5.2.8

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Question

Solve the equations:

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

Forming Augmented Matrix

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

Row Operations

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

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

Solution

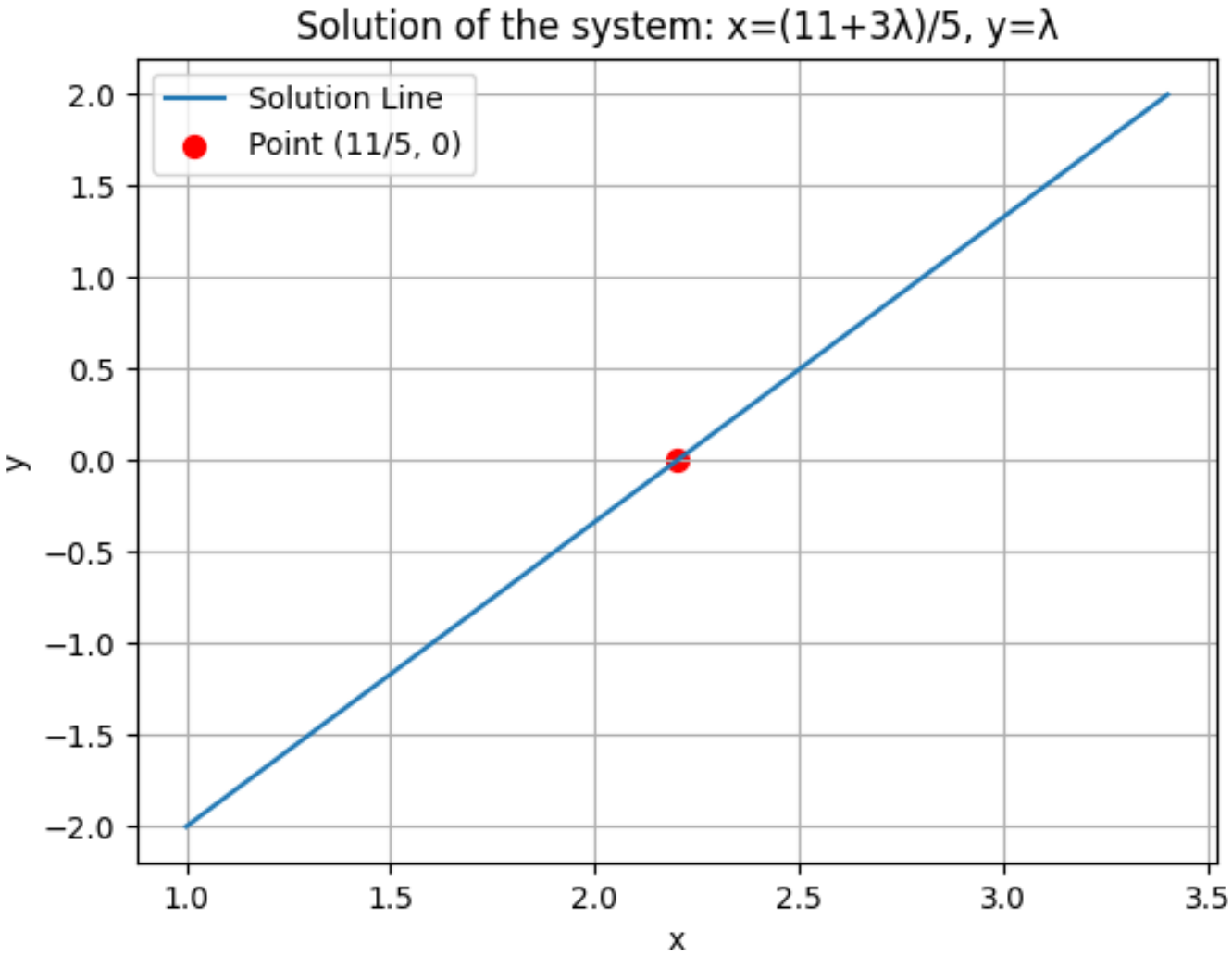
From the first row:

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

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


Solution of the system: x=(11+3λ)/5, y=λ
Solution Line
Point (11/5, 0)
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
y
1.0
1.5
2.0
2.5
3.0
3.5
x

Codes

For Codes, refer to the URL below:
https://github.com/Aditya-Mishra11005/ee1030-2025/tree/temp/ee25btech11005/matgeo/5.2.8/Codes