Week 13 Worksheet
Electrodynamics

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Exercise 1. An infinite solenoid with a number of wire loops per unit length n is hooked up to an alternating current $I = I_0 \sin(\omega t)$. Find the electric field inside the solenoid if the radius of the solenoid $a \ll c/\omega$.
Hint: The z-component of the curl in cylindrical coordinates is

$$(\boldsymbol{\nabla} \times \mathbf{v})_z = \frac{1}{s}\left[\frac{\partial}{\partial s}(s v_\varphi) - \frac{\partial v_s}{\partial \varphi}\right].$$

Exercise 2. A capacitor C is charged up to a voltage V and connected to an inductor L in series at time $t = 0$.

a) ***Griffiths 7.27.*** Find the current in the circuit as a function of time.

b) Show that the total energy of the configuration is constant at any time t, and find this constant.