ASSIGNMENT 2

Y.kavya

Download all python codes from

and latex-tikz codes from

1 QUESTION No 2.11

Which of the following pairs of linear equations has a unique solution,no solution or infinitely many solutions ?

1)

$$\begin{pmatrix} 1 & -3 \end{pmatrix}\mathbf{x} = 3$$
$$\begin{pmatrix} 3 & -9 \end{pmatrix}\mathbf{x} = 2 \tag{1.0.1}$$

2)

$$\begin{pmatrix} 2 & 1 \end{pmatrix}\mathbf{x} = 5$$
$$\begin{pmatrix} 3 & 2 \end{pmatrix}\mathbf{x} = 8 \tag{1.0.2}$$

2 SOLUTION

1)

$$\begin{pmatrix} 1 & -3 \end{pmatrix}\mathbf{x} = 3$$
$$\begin{pmatrix} 3 & -9 \end{pmatrix}\mathbf{x} = 2 \tag{2.0.1}$$

The above equations can be expressed as the matrix equation

$$\begin{pmatrix} 1 & -3 \\ 3 & -9 \end{pmatrix}\mathbf{x} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \tag{2.0.2}$$

The augmented matrix for the above equation is row reduced as follows

$$\begin{pmatrix} 1 & -3 & 3 \\ 3 & -9 & 2 \end{pmatrix} \xleftarrow{R_2 \leftarrow R_2 - 3R_1} \begin{pmatrix} 1 & -3 & 3 \\ 0 & 0 & -7 \end{pmatrix} \tag{2.0.3}$$

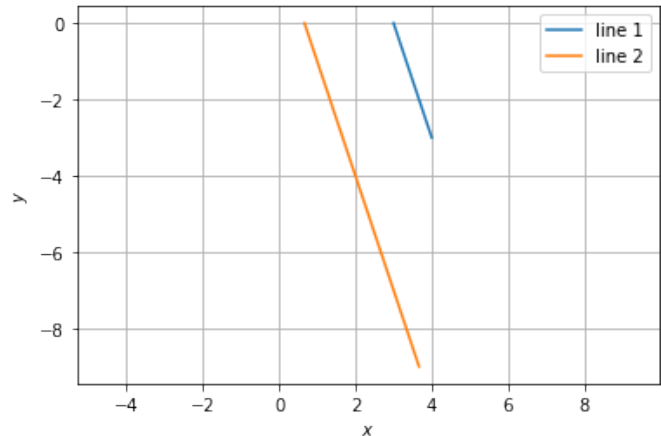$\therefore$ Given lines (1.0.1) have no solutions so we can say they are parallel.

Fig. 2.1: PARALLEL LINES.

2)

$$\begin{pmatrix} 2 & 1 \end{pmatrix}\mathbf{x} = 5$$
$$\begin{pmatrix} 3 & 2 \end{pmatrix}\mathbf{x} = 8 \tag{2.0.4}$$

The above equations can be expressed as the matrix equation

$$\begin{pmatrix} 2 & 1 \\ 3 & 2 \end{pmatrix}\mathbf{x} = \begin{pmatrix} 5 \\ 8 \end{pmatrix} \tag{2.0.5}$$

The augmented matrix for the above equation is row reduced as follows

$$\begin{pmatrix} 2 & 1 & 5 \\ 3 & 2 & 8 \end{pmatrix} \xleftarrow{R_2 \leftarrow 2R_2 - 3R_1} \begin{pmatrix} 2 & 1 & 5 \\ 0 & 1 & 1 \end{pmatrix} \tag{2.0.6}$$

$$\begin{pmatrix} 2 & 1 & 5 \\ 0 & 1 & 1 \end{pmatrix} \xleftarrow{R_1 \leftarrow R_1 - R_2} \begin{pmatrix} 2 & 0 & 4 \\ 0 & 1 & 1 \end{pmatrix} \tag{2.0.7}$$

$$\begin{pmatrix} 2 & 0 & 4 \\ 0 & 1 & 1 \end{pmatrix} \xleftarrow{R_1 \leftarrow \frac{R_1}{2}} \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \end{pmatrix} \tag{2.0.8}$$

$$\implies \mathbf{x} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} \tag{2.0.9}$$
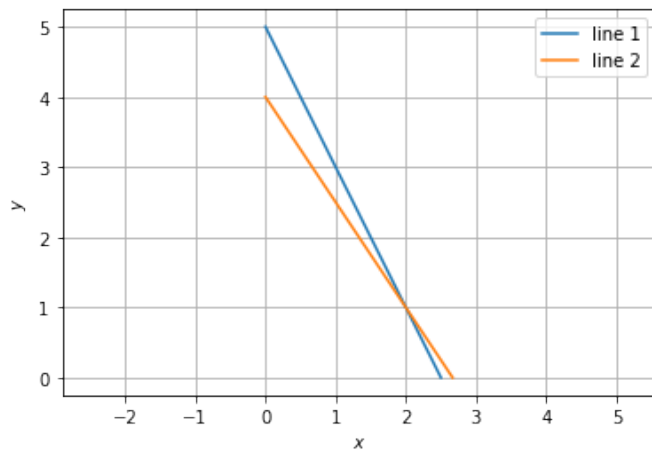
is a solution of (1.0.2)
$\implies$ (1.0.2) has a unique solution so we can say they are interest.

Fig. 2.2: INTERSECTING LINES.