The Chain Rule

Name ______________________

Date ______________ Period ______

The Chain Rule is a process to find the derivative of a composite function.

Let $f(x) = x^3$ and $g(x) = x^2 - 2$

Express $f(g(x)) = (x^2 - 2)^3$ Express $g(f(x)) = (x^3)^2 - 2$

Decompose the following:

$(2x^3 - 1)^4 = f(g(x))$

$g(x) = 2x^3 - 1$ and $f(x) = x^4$

$(x - 1)^2 = f(g(x))$

$g(x) = x - 1$ and $f(x) = x^2$

If $y = f(u)$ is a differentiable function of u and $u = g(x)$ is a differentiable function of x, then $y = f(g(x))$ is a differentiable function of x and…

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} \qquad \text{or} \qquad \frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot g'(x)$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Find the derivative for the following functions

$y = (x^2 + 5)^3$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Find the derivative for the following functions

$y = (4x^3 - 3x)^5$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Find the derivative for the following functions

$$y = \frac{5}{(2x + 4)^3}$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Find the derivative for the following functions

$$y = \sqrt{2x^2 - 3}$$

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

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