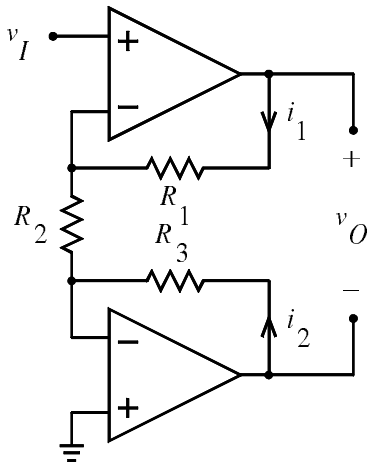
EE 4086 Quiz 1, Summer 1996

SEPTEMER 2, 1996

Professor Leach Name _____

Instructions. Print your name in the space above and on all quiz work sheets. This is a 1 hour quiz. Place a box around all numerical answers. Write the word "over" if you continue your work on another page. Staple your crib sheet on the back of the quiz when you turn it in.

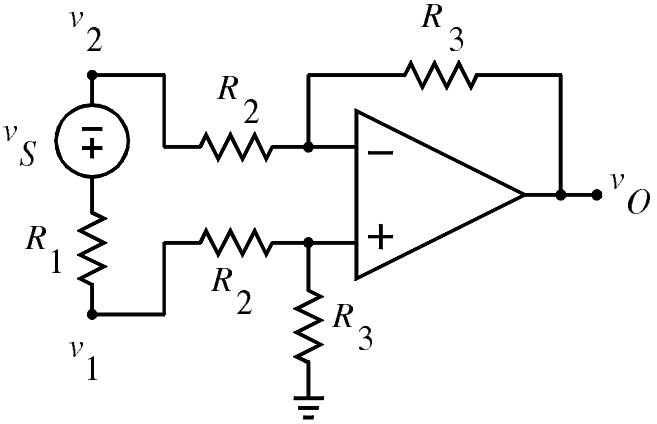
1. A differential output amplifier is shown in Figure P1. It is given that $R_2 = 1$ kΩ.



   (a) If the amplifier has balanced outputs, specify R_1 and R_3 for $v_O/v_I = 10$.

   (b) For $v_I = 2$ V, calculate i_1 and i_2.

2. Figure P2 shows a differential input amplifier. It is given that $R_1 = 1$ kΩ and $R_2 = 2$ kΩ.

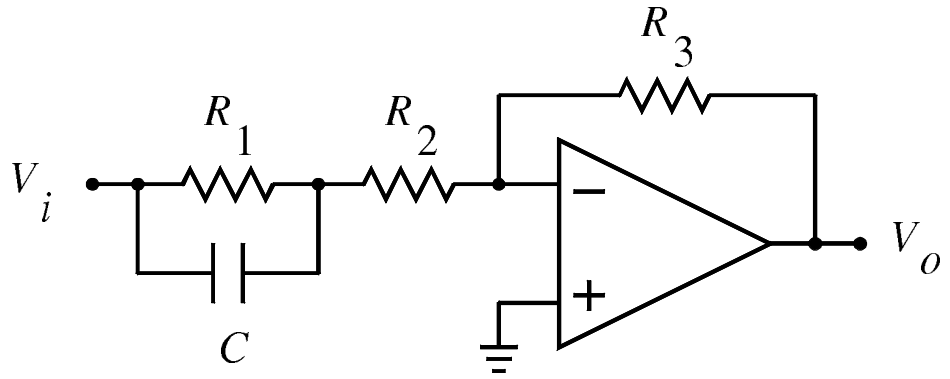


   (a) Specify R_3 for $v_O/(v_1 - v_2) = 4$.

   (b) For $v_S = 2$ V, calculate v_1, v_2, and v_O.

   (c) Calculate the differential and common-mode input voltages.

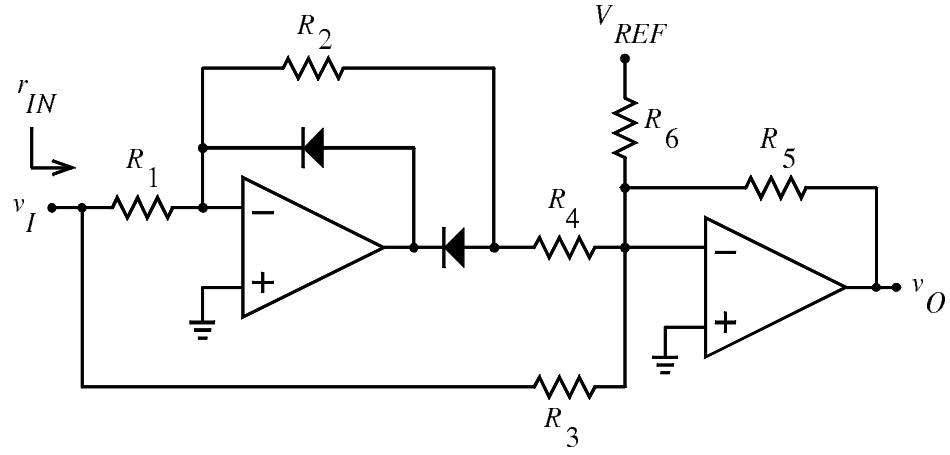
3. Figure P3 shows an op-amp with a RC feedback network. It is given that $R_1 = 8$ kΩ, $R_2 = 2$ kΩ, $R_3 = 10$ kΩ, and $C = 0.1$ μF.



(a) What are the low-frequency and high-frequency gains? From this information, sketch the expected Bode magnitude plot for the voltage gain transfer function.

(b) Derive the voltage gain transfer function and put it into standard time constant form. That is, each pole or zero term must be in the form $(1 + \tau s)$, where τ is the time constant. What are the pole and zero frequencies in radians/sec and in Hz?

4. Figure P4 shows a precision rectifier. It is given that $R_2 = 20$ kΩ, $R_5 = 10$ kΩ, $R_6 = 100$ kΩ, and $V_{REF} = 0$.



(a) If $v_O = 2\,|v_I|$ and $r_{IN} = 4$ kΩ, specify R_1, R_3, and R_4.

(b) For v_I a sine wave, sketch the graph of v_O versus time for $V_{REF} = 0$ and $V_{REF} = 10$ V.