

5E Lesson Plan Template

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Course Description: Algebra 2 / Grades 10 & 11 / Regular

Concepts: Multiplying and Dividing Rational Expressions

Objectives:

SWBAT simplify rational expressions

SWBAT multiply rational expressions

SWBAT divide rational expressions

Texas Essential Knowledge and Skills:

Number and algebraic methods. The student applies mathematical processes to simplify and perform operations on expressions and to solve equations. The student is expected to:

F. Determine the sum, difference, product, and quotient of rational expressions with integral exponents of degree one and of degree two;

English Language Proficiency Standards (learning strategies, listening, speaking, reading or writing)

3. **Cross-curricular second language acquisition/speaking.** The ELL speaks in a variety of modes for a variety of purposes with an awareness of different language registers (formal/informal) using vocabulary with increasing fluency and accuracy in language arts and all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in speaking. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:

D. Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency;

E. Share information in cooperative learning interactions;

Materials List and Advanced Preparations:

28 sheets of white printer paper
16 pairs of scissors (share between 2 students)
28 trasketball worksheet
Small basketball
Trash bin
40 index cards with multiplying and dividing rational expressions on them
Pack of green and yellow dots (stickers)

Safety:

Safely cut paper
Do not throw Basketball at students

Accommodations for Learners with Special Needs (ELL, Special Ed, 504, GT, etc.):

- If students can't see the board, allow students to move to the front
- Allow for students with leaning disabilities to take mire time answering questions
- Walk around and give special instruction to students with special needs when working in groups.
- Give students with hearing disabilities written instructions and reinforce instructions after delivering message to the class to them personally, if needed.

ENGAGEMENT		Time: 20 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Create the Foldable: Students will each be handed a white sheet or paper. Fold in half, (hotdog style). Lay out landscape. Fold left and right side into the middle, sides should be even. There should now be 3 columns. On the left column cut along the middle fold and stop at the column crease. Do the same for the right side. *see picture attached for details*</p>		
<p>Have the students write $\frac{12}{9}$ at the TOP LEFT FLAP half of the paper. Ask what it simplifies to. Have the students break apart the fraction by multiplying smaller factors together. Show that you can cross out common numbers on top and bottom by crossing out 3 and 3. The answer is $\frac{4}{3}$, which is correct. Then change 3 on top and one 3 on bottom to x. Have them derive</p> $\frac{ax}{bx} = \frac{a}{b}$ <p>as a simplifying rule.</p>	<p>What does $\frac{12}{9}$ simplify to?</p> <p>What number can you multiply the fraction by to get the $\frac{12}{9}$ again?</p> <p>What can we cross out? Change both 3's an x. What do I do with the x's now?</p>	$\frac{4}{3}$ $\frac{3 * 4}{3 * 3} = \frac{3 * 2 * 2}{3 * 3}$ <p>We can cross out 3's. It will be the same, cross out the x's</p>
<p>TOP RIGHT FLAP: Use the same process to but this time break up $\frac{12}{9}$ into $\frac{3*2^2}{3^2}$ Change 3 to x again: $\frac{4x}{x^2}$</p>	<p>How can we rewrite $(3*3)$?</p> <p>What happens when we make the 3's into x's?</p>	<p>3^2, 3 squared</p> <p>The top 3 will become x The bottom $3*3$ will become x^2</p>

<p>Show we can cross out the top x which leaves one bottom x. Have them derive</p> $\frac{x^a}{x^b} = x^{a-b}$ <p>as a dividing rule</p>		
<p>BOTTOM RIGHT FLAP: Write $\frac{12}{9}$ again but ask them to find the simplest sum for the numerator and denominator.</p> <p>Cancel the 3's from the numerator and denominator.</p> <p>Change the 3's again to x's. Cancel the same way as above.</p> <p>Students should notice that when something is added in the numerator, we cannot simplify the fraction correctly.</p> <p>Describe the numerator (factors that containing addition or subtraction) as a FAMILY. “Don’t break up families!”</p> <p>Students will derive</p> $\frac{a + bx}{cx}$ <p>DO NOT cross out x's</p>	<p>What numbers add to $\frac{12}{9}$ in simplest form?</p> <p>If we cross out all the 3's, what do we get? Does this agree or disagree with the above?</p> <p>If we change the 3's to x's what do we get?</p> <p>Can we simplify x's? Why/why not?</p>	$\frac{3+3+3+3}{3+3+3}$ $\frac{3 + 3 + 3 + 3}{3 + 3 + 3} = 3$ <p>This is not the same result as above.</p> $\frac{6 + x + x}{x + x + x} = \frac{6 + 2x}{3x}$ <p>NO, because they are added together and are a family.</p>
<p>BOTTOM LEFT FLAP: Break up $\frac{12}{9} =$</p> $\frac{4 + 4 + 4}{3 + 3 + 3}$ <p>Tell students to factor out a common number</p>	<p>What can we factor out of both of these expressions?</p> <p>What does that leave us?</p>	<p>4 out of top 3 out of bottom</p> $\frac{4(1 + 1 + 1)}{3(1 + 1 + 1)}$

<p>Students will derive</p> $\frac{a(x+c)}{b(x+c)} = \frac{a}{b}$	<p>What is the common factor of this fraction? What do we get when we cross out factors? What does this mean?</p>	<p>(1+1+1) 4/3, the same correct answer as before We can cross out similar factors.</p>
<p>Evaluation/Decision Point Assessment</p>	<p>Assessment</p>	<p>Student Outcomes</p>
<p>Students will explain the simplifying rules correctly</p>	<p>Do students understand the simplification rules</p>	<p>Students can simplify fractions</p>

EXPLORATION		Time: 30 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Teacher will pass out "Trasketball Worksheet".</p> <p>While the teacher is handing out the worksheet, students will group themselves in groups of 4.</p> <p>Tell students to assign a runner and a scribe (job description explained below)</p> <p>Teacher will explain: "Up at my desk I have index cards with multiplying and dividing expressions on them. Each team will designate a <i>runner and scribe</i>.</p> <p>The Runner will come up and randomly pick one index card at a time to bring back to his/her group to solve.</p> <p>Each card has a "Play Number" on the back. Fill in the "Play Number" on your WS.</p> <p>The team will work together and solve the problems on the index card.</p> <p>After the team has solved the problem, the Scribe will copy the answers on the index card where indicated.</p> <p>Then the runner will bring the card to me and I will check for correct answers.</p> <p>If the answers are correct, I will give you green stickers, one for each member of the group.</p>	<p>How many people in a group?</p> <p>Who is the scribe? Who is the runner?</p> <p>What does the scribe do?</p> <p>What does the Runner do?</p> <p>Who is the only person who is getting up?</p> <p>What should you do first when your runner brings the index card to your table?</p> <p>Where do you put the stickers?</p>	<p>Four</p> <p>*Students should raise hands to indicate who is who*</p> <p>Writes down the final answers on the index cards</p> <p>Takes the index cards to the teacher</p> <p>The runner</p> <p>Write the Play number in indicated spot</p> <p>On the triangle before Play number</p>

<p>If the answer is incorrect, I will give you yellow dots”.</p> <p>Students will place the dots on the > arrow before the “Play number” so they know which answer is correct and which ones need to be reviewed.</p> <p><i>(If answer is wrong, we will come back to them later, students should not try and fix solutions right now)</i></p> <p>Teacher should put aside incorrect answers in a pile for later.</p> <p>Students will pick up dot stickers and then pick a new card from the pile and repeat process until time runs out.</p> <p>After time is up, teacher will come around and count up each groups number of green dots, (correct answers)</p> <p>On the board, teacher will write each team name and tally the points.</p> <p>*At the end of class* (20 min before end of class, time not included in explore) Students will regroup into their teams. One student in each group should take their “Trashketball WS” out in the hall (the one with green or yellow dots)</p> <p>Trashketball: Class will go to the hallway to play “Trashketball”. An empty trash bill will be put in the middle of the hallway.</p>	<p>What should you do if the answer is wrong?</p>	<p>Place a yellow dot on the ></p> <p>We will come back to this later. Solve the next problem.</p>
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<p>Teacher will explain that each group should count the number of green dots they received on their paper. This will be the number of shots they will take.</p> <p>Each point will be worth 2. One group at a time will play. Teacher will keep score on paper how many points each team has.</p> <p>Teams will then count up how many yellow dots they have.</p> <p>During the explain (which is written later in the lesson) the students should have written down the correct way to solve the problem. They must show that they solved the problem correctly and then will be able to shoot from farther back for one point.</p> <p>Winner is the team with the most points at the end! *Teacher may award prize/award if they wish*</p>		
Evaluation/Decision Point Assessment	Assessment	Student Outcomes
Students have completed activity game	Do students understand multiplying and dividing rational expressions, or do they need more practice?	Students will find where their problems are and will be able to fix them in the next step

EXPLANATION		Time: 15 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Teacher will go over any missed questions in front of the class and ask the students to help solve.</p> <p>(Also: if not enough questions were missed, teacher can solve unsolved cards from the index cards left over for the game)</p> <p>Teacher will write the problem on the board. He/she will ask the class to copy down the problem on the "Game play Review" Worksheet.</p> <p>Teacher will write down the incorrect answer on the board. She will then ask the class where the mistake was made.</p> <p>Then, the students will tell the teacher how to solve it and ask if students want to show the solution on the board.</p> <p>The whole class should write down all the problems on the board, even if they didn't miss them.</p>	<p>Where are we writing down the questions?</p> <p>List the steps to multiply.</p> <p>How can we simplify?</p> <p>What are the "families" multiplied together called [(x+4)(x+2)]</p> <p>What is important to know when talking about factors</p> <p>What do you do with exponents of the same variable? (x²/x)</p> <p>What do you do when dividing?</p>	<p>On the Game Play Review WS</p> <ol style="list-style-type: none"> 1. simplify fractions 2. multiply across <p>Individual fractions (up and down) Diagonal numbers (top left, bottom right) Factor out numbers Factor out variables</p> <p>Factors</p> <p>Do not cross out variable inside families (x+4)/x Cant cross out x</p> <p>Subtract exponents</p> <p>KCF (keep/change/flip) Flip the fraction Then carry out multiplication</p>
Evaluation/Decision Point Assessment	Assessment	Student Outcomes
<p>Students can successfully multiply and divide rational expressions on board and explain where their pervious mistakes were made</p>	<p>Can students multiply and divide rational expressions</p>	<p>Students can multiply and divide rational expressions</p>

ELABORATION		Time: 20 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Teacher will draw a house on the board. (square bottom, triangle top) (one 2d model, one 3d model) (both will have the same length and width measurements) The students will be asked for the Area and Volume formula.</p> <p>Teacher will label each side with a rational expression Students will be asked to work with their shoulder partner to find the Area of rectangle. Then Volume of the bottom of house (box)</p> <p>Have students find Area and Volume of top (triangle/pyramid)</p> <p>Then teacher will say we are interested in the area and volume of the WHOLE house.</p> <p>Refer to the previous lesson (adding and subtracting rational expressions) Ask class of an overview of the rules for adding/subtracting expressions</p> <p>Teacher will then describe the situation: "A college student and her 3 friends are going to be moving into the house. One of the friends has a lot of posters and want to know how much wall space she will have on the front wall if the room is cut into 4 equal pieces. How much wall space will she have?"</p>	<p>Box Area formula? Volume formula?</p> <p>Triangle Area formula? Volume formula?</p> <p>How will we find the area/volume of the whole house?</p> <p>What is important when adding fractions?</p> <p>What is the first step to solving this question?</p> <p>How would you find the area for each student?</p> <p>How is 4 represented as a fraction?</p> <p>Write the expression of the new area for one student.</p> <p>How can you make this division problem into a multiplication problem?</p>	<p>Box $A = l * w$ $V = L * w * h$</p> <p>Triangle $A = \frac{1}{2}bh$ $V = \frac{1}{3}bh$</p> <p>Add both areas Add both volumes <i>Multiply answers</i></p> <p>Must have an LCD to add</p> <p>Find and LCD</p> <p>Divide area by 4</p> <p>$\frac{4}{1}$</p> <p>$\frac{Area}{4}$</p> <p>$(Area) * \frac{1}{4}$</p>

Evaluation/Decision Point Assessment	Assessment	Student Outcomes
Students have completed exercise correctly	Can students apply multiplying and dividing methods to real world situations? Do students remember adding and subtracting fraction rules?	Students can apply adding/subtracting/multiplying/dividing rational expressions to real world applications

EVALUATION		Time: 5 Minutes Trashketball (20 min at end of class)
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
Teacher will hand out the homework page. Teacher will randomly select 3 problems for students to solve on their own. These problems will not be done for homework. Students will hand in a separate sheet of paper before they leave with their answers on it.	Which questions are you solving? Where are you solving these problems Which questions are for homework?	(name the 3 questions teacher chooses) On a separate sheet of paper All the questions but the ones due for class
Play Trashketball (20 min) (see explore for details)		

① $\frac{ax}{bx} = \frac{a}{b}$

② $\frac{x^a}{x^b} = x^{a-b}$

Simplifying
Fraction
Expressions

(~~○~~) (~~○~~)

③ $\frac{a(x+c)}{b(x+c)} = \frac{a}{b}$

④ $\frac{(x+a)}{(x+b)}$

STOP

Multiplying

$$\frac{12}{9} = \frac{4}{3}$$

$$\frac{3 \cdot 4}{3 \cdot 3} = \frac{\cancel{3} \cdot 2 \cdot 2}{3 \cdot \cancel{3}} = \frac{4}{3}$$

change 3 to x

$$\frac{4x}{3x} = \frac{4}{3}$$

* cross out x's w/ same power

NO families,
no problem

no families,
no problem,

$$\frac{12}{9} = \frac{3 \cdot 4}{3 \cdot 3} = \frac{3 \cdot 2 \cdot 2}{3 \cdot 3}$$
$$\Rightarrow \frac{3^1 \cdot 2^2}{3^2 \cdot 1} = \frac{2^2}{3} = \frac{4}{3}$$

change 3 to x

$$\frac{4x}{x^2} = \frac{4}{x} = \frac{4}{3} \quad x=3$$

* subtract exponents of x

Simplifying Fraction Expressions

(♀)(♂)

Families

$$\frac{12}{9} = \frac{(4+4+4)}{3+3+3}$$

$$\frac{4(1+1+1)}{3(1+1+1)} = \frac{4}{3}$$

*

can simplify families when they are exactly the same

Families must be twins to cancel

DO NOT KILL Kittens!



Dont brk up families!

$$\frac{12}{9} = \frac{(4+4)}{3+3+3} = \frac{\cancel{3}+3+\cancel{3}+3}{\cancel{3}+3+3}$$

$$\frac{4}{3} \neq 3$$

DO NOT cancel exponents in families!

MULTIPLYING

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

DIVIDING

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

RATIONAL EXPRESSIONS

MULTIPLYING

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

DIVIDING

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____

▶ Play ____: _____