5.2.8

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Question

Solve the equations:

$$5x - 3y = 11 \quad -10x + 6y = -22$$

Solution

Forming the augmented matrix,

$$\begin{pmatrix} 5 & -3 & \bigm| & 11 \\ -10 & 6 & \bigm| & -22 \end{pmatrix}$$

Perform row operations to reduce to row echelon form:

$$\begin{pmatrix} 5 & -3 & \bigm| & 11 \\ -10 & 6 & \bigm| & -22 \end{pmatrix} \xrightarrow{R_2 \to R_2 + 2R_1} \begin{pmatrix} 5 & -3 & \bigm| & 11 \\ 0 & 0 & \bigm| & 0 \end{pmatrix}$$

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:

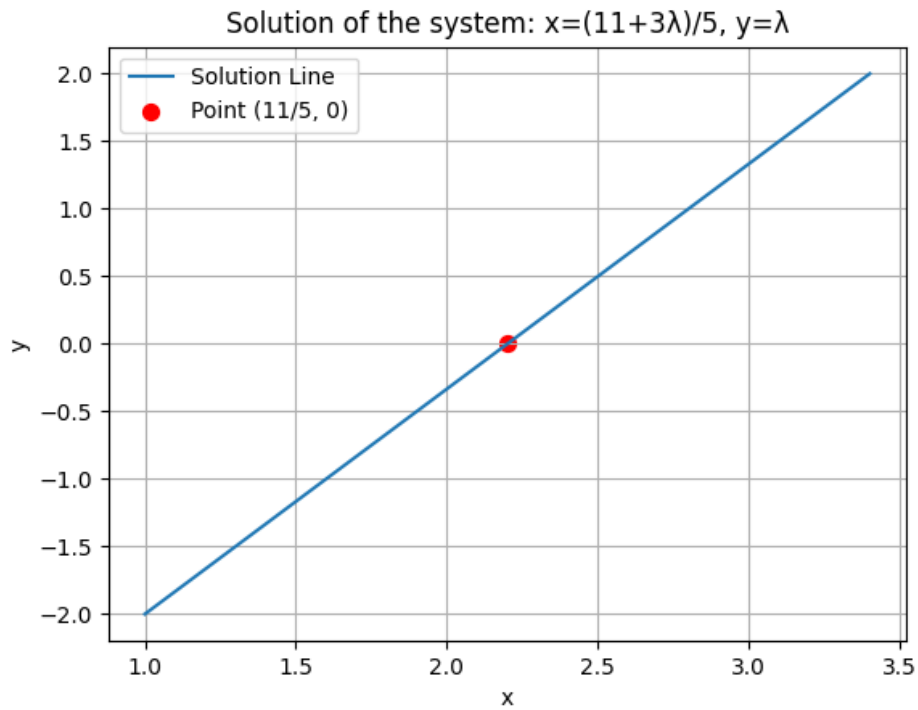$$\boxed{\mathbf{x} = \begin{pmatrix} \frac{11}{5} & 0 \end{pmatrix} + \lambda \begin{pmatrix} \frac{3}{5} & 1 \end{pmatrix}, \quad \lambda \in \mathbb{R}}$$

Plot

Figure 1: 2D plot of the solution