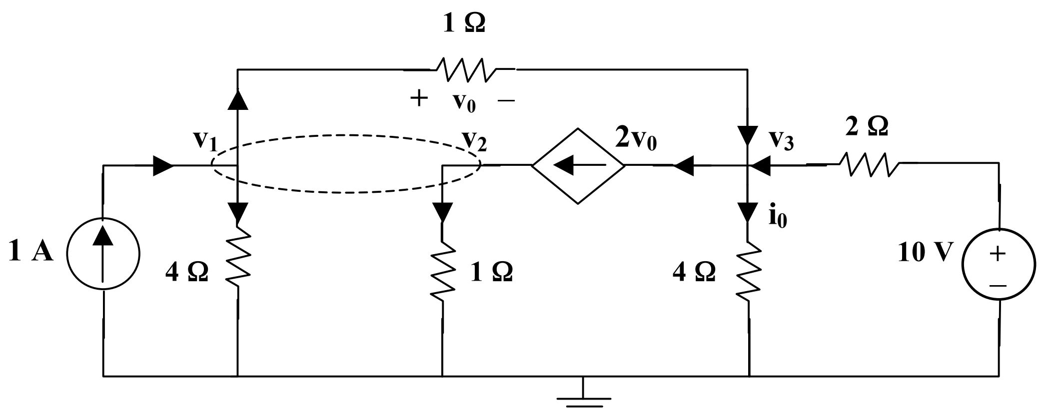
Boise State University
Electrical Engineering Department

EE 210: Circuits I

Solution 1



At the supernode,

$$1 + 2v_0 = \frac{v_1}{4} + \frac{v_2}{1} + \frac{v_1 - v_3}{1} \qquad (1)$$

But $v_o = v_1 - v_3$. Hence (1) becomes,

$$4 = -3v_1 + 4v_2 + 4v_3 \qquad (2)$$

At node 3,

$$2v_o + \frac{v_3}{4} = v_1 - v_3 + \frac{10 - v_3}{2}$$

or

$$20 = 4v_1 + 0v_2 - v_3 \qquad (3)$$

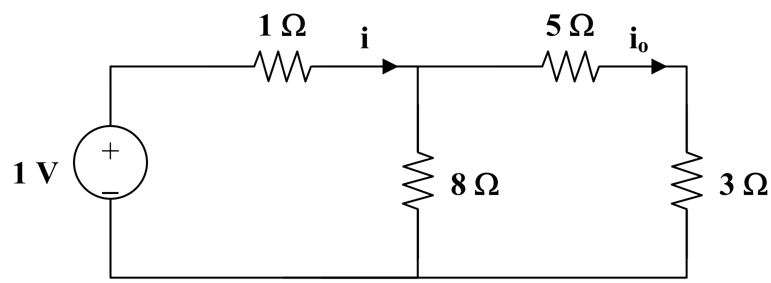
At the supernode, $v_2 = v_1 + 4i_o$. But $i_o = \frac{v_3}{4}$. Hence,

$$v_2 = v_1 + v_3 \qquad (4)$$

Solving (2) to (4) leads to,

$v_1 = \underline{\mathbf{4.97V}}$, $v_2 = \underline{\mathbf{4.85V}}$, $v_3 = \underline{\mathbf{-0.12V}}$.

Solution 2

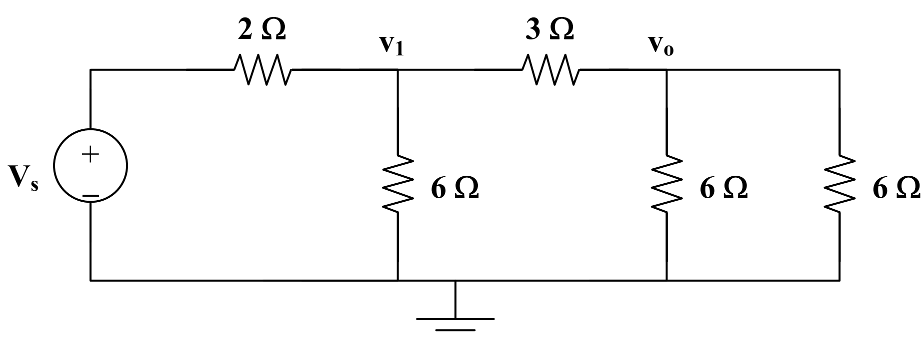


$$8 \| (5+3) = 4\Omega, \quad i = \frac{1}{1+4} = \frac{1}{5}$$

$$i_o = \frac{1}{2} i = \frac{1}{10} = \underline{\mathbf{0.1A}}$$

Since the resistance remains the same we get i = 10/5 = 2A which leads to
$i_o = (1/2)i = (1/2)2 = \underline{\mathbf{1A}}$.

Solution 3



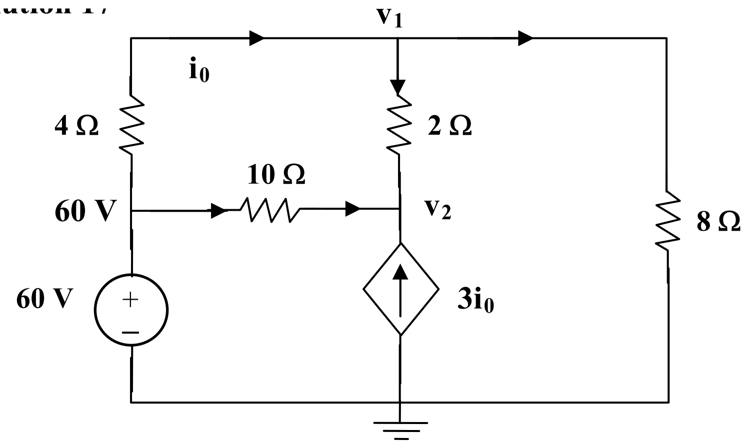
If $v_o = 1V$, $\quad V_1 = \left(\frac{1}{3}\right) + 1 = 2V$

$$V_s = 2\left(\frac{2}{3}\right) + v_1 = \frac{10}{3}$$

If $v_s = \frac{10}{3}$ $\longrightarrow$ $v_o = 1$

Then $v_s = 15$ $\longrightarrow$ $v_o = \frac{3}{10} x15 = \underline{\mathbf{4.5V}}$

Solution 4



At node 1, $\dfrac{60-v_1}{4} = \dfrac{v_1}{8} + \dfrac{v_1 - v_2}{2}$ $\qquad 120 = 7v_1 - 4v_2 \qquad (1)$

At node 2, $3i_0 + \dfrac{60-v_2}{10} + \dfrac{v_1 - v_2}{2} = 0$

But $i_0 = \dfrac{60-v_1}{4}$.

Hence

$$\frac{3(60-v_1)}{4} + \frac{60-v_2}{10} + \frac{v_1-v_2}{2} = 0 \longrightarrow 1020 = 5v_1 + 12v_2 \qquad (2)$$

Solving (1) and (2) gives $v_1 = 53.08$ V. Hence $i_0 = \dfrac{60-v_1}{4} =$ **1.73 A**