Assignment-04

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Question taken from

1 Linear Forms Exercise 2.5(c)

Find out whether the following pair of linear equations are consistent, or inconsistent.

$$\begin{pmatrix} \frac{3}{2} & \frac{5}{3} \end{pmatrix} \mathbf{x} = 7 \qquad (1.0.1)$$

$$\begin{pmatrix} 9 & -10 \end{pmatrix} \mathbf{x} = 14 \qquad (1.0.2)$$

2 Solution

$$\begin{pmatrix} \frac{3}{2} & \frac{5}{3} \end{pmatrix} \mathbf{x} = 7 \qquad (2.0.1)$$

$$\begin{pmatrix} 9 & -10 \end{pmatrix} \mathbf{x} = 14 \qquad (2.0.2)$$

The above equations can be expressed as the matrix equation

$$\begin{pmatrix} \frac{3}{2} & \frac{5}{3} \\ 9 & -10 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 7 \\ 14 \end{pmatrix} \qquad (2.0.3)$$

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

$$\begin{pmatrix} \frac{3}{2} & \frac{5}{3} & 7 \\ 9 & -10 & 14 \end{pmatrix} \xleftarrow{R_1 \leftarrow \frac{2}{3}R_1} \begin{pmatrix} 1 & \frac{10}{9} & \frac{14}{3} \\ 9 & -10 & 14 \end{pmatrix} \qquad (2.0.4)$$

$$\xleftarrow{R_2 \leftarrow add-9time1strowto2ndrow} \begin{pmatrix} 1 & \frac{10}{9} & \frac{14}{3} \\ 0 & -20 & -28 \end{pmatrix} \qquad (2.0.5)$$

$$\xleftarrow{R_2 \leftarrow \frac{-1}{20}R_2} \begin{pmatrix} 1 & \frac{10}{9} & \frac{14}{3} \\ 0 & 1 & \frac{7}{5} \end{pmatrix} \qquad (2.0.6)$$

$$\xleftarrow{R_1 \leftarrow add\frac{-10}{9}time2ndrowto1strow} \begin{pmatrix} 1 & 0 & \frac{28}{9} \\ 0 & 1 & \frac{7}{5} \end{pmatrix} \qquad (2.0.7)$$

So by reduction of the (2×3) matrix

$$\begin{pmatrix} \frac{3}{2} & \frac{5}{3} & 7 \\ 9 & -10 & 14 \end{pmatrix} \qquad (2.0.8)$$

gives matrix with 2 non zero row,so i'ts rank is 2.

$$\begin{pmatrix} \frac{3}{2} & \frac{5}{3} \\ 9 & -10 \end{pmatrix} \qquad (2.0.9)$$

The rank of the above matrix is also 2.
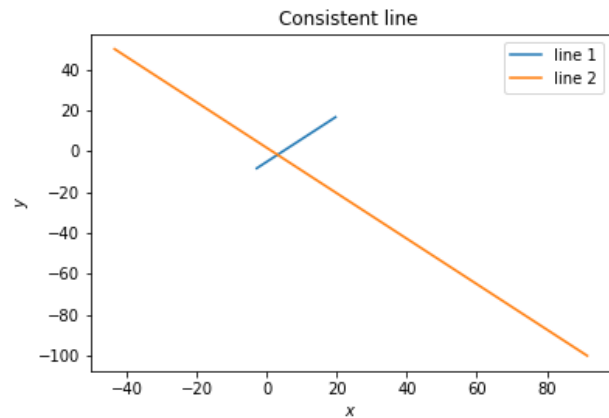$\therefore$ lines are Consistent and gives unique solutipn.

Fig. 2.1: Graphical solution

$\therefore$ This figure verifies that two lines are intersecting at one point.