Name: _____ (please print)

Signature: _____

ECE 2201 – Quiz #5
June 28, 2019

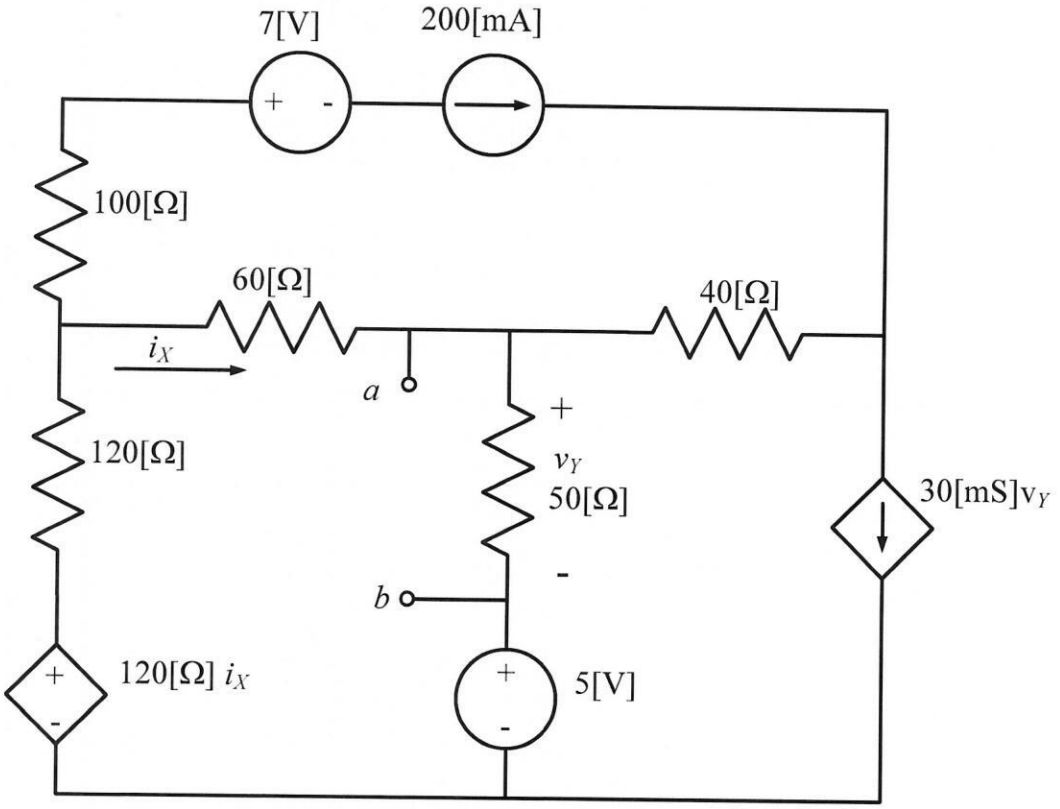
Keep this quiz closed and face up until you are told to begin.

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. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

_____/25

Room for extra work

a) Find the Thevenin Equivalent of the circuit below at terminals a, b.
b) If a 100 [Ω] resistor is connected across terminals a, b, how much power does it dissipate?



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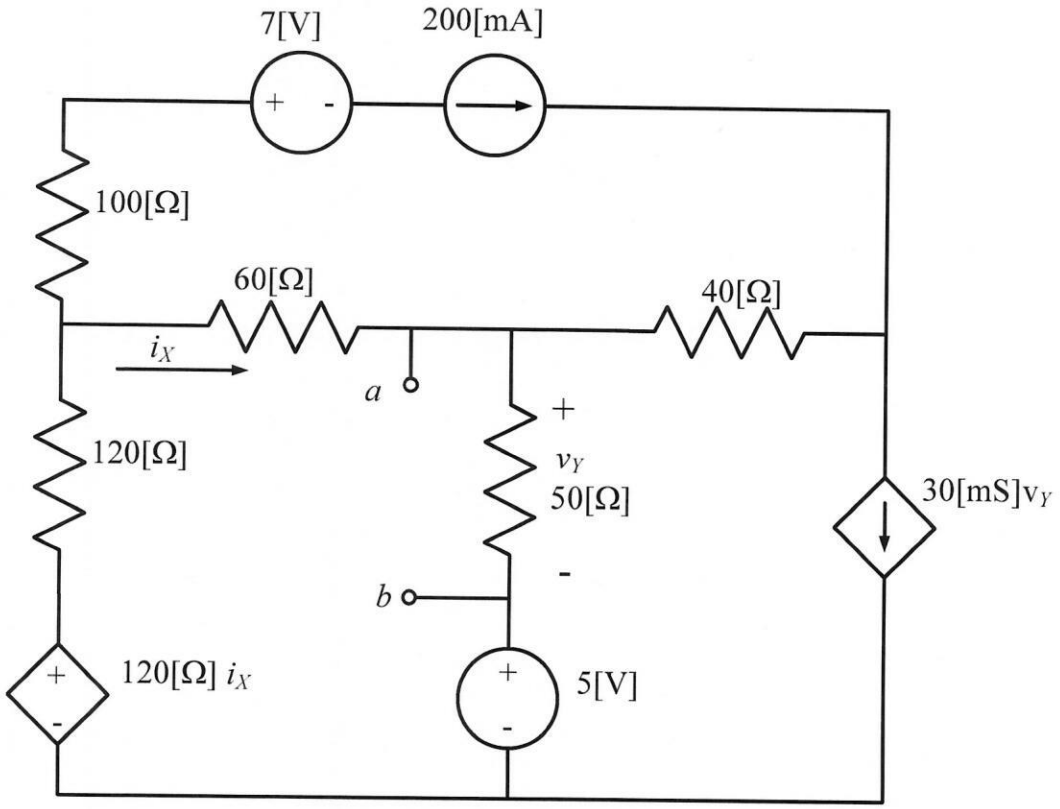


a)

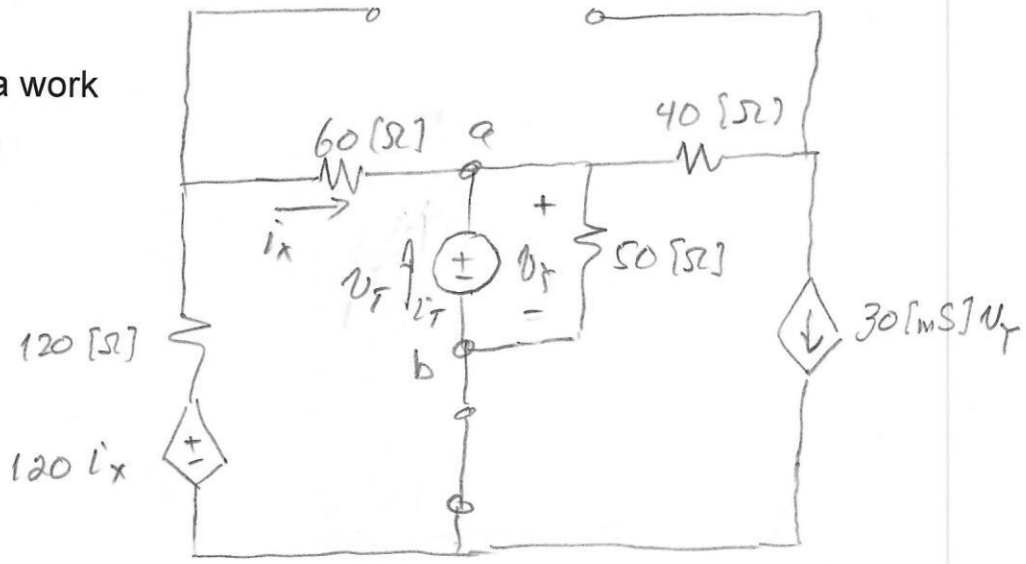
We need two of V_{oc}, i_{sc}, and test source. Of these, V_{oc} is the most difficult, so we should go with the other two. Here, however, we'll do all three to show they are consistent.

pg. 2

Room for extra work

TEST SOURCE:

$v_T = v_T \equiv 1\ [V]$

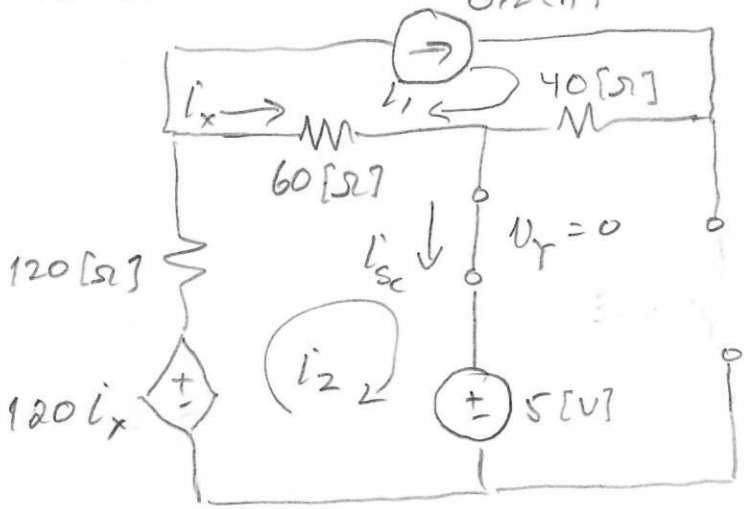


KVL: $60 i_x + 1 - 120 i_x + 120 i_x = 0 \Rightarrow i_x = -\frac{1}{60}\ [A]$

KCL: $-i_T - i_x + \frac{1}{50} + 0.03(1) = 0 \Rightarrow i_T = 0.06667\ [A]$

$\therefore \boxed{R_{Th} = \frac{v_T}{i_T} = \frac{1}{0.06667} = 15\ [\Omega]}$

SHORT-CIRCUIT CURRENT



$i_1 = 0.2\ [A]$

$-120 i_x + 120 i_2 + 60 i_x + 5 = 0$

$i_x = i_2 - i_1$

$\boxed{i_{sc} = i_2 = -0.28333\ [A]}$

p. 4

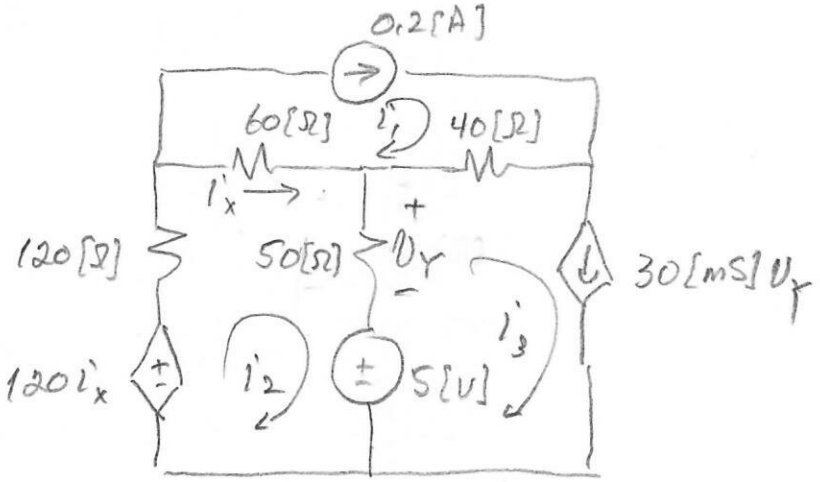
$\therefore \boxed{V_{Th} = R_{TH} \cdot i_{sc} = -4.25\ [V]}$

Note that 7 [V] and 100 [Ω] are in series with a current source and so will have no affect.

Room for extra work

we could stop now and move on to part b, but let's find V_{oc}.

$V_T = V_{oc}$



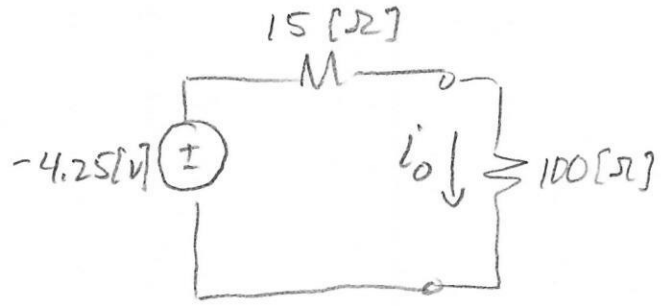
$i_1' = 0.2$ [A] $\qquad i_3' = 0.03\, V_T$

$-120 i_x' + 120 i_2' + i_x' + V_T + 5 = 0$

$i_x' = i_2' - i_1' \qquad V_x = 50(i_2' - i_3')$

$V_T = V_{oc} = -4.25$ [V] so this checks out!

b)



$i_o' = \dfrac{-4.25}{115} = -36.957$ [mA]

$\therefore \; P_{del\ to\ 100\Omega} = i_o'^2 \cdot 100$

$= 136.58$ [mW]