

Logarithmic differentiation (LD)

Basic properties of the natural logarithm:

- $\ln(yz) = \ln(y) + \ln(z)$
- $\ln\left(\frac{y}{z}\right) = \ln(y) - \ln(z)$
- $\ln(y^z) = z \ln(y)$
- For any function g : $\ln(e^{g(x)}) = g(x)$
- $\frac{d}{dx}(\ln(f(x))) = \frac{f'(x)}{f(x)}$.

Recitation Questions

Problem 1 (a) Write as an exponential with base 5. 7^{3x} .

(b) Write in terms of the natural logarithm. $\log_3(4)$.

(c) Expand the following: $\log_{1/2} \left(\frac{6x^5(2 + \tan(x))^x}{\sqrt[5]{e^{4x} + 1}} \right)$.

Problem 2 Find all real numbers x which satisfy each of the following equations.

(a) $\log_x(25) = 2$.

(b) $7^x = 15$

(c) $\ln(x) + 1 = 0$.

Problem 3 *True or False:*

(1) If $f(x) = (x - 2)^x$, then $f'(x) = x(x - 2)^{x-1}$.

(2) If $f(x) = (3x)^x$, then $f'(x) = (3x)^x \ln(3x)$.

Problem 4 Find the derivatives of the following functions:

(a) $f(x) = x^{e^x} + 7x$

(b) $g(x) = (\ln(x) + 9)^{\sec(x^4)}$

(c) $f(x) = \frac{(x+1)^5(\sin(x)+5)^4}{(x^2+5)\sqrt{x-3}}$

(d) $h(x) = \frac{(x^2-7)^5}{\cos^7(x^2-5)}$