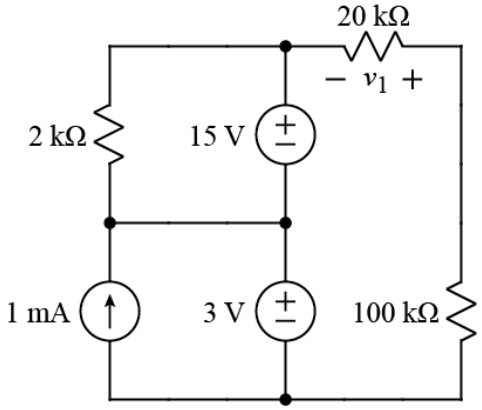
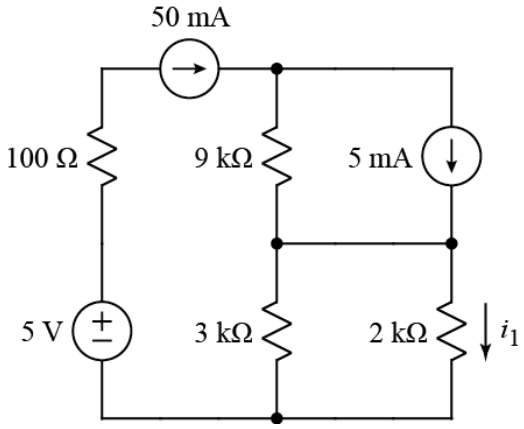
Homework 4

1.



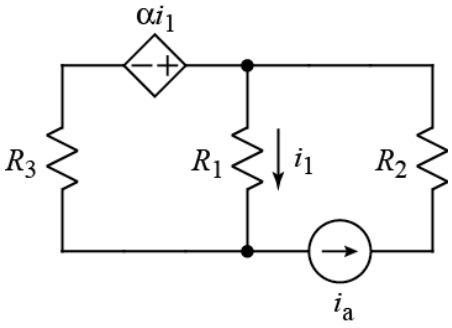
Calculate v_1.

2.



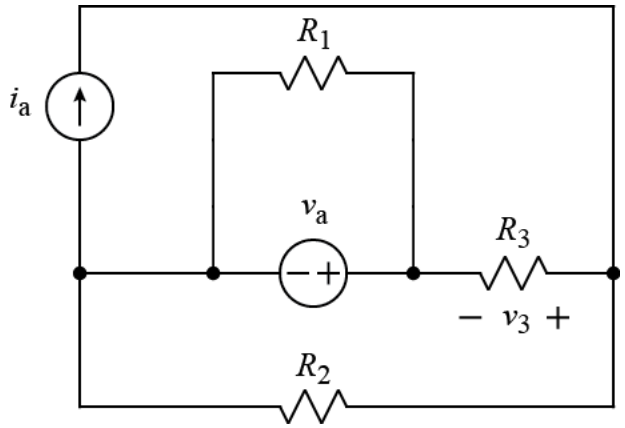
Calculate i_1.

3.



Derive an expression for i_1. The expression must contain no other parameters than i_a, R_1, R_2, R_3, and α. **Note:** $\alpha < 0$. (Hint: It is not just a voltage or current divider.)

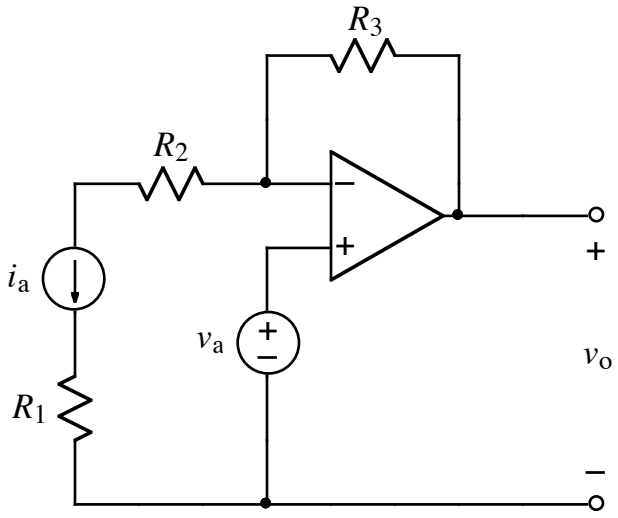
4.



a) Derive an expression for v_3 containing not more than circuit parameters v_a, i_a, R_1, R_2, and R_3.

b) Make at least one consistency check (other than a units check) on your expression. Explain the consistency check clearly.

5.



The op-amp operates in the linear mode. Using an appropriate model of the op-amp, derive an expression for v_o in terms of not more than i_a, v_a, R_1, R_2, and R_3.

Answers:

1. -3 V
2. 30 mA (what tool can you use?)
3. Hint: you need a voltage loop and a current summation
4. You can ignore R1. Why? $v_3 = -v_a \dfrac{R_3}{R_2 + R_3} + i_a \dfrac{R_2 R_3}{R_2 + R_3}$
5. Hint: *R*'s in series with a current source may be ignored (usually). Also, the voltage drop from the – input to the + input is 0 V. Use a v-loop on the right side.