 0                      (b)  $\frac{\pi}{4}$                       (c)  $\frac{\pi}{2}$                       (d)  $\frac{\pi}{6}$

Page | 2

9. Find the vector equation of a line passing through the point A whose position vector is  $3\vec{i} + \vec{j} - \vec{k}$  and which is parallel to the vector  $2\vec{i} - \vec{j} + 2\vec{k}$  . If P is a point on this line such that  $AP = 15$  , find the position vector of P.

10. By vector method , find the equation of the line passing through the point A(2, -3 -4)

And parallel to OB , where O is origin and B (2, -2, -1).

11. Using vector method find the equation of line passing through the points A (3, 2, -1) and

B (4, -1, 3) .Also , write the equation in Cartesian form .

12. Find the vector equation and Cartesian equation of the line passing through the two points

(1, -2t, 1) and (0, -2 - 3) .

13. Find the vector equation of a line passing through a point with position vector  $\vec{i} + 2\vec{j} - 3\vec{k}$  and perpendicular to the vectors  $\vec{i} + \vec{j} + \vec{k}$  and  $2\vec{i} + \vec{j} - \vec{k}$  . Also write the equation of the Line in Cartesian form.

14. Find the vector equation of the line passing through the point  $\vec{i} + 2\vec{j} - \vec{k}$  and perpendicular to vector  $2\vec{j} + 3\vec{j} + \vec{k}$  and  $\vec{j} - \vec{j} + 4\vec{k}$  .

15. find the equation of a line in the Cartesian form passing through the point ( 3, 2, -1 ) and

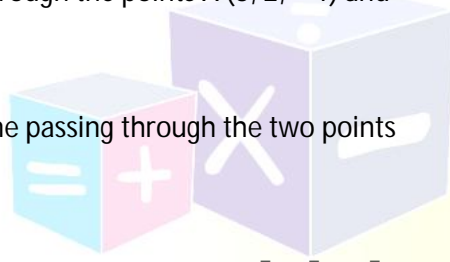
Perpendicular to the vectors  $3\vec{i} + 4\vec{j} + 5\vec{k}$  and  $\vec{i} - \vec{j} + \vec{k}$  .

16. The Cartesian equations of line are  $3x - 1 = 6y + 2 = 1 - z$ . find the vector equation of line.

17. The Cartesian equation of the line are  $3x + 1 = 6y - 2 = 1 - z$ . find its equation in vector form.

18. Find out acute angle between the lines whose direction ratios are 5, 12, -13 and 3, -4, 5.

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19. Show that the lines  $\frac{x-3}{1} = \frac{y-5}{2} = \frac{z-1}{-1}$  and  $\frac{x-4}{2} = \frac{y-2}{-1} = \frac{z-4}{2}$  intersect each other and find

The co-ordinates of their points of intersection

Page | 3

20. If the lines  $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$  and  $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$  intersect each other, then find the value of k.

21. Show that the lines given by

$\frac{x+1}{-10} = \frac{y+3}{-1} = \frac{z-4}{1}$  and  $\frac{x+10}{-1} = \frac{y+1}{-3} = \frac{z-1}{4}$  intersect Also find the Co-ordinates of the point of intersection.

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

23. If the line  $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$  and  $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$  intersect ,then find the value of k .

**Plane:**

24. Find the vector equation of the plane passing through the points (2,2,-1),(3,4,2) and (7, 0, 6) .

25. Find equation of the plane in vector form which is at a distance of 7 units from the origin and the Normal from origin have the direction ratios 3, 6, -2. Also reduce it into Cartesian form .

26. Find the equation of the plane in vector form passing through the point having position vector  $-\vec{2i} + \vec{j}$  and perpendicular to each of the planes  $\vec{r} \cdot (4\vec{i} - \vec{j} + 2\vec{k}) = 7$  also reduce it into Cartesian Form .

27. find vector method ,find the equation of a plane through the point (1,-1,1) which is parallel to the Vector  $2\vec{j} - \vec{j} - \vec{k}$  and  $2\vec{i} + \vec{j} - 3\vec{k}$ .

28. Find the Cartesian equation of the plane passing through the point (1,1,1) ,(2,4,3) and (5,9,7) using vector method .

29. Equation of a plane is  $\vec{r} \cdot (3\hat{i} - 4\hat{j} + 12\hat{k}) = 8$  find the length of the perpendicular from the origin to the plane .

30. Find the angle between the planes  $\vec{r} \cdot (2\vec{i} + \vec{j} - \vec{k}) = 3$  and  $\vec{r} \cdot (\vec{i} + 2\vec{j} + \vec{k}) = 1$  .

31. Find the angle between the line  $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z+2}{4}$  and the plane  $2x + y - 3z + 4 = 0$
32. Find the vector equation of the plane which bisects the line segment joining the point A(5,7,2) and B(-1,-3,4) at right angle .
33. If the perpendiculars drawn from (2,4,5) on yz and zx planes meet them in L and M respectively, Find the equation of the plane OLM where O is the origin.
34. A is (-1,1,2) and B is (5,-3,4) find the equation of plane in vector and Cartesian form which passes Through mid-point of Seg AB and perpendicular to line AB.
35. Find the angle between the planes  $\vec{r} \cdot (2\vec{j} - \vec{j} + \vec{k}) = 6$  and  $\vec{r} \cdot (\vec{i} + \vec{j} + 2\vec{k}) = 7$
36. Find the equation of a plane passing a point A(2,-1,5) and perpendicular to a line passing through The point C (4, 3, 2) and D(2, 1, 1) by vector method .
37. Find the equation of the plane passing through the line of intersection of planes  $2x - y + z = 3$  and  $4x - 3y + 5z + 9 = 0$  and parallel to the line  $\frac{x+1}{2} = \frac{y+3}{4} = \frac{z-3}{5}$
38. Find the vector equation of the plane which is at a distance of 5 units from the origin and which is normal to the vector  $2\hat{i} + \hat{j} + 2\hat{k}$  .
39. Parametric form of the equation of the plane is  $\vec{r} = (2\hat{i} + \hat{k}) + \lambda\hat{i} + \mu(\hat{i} + 2\hat{j} - 3\hat{k})$   $\lambda$  and  $\mu$  are parameters .find normal to the plane and hence equation of the plane in normal form . Write equation of the plane in normal form .write its Cartesian form .
40. Find the equation of the planes of the planes parallel to the plane  $x - 2y + 2z - 4 = 0$  , Which are at a unit distance from the point (1,2,3) .
41. Find the equation of the planes parallel to the plane  $x + 2y + 2z + 8 = 0$  which are at the distance Of 2 units from the point (1,1,2) .
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