# Unit #05: Rational Expressions

Content Area: **Mathematics**
Course(s): **English I, Algebra II**
Time Period: **January**
Length: **5 weeks**
Status: **Published**

## Unit Overview

Simplifying, adding, subtracting, multiplying, and dividing rational expressions are all studied in this unit. Once these skills are learned, they are used to solve equations with fractional coefficients and fractional equations

## Enduring Understandings

Regardless of the method used, the answer will always come out the same.

There are three possible variations on solutions to a quadratic equation as it applies to the real number system and the complex number system.

## Essential Questions

- In what situations do we find it necessary to invent something?
- Why is using a radical important instead of an approximation in real-life situations?

## Lesson Titles/Objectives

- Add and subtract rational expressions.
- Multiply and divide rational expressions.
- Simplify complex fractions.
- Simplify expressions involving the exponent zero and negative integral exponents.
- Simplify quotients using the laws of exponents.
- Simplify rational algebraic expressions.
- Solve equations having fractional coefficients.
- Use scientific notation and significant digits.

## Standards

| | |
|---|---|
| MA.K-12.1 | Make sense of problems and persevere in solving them. |

| | |
|---|---|
| MA.K-12.2 | Reason abstractly and quantitatively. |
| MA.N-RN.B | Use properties of rational and irrational numbers. |
| MA.N-RN.B.3 | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. |
| MA.N-Q.A | Reason quantitatively and use units to solve problems. |
| MA.N-Q.A.1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |
| MA.N-Q.A.2 | Define appropriate quantities for the purpose of descriptive modeling. |
| MA.K-12.6 | Attend to precision. |
| MA.N-Q.A.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| MA.A-APR | Arithmetic with Polynomials and Rational Expressions |
| MA.A-APR.A | Perform arithmetic operations on polynomials |
| MA.A-APR.D.7 | Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. |

## Indicators

| | |
|---|---|
| | Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. |
| | Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. |
| MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. |
| | Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the |

| | |
|---|---|
| | meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. |
| MA.F-IF.C.8b | Use the properties of exponents to interpret expressions for exponential functions. |

## 21st Century Skills and Career Ready Practices

| | |
|---|---|
| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP6 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP9 | Model integrity, ethical leadership and effective management. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |
| CRP.K-12.CRP12 | Work productively in teams while using cultural global competence. |

## Inter-Disciplinary Connections

| | |
|---|---|
| LA.SL.11-12.1 | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. |
| LA.SL.11-12.1.C | Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. |
| LA.SL.11-12.4 | Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. |
| LA.L.11-12.6 | 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; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. |
| 12.9.3.ST-SM.1 | Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities. |
| 12.9.3.ST-SM.2 | Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems. |
| STEM.9-12.9.4.12.O.2 | Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities. |
| STEM.9-12.9.4.12.O.48 | Employ teamwork skills to achieve collective goals and use team members' talents effectively. |

## Warm-Up

- Adding and Subtracting Fractions with unlike denominator Warm ups (without a calculator)
- Kahoot!
- Sample PARCC item
- Sample SAT question
- Socrative

## Anticipatory Set

- Discussion on adding and subtracting basic fractions relates to rational expressions
- Discussion on multiplying and dividing basic fractions relates to rational expressions

## Instructional Strategies/Learning Activities

- Intro lesson on simplifying complex fractions
- Intro lesson on simplifying rational expressions
- Intro lesson on simplifying rational expressions by adding and subtracting
- Intro lesson on simplifying rational expressions by multiplying and dividing
- Intro lesson on solving fractional equations
- Notes will be taken using Power Point
- Review homework
- Review warm up
- Students will present solutions on the board
- Students will work independently on examples
- Students will work together on a worksheet

## Closure

- Discussion on today's lesson
- Exit ticket
- Journal Entry
- Kahoot!
- Oral Questioning
- Poll the class to self-analyze their comfort level of the lesson
- Socrative
- Vocab Review
- What did you learn today?

## Modifications-G&T, LES, Special Education

- Collaborate with after-school programs or clubs to extend learning opportunities.
- Engage students with a variety of Mathematical Practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Provide ELL students with multiple literacy strategies.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Structure the learning around explaining or solving a social or community-based issue.
- Use project-based math learning to connect math with observable phenomena.

## Formative Assessment

- Group Work
- Guided Practice
- Individual Practice
- Kahoot!
- Observation
- Oral Responses
- Simplifying Complex Fractions Quiz
- Simplifying Rational Expressions Quiz
- Smart Response
- Socrative
- Solving Fractional Equations Quiz
- Teacher Observation

## Summative Assessment

- Unit Test on Simplifying Rational Expressions using operations

## Resources & Technology

- chromebook
- Desmos online graphing calculator

- Graphing Calculator
- Kahoot!
- mathxlforschool.com
- PowerPoint
- Smart Board
- Socrative.com
- Teacher generated worksheets
- Textbook: Algebra and Trigonometry Structure and Method Book 2 (McDougal Littell)
- Video to introduce or demonstrate concepts