# 17. PLANES & 3D-LINES

1. The volume of the tetrahedron (in cubic units) formed by the plane $2x+y+z=K$ and the co-ordinate planes is $\frac{2V^3}{3}$, then K:V=

**[AP EAMCET 17-09-20_Shift-2]**

1. 1 : 2   2. 1 : 6
3. 4 : 3   4. 2 : 1

2. Let P(1, −2, 5) be the foot of the perpendicular drawn from the origin to the plane $\pi_1$ and the same P be the foot of the perpendicular from (1, 2, −1) to the plane $\pi_2$. Then the acute angle between the planes $\pi_1$ and $\pi_2$ is

**[2020]**

1. $Cos^{-1}\left(\frac{19}{\sqrt{390}}\right)$   2. $Cos^{-1}\left(\frac{19}{\sqrt{340}}\right)$
3. $Cos^{-1}\left(\frac{19}{\sqrt{370}}\right)$   4. $Cos^{-1}\left(\frac{19}{\sqrt{350}}\right)$

3. The distance of the plane $2x-y-2z-9=0$ from the origin is _______ units

**[AP EAMCET 17-09-20_Shift-2]**

1. 3   2. $\sqrt{3}$
3. 1   4. 9

4. Equation of the line passing through the intersection of the plane $x+2y+3z=4$ and the line $\frac{x-1}{2}=\frac{y+1}{1}=\frac{z-1}{-1}$ and parallel to the vector $(2\bar{i}-3\bar{j})\times(\bar{i}+2\bar{j}-\bar{k})$ is

**[AP EAMCET 18-09-20_Shift-1]**

1. $\frac{x-5}{3}=\frac{y-1}{2}=\frac{z+1}{-7}$   2. $\frac{x-5}{-3}=\frac{y-1}{-2}=\frac{z-1}{7}$
3. $\frac{x-5}{-3}=\frac{y-1}{-2}=\frac{z+1}{-7}$   4. $\frac{x-5}{-3}=\frac{y-1}{2}=\frac{z+1}{7}$

5. The equation of the plane through the intersection of the planes $x+2y+3z-4=0$ and $4x+3y+2z+1=0$ and passing through the origin is **[AP EAMCET 18-09-20_Shift-2]**

1. $17x+14y+11z=0$   2. $7x+4y+z=0$
3. $x+14y+11z=0$   4. $17x+y+z=0$

6. Angle between the lines of intersection of the planes x-y = 0, 2x+y+z = 0 and 2x-z = 0, x+y-3z = 0 is

**[AP EAMCET 21-09-20_Shift-1]**

1. $60^0$   2. $45^0$
3. $30^0$   4. $90^0$

7. Equation of the plane passing through the intersection of the lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-5}{-3}$ and $\frac{x+5}{3}=\frac{y-4}{-1}=\frac{z+3}{4}$ and parallel to the xy-plane is

**[AP EAMCET 22-09-20_Shift-1]**

1. z = 4   2. z = 2
3. z = 5   4. z = -5

8. The equation of the line through the point $(-1,3)$ in symmetrical form, when the angle made by the line with the positive direction of x-axis is $120^0$, is given by **[AP EAMCET 22-09-20_Shift-1]**

1. $\frac{(x+1)}{-1/2}=\frac{(y-3)}{\sqrt{3}/2}=r$   2. $\frac{(x+1)}{1/2}=\frac{(y+3)}{\sqrt{3}/2}=r$
3. $\frac{(x+1)}{-1/2}=\frac{(y+3)}{\sqrt{3}/2}=r$   4. $\frac{(x+1)}{1/2}=\frac{(y-3)}{\sqrt{3}/2}=r$

9. Findtheanglebetweentheplanesx+2y+2z-5=0 and 3x+3y+2z – 8=0

**[AP .EAMCET 22-09-20_Shift-1]**

1. $\cos^{-1}\left(\frac{3}{\sqrt{22}}\right)$   2. $\cos^{-1}\left(\frac{13}{3\sqrt{22}}\right)$
3. $\cos^{-1}\left(\frac{1}{3\sqrt{22}}\right)$   4. $\cos^{-1}\left(\frac{13}{31}\right)$

10. The equation of the plane mid-parallel to the planes $2x-3y+6z+21=0$ and $2x-3y+6z-14=0$ is given by _**[AP EAMCET 22-09-20_Shift-1]**

1. $4x+6y-12z+7=0$   2. $4x-6y-12z-7=0$
3. $4x-6y+12z+7=0$   4. $4x+6y+12z-7=0$

11. The Cartesian 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 $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}$ is

**[AP EAMCET 22-09-20_Shift-2]**

1. $\frac{x-1}{2}=\frac{y+3}{7}=\frac{z-2}{4}$ 2. $\frac{x-1}{-2}=\frac{y+3}{-7}=\frac{z-2}{-4}$

3. $\frac{x+1}{2}=\frac{y+3}{7}=\frac{z+2}{4}$ 4. $\frac{x+1}{2}=\frac{y-3}{-7}=\frac{z+2}{4}$

12. The lines passing through the points (1, 1, -1) and (3,-1,0) makes an angle of $\tan^{-1}\left(\frac{1}{\sqrt{8}}\right)$ with plane $\sqrt{\lambda}x+3y+6z=17.Then\,\lambda=$

1. 5 3 25

3. 15 4. 12

13. The combined equation for a pair of planes is $S\equiv 2x^2-6y^2-12z^2+18yz+2zx+xy=0$. If one of the planes is parallel to $x+2y-2z=5$, then the acute angle between the planes S=0 is

**[TS EAMCET 09-09-20_Shift-1]**

1. $\cos^{-1}\left(\frac{16}{21}\right)$ 2. $\frac{\pi}{2}$

3. $\frac{2\pi}{3}$ 4. $\sin^{-1}\left(\frac{7}{15}\right)$

14. A plane $\Pi$ is passing through the points A=(0,0,2), B=(1,0,1)and C=(3,1,1). If the plane $\Pi$ makes angles $\alpha$ *and* $\beta$ with the XY-and XZ-coordinate planes respectively, then $\sin^2\alpha+\sin^2\beta=$

**[TS EAMCET 09-09-20_Shift-2]**

1. $\frac{7}{6}$ 2. $\frac{5}{6}$

3. 0 4. 1

15. The foot of the perpendicular drawn from the point (1,1,1) to the plane $\pi_1$, is(1,3,5).If (2,2,-1), (3,4,2), (3,3,0) are three points on the plane $\pi_2$, then the angle between the planes $\pi_1$ *and* $\pi_2$ is

**[TS EAMCET 10-09-20_Shift-2]**

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

3. $\frac{\pi}{6}$ 4. $\cos^{-1}\left(\frac{2}{5}\right)$

16. The equation of the plane passing through the line of intersection of planes $\Pi_1=2x+6y+4z-7=0$, $\Pi_2=x-y-2z-2=0$ and perpendicular to the plane $x+y+2z-5=0$ is

**[TS EAMCET 11-09-20_Shift-1]**

1. $3x+y-2z=0$ 2. $6x+2y-4z+55=0$

3. $6x+2y-4z-15=0$ 4. $3x+y-2z-15=0$

17. If $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-7}{2}$ lies in the plane ax+by+z=7 the a+b=

**[TS EAMCET 11-09-20_Shift-2]**

1. -2 3 3

3. 5 4. 7

18. Find the equation of the plane passing through the point $(2,1,3)$ and perpendicular to the planes $x-2y+2z+3=0$ *and* $3x-2y+4z-4=0$

**[AP EAMCET 19-08-2021_Shift-2]**

1. $2x-y-2z+3=0$ 2. $x-2y+2z-3=0$

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

19. A ray of light passing through the point $A(1,2,3)$ strikes the plane $x+y+z=12$ at B and on reflection it passes through $C(3,5,9)$, then OB =

**[AP EAMCET 23-08-2021_Shift-1]**

1. $\sqrt{420}$ 2. $\sqrt{380}$

3. $\sqrt{410}$ 4. $\sqrt{390}$

20. The sum of intercepts of the plane $4x+3y+2z=2$ on the coordinate axes is

**[AP EAMCET 20-08-2021_Shift-2]**

1. 13/6 2. 9

3. 13/12 4. 2

21. The angle between the planes $2x-y+z=6$ & $x+y+2z=3$ is_____

**[AP EAMCET 23-08-2021_Shift-1]**

1. $\frac{\pi}{3}$ 2. $\cos^{-1}\left(\frac{1}{6}\right)$

3. $\frac{\pi}{4}$ 4. $\frac{\pi}{6}$

22. Find the equation of the plane which passes through the points $(0,1,2)$ and $(-1,0,3)$ and is perpendicular to the plane $2x+3y+z=5$.

**[AP EAMCET 23-08-2021_Shift-2]**

1. $3x-4y+18z+32=0$
2. $3x+4y-18z+32=0$
3. $4x+3y-z+1=0$
4. $4x-3y+z+1=0$

23. Find the equation of a plane, given that the foot of perpendicular drawn to the plane from origin is (2, 1, 2).

**[AP EAMCET 24-08-2021_Shift-1]**

1. $3x+y+z=6$
2. $x+y+z-5=0$
3. $2x-y-2z=-1$
4. $2x+y+2z=9$

24. A line AB in three dimensions makes angles $45°$ and $120°$ with the positive x–axis and the positive y–axis respectively. If AB makes an acute angle $\theta$ with the positive z–axis, then $\theta=$___ **[AP EAMCET 24-08-2021_Shift-2]**

1. $30°$
2. $45°$
3. $60°$
4. $75°$

25. A variable plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$, which is at a unit distance from the origin cuts the coordinates axes at A, B and C. If the centroid $(x,y,z)$ of $\Delta ABC$ satisfies $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=k$, then '$k$' equals

**[AP EAMCET 24-08-2021_Shift-2]**

1. 9
2. 3
3. $\frac{1}{9}$
4. $\frac{1}{3}$

26. The plane passing through the points(1, 1, 1), (1, –1, 1) and (–7, –3, –5) is _____

**[AP EAMCET 25-08-2021_Shift-1]**

1. Parallel to x–axis
2. Parallel to y–axis
3. Parallel to z–axis
4. $3x-4z-1=0$

27. The perpendicular distance from origin to the plane $x+2y-2z+5=0$ equals _____ units.

**[AP EAMCET 25-08-2021_Shift-2]**

1. $\frac{3}{5}$
2. $\frac{5}{3}$
3. $\frac{5}{9}$
4. 5

28. $X$ intercept of the plane containing the line of intersection of the planes $x-2y+z+2=0$ and $3x-y-z+1=0$ and also passing through (1,1,1) is_____

**[AP EAMCET 19-08-2021_Shift-2]**

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

29. If the lines $\frac{x-3}{2}=\frac{y-2}{3}=\frac{z-1}{\lambda}$ and $\frac{x-2}{3}=\frac{y-3}{2}=\frac{z-2}{3}$ are coplanar, then $\mathrm{Sin}^{-1}(\sin\lambda)+\mathrm{Cos}^{-1}(\cos\lambda)=$

**[AP EAMCET 20-08-2021_Shift-1]**

1. $8-2\pi$
2. $6-\pi$
3. $3\pi-8$
4. $4\pi-8$

30. A plane $ax+by+cz+1=0$ is perpendicular to the two planes $2x-2y+z=0$ and $x-y+2z=4$ and passes through the point $(1,-2,1)$. Then $a+b-c=$

**[TS EAMCET 04-08-2021_Shift-2]**

1. -6
2. 1
3. 0
4. 2

31. The point on the plane $2x-2y+4z+5=0$ that is nearer to $\left(1,\frac{3}{2},2\right)$ is

**[TS EAMCET 04-08-2021_Shift-1]**

1. $\left(0,\frac{5}{2},0\right)$
2. $\left(-5,\frac{-5}{2},0\right)$
3. $\left(0,0,\frac{-5}{4}\right)$
4. $\left(-\frac{1}{2},0,-1\right)$

32. The Cartesian equation of a plane parallel to the plane $\bar{r}.(2i+3j-4k)=1$ and at a distance of 2 units from it is

**[TS EAMCET 05-08-2021_Shift-1]**

1. $2x+3y-4z=3$
2. $2x+3y-4z=1\pm2\sqrt{29}$
3. $2x+3y-4z=-1\pm2\sqrt{29}$
4. $2x+3y-4z=-3$

33. A point on the plane determined by the points $A(1,1,-1)$, $B(2,-1,0)$ and $C(-1,0,2)$ among the following is

**[TS EAMCET 05-08-2021_Shift-2]**

1. $(1,2,-2)$ 2. $(2,1,-3)$
3. $(2,-2,2)$ 4. $(2,1,2)$

34. The volume (in cubic units) of the tetrahedron bounded by the plane $3x+4y-5z=60$ and the three coordinate plane is

**[TS EAMCET 06-08-2021_Shift-1]**

1. 60 2. 720
3. 600 4. 4800

35. The x–intercept of a plane $\pi$ passing through the point (1, 1, 1) is $\frac{5}{2}$ and the perpendicular distance from the origin to the plane $\pi$ is $\frac{5}{7}$. If the y–intercept of the plane $\pi$ is negative and the z–intercept is positive then its y–intercept is **[AP EAMCET 04-07-2022_Shift-1]**

1. $-5/3$ 2. $-5/6$
3. $-3/2$ 4. $-5/2$

36. If the equation of the plane which is at a distance of 1/3 units from the origin and perpendicular to a line whose directional ratios are (1,2,2) is x+py+qz+r=0 then $\sqrt{p^2+q^2+r^2}=$

**[AP EAMCET 04-07-2022_Shift-2]**

1. 3 2. $\sqrt{5}$
3. $\sqrt{13}$ 4. 2

37. Let the plane $\pi$ pass through the point (1, 0, 1) and perpendicular to the planes $2x+3y-z=2$ and $x-y+2z=1$. Let the equation of the plane passing through the point (11, 7, 5) and parallel to the plane $\pi$ be $ax+by-z+d=0$. Then $\frac{a}{b}+\frac{b}{d}=$

**[AP EAMCET 05-07-2022_Shift-1]**

1. 3 2. 0
3. 2 4. −2

38. If $-2,\frac{4}{3},\frac{-4}{5}$ are the intercepts made by a plane on X, Y, Z–axes respectively then the direction cosines of a normal to this plane are

**[AP EAMCET 05-07-2022_Shift-2]**

1. $\left(\frac{-1}{3},\frac{2}{3},\frac{-2}{3}\right)$ 2. $\left(\frac{2}{3\sqrt{5}},\frac{-4}{3\sqrt{5}},\frac{5}{3\sqrt{5}}\right)$
3. $\left(\frac{-4}{\sqrt{57}},\frac{4}{\sqrt{57}},\frac{-5}{\sqrt{57}}\right)$ 4. $\left(\frac{2}{\sqrt{38}},\frac{-3}{\sqrt{38}},\frac{5}{\sqrt{38}}\right)$

39. If $a,b,c$ are the intercepts made by the plane passing through the point (1, 2, 3) parallel to the plane $3x+4y-5z=0$ *and* $X$,Y,Z–axes respectively then $3a+b+5c=$

**[AP EAMCET 06-07-2022_Shift-1]**

1. 0 2. 1
3. −1 4. 2

40. If (3,4,-7) is the foot of the perpendicular drawn from the point (-2,3,6) to the plane $\pi$ then the sum of the intercepts made by the plane $\pi$ on the x and y-axes is

**[AP EAMCET 06-07-2022_Shift-2]**

1. 132 2. 142
3. 210 4. 175

41. Let ax+by+cz+d=0 be the equation of a plane. Given that 4a+4b+c=0 and a+2b+c=0. Then d=

**[AP EAMCET 07-07-2022_Shift-1]**

1. 9 2. -7
3. 4 4. -5

42. A plane meets the X,Y,Z-axes in A,B,C respectively. If the centroid of the triangle ABC is (2,-3,5) then the perpendicular distance from origin to the given plane is

**[AP EAMCET 07-07-2022_Shift-2]**

1. $\frac{7}{\sqrt{40}}$
2. $\frac{6}{7}$
3. $\frac{8}{\sqrt{50}}$
4. $\frac{90}{19}$

43. Let $A=(-3,-2,7)$ and $B=(3,1,-2)$. Let a plane perpendicular to the line segment AB divide AB in the ratio 2:1. Then the intercept made by the plane on y–axis is

**[AP EAMCET 08-07-2022_Shift-1]**

1. $-\frac{1}{2}$
2. $\frac{1}{3}$
3. 2
4. $-1$

44. Let $\pi$ be the plane passing through the point (3,-3,1) and perpendicular to the line joining the points (3,4,-1), and (2, –1, 5). If the equation of the plane containing the points (3, 4, -1), (-1,2,5) and perpendicular to the plane $\pi$ is $ax+y+cz-d=0$ then $3(a+c)=$

**[AP EAMCET 08-07-2022_Shift-2]**

1. -d
2. 2d
3. d
4. -2d

45. Let the foot of the perpendicular drawn from the point (1, 2, 3) to a plane be (–1, 3, –2). Then the perpendicular distance from the origin to the plane is

**[TS EAMCET 18-07-2022_Shift-1]**

1. $\frac{5}{\sqrt{30}}$
2. $\sqrt{\frac{15}{2}}$
3. $\sqrt{\frac{2}{15}}$
4. $\frac{1}{\sqrt{3}}$

46. Let A=(3, 4, 0), B=(4, 4, 4), C=(-6, 2, 3) and D=(1,1,2), If $\theta$ is the acute angle between the lines AB and CD then $\cos\theta$ =

**[TS EAMCET 18-07-2022_Shift-2]**

1. $\frac{4}{17\sqrt{3}}$
2. $\frac{3}{17\sqrt{3}}$
3. $\frac{12}{17\sqrt{3}}$
4. $\frac{11}{17\sqrt{3}}$

47. A plane containing two lines whose direction ratios are (-1, 2, 1) and (1, 3, 2) passes through the point (2, 1, k). If this plane also passes through the point (3, - 1, 4), then k =

**[TS EAMCET 18-07-2022_Shift-2]**

1. 5
2. 3
3. 6
4. -3

48. Let $6x-3y+2z-6=0$ be the given plane. If $a,b,c$ are the intercepts made by the plane X, Y, Z -axes respectively; $l,m,n$ are the direction cosines of a normal drawn to the plane and p is the perpendicular distance from the origin to the plane, then $|al+bm+cn|=$

**[TS EAMCET 19-07-2022_Shift-I]**

1. $p$
2. $2p$
3. $3p$
4. $4p$

49. If a plane x+y+z–5=0 intersects the line joining A(1,1,1) and B(2,2,2) at P then AP:PB=**[TS EAMCET 19-07-2022_Shift-2]**

1. 1:2
2. 2:3
3. 3:2
4. 2:1

50. If a plane passing through the points (2,3,0), (0,–5,2) and (–2,0,3) meets the X,Y,Z–axes in A,B,C respectively then A=

**[TS EAMCET 20-07-2022_Shift-1]**

1. $\left(\frac{3}{7},0,0\right)$
2. $\left(\frac{7}{3},0,0\right)$
3. $\left(\frac{21}{13},0,0\right)$
4. $(21,0,0)$

51. If $l$, $m$, $n$ are the dc's of a normal to the plane passing through the points (0, 1, 2), (3, 0, 2), (4, 5, 0) then $|l|+|m|+|n|$ =

**[TS EAMCET 20-07-2022_Shift-2]**

1. $\frac{13}{\sqrt{91}}$
2. $\frac{11}{\sqrt{57}}$
3. $\frac{13}{\sqrt{77}}$
4. $\frac{12}{\sqrt{74}}$

52. The distance between two parallel planes $ax+by+cz+d_1=0$, $ax+by+cz+d_2=0$ is given by $\frac{|d_1-d_2|}{\sqrt{a^2+b^2+c^2}}$. If the plane $2x-y+2z+3=0$ has the distances $\frac{1}{3}$ and $\frac{2}{3}$ units from the planes $4x-2y+4z+\lambda=0$ and $2x-y+2z+\mu=0$ respectively, then the maximum value of $\lambda+\mu$ is

**[15th May 2023 Shift 1]**

1. 15
2. 5
3. 13
4. 9

53. Let S be the circum circle of the triangle formed by the line $x-2y-4=0$ with the coordinate axes. If $P(-2,-4)$ is a point in the plane of the circle S and Q is a point on S such that the distance between P and Q is the least, then PQ= **[15th May 2023 Shift 1]**

1. $5-\sqrt{5}$
2. $5+\sqrt{5}$
3. $13+\sqrt{5}$
4. $13-\sqrt{5}$

54. If the plane 56x+4y+9z=2016 meets the coordinate axes in A,B and C, then the centroid of the $\Delta ABC$ is

**[16th May 2023 Shift 1]**

1. $(12,168,224)$
2. $(12,168,112)$
3. $\left(12,168,\frac{224}{3}\right)$
4. $\left(12,-168,\frac{224}{3}\right)$

55. A point on the plane passing through the points $((\sqrt{2},1,4),(0,-1,0)$ and $(0,0,1)$ is **[16th May 2023 Shift 2]**

1. $(-\sqrt{2},1,-4)$
2. $(\sqrt{2},1,-4)$
3. $(\sqrt{2},-1,4)$
4. $(-\sqrt{2},-1,-4)$

56. Coordinate planes and the planes $\pi_1,\pi_2,\pi_3$ which are respectively parallel to YZ, ZX, XY planes at distance a,b,c form a rectangular parallelepiped. $d_1$ is a diagonal of the face on XY-plane not passing through origin and $d_2$ is diagonal of plane $\pi_2$ coterminous with $d_1$. If none of the coordinates of the vertices of the parallelepiped are negative and angle between $d_1$ and $d_2$ is $\theta$, then $\cos\theta=$

**[17th May 2023 Shift 1]**

1. $\frac{a^2}{\sqrt{a^2+b^2}\sqrt{a^2+c^2}}$
2. $\frac{a}{a^2+b^2+c^2}$
3. $\frac{\pi}{2}$
4. $\frac{a^2}{\sqrt{a^2+b^2}\sqrt{b^2+c^2}}$

57. An equation of a plane parallel to the plane x - 2y + 2z – 5 = 0 and which is at one unit distance from the origin is

**[17th May 2023 Shift 1]**

1. $x-2y+2z-1=0$
2. $x-2y+2z+5=0$
3. $x-2y+2z-3=0$
4. $x-2y+2z+1=0$

58. The equation of the plane passing through the point (1,2,2) and perpendicular to the planes x–y+2z=3 and 2x–2y+z+12=0 is

**[17th May 2023 Shift 2]**

1. x–2y+2z–1=0
2. 2x–3y+4z–4=0
3. x+y+z–5=0
4. x+y–3=0

59. If the foot of the perpendicular drawn from (0,0,0) to a plane is (1, 2, 3), then equation of the plane is **[18th May2023 shift -1]**

1. 2x+y+3z=14
2. x+2y+3z=14
3. x+2y+3z+14=0
4. x+2y-3z=14

60. The equation of a plane passing through (-1,2,3) and whose normal makes equal angles with the coordinate axes is **[18th May 2023 Shift 2]**

1. x+y+z+4=0
2. x-y+z+4=0
3. x+y+z-4=0
4. x+y+z=0

61. If the planes $2x+3y+4z+7=0$ and $4x+ky+8z+1=0$ are parallel, then the equation of the plane passing through the point (k,k,k) and having the direction ratios of its normal as (k-1,k, k+1) is

**[19th May 2023 Shift 1]**

1. $x+2y+3z=36$ 2. $3x+4y+5z=72$

3. $4x+5y+6z=90$ 4. $5x+6y+7z=108$

62. Equation of the plane passing through the mid-point of the line segment joining the points $A(4,5,-10)$ *and* $B(-1,2,1)$ and perpendicular to AB is **[12TH MAY 2023 SHIFT-1]**

1. $10x+6y-22z+135=0$
2. $10x+6y-22z-135=0$
3. $5x+3y+11z=135$
4. $10x+6y-22z+185=0$

63. A line $L$ is parallel to both the planes $2x+3y+z=1$ and $x+3y+2z=2$. If the line L makes an angle $\alpha$ with the positive direction of X–axes, then $\cos\alpha=$

**[12TH MAY 2023 SHIFT -2]**

1. $\frac{1}{\sqrt{3}}$ 2. $\frac{1}{\sqrt{2}}$

3. $\frac{1}{2}$ 4. $\frac{\sqrt{3}}{2}$

64. (1,-2,1) is a point on a plane $\pi$ and $\pi$ is parallel to the plane $x-y-z=0$. If the equation of $\pi$ is $ax+by+cz-2=0$, then $b-2c=$ **[13TH MAY 2023 SHIFT-1]**

1. -a 2. 2a

3. -2a 4. a

65. If $(2,-1,3)$ is the foot of the perpendicular drawn from the origin to a plane, then the equation of that plane is

**[EAPCET 14-05-23 SHIFT-1]**

1. $2x+y-3z+6=0$
2. $2x-y+3z-14=0$
3. $2x-y+3z-13=0$
4. $2x+y+3z-10=0$

66. A plane $\pi$ passing through the point (1,1,1) is perpendicular to the line joining the points (6,3,2) and (1, -4, -9). If $ax+by+cz-23=0$ is the equation of the plane $\pi$ then $a+b-c=$ **[EAPCET 13-05-23 SHIFT-2]**

1. 1 2. 23

3. 9 4. 13

## KEY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1) | 4 | 2) | 1 | 3) | 3 | 4) | 3 | 5) | 1 |
| 6) | 4 | 7) | 3 | 8) | 1 | 9) | 2 | 10) | 3 |
| 11) | 4 | 12) | 3 | 13) | 1 | 14) | 1 | 15) | 1 |
| 16) | 3 | 17) | 1 | 18) | 1 | 19) | 3 | 20) | 1 |
| 21) | 1 | 22) | 4 | 23) | 4 | 24) | 3 | 25) | 1 |
| 26) | 2 | 27) | 2 | 28) | 3 | 29) | 3 | 30) | 4 |
| 31) | 1 | 32) | 2 | 33) | 1 | 34) | 3 | 35) | 1 |
| 36) | 1 | 37) | 4 | 38) | 4 | 39) | 3 | 40) | 1 |
| 41) | 2 | 42) | 4 | 43) | 4 | 44) | 3 | 45) | 2 |
| 46) | 2 | 47) | 1 | 48) | 3 | 49) | 4 | 50) | 2 |
| 51) | 4 | 52) | 3 | 53) | 1 | 54) | 3 | 55) | 2 |
| 56) | 1 | 57) | 3 | 58) | 4 | 59) | 2 | 60) | 3 |
| 61) | 4 | 62) | 2 | 63) | 1 | 64) | 4 | 65) | 2 |
| 66) | 1 | | | | | | | | |

## SOLUTIONS

1. $2x+y+z=k$

$x=0, y=0 \Rightarrow z-axis$

$y=0, z=0 \Rightarrow x-axis$

$x=0, z=0 \Rightarrow y-axis$

$\textit{volume of tetrahedron} = \frac{1}{6}\left[\overline{AB}\ \overline{AC}\ \overline{AD}\right]$

$$V=\frac{1}{6}\begin{vmatrix} 0 & k & 0 \\ 0 & 0 & k \\ \frac{-k}{2} & 0 & 0 \end{vmatrix} = \frac{1}{6}\cdot\frac{k^3}{2}$$

$$\frac{2V^3}{3}=\frac{1}{6}\cdot\frac{k^3}{2}$$

$V^3 : k^3 = 1^3 : 2^3 \Rightarrow k : V = 2:1$

2. d.r's of the plane $\pi_1$=1,-2,5

d.r's of the plane $\pi_2$=0,4,-6

let $\theta$ be the angle between $\pi_1$ and $\pi_2$

$$\cos\theta=\frac{|0-8-30|}{\sqrt{1+4+25}\sqrt{16+36}}=\frac{19}{\sqrt{390}}$$

$$\theta=\cos^{-1}\left(\frac{19}{\sqrt{390}}\right)$$

3. Given plane $2x-y-2z-9=0$

Distance from O(0,0,0) to plane

$ax+by+cz+d=0$ is

$$dis\tan ce=\frac{|d|}{\sqrt{a^2+b^2+c^2}}=\frac{|-9|}{\sqrt{4+1+4}}=1$$

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

$P(x,y,z)=(2t+1,t-1,-t+1)$

$x+2y+3z=4$

$(2t+1)+2(t-1)+3(t-1)=4\Rightarrow t=2$

$P(5,1,-1)$,

$(2\bar{i}-3\bar{j})\times(\bar{i}+2\bar{j}-\bar{k})=3\bar{i}+2\bar{j}+7\bar{k}$

Req line is

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

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

5. $\pi_1+\lambda\pi_2=0$

*passes through the point*$(0,0,0)\Rightarrow\lambda=4$

$\therefore$ required plane is

$x+2y+3z-4+4(4x+3y+2z+1)=0$

$\Rightarrow 17x+14y+11z=0$

6. $(a_1,b_1,c_1)$ are dr's of $1^{st}$ line

| | | | |
|---|---|---|---|
| | $a_1$ | $b_1$ | $c_1$ |
| $-1$ | 0 | 1 | $-1$ |
| 1 | 1 | 2 | 1 |

$\frac{a_1}{-1}=\frac{b_1}{-1}=\frac{c_1}{3}$

$(a_1,b_1,c_1)=(-1,-1,3)$

$(a_2,b_2,c_2)$ are dr's of $2^{nd}$ line.

| | | | |
|---|---|---|---|
| | $a_2$ | $b_2$ | $c_2$ |
| 0 | $-1$ | 2 | 0 |
| 1 | $-3$ | 1 | 1 |

$\frac{a_2}{1}=\frac{b_2}{5}=\frac{c_2}{2}$ $(a_2,b_2,c_2)=(1,5,2)$

Since $a_1a_2+b_1b_2+c_1c_2=0\Rightarrow\theta=90^0$

7. Let $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-5}{-3}=r\rightarrow(1)$ &

$\frac{x+5}{3}=\frac{y-4}{-1}=\frac{z+3}{4}=s\rightarrow(2)$

$(x_1,y_1,z_1)=(r+1,2r+2,-3r+5)$

$(x_2,y_2,z_2)=(3s-5,-s+4,4s-3)$

$r+1=3s-5$

$3s-r-6=0\rightarrow(3)$

$2r+2=-s+4$

$s+2r-2=0\rightarrow(4)$

$\frac{s}{2+12}=\frac{1}{6+1}\Rightarrow s=2$

$z=4s-3=4(2)-3=5$

8. $\frac{(x+1)}{\cos120^0}=\frac{y-3}{\sin120^0}=r$ $\quad\frac{x+1}{\frac{-1}{2}}=\frac{y-3}{\frac{\sqrt{3}}{2}}=r$

9. $\cos\theta=\frac{3+6+4}{\sqrt{1+4+4}\sqrt{9+9+4}}=\frac{13}{3\sqrt{22}}$

10. Conceptual

11. *given* $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}.....(1)$

*and* $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}...(2)$

*let $a,b,c$ are dr's of req.line $\perp r$ to* $(1)$ & $(2)$

$a+2b+3c=0$ & $-3a+2b+5c=0$

*by solving weget* $\frac{a}{2}=\frac{b}{-7}=\frac{c}{4}$

*req.line through* $(-1,3,-2)$ is $\frac{x+1}{2}=\frac{y-3}{-7}=\frac{z+2}{4}$

12. Equation of line $\frac{x-1}{2}=\frac{y-1}{-2}=\frac{z+1}{1}$

$\tan\theta=\frac{1}{\sqrt{8}} \Rightarrow \sin\theta=\frac{1}{3}$

$$\sin\theta=\frac{al+bm+cn}{\sqrt{a^2+b^2+c^2}\sqrt{l^2+m^2+n^2}}$$

$$\frac{1}{3}=\frac{2\sqrt{\lambda}-6+6}{\sqrt{9}\sqrt{\lambda+9+36}} \Rightarrow \lambda=15$$

13. $2x^2-6y^2-12z^2+18yz+2zx+xy$

$=(x+2y-2z+k)(2x-3y+6z+l)$

$$\cos\theta=\frac{|a_1a_2+b_1b_2c_1c_2|}{\sqrt{a_1^2+b_1^2+c_1^2}\sqrt{a_2^2+b_2^2+c_2^2}}$$

$$\cos\theta=\frac{16}{21} \Rightarrow \theta=\cos^{-1}\left(\frac{16}{21}\right)$$

14. Normal to the plane $\overline{AB}\times\overline{AC}=(1,-2,1)$

$$d.c's=\left(\frac{1}{\sqrt{6}},\frac{-2}{\sqrt{6}},\frac{1}{\sqrt{6}}\right)$$

$$\cos\alpha=\frac{1}{\sqrt{6}},\ \cos\beta=\frac{2}{\sqrt{6}}$$

$$\sin^2\alpha+\sin^2\beta=1-\frac{1}{6}+1-\frac{4}{6}=\frac{7}{6}$$

15. Equation of $\pi_1$ is $y+2z-13=0$

Equation of $\pi_2$ is $x-2y+z+3=0$

Here $a_1a_2+b_1b_2+c_1c_2=0 \Rightarrow \theta=\frac{\pi}{2}$

16. Equation of the plane passing through line of intersection of planes $\pi_1$ *and* $\pi_2$ is

$\pi_1+\lambda\pi_2=0$

$\Rightarrow(2x+6y+4z-7)+\lambda(x-y-2z-2)=0$

$\Rightarrow(2+\lambda)x+(6-\lambda)y+(4-2\lambda)z-(7+2\lambda)=0$

Since the above plane is perpendicular to $x+y+2z-5=0$

We can write

$(2+\lambda)+(6-\lambda)+2(4-2\lambda)=0 \Rightarrow \lambda=4$

Required equation of plane is

$6x+2y-4z-15=0$

17. Dr's of normal to the plane are (a,b,1)

Dr's of line are (1,1,2)

But line is perpendicular to the normal to the plane.

Then a+b+2=0

a+b=-2

18. Let the required plane

$ax+by+cz+d=0\rightarrow(1)$

$(1)$ *passes through* $(2,1,3)$

$2a+b+3c+d=0\rightarrow(2)$

$(1)\perp^{er}$ *to* $x-2y+2z+3=0\ \&\ 3x-2y+4z-4=0$

$a-2b+2c=0\rightarrow(3)$

$\&\ 3a-2b+4c=0\rightarrow(4)$

*solving* $(2),(3),(4)$

*we get* $a=2,b=-1,c=-2,d=3$

*i.e* $2x-y-2z+3=0$

19. $\pi\rightarrow x+y+z=12$

*image of* $A$ *is* $=Q(5,6,7)$

$\Rightarrow\frac{x-5}{2}=\frac{y-6}{1}=\frac{z-7}{-2}=k$

$B(2k+5,k+6,-2k+7)$

$\Rightarrow 2k+5+k+6-2k+7=12$

$k=-6$

$OB=\sqrt{49+361}=\sqrt{410}$

20. *Given* $4x+3y+2z=2$

sum of intercepts $\frac{1}{2}+\frac{2}{3}+1=\frac{13}{6}$

21. $\pi_1: 2x-y+z-6=0$

$\pi_2: x+y+2z-3=0$

$$\cos\theta=\frac{|2-1+2|}{\sqrt{6}\sqrt{6}}=\frac{3}{6}=\frac{1}{2}$$

$$\theta=\frac{\pi}{3}$$

22. Let the plane $ax+by+cz+d=0$

Passes $(0,1,2)$ $b+2c+d=0 \to (2)$

passes $(-1,0,3)$ $-a+3c+d=0 \to (3)$

$(1) \perp^{er}$ *to* $2x+3y+z-5=0$

$2a+3b+c=0 \to (4)$

*by solving* $a=4, b=-3, c=1$

$\therefore (1) \to 4x-3y+z+1=0$

23. $dr's$ *of* $PQ=(2,1,2)$

Equation of the plane

$2(x-2)+1(y-1)+2(z-2)=0$

$2x+y+2z=9$

24. $\alpha=45^0, \beta=120^0, \gamma=?$

$\cos^2\alpha+\cos^2\beta+\cos^2\gamma=1$

$\frac{1}{4}+\frac{1}{2}+\cos^2\gamma=1 \Rightarrow \cos^2\gamma=\frac{1}{4} \Rightarrow \gamma=60^0$

25. $G=\left(\frac{a}{3},\frac{b}{3},\frac{c}{3}\right)=(x,y,z)$

$a=3x, b=3y, c=3z$

$\because$ *Given* $\perp^{er}$ *distance is* 1

$\Rightarrow \frac{1}{\sqrt{\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}}}=1 \Rightarrow \frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=9$

26. The required plane

$$\begin{vmatrix} x-x_1 & y-y_1 & z-z_1 \\ x_2-x_1 & y_2-y_1 & z_2-z_1 \\ x_3-x_1 & y_3-y_1 & z_3-z_1 \end{vmatrix}=0$$

$\Rightarrow 3x-4z=-1$ (parallel to y-axis)

27. $\pi: x+2y-2z+5=0$

$d=\perp^{er}$ distance from (0,0,0) to $\pi$

$d=\frac{5}{\sqrt{1+4+4}}=\frac{5}{\sqrt{9}}=\frac{5}{3}$ *units*

28. Required equation is

$(x-2y+z+2)+\lambda(3x-y-z+1)=0$ ......(1)

$\Rightarrow \lambda=-1$

Substitute $\lambda=-1$ in equation (1)

$\Rightarrow 2x+y-2z=1$

x- intercept $=\frac{1}{2}$

29. Take $\begin{vmatrix} 3-2 & 2-3 & 1-2 \\ 2 & 3 & \lambda \\ 3 & 2 & 3 \end{vmatrix}=0 \Rightarrow \lambda=4$

$\sin^{-1}(\sin 4)+\cos^{-1}(\cos 4)=\pi-4+2\pi-4$

30. Given $ax+by+cz+1=0....(1)$

$2x-2y+z=0....(2)$

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

$(1)\perp(2) \Rightarrow 2a-2b+c=0...(4)$

$(1)\perp(3) \Rightarrow a-b+2c=0....(5)$

(1) is passing through

$(1,-2,1) \Rightarrow a-2b+c=-1....(6)$

Solving (4),(5) and (6) ,we get

$a=1, b=1 \,\&\, c=0$

Now $a+b-c=1+1-0=2$

31. All points lies on plane $2x-2y+4z+5=0$

32. $\bar{r}.(2\hat{i}+3\hat{j}-4\hat{k})=1$

$\Rightarrow (x\hat{i}+y\hat{j}+z\hat{k}).(2\hat{i}+3\hat{j}-4\hat{k})=1$

$\Rightarrow 2x+3y-4z-1=0....(1)$

Equation of plane parallel to equation (1) is

$2x+3y-4z+h=0...(2)$

Given : distance between (1) & (2) =2

$\Rightarrow \frac{|h+1|}{\sqrt{4+9+16}}=2 \Rightarrow h=-1\pm 2\sqrt{29}$

Hence required equation is:

$2x+3y-4k=1\pm 2\sqrt{29}$

33. Given points $A(1,1,-1), B(2,-1,0) \& C(-1,0,2)$

Let $\begin{vmatrix} x-x_1 & y-y_1 & z-z_1 \\ x_2-x_1 & y_2-y_1 & z_2-z_1 \\ x_3-x_1 & y_3-y_1 & z_3-z_1 \end{vmatrix}=0$

$$\begin{vmatrix} x-1 & y-1 & z+1 \\ 2-1 & -1-1 & 0+1 \\ -1-1 & 0-1 & 2+1 \end{vmatrix}=0 \Rightarrow \begin{vmatrix} x-1 & y-1 & z+1 \\ 1 & -2 & 1 \\ -2 & -1 & 3 \end{vmatrix}=0$$

$\Rightarrow (x-1)[-6+1]-(y-1)[3+2]+(z+1)[-1-4]=0$

$\Rightarrow (x-1)(-5)-(y-1)(5)+(z+1)(-5)=0$

$(x-1)+(y-1)+z+1=0$

$x+y+z-1=0$

Option verification: $1+2-2-1=0$

34. $\frac{x}{20}+\frac{y}{15}+\frac{z}{-12}=1$

$A(20,0,0), B(0,15,0), C(0,0,-12)$ and $O(0,0,0)$.

Volume of tetrahedron $OABC$ is

$$=\frac{1}{6}\begin{vmatrix} 0 & 0 & 0 & 1 \\ 20 & 0 & 0 & 1 \\ 0 & 15 & 0 & 1 \\ 0 & 0 & -12 & 1 \end{vmatrix}=600$$

35. $P(x_1,y_1,z_1)=(1,1,1)$

X- intercept = 5/2

$\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

$\frac{x}{5/2}+\frac{y}{b}+\frac{z}{c}=1$

$\frac{2}{5}+\frac{1}{b}+\frac{1}{c}=1$

$\frac{1}{b}+\frac{1}{c}=1-\frac{2}{5}=\frac{3}{5}$

Since y – intercept of the plane $\pi$ is

Negative,

Z- Intercept of the plane $\pi$ *is Positive*

Y – Intercept = ?

$\perp^r$ Distance from O ( 0,0,0) to eq..(1)= $\frac{5}{7}$

$$\frac{1}{\sqrt{\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}}}=\frac{5}{7}$$

$$25\left(\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}\right)=49$$

$$\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{49}{25}$$

$$\frac{4}{25}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{49}{25}$$

$$\frac{1}{b^2}+\frac{1}{c^2}=\frac{45}{25}=\frac{9}{5}$$

$$\left(\frac{1}{b}+\frac{1}{c}\right)^2-2\frac{1}{bc}=\frac{9}{5}$$

$$\frac{9}{25}-\frac{9}{5}=\frac{2}{bc}\left(\because \frac{1}{b}+\frac{1}{c}=-\frac{3}{5}+\frac{6}{5}=\frac{3}{5}\right)$$

bc = -25/18 (satisfied)

$$=-\frac{5}{3}\cdot\frac{5}{6}=-\frac{25}{18} \therefore b=-\frac{5}{3}, c=\frac{5}{6}$$

$\therefore y-intercept$ of the plane $\pi$ is $-5/3$

36. D.r ( 1,2,2)

$x+2y+2z+r=0$ .............(1)

$\perp^r$ Distance from O(0,0,0) to eq...(1) $=\frac{1}{3}$

$$\frac{r}{\sqrt{1+4+4}}=\frac{1}{3}$$

$$\left(\frac{r}{3}\right)=\frac{1}{3}$$

$r=\pm 1$

$\therefore x+2y+2z+1=0$

$\therefore \sqrt{p^2+q^2+r^2}=\sqrt{2^2+2^2+1^2}=\sqrt{9}=3$

37. $P(x_1, y_1, z_1) = P(1,0,1)$

$2a+3b-c=0$

$a-b+2c=0$

$$\begin{matrix} 3 & -1 & 2 & 3 \\ -1 & 2 & 1 & 1 \end{matrix}$$

$$\frac{a}{6-1}=\frac{b}{-1-4}=\frac{c}{-2-3}$$

$$\frac{a}{5}=\frac{c}{-5}=\frac{c}{-5}$$

Eq. of plane having dr's $(1,-1,1)$& $P(1,0,1)$

$1(x-1)-1(y-0)-1(z-1)=0$

$x-1-y-z+1=0$

$d.r's \quad 1,-1,-1$

$P(x_1, y_1, z_1) = P(11,7,5)$

$1(x-11)-(y-7)-(z-5)=0$

$x-11-y+7-z+5=0$

$x-y-z+1=0$

$a=1,\ b=-1,\ c=-1,\ d=1$

$$\frac{a}{b}+\frac{b}{d}=\frac{1}{-1}+-\frac{1}{1}=-1-1=-2$$

38. $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

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

$-2x+3y-5z=4$

$2x-3y+5z+4=0$...........(1)

Dr's $\quad 2, -3, 5$

Dc's $\frac{2}{\sqrt{38}}, -\frac{3}{\sqrt{38}}, \frac{5}{\sqrt{38}}$.

39. $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ .....(1)

(1) Passes through P(1,2,3)

$\frac{1}{a}+\frac{2}{b}+\frac{3}{c}=1$ ..........(2)

$3x+4y-5z=0$ ..........(3)

$$\frac{3}{1/a}=\frac{4}{1/b}=-\frac{5}{1/c}$$

$3a=4b=-5c=k$

$a=k/3, b=k/4, c=-k/5$

$$(3) \Rightarrow \frac{3}{k}+\frac{8}{k}-\frac{15}{k}=1$$

$$-\frac{4}{k}=1 \Rightarrow k=-4$$

$$a=-\frac{4}{3}, b=-1; c=\frac{4}{5}$$

$3a+b+5c=-4-1+4=-1$

40. Dr $\quad$ (3+1, 4–3, –7–6 )

Dr ( 5, 1, -13 )

$5(x-3)+1(y-4)-13(2+7)=0$

$5x-15+y-4-13z-91=0$

$5x+y-13z-110=0$

$$\frac{5x}{110}+\frac{y}{110}+\frac{z}{-\frac{110}{13}}=1$$

$$\frac{x}{22}+\frac{y}{110}+\frac{z}{-\frac{110}{13}}=1$$

$a+b=22+110=132$

41. Data is not sufficient.

42. G (2,-3,5)

A( a, 0,0) B ( 0, b, 0) C ( 0 , 0 ,c)

$$\frac{a}{3}=2, \frac{b}{3}=-3, \frac{c}{3}=5$$

$$\frac{x}{6}+\frac{y}{-9}+\frac{z}{15}=1$$

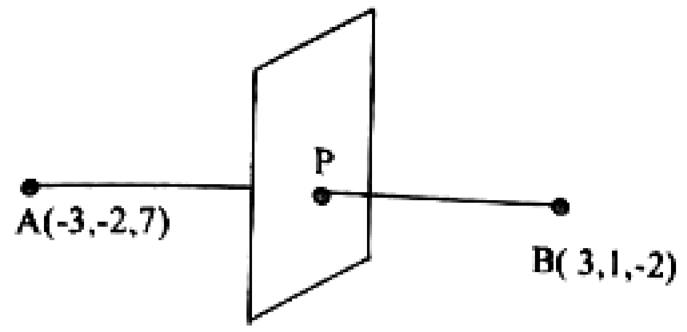
$15x-10y+6z-90=0$ ........(1)

$\perp^r$ distance from O (0,0,0) to eq......(1)

$$=\frac{90}{\sqrt{225+100+36}}=\frac{90}{\sqrt{361}}=\frac{90}{19}$$

43. The line segment AB divide in the ratio 2:1

$$\left(\frac{6-3}{3}, \frac{2-2}{3}, -\frac{4+7}{3}\right)$$




P ( 1, 0, 1)

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

$$2x+y-3z+1=0$$

$$-2x-y+3z=1$$

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

Y – intercept = –1

44. $\begin{vmatrix} x-3 & y-4 & z+1 \\ 4 & 2 & -6 \\ 1 & 5 & -6 \end{vmatrix}=0$

$$x+y+z-6=0$$

$$ax+by+cz-d=0$$

a = 1, b = 1, c = 1, d = 6,

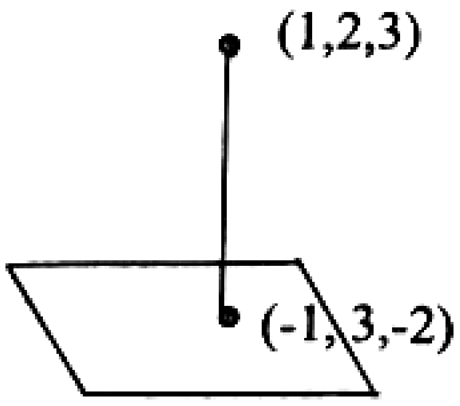
$$a+c=2$$

$$3(a+c)=3(2)=6$$

$$\therefore d=6$$

$$\therefore 3(a+c)=d$$

45. d.r. 2, -1,5




2(x + 1)–1 (y – 3) + 5 (z + z) = 0

2x + 2 – y + 3 +5z +10 =0

2x – y + 5z +15 =0 ........... (1)

⊥ʳ distance from O( 0, 0, 0) to eq. ....(1)

$$\frac{15}{\sqrt{4+1+25}}=\frac{15}{\sqrt{30}}$$

$$=\frac{15}{\sqrt{15}\sqrt{2}}=\sqrt{\frac{15}{2}}$$

46. AB = 1,0,4

CD = 7, -1,-1

$$\cos\theta=\frac{|7+0-4|}{\sqrt{17}\sqrt{49+1+1}}$$

$$=\frac{3}{\sqrt{17}\sqrt{51}}=\frac{3}{\sqrt{17}\sqrt{17}\sqrt{3}}=\frac{3}{17\sqrt{3}}$$

47. $\begin{vmatrix} x-3 & y+1 & z-4 \\ -1 & 2 & 1 \\ 1 & 3 & 2 \end{vmatrix}=0$

$$(x-3)(1)+3(y+1)-5(z-4)=0$$

$$x-3+3y+3-5z+20=0$$

$$x+3y-5z+20=0 \text{ ..............(1)}$$

Eq. (1) passes through P ( 2, 1, k)

$$2+3-5k+20=0$$

$$25-5k=0$$

$$\therefore k=5$$

48. $6x-3y+2z=6$

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

$$a=1, b=-2, c=3$$

$dr's$ $6,-3,2$

$dc's$ $\frac{6}{7},\frac{-3}{7},\frac{2}{7}$

$$l=\frac{6}{7}, m=\frac{-3}{7}, n=\frac{2}{7}, p=\frac{6}{7}$$

$$|al+bm+cn|=\frac{6}{7}+\frac{6}{7}+\frac{6}{7}=\frac{18}{7}$$

$$3p=3\left(\frac{6}{7}\right)=\frac{18}{7}$$

$$|al+bm+cn|=3p$$

49. $x+y+z-5=0$

$A(1,1,1)\ B(2,2,2)$

$\pi_{11}=1+1+-5=-2 \Rightarrow \pi_{22}=2+2+2-5=1$

$-\pi_{11}:\pi_{22}=2:1$

50. $$\begin{vmatrix} x-2 & y-3 & z-0 \\ -2 & -8 & 2 \\ -4 & -3 & 3 \end{vmatrix}=0$$

$(x-2)(-18)-(y-3)(2)+z(-22)=0$

$-18x+36-2y+6-22z=0$

$9x+y+11z-21=0$

$$\frac{x}{\frac{21}{9}}+\frac{y}{21}+\frac{z}{\frac{21}{11}}=1$$

$$a=\frac{21}{9}, b=21, c=\frac{21}{11}$$

$$\therefore A(a,0,0)=A\left(\frac{7}{3},0,0\right)$$

51. $$\begin{vmatrix} x-0 & y-1 & z-2 \\ 3 & -1 & 0 \\ 4 & 4 & -2 \end{vmatrix}=0$$

$$\begin{vmatrix} x & y-1 & z-2 \\ 3 & -1 & 0 \\ 4 & 4 & -2 \end{vmatrix}=0$$

$x(2-0)-(y-1)(-6-0)+(z-2)(12+4)=0$

$2x+6y+16z-38=0$

$x+3y+8z-19=0$

$d.r's \quad 1,3,8$

$$d.c's \quad \frac{1}{\sqrt{74}},\frac{3}{\sqrt{74}},\frac{8}{\sqrt{74}}$$

$$|l|+|m|+|n| = \frac{1+3+8}{\sqrt{74}}$$

$$=\frac{12}{\sqrt{74}}$$

52. $\pi_1: 2x-y+2z+3=0$

$\pi_2: 2x-y+2z+\frac{\lambda}{2}=0$

$\pi_3: 2x-y+2z+\mu=0$

distance between $\pi_1$ & $\pi_2$ *is* $\frac{1}{3}$

$$\Rightarrow \left|\frac{\frac{\lambda}{2}-3}{\sqrt{4+1+4}}\right|=\frac{1}{3}$$

$$\Rightarrow \frac{\lambda}{2}-3=\pm 1$$

$$\Rightarrow \frac{\lambda}{2}=4 \qquad \frac{\lambda}{2}=2$$

$$\Rightarrow \lambda=8 \qquad \lambda=4$$

distance between $\pi_2$ & $\pi_3$ *is* $\frac{2}{3}$

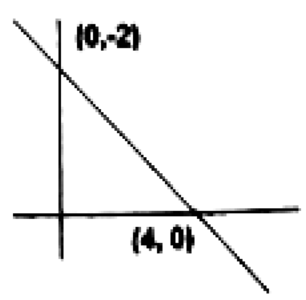
$$\Rightarrow \left|\frac{\mu-3}{\sqrt{4+1+4}}\right|=\frac{2}{3}$$

$$\Rightarrow \mu-3=\pm 2$$

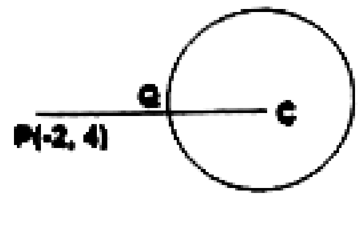
$$\Rightarrow \mu=5 \qquad \mu=1$$

$\therefore$ Then value of $\lambda+\mu=8+5=13$

53. Circum centre of right angle $\Delta$le is midpoint of hypothesis




$\therefore$ Circum centre=(2,−1)




And radius= $\sqrt{5}$

$PQ = CP - r$

$$=\sqrt{(2+2)^2+(-1+4)^2}-\sqrt{5}$$

$$=5-\sqrt{5}$$

54. Given plane is 56x+4y+9z=2016

$\Rightarrow \frac{x}{36}+\frac{y}{504}+\frac{z}{224}=1$

$A=(36,0,0), B=(0,504,0)$

$C=(0,0,224)$

*Centroid of* $\triangle ABC$

$G=\left(\frac{36}{3},\frac{504}{3},\frac{224}{3}\right)$

$=(12,168,\frac{224}{3})$

55. $(0,0,1),(0,-1,0),(\sqrt{2},1,4)$

Equation of plane

$$\begin{vmatrix} x-0 & y-0 & z-1 \\ 0-0 & -1-0 & 0-1 \\ \sqrt{2}-0 & 1-0 & 4-1 \end{vmatrix}=0$$

$$\begin{vmatrix} x & y & z-1 \\ 0 & -1 & -1 \\ \sqrt{2} & 1 & 3 \end{vmatrix}$$

$-\sqrt{2}x-y+z-1=0$

By option verification Option (2) -

56. Conceptual

57.

*Required plane* $x-2y+2z+k=0$

*Given* $\frac{|k|}{\sqrt{1+4+4}}=1$

$|k|=3$

$k=\pm 3$

$x-2y+2z+3=0$

Required plane is (or) $x-2y+2z-3=0$

58. let (a,b,c) are Dr's of normal of the required plane

$x-y+2z-3=0,\ 2x-2y+z+12=0$

$a-b+2c=0......(1)$

$2a-2b+c=0........(2)$

Solve (1) and (2)

$\frac{a}{3}=\frac{b}{3}=\frac{c}{0}$

Reqired plane is

$3(x-1)+3(y-2)=0$

$\Rightarrow x-1+y-2=0$

$\therefore x+y-3=0$

59.

Required equation is

$a(x-x_1)+b(y-y_1)+c(z-z_1)=0$

$(a,b,c)=(1,2,3)$

$(x_1,y_1,z_1)=(1,2,3)$

60. $\cos^2\alpha+\cos^2\beta+\cos^2\gamma=1$

$\alpha=\beta=\gamma$

$3\cos^2\alpha=1\Rightarrow \cos\alpha=\frac{1}{\sqrt{3}}$

$a:b:c=\frac{1}{\sqrt{3}}:\frac{1}{\sqrt{3}}:\frac{1}{\sqrt{3}}=1:1:1$

Eqn of plane is

a(x – x1) + b(y - y1) + c(z – z1) = 0

1(x + 1) + 1 (y – 2) + 1(z – 3) = 0

x + y + z – 4 = 0

61. $\frac{4}{2}=\frac{k}{3}=k=6$

P(6,6,6)

*dr*'s (a,b,c) = (5,6,7)

a(x-x1)+b(y-y1)+c(z-z1)=0

5(x-6)+6(y-6)+7(z-6)=0

$5x+6y+7z=108$

62. Dr's of Normal = Dr's of $\overline{AB}$

$(a,b,c) = (-5,-3,11)$

$= (5,3,-11)$

$$\text{midpoint of } \overline{AB} = \left(\frac{3}{2},\frac{7}{2},\frac{-9}{2}\right)$$

$$x_1, y_1, z_1$$

*Eqn of the plane is*

$$a(x-x_1)+b(y-y_1)+c(z-z_1)=0$$

63.

$$\bar{n}_1 \times \bar{n}_2 = \begin{vmatrix} \bar{i} & \bar{j} & \bar{k} \\ 2 & 3 & 1 \\ 1 & 3 & 2 \end{vmatrix}$$

$$= \bar{i}(3) - 3\bar{j} + 3\bar{k}$$

dr's of the line are (1,-1,1)

dc's of the line are $\left(\frac{1}{\sqrt{3}},\frac{-1}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$

$$\therefore \cos\alpha = \frac{1}{\sqrt{3}}$$

64. Point on plane $\pi$ is (1,–2,1)

dr's of plane $\pi$ are $(1,-1,1)=(a,b,c)$

Equation of $\pi$ plane is

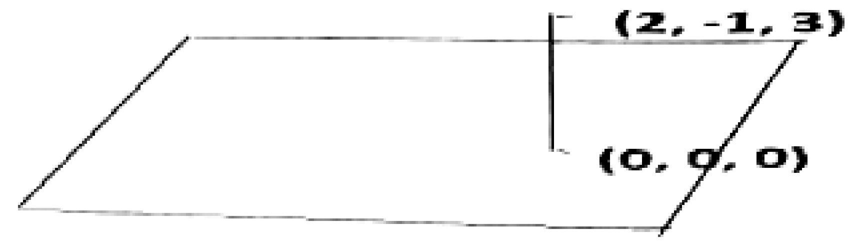
$$a(x-x_1)+b(y-y_1)+c(z-z_1)=0$$

$$x-y-z-2=0$$

$$a=1, b=-1, c=-1$$

$$b-2c=-1-2(-1)=1=a$$

65. Equation of plane is




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

$$2x-y+3z-14=0$$

66. $A(6,3,2,), B(1,-4,-9)$

d. r of AB = 5, 7, 11

$P(x_1, y_1, z_1) = P(1,1,1)$

Equation of the plane

$$5(x-1)+7(y-1)+11(z-1)=0$$

a = 5, b = 7, c = 11

$$\therefore a+b-c=12-11=1$$