Multiplying and Dividing Rational Expressions

Author: Stacy Eichner & Heather McNeill

Date: 02/12/2009

Length of lesson: 52 minutes

Grade/Level: 8th grade, Honors Algebra I

Source of the lesson: Holt Algebra I Florida Teacher's Edition textbook, 2004, Lesson 11.4 **Appropriateness for Middle School Students:** Students are interested in finding simpler ways to evaluate problems. To discover this, students will attempt problems on their own then share answers in front of the class. This offers students time to figure it out on their own, then gives students an alternate way they could have solved the problem. They hear and see the problem being worked out by a fellow student.

Concepts: Students will examine how multiple fractions with rational expressions in then can be solved with different operations. This will allow students to simplify the fractions through comparing similar expressions but still noticing the restrictions in equation.

Students will be able to:

- Simplify rational expressions
- Interpret rational expressions and solve the equation
- Understand the difference between multiplying and dividing different rational expressions

Sunshine State Standards Addressed:

MA.912.A.5.1	Simplify algebraic ratios.
MA.912.A.5.2	Rational expressions and equations - simplify rational expressions and solve rational equations using what has been learned about factoring polynomials.
MA.912.A.5.4	Solve algebraic proportions.
MA.912.A.5.5	Solve rational equations.

Safety: There are no significant concerns.

Materials List and Advanced Preparations:

- Each student needs notebook paper and pencil
- A copy of the post-test for each student (30 copies)
- A whiteboard marker/chalk for written examples

Engagement		Time: 10 minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses
		Potential Misconceptions
Write five problems on the board for students to individually evaluate on paper. This will serve as their warm- up and their Pre-test.	$\frac{7}{12} \cdot \frac{1}{2} = \frac{7}{24}$ $\frac{9}{10} \cdot \frac{3}{4} = \frac{27}{40}$	Students may think they need to find a common denominator.

$\frac{3}{8} \cdot \frac{2}{3} = \frac{1}{4}$ $\frac{2}{3} \cdot \frac{1}{2} = \frac{1}{3}$ $\frac{2}{5} \cdot \frac{5}{6} \cdot \frac{4}{5} = \frac{4}{15}$	
Okay, so what are some helpful techniques that we could use?	Students may not recognize that reducing simplifies the problem. Students may not be aware that they do not need a common denominator when multiplying.
	Time: 7 minutes
Probing/Eliciting Questions	Student Responses Potential Misconceptions
$\frac{x+4}{x-7} \cdot \frac{x-7}{x-3} = \frac{x-4}{x-3}$ $\frac{3}{x-1} \cdot \frac{6}{x} = \frac{18}{x(x-1)}$ $\frac{x+5}{4x^2} \cdot \frac{x-3}{x+5} \cdot \frac{2x}{3} = \frac{x-3}{6x}$	Students may not check restrictions at beginning and end of problem.
	Time: 15 minutes
Probing/Eliciting Questions	Student Responses Potential Misconceptions
$\frac{x+4}{x-7} \cdot \frac{x-7}{x-3} = \frac{x-4}{x-3}$	Students may not understand the inverting of the divisor.
$\frac{3}{x-1} \cdot \frac{6}{x} = \frac{18}{x(x-1)}$	denominator.
$\frac{x+5}{4x^2} \cdot \frac{x-3}{x+5} \cdot \frac{2x}{3} = \frac{x-3}{6x}$ $\frac{x-4}{x} \div \frac{x-4}{x+5} = \frac{x+5}{x}$ *point out that the x terms do not	
	$\frac{3}{8} \cdot \frac{2}{3} = \frac{1}{4}$ $\frac{2}{3} \cdot \frac{1}{2} = \frac{1}{3}$ $\frac{2}{5} \cdot \frac{5}{6} \cdot \frac{4}{5} = \frac{4}{15}$ Okay, so what are some helpful techniques that we could use? Okay, so what are some helpful techniques that we could use? Probing/Eliciting Questions $\frac{x+4}{x-7} \cdot \frac{x-7}{x-3} = \frac{x-4}{x-3}$ $\frac{3}{x-1} \cdot \frac{6}{x} = \frac{18}{x(x-1)}$ $\frac{x+5}{4x^2} \cdot \frac{x-3}{x+5} \cdot \frac{2x}{3} = \frac{x-3}{6x}$ Probing/Eliciting Questions $\frac{x+4}{x-7} \cdot \frac{x-7}{x-3} = \frac{x-4}{x-3}$ $\frac{3}{x-1} \cdot \frac{6}{x} = \frac{18}{x(x-1)}$ $\frac{3}{x-1} \cdot \frac{6}{x} = \frac{18}{x(x-1)}$ $\frac{x+5}{4x^2} \cdot \frac{x-3}{x+5} \cdot \frac{2x}{3} = \frac{x-3}{6x}$ $\frac{x-4}{x^2} \div \frac{x-3}{x+5} \cdot \frac{2x}{3} = \frac{x-3}{6x}$ *point out that the x terms do not divide to one in the answer.

the fraction. *Be sure to catch all restrictions in numerator and denominator, $x \neq 4$ because the divisor $\frac{x-4}{x+5}$ is zero when $x = 2$.	$\frac{6}{p} \div \frac{3}{p^2} = 2p$	
Elaboration		Time: 10 minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses Potential Misconceptions
Write four problems on board and have students work individually on paper, then choose four students to solve it on the board.	*Might want to factor if it helps to simplify. $\frac{x+y}{5x} \cdot \frac{3x}{x^2 - y^2} = \frac{3}{5(x-y)}$ $\frac{n+4}{16} \cdot \frac{12}{n^2 - 16} = \frac{3}{4(n-16)}$ $\frac{t^2 - 9}{6} \div \frac{3 - t}{9} = \frac{-3(t+3)}{2}$ $\frac{x-1}{x-3} \div \frac{x^2 - x}{x^2 - 9} = \frac{x+3}{x}$	Students may not recognize the factoring opportunities.
Evaluation		Time: 10 minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses Potential Misconceptions
Pass out quiz (post-evaluation) **Quiz is posted below		

Practice with Rational Expressions

Name_____

Simplify the following expressions and state any restrictions.

1.)
$$\frac{x-2}{x+3} \cdot \frac{x+3}{x-5} =$$

2.) $\frac{x}{x+5} \cdot \frac{x^2-25}{2x} =$
3.) $\frac{3m^5}{4n^2} \cdot \frac{12n}{15m^2} =$
4.) $\frac{x-9}{x-3} \div \frac{x+3}{x-3} =$
5.) $\frac{x+5}{x-3} \div \frac{1}{(x-3)} =$
6.) $\frac{18p^3}{5q^2} \div \frac{9p}{q^3} =$
7. restriction(s):
answer:
7. restriction(s):
answer:
8. restriction(s):
answer:
9. restriction(s):
9. restriction(s):
9. answer:
9. answer:
9. restriction(s):
9. answer:
9. restriction(s):
9. answer:
9. restriction(s):
9. answer:
9. answer: