ENEE 241/MATH 242 Dr. Wolfe ASSIGNMENT #3 Due February 26, 2001

Readings: *Chapra & Canale* , Sections PT3.2, 9.2, 12.3.

1. Problem 9.3, p.264 *Chapra & Canale* . Do both by hand and with MATLAB .
2. MATLAB
   (a) Let Y be as in problem 9.3, p.264 *Chapra & Canale* . Compute both $Y.\hat{}\ 2$ and $Y\hat{}\ 2$ and explain the difference between the two results.
   (b) Let $\mathbf{a} = [\ 1\ 2\ 3\ 4\ ]$. Compute both $\mathbf{a} * \mathbf{a}'$ and $\mathbf{a}' * \mathbf{a}$ and explain the difference between the two results.
3. MATLAB . Let $\mathbf{w} = \text{rand}(2,1),\ \mathbf{z} = \mathbf{w}/\text{sum}(\mathbf{w})$. Let
$$P = \begin{pmatrix} .2 & .4 \\ .8 & .6 \end{pmatrix}$$
   Compute $P^n\mathbf{z}$ for $n = 1, \ldots 20$. What do you notice ?
4. Solve the following systems by Gauss Elimination (by hand).
   (a)
$$\begin{aligned} -x_1 + 2x_2 + x_3 &= 5 \\ x_1 + 4x_2 - 3x_3 &= -8 \\ -2x_1 \qquad + x_3 &= 5 \end{aligned}$$
   (b)
$$\begin{aligned} x_1 - x_2 + x_3 &= 0 \\ 2x_1 + x_2 - x_3 &= -3 \\ x_1 + 2x_2 - 2x_3 &= -2 \end{aligned}$$
5. Problem 12.22, p.324 *Chapra & Canale* . Just use the MATLAB backslash operator.
6. We consider the <u>nonlinear</u> system
$$\begin{aligned} f_1(x,y) &= 4x^2 + y^2 - 4 = 0 \\ f_2(x,y) &= x + y - \sin(x - y) = 0 \end{aligned}$$
   It is known that this system has a solution near $(1,0)$. We can write this system in vector form $\mathbf{f}(\mathbf{w}) = \mathbf{0}$ where
$$\mathbf{w} = \begin{bmatrix} x \\ y \end{bmatrix}, \quad \mathbf{f}(\mathbf{w}) = \begin{bmatrix} f_1(x,y) \\ f_2(x,y) \end{bmatrix}$$
   Let
$$A = \begin{pmatrix} .125 & 0 \\ -.04 & .65 \end{pmatrix}$$
   Since A is nonsingular, solving $\mathbf{f}(\mathbf{w}) = \mathbf{0}$ is equivalent to finding a fixed point of $\mathbf{g}(\mathbf{w}) = \mathbf{w} - A\mathbf{f}(\mathbf{w})$. Use MATLAB <u>efficiently</u> to find a fixed point of $\mathbf{g}$ by iterations starting with $\mathbf{w_0} = (1,0)'$.