Algebra 1 Unit 5: Introduction to Exponential Functions

Unit Focus

In this unit, students are introduced to exponential relationships. Students learn that exponential relationships are characterized by a constant quotient over equal intervals, and compare it to linear relationships which are characterized by a constant difference over equal intervals. They encounter contexts that change exponentially. These contexts are presented verbally and with tables and graphs. They construct equations and use them to model situations and solve problems. Students investigate these exponential relationships without using function notation and language so that they can focus on gaining an appreciation for critical properties and characteristics of exponential relationships.

Students subsequently view these new types of relationships as functions and employ the notation and terminology of functions (for example, dependent and independent variables). They study graphs of exponential functions both in terms of contexts they represent and abstract functions that don't represent a particular context, observing the effect of different values of a and b on the graph of the function represented by f(x)=ab^x.

In this unit, students learn that the output of an increasing exponential function is eventually greater than the output of an increasing linear function for the same input.

Stage 1: Desired Results - Key Understandings

Standard(s)

Common Core
Mathematics: 8

- Reason abstractly and quantitatively. (CCSS.MATH.MP.2)

Mathematics: 9-12

- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (CCSS.MATH.CONTENT.HSN.Q.A.1)
- Interpret parts of an expression, such as terms, factors, and coefficients. (CCSS.MATH.CONTENT.HSA.SSE.A.1.A)
- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (CCSS.MATH.CONTENT.HSA.CED.A.2)
- 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. (CCSS.MATH.CONTENT.HSF.IF.B.4)

Transfer

Students will be able to independently use their learning to...
T1 Represent situations using mathematical reasoning and symbols

Meaning

Understanding(s)	Essential Question(s)
Students will understand that... **U1** Mathematicians make sense of quantities to represent situations mathematically. **U2** Mathematicians attend to the underlying meaning of quantities and symbols.	*Students will keep considering...* **Q1** How can the relationship between quantities be represented? **Q2** What do the quantities mean?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **K1** Vocabulary: growth factor, exponential function, exponential growth, exponential decay	*Students will be skilled at...* **S1** Comparing growth patterns using calculations and graphs.

Stage 1: Desired Results - Key Understandings

• Determine an explicit expression, a recursive process, or steps for calculation from a context. (CCSS.MATH.CONTENT.HSF.BF.A.1.A) • Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. (CCSS.MATH.CONTENT.HSF.LE.A.3) • Interpret the parameters in a linear or exponential function in terms of a context. (CCSS.MATH.CONTENT.HSF.LE.B.5) **Madison Public Schools Profile of a Graduate** • Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)	**K2** That a represents the starting quantity and b represents the growth factor in the equation y = ab^x. **K3** Situations are characterized by either exponential growth or decay.	**S2** Writing expressions and creating tables when given descriptions of linear and exponential relationships. **S3** Writing an equation in the form y = ab^x to represent a quantity a that grows or decays exponentially. **S4** Calculating growth factor using points on a graph. **S5** Describing the meaning of a negative exponent in equations that represent exponential decay.