

ECE 207 - REVIEW OF RESISTOR CIRCUITS - INV 2

BASIC METHODS OF ANALYSIS

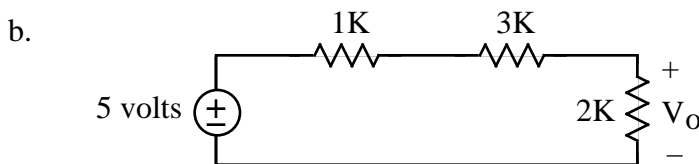
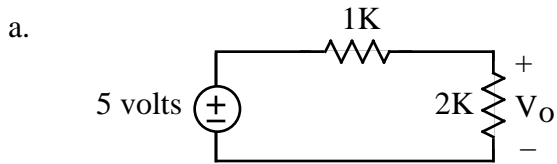
FALL 2000

A.P. FELZER

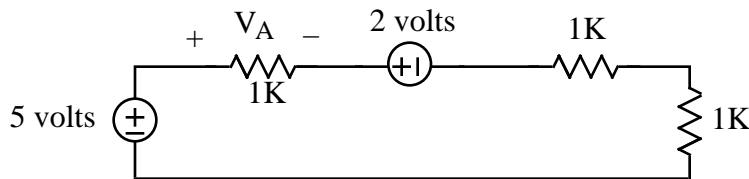
To do "well" on this investigation you must not only get the right answers but must also do neat, complete and concise writeups that make obvious what each problem is, how you're solving the problem and what your answer is. You also need to include drawings of all circuits as well as appropriate graphs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

The main objective of this investigation is to review node analysis. But we begin with a quick review of voltage division.

1. Make use of voltage division to find V_O in each of the following circuits



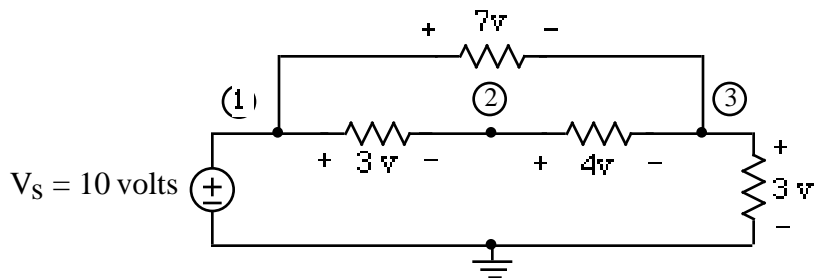
2. Find V_A in the following circuit



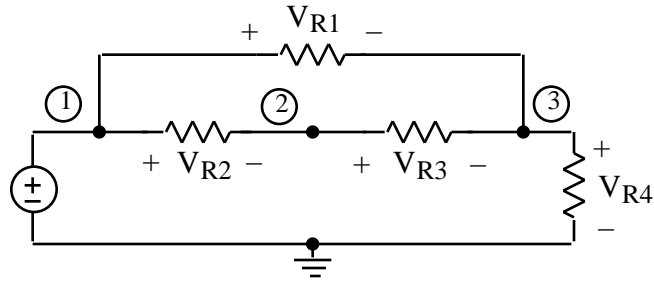
3. The objective of this problem is to review node voltages

- a. Explain in your own words what node voltages are
- b. Draw a picture that illustrates how to connect a voltmeter in a circuit to measure node voltages. Be sure to indicate the colors of the leads

4. Find the node voltages in the following circuit. Put your results in a Table.

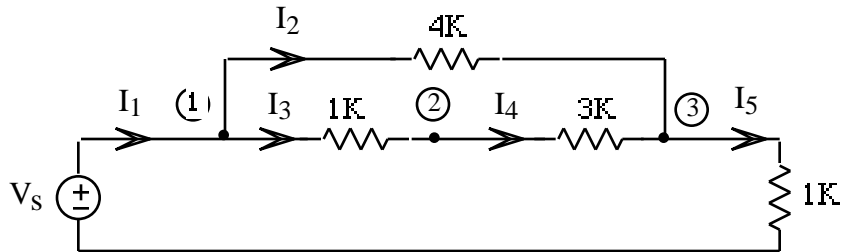


5. Find the voltage drops across the resistors in the following circuit



with node voltages $V_1 = 5$ volts, $V_2 = 4$ volts and $V_3 = 2$ volts. Put your results in a Table.

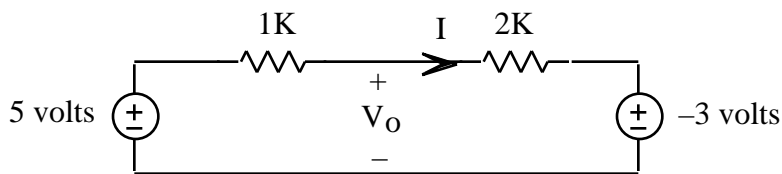
6. Find the currents in the following circuit



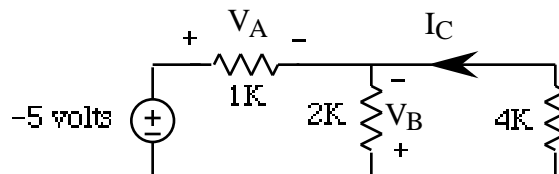
with node voltages $V_1 = 6$ volts, $V_2 = 5$ volts and $V_3 = 2$ volts. Put your results in a Table.

7. The objective of this problem is to review the following algorithm for writing node equations of resistor circuits when all the voltage sources are connected to a common reference:
- (1) Choose a reference node
 - (2) Write the KCL equations at each of the nodes (except those with voltage sources) with the resistor currents expressed in terms of the node voltages. **Be sure to label** each equation with its node number.
 - (3) Solve for the unknown node voltages either by hand, calculator or computer
 - (4) Then make use of the node voltages to calculate all the desired circuit element voltages and currents

Make use of this algorithm to find V_O and I in the following circuit

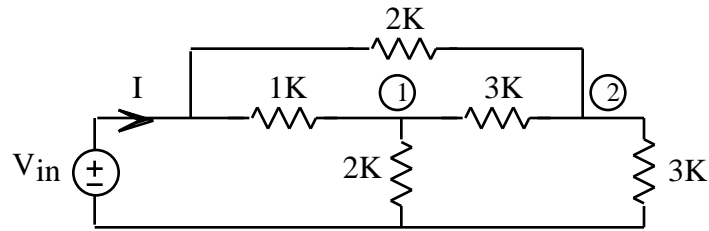


8. Find V_A , V_B and I_C in the following circuit



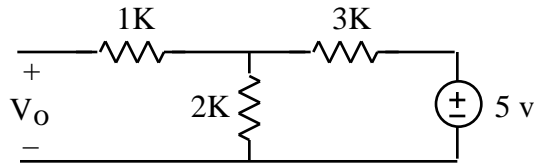
Hint - Find the node voltage first and then everything else

9. Make use of node equations to find the node voltages in the following circuit



in terms of V_{in} . And then make use of your results to find I in terms of V_{in}

10. Find the **open circuit voltage** V_O in the following circuit



11. The objective of this and the following problems is to review some basic math. Is the voltage $v(t)$ satisfying the differential equation $v' + 3v = 5$ increasing or decreasing at $t = 1$ if $v(1) = 2$. How can you tell.
12. Sketch sinusoids $v(t)$ with
- $v(0) = 2$ and $v'(0) = 1$
 - $v(0) = 2$ and $v'(0) = 0$
 - $v(0) = 2$ and $v'(0) = -1$
13. Sketch each of the following voltages on separate graphs for time $t \geq 0$. Draw your curves so the differences are obvious. Note that $\exp(x) = e^x$
- $v_1(t) = \exp(-t)$
 - $v_2(t) = \exp(-3t)$
 - $v_3(t) = 2 \exp(-3t)$
 - $v_4(t) = 2 - \exp(-t)$