Math 210 - Dr. Miller - Summary #2: Arithmetic Properties of Whole Numbers

The following properties are stated first in the strictly verbal language of third through fifth grade textbooks. Second is the formulaic version of our own text, where a, b, and c represent any whole numbers:

1. Commutative Property of Addition:
   (a) Changing the order of the addends does not change the sum.
   (b) $a + b = b + a$

2. Commutative Property of Multiplication:
   (a) Changing the order of the factors does not change the product.
   (b) $ab = ba$

3. Associative Property of Addition:
   (a) Changing the grouping of the addends does not change the sum.
   (b) $(a + b) + c = a + (b + c)$

4. Associative Property of Multiplication:
   (a) Changing the grouping of the factors does not change the product.
   (b) $(ab)c = a(bc)$

5. Identity Property of Addition:
   (a) Adding zero to any number leaves that number unchanged. (We call 0 the additive identity.)
   (b) $a + 0 = 0 + a = a$

6. Identity Property of Multiplication:
   (a) Multiplying any number by 1 leaves that number unchanged. (1 is the multiplicative identity.)
   (b) $a \cdot 1 = 1 \cdot a = a$

7. Zero Property of Multiplication:
   (a) Multiplying any number by 0 gives 0.
   (b) $a \cdot 0 = 0 \cdot a = 0$

8. Distributive Property: There are TWO, and they are usually learned formulaically.
   (a) Distributive Property of Multiplication over Addition: $a(b+c) = ab+ac$ or $(b+c)a = ba+ca$

   (b) Distributive Property of Multiplication over Subtraction: $a(b-c) = ab-ac$ or $(b-c)a = ba-ca$

9. Every property is an EQUALITY; both sides must produce the SAME number.