

23W-EC ENGR-10-LEC-1 Hw #6

SANJIT SARDA

TOTAL POINTS

76 / 100

QUESTION 1

Problem 1 15 pts

1.1 (a) 2 / 5

- 0 pts Correct

- 5 pts Totally wrong method when doing Norton Equivalent.

Correct Norton Equivalent but calculating wrong with Isc or Zout.

✓ - 1.5 pts *Wrong value with Isc.*

✓ - 1.5 pts *Wrong value with Zout.*

- 2 pts Confused norton with thevenin circuit when plotting, though got correct Isc and Zout.

1.2 (b) 2 / 5

- 0 pts Correct

- 5 pts Totally wrong method when doing Norton Equivalent.

Correct Norton Equivalent but calculating wrong with Isc or Zout.

✓ - 1.5 pts *Wrong value with Isc.*

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- 2 pts Confused norton with thevenin circuit when plotting, though got correct Isc and Zout.

1.3 (c) 2 / 5

- 0 pts Correct

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Correct Norton Equivalent but calculating wrong with Isc or Zout.

✓ - 1.5 pts *Wrong value with Isc.*

✓ - 1.5 pts *Wrong value with Zout.*

- 2 pts Confused norton with thevenin circuit when plotting, though got correct Isc and Zout.

QUESTION 2

2 Problem 2 15 / 15

✓ - 0 pts Correct

- 3.5 pts Correct Vth expression but have calculation error leading to incorrect Vth value.

- 3.5 pts Correct Rth expression but have calculation error leading to incorrect Rth value.

- 10 pts Incorrectly using KCL and KVL calculating Vo or Rth when doing Thevenin equivalent.

QUESTION 3

Problem 3 20 pts

3.1 (a) 10 / 10

✓ - 0 pts Correct

- 5 pts Incorrect superposition due to current source only.

- 5 pts Incorrect superposition due to voltage

source only.

- 4 pts Incorrectly solving.

3.2 (b) 10 / 10

✓ - 0 pts Correct

- 5 pts Incorrect superposition due to current source only.

- 5 pts Incorrect superposition due to voltage source only.

QUESTION 4

Problem 4 25 pts

4.1 (a) 5 / 5

✓ - 0 pts Correct

- 5 pts Incorrect plot

4.2 (b) 10 / 10

✓ - 0 pts Correct

- 3 pts Incorrectly apply KVL in loop1

- 3 pts Incorrectly apply KVL in loop2

- 4 pts Incorrect solving

4.3 (c) 0 / 10

- 0 pts Correct

✓ - 3 pts Incorrectly apply KVL in loop1

✓ - 3 pts Incorrectly apply KVL in loop2

✓ - 4 pts Incorrect solving

QUESTION 5

5 Problem 5 10 / 10

✓ - 0 pts Correct

- 2 pts Plotting incorrectly on the equivalent circuit for calculating impedance

- 2 pts Incorrectly applying KVL

- 2 pts Incorrectly applying KCL

QUESTION 6

6 Problem 6 10 / 15

- 0 pts Correct

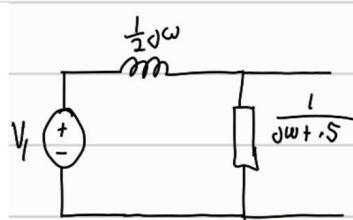
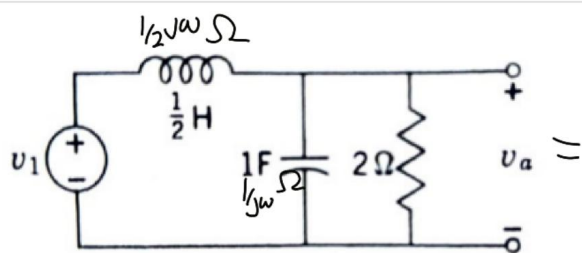
- 4 pts Incorrect voltage and current equations

- 6 pts Incorrectly apply KVL

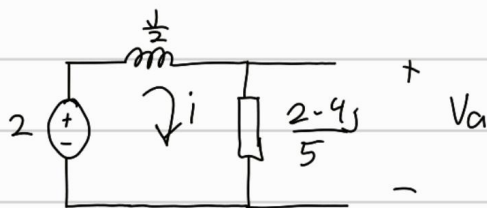
✓ - 5 pts Incorrectly solving

ECE HW 6

①



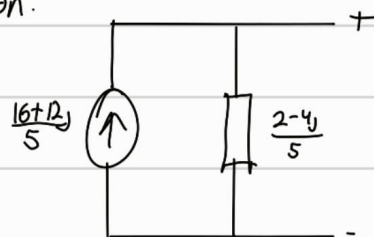
② $V_1 = 2 \cos t \therefore \omega = 1$



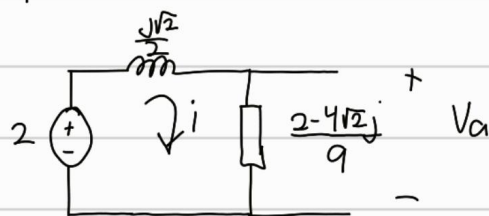
$$V = Zi \therefore 2 = i \left(\frac{1}{2} + \frac{2-4j}{5} \right)$$

$$2 = \frac{i(4-3j)}{10} \therefore i = \frac{16+12j}{5}$$

\therefore Norton:



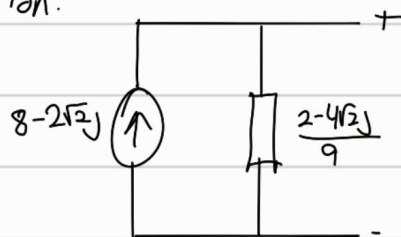
③ $V_1 = 2 \cos \sqrt{2} t \therefore \omega = \sqrt{2}$



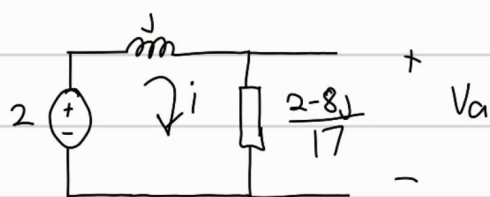
$$V = Zi \therefore 2 = i \left(\frac{j\sqrt{2}}{2} + \frac{2-4j\sqrt{2}}{9} \right)$$

$$2 = i \left(\frac{4+j\sqrt{2}}{18} \right) \therefore i = 8-2\sqrt{2}j$$

\therefore Norton:



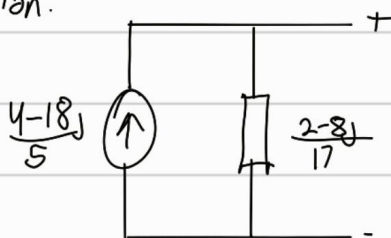
④ $V_1 = 2 \cos 2t \therefore \omega = 2$



$$V = Zi \therefore 2 = i \left(j + \frac{2-8j}{17} \right)$$

$$2 = i \left(\frac{2+9j}{17} \right) \therefore i = \frac{4-18j}{5}$$

\therefore Norton:



1.1 (a) 2 / 5

- 0 pts Correct

- 5 pts Totally wrong method when doing Norton Equivalent.

Correct Norton Equivalent but calculating wrong with I_{sc} or Z_{out} .

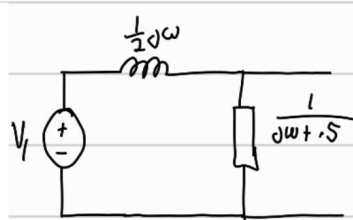
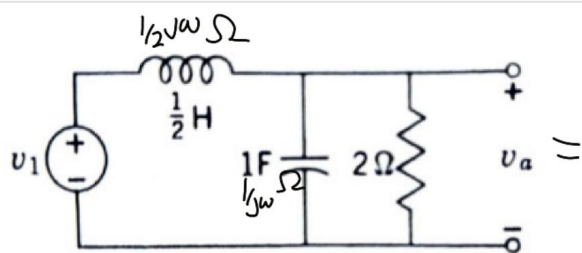
✓ - 1.5 pts *Wrong value with I_{sc} .*

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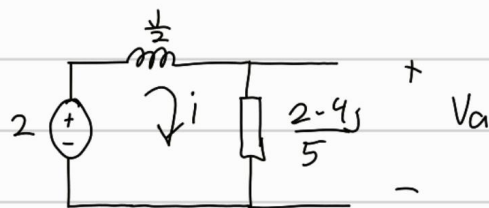
- 2 pts Confused norton with thevenin circuit when plotting, though got correct I_{sc} and Z_{out} .

ECE HW 6

①



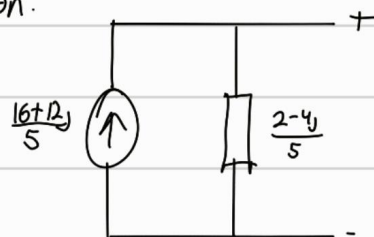
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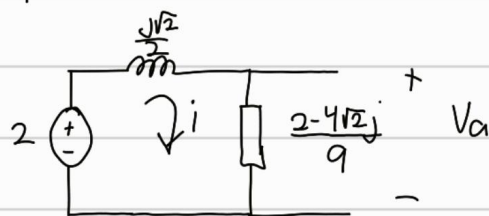
$$V = Zi \therefore 2 = i \left(\frac{1}{2} + \frac{2-j}{5} \right)$$

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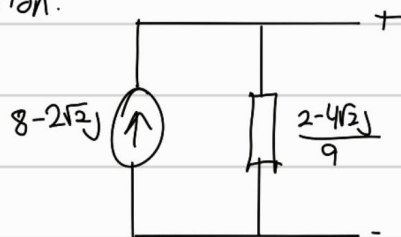
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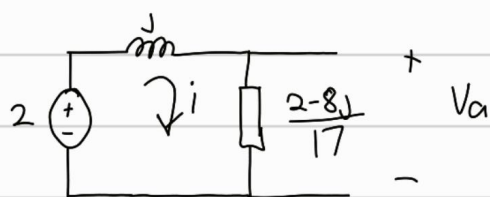
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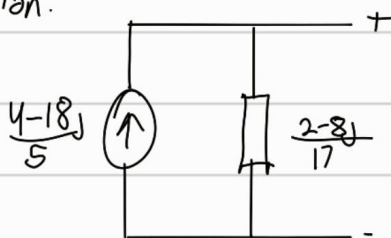
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1.2 (b) 2 / 5

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Correct Norton Equivalent but calculating wrong with I_{sc} or Z_{out} .

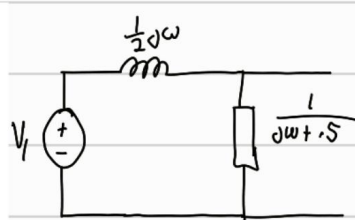
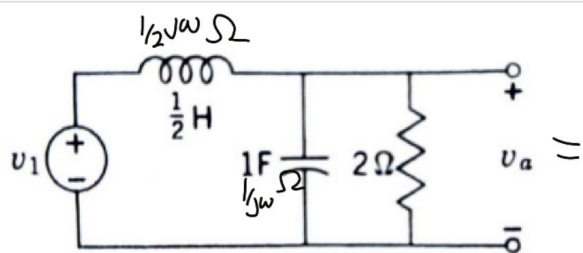
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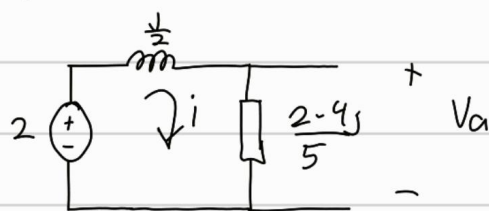
- 2 pts Confused norton with thevenin circuit when plotting, though got correct I_{sc} and Z_{out} .

ECE HW 6

①



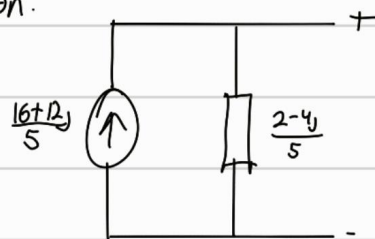
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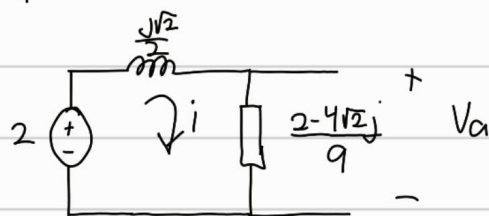
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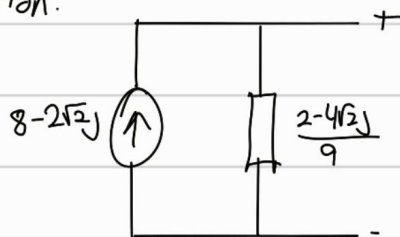
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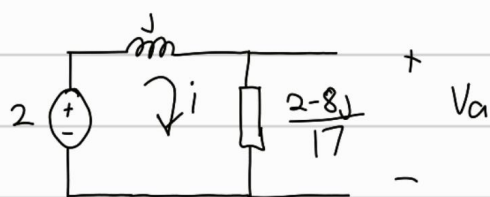
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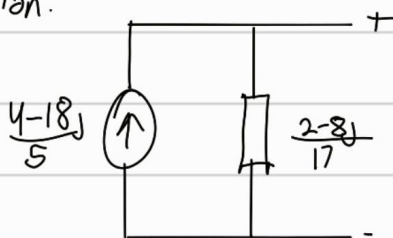
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\therefore Norton:



1.3 (C) 2 / 5

- 0 pts Correct

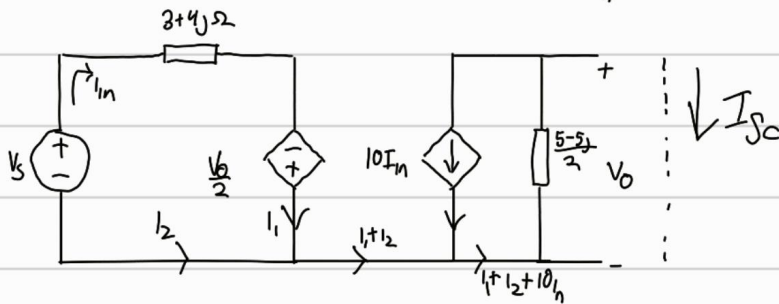
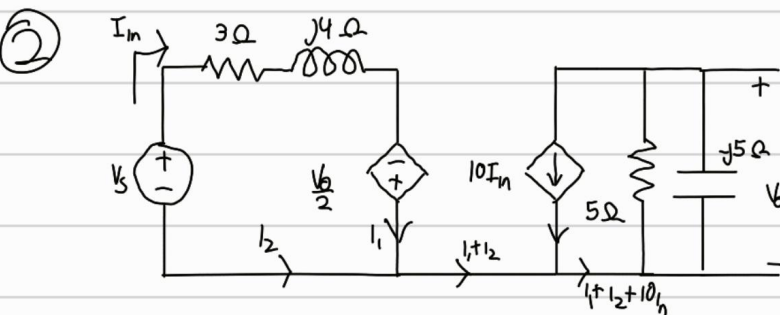
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✓ - 1.5 pts *Wrong value with Z_{out} .*

- 2 pts Confused norton with thevenin circuit when plotting, though got correct I_{sc} and Z_{out} .



Open

$$V_s - I_n(3 + j4) + \frac{V_b}{2} = 0 \quad I_n = \frac{3 + j17}{625} V_s$$

$$\frac{V_b}{\frac{5-j5}{2}} + 10I_n = 0 \quad \therefore -10I_n = \frac{2V_b}{5-j5}$$

$$V_b = \frac{14j - 48}{25} V_s$$

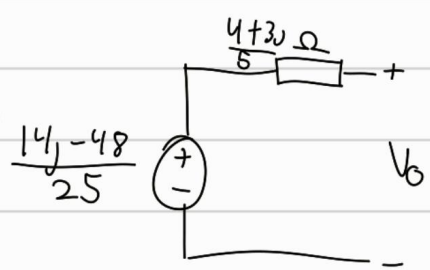
Short

$$I_{sc} = -10I_n, \quad V_s = I_n(3 + j4) \quad R_{TH} = \frac{V_b}{I_{sc}} = \frac{14j - 48}{75} \cdot \frac{5}{8j - 6} = \frac{4 + j3}{5} \Omega$$

$$I_n = \frac{3 - j4}{25} V_s$$

$$I_{sc} = \frac{8j - 6}{5} V_s$$

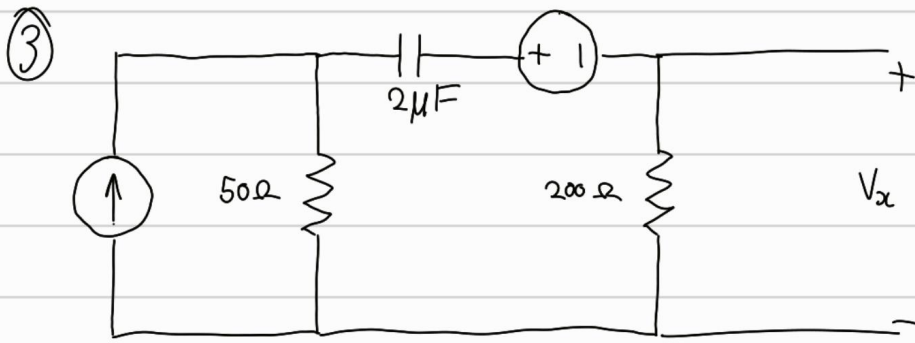
Thevenin!



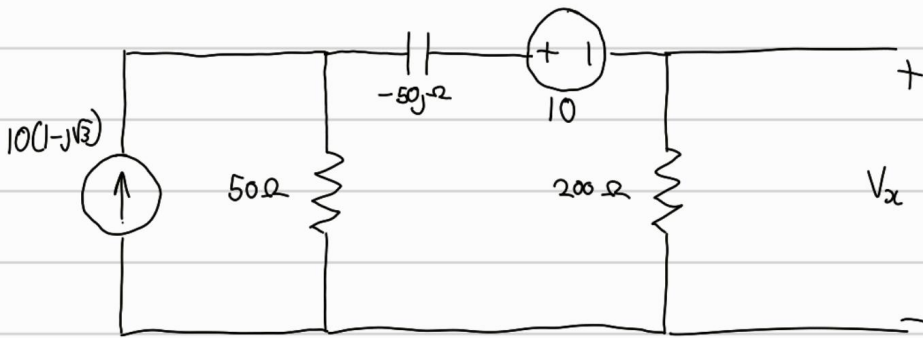
2 Problem 2 15 / 15

✓ - 0 pts Correct

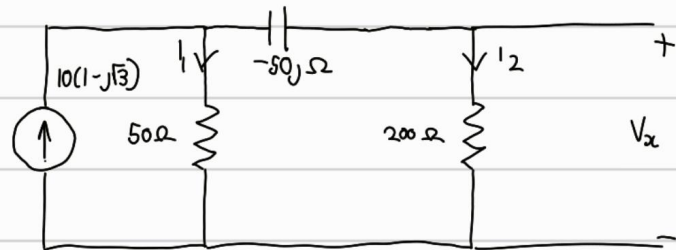
- 3.5 pts Correct Vth expression but have calculation error leading to incorrect Vth value.
- 3.5 pts Correct Rth expression but have calculation error leading to incorrect Rth value.
- 10 pts Incorrectly using KCL and KVL calculating Vo or Rth when doing Thevenin equivalent.



a) $I_B(t) = 20 \cos(10^4 t - \pi/3) \rightarrow 20 e^{-j\pi/3} = 10(1 - j\sqrt{3})$
 $V_a(t) = 10 \cos(10^4 t) \rightarrow 10$



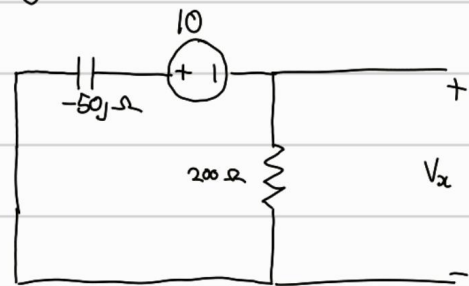
Using superposition
w/o V_a



$$I_2 = \frac{10(1 - j\sqrt{3}) \cdot 50}{50 + 200 - 50j} = \frac{5\sqrt{3} + 25 + (5 - 25\sqrt{3})j}{13}$$

$$V_{X_1} = 200 I_2 = \frac{1000(\sqrt{3} + 5) - 1000(5\sqrt{3} - 1)}{13}$$

w/o C_S



$$V_{X_2} = \frac{200 \cdot -1}{25 - 5j} = \frac{200}{5j - 25} = \frac{20 - 100j}{13}$$

$$V_x = V_{X_1} + V_{X_2} = \frac{1000\sqrt{3} + 4900 + (980 - 5000\sqrt{3})j}{13}$$

$$= \frac{20\sqrt{257426}}{13} \cos(10^4 t - \tan^{-1}\left(\frac{1270\sqrt{3} - 9901}{10505}\right))$$

$$\approx 780.57 \cos(10^4 t - .8585)$$

3.1 (a) 10 / 10

✓ - 0 pts Correct

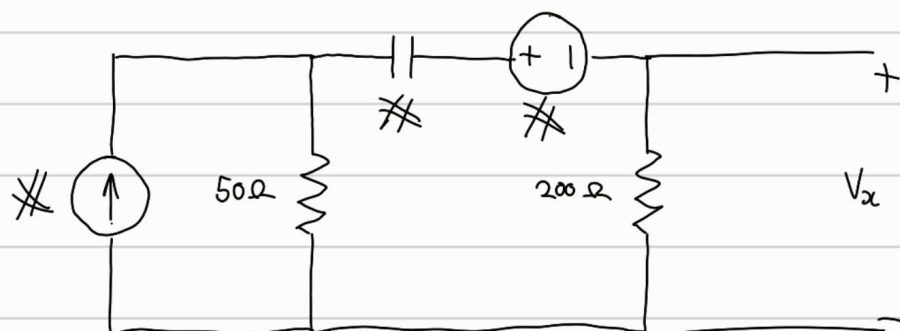
- 5 pts Incorrect superposition due to current source only.

- 5 pts Incorrect superposition due to voltage source only.

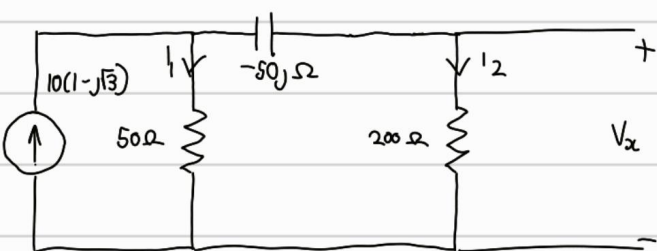
b)

$$I_B(t) = 20 \cos(10^4 t - \pi/3) \rightarrow 20 e^{-j\pi/3} = 10(1 - j\sqrt{3})$$

$$V_a(t) = 10 \cos(10^3 t) \rightarrow 10$$



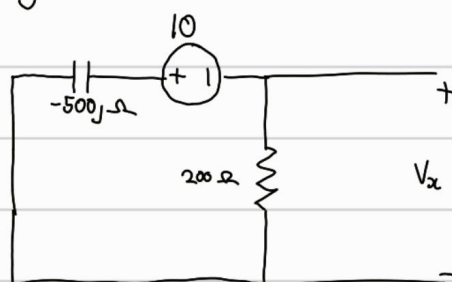
Using superposition
w/o V_a



$$I_2 = \frac{10(1-j\sqrt{3}) \cdot 50}{50 + 200 - 50j} = \frac{5\sqrt{3} + 25 + (5 - 25\sqrt{3})j}{13}$$

$$V_{X_1} = 200 I_2 = \frac{1000(\sqrt{3} + 5) - 1000(5\sqrt{3} - 1)}{13}$$

w/o C_S



$$V_{X_2} = \frac{200 \cdot -10}{250 - 500j} = \frac{200}{50j - 25} = \frac{-8 - 16j}{5}$$

$$V_x = V_{X_1} + V_{X_2} =$$

$$= 785 \cos(10^4 t - 0.85) + 3.58 \cos(10^3 t - 2)$$

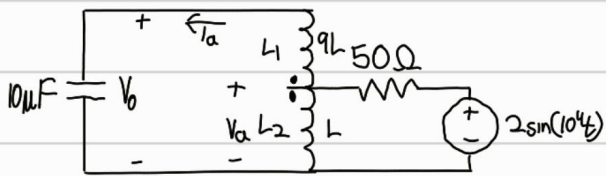
3.2 (b) 10 / 10

✓ - 0 pts Correct

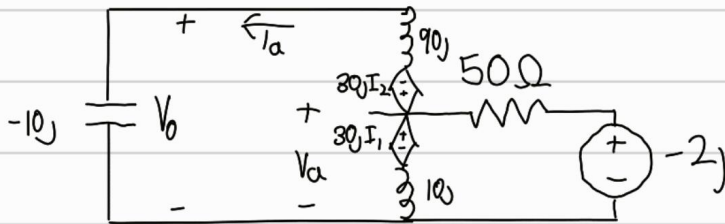
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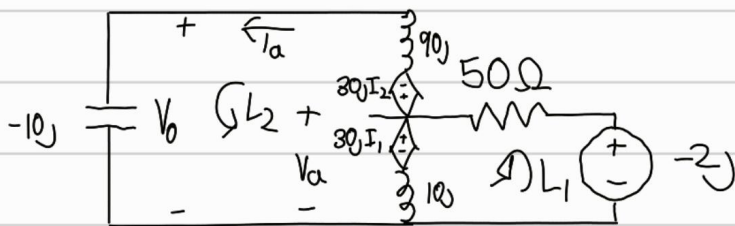
4



a



b



$$(L_1) -2j + I_1(-50 - 30j) + I_2(-50 - 10j) = 0$$

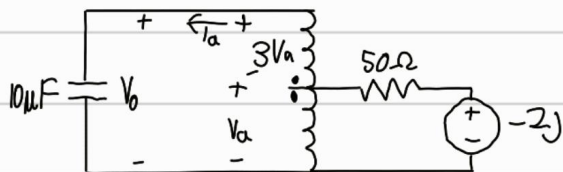
$$(L_2) -30jI_2 - I_1(-90 - 10j) + I_2(10j) + 30jI_1 = 0$$

$$I_1 = \frac{-2}{5}I_2 = \frac{2j}{75 - 5j} = \frac{15j - 1}{565}$$

$$I_2 = \frac{j}{j - 15} = \frac{15j - 1}{226}$$

$$V_a = 30jI_1 + 10jI_2 = \frac{j - 15}{113}$$

c

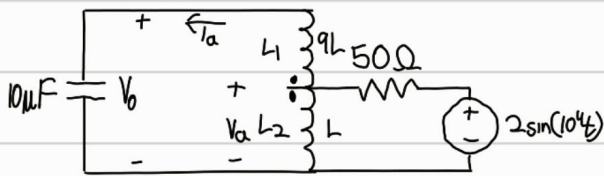


4.1 (a) 5 / 5

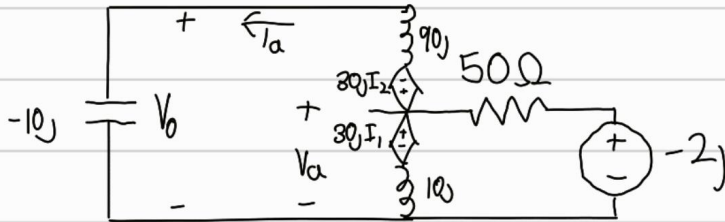
✓ - 0 pts Correct

- 5 pts Incorrect plot

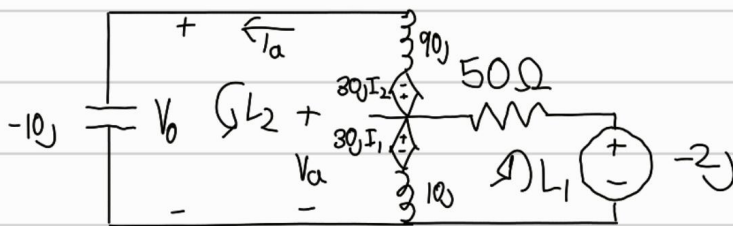
4



a



b



$$L_1 -2j + I_1(-50-30j) + I_2(-50-10j) = 0$$

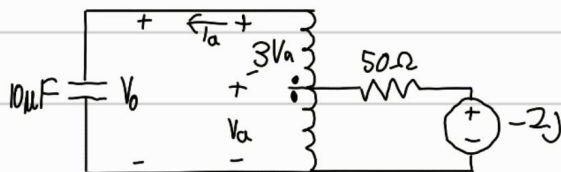
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c



4.2 (b) 10 / 10

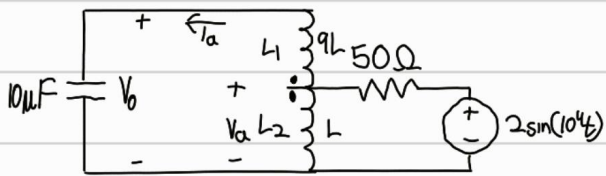
✓ - 0 pts Correct

- 3 pts Incorrectly apply KVL in loop1

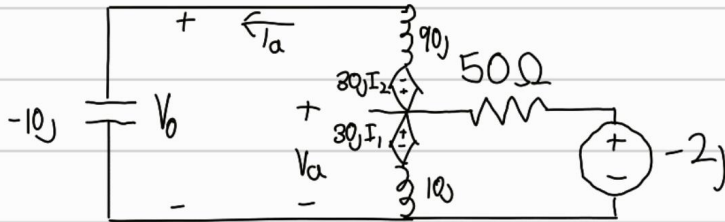
- 3 pts Incorrectly apply KVL in loop2

- 4 pts Incorrect solving

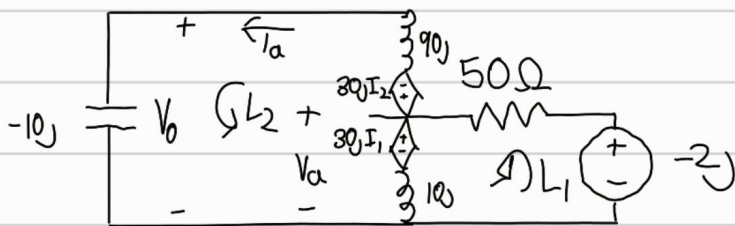
4



a



b



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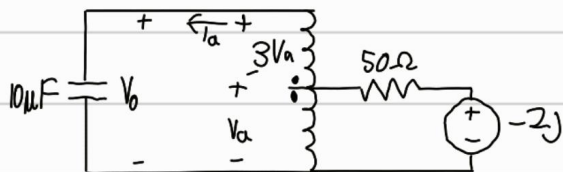
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c



4.3 (c) 0 / 10

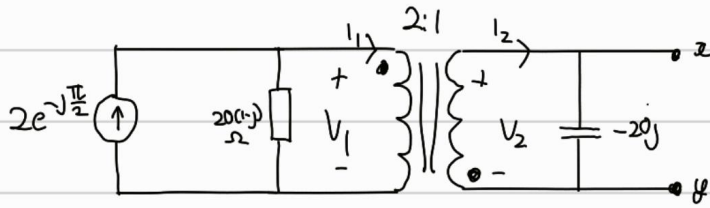
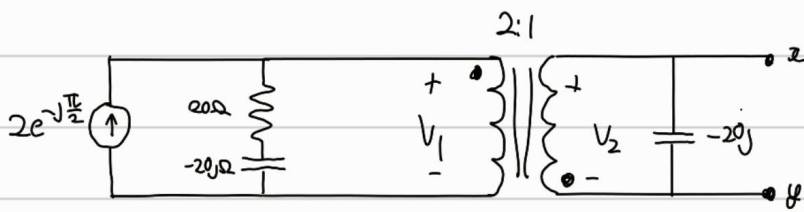
- 0 pts Correct

✓ - 3 pts Incorrectly apply KVL in loop1

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✓ - 4 pts Incorrect solving

5



$$V_2 = 2V_1$$

$$I_2 = -2I_1$$

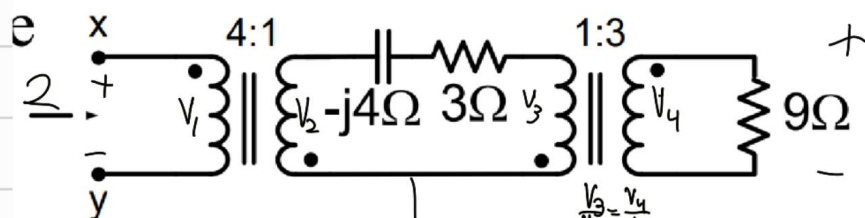
$$\therefore = \begin{array}{|c|} \hline 5-j5 \\ \hline \end{array} \parallel \begin{array}{|c|} \hline -j20 \\ \hline \end{array} = \begin{array}{|c|} \hline \frac{1}{\frac{1}{5-j5} + \frac{1}{j20}} \\ \hline \end{array} = \boxed{\frac{40-60j}{13} \Omega}$$

5 Problem 5 10 / 10

✓ - 0 pts Correct

- 2 pts Plotting incorrectly on the equivalent circuit for calculating impedance
- 2 pts Incorrectly applying KVL
- 2 pts Incorrectly applying KCL
- 4 pts Incorrectly solving.

6)



$$\frac{V_1}{N_1} = \frac{V_2}{N_2} \quad \therefore V_2 = \frac{1}{2} V$$

$$\frac{2}{4} = \frac{V_2}{1} \quad \left[\frac{1}{2} - \frac{V_4}{3} - \frac{V_4}{3} (3-j4) = 0 \right]$$

$$\frac{V_3}{N_3} = \frac{V_4}{N_4}$$

$$3V_3 = V_4$$

$$\therefore V_4 = \frac{3}{16} (1 + j4) V$$

$$\therefore V_4 = \frac{3\sqrt{2}}{16} e^{j\pi/4}$$

6 Problem 6 10 / 15

- 0 pts Correct
- 4 pts Incorrect voltage and current equations
- 6 pts Incorrectly apply KVL
- ✓ - 5 pts *Incorrectly solving*