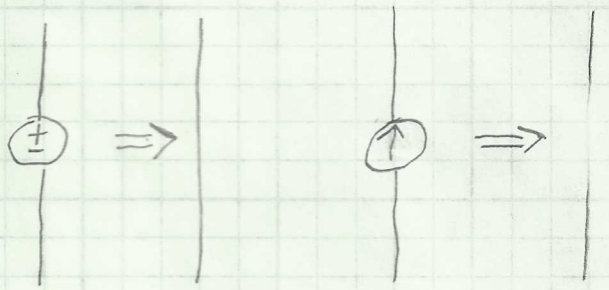
Chap. 3

Network Topology

dead network - the circuit redrown with all of the sources "turned off".



supernode - a pair of nodes in the origal circuit that become a single node in the dead network. (Results from having a voltage source as the only element in a branch)

Nodal Analysis

Procedure:

1. Draw the dead network
2. Identify node in d.n.
3. Remove independent elements
4. Select a reference node (ground).
5. Define unknown voltages between the ref. node and each non-ref. node.

6.) Write the current in every branch in terms of the unknown voltage or known currents.

7) Write KCL eqns @ each non-ref. node.

8. Solve

Procedure: Loop

(1) Draw the dead network.

(2) Remove independent elements.

(3) Assign an unknown current to circulate in each interior loop of the d.n (always in the same direction CW or (CCW)

4) Assign a path of circulation for each current source.

5.) Write the current in every branch in terms of the unknown currents & Known currents.

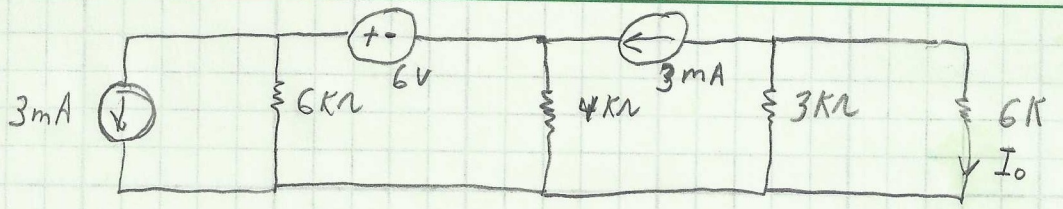
6.) Write the voltages in terms of the defined currents

7) Write KVL eqns around each loop

KVL: in opp. direction of I's

$$\frac{1}{R} = G \leftarrow \text{conductance}$$

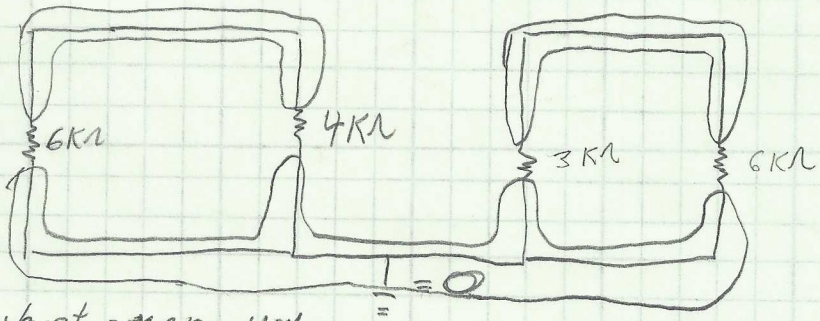
$G \rightarrow$ (Siemens)

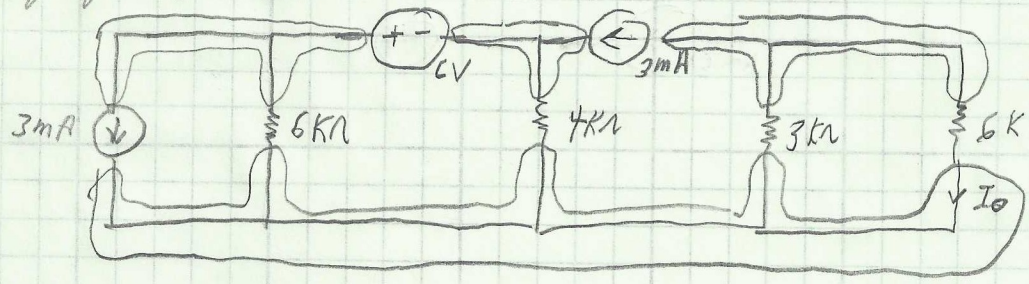


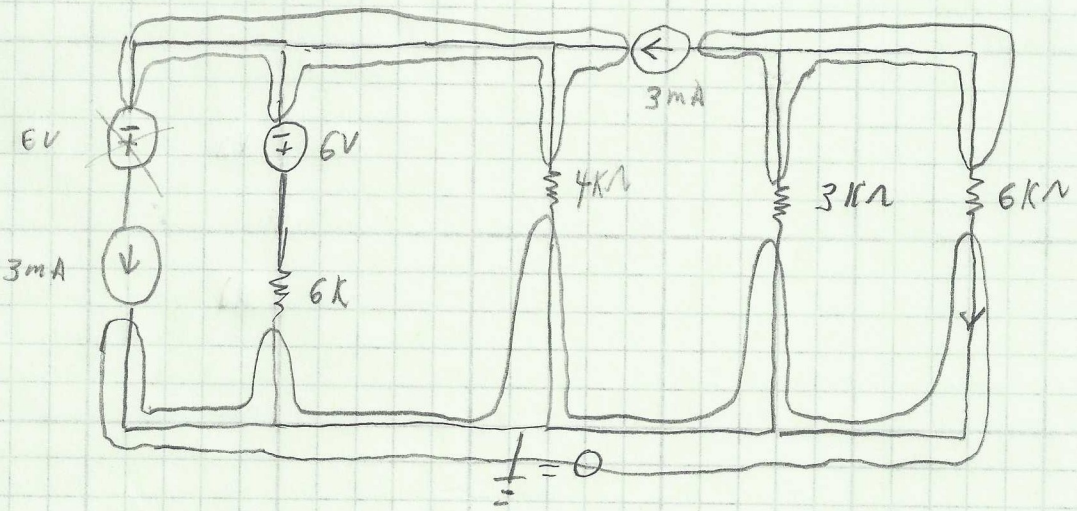

* Source Push

Only applies to voltage sources.

Push away from the unknown (what ever you are trying to find.




When pushing the voltage source into a current source the voltage falls out.

$$\left(\frac{1}{6K} + \frac{1}{4K}\right)V_1 + (0)V_2 = -3mA - \frac{6V}{6K\Omega} + 3mA$$

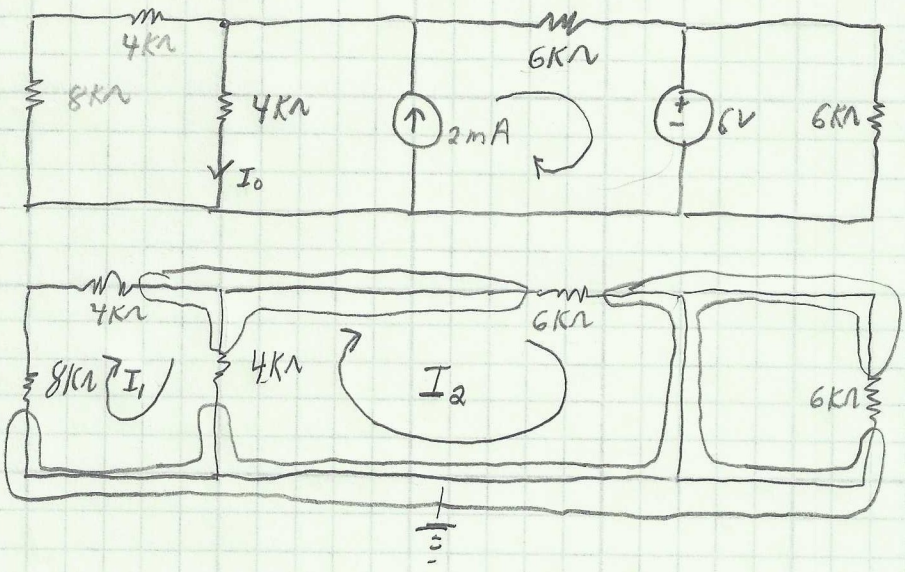
$$(0)V_1 + \left(\frac{1}{3K\Omega} + \frac{1}{6K\Omega}\right)V_2 = -3mA$$

$$\left(\frac{5}{12}\right)V_1 + (0)V_2 = -1mA$$

$$(0)V_1 + \left(\frac{1}{2K\Omega}\right)V_2 = -3mA$$

Special Note

* Push away from dependent variables




Note *

Cannot run current source through another current source.

$$16\,K\Omega\, I_1 + (-4K\Omega)\, I_2 = 0$$

$$(-4K\Omega) I_1 + (10K\Omega)\, I_2 = 12V + 6V$$

$$(16\,K\Omega) I_1 + (-4K\Omega)\, I_2 = 0$$

$$(-4K\Omega)\, I_1 + (10K\Omega) I_2 = -18V$$

$$I_1 = -\tfrac{1}{2}\ mA \qquad I_2 = -2\ mA$$

$$I_o = I_1 - I_2$$

$$= \frac{-1}{2}\ mA - (-2mA)$$

$$= \frac{3}{2}\ mA$$