Assignment 1
Linear Algebra

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1 Problem

Find the distance of the points $\begin{pmatrix} -1 \\ -5 \\ -10 \end{pmatrix}$ from the point of intersection of the line x = $\begin{pmatrix} 2 \\ -1 \\ 2 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 4 \\ 2 \end{pmatrix}$ and the plane $\begin{pmatrix} 1, -1, 1 \end{pmatrix}$X=5.

2 Solution

Given , the equation of line is
x = $\begin{pmatrix} 2i \\ -j \\ 2k \end{pmatrix} + \lambda \begin{pmatrix} 3i \\ 4j \\ 2k \end{pmatrix}$
and the equation of the plain is
$\begin{pmatrix} i, -j, k \end{pmatrix} X = 5$

To find the point of intersection of line and plain,

Putting value of x from equation of line into equation of plane.

$[(2i - j + 2k) + \lambda(3i + 4j + 2k)].(i - j + k) = 5$

$(2i - j + 2k + 3\lambda i + 4\lambda j + 2\lambda k)].(i - j + k) = 5$

$[(2 + 3\lambda)i + (-1 + 4\lambda)j + (2 + 2\lambda)k].(i - j + k) = 5$

$(2 + 3\lambda).1 + (-1 + 4\lambda).(-1) + (2 + 2\lambda).1 = 5$

$2 + 3\lambda + 1 - 4\lambda + 2 + 2\lambda = 5$

$\lambda + 5 = 5$

$\lambda = 5 - 5$

$\lambda = 0$

So the equation of the line is
$X = (2i - j + 2k) + \lambda(3i + 4k + 2k)$

$X = 2i - j + 2k$

Let the point of intersection be(x, y, z)

so, X =xi + yj + zk

xi + yj + zk = 2i -j + 2k

Hence, x=2 , y=-1 , z=2

$Therefore, the point of intersection is (2, -1, 2)$

$Now the distance between two points (x1, y1, z1) and (x2, y2, z2) is \sqrt{(x2 - x1)^2 + (y2 - ya)^2 + (z2 - z1)^2}$

$Distance between (2, -1, 2) and (-1, -5, -10)$
$= \sqrt{(-1 - 2)^2 + (-5 + 1)^2 + (-10 - 2)^2}$
$= \sqrt{(-3)^2 + (-4)^2 + (-12)^2}$
$= \sqrt{9 + 16 + 144}$
$= \sqrt{169}$
$= 13.$