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Analog Signal Processing

Thursday, September 23, 8:45-10pm

Exam I

Last Name (capitalized):	

First Name:	

UIN:		netID:	

Clearly PRINT your name in CAPITAL LETTERS.	**DO NOT write in these spaces.**
	Problem 1 (25 points):_____
This is a closed book and closed notes exam.	
	Problem 2 (25 points):_____
Calculators are not allowed.	
	Problem 3 (25 points):_____
To get credit, please SHOW all your work and simplify your answers.	
	Problem 4 (25 points):_____
Write your final answers in the spaces provided.	
	Total: (100 points):_____
All answers should INCLUDE UNITS whenever appropriate.	
The exam is printed **double-sided**.	

1. (25 pts) The two parts of this problem are unrelated.

(a) [20 pts] Consider the circuit below. It is desired for the output current, $I_o = 1$A. Determine the value of R, I, V_2, and the absorbed power at the current source, P_{I_s}.
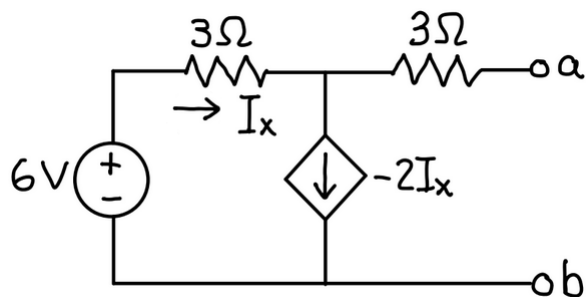

$R =$ _____

$I =$ _____

$V_2 =$ _____

$P_{I_s} =$ _____
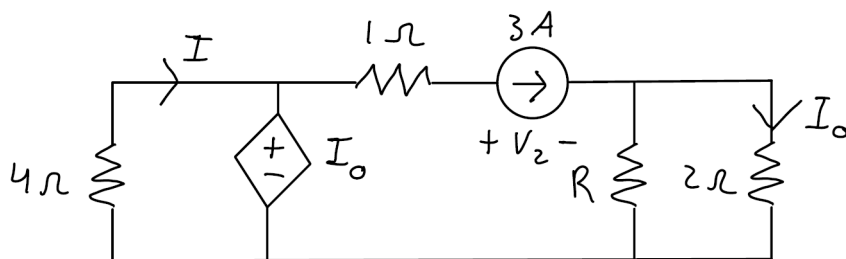
(b) [5 pts] Determine the magnitude and phase of the complex number $Z = \dfrac{e^{j\pi/2}}{e^{-j\pi/4} + e^{j\pi/4}}$.

$|Z| =$ _____

$\angle Z =$ _____

2. (25 points) Parts a and b are unrelated.

  (a) [10 pt] In the following circuit between a and b determine Thevenin's voltage, Thevenin's resistance and the available power of the circuit.
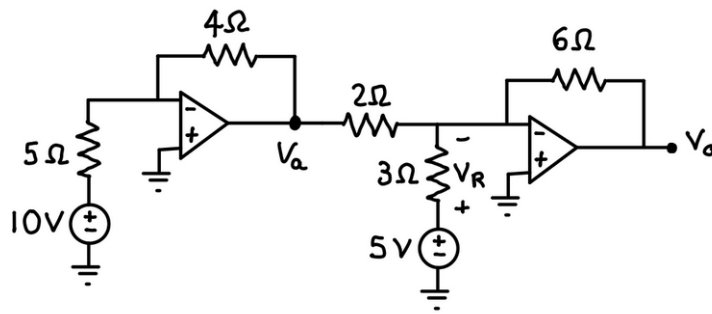

$V_T = $ _____

$R_T = $ _____

$P_a = $ _____

(b) [15 pts] Consider the ideal op amp circuit shown below: Assuming ideal op amp approximations, determine V_a ,V_R and V_o .

$V_a =$ _____
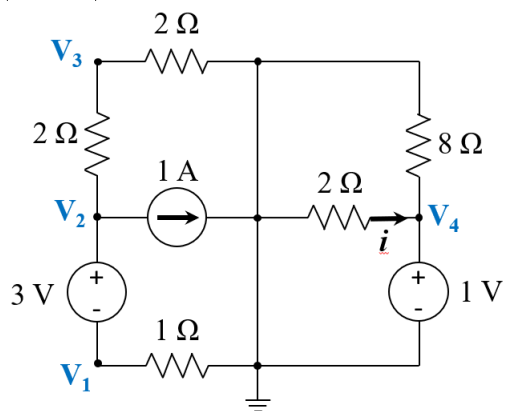
$V_R =$ _____

$V_o =$ _____

3. (25 pts) Consider the following circuit.

(a) [20 pts] Use the node-voltage method to obtain the node voltages V_1, V_2, V_3 and V_4.

$V_1 = \rule{2cm}{0.4pt}$

$V_2 = \rule{2cm}{0.4pt}$

$V_3 = \rule{2cm}{0.4pt}$

$V_4 = \rule{2cm}{0.4pt}$

(b) [5 pts] Determine i.

$i = \rule{2cm}{0.4pt}$

4. (25 pts) In the circuit above, the switch has been closed for a very long time prior to $t = 0$.
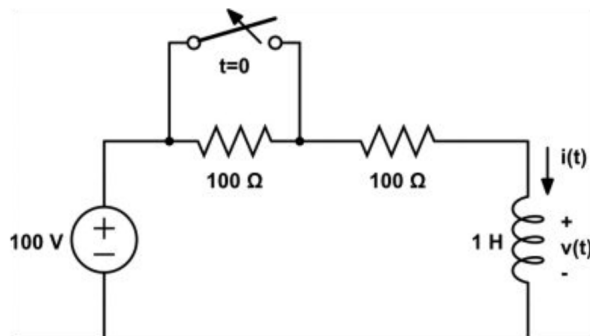
(a) [14 pts] Determine an expression for $i(t)$ for $t > 0$, and identify its zero-state and zero-input parts.

$$i_{ZI}(t) = \underline{\hspace{6cm}}$$

$$i_{ZS}(t) = \underline{\hspace{6cm}}$$

$$i(t) = \underline{\hspace{6cm}}$$

(b) [5 pts] Determine an expression for $v(t)$ for $t > 0$, and identify its zero-state and zero-input parts.

$$v_{ZI}(t) = \underline{\hspace{6cm}}$$

$$v_{ZS}(t) = \underline{\hspace{6cm}}$$

$$v(t) = \underline{\hspace{7cm}}$$

(c) [3 pts] Plot $i(t)$ for $t > 0$.

(d) [3 pts] Plot $v(t)$ for $t > 0$.

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You may use this sheet for additional calculations but **do not** separate this sheet from the rest of the exam.

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