HW Feb 12, Johannes Byle

4.16 Since $F = -\nabla U$

$$F = -2kx\hat{x} - 2ky\hat{y} - 2kz\hat{z}$$

4.21 If a force is conservative $\nabla \times F = 0$. Since $\frac{GMm}{r^2}\hat{r}$ is only dependent on r, and is in the r direction only $\frac{\delta A_r}{\delta r}$ would be nonzero in the curl equation, but that term is not present. Thus $\nabla \times F = 0$.

$$\int \frac{GMm}{r^2} dr = -\frac{GMm}{r}\hat{r}$$

4.36 (a)

$$U = -(MgH + mgh)$$

$$H = l - \frac{b}{sin\theta}$$

$$h = \frac{b}{tan\theta}$$

$$U = -Mg(l - \frac{b}{sin\theta}) - \frac{mgb}{tan\theta}$$

$$U = -Mgl - Mgbcsc\theta - mgbcot\theta$$

(b)

$$\frac{dU}{d\theta} = Mgbcsc\theta cot\theta + mgbcsc^2\theta = gbcsc\theta(Mcot\theta + mcsc\theta)$$

Thus this does not have an equilibrium position.