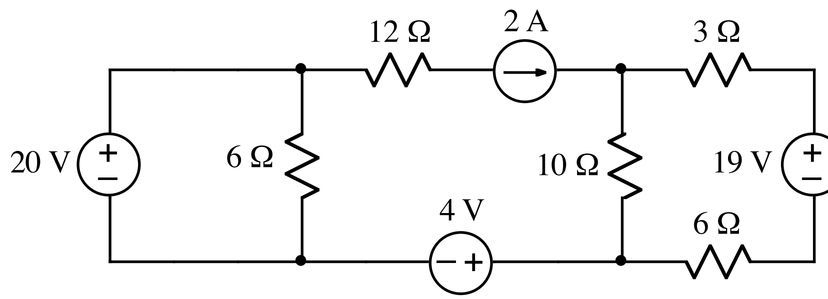
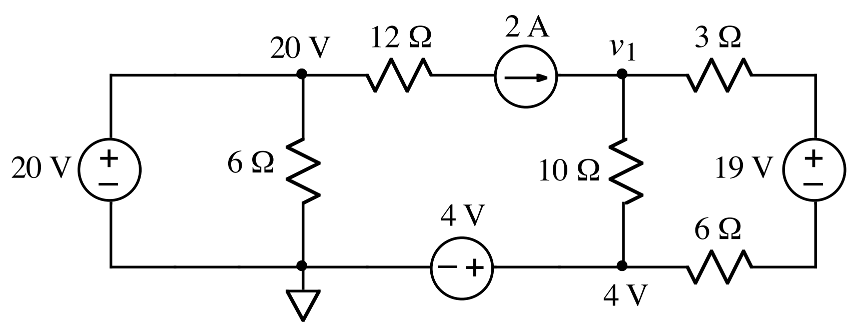
HOMEWORK #6 solution

Ex:



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

SOL'N: Here, the reference node will be placed on the left side of the 4 V source. Other choices lead to different node voltages, which are equally correct. Also, the numbering or labeling of nodes may vary.



With our choice of reference, two node voltages are found by using the values of voltage sources connected to reference, as shown on the circuit diagram.

We have one remaining node, v_1, for which we do a current summation.

$$-2\text{ A} + v_1\frac{v_1 - 4\text{ V}}{10\ \Omega} + \frac{v_1 - (4\text{ V} + 19\text{ V})}{3\ \Omega + 6\ \Omega} = 0\text{ A}$$

Note that we may slide the 19 V source through the 6 Ω resistor, leaving us with the 3 Ω and 6 Ω adjacent, with v_1 on one side and 4 V + 19 V on the other side.

We have only one variable, which we now solve for.

$$v_1\left(\frac{1}{10\ \Omega} + \frac{1}{3\ \Omega + 6\ \Omega}\right) = 2\text{ A} + \frac{4\text{ V}}{10\ \Omega} + \frac{23\text{ V}}{3\ \Omega + 6\ \Omega}$$

or

$$90\ \Omega \cdot v_1\left(\frac{1}{10\ \Omega} + \frac{1}{3\ \Omega + 6\ \Omega}\right) = \left(2\ \text{A} + \frac{4\ \text{V}}{10\ \Omega} + \frac{23\ \text{V}}{3\ \Omega + 6\ \Omega}\right) \cdot 90\ \Omega$$

or

$$v_1(9 + 10) = 180 + 36 + 230\ \text{V}$$

or

$$v_1(9 + 10) = \frac{446\ \text{V}}{19} \approx 23.5\ \text{V}$$