MATHS

BOOKS - NEW JYOTHI MATHS (TAMIL ENGLISH)

THREE DIMENSIONAL GEOMETRY

Example

1. If a line makes angles 90°, 60° and 30° with the positive direction of x,y and z axis respectively. Find its directions cosines .

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2. Show that $\frac{\pi}{4}, \frac{\pi}{6}$ and $\frac{2\pi}{3}$ cannot be the direction angles of any vector.

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3. If α, β, γ are the direction angles of a line

(i)Show that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2.$

(ii)Find the value of $\cos 2\alpha + \cos 2\beta + \cos 2\gamma.$

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4. If a line has direction ratios 2,-1,-2 determines its direction cosines .

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5. The direction ratios of a line are 1,-2,5 , find the direction cosines of the line.

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6. Find the direction cosines of the line passing through the two points (-2,4,-5) and (1,2,3).

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7. Find the direction cosines of x,y and z axis.

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

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9. Find the vector and cartesian equations of the line through the point (5,2,-4) and which is parallel

to the vector $3\hat{i} + 2\hat{j} - 8\hat{k}$.

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10. The cartesian equation of a line is $\frac{x+3}{2} = \frac{y-5}{4} = \frac{z+6}{2}$. Find its vector equation .

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11. Find the equation of a line parallel to x-axis and passing through the origin.

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12. A line passes through the point (3,-2,5) and parallel to the vector $2\hat{i} + \hat{j} - 2\hat{k}$

i.What is the vector equation of the line ?

ii. What is the cartesian equation of the line ?

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13. Find the cartesian equation of the line which passes through the point (-2,4,-5) and parallel to the line given by

$$\frac{x+3}{3} = \frac{y-4}{5} = \frac{z+8}{6}.$$

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14. Find the vector equation for the line passing through the points (-1,0,2) and (3,4,6).

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15. Consider the points A(3,-4,-5) and B(2,-3,1).

i.Find the vector and cartesian equations of the line passing through the points A and B.

ii. Find the point where the line crosses the XY plane.

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16. Find the angle between the lines having direction ratios 1,1,2 and $\sqrt{3}-1, -\sqrt{3}-1, 4$

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17. 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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18. Find the angle between the pair of lines given by $\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$ and $\vec{r} = 5\hat{i} - 2\hat{j} + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$

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19. Find the value of 'p' if the lines $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{p} = \frac{z}{3}$ are perpendicular .

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20. Given the straight lines

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

$\overrightarrow{r} = \left(5\hat{j} - 2\hat{k}\right) + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$

i.Find the angle between the lines.

ii. Obtain a unit vector perpendicular to both the lines.

iii. Form the equation of the line perpendicular to the given lines and passing through the point (1,1,1).

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21. Consider the lines $\frac{x-3}{2}=\frac{y-1}{5}=\frac{z+3}{4}$ and $\frac{x+5}{1}=\frac{y+2}{1}=\frac{z-3}{2}$.

i.Find the angle between them.

ii. Find the shortest distance between them.

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22. Find the shortest distance between the lines l_1 and l_2 whose vector equations are $\vec{\gamma}=\hat{i}+\hat{j}+\lambda\left(2\hat{i}-\hat{j}+\hat{k}\right)$ and $\vec{\gamma}=2\hat{i}+\hat{j}-\hat{k}+\mu\left(3\hat{i}-5\hat{j}+2\hat{k}\right)$

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23. Consider the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$

i.Express the equations in the vector form.

ii. Find the shortest distance between these lines.

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24. Consider the lines $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k} + \lambda\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ and $\vec{r} = 2\hat{i} + 3\hat{j} + 4\hat{k} + \mu\left(3\hat{i} + 4\hat{j} + 5\hat{k}\right)$.

i.Convert the equations to cartesian form

ii. Show that the lines are not skew lines.

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25. Find the distance between the lines l_1 and l_2 given by $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$ and $\vec{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + \mu\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$

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26. i.Find the cartesian equation of the plane passing through the point (1,2,-3) and perpendicular to the vector $2\hat{i} - \hat{j} + 2\hat{k}$.

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

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27. Find the vector equation of the plane which is at a distance of $\frac{6}{\sqrt{29}}$ from the origin and its normal vector from the origin is $2\hat{i}-3\hat{j}+4\hat{k}$. Also find its cartesian form.

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28. The foot of the perpendicular drawn from origin to a plane is (4,-2,5).

i.How far is the plane from the origin ?

ii.Find a unit vector perpendicular to that plane.

iii. Obtain the equation of the plane is general form.

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29. Find the direction cosines of the unit vector perpendicular to the plane.

$\vec{r}\left(6\hat{i}-3\hat{j}-2\hat{k}\right)+1=0$

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30. Consider the Cartesian equation of a line

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

i.Find its vector equation.

ii. Find its intersecting point with the plane 5x+2y-6z-7=0

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31. Find the equation of the line which passes through the point (1,2,3) and is parallel to the vector $3\hat{i}+2\hat{j}-2\hat{k}$.

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32. Find the coordinates of the foot of the perpendicular P from the origin to the plane $2x-3y+4z-6=0$

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33. Given the plane $5x-2y+4z-9=0$

i.Find the coordinates of foot of the perpendicular from the origin to the plane.

ii. Find the vector equation and the cartesian equation of this perpendicular .

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34. Find the vector and cartesian equations of the plane that passes through the point (1,0,-2) and normal to $\hat{i} + \hat{j} - \hat{k}$.

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35. Find the vector equation of the plane passing through the points R(2,5,-3) , S(-2,-3,5) and T(5,3,-3)

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36. Consider the points A(2,2,-1) , B(3,4,2) and C(7,0,6)

i.Find AB.

ii. Find the vector and cartesian equation of the plane passing through these points .

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37. Find the equation of the plane that passes through three points : (1,1,-1),(6,4,-5),(-4,-2,3) .

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38. Find the intercepts cut off by the plane 2x+y-z=5.

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39. Consider the vector equation of two planes $\vec{r}\left(2\hat{i}+\hat{j}+\hat{k}\right)=3$ and $\vec{r}\left(\hat{i}-\hat{j}-\hat{k}\right)=4$

i.Find the vector equation of any plane through the intersection of the above two planes.

ii. Find the vector equation of the plane through the intersection of the above two planes and the point (1,2,-1).

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40. Find the vector equation of the plane passing through the intersection of the two planes $\vec{r}\left(\hat{i}+\hat{j}+\hat{k}\right)=6$ and $\vec{r}\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=-5$ and through the point (1,1,1)

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41. Consider the planes 3x-4y+5z=10 and 2x+2y-3z=4

i.Write the equation of the plane through the line of intersection of the above planes.

ii. Write the direction ratios of the line x=2y=3z

iii. If the line in (ii) is parallel to the plane in (i), show that the plane is x-20y+27z=14.

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42. 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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43. The planes 2x -y+4z=5 and 5x-2.5y+10z=6 are

A. perpendicular

B. parallel

C. intersect y-axis

D. passes through $\left(0, 0, \frac{5}{4}\right)$

Answer:

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44. Equation to the two planes are 2x+y-2z=5 and 3x-6y-2z=7

i.Find the normal vectors to these planes

ii. Find the angle between these two planes.

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45. Prove that if a plane has the intercepts a,b,c and is at a distance of p units from the origin , then $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{1}{p^2}$

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

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47. If the points (1,1,p) and (-3,0,1) are equidistant from the plane $\vec{r}.\left(3\hat{i}+4\hat{j}-12\hat{k}\right)+13=0$, then find the value o p.

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48. 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

Answer:

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49. Find the angle between the line $\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane 10x+2y-11z=3.

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50. i.Find the cartesian equation of the plane passing through the point (1,2,-3) and

perpendicular to the vector $2\hat{i} - \hat{j} + 2\hat{k}$.

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

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51. Find the equation of the plane that contains the point (1,-1,2) and is perpendicular to each of the planes 2x+3y-2z=5 and x+2y-3z=8.

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52. 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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Ncert Textbook Exercise 11 1

1. Find the direction cosines of a line which makes equal angles with the coordinate axes.

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2. If a line has the direction ratios -18,12,-4 , then what are its direction cosines ?

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3. Show that the points (2,3,4) , (-1,-2,1), (5,8,7) are collinear.

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4. Find the direction cosines of the sides of the triangle whose vertices are (3,5,-4), (-1,1,2) and (-5,-5,-2).

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Ncert Textbook Exercise 11 2

1. Show that the three lines with direction cosines $\frac{12}{13}, \frac{-3}{13}, \frac{-4}{13}, \frac{4}{13}, \frac{12}{13}, \frac{3}{13}, \frac{3}{13}, \frac{-4}{13}, \frac{12}{13}$, are mutually perpendicular .

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2. Show that the line through the points (1,-1,2) , (3,4,-2) is perpendicular to the line through the

points (0,3,2) and (3,5,6).

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3. Show that the line through the points (4,7,8), (2,3,4) is parallel to the line through the points (-1,-2,1), (1,2,5)

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4. Find the equation of the line which passes through the point (1,2,3) and is parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$.

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5. Find the equation of the line in vector and in cartesian form that passes through the point with position vector $2\hat{i} - \hat{j} + 4\hat{k}$ and is in the direction $\hat{i} + 2\hat{j} - \hat{k}$

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6. Find the cartesian equation of the line which passes through the point (-2,4,-5) and parallel to

the line given by

$$\frac{x+3}{3} = \frac{y-4}{5} = \frac{z+8}{6}.$$

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7. The cartesian equation of a line is $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$. Write its vector form.

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8. Find the vector and the cartesian equations of the lines that pass through the origin and (5,-2,3).

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9. Find the vector and the cartesian equations of the line that passes through the points (3,-2,-5), (3,-2,6).

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10. Find the angle between the following pairs of lines : $.\vec{r} = 3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right)$ and $\vec{r} = 2\hat{i} - \hat{j} - 56\hat{k} + \mu\left(3\hat{i} - 5\hat{j} - 4\hat{k}\right)$

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11. Find the angle between the following pairs of lines :

i. $\frac{x-2}{2}=\frac{y-1}{5}=\frac{z+3}{-3}$ and $\frac{x+2}{-1}=\frac{y-4}{8}=\frac{z-5}{4}$

ii. $\frac{x}{2}=\frac{y}{2}=\frac{z}{1}$ and $\frac{x-5}{4}=\frac{y-2}{1}=\frac{z-3}{8}$

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12. Find the values of p so that the lines

$\frac{1-x}{3}=\frac{7y-14}{2p}=\frac{z-3}{2}$ and $\frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$ are at right angles.

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13. Show that the lines $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ are perpendicular to each other.

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

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15. Find the shortest distance between the lines

$$\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$$

and

$$\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$$

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16. Find the shortest distance between the lines whose vector equations are

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

and

$$\vec{r}=4\hat{i}+5\hat{j}+6\hat{k}+\mu\left(2\hat{i}+3\hat{j}+\hat{k}\right)$$

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17. Find the shortest distance between the lines whose vector equations are $\vec{r} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + \lambda\left(\hat{i} - 3\hat{j} + 2\hat{k}\right)$ and $\vec{r} = 4\hat{i} + 5\hat{j} + 6\hat{k} + \mu\left(2\hat{i} + 3\hat{j} + \hat{k}\right)$

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Ncert Textbook Exercise 11 3

1. In each of the following cases , determine the direction cosines of the normal to the plane and the distance from the origin .

a. z=2 , b.x+y+z=1 , c. 2x+3y-z=5, d.5y+8=0

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

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3. Find The Cartesian equation of the following planes.

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

ii. $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right) = 1$

iii. $\vec{r} \cdot \left[(s - 2t)j\hat{i} + (3 - t)\hat{j} + (2s + t)\hat{k}\right]$ =15

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4. In the following cases, find the coordinates of the foot of the perpendicular drawn from the origin.

a.2x+3y+4z-12=0

b.3y+4z-6=0

c. x+y+z=1

d. 5y+8=0

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5. Find the vector and cartesian equations of the planes

a. that passes through the point (1,0,-2) and normal to the planes is $\hat{i} + \hat{j} - \hat{k}$

b. 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 intercepts cut off by the plane 2x+y-z=5.

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

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8. Find the vector equation of the plane passing through the intesection 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 through the point (2,1,3).

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9. Find the equation of the plane through the line of intersection of the planes $x+y+z=1$ and $2x+3y+4z=5$ which is perpendicular to the plane $x-y+z=0$

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10. In the follwing cases , determine whether the given planes are parallel or perpendicular and in case they are neither , find the angles between them.

a. $7x+5y+6z+30=0$ and $3x-y-10z+4=0$

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

c. 2x-2y +4z +5=0 and 3x-3y+6z-1=0

d. 2x-y+3z-1=0 and 2x-y+3z+3=0

e. 4x+8y+z-8=0 and y+z-4=0

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11. In the following cases, find the distance of each of the given points from the corresponding given plane.

Point	Plane
$a.\ (0, 0, 0)$	$3x - 4y + 12z = 3$
$b.\ (3, -2, 1)$	$2x - y + 2z + 3 = 0$
$c.\ (2, 3, -5)$	$x + 2y - 2z = 9$
$d.\ (-6, 0, 0)$	$2x - 3y + 6z - 2 = 0$

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Additional Questions For Practice 11 1

1. A line is inclined to the x-axis at 45° and y-axis at 60°. Find the angle at which the line is inclined to z-axis.

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2. For what values of α and β the points (1, 2, 3), (α, β, 7) and (2, 10, 1) are collinear.

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Additional Questions For Practice 11 2

1. Write the vector equation of a line passing through the points (-3, 1, 2) and (2,3,4).

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2. Consider the vector $2\hat{i} + 2\hat{j} - 3\hat{k}$ .Find the equation of line passing through A(3.4,5) and parallel to given vector , in the vector form and in the Cartesian form.

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3. Consider the points A(5,1,6) and B(3,4,1)

i.Find the cartesian equation of the line through A and B.

ii. Find the point where the line crosses the yz plane.

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4. Find the vector and Cartesian equation of the line pasing through the points (3,4,-7) and (5,1,6)

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

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6. Show that the line joining the points (2,2,2) and (4,4,4) passes through the origin.

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

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

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8. Find the angle between the lines having direction ratios 2,-1,1 and 5,1,2.

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9. 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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10. Find the angle between the pair of lines direction ratios 2, 6, 3 and 1, 2, 2.

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11. Find the value of p so that the lines $\frac{x-5}{7}=\frac{y+2}{-5}=\frac{z}{1}$ and $\frac{x}{p}=\frac{y}{2}=\frac{z}{3}$ are perpendicular to each other.

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12. Show that the lines $\frac{x-1}{-3}=\frac{11y-22}{20}=\frac{z-3}{2}$ and $\frac{11-11x}{30}=\frac{y-5}{1}=\frac{6-z}{5}$ are perpendicular to each other.

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

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14. Find the shortest distance between the lines

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

and

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

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15. Find the distance between the lines

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

and

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

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Additional Questions For Practice 11 3

1. Find the vector and cartesian equation of plane which is at a distance 5 units from the origin and having a normal vector $3\hat{i} + 2\hat{j} - \hat{k}$.

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2. Find The Cartesian equation of the following planes.

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

ii. $\vec{r} \cdot \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right) = 1$

iii. $\vec{r} \cdot \left[(s - 2t)j\hat{i} + (3 - t)\hat{j} + (2s + t)\hat{k}\right]$ =15

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3. Find the normal vector to the plane $4x + 2y + 3z - 6 = 0$

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4. A plane is at a distance 3 units from the origin. The direction ratios of normal to the plane are 1,-2,1. Find the vector and cartesian equation of the plane.

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5. Find the Cartesian equation of the plane through the point with position vector $2\hat{i} - \hat{j} + \hat{k}$ and perpendicular to the vector $4\hat{i} + 2\hat{j} - 3\hat{k}$.

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

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7. Find the equation of plane passing through (2, 5, 1), (3, 4, 2) and (2,2,-1).

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8. Find the vector equation of the plane pass ing through the intersection of the planes $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)=6$ and $\vec{r}.\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=-5$, and the point (1,1,1).

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

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10. Find the angle between the planes $2x-y+z=6$ and $x+y+2z=7$

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11. Find the angle between the two planes 3x - 6y + 2z =7 and 2x + 2y – 2z = 5.

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

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

plane $\vec{r} \cdot \left(3\hat{i} - 2\hat{j} + 5\hat{k}\right) = 4$

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Ncert Miscellaneous Exercise

1. Show that the line joining the origin to the point (2,1,1) is perpendicular to the line determined by the points (3,5,-1),(4,3,-1)

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2. 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 these are $m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1$

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3. Find the angle between the lines whose direction ratios are a,b,c and b-c,c-a,a-b.

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4. Find the equation of a line parallel to x-axis and passing through the origin.

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5. If the coordinates of the points A,B,C,D be (1,2,3), (4,5,7),(-4,3,-6) and (2,9,2) respectively , then find the angle between the line AB and CD.

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6. If the lines $\frac{x-1}{-3}=\frac{y-2}{2k}=\frac{z-3}{2}$ and $\frac{x-1}{3k}=\frac{y-1}{1}=\frac{z-6}{-5}$ are perpendicular , find

the value of k .

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7. Find the vector equation of the line passing through (1,2,3) and perpendicular to the plane $\vec{r}.\left(\hat{i}+2\hat{j}-5\hat{k}\right)+9=0$

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

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9. Find the shortest distance between the lines $\vec{r} = 6\hat{i} + 2\hat{j} + 2\hat{k} + \lambda\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$ and $\vec{r} = -4\hat{i} - \hat{k} + \mu\left(3\hat{i} - 2\hat{j} - 2\hat{k}\right)$

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

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11. Find the coordinates of the point where the line through (5,1,6) and (3,4,1) crosses the ZX-plane .

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12. Find the coordinates of the point where the line through (3,-4,-5) and (2,-3,1) crosses the plane 2x+y+z=7.

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13. Find the vector and cartesian equations of the plane passing through the point (-1,3,2) and

perpendicular to the planes.x + 2y + 2=5 and 3x+y+2z=8.

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14. If the points (1,1,p) and (-3,0,1) are equidistant from the plane $\vec{r}.\left(3\hat{i}+4\hat{j}-12\hat{k}\right)+13=0$, then find the value o p.

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15. Find the equation of the plane passing through the line of intersection of the planes

$\vec{r} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 1$ and

$\vec{r} \cdot \left(2\hat{i} + 3\hat{j} - \hat{k}\right) + 4 = 0$ and parallel to x axis.

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16. If O is the origin and the coordinates of P be (1,2,-3) , then find the equation of the plane passing through P and perpendicular to OP.

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17. Find the equation of the plane which contains the line of intersection of the planes

$\vec{r}.\left(\hat{i}+2\hat{j}+3\hat{k}\right)-4=0$ and $\vec{r}.\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ 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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18. Find the angle between the line $\vec{r}=\left(2\hat{i}+2\hat{j}+\hat{k}\right)+\lambda\left(2\hat{i}-3\hat{j}+2\hat{k}\right)$ and the plane $\vec{r}.\left(3\hat{i}-2\hat{j}+5\hat{k}\right)=4$

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19. Find the vector equation of the line passing through (1,2,3) and parallel to the planes $\vec{r}.\left(\hat{i}-\hat{j}+2\hat{k}\right)=5$ and $\vec{r}.\left(3\hat{i}+\hat{j}+\hat{k}\right)=6.$

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20. If a,b , c are distinct +ve real numbers and $a^2+b^2+c^2=1$ then $ab+bc+ca$ is

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21. The planes 2x -y+4z=5 and 5x-2.5y+10z=6 are

A. perpendicular

B. parallel

C. intersect y-axis

D. passes through $\left(0, 0, \frac{5}{4}\right)$

Answer:

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Unit Test

1. Find the direction consines of a line whose direction ratios are 1,3,-2

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2. Find the angle between the planes $2x - 3y + 4z = 1$ and $-x + y = 4$

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3. Find the cartesian and vector equation of a line which passes through the point (1, 2, 3) and

parallel to the line $\frac{-x-2}{1} = \frac{y+3}{7} = \frac{2z-6}{3}$

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

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5. Find the distance of the point (5,-5, -10) from the point of intersection of a straight line passing through the points A(4, 1, 2) and B(7, 5, 4) with the plane x-y+z=5.

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6. Find the equation of the plane through the intersection of the planes $x + 3y + 6 = 0$ and $3x - y - 4z = 0$ whose perpendicular distance from the orgin is equal to 1.

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7. Find the foot of the perpendicular drawn from the point (1,0, 3) to the join of points (4,7,1) and (3,5,3).

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8. Find the shortest distance between the lines

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

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

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Objective

1. The distance between x axis and the point (3,12,5)

is

A. 3

B. 13

C. 14

D. 12

Answer: B

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2. The perpendicular distance of the point (6,5,8) from y-axis

A. 5 units

B. 6 units

C. 10 units

D. 9 units

Answer: C

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3. If $\frac{1}{2}, \frac{1}{3}, n$ are the direction cosines of a line , then the value of n is

A. $\sqrt{23}/6$

B. $23/36$

C. $2/3$

D. $3/2$

Answer: A

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4. A line makes angles of 45° and 60° with the z-axis and the x-axis respectively. The angle made by it with y-axis is

A. 30° or 150°

B. 60° or 120°

C. 45° or 135°

D. 90°

Answer: B

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5. If direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c},$ then.

A. 0 lt c lt 1

B. c gt 2

C. $c = \pm\sqrt{2}$

D. $c = \pm\sqrt{3}$

Answer: D

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6. The coordinates of a point P are (3,12,4) w.r.t. the origin O. Then the direction cosines of OP are

A. $3, 12, 4$

B. $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}$

C. $\frac{3}{\sqrt{13}}, \frac{12}{\sqrt{13}}, \frac{4}{\sqrt{13}}$

D. $\frac{3}{13}, \frac{12}{13}, \frac{4}{13}$

Answer: D

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7. The direction cosines of a line that makes equal angles with the three axes in the space are

A. $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{3}, \pm\frac{1}{3}$

B. $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$

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

D. $\pm\sqrt{\frac{1}{7}}, \pm\sqrt{\frac{3}{14}}, \pm\sqrt{\frac{1}{14}}$

Answer: B

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8. If the direction cosines of a line are k,k,k , then

A. k gt 0

B. 0 lt k lt 1

C. k=1

D. $k = \frac{1}{3}$ or $\frac{-1}{\sqrt{3}}$

Answer: D

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9. The direction cosines of a straight line, whose projections on the coordinate axes , OX, OY, OZ are 12,4,13 respectively , are

A. $\frac{12}{29}, \frac{4}{29}, \frac{13}{29}$

B. $\frac{12}{\sqrt{329}}, \frac{4}{\sqrt{329}}, \frac{13}{\sqrt{329}}$

C. $\frac{1}{12}, \frac{1}{4}, \frac{1}{3}$

D. $\frac{12}{329}, \frac{4}{329}, \frac{13}{329}$

Answer: B

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10. The vector equation of the straight line $\frac{1-x}{3}=\frac{y+1}{-2}=\frac{3-z}{-1}$ is

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

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

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

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

Answer: A

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11. The line $\frac{x-x_1}{0}=\frac{y-y_1}{1}=\frac{z-z_1}{2}$ is

A. a perpendicular to the x-axis

B. perpendicular to the yz-plane

C. parallel to the y-axis

D. parallel to the xz-plane

Answer: A

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12. A unit vector parallel to the straight line $\frac{x-2}{3}=\frac{3+y}{-1}=\frac{z-2}{-4}$ is

A. $\frac{1}{\sqrt{26}}\left(3\hat{i}-\hat{j}+4\hat{k}\right)$

B. $\frac{1}{\sqrt{26}}\left(\hat{i}+3\hat{j}-\hat{k}\right)$

C. $\frac{1}{\sqrt{26}}\left(3\hat{i}-\hat{j}-4\hat{k}\right)$

D. $\frac{1}{\sqrt{26}}\left(3\hat{i}+\hat{j}+4\hat{k}\right)$

Answer: C

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13. The two lines $x=ay+b$, $z=cy+d$ and $x=a'y+b'$, $z=c'y+d$ will be perpendicular ,if and only if

A. $aa'+bb'+cc'=0$

B. $(a+a')(b+b')+(c+c')=0$

C. $aa'+cc'+1=0$

D. $aa'+bb'+cc'+1=0$

Answer: C

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14. If the vector equation of a line $\frac{x-2}{2} = \frac{2y-5}{-3} = z+1$ is $\vec{r} = 2\hat{i} + \frac{5}{2}\hat{j} - \hat{k} + \lambda\left(2\hat{i} - \frac{3}{2}\hat{j} + p\hat{k}\right)$ then p is equal to

A. 0

B. 1

C. 2

D. 3

Answer: B

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15. If the staight line $\frac{x-1}{k}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x-2}{3}=\frac{y-3}{k}=\frac{z-1}{3}$ intersect at a point , then the integer k is equal to

A. -5

B. 5

C. 2

D. -2

Answer: A

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16. The equation of the line joining the points (-3,4,11) and (1,-2,7) is

A. $\frac{x+3}{2} = \frac{y-3}{3} = \frac{z-11}{4}$

B. $\frac{x+3}{-2} = \frac{y-4}{3} = \frac{z-11}{2}$

C. $\frac{x+3}{-2} = \frac{y+4}{3} = \frac{z+11}{2}$

D. x+3

Answer: B

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17. The vector equation of the line 6x-3=3y+4=2z-2 is

A. $\vec{r} = \hat{i} - \hat{j} + \hat{k} + \lambda\left(6\hat{i} + \hat{j} + \hat{k}\right)$

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

C.

$$\vec{r} = \left(\frac{1}{2}\hat{i} - \frac{4}{3}\hat{j} + \hat{k}\right) + \lambda\left(\frac{1}{6}\hat{i} + \frac{1}{3}\hat{j} + \frac{1}{2}\hat{k}\right)$$

D. None of these

Answer: C

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18. The angle between the staight lines $\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+3}{4}$ and

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

A. 45°

B. 30°

C. 60°

D. 90°

Answer: D

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19. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$ are mutually

perpendicular then k is equal to

A. $\frac{-10}{7}$

B. $\frac{-7}{10}$

C. -10

D. -7

Answer: A

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20. A line makes angles α, β, γ with the coordinates axes . If $\alpha + \beta = 90^\circ$ then γ is equal

to

A. 0°

B. 90°

C. 180°

D. 60°

Answer: B

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21. The angle between the lines x=1,y=2 and y=-1 ,z=0

is

A. 90°

B. 30°

C. 60°

D. 0°

Answer: A

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22. The distance between the lines $\vec{r} = \vec{a}_1 + t\vec{b}$ and $\vec{r} = \vec{a}_2 + s\vec{b}$ is

A. $\left|\left(\vec{a}_2 - \vec{a}_1\right)\vec{b}\right|$

B. $\frac{\left|\left(\vec{a}_2 - \vec{a}_1\right) \times \vec{b}\right|}{\left|\vec{b}\right|}$

C. $\left|\frac{\left(\vec{a}_2 - \vec{a}_1\right) \times \vec{b}}{\left|\vec{a}_2 - \vec{a}_1\right|}\right|$

D. $\left|\frac{\left(\vec{a}_2 - \vec{a}_1\right) \times \vec{b}}{\left|\vec{a}_2 - \vec{a}_1\right|\left|\vec{b}\right|}\right|$

Answer: B

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23. The vector equation of a plane which is at a distance of $\frac{6}{\sqrt{29}}$ from the origin and its normal

vector from the origin is $2\hat{i} - 3\hat{j} + 4\hat{k}$ is

A. $\vec{r} \cdot \left(2\hat{i} - 3\hat{j} + 4\hat{k}\right) = \frac{6}{\sqrt{29}}$

B. $\vec{r} \cdot \left(\frac{2}{\sqrt{29}}\hat{i} - \frac{3}{\sqrt{29}}\hat{j} + \frac{4}{\sqrt{29}}\hat{k}\right) = \frac{6}{\sqrt{29}}$

C. both (a) and (b)

D. none of these

Answer: B

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24. The equation of a plane with intercepts 2,3,and 4 on the x,y and z axes respectively is

A. 2x+3y+4z=12

B. 6x+4y+3z=12

C. 2x+3y+4z=1

D. 6x+4y+3z=1

Answer: B

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25. The direction cosines of the normal to the plane 6x-2y-2z=1 are

A. $\left(\frac{6}{7}, 3, \frac{-2}{7}\right)$

B. $(6, -3, -2)$

C. $\frac{1}{7}(6, -3, -2)$

D. $\frac{1}{7}(6, 3, 2)$

Answer: C

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26. The distance of the point (2,1,-1) from the plane x-2y+4z=9 is

A. $\frac{\sqrt{13}}{21}$

B. $\frac{13}{21}$

C. $\frac{13}{\sqrt{21}}$

D. $\sqrt{\frac{13}{21}}$

Answer: C

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27. 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. -4

C. 2

D. -2

Answer: B

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

A. 5x-6y+7z+20=0

B. 5x-6y+7z-20=0

C. $-5x+6y-7z+3=0$

D. $5x+6y+7z+3=0$

Answer: B

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29. The vector equation of the plane through the point (2,1,-1) and parallel to the plane $\vec{r}.\left(\hat{i}+3\hat{j}-\hat{k}\right)=0$ is

A. $\vec{r}.\left(\hat{i}+9\hat{j}+11\hat{k}\right)=6$

B. $\vec{r}.\left(\hat{i}-9\hat{j}+11\hat{k}\right)=4$

C. $\vec{r}.\left(\hat{i}+3\hat{j}-\hat{k}\right)=6$

D. $\vec{r}.\left(\hat{i}+3\hat{j}-\hat{k}\right)=4$

Answer: C

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

A. $3x-2y+4z=11$

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

C. $3x-2y+4z=10$

D. $3(x-1)-2(y-2)+4(z-3)=5$

Answer: A

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31. The staight line passing through the point (1,0,-2) and perpendicular to the plane x-2y+5z-7=0 is

A. $\frac{x-1}{1}=\frac{y}{0}=\frac{z-5}{-2}$

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

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

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

Answer: D

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32. Equation of the line passing through $\hat{i}+\hat{j}-3\hat{k}$ and perpendicular to the plane 2x-4y+3z+5=0 is

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

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

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

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

Answer: B

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33. The angle between a normal to the plane 2x-y+2z-1=0 and the z-axis is

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

B. $\sin^{-1}\left(\frac{2}{3}\right)$

C. $\cos^{-1}\left(\frac{2}{3}\right)$

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

Answer: C

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34. Distance between the parallel planes $2x+y+2z=8$ and $4x+2y+4z+5=0$ is

A. $\frac{7}{2}$

B. $\frac{5}{2}$

C. $\frac{3}{2}$

D. $\frac{9}{2}$

Answer: A

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35. The angle θ between the line $\vec{r} = \vec{a} + \lambda \vec{b}$ and the plane $\vec{r} . \hat{n} = d$ is given by

A. $\sin^{-1}\left(\frac{\vec{b} . \hat{n}}{\left|\vec{b}\right| . \left|\vec{n}\right|}\right)$

B. $\cos^{-1}\left(\frac{\vec{b} . \hat{n}}{\left|\vec{b}\right| . \left|\vec{n}\right|}\right)$

C. $\sin^{-1}\left(\frac{\vec{a} . \hat{n}}{\left|\vec{a}\right|}\right)$

D. $\cos^{-1}\left(\frac{\vec{a} . \hat{n}}{\left|\vec{a}\right|}\right)$

Answer: A

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36. The reflection of the point (α, β, γ) in the xy plane is

A. $(\alpha, \beta, 0)$

B. $(0, 0, \gamma)$

C. $(-\alpha, -\beta, \gamma)$

D. $(\alpha, \beta, -\gamma)$

Answer: D

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