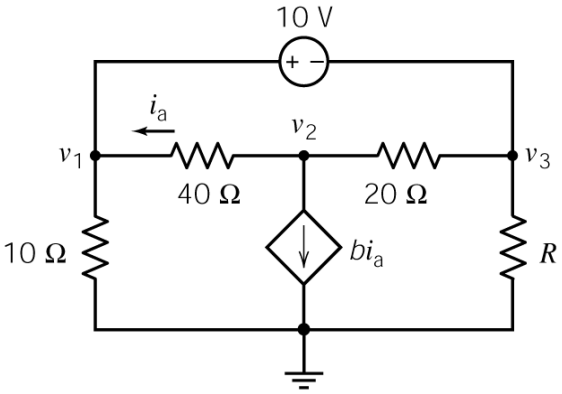
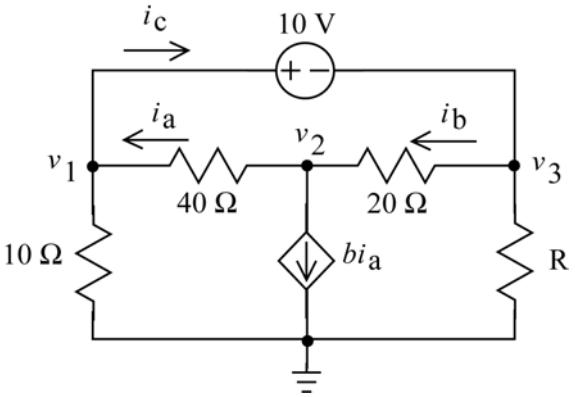
Problem 4.4-9 The node voltages in this circuit are

$$v_1 = 4 \text{ V}, v_2 = 0 \text{ V}, \quad \text{and} \quad v_3 = -6 \text{ V}$$

Determine the values of the resistance, R, and of the gain, b, of the CCCS.



Solution to Problem 4.4-9



Apply KCL at node 2:

$$i_a + bi_a = i_b = \frac{v_3 - v_2}{20} = \frac{-6-(0)}{20} = -0.3 \text{ A}$$

but

$$i_a = \frac{v_2 - v_1}{40} = \frac{0-4}{40} = -0.1$$

so

$$(1+b)(-0.1) = (-0.3) \quad \Rightarrow \quad b = 2 \ \frac{\text{A}}{\text{A}}$$

Next apply KCL to the supernode corresponding to the voltage source.

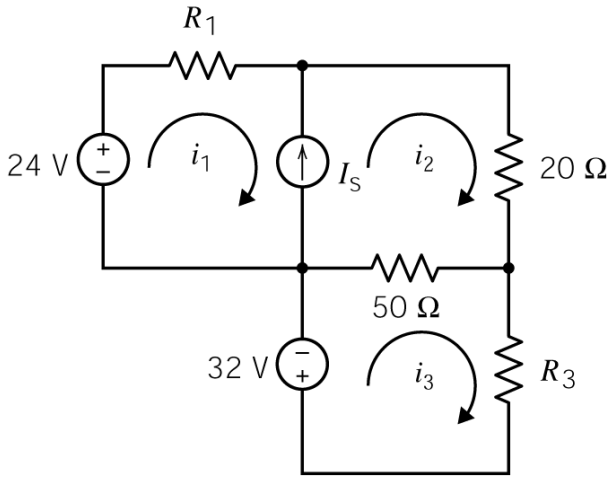
$$\frac{v_1}{10} + 2\, i_a + \frac{v_3}{R} = 0 \quad \Rightarrow \quad \frac{4}{10} + 2(-0.1) + \frac{-6}{R} = 0 \quad \Rightarrow \quad R = \frac{6}{.2} = 30 \ \Omega$$

Problem 4.6-10 The mesh currents in this circuit are

$$i_1 = -2.2213 \text{ A}, \; i_2 = 0.7787 \text{ A}, \quad \text{and} \quad i_3 = 0.0770 \text{ A}$$

(a) Determine the values of the resistances R_1 and R_3.

(b) Determine the value of the power supplied by the current source.



Solution to Problem 4.6-10

(a)

$$50\left(i_3 - i_2\right) + R_3 i_3 + 32 = 0 \quad \Rightarrow \quad 50\left(0.0770 - 0.7787\right) + R_3\left(0.0770\right) + 32 = 0$$
$$\Rightarrow \quad R_3 = 40 \ \Omega$$

$$i_1 R_1 + 20 i_2 + 50\left(i_2 - i_3\right) - 24 = 0 \quad \Rightarrow \quad R_1\left(-2.2213\right) + 20\left(0.7787\right) + 50\left(0.7787 - 0.0770\right) = 24$$
$$\Rightarrow \quad R_1 = 12 \ \Omega$$

(b)

$$I_s = i_2 - i_1 = 0.7787 - \left(-2.2213\right) = 3 \text{ A}$$

The power supplied by the current source is

$$p = I_s\left(24 - R_1 i_1\right) = 3\left(24 - 12\left(-2.2213\right)\right) = 152 \text{ W}$$