Problem 1. [20 pts] Kepler Hamiltonian

Obtain the Hamiltonian and write Hamilton's equations for a particle in the Kepler's potential ($V(r) = -k/r$).

Problem 2. [20 pts] Hamiltonian for a particle in an electromagnetic field

Obtain the Hamiltonian and write Hamilton's equations for a charged particle in an electromagnetic field. Show that these equations are equivalent to the ones obtained from the Lagrangian formalism.

Problem 3. [20 pts] Poisson brackets of angular momentum

Consider a free particle in three-dimensions, and consider cartesian coordinates. If L_i are the components of angular momentum $i = 1, 2, 3$, compute the following Poisson brackets: $\{L_i, L_j\}$, $\{\mathbf{L}^2, L_i\}$. Are they familiar to you?