Homework 7
Due at the beginning of class March 5

1. A uniform magnetic field $B(t)\hat{z}$ just fills a circular region in the x-y plane of radius R centered at the origin. Derive an expression for the induced electric field everywhere in the x-y plane.

2. A wheel of radius $a > R$ in the xy plane and carrying uniform charge density λ along the rim is free to rotate symmetrically along the z axis of the previous problem except that the field initially is B_0. What happens if the magnetic field is quickly turned off? Calculate the effect.

3. A long wire carries time dependent current. In the quasistatic approximation (`http://en.wikipedia.org/wiki/Quasistatic_approximation`), what direction does the electric field point? Justify your answer. Calculate the effect.

4. Model the self inductance of a rectangular wire loop of width D and length $L << D$. What assumptions do you have to make to get an answer?

5. Complete the details of the derivation (e.g. work out the integration by parts) of energy in the vector potential and magnetic fields. Explain in words what the final two terms mean.

6. A long coaxial cable has current I_0 flow down the surface of the inner conductor and back along the outer conductor surface of radius R. Find the magnetic energy stored in a length L.