Homework #8 (10 points) - Show all work on the following problems:

Problem 1 (2.5 points): A point charge q moves in a circle of radius a in the x-y plane (centered at the origin) with constant angular velocity ω. If the charge is at $(x,y) = (a,0)$ at $t=0$, find the Liénard-Wiechert scalar and vector potentials for points along the z-axis.

Problem 2 (2.5 points): Find the total electric flux $\oint \vec{E} \cdot \overrightarrow{da}$ through the surface of a sphere centered around a point charge moving with constant velocity. *Hint: The answer is the same as for a stationary point charge – but the math is a little harder.*

Problem 3 (2.5 points): Check that the retarded potentials of an oscillating dipole satisfy the Lorenz gauge condition $\nabla \cdot \vec{A} = -\mu_0 \varepsilon_0 \frac{\partial V}{\partial t}$. Do not assume $r >> c/\omega$.

Problem 4 (2.5 points): Express the scalar and vector potentials, the electric and magnetic fields, and the time-averaged Poynting flux (Eqs. 11.14, 11.17, 11.18, 11.19, 11.21) for electric dipole radiation in a coordinate-independent form, using $p_0 cos\theta = \overrightarrow{p_0} \cdot \hat{r}$.