MAT122

Logarithmic Derivatives

Part I

Derivative of $y = \log_b x$

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

$$\frac{d}{dx}a^x = a^x \cdot \ln a$$

ex. $\left(\log_7 x\right)'$

ex. $\left(\log x\right)'$

Special Case:

Do: $\left(\log_5 x\right)'$

Do: $\left(5^x\right)'$

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

Derivative of $y = \ln x$ with Chain Rule

ex. $\left(\sqrt{\ln x}\right)'$

ex. $\dfrac{d}{dx}\left[\ln(x^2 - 5)\right]$

$= \boxed{\dfrac{2x}{x^2 - 5}}$

$= \boxed{\dfrac{1}{2x\sqrt{\ln x}}}$

Log and Exponential Derivatives - Do

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

$$\frac{d}{dx}a^x = a^x \ln a$$

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

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

Do: differentiate $y = 10^x$

Do: differentiate $y = \ln(5x^2 + 1)$

Do: find $\left(e^{5x^2+1}\right)'$

Double Chain Rule

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

ex: Find $f'(x)$ when $f(x) = \ln(5x^2 + 1)^4$.

$$= \boxed{\frac{40x}{5x^2 + 1}}$$