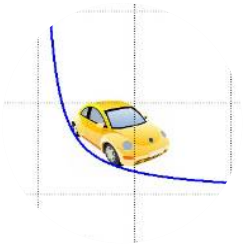

Driving Rationally

Introduction to Rational Functions and Asymptotes

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Published by *K20 Center*

Grade Level	11th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	120 minutes
Course	Algebra 2		

Essential Question

How is a rational function different than other functions?

Summary

Students will examine a problem about driving speeds to investigate a rational function.

Snapshot

Engage

Students work in groups to model a real-life situation about a road trip.

Explore

Students will write a function to describe a real life scenario.

Explain

Students will explain how the function they wrote is different than previously studied functions and will be introduced to the definition of rational function.

Extend

Students will explore the behavior of the function they wrote near the vertical asymptote and will be introduced to the different types of asymptotes.

Evaluate

Students will consider other phenomena and determine if the phenomena can be described using a rational function.

Standards

Oklahoma Academic Standards Mathematics (Algebra 2)

A2.F.1.6: Graph a rational function and identify the domain (including holes), range, x- and y-intercepts, vertical and horizontal asymptotes, using various methods and tools that may include a graphing calculator or other appropriate technology (excluding slant or oblique asymptotes).

Attachments

- Driving Rationally-Extend - Spanish.docx
- Driving Rationally-Extend - Spanish.pdf
- Driving Rationally-Extend.docx
- Driving Rationally-Extend.pdf
- Driving Rationally.pdf
- Driving Rationally.pptx

Materials

- PowerPoint (attached)
- Hand out For Extension (attached)

Engage

Display the first slide of the attached PowerPoint for students. Place students into groups of two or three to work on the displayed problem.

Teacher's Note

It's a common mistake for students to think the solution is 40 miles per hour (mph), since the average of 40 mph and 60 mph is 50 mph. Should students make this mistake, walk them through the process of finding the average speed, assuming Antonia does drive 40 mph for the second 100 miles. In this case, she would have taken 1 2/3 hours to drive the first 100 miles and would take 2 1/2 hours to drive the second 100 miles. That means she took 4 1/6 hours to drive 200 miles, an average of 48 mph, not the 50 mph we want.

As groups work, travel between them to get a sense of the methods groups are devising to find a solution. After most groups seem to have reached the solution (42 6/7 miles per hour), call on several groups to share their methods for determining the solution. Be sure to call on the groups with the less efficient methods first, then work toward groups with more efficient methods.

Explore

Once the class has reached a consensus about the solution and has seen several methods, move on to the next slide, which asks students to repeat the problem using different values, finally using variables for the different quantities in the problem. Repeat the procedure from the Engage section, this time having students share only the final function they wrote. Be sure the class comes to a consensus about what this function should be, and ensure they simplify the function as much as possible. This will help students to see that their functions are equivalent, even if they initially wrote the functions in different ways.

Sample Solution 1

Students know that the average speed needs to be 50. Since speed equals distance divided by time (and the distance is 200 miles) only the time remains to be determined. For the first 100 miles, the time will be 100/x (where x is the speed during the first 100 miles). For the second half, the time will be 100 / y (where y is the speed during the first 100 miles). So the total time is 100 / x + 100 / y. We can simplify to make this 100 (x + y) / xy. Then, the expression for the average speed on the trip becomes 200 / (100 (x + y) / xy)) which simplifies to 2xy / (x + y). The average speed needs to be 50, so 2xy / (x + y) = 50. This can then be solved for y.

Sample Solution 2

Since the average speed needs to be 50, and the total distance is 200, the total trip should take 4 hours since 200 / 4 = 50. The first 100 miles will take 100 / x hours, and the second hundred miles will take 100 / y hours, so the total time is 100 / x + 100 / y. Therefore, 100 / x + 100 / y = 4. This equations can be solved for y.

Explain

Move on to the next slide. Have students work in their groups to answer these questions. After several minutes, have students share their responses. Explain to students that they have just described several properties of rational functions. Then forward to the next slide to show the definition of a rational function. Discuss how the function they have examined today fits this definition of a rational function. Students should copy the definition into their notes.

Extend

Distribute the "Driving Rationally-Extend" worksheet (located under Attachments) to students. Students may complete this worksheet in groups in class or at home for homework. Once students have completed the worksheet, review their answers with them. Tell students that these questions asked them to examine values near an asymptote of the function y = 25x / (x - 25). Ask students to make a hypothesis about what the definition of asymptote may be. Then, return to slides five and six to provide students with the definition of asymptotes and some examples. Students should copy these into their notes.

Evaluate

Forward to slide nine. Have students work in groups to complete the question presented. Groups should write their responses, supporting their claims by explaining why the phenomena may have asymptotes (or not), and create a sketch of the phenomena. Evaluate students' ability to conceptualize the phenomena described.

End class by having students create predictions about when rational functions will have certain types of asymptotes. This will foreshadow future lessons about asymptotes.

Resources

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