5.2.31

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Question:
solve the following system of linear equations .

$$2x + 3y = 8$$

$$4x + 6y = 7$$

Solution:
Consider the system of linear equations:

$$2x + 3y = 8 \tag{1}$$

$$4x + 6y = 7 \tag{2}$$

Step 1: Write in matrix form

$$\underbrace{\begin{pmatrix} 2 & 3 \\ 4 & 6 \end{pmatrix}}_{(A)} \underbrace{\begin{pmatrix} x \\ y \end{pmatrix}}_{(X)} = \underbrace{\begin{pmatrix} 8 \\ 7 \end{pmatrix}}_{(B)} \tag{3}$$

Step 2: Check the determinant of the coefficient matrix

$$\det(A) = \begin{vmatrix} 2 & 3 \\ 4 & 6 \end{vmatrix} = (2)(6) - (3)(4) = 12 - 12 = 0 \tag{4}$$

Since the determinant is zero, the system is either inconsistent or has infinitely many solutions.

Step 3: Check for consistency

Compare ratios of coefficients and constants:

$$\frac{2}{4} = \frac{3}{6} = \frac{1}{2} \quad \text{but} \quad \frac{8}{7} \neq \frac{1}{2} \tag{5}$$

Conclusion

The system is **inconsistent**. Therefore,

$$\text{No solution exists.} \tag{6}$$

Graph presentation:

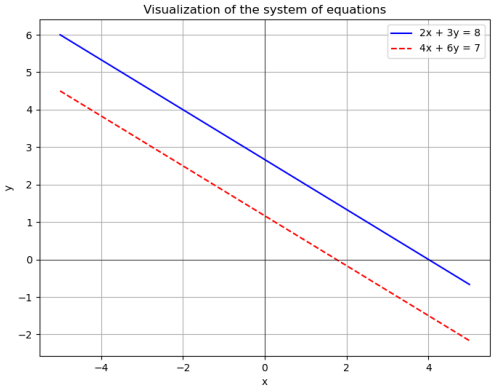

Fig. 1