

READ pg 322 - 328
Section 5.1 Handout
The Natural Logarithmic Function, Differentiation

Name _____

Recall..... Logarithmic Properties

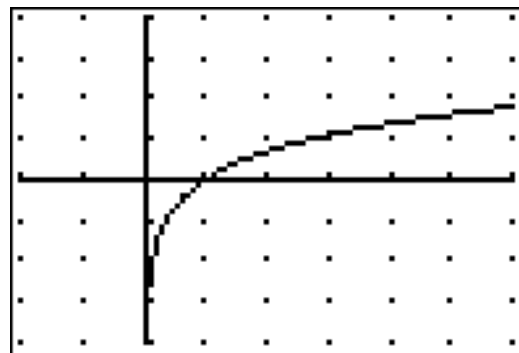
1. $\ln(1) = 0$ 2. $\ln(ab) = \ln a + \ln b$ 3. $\ln(a^n) = n \ln a$ 4. $\ln\left(\frac{a}{b}\right) = \ln a - \ln b$

Definition of the Natural Log:

$$\ln x = \int_1^x \frac{1}{t} dt, \quad x > 0$$

Definition of e :

$$\ln e = \int_1^e \frac{1}{t} dt = 1$$



Properties of the Natural Logarithmic function:

- The domain is $(0, \infty)$ and the range is $(-\infty, \infty)$
- The function is continuous, increasing, and one-to-one
- The graph is concave down

Derivative of the Natural Log

• $\frac{d}{dx}[\ln u] = \frac{u'}{u}, \quad u > 0$ also $\frac{d}{dx}[\ln |u|] = \frac{u'}{u}$

Ex1. $\frac{d}{dx}[\ln(3x)] =$

Ex2. $\frac{d}{dx}[\ln(x^3 + 2x)] =$

Ex3. $\frac{d}{dx}[3x \ln(x)] =$

Ex4. $\frac{d}{dx}[(\ln x)^3] =$

Find $f'(x)$

Ex5. $f(x) = \ln \sqrt{x+1}$

Ex6. $f(x) = \ln \frac{x(x^2+1)^2}{\sqrt{2x^3-1}}$

PART II: Logarithmic differentiation:

Ex7: $y = \frac{(x-2)^2}{\sqrt{x^2+1}}, \quad x \neq 2$