DERIVATING OF LOG FUNCTIONS

Note Title 4/8/2019

* NOTE: ALL LOG RULES FROM PRE-CALC 12 APPLY *

$$a^{\log_a x} = x$$

$$\log e^x = \ln x \implies e^{\ln x} = x$$

GIVEN $f(x) = \ln x$ FIND $f'(x)$

$$e^{f(x)} = e^{\ln x}$$

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

$\log_3 x = 4$

$3^4 = x$

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

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

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

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

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

$$* \quad \frac{d}{dx} \ln f(x) = f'(x) \cdot \frac{1}{f(x)} \quad *$$

IE FIND $f'(x)$ IF $f(x) = \ln(3x^2 + 6x)$

SOLN $f'(x) = (6x+6) \cdot \frac{1}{3x^2+6x} \Rightarrow \frac{6x+6}{3x^2+6x}$

IE $f(x) = \ln\left[\frac{(e^x + 6x)}{4x}\right]$

SOLN $f(x) = \ln(e^x + 6x) - \ln(4x)$

$f'(x) = (e^x + 6) \cdot \frac{1}{e^x+6x} - 4 \cdot \frac{1}{4x}$

$$= \frac{e^x + 6}{e^x + 6x} - \frac{4}{4x}$$

$$= \frac{e^x + 6}{e^x + 6x} - \frac{1}{x}$$

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

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

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