AP Calculus AB
Derivatives of Logarithmic Functions Notes

Name Key

Derivatives of Logarithmic Functions

Find the derivative of $y = \log_a x$

$a^y = x$

$a^y \cdot \ln a \cdot y' = 1$

$y' = \frac{1}{a^y \ln a}$

$y' = \frac{1}{x \cdot \ln a}$

$$\frac{d}{dx}(\log_a u) = \frac{u'}{u \ln a}$$

By putting *e* in for a, the formula changes to

$\ln(e) = 1$

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

Examples:
Find the derivative

1. $y = \ln(x^3 + 2x)$

$y' = \frac{3x^2+2}{x^3+2x}$

2. $y = \ln(\cot x)$

$y' = \frac{-\csc^2 x}{\cot x}$

3. $y = \log_4(3 - \cos x)$

$y' = \frac{\sin x}{(3-\cos x)\ln 4}$

4. $y = \ln\frac{(x^2+3)^4}{(x-1)}$

$y = \ln(x^2+3)^4 - \ln(x-1)$

$y = 4\ln(x^2+3) - \ln(x-1)$

$y' = \frac{4(2x)}{x^2+3} - \frac{1}{(x-1)}$

$y' = \frac{8x}{x^2+3} - \frac{1}{x-1}$