- Linear Systems

  Linear Algebra provides a way to compluctly represent Linear Systems

- Inner Products

- Outer Products

- Matrix Multiplication

$$C = AB \quad A \in \mathbb{R}^{??}, \; B \in \mathbb{R}^{??} \Rightarrow C \in \mathbb{R}^{??}$$

at least 3 different ways of thinking about matrix multiplication

1. w/ inner products

2. w/ outer products

3. matrix-vector products

- Trace

$$Tr(A) = \sum_{i=1}^{n} A_{ii}$$

exercise: check that $Tr(AB) = Tr(BA)$ $A \in \mathbb{R}^{m,n}$, $B \in \mathbb{R}^{n,m}$

- Norms: informally a measure of length of a vector

More formally, a norm is any fn $f: \mathbb{R}^n \mapsto \mathbb{R}$ that satisfies the following 4 properties

1. $\forall x \in \mathbb{R}^n,\ f(x) \geq 0$ (non-negativity)
2. $f(x) = 0 \Leftrightarrow x = 0$ (definiteness)
3. $\forall x \in \mathbb{R}^n,\ t \in \mathbb{R},\ f(tx) = |t| f(x)$ (homogeneity)
4. $\forall x, y \in \mathbb{R}^n,\ f(x+y) \leq f(x) + f(y)$ (triangle inequality)

examples

$\|x\|_2 =$

$\|x\|_1 =$

$\|x\|_\infty =$

Cauchy - Schwartz