### Definition

A square real matrix is *symmetric* (we call it a *symmetric matrix*) if its values do not depend on the order of the indices. In other words, a matrix is symmetric if the values above and below the diagonal are a mirror image.

#### Examples

The matrix

$$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$$

is symmetric. The matrix

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

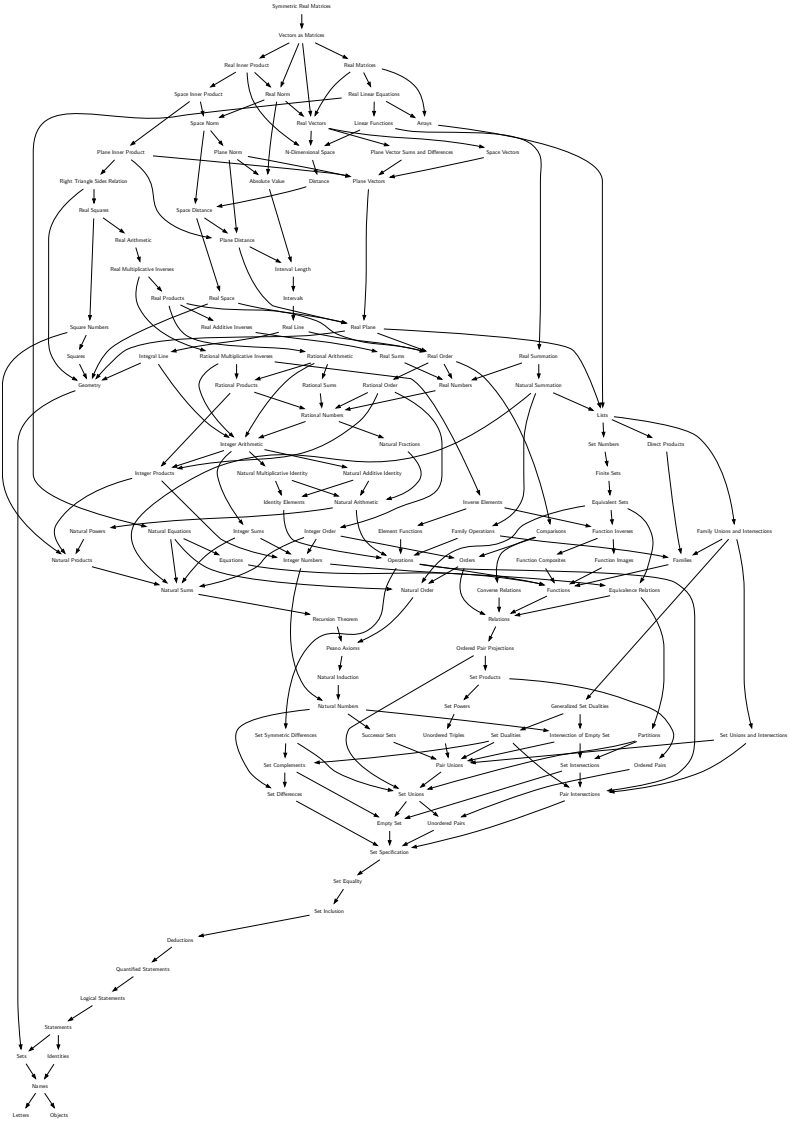
is not.

#### Notation

Suppose $A \in \mathbf{R}^{n\times n}$ with $A^\top = A$ (i.e., symmetric). We denote the set of all such symmetric $n \times n$ real matrices by $\mathbf{S}^n$. So

$$\mathbf{S}^n = \big\{ A \in \mathbf{R}^{n\times n} \;\big|\; A^\top = A \big\}.$$

In particular, $\mathbf{S}^n \subset \mathbf{R}^{n\times n}$.


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