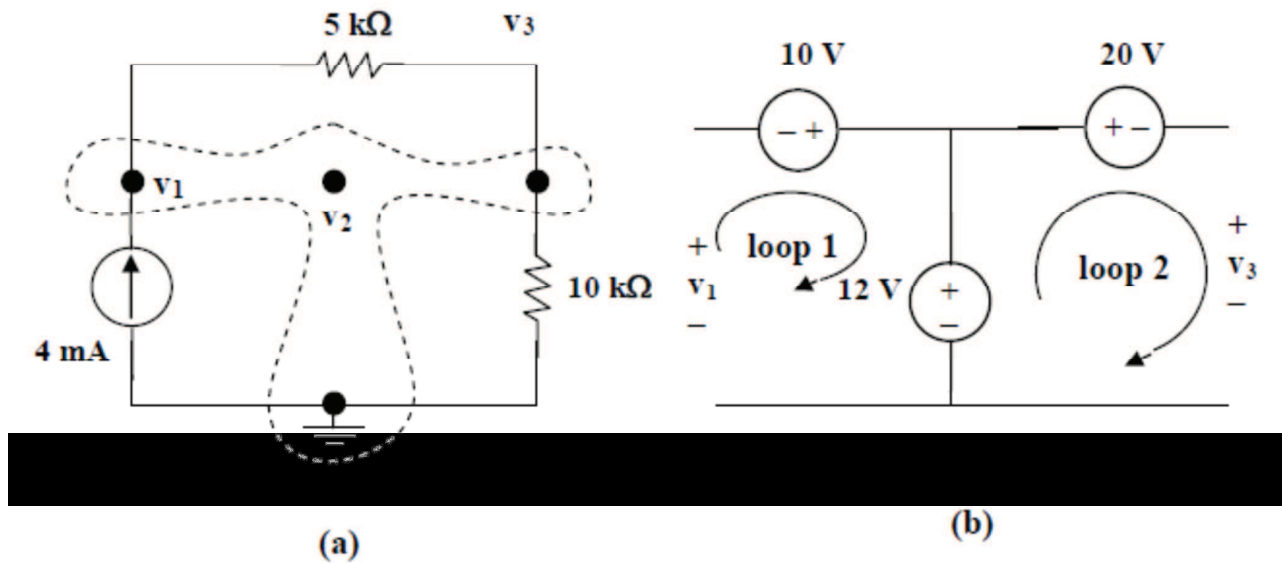


Assignment 4 Solutions

3.32



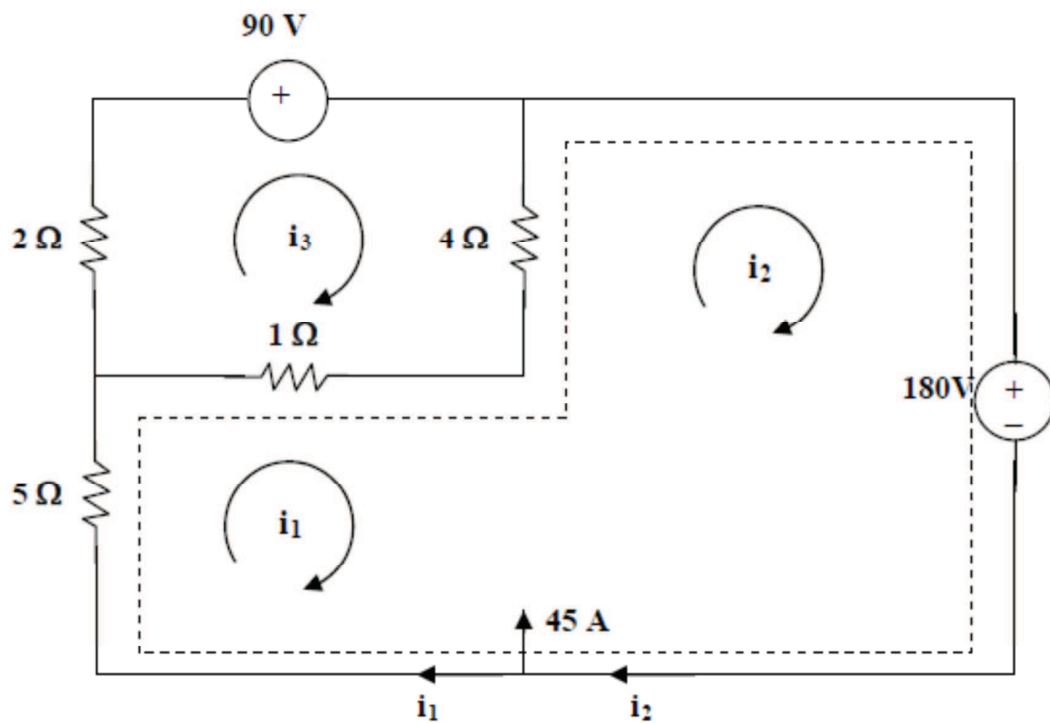
We have a supernode as shown in figure (a). It is evident that $v_2 = 12\text{ V}$. Applying KVL to loops 1 and 2 in figure (b), we obtain,

$$-v_1 - 10 + 12 = 0 \text{ or } v_1 = 2 \text{ and } -12 + 20 + v_3 = 0 \text{ or } v_3 = -8\text{ V}$$

Thus,

$$v_1 = 2\text{ V}, v_2 = 12\text{ V}, v_3 = -8\text{ V}.$$

3.44



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

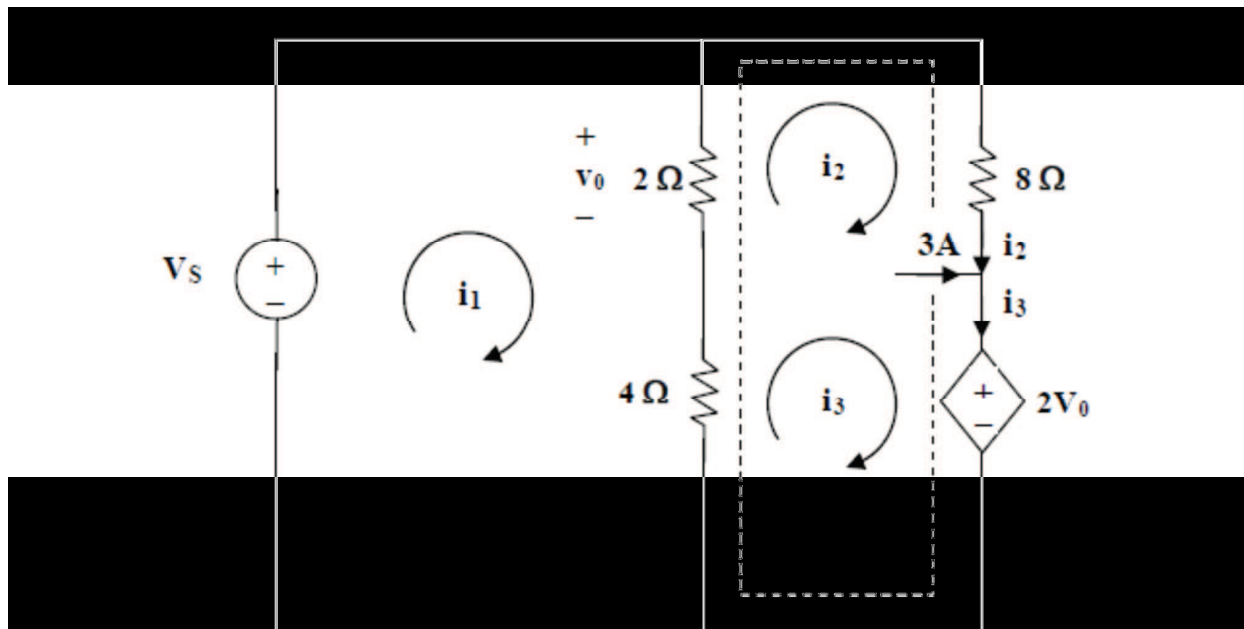
$$6i_1 + 4i_2 - 5i_3 + 180 = 0 \quad (1)$$

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

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

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

3.52



For mesh 1,

$$2(i_1 - i_2) + 4(i_1 - i_3) - 12 = 0 \text{ which leads to } 3i_1 - i_2 - 2i_3 = 6 \quad (1)$$

For the supermesh, $2(i_2 - i_1) + 8i_2 + 2v_0 + 4(i_3 - i_1) = 0$

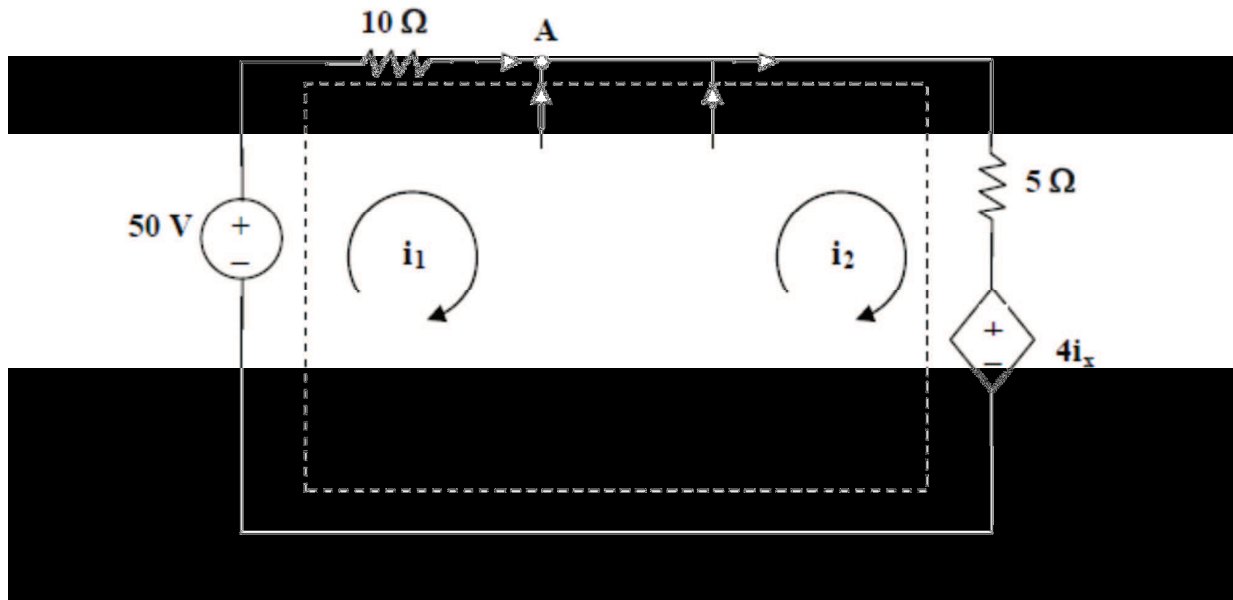
But $v_0 = 2(i_1 - i_2)$ which leads to $-i_1 + 3i_2 + 2i_3 = 0$
(2)

For the independent current source, $i_3 = 3 + i_2$ (3)

Solving (1), (2), and (3), we obtain,

$$i_1 = 3.5 \text{ A}, \quad i_2 = -0.5 \text{ A}, \quad i_3 = 2.5 \text{ A}.$$

3.63



For the supermesh, $-50 + 10i_1 + 5i_2 + 4i_x = 0$, but $i_x = i_1$. Hence,

$$50 = 14i_1 + 5i_2 \quad (1)$$

At node A, $i_1 + 3 + (v_x/4) = i_2$, but $v_x = 2(i_1 - i_2)$, hence, $i_1 + 2 = i_2$ (2)

Solving (1) and (2) gives $i_1 = 2.105$ A and $i_2 = 4.105$ A

$$v_x = 2(i_1 - i_2) = -4 \text{ volts and } i_x = i_2 - 2 = 2.105 \text{ amp}$$

3.84

From the output loop, $v_0 = 50i_0 \times 20 \times 10^{-3} = 10^6 i_0$ (1)

From the input loop, $15 \times 10^{-3} + 4000i_0 - v_0/100 = 0$ (2)

From (1) and (2) we get, $i_0 = 2.5 \mu\text{A}$ and $v_0 = 2.5$ volt.