# Chain Rule (Section 3.4)

# Intro

We use the chain rule to take the derivative of a composition of functions (one function is inside of another function). It lets us take the derivative of nearly any combination of functions.

# Overview

The Chain Rule

Examples of the Chain Rule

Hard examples of the Chain Rule

# Chain rule

To take the derivative of a composition of two functions, we use the chain rule.

If

$$f(x) = u(v(x)),$$

then

$$f'(x) = u'(v(x)) \cdot v'(x)$$

# Example

Find the derivative.

$$f(x) = \sqrt{x^2 + 1}$$

# Example

Find the derivative.

$$f(x) = (x^2 - e^x)^6$$

# Example

Find the derivative.

$$f(x) = e^{x^3 - \frac{1}{x}}$$

# Example

Find the derivative.

$$f(x) = \sin(4x^3 - e^x + 4)$$

# Example

Find the derivative.

$$f(x) = (x^2 + 2x - 1)^6$$

# Example

Combine derivative rules to find the derivative of $f(x)$.

$$f(x) = \cot\left(\frac{x}{x^2 - 1}\right)$$

# Example

Combine derivative rules to find the derivative of $f(x)$.

$$f(x) = e^{(x^2+1)(x^3-1)}$$

# Example

Combine derivative rules to find the derivative of $f(x)$.

$$f(x) = \tan((3x+1)^4)$$

# Pie chart

http://data.iwastesomuchtime.com/November-19-2011-23-56-17-endlessorigami.jpg

# Examples (Group work)

In groups, combine derivative rules to find the derivative of $f(x)$. If you get stuck on one, try the next.

$$f(x) = e^x(x^2 + 1(x^5 - x)^2$$

$$f(x) = \frac{\csc(4x^2)}{x^2}$$

$$f(x) = e^{(e^{2x})/(2x+1)}$$