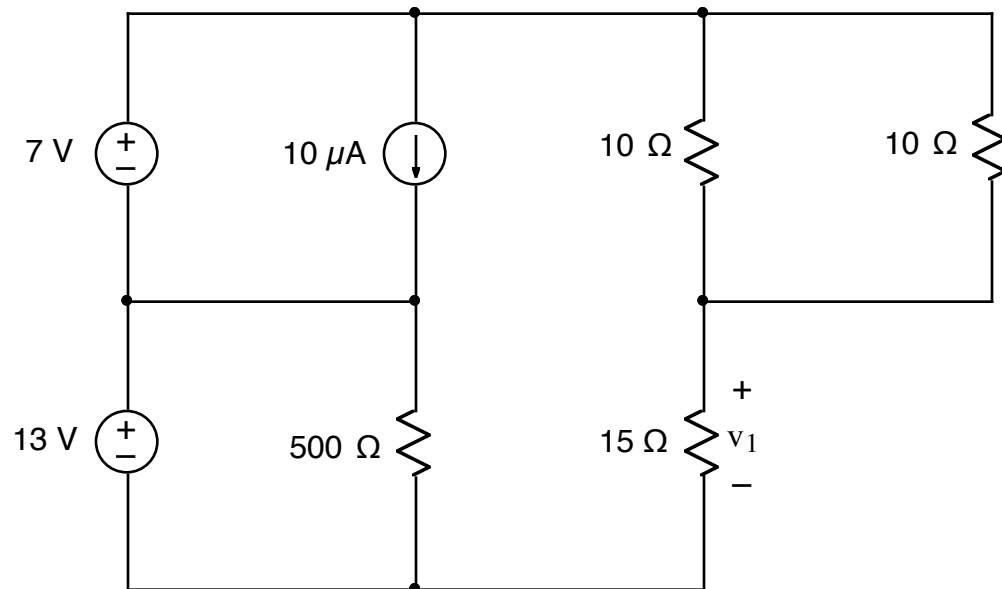
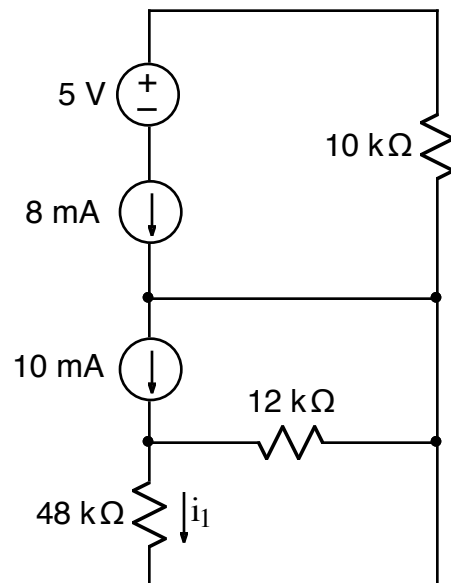


1.



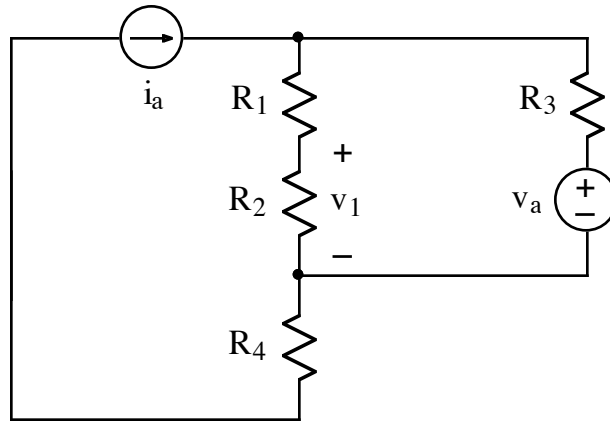
Calculate  $v_1$ .

2.



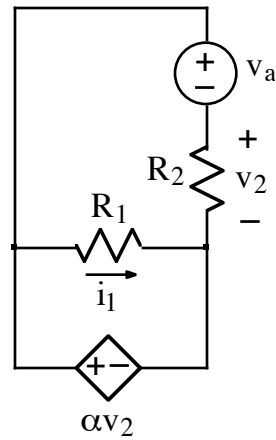
Calculate  $i_1$ .

3.



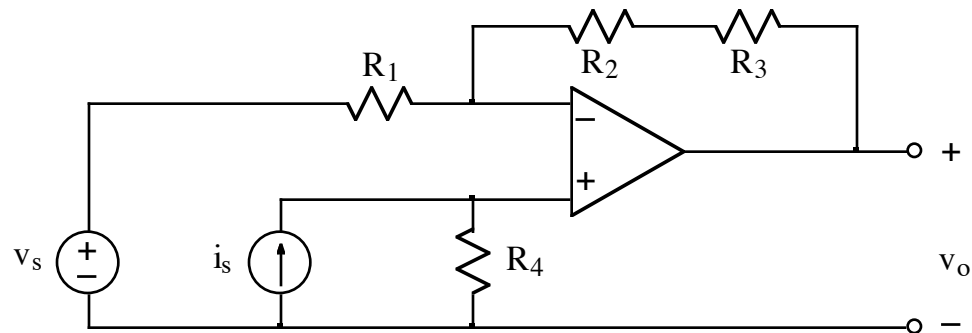
Derive an expression for  $v_1$ . The expression must not contain more than the circuit parameters  $v_a$ ,  $i_a$ ,  $R_1$ ,  $R_2$ , and  $R_3$ .

4.



- Derive an expression for  $i_1$ . The expression must not contain more than the circuit parameters  $\alpha$ ,  $v_a$ ,  $R_1$ , and  $R_2$ . **Note:**  $\alpha \neq 0$ .
- 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  $v_s$ ,  $i_s$ ,  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$ .