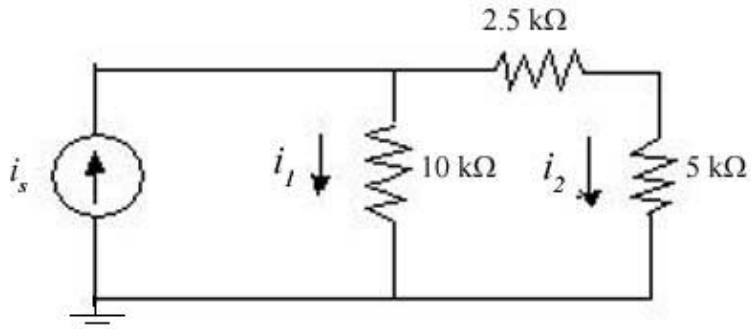
UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering and Computer Sciences
A.M. Flynn, R.T. Howe and R.M. White

Midterm 1: EECS 40/40I/41I
February 22, 1996

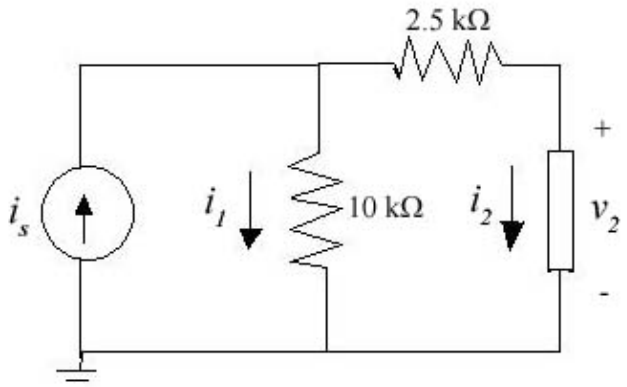
1. Closed book exam - no books, programmed calculators, etc. One 8.5" x 11" sheet of notes allowed.
2. Do your calculations on this exam. **MAKE YOUR METHODS CLEAR TO THE GRADER.**
3. Print and sign your name on this page and CHECK YOUR SECTION in the box above.
4. There are 4 problems. Make sure you have them all.
5. All exams are not identical.

---

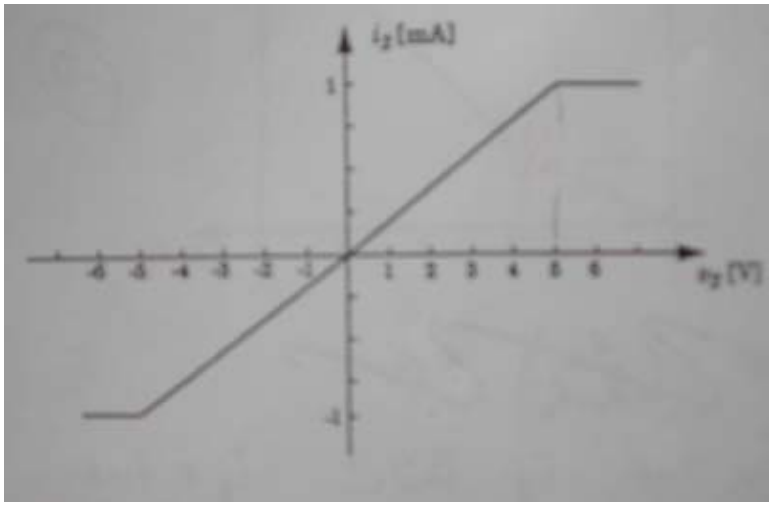
1. Circuit analysis [25 points]



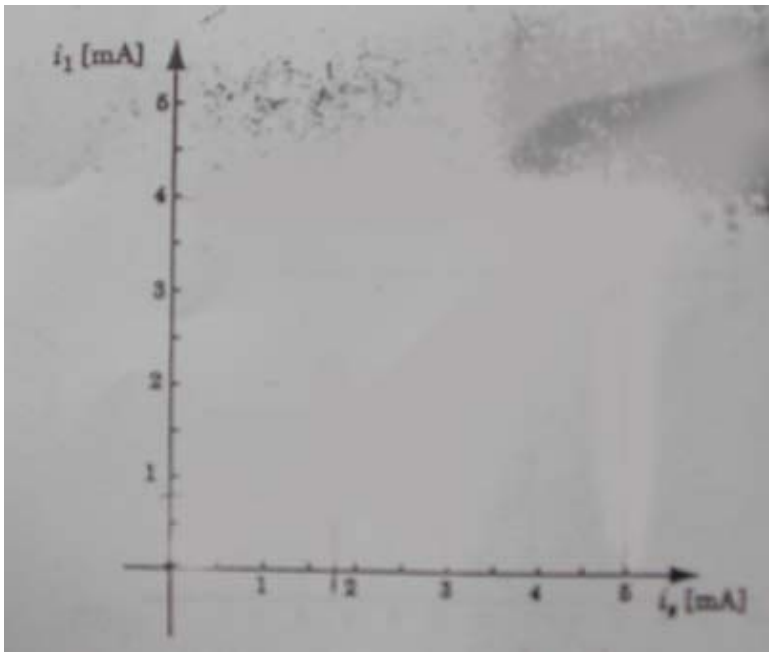
a) [7 pts] What is the numerical value of the current *i2* in the above circuit, for the case when *is* = 1.5 mA?



b) [8 pts] The 5 kOhms resistor is replaced with a non-linear circuit element having *i2* vs. *v2* characteristics given in the graph below. What is the numerical value of the current *i2* for the case when *is* = 1.5 mA? *Hint:* consider what this element is equivalent to over its linear range.

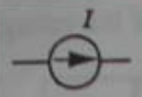
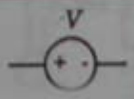
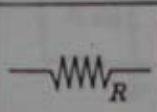
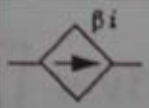
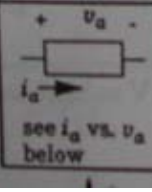


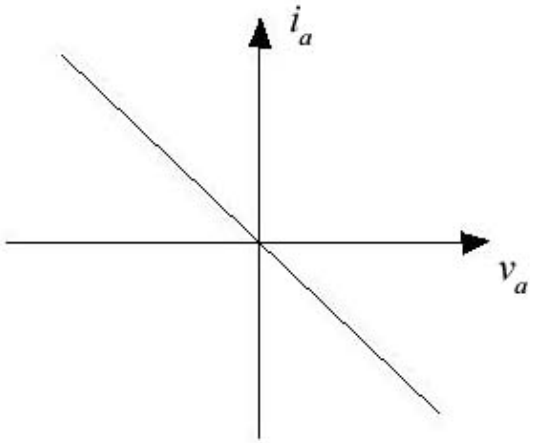
c) [10 pts] Plot the current *i1*, the current through the 10 kOhms resistor, as a function of the source current *is* for *is* = 0 to 5 mA on the graph provided below.



---

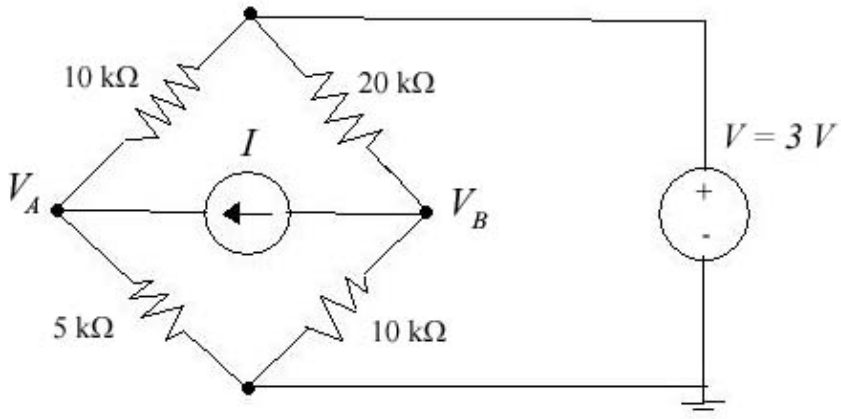
2. Power [25 points]

Circuit Element	Power delivered *may be* positive	Power delivered *may be* negative	Power delivered *may be* zero	Brief justification
				
				
				
				
 see i_a vs. v_a below				



For each of the five circuit elements, check the correct statements regarding the sign and value of the power *delivered to the element* ($P = iv$), which is consistent with the convention that positive power in an element corresponds to dissipation and a negative power corresponds to generation. If you check the "may be zero" box, give a brief justification for your answer. [5 pts per element]

3. Bridge circuit with multiple sources [25 points]

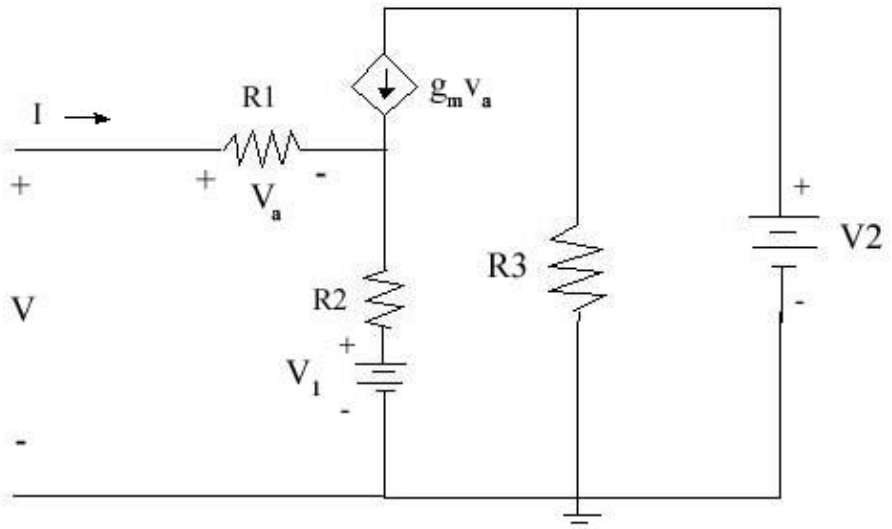


a) [7 pts] For $I = 0$ in the above circuit, find the numerical value of the voltage *VB* (with respect to ground)

b) [8 pts] For $I = 0$, what is the power delivered to the circuit by the 3 V voltage source?

4. [25 points]

a) [15 pts] Find the Thevenin equivalent circuit, of the circuit below, seen looking into the terminals at left.



Vth =

RT =

b) [10 pts] What is Vo as a function of V1 and V2? Use ideal op-amp assumptions. Find an expression for Vo, symbolically and then plug in values for the resistors:

R1 = 5 KOhms
R2 = 10 KOhms
R3 = 60 KOhms
R4 = 60 KOhms

Vo =

Vo =

c) [10 pts] For *I* = 100 uA, find the numerical value of the voltage *VB*. *Hints*: superposition is probably useful; your answer to part (a) may be helpful.