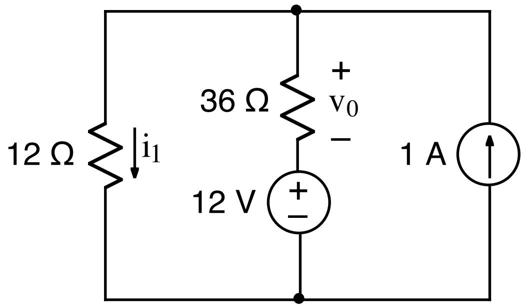
Ex:



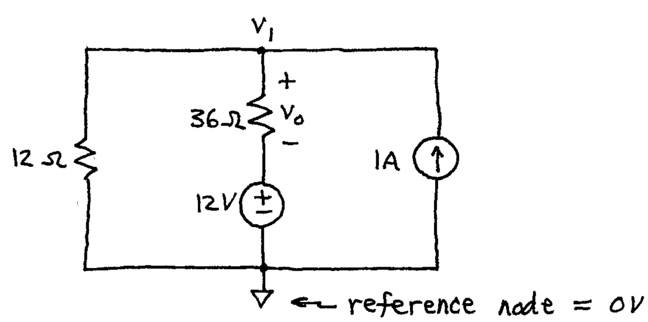
Use the node-voltage method to find i_1 and v_0.

soln: We follow a standard procedure:

1) Assign a reference node, typically on the bottom of the circuit.

2) Assign node voltages such as $v_1, v_2, \ldots$ to nodes where 3 or more wires connect.

Here, we call the top node v_1.



The – sign of all voltage measurements is at the reference node. Thus, v_1 is the v-drop from the top node to the reference node.

3) Look for dependent sources. None here!

4) Look super nodes, (i.e., nodes connected by only a voltage source). None here!

5) Write current-summation eq'ns for each node.

v_1 node: $$\frac{v_1 - 0V}{12\Omega} + \frac{v_1 - 12V}{36\Omega} - 1A = 0A$$

Note: We sum the currents flowing out of the node. Our terms are always of the same form: the voltage of the node we are at appears as a positive term from which we subtract the voltage at the neighboring node. We divide the v-drop by the total resistance between nodes to find the current.

6) We solve our eq'n for the node-voltage, v_1.

$$v_1\left(\frac{1}{12\Omega} + \frac{1}{36\Omega}\right) = \frac{12V}{36\Omega} + 1A = \frac{4}{3}A$$

or $$v_1 = \frac{4}{3}A \cdot \frac{1}{\frac{1}{12\Omega} + \frac{1}{36\Omega}} = \frac{4}{3}A \cdot 12\Omega \| 36\Omega$$

$$v_1 = \frac{4}{3}A \cdot 12\Omega \cdot 1\|3 = \frac{\cancel{4}}{\cancel{3}}A \cdot 12\Omega \cdot \frac{\cancel{3}}{\cancel{4}} = 12V$$

Given $v_1 = 12V$, we have $i_1 = \frac{12V}{12\Omega} = 1A$ and

$$v_0 = v_1 - 12V = 12V - 12V = 0V.$$