Boise State University
Electrical Engineering Department

EE 210: Circuits I

Solution 1

For mesh 1,

$$-10 - 2I_x + 10I_1 - 6I_2 = 0$$

But $I_x = I_1 - I_2$. Hence,

$10 = -2I_1 + 2I_2 + 10I_1 - 6I_2 \longrightarrow 5 = 4I_1 - 2I_2$ (1)

For mesh 2,

$12 + 8I_2 - 6I_1 = 0 \longrightarrow 6 = 3I_1 - 4I_2$ (2)

Solving (1) and (2) leads to

$I_1 = 0.8\,\text{A}, \quad I_2 = -0.9\text{A}$

Solution 2

Assume R is in kilo-ohms.

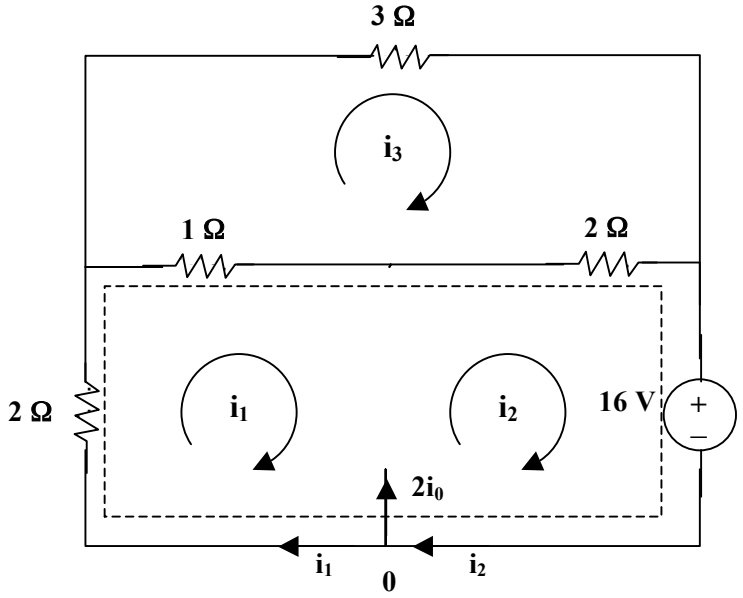
$V_2 = 4k\Omega x 18mA = \underline{72V}, \qquad V_1 = 100 - V_2 = 100 - 72 = \underline{28V}$

Current through R is

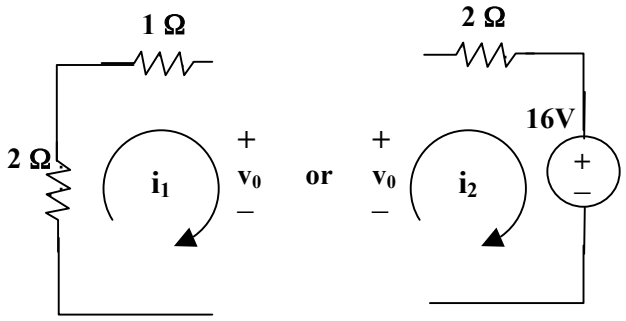
$$i_R = \frac{3}{3+R} i_{o,} \qquad V_1 = i_R R \longrightarrow 28 = \frac{3}{3+R}(18)R$$

This leads to R = 84/26 = **3.23 kΩ**

Solution 3



(a)



(b)

For the supermesh in figure (a),

$$3i_1 + 2i_2 – 3i_3 + 16 = 0 \qquad (1)$$

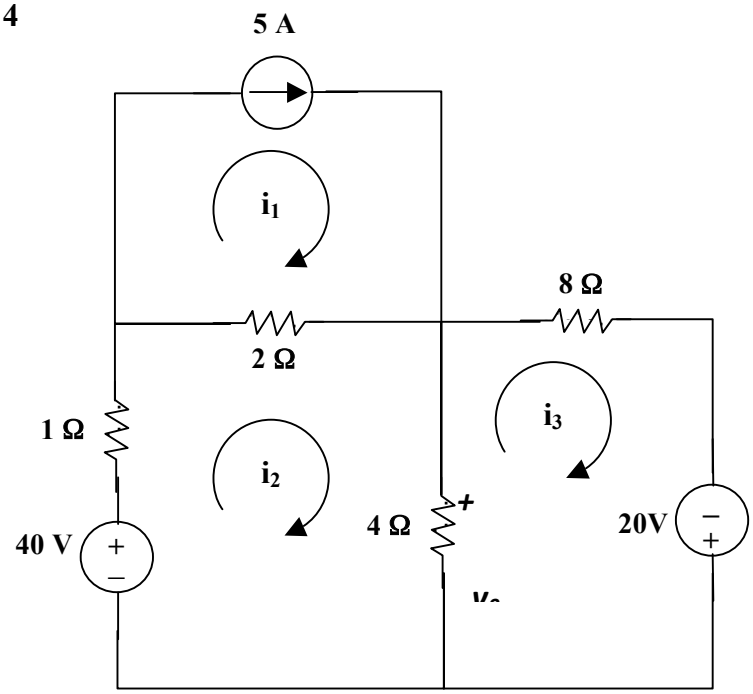
At node 0, $i_2 – i_1 = 2i_0$ and $i_0 = -i_1$ which leads to $i_2 = -i_1$ (2)

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

Solving (1) to (3), $i_1 = (-32/3)$A, $i_2 = (32/3)$A, $i_3 = (16/9)$A

$i_0 = -i_1 =$ **10.667 A**, from fig. (b), $v_0 = i_3 - 3i_1 = (16/9) + 32 =$ **33.78 V**.

Solution 4



For loop 1, $i_1 = 5A$ (1)

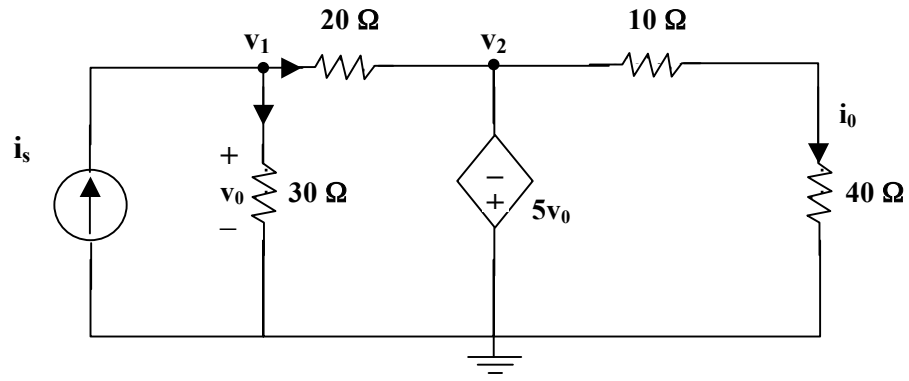
For loop 2, $-40 + 7i_2 - 2i_1 - 4i_3 = 0$ which leads to $50 = 7i_2 - 4i_3$ (2)

For loop 3, $-20 + 12i_3 - 4i_2 = 0$ which leads to $5 = -i_2 + 3i_3$ (3)

Solving with (2) and (3), $i_2 = 10$ A, $i_3 = 5$ A

And, $v_0 = 4(i_2 - i_3) = 4(10 - 5) =$ **20 V**.

Solution 5



At node 1, $i_s = (v_1/30) + ((v_1 - v_2)/20)$ which leads to $60i_s = 5v_1 - 3v_2$ (1)

But $v_2 = -5v_0$ and $v_0 = v_1$ which leads to $v_2 = -5v_1$

Hence, $60i_s = 5v_1 + 15v_1 = 20v_1$ which leads to $v_1 = 3i_s$, $v_2 = -15i_s$

$i_0 = v_2/50 = -15i_s/50$ which leads to $i_0/i_s = -15/50 =$ **–0.3**