Unit 05: Rational Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 2**
Length: **2-3 weeks**
Status: **Published**

Brief Summary of Unit

Students will review the four operations with rational functions and utilize asymptotes and charts of values to graph them. Students will also explore techniques to solve rational equations and discuss extraneous solutions.

Standards

LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L5	Demonstrate understanding of word relationships and nuances in word meanings.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
MA.A-APR.D.6	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.
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.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to

	solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
	For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P

Transfer

- Simplifying and operating on fractions can be directly related to rational expressions.
- Solving fractions can be directly related to rational equations.
- Using the information in a rational's numerator and denominator, the graph of the function can be determined.

Essential Questions

- How are rational expressions simplified? How are these simplification techniques applied to solve rational equations and graph rational functions?

Essential Understandings

- A horizontal asymptote may be crossed by a rational function, but a rational function will never intersect a vertical asymptote.
- Rational equations contain extraneous solution(s) based on the domain of the individual rational functions involved.
- A common denominator is needed whenever two rational functions are added or subtracted.
- Distribution of a negative sign is important when subtracting two rational expressions.
- When dividing by a rational function one must multiply by its reciprocal.

Students Will Know

- The effect of asymptotes on graphs of rational functions.
- How to find a common denominator and its uses in addition and subtraction of rational expressions
- The process of dividing and multiplying rational expressions.
- The proper steps that are needed to solve rational equations.

Students Will Be Skilled At

- Applying basic algebraic operations on rational expressions.
- Identifying how asymptotes effect the graph of a rational function.
- Solving rational functions, with one rational on each side or two rationals on one side.

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

- Explain and apply asymptotic behavior.
- Graph rational functions.
- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Perform the four basic numerical operations on rational functions.
- Provide alternative means of assessments for certain students
- Students will explore rational functions through the graphing calculator and explain the need for vertical and horizontal asymptotes by examining a table of values. For example, students may graph y = and use the table feature of the graphing calculator to discover what happens to the y-values as we select numbers such as 1.9, 1.99, 1.999, etc. Also, as we select really large numbers students will discover why the function will get closer and closer to y = 0.
- Take tests and quizzes that will assess the essential questions, including pre-assessments.
- Teacher Observation
- Tests and quizzes that assess the essential questions

Learning Plan

- Graph rational functions and discuss asymptotes.
- Preview the essential questions and connect to learning throughout the unit.

- Simplify rational expressions using all four mathematical operations.
- Solve rational equations and discuss domain restrictions.
- The graphing calculator will be used in an exploratory manner to give an intuitive idea of a limit. This will be accomplished as described in the above performance task.

Materials

Core instructional materials: Core Book List including PreCalculus Enhanced with Graphing Utilities, Sullivan, Savvas

Supplemental materials: Khan Academy, Edia, and DeltaMath

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

Suggested Strategies for Modifications

Possible accommodations/modification for CP PreCalc & Trig