Physics 142, Fall 2013
Homework #2
Due in P142 homework locker 4pm, Friday, September 20, 2013

Feel free to discuss the problems with me and/or each other. Each student must write up his/her own solutions separately.

Unless otherwise indicated, problems are from Ohanian and Markert, Third Edition, Volume 2.

1. O&M chapter 22, problem 48.

2. O&M chapter 22, problem 50.

3. O&M chapter 22, problem 51.

4. O&M chapter 22, problem 52.

5. Although the best available experimental data are consistent with Coulomb's Law, they are also consistent with a modified Coulomb's Law of the form

$$F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}e^{-r/r_0}$$

where r_0 is a constant with the dimensions of a length and a numerical value which is known to be greater than 10^9 m and is probably much larger. Assuming that $r_0 = 10^9$ m, what is the fractional deviation between Coulomb's Law and the modified Coulomb's Law for $r = 1$ m? For $r = 10^4$ m? (Hint: Use the approximation $e^x \approx 1 + x$ for small x.)