

**Economics 2301**  
**Quiz 4**

**Name** \_\_\_\_\_  
**Fall, 2010**

**Definitions (10 pts)**

The derivative of  $\ln(g(x)/h(x))$

$$\frac{d \ln[g(x)/h(x)]}{dx} = \frac{g'(x)}{g(x)} - \frac{h'(x)}{h(x)}$$

Product rule for differentiation of  $y=g(x)h(x)$

$$\frac{dy}{dx} = g'(x)h(x) + h'(x)g(x)$$

Chain rule for  $y=g(h(x))$

$$\frac{dy}{dx} = g'(h(x))h'(x)$$

The derivative of  $f(x)=\log_b(x)$

$$\frac{d \log_b(x)}{dx} = \frac{1}{x} \cdot \frac{1}{\ln(b)} = \log_b(e) \cdot \frac{1}{x}$$

**Quotient Rule**

$$f(x) = \frac{g(x)}{h(x)}$$

$$f'(x) = \frac{g'(x)h(x) - g(x)h'(x)}{[h(x)]^2}$$

**Problems (10 pts)**

Calculate the differential for the function  $y = (3x^2 - 4x^3)^2$ . Calculate the predicted change in Y using your differential for  $x=3$  and  $dx=1$ .

$$dy = 2(3x^2 - 4x^3) \cdot (6x - 12x^2) dx$$

for  $x = 3$  and  $dx = 1$

$$dy = 2(3(3)^2 - 4(3)^3)(6 \cdot 3 - 12 \cdot (3)^2) \cdot 1 = 2(27 - 108)(18 - 108) = 2 \cdot (-81)(-90) = 14,580$$

Evaluate  $dy/dx$  for the function  $y = 2x^{0.3} / (3x^2 - 2e^{-2x})$ .

$$\begin{aligned} \frac{dy}{dx} &= \frac{0.6x^{-0.7}(3x^2 - 2e^{-2x}) - 2x^{0.3}(6x + 4e^{-2x})}{(3x^2 - 2e^{-2x})^2} = \frac{(1.8x^{1.3} - 12x^{1.3}) - 2e^{-2x}(0.6x^{-0.7} + 4x^{0.3})}{(3x^2 - 2e^{-2x})^2} \\ &= \frac{-[10.2x^{1.3} + 2e^{-2x}(0.6x^{-0.7} + 4x^{0.3})]}{(3x^2 - 2e^{-2x})^2} \end{aligned}$$