**Activity 4.4.2 Rational Expressions II**

In this activity, you will simplify rational expressions that have both like and unlike denominators. The process is similar to simplifying expressions with fractions. When we

add or subtract fractions, we need to have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ denominator. Remember that

fractions in the form of  can be written in the form of . For example,  can be written as. These are equivalent expressions. Hence, using the distributive property +  would be **\_\_\_\_\_\_\_\_\_\_\_.** Without a common denominator, we cannot use the distributive property. Sometimes it is useful to be able to convert between these two forms in order to simplify rational expressions. Some rational expressions will require you to factor first in order to simplify them.

Let’s simplify the following rational expression.

Ex. 1:  We already have a CD so we need to keep the denominator so we can use the distributive property and combine the numerators.

 Now, we can combine like terms in the numerator.

 … One last thing ...

In this example, there is a **restriction**. The domain cannot contain the value -2 because the denominator of any fraction cannot be equal to zero. (Set x + 2 = 0 and solve for x to get the restriction. Therefore, x cannot equal -2 in the expression.)

The domain of the expression is .

Simplify the following rational expressions and list the domain and any restrictions.

1.  2.  3. 

4. A square has a side with measure . What is an expression for the perimeter of the square? What is the domain of this expression? (Hint: Be sensitive to the fact that we are talking about the measure of the side of a square.) What is the restriction?

5. An equilateral triangle has a side length of . Find an expression for the perimeter of the triangle. What is the domain of the expression? What is the restriction?

Let’s simplify the following rational expression…

Ex. 2: 

First, we should **find the least common denominator** (CD). The CD in this example is 4x. We now need to change the fractions so they have a CD.

 Multiply the fraction on the left by .

 Simplify the fraction on the left and then add the fractions using the distributive property.

.



The restriction is that x cannot equal zero because the denominator of any fraction cannot be zero.

The domain of the expression is.

Ex. 3:  The CD is *x*(*x+*2), so we need to change the fraction on the right so that we have a common denominator.



 Now, distribute in the numerator.

 Combine the numerators. Be careful with the subtraction!

 Distribute the subtraction.



The restrictions are that x cannot be equal to 0 or -2. (Set x(x + 2) = 0 and solve for x to get the restrictions.)

The domain of the expression is .

Simplify the following rational expressions and list the domain and any restrictions.

5.   6.  7. 

8. A rectangle has a length of  and a width of . Find an expression for the perimeter. What is the domain? Are there any restrictions? If so, list them.

9. A parallelogram has side lengths of  and . Find an expression for the perimeter. What is the domain? List the restrictions.

Sometimes you may need to factor first in order to simplify rational expressions.

Ex. 4:  First, factor the denominator in the fraction on the right.

 Now find the CD. The CD = (x – 2)(x – 4) .

 Multiply the fraction on the left by .

 Combine the numerators.

 Simplify.



The restrictions are that x cannot be equal to 2 or 4.

The domain of the expression is 

Simplify the following rational expressions and list the domain and any restrictions.

10.  11.  12. 

13. An isosceles triangle has a base of  and sides of equal measure that are each . Find an expression for the perimeter. List the domain. List the restrictions.

14. Consider two positive numbers whose product is 9. Find an expression for the sum of the two numbers. Use that expression to define a function. When will that sum be a minimum? (Hint: Graph your function and try to find the lowest point on the curve.)

15. Describe in your own words how to simplify a rational expression. Create an example to illustrate your procedure.

16. English schools’ Track and Field puts forth benchmarks for sprinting times. After 52 weeks of training, 12 and 13 year olds should aim for a time of 13.2 seconds for a 100 meter sprint. Fourteen and 15 year olds should aim for a time of 11.6 seconds for a 100 meter sprint. Sixteen and 17 year olds should aim for a time of 12.5 seconds for a 100 meter sprint. Find an expression to determine the speed for each of the three age groups in meters per second. Then convert each speed to miles per hour.

Simplify the following. List the domain and any restrictions.

17**. **

18**. **

19. ****