

## 1. Properties of Real Numbers

There are properties that you need to be able to identify. These apply to real numbers and they only apply to addition and multiplication

The first is:  $a + b = b + a$ . Notice they switched order. I think of it like community property. It doesn't matter if it was mine or his first. The order does not matter.

### **The commutative properties for addition and multiplication**

$$a + b = b + a$$

$$ab = ba$$

The next is:  $a + (b + c) = (a + b) + c$ . Notice that at first  $b$  and  $c$  are grouped together like friends and then  $a$  and  $b$  are friends. Well think of your friends as your associations and it will help you to remember this property.

### **The associative properties for addition and multiplication**

$$(a + b) + c = a + (b + c)$$

$$(ab)c = a(bc)$$

\*But what about this one:  $(a + b) + c = (b + a) + c$ . Which rule applies here? Did they change friends or order? They changed order which makes this commutative.

This next property is one you will become very familiar with.

### **The distributive property of multiplication over addition.**

$$a(b + c) = ab + ac$$

We multiply the  $a$  times each of the numbers in the parenthesis.

Now we have **the identity properties of addition and multiplication.**

$$a + 0 = a$$

$$a \cdot 1 = 1 \cdot a = a$$

Notice they end up equaling themselves, which is how you can remember identity.

**The inverse properties of addition and multiplication.**

$$a + (-a) = 0$$

$$a \cdot \frac{1}{a} = 1, a \neq 0$$

The first  $a$  is positive and we combine it with its negative. Those are inverse operations, adding and subtracting. With the multiplication one, we multiply  $a$  times its inverse which is like dividing. Again, multiplication and division are inverse operations.

**The multiplication property of zero:** the product of any number and zero is zero.

$$a \cdot 0 = 0 \cdot a = 0$$

You also need to make note of the Double Negative Rule.

$$-(-a) = a$$