Name: _____ (please print)

Signature: _____

ECE 2201 – Quiz #5
November 17, 2021

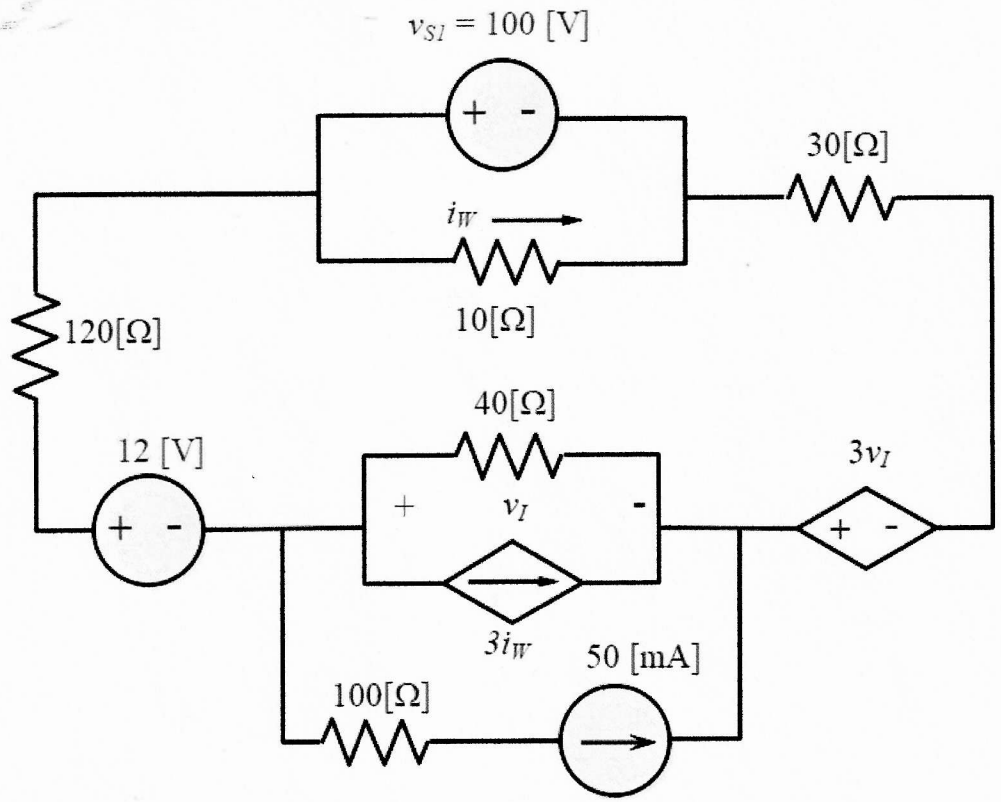
- This quiz is closed book, closed notes. You may have one 8 ½" x 11" piece of paper, written on both sides, as a crib sheet.
- Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not 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.

_____/25

Room for extra work

For the circuit below, do the following.

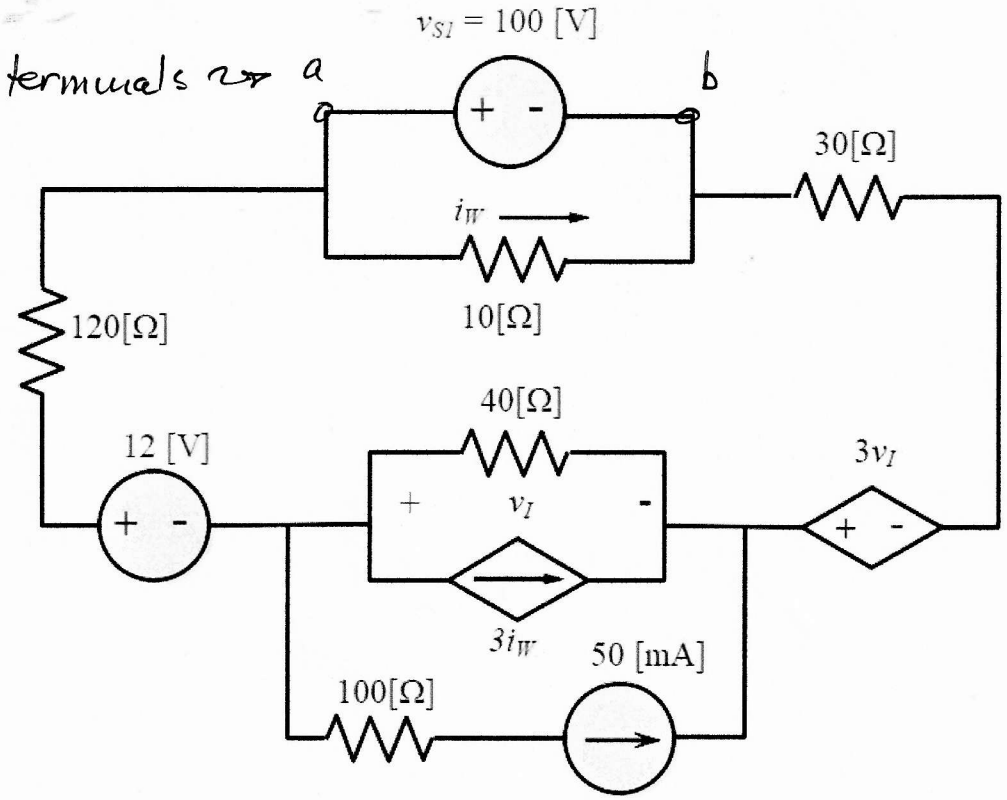
a) Find the Norton equivalent circuit seen by the independent voltage source v_{S1}.
b) Find the power delivered to v_{S1} by the circuit.



Room for extra work

For the circuit below, do the following.

a) Find the Norton equivalent circuit seen by the independent voltage source v_{SI}.
b) Find the power delivered to v_{SI} by the circuit.



Identify terminals a & b

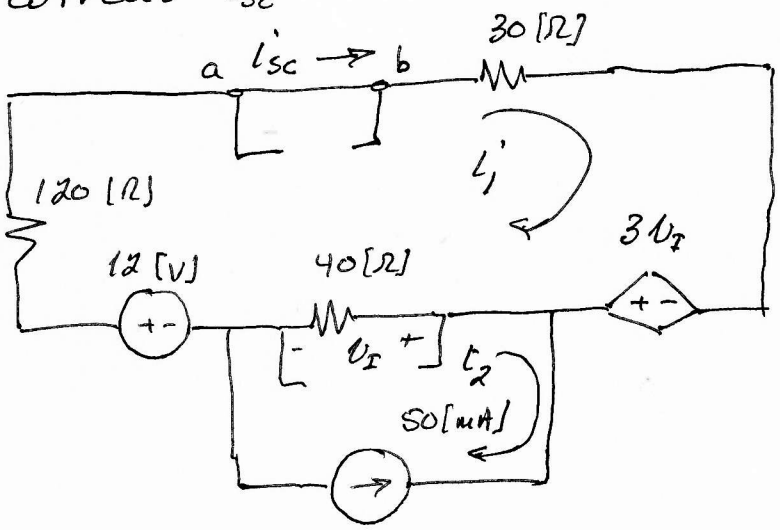
It should be clear that finding the short-circuit current and using a test source result in significant simplification of the circuit. We will do those things first, and then do open-circuit voltage as a check.

Room for extra work

Short-circuit current i'_{sc}:

$i'_w \to 0$

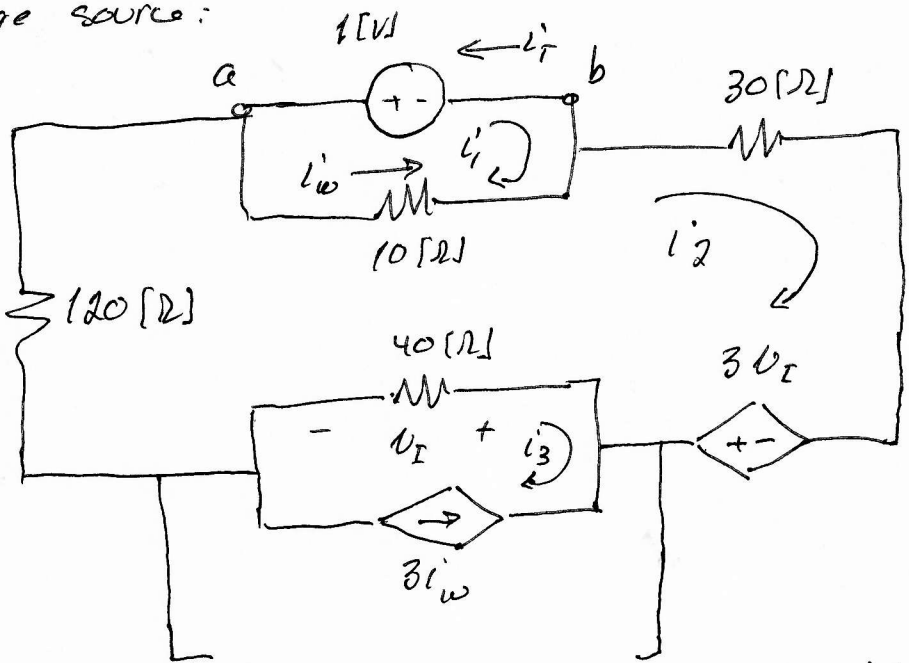
$\Rightarrow 3i'_w \to 0$



$150 i'_1 - 3v_I + v_I - 12 = 0$ $\quad v_I = 40(i'_1 - i'_2)$ $\quad i'_2 = -0.05$ [A]

$\Rightarrow \boxed{i'_1 = i'_{sc} = 0.22857 \text{ [A]}}$ $\quad v_I = 11.14$ [V] $\quad i'_N = i'_{sc}$

Test voltage source:



$i'_T = -i'_1$

$= -0.22857$ [A]

$v_T = 25.143$ [V]

$\boxed{R_N = 1/i'_T = -4.375 \text{ [V]}}$

$1 + 10(i'_1 - i'_2) = 0$

$10(i'_2 - i'_1) + 150 i'_2 - 2v_I = 0$

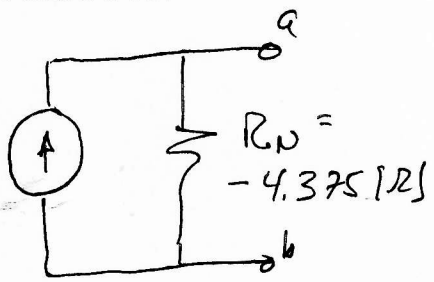
$i'_3 = -3i'_w$

$v_I = 40(i'_2 - i'_3)$

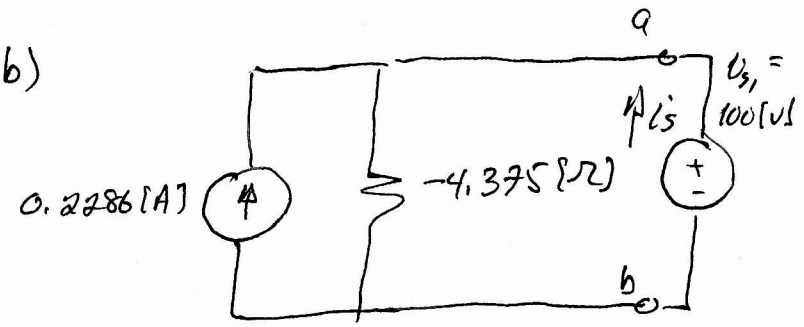
$i'_w = 1/10 = 0.1$ [A]

Room for extra work

a)



b)



$$-i_s - 0.2286 + \frac{100}{-4.375} = 0 \qquad i_s = -23.086\ [A]$$

$$P_{del\ to\ v_{s_1}} = P_{abs\ by\ v_{s_1}} = -100\, i_s = 2308.6\ [W]$$

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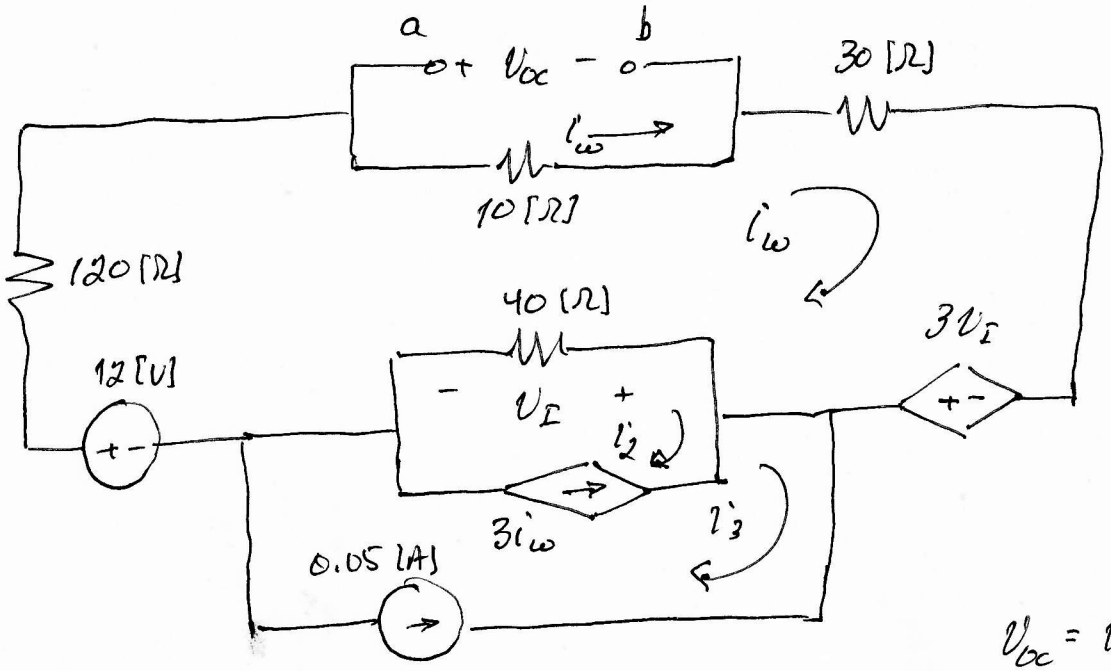
open-circuit voltage v_{oc}:



$$160\, i_\omega - 2v_I - 12 = 0$$

$$i_3 - i_2 = 3i_\omega$$

$$i_3 = -0.05\ [A]$$

$$v_I = 40(i_\omega - i_2)$$

$$\left.\begin{aligned} i_\omega &= -0.1\ [A] \\ v_I &= -14\ [V] \\ i_2 &= 0.25\ [A] \end{aligned}\right\}$$

$$v_{oc} = 10\, i_\omega = -1\ [V]$$

$$R_N = \frac{v_{oc}}{i_{sc}} = -4.375\ [\Omega]$$