MATHS

BOOKS - A N EXCEL PUBLICATION

THREE DIMENSTIONAL GEOMETRY

Question Bank

1. Consider the points A(0,0,2) and B(3,0,1) . Write direction ratio of the joining A and B.

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2. Consider the points A(0,0,2) and B(3,0,1) . Find the direction cosines of the

line passing through the given points.

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3. Suppose α, β, γ are the angles made a line with the three axes respectively. Fill in the blank by choosing the correct answer from the barcket

$\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma$= ..... (2,0,1,3)

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4. If a line makes α, β, γ with x,y,z axis respectively, then prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$

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5. Consider the points A(3,2,4), B(5,8,0) and C(4,5,2).Find the direction ratio of AB and BC. Hence, prove the A, B, C are collinear.

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6. Consider the points A(3,2,4), B(5,8,0(and C(4,5,2). Using only distance formula

prove that A, B and C are collinear. Also prove that C is the mid point of AB.

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7. 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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8. 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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9. Find the direction cosine of a line which makes equal angles

with the co-ordinate axes.

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

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

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12. 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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13. Find direction cosines of the line passing through the poins P(-2, 4, -5) and

C(1, 2, 3).

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14. 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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15. 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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16. Find the equation of the line through the points (-1, -2, 1) and (1, 2, 5).

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17. Find the equation of the line which passes through the point '(1,2,3)' and is parallel to the vector '3 hati+2 hatj-2 hatk'.

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18. 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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19. Find the cartersian 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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20. The cartestian 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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21. Find the vector and the cartesian equation of the lines that passes through the origin and '(5,-2,3)'

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22. 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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23. Find the angle between the pair lines

$\bar{r} = 2i - 5j + k + \lambda(3i + 2j + 6k)$ and

$\bar{r} = 7i - 6k + \mu(i + 2j + 2k)$

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24. Find the angle between the following pairs of lines.

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

$\vec{r} = 2\hat{i} - \hat{j} - 56\hat{k} + \mu\left(3\hat{i} - 5\hat{j} - 4\hat{k}\right)$

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25. Find the angles between the lines

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

and

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

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26. Find the angle between the following pairs of lines.

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

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27. 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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28. Find the shortest distance between the lines whose vector equations are

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

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

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29. 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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30. Consider the plane passing through (2, 3, 5) and perpendiular to the vector

$4\hat{i} + 2\hat{j} - 3\hat{k}$ Find the vector equation of the plane

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31. Consider the plane passing through (2, 3, 5) and perpendiular to the vector

$4\hat{i} + 2\hat{j} - 3\hat{k}$ Find the cartesian equation of the plane

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32. Consider a plane passing through the points A(-2, 6, -6), B(-3, 10, -9) and C(-5, 0, -6) Find the equation of the plane

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33. Consider a plane passing through the points A(-2, 6, -6), B(-3, 10, -9) and C(-5, 0, -6)

Find the direction cosine of the normal to the plane.

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34. Find the eqauation of the plane through the points (2, 1, -1) and (-1, 3, 4)

and perpendicualr to the plane x-2y+4z=10.

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35. Consider the points A(2, 2, 1) and B(9, 3, 6) and the plane 2x+6y+6z-1=0. Find the equation of the plane passing through A and B and perpendicular to the given plane.

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36. 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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37. Suppose that a plane meets the co-ordinate axes at A, B, C such that the centroid of $\triangle ABC$ is (3, 3, 3). If the intercepts made by the plane with the axes be a, b, c respectively, find the co-ordinates of A, B, C. Hence find the equation of the plane.

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

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39. Consider a point P(-2, -1, -4) and the plane $\vec{r}.\left(3\hat{i}+4\hat{j}+5\hat{k}\right)=10$. Write the cartesian equation of the given plane. Hence, find the perpendicular distance of P from the plane.

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40. Consider a point P(-2, -1, -4) and the plane $\vec{r}.\left(3\hat{i}+4\hat{j}+5\hat{k}\right)=10$. Find the distance between the given plane and the plane 6x+8y+10z=3

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

Find the point of intersection of the line and the plane.

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42. Consider the line $\vec{r}=\left(\hat{i}+2\hat{j}-\hat{k}\right)+\lambda\left(2\hat{i}+\hat{j}+4\hat{k}\right)$ and the plane $\vec{r}.\left(\hat{i}-6\hat{j}+\hat{k}\right)+12=0$. Find a vector parallel to the line and

a vector normal to the plane.

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43. Consider the line $\vec{r} = \left(\hat{i} + 2\hat{j} - \hat{k}\right) + \lambda\left(2\hat{i} + \hat{j} + 4\hat{k}\right)$ and the plane $\vec{r} . \left(\hat{i} - 6\hat{j} + \hat{k}\right) + 12 = 0$.Prove that the line lies on the plane.

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

z = 2.

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

$x + y + z = 1$.

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46. Determine the direction cosines of the normal to the plane and the distance

from the origin $2x + 3y - z = 5$.

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47. Determine the direction cosines of the normal to the plane

and the distance from the origin 5x + 8 = 0.

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48. 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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49. Find the cartesian equation fo the following planes.

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

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50. Find the cartesian equation fo the following planes.

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

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51. Find the cartesian equation fo the following planes.

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

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52. Find the co-ordinates of the foot of the perpendicular drawn from

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

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53. In the following cases, find the co-ordinates of the foot of the perpendicular

drawn from the origin. $3y + 4z - 6 = 0$

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54. Find the co-ordinates of the foot of the perpendicular

drawn from the origin. $x + y + z = 1$

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55. Find the co-ordinates of the foot of the perpendicular drawn from the origin. 5y + 8 = 0

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56. Find the vector and cartesian equations of the plane that passes through

the point (1, 0, -2) and normal to the plane is $\hat{i} + \hat{j} - \hat{k}$

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57. Find the vector and cartesian equations of the plane that passes through

the point (1, 4, 6) and normal to the plane is $\hat{i} - 2\hat{j} + \hat{k}$

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58. Find the equation of the planes that pass through the points..

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

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59. Find the equation of the planes that pass through the points...

(1, 1, 0), (1, 2, 1), (-2, 2, -1)

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

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

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62. Find the equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point (2,2,1)`

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63. 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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64. 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 x-y+z=0

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65. 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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66. Determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them : 7x+5y+6z+30=0 and 3x-y-10z+4=0

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67. Determine whether the given planes are parallel or perpendicular and in case they are neither, find the

angle between them : $2x+y+3z-2=0$ and $x-2y+5=0$

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68. In th following cases, determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them $2x-2y+4z+5=0$ and $3x-3y+6z-1=0$

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69. In th following cases, determine whether the given planes are parallel or perpendicular and in case they are

neither, find the angle between them (d) $2x-y+3z-1=0$ and $2x-y+3z+3=0$

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70. In th following cases, determine whether the given planes are parallel or perpendicular and in case they are neither, find the angle between them $4x+8y+z-8=0$ and $y+z-4=0$

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71. In the following cases, find the distance of each of the given point from the corresponding given plane

(0,0,0) : 3x-4y+12z = 3

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72. In the following cases, find the distance of each of the given point from the corresponding given plane

(3,-2,1) : 2x-y+2z+3 = 0

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73. In the following cases, find the distance of each of the given point from the corresponding given plane

(2,3,-5) : x+2y-2z = 9

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74. In the following cases, find the distance of each of the given point from the corresponding given plane

(-6,0,0) : $2x-3y+6z-2=0$

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75. 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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76. 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 $m_1n_2 - m_2n_2, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1$

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

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

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79. If the co-ordinates 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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80. 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, then find the value of k.

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

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83. 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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84. 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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85. Find the co-ordinates of the point where the line through (5,1,6) and (3,4,1)

crosses the ZX plane

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86. 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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87. Find the equation of the Plane passing through one point (-1,3,2) and $\perp$ r to the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 0$

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

value of p

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89. 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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90. 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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91. 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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92. 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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93. 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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94. 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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95. 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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96. 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. $\frac{2}{\sqrt{29}}$ units

Answer:

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97. Choose the correct answer. The planes 2x-y+4z=5 and 5x-2.5y+10z=6 are a)perpendicular b)parallel c)intersect y-axis d)passes through (0, 0, 5/4)

A. perpendicular

B. parallel,

C. intersect y-axis,

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

Answer: Since $\frac{2}{3} = \frac{-1}{-2.5} = \frac{4}{10} = \frac{1}{2.5}$**, the direction**

ratios of the normals to the given planes are proportional

$\therefore$ Th normals are parallel. Hence, the planes are parallel

$thref \text{ or } e$ The answer is (B)

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