

The Natural Logarithm

Objectives: Use natural logarithms – simplify, change forms, solve equations.

Warm up: Graph the equation $y = e^x$ and $y = \ln x$

$\log_e x = \ln x$. This is called the natural logarithm.

1. Simplify the following:

a) $\ln e^x$

b) $e^{\ln x}$

c) $\ln e$

d) $\ln 1$

2. Solve for x in the following:

a) $\ln x = 5$

b) $e^x = 20.086$

c) $e^{3-2x} = 4$

3. Sketch the graphs of the following functions.

a) $y = -\ln x$

b) $y = \ln(-x)$

4. Express $\frac{2}{3} \ln x - 4 \ln y + \ln(x+1)$ as a single logarithm.

5. Find the domain of the function $f(x) = \ln(16 - x^2)$

6. Find $\lim_{x \rightarrow 4^-} \ln(16 - x^2)$

Homework: Page 375 #3,4,5,6,9(a,b),10.

The Derivative of Logarithmic Functions

Objectives: Find Derivatives of Logarithmic functions.

Use the exponential form and implicit differentiation to find the derivative of $y = \ln x$
“ $y = \ln x$ is the same as $y = \log_e x$ is the same as $e^y = x$ ”

SUMMARY: $y = \ln(u) \dots \frac{dy}{dx} =$

Examples:

1. Differentiate

a) $y = x^2 \ln x$

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

c) $y = (\ln x)^3$

d) $y = x \ln x$

e) $y = \ln \frac{x}{\sqrt{x+1}}$

f) $y = \ln|x|$

2. Find the derivative of $y = \log_3 x$

3. Develop a formula for finding $\frac{d}{dx} \log_b x$ using what you discovered above.

4. Find $f'(x)$ if $f(x) = \log(x^2 + x)$

Homework: Page 383 #1(a,b,c,d,e,g,h,j,k,l) 3, 5(a,b,d)