ME 464/664 Solns, Exam 1 2006

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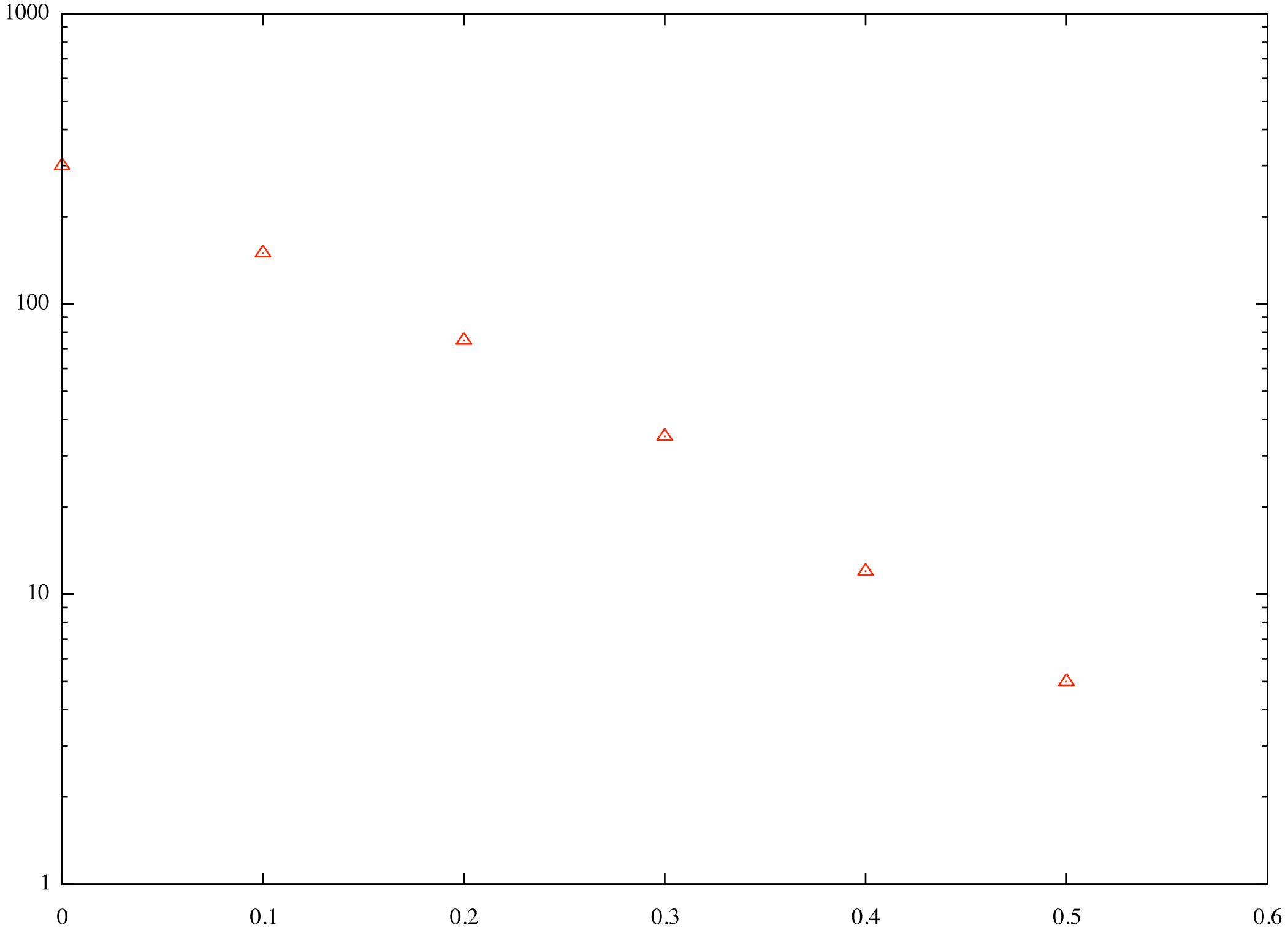
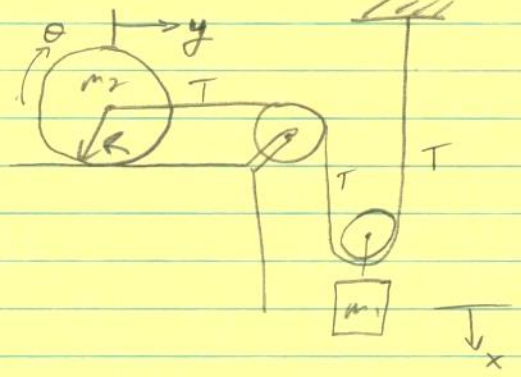
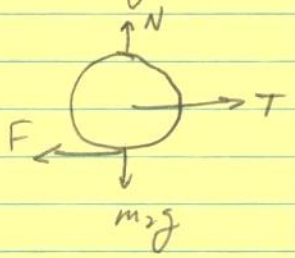
```
t=(0:.1:.6)';
T=[300 150 75 35 12 5 2]';

semilogy(t,T,'*')

logT=log(T);

p=polyfit(t,logT,1)
m=p(1)
b=exp(p(2))

disp(['solution is ' num2str(b) 'e^' num2str(m) 'T'])
```


1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6

2)



$2X = y$, $R\theta = y$



① $m_1 \ddot{x} = m_1 g - 2T$

② $m_2 \ddot{y} = T - F$

③ $I\ddot{\theta} = FR$, $F = \frac{I}{R}\ddot{\theta}$

③ into ② $m_2 \ddot{y} = T - \frac{I}{R}\ddot{\theta}$

simplify $m_2 \ddot{y} = T - \frac{I}{R^2}\ddot{y}$

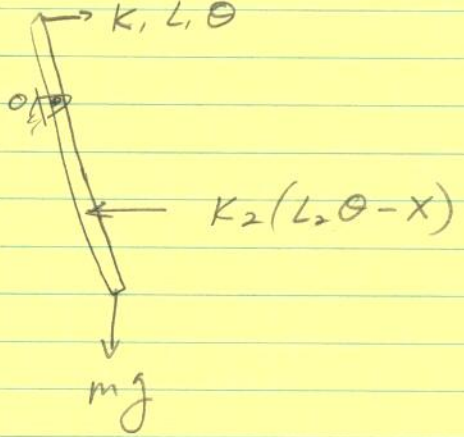
simplify $T = \left(m_2 + \frac{I}{R^2}\right)\ddot{y}$

Subst into ①

$$m_1 \ddot{x} = m_1 g - 2\left(m_2 + \frac{I}{R^2}\right)\ddot{y}$$

$$\left[m_1 + 4\left(m_2 + \frac{I}{R^2}\right)\right]\ddot{x} = m_1 g$$

3)



$$\sum M_o = I\ddot{\theta} = -K_1 L_1 \theta (L_1 \cos\theta) - K_2(L_2\theta - x) L_2 - mg L_3 \sin\theta$$

$\sin\theta \approx \theta$ for small θ, $\cos\theta \approx 1$ for small θ

$$I\ddot{\theta} + (K_1 L_1^2 + K_2 L_2^2)\theta = mg L_3 \sin\theta + K_2 L_2 x$$

4) Linear: 2, 3

Autonomous: 1, 2, 4