

Lesson Plan: Logarithmic Functions and Their Graphs

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Lesson: LOGARITHMIC FUNCTIONS AND THEIR GRAPHS

Course: PRE-CALCULUS (College Level)

Timeframe: 75 minutes

Target Audience: college or university students in Pre-Calculus course

Materials needed: laptop, projector, Exploring Logarithmic Functions worksheet (attached), GeoGebra file Exploring logarithmic functions (download [here](#).)

Objectives: Students will be able to

Basic:

1. Graph logarithmic functions
2. Convert between exponential and logarithmic forms
3. Evaluate logarithms

Advanced:

1. Know how to use common logarithms (**** how will you measure this? Would it be better to say:

Convert logarithmic expressions between bases, solve log equations,....?)

2. Know how to use natural logarithms (***) ***same here***

Background:

This lesson plan is for two sections in a PreCalculus course at CSU Los Angeles. The textbook is PreCalculus OpenStax College. (Textbook link: <https://openstax.org/details/precalculus>) This lesson is tentatively scheduled in Week 5. Prior to this lesson, students learn about functions and function notation, finding the domain and range of a function from a formula or a graph, graphing polynomial functions and rational functions, and exponential functions and how to graph them.

Introduction to Lesson:

Students will use the knowledge from previous lessons (described above) to do the *Exploring Logarithmic Functions* worksheet at home. To ensure students do the prep work before class, they are asked to enter their answers on Moodle before this lesson starts.

In class students will be guided to compare and to discuss their work with their partner and in a group to master how to graph a logarithmic function, to convert between exponential and logarithmic forms, and to evaluate logarithms. If time permits, we will learn how to use common and natural logarithms.

Procedure [Time needed, include additional steps if needed]:

Pre-Class Individual Space Activities and Resources:

Please see the file “*Exploring Logarithmic Functions*”

In-Class Group Space Activities and Resources:

Steps	Purpose	Estimated Time	Learning Objective
<p>Step 1: Introducing the lesson Hook: Ask students to use their calculator to evaluate $\log_3 5$ and compare their answer with their neighbor.</p>	<p>To show students that they cannot use a calculator to find the answer for this problem. Then introducing that they can use the information from the worksheet to estimate the answer.</p>	5 minutes	<p>Explain to students that they will be learning a function to help them to estimate the answer for the question.</p>
<p>Step 2: Graphing a basic logarithmic function Ask students to take out their <i>Exploring Logarithmic Functions</i> worksheet. Divide students in groups of 4. Have them take turns to write their answers and graph of Part 1 on the board. I will rotate between groups to make sure that they have the correct answer for Step 3 and 4.</p>	<p>To make sure that students have an opportunity to share/discuss their work</p>	15 minutes	<p>Students can find out that the exponential and logarithmic functions are the inverse of each other.</p> <p>Students recognize the shape of logarithmic function, the vertical asymptote, and learn that the graph of $g(x) = \log_b x$ passes through the three special points (1, 0), (b, 1) and (1/b, -1) Students are able to identify the domain of a logarithmic function.</p>
<p>Step 3: Graphing logarithmic functions Ask students to use the transformation to graph the following equations on the same coordinates.</p> <p>$y = \log_3 x$, $y = \log_3 (x - 2)$ and $y = \log_3 (x - 2) + 1$</p> <p>Ask students if they can estimate the value of $\log_3 5$ using the graph of $y = \log_3 x$.</p>	<p>Show students how to build the new graph from the previous knowledge</p>	15 minutes	<p>Students can graph a logarithmic function using transformation.</p>

<p>Step 4: Convert between exponential and logarithmic equations In a group, have students share their work on Part 2 of the worksheet on how to convert between exponential and logarithmic equations.</p> <p>Then have students try on their own the following problems and share their work with a partner.</p> <p>Rewrite the equation in logarithmic form</p> <p>a. $81 = 3^4$ b. $125 = 5^x$</p> <p>Rewrite the equation in exponential form</p> <p>a. $\log_2 64 = 6$ b. $\log_x 64 = 4$</p>	<p>Help students to see the relationship between exponential and logarithmic equation.</p>	<p>15 minutes</p>	<p>Students can convert between exponential and logarithmic equations.</p>
<p>Step 5: Evaluate logarithms In a group, have students share their work on Part 3 of the worksheet on how to evaluate logarithms.</p> <p>Then have students try on their own the following problems and share their work with a partner.</p> <p>Evaluate</p> <p>a. $\log_{10} 10,000 = \log_{10} 10,000 = ?$</p> <p>b. $\log_2 128 = ?$ c. $\log_{16} 2 = ?$ d. $\log_3 \left(\frac{1}{27}\right) = ?$</p>	<p>Help students to use the relationship between exponential and logarithmic equation to evaluate logarithms.</p>	<p>15 minutes</p>	<p>Students can evaluate logarithms.</p>

Closure/Evaluation: (10 minutes)

Have students try the following problems as a Wrap-up.

- Graph $f(x) = \log_2 (x - 3) - 1$
- Rewrite the equation in logarithmic form $5 = x^4$
- Evaluate: $\log_4 \left(\frac{1}{2}\right)$

Analysis:

I will rotate between groups to check if students are on the right track and to provide hints/helps when needed. If I see too many students in a group get stuck, I will give a step-by-step direction to work on the problems.

*(*** might be better to ask them questions on how they could approach, rather than giving them step-by-step instruction)*

Post-Class Individual Space Activities:

I will assign students to do the following homework problems for the textbook.

4.3: 7 – 53 odd

4.4: 7 – 41 odd,

*******Maybe you could also have them do some comparison between problems, identifying types of problems to deepen their learning.***

Connections to Future Lesson Plan(s):

In this lesson, students learn how to evaluate logarithms but they couldn't evaluate the logarithm from the introduction part yet. I will post this question again at the end of the lesson and let them know that will build some more tools in the next lesson to solve it.