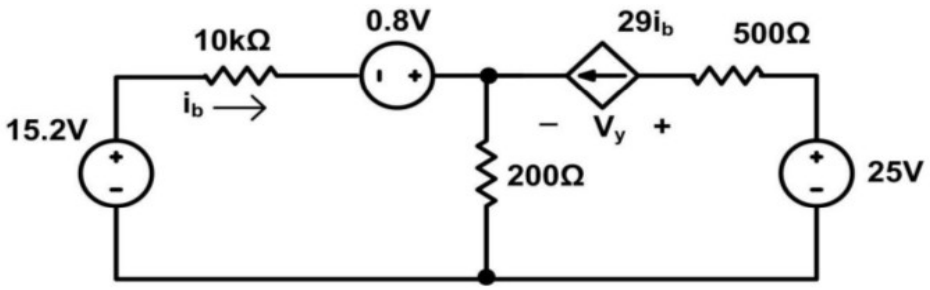
Homework 1 ECE100
Instructor: Prof. Gupta
Due: 4/12 3PM.

Part1: Practice Problems (You are <u>not required</u> to submit your solutions)

Q1. P1.27 from the book

Q2. P1.66 from the book.

Q3. Find the voltage Vy in the following circuit.

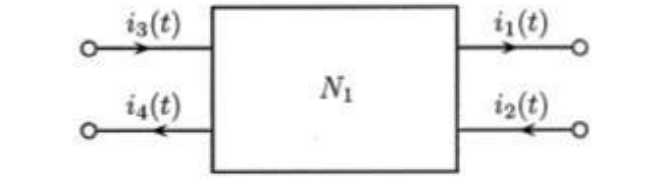


Part 2: Questions (You are <u>required</u> to submit your solutions to the following questions)

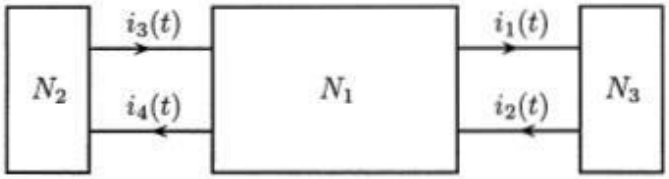
Note: Please show all steps that lead to your answer.

Q1. Consider the network N1 shown in the figures below. Answer the questions following the figures.

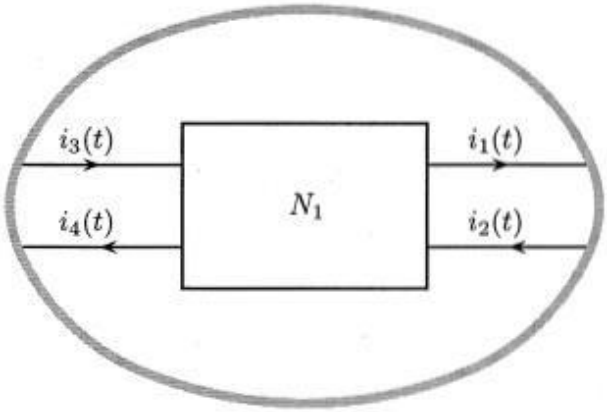
(5 points)



(a)



(b)

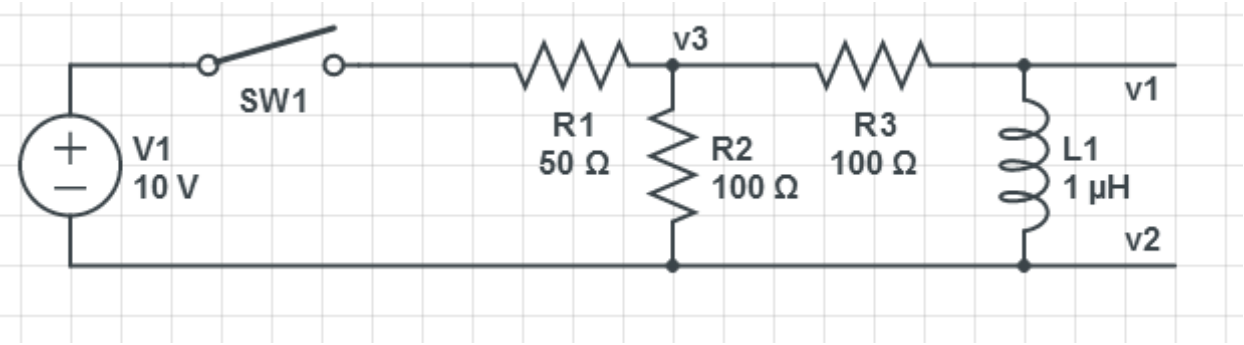


(c)

(i) When network **N1** is connected to the two sub-networks **N2** and **N3** as shown in Figure (b), what is the relation between currents $i_1(t)$ and $i_2(t)$?

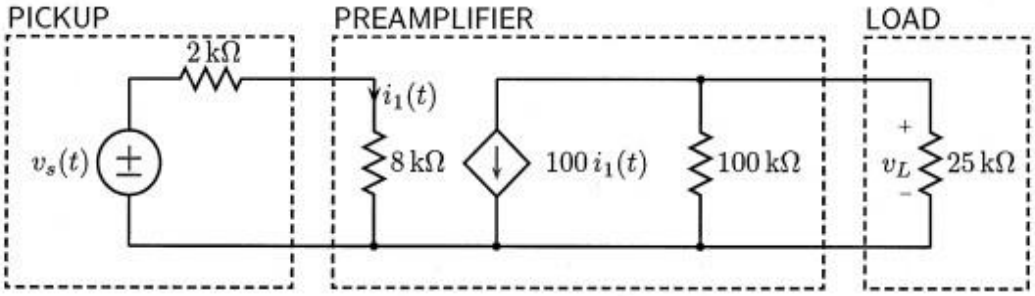
(ii) Does the result that you derived in (i) apply to $i_1(t)$ and $i_2(t)$ when **N1** is embedded in a larger (but unknown) network as shown in Figure (c) ? Explain your answer.

Q2. At time t=0 switch SW1 was closed Assuming current through the inductor L1 is i_2.

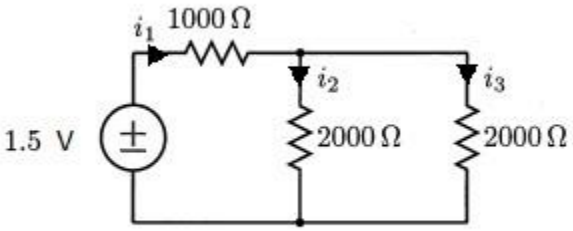


(a) Just after the switch is closed, what is the value of v3-v2. (2 point)
(b) At t=t0, v1-v2=+4V. find the value of $i_2(t0)$ and $di_2(t0)/dt$. (2 points)
(c) At time t=t1, v3-v2=+5V. Calculate $i_2(t1)$ and $di_2(t1)/dt$ (1 point)

Q3. Shown below is a circuit model of a "single transistor preamplifier" that is used to amplify the output of a low amplitude magnetic pickup ($v_s(t)$) and drive a 25kOhm load. Express $v_L(t)$, the voltage measured across the load, as a function of the magnetic pick up (i.e. $v_s(t)$). (10 points)



Q4. Consider the circuit below and answer the questions that follow. (10 points)



(a) This circuit contains three elements and thus there are six element variables, all of which are constant since the voltage source is constant. The currents are labelled and the voltages across the terminals of the three resistors are implied by the default sign convention. Write a set of six linear equations in the variables v_1, v_2, v_3, i_1, i_2, and i_3 that specify the complete solution. These should take the form of three element relations, one KCL equation, and two KVL equations.

(b) Solve the above set of equations to determine the values of the element variables.

(c) Evaluate the power absorbed by all of the elements and sources. Show that the total power absorbed in the resistors is equal to the total power supplied by the source.

Note: The net power in a circuit must *always* be zero. Above problems show this by example.

Q5. Find the equivalent resistance between **X** and **Y** of the infinite ladder network shown below. (5 points)