Exam 1 Prep(Stats102B)

Derivative Rules:

Basic Derivative Rules

- **Constant Rule**

$$\frac{d}{dx}[c] = 0$$

- **Power Rule**

$$\frac{d}{dx}[x^n] = nx^{n-1} \quad \text{for any real } n$$

- **Constant Multiple Rule**

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

- **Sum and Difference Rule**

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

- **Product Rule**

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

- **Quotient Rule**

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

Chain Rule

If $y = f(g(x))$, then:

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

Common Function Derivatives

- **Exponential Functions**

$$\frac{d}{dx}[e^x] = e^x$$

$$\frac{d}{dx}[e^{u(x)}] = e^{u(x)} \cdot u'(x)$$

- **Logarithmic Functions**

$$\frac{d}{dx}[\ln x] = \frac{1}{x}$$

$$\frac{d}{dx}[\ln(u(x))] = \frac{u'(x)}{u(x)}$$

Note: Trigonometric derivatives like sin *and* cos *are not required.*

Example: Chain Rule

Let $f(x) = \ln(3x^2 + 1)$

Then:

$$f'(x) = \frac{d}{dx}[\ln(3x^2 + 1)] = \frac{6x}{3x^2 + 1}$$

Practice Exam 1 - FRQs

Problem 1

Let $f(x) = x - log(x)$,
where log(.) donates the natural log base algorithm

1. Show that f(x) has a unique global min. Justify your answer