Marietta City Schools

2023–2024 District Unit Planner

Honors Advanced Algebra: Concepts & Connections

Unit title	Unit 5 (DOE Unit 7): Exploring Rational Functions	**Unit duration (hours)**	

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

GA DoE Standards

Standards

AA.FGR.8: Analyze the behaviors of rational functions to model applicable, mathematical problems.

AA.FGR.8.1 Rewrite simple rational expressions in equivalent forms.

Fundamentals

• Students should be given opportunities to explore culturally relevant situations and problems that can be represented with rational expressions.

• Students should be able to rewrite rational expressions in various equivalent forms, based on the context of the problem, with the understanding that any factor of the numerator, over itself in the denominator, is equal to a factor of one

Example

- $\frac{x^2+4x+4}{x^2-4}=\frac{(x+2)(x+2)}{(x+2)(x-2)}=1*\frac{(x+2)}{(x-2)}=\frac{x+2}{x-2}$

AA.FGR.8.2 Add, subtract, multiply and divide rational expressions, including problems in context and express rational expressions in irreducible form.

Fundamentals

• Limit operations with rational expressions to those that would occur within the context of real-life problems, e.g., uniform motion, work, mixtures.

• Limit division to factorable expressions for which no remainder exists

Example

• Mary spent the first 120 miles of her road trip in traffic. When the traffic cleared, she was able to drive twice as fast for the remaining 300 miles. Write an expression that represents the total time she drove in terms of her known distance and unknown rates.

$$\frac{120}{x}+\frac{300}{2x}=\frac{120}{x}+\frac{150}{x}=\frac{270}{x}$$

AA.FGR.8.3 Graph rational functions, identifying key characteristics.

Fundamentals

• Students should be given graphs, or use technology to generate their own graphs, to identify characteristics of rational functions.
• Students should be able to use technology to graph and identify key features of rational functions, to include x and y-intercepts, roots of multiplicity, zeros, and solutions; domain, range, and intervals where the function is increasing, decreasing, positive, and/or negative (using inequality and interval notations); vertex, extreme value, and axis of symmetry; end behavior, using technology where appropriate.

AA.FGR.8.4 Solve simple rational equations in one variable, and give examples showing how extraneous solutions may arise.

Fundamentals

• Limit solving rational equations to those that would occur within the context of real-world problems, e.g., uniform motion, work, mixtures.
• Students should be able to check for extraneous solutions.

Strategies and Methods

• Students should be encouraged to use technology and tools to solve rational equations in order to enhance conceptual understanding.
• Less time should be devoted to the mechanics of solving rational equations and more time should be devoted to building students' capacity for interpreting rational functions within context.

AA.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

AA.MM.1.1 Explain applicable, mathematical problems using a mathematical model.

Fundamentals

• Students should be provided with opportunities to learn mathematics in the context of culturally relevant problems.
• Mathematically applicable problems are problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (i.e., model with mathematics).

AA.MM.1.2 Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.

Fundamentals

• Mathematically proficient students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.

AA.MM.1.3 Using abstract and quantitative reasoning, make decisions about information and data from a mathematical, applicable situation.

Fundamentals

• Students should be able to:
  o analyze functions, graphs, tables, and equations and make decisions about the real-life situations they describe based upon their understanding of mathematical functions.
  o analyze statistical results to decide the best course of action or approach to a problem.

Example

• Given a rectangle with length = (x – 2) and width = (2x + 3), a student could discover and articulate that the area = (x – 2)(2x + 3) = 2x2 – x – 6. From the student's understanding of parabolas, a student would know that the parabola that represents all possible areas of this rectangle opens upwards and that there is no maximum area possible for this rectangle.

AA.MM.1.4 Use various mathematical representations and structures to represent and solve real-life problems.

Fundamentals

• Students should be able to generate models, graphs, charts, and equations, to represent real-world phenomena in order to solve problems.
• Students should be provided opportunities to generate representations of real-world phenomena utilizing technology to show these phenomena and to solve problems.

Concepts/Skills to support mastery of standards

Vocabulary

Asymptote	Axis	Decreasing	End Behavior	Extraneous Solutions	Features
Horizontal Asymptote	Increasing	Irrational Number	Negative Exponent	Quadrant	Rational Expression
Rational Function	Reciprocal	Root	Slant Asymptote	Vertical Asymptote	Zero

Notation

Inequality and Interval Notation for Graphing Characteristics (Domain, Range, Intervals of Inc/Dec, and End Behavior)

Essential Questions

1. What are rational expressions, and how do they differ from rational numbers?
2. How can we simplify rational expressions and determine restrictions on their domain?
3. What methods can we use to add, subtract, multiply, and divide rational expressions?
4. What is the difference between rational expressions and rational equations?
5. How do we solve equations involving rational expressions, including those with extraneous solutions?
6. How can we apply rational expressions to real-world problems, such as rates, proportions, and mixtures?
7. What is the significance of asymptotes in rational functions, and how do we find and interpret them?
8. How do we graph rational functions, considering key features like intercepts, holes, and end behavior?
9. What transformations can we apply to the graph of a rational function, and how do they affect its behavior?
10. How do rational expressions and functions relate to other types of functions, such as linear and quadratic functions?

Assessment Tasks

List of common formative and summative assessments.

Formative Assessment(s):

Daily HW/CW assignments to check for understanding

TOTD for quick checks

Summative Assessment(s):

Rational expression quiz

Unit 7 test - Rational Functions

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
AA.FGR.8 • **AA.FGR.8.3** **AA.MM.1** • **AA.MM.1.1** • **AA.MM.1.4**	**Marbleslides: Rational Functions** In this learning plan, students will work with graphing applications like Desmos.com to transform rational functions and make marbles go through specific points. The plan emphasizes perseverance, critical thinking, and reasoning skills as students graph and analyze the key characteristics of rational functions. Common misconceptions are addressed, and students are encouraged to seek help and apply feedback. The plan aims to develop students' mathematical modeling abilities and their application of mathematics to real-life situations. **Learning Goal(s)** 1. I can graph rational functions. 2. I can identify key characteristics. 3. I can use my knowledge of the graphs of rational functions to translate or change the graphs using a graphing application.	Students will be able to work at their own pace in collaborative groups where additional scaffolding is available as needed. Challenge slides provide extensions for students working at a faster pace.

Content Resources

Textbook Correlation: enVision A|G|A - Algebra 2

AA.FGR.8.1 - Lessons 4-3, 4-4
AA.FGR.8.2 - Lessons 4-3, 4-4
AA.FGR.8.3 - Lessons 4-1, 4-2
AA.FGR.8.4 - Lessons 4-5, Topic 4-Mathematical Modeling in 3 Acts

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Desmos.com