**Lesson Plan Title:** Simplify/Evaluate and Zeroth Power

**Teacher’s Name:** Anna Eng  **Subject/Course:** Mathematics

**Unit:** Exponents and Scientific Notation **Grade Level:** 8th Grade

**Overview of and Motivation for Lesson:**

Students will divide exponents with the same base by applying the Quotient Rule for Exponents. Students will differentiate between “simplify” and “evaluate.” Students will discover that a base raised to the power of zero is evaluated to be 1.

|  |
| --- |
| **Stage 1-Desired Results** |
| **Standard(s):*** 8.EE.A - Work with radicals and integer exponents.
	+ 1. - Know and apply the properties of integer exponents to generate equivalent numerical expressions.
		- For example, 32 x 3-5 = 3-3 = ⅓3 = 1/27.
 |
| **Aim/Essential Question:*** How can you evaluate a nonzero number with an exponent of zero?
 |
| **Understanding(s):***Students will understand that . . .** for any nonzero number *a*, *a*0 = 1. The power 00 is *undefined*.
* a power is a product of repeated factors. The base of a power is the common factor. The exponent of a power indicates the number of times the base is used as a factor.
 |
| **Content Objectives:** *Students will be able to . . .* * write expressions involving exponents and evaluate powers.
* simplify expressions using the definitions of zero and negative exponents to evaluate and simplify expressions.
* differentiate between simplifying or evaluating an expression.
 | **Language Objectives:**ELD Level 3. *Students will be able to . . . in English** listen to the terms: “simplify” and “evaluate,” and identify the differences in practice examples.

ELD Level 5. *Students will be able to . . . in English** identify the terms: “simplify” and “evaluate” for use in a given expression and apply these to examples.
 |
| **Key Vocabulary*** expression
* exponent
* power
* Product of Powers Property / Product Rule for Exponents
* Power of Powers Property / Power Rule for Exponents
* Quotient of Powers Property / Quotient Rule for Exponents
* Zeroth Power
* base
* factor
* simplify
* evaluate
 |
| **Stage 2-Assessment Evidence** |
| **Performance Task or Key Evidence*** Students will be trying examples of simplifying expressions similar to the ones shown in the videos. Using Pear Deck, they will draw or type on their screens to answer the examples for the teacher to view. If students need extra practice, additional examples will be provided.
 |
| **Key Criteria to measure Performance Task or Key Evidence*** Students’ steps in simplifying expressions with exponents.
	+ Do they expand the expression to show the factors?
	+ When multiplying exponents with the same base, do they use the Product Rule for Exponents?
	+ When dividing exponents with the same base, do they use the Product Rule for Exponents?
	+ When evaluating a nonzero number raised to the power of 0, do they get 1?
 |
| **Stage 3- Learning Plan** |
| **Learning Activities:**Do Now/Bell Ringer/Opener:* Check-in & Attendance
	+ Using a presentation (with Pear Deck).
	+ Warm-up
		- 4 problems practicing a mix of Product, Power, and Quotient Rule.
	+ (~7 minutes)

Learning Activity 1:* Using a [presentation](https://docs.google.com/presentation/d/10Jq4ZppcyMwgQwr7ybO6xLR-HiRKOMew9KYFimBzqmM/edit?usp=sharing) (with Pear Deck).
	+ Simplify vs. Evaluate (video and examples)
		- (~20 minutes)
	+ Expand out Quotient Rule to get zero exponent
		- (~5 minutes)
	+ Student practice [Backup example problems are included for extra practice as needed]

Learning Activity 2:* Using a presentation (with Pear Deck).
	+ Zeroth Power (video and examples)
		- Includes practice with negative exponents and ending up with a zero as an exponent. (Simplify, then evaluate).
	+ (About 20 minutes total)

Application Students will be able to apply the Product Rule, Power Rule, or Quotient Rule for Exponents in simplifying and evaluating expressions, even in cases where a nonzero base has an exponent of zero. They will be able to determine when they can use the Product Rule, Power Rule, or Quotient Rule for Exponents and apply it to more complex and longer expressions. Students will be able to differentiate between instances when these rules can be applied instead of different integer exponent operations.Summary/Closing* Check for any final questions.
* Describe homework/asynchronous aspects.
* Describe additional video resources.
* (~4 minutes)

**Multiple Intelligences Addressed:**

|  |  |  |  |
| --- | --- | --- | --- |
| ☐ Linguistic | ☐ Logical-Mathematical | ☐ Musical  | ☐Bodily-kinesthetic |
| ☐ Spatial  | ☐ Interpersonal | ☐Intrapersonal | ☐Naturalistic  |

**Student Grouping****☐** Whole Class ☐ Small Group ☐ Pairs ☐ Individual**Instructional Delivery Methods**☐Teacher Modeling/Demonstration ☐ Lecture ☐ Discussion☐ Cooperative Learning ☐ Centers ☐ Problem Solving☐ Independent Projects |
| **Accommodations*** Provide captions for the videos for students to follow along.
* Provide videos with visual and audio included.
 | **Modifications** |
| **Homework/Extension Activities:*** 10 questions.
	+ 4 expressions (2 parts per each) to be simplified and evaluated
	+ 5 expressions (1 or 2 parts per each) to be simplified by using the Product Rule and Quotient Rule for Exponents
	+ 1 equations for one solution practice
* YouTube videos for reference of the Zeroth Power.
 |
| **Materials and Equipment Needed:*** Pear Deck
* Screencastify Videos
 |

**Adapted from Grant Wiggins and Jay McTighe-*Understanding by Design***