

Physics 2211K  
Principles of Physics I  
Fall 2010  
Dr. Nelson

**Labs:** M 9:00 – 11:50 (CRN 81031)  
W 9:00 – 11:50 (CRN 81032)  
W 1:00 – 3:50 (CRN 81033)

# General Course Content

## **Mechanics, Part 1:**

**Motion: how do we describe it?**

**Actions that change motion: force & Newton's "laws"**

## **Mechanics, Part 2:**

**Another way of looking at force & motion: momentum, energy, and work**

## **Mechanics, Part 3: Applications of Newton's laws**

**Rigid bodies**

**Gravity**

**Oscillations & vibrations**

**Materials: fluids & elasticity**

## **Mechanics, Part 4:**

**A broad view of energy: thermodynamics**

## **Mechanics, Part 5:**

**Waves & wave motion: mechanical aspects**



## How we'll do it with this book:

1. Describing motion: Kinematics.  
Ch. 1 – 4
2. Newton's laws: Force and momentum.  
Ch. 5 – 9
3. Work, energy, and motion of rigid bodies.  
Ch. 10 - 13
4. Oscillations, thermodynamics, and wave motion.  
Ch. 14, 16, 17, 20, 21



# About the Course

## Direct objectives:

Learn basic principles of physics (mechanics) and how they apply to “real world” problems.

## Indirect objectives:

Further develop skills to analyze and approach problems systematically.

## Methodologies:

Mathematical description of physical situations; further develop mathematical skills necessary for analysis; apply graphical representation; interpret graphical representations.

## Math skills:

Algebra, trigonometry, calculus (derivatives and integrals)

## Why should you care?

\*



# Some Basics from Ch. 1

Vectors: Vectors express *magnitude* and *direction*

See section 1.3 (later, in Ch. 3, we'll work with vectors in more detail)

Fundamental quantities:

*Mass, length, and time.*

Units: SI system (English system) see section 1.8

**Length:** meter (foot)

**Time:** second

**Mass:** kilogram (???) --- also, mass vs. weight???

Significant figures: see section 1.8

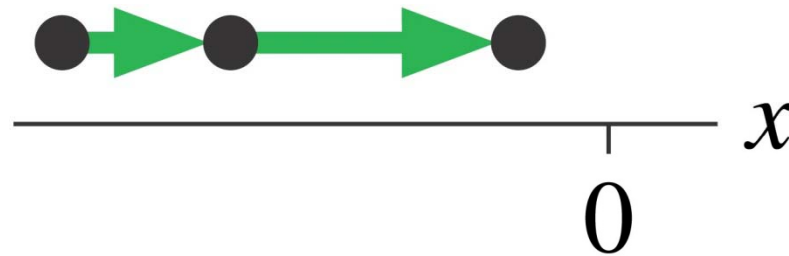
Particles: For now, we will describe objects as having no dimensions—that is, they are single-point objects...

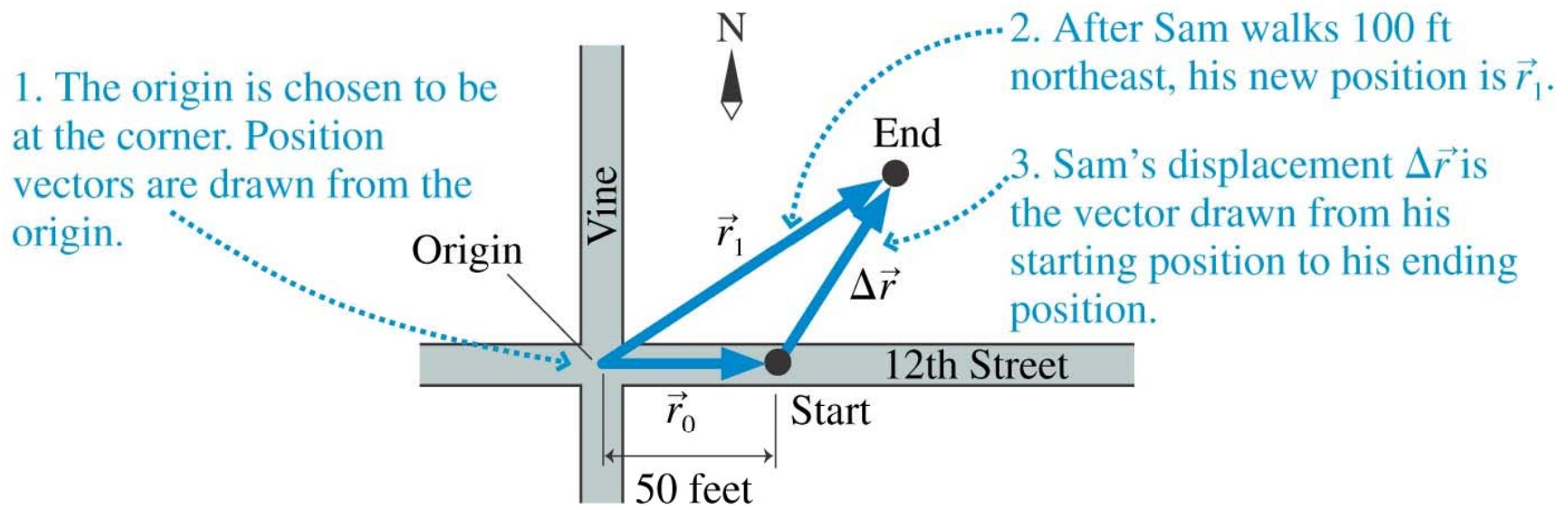


# Position

At its most basic, motion is a *change of position*...so, we need to have a good way to describe position. This introduces *coordinate systems* and *vectors*.

We will introduce these in a two-step manner: 1<sup>st</sup> we'll use a one-dimensional system (a line), and then will expand it to two dimensions (a plane).





Copyright © 2008 Pearson Education, Inc., publishing as Pearson Addison-Wesley.

**Figure 1.6 (from the text)**



# Average Speed, Average Velocity

To quantify an object's fastness or slowness, we define a ratio as follows:

$$\text{average speed} = \frac{\text{distance traveled}}{\text{time required}}$$

Average speed does not include information about direction of motion. Average velocity does include direction. The average velocity of an object during a time interval  $\Delta t$ , in which the object undergoes a displacement  $\Delta \mathbf{r}$ , is the vector



$$\vec{v}_{\text{avg}} = \frac{\Delta \vec{r}}{\Delta t}$$



# Linear Acceleration

Because velocity is a vector, it can change in two possible ways.

1. The magnitude can change, indicating a change in speed, or
2. The direction can change, indicating that the object has changed direction.

$$\vec{a} = \frac{\text{change in velocity}}{\text{time required}} = \frac{\Delta \vec{v}}{\Delta t}$$



# Assignment

- **Enroll in the class on Mastering Physics**
  - <http://www.masteringphysics.com/>
- **Go through the introduction to Mastering Physics**
- **Read through Chapters 1 & 2**
- **Begin working on practice problems**
- **Begin homework set 1 (in Mastering Physics)**

