5

4.18

✓ Answer

$$0 = \frac{v_n}{480} - \frac{v_o}{2400} - \frac{v_x}{600}$$
$$0 = \frac{v_n}{600} - \frac{v_x}{1200}$$
$$0 = -\frac{v_n}{400} - \frac{v_s}{400} + \frac{v_x}{200}$$

$$\frac{v_o}{v_s} = -1$$

4.23

*4.23 Find the value of v_o in the circuit in Fig. P4.23.

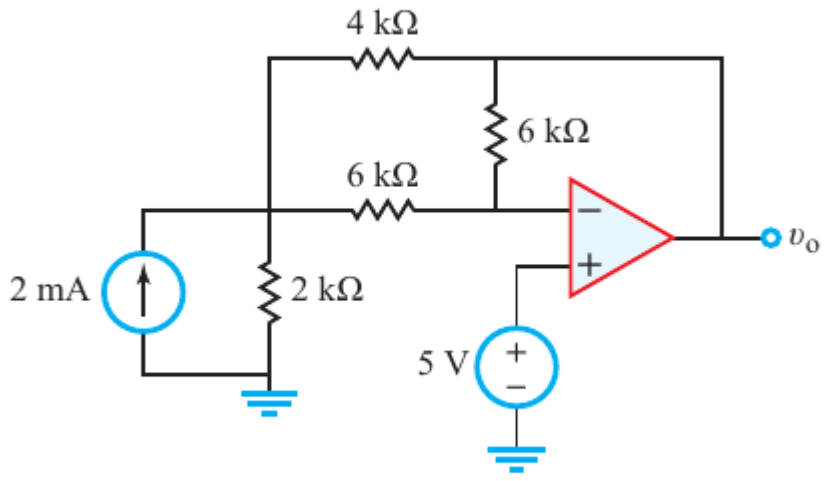

Figure P4.23 Circuit for Problem 4.23.

✓ Answer

$$0 = -\frac{v_n}{6000} - \frac{v_o}{4000} + \frac{11v_x}{12000} - 0.002$$
$$0 = \frac{v_n}{3000} - \frac{v_o}{6000} - \frac{v_x}{6000}$$
$$0 = \frac{v_n}{3000} - \frac{v_o}{6000} - \frac{v_x}{6000}$$

$$v_o = 5.42857142857143\ V$$

4.36

✓ **Answer**

$$0 = \frac{19v_n}{20000} - \frac{v_o}{4000} - \frac{51}{10000}$$
$$0 = \frac{v_n}{2400} - \frac{3}{2000}$$

$$v_o = -\frac{168}{25}\ V$$

4.37

✓ **Answer**

$$0 = -\frac{17}{12000} + \frac{4 - v_o}{r_f}$$

$$r_f = \frac{48000}{17} - \frac{12000v_o}{17}$$
$$v_o = 4 - \frac{17r_f}{12000} = -10$$
$$r_f = \frac{168000}{17}\ \Omega$$

4.50

✓ **Answer**

$$0 = \frac{v_{n1}}{50000} - \frac{v_s}{50000}$$
$$0 = \frac{v_{n1}}{2000} - \frac{v_{n2}}{4000} - \frac{v_{o1}}{12000}$$
$$0 = \frac{v_{n2}}{10000} - \frac{v_{o1}}{10000}$$
$$0 = -\frac{v_{n1}}{4000} + \frac{7v_{n2}}{8000} - \frac{v_{o2}}{8000}$$

$$v_{o2} = \frac{17v_s}{2}$$