

Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #5
July 16, 2015

**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.

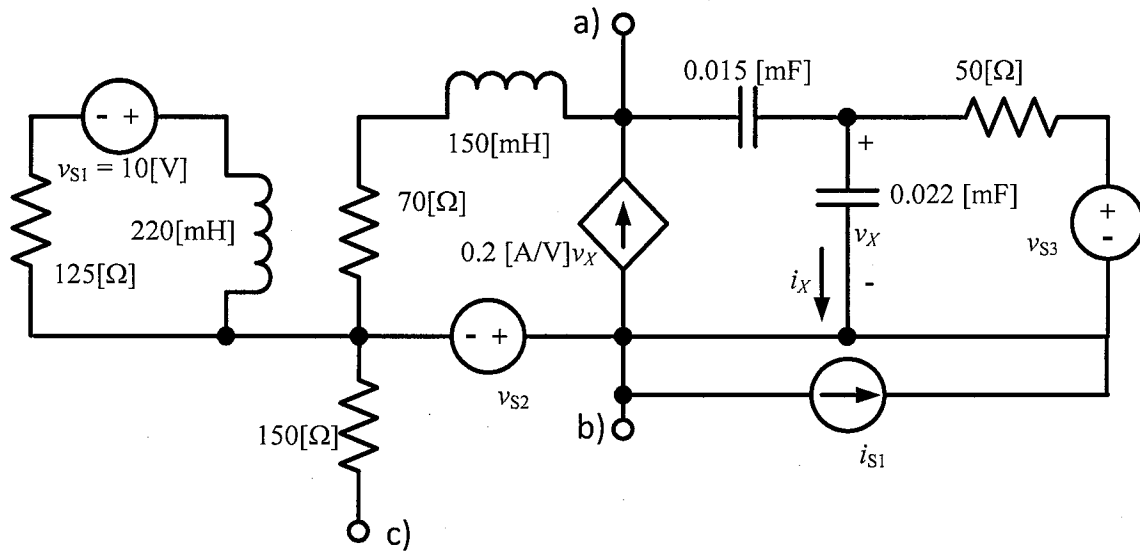
_____ /25

For the circuit below, find the Thevenin Equivalent in the time domain with respect to terminals a), b). Draw the Thevenin Equivalent circuit, and carefully label the parameters.

$$v_{s2} = 250[\text{mV}] \cos(1000t + 22^\circ)$$

$$v_{s3} = 175[\text{mV}] \sin(1000t - 22^\circ)$$

$$i_{s1} = 200[\text{mA}] \cos(1000t)$$



Room for extra work

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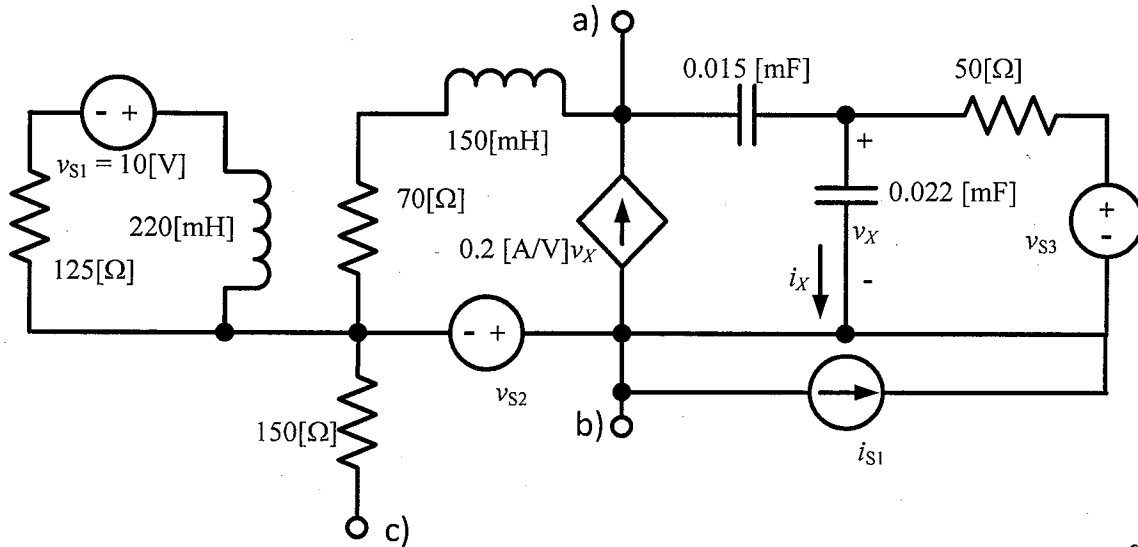
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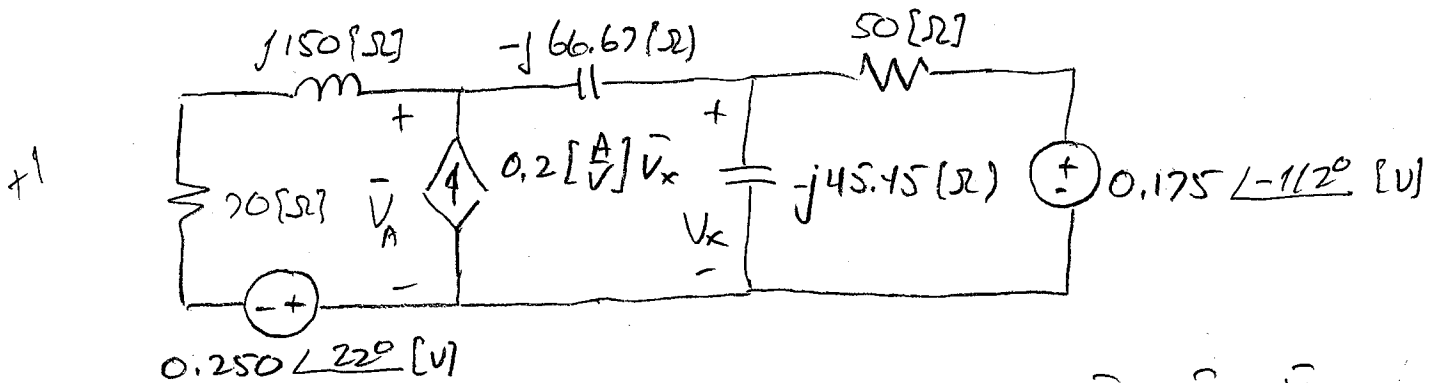
$$v_{s2} = 250[\text{mV}] \cos(1000[\text{rad/s}] t + 22^\circ)$$

$$v_{s3} = 175[\text{mV}] \sin(1000[\text{rad/s}] t - 22^\circ)$$

$$i_{s1} = 200[\text{mA}] \cos(1000[\text{rad/s}] t)$$



We will convert to phasor domain and remove the irrelevant components. We also need to convert sin to cos: $\sin(1000[\text{rad/s}] t - 22^\circ) = \cos(1000[\text{rad/s}] t - 112^\circ)$.



$$\frac{\hat{V}_A + 0.25 \angle 22^\circ}{70 + j150} - 0.2 \hat{V}_x + \frac{\hat{V}_A - \hat{V}_x}{-j66.67} = 0$$

$$\frac{\hat{V}_x}{-j45.45} + \frac{\hat{V}_x - 0.175 \angle -112^\circ}{50} + \frac{\hat{V}_x - \hat{V}_A}{-j66.67} = 0$$

$$\hat{V}_A = \hat{V}_{oc} = \hat{V}_{TH}$$

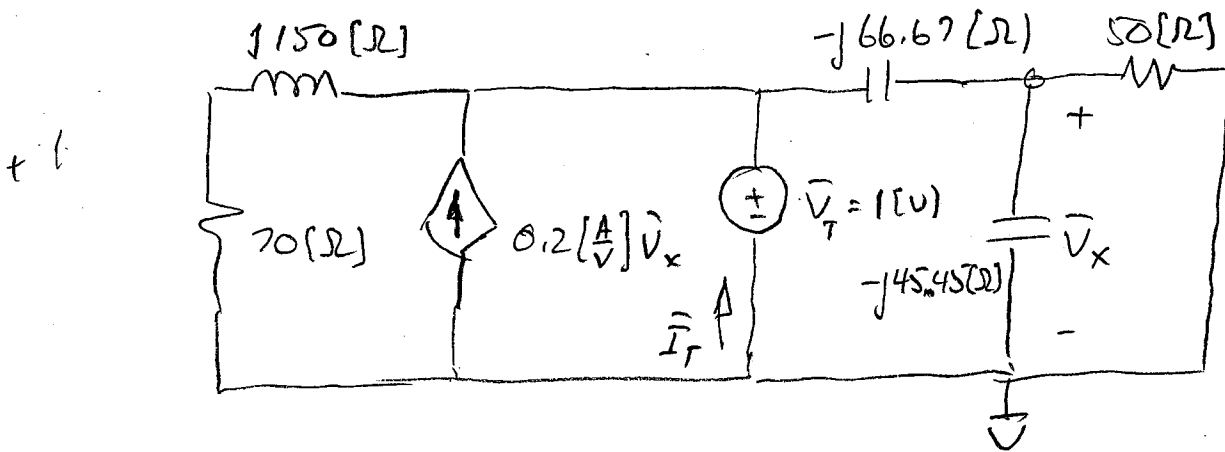
$$\hat{V}_{TH} = 0.2864 - j0.09362 [\text{V}]$$

$$= 0.2730 \angle -29.06^\circ [\text{V}]$$

$$\hat{V}_x = 0.01362 + j0.00486 [\text{V}]$$

$$= 0.01446 \angle 19.58^\circ [\text{V}]$$

Room for extra work



+3 +1
$$\frac{\hat{V}_x}{50} + \frac{\hat{V}_x - 1}{-j66.67} + \frac{\hat{V}_x}{-j45.45} = 0 \Rightarrow \hat{V}_x = 0.357 \angle 28.39^\circ \text{ [V]}$$

$$0.314 + j0.170 \text{ [V]}$$

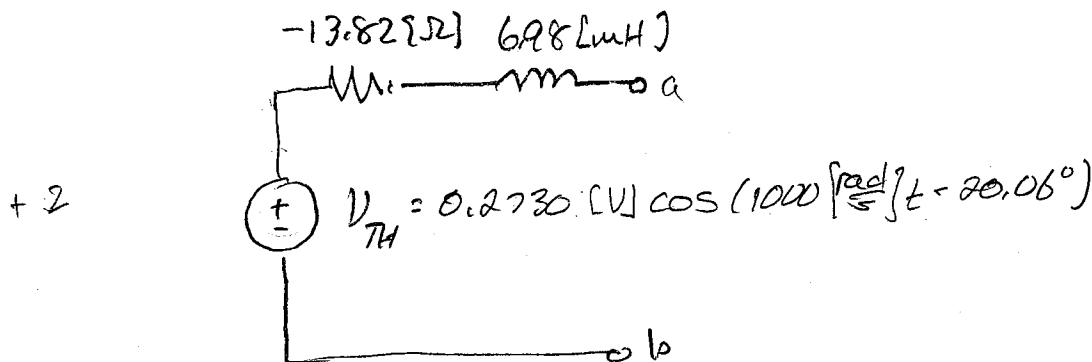
+3 +1
$$\hat{I}_T = \frac{1 - \hat{V}_x}{-j66.67} - 0.2 \hat{V}_x + \frac{1}{70 + j150} = 0.0646 \angle -153.2^\circ \text{ [A]}$$

$$-0.0577 - j0.0291 \text{ [A]}$$

+2
$$Z_{TH} = \frac{1}{\hat{I}_T} = 15.48 \angle 153.2^\circ \text{ [\Omega]} = -13.82 + j6.980 \text{ [\Omega]}$$

$$15.48 \angle 153.2^\circ \text{ [\Omega]}$$

+1 So we have
$$j6.980 = j\omega L \Rightarrow L = 6.98 \text{ [mH]}$$



+2
$$\hat{I}_{50} = \frac{\hat{V}_{oc}}{Z_{TH}} = \begin{cases} 0.0176 \angle -173.3^\circ \text{ [A]} \\ -0.0175 - j0.00206 \text{ [A]} \end{cases}$$