5.11 Using Fig. 5.50, design a problem to help other students to better understand how ideal op amps work.

Although there are many ways to work this problem, this is an example based on the same kind of problem asked in the third edition.

Problem

Find v_o and i_o in the circuit in Fig. 5.50.

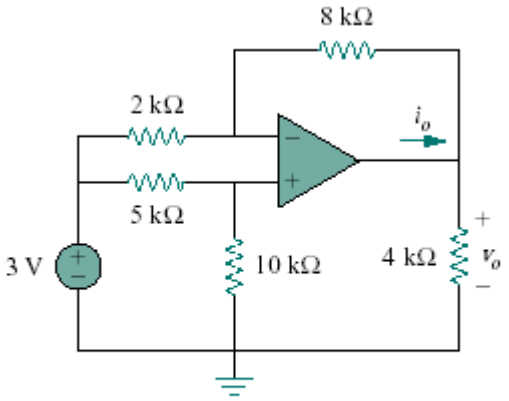
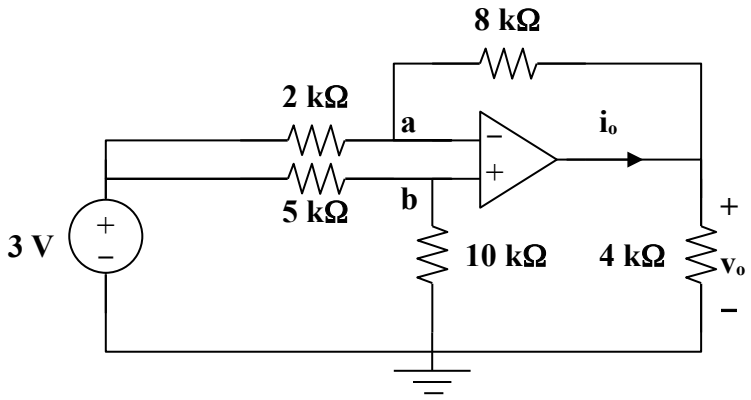


Figure 5.50 for Prob. 5.11

Solution



$$v_b = \frac{10}{10+5}(3) = 2\text{V}$$

At node a,

$$\frac{3 - v_a}{2} = \frac{v_a - v_o}{8} \longrightarrow 12 = 5v_a - v_o$$

But $v_a = v_b = 2V$,

$$12 = 10 - v_o \longrightarrow v_o = \mathbf{-2V}$$

$$-i_o = \frac{v_a - v_o}{8} + \frac{0 - v_o}{4} = \frac{2+2}{8} + \frac{2}{4} = 1\text{mA}$$

$$i_o = \mathbf{-1mA}$$