

Chapter 5, Solution 16

Using Fig. 5.55, design a problem to help students better understand inverting op amps.

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

Obtain i_x and i_y in the op amp circuit in Fig. 5.55.

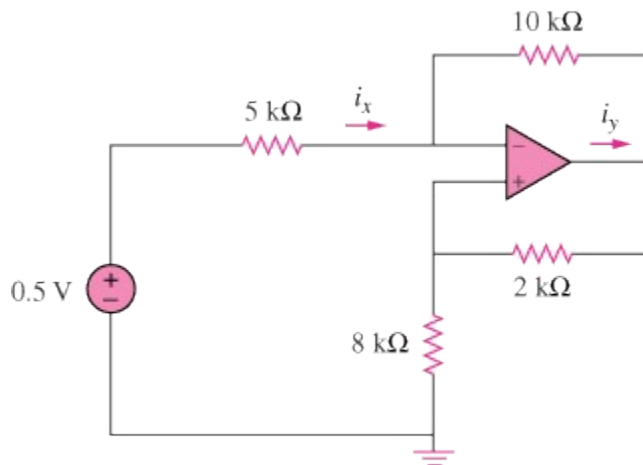
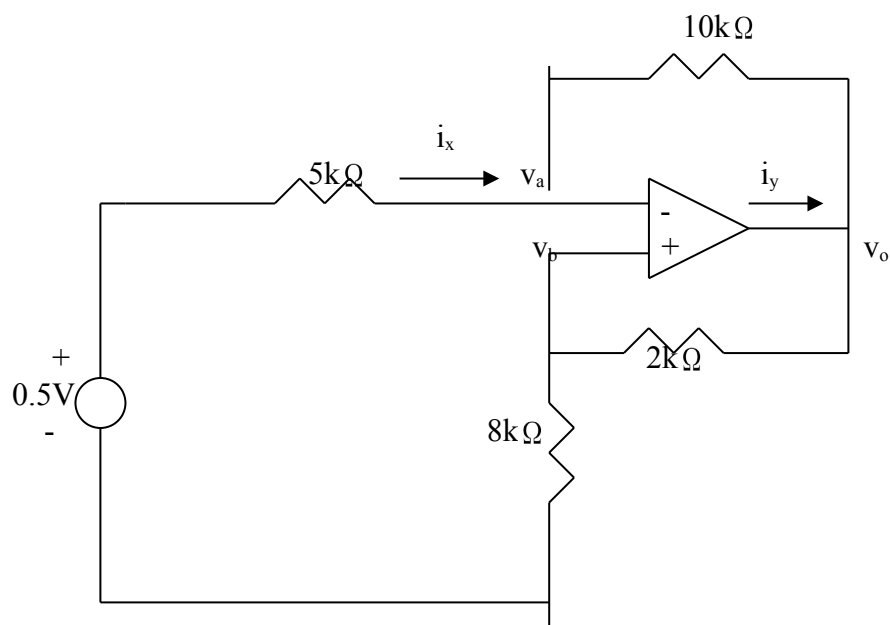


Figure 5.55

Solution



Let currents be in mA and resistances be in $k\Omega$. At node a,

$$\frac{0.5 - v_a}{5} = \frac{v_a - v_o}{10} \longrightarrow 1 = 3v_a - v_o \quad (1)$$

But

$$v_a = v_b = \frac{8}{8+2}v_o \longrightarrow v_o = \frac{10}{8}v_a \quad (2)$$

Substituting (2) into (1) gives

$$1 = 3v_a - \frac{10}{8}v_a \longrightarrow v_a = \frac{8}{14}$$

Thus,

$$i_x = \frac{0.5 - v_a}{5} = -1/70 \text{ mA} = \underline{-14.28 \mu\text{A}}$$

$$i_y = \frac{v_o - v_b}{2} + \frac{v_o - v_a}{10} = 0.6(v_o - v_a) = 0.6\left(\frac{10}{8}v_a - v_a\right) = \frac{0.6}{4} \times \frac{8}{14} \text{ mA}$$

$$= 85.71 \mu\text{A}$$