ENGR 2910-101: Circuit Analysis

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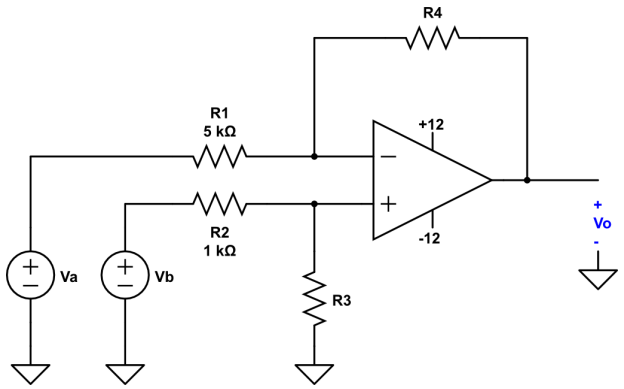
Midterm 2

Due: 03/29/23

Please show all your work and circle your answers to each question.

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.

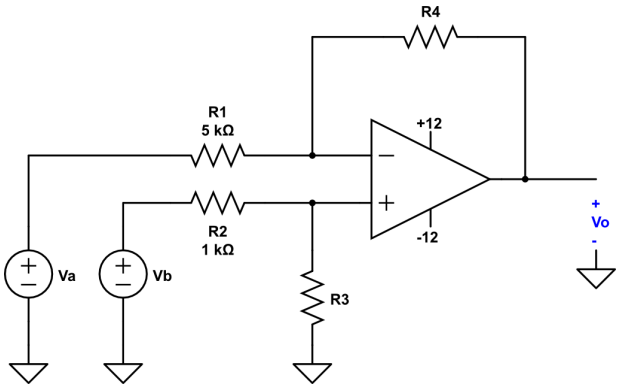
(b) If $V_a = 4V$, find the range for V_b that keeps the amplifier in the linear operating region.

(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.

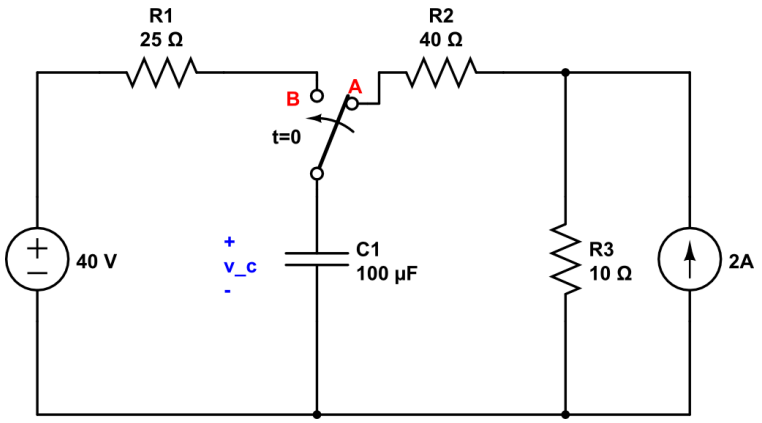
(d) What is the A_{dm}, A_{cm}, and CMRR for the amplifier with the resistor values from (c)?

Question 2 [25]

What is the equivalent resistance between A and B?



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 $t \geq 0$.

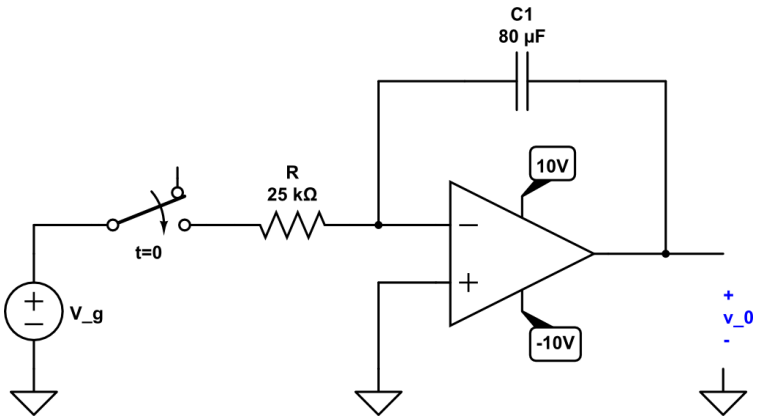
(b) At time xxx the switch moves back to position a. Find

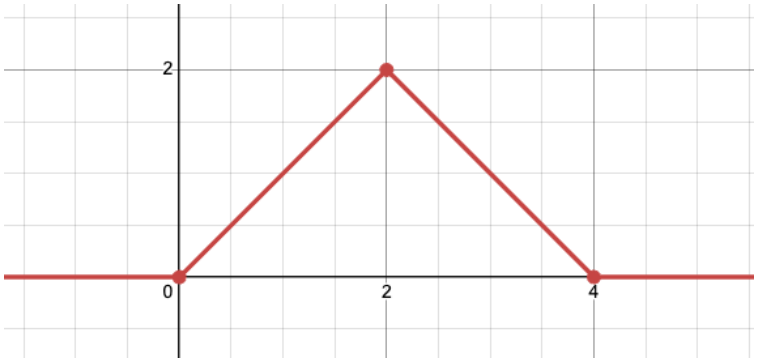
(i) The initial and final values for the capacitor voltage

(ii) The time constant

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

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 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.