1/7/13

PHYS 1410 L1

- Continuing in similar vein as Fall, except the physical aspect will be somewhat less intuitive at first since a lot of the ideas don't have simple mechanical analogs common to everyday experience

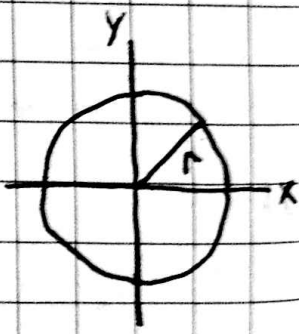
- A couple general tips from the outset to help ensure success:

  - Stay organized and keep a well thought out notebook (hard bound, quad-ruled)
  - When doing HW via WebAssign, clearly write out your work in your notebook. These notes will be an important reference for you, so the cleaner/neater, the easier things will be down the road.
  - PRACTICE! There are lots of problems in the book (w/ solutions). Try to work through some of them regularly.
  - Try to feel comfortable w/ the mathematics. As if it were a second language that allows you to more efficiently + effectively tackle complex concepts

eg. Consider trying to describe to someone all the points on the edge of a circle in words.

VS

Consider the coord. system to the right. All points on circumfrence of circle satisfy $x^2 + y^2 = r^2$



NOTE: A lot of assumptions (or axioms) are made that allow the mathematical framework we use to be so powerful.

1/7/13

- Big picture, the value of 1410 is two-fold:
  1. Allows you to get a much deeper understanding of the physical world around you
  2. Provides you an opportunity to learn how to ask deep probing questions, as well as set out effectively to find answers
     → CRITICAL THINKING

- Challenge yourself to ask questions that relate what you learn in class to everyday things you encounter (e.g. How does my cellphone work?). Good questions will spawn a whole new host of (good) questions!

- Note that while part of my role is to help explain things clearly to you, more importantly, I am here to help you learn how to explain things to everyone else.

- Use various online resources you have access to (eg. google, youtube, wikipedia). You have an unprecedented amount of information literally at your fingertips. Use it!!

- Rough outline for the course:
  - Electric forces + fields (ch. 17)
  - Electric potential (ch. 18)
  - Electric current + circuits (ch. 19)
  - Magnetic fields + forces (ch. 20)
  - Magnetic induction (ch. 21)
  - Harmonic motion (ch. 11)
  - AC circuits (ch. 22)
  - Waves (ch. 12)
  - Electromagnetic waves (ch. 23)

this is the 'capstone' topic we are progressing towards

1/7/13

- Questions we may ask from the outset:
  - what is electricity?
  - what is charge?
  - where do these things come from physically? the brain
  - how do they relate to electronic devices (e.g. a phone, TV)?
  - what does studying them tell us about the physical world?
  - historically, how has studying electricity affected science?

NOTE: Our knowledge about electricity and our engineering mastery over it has fundamentally changed society via technology! (so it's important we all have a good foundation for how this all works!)

- The term 'electron' stems from the Greek word for amber, a material they recognized had some interesting/odd properties (ch. 17.1)

ex Two cats at home = lots of fuzz all over the place. Taking a pen and rubbing it w/ a piece of cloth, then bringing the pen near the couch, causes fur to be attracted to the pen. Why?

IDEA Matter not only has mass, but another fundamental property: CHARGE.

Intuition tells us:
- there are opposites (positive and negative)
- opposites attract
- the same repel
- charge is connected to atoms (i.e. electrons, protons)
- things can be charged or neutral

PHYS 1410 L1 | 1/9/13

History (re electric charge)

- Greeks and amber
- 1600's - basic studies of electricity (e.g. electro-static generator)
- Faraday (1791-1867) - established many basic properties
- Maxwell (1831-1879) - united various concepts into a coherent central theory
- Rutherford (1871-1937) - scattering expts. determined how charge is distributed in atoms

→ New model for the atom: positively-charged tiny nucleus and a negatively-charged smeared out cloud

(Coulomb see below)

ASIDE: This idea added to the growing set of observations that there was something odd going on on a small scale, as if things were quantized rather than continuous. Thus, the early 20th century saw the rapid development of **quantum mechanics**

Charles-Augustin de Coulomb (1736-1806)

- carefully studied forces between charges → **Coulomb's Law**
- Realized that there are a lot of connections between mechanical things (think fall semester) and the electrical realm

Less commonly known (but important!) aspects of charge

- quantized, w/ a fundamental base value (leading to an electron)
- moving charge interacts with/causes magnetic fields (leading into light)
- atoms and molecules can lose/gain charge, creating ions (these are very important in our bodies, e.g., how our brain functions)