Unit 6 Rational Exponents & Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **3-4 weeks**
Status: **Published**

Brief Summary of Unit

The first part of this unit presents nth roots and how they can be written as rational exponents. This distinctly ties into the radical and exponent work students completed in Algebra 1. The second half of this unit dives into using the four algebraic operations on functions, and introducing the composite operation. If time allows, the topic of inverses should also be covered in this unit.

Revision Date: July 2024

Standards

N.RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
F.BF.A.1.b	Combine standard function types using arithmetic operations.
N.RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
F.BF.A.1.c	Compose functions.
L.KL.9–10.2.A	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
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.
F.BF.B.4.a	Solve an equation of the form 𝑓(𝑥) = 𝑐 for a simple function 𝑓 that has an inverse and write an expression for the inverse.
A.CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
A.REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
SL.PE.11–12.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

Essential Questions

- How can we find the inverse of radical functions? (IF TIME ALLOWS)
- How can we solve radical equations?
- How can we solve rational exponent equations?
- How can we use rational exponents to represent a power involving a radical?
- How can we use the properties of exponents to simplify products and quotients of radicals?
- How do the radical operations apply to nth roots?
- How do you complete the composite operation? How do you evaluate it?
- How do you determine if two functions are inverses? (IF TIME ALLOWS)
- What are the four algebraic operations as applied to functions and how can they be evaluated?
- What is an extraneous solution?

Enduring Understandings

- Evaluate and find compositions of functions.
- Evaluate expressions and solve equations containing nth roots and rational exponents.
- Perform arithmetic operations on two functions.
- Simplify radical expressions involving radicands with numerical expressions and/or variables.
- Solve equations containing radicals and rational exponents.
- Understand the relationship between inverse functions. (IF TIME ALLOWS)

Students Will Know

- How to find compositions of functions.
- How to find inverses of functions. (IF TIME ALLOWS)
- How to represent roots using rational exponents.
- How to solve radical equations.
- Properties of rational exponents and radicals.

Students Will Be Skilled At

- Determining whether a pair of functions are inverses. (IF TIME ALLOWS)
- Evaluating a composition of functions.
- Evaluating an arithmetic combination of two functions for a given input.
- Evaluating expressions with rational exponents.
- Explaining the meaning of a rational exponent.
- Explaining what inverses are. (IF TIME ALLOWS)
- Explaining what it means to perform an arithmetic operation on two functions.

- Explaining when radical expressions are in simplest form.
- Finding a composition of functions.
- Finding arithmetic combinations of two functions.
- Finding inverses of linear and nonlinear functions. (IF TIME ALLOWS)
- Identifying extraneous solutions of radical equations.
- Simplifying radical expressions with rational exponents.
- Simplifying variable expressions containing rational exponents and radicals.
- Solving equations using nth roots.
- Solving radical equations.
- Solving real-life problems involving radical equations.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

The following list is meant to create a day-to-day plan. Teachers are encouraged to slow down or condense days as appropriate to the student population in the class. Assessment(s) should be given when appropriate. (This unit includes the topic of inverses, which should only be included if time allows. Plan appropriately and talk with other teachers of this course to determine what can be covered and must be included in the final exam.)

- Begin by reminding students of vocabulary such as index and radicand. Also, recall that the opposite operation of the square root is raising to the second power. Extend this into the idea that a square root is a fraction (rational) exponent. Point out that an nth root is also a rational exponent and can follow the same opposite operation technique. Next remind students that when solving a square root, the solution must include plus/minus (advanced students can discuss the theory behind this concept). Expand this idea to any even integer for n. Have students explore odd n integers greater than one and if their solutions must include plus/minus. Apply the basic knowledge that a negative exponent creates a fraction. Practice evaluating nth roots and expressions with rational exponents.
- Have students recall as many exponents properties as possible, filling in the gaps in knowledge. Apply these properties to rational exponents. Have students recall how to algebraically simplify radicals and using operations on them, filling in the gaps in knowledge. Apply these rules to nth roots. Give time to simplifying variable expressions as radicands for nth roots.
- Students will likely need additional time to practice simplifying rational exponents from the skills above.
- Begin by having students recall again that a square root and square exponent are opposite operations and will cancel each other. Work this skill together when there are multiple steps to solve the equation. Expand this concept to nth root problems. Be sure to include examples of the variable on both sides so that students are aware that extraneous solutions may exist. Also include examples of nth roots on both sides of the equation, again reminding students to check for extraneous solutions.
- Students should remember that rational exponents are similar to radicals, and therefore have a similar solving method. Solving rational exponents equations on a separate day allows students to think of these processes differently by using all sorts of rational exponents in the equations. When needed, have students reduce a number with a rational exponent, keeping in mind when the solution must include plus/minus.
- Students will likely need additional time to practice both methods of solving radical equations and rational exponent equations.
- Have students recall their abilities to use the four algebraic operations on functions, filling in any knowledge gaps. This should be familiar from Algebra 1. Also, work to evaluate these functions after the operation is completed. Introduce that students can evaluate the individual functions first then use the indicated operation. Either method works!
- Introduce the concept of the composite operation. Slowly work on this operation alone, then layering in evaluating this operation.
- Students will likely need additional time to practice the composite operation specifically, but also evaluating all five operations.

At this point, the following inverse topics should only be included if all teachers of this course agree on the information to be covered. These topics should also be reflected appropriately in the final exams.

- Introduce the idea of an inverse by discussing the line of reflection y=x. Pointing out directions distinctly, discuss the difference of "solve y=f(x) for x" versus "find the inverse". Practice the process of each of these directions. Layer in the evaluation of each. Connect inverse function notation the inverse trigonometry notation from Geometry. Explore creating inverse functions for nonlinear functions too. (For advanced students, discuss the Horizontal Line Test to determine is a graphed inverse is a function or not.)
- Given two functions, use the composite operation to determine if the functions are inverses. Practice this skill carefully, as students are likely to make basic algebra mistakes.

Materials

Core instructional materials:Core Book List including Big Ideas Math Algebra 2 2022

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Teacher created activiites
- Teacher created notes

Suggested Strategies for Modifications

Possible accommodations/modification for Algebra 2