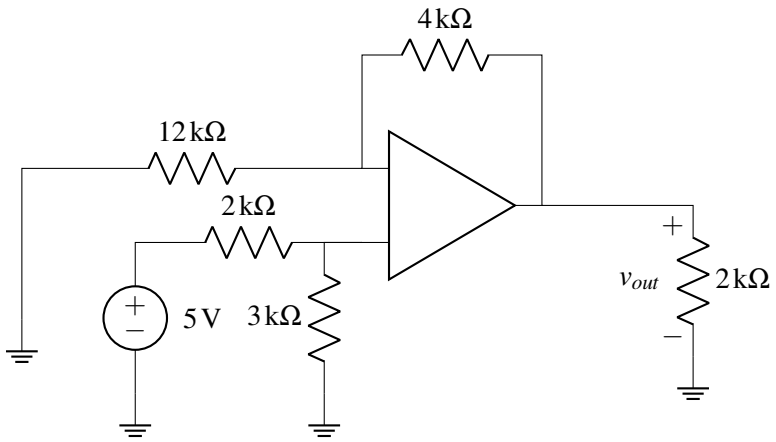
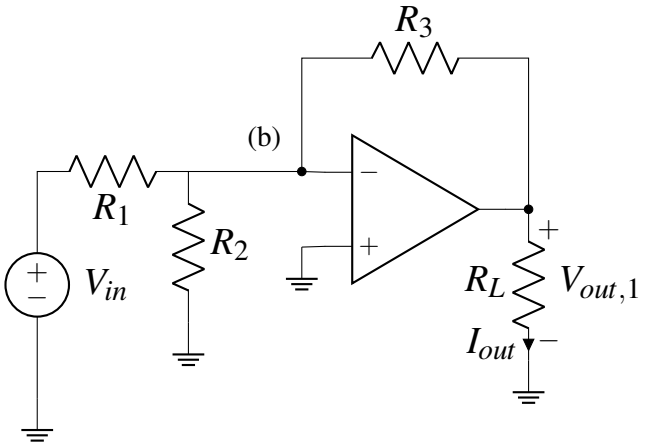
EECS 16A Designing Information Devices and Systems I
Spring 2023 Exam Prep 11B

1. Op Amps and Comparators (Fall 2022 Midterm 2 Question 5)

(a) Consider the following op-amp **for this part only**. Notice the + and - signs are missing on the op-amp input. Please label them such that the op-amp is in negative feedback.



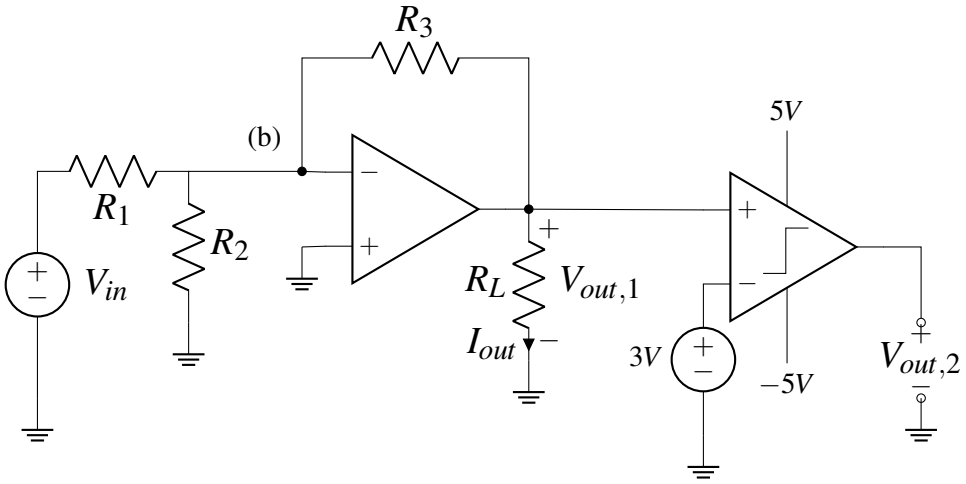
For the next two parts, consider an entirely new op-amp circuit. Determine the following (you can assume that the op-amp is ideal and in negative feedback):



(b) What is the voltage held at the negative terminal of the op-amp (the node labeled (b))? Express your answer in terms of the variables shown in the circuit diagram.

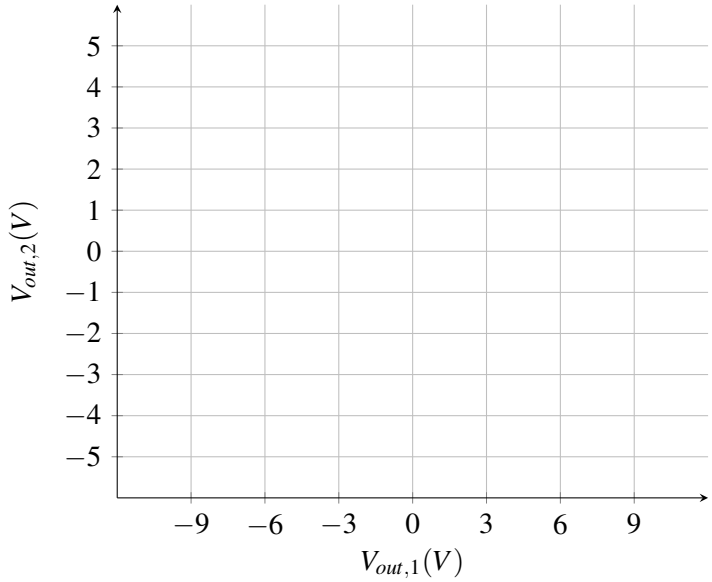
(c) What is I_{out}, the current flowing through R_L? **Express your answer ONLY in terms of** $V_{in}, R_1, R_2, R_3, R_L$. You **cannot** use $V_{out,1}$ in your final expression.

(d) Now consider attaching an ideal comparator to the output of the op-amp circuit from the previous part.



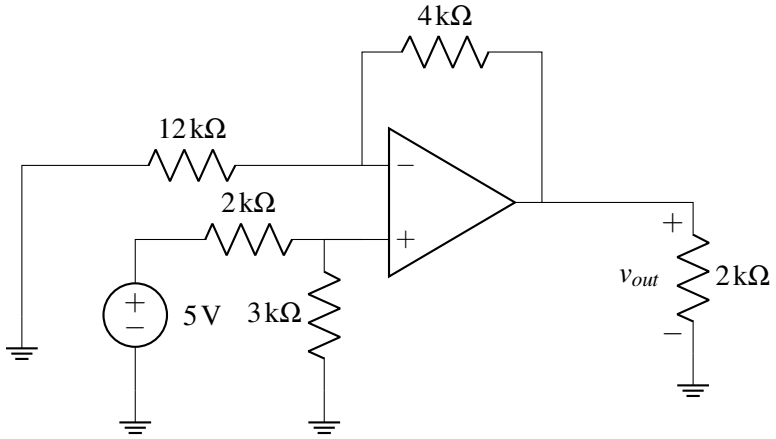
Suppose the output voltage of the op-amp is $V_{out,1} = -2V$ What is $V_{out,2}$, the voltage outputted by the comparator?

(e) Sketch the output behavior of the comparator on the plot provided for different values of $V_{out,1}$.

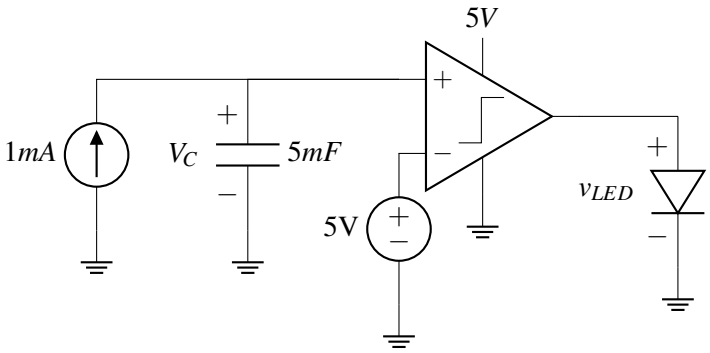


2. Op-amps and Comparators (Spring 2022 Midterm 2 Question 10)

(a) You are given the following op-amp in negative feedback. Find v_{out}.



(b) You are given the circuit below. The capacitor is initially uncharged. At time t = 0, the current source is turned on. Find V_c(t).



(c) The LED turns on when the voltage across it is greater than 3.3V. Using the same setup as part (b), at what time t does the LED turn on?

