Definition

Let $f : D \to \mathbf{R}$ be a multivariate real-valued function where $D \subset \mathbf{R}^d$. The *graph* of f is the set in $\mathbf{R}^{d+1}$ defined by

$$\{(x, f(x)) \in \mathbf{R}^d \times \mathbf{R} \mid x \in D\}.$$

The *epigraph* of f is the set in $\mathbf{R}^{d+1}$ defined by

$$\{(x, t) \in \mathbf{R}^d \mid x \in D \text{ and } f(x) \leq t\}.$$

Notation

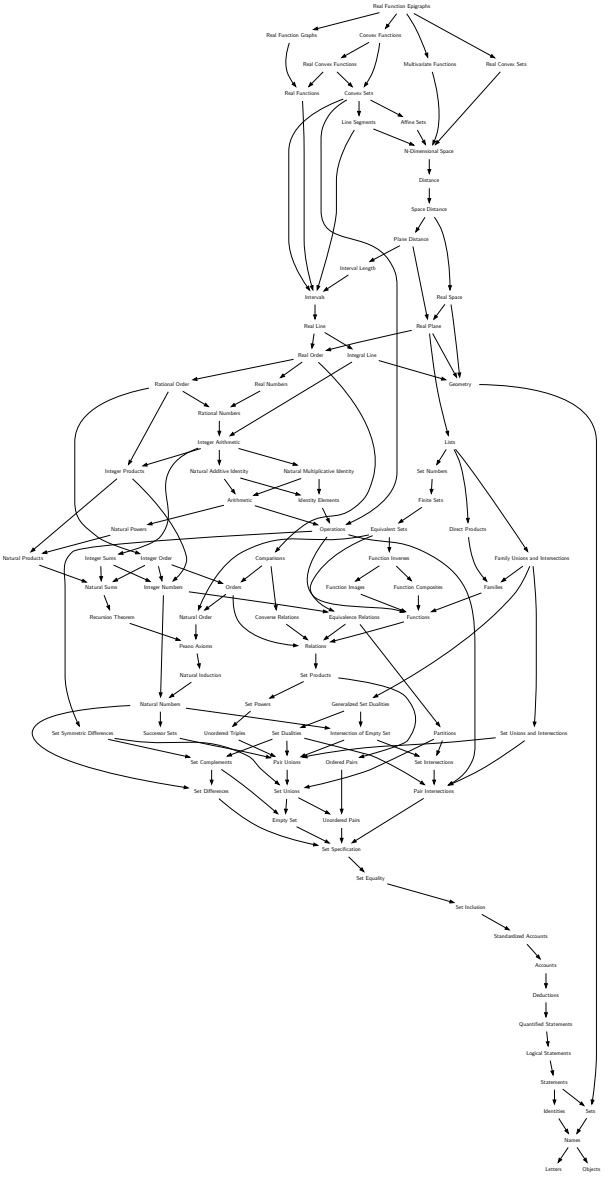
We denote the epigraph of a function f by $\operatorname{epi} f$.

Connecting convex sets and convex functions

A function $f : \mathbf{R}^d \to \mathbf{R}$ is convex if and only if $\operatorname{epi} f$ is a convex set.

Note on terminology

The prefix "epi" is Greek, meaning "above".


Real Function Epigraphs
Real Function Graphs
Convex Functions
Real Convex Functions
Multivariate Functions
Real Convex Sets
Real Functions
Convex Sets
Line Segments
Affine Sets
N-Dimensional Space
Distance
Space Distance
Plane Distance
Interval Length
Intervals
Real Space
Real Line
Real Plane
Real Order
Integral Line
Geometry
Rational Order
Real Numbers
Rational Numbers
Integer Arithmetic
Logic
Integer Products
Natural Additive Identity
Natural Multiplicative Identity
Set Notation
Arithmetic
Identity Elements
Finite Sets
Natural Powers
Operations
Equivalent Sets
Direct Products
Natural Products
Integer Sums
Integer Order
Comparisons
Function Inverses
Family Unions and Intersections
Natural Sums
Integer Numbers
Orders
Function Images
Function Composites
Families
Recursion Theorem
Natural Order
Converse Relations
Equivalence Relations
Functions
Peano Axioms
Relations
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
Ordered Pairs
Set Intersections
Set Differences
Set Unions
Pair Intersection
Empty Set
Unordered Pairs
Set Specification
Set Equality
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects