

Exponential and Logarithm Derivatives

Derivatives of Exp and Log

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

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

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

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

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

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

Logarithmic Differentiation

$$\frac{d}{dx} [f(x)] = f(x) \left(\frac{d}{dx} \ln(f(x)) \right)$$

$$\frac{d}{dx} [f(x)^{g(x)}] = g(x) f(x)^{g(x)-1} f'(x)$$

$$\frac{d}{dx} \ln(fg) = \frac{f'}{f} + \frac{g'}{g}$$

$$\frac{d}{dx} \ln(f^n) = n \frac{f'}{f}$$

$$+ f'(x) f(x)^{g(x)} \ln f(x)$$

1. Compute derivatives of the following exponential functions.

A. $f(x) = x^3 e^{2x}$

B. $f(x) = e^{(2x^3)}$

C. $f(x) = (e^{2x})^3$

D. $f(x) = \sin(e^x)$

E. $f(x) = x^3 3^x$

F. $f(x) = \frac{e^x - e^{-x}}{2x}$

2. Compute derivatives of the following logarithm functions.

A. $f(x) = (2x + 1) \ln x$

B. $f(x) = \ln(2x + 1)$

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

D. $f(x) = \ln(\tan(x))$

E. $f(x) = (\ln x)^2$

F. $f(x) = \ln(\ln x)^2$

3. Use logarithmic differentiation to write the derivative.

A. $\frac{d}{dx} \left[\frac{(2x+1)^2 x^3}{(x^2+1)^5} \right]$

B. $\frac{d}{dx} \left[\frac{(x^2+2)^4}{(x-1)^2 (x^2+4)^5} \right]$

C. $\frac{d}{dx} \left[\frac{\sqrt{x^3+x^2} (5x-3)^2}{(2x+4)^9} \right]$

D. $\frac{d}{dx} \left[(2x+3)^{4x+5} \right]$

E. $\frac{d}{dx} \left[(\sec x)^{\tan x} \right]$

F. $\frac{d}{dx} \left[(\ln x)^{x^4} \right]$