CHAPTER 1 SECTION 3

PROPERTIES OF REAL NUMBERS
AND THE <u>USE</u> OF EXPONENTS

A. CLOSURE PROPERTY

1. **ADDITION -** If A and B are real numbers, then A + B is a unique real number

2. **MULTIPLICATION -** If A and B are real numbers, then AB is a unique real number.

These properties states that for every two real numbers that you add or multiply, you should get a different answer. In other words, 2 + 3 = 5 every time that you add 2 and 3. The same thing applies when two real numbers are multiplied, 2 * 3 = 6 always.

B. COMMUTATIVE PROPERTY

1. **ADDITION -** If A and B are real numbers, then A + B = B + A

2. **MULTIPLICATION -** If A and B are real numbers, then AB = BA

These properties state that if A and B are real numbers, then the order that you add or multiply these <u>*two*</u> numbers does not matter, their solution will be the same.

2 + 3 = 5 and 3 + 2 = 5
2 * 3 = 6 and 3 * 2 = 6

C. ASSOCIATIVE PROPERTY

1. **ADDITION -** If A, B, and C are real numbers, then (A + B) + C = A + (B + C)

2. **MULTIPLICATION -** If A, B, and C are real numbers, then (AB) C = A (BC)

These properties should not be confused with the commutative properties, even though the same principles apply. The associative property involves <u>*more*</u> than two values. The grouping signs indicate which values were combined first.

(2 + 3) + 5 = 2 + (3 + 5) = (2 + 5) + 3
(2 * 3) * 4 = 2 * (3 * 4) = (2 * 4) * 3

D. IDENTITY PROPERTY

1. **ADDITION -** If A is a real number, then A + 0 = A

2. **MULTIPLICATION -** If A is a real number, then
A*1 = 1 * A = A

These properties discuss the manner in which a value that you start with, A, can be part of a problem *and* be an answer at the same time. For addition, this is done by adding the value to zero. For multiplication, this is done by multiplying the value by one.

5 + 0 = 0 + 5 = 5
5 * 1 = 1 * 5 = 5

E. INVERSE PROPERTY

1. **ADDITIVE -** For every real number A, there exists a unique real number such that A + (- A) = - A + A = 0

2. **MULTIPLICATIVE -** For every *non-zero* real number A, there exists a unique number $\frac{1}{A}$ such that A $\left(\frac{1}{A}\right) = \left(\frac{1}{A}\right)$ A = 1

The additive property states that if you add a number, A, to its opposite, -A, you get zero as a solution. The multiplicative property states that if you multiply a number, A, by its inverse (reciprocal), $\left(\frac{1}{A}\right)$, you will get one as a product.

F. MULTIPLICATION PROPERTY OF ZERO

If A is a real number, then A * 0 = 0 * A.

This property states that if you multiply a value by zero, the answer is always zero.

G. MULTIPLICATION PROPERTY OF NEGATIVE ONE

If A is any real number, then A (-1) = - 1 (A) = - A.

This property states that if you multiply a number by – 1 that you get its opposite for a result.

5 (-1) = - 5   -7 (-1) = 7

H. DISTRIBUTIVE PROPERTY

If A, B, and C are real numbers, then A (B $\pm$ C) = AB $\pm$ AC.

This property states that if you multiply a quantity times a quantity of a sum or difference, the multiplication operation distributes over the operator.

2 (3 + 5) = (2)(3) + (2)(5) = 6 + 10 = 16
2 (8) = 16

2 (5 – 3) = (2)(5) – (2)(3) = 10 – 6 = 4
2 (2) = 4

I. EXPONENTS

Exponents are used to indicate repeated multiplication. Written in the format B^x , B stands for the *base* that is being multiplied by itself the amount of times equal to *x*, the *exponent*.

5^3 = 5 * 5 * 5 = 125 (A base of 5 multiplied by itself 3 times.)

2^5 = 2 * 2 * 2 * 2 * 2 = 32 (A base of 2 multiplied by itself 5 times.)