ECEn 462 (Block 1)
Electromagnetic Radiation and Propagation
Homework #6

1. Book problem 9.2.1
2. A center-fed short dipole extends from $-L<z<L$, where L is small compared to the wavelength ($L<<\lambda$). The current distribution along the antenna has a maximum in the center $I(z=0) = I_o$ and is zero at ends $I(z=\pm L) = 0$. Assume that the current magnitude is linear along it length. Find expressions for the following:
   a. The electric field in the far-field
   b. The power radiated in the far-field, P_{rad}.
   c. The radiation resistance R_{rad}
   d. The antenna gain function $G(\theta,\varphi)$
3. A half-wave dipole is described as a current density
$$\vec{J}(r) = \hat{z}\,\delta(x)\,\delta(y)\,I_o\cos(k\,z)$$
   For $-\lambda/4 < z < \lambda/4$. Find expressions for the following
   a. The magnetic vector potential in the far-field
   b. The electric field in the far-field
   c. The power radiated in the far-field, P_{rad}. Use the fact that
$$\int_0^{\pi} \frac{\cos^2[(\pi/2)\cos\theta]}{\sin\theta}\,d\theta = 1.22$$
   d. The radiation resistance R_{rad}
   e. The antenna gain function $G(\theta,\varphi)$
4. A center-fed half-wave dipole is bent in the shape of a square (see Figure 1). If the current along the length of the dipole varies as $\cos(k\,z)$ (similar to problem 3), what is the magnetic vector potential $\vec{A}$. You only need to set up the integral but not solve it.

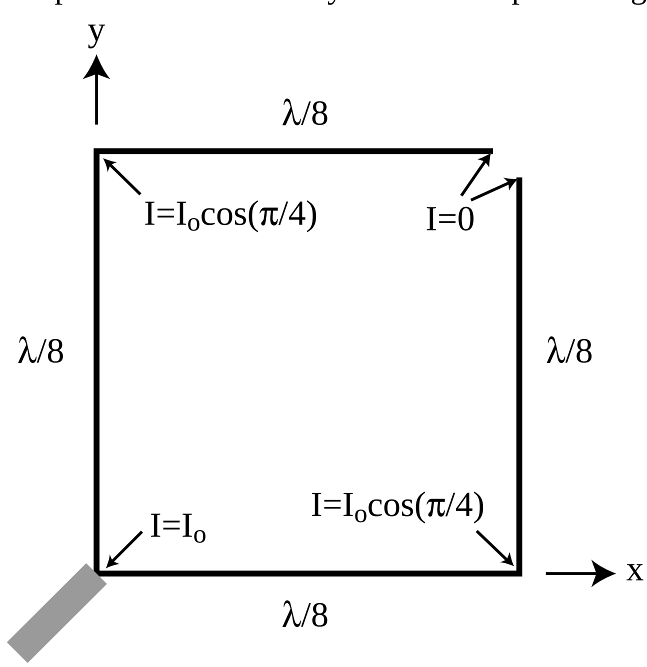

Figure 1