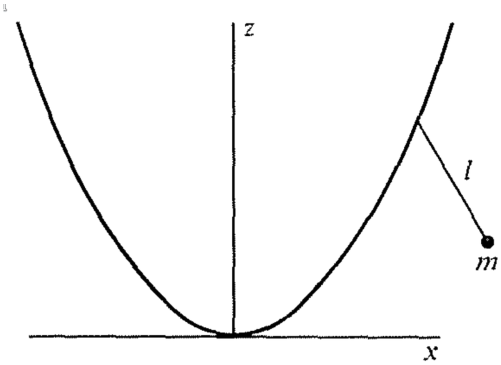
(Due Friday, Dec. 4)

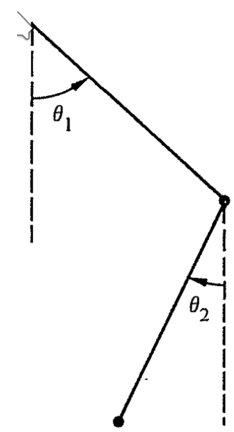
Problems

Solve the following problems.

- The point of suspension of a simple pendulum of length l and mass m is constrained to move on a parabola $z = a x^2$ in the vertical plane.
    - Derive a Hamiltonian governing the motion of the pendulum and its point of suspension.
    - Obtain Hamilton's equations of motion.



- Consider the double pendulum shown in the figure with equal lengths, but not equal masses.
    - Using equation (8.27), find the Hamiltonian.
    - Determine Hamilton's equations of motion.



- A particle of mass m and electric charge e moves in a plane under the influence of a central force potential $V(r)$ and a constant uniform magnetic field **B**, perpendicular to the plane, and generated by a static vector potential,

$$\boldsymbol{A} = \frac{1}{2}\boldsymbol{B} \times \boldsymbol{r}.$$

    - Find (i) the generalized momenta, (ii) Hamiltonian, and (iii) Hamilton's equations of motion relative to the lab inertial system.
    - Repeat now using coordinates rotating relative to the previous inertial system about an axis perpendicular to the plane and with an angular rate of rotation given by, $\omega = -\dfrac{eB}{2m}$.