

Lesson Plan: Exploring Rational Functions - Quadratic over Linear

Objective:

- To understand the concept and characteristics of rational functions with a quadratic numerator and linear denominator.
- To analyze the effects of changing coefficients on the graph of these functions, identify asymptotes, x-intercepts, and explore removable discontinuities.

Time: 60 Minutes

Part 1: Introduction to Rational Functions (10 minutes)

- Brief Lecture: Define rational functions, with a focus on those that are quadratic over linear. Explain key terms such as domain, range, asymptotes (vertical, horizontal, oblique), and removable discontinuity.
- Inquiry-Based Questions: Pose factual inquiry questions to engage students and assess prior knowledge.

Part 2: Characteristics of Rational Functions (15 minutes)

1. Mini-Lecture on Asymptotes and Intercepts:

- Explain the significance of vertical asymptotes, horizontal asymptotes, and x-intercepts in understanding the behavior of rational functions.

2. Interactive Demonstration:

- Use graphing software to demonstrate how variations in coefficients affect the graph's shape, emphasizing the behavior near asymptotes and at intercepts.

Part 3: Mini-Investigation: Coefficients and Graph Behavior (20 minutes)

- Students will work in small groups using graphing calculators or software to explore how changing coefficients in the quadratic numerator and linear denominator affects the graph.

They should:

1. Experiment with different values for coefficients and observe graph shape changes.
2. Modify linear denominator coefficients and note the impact.
3. Identify and discuss the vertical asymptote's relationship with the denominator's coefficients.
4. Investigate the function's behavior around the vertical asymptote.
5. Determine x-intercepts by setting the numerator to zero.
6. Examine the effect of a real root in the numerator on the graph.
7. Challenge: Create conditions for a removable discontinuity.

Part 4: Group Presentations and Class Discussion (10 minutes)

- Each group presents their findings, focusing on the effects of coefficient changes, asymptote identification, and notable graph behaviors.
- Discuss conceptual and debatable inquiry questions as a class, encouraging students to link rational functions to broader mathematical and real-world contexts.

Part 5: Wrap-Up and Homework Assignment (5 minutes)

- Summary: Recap the main findings and insights gained during the lesson.

- Homework: Assign problems involving rational functions, including finding asymptotes, intercepts, and analyzing graph behavior. Encourage students to use graphing tools for exploration.

Materials Needed:

- Presentation slides/whiteboard for lecture.
- Graphing calculators or computer software for graph exploration.
- Printed handouts with mini-investigation instructions and inquiry questions.

Assessment:

- Participation in group activities and class discussion.
- Accuracy and insightfulness in mini-investigation findings and presentations.
- Completion and understanding demonstrated in the homework assignment.

Additional Notes:

- Encourage students to think critically about how rational functions connect to real-world phenomena, such as rates of change in physics or economics.
- Be prepared to guide students in using graphing technology, facilitating their exploration and discovery process.