Physics 121 – August 31, 2017

Assignments:

This week:

- Finish reading Chapter 2 of textbook (you can skip polar coordinates for now)
- Complete ETA Problem Set #2 by Sept 4 at 4 PM
- Chapter 2 written problems 38, 47, 50, 62, and 68, **due Sept 5 by 9:30 AM**
- Start reading Chapter 3 (linear motion concepts)

Vectors

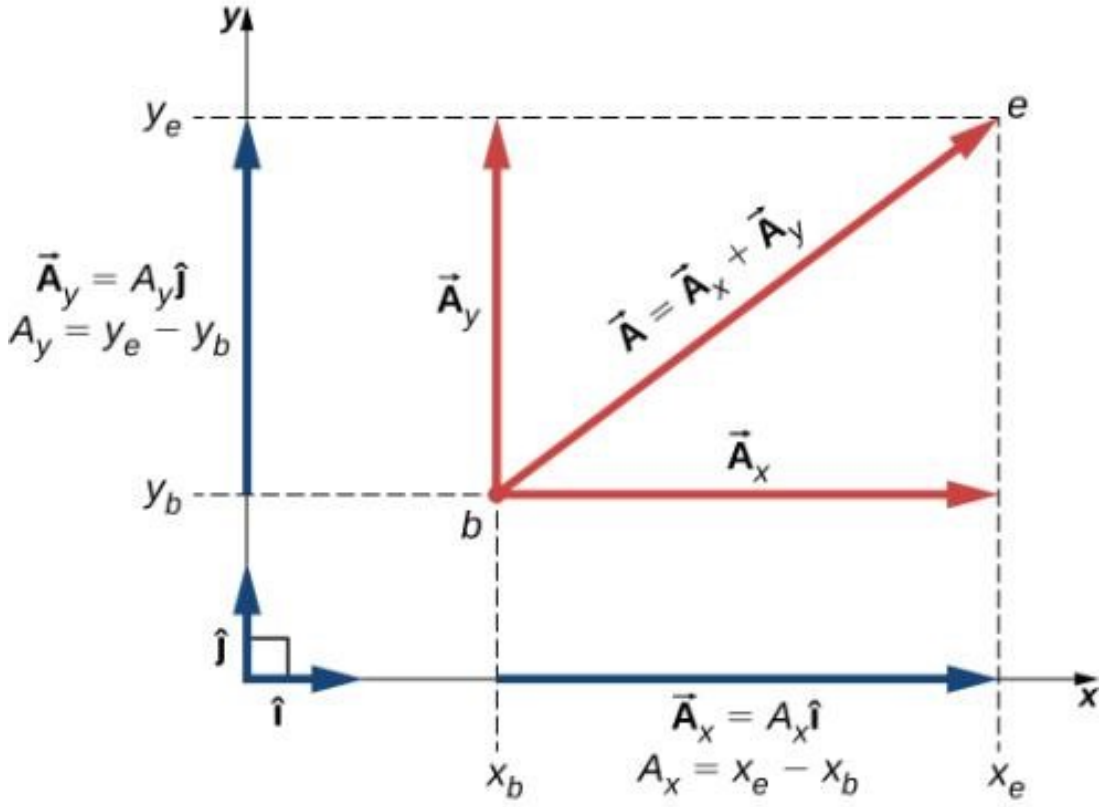
1. **Scalars** are quantities that can be represented by a single number: mass, distance between two points, elapsed time, etc.

Note that scalars can be defined at some point (temperature at the origin of some coordinate system), or we might be talking about a **scalar field,** such as T(x,y,z) equals the temperature defined at all points (x,y,z) in this room.

2. **Vectors** are quantities that must carry two pieces of information: magnitude and direction. Examples are velocity, acceleration, and force.

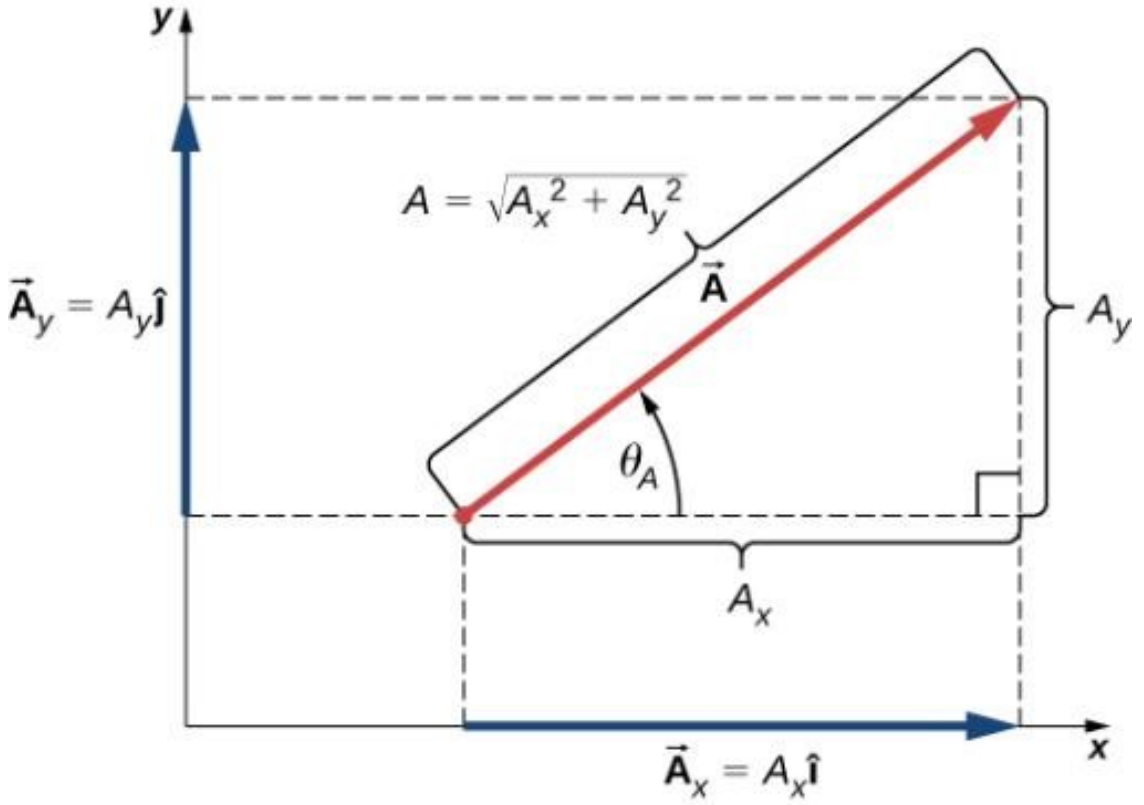
Note that vectors can also be defined at some point (or not), and they can also be used to define a **vector field**, such as the wind velocity (speed and direction) defined at all points in this room.

FIGURE 2.16



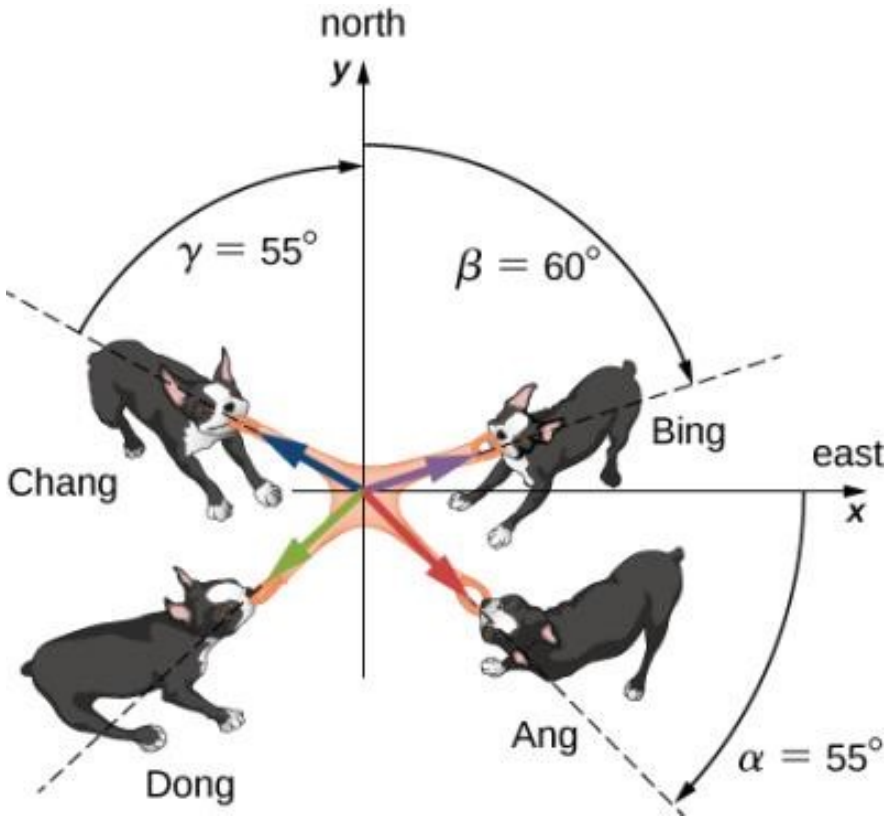
Vector $\vec{\mathbf{A}}$ in a plane in the Cartesian coordinate system is the vector sum of its vector *x*- and *y*-components. The *x*-vector component $\vec{\mathbf{A}}_x$ is the orthogonal projection of vector $\vec{\mathbf{A}}$ onto the *x*-axis. The *y*-vector component $\vec{\mathbf{A}}_y$ is the orthogonal projection of vector onto the *y*-axis. The numbers A_x and A_y that multiply the unit vectors are the scalar components of the vector.

FIGURE 2.18



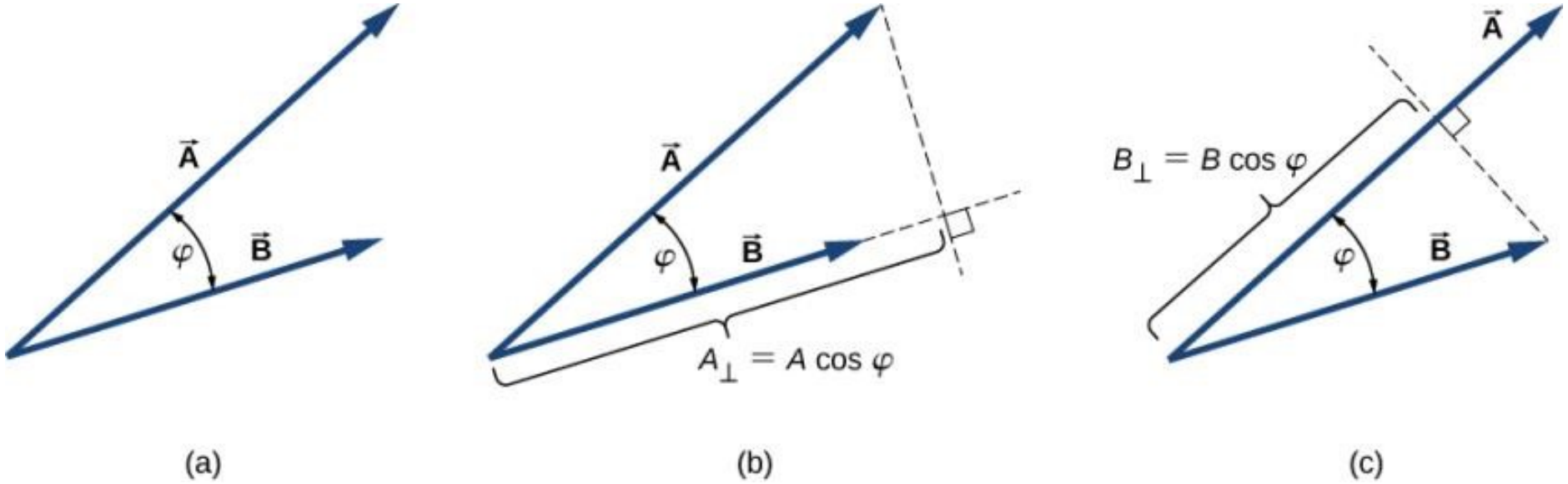
For vector $\vec{\mathbf{A}}$, its magnitude A and its direction angle θ_A are related to the magnitudes of its scalar components because A, A_x, and A_y form a right triangle.

FIGURE 2.25



Four dogs play a tug-of-war game with a toy.

FIGURE 2.27



The scalar product of two vectors.

(a) The angle between the two vectors.

(b) The orthogonal projection $A_\perp$ of vector $\vec{\mathbf{A}}$ onto the direction of vector $\vec{\mathbf{B}}$.

(c) The orthogonal projection $B_\perp$ of vector $\vec{\mathbf{B}}$ onto the direction of vector $\vec{\mathbf{A}}$.