

Properties of Logarithms

log has base ___ ln has base ___ $e^{\ln x} = \underline{\hspace{1cm}}$ $\ln e^x = \underline{\hspace{1cm}}$

	The Rule	Condensed	Expanded
Power Rule	$\log_b a^n =$	$\ln(3xy)^2$	
Product Rule	$\log_b(m \cdot n) =$		$2\ln 3 + \frac{1}{2}\ln x + \frac{3}{2}\ln y$
Quotient Rule	$\log_b \frac{m}{n} =$		$2\ln 3 - 2\ln x + 4\ln x$
Change of Base Rule	$\log_b a =$	$\log_5 25$	

Find the Derivative of the function.

- $f(x) = \ln\left(\frac{x}{x+1}\right)$
- $y = \ln\sqrt{\frac{x-1}{x+1}}$
- $y = \ln(\ln x)$
- $\ln(xy) + 5x = 30$
- $f(x) = e^{4x^2-6}$
- $f(x) = e^{-3/x}$
- Find the relative extrema and Points of Inflection for $y = x \ln x$
- Find the equation of a tangent line to $f(x) = e^{3x} \cdot \ln(x)$ at (1,0).

Steps for Using LOG Differentiation

- Take the natural log of both sides.
- Use the properties of logarithms to write the expanded form of both sides.
- Take the derivative of both sides
- Solve for $\frac{dy}{dx}$
- Substitute y.

Find the derivative using LOG differentiation (Tested on the AP Exam).

$$9. \quad y = \frac{(x+1)(x+2)}{(x-1)(x-2)}$$

Evaluate each Integral.

- $\int \frac{1}{3x+2} dx$
- $\int \frac{x(x+2)}{x^3+3x^2-4} dx$
- $\int \frac{x^3-6x-20}{x+5} dx$
- $\int \frac{1}{x \cdot \ln(x^3)} dx$
- $\int_0^1 \frac{x-1}{x+1} dx$
- $\int e^{3x+1} dx$
- $\int \frac{e^{1/x}}{x^2} dx$
- $\int 5xe^{-x^2} dx$
- $\int_0^1 \frac{e^x}{1+e^x} dx$
- $\int \frac{2e^x-2e^{-x}}{(e^x+e^{-x})^2} dx$

$$11. \text{ Find } F'(x) \text{ if } F(x) = \int_1^{x^2} \frac{1}{t} dt$$

$$12. \text{ Find the area bounded by the functions } y = \frac{x+4}{x}, x = 1, x = 4, y = 0.$$

$$13. \text{ Find the average value of } f(x) = \sec\left(\frac{\pi x}{6}\right) dx \text{ on the interval } [0,2].$$

14. Find a particular solution that satisfies each of the following conditions:

$$f''(x) = \sin x + e^{2x}$$

$$f'(0) = \frac{1}{2}$$

$$f(0) = \frac{1}{4}$$

$$f(0) = \frac{1}{4}$$