1.3 Vector Equations

What is Linear Algebra?
Linear equations in n unknown $x_1...mx_n$

$$a_1x_2 + a_2x_2 + ... + a_nx_n = k$$

System of Linear Equations
M linear equations in n unknowns $x_1, ..., x_n$.

$$\{a_1x_1 + a_2x_2 + ... + a_nx_n = b_1 \rightarrow Ax = b$$
$$\{a_{m1}x_1 + a_{m2}x_2 + ... + a_{mn}x_n = b_m$$

$$Ax = b$$
$$\begin{bmatrix} a_1 & ... & a_n \\ . & & . \\ . & & . \\ a_{m1} & ... & a_{mn} \end{bmatrix} \begin{bmatrix} x_1 \\ . \\ . \\ x_n \end{bmatrix} = \begin{bmatrix} b_1 \\ . \\ . \\ b_m \end{bmatrix}$$

2 Dimensional Matrix

$$\mathbb{R}^2, \ \vec{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Operations on Vectors

Vector Addition

$$\vec{u} + \vec{v}$$

Scalar Multiplication

$$c \cdot \vec{u}$$

Linear Combinations *
Given vectors $v_1, v_2, v_p \in \mathbb{R}^n$ and scalars $c_1, c_2, ..., c_p$. The vector y defined by $y = c_1v_1 + c_2v_2 + ... + c_3v_3$ is called a linear combination of the vectors $v_1, ..., v_p$ with weights $c_1, ..., c_p$.

An example of linear combinationation being applied would be RGB colors. Where v_1, v_2 & $, v_3$ are red, green, & blue. While the scalar values $c_1, c_2,$ & c_3 would be the magnitude of those colors.

Least Squares
Span $v_1, ..., v_p$ is the set of all linear combinatiopns of $v_1, v)_2, ..., v_p$.

$$v_1, v_2, v_3 =$$