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:

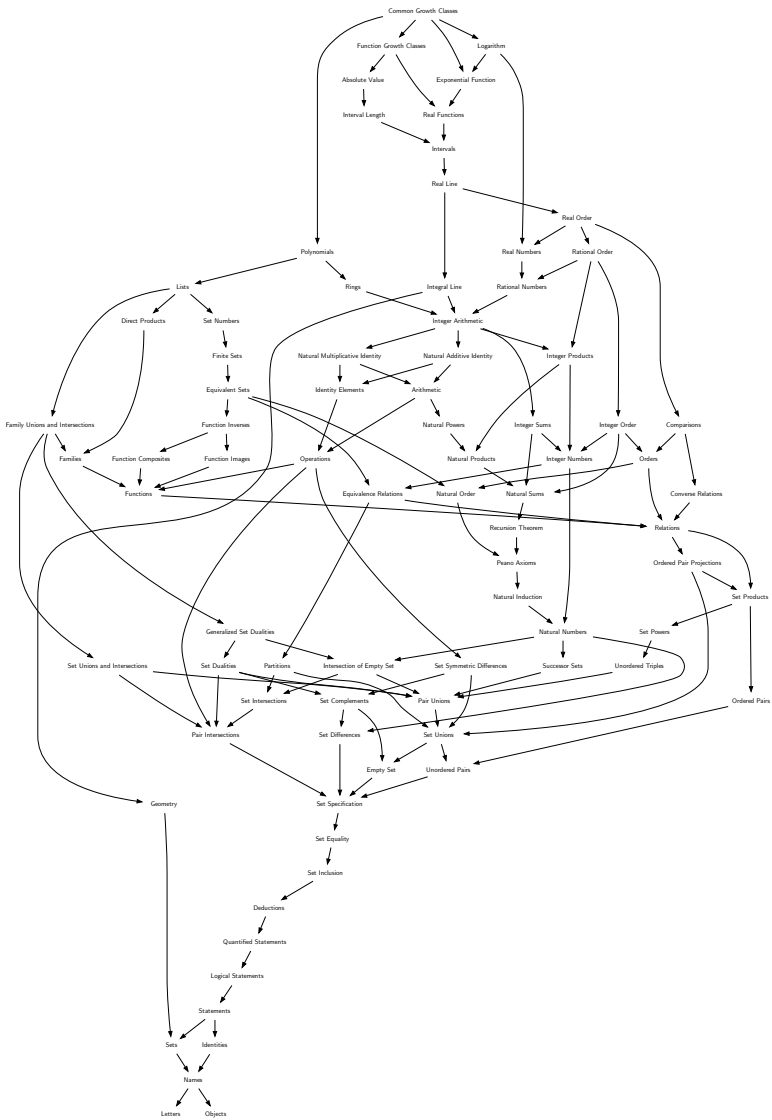
$$O(1) \subset O(\log(x)) \subset O((\log(x))^c) \subset \cdots \subset O(x^c) \subset O(c^x).$$

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 $f, g : \mathbf{R} \to \mathbf{R}$ and defined $h : \mathbf{R} \to \mathbf{R}$ 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
Logarithm
Absolute Value
Exponential Function
Interval Length
Real Functions
Intervals
Real Line
Real Order
Polynomials
Real Numbers
Rational Order
Lists
Rings
Integral Line
Rational Numbers
Direct Products
Set Numbers
Integer Arithmetic
Finite Sets
Natural Multiplicative Identity
Natural Additive Identity
Integer Products
Equivalent Sets
Identity Elements
Arithmetic
Family Unions and Intersections
Function Inverses
Natural Powers
Integer Sums
Integer Order
Comparisons
Families
Function Compositions
Function Images
Operations
Natural Products
Integer Numbers
Orders
Functions
Equivalence Relations
Natural Order
Natural Sums
Converse Relations
Recursion Theorem
Relations
Peano Axioms
Ordered Pair Projections
Natural Induction
Set Products
Generalized Set Dualities
Natural Numbers
Set Powers
Set Unions and Intersections
Set Dualities
Partitions
Intersection of Empty Set
Set Symmetric Differences
Successor Sets
Unordered Triples
Set Intersections
Set Complements
Pair Unions
Ordered Pairs
Pair Intersections
Set Differences
Set Unions
Empty Set
Unordered Pairs
Geometry
Set Specification
Set Equality
Set Inclusion
Deductions
Quantified Statements
Logical Statements
Statements
Sets
Identities
Names
Letters
Objects