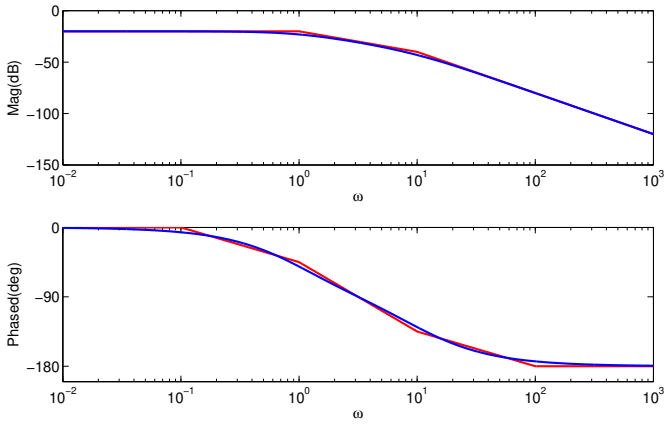
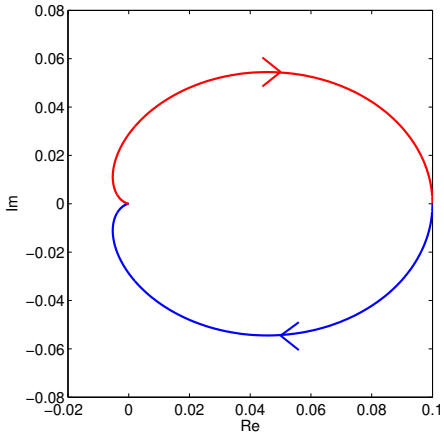
MAE 143B - Homework 8

7.1/7.2

a)



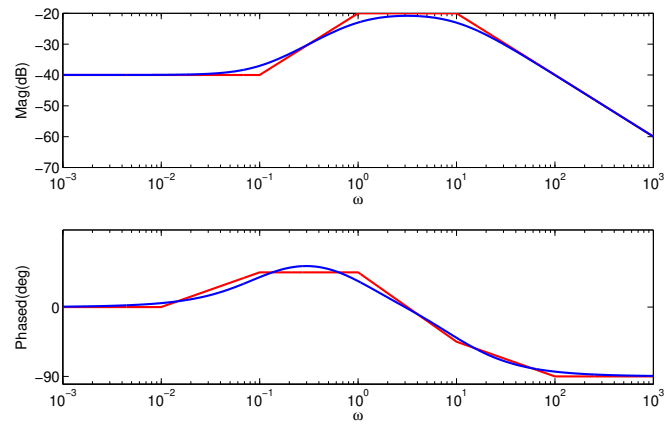
Bode plot for 7.1; red for straight-line approximation.



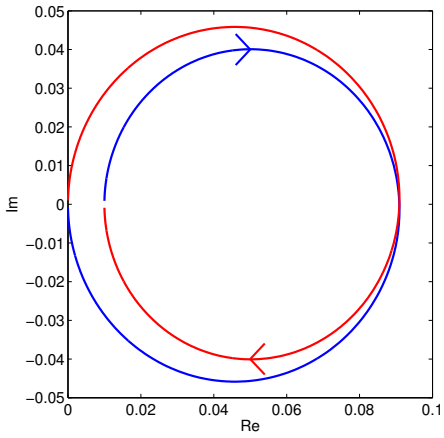
Polar plot for 7.2; red for negative ω.

Figure 1: $G(s) = \frac{1}{(s+1)(s+10)}$

b)



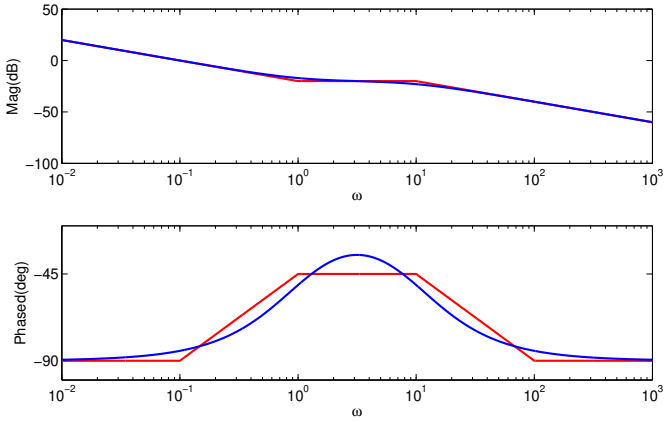
Bode plot for 7.1; red for straight-line approximation.



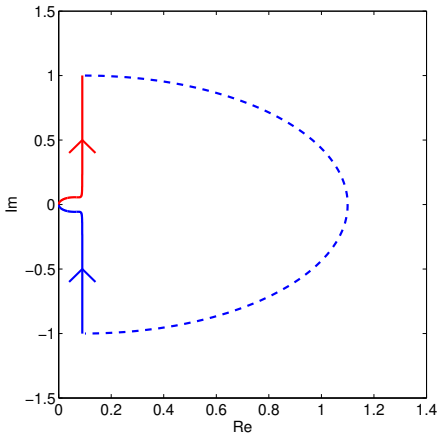
Polar plot for 7.2; red for negative ω.

Figure 2: $G(s) = \frac{s+0.1}{(s+1)(s+10)}$

h)



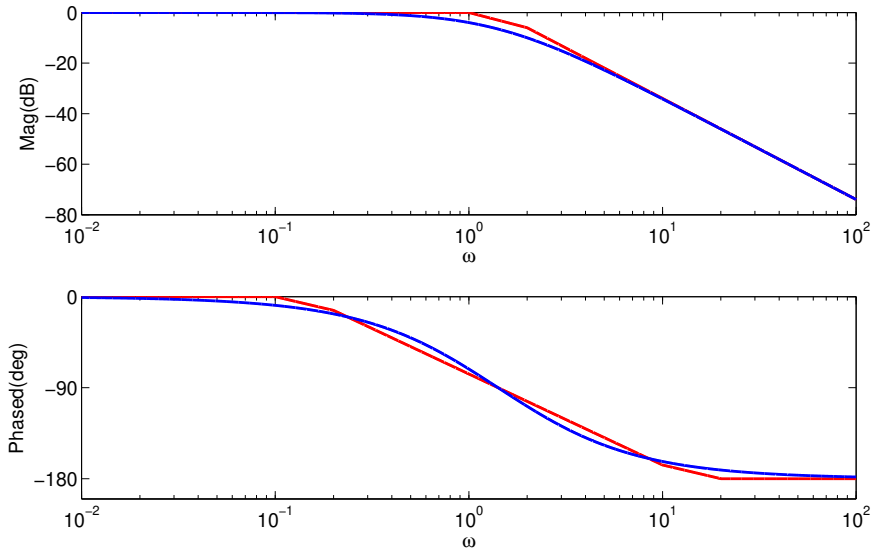
Bode plot for 7.1; red for straight-line approximation.



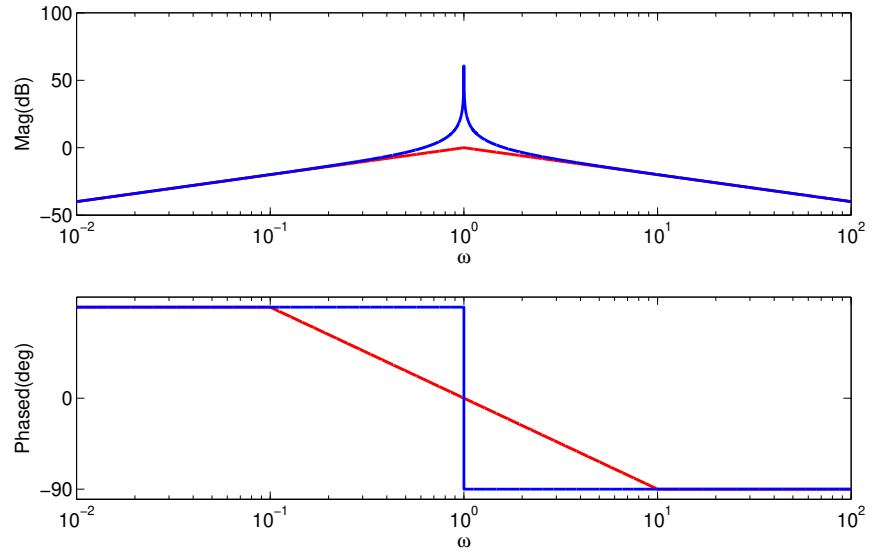
Polar plot for 7.2; red for negative ω; semi-circle is traversed at radius $\rho \to \infty$.

Figure 3: $G(s) = \frac{s+1}{s(s+10)}$

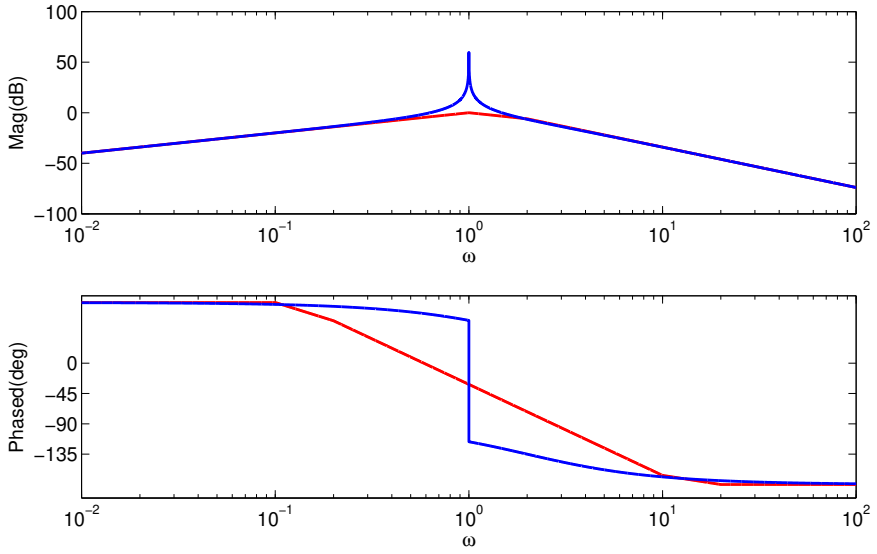
7.3



a) $G(s) = \frac{2}{(s+1)(s+2)}$; red for straight-line approximation.



f) $G(s) = \frac{s}{s^2+1}$; red for straight-line approximation.



h) $G(s) = \frac{2s}{(s^2+1)(s+2)}$; red for straight-line approximation.

7.6

a)

$$G(s) = \frac{s+1}{s+10}$$

d)

$$G(s) = \frac{s+10}{(s+1)^2}$$

h)

In this case, we have complex conjugate second order poles, leading to

$$G(s) = \frac{s+1}{(1+2\zeta s/\omega_n + s^2/\omega_n^2)},$$

with $\omega_n = 1$ and $\zeta \approx 0.2$. This yields

$$G(s) \approx \frac{s+10}{1+0.4s+s^2}.$$