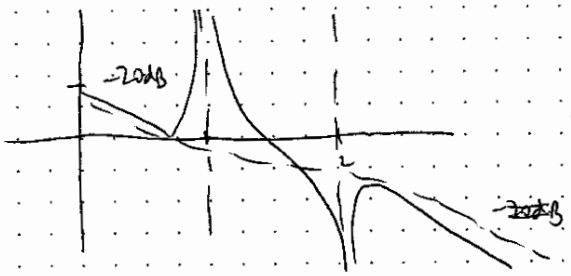
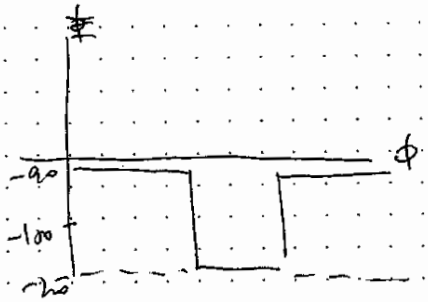
EE141 HW 7

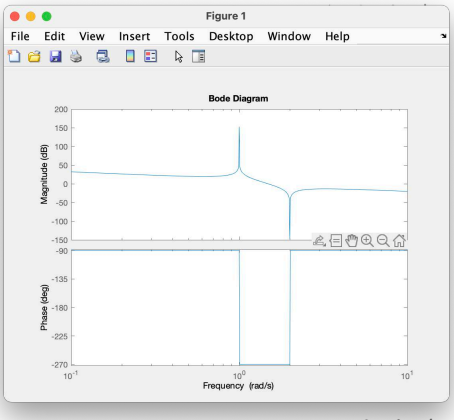
(5) $L(s) = \frac{s^2+4}{s(s^2+1)} = \frac{4(s^2/4+1)}{s(s^2+1)}$ asymp $4/s$ ← -20 dB/dec.

$L(j\omega) = \frac{4\left(4\left(\frac{j\omega}{2}\right)^2+1\right)}{(j\omega)^2+1)j\omega}$ asymp: 1, 2

$20 \log 4 = 12$ dB

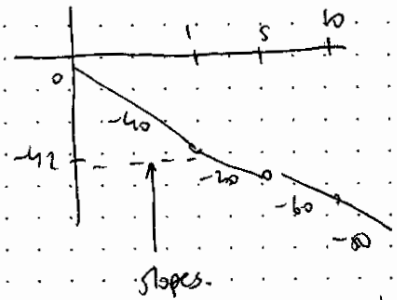




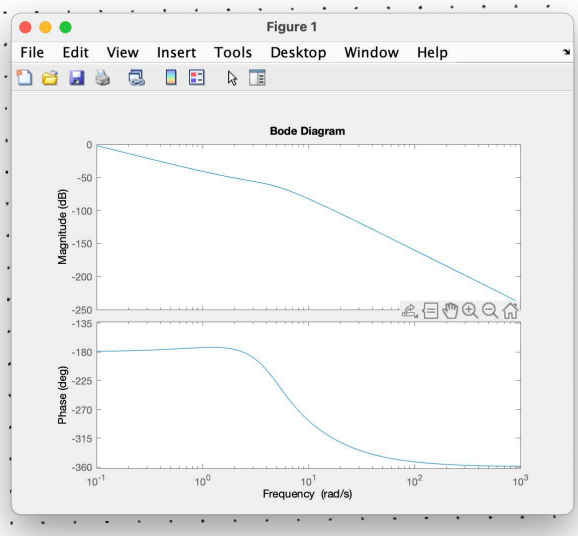


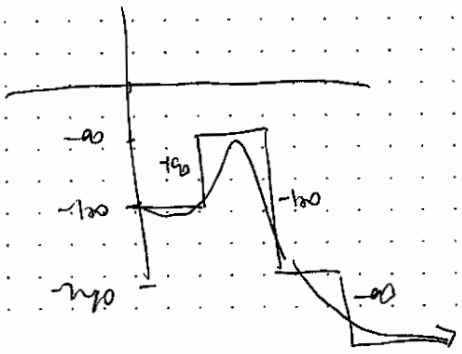
(6.7) $\frac{s+2}{s^2(s+10)(s^2+6s+25)} = \frac{2}{250} \cdot \frac{\frac{s}{2}+1}{s^2\left(\frac{s}{10}+1\right)\left(\left(\frac{s}{5}\right)^2+\frac{6}{25}s+1\right)}$

$\frac{1}{125}\left(\frac{\frac{j\omega}{2}+1}{(j\omega)^2\left(\frac{j\omega}{10}+1\right)\left(\left(\frac{j\omega}{5}\right)^2+\frac{6}{25}(j\omega)+1\right)}\right)$

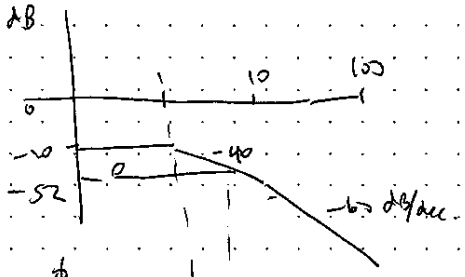


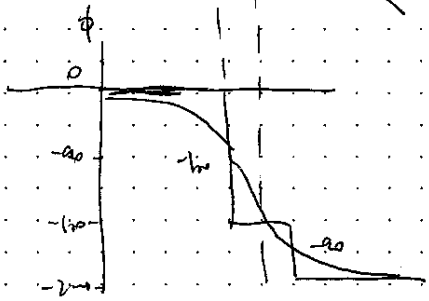
$20 \log\left(\frac{1}{125}\right) = -42$ dB





b(b) $KG(s) = \frac{K}{(s+1)(s+1)^2}$ $K=1$ $\frac{1}{10}$ $\frac{1}{\left(\frac{\omega}{10}+1\right)(\omega+1)(\omega+1)}$ $20\log\left(\frac{1}{10}\right) = -20$ dB.





$\phi = -2\tan^{-1}(\omega) - \tan^{-1}\left(\frac{\omega}{10}\right)$

$180 = -2\tan^{-1}(\omega) - \tan^{-1}\left(\frac{\omega}{10}\right)$

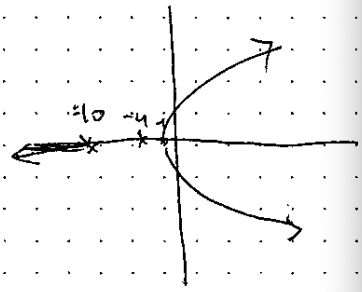
$K = 242$ when crossing 180

$K < 242$ stable

$K > 242$ unstable

$\alpha = \frac{\Sigma p - \Sigma z}{n-m} = -4$

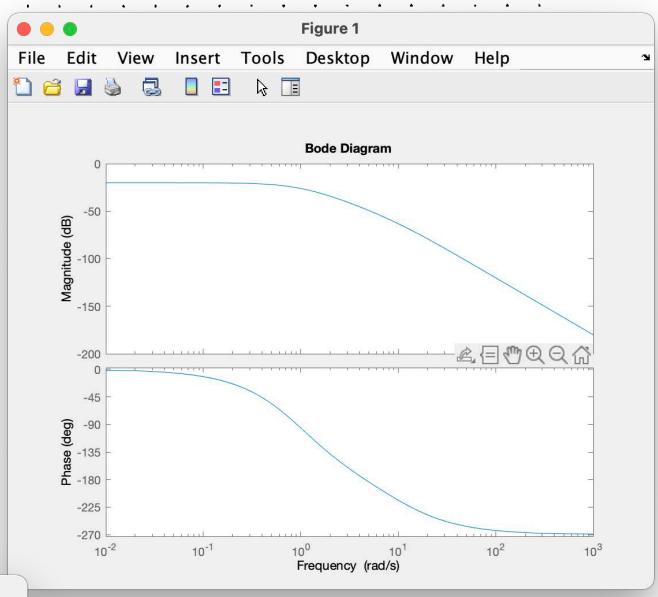
$-1, -1, -10$

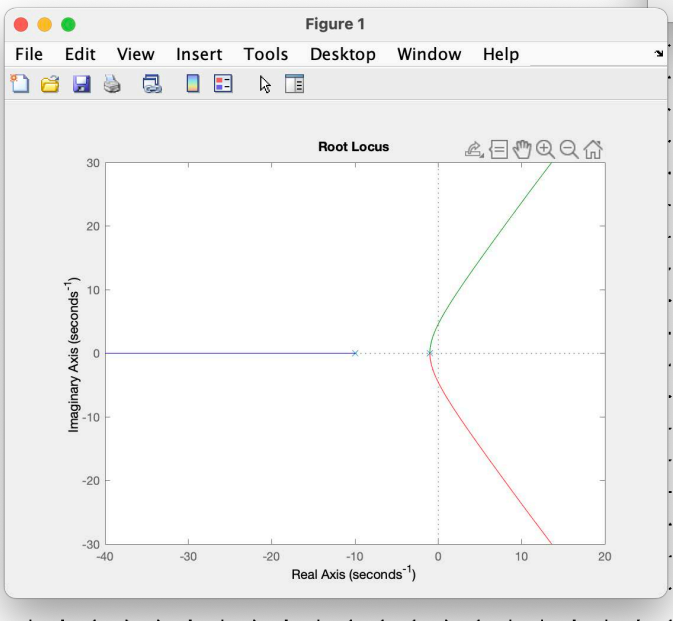


$\phi_1 = 60°$

$\phi_2 = 180°$

$\phi_3 = -60°$



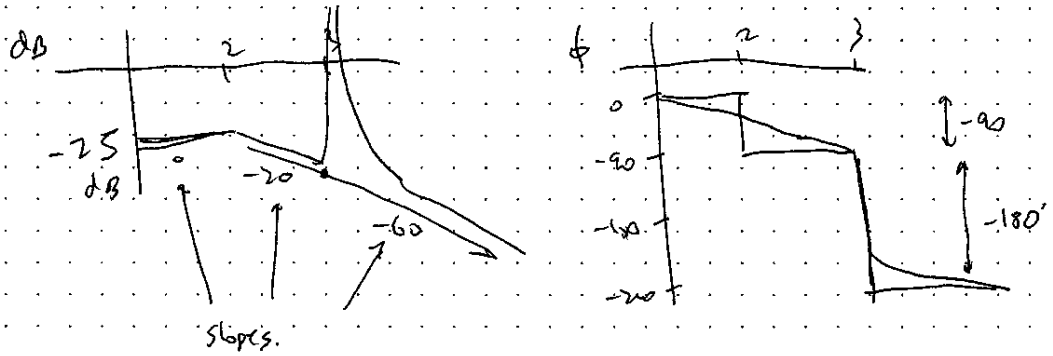


6.17)

$$K(G(s)) = \frac{K}{(s+2)(s^2+9)} \xrightarrow{K=1} \frac{1}{18} \frac{1}{\left(\frac{j\omega}{2}+1\right)\left(\frac{s^2}{9}+1\right)}$$

assume @ 3

$$20\log\left(\frac{1}{W}\right) = -25\,dB$$



TL crosses 180° assymptotically. ∴ value of K will make system stable.

$$\alpha = \frac{\sum p - \sum z}{n-m} = -\frac{2}{3}$$

$$\phi_1 = 60$$

$$\phi_2 = -60$$

$$\phi_3 = 180$$