Matrix Theory EE5609
Assignment-1

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Problem: Find the direction in which a straight line must be drawn through the point $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ so that its point of intersection with the line

$$(1 \quad 1)x = 4$$

may be the distance of 3 units from this point.

Solution: Given equation in the parametric form is:

$$x = \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

Let x be the point of intersection, then:

$$x = \begin{pmatrix} 3 + \lambda \\ 1 - \lambda \end{pmatrix}$$

Also the distance between the point $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and the given line is 3.

$$\implies \left\| x - \begin{pmatrix} -1 \\ 2 \end{pmatrix} \right\| = 3$$

$$\implies \left\| \begin{pmatrix} 3 + \lambda \\ 1 - \lambda \end{pmatrix} - \begin{pmatrix} -1 \\ 2 \end{pmatrix} \right\| = 3$$

$$\implies (4 + \lambda)^2 + (-1 - \lambda)^2 = 9$$

$$\implies \lambda = -4 \quad or \quad \lambda = -1$$

Hence, point of intersection is:

$$x = \begin{pmatrix} -1 \\ 5 \end{pmatrix} or \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$

Thus the direction vector of the required line:

$$Case1 : m1 = \begin{pmatrix} -1 \\ 2 \end{pmatrix} - \begin{pmatrix} -1 \\ 5 \end{pmatrix} = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$$

$$Case2 : m2 = \begin{pmatrix} -1 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$$

lines and planes