

Homework #1

MEMS 0031 - Electrical Circuits

Assigned: May 7th, 2020

Due: May 13th, 2020 at 11:59 pm

Problem #1

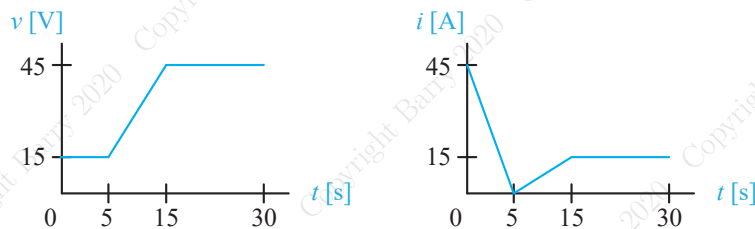
The total charge entering a circuit element is expressed as $q(t)=1(t-e^{-10t})$ for when $t \geq 0$. When $t < 0$, $q(t)=5$ [C]. Determine the current in the circuit element for $t \geq 0$.

Problem #2

The current in a circuit element is $i(t)=5(t-e^{-20t^2})$ [A] when $t \geq 0$. When $t < 0$, $i(t)=1.5$ [A]. Determine the total charge that has entered the circuit element for $t \geq 0$.

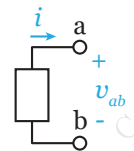
Problem #3

The time variation of current and voltage through and across an electrical circuit element is depicted in the figure below. Sketch the power delivered to the element for the time interval between 0 and 30 seconds. What is the total energy delivered to the element for the time interval between 0 and 30 seconds?



Problem #4

Find the power, $P(t)$, supplied by the element shown in the figure to the right when $v(t)=4\cos(3t)$ [V] and $i(t)=\sin(3t)/12$ [A]. Determine $P(t)$ for when $t=0.75$ and 1.2 [s].



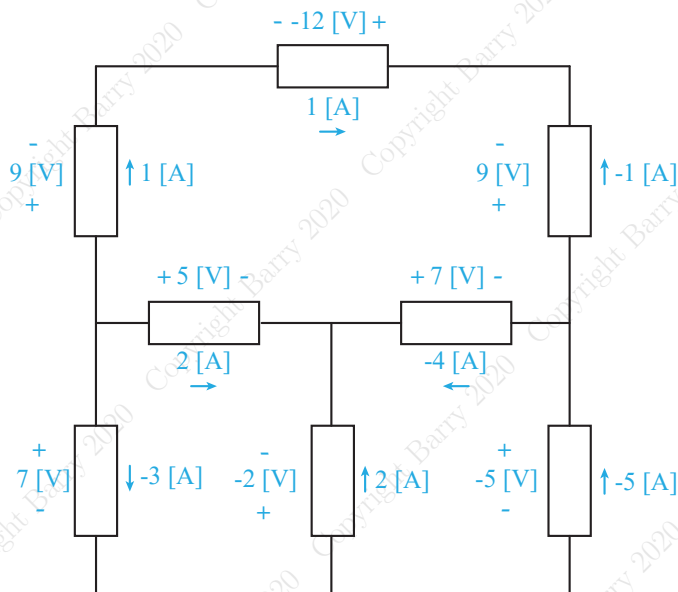
Problem #5

A car uses a 14.7 [V] battery to power the starter motor. If the starter motor draws 250 [A], what is the power supplied by the battery? What is the power supplied by the battery over a 1 second period?

Problem #6

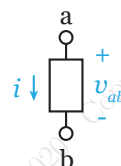
Given the circuit below, determine:

- The power supplied;
- The power dissipated;
- If the circuit obeys the Conservation of Energy.



Problem #7

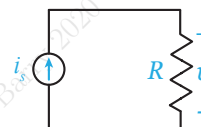
An electrical circuit element has voltage and current values as shown in the figure to the right. Determine if this particular circuit element is linear or non-linear.



v [V]	i [A]
-2	-2
0	0
1.5	1.5
3.78	3.76
4.2	4.1
5	4.8

Problem #8

A current source and resistor are connected in series as shown in the figure to the right. If the current source is 5 [A] and the voltage drop across the resistor is 18.3 [V], calculate a) the resistance R of the resistor, and b) the power dissipated by the resistor.



Problem #9

A voltage source and resistor are connected in series as shown in the figure to the right. If the voltage source is 16 [V] and the resistance of the resistor is 4.2 [Ω], determine a) the current i drawn from the voltage source, and b) the power dissipated by the resistor.

