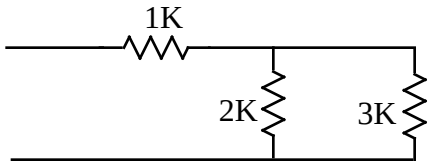
ECE 109 - EQUIVALENT CIRCUITS - INVESTIGATION 18
THEVENIN'S THEOREM - PART I

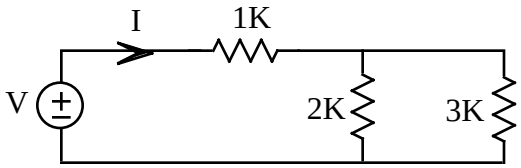
FALL 2006 **A.P. FELZER**

To do "well" on this investigation you must not only get the right answers but must also do neat, complete and concise writeups that make obvious what each problem is, how you're solving the problem and what your answer is. You also need to include drawings of all circuits as well as appropriate graphs and tables.

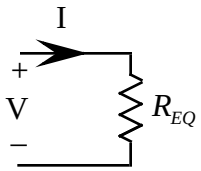
We know from the previous Investigation that if we take a resistor circuit like the following



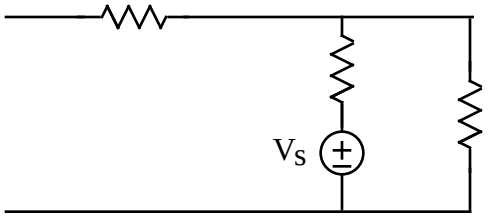
and connect up a voltage (or current) source as follows



then V will be proportional to I with $V = R_{EQ} I$ with R_{EQ} equal to the value of the resistance of the equivalent circuit as follows

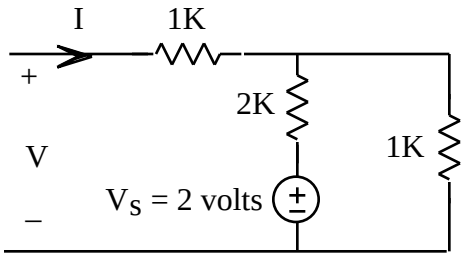


The objective of this Investigation is to find how V is related to I when our circuits contain not only resistors but also sources like the following



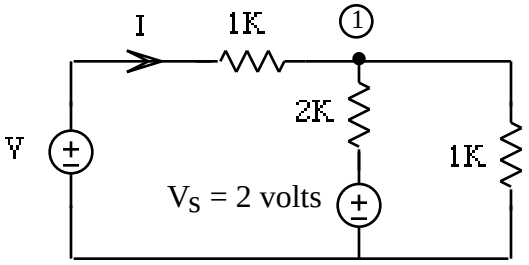
The objective of the next three Investigations is to then make use of these results to find corresponding equivalent circuits. Be sure to take a look at the **Computer Demos** on Thevenin's Equivalent.

1. Let us begin with the following circuit



containing the voltage source $V_s = 2$ volts

a. Find V as a function of I for this circuit just as you did for purely resistor circuits in the last Investigation. In particular, connect a voltage source V as follows

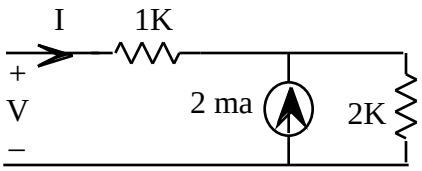


and then do the corresponding node analysis to find V_1 in terms of V

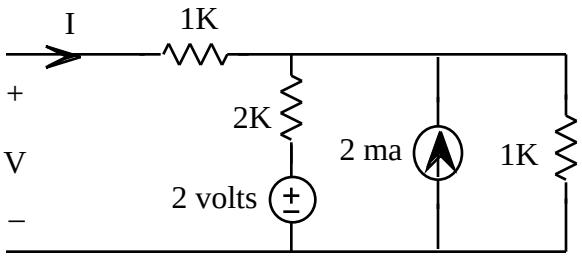
b. Then plot V as a function of I. Describe your graph.

2. Repeat Problem (1) for the same circuit but now with $V_s = -2$ volts

3. Again repeat Problem (1) - this time for the circuit

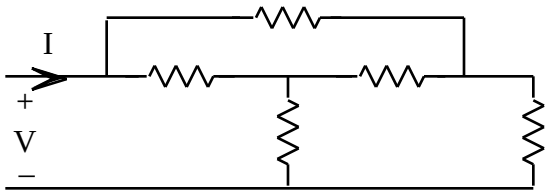


4. Now suppose we have a circuit with more than one source like the following

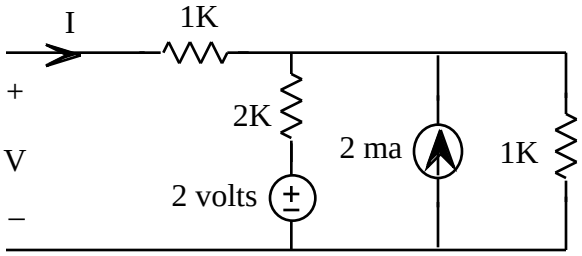


a. Sketch what you expect V to look like as a function of I
b. Make use of node equations to find V as a function of I
c. Use your result from part (b) to draw a graph of V as a function of I. Does your graph agree with your conjecture in part (a). If not, explain what in fact is going on

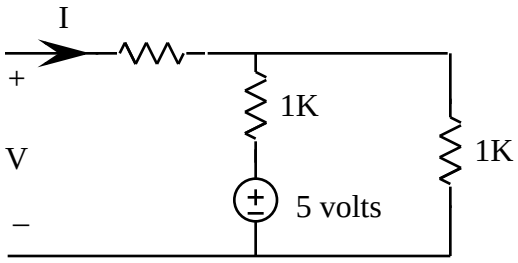
5. Describe the similarities and differences between graphs of V as a function of I for purely resistor circuits like this



and those containing sources like the following



6. Find I and the open circuit voltage V in the following circuit



7. Math Review: Sketch the integral of the following signal