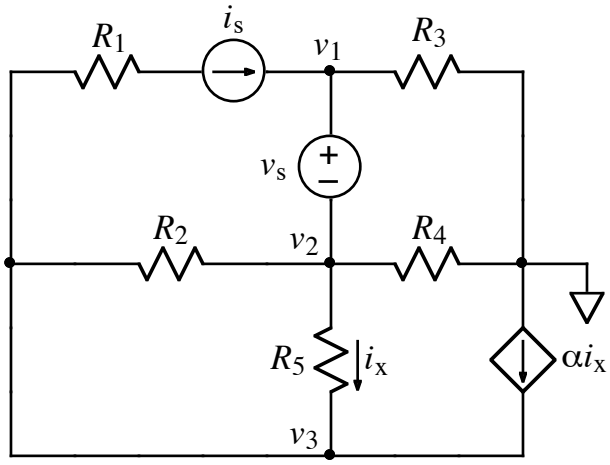
HOMEWORK #8 solution

Ex:



For the circuit shown, write three independent equations for the node-voltages, v_1, v_2, and v_3. The quantity i_x must not appear in the equations.

Sol'n: We define the dependent source variable, i_x, in terms of node voltages:

$$i_x = \frac{v_2 - v_3}{R_5}$$

For nodes v_1 and v_2, we have a supernode with a voltage equation and a current summation out of both nodes (excluding the v_s source).

$$v_s = v_1 - v_2$$

$$-i_s + \frac{v_1}{R_3} + \frac{v_2 - v_3}{R_2} + \frac{v_2 - v_3}{R_5} + \frac{v_2}{R_4} = 0 \text{ A}$$

For node v_3 we must include currents flowing into all components connected by wires to the v_3 node. We also use the definition of i_x in terms of node voltages.

$$i_s + \frac{v_3 - v_2}{R_2} + \frac{v_3 - v_2}{R_5} - \alpha \frac{v_2 - v_3}{R_5} = 0 \text{ A}$$