Nonlinear Systems: Homework Assignment #1

Due at the start of class on Friday Feb 9th

1. Problem 1.5 in HK (Note: HK refers to Hassan Khalil's Nonlinear Systems textbook, 3rd edition)
2. 1.15 in HK
3. Using ode45 in Matlab (or equivalent), simulate the Lorenz system

$$\dot{x} = \sigma(y - x)$$

$$\dot{y} = rx - y - xz$$

$$\dot{z} = xy - bz$$

with $\sigma = 10, b = \frac{8}{3}, and\ r = 28.$ Use plot3 to plot solutions for the initial conditions (0,2,0), (0,-2,0), and (0,2.01,0). Briefly describe the behavior of the solutions and their dependence on the initial conditions. Please include your Matlab figures and source code.

4. Problem 2.1(2) in HK
5. Problem 2.8 in HK
6. Problem 2.17(2) in HK
7. Problem 2.27(3) in HK
8. Problem 3.1 (6) in HK
9. Problem 3.2 (1) in HK
10. Problem 3.9 in HK