0.1 Systems of Linear Equations

0.1.1 Matrix Representation

Note:-

A system of linear equations can be represented in matrix form as $A\vec{x} = \vec{b}$, where:

- A is an $m \times n$ matrix (the coefficient matrix).
- $\vec{x}$ is a column vector of variables $(x_1, x_2, ..., x_n)$.
- $\vec{b}$ is a column vector of constants $(v_1, v_2, ..., v_n)$.

This can be visualized as:

$$\begin{bmatrix} & A & \end{bmatrix}_{m \times n} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix}$$

Which is equivalent to:

$$A \cdot \vec{x} = \vec{b}$$

0.1.2 Fundamental Questions

Question 1: Question 1

Does a solution exist?

Question 2: Question 2

If a solution exists, is it unique (one solution) or are there multiple (many) solutions?