

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.

Download all python codes from
<https://github.com/cs19resch11004/hari>

Download all Latex-tikz codes from
<https://github.com/cs19resch11004/hari>

I. PROBLEM

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

$$(1 \ 7) \vec{X} = 0 \quad (1)$$

$$(6 \ 3) \vec{X} = 5 \quad (2)$$

$$(0 \ 1) \vec{X} = 0 \quad (3)$$

Solution:

Let $ax + by + c = 0$ be a line, then its normal vector and Direction Vectors respectively, let say

$$\vec{N} = \begin{pmatrix} a \\ b \end{pmatrix} \quad (4)$$

$$\vec{D} = \begin{pmatrix} b \\ -a \end{pmatrix} \quad (5)$$

Y-intercept of a straight line $y = mx + c$ is c.

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

$$\vec{N} = \begin{pmatrix} 1 \\ 7 \end{pmatrix} \quad (6)$$

Two different points on the given line in the form

positional vectors are (say $\vec{A} = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$ and $\vec{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$).

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

$$\vec{N} = \begin{pmatrix} 6 \\ 3 \end{pmatrix} \quad (7)$$

Two different points on the given line in the form positional vectors are (say $\vec{A} = \begin{pmatrix} 0 \\ 5/3 \end{pmatrix}$ and $\vec{B} = \begin{pmatrix} 5/6 \\ 0 \end{pmatrix}$).

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 $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

Two different points on the given line in the form positional vectors are (say $\vec{A} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ and $\vec{B} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$).

$$\begin{aligned}\text{Direction Vector } \vec{D} &= \vec{A} - \vec{B} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} - \begin{pmatrix} 2 \\ 0 \end{pmatrix} \\ &= \begin{pmatrix} 3 \\ 0 \end{pmatrix}\end{aligned}$$

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