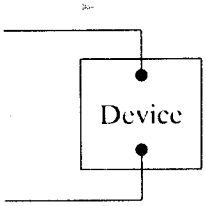
ECEN 2632 - Fall 2013 Test #1 **100 points** **NAME** KEY

(Please show ALL of your work and label the circuits to achieve maximum credit)

1. [10 POINTS]

Five coulombs of charge pass through the element (device) from top to bottom in 10 seconds. The element delivers 120 J of energy during the 10 seconds. Determine the values for v_t and i_t.



$q = 5C \quad t = 10s$

$w = 120J \quad t = 10s$

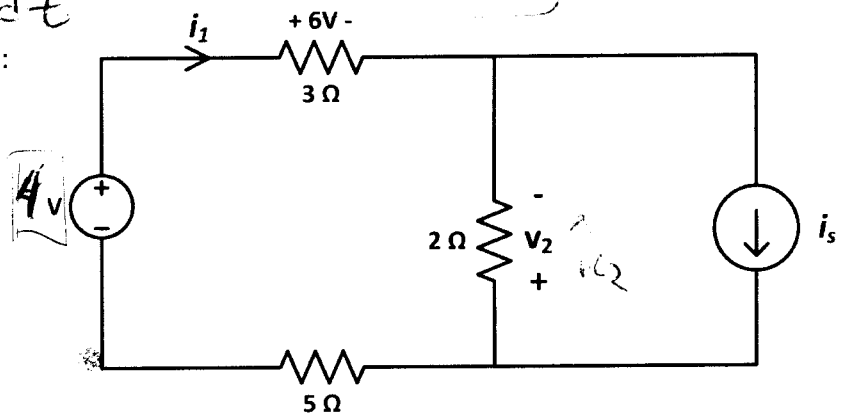
$v = \frac{dw}{dq} = \frac{120}{5} = 24V$

$i = \frac{dq}{dt} = \frac{5}{10} = 0.5A$

2. [15 POINTS]

Given that the following circuit is valid:

a) Using Ohm's Law find i_1



$i_1 = \frac{6}{3} = 2A$

b) Find v_2 using KVL

$-4 + 6 - V_2 + 5i_1 = 0$

$V_2 = 2 + 5(2) = 12V$

c) Find i_s using KCL

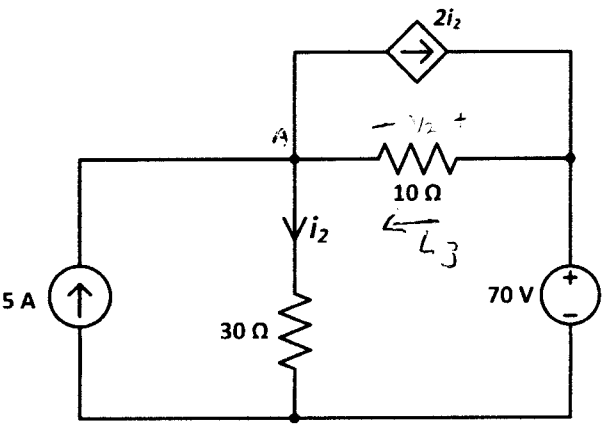
$-i_1 + i_s - i_2 = 0$

$i_2 = \frac{V_2}{2}$

$i_2 = 2 + \frac{12}{2}$

$i_2 = 8A$

3. [25 POINTS] Using KCL, KVL and Ohm's Law:
   a. Find i_2



KCL A

$-5 + L_2 + 2L_2 - L_3 = 0$ (1)

$3L_2 - 5 = L_3$ (2)

KVL, +

$V_3 = 10L_3$ (1) $V_3 = 30L_2$ (2)

$10L_3 + 30L_2 - 70 = 0$ (1)

Sub

$10(3L_2 - 5) + 30L_2 = 70$

$30L_2 - 50 + 30L_2 = 70$

$60L_2 = 120$

$L_2 = 2\,A$ (2)

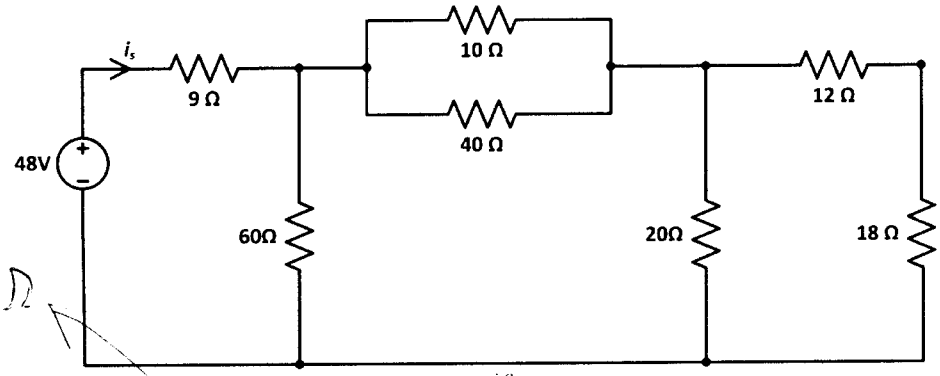
   b. Find the power absorbed by the 10 Ω resistor

$P_{10} = L_3^2 R = (3(2) - 5)^2 10$ (3)

$P_{10} = 10\,W$ (2)

4. [25 POINTS]

a) Find the equivalent resistance as seen by the source.



$= 12 + 18 = 30\,\Omega$

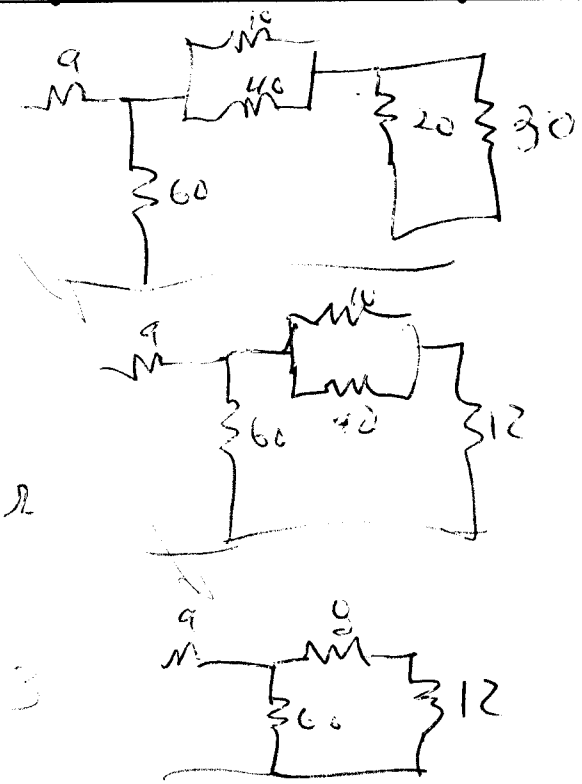
$20 \parallel 30 = \frac{600}{50} = 12\,\Omega$

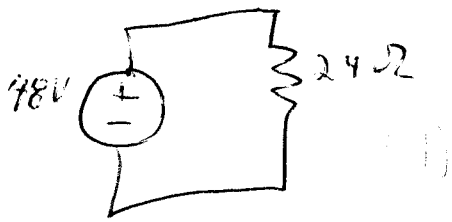
$10 \parallel 40 = \frac{400}{50} = 8\,\Omega$

$8 + 12 = 20\,\Omega$

$20 \parallel 60 = \frac{1200}{80} = 15\,\Omega$

$R_{eq} = 9 + 15 = 24\,\Omega$





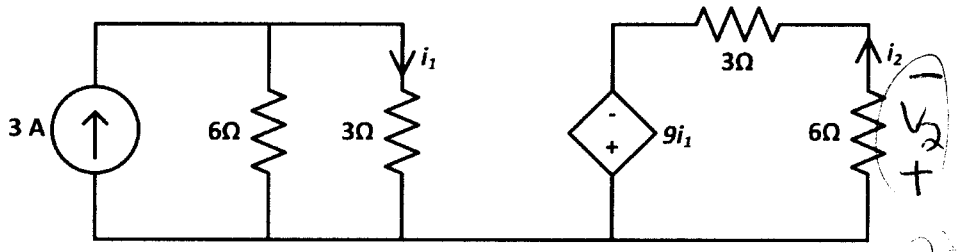
b) Determine the power delivered by the 48V source.

$P = V_s I_s = 48\left(\frac{48}{24}\right) = 96\,W$

$I_s = \frac{48}{24}$ A

5. [25 POINTS]

a. Use a current division equation to determine i_1



$$i_1 = \left(\frac{6}{6+3}\right)3 = \frac{2A}{2}$$

b. Use the result from part (a) and a voltage division equation to determine the voltage across the 6Ω resistor on the **right.** Assign a name to the voltage you find and show its polarity on the circuit above.

$$v_2 = \left(\frac{6}{3+6}\right)9i_1 = \frac{2}{3}(9)(2) = [redacted]\ 12V$$

c. Use the result from part (b) to determine i_2

$$i_2 = \frac{v_2}{6} = \frac{12}{6} = 2A$$