

Agenda/Objectives/Notes PAPPC Sections 3.2 & 3.3

Starter Problem

Solve the exponential equations.

$$1. \left(\frac{1}{5}\right)^{x+1} = 125$$

$$2. e^{x^2+6} = e^{5x}$$

Today's Agenda

1. Starter problems
2. Review assignment due
3. Review/correct chapter 2 test
4. Today's objectives
5. Today's assignment: Section 3.2 236/5, 8, 12, 16, 18, 21, 27, 30, 31, 35, 36, 47, 52, 55, 60, 67, 70, 78, 79, 85, 88, 90, 98 & Section 3.3 243/3-79 EOO

Today's Objectives: You will be able to

1. Recognize and evaluate natural and logarithmic functions with base a .
2. Graph logarithmic functions
3. Use change-of-base formula.
4. Use properties of logs
5. Use logarithmic functions to model and solve real-life problems

Notes Section 3.2

Definition of a Logarithmic Function with Base a

For $x > 0$, and $a > 0$, and $a \neq 1$,

$$y = \log_a x \text{ if and only if } x = a^y.$$

The function given by $f(x) = \log_a x$ (read "log with base a of x ") is called the **logarithmic function with base a** .

To evaluate logarithms use the above definition

Ex: Evaluate $f(x) = \log_2$ for $x = 16$

Rewrite in exponential form: $2^x = 16$ then solve $2^x = 2^4 \rightarrow x = 4$.

Properties of Logarithms

1. $\log_a 1 = 0$ because $a^0 = 1$
2. $\log_a a = 1$ because $a^1 = a$
3. $\log_a a^x = x$ because $a^x = a^x$ and $a^{\log_a x} = x$
4. If $\log_a x = \log_a y$ then $x = y$

Properties of Natural Logarithms

1. $\ln 1 = 0$ because $e^0 = 1$
2. $\ln e = 1$ because $e^1 = e$
3. $\ln e^x = x$ because $e^x = e^x$ and $e^{\ln x} = x$
4. if $\ln x = \ln y$ then $x = y$

Notes Section 3.3

Change of Base Formula

Let a , b , and, x be positive real numbers such that $a \neq 1$ and $b \neq 1$. Then $\log_a x$ can be converted to a different base as follows.

<i>Base b</i>	<i>Base a</i>	<i>Base e</i>
$\log_a x = \frac{\log_b x}{\log_b a}$	$\log_a x = \frac{\log x}{\log a}$	$\log_a x = \frac{\ln x}{\ln a}$

Properties of Logarithms

Let a be a positive number such that $a \neq 1$, and let n be a real number. If u and v are positive real numbers, the following properties are true.

<i>Logarithm with base a</i>	<i>Natural Logarithm</i>
1. Product Property : $\log_a (uv) = \log_a u + \log_a v$	$\ln(uv) = \ln u + \ln v$
2. Quotient Property : $\log_a \frac{u}{v} = \log_a u - \log_a v$	$\ln \frac{u}{v} = \ln u - \ln v$
3. Power Property : $\log_a u^n = n \log_a u$	$\ln u^n = n \ln u$