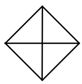
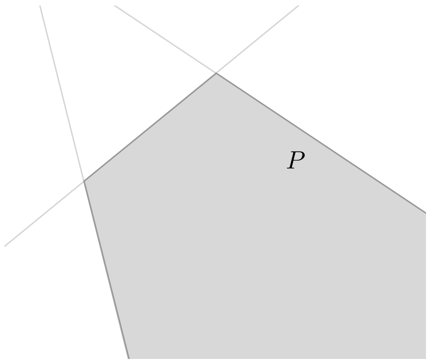


Definition

A *polyhedron* (or *real polyhedron*, or *convex polyhedron*) is a set $P \subset \mathbf{R}^n$ for which there exists $A \in \mathbf{R}^{m \times n}$ and $b \in \mathbf{R}^m$ satisfying

$$P = \{x \in \mathbf{R}^n \mid Ax \leq b\}.$$

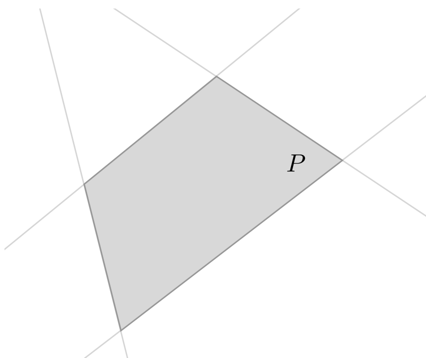
In other words, a polyhedron is an intersection of finitely many halfspaces. If A and b are rational, then P is called a *rational polyhedron.*



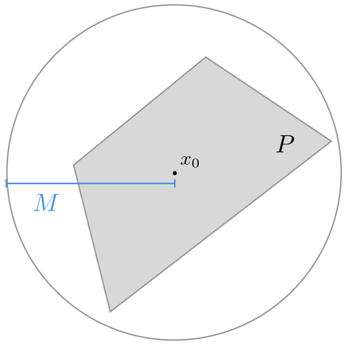
A polyhedron P is a *polytope* (a *real polytope*) if it is *bounded.* In other words, there exists $x_0 \in P$ and $M > 0$ such that

$$P \subset B_M(x_0) = \{x \mid \|x - x_0\| < M\}$$

Here $B_M(x_0)$ denotes the open ball of radius M, as usual.

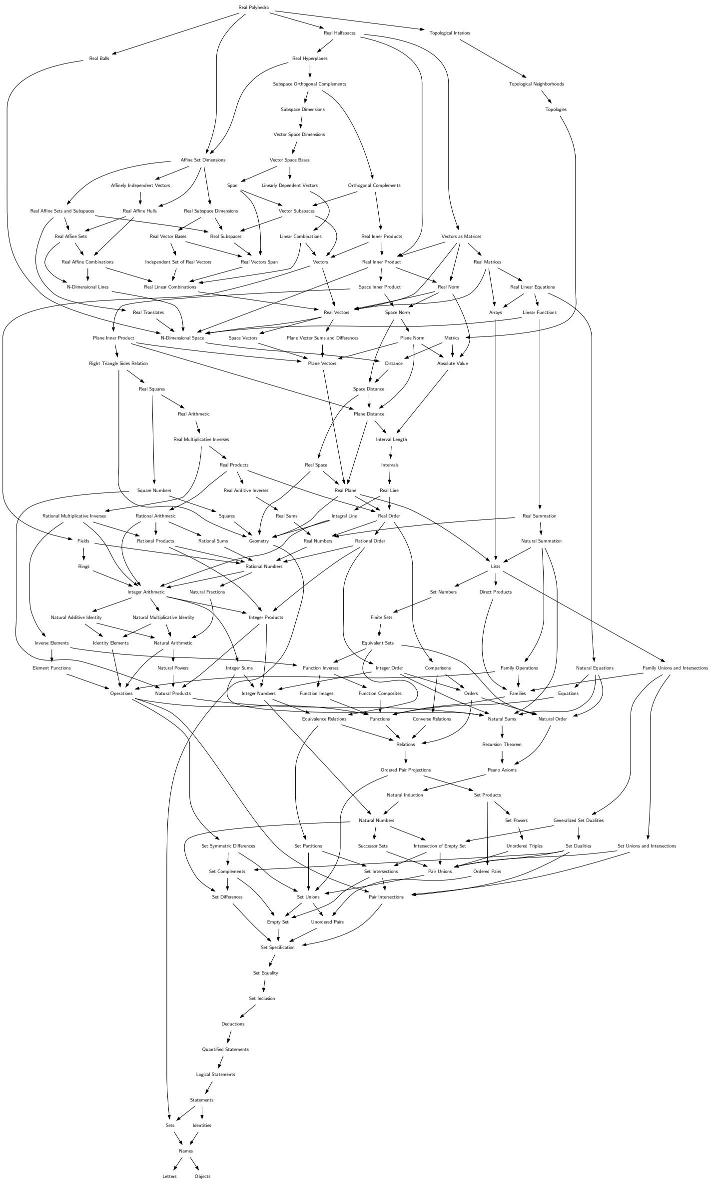


As usual, the dimension of a polyhedron P is the dimension of the affine hull of P, which we denote by $\dim P$. P is called *full-dimensional* if $\dim P = n$. An equivalent condition for P to be full-dimensional is that there exist an interior point of P (as a subset of $\mathbf{R}^n$)



Terminology

Caution: some authors have a more relaxed notion of polyhedra, which does not require the polyhedra be convex.


Real Polyhedra
Real Halfspaces
Topological Interiors
Real Balls
Real Hyperplanes
Subspace Orthogonal Complements
Topological Neighborhoods
Subspace Dimensions
Topologies
Vector Space Dimensions
Affine Set Dimensions
Vector Space Bases
Affinely Independent Vectors
Span
Linearly Dependent Vectors
Orthogonal Complements
Real Affine Sets and Subspaces
Real Affine Hulls
Real Subspace Dimensions
Vector Subspaces
Real Affine Sets
Real Vector Bases
Real Subspaces
Linear Combinations
Real Inner Products
Vectors as Matrices
Real Affine Combinations
Independent Set of Real Vectors
Real Vectors Span
Vectors
Real Inner Product
Real Matrices
N-Dimensional Lines
Real Linear Combinations
Space Inner Product
Real Norm
Real Linear Equations
Real Translates
Real Vectors
Space Norm
Arrays
Linear Functions
Plane Inner Product
N-Dimensional Space
Space Vectors
Plane Vector Sums and Differences
Plane Norm
Metrics
Right Triangle Sides Relation
Plane Vectors
Distance
Absolute Value
Real Squares
Space Distance
Real Arithmetic
Plane Distance
Real Multiplicative Inverses
Interval Length
Real Products
Real Space
Intervals
Square Numbers
Real Additive Inverses
Real Plane
Real Line
Rational Multiplicative Inverses
Rational Arithmetic
Squares
Real Sums
Integral Line
Real Order
Real Summation
Fields
Rational Products
Rational Sums
Geometry
Real Numbers
Rational Order
Natural Summation
Rings
Rational Numbers
Lists
Integer Arithmetic
Natural Fractions
Set Numbers
Direct Products
Natural Additive Identity
Natural Multiplicative Identity
Integer Products
Finite Sets
Inverse Elements
Identity Elements
Natural Arithmetic
Equivalent Sets
Element Functions
Natural Powers
Integer Sums
Function Inverses
Integer Order
Comparisons
Family Operations
Natural Equations
Family Unions and Intersections
Operations
Natural Products
Integer Numbers
Function Images
Function Composites
Orders
Families
Equations
Equivalence Relations
Functions
Converse Relations
Natural Sums
Natural Order
Relations
Recursion Theorem
Ordered Pair Projections
Peano Axioms
Natural Induction
Set Products
Natural Numbers
Set Powers
Generalized Set Dualities
Set Symmetric Differences
Set Partitions
Successor Sets
Intersection of Empty Set
Unordered Triples
Set Dualities
Set Unions and Intersections
Set Complements
Set Intersections
Pair Unions
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
Letters
Objects