Assignment - 1

Ganesh Yadav
MD/2020/712

***Abstract*—This is a simple document to learn about writing vectors and matrices using latex, draw figures using Python, Latex.**

Download all and latex-tikz codes from

```
svn co https://github.com/Ganeshyadav712/
    Assignment−1.git
```

1 Vectors
(cbse/math/10/2006 set1 - Q11)

1.1. Draw the graphs of the following equations:

$$4x - y - 8 = 0 \tag{1.1.1}$$
$$or \begin{pmatrix} 4 & -1 \end{pmatrix} \mathbf{x} = 8 \tag{1.1.2}$$
$$2x - 3y + 6 = 0 \tag{1.1.3}$$
$$or \begin{pmatrix} 2 & -3 \end{pmatrix} \mathbf{x} = -6 \tag{1.1.4}$$

Also determine the vertices of the triangle formed by the lines and the x axis.

Solution:

a) We have equations of two lines: Which is written in vector form:

$$\begin{pmatrix} 4 & -1 \end{pmatrix} \mathbf{x} = 8 \tag{1.1.5}$$

and

$$\begin{pmatrix} 2 & -3 \end{pmatrix} \mathbf{x} = -6 \tag{1.1.6}$$

where

$$\mathbf{x} = \begin{pmatrix} x \\ y \end{pmatrix} \tag{1.1.7}$$

Both equations are written together in matrix form as:

$$\begin{pmatrix} 4 & -1 \\ 2 & -3 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 8 \\ -6 \end{pmatrix} \tag{1.1.8}$$

Augmented matrix for above is:

$$\begin{pmatrix} 4 & -1 & 8 \\ 2 & -3 & -6 \end{pmatrix} \tag{1.1.9}$$

This can be reduced as follows:

$$\begin{pmatrix} 4 & -1 & 8 \\ 2 & -3 & -6 \end{pmatrix} \xleftrightarrow{R_1 \leftarrow \frac{R_1}{4}} \begin{pmatrix} 1 & -\frac{1}{4} & 2 \\ 2 & -3 & -6 \end{pmatrix} \tag{1.1.10}$$
$$\xleftrightarrow{R_2 \leftarrow R_2 - 2R_1} \begin{pmatrix} 1 & \frac{-1}{4} & 2 \\ 0 & -\frac{5}{2} & -10 \end{pmatrix} \tag{1.1.11}$$
$$\xleftrightarrow{R_2 \leftarrow -\frac{2}{5}R_2} \begin{pmatrix} 1 & -\frac{1}{4} & 2 \\ 0 & 1 & 4 \end{pmatrix} \tag{1.1.12}$$
$$\xleftrightarrow{R_1 \leftarrow R_1 + \frac{1}{4}R_2} \begin{pmatrix} 1 & 0 & 3 \\ 0 & 1 & 4 \end{pmatrix} \tag{1.1.13}$$

$$\therefore \mathbf{P} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} \tag{1.1.14}$$

is the point of intersection of the lines and the vertex of the triangle formed by the two lines with x-axis as base.

b) To find out intersection of (1.1.5) with the x axis:
equation of x axis is

$$\begin{pmatrix} 0 & 1 \end{pmatrix} \mathbf{x} = 0 \tag{1.1.15}$$

we have 2 equations:

$$\begin{pmatrix} 4 & -1 \end{pmatrix} \mathbf{x} = 8 \tag{1.1.16}$$
$$\begin{pmatrix} 0 & 1 \end{pmatrix} \mathbf{x} = 0 \tag{1.1.17}$$

Augmented matrix for above is:

$$\begin{pmatrix} 4 & -1 & 8 \\ 0 & 1 & 0 \end{pmatrix} \tag{1.1.18}$$

This can be reduced as follows:

$$\begin{pmatrix} 4 & -1 & 8 \\ 0 & 1 & 0 \end{pmatrix} \xleftrightarrow{R_1 \leftarrow \frac{1}{4}R_1} \begin{pmatrix} 1 & -\frac{1}{4} & 2 \\ 0 & 1 & 0 \end{pmatrix} \tag{1.1.19}$$

$$\xleftrightarrow{R_1 \leftarrow R_1 + \frac{1}{4}R_2} \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 0 \end{pmatrix} \tag{1.1.20}$$

$$\tag{1.1.21}$$

$$\therefore \mathbf{Q} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \tag{1.1.22}$$

is the point of intersection of the line (1.1.5) with the x axis.

c) To find out intersection of (1.1.6) with the x axis:
equation of x axis is

$$\begin{pmatrix} 0 & 1 \end{pmatrix} \mathbf{x} = 0 \tag{1.1.23}$$

we have 2 equations:

$$\begin{pmatrix} 2 & -3 \end{pmatrix} \mathbf{x} = -6 \tag{1.1.24}$$

$$\begin{pmatrix} 0 & 1 \end{pmatrix} \mathbf{x} = 0 \tag{1.1.25}$$

Augmented matrix for above is:

$$\begin{pmatrix} 2 & -3 & -6 \\ 0 & 1 & 0 \end{pmatrix} \tag{1.1.26}$$

This can be reduced as follows:

$$\begin{pmatrix} 2 & -3 & -6 \\ 0 & 1 & 0 \end{pmatrix} \xleftrightarrow{R_1 \leftarrow \frac{1}{2}R_1} \begin{pmatrix} 1 & -\frac{3}{2} & -3 \\ 0 & 1 & 0 \end{pmatrix} \tag{1.1.27}$$

$$\xleftrightarrow{R_1 \leftarrow R_1 + (-\frac{3}{2})R_2} \begin{pmatrix} 1 & 0 & -3 \\ 0 & 1 & 0 \end{pmatrix} \tag{1.1.28}$$

$$\tag{1.1.29}$$

$$\mathbf{R} = \begin{pmatrix} -3 \\ 0 \end{pmatrix} \tag{1.1.30}$$

is the point of intersection of the line (1.1.6) with the x axis.

$$\mathbf{P} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} \tag{1.1.31}$$

$$\mathbf{Q} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \tag{1.1.32}$$

$$\mathbf{R} = \begin{pmatrix} -3 \\ 0 \end{pmatrix} \tag{1.1.33}$$

$$\tag{1.1.34}$$

represent the vertices of the triangle formed by the lines (1.1.5) & (1.1.6) with the X-axis.

P is the vertex of the triangle. Q is the point at which $4x - y - 8 = 0$ meets the X-axis. R is the point at which $2x - 3y + 6 = 0$ meets the X-axis.

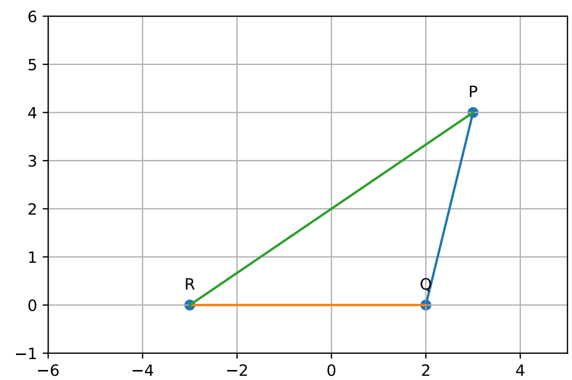

Fig. 1.1. Two lines representing given equations meet at point $\begin{pmatrix} 3 & 4 \end{pmatrix}$
.