Assignment No.4

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Question taken from

1 Linear Forms Exercise 2.5(a)

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

$$\begin{pmatrix} 3 & 2 \end{pmatrix} \mathbf{x} = 5 \tag{1.0.1}$$

$$\begin{pmatrix} 2 & -3 \end{pmatrix} \mathbf{x} = 7 \tag{1.0.2}$$

2 Solution

$$\begin{pmatrix} 3 & 2 \end{pmatrix} \mathbf{x} = 5 \tag{2.0.1}$$

$$\begin{pmatrix} 2 & -3 \end{pmatrix} \mathbf{x} = 7 \tag{2.0.2}$$

The above equations can be expressed as the matrix equation

$$\begin{pmatrix} 3 & 2 \\ 2 & -3 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 5 \\ 7 \end{pmatrix} \tag{2.0.3}$$

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

$$\begin{pmatrix} 3 & 2 & 5 \\ 2 & -3 & 7 \end{pmatrix} \xrightarrow{R_1 \leftarrow \frac{1}{3} R_1} \begin{pmatrix} 1 & \frac{2}{3} & \frac{5}{3} \\ 2 & -3 & 7 \end{pmatrix} \tag{2.0.4}$$

$$\xrightarrow{R_2 \leftarrow -2R_1 + R_2} \begin{pmatrix} 1 & \frac{2}{3} & \frac{5}{3} \\ 0 & \frac{-13}{3} & \frac{11}{3} \end{pmatrix} \tag{2.0.5}$$

$$\xrightarrow{R_2 \leftarrow \frac{-3}{13} R_2} \begin{pmatrix} 1 & \frac{2}{3} & \frac{5}{3} \\ 0 & 1 & \frac{-11}{13} \end{pmatrix} \tag{2.0.6}$$

$$\xrightarrow{R_1 \leftarrow \frac{-2}{3} R_2 + R_1} \begin{pmatrix} 1 & 0 & \frac{29}{13} \\ 0 & 1 & \frac{-11}{13} \end{pmatrix} \tag{2.0.7}$$
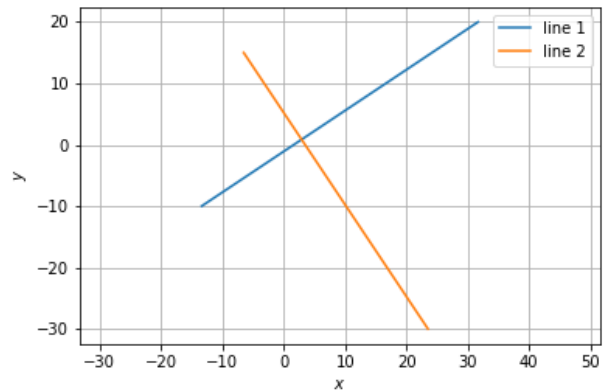
So by reduction of the (2×3) matrix

$$\begin{pmatrix} 3 & 2 & 5 \\ 2 & -3 & 7 \end{pmatrix} \tag{2.0.8}$$

gives matrix with 2 nonzero row, So it's rank is 2.

$$\begin{pmatrix} 3 & 2 \\ 2 & -3 \end{pmatrix} \tag{2.0.9}$$

Also,the rank of the above matrix is also 2.
∴ lines are Consistent and gives unique solution.

Fig. 2.1: Graphical solution

∴ This figure verifies that two lines are intersecting at one point.