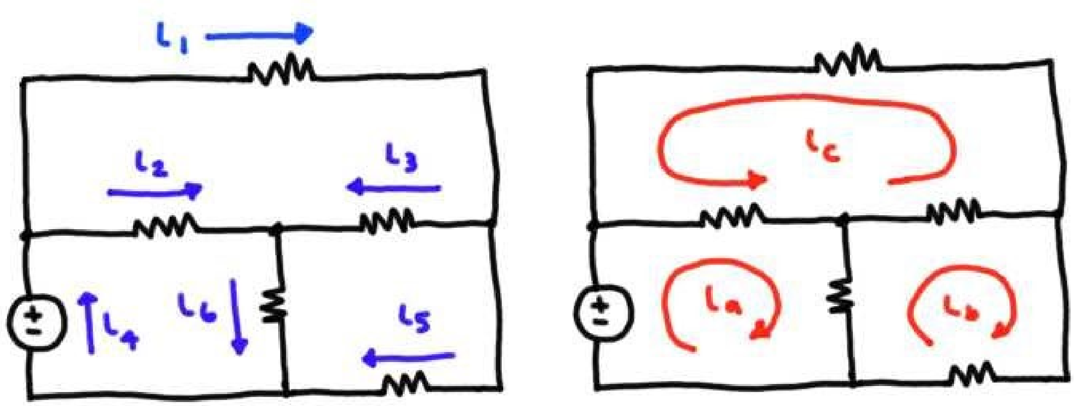
The Mesh-Current Method: This is the second of the generalized circuit analysis methods that are useful at this level. Unlike the node-voltage method, which was presented earlier, which can be applied to any circuit, the mesh-current method has a restriction. Just like the node-voltage method, we begin our discussion of the mesh-current method with the introduction of some definitions.

Definitions:

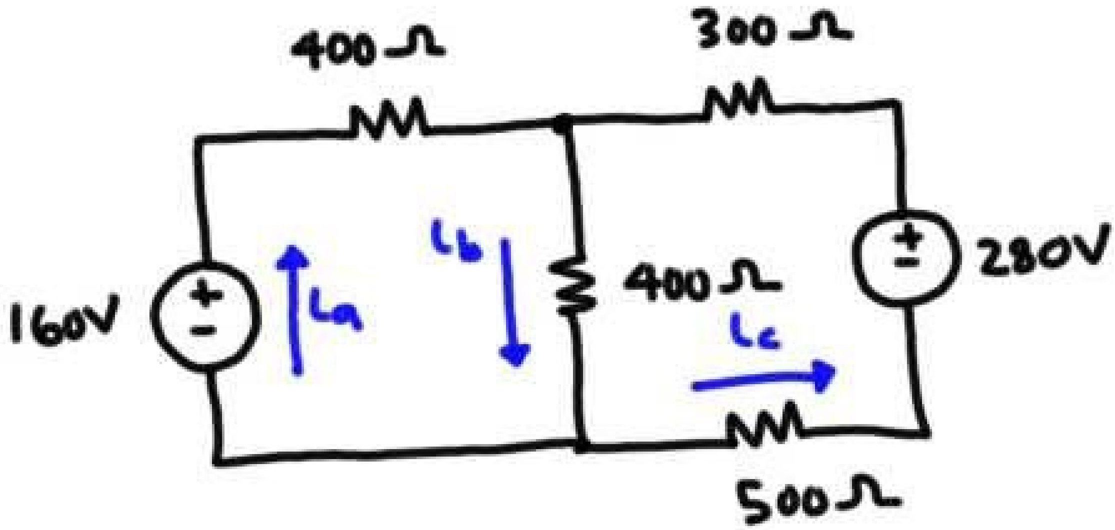
1) The mesh-current method can only be used to analyze planar circuits. What is a planar circuit? Can you think of an example of a circuit that is not planar? (You might have to think in three dimensions. Imagine a circuit in which all of the edges of a cube have resistors. Is such a circuit planar? Why or why not?)
2) What is the difference between a mesh and a loop?
3) How is the mesh-current defined? How does this compare to the branch currents that you have seen so far? If you don't remember the definition of a branch current, look it up and define it.

Mesh-currents versus Branch Currents: In the two figures shown below, the figure on the left shows the branch currents, $i_1 - i_6$, while the figure on the right shows the mesh-currents, $i_a - i_c$. Determine the branch currents in terms of the mesh-currents. Note that the resistors and voltage source will have no effect on these calculations, so they have not been given variable names.



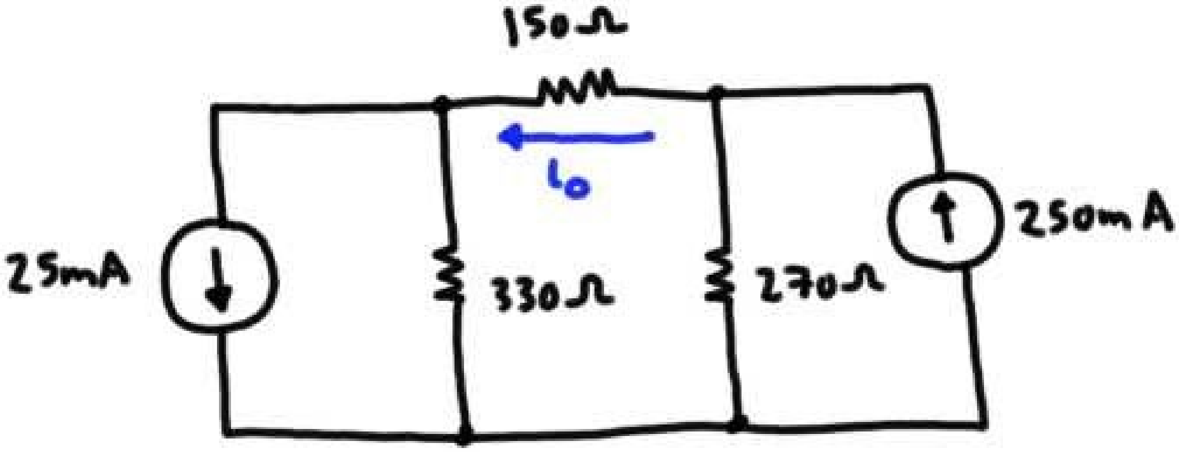
Voltage Sources and the Mesh-Current Method: Using the mesh-current method answer the following questions.

For the circuit shown below, (a) find the branches currents i_a, i_b, i_c. (b) Repeat the same calculation if the polarity of the 280 V source is reversed.



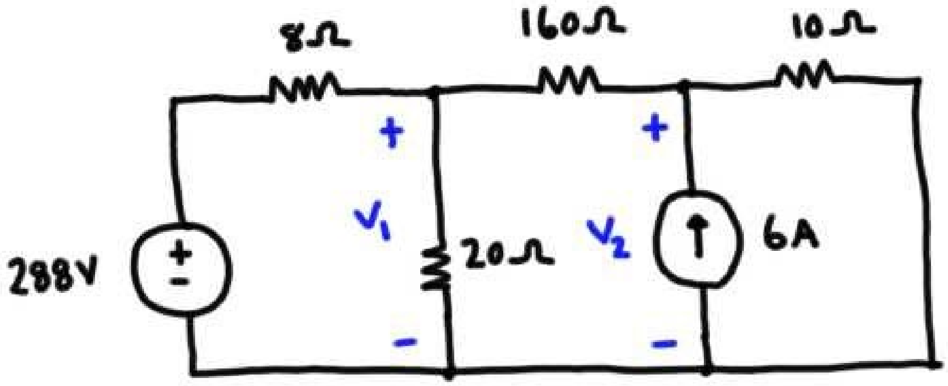
Current Sources and the Mesh-Current Method: Using the mesh-current method answer the following questions.

For the circuit shown below, (a) find the current i_0, (b) find the total power developed in the circuit.



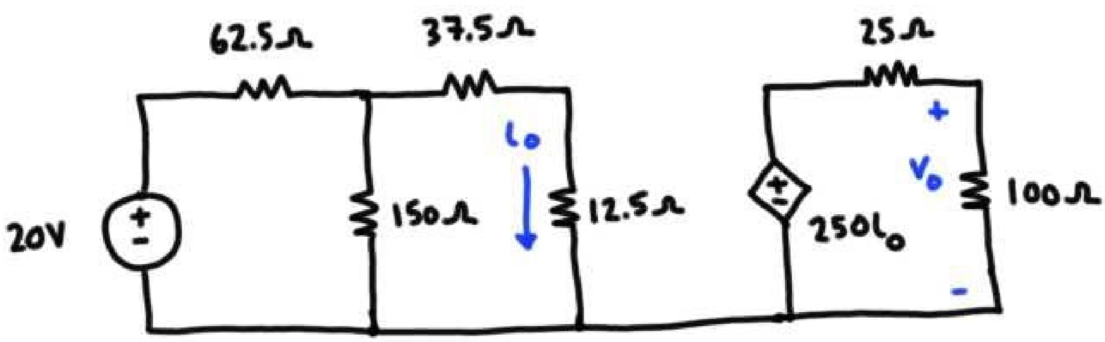
Circuit with Both Voltage and Current Sources: Using the mesh-current method answer the following questions.

For the circuit shown below, (a) find the voltages, v_1 and v_2, (b) verify the power check. *Note:* this problem is trickier than it seems when using the mesh-current method, so be a bit careful. *Hint:* Remember that only voltages go into KVL.



Dependent Sources and the Mesh-Current Method: Using the mesh-current method answer the following questions.

Given the circuit shown below, (a) find the voltage v_0 and the current i_0, (b) the power associated with the dependent source and whether the source is delivering or absorbing power.



Changing the Direction of the Mesh-Currents: Using the mesh-current method answer the following questions.

In the below circuit, (a) find the power dissipated by the 15 Ω resistor, (b) reverse the direction of your defined mesh-currents and calculate the power dissipated again. How does the power calculated in part (a) compare to the power in part (b)?