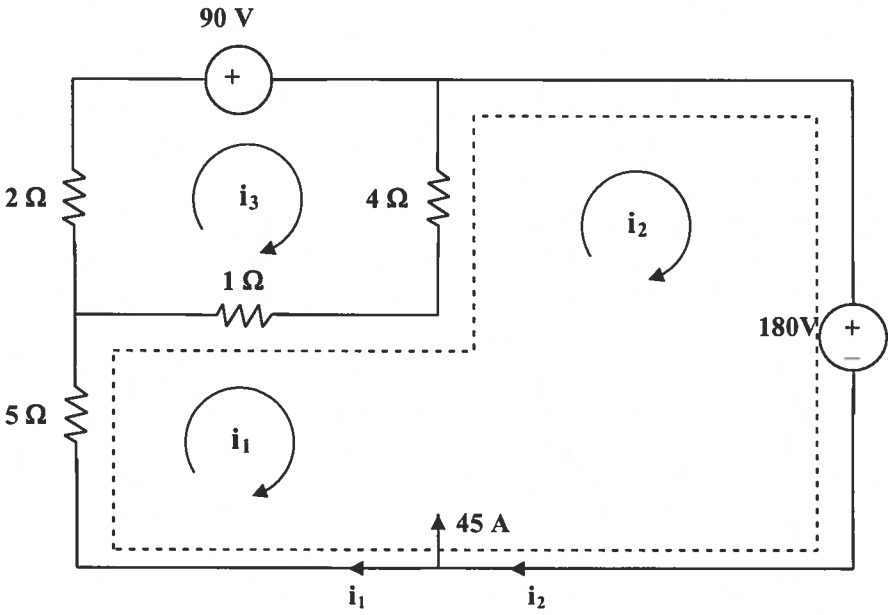
**Chapter 3, Solution 44**




Loop 1 and 2 form a supermesh. For the supermesh,

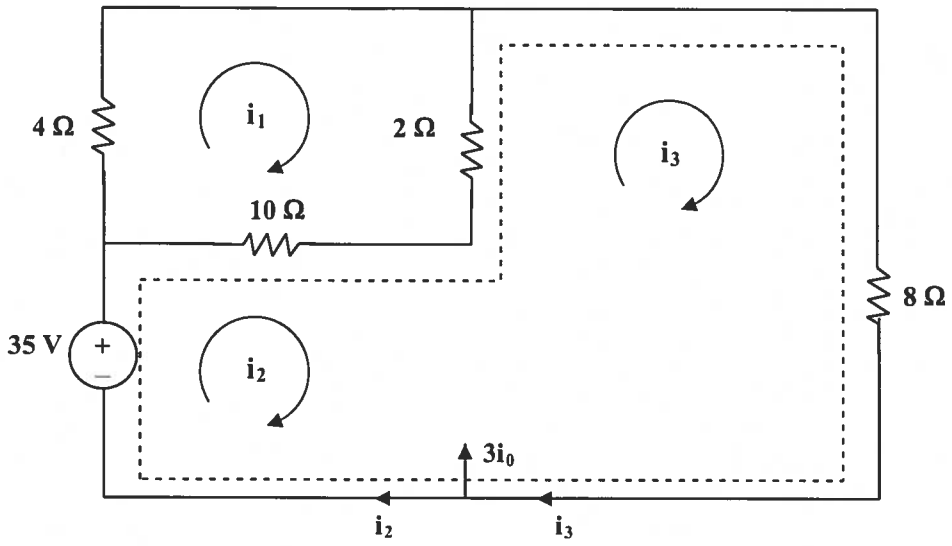
$$6i_1 + 4i_2 - 5i_3 + 180 = 0 \qquad (1)$$

For loop 3, $$-i_1 - 4i_2 + 7i_3 + 90 = 0 \qquad (2)$$

Also, $$i_2 = 45 + i_1 \qquad (3)$$

Solving (1) to (3), $i_1 = -46$, $i_3 = -20$; $\quad i_o = i_1 - i_3 = \mathbf{-26\ A}$

**Chapter 3, Solution 50**




For loop 1, $16i_1 - 10i_2 - 2i_3 = 0$ which leads to $8i_1 - 5i_2 - i_3 = 0$ (1)

For the supermesh, $-35 + 10i_2 - 10i_1 + 10i_3 - 2i_1 = 0$

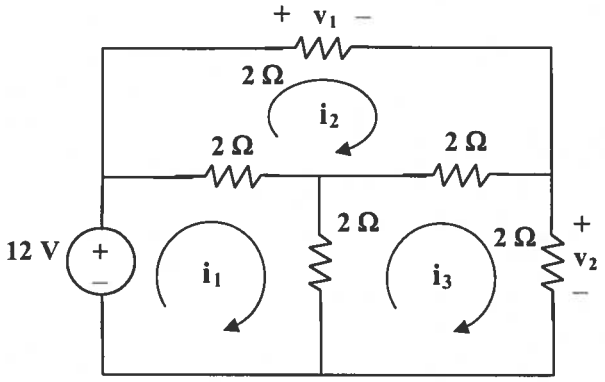
or $-6i_1 + 5i_2 + 5i_3 = 17.5$ (2)

Also, $3i_0 = i_3 - i_2$ and $i_0 = i_1$ which leads to $3i_1 = i_3 - i_2$ (3)

Solving (1), (2), and (3), we obtain $i_1 = 1.0098$ and

$$i_0 = i_1 = \mathbf{1.0098\ A}$$

**Chapter 3, Solution 56**




For loop 1, $12 = 4i_1 - 2i_2 - 2i_3$ which leads to $6 = 2i_1 - i_2 - i_3$ (1)

For loop 2, $0 = 6i_2 - 2i_1 - 2i_3$ which leads to $0 = -i_1 + 3i_2 - i_3$ (2)

For loop 3, $0 = 6i_3 - 2i_1 - 2i_2$ which leads to $0 = -i_1 - i_2 + 3i_3$ (3)

In matrix form (1), (2), and (3) become,

$$\begin{bmatrix} 2 & -1 & -1 \\ -1 & 3 & -1 \\ -1 & -1 & 3 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 0 \\ 0 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 2 & -1 & -1 \\ -1 & 3 & -1 \\ -1 & -1 & 3 \end{vmatrix} = 8, \quad \Delta_2 = \begin{vmatrix} 2 & 6 & -1 \\ -1 & 3 & -1 \\ -1 & 0 & 3 \end{vmatrix} = 24$$

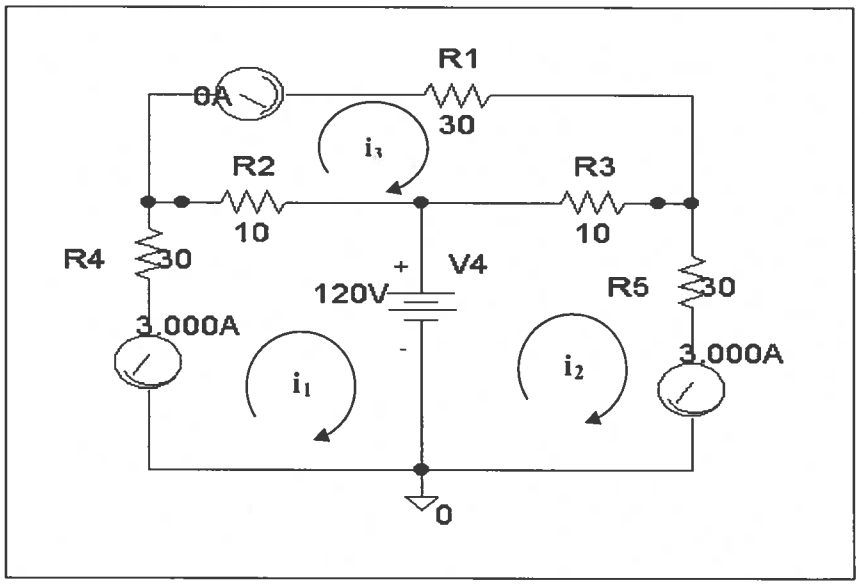
$$\Delta_3 = \begin{vmatrix} 2 & -1 & 6 \\ -1 & 3 & 0 \\ -1 & -1 & 0 \end{vmatrix} = 24 \text{ , therefore } i_2 = i_3 = 24/8 = 3\text{A},$$

$v_1 = 2i_2 =$ **6 volts**, $v = 2i_3 =$ **6 volts**

**Chapter 3, Solution 75**

```
* Schematics Netlist *

R_R4          $N_0002 $N_0001  30
R_R2          $N_0001 $N_0003  10
R_R1          $N_0005 $N_0004  30
R_R3          $N_0003 $N_0004  10
R_R5          $N_0006 $N_0004  30
V_V4          $N_0003 0 120V
v_V3          $N_0005 $N_0001 0
v_V2          0 $N_0006 0
v_V1          0 $N_0002 0
```




Clearly, $i_1 = -3$ **amps**, $i_2 = 0$ **amps**, and $i_3 = 3$ **amps**, which agrees with the answers in Problem 3.44.

## Chapter 3, Solution 88

Let $v_1$ be the potential at the top end of the 100-ohm resistor.

$$(v_s - v_1)/200 = v_1/100 + (v_1 - 10^{-3}v_0)/2000 \qquad (1)$$

For the right loop, $v_0 = -40i_0(10{,}000) = -40(v_1 - 10^{-3})10{,}000/2000$,

$$\text{or, } v_0 = -200v_1 + 0.2v_0 = -4x10^{-3}v_0 \qquad (2)$$

Substituting (2) into (1) gives, $(v_s + 0.004v_1)/2 = -0.004v_0 + (-0.004v_1 - 0.001v_0)/20$

This leads to $0.125v_0 = 10v_s$ or $(v_0/v_s) = 10/0.125 = \mathbf{-80}$