UbD Algebra 2 - Exponential Functions and Equations

Time Frame: 18 Lessons	Unit 4: Exponential Functions and Equations	Course Name: Algebra 2

Stage 1: Desired Results

Established Goal(s)

Standards Addressed:

HSA-REI.D.11
Explain why the x-coordinates of the points where the graphs of the equations y=f(x) and y=g(x) intersect are the solutions of the equation f(x)=g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

HSA-SSE.A.1
Interpret expressions that represent a quantity in terms of its context.

HSA-SSE.A.1.a
Interpret parts of an expression, such as terms, factors, and coefficients.

HSA-SSE.A.1.b
Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)ˆn as the product of P and a factor not depending on P.

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.

HSA-SSE.B.3.c
Use the properties of exponents to transform expressions for exponential functions. .

HSF-BF.A.1.a
Determine an explicit expression, a recursive process, or steps for calculation from a context.

Transferable Skills

Students will be able to independently use their learning to...

- **apply exponential functions and equations, mathematical knowledge, skill, and reasoning to solve real-world problems.**
- develop clear and effective communication.
- increase self-direction.
- develop creative and practical problem-solving.
- develop informed and integrative thinking.

Meaning

Understandings
Students will understand that...

- properties of exponents can be used to estimate or find the value of a function when the input is a rational number.
- logarithms are a way to express the exponent that makes an exponential equation true.
- that the constant *e* is irrational, its value is approximately 2.7, and it is used in many exponential functions that model real-life situations with a continuous growth rate.
- they can express the solution to exponential equations in base *e* using the natural logarithm.
- logarithmic functions can be used to answer questions about real-life situations such as population growth, acidity of substances, and intensity of earthquakes.

Essential Questions

- What are the properties and applications of functions, including exponential and logarithmic functions?
- How has algebra developed over time, and how has it contributed to our understanding of mathematics and the natural world?
- How can we use advanced algebraic techniques to model and solve real-world problems?

UbD Algebra 2 - Exponential Functions and Equations

	Acquisition	
HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. **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. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. **HSF-IF.C** Analyze functions using different representations. **HSF-IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. **HSF-IF.C.7.e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **HSF-IF.C.8.b** Use the properties of exponents to interpret expressions for exponential functions. **HSF-LE.A** Construct and compare linear, quadratic, and exponential models and solve problems. **HSF-LE.A.1.a** Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. **HSF-LE.A.1.b** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **HSF-LE.A.1.c**	*Students will know...* ● how to calculate values that are changing exponentially. ● that exponential functions change by equal factors over equal intervals. ● how to calculate a growth or decay factor of an exponential function for different input intervals. ● how to explain why an exponential function changes by the same factor over equal intervals, even when those intervals are not whole numbers. ● how to write equations for exponential functions from two input-output pairs, even when the input pairs are not one unit apart. ● how to use the half-life of elements to calculate how much of the element remains over time. ● how to approximate the value of unknown exponents ● that a logarithm is a way to represent an exponent in an exponential equation. ● how to use known values of logarithms to estimate the value of other logarithms. ● that *e* is an irrational constant, like pi, that has a value of about 2.718 ● how to calculate where two exponential graphs meet using logarithms. ● how to interpret the intersection of the graphs of two exponential functions in context. ● how to interpret logarithmic functions in context.	*Students will be able to...* ● determine the value of exponential functions at non-whole number inputs. ● how to evaluate a logarithmic expression. ● use technology to determine the value of a logarithm. ● understand that is used in exponential models when we assume the growth rate is applied at every moment. ● solve simple exponential equations using logarithms. ● solve exponential equations using logs or by graphing ● understand how logarithms are used to measure things like acidity and the intensity of earthquakes. Mathematical Practices: ● make sense of problems and persevere in solving them. ● reason abstractly and quantitatively. ● construct viable arguments and critique the reasoning of others. ● model with mathematics. ● use appropriate tools strategically. ● attend to precision. ● look for and make use of structure. ● look for and express regularity in repeated reasoning.

UbD Algebra 2 - Exponential Functions and Equations

Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **HSF-LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **HSF-LE.A.4** For exponential models, express as a logarithm the solution to abˆ(ct)=d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. **HSF-LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context. **HSN-RN.A.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.		