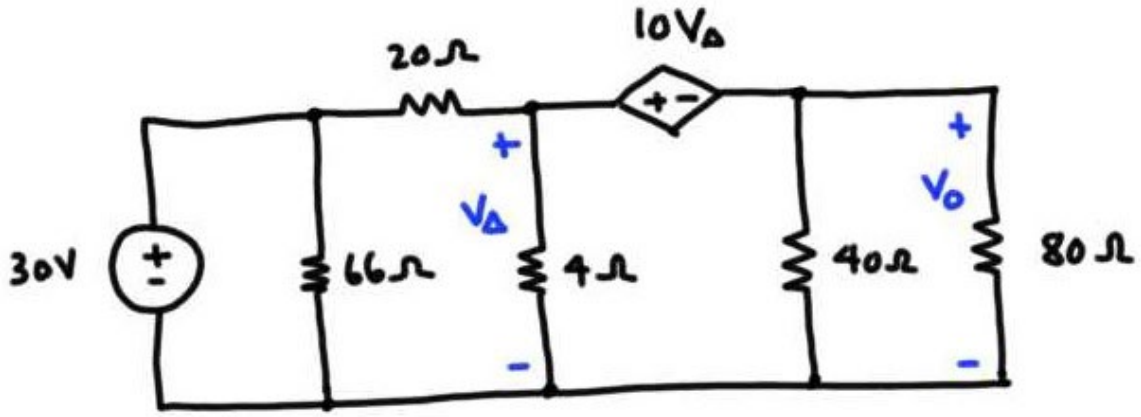
Supernode: Firstly, supernodes can only be defined when analyzing a circuit with the node-voltage method. Whenever a voltage source is sandwiched between two essential nodes (typically) then the two nodes can be combined into one big supernode. We can then use KCL to write down a system of equations that takes into account only the currents coming into and going out of the supernode. A constraint equation that relates the voltages at nodes of the voltage source can be written down to help complete the system of equations needed to solve the circuit.

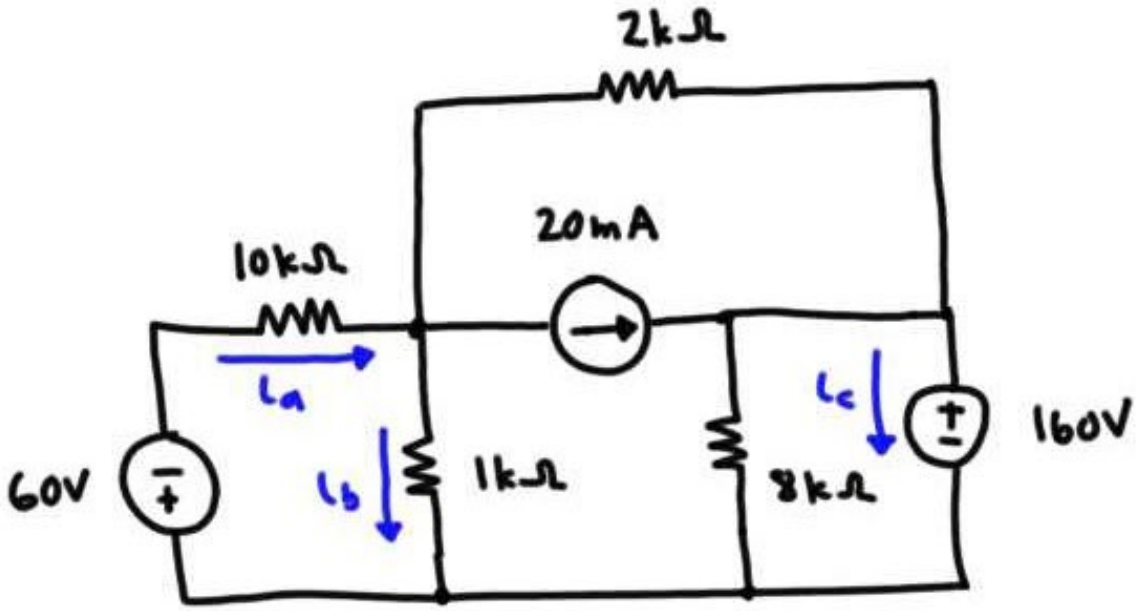
1) For the circuit shown below, use the node-voltage method to solve for a) v_0 and b) v_Δ.



2) Use the mesh-current method to analyze the circuit shown above to confirm the found values of a) v_0 and b) v_Δ in part 1)
3) Which method was easier to use? Why?
4) Use the results of either method (your choice) to calculate the total power developed in the circuit.

Supermesh: Firstly, supermeshes can only be defined when analyzing a circuit with the mesh-current method. Whenever a current source is in between two essential nodes, then a loop can be defined that avoids going through the current source – this loop is called a supermesh. We can then use KVL around the supermesh using the mesh currents already defined in the circuit to set up an equation. A constraint equation can be obtained by rewriting the current provided by the current source and the mesh currents defined. These two equations will help in setting up a complete system of equations in terms of the mesh-currents used to analyze the circuit.

1) For the circuit shown below, use the mesh-current method to find the branch currents i_a, i_b, and i_c.

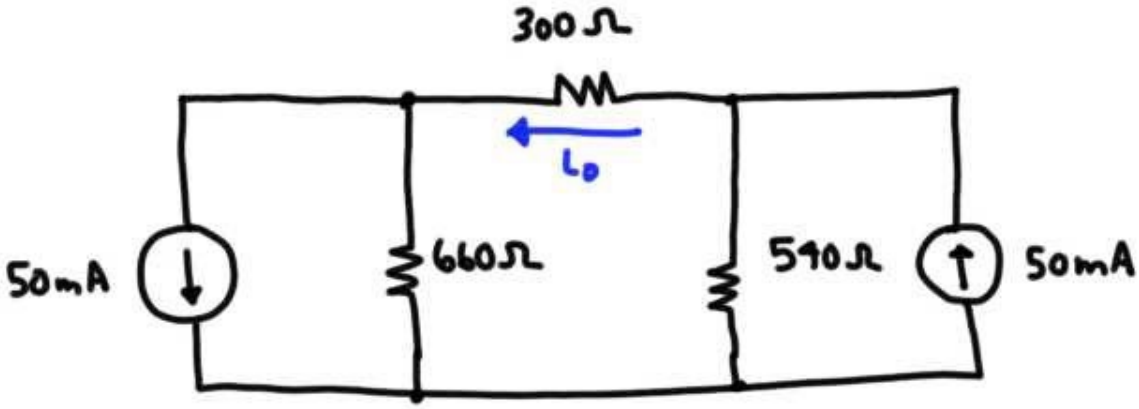


2) Use the node-voltage method to analyze the circuit shown above to confirm the found values of the branch currents found in part 1).
3) Which method was easier to use? Why?
4) Use the results of either method to verify the power check, i.e. that the total power generated is equal to the total power dissipated.

Source Transformations:

Problem #1:

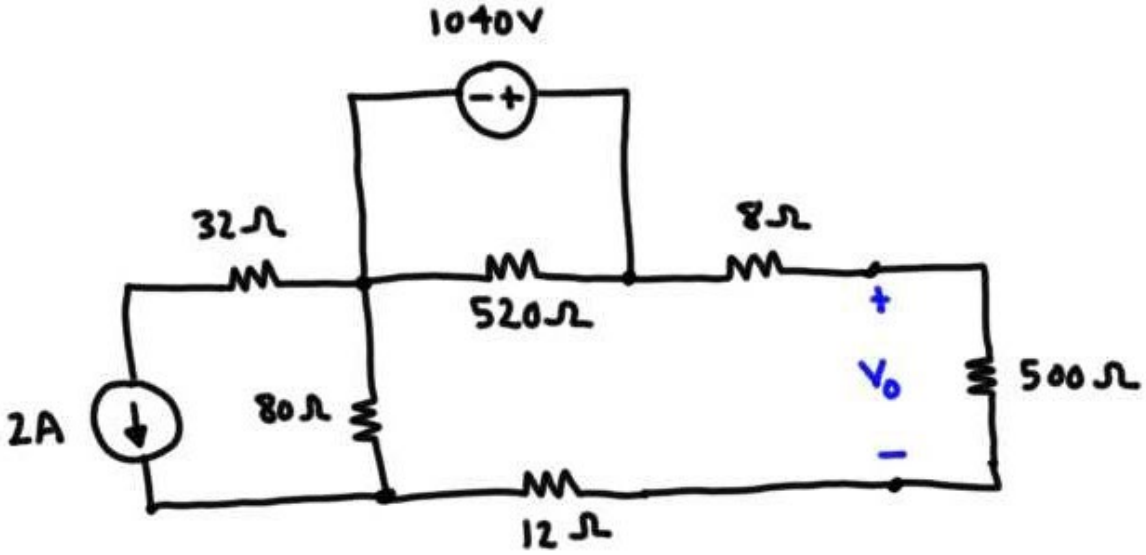
1) Given the circuit shown below, use source transformations to calculate the current i_0 flowing in the 300Ω resistor.



2) Verify your solution by using the node-voltage method to find i_0.

Problem #2:

1) Use a series of source transformations to find the voltage v_0 in the circuit shown below.



2) Find the power developed by the $1040V$ source.
3) Find the power developed by the $2A$ source.
4) Verify that the total power developed is equal to the total power dissipated.