11. THREE DIMENSIONAL GEOMETRY

1. Find the distance of the point (2, 3, 4) from the x – axis. **[CBSE 2010]**
2. Find the locus of a point which is equidistant from the points A (0, 2, 3) and B (2, –2, 1).
3. Show that the points A(0, 1, 2), B(2, –1, 3), C(1, –3, 1) are vertices of an isosceles right – angled triangle.
4. Find the distance between the points A and B with position vectors $\hat{i}-j$ and $2\hat{i}+j+2k$.
5. If a line makes angles of 90°, 60° and 30° with the positive direction of x, y and z – axis respectively, find its direction cosines.
6. If a line has direction ratios proportional to 2, –1, –2, then what are its direction cosines? **[CBSE 2012]**
7. Write direction cosines of a line parallel to z – axis. **[CBSE 2012]**
8. If a line has direction ratios 2, –1, –2, determine its cosine ratios.
9. Find the direction cosines of the line passing through the two points (–2, 4, –5) and (1, 2, 3).
10. Write the direction cosines of the normal to the plane $3x+4y+12z=52$. **[CBSE 2015]**
11. Using direction cosines ratios show that the points A (2, 3, –4), B (1, –2, 3) and C(3,8, –11) are collinear.
12. Find the direction cosines of the sides of the triangle whose vertices are (3, 5, –4), (–1, 1, 2) and (–5, –5, –2).
13. Write the direction ratios of the following lines: $x=-3,\ \frac{y-4}{3}=\frac{2-z}{1}$ **[CBSE 2015]**
14. Find the coordinates of the point which divides the join P(2, –1, 4) and Q(4, 3, 2) in the ratio 2 : 3 (i) internally (ii) externally.
15. Given that P(3, 2, –4), Q(5, 4, –6) and R(9, 8, –10) are collinear. Find the ratio in which Q divides PR.
16. Find the coordinates of the points which trisect the line segment AB, given that A(2, 1, –3) and B(5, –8, 3).
17. Find the ratio in which join the A(2, 1, 5) and B(3, 4, 3) is divided by the plane $2x+2y-2z=1$. Also find the coordinates of the point of division.
18. Using section formula, prove that the three points A(–2, 3, 5), B(1, 2, 3) and C(7, 0, –1) are collinear.
19. Show that the centroid of the triangle with vertices $A(x_1,y_1,z_1)$, $B(x_2,y_2,z_2)$, $C(x_3,y_3,z_3)$ is $\left(\frac{x_1+x_2+x_3}{3},\frac{y_1+y_2+y_3}{3},\frac{z_1+z_2+z_3}{3}\right)$.
20. Find the coordinates of the foot of the perpendicular drawn from the point A(1,2,1) to the line joining B(1, 4, 6) and C(5, 4, 4).
21. Find the angle between the vectors with direction ratios proportional to (4, –3, 5) and (3, 4, 5).
22. If l_1,m_1,n_1 and l_2,m_2,n_2 be the direction cosines of two mutually perpendicular lines, show that the direction cosines of the line perpendicular to both of them are $(m_1n_2-m_2n_1),(n_1l_2-n_2l_1),(l_1m_2-l_2m_1)$.
23. Find the vector and Cartesian equations of the line through the point (5, 2, – 4) and which is parallel to the vector $3\hat{i}+2j-8k$.
24. Find the vector and Cartesian equations of the line passing through the points (–1,0,2) and (3, 4, 6).
25. The points A(4,5,10), B(2,3,4) and C(1,2,1) are three vertices of a parallelogram ABCD. Find vector and Cartesian equations for the sides AB and BC and find the coordinates of D. **[CBSE 2010]**
26. Find the vector equation of the line passing through a point with position vector $2\hat{i}-j+k$, and parallel to the line joining the points $-\hat{i}+4j+k$ and $\hat{i}+2j+2k$. Also, find the Cartesian equivalent of this equation. **[CBSE 2003]**

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27. The Cartesian of a line are $6x-2=3y+1=2z-2$. Find its direction ratios also find vector equation of the line. **[CBSE 2003]**

28. Show that the points whose position vectors are $5\hat{i}+5k, 2\hat{i}+j+3k$ and $-4\hat{i}+3j-k$ are collinear.

29. If the points A(–1, 3, 2), B(–4, 2, –2) and C(5, 5, λ) are collinear, find the value of λ.

30. Find the point on the line $\frac{x+2}{3}=\frac{y+1}{2}=\frac{z-3}{2}$ at a distance of $3\sqrt{2}$ from the point (1, 2, 3). **[CBSE 2008]**

31. Find the points on the line $\frac{x+2}{3}=\frac{y+1}{2}=\frac{z-3}{2}$ at a distance of 5 units from the point P(1, 3, 3). **[CBSE 2010]**

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

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

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

35. The Cartesian equation of a line AB is $\frac{2x-1}{\sqrt{3}}=\frac{y+2}{2}=\frac{z-3}{3}$. Find the direction cosines of a line parallel to AB. **[CBSE 2008]**

36. 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.

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

38. Find the Cartesian and vector equations of a line which passes through the point (1, 2, 3) and is parallel to the line $\frac{-x-2}{1}=\frac{y+3}{7}=\frac{2z-6}{3}$. **[CBSE 2004]**

39. The Cartesian equations of a line are $3x+1=6y-2=1-z$. Find the fixed point through which it passes, its direction ratios and also its vector and also its vector equation. **[CBSE 2004]**

40. Write the vector equations of the following lines and hence determine the distance between them

$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z+4}{6}$, $\frac{x-3}{4}=\frac{y-3}{6}=\frac{z+5}{12}$ **[CBSE 2010]**

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

42. 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.

43. Find the shortest distance between the lines:

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

(b) $\vec{r}=(\hat{i}+2j+3k)+\lambda(2\hat{i}+3j+4k)$ and $\vec{r}=(2\hat{i}+4j+5k)+\mu(4\hat{i}+6j+8k)$ **[CBSE 2008]**

(c) $\vec{r}=(1-t)\hat{i}+(t-2)j+(3-t)k$ and $\vec{r}=(s+1)\hat{i}+(2s-1)j-(2s+1)k$ **[CBSE 2002, 2011]**

(d) $\vec{r}=(2\hat{i}-j-k)+\lambda(2\hat{i}-5j+2k)$ and $\vec{r}=(\hat{i}+2j+k)+\mu(\hat{i}-j+k)$ **[CBSE 2008]**

(e) $\vec{r}=(\hat{i}+j)+\lambda(2\hat{i}-j+k)$ and $\vec{r}=(2\hat{i}+j-k)+\mu(3\hat{i}-5j+2k)$ **[2014]**

(f) $\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$ and

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

(g) $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and

$\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-5}{5}$ **[CBSE 2005]**

(h) $\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$ and

$\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$ **[CBSE 2008]**

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

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

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

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

44. Find the shortest distance between the skew – lines:

$l_1:\frac{x-1}{2}=\frac{y+1}{1}=\frac{z-2}{4}$, $l_2:\frac{x+2}{4}=\frac{y-0}{-3}=\frac{z+1}{1}$.

45. 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) and (4, 3, –1).

46. Find the equation of the line passing through the point (–1, 3, –2) and perpendicular to the lines $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}$. **[CBSE 2005, 2012]**

47. A line passes through (2, –1, 3) and is perpendicular to the line $\vec{r}=\hat{i}+j-k+\lambda\left(2\hat{i}-2j+k\right)$ and $\vec{r}=2\hat{i}-j-3k+\mu\left(\hat{i}+2j+2k\right)$. Obtain its equation. **[CBSE 2012]**

48. Find the vector equation of the line passing through the point (1, 2, –4) and perpendicular to the lines:

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

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

49. Determine the equations of the line passing through the point (1, 2, –4) and perpendicular to the two lines:

$\frac{x-8}{8}=\frac{y+9}{-16}=\frac{z-10}{7}$ and

$\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$ **[CBSE 2012]**

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

51. Find the value of λ so that the following lines are perpendicular to each other:

$\frac{x-5}{5\lambda+2}=\frac{2-y}{5}=\frac{1-z}{-1}$, $\frac{x}{1}=\frac{2y+1}{4\lambda}=\frac{1-z}{-3}$.

[CBSE 2009]

52. Find the value of λ so that the lines $\frac{1-x}{3}=\frac{7y-14}{2\lambda}=\frac{z-3}{2}$ and $\frac{1-x}{3}=\frac{7y-14}{2\lambda}=\frac{z-3}{2}$ are at right angle.

53. Find the equation of a line parallel to x – axis and passing through the origin.

54. Find the angle between the pairs of line:

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

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

[CBSE 2011]

55. Find the angle between the lines with direction ratios proportional to (a, b, c) and (b – c, c – a, a – b).

56. Find the angle between the lines $\vec{r}=2\hat{i}-5\hat{j}+\hat{k}+\lambda\left(3\hat{i}+2\hat{j}+6\hat{k}\right)$ and $\vec{r}=7\hat{i}-6\hat{k}+\mu\left(\hat{i}+2\hat{j}+2\hat{k}\right)$. **[CBSE 2014]**

57. 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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58. Show that the line $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$ intersect. Find their point of intersection. **[CBSE 2004, 2005]**

59. Show that the lines $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ intersect. Also find their point of intersection. **[2014]**

60. Show that the lines $\frac{x-1}{2}=\frac{y+1}{2}=\frac{z-1}{5}$ and $\frac{x+2}{4}=\frac{y-1}{3}=\frac{z+1}{-2}$ do not intersect. **[CBSE 2002]**

61. Show that the lines $\vec{r}=\hat{i}+j+k+\lambda\left(3\hat{i}-j\right)$ and $\vec{r}=4\hat{i}-k+\mu\left(2\hat{i}+3k\right)$.

62. Determine whether the following pair of line intersect or not:
$\frac{x-5}{4}=\frac{y-7}{4}=\frac{z+3}{-5}$, $\frac{x-8}{7}=\frac{y-4}{1}=\frac{z-5}{3}$. **[CBSE 2002]**

63. Find the foot of perpendicular from the point (0, 2, 3) on the line $\frac{x+3}{5}=\frac{y-1}{2}=\frac{z+4}{3}$ Also, find the length of the perpendicular.

64. Find the perpendicular distance of the point (1, 0, 0) on the line $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z+10}{8}$ Also, find the coordinates of the foot of the perpendicular and the equation of the perpendicular. **[CBSE 2005, 2011]**

65. Find the equation of line passing through the points A (0, 6, –9) and (–3, –6, 3). If D is the foot of perpendicular drawn from a point C(7, 4, –1) on the line AB, then find the coordinates of the point D and the equation of line CD. **[CBSE 2010]**

66. Find the image of the point (1, 6, 3) in the line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$. Also write the equation of the line joining the given point and its image and find the length of the segment joining the given point and its image. **[CBSE 2010]**

67. Find the equation of the plane passing through the points A(2, 2, –1), B(3, 4, 2) and C(7, 0, 6).

68. Find the equation of the plane passing through the points A(0, –1, 0), B(3, 3, 0) and C(1, 1, 1). **[CBSE 2004]**

69. Show that the four points (0, –1, –1), (4,5,1), (3, 9, 4) and (–4, 4, 4) are coplanar and find the equation of the common plane.

70. Find the vector equation of the plane which is at distance of 3 units from the origin and has k as the unit vector normal to it.

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

72. Find the direction cosines of the unit vector perpendicular to the plane $\vec{r}.\left(6\hat{i}-3j-3k\right)+1=0$ passing through the origin.

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

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

75. Find the distance between the point (6,5,9) and the plane determined by the points A(3, –1, 2), B(5, 2, 4) and C(–1, –1, 6). **[CBSE 2010, 2012]**

76. Find the distance between the point (7, 2, 4) and the plane determined by the points $A(2,5,-3), B(-2-3,5)$ and $c(5,3,-3)$ **[CBSE 2014]**

77. Find the equation of the plane determined by the points A(3, –1, 2), B(5, 2, 4) and C(–1, –1, 6) and hence find the distance between the plane and the point P(6, 5, 9). **[CBSE 2012]**

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78. Find the coordinates of the foot of the perpendicular drawn from the origin to the plane $2x-3y+4z-6=0$.
79. Find the coordinates of the foot of the perpendicular drawn from the origin to the plane is (4, –2, –5). Also, find the equation of the plane.
80. Reduce the equation 2x – 3y – 6z = 14 to the normal form and hence find the length of perpendicular from the origin to the plane. Also, find the direction cosines of the normal to the plane.
81. Find a unit vector normal to the plane $x+2y+3z-6=0$.
82. Find the equation of the plane passing through the point (1, 2, 1) and perpendicular to the line joining the points (1, 4, 2) and (2, 3, 5). Also, find the perpendicular distance of the origin from this plane.
83. Find the Cartesian form of equation of a plane whose vector equation is:
    (a) $\vec{r}.\left(12\hat{i}-3j+4k\right)+5=0$
    (b) $\vec{r}.\left(-\hat{i}+j+2k\right)=9$
84. 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.
85. Find the vector equation of the plane passing through the point $P(2,5,-3)$, $Q(-2,-3,5)$ and $R(5,3,-3)$.
86. Find the vector equation of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i}+j+k\right)=6$ and $\vec{r}.\left(2\hat{i}+3j+4k\right)=-5$ and the point $(1,1,1)$.
87. Show 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.
88. Shown that lines: $\vec{r}=\hat{i}+\hat{j}+\hat{k}+\lambda\left(\hat{i}-\hat{j}+\hat{k}\right)$ $\vec{r}=4\hat{j}+2\hat{k}+\mu\left(2\hat{i}-\hat{j}+3\hat{k}\right)$ are coplanar. Also, find the equation of the plane containing these lines. **[CBSE 2015]**
89. Find the angle between the planes $2x+y-2z=5$ and $3x-6y-2z=7$.
90. Find the distance of a point $(2,5,-3)$ from the plane $\vec{r}.\left(6\hat{i}-3j+2k\right)=4$.
91. Find the angle between the line $\frac{x+1}{2}=\frac{y}{3}=\frac{z-3}{6}$ and $10x+2y-11z=3$.
92. Find the angle between the normal to the planes 2x – y + z = 6 and x + y +2z = 7.
93. Find the angle between the line $\vec{r}=\left(\hat{i}+2j-k\right)+\lambda\left(\hat{i}-j+k\right)$ and the plane $\vec{r}.\left(2\hat{i}-j+k\right)=4$.
94. Show that the line whose vector equation is $\vec{r}=\left(2\hat{i}-2j+3k\right)+\lambda\left(\hat{i}-j+4k\right)$ is parallel to the plane whose vector equation is $\vec{r}.\left(\hat{i}+5j+k\right)=5$. Also, find the distance between them.
95. Find the vector equation of a plane which is at a distance of 7 units from the origin and normal to the vector $3\hat{i}+5j-6k$.
96. Find the equation of the plane passing through the points $(1,1,-1)$, $(6,4,-5)$ and $(-4,-2,3)$.
97. Find the equation of the plane with intercept 3 on the y – axis and parallel to ZOX plane.
98. Reduce the equations of the following planes in intercept form and find its intercepts on the coordinate axes:
    (a) 4x + 3y – 6z – 12 = 0.
    (b) 2x + 3y – z = 6.
99. Find the vector equation of a plane passing through a point having position vector $2\hat{i}+3j-4k$ and perpendicular the vector $2\hat{i}-j+2k$. Also, reduce it to Cartesian form.

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100. Find the equation in Cartesian form of the plane passing through the point (3, –3, 1) and normal to the line joining the points (3, 4, –1) and (2, –1, 5).

101. 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).

102. Find the Cartesian as well as vector equations of the planes through the intersection of the planes $\vec{r}.\left(2\hat{i}+6j\right)+12=0$ and $\vec{r}.\left(3\hat{i}-j+4k\right)=0$ which are at a unit distance from the origin. **[CBSE 2005]**

103. Find the equation of the plane through the line of intersection of the planes $\vec{r}.\left(\hat{i}+3j\right)+6=0$ and $\vec{r}.\left(3\hat{i}-j-4k\right)=0$ which is at a unit distance from the origin. **[CBSE 2010]**

104. Find the Vector and Cartesian equations of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)=6$ and $\hat{r}\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=-5$ and the point (1,1, 1). **[CBSE 2015]**

105. Find the equation of the plane that contains the line of intersection of the planes $\vec{r}.\left(\hat{i}+2j+3k\right)-4=0$ and $\vec{r}.\left(2\hat{i}+j-k\right)+5=0$ and which is perpendicular to the plane $\vec{r}.\left(5\hat{i}+3j-6k\right)+8=0$. **[CBSE 2005]**

106. Find the equation of the plane passing through the intersection of the planes $\vec{r}.\left(2\hat{i}+j+3k\right)=7$, $\vec{r}.\left(2\hat{i}+5j+3k\right)=9$ and the point (2, 1, 3) **[CBSE 2007]**

107. 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 $x-y+z=0$.

108. 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 $x+2y-3z=8$. Hence find the distance of point P(-2, 5, 5) from the plane obtained above. **[CBSE 2014]**

109. 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 $3x+3y+z=0$.

110. Find the equation of the plane passing through the point (1, 1, –1) and perpendicular to the planes $x+2y+3z-7=0$ and $2x-3y+4z=0$. **[CBSE 2003]**

111. Find the equation of the plane passing through the point (–1, –1, 2) and perpendicular to the planes $3x+2y-3z=1$ and $5x-4y+z=5$. **[CBSE 2004, 2008]**

112. Find the equation of the plane passing through the point (1, –3, –2) and perpendicular to the planes $x+2y+2z=5$ and $3x+3y+2z=8$. **[CBSE 2009]**

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

114. Find the equation of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i}+j+k\right)=1$ and $\vec{r}.\left(2\hat{i}+3j-k\right)+4=0$ and parallel to x – axis. **[CBSE 2011]**

115. Find the equations of the line passing through the point (3, 0, 1) and parallel to the plane $x+2y=0$ and $3y-z=0$. **[CBSE 2012]**

116. Find the equation of the plane passing through (a, b, c) and parallel to the plane $\vec{r}.\left(\hat{i}+j+k\right)=2$. **[CBSE 2014]**

117. Find the coordinates of the point where the line through (5, 1, 6) and (3, 4, 1) crosses the (i) yz – plane (ii) zx – plane.

118. 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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119. Find the equation of the plane through the points (3, 4, 2) and (7, 0, 6) and perpendicular to the plane 2x – 5y=15. **[CBSE 2012]**

120. Find the equation of the plane passing through the points (1, –1 , 2) and (2, –2, 2) and perpendicular to the plane 6x – 2y + 2z = 9. **[CBSE 2005]**

121. Find the vector and Cartesian equations of the plane which Find the vector and Cartesian equations of the plane which bisects the line joining the points (3, -2, 1) and (1, 4, -3) at right angles. **[CBSE 2015]**

122. Find the equation of the plane through the points (2, 1, –1) and (–1, 3, 4) perpendicular to the plane x – 2y +4z =10. Also, show that the plane thus obtained contains the line $\vec{r}=\hat{i}+3j+4k+\lambda\left(3\hat{i}-2j-5k\right)$

[CBSE 2012]

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

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

125. If O be 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.

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

127. Find the equation of the plane which contains the line of intersection of the planes $\vec{r}.\left(\hat{i}+2j+3k\right)=4$, $\vec{r}.\left(2\hat{i}+j-k\right)+5=0$ and which is perpendicular to the plane $\vec{r}.\left(5\hat{i}+3j-6k\right)+8=0$.

128. 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.

[CBSE 2012]

129. Find the coordinates of the point where the line through the points (3,–4,–5) and (2, –3,1) crosses the plane 2x + y + z = 7 **[CBSE 2012]**

130. 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.

131. Find the vector equation of the plane that contains the lines $\vec{r}=\left(\hat{i}+j\right)+\lambda\left(\hat{i}+2j-k\right)$ and $\vec{r}=\left(\hat{i}+j\right)+\mu\left(-\hat{i}+j-2k\right)$. Also, find the length of the perpendicular drawn from the point (2, 1, 4) to the plane thus obtained. **[CBSE 2012]**

132. Find the distance of the point (–1, –5, –10) from the point of intersection of the line $\vec{r}=\left(2\hat{i}-j+2k\right)+\lambda\left(3\hat{i}+4j+2k\right)$ and the plane $\vec{r}.\left(\hat{i}-j+k\right)=5$. **[CBSE 2014]**

133. Find the vector equation of the plane passing through the points (3, 4, 2) and (7,0,6) and perpendicular to the plane $2x-5y-15=0$. Also, show that the plane thus obtained contains the line $\vec{r}=\left(\hat{i}+3j-2k\right)+\lambda\left(\hat{i}-j+k\right)$. **[CBSE 2012]**

134. Find the distance of the point P(-1, -5, -10) from the point of intersection of the line joining the points A(2,-1, 2) and B(5, 3, 4) with the plane $x-y+z=5$. **[CBSE 2014]**

135. If the lines $\frac{x-1}{-3}=\frac{y-2}{-2k}=\frac{z-3}{2}$ and $\frac{x-1}{k}=\frac{y-2}{1}=\frac{z-3}{5}$ are perpendicular, find the value of k and hence find the equation of the plane containing these lines. **[CBSE 2012]**

136. Find the length and foot of the perpendicular from the point (1, 1, 2) to the plane $\vec{r}.\left(\hat{i}-2j+4k\right)+5=0$.

[CBSE 2002 C]

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137. Find the value of λ such that the line $\frac{x-2}{6}=\frac{y-1}{\lambda}=\frac{z+5}{-4}$ and is perpendicular to the plane $3x - y - 2z = 7$. **[CBSE 2010]**

138. Find the image of the point (3, –2, 1) in the plane $3x - y + 4z = 2$.

139. Find the length and foot of the perpendicular from the point (7, 14, 5) to the plane $2x + 4y - z = 2$. Also, find the image the point P in the plane. **[CBSE 2012]**

140. Find the coordinates of the foot of the perpendicular and the perpendicular distance of the point P (3, 2, 1) from the plane $2x - y + z + 1 = 0$. Also, find the image of the point P in the plane.

[CBSE 2010, 2012]

141. Let P(3,2,6) be a point in the space and Q be point on the line $\vec{r}=\left(\hat{i}-\hat{j}+2\hat{k}\right)+\mu\left(-3\hat{i}+\hat{j}+5\hat{k}\right)$. then find the value of μ for which the vector $\overrightarrow{PQ}$ is parallel to the plane $x-4y+3z=1$

[CBSE 2015]

142. A line passing through the point A with position vector $\vec{a}=4\hat{i}+2\hat{j}+2\hat{k}$. is parallel to the vector $\vec{b}=2\hat{i}+3\hat{j}+6\hat{k}$. Find the length of the perpendicular drawn on this line from a point P with vector $\vec{r_1}=\hat{i}+2\hat{j}+3\hat{k}$ **[CBSE 2015]**

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