1. Redo practice problem 14.3 in Alexander and Sadiku, 5h Edition for $H(\omega) = \frac{4(j\omega+3)}{j\omega(j\omega+20)}$.

2. (D-95) Complete the table below. Do not use a pocket calculator!

Voltage ratio x	dB(x)
2	6 dB
4	
32	
10	
40	
100	
0.001	
1.6	
	120
	-26
	-3

3. (D-98)

   a) Draw the Bode Plot of $H(s) = \frac{V_2(s)}{V_1(s)}$ for $R_1 = 6.9\,\text{kOHm}$ and $C_1 = 2.7\,\text{nF}$. What is the response at the following frequencies?

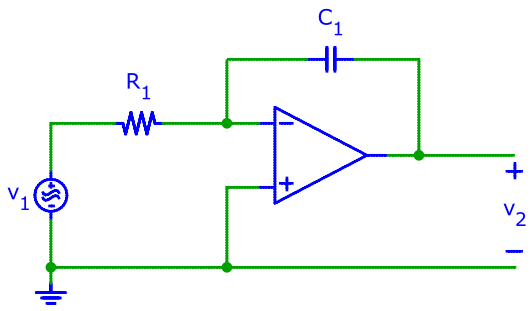
Frequency	Magnitude [dB], Phase [deg]
1 Hz	
1 kHz	
1 MHz	

   b) Repeat with the positions of the resistor and capacitor exchanged. What mathematical operation does this circuit perform?

Frequency	Magnitude [dB], Phase [deg]
1 Hz	
1 kHz	
1 MHz	

   c) Draw the Bode Plot of the circuits from parts (a) and (b) in series.

Frequency	Magnitude [dB], Phase [deg]
1 Hz	
1 kHz	
1 MHz	



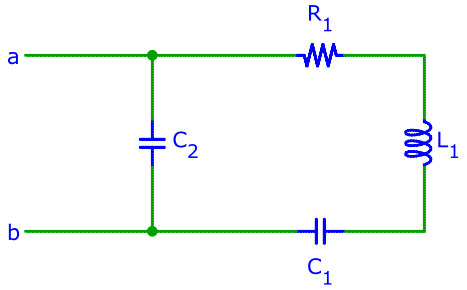
4. (D-99) Draw the Bode plot (piecewise linear approximation) from 1 Hz to 1 MHz for the following transfer function:

$$H(s) = \frac{s\left(1+\frac{s}{z_1}\right)}{z_o\left(1+\frac{s}{p_1}\right)\left(1+\frac{s}{p_2}\right)}$$

with $s = j\omega$ and $z_0 = 2\pi \times 10\,\text{Hz}$, $z_1 = 2\pi \times 10\,\text{kHz}$ $p_1 = 2\pi \times 1\,\text{kHz}$, $p_2 = 2\pi \times 100\,\text{kHz}$. Label the axes!

5. (D-100) For the circuit below, calculate the magnitude $Z(s)$ between terminals (a,b). Use $R_1 = 6.3\,\text{k}\Omega$, $L_1 = 4.9\,\text{nH}$, $C_1 = 9.8\,\text{nF}$ and $C_2 = 4.9\,\text{pF}$.

Frequency	Magnitude [Ω], Phase [deg]
1 Hz	
1 kHz	
1 MHz	



6. Figure 1 shows the frequency response of the voltage gain of some amplifier.
For each of the following input voltages, find the steady-state output voltage.

   a) $v_{in}(t) = \sin(t+1)$

   b) $v_{in}(t) = 10$

   c) $v_{in}(t) = 10\cos^2(5t)$ Hint: Write $\cos^2(\cdot)$ as a sum of sinusoids.

7. Let $\mathbb{I}_{in}$ and $\mathbb{I}_{out}$ in Figure 2 be the phasors of the input current I_{in} and the output current I_{out} respectively.

   a) Find the current gain of the circuit.
   The current gain $\mathbb{G}(\omega)$ is the ratio of the phasors $\mathbb{I}_{out}/\mathbb{I}_{in}$.

   b) With $R_1 = 1\ K\Omega$, $R_2 = 5\ k\Omega$, $L = 100\ mH$, $C = 3\ \mu F$, sketch the magnitude frequency response of the current gain, i.e. plot $|\mathbb{G}(\omega)|$ versus ω.

   c) Is this a low/high/band pass filter?

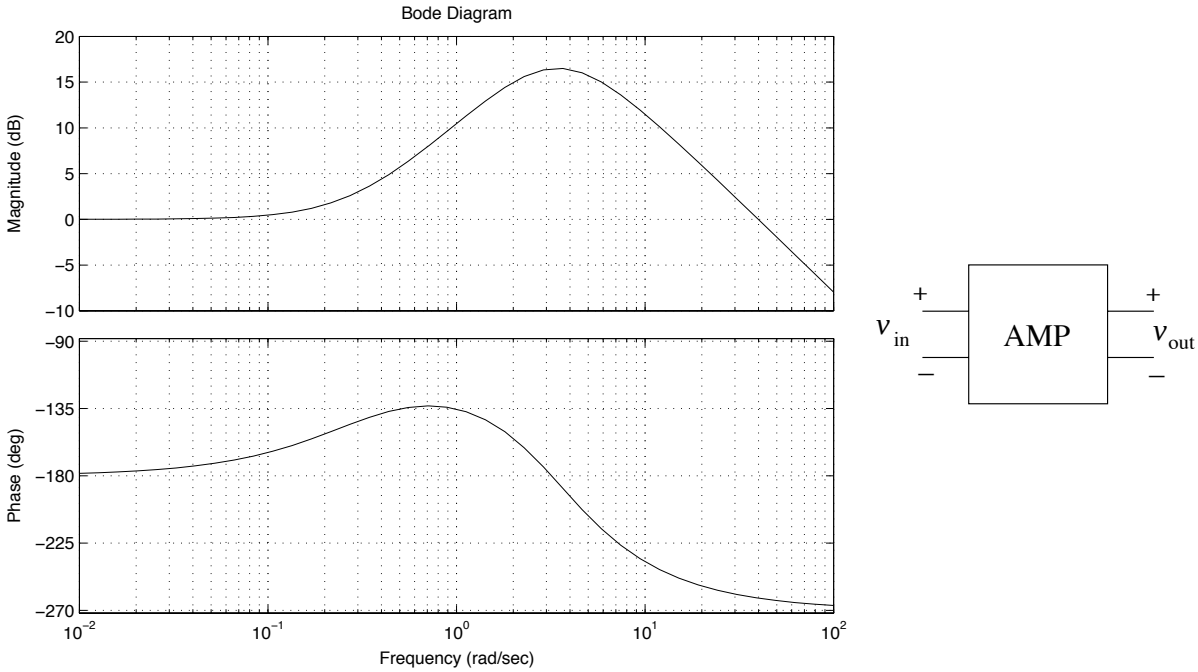


Figure 1 Bode Diagram

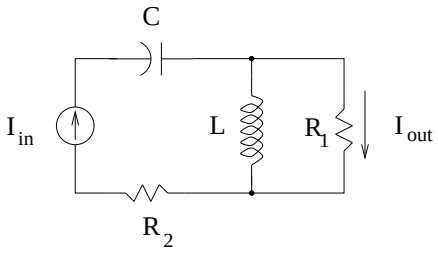


Figure 2 RLC Circuit.