

Summary of Derivative Rules for Exponential and Logarithmic Differentiation

Exponential Functions

Natural Exponential Function

$$f(x) = e^x$$

$$f'(x) = e^x$$

$$f(x) = e^{g(x)}$$

$$f'(x) = e^{g(x)} \cdot g'(x)$$

All Other Exponential Functions

Note: $b > 0$

$$f(x) = b^x$$

$$f'(x) = b^x \cdot \ln b$$

$$f(x) = b^{g(x)}$$

$$f'(x) = b^{g(x)} \cdot g'(x) \cdot \ln b$$

Logarithmic Functions

Natural Logarithmic Functions

Note: $x > 0$, $g(x) > 0$

$$f(x) = \ln x$$

$$f'(x) = \frac{1}{x}$$

$$f(x) = \ln g(x)$$

$$f'(x) = \frac{1}{g(x)} \cdot g'(x)$$

Or

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

All Other Logarithmic Functions

Note: $x > 0$, $\ln b > 0$, $g(x) > 0$

$$f(x) = \log_b x$$

$$f'(x) = \frac{1}{x \cdot \ln b}$$

$$f(x) = \log_b g(x)$$

$$f'(x) = \frac{1}{g(x) \cdot \ln b} \cdot g'(x)$$

Or

$$f'(x) = \frac{g'(x)}{g(x) \cdot \ln b}$$