MSMC

The Rational Number

Unit Plan

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Unit Plan- The Rational Expression — Fall 2011

Rationale:

Throughout all of the high school mathematics courses, certain algebra skills are essential to being successful, and universal to each course. Although rational numbers and the use of rational expressions is taught as a new concept in Algebra 2/ Trig, it is something the students have unknowingly used in previous math courses. In algebra, the students have solved for variables that were representations of rational numbers, and learned various techniques to do so. In addition, Geometry focuses on two-dimensional shapes; however rational numbers and rational expressions have been used to represent the lengths of the side of a figure, or the area it occupies. Now, in Algebra 2/Trig the students are made aware of these rational numbers, learn their characteristics, and differentiate them from irrational, imaginary, and other types of numbers that exist in mathematics.

Although most of the people in this world are unaware of it, they use rational numbers on a daily basis. Rational expressions can be used to represent any measurement, value, or numerical value in our world. From the dimensions of a room, to the volts in a circuit, rational numbers are just a small representation of mathematics' role in our world.

New York State does not reference the use of rational numbers many times in their published standards however, the curriculum for the majority of the course is built upon the foundation provided in the Rational Expressions unit. From this point, the students go onto learning about other types of numbers such as Irrational and Imaginary Numbers. Without the basic understanding of the type of numbers they have been using since they learned to count, they cannot move onto study various numbers in our number system.

Within this unit, the students begin by learning what rational numbers are, and how they are represented using Algebra. The basic skill of representing them as a fraction and reducing them to simplest form is introduced first because these skills will be necessary to perform mathematical operations. Then the students will learn the rules, and steps to add, subtract, multiply, and divide various rational expressions. Each operation requires various steps, and skills therefore, they are each taught as an isolated lesson before learning how to solve for these rational numbers, that have up to this point, been represented by variables. Once the students have mastered these skills, they will begin to solve equations and inequalities with rational numbers. Each of these topics require the students to use all of the skills learned thus far in the unit, as well as basic algebra concepts taught in systems of equations. By the end of the unit, the students will be prepared to move on to learn about the other types of numbers used in math, as well as apply the knowledge they learned to authentic situations in their lives. The curriculum itself is not very engaging or exciting, but it's up to the teachers to make the material relevant to

the students, and their lives. Aside from the regents given at the end of the year, the students will see rational numbers in their near future and unintentionally use them on a daily basis.

Goals and Objectives:

Students will be able to simplify rational expressions.

1) Given a rational expression, students will be able to write its reciprocal, with 100% accuracy.
2) Given a rational expression, students will be able to factor the numerator and denominator, and state whether or not it is in simplest form, with 100% accuracy.
3) Given a rational expression that can be reduced, students will be able to re-write it in simplest form, with 100% accuracy.
4) Given a rational expression, students will be able to state what value will make the expression undefined, with 100% accuracy.

Students will be able to perform mathematical operations using rational expressions.

1) Given a two rational expressions, students will be able to find the least common denominator for the two rational expressions, with 100% accuracy.
2) Given two rational expressions, students will be able to add them and express their sum in simplest form, for 9 out of 10 examples.
3) Given two rational expressions, students will be able to subtract them and express their difference in simplest form, for 9 out of 10 examples.
4) Given two rational expressions, students will be able to multiply them and express their product in simplest form, for 9 out of 10 examples.
5) Given two rational expressions, students will be able to divide them and express their quotient in simplest form, for 9 out of 10 examples.
6) Given a complex fraction, students will be able to simplify it and re-write the answer in simplest form, for 9 out of 10 examples.

Students will be able to solve rational equations and inequalities.

1) Given a rational equation, students will be able to solve for the variable, for 9 out of 10 examples.
2) Given a rational inequality, students will be able to find the solutions that satisfy the inequality, and graph them on a number line, for 9 out of 10 examples.

Learning Standards:

New York State Learning Standard MST 3:
Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability and trigonometry.

Process Strand: *Communication Strand:* Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

A2.CM.3 Present organized mathematical ideas with the use of appropriate standard notations, including the use of symbols and other representations when sharing an idea in verbal and written form.

Connections Strand: Students will recognize and use connections among mathematical ideas.

A2.CN.2 Understand corresponding procedures for similar problems or mathematical concepts.

Content Strand:

Algebra Strand: Students will perform algebraic procedures accurately.

Variables and Expressions

A2.A.7 Factor polynomial expressions completely, using any combination of the following techniques: common factor extraction, difference of two perfect squares, quadratic trinomials.

A2.A.16 Perform arithmetic operations with rational expressions and rename to lowest terms

A2.A.17 Simplify complex fractional expressions

A2.A.23 Solve rational equations and inequalities

Standards of the National Council of Teachers of Mathematics:

Process Strand: *Connection:* instructional programs from kindergarten through grade 12 should enable all students to:

- Recognize and use connections among mathematical ideas.

Communication: instructional programs from kindergarten through grade 12 should enable all students to:

- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Content Strand: *Algebra:* Instructional programs from prekindergarten through grade 12 should enable all students to represent and analyze mathematical situations and structures using algebraic symbols.

In grades 9-12 all students should:

- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations.

Subject Matter Outline:

<u>Chapter 2- The Rational Number</u>

2.1 <u>Rational Numbers</u>

a. Rational Number- a number that can be written a/b, in which a and b are integers, and b $\neq$0.

b. Multiplicative Inverse/Reciprocal- swap the numerator and denominator of the fraction.

c. Rational Expression- the quotient of two polynomials.

2.2 <u>Simplifying Rational Expressions</u>

a. A rational expression is undefined when the denominator equals zero.

b. Simplest Form/Lowest Terms- no factor in the numerator is also a factor of the denominator.

i. Steps to simplifying a rational expression:

1. Factor the numerator.
2. Factor the denominator.
3. Cancel out common factors.

c. Factors that are opposite- polynomials that are opposite or additive inverses of each other.

2.3 Multiplying and Dividing Rational Expressions

i. Steps for multiplying rational expressions:

1. Factor the numerators and denominators, if possible.
2. Cancel any common factors from the numerators and denominators.
3. Multiply across.
4. Reduce, if possible.

ii. Steps for dividing rational expressions:

1. Change ÷ to ×.
2. Take the reciprocal of the fraction following the ÷ sign.
3. Factor the numerators and denominators, if possible.
4. Cancel any common factors from the numerators and denominators.
5. Multiply across.
6. Reduce, if possible.

2.4 Adding and Subtracting Rational Expressions

i. Steps for adding and subtracting rational expressions:

1. Factor the numerators and denominators, if possible.
2. Find the least common denominator (LCD).
3. Multiply each numerator and denominator by the common factor that will result in the common denominator.
4. Add/Subtract the numerators, and keep the denominator.
5. Reduce, if possible.

2.5 Complex Fractions

a. Complex Fractions- a fraction whose numerator, denominator, or both contain fractions.

b. Complex Rational Expression- has a rational expression in the numerator, denominator, or both.

i. How to simplify a complex fraction:

1. Multiply the numerator by the reciprocal of the denominator of the fraction.

2.6 Solving Rational Equations

i. Steps to solve a rational equation:

1. Get a single fraction on either side of the equal sign.
2. Cross multiply.
3. Solve for the variable.
4. Check solution(s).

2.7 Solving Rational Inequalities

i. Steps to solving a rational inequality:

1. Change the inequality to an equation.
2. Solve for the variable.
3. Determine what value makes the fraction undefined.
4. Draw a number line indicating an open circle on the undefined value, and the appropriate circle on the value of the variable.
5. Choose solutions from each section of the graph, and substitute it into the original inequality.
6. Shade the number line where the values are true.

Method for Starting the Unit #1

To introduce the unit "The Rational Number," I will begin by explaining to the class what this new unit is going to be about. I will point out that we will be working with what we call in mathematics "rational numbers." All of the variables we use and solve for in this chapter will represent rational numbers, versus other types of numbers like irrational numbers. We will use irrational numbers later in this course, but for now we are going to only work with rational numbers. When we represent rational numbers using variables, we call these "rational expressions." Throughout this chapter we will be adding, subtracting, multiply, and dividing these rational expressions, as well as solving for the rational numbers represented by the variables. Before we begin working with these rational expressions, we will watch a video by the Khan Academy introducing us to rational numbers and distinguishing them from other numbers.

Link to the video: http://www.khanacademy.org/video/identifying-rational-numbers?playlist=Developmental+Math

Once the class completes the video, I will answer any questions and explain that in the next lesson we will learn how to take these skills one step further.

Method for Starting the Unit #2

One method for starting the unit "The Rational Number," would be to give the students an opportunity to make predictions, and analyze the vocabulary words on their own to try to come up with their own understanding of rational numbers.

I will split the students up into small groups of 2-3 people, and each group will be given an envelope containing 20 irrational and rational numbers, and the definitions of "rational numbers" and "irrational numbers." (Rational Number- a number that can be written as a fraction. Irrational Number- a non-repeating decimal.) As a group, the students will be asked to organize the numbers into a rational, and irrational pile. They are not allowed to use any other resources, or ask the teacher questions regarding the definitions, or types of numbers they have. Using just the definitions given to them, and their peers, the students must try to classify all of the numbers.

Once they have completed organizing the numbers I will re-focus the class, and ask each group what they classified each number as and why. Once we have gone around the room, I will tell the class more about rational and irrational numbers and clarify any mistakes or misunderstandings they had during the activity. Finally I will tie this into the chapter and inform the class that throughout this chapter we will be working with variables that represent rational numbers, and the different techniques to simplifying and solving them.

Method for Starting the Unit #3

Another way to introduce chapter 2, is to simply pass out a guided notes sheet, with all the definitions of the vocabulary terms necessary for this chapter, as well as examples that ties previous knowledge from other chapters, in with the techniques we will be using to build upon this knowledge. To begin the class the teacher will ask the students to recall some of the material that was tested on the previous chapter's test. With each response the students make, the teacher will connect those concepts/tasks to this chapter. Due to this particular chapter, and the layout of the curriculum, many of the skills used in Chapter 1, are repeated in Chapter 2.

Once the teacher elicits answers from the students regarding last chapter, the teacher will introduce the topic of this chapter, which is Rational Numbers. These students will need to learn what rational numbers are, how they work, and what they represent in order to move on further, and delve into the world of irrational numbers. As a class, the teacher will guide the students through the introductory notes, going over the key vocabulary and concepts that are universal throughout this chapter. Once questions are answered, and the students begin to comprehend the vocabulary, the teacher will begin introducing how to simplify rational expressions. Once the basics are covered then the class will progress through the chapter, referring to the skills and vocabulary taught in the introductory lesson.

CHAPTER 2, SECTIONS 1 AND 2 LESSON PLAN:

Goal: Students will be able to simplify rational expressions, and find the values that make it undefined.

Learning Standards:
New York State Learning Standard MST 3:
Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability and trigonometry.
Process Strand: *Communication Strand:* Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

A2.CM.3 Present organized mathematical ideas with the use of appropriate standard notations, including the use of symbols and other representations when sharing an idea in verbal and written form.

Connections Strand: Students will recognize and use connections among mathematical ideas.

A2.CN.2 Understand corresponding procedures for similar problems or mathematical concepts.

Content Strand:

Algebra Strand: Students will perform algebraic procedures accurately.

Variables and Expressions

A2.A.7 Factor polynomial expressions completely, using any combination of the following techniques: common factor extraction, difference of two perfect squares, quadratic trinomials.

Standards of the National Council of Teachers of Mathematics:

Process Strand: *Connection:* instructional programs from kindergarten through grade 12 should enable all students to:

- Recognize and use connections among mathematical ideas.

Communication: instructional programs from kindergarten through grade 12 should enable all students to:

- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Content Strand: *Algebra:* Instructional programs from prekindergarten through grade 12 should enable all students to represent and analyze mathematical situations and structures using algebraic symbols.

In grades 9-12 all students should:

- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations.

Objective: Given a rational expression, students will be able to reduce it to simplest terms, and determine what values make it undefined, for 10 out of 10 examples.

Materials: Chapter 2 notes and homework packet, and SMARTBoard.

Use of Technology:

I will use a Smartboard to present the notes to the class, and fill them in during class discussion. At the end of the day, I will post the notes to the school website for students to access it if they need.

Introduction:

Once attendance is taken, begin the period by explaining that we are moving into chapter 2 and what it consists of. Emphasize that this unit is really nothing new to the students, it's just an extension of techniques and problems used in chapter 1. The information from chapter 2 is extremely important for these students because it is something that will be used further in this course, seen multiple times on the regents, and for many, success in this class is their key to graduate. It is also important that the students are reminded that if they stumble upon any challenges in this unit that they come see Mrs. MacLeod or I for extra help, before the challenge becomes too overwhelming.

At this point the note packet for all of chapter 2 as well as the homework packet will be handed out to the students. They are expected to have these two packets with them every day in class, as we will use them to take notes, and do example problems.

Development:

Strategy: Direct Instruction

Once everyone has a note packet, I will ask the students what they remember about rational numbers, and reciprocals. These terms should be familiar to the students, however they may not remember the exact definitions. Once some prior knowledge has been activated, I will discuss the definitions of the vocabulary words and give them some examples. Then I will elicit more examples from the class, and write them on the Smartboard.

Next I will explain to the students that there are times when a fraction is undefined, and how to determine when exactly it is undefined. It's important for the class to understand that a rational expression may look overwhelming, and complex, however, in terms of being "undefined," only the denominator matters. They simply need to set the denominator equal to zero, and solve for the variable. This is something they have been doing since Algebra, and should not cause many issues, as long as they remember to set the denominator equal to zero, and not the numerator.

There are three examples of rational expressions in the notes, with directions asking the students to determine what value(s) make it undefined. I will do the first two examples with the class, and then I will ask them to do the third one independently. During this time I will walk around the room and see how they are doing, and check for understanding. After most of them are complete, I will choose a student to go to the SMARTBoard and put their work up there for the rest of the class to see, and make sure they did it correctly.

Next we will go over what it means to put a rational expression into simplest form, or lowest terms, and the steps to take when doing so. I will begin by showing the class a fraction, consisting of real numbers that is not in simplest form. Next, the class will be asked to think about what they have done in previous math classes to reduce fractions like this. After getting them to remember the steps they've taken previously, and are very familiar with, I will show them, using the examples in the notes, how the steps to reduce rational expressions are exactly the same. Just like the examples for "defined vs. undefined," I will complete the first two examples, then give the students some time to complete the last one on their own. After going around the room and checking that the students are on task, and completing the process correctly, I will choose a student to go to the Smartboard to show their work to the rest of the class.

Finally I will show the class that they may run into examples that have "factors that are opposite," and how to deal with them mathematically. Using the example in the notes, I will show the class how to determine if you have an opposite factor, and how to get it to cancel out. If there is extra time, I will give the students a second problem consisting of opposite factors and ask them to complete it on their own.

Guided Practice:

The example problems that are in the notes will be used for guided practice. I will allow the students time to complete the problems independently, then go over the process to solving it, and show the correct answer. This way, the students can check that they did the problem correctly, and can ask questions before they get home and are doing the homework.

Independent Practice:

For homework, the students will have to complete handout 7533 #1-13. These problems will require the students to simplify rational expressions, as well as determine what makes them undefined.

Closure:

To close the lesson, I will tell the students what their homework is, and ask some questions about what we learned during class. I will check that the students had a good understanding of what a rational expression is, how to decide to determine when it's undefined, and how to simplify it. Finally, I will leave the last 5 minutes of class for the students to complete a Do Now problem, requiring them to simplify a rational expression. They will be able to use their notes, and I will collect this as they leave the room. If the students are able to complete the Do Now activity, then they shouldn't have any major troubles with the homework.

Accommodations and Modifications:

The only modification/accommodation required for some of the students in this class is that they are given a copy of class notes. All of the students will be receiving the notes in the beginning of class so no extra actions are necessary.

Evaluation:

The students will be given a quiz on 2.1-2.4 once those notes are completed. Once we are done with the whole chapter, the students will take a unit test to apply their knowledge and understanding of rational expressions.

CHAPTER 3, SECTION 3 LESSON PLAN:

Goal: Students will be able to multiply and divide rational expressions.

Learning Standards:

New York State Learning Standard MST 3:

Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability and trigonometry.

Process Strand: *Communication Strand:* Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

A2.CM.3 Present organized mathematical ideas with the use of appropriate standard notations, including the use of symbols and other representations when sharing an idea in verbal and written form.

Connections Strand: Students will recognize and use connections among mathematical ideas.

A2.CN.2 Understand corresponding procedures for similar problems or mathematical concepts.

Content Strand:

Algebra Strand: Students will perform algebraic procedures accurately.

Variables and Expressions

A2.A.7 Factor polynomial expressions completely, using any combination of the following techniques: common factor extraction, difference of two perfect squares, quadratic trinomials.

A2.A.16 Perform arithmetic operations with rational expressions and rename to lowest terms

Standards of the National Council of Teachers of Mathematics:

Process Strand: *Connection:* instructional programs from kindergarten through grade 12 should enable all students to:

- Recognize and use connections among mathematical ideas.

Communication: instructional programs from kindergarten through grade 12 should enable all students to:

- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Content Strand: *Algebra:* Instructional programs from prekindergarten through grade 12 should enable all students to represent and analyze mathematical situations and structures using algebraic symbols.

In grades 9-12 all students should:

- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations.

Objective: Given two rational expressions, students will be able to multiply and a divide them, as well as reduce it to simplest form, and determine what values make it undefined, for 10 out of 10 examples.

Materials: Chapter 2 notes and homework packet, and SMARTBoard.

Use of Technology:

I will use a Smartboard to present the notes to the class, and fill them in during class discussion. At the end of the day, I will post the notes to the school website for students to access it if they need.

Introduction:

Once attendance is taken, begin the period by going around the room to check homework for the previous night, as well as hand out the answers to the homework and ask the students to look over it to see if they have any questions. After everyone's homework is checked, ask for feedback, questions, and/or any concerns the class has about last night's homework and clarify points that need to be.

At this point, I will then choose a row, and ask everyone in that row if they can tell me one thing we learned from yesterday's lesson, or any key points that were important to remember. I will use their answers and comments to transition into this lesson, pointing out the connections and similarities between the two.

Development:

Strategy: Direct Instruction

With the copy of the students' notes projected on the Smartboard, I will begin to teach the students the steps to multiplying two rational expressions. Before giving them any algebra, I will start off by asking them to multiply two fractions, only containing real numbers. By

recalling this prior knowledge, it will allow the students to see the similarities between the two types of problems, and encourage them to come up with the steps necessary for this lesson on their own. Then as a class, we will begin to multiply rational expressions, consisting of real numbers and variables, and practice the steps together. Finally I will ask the students to complete a problem on their own, as I walk around the room, monitoring their understanding. Once they are completed, I will ask for a volunteer to put their work on the Smartboard, for the rest of the class to see.

After we have gone over the multiplication of rational expressions, we will move on to division. Just like in the multiplication notes, I will first ask the students to divide two fractions, only containing real numbers. After activating prior knowledge, and getting a feel for what the students remember about this process, we will move on to dividing rational expressions, containing real numbers and variables. I will complete the example problems from the notes on the Smartboard as the students follow along in their packets. Once all of the example problems are completed, I will ask the students to once again complete a problem on their own. As they work independently I will circulate the room, checking on each individual's progress, and monitor their progress. Once they are complete, I will ask for a different volunteer to come to the Smartboard to show the rest of their peers the completed work.

Throughout the lesson, I will remind the students that their final answers need to be in simplest form, and include all of the values that make the expression undefined in order to receive full credit.

Guided Practice:

The example problems that are in the notes will be used for guided practice. I will allow the students time to complete the problems independently, then go over the process to solving it, and show the correct answer. This way, the students can check that they did the problem correctly, and can ask questions before they get home and are doing the homework.

Independent Practice:

For homework, the students will have to complete handout 7533 #14-28. These problems will require the students to multiply and divide rational expressions, simplify them, and determine what makes them undefined.

Closure:

To close the lesson, I will tell the students what their homework is, and ask some questions about what we learned during class. I will check that the students have a good understanding of the steps and procedures necessary to be successful on the homework. Finally, I will leave the last 5 minutes of class for the students to complete a Do Now problem, requiring them to simplify a rational expression, and determine when it is undefined. This is a prerequisite for today's lesson, and something they need to be comfortable with in order to complete the homework. They will be able to use their notes, and I will collect this as they leave the room.

Accommodations and Modifications:

The only modification/accommodation required for some of the students in this class is that they are given a copy of class notes. All of the students will be receiving the notes in the beginning of class so no extra actions are necessary.

Evaluation:

The students will be given a quiz on 2.1-2.4 once those notes are completed. Once we are done with the whole chapter, the students will take a unit test to apply their knowledge and understanding of rational expressions.

CHAPTER 2, SECTION 5 LESSON PLAN:

Goal: Students will be able to simplify complex rational expressions.

Learning Standards:

New York State Learning Standard MST 3:

Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability and trigonometry.

Process Strand: *Communication Strand:* Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

A2.CM.3 Present organized mathematical ideas with the use of appropriate standard notations, including the use of symbols and other representations when sharing an idea in verbal and written form.

Connections Strand: Students will recognize and use connections among mathematical ideas.

A2.CN.2 Understand corresponding procedures for similar problems or mathematical concepts.

Content Strand:

Algebra Strand: Students will perform algebraic procedures accurately.

Variables and Expressions

A2.A.7 Factor polynomial expressions completely, using any combination of the following techniques: common factor extraction, difference of two perfect squares, quadratic trinomials.

A2.A.16 Perform arithmetic operations with rational expressions and rename to lowest terms

A2.A.17 Simplify complex fractional expressions

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Content Strand: *Algebra:* Instructional programs from prekindergarten through grade 12 should enable all students to represent and analyze mathematical situations and structures using algebraic symbols.

In grades 9-12 all students should:

- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations.

Objective: Given a complex rational expression, students will be able to find a least common denominator, and simplify it to a rational expression in simplest form, for 10 out of 10 examples.

Materials: Chapter 2 notes and homework packet, and SmartBoard.

Use of Technology:

I will use a Smartboard to present the notes to the class, and fill them in during class discussion. At the end of the day, I will post the notes to the school website for students to access it if they need.

Introduction:

Once attendance is taken, begin the period by reviewing what we last left off on from Monday and Tuesday's lesson. Call on students and ask if they can tell me one thing we learned from the previous lesson, or any key points that were important to remember. I will use their answers and comments to transition into this lesson, pointing out the connections and similarities between the two.

Development:

Strategy: Direct Instruction

With the copy of the students' notes projected on the Smartboard, I will begin by going over the vocabulary terms from this lesson, show the class specific examples, and ask them if they can come up with their own examples to add to their notes

Once the necessary vocabulary words are gone over, I will begin showing the class the steps and procedure for reducing complex rational expressions by using a problem in the notes. I will think aloud as I complete the work, and explain the reasons I am completing each step. After completing a couple problems, and noticing the class is starting to get the gist of it, I will ask them to complete a problem on their own. During this time, I will circulate the room, checking for understanding as well as common errors. If I notice a pattern of common mistakes, I will take the time to explain it to the whole class, and ask them to check and see if they have made this error as well. Finally, I will ask for a volunteer to come to the Smartboard to write down their answer for the rest of the class to see. I will explain how/why that student took the steps they did, and check to see if anyone has any questions on the topic thus far. Throughout the lesson, I will remind the students that their final answers need to be in simplest form in order to receive full credit.

Once the class begins to show a general understanding of the topic, I will ask them to complete a Do Now assignment requiring them to do the steps we learned in the notes today. They will be allowed to use their notes, as well as ask questions if they have any.

Guided Practice:

The example problems that are in the notes will be used for guided practice. I will allow the students time to complete the problems independently, then go over the process to solving it, and show the correct answer. This way, the students can check that they did the problem correctly, and can ask questions before they get home and are doing the homework.

Independent Practice:

For homework, the students will have to complete handout 3734 #1-11. These problems will require the students to simplify complex rational expressions and determine what makes them undefined.

Closure

To close the lesson, I will tell the students what their homework is, and ask some questions about what we learned during class. I will check that the students have a good understanding of the steps and procedures necessary to be successful on the homework. Finally, I will leave the last 5 minutes of class for the students to complete a Do Now problem, requiring them to simplify complex rational expressions. They will be able to use their notes, and I will collect this as they leave the room. If they complete before the bell rings they are to begin on their homework.

Accommodations and Modifications:

The only modification/accommodation required for some of the students in this class is that they are given a copy of class notes. All of the students will be receiving the notes in the beginning of class so no extra actions are necessary.

Evaluation:

Once we are done with the whole chapter, the students will take a unit test to apply their knowledge and understanding of rational expressions.

CHAPTER 2, SECTION 7 LESSON PLAN:

Goal: Students will be able to solve rational inequalities and graph them on a number line.

Learning Standards:

New York State Learning Standard MST 3:

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A2.CN.2 Understand corresponding procedures for similar problems or mathematical concepts.

Content Strand:

Algebra Strand: Students will perform algebraic procedures accurately.

Variables and Expressions

A2.A.7 Factor polynomial expressions completely, using any combination of the following techniques: common factor extraction, difference of two perfect squares, quadratic trinomials.

A2.A.16 Perform arithmetic operations with rational expressions and rename to lowest terms

A2.A.17 Simplify complex fractional expressions

A2.A.23 Solve rational equations and inequalities

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Content Strand: *Algebra:* Instructional programs from prekindergarten through grade 12 should enable all students to represent and analyze mathematical situations and structures using algebraic symbols.

In grades 9-12 all students should:

- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations.

Objective: Given a complex rational inequality, students will be able to solve for the variable, and graph the solution(s) on a number line, for 9 out of 10 examples.

Materials: Chapter 2 notes and homework packet, and SmartBoard.

Use of Technology:

I will use a Smartboard to present the notes to the class, and fill them in during class discussion. At the end of the day, I will post the notes to the school website for students to access it if they need.

Introduction:

Once attendance is taken, begin the period by reviewing what we last left off on from Tuesday's lesson. Call on students and ask if they can tell me one thing we learned from the previous lesson, or any key points that were important to remember. I will use their answers and comments to transition into this lesson, pointing out the connections and similarities between the two.

Development:

Strategy: Direct Instruction

With the copy of the students' notes projected on the Smartboard, I will begin by discussing how the work we are doing today does not require any work from them that they haven't had to do before. I will do the first examples in the note packet on the Smartboard, as the students follow along, and copy my work into their notes. Then I will go through the process for checking the answer, and graphing its solutions. Once the first example is completed, I will review the steps for solving a rational inequality that is printed on the top of their notes. Using the example that we just completed, I will point out each step, and where/how we completed it in example 1.

Once the steps have been reviewed, and questions are answered, I will move on to example 2 in the notes. This time I will complete the notes on the Smartboard, but I will call on the students to tell me what the next steps are that I need to take. If they are showing any difficulty or are not sure what my next step is, I will instruct them to either refer to the steps listed on the top of the notes, or example 1 for a hint. Calling on different students in the room, I will have them guide me through solving the inequality in example 2, and necessary steps for graphing its solutions.

Next, I will ask the students to try to do number 8 from the homework on their own. If they have any questions or are confused they may raise their hand for help. During this time I will circulate the classroom, checking for understanding, and answering any questions the class might have. If there seems to be a common misunderstanding, I will address it with the whole class in case anyone else was experiencing the same problem. Finally, I will ask for a volunteer to come to the Smartboard to show the steps they took for solving the inequality, and a second volunteer to show their work for the "check" portion of the steps as well as graphing the solution. Finally, I will answer any questions, comments, or concerns they may have regarding the steps used to solve rational inequalities.

Guided Practice:

The example problems that are in the notes will be used for guided practice. I will allow the students time to complete the problems independently, then go over the process to solving it, and show the correct answer. This way, the students can check that they did the problem correctly, and can ask questions before they get home and are doing the homework.

Independent Practice:

For homework, the students will have to complete handout 8266 #6-11. These problems will require the students to solve rational inequalities and graph their solution(s).

Closure:

To close the lesson, I will tell the students what their homework is, and ask some questions about what we learned during class. I will check that the students have a good understanding of the steps and procedures necessary to be successful on the homework. I will also inform the students about the plans for the rest of the week regarding the chapter test and remind them of their project due on Monday, October 17, and see if they have any questions on it.

Accommodations and Modifications:

The only modification/accommodation required for some of the students in this class is that they are given a copy of class notes. All of the students will be receiving the notes in the beginning of class so no extra actions are necessary.

Evaluation:

Once we are done with the whole chapter, the students will take a unit test to apply their knowledge and understanding of rational expressions. In addition, they have a project due on Monday, October 17 that requires them to apply their knowledge of rational expressions to the use of electrical circuits.

Culminating Project: Circuits Lab (see attached)

Evaluations (see attached):

- Pretest
- Quiz
- Test
- Post Test
- Culminating Project

Reflection

After having planned, created all of the material, and taught everything in the Rational Numbers unit, I realized that I learned as much in this unit as the students did. Throughout the planning process of this chapter, I knew I wanted to teach the lesson in certain order, starting with the basics of simplifying rational expressions, then moving on to the operations. As I planned for this unit, my goal was to make the notes as simple as possible. Many of the rules and steps that the students learn can be easily confused, therefore the more straight forward the notes, and more repetition and practice the students receive the better. I gave the whole class a copy of all the notes for Chapter 2 as well as the homework assignments. This way, if anyone missed class, they already had what they missed. I was told not to be optimistic regarding the outcomes of the chapter because it never has shown positive results.

Now that I have completed the chapter, I am happy with the outcomes and believe that my careful planning paid off. Although the students were clearly uninterested in the material they were learning they did a very good job of remembering the various rules. I opted to give them a quiz after multiplying and dividing rational expressions. The quiz required them to know the basic rules of simplifying rational expressions and use various factoring techniques that many of them struggled with in chapter one. After the quiz was completed, the final sections were on simplifying complex rational expressions, as well as solving equations and inequalities. Then once these were complete we spent a day reviewing, then took the chapter test. I do not regret any decisions based on planning, I only wish I had one additional day to review, however I learned that in a high school math regents class in New York State, if you do not keep up a steady pace, you will never get through the required curriculum.

Looking back, I wouldn't change much, I would have like to incorporate a group activity however the unit we covered is very dry and difficult to "spice up." Although the culminating

project, allowed the students to connect the skills used when working with rational expressions to electrical circuits. This made the curriculum more authentic by relating it to something every student uses every day. Overall I'm very pleased with the outcomes of this unit plan, and it was a very valuable learning experience for me.

References:

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