1. A long straight wire rotates with uniform angular speed ω on a frictionless horizontal surface. A bead of mass m on the wire is constrained to move with the same angular speed, but is free to slide along the wire with speed $\dot{r}$.

   (a) Write down an expression for the kinetic energy of the bead in terms $\dot{r}$ and $\dot{\theta}$.

   (b) Use the principle of least action with the condition $\dot{\theta} = \omega =$ constant to derive a differential equation for r. (Life is easier if you use the full Euler-Lagrange equation rather than the first integral .)

   (c) Given the initial conditions, $r(0) = 1$, $\dot{r}(0) = 0$ show that the bead follows the path $r(\theta) = \cosh\theta$, and sketch this path.

2. Solve the following problems from *Perfect Form* by Lemons: 4.5, 4.6 and 4.7.