Matrix Theory (EE5609) Assignment-1

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Abstract—**This document contains the solution to find the direction vector for a straight line drawn through the given point**

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1 Problem

Find the direction in which a straight line must be drawn through the point **B** so that its point of intersection with the line may be the distance of 3 units from this point, where

$$\mathbf{B} = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \tag{1.0.1}$$

and the line

$$(1 \quad 1)\mathbf{X} = 4 \tag{1.0.2}$$

2 Solution

The given equation of the line in parametric form:

$$\mathbf{X} = \mathbf{A} + \lambda\mathbf{M} \tag{2.0.1}$$

where,

$$\mathbf{A} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \tag{2.0.2}$$

$$\mathbf{M} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{2.0.3}$$

If **X** be the point of intersection,

$$\|\mathbf{X} - \mathbf{B}\| = 3 \tag{2.0.4}$$

$$\sqrt{(4 + \lambda)^2 + (-1 - \lambda)^2} = 3 \tag{2.0.5}$$

$$\lambda^2 + 5\lambda + 4 = 0 \tag{2.0.6}$$

$$\lambda = -4 \quad or \quad \lambda = -1 \tag{2.0.7}$$

The point of intersection,

$$\therefore \mathbf{X} = \begin{pmatrix} -1 \\ 5 \end{pmatrix} or \begin{pmatrix} 2 \\ 2 \end{pmatrix} \tag{2.0.8}$$

The direction vector,

$$\mathbf{V} = \mathbf{B} - \mathbf{X} \tag{2.0.9}$$

$$\mathbf{V} = \begin{pmatrix} 0 \\ -3 \end{pmatrix} or \begin{pmatrix} -3 \\ 0 \end{pmatrix} \tag{2.0.10}$$