

5.2.8

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Question

Solve the equations:

$$\begin{aligned}5x - 3y &= 11 \\ -10x + 6y &= -22\end{aligned}$$

Solution

Forming the augmented matrix,

$$\left(\begin{array}{cc|c} 5 & -3 & 11 \\ -10 & 6 & -22 \end{array} \right)$$

Perform row operations to reduce to row echelon form:

$$\left(\begin{array}{cc|c} 5 & -3 & 11 \\ -10 & 6 & -22 \end{array} \right) \xrightarrow{R_2 \rightarrow R_2 + 2R_1} \left(\begin{array}{cc|c} 5 & -3 & 11 \\ 0 & 0 & 0 \end{array} \right)$$

The second row turns out to be all zeros, meaning the system is dependent and consistent.

From the first row:

$$5x - 3y = 11 \implies x = \frac{11 + 3y}{5}$$

Let $\mathbf{y} = \lambda, \lambda \in \mathbb{R}$

Then, the general solution is:

$$\mathbf{x} = \begin{pmatrix} \frac{11}{5} \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} \frac{3}{5} \\ 1 \end{pmatrix}, \quad \lambda \in \mathbb{R}$$

Plot

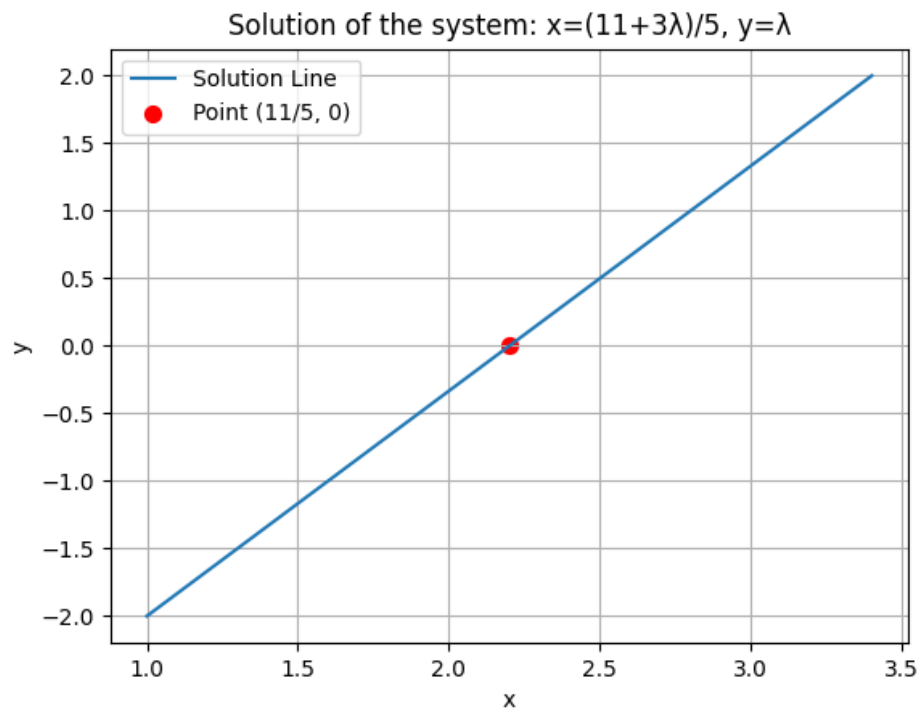


Figure 1: 2D plot of the solution