Why

We are regularly referring to a few common growth classes.

Definitions

Let $c \in \mathbf{R}$. Then we name the following growth classes

growth class	name
$O(1)$	*constant growth class*
$O(\log(x))$	*logarithmic growth class*
$O((\log(x))^c)$	*polylogarithmic growth class*
$O(x)$	*linear growth class*
$O(x^2)$	*quadratic growth class*
$O(x^c)$	*polynomial growth class*
$O(c^x)$	*exponential growth class*

We have written these in order:

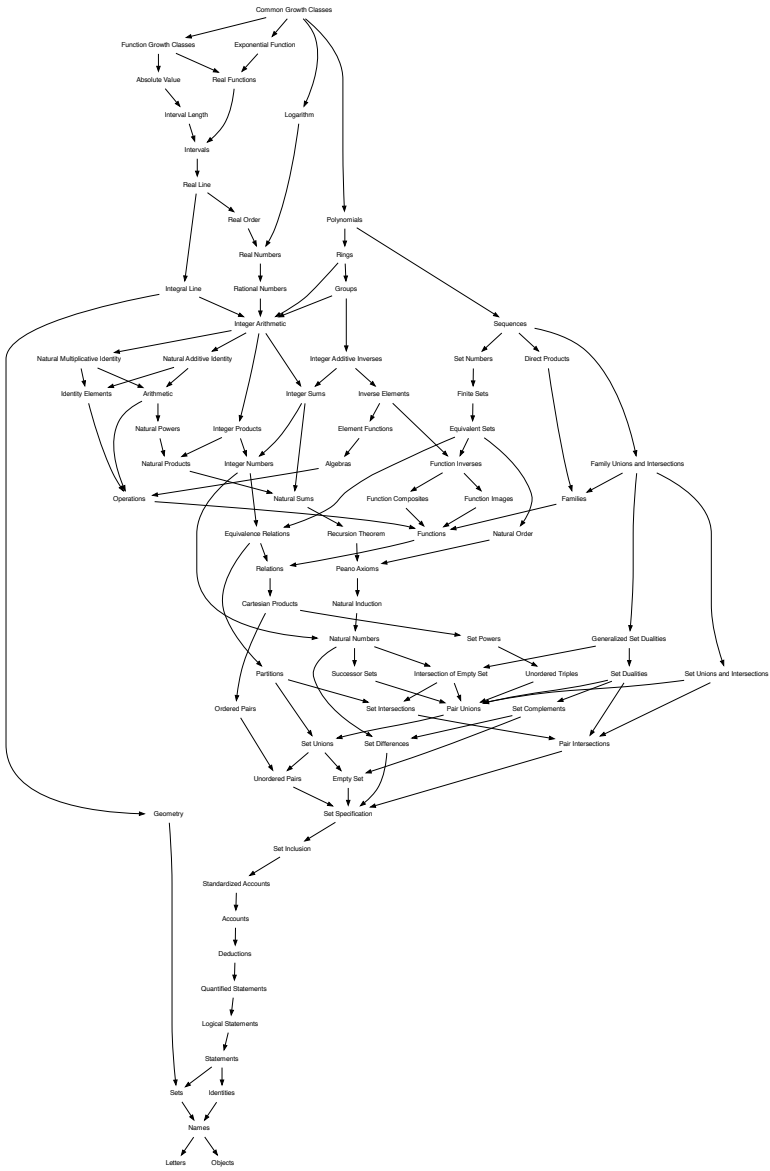
$$O(1) \subset O(\log(x)) \subset O((\log(x))^c) \subset \cdots \subset O(x^c) \subset O(c^x).$$

A function that grows faster (is in the upper growth class) of a power of x is called *superpolynomial*. One that grows slower than c^n for some $c \in \mathbf{R}$ is called *subexponential*. The class $O(\log(x^c))) = O(\log(x))$ since $\log(x^c) = c \log x$. Similarly, for all $c_1, c_2 > 0$, $O(\log_{c_1}(x)) = O(\log_{c_2}(x))$.

This list is useful because of the following

Proposition 1. *Let* $f, g : \mathsf{R} \to \mathsf{R}$ *and defined* $h : \mathsf{R} \to \mathsf{R}$ *by* $h = f + g$*. If* $O(f) \subset O(g)$*, then* $h \in O(g)$*.*

In other words, if a function h is the sum of f and g and g is growing faster, then g (the one growing faster) determines the order of h.


Common Growth Classes
Function Growth Classes
Exponential Function
Absolute Value
Real Functions
Interval Length
Logarithm
Intervals
Real Line
Real Order
Polynomials
Real Numbers
Rings
Integral Line
Rational Numbers
Groups
Integer Arithmetic
Sequences
Natural Multiplicative Identity
Natural Additive Identity
Integer Additive Inverses
Set Numbers
Direct Products
Identity Elements
Arithmetic
Integer Sums
Inverse Elements
Finite Sets
Natural Powers
Integer Products
Element Functions
Equivalent Sets
Natural Products
Integer Numbers
Algebras
Function Inverses
Family Unions and Intersections
Operations
Natural Sums
Function Composites
Function Images
Families
Equivalence Relations
Recursion Theorem
Functions
Natural Order
Relations
Peano Axioms
Cartesian Products
Natural Induction
Natural Numbers
Set Powers
Generalized Set Dualities
Partitions
Successor Sets
Intersection of Empty Set
Unordered Triples
Set Dualities
Set Unions and Intersections
Ordered Pairs
Set Intersections
Pair Unions
Set Complements
Set Unions
Set Differences
Pair Intersections
Unordered Pairs
Empty Set
Geometry
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Sets
Identities
Names
Letters
Objects