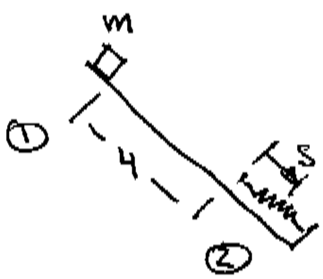
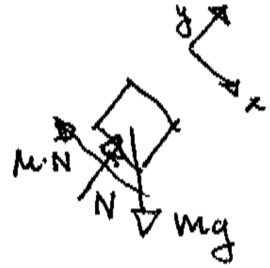
Test 1 ME 230 Spring 09

1a)



FBD



y dir: $N - mg\frac{1}{\sqrt{2}} = 0$

$N = \frac{1}{\sqrt{2}} \cdot mg$

Position ①: $V_1 = 0$, $T_1 = 0$

Position ②: $V_2 = -(4+s)\cdot\frac{1}{\sqrt{2}}\cdot mg + \frac{1}{2}ks^2$, $T_2 = 0$

Work done by friction force:

$$W_f = (N\cdot\mu)(4+s) = \frac{1}{\sqrt{2}} mg\cdot\mu(4+s)$$

$T_1 + V_1 = T_2 + V_2 + W_f \Rightarrow$

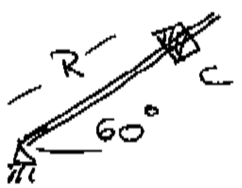
$$0 = -(4+s)\frac{1}{\sqrt{2}}mg + \frac{1}{2}ks^2 + \frac{1}{\sqrt{2}}mg\mu(4+s) \Rightarrow$$

$$s^2 - \sqrt{2}(4+s)\frac{mg}{k}(1-\mu) = 0 \Rightarrow s^2 - \sqrt{2}\frac{mg}{k}(1-\mu)s - \sqrt{2}\cdot 4\frac{mg}{k}(1-\mu) = ($$

solve for s.

1b) $F = kx^3 \Rightarrow V = \int_0^x kx'^3 dx' = \frac{1}{4}kx^4 \Leftarrow$ ans

2)



$\underset{\sim}{a}_c = a_r\underset{\sim}{u}_r + a_\theta\cdot u_\theta$

$\underset{\sim}{a}_r = \ddot{r} - r\dot{\theta}^2$

$a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta}$

FBD:

θ dir: $-F_\theta = ma_\theta = m(\cancel{r\cdot\ddot{\theta}}^{\,0} + 2\dot{r}\dot{\theta}) = 0.4(2(-3)\cdot 1.5)$

$F_\theta = 3.6$ N

Total force $\boxed{\underset{\sim}{F} = -3.6\,\underset{\sim}{u}_\theta \text{ N}}$