

# Polynomial and Trigonometric Functions in Ruby

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# Overview

- Project Description
- Objects and created methods
- Creating the function
- Demo

# Project Description

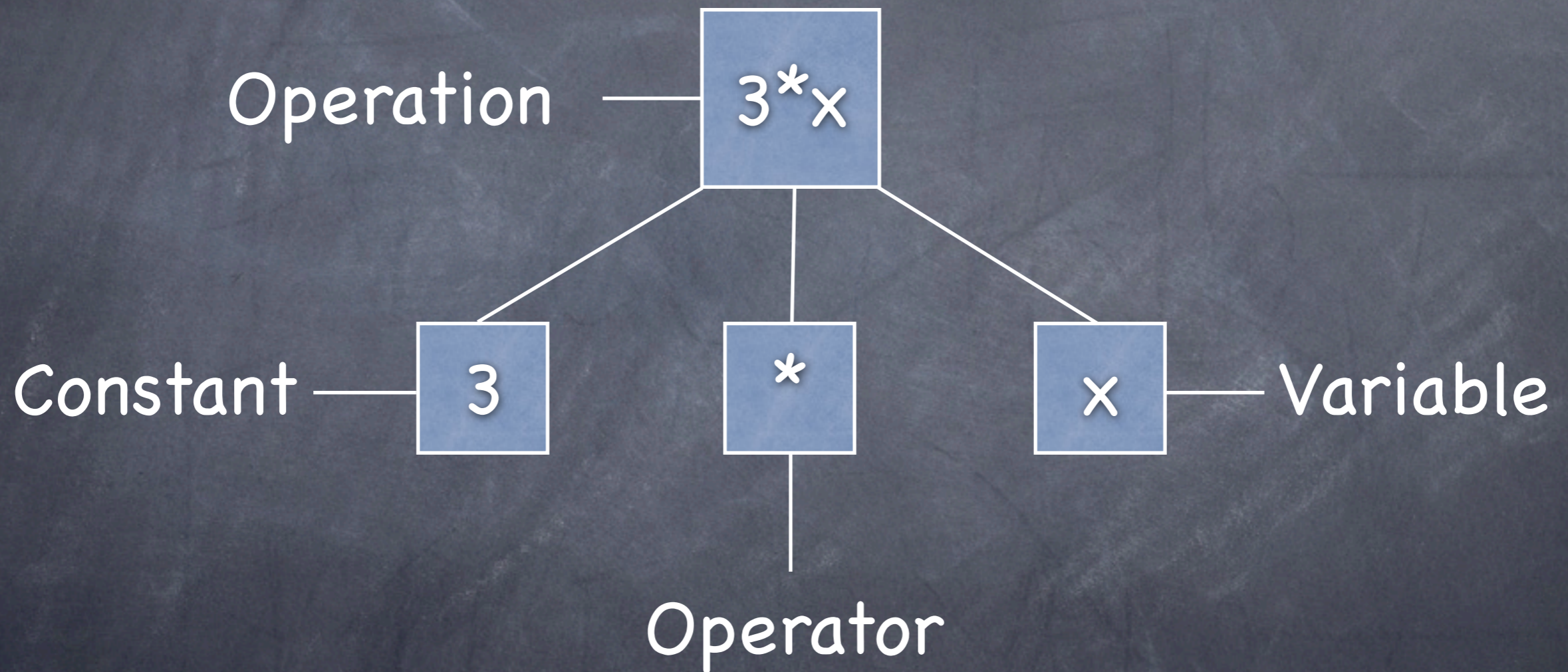
- Mathematical functions
  - $f(x) = x^2 + 2$
- Implemented in Ruby
  - Created and represented as objects
  - Easy to use
  - Extendible

# Creating the Object

- Objects in a function
  - Constants. 1, 2, 3, 5, etc.
  - Variables.  $x$
  - Operators.  $+$ ,  $-$ ,  $/$ ,  $*$ ,  $^$ ,  $\sin$ ,  $\cos$ ,  $\tan$
  - Operations.

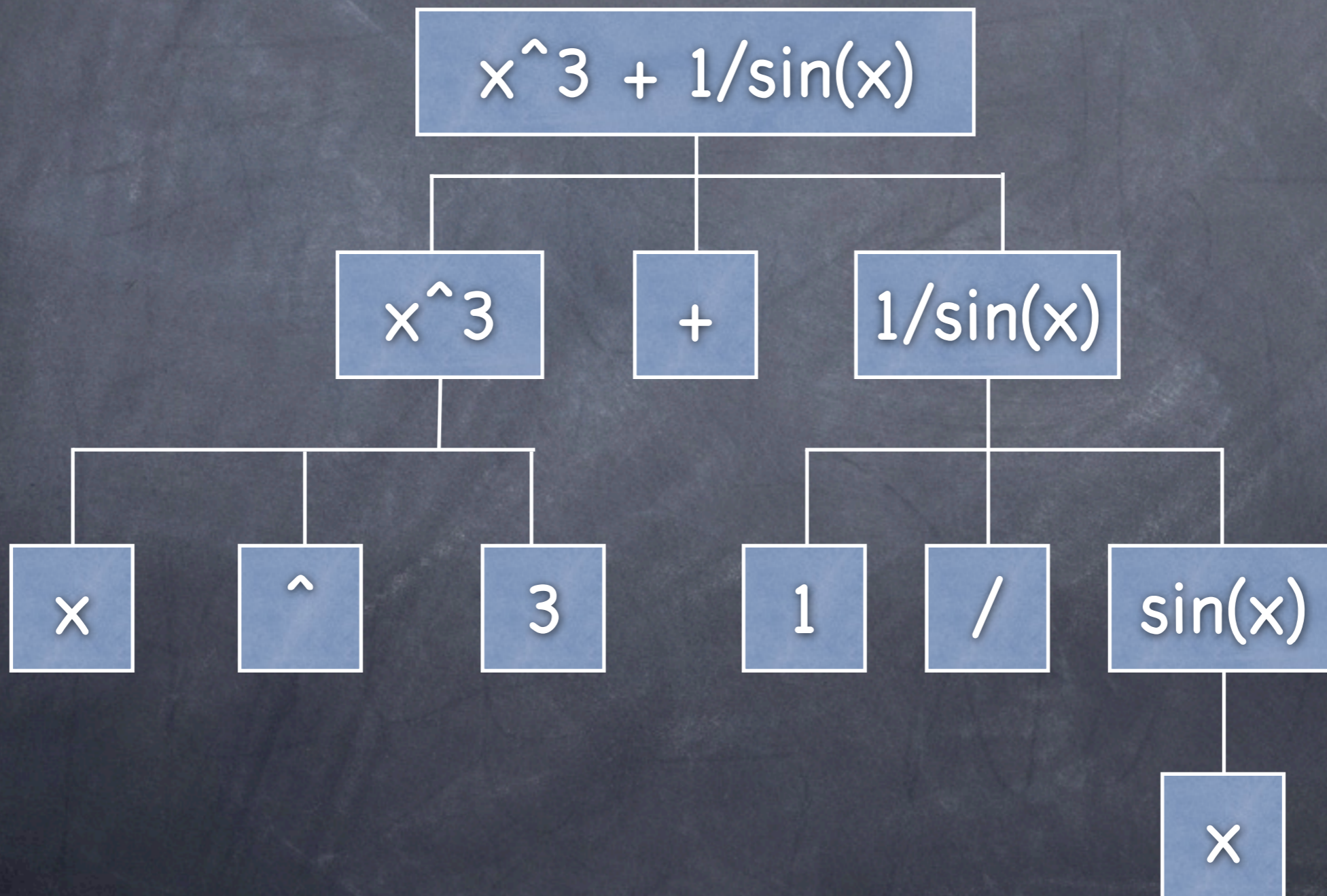
# $f(x)$ as an Object

$$f(x) = 3x$$



# $f(x)$ as an Object

$$f(x) = x^3 + \frac{1}{\sin(x)}$$



# $f(x)$ as an Object

- $f(x)$  represented as a tree
  - Easily create methods
    - Inherit and implement methods
    - Methods are called recursively

# Methods

- Implemented methods
  - Evaluation
  - Derive
  - Simplify

# Methods

- Evaluation
  - Applies operators
  - Returns constants
  - Inserts parameter into variable

# Derivatives

- Elementary cases:

- $f(x) = C$

- $f' = 0$

- $f(x) = x$

- $f' = 1$

- $f(x) = x^n$

- $f'(x) = nx^{n-1}$

# Derivatives

- Addition/Subtraction

- $(f + g)' = f' + g'$

- $(f - g)' = f' - g'$

- Product

- $(f * g)' = f'g + g'f$

# Derivatives

- Quotient

- $\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$

- Chain Rule

- $f(x) = h(g(x))$

- $f'(x) = h'(g(x))g'(x)$

# Constructing the Object

- Created from a single string
  - "x<sup>2</sup> + 3"
- Recursive Decent Parser
  - Tokens
  - Rules
    - Order of Operations

# Demo

- Ruby Library
  - Scripts
  - Programs
  - Ruby on Rails