Math 3280 Worksheet 27:

Group members (2 to 4): _____

(1) Rewrite the initial value problem $y(0) = 1$, $y'(0) = 2$, $y''(0) = 0$, $y''' + y'' - xy' = x$ as an equivalent first-order system.

(2) Suppose a swinging door is damped so that angle of the door (relative to the wall its in) satisfies the differential equation:

$$\theta'' + 2\theta' + \theta = 0$$

for $0 \leq \theta \leq \pi$ (derivatives are with respect to time $t$).
Initially the door is open at an angle of $\theta(0) = \pi/2$.
(a) Find the solution $\theta(t)$, treating the initial velocity $v_0 = \theta'(0)$ as a parameter.

(b) If it is pushed shut with an initial velocity of $\theta'(0) = v_0 < 0$, for what values of $v_0$ will the door actually close completely ($\theta = 0$) in finite time?