Computational Methods in Structural Dynamics, Final   Winter 2000
One 8.5" by 11" cheat sheet.

1. The partially non-dimensionalized equation of motion of a tapered beam is given by:
$\frac{\partial^2}{\partial \xi^2} \left(\frac{2}{3} \xi^3 \frac{\partial^2 w}{\partial \xi^2} \right) + 2 \xi \frac{\partial^2 w}{\partial t^2} = 0$. Assuming a deflection form of $W(\xi) = a_1 (1 - \xi)^2 + a_2 \xi (1 - \xi)^2$, estimate the first and second natural frequencies of the beam using both one and two term representations of the mode shape/s *using the collocation method.* (10 points)

2. A system is modeled by the following equation. Assume m, c, and k are greater than zero. Is the system asymptotically stable? You must justify your answer using Liapunov stability. (10 points)

$$\begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix} \ddot{\mathbf{x}} + \begin{bmatrix} c & -c \\ -c & c \end{bmatrix} \dot{\mathbf{x}} + \begin{bmatrix} 2k & -k \\ -k & k \end{bmatrix} \mathbf{x} = \mathbf{0}$$