MATHS

BOOKS - V PUBLICATION

THREE DIMENSIONAL GEOMETRY

Question Bank

1. If a line makes angles. $90^\circ, 60^\circ, 30^\circ$ with the x, y and z axes respectively,

find its direction cosines

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2. If a line has direction ratios '2,-1,-2', determine direction cosines.

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3. Find the direction cosines of the line passing through the following points: $(-2, 4, -5), (1, 2, 3)$.

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

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

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6. If a lne makes angles. $90^\circ, 135^\circ, 45^\circ$ with the x,y and Z-axes respectively, find its direction cosines.

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

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8. If a line has the direction ratios '-18,(12) ,-4', then what are its direction cosines?

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

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10. 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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11. Find the vector and Cartesian equations of the line through the point $(5, 2, -4)$ and which is pralel to the vector $3\hat{i} + 2\hat{j} - 8k$.

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

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13. The Cartesian equation of a line is $\frac{x+3}{2} = \frac{y-5}{4} = \frac{z+6}{2}$. Find the vector equation for the line.

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14. Find the angle between the pair of lines given by

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

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

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15. 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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16. Find the shortest distance between the lines l_1 and l_2

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

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

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17. Find the distance between the lines l_1 and l_2, given by

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

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

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18. 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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19. Show that the line through the points (1, -1, 2) and (3, 4,-2) is perpendicular to the through the points (0, 3,2) and (3, 5, 6).

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20. 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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21. The equation of the line which passes through the point (1,2,3) and parallel to the vector 3i+2j-2k is

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22. Find the equation of the line in vector and in cartesian form that passes through the point with position vector '2 hati-hatj+4 hatk' and is in the direction 'hati+2 hatj-hatk'.

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23. Find the Cartesian equation of the line with passes through the point (-2, 4, -5) and parallel to the line given by $\frac{x+3}{3} = \frac{y-4}{3} = \frac{z+8}{6}$.

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24. The Cartesian equations of a line are $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$. Find a vector equation for the line.

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25. Find the Cartesian equation of the line passing through origin and (5,-2,3)

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26. Find the vector and the cartesian equations of the lines that passes through

the points (3, -2, -5) and (3, -2, 6)

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

i) $\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and $\vec{r} = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

(ii) $\vec{r} = 3\hat{i} + \hat{j} - 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right)$ 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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28. Find the angles between the lines

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

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29. Find the values of p so that the lines

$$\frac{1-x}{3}=\frac{7y-14}{2p}=\frac{z-3}{2} \text{ and } \frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$$

are at right angles.

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30. 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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31. Find the shortest distance between the skew lines $\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$ and $\vec{r} = (2\hat{i} - \hat{j} - \hat{k}) + \eta(2\hat{i} + \hat{j} + 2\hat{k})$

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

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34. Find the shortest distance between the lines whose vector equations are $\rightarrow r = (1-t)\hat{i} + (t-2)\hat{j} + (3-2t)\hat{k}$and $\rightarrow r = (s+1)\hat{i} + (2s-1)\hat{j} - (2s+1)\hat{k}$

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35. 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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36. Find the direction cosines of the unit vector perpendicular to the plane $\rightarrow r6\hat{i} - 3\dot{\hat{j}} - 2\hat{k} + 1 = 0$passing through the origin.

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37. Find the distance of the plane $2x - 3y + 4z - 6 = 0$from the origin.

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

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

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

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41. Find the equation of the plane with intercepts 2, 3 and 4 on the x, y and z-axis respectively.

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42. Find the vector equation of the Plane Passing through the intersection of the planes $\bar{r}.(i + j + k) = 6$ and $\bar{r}.(2i + 3j + 4k) = -5$ and through the point (1,1,1).

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43. Show that the lines

$$\frac{x+3}{-3}=\frac{y-1}{1}=\frac{z-5}{5} \text{ and } \frac{x+1}{-1}=\frac{y-2}{2}=\frac{z-5}{5}$$ are coplanar.

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

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

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46. Find the distance of a point $(2, 5, -3)$ from the plane $\vec{r}.\left(6\hat{i} - 3\hat{j} + 2\hat{k}\right) = 4$

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47. 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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48. Determine the direction cosines of the normal to the plane and the distance from the origin.

z = 2.

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49. 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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50. Find the cartesian equation fo the following planes. $\vec{r}.\left(\hat{i} + \hat{j} - \hat{k}\right) = 2$

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51. Find the vector and cartesian equations of the planes

a) that passes through the point $(1, 0, -2)$ and the normal to the plane 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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52. Find the equation of the planes that pass through the points..

(1, 1, -1), (6, 4, -5), (-4, -2, 3)

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

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

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

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

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57. Find the vector 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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58. Find the angle between the planes whose vector equations are

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

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59. A line makes angles $\angle, \beta, \gamma$ and δ with the diagonals of a cube. Show that $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta=4/3$.

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60. Find the equation of the plane that contains the point (1, -1, 2) and is perpendicualr

to each of the planes 2x+3y-3z=5 and x+2y-3z=8

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61. Find the distance between the point $P(6, 5, 9)$ and the plane determined by the points $A(3, -1, 2)$, $B(5, 2, 4)$ and $C(-1, -1, 6)$.

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62. 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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63. 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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64. 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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65. 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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66. Find the angle between the lines whose direction ratios are a, b, c and $b-c, c-a, a-b$.

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

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68. 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 lines AB *and* CD.

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69. 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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70. Write 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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71. Find the equation of the plane passing through (a, b, c) and parallel to the plane $\vec{r}\,\hat{i}+\dot{\hat{j}}+\hat{k}=2.$

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72. 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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73. Find the co-ordinates of the point where the line through (5,1,6) and (3,4,1)

crosses the YZ plane

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74. 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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75. Find the co-ordinates 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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76. 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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77. If the points (1,1,p) and (-3,0,1) be equidistant from the plane $\vec{r} \cdot \left(3\hat{i} + 4\hat{j} - 12\hat{k}\right) + 13 = 0$, then find the value of p

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

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

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80. Find the equation of the plane which contains the line of intersection of the planes $\vec{r}.\left(\hat{i}+2\hat{j}+3\hat{k}\right)-4=0,$

$\vec{r}.\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ and which is perpendicular to the plane $\vec{r}.\left(5\hat{i}+3\hat{j}-6\hat{k}\right)+8=0$

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

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82. 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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83. Find the vector equation of the line passing through the point (1,2,-4) and perpendicular to the 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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84. Prove that if a plane has the intercepts a, b, c and it is at a distance 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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85. Distance between the two planes: '2 x+3 y+4 z=4' and '4 x+6 y+8 z=(12)' is

A. 2 units

B. 4 units

C. 8 units

D. 2sqrt29' units

Answer: D

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

A. Perpendicular

B. Parallel

C. Intersect y-axis

D. passes through '(0,0 , 5/4)'.

Answer: B

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87. Can a line have direction angles $45^\circ, 60^\circ, 135^\circ$?

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88. A line makes angles of 45° and 60° with the positive axes of X and Y respectively. What angle does it makes with the positive axis of Z

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89. Find the direction cosine of a line which makes equal angles with the co-ordinate axes.

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90. 1, '-2,-2' are direction ratios of a line. What are its direction cosines?

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91. Find d.c.'s of the line passing through the points 'P(4,3,-5)' and 'Q(-2,1-8) .'

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92. A line passes through the points $(6, -7, -1)$ and $(2, -3, 1)$Find the direction ratios and direction cosines of the line so directed that the angle α is acute.

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93. Find the angle between the lines whose diréction ratios are '2,3,4' and '1,-2,1'

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94. Find the obtuse angle between the lines with direction ratios '3,-6,2' and '1,-2,-2 .'

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95. If points 'P, Q' are '(2,3,-6)' and '(3,-4,5)', find the angle that OP makes with OQ.

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96. If A, B, C, D are the points $(3, 4, 5), (4, 6, 3), (-1, 2, 4)$ and $(1, 0, 5)$, find the angle between CD and AB

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97. Find the coordinates of foot of perpendicular drawn from the point $(1, 2, 1)$ to the line joining the points $(1, 4, 6)$ and $(5, 4, 4)$

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98. Prove that the line joining the midpoints of the two sides of a triangle is parallel to the third side and half of its length.

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99. The cartesian equations of a line are $6x - 2 = 3y + 1 = 2z - 2.$

Find direction of the ratios of the line and write down the cartesian

and vector equations of the line through $(2, -1, -1)$, which is parallel to the given line.

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100. Find the shortest distance between the lines:

$\vec{r} = 3\hat{i} + 8\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} - \hat{j} + \hat{k}\right)$ and

$\vec{r} = -3\hat{i} - 7\hat{j} + 6\hat{k} + \mu\left(-3\hat{i} + 2\hat{j} + 4\hat{k}\right)$

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101. Find the shortest distance between the lines $\vec{r} = (1-t)\hat{i} + (t-2)\hat{j} + (3-2t)\hat{k}$ and $\vec{r} = (s+1)\hat{i} + (2s-1)\hat{j} - (2s+1)\hat{k}$

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

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103. Find the length and foot of the perpendicular from the point $(7, 14, 5)$ to the plane $2x + 4y - z = 2$.

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