Date
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Lecture Notes - 13

BCA I Year (II Sem)

Subject - Mathematics- II

UNIT = 5

Topic - The plane

P-291

* **Plane →** The plane is surface such that the straight line joining any two points on the surface. Thus the every line joining any two points of the plane. Point of will satisfy the equation of the plane.

* General Equation of the plane is

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

Imp

Theorem: To show that every equation of the first degree in x, y, z represents a plane

Or

To prove that the equation $ax+by+cz+d=0$ represents a plane

NOTE * Normal form of equation of plane

If l, m, n are the direction cosines of the normal, then the equation of the plane is

$$lx + my + nz = p.$$

NOTE * Intercept form of equations of the plane is

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

NOTE *
(i) The equation of yz-plane is $x = 0$

(ii) The equation of zx-plane is $y = 0$

(iii) The equation of xy-plane is $z = 0$

NOTE *
(i) Equation of plane parallel to yz-plane is $x = a$

(ii) Equation of plane parallel to zx-plane is $y = b$

(iii) Equation of plane parallel to xy-plane is $z = c$

Exp-1 find the intercept of the plane $3x + 4y - 12z = 24$ on the Co-ordinate axes.

Sol^n The Equation of plane can be Written as

$$\frac{3x}{24} + \frac{4y}{24} - \frac{12z}{24} = \frac{24}{24}$$

$$\Rightarrow \frac{x}{8} + \frac{y}{6} - \frac{z}{2} = 1$$

We know that the intercept form of the plane is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$

Hence The required intercepts are $8, 6, -2$ Ans

Exp-2 Find the intercepts ~~~~ made on the Co-Ordinate axes by the plane $5x - 2y - 7z = 11$. Also find the direction Cosines of the normal of the plane.

Sol" The given equation of the plane can be written as

$$\frac{5x}{11} - \frac{2y}{11} - \frac{7z}{11} = 1$$

$$\Rightarrow \frac{x}{\left(\frac{11}{5}\right)} + \frac{y}{\left(\frac{-11}{2}\right)} + \frac{z}{\left(\frac{-11}{7}\right)} = 1$$

Then required intercept are $\frac{11}{5}, -\frac{11}{2}, -\frac{11}{7}$

∴ The direction ~~Cosines~~ ratios of the normal plane are the Coefficient of the x, y, z i.e 5, -2, -7

Then the direction Cosines of the normal to the plane are

$$\frac{5}{\sqrt{(5)^2+(-2)^2+(-7)^2}}, \frac{-2}{\sqrt{(5)^2+(-2)^2+(-7)^2}},$$

and $$\frac{-7}{\sqrt{(5)^2+(-2)^2+(-7)^2}}$$

$$\Rightarrow \frac{5}{\sqrt{25+4+49}}, \frac{-2}{\sqrt{25+4+49}}, \frac{-7}{\sqrt{25+4+49}}$$

$$\Rightarrow \frac{5}{\sqrt{78}}, -\frac{2}{\sqrt{78}}, -\frac{7}{\sqrt{78}}$$ Ans