06 Rational Functions and Equations

Content Area: **TEMPLATE**
Course(s):
Time Period: **Full Year**
Length: **4 - 5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

This course is an extension of Algebra 1. Emphasis is upon the development of insights into the structure of algebra as a deductive process. The content includes function foundations, equations and inequalities, polynomial functions and equations, rational functions and equations, radical expressions and equations, exponential and logarithmic functions and equations, trigonometric functions and equations, introductory data analysis, and probability.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

- Solving equations is a process of reasoning
- Every rational function is expressed as a ratio of two polynomial functions

Essential Questions:

- Are two quantities inversely proportional if an increase in one corresponds to a decrease in the other?
- What kinds of asymptotes are possible for a rational function?
- Are a rational expression and its simplified form equivalent?

Enduring Understanding:

- A rational function is a ratio of polynomial functions. If a rational function is in simplified form and the polynomial in the denominator is not a constant, the graph of the rational function features asymptotic behavior.
- You can use much of what you know about multiplying and dividing fractions to multiply and divide rational expressions.
- To operate with rational expressions, you can use much of what you know about operating with fractions.
- When solving an equation involving rational expressions multiplying by the common denominator can result in extraneous solutions.

CONTENT AREA STANDARDS

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.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
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.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

CS.K-12.4.a	Extract common features from a set of interrelated processes or complex phenomena.
CS.K-12.4.c	Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.
CS.K-12.4.d	Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
PFL.9.1.K12.P.4	Demonstrate creativity and innovation.
PFL.9.1.K12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
PFL.9.1.K12.P.6	Model integrity, ethical leadership and effective management.
PFL.9.1.K12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
PFL.9.1.K12.P.9	Work productively in teams while using cultural/global competence.

STUDENT LEARNING TARGETS
Refer to the 'Declarative Knowledge' and 'Procedural Knowledge sections.

Declarative Knowledge
Students will understand that:

- Operations can be performed within the set of rational expressions and equations.
- The role of asymptotes in graphing rational functions.
- Rational expressions and equations can be written in specific forms (factored, standard, or other) for specific purposes (solving, identifying critical attributes, graphing).
- How to write equations to accurately represent an application.
- Rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression.

Procedural Knowledge

Students will be able to:

- Simplify rational expressions/functions
- Simplify complex fractions
- Demonstrate knowledge of factoring as it applies to combining rational functions
- Identify restrictions on domain/range of rational functions
- Identify nature of any discontinuities in graphs
- Determine coordinates of holes
- Determine equation of vertical asymptote
- Graph rational functions/equations expressed symbolically
- Create rational equations to solve various types of number problems (number relationships, distance/rate, work/rate)
- Analyze rational functions using different representations
- Give examples showing how extraneous solutions may arise when solving simple rational and radical equations in one variable
- Interpret key features of graphs and tables of a function that models a relationship between two quantities
- Rewrite simple rational expressions in different forms
- Sketch graphs showing key features given a verbal description of the relationship
- Add, subtract, multiply, and divide rational expressions
- Rewrite expressions involving radicals and rational exponents using the properties of exponents

EVIDENCE OF LEARNING

Refer to the 'Formative Assessments' and 'Summative Assessments' sections.

Formative Assessments

- Class Discussion
- Teacher observation
- Exit/Entrance Tickets
- Classwork
- Homework

Summative Assessments

- Quizzes
- Test
- Projects

RESOURCES (Instructional, Supplemental, Intervention Materials)

- Sullivan Algebra and Trigonometry Textbook (Chapter 5)
- Khan Academy
- Polynomial Reference
- Deltamath
- Illustrative Mathematics Tasks by standard
- Illustrative Mathematics Curriculum
- Desmos

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations such as curvature of rollercoasters, cost analysis, company evaluation, voltage, projectiles, and gas laws in chemistry. Examples can be found in topic specific textbook problems and digital resources.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.