R.E.A.L. Math 1010 Supplemental Activity Name: ____________________________

S2 Inverse and Identity Properties

In mathematics, an **Identity** is a number that when added, subtracted, multiplied or divided with any number (*n*) the identity allows that number to stay the same. This is an important tool for maintaining equivalence in algebraic expressions.

1. State the number that is the identity for the following operations and give an example.

a) Addition

b) Subtraction

c) Multiplication

d) Division

In this activity, we are going to focus on the identity for multiplication, the numeral one. We call 1 the Multiplicative Identity. We know that any number multiplied by 1 equals itself.

2. Represent the number 1 in two different ways, without using the numeral "1"

3. Fill in the blanks:

a) $m \cdot \_\_\_\_ = 1$

b) $m + \_\_\_ = 0$

The values that make these statements true are called **inverses**. Exercise 3a demonstrates the **multiplicative inverse** and 3b demonstrates the **additive inverse**. In this activity, we are going to focus on the multiplicative inverse.

4. Write the multiplicative inverse for each of the following:

a) 2

b) 7

c) $\frac{1}{12}$

d) $\frac{8}{15}$

5. When you multiply multiplicative inverses together, what is the outcome? What do we call that number?

6. In the following expressions, find the numbers or variables that are multiplicative inverses of each other. Explain what makes them multiplicative inverses.

a) $\frac{2 \cdot 3}{7 \cdot 2}$

b) $\frac{4xy}{7xz}$

10. Let x = 1, y = 2, and z= 3 in each of the following expressions, $\frac{4xy}{7yz}$ and $\frac{4x}{7z}$. What does your outcome demonstrate?

Fractions vs. Rational Expressions

A fraction that has variables in it is called a **Rational Expression**. We use the same principles to add, subtract, multiply and divide rational expressions as we use to add fractions.

Simplifying Rational Expressions

When simplifying rational expressions, we look for multiplicative inverse pairs that make up the multiplicative identity and apply the multiplicative identity property. For example:

$\frac{4xy}{7yz}$ can be written showing the multiplicative inverse pair of $\frac{y}{y}$ like this $\frac{4x}{7z} \cdot \frac{y}{y}$

The multiplicative inverse pair of $\frac{y}{y} = 1.$

Therefore $\frac{4x}{7z} \cdot 1 = \frac{4x}{7z}$, by the multiplicative identity property.

The Big One

To emphasize the value of multiplicative inverse pairs, a "Big One" is drawn around the multiplicative inverse pair.

$$\frac{(x-1)(x+3)}{(x-2)(x+3)} = \frac{(x-1)}{(x-2)}$$

11. Is $\frac{x}{x}$ a multiplicative inverse pair in $\frac{x-1}{x-2}$? Why or why not? Can you prove your answer?

12. Simplify the following rational expressions by following the examples:

1- Factor as needed
2- Write the multiplicative inverse pair separately and write a "Big One" around each one
3- Write the multiplicative inverse pair as the multiplicative identity (1)
4- Write the equivalent expression without the 1.

Example 1: $\frac{6xy+9y}{3y} = \frac{3y(2x+3)}{3y} = \frac{3y}{3y} \cdot (2x+3) = 1 \cdot (2x+3) = 2x+3$

a) $\frac{2x}{x^2}$

b) $\frac{4z-6}{10z+8}$