

# System of Equations

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## Question

Solve the following system of equations:

$$x - y = 8, \quad 3x - 3y = 16$$

## Solution

Each equation can be expressed in vector form as a dot product:

$$\begin{pmatrix} 1 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 8, \quad (1)$$

$$\begin{pmatrix} 3 & -3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 16. \quad (2)$$

Stacking these gives the matrix equation

$$\begin{pmatrix} 1 & -1 \\ 3 & -3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 8 \\ 16 \end{pmatrix}. \quad (3)$$

In augmented form,

$$\begin{pmatrix} 1 & -1 & 8 \\ 3 & -3 & 16 \end{pmatrix}. \quad (4)$$

Applying the row operation  $R_2 \rightarrow R_2 - 3R_1$ ,

$$\begin{pmatrix} 1 & -1 & 8 \\ 0 & 0 & -8 \end{pmatrix}. \quad (5)$$

This yields the contradiction

$$0 = -8. \quad (6)$$

Hence the system is inconsistent,

No solution

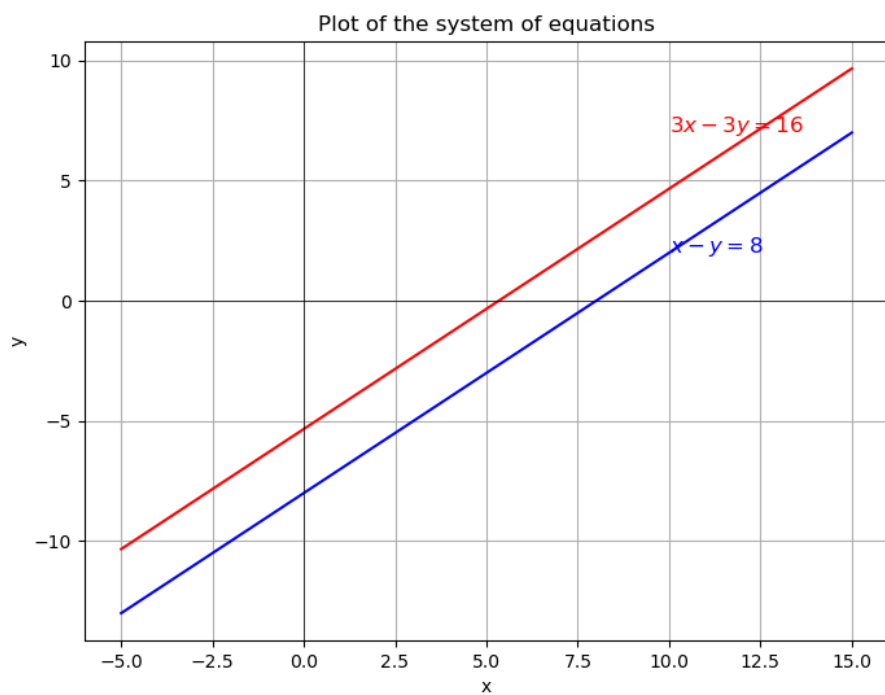


Figure 1: Lines