Ex:

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

**Sol'n:** 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 eqns for each node.

\[ V_1 \text{ node: } V_1 - 0V + \frac{V_1 - 12V}{12\Omega} - 1A = 0A \]
\[ \frac{V_1}{36\Omega} \]

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 eqn 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 \( V_1 = \frac{4}{3} A \cdot \frac{1}{\frac{1}{12\Omega} + \frac{1}{36\Omega}} = \frac{4}{3} A \cdot \frac{12\Omega}{36\Omega} \parallel \frac{12\Omega}{36\Omega} \)

\[ V_1 = \frac{4}{3} A \cdot 12\Omega \cdot \frac{1}{3} = \frac{4}{3} A \cdot 12\Omega \cdot \frac{3\Omega}{3} = 12V \]

Given \( V_1 = 12V \), we have \( i_1 = \frac{12V}{12\Omega} = 1A \) and

\[ V_0 = V_1 - 12V = 12V - 12V = 0V. \]