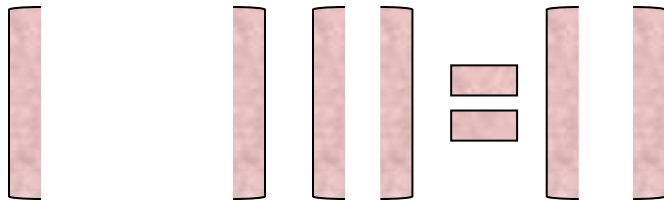


MATRIX EQUATION – Example 1

- Consider the following set of equations:
$$\begin{aligned}x_1 - x_2 &= 3 \\ 2x_1 + x_2 &= 9\end{aligned}$$

- How can we write this in the form of matrix multiplication $Ax=b$?



A diagram illustrating the matrix equation $Ax=b$ using vertical bars to represent matrices and vectors. On the left, a single vertical bar represents the coefficient matrix A . This is followed by two vertical bars representing the variable vector x . An equals sign, composed of two horizontal bars, is placed between the coefficient matrix and the constant vector. On the right, two vertical bars represent the constant vector b .

$$\begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 3 \\ 9 \end{bmatrix}$$

SOLVING MATRIX EQUATIONS USING INVERSE

- $Ax = b$
- $A^{-1}Ax = A^{-1}b$
- $Ix = A^{-1}b$
- $x = A^{-1}b$

MATRIX EQUATION – Example 2

- Consider following system

$$x_1 + 2x_2 - x_3 = 4$$

$$-5x_2 + 3x_3 = 1$$

- What is the above in the $Ax = b$ format?

$$\begin{bmatrix} 1 & 2 & -1 \\ 0 & -5 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$$

MATRIX EQUATION - Example 2

- Also note, that we can write
$$\begin{bmatrix} 1 & 2 & -1 \\ 0 & -5 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$$
- as this:
$$x_1 \begin{bmatrix} 1 \\ 0 \end{bmatrix} + x_2 \begin{bmatrix} 2 \\ -5 \end{bmatrix} + x_3 \begin{bmatrix} -1 \\ 3 \end{bmatrix} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$$
- The above expression is called **Linear Combination** of columns of A.