A Method for Applying Kirchoff's Laws

1. (optional) Combine any resistors that are either in series or in parallel to simplify the circuit as much as possible and redraw the simplified circuit.

2. In each branch of the circuit choose a direction for the flow of current in the branch and label that direction on the circuit.

3. Identify all of the junctions (places were current splits) in the circuit. Apply the junction rule in the circuit one fewer times than your circuit has junctions.

4. Label the high and low potential sides of each circuit element given your choice for the direction of current flow.
   (a) The longer terminal of the battery is the high potential side the shorter terminal is the low potential side.
   (b) For a resistor, remember that conventional current (positive charge) always flows from high potential to low potential.

5. Apply the loop rule to one fewer loops than the total number of loops in your circuit. To do this:
   (a) Choose a direction to go around each loop you have picked and label this direction on your circuit.
   (b) As you encounter a battery, list its potential and as you encounter a resistor, list its IR drop using the second sign you come to on the particular circuit element.

6. Solve the resulting system of equations for the current in each branch of the circuit using algebra.

Notes:

- Note that you are not required to choose the *correct* direction for the flow of current in step 2. This method works regardless of the choice of the direction of the flow of current. If you choose a direction incorrectly, you will simply get a negative sign on the current when you solve the resulting system of equations. The negative sign simply tells you that the current flows in the opposite way you have chosen.

- There are two direction used in this method: the direction of current flow and the direction you go around each loop. Do not confuse these directions. Make sure you go the same direction around the entire loop.

- If you solve for a current and get a negative value, that negative sign simply tells you that the current flows the other direction in your circuit. Do **not**, however, drop the minus sign until you have solved for all other currents in your circuit. The equations you have developed are based on your choice of direction for a given current. Carry the negative sign until you have solved for <u>all</u> currents in your circuit. Only after you have solved for all of the currents flowing in your circuit should you drop any minus signs.