



TRINITY COLLEGE FOR WOMEN NAMAKKAL

Department of Mathematics

TRIGONOMETRY AND ANALYTIC GEOMETRY OF 3D

21UMA08 - EVEN Semester

Presented by

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ANALYTIC GEOMETRY OF 3D

- Straight line
- Equation determined by intersection of two planes
- Symmetrical form
- Conversion of the equation of the line to symmetrical form
- Equation of the line passing through two points

STRAIGHT LINE

1. A STRAIGHT LINE MAY BE DETERMINED AS THE INTERSECTION OF TWO PLANES

Let the equations of two planes be

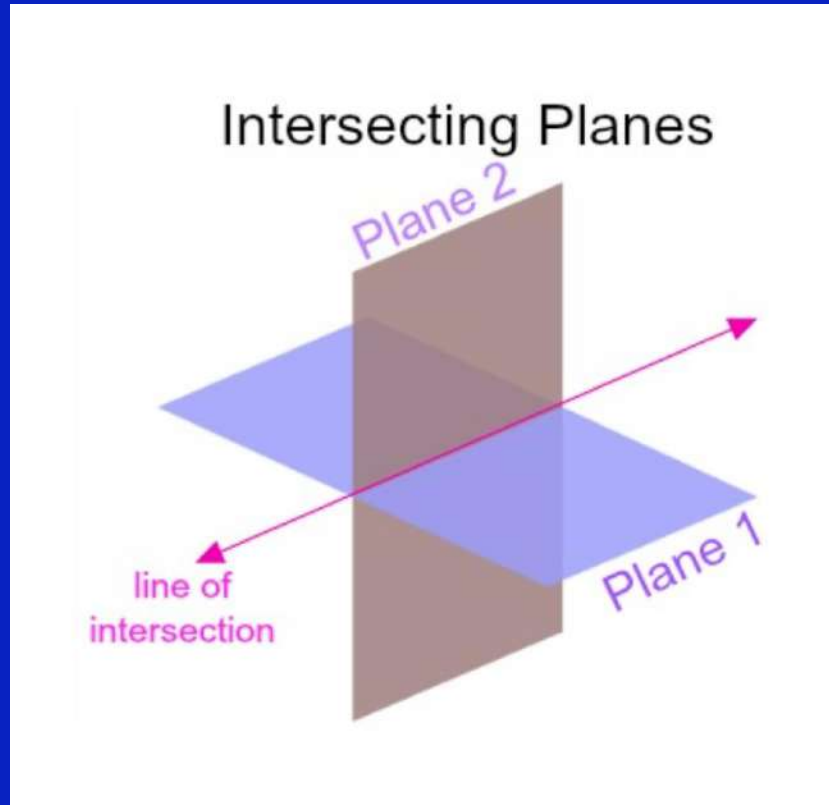
$$Ax+By+Cz+D = 0 ; A_1x+B_1y+C_1z+D_1 = 0$$

Any two set of values of x,y,z which satisfy the two equations simultaneously, will give the co-ordinates of intersection o the two planes. Hence, the equations of the planes taken together.

$$Ax+By+Cz+D =0 =A_1x+B_1y+C_1z+D_1$$

Gives the equation of the line of intersection of the two planes.

Straight line intersecting two planes



2. SYMMETRICAL FORM OF THE EQUATION OF A LINE

Let the direction cosines of a line passing through a given point $A(x_1, y_1, z_1)$ be l, m, n .

Let the co-ordinates of any point P on it be (x, y, z) .
And let the distance AP be r .

projecting AP on the co-ordinate axes, we get

$$x - x_1 = lr ; y - y_1 = mr ; z - z_1 = nr$$

Hence, the equations of the line are,

$$\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n}$$

Symmetrical form of equation of line

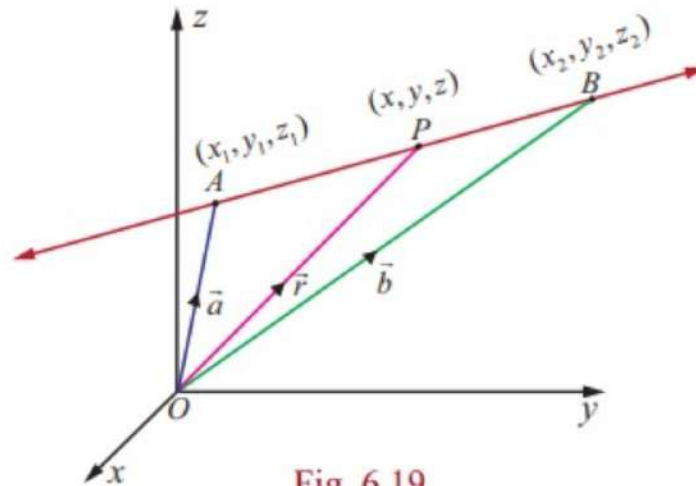


Fig. 6.19

$$\frac{x-x_1}{x_2-x_1} = \frac{y-y_1}{y_2-y_1} = \frac{z-z_1}{z_2-z_1}.$$

3. THE SYMMETRICAL FORM OF THE EQUATION OF THE LINE

$$ax+by+cz+d = 0 = ax_1+by_1+cz_1+d_1 ,$$

To put the equations of the line into the symmetrical form we have to find

- (1) The direction ratios of the line and
- (2) The coordinates of any point on it.

let the direction ratios of the line be l, m, n

The line is perpendicular to the normals of both the planes, since the line lies in both the planes.

The direction ratios of the normals of the plane are
Respectively a, b, c and a_1, b_1, c_1 ,

Equation of straight line intersecting two points

If the given points are $x_1+y_1+z_1$ and $x_2+y_2+z_2$.

The direction ratios of the line passing through them are

$$x_2-x_1, y_2-y_1, z_2-z_1$$

The equation of line is

$$\frac{x-x_1}{x_2-x_1}, \frac{y-y_1}{y_2-y_1}, \frac{z-z_1}{z_2-z_1}$$

THE PLANE AND THE STRAIGHT LINE

The condition for the line $x-x_1/l = y-y_1/m = z-z_1/n$ to be parallel to the plane $ax+by+cz+d = 0$

Any point in this line can be put in the form $[x_1+lr, y_1+mr, z_1+nr]$

If this point lies on the plane, we get a

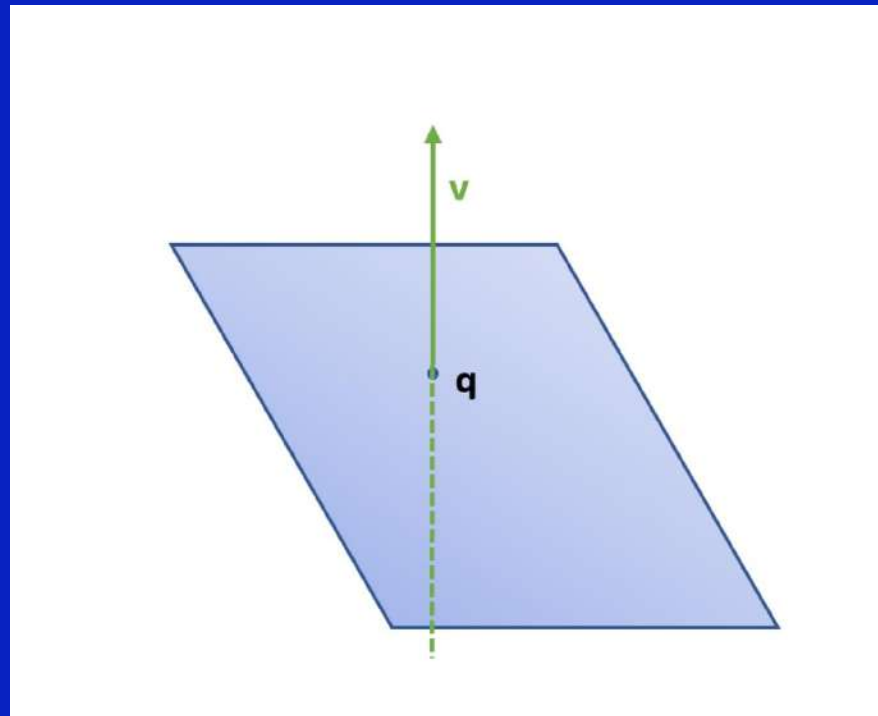
$$(x_1+lr)+b(y_1+mr)+c(z_1+nr)+d = 0$$

$$(i e) ax_1+by_1+cz_1+d+r (al + bm + cn) = 0$$

Here r is proportional to distance

$$R = -ax_1+by_1+cz_1+d/al+bn+cn$$

The straight line and the plane



THANK YOU

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