Lambda Calculus

Alpha-Conversion

$\lambda x.M = \lambda y.[x := y]M \text{ if } (y \text{ nfin } \lambda x.M)$

Example

$(\lambda x.x) = (\lambda y.y)$

```
a = (\x -> x)
a = (\y -> y) -- α-Reduction
```

Beta-Reduction

$(\lambda x.M)N = [x := N]M$

Example

$(\lambda x.x)a = a$

$(\lambda x.xy)a = ay)$

```
a = (\x -> x) 5
a = 5 -- β-Reduction
```

Eta-Reduction

$(\lambda x.fx) = f$

```
add5 xs = map (\x -> x + 5) xs
add5' = map(\x -> x + 5) -- η-Reduction
```