ECE 209 — Exam # 1

Estimated time for completion: <1.25 hour
3 October 2019

Rules of the Exam

Rule 1: The examination period begins at 9:30am on Thursday, 3 October 2019, and ends at 10:45am on Thursday, 3 October 2019.

Rule 2: There are four problems, plus a bonus problem.

Rule 3: The exam is closed book and closed notes. You may use an 8.5" x 11" sheet of paper with notes and a calculator.

Rule 4: Do not leave the room until you have completed the exam.

Rule 5: To receive full credit for an answer, include the units along with the numerical answer.

Rule 6: Show all work - answers without supporting work will not receive credit.

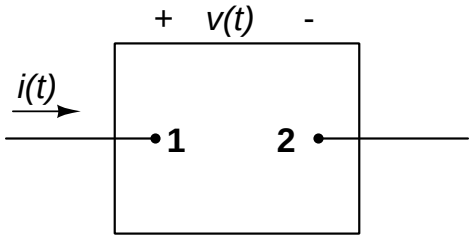
Name

Problem 1 (20 points). The voltage and current at the terminals of the circuit element below are zero for $t < 0$. For $t \geq 0$ they are:

$$v(t) = 75 - 75e^{-1000t}\,\text{V}$$

and

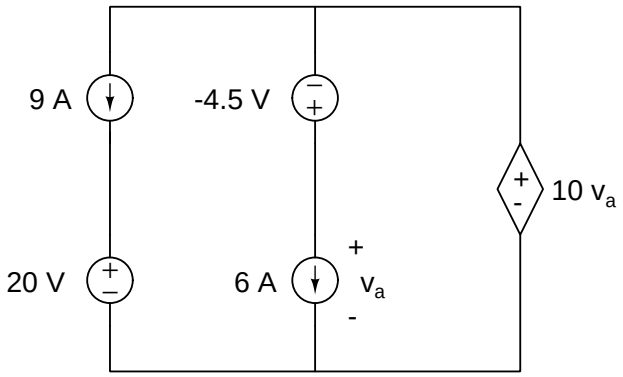
$$i(t) = 50e^{-1000t}\,\text{mA}$$



Part A: Find the maximum value of the power delivered to the circuit. _____

Part B: Find the total energy delivered to the circuit element. _____

Problem 2 (20 points). Consider the circuit below:



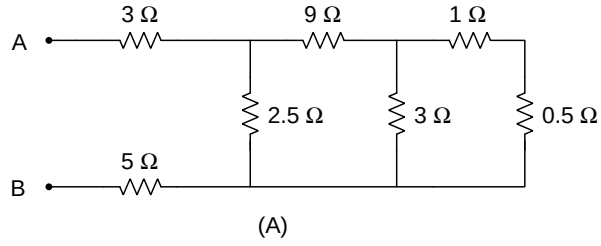
If $v_a = 0.5$ V, is the interconnection valid (yes/no)? _____

If the interconnection is valid, identify the voltage and current sources that generate power by circling them in the figure above.

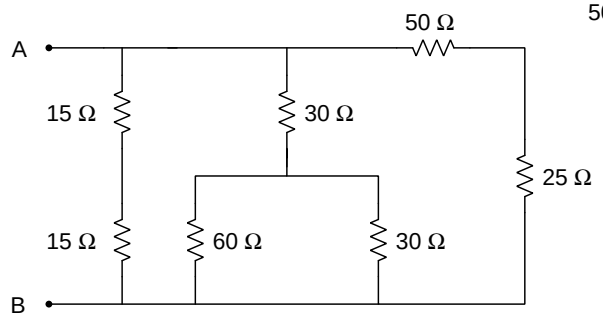
If the circuit is not valid, explain why.

Problem 3 (30 points)

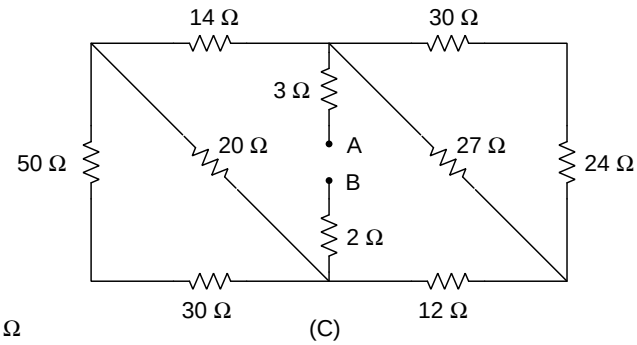
Consider the three series and parallel resistor combinations below:



(A)



(B)



(C)

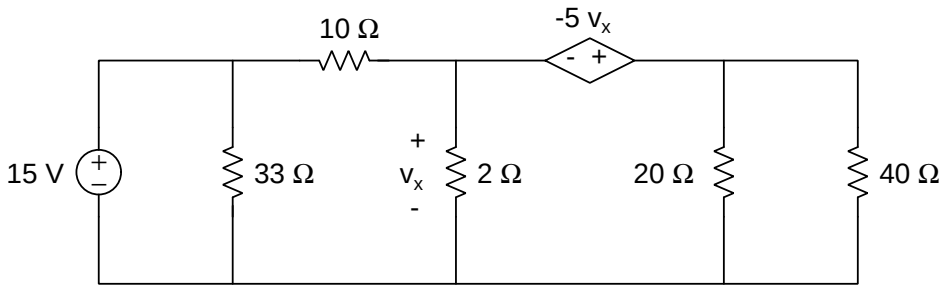
For circuits (A), (B), and (C) calculate R_{ab}, the equivalent resistance between terminals A and B:

R_{ab} for circuit (A): _____

R_{ab} for circuit (B): _____

R_{ab} for circuit (C): _____

Problem 4 (30 points). In the circuit shown below, calculate the power associated with each circuit component, the total power generated, and the total power dissipated (or absorbed).



Power associated with the 15 V independent source? _____

Power associated with the $5v_x$ V dependent source? _____

Power associated with the 2Ω resistor? _____

Power associated with the 10Ω resistor? _____

Power associated with the 20Ω resistor? _____

Power associated with the 33Ω resistor? _____

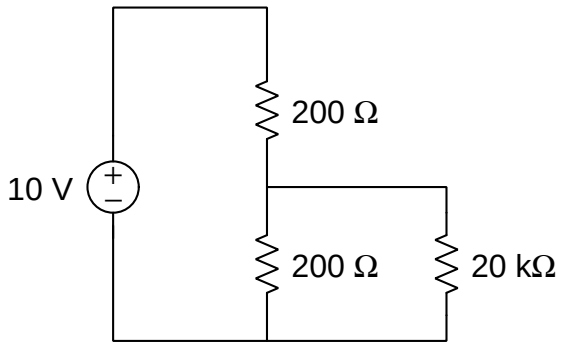
Power associated with the 40Ω resistor? _____

How much power is generated in the circuit? _____

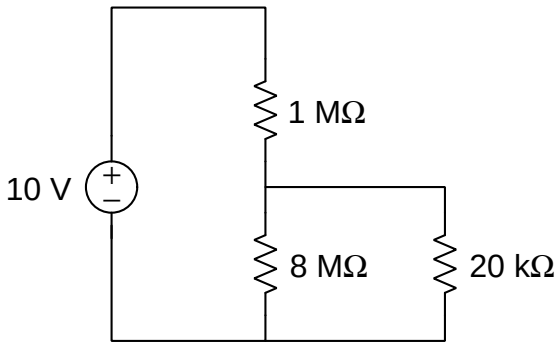
How much power is dissipated or absorbed in the circuit? _____

Bonus Problem (5 points)

Consider the two circuits below. Assume all components are ideal.



Circuit A



Circuit B

Is the absolute value of the voltage across the 20 kΩ resistor in "Circuit A" *greater than*, *less than*, or *equal to* that across the 20 kΩ resistor in "Circuit B?"

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