

Course: Algebra I
Unit #/ Unit Name: Unit #7 Exponents and Exponential Functions

Year of Implementation: 2019-2020

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:

<https://www.state.nj.us/education/cccs/2016/math/standards.pdf>

Unit Standards:

Seeing Structure in Expressions A-SSE: 1

- Interpret the structure of expressions

Creating Equations A-CED: 1, 2

- Create equations that describe numbers or relationships

Interpreting Functions F-IF: 1, 2, 8b

- Understand the concept of a function and use function notation.
- Analyze functions using different representations.

Linear and Exponential Models F-LE: A, 1c

- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

21st Century Themes

(www.21stcenturyskills.org)

x Global Awareness

x Financial, Economic, Business and Entrepreneurial Literacy

- Civic Literacy
- Health Literacy
- Environmental Literacy

Learning and Innovation Skills:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media and Technology Skills:

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

Life and Career Skills:

- Flexibility and Adaptability
- Productivity and Accountability
- Initiative and Self-Direction
- Leadership and Responsibility
- Social and Cross-Cultural Skills

Transfer Goal(s): Students will be able to independently use their learning to compare different models and effectively communicate their reasoning.

Enduring Understandings

Students will understand that...

EU1

Real-world situations can be represented symbolically, graphically, and verbally.

EU2

Expressions can take different forms and remain equivalent.

Essential Questions

EU1

How can we model situations using exponents?
Which model can best fit this situation?

EU2

How can the properties of exponents help explain why $a^0 = 1$?

Knowledge

Students will know...

Skills

Students will be able to...

EU1

- an exponential function can model growth or decay in real life when describing situations such as population growth, compound interest, and car depreciation.
- in the exponential function $y = ab^x$, a represents the initial amount and b represents the growth/decay factor.

- compound interest can be found using the formula

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

, where A represents the balance, P represents the principal (initial deposit), r represents the annual interest rate (expressed as a decimal), n represents the number of times interest is compounded yearly, and t represents the time in years.

EU2

- expressions can be rewritten and simplified using properties of exponents.

EU1

- distinguish between linear and nonlinear functions.
- recognize when an exponential model is appropriate (growth or decay).
- determine if an exponential function is increasing or decreasing.
- graph exponential functions.
- model exponential growth and decay.
- calculate compound interest.

EU2

- simplify expressions using properties of exponents.

Stage Two - Assessment

- Other Evidence:
- Tests on graphing exponential growth and decay functions, modeling exponential growth and decay, finding compound and simple interest.
- Quizzes on identifying exponential growth and decay functions by inspection of function and/or its graph, discriminating between exponential functions, linear, and quadratic functions.
- Assessed Elements from Recommended Performance Tasks
- Other teacher-graded evaluations
- Presentations of student research

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:** Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.

Activities:

- Population Growth activity: Population growth modeled concretely as students see the increase in number of fish in water and graphically as well. <http://www.otherwise.com/population/exponent.html> (A - EU1)
- Nspire exponential activity: Through a TI-Nspire activity, students will identify the characteristics of exponential functions. The activity can be found at <http://education.ti.com/calculators/timathnspired/US/Activities/Detail?sa=5022&t=5025&id=11976>. (A – EU1/EU2)
- **M&M's lab:** Growth and Decay: (on google drive) (M/T – EU1/EU2)
- **Exponents Modeling Performance:** (on google drive) (M/T – EU2/EU3)

Critical Vocabulary:

The following terms should be utilized...

- | | |
|-----------------------|----------------|
| -exponential function | -growth factor |
| -exponential growth | -decay factor |
| -exponential decay | -principal |
| -compound interest | -interest rate |
| -exponent | |
| -base | |
| -leading coefficient | |

The following is the suggested sequence of learning activities for the Algebra I ACC class. Adjustments should be made accordingly for other levels.

- Properties of Exponents
 - Product Rule
 - Power Rule
 - Zero Rule
 - Negative Rule
 - Quotient Rule
 - Assessment of Properties
- Graph exponential functions with TI-Nspire using $y = a \cdot b^x$

- Identify if function is growth or decay
- Identify the asymptote and y-intercept of the function
- Exponential growth/decay using $y = a(1 \pm r)^x$
 - Using equations and applications, identify the growth/decay factor and growth/decay rate
- Compound interest: equations and applications
- Recommended Performance Task