1) Find the voltage transfer function $T(s) = \frac{V_o(s)}{V_i(s)}$ for the following two networks.
2. An amplifier frequency response is characterized by the transfer function $A(s)$ given by

$$A(s) = \frac{10^6s}{(s+10^3)(s+10^5)}.$$ 

- Transform $A(s)$ to put it in the following form

$$A(s) = A_M F_L(s) F_H(s)$$

where $A_M$ is the midgap gain, $F_L(s)$ is the low frequency response with a generic form

$$F_L(s) = \frac{1}{1 + \frac{s}{\omega_L}}$$

and

$$F_H(s) = \frac{1}{1 + \frac{s}{\omega_H}}$$

- Find the midgap gain $A_M$, the low pole angular frequency $\omega_L$ in rad/s, and the high pole angular frequency $\omega_H$ in rad/s.

- Make a Bode plot of the magnitude of the gain in dB versus $\omega$ using a logarithmic scale for the $\omega$. Make sure to indicate the location of the low and high frequency poles. Use the Bode plot (Bode.pdf file) available on my UC website.

- Make a Bode plot of the phase of $A(s)$ versus $\omega$. Make sure to indicate the location of the low and high frequency poles.

- From your Bode plots, find the approximate magnitude of the gain and value of the phase of $A(s)$ at the angular frequency, $\omega = 10^5$ rad/s.

$$A(s) = \frac{10^6s}{(s+10^3)(s+10^5)} = \frac{\frac{s}{5}}{1 + \frac{s}{10^5}} = \frac{10^6}{(1 + \frac{s}{10^3})(1 + \frac{s}{5 \times 10^5})} = \frac{10}{(1 + \frac{s}{10^3})(1 + \frac{s}{5 \times 10^5})}$$

$$A(\omega) = 10 \frac{1}{1 - j \frac{10^3}{\omega}} \left( 1 - j \frac{\omega}{10^5} \right)$$

$$A_M = 10 \frac{V}{V}$$

$$\omega_L = 10^3 \text{ rad/s}$$

$$\omega_H = 10^5 \text{ rad/s}$$

$$A_M(\text{dB}) = 20 \log_{10} 10 = 20 \text{ dB}$$

$$A(\text{dB}) = 20 \text{ dB}$$

At $\omega = 10^5 \text{ rad/s}:

| Magnitude = 20 dB |
| Phase = -45° |
3. Construct the Bode plot of the phase shift versus angular frequency $\omega$ for the following low frequency behavior $F_L(s)$ function. Show the individual contribution of the phase shift due to each pole and zero as a dashed line, then show the total phase shift as a full line. Indicate on each segment of the total phase shift their slope (in degrees/decade). Make sure to put $F_L(s)$ in its canonical form first.

\[ F_L(s) = \frac{s(s+2)}{(s+25)(s+700)} \]

\[ A_m = 1 \frac{V}{V} \]
\[ \omega_z = 2 \text{ rad/s} \]
\[ \omega_p = 25 \text{ rad/s} \]
\[ \omega_p = 700 \text{ rad/s} \]

\[ A_{m_1}(\text{dB}) = 20 \log(1) \]
\[ A_{m_2}(\text{dB}) = 0 \text{ dB} \]

(see attached for Bode plot)
PHASE SHIFT (degrees)

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- PHASE -

Log 6 cycles x Li