EECS 215-002 Quiz 1 Fall 2017

Name : **ID #**

Problem # 1 (6 points)

Charge entering the positive terminal of an element is $Q = 8(1-e^{-t})\ mC$, if the power delivered to the element is $P = 8e^{-t}\ W$, determine:

a) The voltage across the element at any time t.

$$i(t) = \frac{dQ}{dt} = 8e^{-t}\ mA$$

$$P(t) = i(t)\,v(t)$$

$$8e^{-t} = 8e^{-t} \times 10^{-3}\ A \cdot v(t)$$

$$v(t) = 1000\ V$$

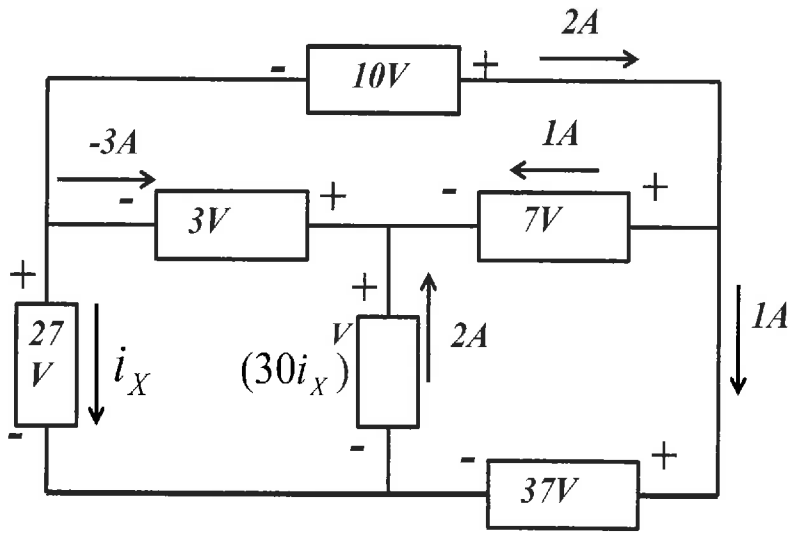
b) Energy delivered in one seconds (between 0 and 1sec).

$$W = \int_0^1 P(t)\,dt = \int_0^1 8e^{-t}\,dt = -8e^{-t}\Big|_0^1$$

$$W = -8e^{-1} + 8 = 5.057\ J$$

Problem # 2 (6 points)

Find current i_x in this circuit using the **balance of consumed and supplied power**.



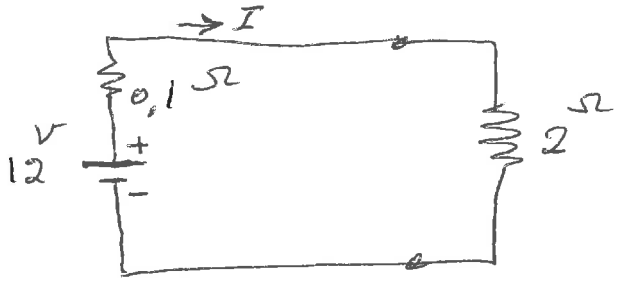
$$27i_x - 60i_x + 37 + 7 + 9 - 20 = 0$$

$$-33i_x + 33 = 0$$

$$i_x = 1\ A$$

Problem # 3 (8 points)
The internal resistance of a 12 volts battery is 0.1Ω. If battery is connected to a 2Ω resistive load, answer the following questions:

a) Draw the electric circuit associated with this application that includes the battery as a voltage source, and the resistors.



b) Calculate the power delivered to the 2Ω resistive load.

$$I = \frac{12\,V}{2 + 0,1} = \frac{12}{2,1} = 5,714\,A$$

$$P_{2\Omega} = 2^{\Omega} \cdot (5,714)^2 = 65,3\,W$$

c) Power dissipated in the internal resistance of the battery.

$$P_{0,1\Omega} = 0,1^{\Omega} \cdot I^2 = 0,1 \times (5,714)^2$$
$$= 3,265\,W$$

d) Power supplied by the battery

$$P_{Battery} = V \cdot I = 12 \times 5,714\,A$$
$$= 68,57\,W$$