Name: Solutions (please print)

Signature: ______________________________

ECE 2201 – Quiz # 6
December 1, 2016

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.

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For the circuit shown in Figure 1, the Thévenin equivalent as seen by the v_{S1} voltage source is given in Figure 2. Find **K** and R_Y. Be careful with the units!

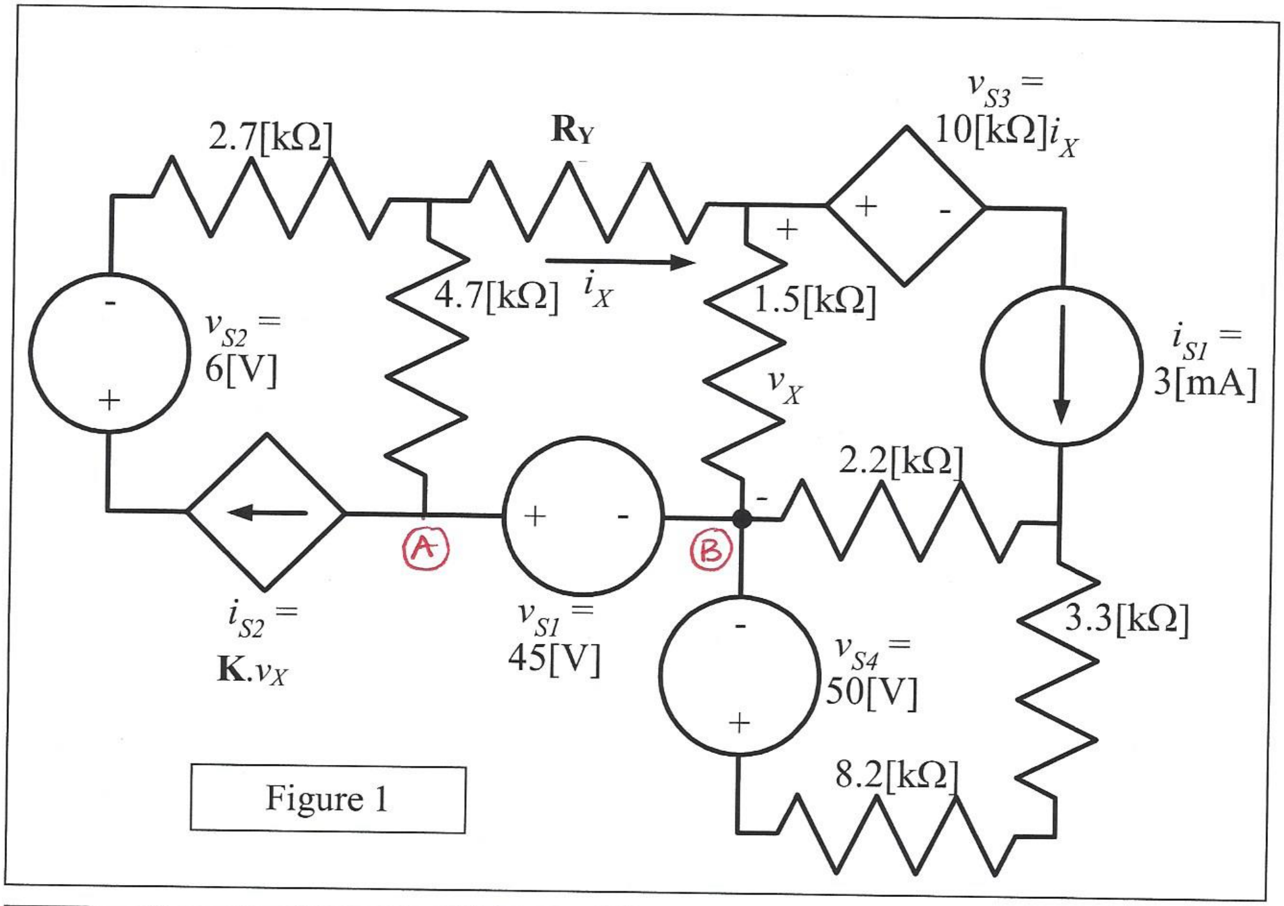


Figure 1

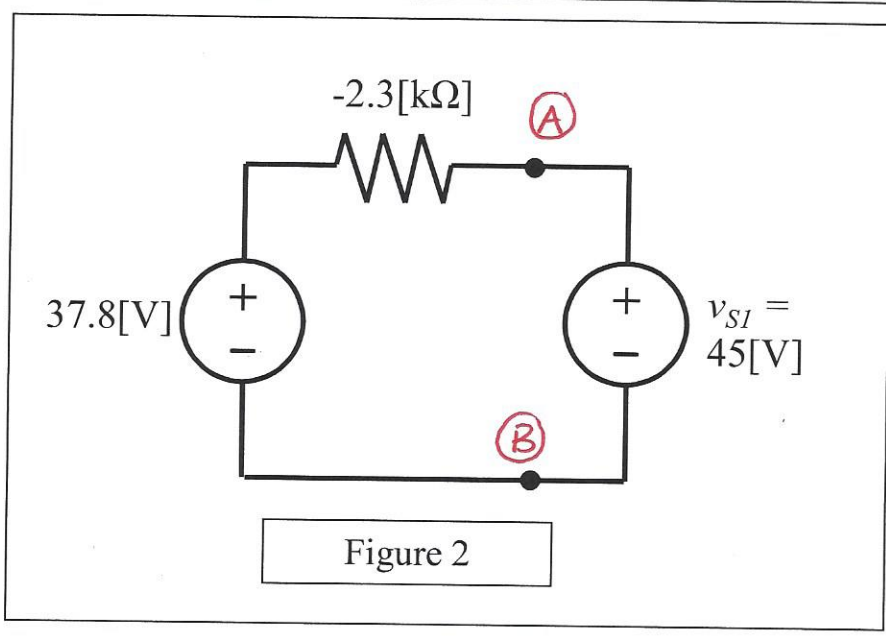


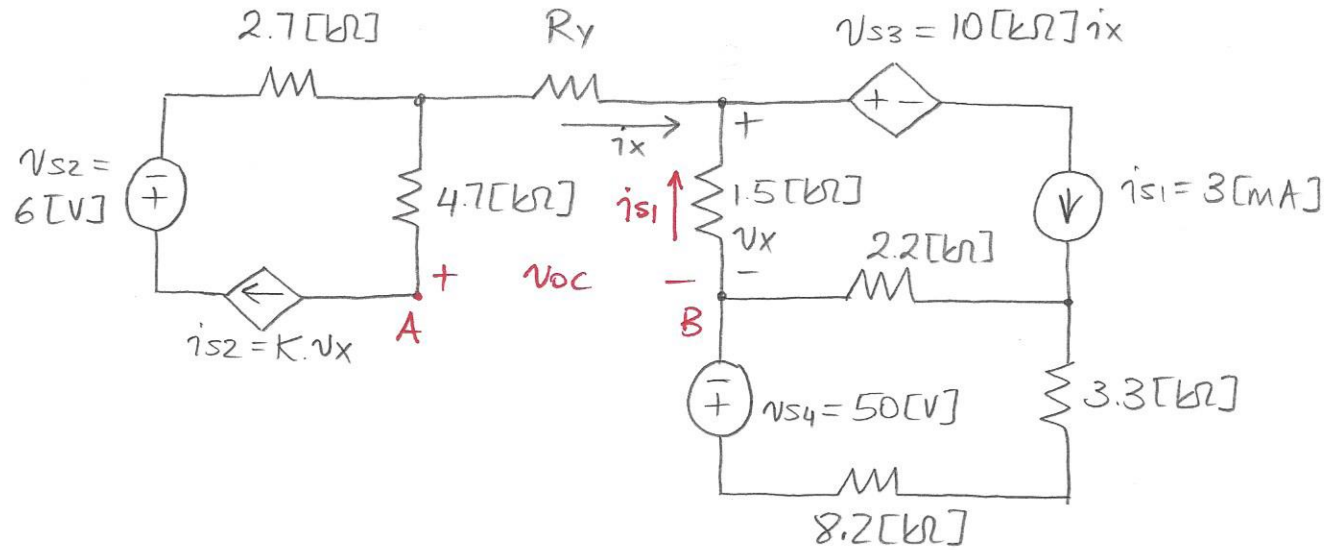
Figure 2

$V_{TH} = 37.8$ [V]
$R_{TH} = -2.3$ [kΩ]
are given.

$\Rightarrow V_{OC} = 37.8$ [V]

Finding v_{oc}

We are given the Thévenin eq. circuit seen by v_{s1}. So, v_{s1} must be taken out. And we need to label the open-circuit volt., v_{oc}.



KCL @ closed surface $\Rightarrow$ $i_x = 0$

KVL: $-v_{oc} - i_{s2} \cdot 4.7[k\Omega] + v_x = 0$

$-v_{oc} - K\, v_x \cdot 4.7[k\Omega] + v_x = 0$

Since $i_x = 0$, current through $1.5[k\Omega]$ is equal to i_{s1}.

$v_x = -i_{s1} \cdot 1.5[k\Omega] = -4.5[V]$

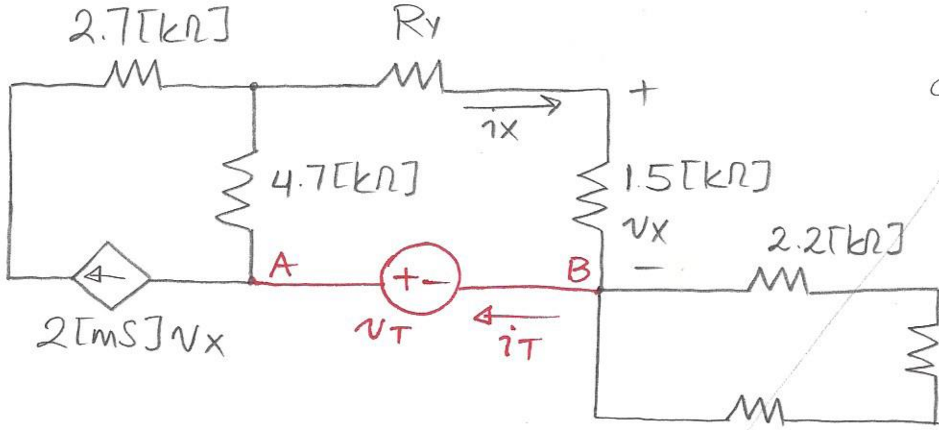
Note that, v_{oc} is given.

$-37.8[V] - K \cdot (-4.5[V])\, 4.7[k\Omega] - 4.5[V] = 0$

$K = 2\,[mS]$

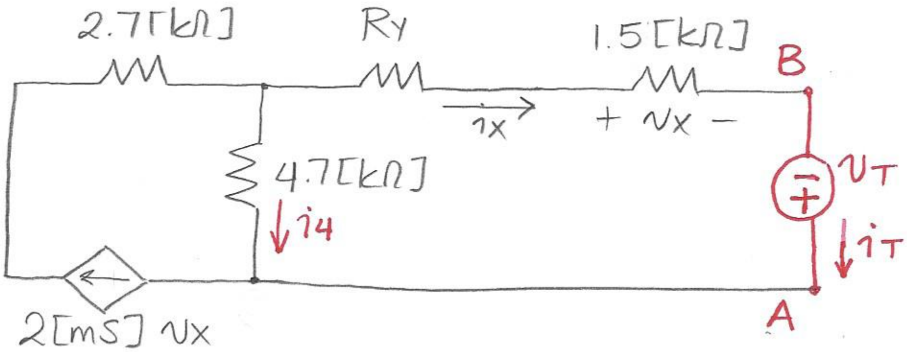
Finding R_{TH}

First, we need to kill independent sources:



The series combination of 2.2[kΩ], 3.3[kΩ] and 8.2[kΩ] is shorted.

We'll apply test source method:



Note that $\frac{v_T}{i_T} = R_{TH} = -2.3[k\Omega]$

Let's pick $v_T = 23[V]$

then $i_T = -10[mA]$

$i_x = i_T \qquad v_x = i_x \cdot 1.5[k\Omega] = i_T \cdot 1.5[k\Omega]$

KCL @ A: $i_4 = 2[mS]\, v_x - i_T$

KVL: $-v_T - i_4 \cdot 4.7[k\Omega] + i_T(R_Y + 1.5[k\Omega]) = 0$

$-v_T - (2[mS]\, v_x - i_T) + i_T(R_Y + 1.5[k\Omega]) = 0$

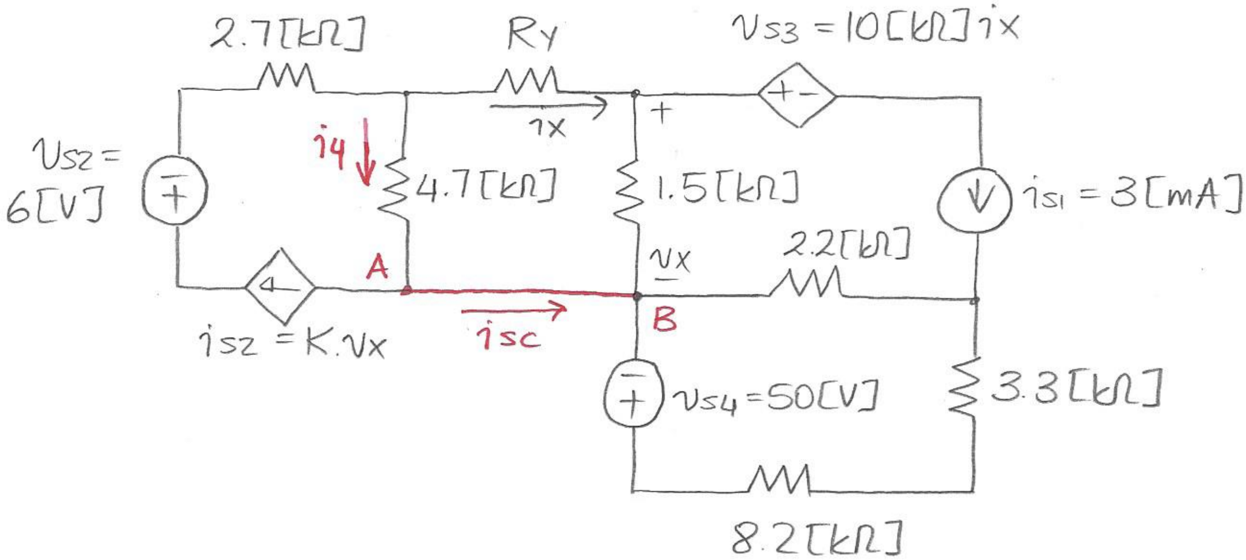
$-23[V] - (2[mS]\, i_T \cdot 1.5[k\Omega] - i_T) + i_T(R_Y + 1.5[k\Omega]) = 0$

Replacing i_T with $-10[mA]$ and solving for R_Y:

We get $\boxed{R_Y = 5.6[k\Omega]}$

Alternatively, you could find isc.

Finding: isc



KCL @ closed surface : $i_{sc} = -i_x = \dfrac{37.8[V]}{-2.3[k\Omega]}$ (given)

$v_x = 1.5[k\Omega]\,(i_x - 3[mA])$

$i_{sc} = -16.435[mA]$

$v_x = 1.5[k\Omega]\,(16.435[mA] - 3[mA]) = 20.152[V]$

KCL @ (A) : $i_4 = K v_x + i_{sc} = K\,20.152[V] - 16.435[mA]$

KVL : $v_x - i_4 \cdot 4.7[k\Omega] + R_Y \cdot i_x = 0$

$$20.152[V] - (K\,20.152[V] - 16.435[mA])\,4.7[k\Omega] + R_Y \cdot 16.435[mA] = 0 \quad (1)$$

Remember from finding R_{TH}, we got ;

$$-23[V] - (K \cdot i_T \cdot 1.5[k\Omega] - i_T) + i_T\,(R_Y + 1.5[k\Omega]) = 0 \quad (2)$$

w/ $i_T = -10[mA]$. (Note that I'm assuming that we don't know K yet)

2 equations, 2 unknowns : K and R_Y.

Solving (1) and (2), we get $K = 2[mS]$ and $R_Y = 5.6[k\Omega]$