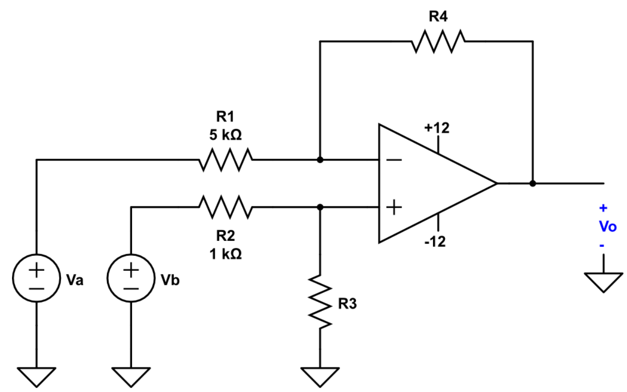
ENGR 2910-101: Circuit Analysis

Instructor: Brian Rashap

Midterm 2

Due: 03/29/23

Question 1 [25]



(a) For the differntial amplifier shown above, find values for R_3 and R_4 that amplify the difference between the V_a and V_b by 4.

(b) If $V_a = 4V$, find the range for V_b that keeps the amplifier in the linear operating region.

(c) If the R_1 resistor is reduced to $4k\Omega$ and all other values remain the same, that is the new range for V_b that keeps the amplifier in the linear operating region.

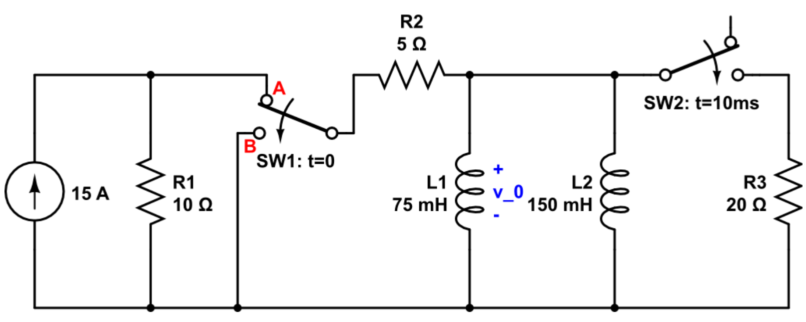
(d) What is the A_{dm}, A_{cm}, and CMRR for the amplifier with the resistor values from (c)?

Question 2 [25]

In the circuit below, for $t < 0$ SW1 is in the A Position and SW2 is open. At $t = 0$, SW1 moves to Position B. Then, at $t = 10ms$, SW2 closes.

(a) Find v_0 (the voltage across L_1 at $t = 20ms$.

(b) How much energy is stored in L_2 at $t = 20ms$?



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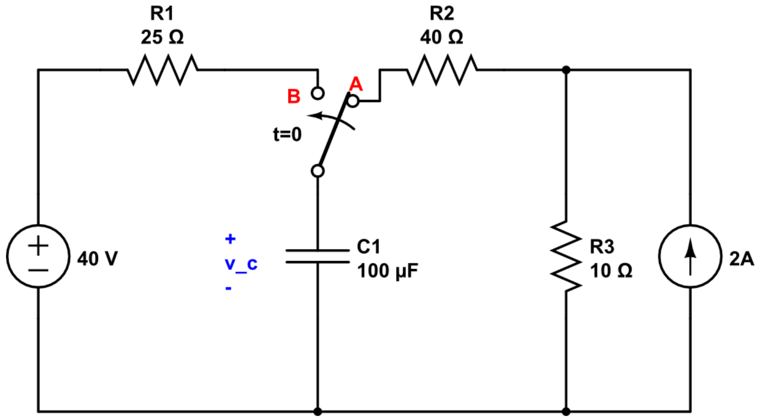
Question 3 [25]

For the below circuit has been in position a for a long time.



(a) At $t = 0$, the switch instantly moves to position b and stays there. Find:

(i) The initial and final values for the capacitor voltage

(ii) The time constant

(iii) The expression for the capacitor voltage for $t \geq 0$.

(b) At $t = 5ms$ the switch moves back to position a. Find

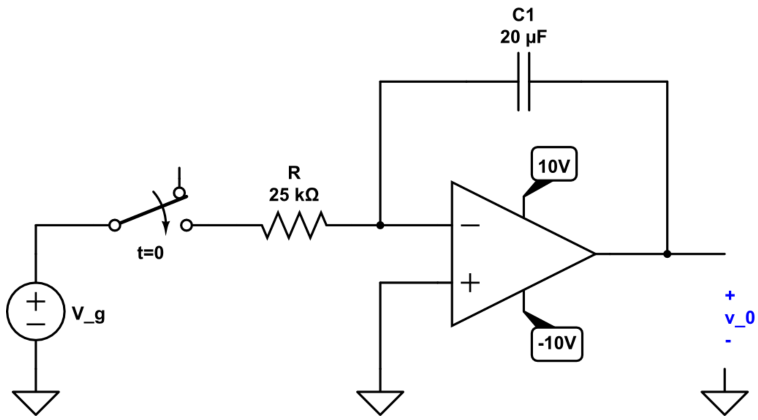
(i) The initial and final values for the capacitor voltage

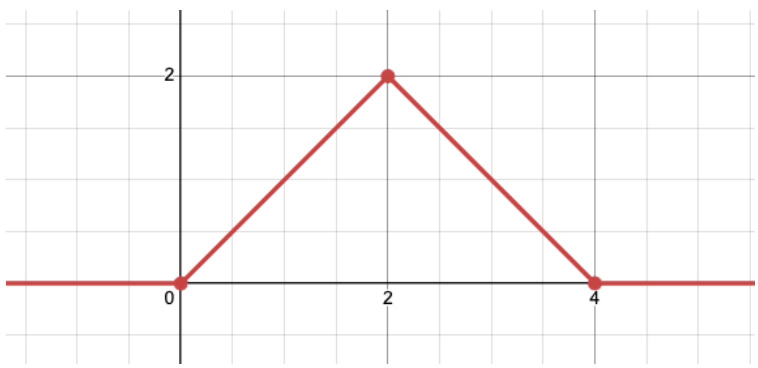
(ii) The time constant

(iii) The expression for the capacitor voltage for $t \geq 5ms$.

Question 4 [25]

Consider the voltage divider below (both with and without a load):





(a) Find a numerical expression for V_g for $0s \leq t \leq 2s$ and $2s \leq t \leq 4s$

(b) Derive the numerical expression for $v_0(t)$ for $0s \leq t \leq 2s$ and $2s \leq t \leq 4s$

(c) Sketch the output waveform between $0s$ and $4s$.

(d) Now consider a waveform with a peak at $4V$ rather than $2V$, sketch the resulting waveform.