Unit 1: Exponential & Logarithmic Functions & Graphs

Content Area: **Mathematics**
Course(s): **Pre-Calculus**
Time Period: **6 weeks**
Length: **6 Weeks**
Status: **Published**

Unit Overview

During this unit, students will…

- Create equations.
- Build functions that model a relationship between two quantities.
- Model solutions
- Create and analyze tables & graphs.
- Build functions that model real world phenomena
- Use properties of exponents and logs to simplify and solve equations.
- Analyze functions using different representations.

BLITZER- CHAPTER 3

Transfer

Students will be able to independently use their learning to...

- Write exponential models and functions to describe real-world situations.
- Use patterns of transformation to sketch graphs of simple functions, or to write equations of simple functions based on their graphs.
- Describe the relationship between exponential and logarithmic expressions.
- Simplify and evaluate exponential and logarithmic equations.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- Algebraic expressions can be simplified and rewritten in different equivalent forms.
- Functions can be represented in a variety of different formats.
- Exponential expressions can be simplified using the properties of exponents.
- Exponential expressions are often useful in modeling real-life situations.

Essential Questions

Students will keep considering...

- How can mathematical models be used as tools to describe and help explain real-life situations?
- How can various mathematical expressions be simplified both effectively and efficiently?
- How can you sketch accurate graphs of functions?
- How can a given equation be solved both effectively and efficiently?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?

Application of Knowledge and Skill

Students will know...

Students will know...

- How to create and analyze tables, graphs, and equations.
- Different representations of functions and how they relate to each other.
- The rules and procedures used to manipulate exponential expressions.
- Exponential notations are different forms of expressing equivalent values.
- How various aspects of exponential & logarithmic models affect the graph and the solutions.
- How exponential and logarithmic equations can model real life phenomena.

Students will be skilled at...

Students will be skilled at...

- Rewriting logarithmic and exponential expressions.
- Creating and analyzig tables and graphs.

- Creating, solving and modeling equations from data.
- Writing and graphing exponential functions to model real-world situations.
- Using properties of exponents and logs to solve exponential and logarithmic equations.
- Analyzing the relationships among functions represented as tables of values, algebraic formulas, written statements, and graphs.

Academic Vocabulary

Exponential Function

Base

Exponent

Natural base

Compound Interest

Principal

Compounded (quarterly, semiannually, continuously)

Logarithmic Form

Logarithm

Natural Log

Common Logarithm

Expanding

Condensing

Change of Base Formula

Growth

Decay

Learning Goal 1.1

SWBAT define and use the properties of exponential and logarithmic expressions and functions in order to solve real world applications.

Target 1.1.1 (Exponential & Logarithmic Graphs)

SWBAT:

- evaluate and graph exponential and logarithmic functions **(DOK 2)**
- use properties of exponents and logs to switch from one form to another. **(DOK 2)**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.F-LE.A.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to ab to the ct power = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Target 1.1.2 Condense/Expand Logarithmic Expressions

SWBAT

- use properties of logarithms & exponents to expand/condense expressions and solve equations. **(DOK 2)**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.6	Attend to precision.
MA.F-BF.B.5	Use the inverse relationship between exponents and logarithms to solve problems involving logarithms and exponents.
MA.F-LE.A.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to ab to the ct power = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Target 1.1.3 Exponential Growth and Decay

SWBAT

- investigate and model exponential growth and decay by annalyzing real world applications. **(DOK 4)**
- solve continously and noncontinuously compound interest equations and real-life applications. **(DOK 3)**
- create, model, and solve word problems using exponential equations using exponential and logarithmic properties. **(DOK 3)**
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MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.F-BF.A	Build a function that models a relationship between two quantities
MA.F-BF.B.5	Use the inverse relationship between exponents and logarithms to solve problems involving logarithms and exponents.
MA.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
MA.F-LE.A.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MA.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).
MA.F-LE.A.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.
MA.F-LE.A.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to ab to the ct power = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Formative Assessment and Performance Opportunities

- academic games
- Class discussions
- Classwork
- Do nows
- Exit tickets
- Homework
- Problem based learning
- student interviews
- Teacher observation
- whiteboard/communicator opportunities

Summative Assessment

- Link It Exams
- Projects
- Quizzes

- student interviews
- Tests
- Unit Exam

21st Century Life and Careers

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
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	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.12.C	Career Preparation
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Technology

TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.D	Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.E.1	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.2.12.A.CS2	The core concepts of technology.

Accommodations and Modifications

- 504 Accommodations
- Academic Games of Review Packet for each section
- centers/stations
- challenge questions

- IEP Modifications
- Individual vs. large group wipeboard Q & A
- manipulatives (highlighting, underlining, starring critical information)
- Provide You Tube videos
- scaffolding questions
- small group instruction (opportunity to work with teacher 1-on-1)
- Use of technology such as google classroom to provide answer keys

Unit Resources

- Google Classroom
- Kuta software
- NCTM website
- online textbook materials
- Text
- You Tube & Internet Videos

Interdisciplinary Connections

A Skittles experiment where you start with 1 skittle in a large box and shake. If an S appears, you add the amount of "S" skittles that appear to the box and continue this process to investigae population growth. After 15-20 trials, students will see how population grows exponentially and then can use an Excel or similiar program to create an exponential function to model the growth. Then, students can do the same experiment, but in reverse to show how population can decay by taking away "S" skittles that appear. Students then answer a questionnaire explaining/brainstorming ideas of why and how populations grow and/or die off. (MA.9-12.F-LE.A.1; MA.9-12.F-LE.A.1c; MA.9-12.F-LE.A.2)

9-12.HS-LS2-7.6.1	Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
9-12.HS-LS2-7.7.1	students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.
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9-12.HS-LS2-7.LS4.D.2	Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning

and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.