Closing Tue, Jan. 12: 12.1, 12.2, 12.3
Closing Thu, Jan. 14: 12.4(1), 12.4(2)

Read my online review postings from today in my most recent course announcement which include summaries of 12.1, 12.2, 12.3, and 12.4 and some supplement information on vectors and physics.

Also, worksheet 1 solutions are online.

Print off Worksheets 2a, 2b, 2c and bring to quiz section over the next week.

12.2 Vectors

Goal: Introduce vector basics.

Def'n: A **vector** is a quantity with magnitude and direction.

Graphically, we usually depict a vector with an arrow (the length is the magnitude). The `tail' of arrow is called the initial point and the `head' is called the terminal point.

If the vector is drawn with the tail at the origin and that results in the head being at the point (v_1, v_2, v_3), then we denote the vector by
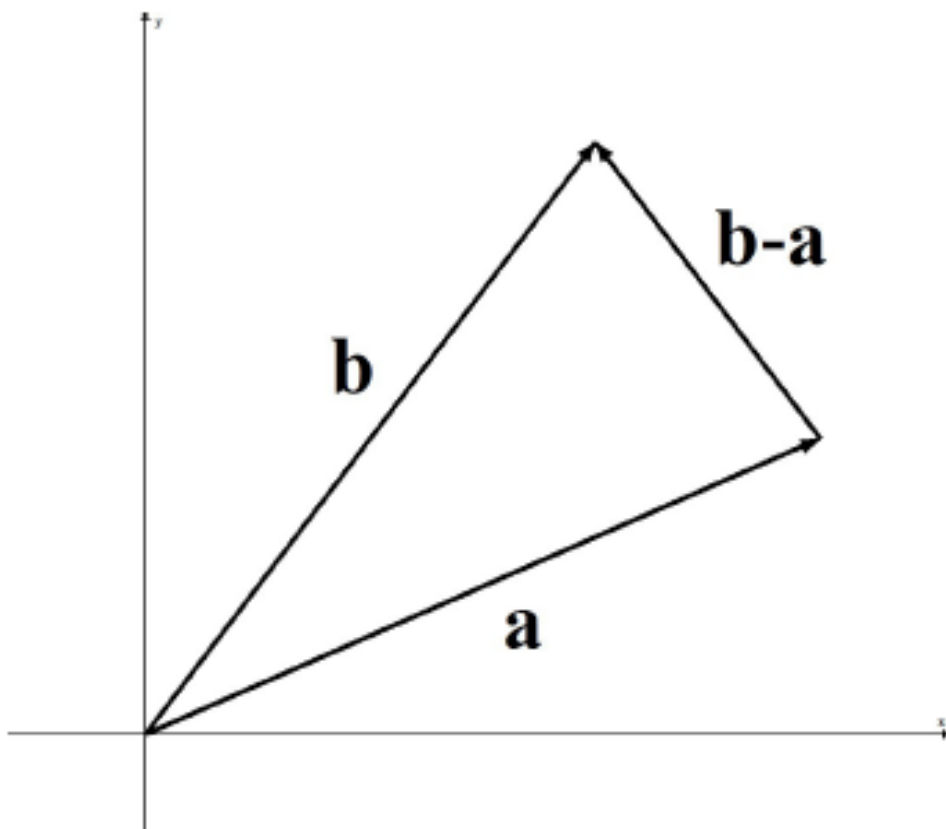
$$\mathbf{v} = < v_1, v_2, v_3 >$$

Basic fact list:

- Two vectors are equal if all components are equal.

- We denote **magnitude** by
$$|v| = \sqrt{v_1{}^2 + v_2{}^2 + v_3{}^2}$$

- To denote the **vector from A(a_1,a_2,a_3) to B(b_1,b_2,b_3),** we write

$$\overrightarrow{AB} = <b_1 - a_1,\ b_2 - a_2,\ b_3 - a_3>$$

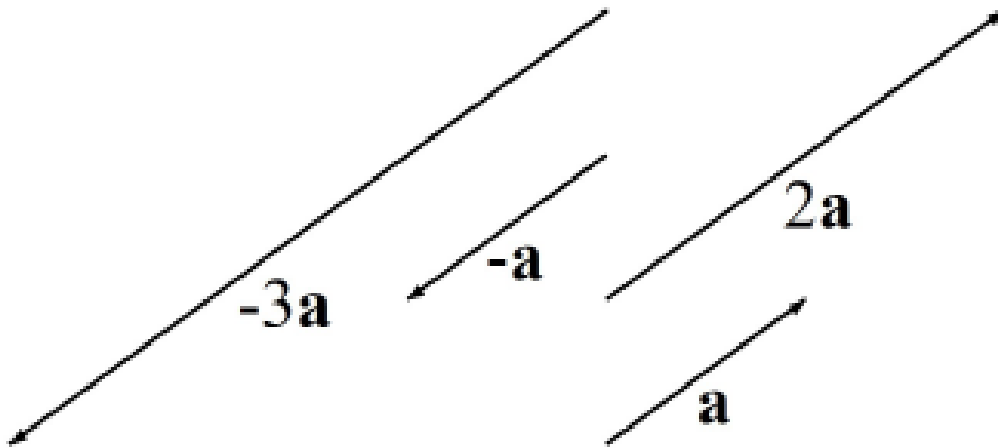- **Scalar Multiplication**

If c is a constant, then we define

$$c\mathbf{v} = <\, cv_1,\ cv_2,\ cv_3\, >,$$

which scales the magnitude by a factor of c.

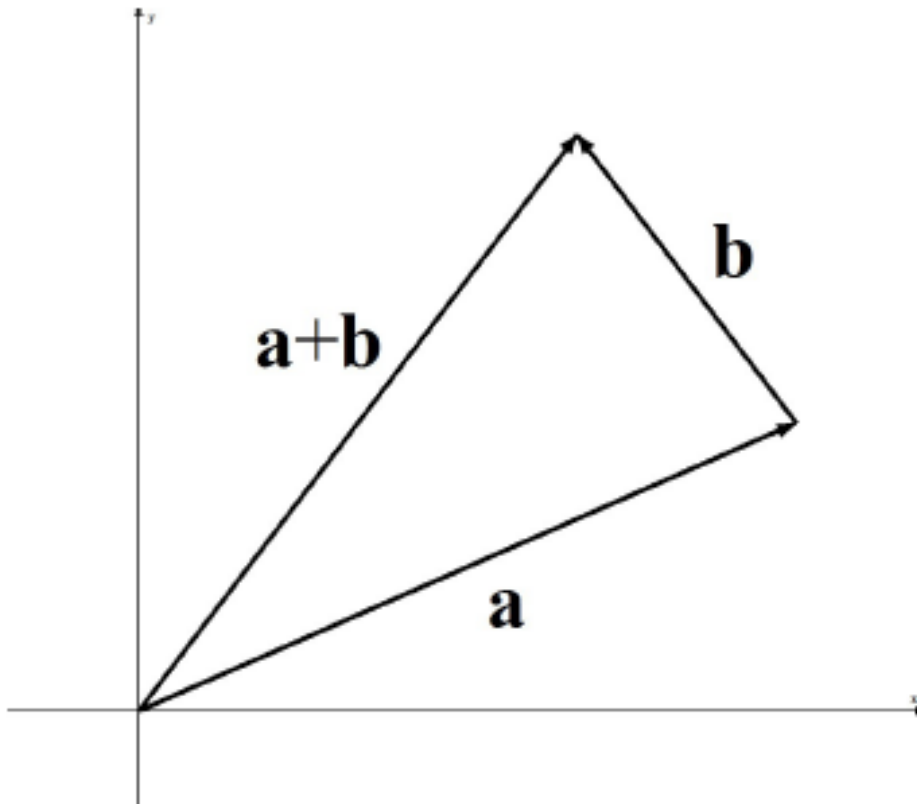- A **unit vector** has length one. Note:

$$\frac{1}{|v|}v = \text{unit vector in the same}$$

direction as **v**.

- We define the **vector sum** by

$$\mathbf{v} + \mathbf{w} = \langle v_1, v_2, v_3 \rangle + \langle w_1, w_2, w_3 \rangle$$

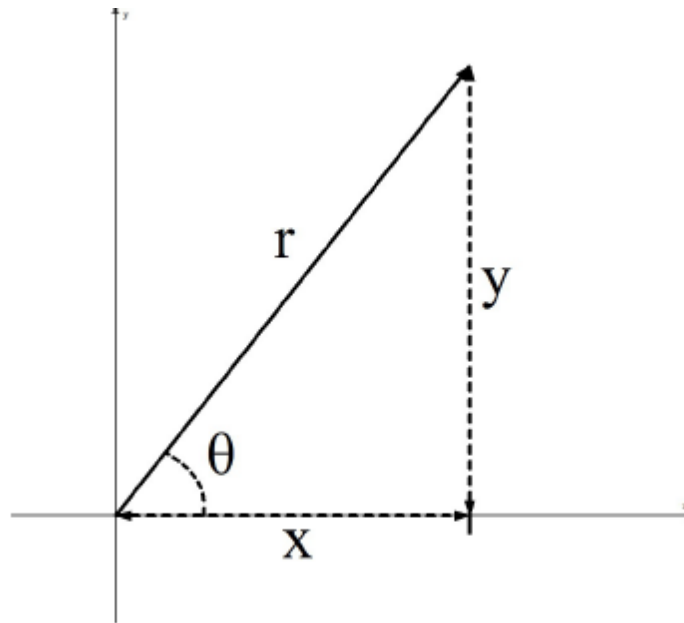$$= \langle v_1 + w_1, v_2 + w_2, v_2 + w_2 \rangle$$

- Standard unit basis vectors:

$$\mathbf{i} = \langle 1, 0, 0 \rangle$$
$$\mathbf{j} = \langle 0, 1, 0 \rangle$$
$$\mathbf{k} = \langle 0, 0, 1 \rangle$$

- In 2D, you may be given the angle, θ, and length, *r*, as shown

Remember,

$$x = r \cos(\theta), \quad y = r \sin(\theta), \quad x^2 + y^2 = r^2.$$

- In 2D, if you want a vector that is **parallel to a line with slope *m*,** then the vector < 1 , m > works.