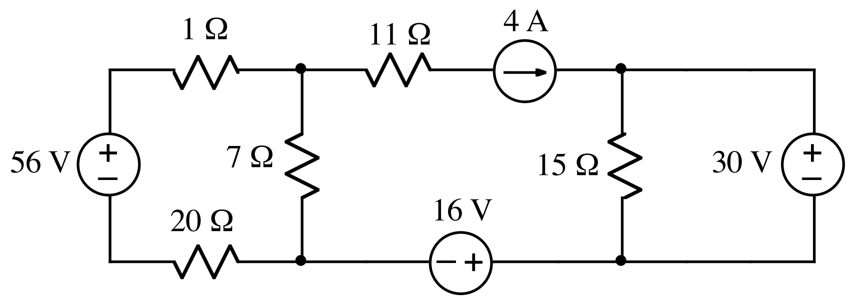
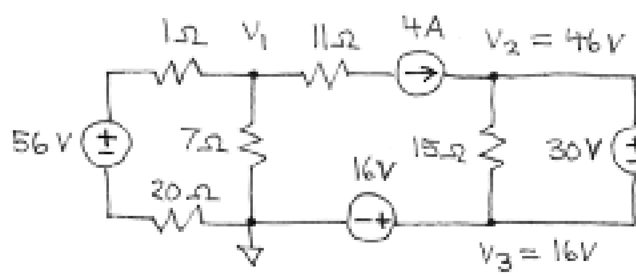
Ex:



Choose a reference node and use the node-voltage method to the remaining node voltages.

SOL'N: Node voltages shift up or down, depending on which node is chosen as the reference node. The choice is arbitrary. Here, the reference node will be below the 7Ω resistor.

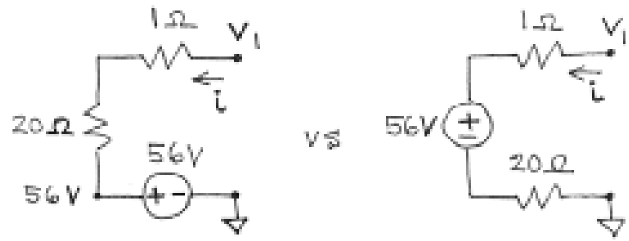


We find that v_2 and v_3 are known values, owing to the 16V and 30V sources connected in series to the reference node, (with no series resistors).

We have only the v_1 node to solve for. The summation of currents out of the v_1 node yields the following eq'n:

$$\frac{v_1 - 56\text{V}}{1\Omega + 20\Omega} + \frac{v_1}{7\Omega} + 4\text{A} = 0\text{A}$$

Note: The first term of the current summation is found by sliding the 20Ω resistor thru the 56V source.



The current **i** is the same in both circuits:

$$i = \frac{v_1 - 56V}{1\Omega + 20\Omega}$$

Returning to the eq'n for v_1, we group together the terms multiplying v_1 and move constants to the right side:

$$v_1\left(\frac{1}{21\Omega} + \frac{1}{7\Omega}\right) = \frac{56V}{21\Omega} - 4A$$

Multiplying both sides by 21Ω yields the following:

$$v_1(1+3) = 56V - 21\Omega(4A) = 56V - 84V$$

or

$$v_1 = -\frac{28V}{4} = -7V$$

Note: The currents flowing out of the v_1 node are −3A to the left, −1A down, and 4A to the right. The sum is zero. ✓