



Unit 8: Exponential and Logarithmic Functions

Unit Length: 20 days

Domain: Seeing Structure in Expressions

- Cluster 8: Write expressions in equivalent forms to solve problems.

Domain: Creating Equations

- Cluster 13: Create equations that describe numbers or relationships.

Domain: Reasoning with Equations and Inequalities

- Cluster 14: Understand solving equations as a process of reasoning and explain the reasoning.

Domain: Interpreting Functions

- Cluster 19: Interpret functions that arise in applications in terms of the context.
- Cluster 20: Analyze functions using different representations.

Domain: Building Functions

- Cluster 22: Build new functions from existing functions.

Domain: Linear, Quadratic, and Exponential Models

- Cluster 23: Construct and compare linear, quadratic, and exponential models and solve problems.

Standards:

- HSA.SSE.B.3:
 - Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression: use the **properties of exponents** to transform expressions for **exponential functions**.
 - For example: The expression $1.15t$ can be rewritten as $(1.15_{1/2})_{12t} \approx 1.012_{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
- *HSA.CED.A.1:
 - Create equations and inequalities in one variable and use them to solve problems: **exponential functions**.
- *HSA.REI.A.1:
 - Assuming that equations have a solution, construct a solution and justify the reasoning used.



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- Note: Students are not required to use only one procedure to solve problems nor are they required to show each step of the process. Students should be able to justify their solution in their own words.
- HSF.IF.B.4:
 - For a function that models a relationship between two quantities: interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
 - Note: Key features may include but not limited to: **intercepts**; intervals where the function is **increasing, decreasing, positive, or negative**; relative maximums and minimums; symmetries; **end behavior**; and periodicity.
- *HSF.IF.C.7:
 - Graph functions expressed algebraically and show key features of the graph, with and without technology: graph **exponential** and **logarithmic functions**, showing **intercepts** and **end behavior**.
- HSF.IF.C.8:
 - Write expressions for functions in different but equivalent forms to reveal key features of the function: use the **properties of exponents** to interpret expressions for **exponential functions**.
- *HSF.BF.B.3:
 - Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$ and $f(x + k)$ for specific values of k (k a **constant** both positive and negative); find the value of k given the graphs of the transformed functions; Experiment with multiple **transformations** and illustrate an explanation of the effects on the graph with or without technology.
 - Note: Include recognizing **even** and **odd** functions from their graphs and algebraic expressions for them.
- HSF.BF.B.4:
 - Find **inverse** functions.
- *HSF.LE.A.2
 - Construct **exponential** equations: given a graph; a description of a relationship; or two input-output pairs (include reading these from a table).
- HSF.LE.A.4
 - Construct **exponential equations**: express **exponential models** as **logarithms**; express **logarithmic models** as **exponentials**; use **properties of logarithms** to simplify and evaluate **logarithmic expressions** (**expanding** and/or **condensing logarithms** as appropriate); **evaluate logarithms** with or without technology.
 - Note: For **exponential models**, express the solution to where a , c , and d are **constants** and b is the **base** (Including, but not limited to: 2, 10, or e) as a **logarithm**; then evaluate the **logarithm** with or without technology. Connection to F.BF.B.5.

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Vocabulary to Emphasize is highlighted in **bold** script.



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Learning Goal	Notes	Bellwork/Exit	Practice
<p>Students will explore real-world problems and be able to describe properties of exponential functions.</p> <p>Students will identify key features and be able to describe exponential functions using academic vocabulary.</p>	<p>Exponential Growth and Decay Note with Key.</p>	<p>Pre-Assessment CFA #1: Exponential Growth and Decay with Key.</p> <p>CFA #1: Exponential Growth and Decay with Key.</p>	<p>Worksheet #1: Exponential Growth and Decay with Key.</p> <p>Worksheet #2: Exponential Growth and Decay with Key.</p> <p>Lab: Exponential Growth and Decay Fish Population using M&Ms from TPT (No Key).</p> <p>Task: Exponential Growth and Decay “When are we ever going to use this?” from TPT with Key.</p> <p>MAPSHELL Lesson: Linear and Exponential Growth with Teacher Commentary.</p>
<p>Students will understand the relationship between exponents and logarithms and be able to explain this relationship.</p> <p>Students will express the solution of an exponential equation as a logarithm as well as evaluate the logarithm and be able to explain how the exponential equation is solved.</p> <p>Students will use the properties of logarithms to solve exponential and logarithmic equations.</p> <p>Students will express logarithmic models as exponentials as well as use properties of logarithms and exponentials to solve equations and be able to explain how the equations were solved.</p>	<p>Exponential and Logarithmic Relationship Note with Key.</p> <p>Logarithmic Properties Note with Key Discovery Note: Logarithmic Properties with Practice from TPT with Key.</p> <p>Solving Exponential and Logarithmic Equations Note with Key.</p> <p>Natural Logarithm Base Note with Key.</p>	<p>Pre-Assessment CFA #2: Solving Exponential and Logarithmic Equations with Key.</p> <p>CFA #2: Solving Exponential and Logarithmic Equations with Key.</p>	<p>Worksheet #1: Exponential and Logarithmic Relationship with Key.</p> <p>Worksheet #2: Exponential and Logarithmic Relationship with Key.</p> <p>Worksheet #1: Logarithmic Properties with Key.</p> <p>Worksheet #2: Logarithmic Properties with Key.</p> <p>Matching Activity: Simplifying Exponential and Logarithmic.</p> <p>Expressions with Key Puzzle: Logarithmic Properties No Key.</p> <p>Worksheet #1: Solving Exponential and Logarithmic Equations with Key.</p> <p>Worksheet #2: Solving Exponential and Logarithmic Equations with Key.</p> <p>Worksheet #1: Natural Logarithm Base with Key.</p> <p>Worksheet #2: Natural Logarithm Base with Key.</p> <p>Task: Solving an Base Equation Bacteria Growth with Teacher Commentary from IM.</p>



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<p>Students will distinguish between situations that can be modeled with linear function and with exponential functions.</p> <p>Students will represent data on two quantitative variables on a coordinate grid and be able to describe how the variables are related by fitting a function, assessing its fit and using it to solve problems.</p> <p>Students will identify effects on the graph under various transformations and be able to describe exponential functions using key features.</p>	<p>Modeling Exponential Functions Note with Key.</p> <p>Transforming Exponential and Logarithmic Functions Note with Key.</p>	<p>Pre-Assessment CFA #3: Transforming Exponential and Logarithmic Functions with Key.</p> <p>CFA #3: Transforming Exponential and Logarithmic Functions with Key.</p>	<p>Worksheet #1: Modeling Exponential Functions with Key.</p> <p>Worksheet #2: Modeling Exponential Functions with Key.</p> <p>Worksheet #1: Transforming Exponential and Logarithmic Functions with Key.</p> <p>Worksheet #2: Transforming Exponential and Logarithmic Functions with Key.</p> <p>Matching Activity: Exponential Graph to Equation from TPT with Key.</p>



Unit 8 Summative Test: Exponential and Logarithmic Functions
(Regular Version with Key)

Unit 8 Summative Test: Exponential and Logarithmic Functions
(PAP Version with Key)