ASSIGNMENT 2

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1 QUESTION No 2.10

Find the intersection of the following lines?
1)

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

2)

$$\begin{pmatrix} 0.2 & 0.3 \end{pmatrix} \mathbf{x} = 1.3 \\ \begin{pmatrix} 0.4 & 0.5 \end{pmatrix} \mathbf{x} = 2.3 \tag{1.0.2}$$

2 SOLUTION

1)

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

The above equations can be expressed as the matrix equation

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

Now we converted these matrix equation in augmented matrix form using row reduction

$$\begin{pmatrix} 3 & -1 & 3 \\ 9 & -3 & 9 \end{pmatrix} \xleftarrow{R_2 \to \frac{R_2}{3}} \begin{pmatrix} 3 & -1 & 3 \\ 3 & -1 & 3 \end{pmatrix} \tag{2.0.3}$$

As $R_1 = R_2$, left part can never be converted into a identity matrix,and we can see now both row are same that means both lines are same they intersect at infinitely many points.
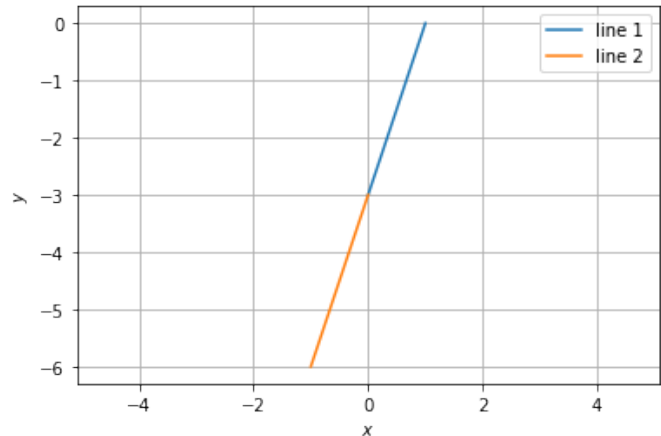PLOT OF GIVEN LINES-

Fig. 2.1: SAME-LINES

2)

$$\begin{pmatrix} 0.2 & 0.3 \end{pmatrix} \mathbf{x} = 1.3 \\ \begin{pmatrix} 0.4 & 0.5 \end{pmatrix} \mathbf{x} = 2.3 \tag{2.0.4}$$

The above equations can be expressed as the matrix equation

$$\begin{pmatrix} 0.2 & 0.3 \\ 0.4 & 0.5 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1.3 \\ 1.4 \end{pmatrix} \tag{2.0.5}$$

Now we converted these matrix equation in augmented matrix form using row reduction

$$\begin{pmatrix} 0.2 & 0.3 & 1.3 \\ 0.4 & 0.5 & 1.4 \end{pmatrix} \xleftarrow{R_2 \to R_2 - 2R_1} \begin{pmatrix} 0.2 & 0.3 & 1.3 \\ 0 & -0.1 & -0.3 \end{pmatrix} \tag{2.0.6}$$

$$\xleftarrow{R_2 \to \frac{R_2}{-0.1}} \begin{pmatrix} 0.2 & 0.3 & 1.3 \\ 0 & 1 & 3 \end{pmatrix} \tag{2.0.7}$$

$$\xleftarrow{R_1 \to R_1 - 0.3R_2} \begin{pmatrix} 0.2 & 0 & 0.4 \\ 0 & 1 & 3 \end{pmatrix} \tag{2.0.8}$$

$$\xleftarrow{R_1 \to \frac{R_1}{0.2}} \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \end{pmatrix} \tag{2.0.9}$$

As left part is converted into identity matrix

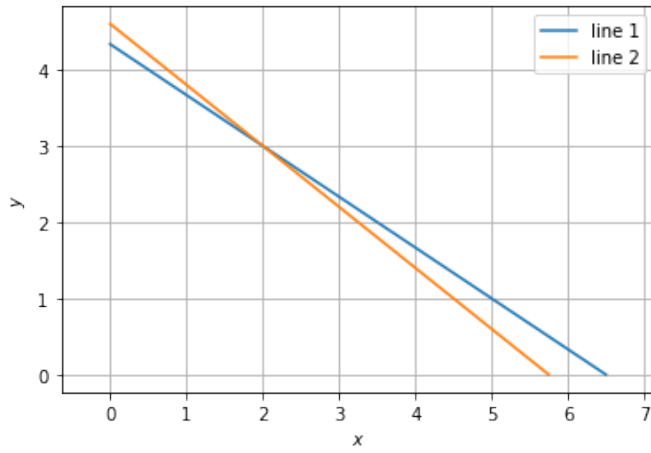the intersection vector is $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$

PLOT OF GIVEN LINES -

Fig. 2.2: INTERSECTING-LINES