

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)	Transferable Skills	
Standards Addressed:	Students will be able to independently use their learning to...	
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 $P(1+r)^n$ 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-BFA.1.a Determine an explicit expression, a recursive process, or steps for calculation from a context.	● 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	
	<u>Understandings</u> <i>Students will understand that...</i> ● 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.	<u>Essential Questions</u> ● 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?

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HSF-IF.A.2	Acquisition	
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	<i>Students will know...</i> • 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 π, 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.	<i>Students will be able to...</i> • 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 e 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.

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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 $ab^{(ct)}=d$ 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.