September 26, 2005

PHY 711 – Problem Set # 14

Consider a particle of mass m and charge q moving in a constant magnetic file $\mathbf{B} = B_0\hat{\mathbf{z}}$.

1. Show that this magnetic field can be described by the vector potential

$$\mathbf{A} = \frac{1}{2}B_0(x\hat{\mathbf{y}} - y\hat{\mathbf{x}}).$$

2. From Newton's second law in cartesian coordinates, find the equations of motion of the particle. (It is not necessary to solve them.)

3. Form the Lagrangian and determine the equations of motion, comparing your results with part (2).

4. Form the Hamiltonian and determine the equations of motion, comparing your results with parts (2) and (3).