(Alg 1) Unit 6: Exponential Functions & Sequences

Content Area: **Math**
Course(s): **Math**
Time Period: **January**
Length: **3 weeks**
Status: **Published**

Unit Overview

In this unit, students will learn about the following topics:

- Properties of exponents

- Radicals & rational exponents

- Exponential functions

- Exponential growth & decay

- Solving exponential equations

- Geometric sequences

- Recursively defined sequences

Enduring Understandings

SWBAT:

- Simplify exponential expressions using properties of exponents

- Simplify expressions involving radicals & rational exponents

- Evaluate exponential functions for given values

- Graph exponential functions

- Model real-world problems with exponential functions

- Find domain and range of exponential functions

- Write & graph exponential growth & decay functions

- Evaluate exponential growth & decay functions

- Identify the different pieces of exponential growth & decay functions (growth/decay rate, initial value, time, etc.)

- Solve exponential equations by rewriting each side with the same base

- Write & graph geometric sequences

- Find the common ratio for a geometric sequence

- Convert between explicit and recursive formulas for both arithmetic & geometric sequences

- Write & graph recursively defined sequences

Essential Questions

How can we:

- apply the product of powers property to simplify algebraic expressions?
- apply the quotient of powers property to simplify algebraic expressions?
- apply the power of a power property to simplify algebraic expressions?
- apply the power of a product property to simplify algebraic expressions?
- apply the power of a quotient property to simplify algebraic expressions?
- apply the properties of negative & zero exponents to simplify algebraic expressions?
- model real world scenarios with scientific notation?
- utilize the properties of operations in scientific notation in order to simplify scientific notation expressions?
- convert between radical form and rational exponent form?
- simplify expressions involving radicals?
- simplify expressions involving rational exponents?
- graph exponential functions?
- write exponential functions that model real-world scenarios?
- evaluate exponential functions?
- identify the domain & range of exponential functions?
- model & solve real-world problems using exponential functions?
- write & graph exponential growth & decay functions?
- identify growth/decay rate, as well as growth/decay factors?
- apply the compound interest formula?
- use the compound interest formula to solve for interest, principal, rate, time, or total balance?
- solve exponential equations by rewriting the bases of each side of the equation?
- solve an equation involving an exponential expression using technology?
- write & graph functions representing geometric sequences?
- find the common ratio of geometric sequences?
- write and graph functions represented as recursively defined sequences?
- convert between explicit form and recursive form?
- represent real-world scenarios using recursively defined sequences?

Instructional Strategies & Learning Activities

- Guided Practice

- Daily Do Now
- Extra Practice & Puzzle Time (Resources)
- Scavenger Hunts
- Coloring Activities
- Task Cards (Around the World)
- Maze Activities
- Quizizz Online Assignments
- Kahoot! Online Games
- GimKit Online Games

Integration of 21st Century Themes and Skills

P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
9.2.8.CAP.6	Compare the costs of post-secondary education with the potential increase in income from a career of choice.
9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
PFL.9.1.8.A.2	Relate how career choices, education choices, skills, entrepreneurship, and economic conditions affect income.
PFL.9.1.8.A.6	Explain how income affects spending decisions.

Technology & Design Integration

8.1.8.DA.5	Test, analyze, and refine computational models.
8.1.8.AP.4	Decompose problems and sub-problems into parts to facilitate the design, implementation, and review of programs.
8.1.8.AP.6	Refine a solution that meets users' needs by incorporating feedback from team members and users.
8.1.8.AP.8	Systematically test and refine programs using a range of test cases and users.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.8.E.CS4	Process data and report results.
TECH.8.1.8.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.1.8.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
TECH.8.2.8.D.CS1	Apply the design process.

Interdisciplinary Connections

L.KL.8.2.A	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.
L.KL.8.2.B	Gather vocabulary knowledge when selecting a word or phrase important to comprehension or expression.
L.VL.8.3.A	Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
L.VL.8.3.B	Analyze the impact of specific word choices on meaning and tone.
L.VL.8.3.C	Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., precede, recede, secede).
L.VL.8.3.D	Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.
L.VL.8.3.E	Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking

	the inferred meaning in context or in a dictionary).
ETS1.B	Developing Possible Solutions
ETS1.C	Optimizing the Design Solution
VPA.1.3.8.D.1	Incorporate various art elements and the principles of balance, harmony, unity, emphasis, proportion, and rhythm/movement in the creation of two- and three- dimensional artworks, using a broad array of art media and art mediums to enhance the expression of creative ideas (e.g., perspective, implied space, illusionary depth, value, and pattern).

Differentiation

Definitions of Differentiation Components:

- Content – the specific information that is to be taught in the lesson/unit/course of instruction.
- Process – how the student will acquire the content information.
- Product – how the student will demonstrate understanding of the content.
- Learning Environment – the environment where learning is taking place including physical location and/or student grouping

Differentiation occurring in this unit:

- High-achieving students will assist low-achieving students in mixed ability groupings for games and activities.
- High-achieving students can complete sudoku puzzles and logic puzzles as extension activities.
- Limit number/difficulty of problems for low-achieving students to demonstrate mastery.
- Narrow down problem choice to core concepts for low-achieving students.
- Leveled group-based activities, determined by formative assessment.

Modifications & Accommodations

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Benchmark Assessments

Schoolwide Benchmark assessments:

- Linkit Benchmarks (Form A in September, Form B in January, Form C in June): Linked to NJSLA standards

Additional Benchmarks used in this unit:

- IXL Diagnostic + continued practice during IXL periods

Formative Assessments

Formative Assessments used in this unit:

- Kahoot! Games

- Quizizz Games

- Homework

- Q & A

- Scavenger Hunts

- Coloring Activities

- Task Cards

- Partner Activities

Summative Assessments

Summative assessments for this unit:

- Chapter Test
- Quizzes

Instructional Materials

1. Big Ideas Math: Math & You 6th Grade Textbook
2. Quizizz
3. Kahoot!
4. Scavenger Hunts
5. Task Cards
6. Coloring Activities

7. GimKit

Standards

F.BF.A.1.a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
F.BF.A.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.
A.CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
A.CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
F.IF.A.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.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
A.REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
F.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.
F.IF.C.7.e	Graph exponential and logarithmic functions, showing intercepts and end behavior.
A.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.
F.IF.C.8.b	Use the properties of exponents to interpret expressions for exponential functions.
F.IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
F.LE.A.1.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).
A.SSE.B.3.c	Use the properties of exponents to transform expressions for exponential functions.
A.SSE.B.4	Derive and/or explain the formula for the sum of a finite geometric series (when the

common ratio is not 1), and use the formula to solve problems.