Hello!!!

- Please check your answers to the homework problems from last night.
- I will do one of them if you would like.

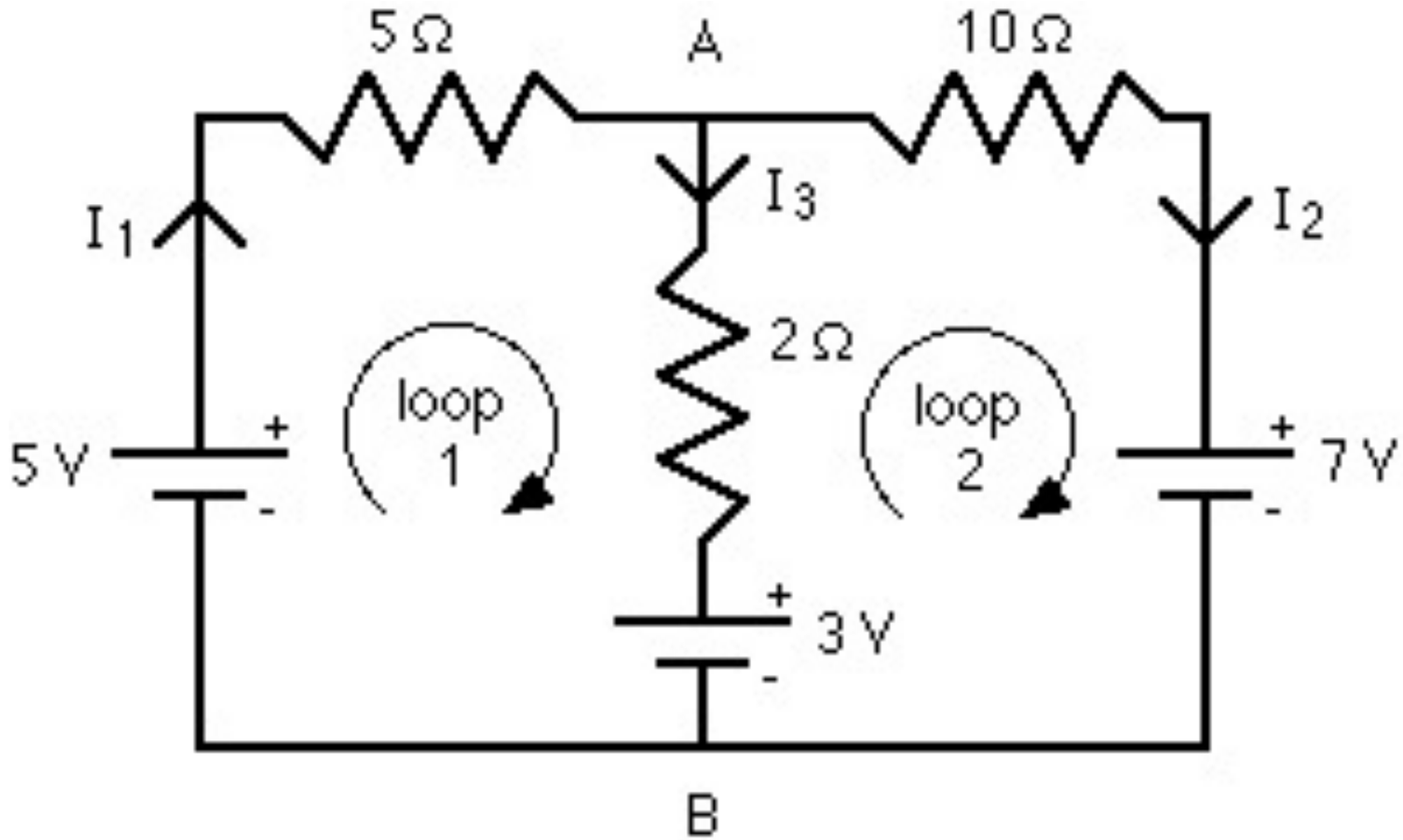
Requested Homework

Today

- Kirchhoff's Laws
- Work on research project.

The Coming Days

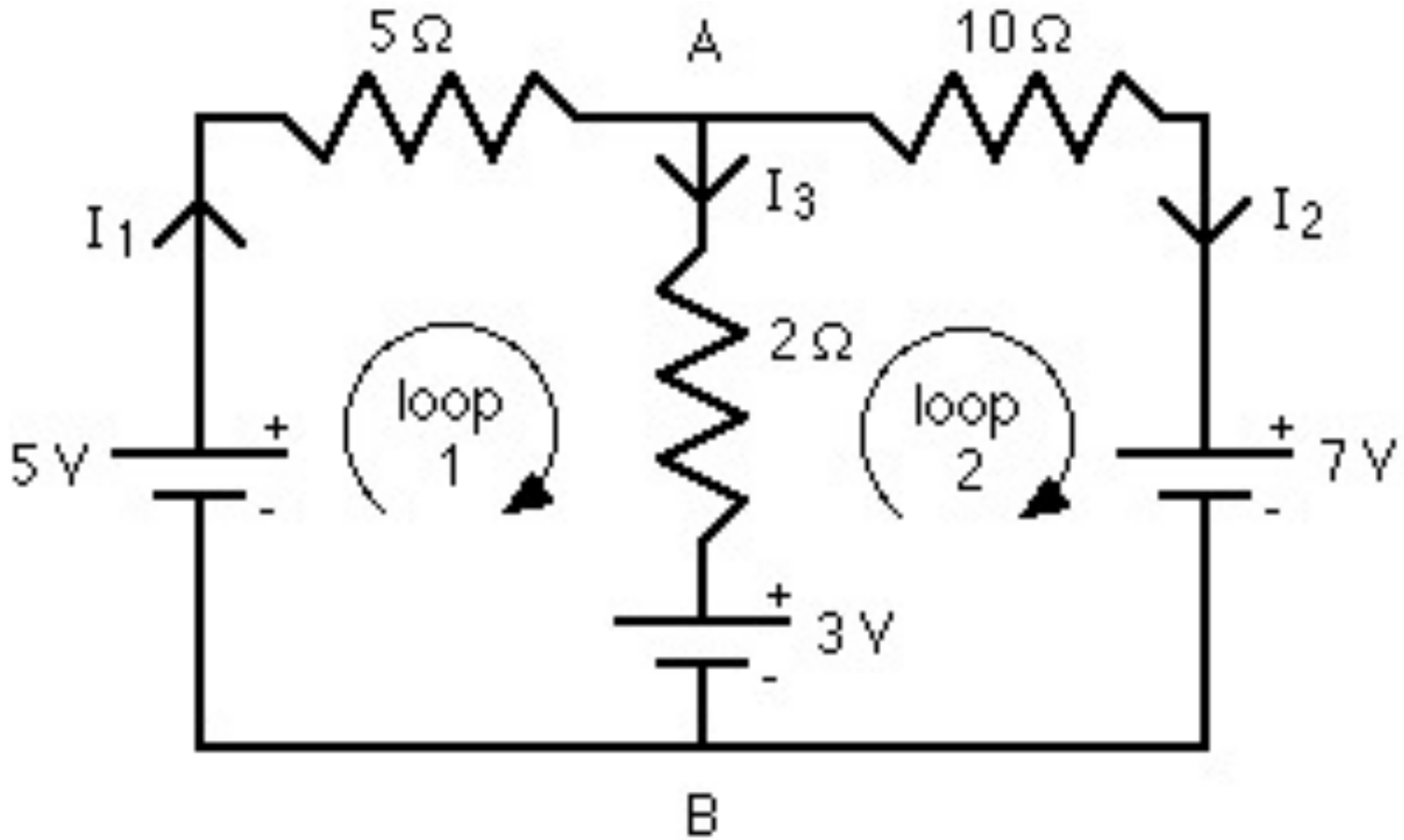
- W: Begin Kirchhoff's Laws
- R: Finish Kirchhoff's Laws
- F: Research Project
- M: Review for Electricity Quiz
- T: Electricity Quiz



Kirchhoff's Laws

Junctions

- In a circuit, anywhere that more than two wires meet is a junction.
- Label the junction with capital letters.



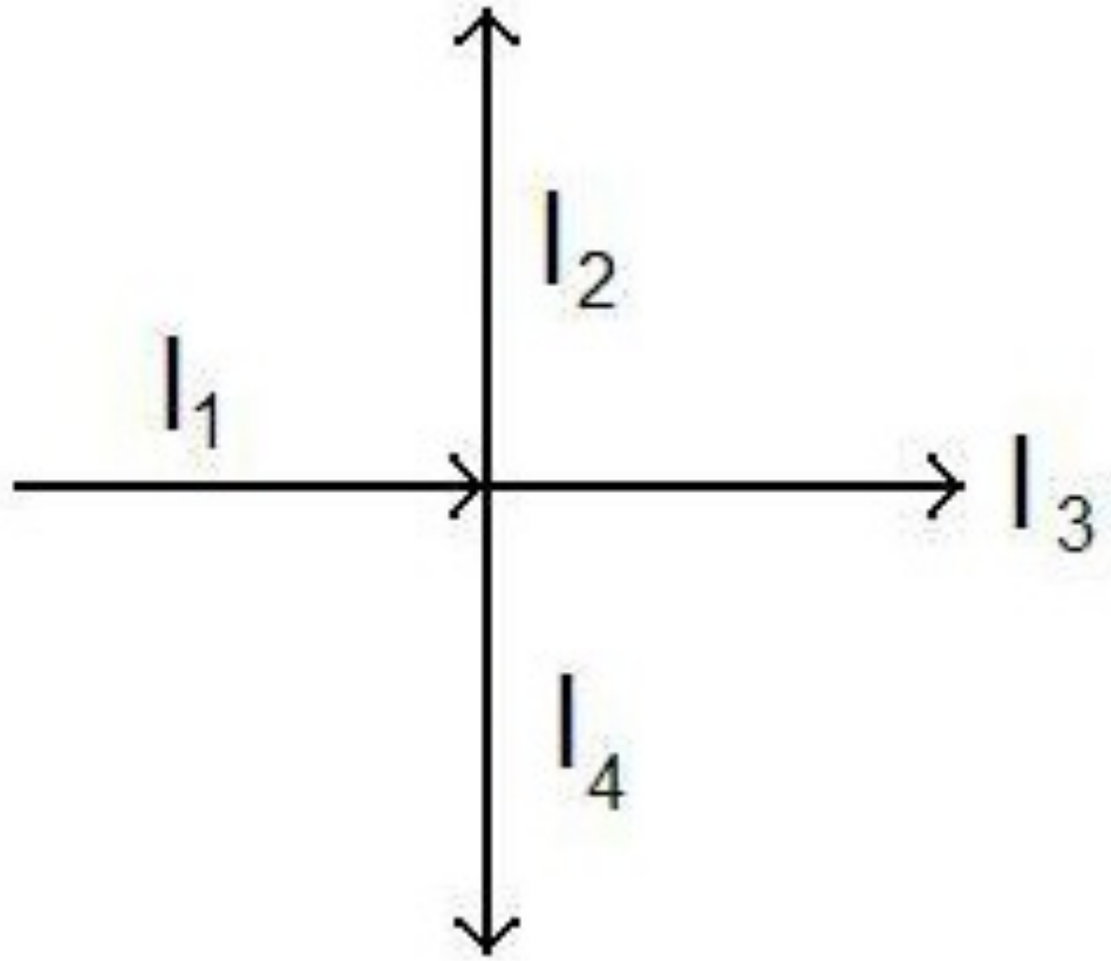
Junctions

Junction Rule

- The sum of the currents at a junction is equal to 0 amps.
- A current is greater than 0 amps if it enters a junction.
- A current is less than 0 amps if it exits a junction.
- The sum of the currents is zero amps.
- Conservation of charge!

Can we have negative current?

- A junction is neither a source nor a sink of current.
- The current entering a junction has to be equal to the current going out of the junction.
- There cannot be any build up of charge (current) at a junction.



$$I_1 = I_2 + I_3 + I_4$$

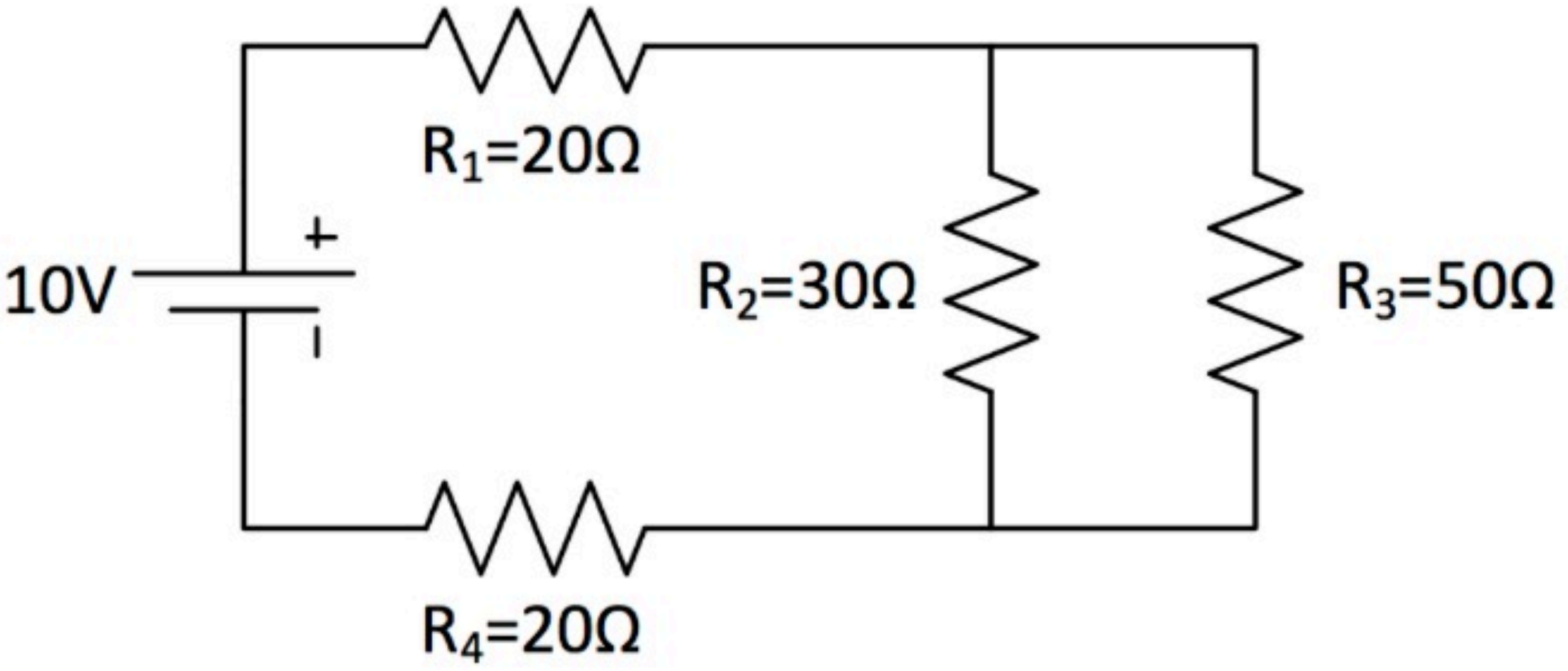
Example

Rewrite

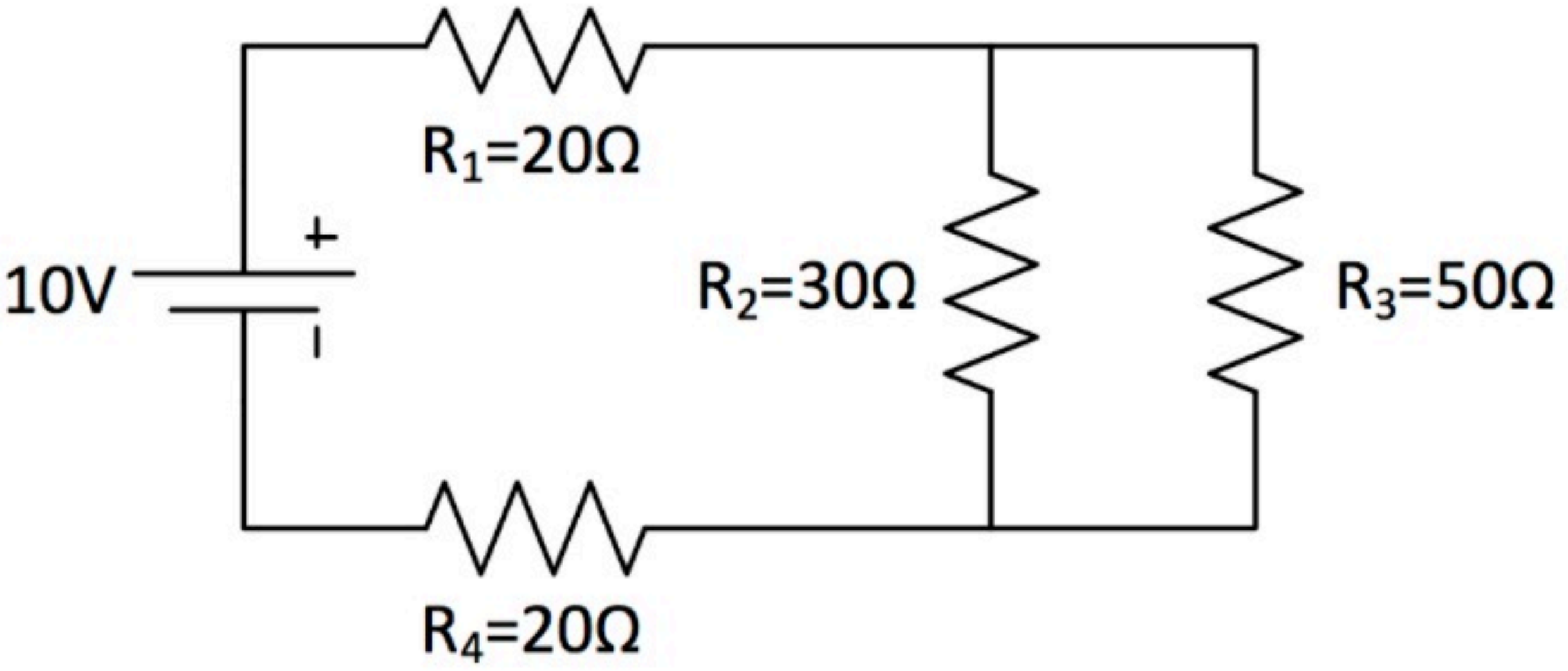
- Set all total currents to 0.
- The example: I1=I2+I3+I4
- Rewrite:I1-I2-I3-I4=0

Loop Rule

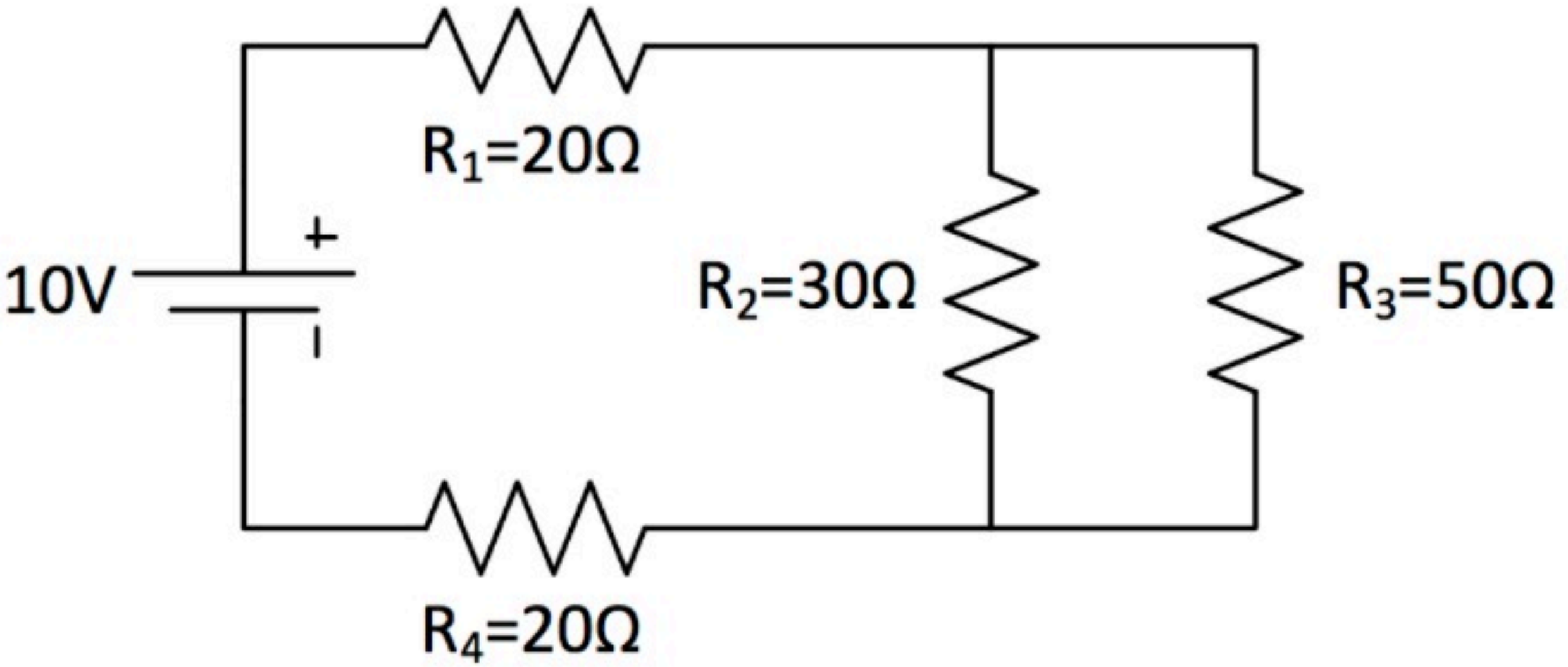
- Sum of the potential (voltage) in any loop is always zero.
- Potential increases across a battery from neg to positive. Decreases in the other direction.
- Potential decreases across a resister. Increases against the current.
- Conservation of energy!



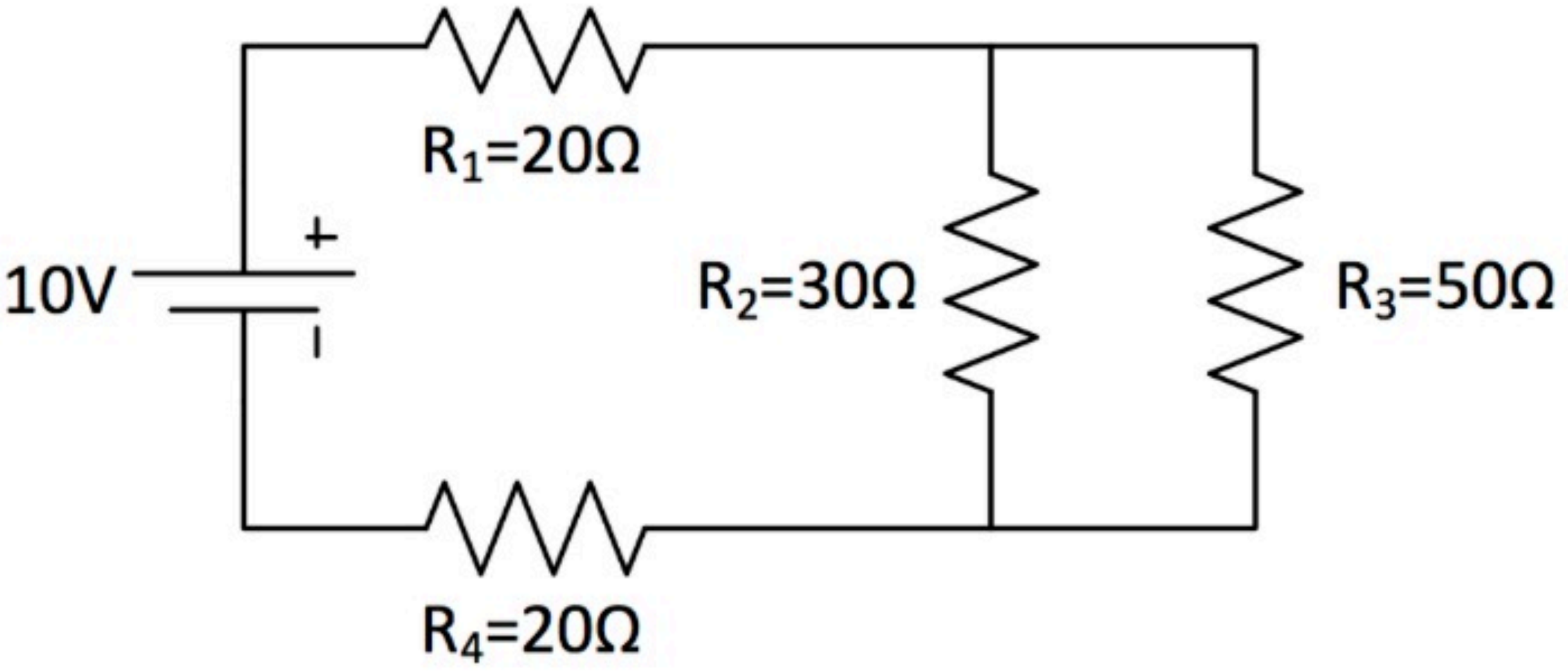
Find V and I on each resister



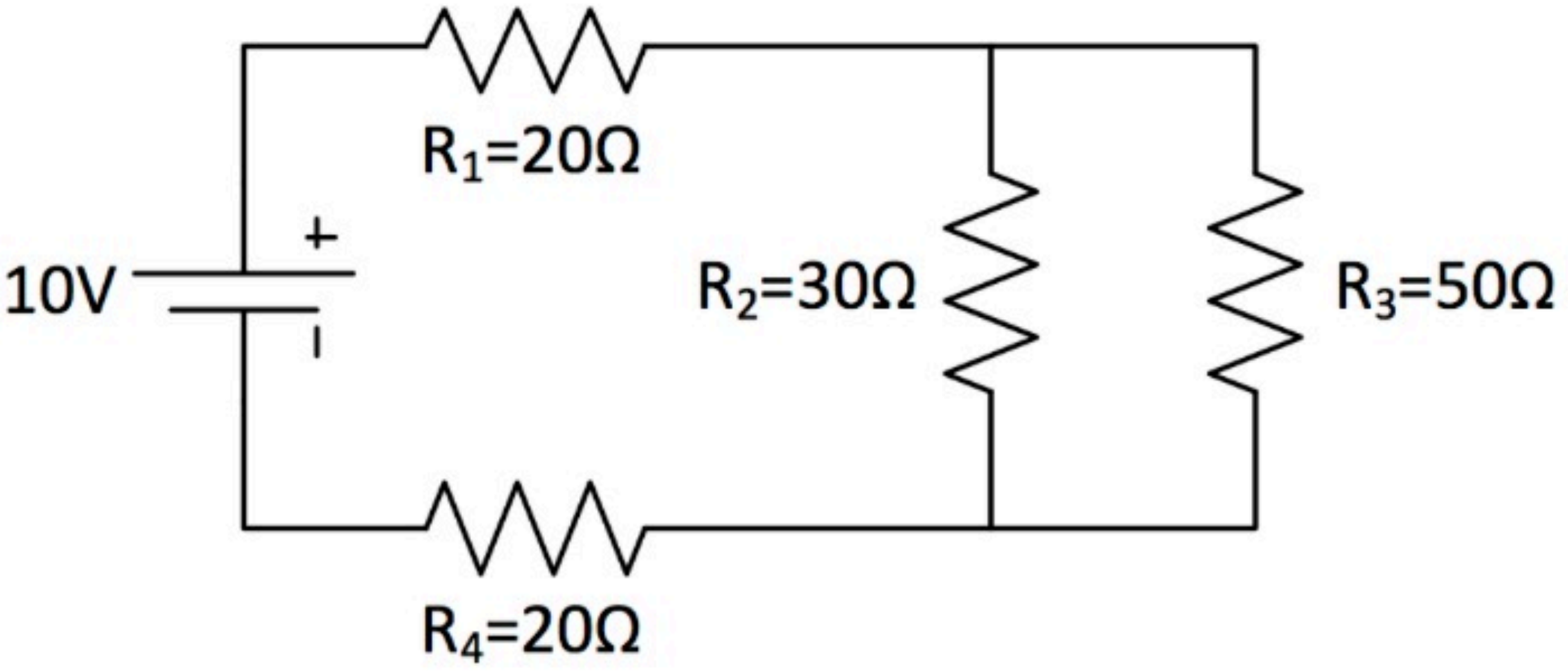
Define the Loops



Loop I



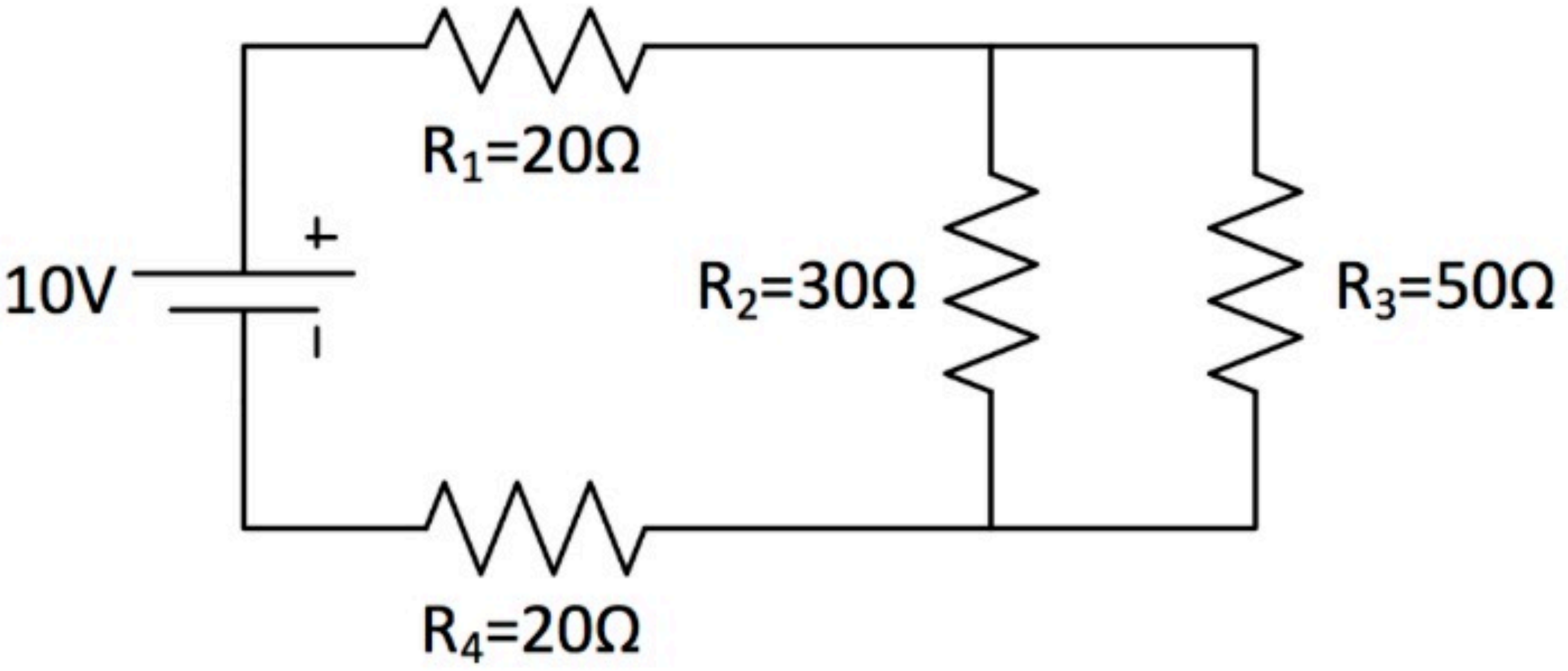
Loop 2



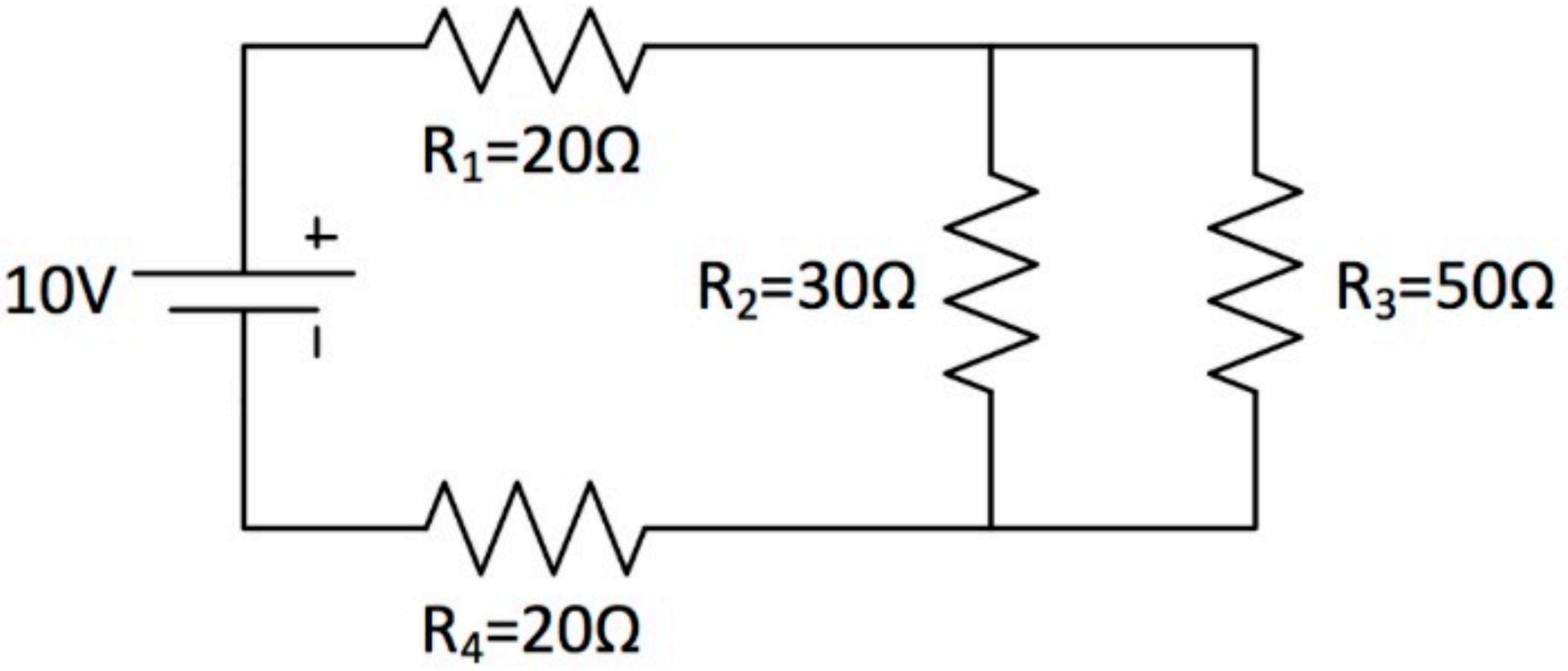
Loop 3

Current Rule

- The sum of the currents at any junction is zero.
- Each brach within a circuit has its own current.
- Write an equation for the currents at each junction.



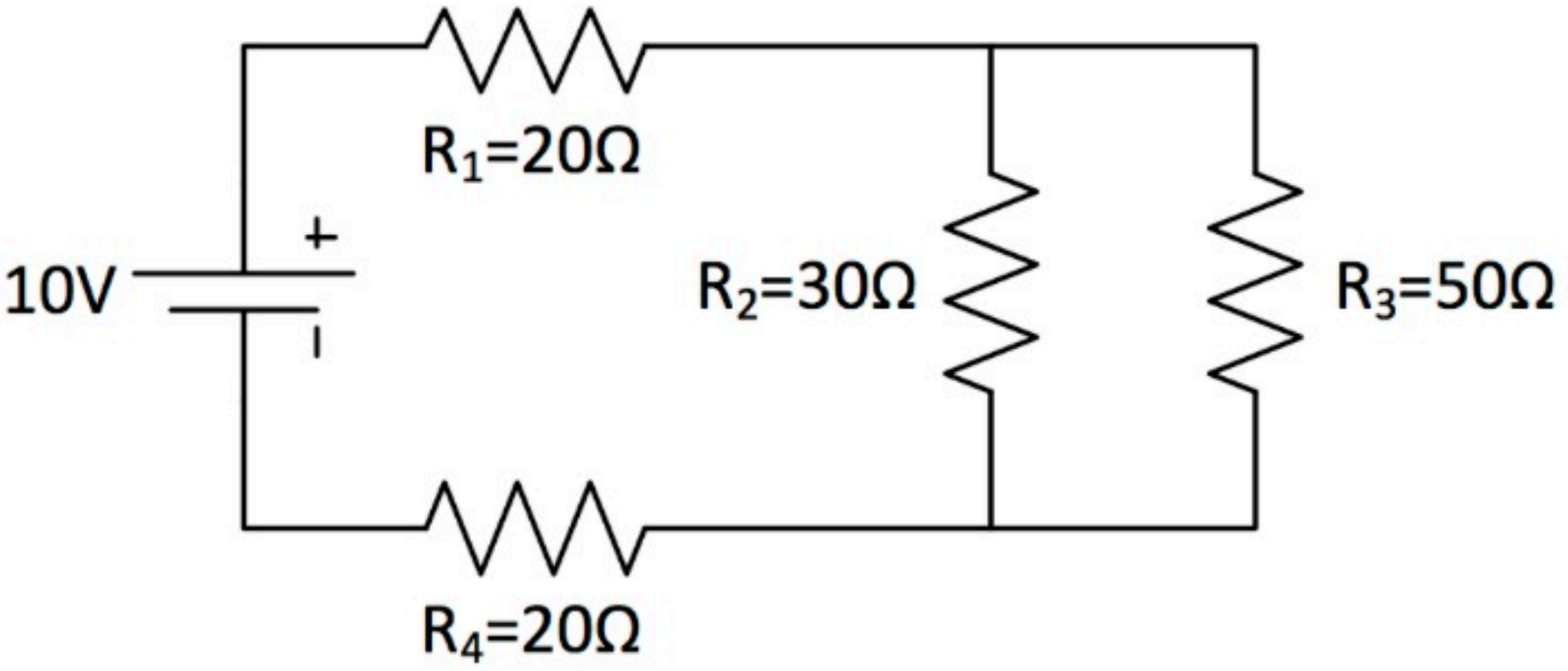
Identify the branches and junctions



Identify the currents (1, 2 & 3)

Sum the Voltage

- Go through each loop and write an equation that sums the voltage.
  - Batteries: negative to positive is positive voltage. Pos to neg is negative voltage.
  - Resisters: IR=V. Going with the current is a voltage drop. Going against the current is a voltage increase.



Loop Equations

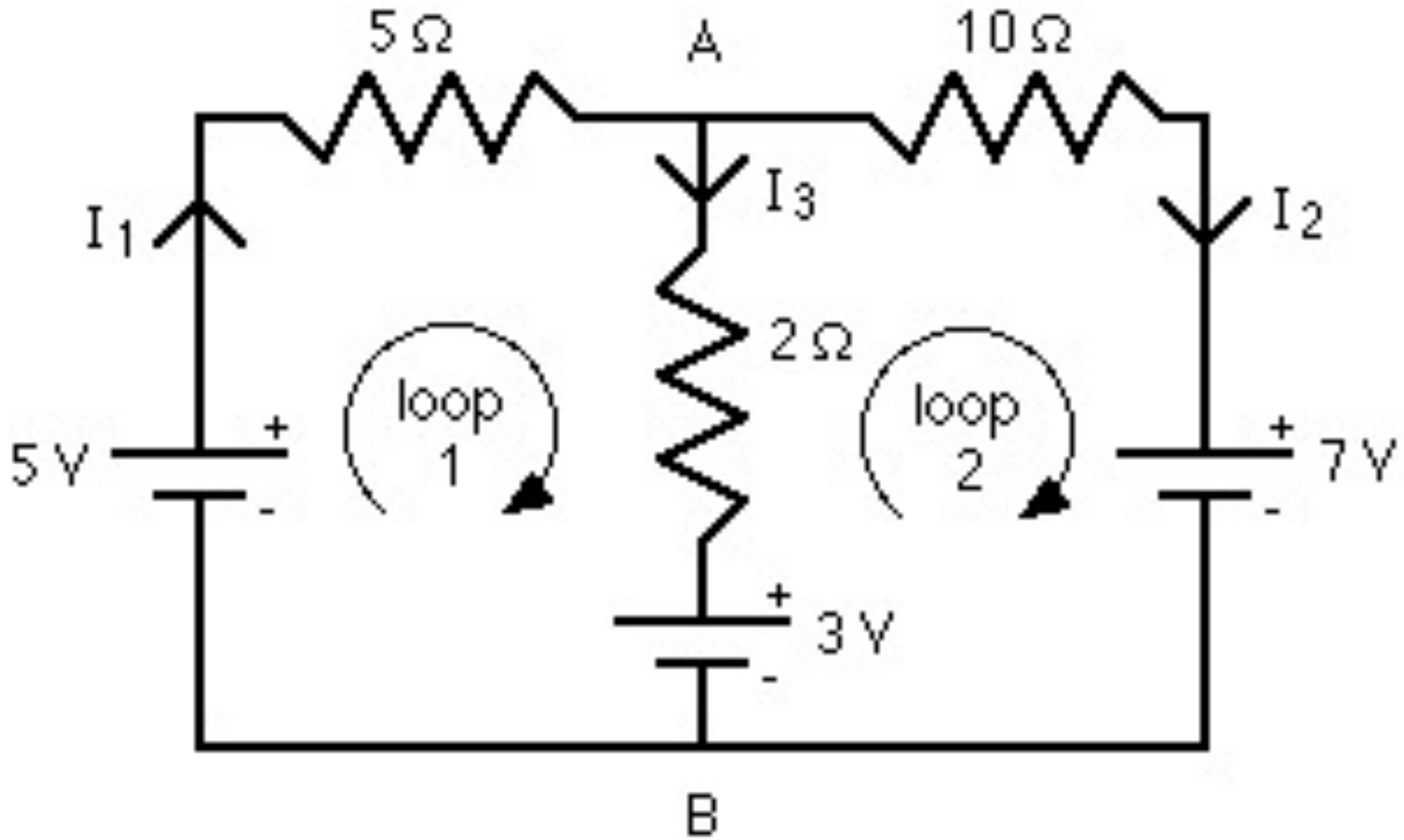
Mathemagician

- You will have to isolate the currents in each loop equation.
- Then substitute them into the current equation to yield one current.
- Solve for the unknown variable.

Algebra

Final Step

- You have now solved for one of the currents.
- Plug this information into one of the loop equations and solve for another current.
- Do this until all of the currents are found.
- **Note:** If you find a current to be negative, it's flow is in the other direction.



Multiple Batteries

Process

- Define and label the junctions.
- Define and give direction to the currents.
- Write the current equations for each junction.
- Write the voltage equation for each loop.
- Isolate the currents and plug into the junction equations.