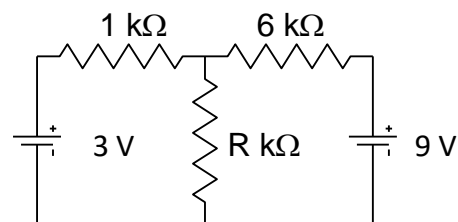


## Homework 2 Kirchhoff's Laws

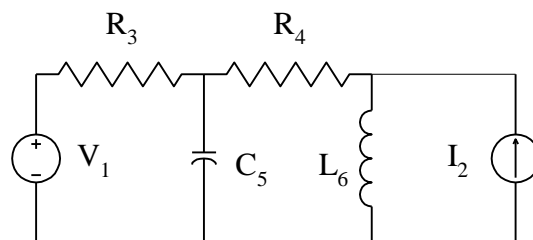
### HW06:

John “explains” to Jasmine, after the battery in his calculator died, that a 9 Volt battery can be used to charge a 3Volt battery simply by connecting their negative terminals together and connecting a large resistor between their positive terminals. Jasmine said that her friend Sven said that you need more than one resistor, like in the circuit shown on the right. Who is correct, John or Sven? Why? If Sven is right, what value should he use for  $R$ ? Explain.



### HW07:

Consider the circuit shown to the right. How many trivial / non-trivial meshes / nodes are there (4 different answers)? Write the complete set of first-order differential equations, including any trivial nodes or branches.



### HW08:

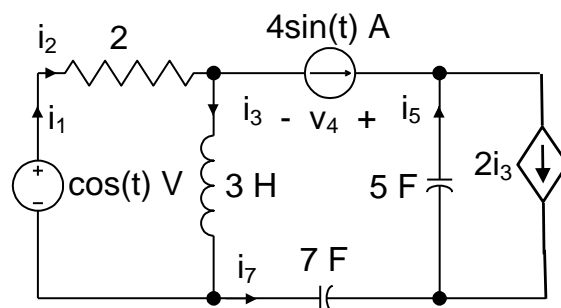
Design” a circuit with only one 9 V battery and resistors that has three nodes and two meshes, and that dissipates 9 Watts of power in the battery.

- Draw a picture of your circuit and explain your reasoning behind your design - How did you get to the final circuit?
- Label all nodes, meshes, branches, and reference directions, and write the complete set of algebraic equations that are needed to prove that your circuit fulfills the requirements of the problem.

### HW09:

Consider the circuit shown to the right.

- How many trivial nodes are there? \_\_\_\_\_
- How many non-trivial nodes are there? \_\_\_\_\_
- How many trivial meshes are there? \_\_\_\_\_
- How many non-trivial meshes are there? \_\_\_\_\_
- Find the *complete system* of first-order differential equations (include Kirchhoff's laws for trivial nodes and meshes). Clearly indicate the KCL equations, KVL equations, and terminal relationships used in the process. Let  $v_7$  be the voltage that is paired with  $i_7$ , etc.



HW10:

Solve for the output voltage in the op-amp circuit to the right.

