6.4 Properties of Vector Addition and Scalar Multiplication (*6.3 is too simple*)

We want to use **vectors** to "**do mathematics**". To be able to perform mathematical operations, we need a ***structure*** (a set of mathematical rules) inside of which we "do the math". Such a mathematical **structure** can be considered **an algebra**.

Today we will see **SEVEN RULES** making up a basic structure (algebra) which will allows us to perform Vector Addition and Scalar Multiplication of vectors.

Given vectors $\vec{a}, \vec{b},$ and $\vec{c}$ and scalars $k, m,$ and n:

1) The Commutative Property of Vector Addition

2) The Associative Property of Vector Addition

3) The Distributive Property of Scalar Multiplication Over Addition

4) The Additive Inverse Element

5) The Additive Identity Element for Vector Addition

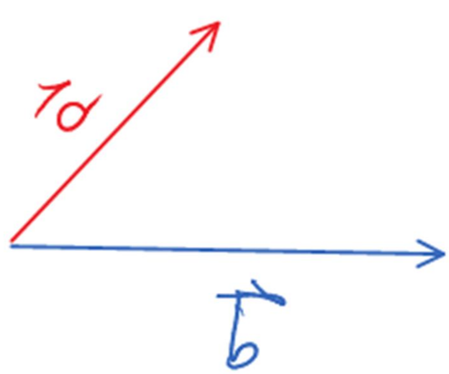
6) The Associative Law for Scalar Multiplication

7) The Distributive Law for Scalar Multiplication

The **seven rules** above constitute the **ALGEBRAIC STRUCTURE** inside of which we will work with vectors. Note that the structure is very familiar!

A geometric proof of Rule 1

Given $\vec{a}$ and $\vec{b}$ in their standard positions:



Example 6.3.1

Given $\vec{x} = 5\hat{i} + 2\hat{j} - 3\hat{k}$, and $\vec{y} = -2\hat{i} + 7\hat{j} + 5\hat{k}$, determine:

a) $\vec{x} + \vec{y}$

b) $2\vec{x} - 4\vec{y}$

Example 6.3.2

From your text: Pg. 307 #5

Show $\overrightarrow{PQ} = \left(\overrightarrow{RQ} + \overrightarrow{SR}\right) + \overrightarrow{TS} + \overrightarrow{PT}$

Example 6.3.3

Given $\vec{a} = 4\vec{x} - \vec{y}$, and $\vec{b} = 2\vec{x} + 3\vec{y}$, write $\vec{x}$ and $\vec{y}$ **in terms of** $\vec{a}$ and $\vec{b}$.

Class/Homework for Section 6.3

Pg. 307 #1 – 11