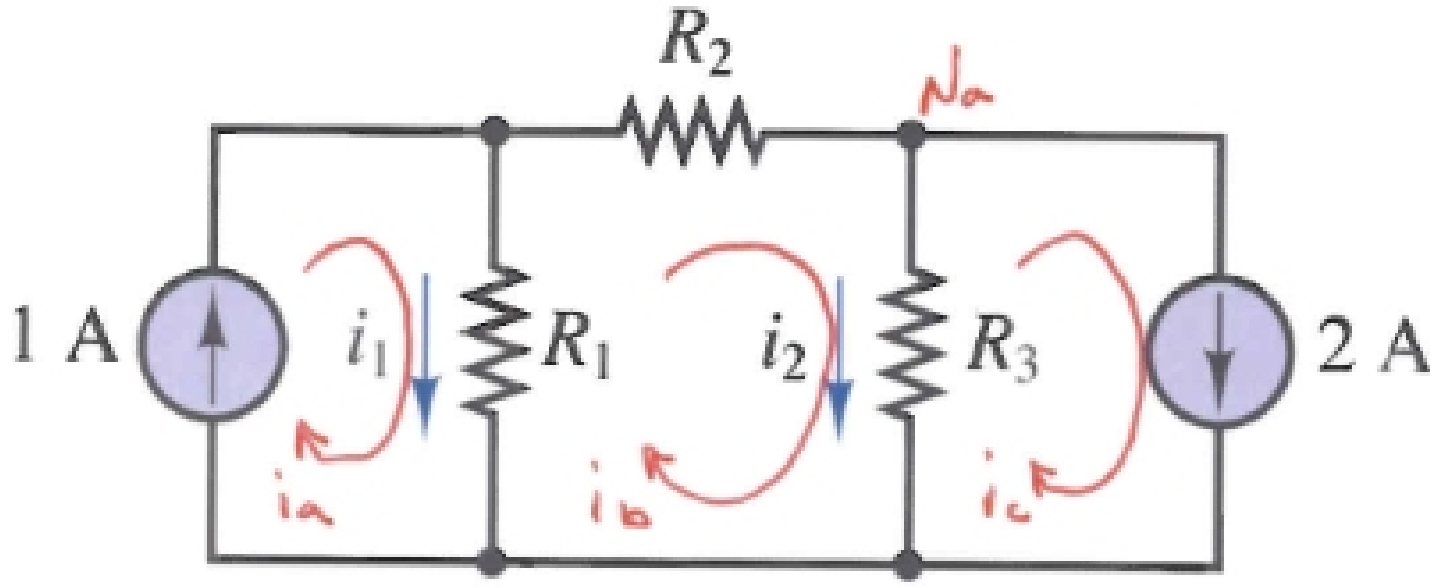
P 3.8



1. The mesh currents are labeled i_a, i_b, and i_c to avoid confusion with the existing labels i_1 and i_2.

   Label all meshes ($n=3$)

2. Identify dependent loops (current sources) $m=2$

   Note: $i_A = 1A$, $i_c = 2A$ } due to current sources

3. Write $n-m = 3-2 = 1$ KVL around the center (independent) mesh

   Mesh b: $\sum_{drops} V_n = R_1(i_b - i_a) + R_2 i_b + R_3(i_b - i_c) = 0$

4. Can substitute i_a & i_c and solve or solve 3 eqns:

$$\begin{bmatrix} 1 & 0 & 0 \\ -R_1 & R_1+R_2+R_3 & -R_3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} = \begin{bmatrix} 1A \\ 0 \\ 2A \end{bmatrix}$$

   substitute the values from problem 3.7

P 3.8 (cont.)

$$\begin{bmatrix} 1 & 0 & 0 \\ -3\Omega & 10\Omega & -6\Omega \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} = \begin{bmatrix} 1A \\ 0 \\ 2A \end{bmatrix}$$

$$\begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} = \begin{bmatrix} 1\,A \\ 1.5\,A \\ 2.0\,A \end{bmatrix}$$

We have "solved" the circuit, now find the values of interest

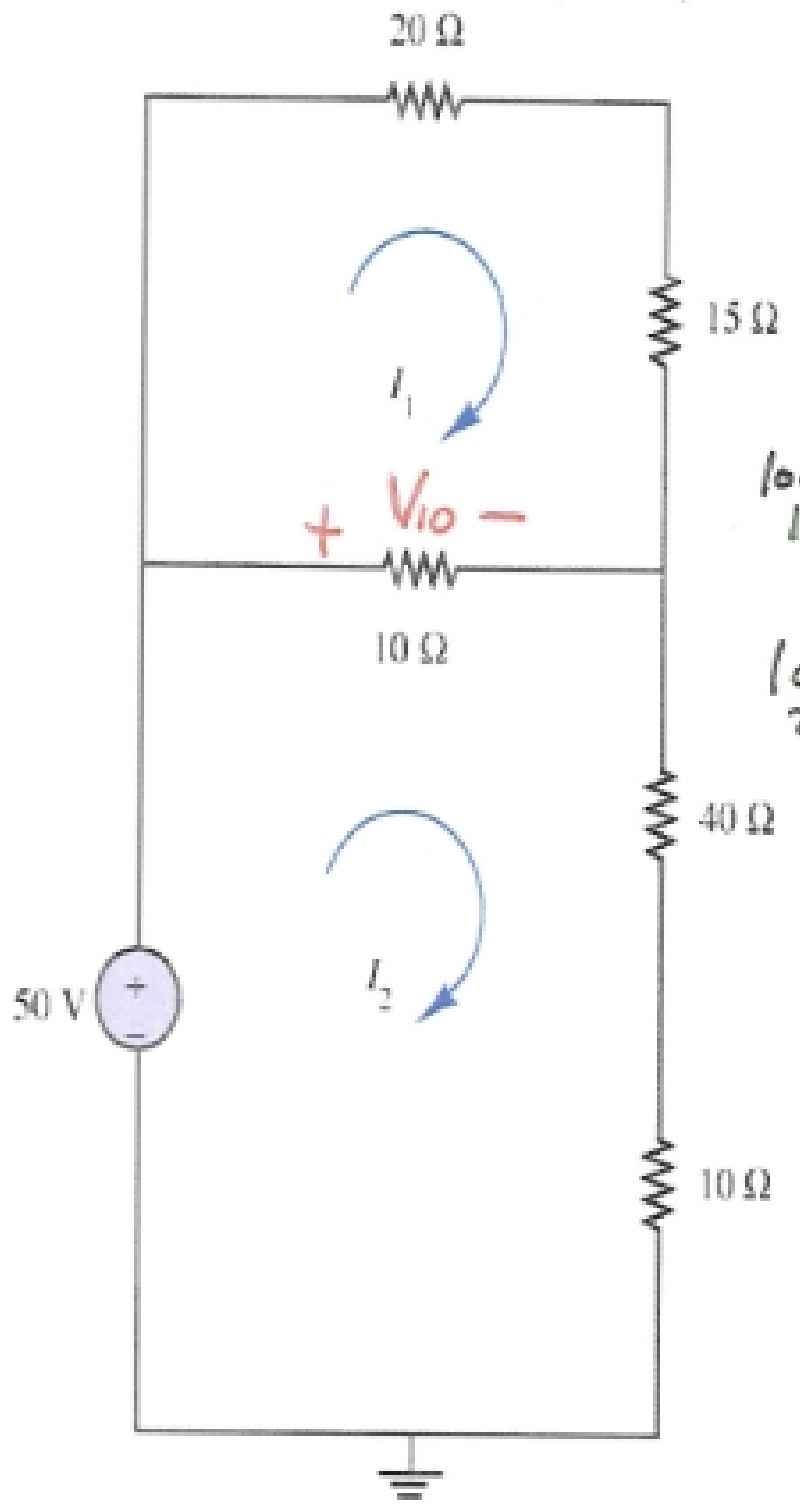
$$i_1 = i_a - i_b = 1A - 1.5A = -0.5A$$

$$i_2 = i_b - i_c = 1.5A - 2.0A = -0.5A$$

$\sum_{\text{into node a}} I_n = i_b - i_2 - i_c = 0$

$i_2 = i_b - i_c$

P 3.15



1. Use the loops indicated
   n=2
2. No dependent meshes (i.e current sources) m=0
3. Write 2 KVL equations

$$\text{loop}_1: \sum_{\text{drops}} = I_1 20\Omega + I_1 15\Omega + (I_1 - I_2)10\Omega = 0$$

$$\text{loop}_2: \sum_{\text{drops}} = I_2 40\Omega + I_2 10\Omega + (I_2 - I_1)10\Omega - 50V = 0$$

4. Solve

$$\begin{bmatrix} 45\Omega & -10\Omega \\ -10\Omega & 60\Omega \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 50V \end{bmatrix}$$

$$\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 0.192\ A \\ 0.865\ A \end{bmatrix}$$

Note that we would need to be given the polarity to truely answer the question asked. Lets randomly assign V_{10} as shown..

$$V_{10} = (I_2 - I_1)10\Omega = 6.731V$$

The problem really only asks about the magnitude of the voltage (since they did not provide a reference)

$$\therefore |V_{10}| = |6.731\ V| = 6.731\ V$$