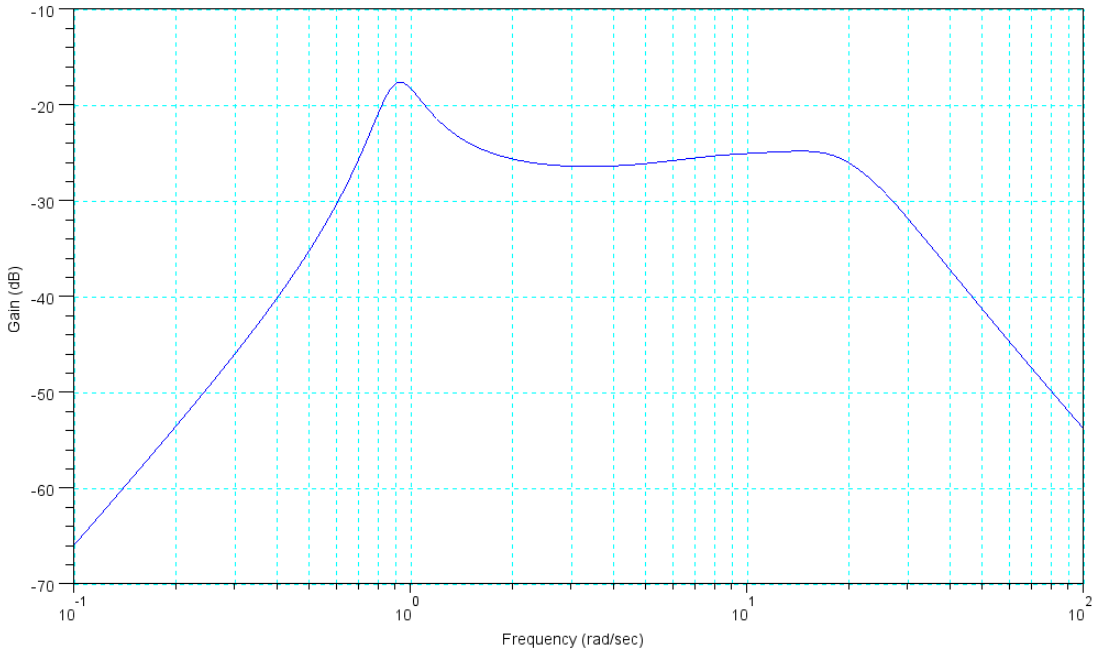
Homework #12: ECE 461/661

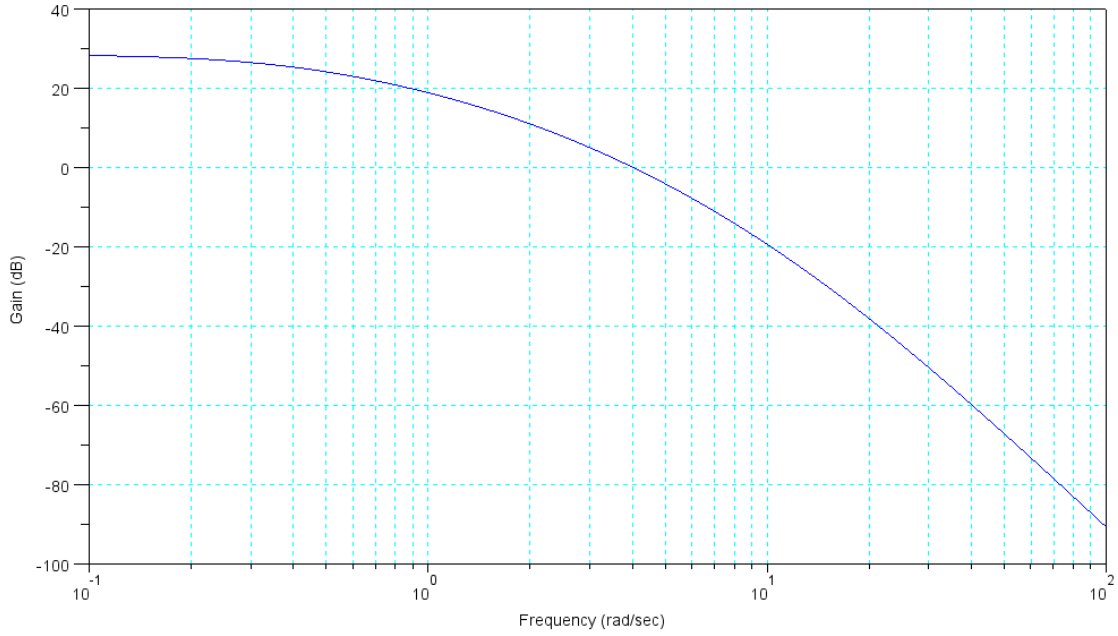
Bode Plots, Nichols Charts, Nyquist and Inverse Nyquist Diagrams. Due Monday, December 3rd, 2018

Bode Plots

1) Determine the system which has the following gain vs. frequency (Bode plot)



2) Determine the system which has the following gain vs. frequency



Nichols Charts

3) The gain vs. frequency for a system is as follows:

Freq (rad/sec)	0	2	1	3	4	5
Gain (dB)	29.11	21.07	13.46	7.58	2.77	-1.31
Phase (deg)	0	-98	-136	-160	-176	-188

a) Plot this data on a Nichols Chart

b) Determine the range of gain, k, which results in a stable closed-loop system

c) From this data, determine the gain, k, which results in a resonance of Mm = +6dB

4) For the system

$$G(s) = \left(\frac{1000}{(s+2)(s+5)(s+20)} \right)$$

a) Plot the gain & phase of G(s) on a Nichols chart

b) Determine the gain, k, which results in a resonance of Mm = +6dB

c) Check your answer by plotting the closed-loop gain vs. frequency

$$G_{cl} = \left(\frac{Gk}{1+Gk} \right)$$

5) For the system with a 200ms delay

$$G(s) = \left(\frac{1000}{(s+2)(s+5)(s+20)} \right) \cdot e^{-0.2s}$$

a) Plot the gain & phase of G(s) on a Nichols chart

b) Determine the gain, k, which results in a resonance of Mm = +6dB

c) Check your answer by plotting the closed-loop gain vs. frequency

Nyquise Plots

6) Using a Nyquist plot, determine the gain, k, which results in a resonance of Mm = +6dB

$$G(s) = \left(\frac{1000}{(s+2)(s+5)(s+20)} \right)$$

Inverse Nyquist Plots

7) Using a Nyquist plot, determine the gain, k, which results in a resonance of Mm = +6dB

$$G(s) = \left(\frac{1000}{(s+2)(s+5)(s+20)} \right)$$