Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #4
April 3, 2013

Keep this quiz closed and face up until you are told to begin.

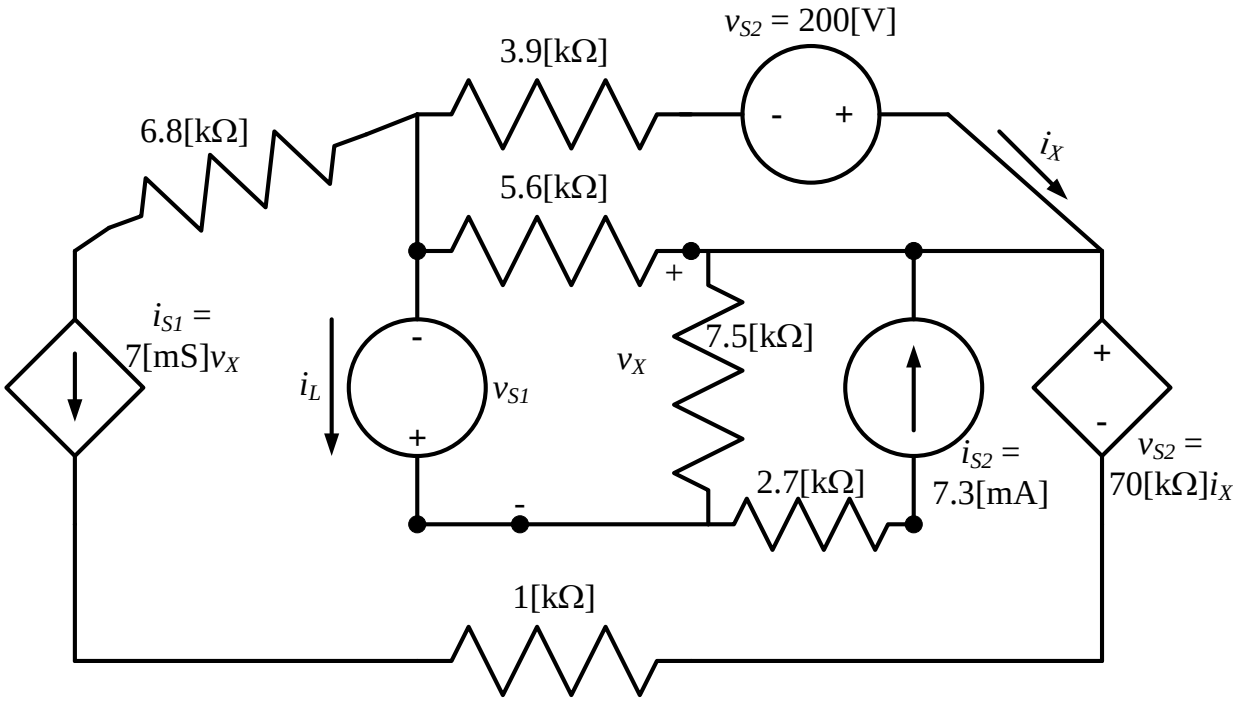
1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**
4. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

_____/20

Room for extra work

The circuit below has an independent voltage source with a value of v_{S1}.

a) Find the Thévenin equivalent of this circuit as seen by the independent voltage source, v_{S1}.
b) Find the power absorbed by the independent voltage source, v_{S1} in this circuit, when v_{S1} = 72[V].
c) Find the power absorbed by the independent voltage source, v_{S1} in this circuit, when v_{S1} = -72[V].



Room for extra work

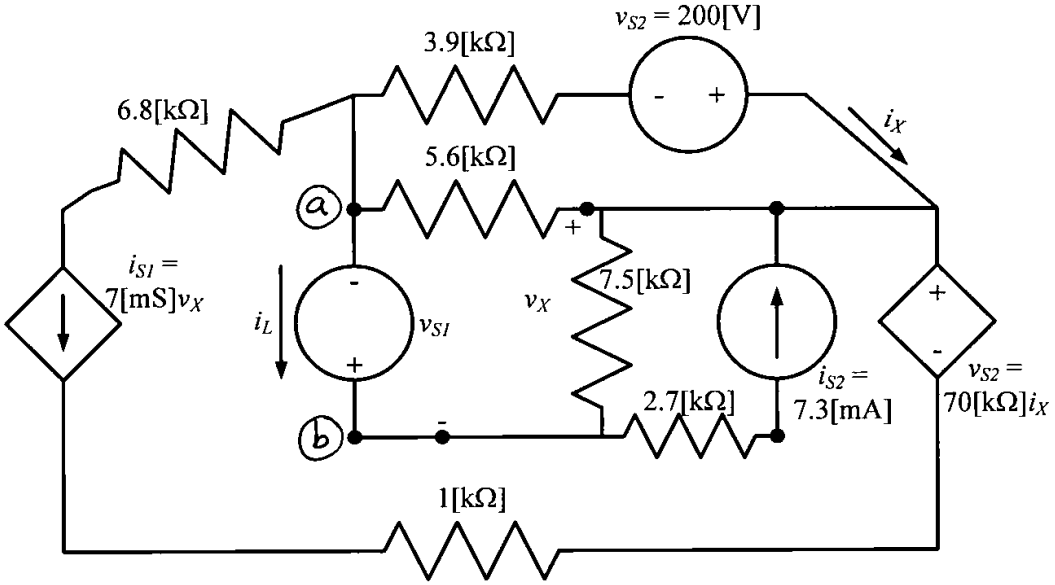
ECE 2300 -- Quiz #4 – April 3, 2013 – Solution

The circuit below has an independent voltage source with a value of v_{S1}.

a) Find the Thévenin equivalent of this circuit as seen by the independent voltage source, v_{S1}.

b) Find the power absorbed by the independent voltage source, v_{S1} in this circuit, when v_{S1} = 72[V].

c) Find the power absorbed by the independent voltage source, v_{S1} in this circuit, when v_{S1} = -72[V].



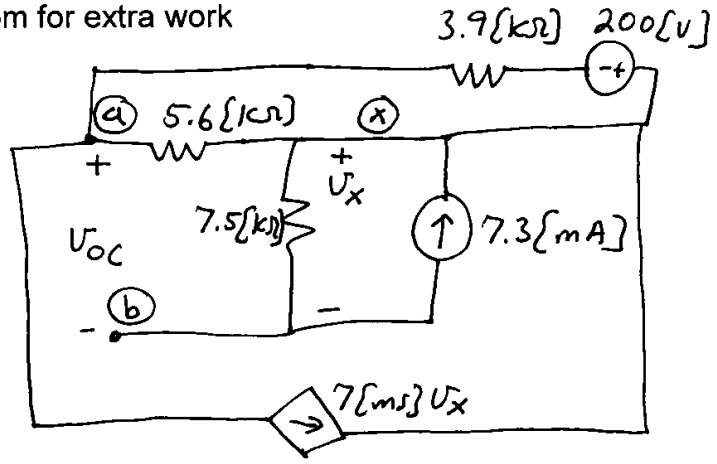
a)

To begin, we remove the v_{S1} source. We name the terminals @ and (b). We also remove the components in series with the two current sources, since we are not looking inside those series combinations.

We choose to begin the next step by choosing to find the open-circuit voltage, v_{oc}. We define this on the diagram on the next page.

See next page

Room for extra work



KCL @ ⓐ

$$\frac{V_{oc} - V_x}{5.6[k\Omega]} + \frac{V_{oc} + 200[V] - V_x}{3.9[k\Omega]} + 7[mS]\,V_x = 0$$

KCL @ ⓧ

$$-7.3[mA] + \frac{V_x}{7.5[k\Omega]} + \frac{V_x - V_{oc}}{5.6[k\Omega]} + \frac{V_x - 200[V] - V_{oc}}{3.9[k\Omega]} +$$

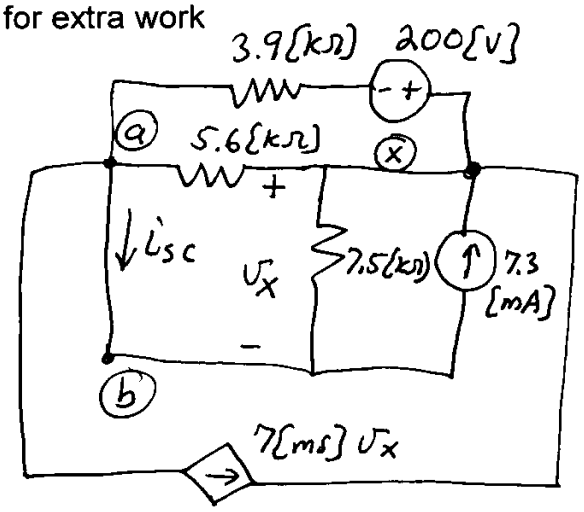
$$-7[mS]\,V_x = 0.$$

Solving, we get $V_x = 54.75[V]$ and

$$\boxed{V_{oc} = -944.2[V]}$$

So, now, we have the open-circuit voltage. Next, let us find the short-circuit current. We redraw this on the next page.

Room for extra work



KCL @ (x)

$$-7.3[mA] + \frac{v_x}{7.5[k\Omega]} + \frac{v_x}{5.6[k\Omega]} + \frac{v_x - 200[V]}{3.9[k\Omega]} - 7[mS]v_x = 0$$

KCL @ (b)

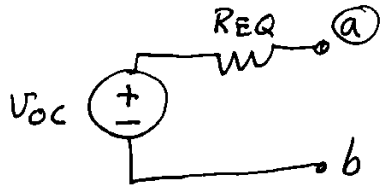
$$-i_{sc} - \frac{v_x}{7.5[k\Omega]} + 7.3[mA] = 0$$

Solving: $v_x = -9.108[V]$

$i_{sc} = 8.514[mA]$

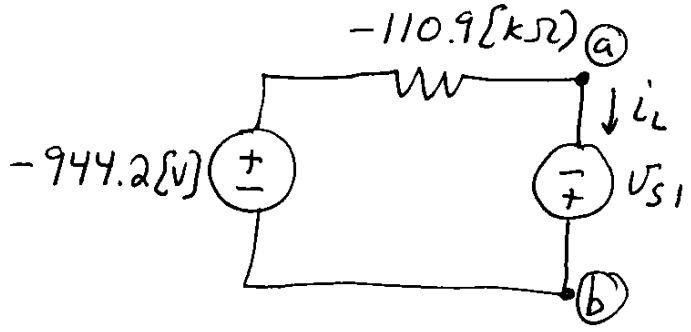
So, $R_{EQ} = \frac{v_{oc}}{i_{sc}} = \frac{-944.2[V]}{8.514[mA]} = \boxed{-110.9[k\Omega]}$

Thev. Equiv. is:



See next page

b) We draw the Thevenin equivalent, with v_{s1}.



$$i_L = \frac{-944.2[V] + v_{s1}}{-110.9[k\Omega]}$$

For $v_{s1} = 72[V]$

$$i_L = 7.865[mA]$$

$$p_{ABS.BY.\,v_{s1}} = -v_{s1}\, i_L = -(72[V])(7.865[mA])$$

$$= \boxed{-566[mW]}$$

c) For $v_{s1} = -72[V]$

$$i_L = 9.163[mA]$$

$$p_{ABS.BY.\,v_{s1}} = -v_{s1}\, i_L = -(-72[V])(9.163[mA])$$

$$= \boxed{659.8[mW]}$$