Warm Up

Differentiate each function with respect to x.

1) $y = \dfrac{5x^3 - 1}{5x^4 + 5}$

$$\frac{dy}{dx} = \frac{(5x^4 + 5) \cdot 15x^2 - (5x^3 - 1) \cdot 20x^3}{(5x^4 + 5)^2}$$

$$= \frac{-5x^6 + 4x^3 + 15x^2}{5x^8 + 10x^4 + 5}$$

The Chain Rule
"Skin and Guts"

Objective: You will be able to:

- find the derivative of composite functions

Composite Function: f(g(x))

f(x) = the "skin"

g(x) = the "guts"

Identify f(x) and g(x) for the following functions:

$(x^2 + 1)^3$ f(x) = x^3

g(x) = x^2+1

$\frac{3}{(x - 4x^3)^2}$ f(x) = $\frac{3}{x^2}$

g(x) = $x-4x^3$

$\sqrt{x^2 - 3x}$ f(x) = $\sqrt{x}$

g(x) = x^2-3x

Chain Rule

$$\frac{d}{dx}[f(g(x)] = f'(g(x)) \cdot g'(x)$$

"derivative of the outer (skin) with the inner (guts) in tact, times the derivative of the inner (guts)"

Still need to remember and apply other rules as they come up.

Don't forget

- Power
- Product
- Quotient

Ex. 1

has chain and power

$$y = (x^2 + 1)^3$$

$$dy/dx\ 3(x^2+1)^2(2x)$$

$$dy/dx = 6x(x^2+1)^2$$

Ex. 2

has chain and power

$$f(x) = (2x - 4x^2)^4$$

$$dy/dx = 4(2x-4x^2)^3(2-8x)$$

$$dy/dx = (2x-4x^2)^3(8-32x)$$

Ex. 3

has chain and power

$$y = \sqrt{x^2 - 3x} \quad = (x^2 - 3x)^{1/2}$$

$dy/dx = \frac{1}{2}(x^2 - 3x)^{-1/2}(2x - 3)$

$dy/dx = (x^2 - 3x)^{-1/2}(x - 3/2)$

Worksheet 1