4.40 Find v_o in the circuit in Fig. P4.40.

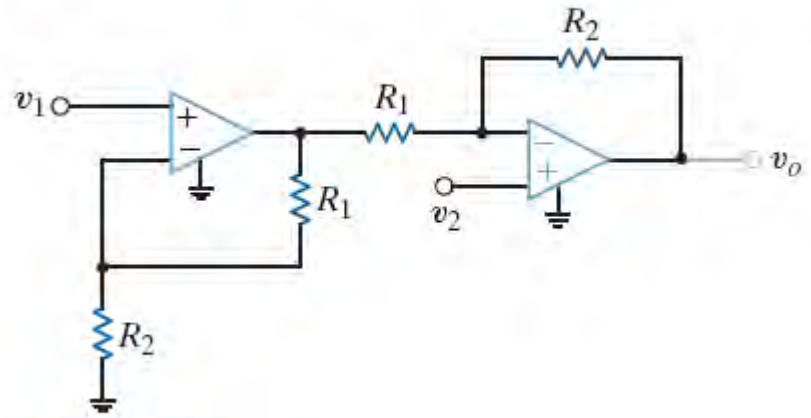
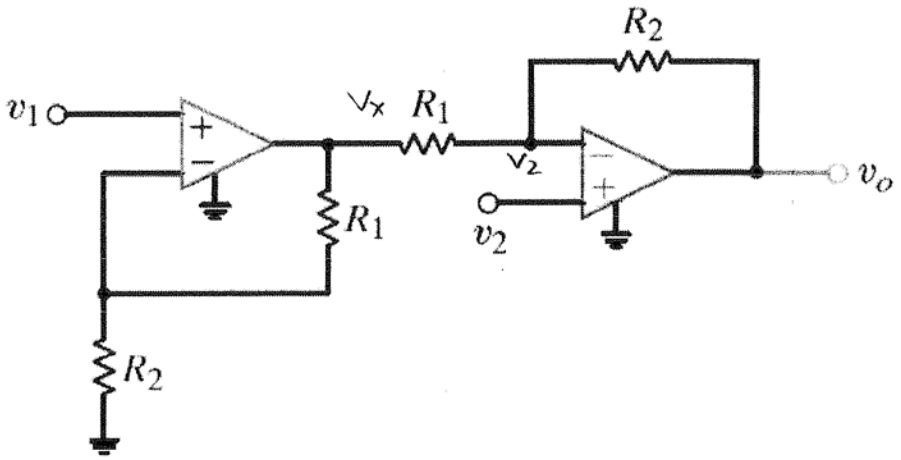


Figure P4.40

SOLUTION:



The first op-amp is a non-inverting configuration.

$$\frac{V_x}{V_1} = 1 + \frac{R_1}{R_2}$$

$$V_x = V_1\left(\frac{R_2 + R_1}{R_2}\right)$$

KCL at V_- of the 2nd op-amp:

$$\frac{V_x - V_2}{R_1} + \frac{V_o - V_2}{R_2} = 0$$

$$V_o = V_2\left(1 + \frac{R_2}{R_1}\right) - \frac{R_2}{R_1} V_x$$

$$V_o = V_2\left(1 + \frac{R_2}{R_1}\right) - \frac{R_2}{R_1}\left(V_1\left[\frac{R_2 + R_1}{R_2}\right]\right)$$

$$V_o = \left(1 + \frac{R_2}{R_1}\right)(V_2 - V_1)$$

5.14 Find I_o in the circuit in Fig. P5.14 using superposition.

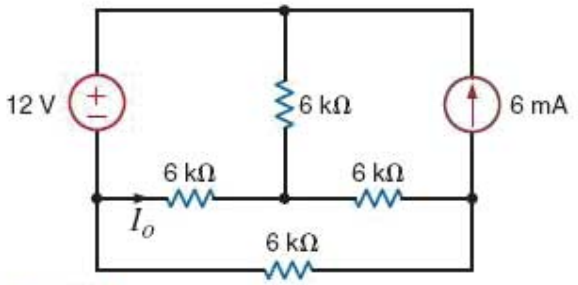
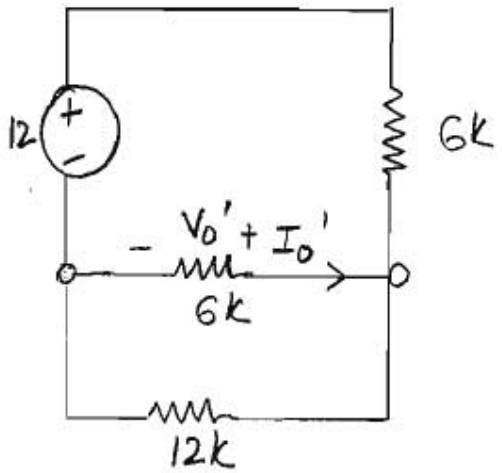


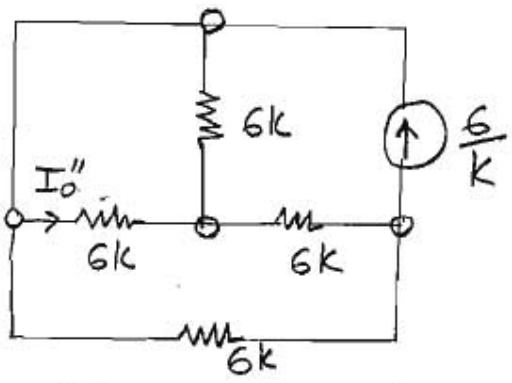
Figure P5.14

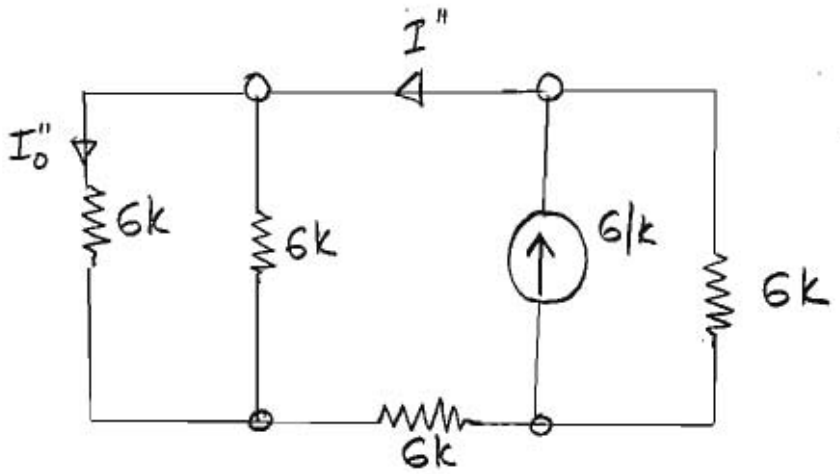
SOLUTION:



$$V_o' = (12)\left(\frac{4k}{10k}\right) = \frac{48}{10} = \frac{24}{5}\,V$$

$$I_o' = \frac{-24/5}{6k} = -\frac{4}{5k}\,A$$





$$I'' = \frac{6}{k}\left(\frac{6k}{15k}\right) = \frac{36}{15k} = \frac{12}{5k}$$

$$I_0'' = I''/2 = \frac{6}{5k}\,A$$

$$I_0 = I_0' + I_0''$$

$$= -\frac{4}{5k} + \frac{6}{5k}$$

$$= 2/5k\ A$$