Activity Revision Collaboration (ARC)

Exponents

College Algebra/Algebra for STEM

Dee Cooper

Northern Oklahoma College

dee.cooper@noc.edu

580-789-0196

Christi Hook

Northern Oklahoma College

christi.hook@noc.edu

580-716-2446

Cecil Phibbs

Northern Oklahoma College

cecil.phibbs@noc.edu

405-921-1884

Instructional Plan: Exponents and their properties.

Abstract: In this activity for exponents and their properties, students will work individually or in groups through problems using exponents. Each group of problems seeks to help students develop a specific exponential rule. These rules known as Properties of Exponents allow students to properly manipulate problems involving multiplication and division of like bases with exponents as well as raising an exponent to another exponent.   Each section deals with a different one of these properties and allows students to discover the property through expanding and then simplifying an exponential expression. Part four gives students a chance to apply the properties by identifying common exponential mistakes and fixing them using the correct exponential property.

Rationale for selecting/designing this problem/task sequence: This multi-part activity builds on students' prior knowledge of using exponents with just a base value raised to an exponent and helps them understand applying further mathematical operations with exponents. This is separated into three parts each focused on one of the three exponential properties:

- Multiplying 2 exponent values with the same base
- Dividing 2 exponent values with the same base
- Raising an exponent to another exponent

By the end of this activity, students will have developed in their own words each of these 3 exponential properties. In the last part they are given a chance to apply their properties with a list of expressions showing common errors which they will correct and explain what steps should have been used in writing an equivalent exponential expression.

Prerequisite Knowledge:

- Students must have an understanding of how to represent repeated multiplication with exponents.
- Students must be able to perform basic calculations with exponents (either by hand or a calculator).
- Students should be able to explain in writing the steps to complete a multiplication or division problem.

Learning objective(s) and alignment with Student Learning Outcomes (SLO From CEP Matrix):

- Algebraically solve equations including linear, quadratic, polynomial, rational, radical, absolute value, exponential, and logarithmic.
- Create models for real-world situations through appropriate mathematical strategies.
- Communicate mathematical ideas using valid terminology.

MIP Components of Inquiry:
This section outlines how our activity will meet the Mathematical Inquiry Project (MIP) criteria for active learning, meaningful applications, and academic success skills.

Active Learning: Students learn through engaging in deep problems requiring them to select, perform, and evaluate actions whose structures are equivalent to the structures of the concepts to be learned.

- Students will discover the rules of exponents by working examples into expanded form and then simplifying. This will allow them to see the process that is happening mathematically for each exponent property.
- From their expanded discovery they will create a rule using their own interpretation.
- Students will be able to engage in productive discussion in groups and with the instructor to develop the exponent properties based on their experimental learning from completing the exercises.
- Part 4 allows students to see and realize common exponent errors. They will be able to apply their newly discovered exponential properties to fix the errors. This will also engage them in discussion to explain why each error could have occurred and the steps that should have been used while fixing the error.

Meaningful Applications: Applications are incorporated in mathematics classes to support students in identifying mathematical relationships, making and justifying claims, and generalizing across contexts to extract common mathematical structure.

- Students will justify the rules of exponents by discussion with class and instructor.
- Students will discover common errors made in exponent examples.
- Students will be able to apply prerequisite skills of repeated multiplication to create mathematical relationships with exponents and their properties. This will help students to realize how mathematical relationships can further their understanding in the learning process.
- Being able to see the exponent properties evolve as they work through the examples, students will be able to develop a deeper understanding for the exponential properties and also understand how common mistakes are made with the errors in part 4. This will allow students to see the mathematical importance of persevering to successful outcomes and determining proper application of each property.

Academic Success Skills: Students construct an identity as learners in ways that enable productive engagement in their education and the associated academic community.

- Students will engage in Academic Success Skills by working in groups to collaborate on specific terminology to create clear and concise definitions.
- Students will develop a deeper understanding of exponent rules by application of their discovery into real world problems.
- By creating their own rules for exponent properties, students can engage as productive learners and will see a benefit to not only using the exponent properties but understanding their application to related problems.
- Understanding the process to the rules they have created will allow students to be inquisitive learners. Rather than accepting mathematical theorems and properties at face value they can apply this same approach of breaking down and then building up the work to future problems. This will allow students to deepen their mathematical understanding and become deeply involved in the Mathematical community and their individual learning journey.
- Students will be able to see these properties as meaningful mathematical tools and understand how to search for similar meaning in other areas of Mathematics, helping them be confident in their mathematical abilities and realize that they can be successful math learners.