Electromagnetism (PHYS 295): Week 4

Intro:

Multipoles, image charge configurations, and conductors will be our topics this week.

Due Friday February 17 before class

Reading:
- Chapter 3 sections 5-7
- Appendix F of PM

A look ahead:
- Simple circuits and Ohm's "law" in Chapter 4 of PM

Problems:

(1) **How far is "far way"?** Picking up on our discussion in class: Suppose you wish to know the electric potential of a physical dipole within 1%. Assume that the configuration and coordinates are chosen as we had in class.
   (a) How close to the origin can you accurately (to 1%) model the dipole ignoring the octupole term? Express your result for r in terms of the spacing between the charges, d.
   (b) If you include the octupole term how close can you get and still accurately (to 1%) model the field?

(2) 2.61 A special case of the dipole field

(3) 2.73 Trying out Laplace's equation

(4) (2 pts.) 2.74 Trying out Laplace's equation and finding a field for an unusual charge distribution. For the field lines in part (b) consider the ratio E_z/E_x. This gives the slope.

(5) 3.31 Conducting shell puzzles - try adding field lines.

(6) 3.42 An image charge problem - skip the last set of questions about generalizing the technique to other geometries