

# Assignment3

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Download all python codes from

<https://github.com/Sowmyabandi99/Assignment3/tree/main/Assignment3/Assignment3.py>

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)

$$(1 \ 7)\mathbf{x} = 0 \quad (1.0.1)$$

2)

$$(6 \ 3)\mathbf{x} = 5 \quad (1.0.2)$$

3)

$$(0 \ 1)\mathbf{x} = 0 \quad (1.0.3)$$

## 2 SOLUTION

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

Direction vector

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

and y-intercept =  $\frac{c}{b}e_2$ , where  $e_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

1) From the given line  $(1 \ 7)\mathbf{x} = 0$ , we have

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

Normal vector

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

Direction vector

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

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

2) From the given line  $(6 \ 3)\mathbf{x} = 5$ , we have

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

Normal vector

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

Direction vector

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

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

3) From the given line  $(0 \ 1)\mathbf{x} = 0$ , we have

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

Normal vector

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

Direction vector

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

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

PLOT OF GIVEN LINES -

Plot of (1.0.1) -

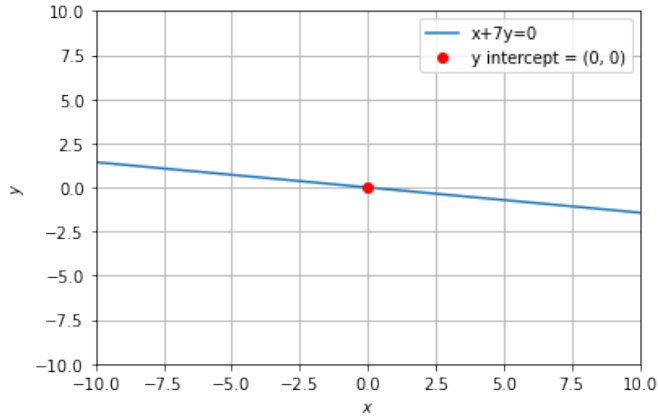


Fig. 2.1: Figure1

Plot of (1.0.2) -

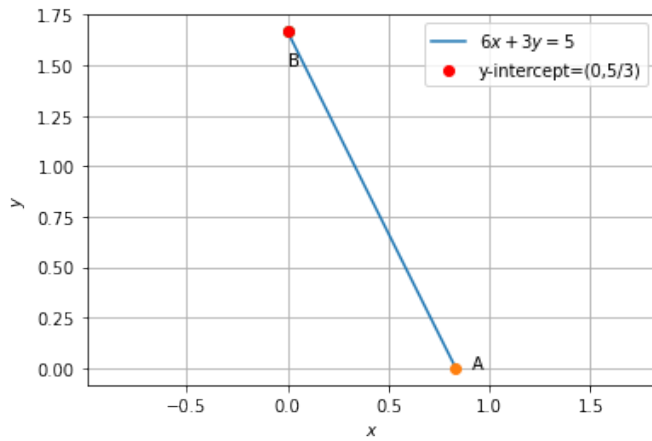


Fig. 2.2: Figure2

Plot of (1.0.3)

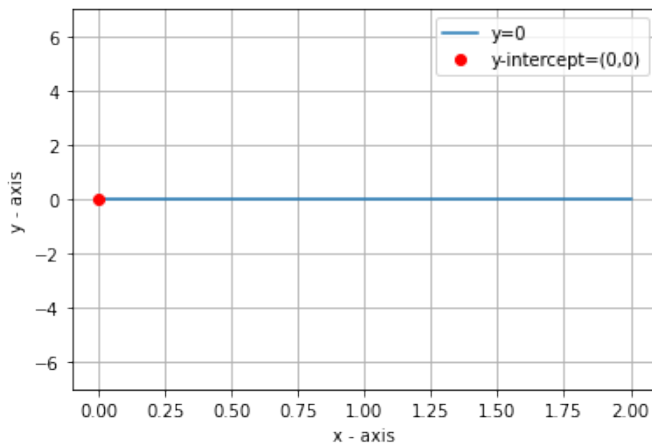


Fig. 2.3: Figure3