Section 8.1: Resultant

**Resultant** - the sum of two vectors (or the resulting vector) when two forces are acted upon an object

Use the components to draw the vector
- Draw in the components
- Two Methods
  1.) Tip-to-Tail
     - a.) start at origin
     - b.) draw horizontal component
     - c.) draw vertical component from the tail of 1st vector
     - d.) draw resultant
  2.) Parallelogram Method
     - a.) start at origin
     - b.) draw 1st vector
     - c.) draw 2nd vector
     - d.) make a parallelogram
     - e.) draw diagonal from the origin

**Drawing Example:**

**v = 6 (North) and h = 12 (West)**

**Tip-to-Tail**

**Parallelogram Method**
8.1: Resultant of 2 vectors

Review Facts:

I. Parallelogram
   * opposite sides congruent
   * opposite angles congruent
   * angles on same-side are supplementary

II. Law of Sines - will not find an obtuse angle

III. Law of Cosines - use when you don't know a side/angle pair (SAS or SSS).

IV. Direction - degrees from positive x-axis to line (CCW)
**Parallelogram Method:**

Example: find $\vec{a} + \vec{b}$

$\vec{a} = 2.6 \, (128^\circ)$ and $\vec{b} = 4 \, (45^\circ)$

**Magnitude of $\vec{r}$**

Given SAS $\rightarrow$ Law of Cosines

$M^2 = 4^2 + 2.6^2 - 2(4)(2.6)\cos 97$

$M = 25.29488$

$M = 5.03$

**Direction of $\vec{r}$**

Solve for $\Theta$ using Law of Sines

$\frac{\sin 97}{5.03} = \frac{\sin \Theta}{2.6}$

$5.03 \sin \Theta = 2.6 \sin 97$

$5.03 \sin 97$

$\sin^{-1} \left( \frac{2.6 \sin 97}{5.03} \right) = \Theta$

$\Theta = 30.87^\circ$

The resultant is $\vec{r} = 5.03 \, (75.87^\circ)$