Assignment 1

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Abstract— **This document explains the concept of Normal vector, Direction Vector and Y-intercept of a straight line by solving number of problems.**

I. PROBLEM

Find the direction vectors and and y-intercepts of the following lines

$$\begin{pmatrix} 1 & 7 \end{pmatrix} \vec{X} = 0 \tag{1}$$

$$\begin{pmatrix} 6 & 3 \end{pmatrix} \vec{X} = 5 \tag{2}$$

$$\begin{pmatrix} 0 & 1 \end{pmatrix} \vec{X} = 0 \tag{3}$$

Solution:

$$\vec{n} = \begin{pmatrix} a \\ b \end{pmatrix} \tag{4}$$

$$\vec{d} = \begin{pmatrix} b \\ -a \end{pmatrix} \tag{5}$$

1) $x + 7y = 0$,
Normal vector $\vec{N}$ of $x + 7y = 0$ is

$$\vec{n} = \begin{pmatrix} 1 \\ 7 \end{pmatrix} \tag{6}$$

Direction Vector $\vec{d} = \vec{A} - \vec{B} = \begin{pmatrix} 7 \\ -1 \end{pmatrix} - \begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$

Y-intercept of a straight line $x + 7y = 0$ is 0

2) $6x + 3y = 5$,
Normal vector $\vec{n}$ of $6x + 3y = 5$ is

$$\vec{n} = \begin{pmatrix} 6 \\ 3 \end{pmatrix} \tag{7}$$

Direction Vector $\vec{d} = \vec{A} - \vec{B} = \begin{pmatrix} 0 \\ 5/3 \end{pmatrix} - \begin{pmatrix} 5/6 \\ 0 \end{pmatrix})$
$= \begin{pmatrix} -5/6 \\ 5/3 \end{pmatrix}$

Y-intercept of a straight line $6x + 3y = 5$ is 5/3

3) $y = 0$,
Normal vector $\vec{n}$ of $y = 0$ is $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

Direction Vector $\vec{d} = \vec{A} - \vec{B} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} - \begin{pmatrix} 2 \\ 0 \end{pmatrix}$
$= \begin{pmatrix} 3 \\ 0 \end{pmatrix}$

Y-intercept of a straight line $y = 0$ is 0