Assignment3

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1 QUESTION NO. 2.16

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

1)
$$\begin{pmatrix} 1 & 7 \end{pmatrix} \mathbf{x} = 0 \qquad (1.0.1)$$

2)
$$\begin{pmatrix} 6 & 3 \end{pmatrix} \mathbf{x} = 5 \qquad (1.0.2)$$

3)
$$\begin{pmatrix} 0 & 1 \end{pmatrix} \mathbf{x} = 0 \qquad (1.0.3)$$

2 SOLUTION

Lemma 2.1. *Direction vector and y-intercept of the line* $\mathbf{n}^T\mathbf{x} = c$*, where* $n = \begin{pmatrix} a \\ b \end{pmatrix}$ *are:*
Direction vector

$$\mathbf{m} = \begin{pmatrix} b \\ -a \end{pmatrix} \qquad (2.0.1)$$

and
y-intercept $= \frac{c}{\mathbf{n}^T e_2}$*, where* $e_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

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

$$a = 1, b = 7, c = 0 \qquad (2.0.2)$$

Normal vector

$$\mathbf{n} = \begin{pmatrix} 1 \\ 7 \end{pmatrix} \qquad (2.0.3)$$

Direction vector

$$\mathbf{m} = \begin{pmatrix} 7 \\ -1 \end{pmatrix} \qquad (2.0.4)$$

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

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

$$a = 6, b = 3, c = 5 \qquad (2.0.5)$$

Normal vector

$$\mathbf{n} = \begin{pmatrix} 6 \\ 3 \end{pmatrix} \qquad (2.0.6)$$

Direction vector

$$\mathbf{m} = \begin{pmatrix} 3 \\ -6 \end{pmatrix} \qquad (2.0.7)$$

y-intercept $= \frac{5}{3}e_2$

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

$$a = 0, b = 1, c = 0 \qquad (2.0.8)$$

Normal vector

$$\mathbf{n} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \qquad (2.0.9)$$

Direction vector

$$\mathbf{m} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \qquad (2.0.10)$$

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

PLOT OF GIVEN LINES -
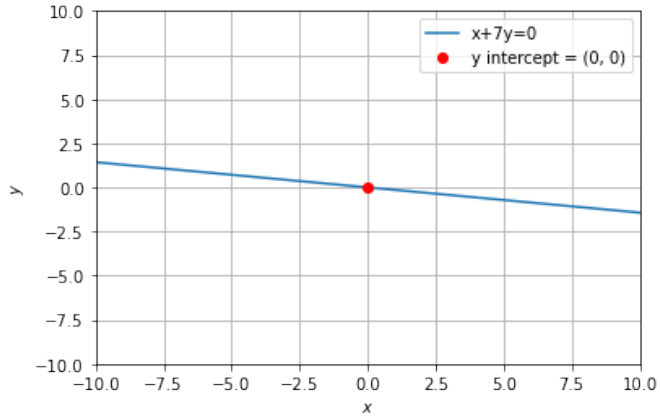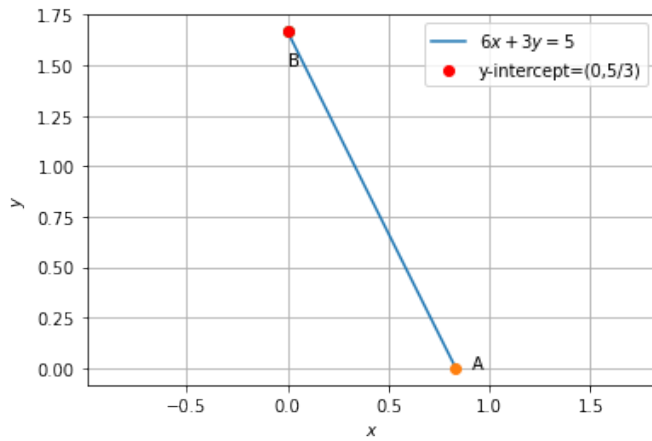
Plot of (1.0.1) -

Fig. 2.1: Figure1
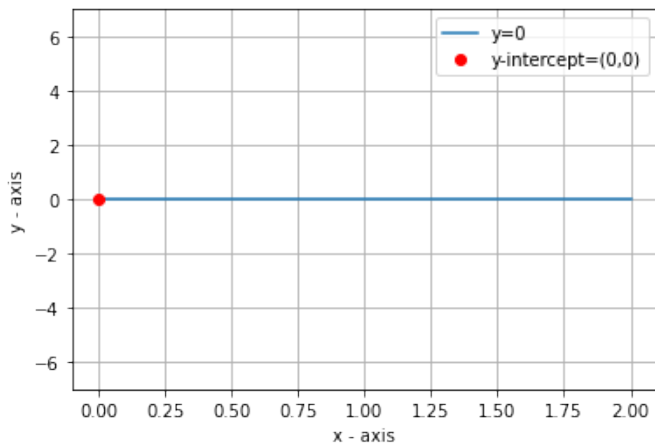
Plot of (1.0.2) -

Fig. 2.2: Figure2

Plot of (1.0.3)

Fig. 2.3: Figure3