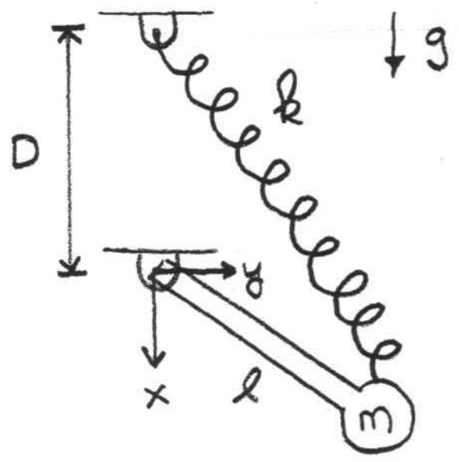
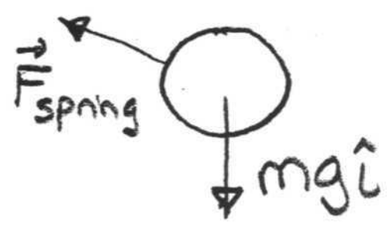
TAM 203
Homework Solutions

Due 4/24/08

13.123



FBD of mass:



$D = 4m,\ l = 3m$

$k = 5\ N/m,\ m = 2kg$

$g = 10\ m/s^2$

$$\vec{F}_{spring} = -k\vec{x}_{spring} = -k(D\hat{\imath} + \vec{r})$$

$$\sum \vec{F} = m\vec{a} \quad \therefore \quad -k(D\hat{\imath}+\vec{r}) + mg\hat{\imath} = ml(-\dot{\theta}^2\hat{e}_r + \ddot{\theta}\hat{e}_\theta)$$

$$\text{OR} \quad mg\hat{\imath} - kD\hat{\imath} - k\vec{r} = ml\ddot{\theta}\hat{e}_\theta - ml\dot{\theta}^2\hat{e}_r$$

$$mg\hat{\imath} - kD\hat{\imath} - kl\hat{e}_r = ml\ddot{\theta}\hat{e}_\theta - ml\dot{\theta}^2 l\hat{e}_r$$

$$\{\} \cdot \hat{e}_\theta \rightarrow \quad mg(-\sin\theta) - kD(-\sin\theta) = ml\ddot{\theta}$$

$$\text{OR} \quad ml\ddot{\theta} = \sin\theta\,(kD - mg)$$

Therefore, $\boxed{\ddot{\theta} = \dfrac{kD-mg}{ml}\sin\theta}$

Since $kD = 20\ N = mg$, $\boxed{\ddot{\theta} = 0 \text{ at all times}}$