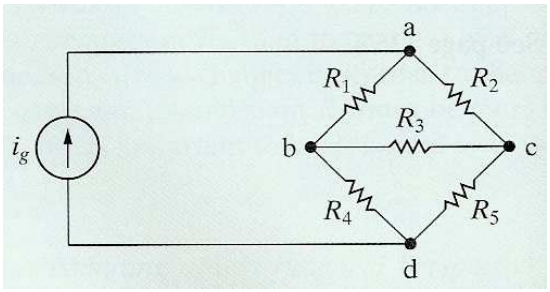
Department of Electrical & Computer Engineering

University of California, Santa Barbara

Homework #3

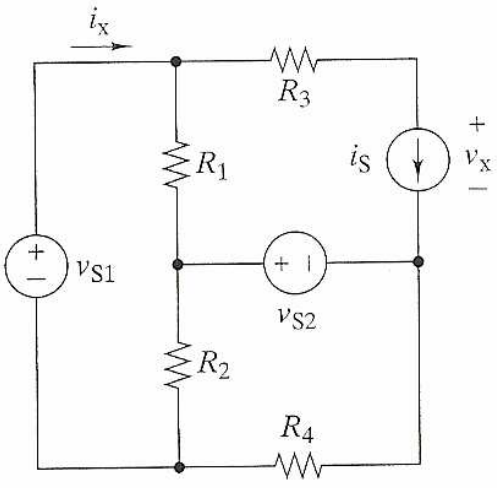
Due Date: May 2, 2008 (by 5 pm)

1. For the circuit below, assume that the current i_g is known. The resistors R_1- R_5 are also known.
   a) How many unknown currents are there?
   b) How many independent equations can be written using Kirchhoff's current law (KCL)?
   c) Write an independent set of KCL equations.
   d) How many independent equations can be derived from Kirchhoff's voltage law (KVL)?
   e) Write a set of independent KVL equations.

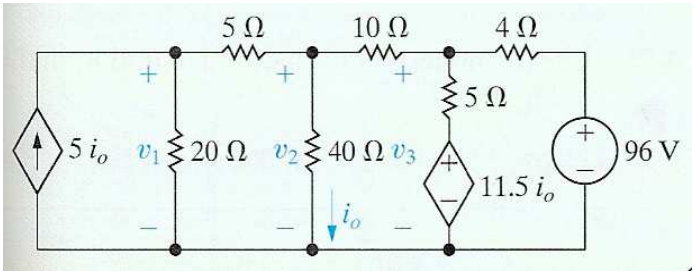


2. (a) Formulate mesh-current equation for the circuit in figure below.

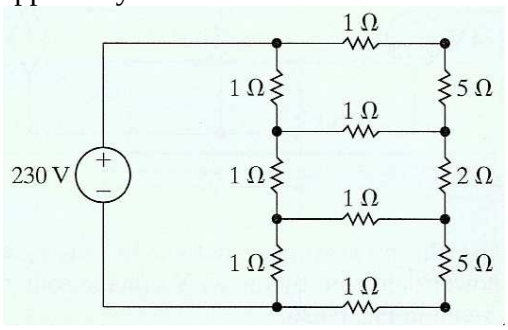
   (b) Solve for v_x and i_x when R_1=R_2=10KΩ R_3= 2KΩ R_4 = 1 KΩ i_s = 2.5 mA, v_{s1} = 12 V, and v_{s2} = 0.5 V
   (c) Find the power supplied by v_{s1}.



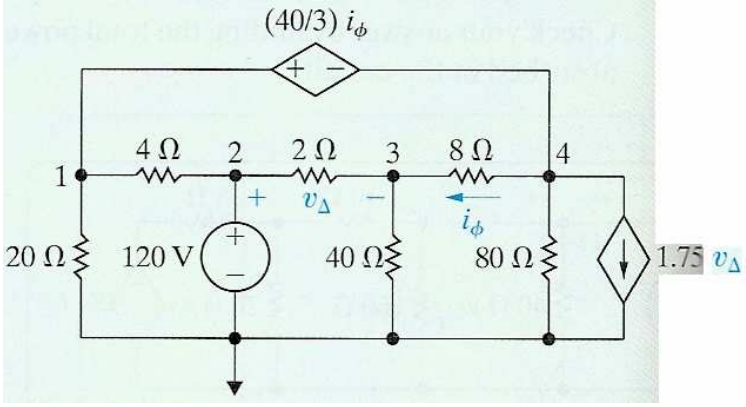
3. Find (a) the node voltages v_1 , v_2 and v_3 in the circuit below. (b) Total power dissipated in circuit.



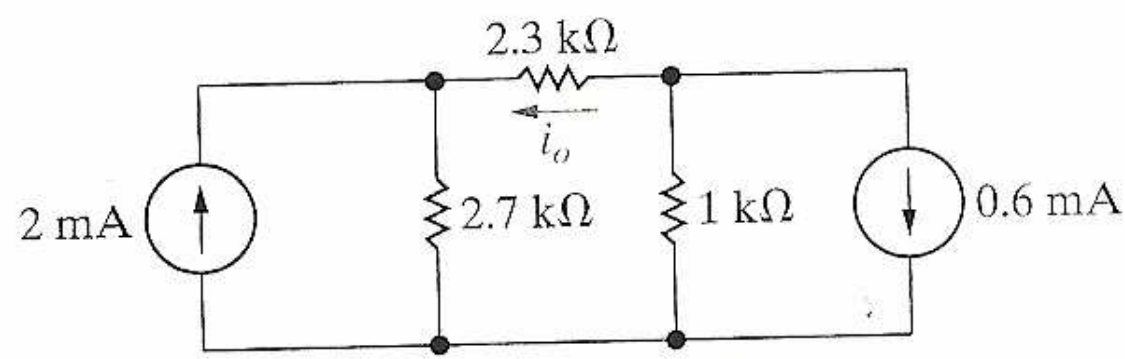
4. (a) Use the node-voltage method to find the power dissipated in the 2Ω resistor in the following circuit. (b) Find the power supplied by the 230V source.



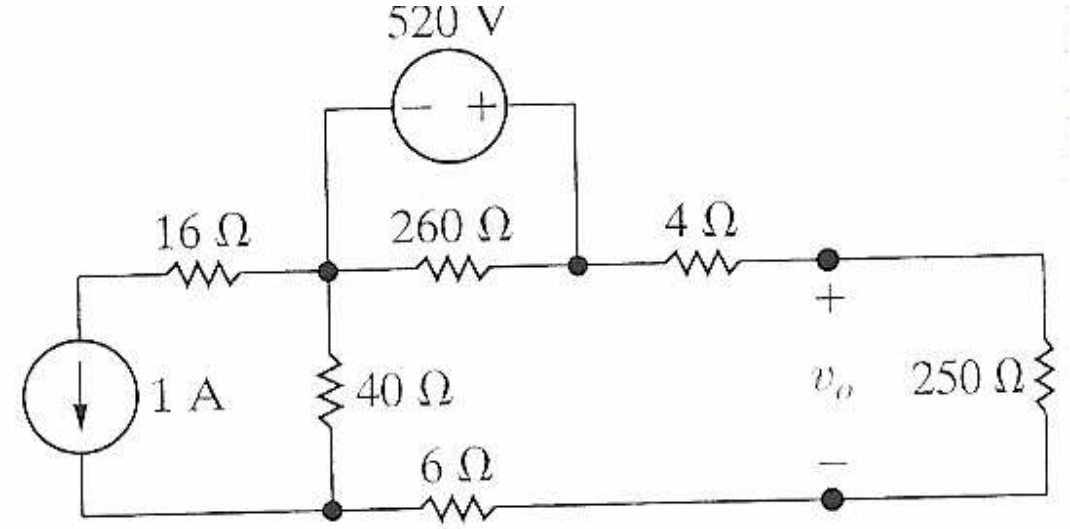
5. Assume you are a project engineer and one of your staff is assigned to analyze the circuit shown below. The reference node and node numbers given on the figure were assigned by the analyst. Her solution gives the values of v_3 and v_4 as 108V and 81.6V respectively.
Test these values by checking the total power developed in the circuit against the total power dissipated. Do you agree with the solution submitted by the analyst?



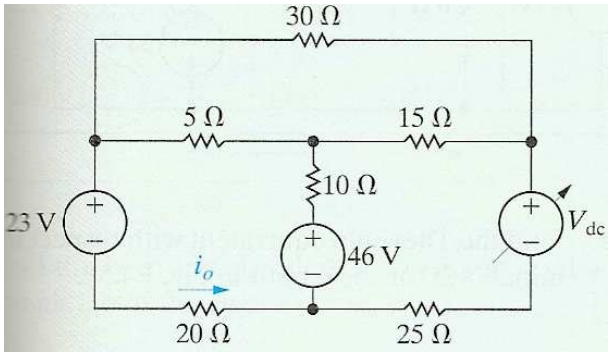
6. (a) Use series of source transformations to find the current i_0 in the circuit shown below.
   (b) Verify your solution by using the node-voltage method to find i_0.



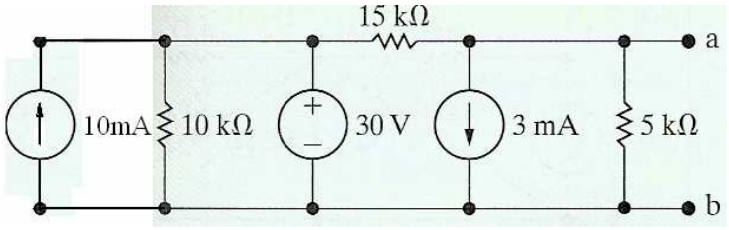
7. (a) Use source transformations to find v_0 in the circuit in fig below
   (b) Find the power developed by 520 V source.
   (c) Find the power developed by the 1 A current source.



8. The variable dc voltage source in the circuit shown below is adjusted so that i_o is zero.
   (a) Find the value of V_{dc}.
   (b) Check your solution by showing the power developed equals the power dissipated.



9. Find the Norton equivalent with respect to the terminals a, b in the circuit below.

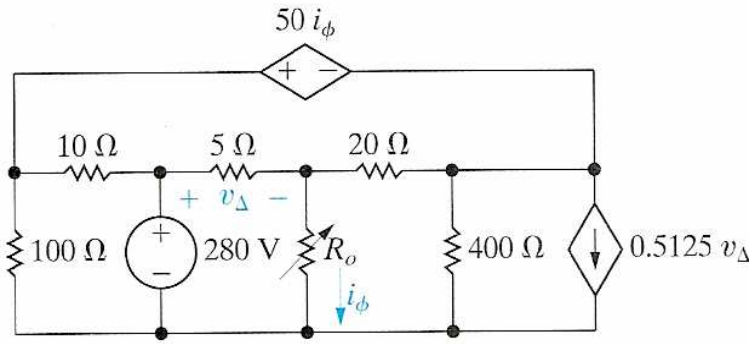


10. The variable resistor in the circuit below is adjusted for maximum power transfer to R_o.

    (a) Find the numerical value of R_o.

    (b) Find the maximum power delivered to R_o.

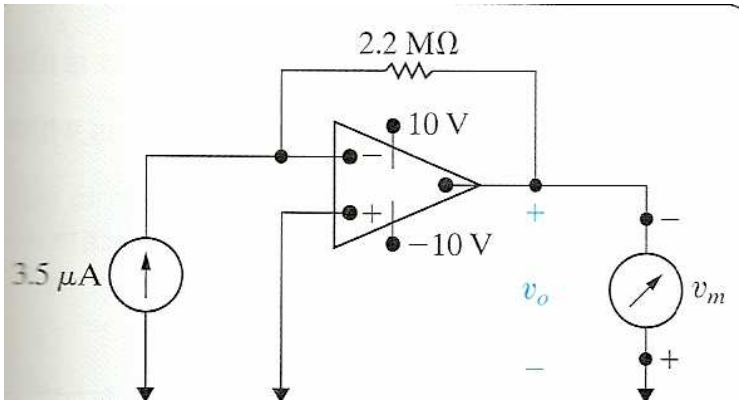
    (c) How much power does the 280V source deliver to the circuit when R_o is adjusted to the value found in (a)?



11. (a) Search for LM 741 Data Sheet on internet and draw pin diagram of LM 741. What is use of each pin?
    (b) Find out typical values of following parameters:
        1. Input offset voltage
        2. Bandwidth
        3. Input resistance

    What are these values for an Ideal Op-Amp? Write significance of these parameters. (Write down proper references for this question)

12. A voltmeter with a full-scale reading of 10V is used to measure the output voltage in the following circuit. What is the reading of the voltmeter? Assume the op amp is ideal.



13. (a) The op amp in the circuit shown below is ideal. The adjustable resistor R_Δ has a maximum value of 100kΩ, and α is restricted to the range of $0.2 \le \alpha \le 1.0$. Calculate the range of v_o if v_g = 40mV.
    (b) If α is no restricted, at what value of α will the op amp saturate?