**Phys 3610, Fall 2008**
**Problem Set #3, Hint-o-licious Hints**

**1.** *Taylor*, **3.37**

**2.** *Taylor*, **4.9**

**3.** *Taylor*, **4.23** The most convenient test for the conservative-ness of a force is to see if $\nabla \times \mathbf{F} = 0$. Find $U$ however you can by devising a function such that $\mathbf{F} = -\nabla U$. Of course, the general relation

$$U(\mathbf{r}) = -\int_{\mathbf{r}_0}^{\mathbf{r}} \mathbf{F}(\mathbf{r}') \cdot d\mathbf{r}'$$

will always work but it isn't usually the easiest way.

**4.** *Taylor*, **4.28** The point of this is to see if we can derive the well-known oscillatory motion $x(t)$ of a mass on a spring using the "Complete Solution" method given on pp. 127-128. Use (4.58) to get $t$ as a function of $x$ and invert.

**5.** *Taylor*, **4.30** As far as I can tell, this one is algebraically simple. Draw a picture of the toy tilted at angle $\theta$. The height of the hemisphere's center in fact does not change with $\theta$ so one finds that the height of the center of mass (above the floor) is given by

$$(h - R)\cos\theta + R$$

. The condition of equilibrium is of course $\frac{dU}{d\theta} = 0$ and for stable equilibrium $\frac{d^2U}{d\theta^2} > 0$.

**6.** *Taylor*, **4.35** Here you are asked to redo the energy derivation of the Atwood machine but now include the energy of the (massive) pulley. If the speed of the masses –and any one bit of the string– is $v$, then the angular speed of the pulley is $\omega = v/R$ if the the string does not slip (which we assume).

**7.** *Taylor*, **5.2**

**8.** *Taylor*, **5.13**