EE3900 Assignment - 2

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Download latex-tikz codes from

https://github.com/adhvik24/EE3900/blob/main/Assignment2/Assignment2.tex

Download python codes from

https://github.com/adhvik24/EE3900/blob/main/Assignment2/code.py

1 Matrix Qn 2.70

Examine the consistency of the system of given equations:

$x + 2y = 2$

$2x + 3y = 3$

2 SOLUTION

If solution exists for the given system of equations then they said to be consistent, otherwise they are inconsistent. The above equations can be expressed as the matrix equation

$$\begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} \mathbf{X} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \tag{2.0.1}$$

The augmented matrix for the above equation and row reducing as follows

$$\begin{pmatrix} 1 & 2 & 2 \\ 2 & 3 & 3 \end{pmatrix} \xleftrightarrow{R_2 \to R_2 - 2R_1} \begin{pmatrix} 1 & 2 & 2 \\ 0 & -1 & -1 \end{pmatrix} \tag{2.0.2}$$

$$\xleftrightarrow{R_1 \to R_1 + 2R_2} \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & -1 \end{pmatrix} \tag{2.0.3}$$

$$\implies \text{Rank} \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = \text{Rank} \begin{pmatrix} 1 & 2 & 2 \\ 2 & 3 & 3 \end{pmatrix} = 2 \tag{2.0.4}$$

Here, $Rank(A) = Rank(A|B)$. Therefore, the system is consistent. Also, there exist a unique solution as $Rank(A) = n$ (number of unknown).
From equation (2.0.3), we get:

$$\mathbf{X} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \tag{2.0.5}$$

Plotting the lines and the intersection point in Fig.1

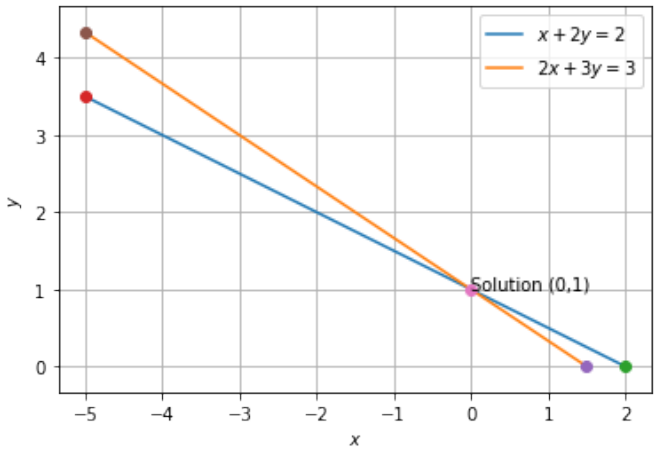

Fig. 1: Lines and their intersection denoting the solution

$\therefore$ The given system of equation is consistent with unique solution of,

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$