Name: Solution (please print)

Signature: _____

ECE 2201 – Quiz #4 - B
November 1, 2018

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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A device can be modeled using a current source in parallel with a resistance. This device was connected to a 500[V] voltage source, as shown in Figure 1, and a current i_5 of 5.65[mA] resulted. The same device was then connected to a 4[mA] current source as shown in Figure 2, and a voltage v_4 of -4087[V] resulted.

a) Find a model for the device, and draw it, labeling terminals A and B. Show on that diagram the numerical values of the components.
b) When two identical versions of the device are connected as shown in Figure 3, the current i_Z is measured to be 7.2[mA]. Apply NVM to write a set of equations to find R_X. **Do not solve** the equations.

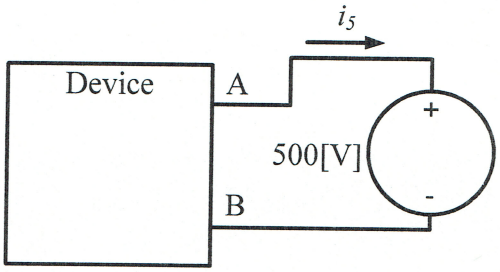


Figure 1

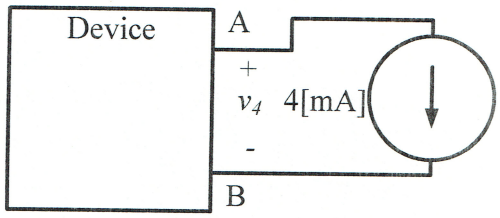


Figure 2

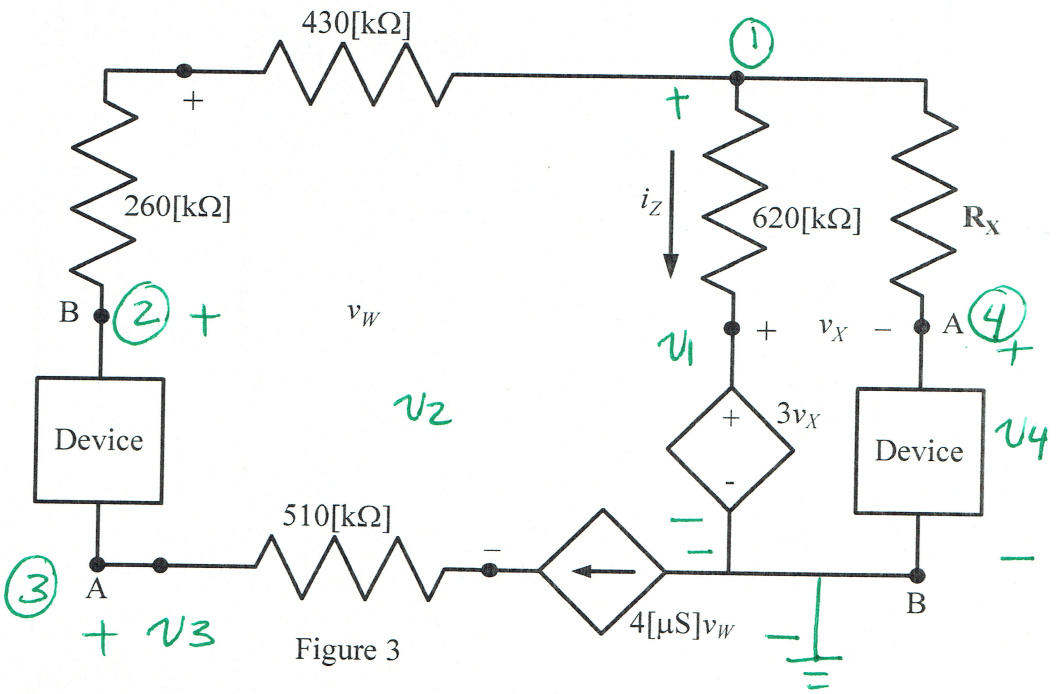
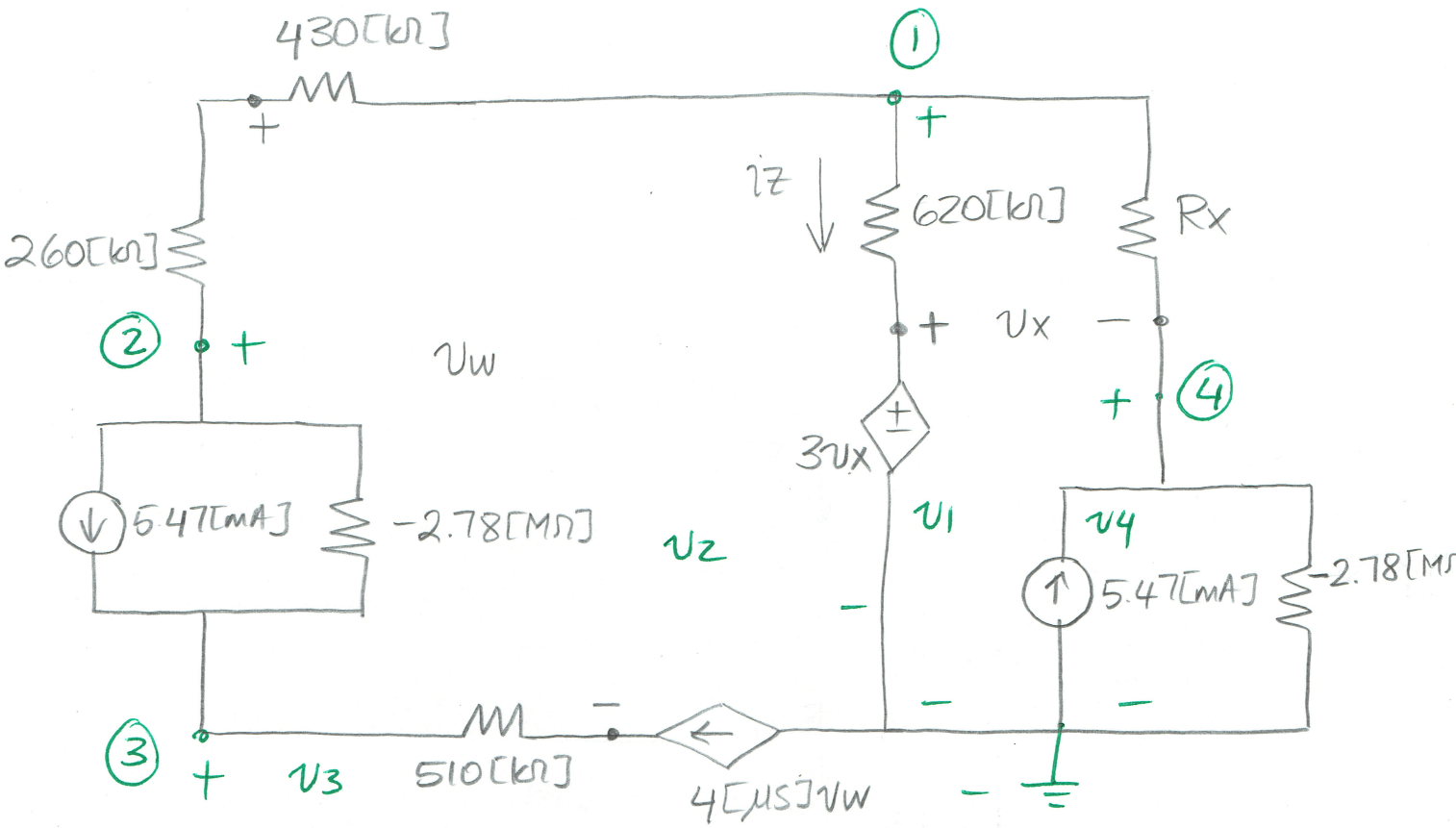


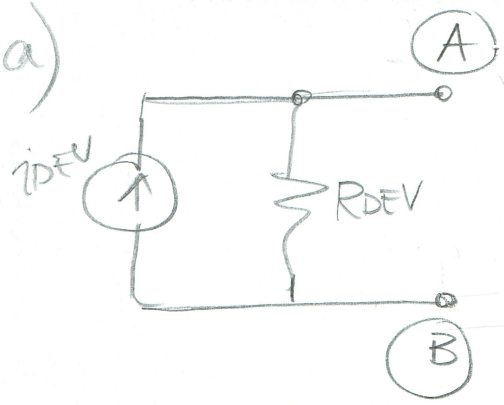
Figure 3



NVM will give us 5-1+2 = 6 equations.

Including Rx, we have 7 unknowns. We need 1 more eq. to use the value of iz given in the problem.

a)



$$-i_{DEV} + \frac{500[V]}{R_{DEV}} + 5.65[mA] = 0 \quad (+3)$$

$$-i_{DEV} + \frac{(-4087[V])}{R_{DEV}} + 4[mA] = 0 \quad (+3)$$

$$i_{DEV} = 5.47[mA]$$
$$R_{DEV} = -2.78[M\Omega] \quad (+1)$$

b)

① $\frac{v_1 - 3v_x}{620k\Omega} + \frac{v_1 - v_4}{R_x} + \frac{v_1 - v_2}{(430+260)\,k\Omega} = 0$ (+2)

② $\frac{v_2 - v_1}{(430+260)\,k\Omega} + i_{DEV} + \frac{v_2 - v_3}{R_{DEV}} = 0$ (+2)

③ $-i_{DEV} + \frac{v_3 - v_2}{R_{DEV}} - 4[\mu S]\,v_w = 0$ (+2)

④ $\frac{v_4 - v_1}{R_x} - i_{DEV} + \frac{v_4}{R_{DEV}} = 0$ (+2)

v_x $v_x + v_4 - 3v_x = 0$ (+3)

v_w $0 = v_w + 510k\Omega \times 4[\mu S]\,v_w + v_3 - v_2 + 260k\Omega \times 4[\mu S]\,v_w$ (+4)

i_z $\frac{v_1 - 3v_x}{620k\Omega} = 7.2[mA]$ (+3)