# Unit 08 (Chpt 6) Exponential and Logarithmic Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **3 weeks**
Status: **Published**

## Brief Summary of Unit

Most of the functions studied so far have involved a variable being raised to a power. The variable is the base and the exponent is constant. For exponential functions, the roles are reversed; the base is constant and the exponent varies. Inverses of exponential functions are logarithmic functions. Exponential growth and decay is often seen in real world examples.

**Revised Date:** June 2024

## Standards

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| 1 | Developing Responsibility for Learning: Cultivating independence, self-reflection, and responsibility for one's own learning. |
| 2 | Adapting Communication: Adapting communication in response to the varying demands of audience, task, purpose, and discipline. |
| 3 | Valuing Evidence in Argumentation: Constructing viable claims and evaluating, defending, challenging, and qualifying the arguments of others. |
| 4 | Building Knowledge: Building strong content knowledge and connecting ideas across disciplines using a variety of text resources and media. |
| 5 | Leveraging Technology: Employing technology and digital media thoughtfully, strategically and capably to enhance reading, writing, speaking, listening, and language use. |
| 3.a | Identify complex, interdisciplinary, real-world problems that can be solved computationally. |
| 3.b | Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures. |
| 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. |
| 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. |
| F.IF.C.9 | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). |
| 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. |
| | Scale, Proportion, and Quantity |

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| PS1.C | Nuclear Processes |
| | Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. |
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| | Using Mathematics and Computational Thinking |
| TEC.K-12.8.1 | All students will use computer applications to gather and organize information and to solve problems. |
| TEC.K-12.8.2 | All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment. |
| WORK.K-12.9.1 | All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace. |
| WORK.K-12.9.2 | All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace. |

## Essential Questions

- How can exponential and logarithmic equations be solved using multiple methods?
- How can exponential equations be rewritten in logarithmic form?
- What are the key features of the graphs of exponential functions and logarithmic functions?
- What is the relationship between exponential and logarithmic functions?

## Enduring Understandings

- Both exponential and logarithmic Functions have properties that are closely related. The properties are applied to solve logarithmic and exponential equations.
- Exponential functions are different from linear functions as exponential functions have a constant percent increase or decrease as opposed to Linear Functions that have a constant rate of change.
- The inverse of exponential functions are logarithmic functions.

## Students Will Know

- Students will know how to solve exponential equations by using rules of exponents and equivalent bases, if possible.
- Students will know that the graphs of exponential and logarithmic functions have defining properties: domain, range, x-intercept, y-intercept and asymptote.

- Students will know that the properties of logarithms can be used to simplify logarithmic expressions.
- Students will know that the properties of logarithms can be used to solve logarithmic equations.
- Students will know the relationship between an asymptote and the function's domain and range for exponential and logarithmic functions.

## Students Will Be Skilled At

- Students will be skilled at applying the change of base formula.
- Students will be skilled at evaluating exponential expressions and equations that model growth and decay in the real world.
- Students will be skilled at explaining the inverse relationship between exponential and logarithmic functions.
- Students will be skilled at graphing exponential and logarithmic functions using technology and algebraically.
- Students will be skilled at identifying key features of the graphs of logarithmic and exponential functions.
- Students will be skilled at rewriting exponential expressions using like bases if possible.
- Students will be skilled at using the properties of logs to simplify expressions and solve equations.
- Students will be skilled at writing equivalent forms of exponential and logarithmic equations, including base e and natural logs.

## 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

If time allows, a short unit on Exponential functions and Logarithms can be completed. Discuss progress with other Algebra 2/Intro to Trig CP teachers as well as Pre-Calc and Trig CP teachers.

Unit 8 Exponential and Logarithmic Functions (Chapter 6, 2 weeks)

- Graphing exponential growth and decay functions. Discuss characteristics, domain, range, y-intercept. Discuss the meaning of exponential growth and decay using tables. (6.1)
- Solve real world problems using exponential growth. (6.1)
- Solve exponential equations by making like bases, using Property of Equality for Exponential Equations. (6.6)
- Introduce the concept of logs by solving exponential equations where like bases can not be found. Write expressions in log form and exponential form. Evaluate logs without calculator and with a calculator using change of base formula. (6.3)
- Introduce concept of e and continuously compounding interest formula. (6.2)
- Discuss properties of logs. Expand and condense log expressions. (6.5)
- Use properties of logs to solve logarithmic and exponential equations. (6.6)

## Materials

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

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook and ancillary materials.
- Graphing utility (online or calculator).
- Khan Academy, Delta Math, Edia, Ed Puzzle.
- Teacher created activiites
- Teacher created notes

## Suggested Strategies for Modification

Suggested Strategies for Modification for Algebra 2/Intro to Trig CP