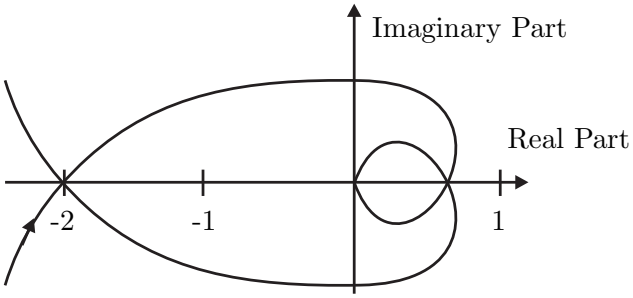
Homework 8: Nyquist Plot and Nyquist Criterion

Note: This homework assignment is due on Monday 23.04.2012, 15:40.

Problem 18:

We consider the basic feedback control loop with the open-loop transfer function $G_o(s) = K \cdot G(s)$. We assume that K is a positive constant and $G(s)$ has no poles in the open right half plane. The Nyquist plot of $G_o(s)$ for the value $K = 10$ is shown in the following figure.



a. Why is the basic feedback control loop instable for $K = 10$?

b. How should we choose K such that stability is achieved? Sketch the Nyquist plot for one possible choice of K.

Problem 19:

Sketch the Nyquist plot of the following transfer functions

$$G_1(s) = \frac{1}{s+4} \qquad G_2(s) = \frac{s+4}{s(s+10)(s+20)} \qquad G_3(s) = \frac{s+4}{s^2}$$

Problem 20:

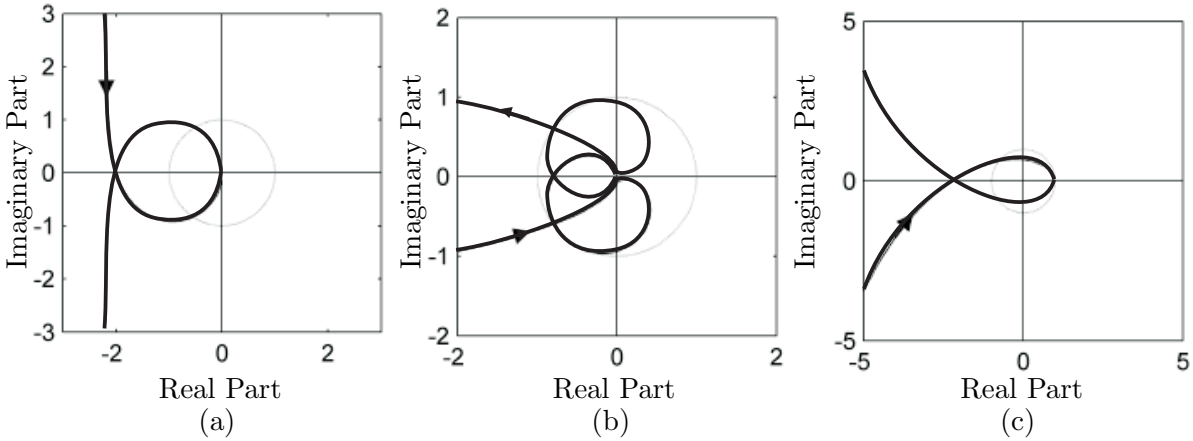
The following three open-loop transfer functions are given

$$G_{o1}(s) = \frac{85(s+1)(s^2+2s+43.25)}{s^2(s^2+2s+82)(s^2+2s+101)}$$

$$G_{o2}(s) = \frac{s^4+2s^3+1.5s^2+3.5s+4}{s(s+1)^3}$$

$$G_{o3}(s) = \frac{20(s+1)}{s(s-10)}$$

a. Match the above transfer functions to the Nyquist plots in the following figure.



b. Decide which of the open-loop transfer functions leads to a stable basic feedback control loop. Justify your answer!