Assignment3

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Download all python codes from

https://github.com/Sowmyabandi99/Assignment3/tree/main/Assignment3/Assignment3

and download all latex-tikz codes from

https://github.com/Sowmyabandi99/Assignment3/blob/main/Assignment3/main.tex

1 Question No. 2.16

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

1)

$$\begin{pmatrix}1 & 7\end{pmatrix}\mathbf{x} = 0 \tag{1.0.1}$$

2)

$$\begin{pmatrix}6 & 3\end{pmatrix}\mathbf{x} = 5 \tag{1.0.2}$$

3)

$$\begin{pmatrix}0 & 1\end{pmatrix}\mathbf{x} = 0 \tag{1.0.3}$$

2 Solution

Lemma 2.1. *Direction vector and y-intercept of the line* $\mathbf{n}^T\mathbf{x} = c$ *are:*
Direction vector

$$\mathbf{m} = \begin{pmatrix} b \\ -a \end{pmatrix} \tag{2.0.1}$$

and

$$\textit{y-intercept} = \frac{c}{\mathbf{n}^T\mathbf{e_2}} \quad \left(\because \mathbf{e_2} = \begin{pmatrix}0\\1\end{pmatrix}\right)$$

1) From the given line $\begin{pmatrix}1 & 7\end{pmatrix}\mathbf{x} = 0$,we have

$$a = 1, b = 7, c = 0 \tag{2.0.2}$$

Normal vector

$$\mathbf{n} = \begin{pmatrix}1\\7\end{pmatrix} \tag{2.0.3}$$

Direction vector

$$\mathbf{m} = \begin{pmatrix}7\\-1\end{pmatrix} \tag{2.0.4}$$

y-intercept $= \begin{pmatrix}0\\0\end{pmatrix}$
PLOT OF THE GIVEN LINE:

Plot of (1.0.1) -

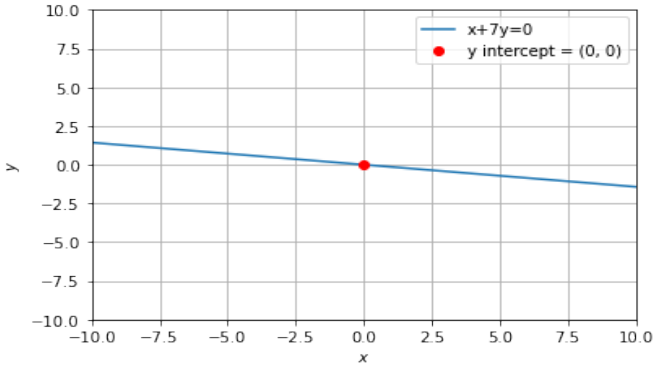

Fig. 2.1: Figure1

2) From the given line $\begin{pmatrix}6 & 3\end{pmatrix}\mathbf{x} = 5$,we have

$$a = 6, b = 3, c = 5 \tag{2.0.5}$$

Normal vector

$$\mathbf{n} = \begin{pmatrix}6\\3\end{pmatrix} \tag{2.0.6}$$

Direction vector

$$\mathbf{m} = \begin{pmatrix}3\\-6\end{pmatrix} \tag{2.0.7}$$

y-intercept $= \frac{5}{3}\mathbf{e_2}$
PLOT OF THE GIVEN LINE:

Plot of (1.0.2)

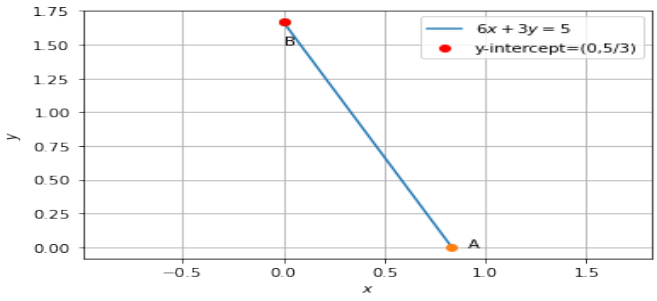

Fig. 2.2: Figure2

3) From the given line $\begin{pmatrix}0 & 1\end{pmatrix}\mathbf{x} = 0$,we have

$$a = 0, b = 1, c = 0 \tag{2.0.8}$$

Normal vector

$$\mathbf{n} = \begin{pmatrix}0\\1\end{pmatrix} \tag{2.0.9}$$

Direction vector

$$\mathbf{m} = \begin{pmatrix}1\\0\end{pmatrix} \tag{2.0.10}$$

y-intercept $= \begin{pmatrix}0\\0\end{pmatrix}$

PLOT OF GIVEN LINE:

Plot of (1.0.3) -

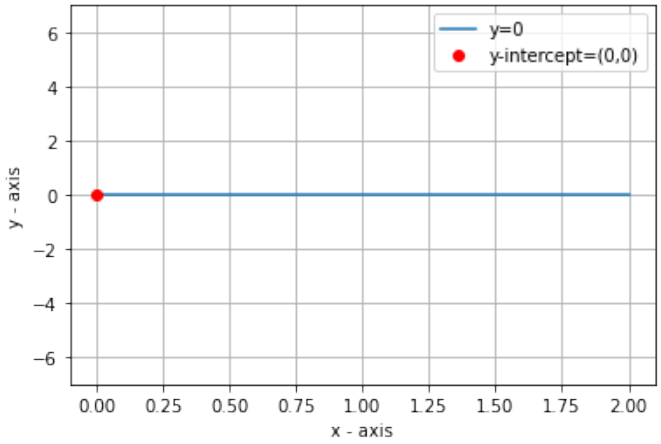

Fig. 2.3: Figure3