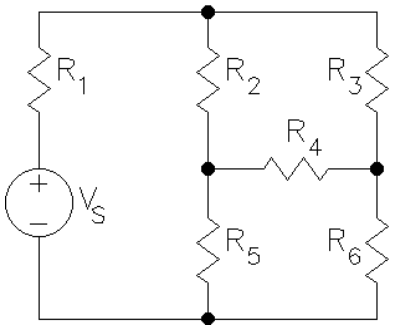
ECE 2210 / 00 homework # 6

Nodal Analysis

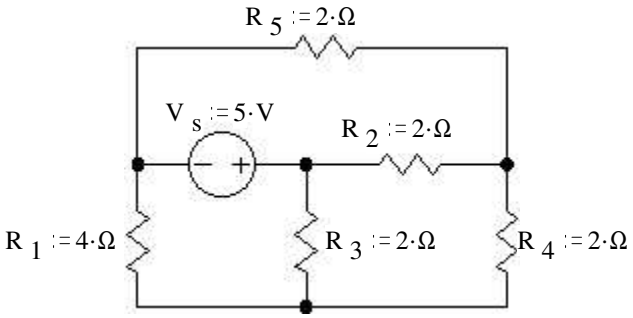
1. a) If you select the bottom node as ground, how many unknown node voltages remain? (Assume V_S is a known quantity.) How many simultaneous equations would you need to solve to analize this circuit?

   b) Use nodal analysis to find all the necessary simultaneous equations.

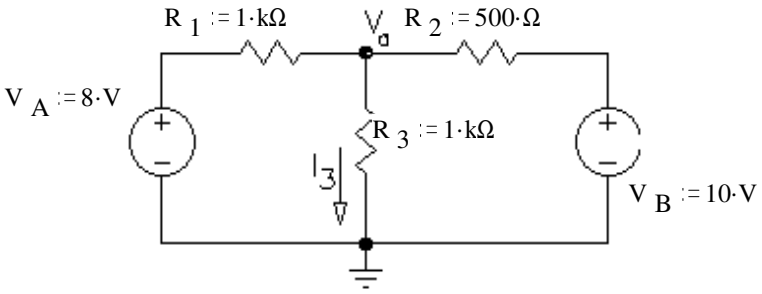


2. a) Use nodal analysis to find all the node voltages.

   b) Your node voltages will depend on your selection of a reference node (ground) as well as your arbitrary node labels, so the grader won't look at these specifically. Use your node voltages to find the potential (voltage) across each resistor. Report the magnitude and polarity of each.

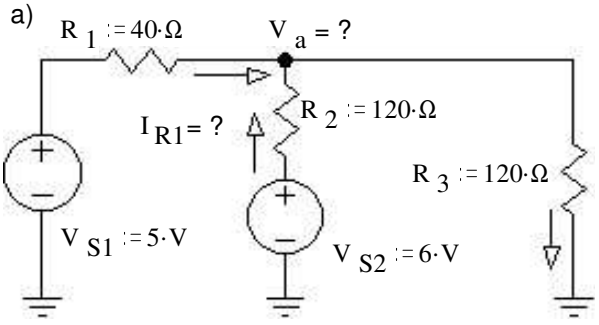


3. Use Nodal analysis to find V_a and use V_a to find I_3.

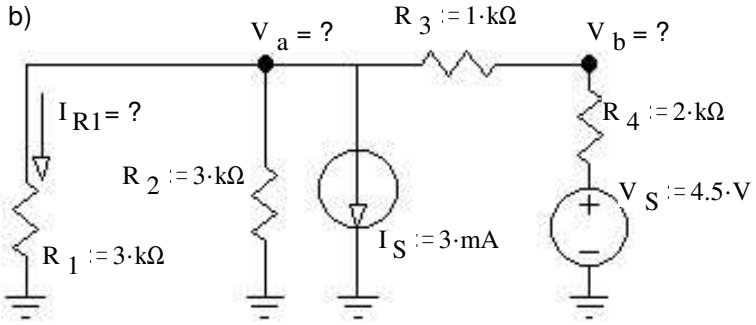


4. Use Nodal analysis to solve following problems: Each problem asks for at least 1 voltage and a current. Use the voltage(s) to find the current.

a)



b)



hint: you may be able to eliminate one unknown node for the initial calculation.

Answers

1. a) 3,3 b) $V_a\cdot\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right)-\frac{V_b}{R_2}-\frac{V_c}{R_3}=\frac{V_S}{R_1}$, $\frac{V_a}{R_2}-V_b\cdot\left(\frac{1}{R_2}+\frac{1}{R_5}+\frac{1}{R_4}\right)+\frac{V_c}{R_4}=0\cdot A$

   $\frac{V_a}{R_3}+\frac{V_b}{R_4}-V_c\cdot\left(\frac{1}{R_3}+\frac{1}{R_4}+\frac{1}{R_6}\right)=0\cdot A$

2. a) Answer will depend on your choice of ground, so check your answers to part b to see if you did part a right.
   b) 3.077·V , + bottom , 2.308·V , + left , 1.923·V , + top , 0.385·V , + bottom , 2.692·V , + right

3. 7·V , 7·mA 4. a) 4.2·V , 20·mA b) $V_a := -1.5\cdot V$ $V_b := 0.5\cdot V$ $I_{R1} := -0.5\cdot mA$

You may not get this homework back before the **1st exam.** Photocopy it if you want to be sure to have it.