University of Colorado, Department of Physics
PHYS3320, Spring 2016, HW 12
due Fri, Apr 22 by 5:00pm, in the mailbox at the entrance to the physics helproom

1. [Total: 10 pts]
   If you try to compute the vector potential $\mathbf{A}(\mathbf{r})$ from an infinitely-long straight wire carrying a steady current I, you will get a nasty surprise: the integral for $\mathbf{A}$ diverges logarithmically. Thus, it seems that it is not possible to calculate the $\mathbf{B}$-field via the vector potential in this case. But, there is a nice trick for getting around the infinity in such cases.

   a) [4 pts] Compute the vector potential $\mathbf{A}(\mathbf{r})$ at a distance r from the center of a very long wire, so the limits of integration are $+L$ to $-L$ (where $L \gg r$), instead of ∞ to $-\infty$.

   b) [6 pts] Now compute $\mathbf{B}$ by taking the curl of $\mathbf{A}$ and *then* (at the end) taking the limit as $L \to \infty$.
   (When computing the curl, choose coordinates intelligently. Should you work in Cartesian coordinates, spherical coordinates, ...?)

2. [10 pts] Griffiths 10.10

3. [10 pts] Griffiths 10.12

4. [10 pts] Griffiths 10.15