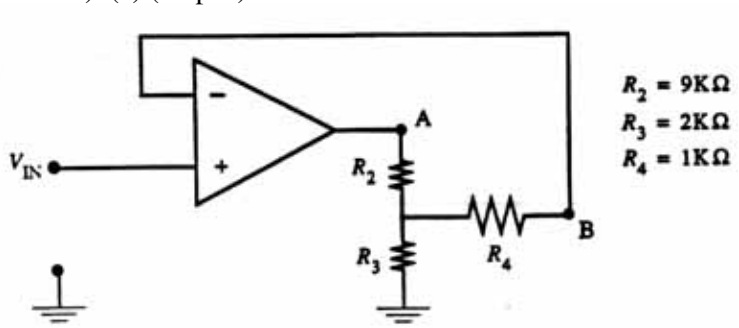
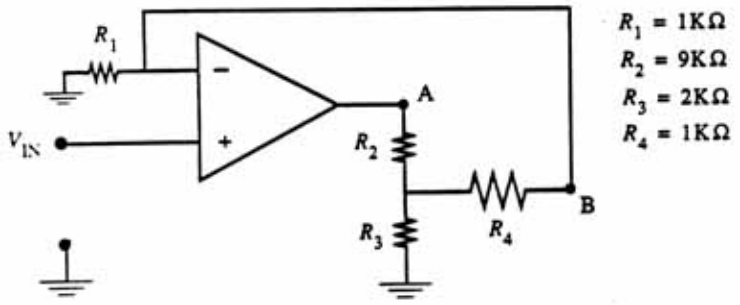
EE40, Spring 1994
Midterm #1

Problem #1

Problem 1 (20 points) Using the Ideal Op-Amp Technique, analyze the following circuit to find Va and Vb (in terms of Vin). (a) (10 pts.)

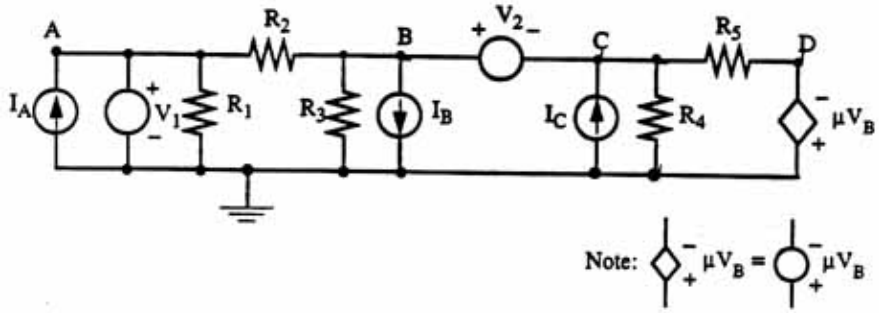


(b) (10 pts.)



Problem #2

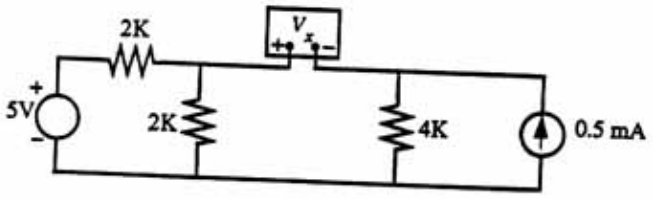
Problem 2 (20 points) You are to analyze the following dc circuit using node analysis. There are four unknown node voltages, VA, VB, VC, VD. Assume IA, IB, IC, V1, V2 (and R1, R2, R3, R4, R5, and u) are all known. You must therefore write four independent equations (in the appropriate space on the following page) sufficient to solve for the four voltages. DO NOT SOLVE.



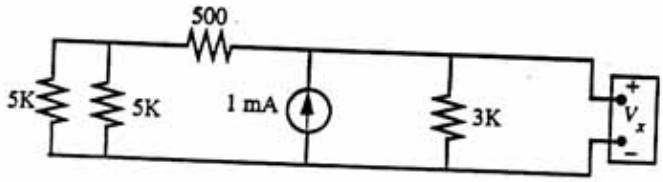
Problem #3

Problem 3 (20 points -- 4 points for each of 5 parts) Find the voltage Vx or current Ix which would be read by the ideal voltmeter of ammeter. Hint: Nodal analysis is not needed and will take too much time. There will be no partial credit on this problem!

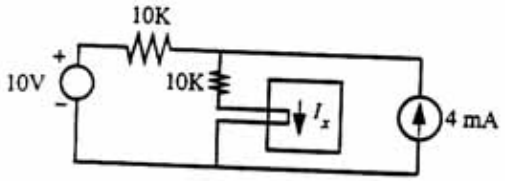
(a)



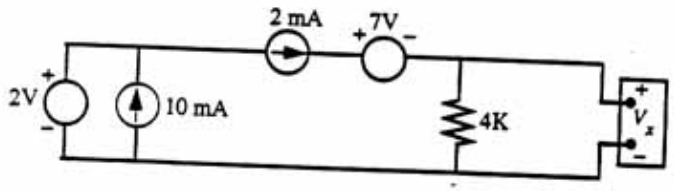
(b)



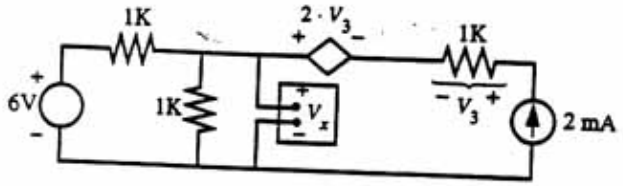
(c)



(d)

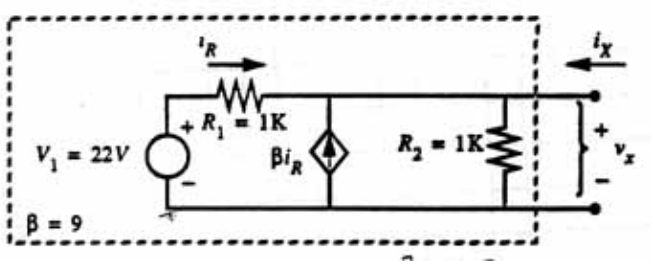


(e)

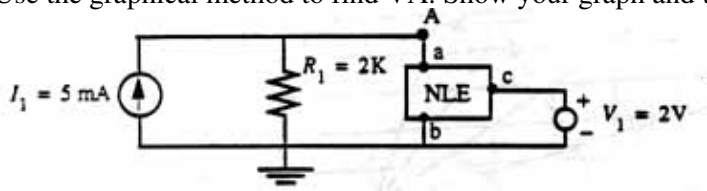


Problem #4

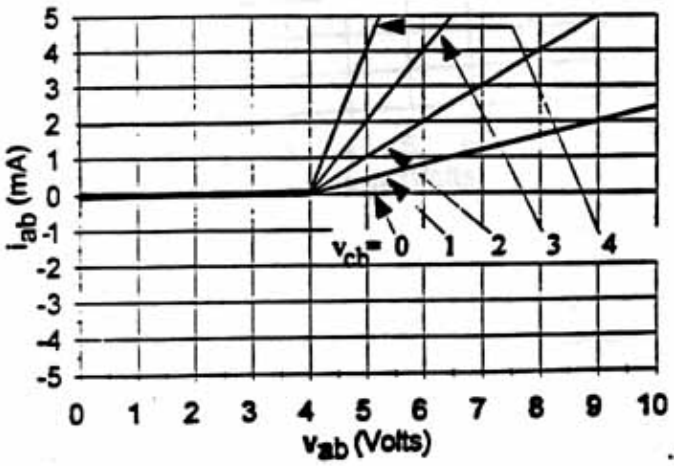
Problem 4 (20 points -- 10 points per part) (a) Draw the I-V graph (ix vs. vx) of the circuit in the box on the axes provided on the next page. [appended below]



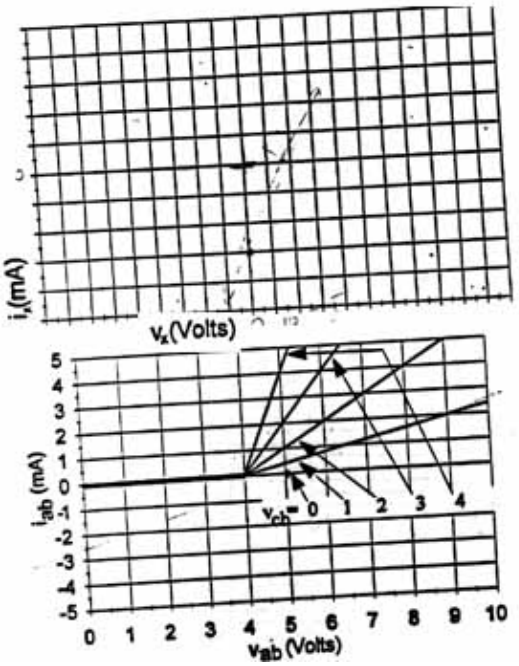
(b) Use the graphical method to find VA. Show your graph and the solution on the next page.



The properties of the non-linear element NLE are given below.



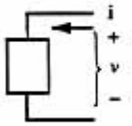
Problem 4 Worksheet and Solutions (a) Note: You must label the axes. [provided graph-space]

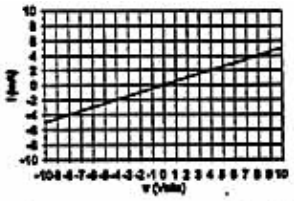


Problem #5

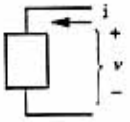
Problem 5 (20 points) Find the simplest possible set of cicuit elements (that is, the components and their numerical values)which would have the iv characteristics displayed for each of the following circuits (what could be in the box?).

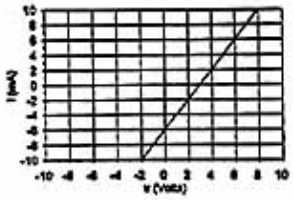
(a) (2 pts.)



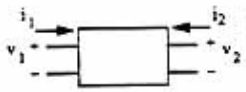


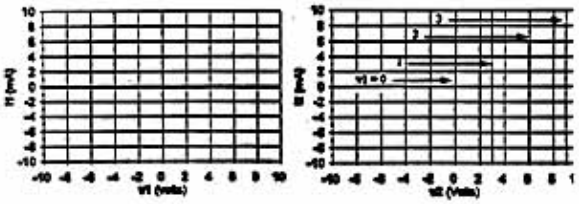
(b) (4 pts.)





(c) (6 pts.)





(d) (8 pts.)