ECE 209 — Exam # 3

Estimated time for completion: <1.25 hour
21 November 2017

Rules of the Exam

Rule 1: The examination begins at 9:30am on Tuesday 21 November 2017 and ends at 10:45pm on Tuesday 21 November 2017.

Rule 2: There are three problems.

Rule 3: The exam is closed book and closed notes. You may use an 8.5" x 11" sheet of paper with notes and a calculator.

Rule 4: Do not leave the room until you have completed the exam.

Rule 5: To receive full credit for an answer include the units along with the numerical answer.

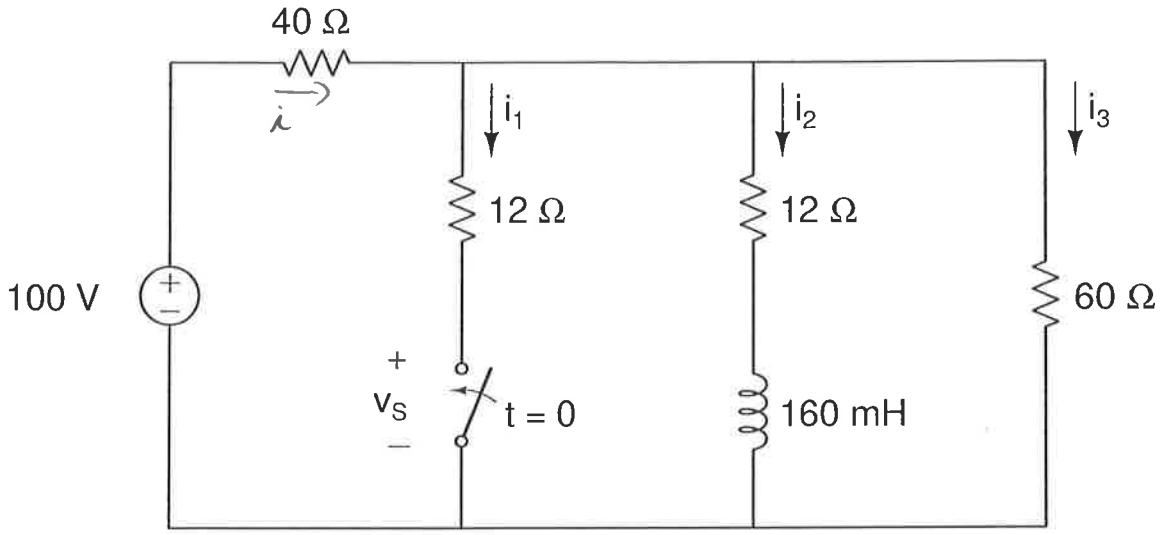
Rule 6: Show all work - answers without supporting work will not receive credit.

Answer Key

Name

Problem 1 (30 points)

In the circuit below, the switch has been open for a very long time, and closes at $t = 0$.



$\tau = \frac{L}{R}$ $R = 40 \| 12 \| 60 + 12$ $= 20\,\Omega$

$12 \| 60 = 10$

$12 \| 12 \| 60 = 5.45$

What is the time constant of the circuit for $t > 0$? $\tau = 8$ ms

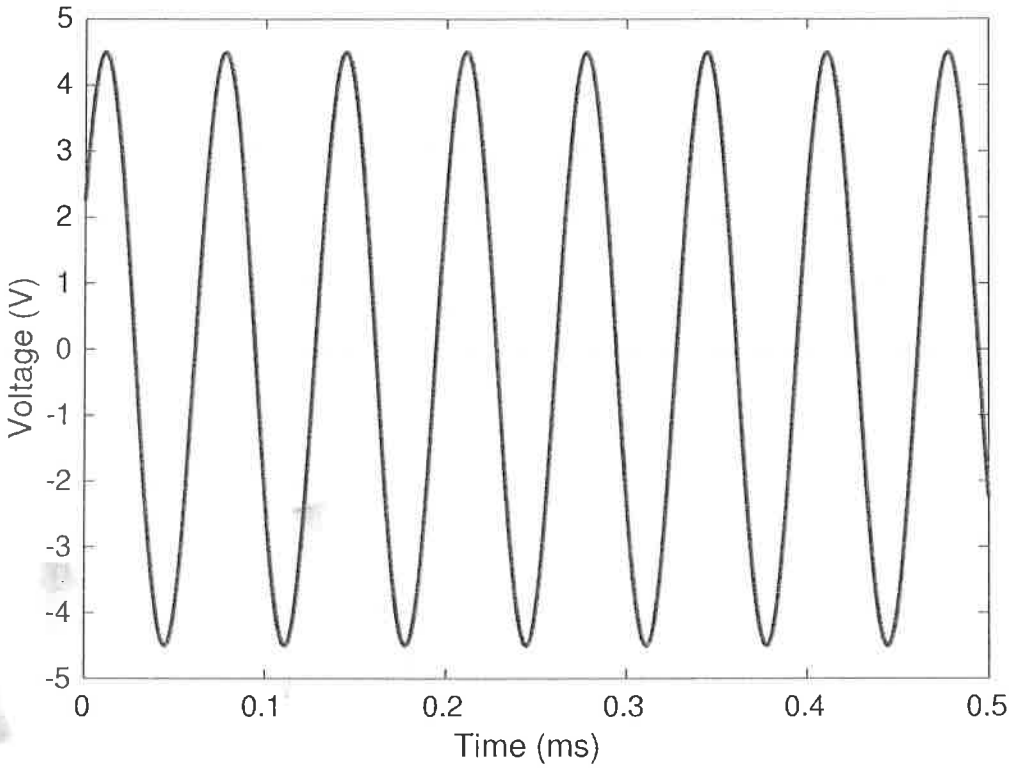
$t = \infty$ $i = 2.2$ A

Complete the table below: See page 5.

	$t = 0^-$	$t = 0^+$	$t = 10$ ms	$t = \infty$
i_1	0 A	0.553 A	0.872 A	1.0 A
i_2	1.67 A	→ 1.67 A	1.192 A	1.0 A
i_3	0.33 A	0.111 A	0.175 A	0.2 A
v_S	20 V	0 V	0 V	0 V

Problem 2 (40 points)

Part A: Consider the voltage waveform shown below:



What is V_{RMS}? 3.18 V

What is the peak-to-peak voltage? 9.0 V

What is the frequency in Hz? 15 KHz

What is the equation for $v(t)$? $4.5\cos(30\times10^{3}\pi t - 60^{\circ})$

What is **V** the Phasor representation of $v(t)$ $4.5\angle -60^{\circ}$

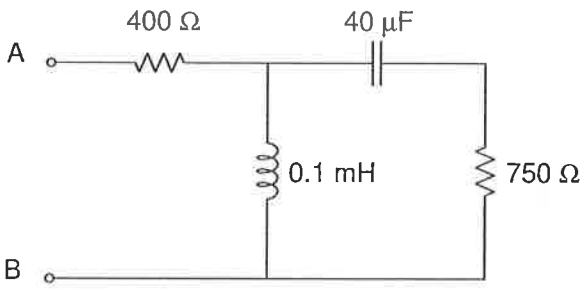
Problem 3 (30 points)

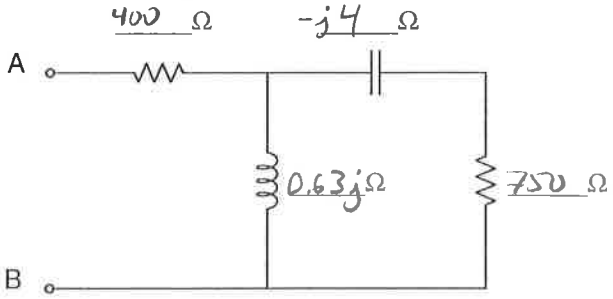
Perform the following operations. Express your result in either rectangular (Cartesian) or polar notation.

$2\angle 60° - 4j =$ $1 - j2.27$ or $2.48\angle -66.2°$

$(4\angle 40° \times 2\angle 40°) + (8 + j8) =$ $9.39 + j15.9$ or $18.45\angle 59.4$

Convert the circuit on the left to the frequency domain when the frequency is 1 kHz.





What is the equivalent impedance between terminals **A** and **B**? $400 + 0.63j$

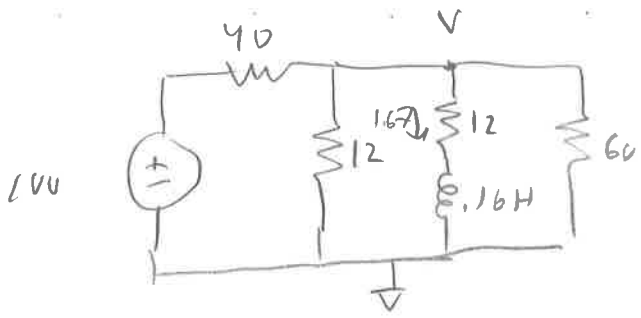
$$Z_{AB} = (750 - j4) \,||\, (0.63j) + 400$$

$$\left(\frac{1}{750 - j4} + \frac{1}{j0.63} \right)^{-1} + 400$$

$$5.3 \times 10^{-4} + 0.63j$$

(Blank Page)

@ $t = 0^+$



KCL @ V: $\frac{V}{60} + 1.67 + \frac{V}{12} + \frac{V-100}{40} = 0$

$V = 6.64V$

(Blank Page)