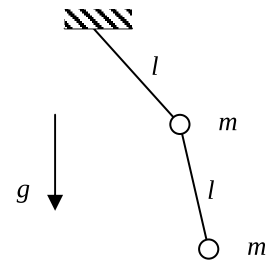
PHY 501 **Classical Mechanics** Fall 2006

Homework #5

(due Friday October 27)

Problem 5.1. (Graded of 20 points.) For a double pendulum confined to a vertical plane, with parameters shown in Fig. below, find possible frequencies of small sinusoidal oscillations, and the corresponding distribution coefficients. Sketch both oscillation modes.



Problem 5.2. (10 points.) We know that the second term in the planetary problem's Lagrangian

$$L = \frac{m}{2}\dot{r}^2 + \frac{m}{2}r^2\dot{\varphi}^2 - U(r)$$

equals $L_z^2/2mr^2$. Explain why it cannot be, after this substitution, merged with $U(r)$ in the above expression. (This would of course give the effective 1D potential energy $U(r) - L_z^2/2mr^2$, substantially different from the (correct) $U_{ef}(r) = U(r) + L_z^2/2mr^2$ calculated in class.) Indeed, we have carried out an apparently similar transformation of the Lagrangian for the bead-on-rotating-ring problem (see in the very end of Sec. 3.1 of the lecture notes); why cannot the same trick work for the planetary problem?