MP2c-Exponents and Exponential Functions

Content Area: **Math**
Course(s): **Algebra 1 Accelerated**
Time Period: **Marking Period 2**
Length: **EnVisions Topic 6 and Envisions 8th Grade Math 1.8, 1.9 and 1.10, 18 Days**
Status: **Published**

Essential Questions

- How do you use exponential functions to model situations and solve problems?

Big Ideas

- Determine all properties of exponents.
- Add, subtract, and multiply polynomials by using properties of exponents and combining like terms.
- Closure of polynomials.

Diversity Integration

Objective: Students will write the exponential functions for population growth or decay in two different countries.

Description of Activity: Students will find the population for two different countries for the past 25 years. Using the data they will write the equation for population growth or decay.

CSDT Technology Connection

8.1.8.ETW.2 Identify the natural resources needed to create a product.

Enduring Understandings

Expressions and Equations

8.EE.A.1 Know and apply the properties of integer exponents to generate numerical expressions. For example

32 3-5=31/3=133=127.

8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2=p and x3=p where p is a positive rational number.

8.EE.A.3 Use numbers expressed in the form of a single digit times and integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3108 and the population of the world as 7109 and determine that the world population is more than 20 times larger.

8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading) Interpret scientific notation that has been generated by technology.

The Real Number System

N.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. 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.

- Integer Exponents
- Rational Exponents

N.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Interpreting Functions

F.IF.A.3 [M] 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 $n \geq 1$.

- Geometric Sequence

F.I.F.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.★

F.I.F.B.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.C.7e Graph exponential and logarithmic functions, showing intercepts and end behaviorF.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Building Functions

F.BF.B.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. c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.

F.BF.B.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.B.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.

Construct and compare linear and exponential models and solve problems

F.LE.A.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.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).

Interpret expressions for functions in terms of the situation they model

F.LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context.

Seeing Structure in Expressions

A.SSE.A.1a[M] Interpret parts of an expression, such as terms, factors, and coefficients.

- Polynomials

A.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12) 12t ≈1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

Creating Equations

A.CED.A2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Reason quantitatively and use units to solve problems.

N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Geometry- Understand and apply the Pythagorean Theorem

8.G.B6 [M] Explain a proof of the Pythagorean Theorem and its converse.

8.G.B7 [M] Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.B8 [M] Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Mathematical Practices Focus

1. Make sense of problems and persevere in solving them. Pages 217, 224

2. Reason abstractly and quantitatively. Pages 246

3. Construct viable arguments and critique the reasoning of others. Pages 217, 224. 231,239, 246

4. Model with mathematics. Pages 231,252

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure. Pages 224, 239, 246

8. Look for and express regularity in repeated reasoning. Page 217, 231, 239