203a Homework 1, due Jan. 16

1. Garg 4.3.

2. Garg 14.1.

3. Garg 16.2.

4. Garg 18.1.

5. Garg 21.1.

6. A "dyon" is a (hypothetical) particle with both electric charge q and magnetic charge g. The force on a dyon in electric and magnetic fields is

$$\vec{F} = q\vec{E} + \frac{q}{c}\vec{v} \times \vec{B} + g\vec{B} - \frac{g}{c}\vec{v} \times \vec{E},$$

where the contributions proportional to g follow from the first two with the replacements $q \to g$, $\vec{E} \to \vec{B}$, $\vec{B} \to -\vec{E}$ mentioned in lecture.

a. Find the electric and magnetic fields due to a dyon with electric charge q_1 and magnetic charge g_1 which is nailed down at the origin (it doesn't move).

b. Find the force on a second dyon, with charges q_2 and g_2, at position $\vec{r}$, and velocity $\vec{v}$ (nonrelativistic), in the background of the dyon at the origin of part (a.). Is the angular momentum of the second dyon about the origin conserved? Is the magnitude of the angular momentum conserved?