Advanced Systems of Linear Equations Practice Set

Problem Curator: Phanie

There are 15 systems of linear equations designed to be solved using:

1. Gaussian Elimination

2. Inverse Matrix Method

3. Substitution/Elimination

4. Row/Column Picture Analysis

Part A: 2x2 Systems (3 Problems)

Problem 1 (Non-Unit Pivot):

$$\begin{cases} 2x + 3y = 7 \\ 4x - 5y = 3 \end{cases}$$

Problem 2 (Negative Coefficients):

$$\begin{cases} 5x - 2y = -13 \\ -3x + 7y = 31 \end{cases}$$

Problem 3 (Large Constants):

$$\begin{cases} 7x + 4y = 26 \\ 6x - 11y = -97 \end{cases}$$

Part B: 3x3 Systems (12 Problems)

Problem 4 (Standard):

$$\begin{cases} x + 2y - z = 3 \\ 2x + 5y + z = 14 \\ 3x - y + 2z = 9 \end{cases}$$

Problem 5 (Zero in Matrix):

$$\begin{cases} x - 2y + 3z = 7 \\ 2x + y + z = 4 \\ -3x + 2y - 2z = -10 \end{cases}$$

Problem 6 (Missing Variables):

$$\begin{cases} 2x - 3y = -4 \\ x + z = 5 \\ 3x - y + 2z = 16 \end{cases}$$

Problem 7 (All Non-Zero Coefficients):

$$\begin{cases} 2x + 3y + z = 1 \\ 3x + 3y + z = 2 \\ 2x + 4y + z = -2 \end{cases}$$

Problem 8 (Descending Constants):

$$\begin{cases} x + y + z = 6 \\ x - y + z = 2 \\ x + 2y - z = 2 \end{cases}$$

Problem 9 (The "Staircase"):

$$\begin{cases} x + y - z = 4 \\ 2x - y + 3z = 9 \\ 3x + 2y - 2z = 1 \end{cases}$$

Problem 10 (Higher Multiples):

$$\begin{cases} 3x + 2y + 4z = 13 \\ 2x + y + 3z = 9 \\ x + 3y + 2z = 5 \end{cases}$$

Problem 11 (Alternating Signs):

$$\begin{cases} 2x - y + 3z = 20 \\ -x + 5y - 2z = -5 \\ 3x + 2y - 4z = -1 \end{cases}$$

Problem 12 (Sparse Matrix):

$$\begin{cases} 4x + z = 7 \\ 2x - 3y = -10 \\ y + 2z = 8 \end{cases}$$

Problem 13 (High Pivot):

$$\begin{cases} 5x - 2y + z = 4 \\ 2x + 3y - 2z = 7 \\ 3x + y + z = 5 \end{cases}$$

Problem 14 (Similar Rows):

$$\begin{cases} x + 2y + 3z = 14 \\ x + 2y + z = 6 \\ x + y + 2z = 8 \end{cases}$$

Problem 15 (The Final Challenge):

$$\begin{cases} 2x + 5y - 3z = -7 \\ 4x + 3y + 2z = 21 \\ -2x + y + 5z = 23 \end{cases}$$