# System Modeling, Dynamics and Control
Tutorial 9, Autumn Semester, 2006

1. The figures below show the polar plots of four open-loop transfer functions. The transfer functions shown in (a), (c) and (d) are all stable, while the transfer function shown in (b) is a second-order transfer function with one ORHP pole. Which of the unity-feedback closed-loop systems formed from these four systems will be stable? If the feedback is through a positive gain K, how will your answer change with increasing/decreasing K?

(a)

(b)

(c)

(d)
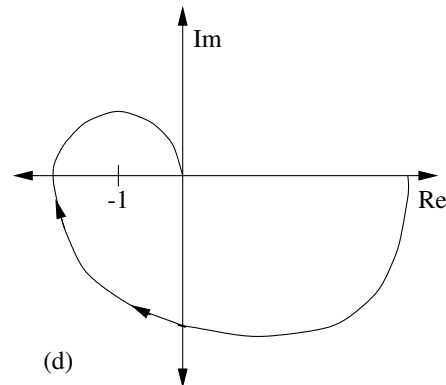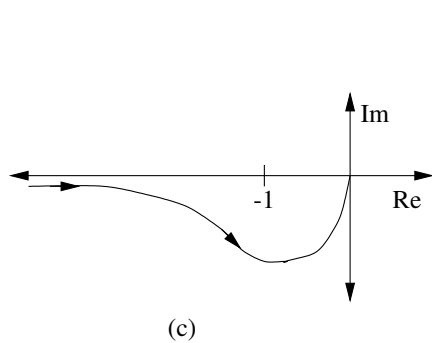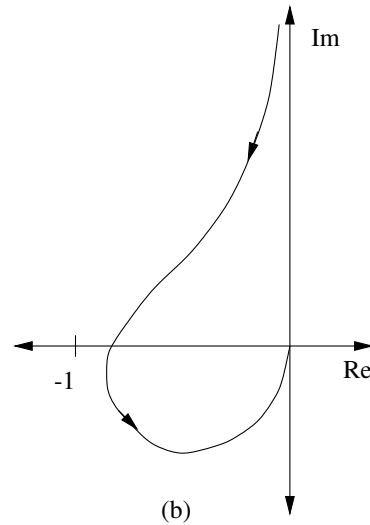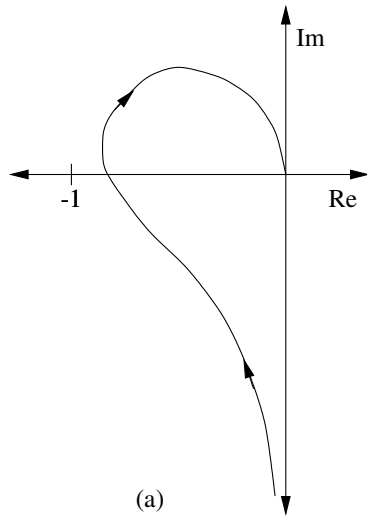
2. Is the closed-loop system having open-loop transfer function $G(s)H(s) = K[s(s+1)(s+2)]^{-1}$ stable for $K = 2$? Find the critical value of K for stability.

3. A closed-loop system has $G(s) = 1/s^2$ and $H(s) = K(s+2)$. Find K such that the system has a phase margin of $50°$. What is the gain margin for this value of K?

4. Determine the closed-loop stability of a unity feedback system having the open-loop transfer function $G(s) = K(1-s)/(s+1)$.