Name: ______________________________ (please print)

Signature: ___________________________

ECE 2201 – Quiz #6
April 27, 2023

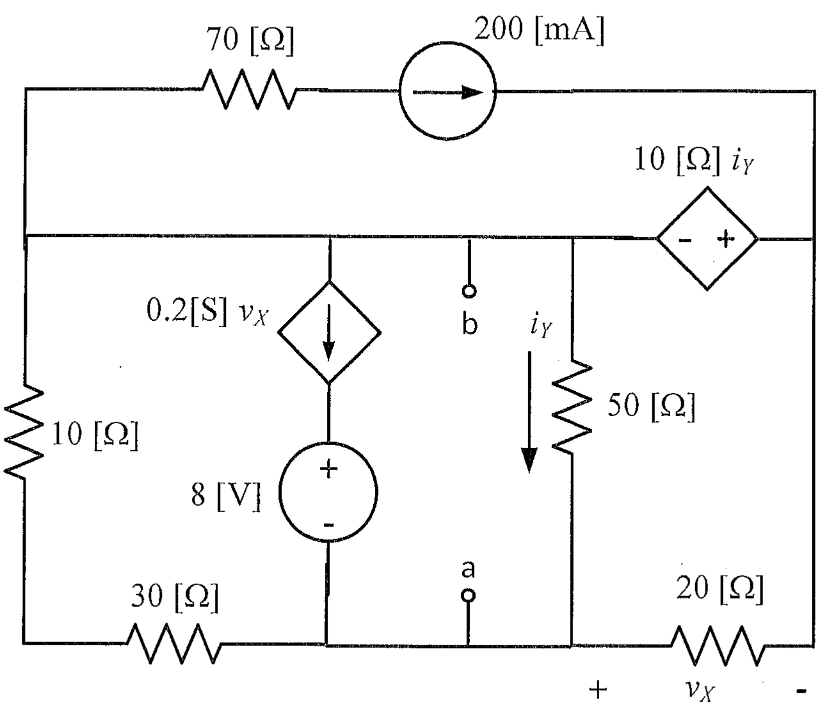
- This quiz is closed book, closed notes.
- Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
- Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
- If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
- Do not use red ink. Do not use red pencil.
- You will have 30 minutes to work on this quiz.

_________________/20

Room for extra work

Find the Norton equivalent of the circuit below with respect to terminals a, b. Draw the Norton equivalent showing the terminals a,b, and labeling the components clearly.

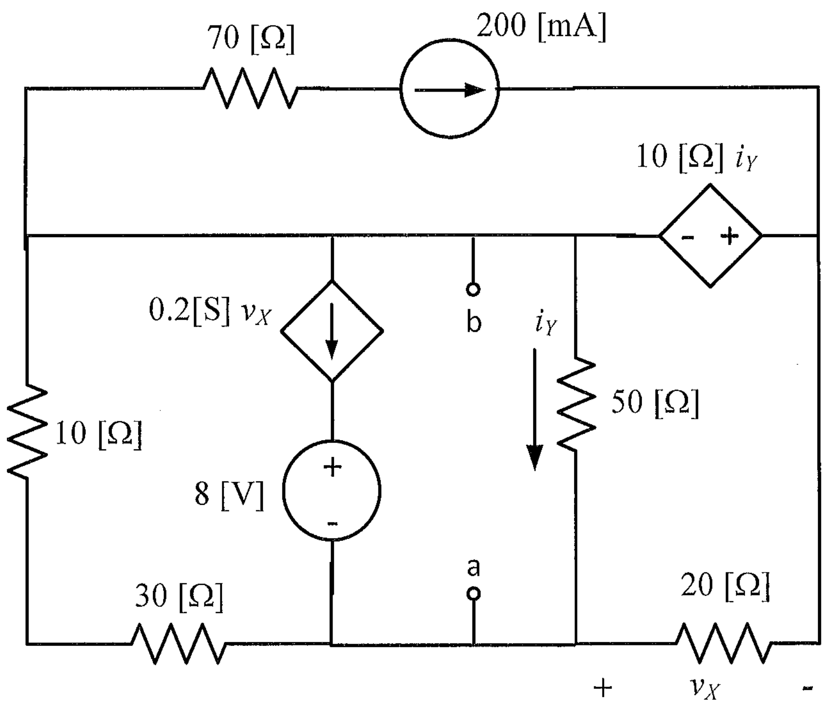
If a voltage source $v_{SI} = 10$ [V] is connected to a, b, with the positive terminal at a, how much power does v_{SI} deliver to the circuit?



Room for extra work

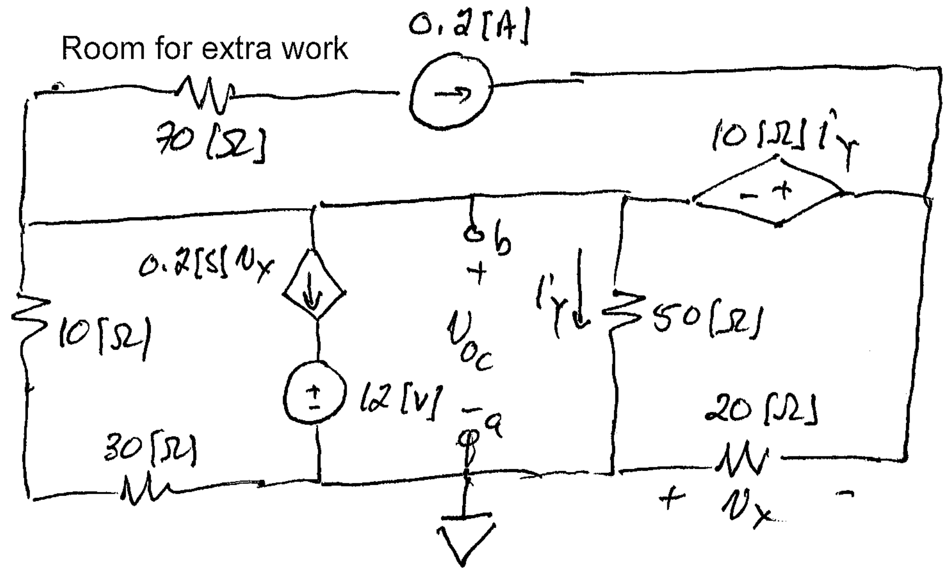
Find the Norton equivalent of the circuit below with respect to terminals a, b. Draw the Norton equivalent showing the terminals a,b, and labeling the components clearly.

If a voltage source $v_{S1} = 10$ [V] is connected to a, b, with the positive terminal at a, how much power does v_{S1} deliver to the circuit?



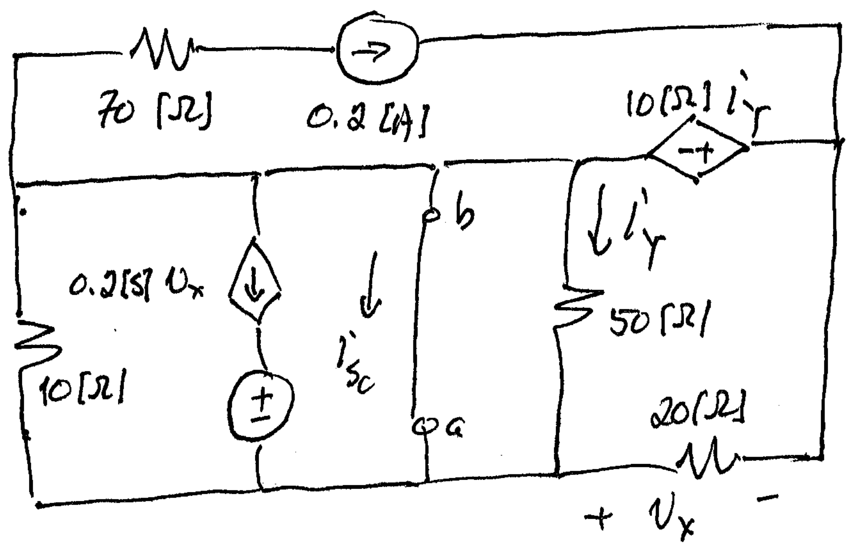
The independent current source is in parallel with a (dependent) voltage source, and the independent voltage source is in series with a (dependent) current source. So with respect to terminals a, b, these sources have no effect. So there are no independent sources as far as a, b are concerned, and as a result, $v_{OC} = i_{SC} = 0$. But we will prove that...

Room for extra work



Note: $-v_X$ is a node voltage, as is v_{oc}.

$$\left.\begin{array}{l} \dfrac{v_{oc}}{50} + 0.2\, v_X + \dfrac{v_{oc}}{40} + \dfrac{(-v_X)}{20} = 0 \\ -v_X - v_{oc} - 10\, i'_Y = 0 \qquad i'_Y = v_{oc}/50 \end{array}\right\} \Rightarrow \begin{array}{l} v_X = 0 \\ v_{oc} = 0 \\ i'_Y = 0 \end{array}$$



short circuit $\Rightarrow i'_Y = 0$

so $10\,[\Omega]\; i'_Y = 0$

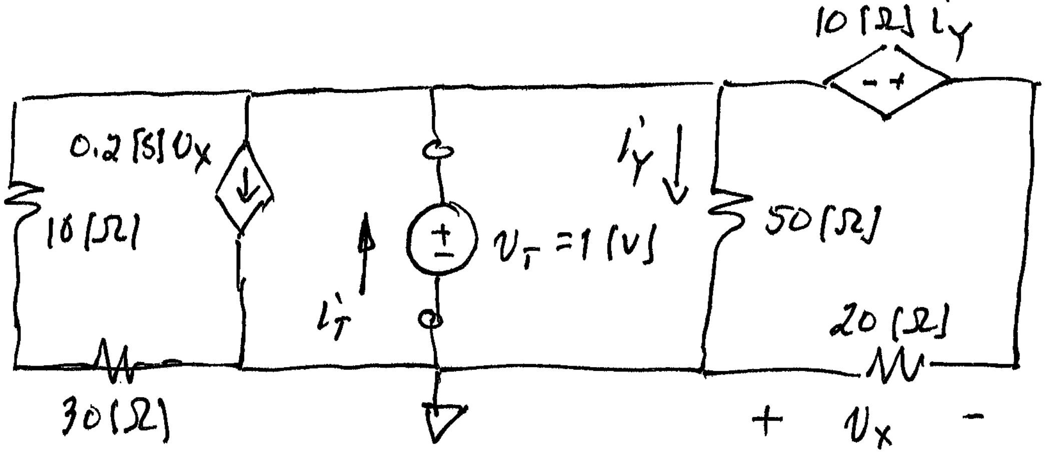
so $v_X = 0$

so $0.2\, v_X = 0$

so $i'_{sc} = 0$

So the Norton current is 0. Let's find the Norton resistance...

Room for extra work



We have recognized that 70 [Ω] and 200 [mA] and 8 [V] have no effect, but of course leaving them in gives the same result.

$$i_T' = 0.2 v_X + \frac{1}{40} + \frac{1}{50} + \frac{(-v_X)}{20}$$

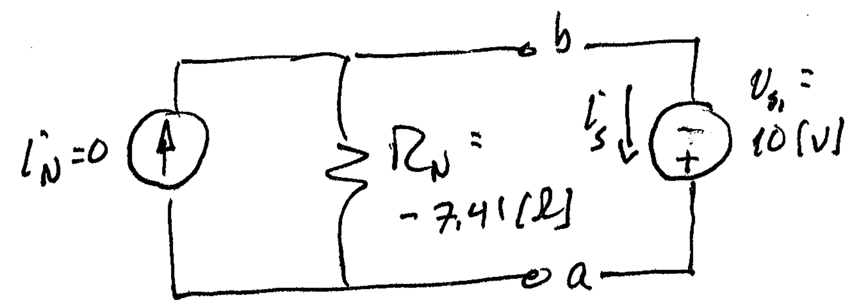
$$-v_X - 1 - 10\, i_Y' = 0 \qquad i_Y' = 1/50$$

$i_T' = -0.135$ [A]

$v_X = -1.2$ [V]

$i_Y' = 20$ [mA]

$$R_N = \frac{1}{i_T} = -7.41 \text{ [V]}$$



$$-10 + i_s'(-7.41) = 0$$

$$i_s' = \frac{10}{-7.41} = -1.35 \text{ [A]}$$

$\therefore$ $P_{del\ by\ v_{s1}} = 10 \cdot i_s' = -13.5$ [W]