Why

We want to measure angles in space.[1]

Definition

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

$$x_1 y_1 + x_2 y_2 + \cdots + x_n y_n$$

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

Properties

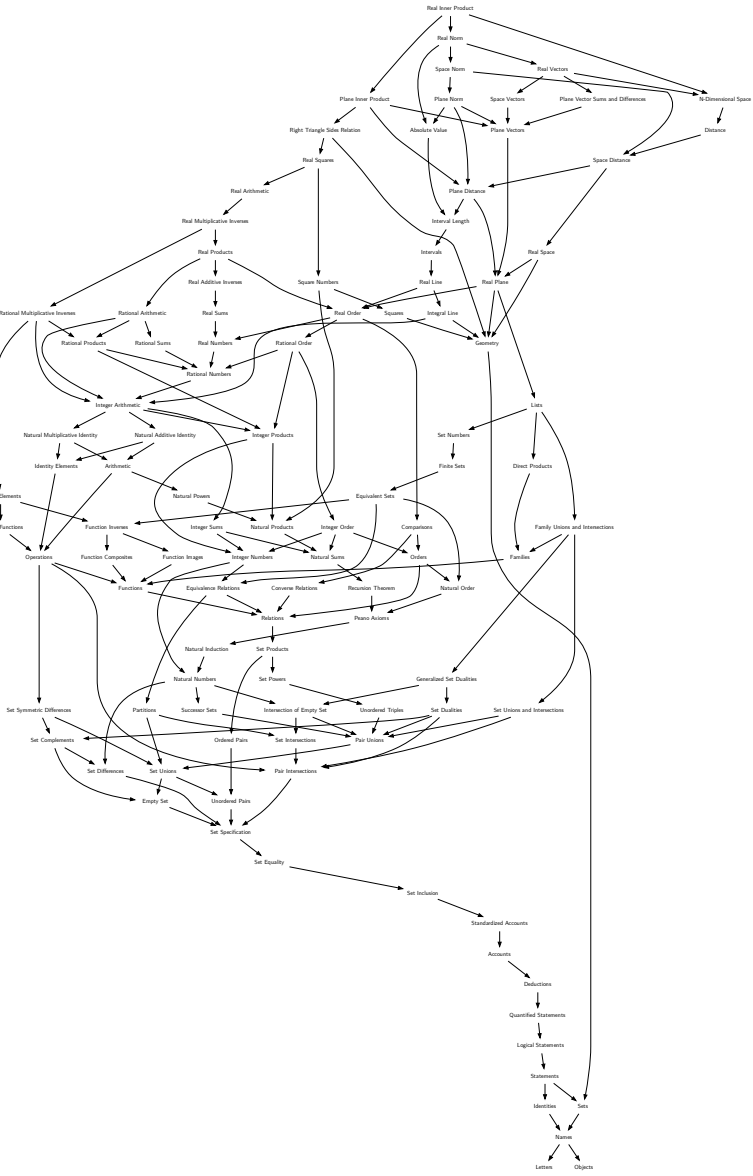
The inner product has several important properties

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 $\|x\| = \sqrt{\langle x, x \rangle}$.

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


Real Inner Product
Real Norm
Space Norm
Real Vectors
Plane Inner Product
Plane Norm
Space Vectors
Plane Vector Sums and Differences
N-Dimensional Space
Right Triangle Sides Relation
Absolute Value
Plane Vectors
Distance
Real Squares
Space Distance
Real Arithmetic
Plane Distance
Real Multiplicative Inverses
Interval Length
Real Products
Intervals
Real Space
Real Additive Inverses
Square Numbers
Real Line
Real Plane
Rational Multiplicative Inverses
Rational Arithmetic
Real Sums
Real Order
Squares
Integral Line
Rational Products
Rational Sums
Real Numbers
Rational Order
Geometry
Rational Numbers
Integer Arithmetic
Lists
Natural Multiplicative Identity
Natural Additive Identity
Integer Products
Set Numbers
Identity Elements
Arithmetic
Finite Sets
Direct Products
Inverse Elements
Natural Powers
Equivalent Sets
Element Functions
Function Inverses
Integer Sums
Natural Products
Integer Order
Compositions
Family Unions and Intersections
Operations
Function Composites
Function Images
Integer Numbers
Natural Sums
Orders
Families
Functions
Equivalence Relations
Converse Relations
Recursion Theorem
Natural Order
Relations
Peano Axioms
Natural Induction
Set Products
Natural Numbers
Set Powers
Generalized Set Dualities
Set Symmetric Differences
Partitions
Successor Sets
Intersection of Empty Set
Unordered Triples
Set Dualities
Set Unions and Intersections
Set Complements
Ordered Pairs
Set Intersections
Pair Unions
Set Differences
Set Unions
Pair Intersections
Empty Set
Unordered Pairs
Set Specification
Set Equality
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects