Unit 8 Logarithmic Functions (Advanced)

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **1-2 weeks**
Status: **Published**

Brief Summary of Unit

This unit should only be covered if time allows as an extension of the exponential unit. These topics will include finding the relationship between exponential functions and logarithmic functions, Using logarithmic properties, solving logarithmic equations, and graphing logarithmic functions with transformations. Students will also see how logarithms are used in real-life situations.

Revision Date: July 2024

Standards

9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
L.KL.9–10.2.A	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
F.BF.B.3	Identify the effect on the graph of replacing □(□) by □(□) + □, □ □(□), □(□□), and □(□ + □) for specific values of □(both positive and negative); find the value of □ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
F.BF.B.4.a	Solve an equation of the form □(□) = □ for a simple function □ that has an inverse and write an expression for the inverse.
A.CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
F.IF.C.7.e	Graph exponential and logarithmic functions, showing intercepts and end behavior.
F.IF.C.8.b	Use the properties of exponents to interpret expressions for exponential functions.
A.SSE.A.2	Use the structure of an expression to identify ways to rewrite it.
F.LE.A.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to □□^{ct} = □ where □, □, and □ are numbers and the base □ is 2, 10, or □; evaluate the logarithm using technology.
SL.PE.11–12.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

Essential Questions

- How are exponential functions related to logarithmic functions?
- How can you condense/expand a logarithm?
- How do you apply transformations to the graph of a logarithmic function?
- How do you solve an equation with a logarithm on both sides?
- What is a natural logarithm? What is a common logarithm?
- What is an extraneous solution as it pertains to a logarithmic function?
- What real-life problems can be solve by using logarithms?
- Why is the change-of-base formula needed?

Enduring Understandings

- Describe and graph transformations of logarithmic functions.
- Solve logarithmic equations using a variety of methods.
- Understand the special inverse relationship between exponential and logarithmic functions.
- Use properties of logarithms to expand, condense, simplify, and solve.
- Write logarithmic functions to model sets of data using real world applications.

Students Will Know

- How to model logarithmic functions.
- How to simplify logarithmic expressions.
- How to solve logarithmic equations.

Students Will Be Skilled At

- Describing transformations of logarithmic functions.
- Evaluating logarithmic expressions.
- Evaluating logarithms.
- Expanding or condensing logarithmic expressions.
- Explaining how to use change-of-base formula.
- Explaining the meaning of a logarithm with base b.
- Graphing logarithmic functions.
- Graphing transformations of logarithmic functions.
- Solving logarithmic equations.
- Using technology to find logarithmic models for sets of data.
- Writing functions that represent logarithmic functions.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

Again, this unit is only being covered if all teachers agree on which topics should be taught before the final exam. The following list is meant to create a day-to-day plan. Teachers are encouraged to slow down or condense days as appropriate to the student population in the class. Assessment(s) should be given when appropriate.

- Logarithms should be introduced as a related function to the exponential function. Emphasize the relationship of the logarithmic form and exponential form, and practice the skill of switching forms. Evaluate logarithmic expressions by finding the exponential form. Introduce natural logarithms and apply the same evaluation skills.
- Students will likely need additional time to practice evaluating common logarithms and natural logarithms.
- Use technology to determine the common logarithm parent function. Students should notice its vertical asymptote and critical point (1,0). (Advanced students should compare this parent graph to the exponential function and make some deductions.) Apply all transformation rules to the logarithmic parent function. Practice writing a transformed logarithmic function based on a description and based on a graph.
- Introduce the following properties for logarithms: product property, quotient property, and power property. Apply these properties to natural logarithms as well. Practice using these properties when condensing and expanding logarithms.
- When solving logarithms that are not common or natural, use the change-of-base formula. Use technology to evaluate logarithms after applying this formula. Emphasize that this formula can be changed to common logarithms or natural logarithms. Then, begin applying these solving skills to

model real-life situations.

- Introduce the Property of Equality applies to logarithmic functions. Apply this to both common logarithms and natural logarithms. Remind students that the quantity of the logarithm cannot be negative, so they need to check for extraneous solutions.
- Students will likely need additional time to practice solving logarithms. Use this extra time to reinforce their factoring skills within these problems.
- Create real-life problems where students will need to apply the logarithmic properties and solve for unknown values.

Materials

Core instructional materials:Core Book List including Big Ideas Math Algebra 2 2022

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook
- Graphing utility (online or calculator).
- Khan Academy
- Teacher created activiites
- Teacher created notes

Suggested Strategies for Modifications

Possible accommodations/modification for Algebra 2