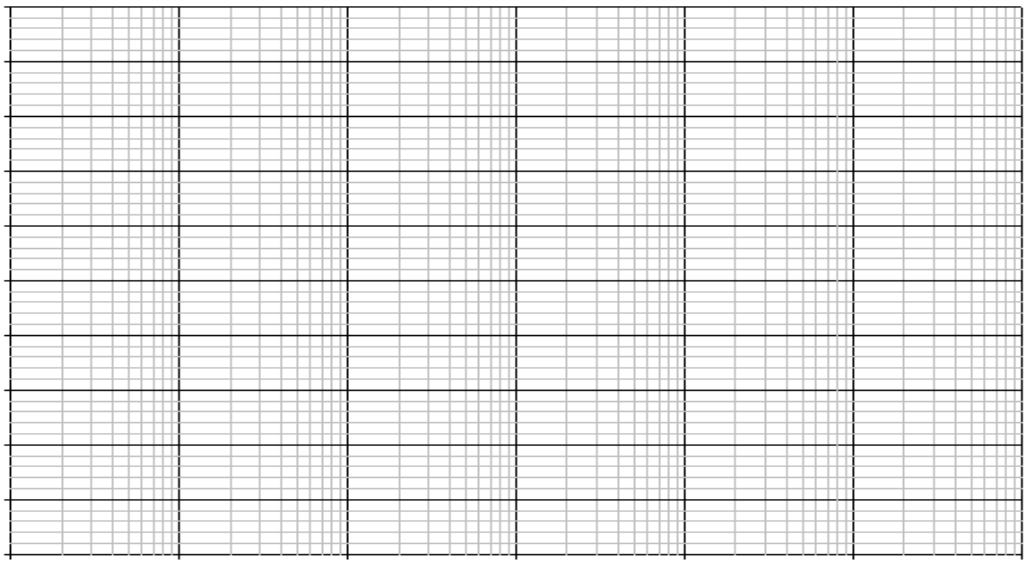
1) Bode plots/Transfer functions

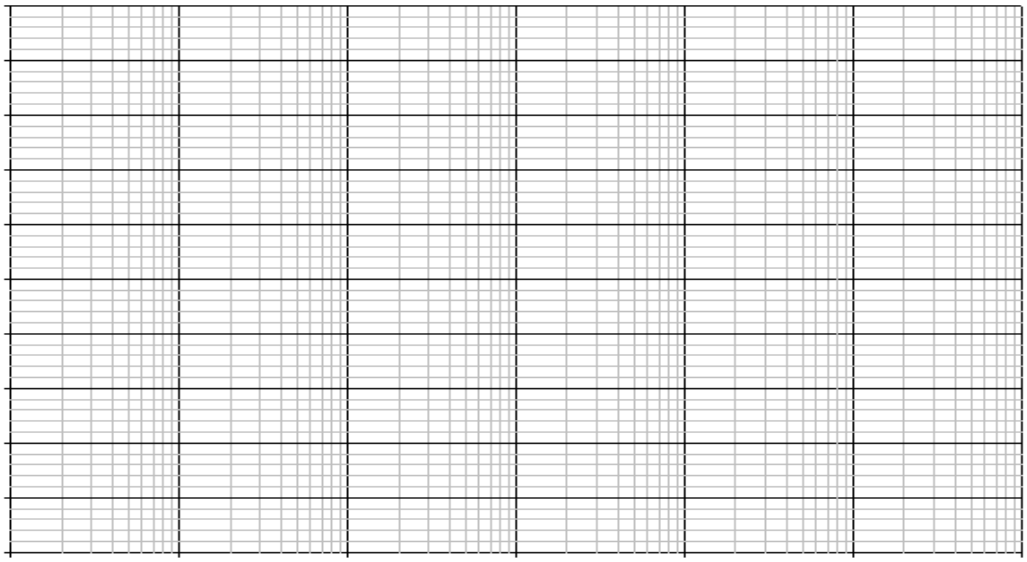
a. Draw magnitude and phase bode plots for the transfer function

$$H(s) = 0.01 \cdot \frac{s \cdot (s + 100)}{(s + 1E4)}$$

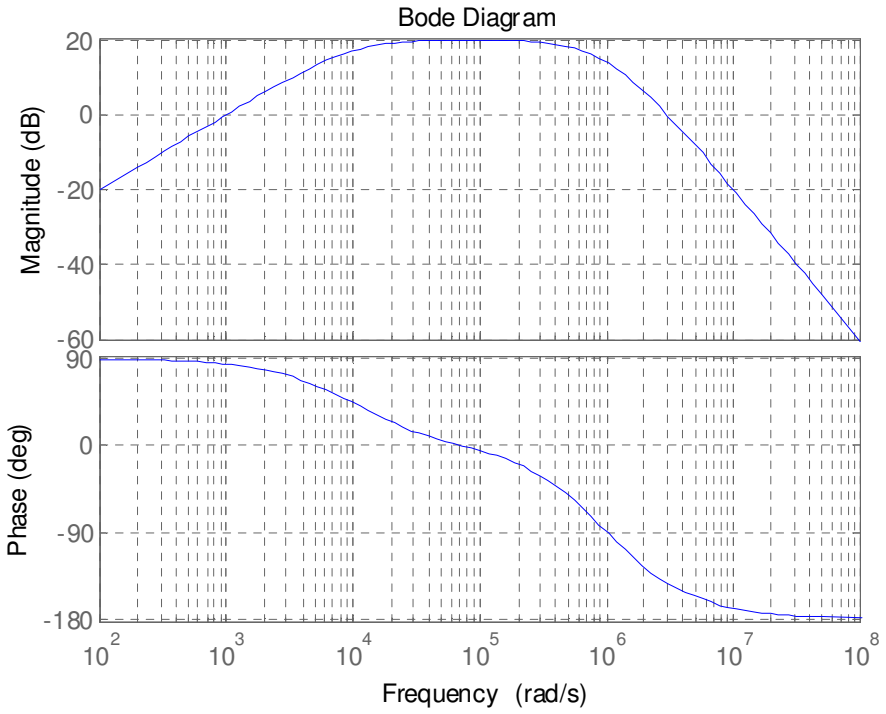
In your magnitude plot, indicate corrections at the poles and zeros.



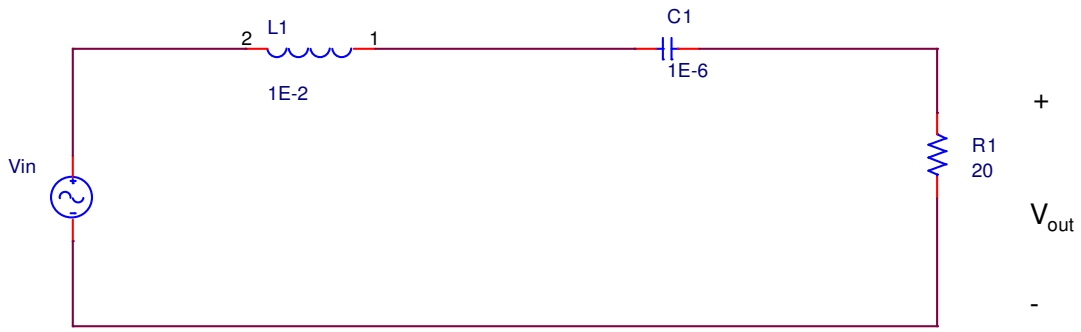
Phase plot



b. Determine the transfer function for the following magnitude and phase Bode plots (the plots are for the same circuit).



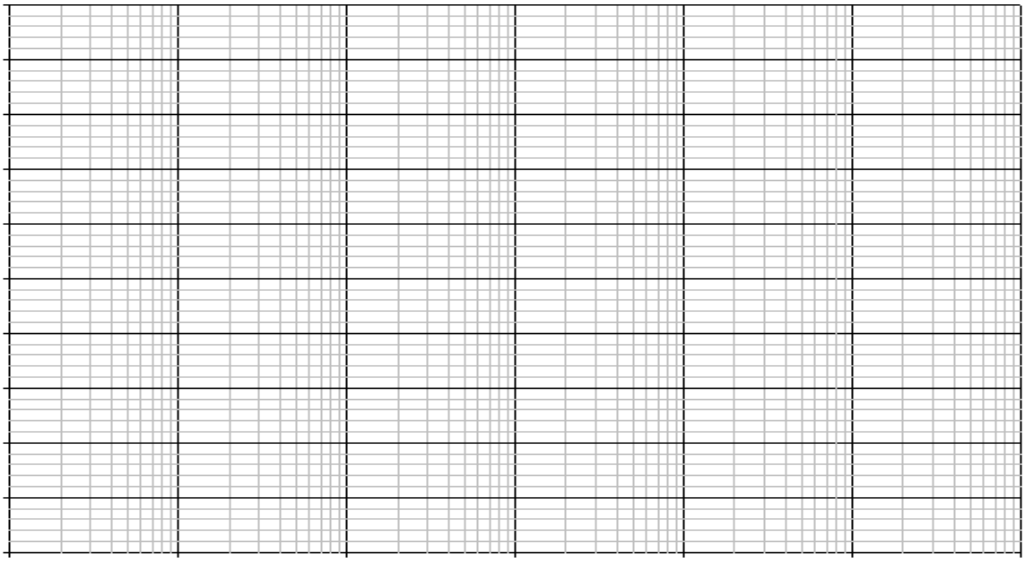
2) 2nd order Bandpass Bode plots



a. Determine the transfer function for the above circuit,

b. Determine α, ω_0, and ζ (damping ratio).

c. Draw the Bode-magnitude plot. Indicate the magnitude (dB) of the transfer function at the resonant frequency.



4) Design problems-Multiple Stages

Using only first order filters and opamp circuits for each stage, design a filter that meets the specifications below. You need to pick values for any resistors, capacitors or inductors in your circuit. Your circuit must consist of at least one inductor and at least one capacitor.

a. Lowpass filter with a cutoff frequency of 1 MHz (Note: this value is given in Hz).
b. In the passband, the gain must be >10dB
c. The asymptotic slope of the stopbands should be -60dB/decade
d. You circuit must contain at least one inductor and at least one capacitor.

5) Design Problem

Design a bandpass filter with the following specifications. Show your work and justify your calculations. Include a schematic of your circuit.

a. The passband is 1E4<ω<1E6
b. The passband gain should be 5dB
c. The low frequency stopband rolloff should be 20db/decade
d. The high frequency stopband rolloff shoudl be 60 db/decade
e. The low frequency cutoff frequency, 1E4 [rad/s] should be -3dB relative to the passbnad.
f. The high frequency cutoff frequency, 1E6 [rad/s], should be -3dB relative to the passbnad.
g. You cannot use any first order circuit stages