Why

We can view the set of real-valued $n \times k$ matrices as a vector space over $\mathbf{R}$.

Definition

The *matrix sum* of two matrices $A, B \in \mathbf{R}^{n \times k}$ is the matrix $C \in \mathbf{R}^{n \times k}$ defined by $C_{ij} = A_{ij} + B_{ij}$. In other words, the matrix C is given by summing the entires of A and B "entry-wise". We denote the matrix sum by $A + B$.

For $\alpha \in \mathbf{R}$, the *α-scaled version* of $A \in \mathbf{R}^{n \times k}$ is the matrix $C \in \mathbf{R}^{n \times k}$ given by $C_{ij} = \alpha A_{ij}$. In other words, the matrix C is given by scaling the entries of A "entry-wise". We denote the α-scaled version of A by αA. These two definitions are justified by the following.

The *$n \times k$-matrix space* is the vector space over $\mathbf{R}^{n \times k}$ in which addition is given by the matrix sumer and scalar multiplication by entry-wise scaling.[1]

Subspace of symmetric matrices

The subset of symmetric n by n matrices is a subset of $\mathbf{R}^{n \times n}$.

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[1] Future editions will rework this sheet.

Real Matrix Space

Symmetric Matrices

Matrix Transpose · Symmetric Real Matrices

Vectors as Matrices · Subspaces

Real Inner Product · Real Matrices · Linear Equations · Vectors · Real Subspaces

Space Inner Product · Real Norm · Linear Function · Real Vectors Span

Space Norm · Linear Function · Arrays · Real Vectors · Real Linear Combinations

Plane Inner Product · Plane Norm · N-Dimensional Space · Space Vector · Plane Vector Sums and Differences

Right Triangle Sides Relation · Absolute Value · Distance · Plane Vectors

Real Square · Space Distance

Real Arithmetic · Plane Distance

Real Multiplicative Inverse · Interval Length

Real Products · Real Space · Intervals

Square Numbers · Real Additive Inverse · Real Line · Real Plane

Squares · Integral Line · Rational Multiplicative Inverse · Rational Arithmetic · Real Sums · Real Order · Real Summation

Geometry · Rational Products · Rational Sums · Real Numbers · Fields · Rational Order

Rational Numbers · Rings · Lists

Integer Arithmetic · Set Numbers · Direct Products

Integer Products · Natural Multiplicative Identity · Natural Additive Identity · Finite Sets

Natural Power · Integer Sum · Natural Equations · Arithmetic · Identity Elements · Inverse Elements · Natural Summation · Equivalent Sets · Family Operations · Family Unions and Intersections

Natural Products · Integer Order · Equations · Integer Number · Orders · Function Inverse · Element Functions · Comparisons · Families

Natural Sums · Function Image · Function Composites · Operations

Natural Order · Functions · Converse Relations · Equivalence Relations

Recursion Theorem · Relations

Peano Axioms · Ordered Pair Projections

Natural Induction · Set Products · Generalized Set Dualities · Set Unions and Intersections

Natural Number · Set Powers

Set Symmetric Differences · Successor Sets · Unordered Triples · Set Dualities · Intersection of Empty Set · Partitions

Set Complements · Pair Unions · Set Intersections · Ordered Pairs

Set Differences · Set Unions · Unordered Pairs · Pair Intersections

Empty Set

Set Specification

Set Equality

Set Inclusion

Deductions

Quantified Statements

Logical Statements

Statements

Sets · Identities

Names

Letters · Objects

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