

Section 4.2 Logarithmic Functions and Their Graphs

Objective: In this lesson you learned how to recognize, evaluate, and graph logarithmic functions.

Course Number

Instructor

Date

Important Vocabulary

Define each term or concept.

Common logarithmic function

Natural logarithmic function

I. Logarithmic Functions (Pages 311–312)

The **logarithmic function with base a** is defined as

_____ , for $x > 0$ and $0 < a \neq 1$, if and only if $x = a^y$.

The logarithmic function with base a is the _____ of the exponential function $f(x) = a^x$.

The equation $x = a^y$ in exponential form is equivalent to the equation _____ in logarithmic form.

When evaluating logarithms, remember that a logarithm is a(n) _____. This means that $\log_a x$ is the _____ to which a must be raised to obtain _____.

Example 1: Use the definition of logarithmic function to evaluate $\log_5 125$.

Example 2: Use a calculator to evaluate $\log_{10} 300$.

Complete the following properties of logarithms:

- 1) $\log_a 1 =$ _____
- 2) $\log_a a =$ _____
- 3) $\log_a a^x =$ _____ and $a^{\log_a x} =$ _____
- 4) If $\log_a x = \log_a y$, then _____.

What you should learn

How to recognize and evaluate logarithmic functions with base a

Example 3: Solve the equation $\log_7 x = 1$ for x .

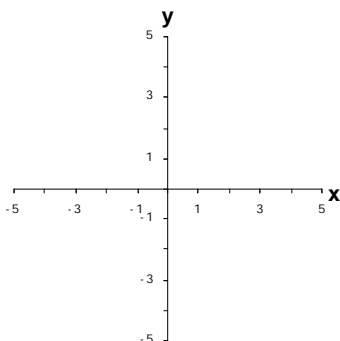
II. Graphs of Logarithmic Functions (Pages 313–314)

For $a > 1$, is the graph of $y = \log_a x$ increasing or decreasing over its domain? _____

For the graph of $y = \log_a x$, $a > 1$, the domain is _____, the range is _____, and the intercept is _____.

Also, the graph has _____ as a vertical asymptote. The graph of $y = \log_a x$ is a reflection of the graph of $y = a^x$ about _____.

Example 4: Sketch the graph of the function $f(x) = \log_3 x$.



III. The Natural Logarithmic Function (Pages 315–316)

Complete the following properties of natural logarithms:

- 1) $\ln 1 =$ _____
- 2) $\ln e =$ _____
- 3) $\ln e^x =$ _____ and $e^{\ln x} =$ _____
- 4) If $\ln x = \ln y$, then _____.

Example 5: Use a calculator to evaluate $\ln 10$.

What you should learn
How to graph logarithmic functions

What you should learn
How to recognize, evaluate, and graph natural logarithmic functions

Example 6: Find the domain of the function $f(x) = \ln(x + 3)$.

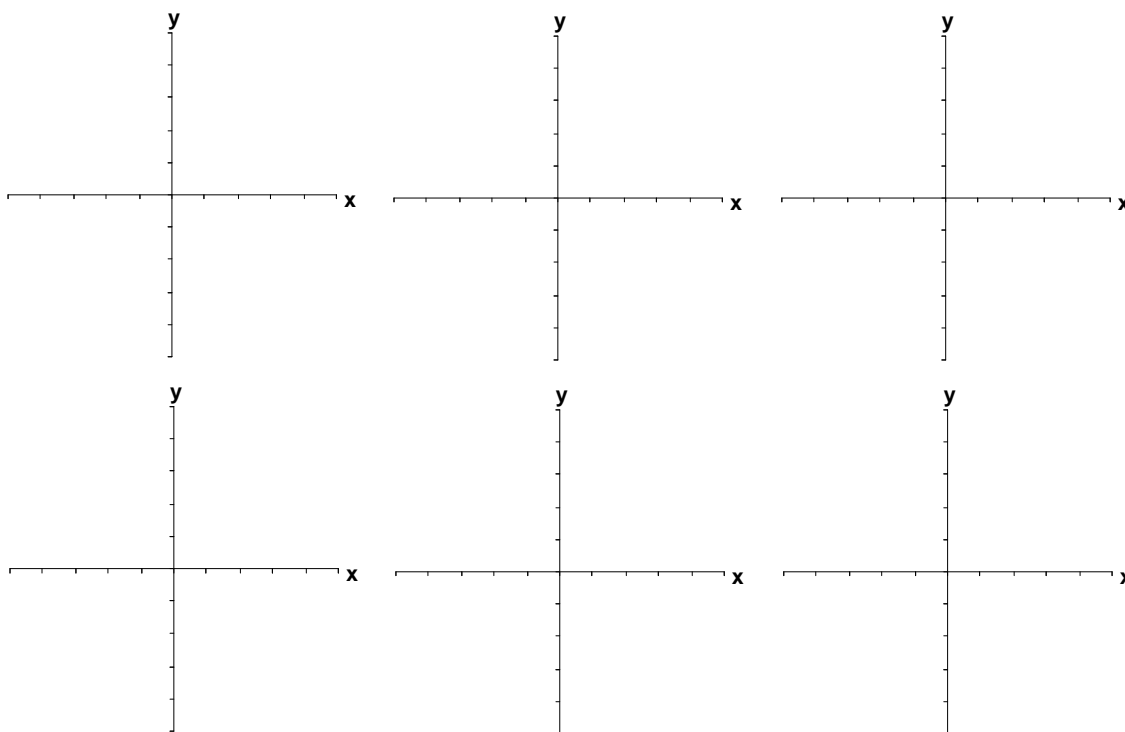
IV. Applications of Logarithmic Functions (Page 317)

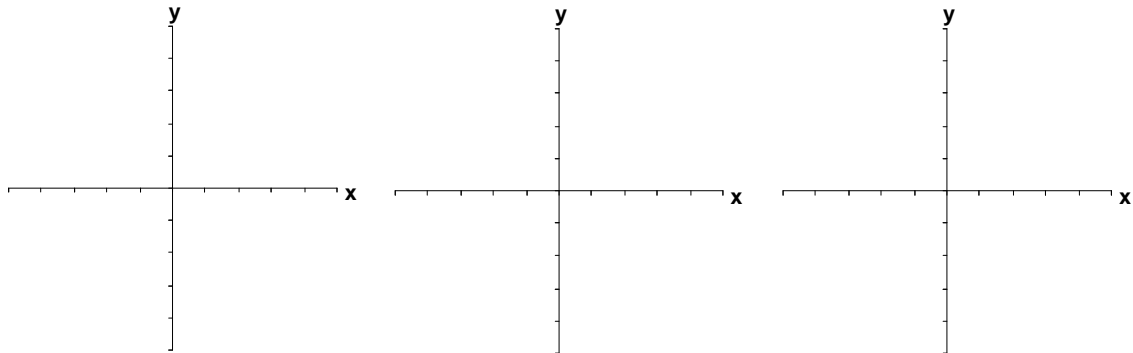
Describe a real-life situation in which logarithms are used.

What you should learn

How to use logarithmic functions to model and solve real-life problems

Example 7: A principal P , invested at 6% interest and compounded continuously, increases to an amount K times the original principal after t years, where t is given by $t = \frac{\ln K}{0.06}$. How long will it take the original investment to double in value? To triple in value?



Additional notes**Homework Assignment**

Page(s)

Exercises