Name: _____ (please print)

Signature: _____

ECE 2202 – Quiz 1

September 5, 2024

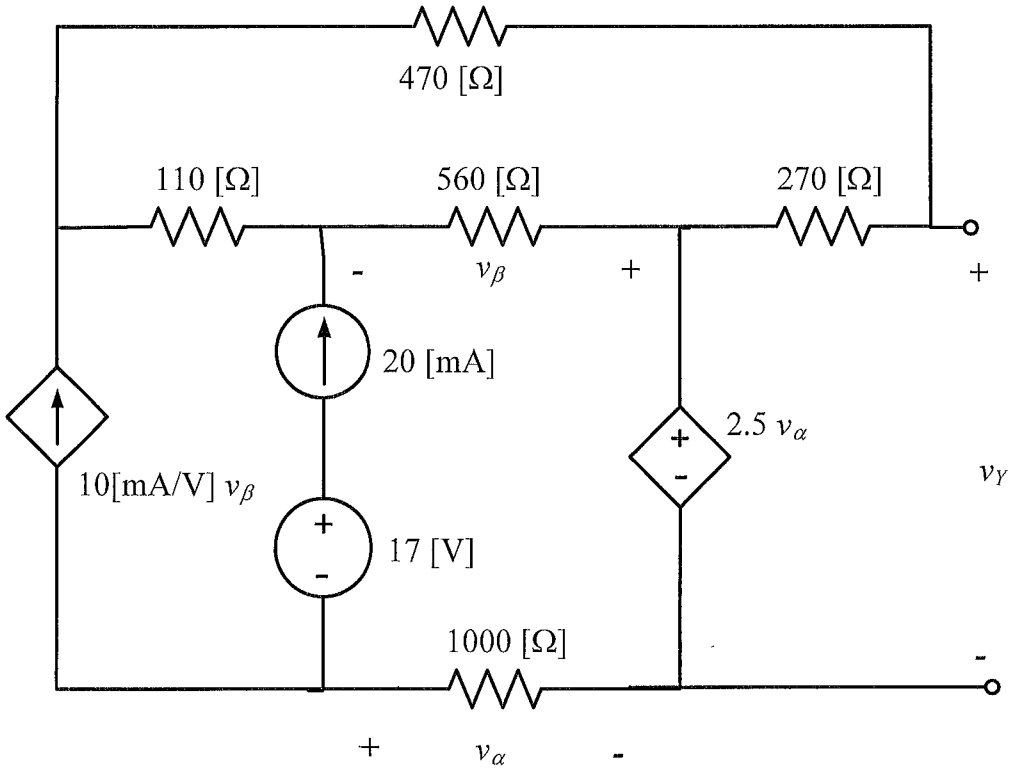
1. This quiz is closed book, closed notes. You may have one 8.5 x 11" crib sheet.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, 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.

_____/20

Room for extra work

For the circuit shown:

a) Find the Thevenin equivalent as seen by the 560 [Ω] resistor. Draw the Thevenin equivalent circuit, carefully labeling the Thevenin parameters.
b) In the original circuit, a 1200 [Ω] resistor is placed in parallel with the 560 [Ω] resistor. What is the new Thevenin equivalent seen by the 560 [Ω] resistor?



Room for extra work

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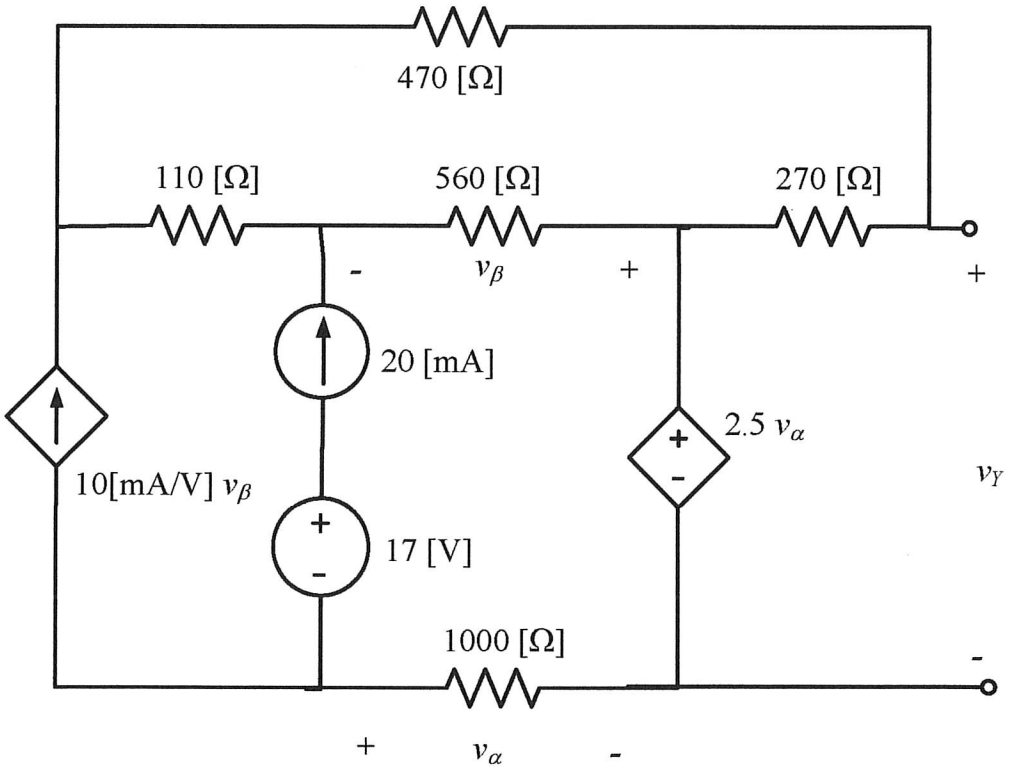
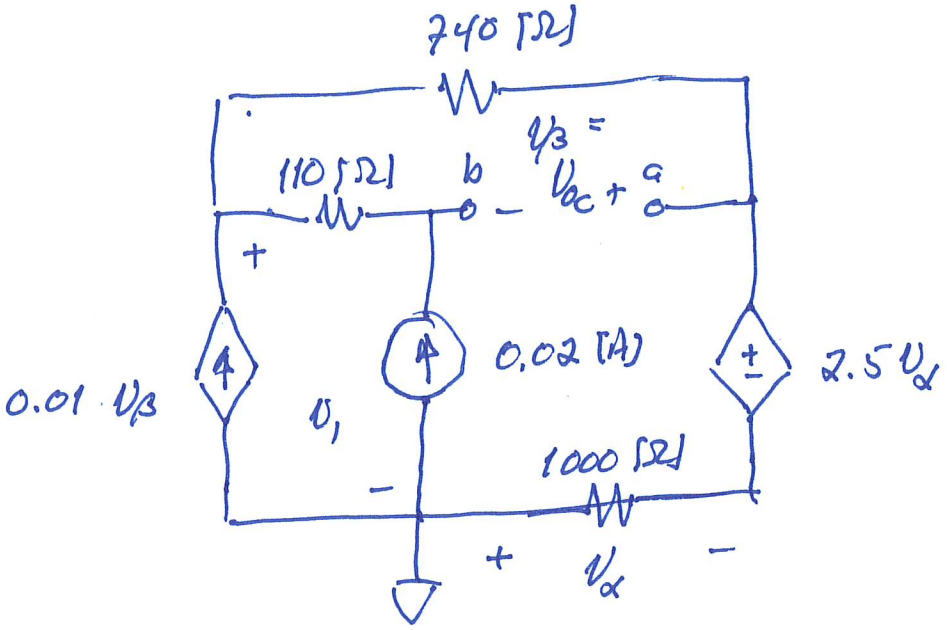


We need to choose two of open-circuit voltage, short-circuit current, and test source. Since short circuit current will make $V_\beta = 0$, this will simplify things. So will a test source, which removes the branch with the 20 [mA] source. These two things are the best way to go, but we will do all three.

R_{TH}: remove 560 [Ω] and replace with a test source.

Also note that since we don't need V_β for anything, we can combine 270 [Ω] and 3 [470 [Ω] in series.

Room for extra work



$$\frac{v_1 - 2.5 v_\alpha}{1740} - 0.02 - 0.01 v_\beta = 0$$

$$v_\alpha = \frac{v_1 - 2.5 v_\alpha}{1740} \cdot 1000$$

$$v_\beta = 0.02(110) + \frac{v_1 - 2.5 v_\alpha}{1740} \cdot 940$$

$v_1 = -0.8154$ [V]

$v_\alpha = -0.1923$ [V]

$v_\beta = -2.02$ [V]

+14

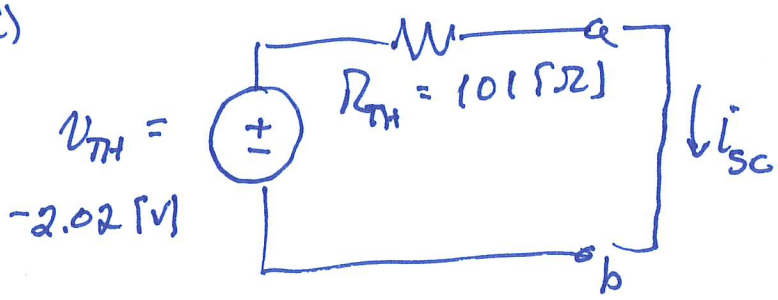
$v_{oc} = v_\beta = -2.02$ [V] so this checks!

2' 2'

Room for extra work

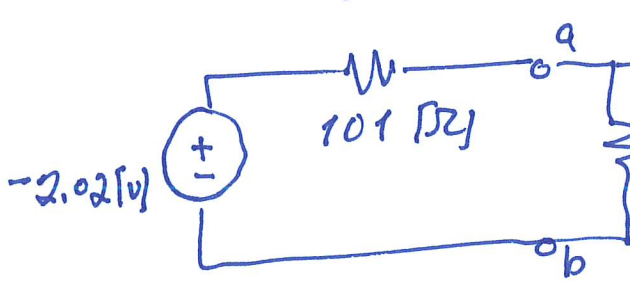
For i'_{sc} directed from a to b as shown...

a)



+6

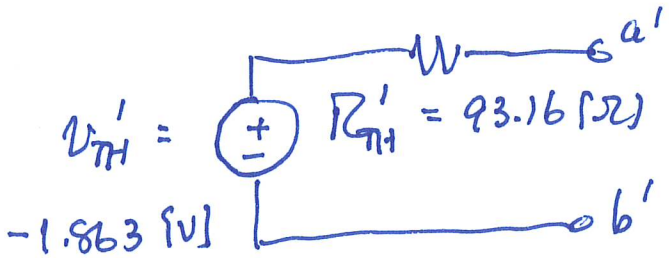
b) With 1200 [Ω] in parallel with 560 [Ω], the new Thevenin Equivalent seen by 560 [Ω] is...



$$V_{oc} = -2.02 \cdot \frac{1200}{1200+101}$$

$$= -1.863\ [V]$$

+6

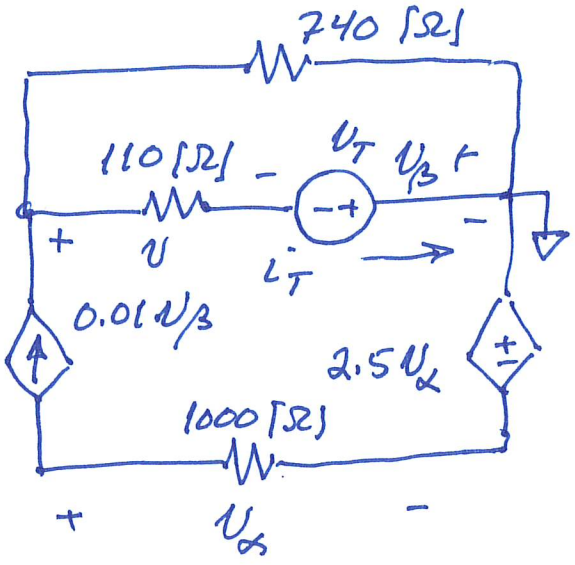


$$R'_{TH} = 1200 \,//\, 101 = 93.16\ [\Omega]$$

Let's also do open-circuit voltage...

→ pg 2'

Room for extra work



$v_T = 1$ [V]

$\frac{v}{740} + \frac{v+1}{110} - 0.01 v_\beta = 0$

$v_\beta = v_T = 1$ [V]

$\Rightarrow v = 72.125$ [V]

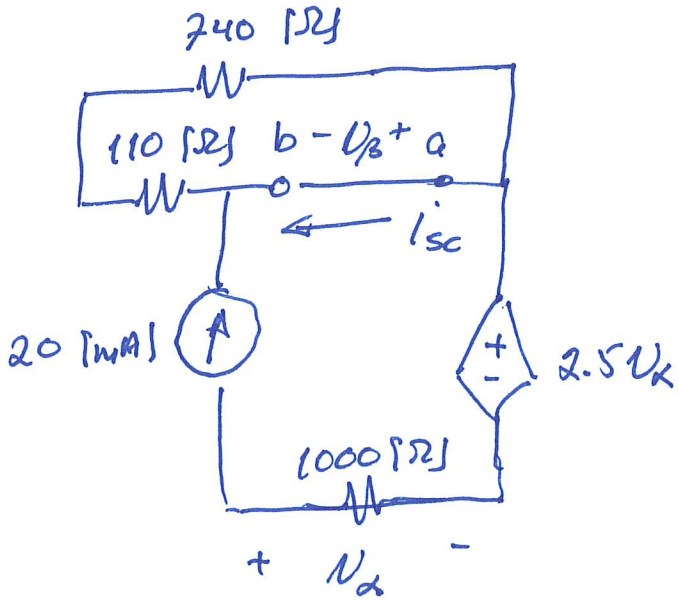
$i_T - 0.01(1) + \frac{v}{740} = 0 \Rightarrow i_T = 9.902$ [mA]

+14

$\therefore R_{TH} = 101$ [Ω]

Short-circuit current:

Remove 560 [Ω] and replace with a short $\Rightarrow v_\beta = 0$.



740 [Ω] and 110 [Ω] are shorted, so ...

$i_{sc} = -0.02$ [A]

$\therefore v_{TH} = R_{TH} \cdot i_{sc} = -2.02$ [V]

+14

pg 2