Stage 1 Desired Results

ESTABLISHED GOALS (CCSS)

N.RN.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. For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.
N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents

A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables

A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
A.REI.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.★
A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes

F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1

F.IF.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

Transfer

Students will be able to independently use their learning to…

understand functions graphically, numerically, symbolically and verbally, find system of equations, use integer exponents to consider exponential function, compare and contract linear and exponential functions, distinguish between additive and multiplicative change, interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Meaning

UNDERSTANDINGS

Students will understand that…

- *graphs visually represent the relationship between two variable quantities as they both change*
- *the value of one variable may be uniquely determined by the value of another variable*
- *linear and non-linear functions can be represented using tables, words, equations, sets of ordered pairs & graphs*
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ESSENTIAL QUESTIONS:

How can you represent quantities, patterns and relationships?

How are properties related to algebra?

Can equations that appear to be different be equivalent?

How can you solve equations?

How can you represent and describe functions?

Can functions describe real-world situations?

Acquisition

Students will know…

- ✓ *understand the concepts of functions*
- ✓ *the use of functions*
- ✓ *how to represent patterns to describe linear functions*

Students will be skilled at…

- ✓ extending the properties of exponents to rational exponents
- ✓ solving systems of equations
- ✓ representing and solving equations and inequalities graphically
- ✓ using functions
- ✓ interpreting functions that arise in applications in terms of a context
- ✓ analyzing functions using different representations
- ✓ building functions that models a relationship between two quantities
- ✓ build new functions from existing functions
- ✓ construct and compare linear, quadratic and exponential models and solve them
- ✓ interpret expressions for functions in terms of the situations they model

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.★ **F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.★ **F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★ **F.IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. **F.BF.1** Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. **F.BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. **F.BF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them **F.LE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals; and that exponential functions grow by equal factors over equal intervals.		

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **F.LE.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). **F.LE.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. **F.LE.5** Interpret the parameters in a linear or exponential function in terms of a context.		

Stage 2 Evidence

Evaluative Criteria	Assessment Evidence
PERFORMANCE TASKS	**CURRICULUM EMBEDED PERFOMANCE ASSESSMENT (PERFORMANCE TASKS):** • Solve • Use a table to complete each part • Solve. Show work and explain you steps
	OTHER EVIDENCE: • Use of fundamental math facts • Use of technology • Use of properties •
CLAIMS	**CLAIM 1** **CLAIM 2** **CLAIM 3** **CLAIM 4**
DEPTH OF KNOWLEDGE LEVELS	**DOK 1** **DOK2** **DOK 3** **DOK4**
ACHIEVEMENT LEVEL DESCRIPTORS	**ALD 1** **ALD 2** **ALD 3** **ALD 4**

Stage 3 Learning Plan

Summary of Key Learning Events and Instruction

Lesson 2a	
