Radical Yet Rational, Part 2

Solving With Rational Exponents and Radicals

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Grade Level	10th – 11th Grade	**Time Frame**	80-90 minutes
Subject	Mathematics	**Duration**	2 class periods
Course	Algebra 2		

Essential Question

How do we use rational exponents and radicals to solve problems?

Summary

In this lesson, students will recall solving quadratic equations and rewriting radical expressions as expressions with rational exponents and vice versa. Students will learn how to solve equations with rational exponents and radicals. Then, students will apply this new knowledge to both mathematical and real-world problems. This is the second lesson of three in the "Radical Yet Rational" lesson series.

Snapshot

Engage

Students recall rewriting and simplifying expressions with rational exponents and radicals.

Explore

Students solve quadratic equations and apply what they know to equations with rational exponents.

Explain

Students complete guided notes with the class and formalize their understanding of how to solve equations with rational exponents using either radicals or rational exponents.

Extend

Students apply what they have learned to solve real-world problems.

Evaluate

Students select three equations from a Choice Board and demonstrate their understanding of how to solve equations with rational exponents using either radicals or rational exponents.

Standards

Oklahoma Academic Standards Mathematics (Algebra 2)

A2.N.1.3: Understand and apply the relationship between rational exponents to integer exponents and radicals to solve problems.
A2.A.2.5: Rewrite algebraic expressions involving radicals and rational exponents using the properties of exponents.

Attachments

- Choice Board—Radical Yet Rational Part 2 - Spanish.docx
- Choice Board—Radical Yet Rational Part 2 - Spanish.pdf
- Choice Board—Radical Yet Rational Part 2.docx
- Choice Board—Radical Yet Rational Part 2.pdf
- Guided Notes Teacher Guide and Model Notes—Radical Yet Rational Part 2.docx
- Guided Notes Teacher Guide and Model Notes—Radical Yet Rational Part 2.pdf
- Guided Notes—Radical Yet Rational Part 2.docx
- Guided Notes—Radical Yet Rational Part 2.pdf
- Guided-Notes-Radical-Yet-Rational-Part-2 - Spanish.docx
- Guided-Notes-Radical-Yet-Rational-Part-2 - Spanish.pdf
- Lesson Slides–Radical Yet Rational Part 2.pptx
- Real World Rational Exponents—Radical Yet Rational Part 2.docx
- Real World Rational Exponents—Radical Yet Rational Part 2.pdf
- Real-World-Rational-Exponents-Radical-Yet-Rational-Part-2 - Spanish.docx
- Real-World-Rational-Exponents-Radical-Yet-Rational-Part-2 - Spanish.pdf
- Search and Solve—Radical Yet Rational Part 2.docx
- Search and Solve—Radical Yet Rational Part 2.pdf
- Search-and-Solve-Radical-Yet-Rational-Part-2 - Spanish.docx
- Search-and-Solve-Radical-Yet-Rational-Part-2 - Spanish.pdf

Materials

- Guided Notes handout (attached; one per student; printed front only)
- Guided Notes (Teacher Guide and Model Notes) (attached; for teacher use)
- Desmos account
- Pencils
- Student devices with internet access

5 minutes

Engage

Teacher's Note: Desmos Activity Preparation

To use this Desmos Classroom activity, select the following link: "Radical Yet Rational, Part 2." Create an account or sign in under the "Activity Sessions" heading. After you log in, the green "Assign" dropdown button will be active. Click the arrow next to the word "Assign," then select "Single Session Code." After making some setting selections, select "Create Invitation Code" and give the session code to students. For more information about previewing and assigning a Desmos Classroom activity, go to https://k20center.ou.edu/externalapps/using-activities/.

For more detailed information about Desmos features and how-to tips, go to https://k20center.ou.edu/externalapps/desmos-home-page/.

To set up the activity's pacing for students, select "View Dashboard" (next to the session code). In the upper-left corner of your screen, select the icon above the word "Pacing." Desmos Classroom should then prompt you to select the first and last screens that you want students to see. When prompted to set a range, select screens 1 and 3. Select "Restrict to Screens 1–3" to confirm your selection. This allows students to access only screens 1–3 at this time. For more information about teacher pacing, go to https://k20center.ou.edu/externalapps/pacing-activities/.

Provide students with your session code. Then, have students go to student.desmos.com and enter the session code.

Teacher's Note: Sign-in Options

If students sign in with their Google or Desmos accounts, then their progress is saved, and they can resume the activity or view their work later. If students continue without signing in, they can complete the activity, but they must do so in one sitting. It is strongly recommended that students sign in; otherwise, they risk losing their work.

Introduce the lesson using **screens 1–2** of the Desmos activity. **Screen 1** displays the lesson's essential question. **Screen 2** identifies the lesson's learning objectives. Review each of these with students to the extent you feel necessary.

Ask students to find a partner or assign student pairs. Direct students' attention to **screen 3** and have them work in pairs to find the mistake in the simplifying process. Once students select the step that contains the error, they are asked to describe and correct the error in their own words. Use student responses to see which misconceptions remain from the previous lesson: "Radical Yet Rational, Part 1."

15 minutes

Explore

On the Desmos dashboard, click the orange plus sign twice to allow students to progress to **screens 4–5**. Have students work in pairs to solve the given equations.

On screen 4, students are asked to solve two quadratic equations, and they receive immediate feedback on each response. On screen 5, students are asked to attempt to solve a cubic equation and an equation with a rational exponent using what they know about solving quadratic equations with square roots.

Teacher's Note: Guiding the Lesson

Students are likely to succeed in solving the quadratic equations by using square roots, since that is a topic recently covered in Algebra 2. However, students may struggle with solving the cubic equation and the equation with the rational exponent. On screen 5, ask students to show all their thinking, written algebraically and/or in words. Alternatively, consider having students type their last line of work, as this is still valuable feedback.

To give students a push in the right direction, encourage students to apply what they know about solving quadratics and what they learned in the previous lesson about rewriting rational exponents. *Try not to give students the next steps or the answers.* At this point in the lesson, students should just determine what they already know and try to develop ideas for how this might apply to similar scenarios. These two questions will be worked out in full during the Explain portion of the lesson.

Ask students to share their thinking on how to solve the last two questions—what they know, what they are unsure of, etc. Remind the class it is okay that these problems are not completely solved yet, since this time is for students to determine what they already know.

As students share, take note of which misconceptions exist. Be sure to address these during the Explain portion of the lesson.

25 minutes

Explain

Teacher's Note: Pacing the Lesson

If you have a traditional 45-minute class period, this lesson must be paused and resumed the next day. For a smooth transition, consider pausing and resuming the lesson during the Explain portion. Finish the first class period after completing the first two examples from the Guided Notes handout, and send students home thinking about the third example. You can begin the next class period by having students share their ideas for the third example.

On the Desmos dashboard, click the orange plus sign to allow students to progress to **screen 6**. Ask students to set aside the Desmos activity.

Pass out the attached **Guided Notes** handout to each student. Complete the handout as a class. Have students add this handout to their math notebooks if that is a classroom norm.

Teacher Guide and Model Notes

To see guiding questions for each problem and an example of how to fill out the Guided Notes handout, refer to the attached **Guided Notes (Teacher Guide and Model Notes)** document. These notes are intended to show students how to solve equations using more than one method. As you go through the Guided Notes, consider reminding students that they need to write both methods in their notes for later reference. This way, when they are asked to practice on their own, they can choose their preferred method.

Teacher's Note: Communicating Expectations

Decide what you want students' later work to look like and be sure to inform students of your expectations. Do you expect students to demonstrate a specified method on certain problems but otherwise have choice? Do you expect students to have choice on every problem and not need to demonstrate mastery of both methods?

20 minutes

Extend

On the Desmos dashboard, click the orange "Stop" button to allow students to complete the Desmos activity at their own pace.

On **screens 7–8**, students apply what they know to two real-world scenarios: planetary motion and depreciation. Have students work in pairs to solve equations with rational exponents using what they have learned in this lesson.

The Desmos activity has a built-in self-check on screens 7–8, so students receive immediate feedback on their responses.

15 minutes

Evaluate

Use the Choice Board strategy to assess students' ability to solve equations with radicals and rational exponents using either method.

Screen 9 contains nine questions, which are divided into three columns (A, B, and C) and three rows (1, 2, and 3). Students are to select one question per column and one question per row, completing a total of three questions.

In column A, students must provide a written explanation of how to solve one of the equations containing rational exponents. In column B, students must algebraically solve one equation containing radicals. In column C, students must algebraically solve one equation containing rational exponents.

On **screen 10**, students indicate which questions they have chosen and type their final answers.

Teacher's Note: Guiding the Activity

Before beginning this activity, ensure that all students understand the directions. Consider giving students an example. If they choose the first question in column A—let's call it question 1A—they may not choose another question from row 1 or column A for credit. In other words, if they pick question 1A, they may not do question 1B, 1C, 2A, or 3A for credit. Then, let's say they choose the third question in column B—in this case, they *must* complete the second question in column C. In other words, they would complete questions 1A, 2C, and 3B.

Possible combinations are as follows:

1A–2B–3C 1B–2A–3C 1C–2A–3B

1A–2C–3B 1B–2C–3A 1C–2B–3A

The Desmos activity provides feedback to students who make improper selections. This is to prevent a student who misunderstood the directions from attempting to complete questions 2A, 2B, and 2C, for example.

Use student responses from screen 10 to see which misconceptions persist before moving on to the next lesson: "Radical Yet Rational, Part 3."

Teacher's Note: Desmos Feedback

Once students have completed the Desmos activity, use the dashboard to check for misunderstandings.

Remember that screens where students explain their thinking in words do not display a checkmark on the dashboard. These screens show either a dot, which indicates the non-text answers are correct and you just need to check the text responses, or an "x," which means the non-text answers are incorrect. For example, on screen 3, if a student selected Step 1, then the dashboard would show a dot, since that is the correct answer. If a student selected Step 2, the dashboard would show an "x," since Step 2 is not the correct answer.

The dashboard does display a checkmark on screen 4 for students who entered correct answers, since there is not a place to type words on that screen.

Resources

- ElisaRiva. (2017, February 13). Brain, mind, psychology [Illustration]. Pixabay. https://pixabay.com/illustrations/brain-mind-psychology-idea-drawing-2062057/
- K20 Center. (n.d.). Choice Boards. Strategies. https://learn.k20center.ou.edu/strategy/73
- K20 Center. (n.d.). Desmos Classroom. Tech tools. https://learn.k20center.ou.edu/tech-tool/1081