

REAL INNER PRODUCT

Why

We want to measure angles in space.¹

Definition

The real inner product (or dot product, scalar product) of two real vectors $x, y \in \mathbb{R}^n$ is

$$x_1y_1 + x_2y_2 + \dots + x_ny_n$$

We denote the inner product of x and y by $\langle x, y \rangle$.

Properties

The inner product has several important properties

- 1. $\langle \alpha x, y \rangle = \alpha \langle x, y \rangle$
- 2. $\langle x + y, z \rangle = \langle x, z \rangle + \langle y, z \rangle$
- 3. $\langle x, y \rangle = \langle y, x \rangle$
- 4. $\langle x, x \rangle \geq 0$
- 5. $\langle x, x \rangle = 0 \longleftrightarrow x = 0$

Connection to norm

It is important to note that $||x|| = \sqrt{\langle x, x \rangle}$.

¹Future editions will expand, and perhaps give the development for \mathbb{R}^2 first. Future editions will include pictures.

