Read: 9.7

Problems:

- 9.37 (both sketch by hand and verify with Matlab function nyquist).

- **Problem 2:** Determine the range of $k$ for which each of the following plants, under unity feedback, is stable by hand-sketching a Bode plot for $k = 1$ and imagining the magnitude plot sliding up or down in until instability results. Validate your results using the Matlab function margin.

  (a) 
  \[ kG(s) = \frac{k(s + 1)}{s(s + 5)} \]

  (b) 
  \[ kG(s) = \frac{k}{(s + 0.5)(s^2 + 1.2s + 9)} \]

- **Problem 3:** The Nyquist diagrams for two stable, open-loop systems are sketched in Fig. 1. The proposed operating gain is 1 and arrows indicate increasing frequency. In each case give a rough estimate of the following quantities for the closed-loop (unity feedback) system:

  (a) Phase margin
  
  (b) Range of gain for stability (if any)
  
  (c) System type (0,1, or 2)
Fig. 1. Nyquist plots for Problem 3