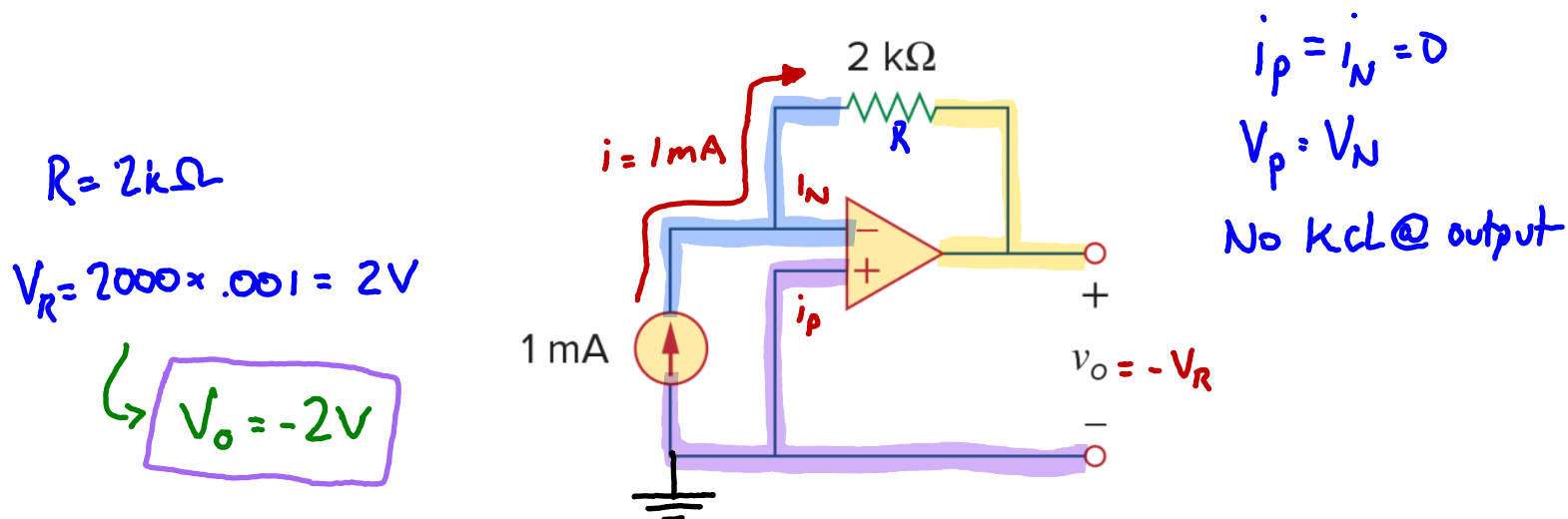


Homework 9
Due: Friday, April 14th, 2023 by 7PM.

Note: In order to receive full credit, you must show your work and carefully justify your answers. The correct answer without any work will receive little or no credit.

1. Find v_o .



2. Determine V_o/V_s given that $C_1 = C_2 = 1\text{nF}$, $R_1 = R_2 = 100\text{k}\Omega$, $R_3 = 20\text{k}\Omega$, $R_4 = 40\text{k}\Omega$, and $\omega = 2000\text{ rad/sec}$.

$$A = V_s$$

$$F = 0V$$

KCL@B

$$i_{C1} = i_{C2} + i_{R1}$$

$$\frac{V_{C1}}{500\text{k}\Omega} = \frac{V_{C2}}{500\text{k}\Omega} + \frac{V_{R1}}{100\text{k}\Omega}$$

$$\frac{V_{C1} - V_{C2}}{500\text{k}\Omega} = \frac{V_{R1}}{100\text{k}\Omega}$$

$$V_{C1} - V_{C2} = 5jV_{R1}$$

$$V_s - 2V_D + V_C = 5jV_B - 5jV_D$$

$$V_s - V_B(2 + 5j) + V_C + 5jV_D = 0$$

$$V_{C1} = V_s - V_B$$

$$V_{C2} = V_B - V_C$$

$$V_{R1} = V_B - V_D$$

KCL@C:

$$i_{C2} = i_{R2}$$

$$\frac{V_{C2}}{500\text{k}\Omega} = \frac{V_{R2}}{100\text{k}\Omega}$$

$$V_{C2} = 5jV_{R2}$$

$$V_B - V_C = 5jV_C$$

$$V_B - V_C(1 + 5j) = 0$$

KCL@E:

$$i_{R4} = i_{R3}$$

$$\frac{V_{R4}}{40\text{k}\Omega} = \frac{V_{R3}}{20\text{k}\Omega}$$

$$V_{R4} = 2V_{R3}$$

$$V_D - V_E = 2V_E$$

$$V_D - 3V_E = 0$$

$$V_{R4} = V_D - V_E$$

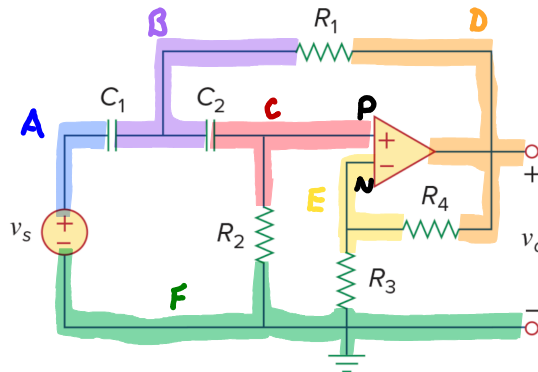
$$V_{R3} = V_E$$

$$V_{R2} = V_C$$

$$i_P = i_N = 0$$

$$V_P = V_N$$

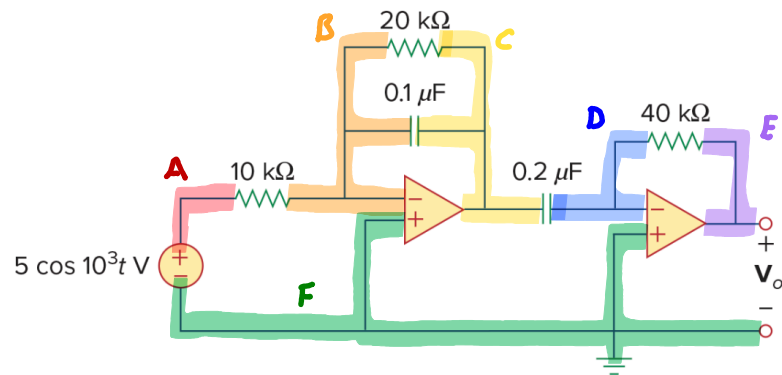
No KCL@output



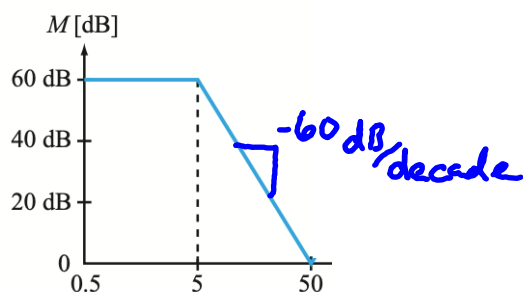
V_s	V_B	V_C	V_D	V_E	x
1	$-2-5j$	1	$5j$	0	0
0	1	$-1-5j$	0	0	0
0	0	0	1	-3	0
↓					
1	0	$5j$	0	$15j$	0
0	1	$5j$	0	0	0
0	0	0	1	-3	0

NOT
Done
Yet !!!

3. Obtain $\mathbf{V_o}$ for the op-amp circuit below:



4. For the bode plot below:
- What is the transfer function that represents this plot?
 - Design a filter connected for the transfer function found in part A. Clearly specify the circuit drawing and pick realistic values for the resistors and capacitors.



$$60 = 20 \log_{10}(k)$$

$$3 = \log_{10}(k)$$

$$10^3 = k$$