Problem 4.40 Develop a block-diagram representation for the circuit in Fig. P4.40 for $\upsilon_{s_2} = \upsilon_{s_3} = 0$ and:

(a) $R_1 =$ open circuit.

(b) $R_1 = 10\ \text{k}\Omega$.

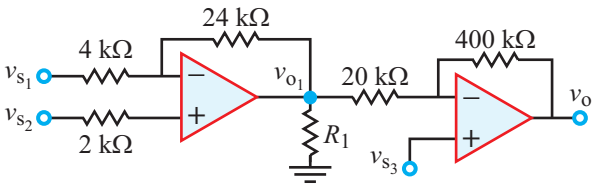


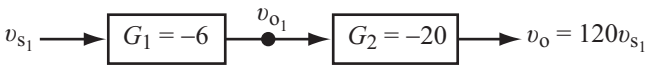
Figure P4.40: Circuit for Problem 4.40.

Solution: (a) For $\upsilon_{s_2} = 0$, the first stage is an inverting amplifier with

$$\upsilon_{o_1} = -\frac{24}{4}\,\upsilon_{s_1} = -6\upsilon_{s_1}.$$

For $\upsilon_{s_3} = 0$, the second stage is also an inverting amplifier, with

$$\upsilon_o = -\frac{400}{20}\,\upsilon_{o_1} = -20\upsilon_{o_1}$$



(b) R_1 has no bearing on the solution, so long as $R_1 \gg R_o$, where R_o is the output resistance of the op amp, which typically is on the order of 10–100 Ω.

Hence, for $R_1 = 10\ \text{k}\Omega$, the solution in (a) remains valid.