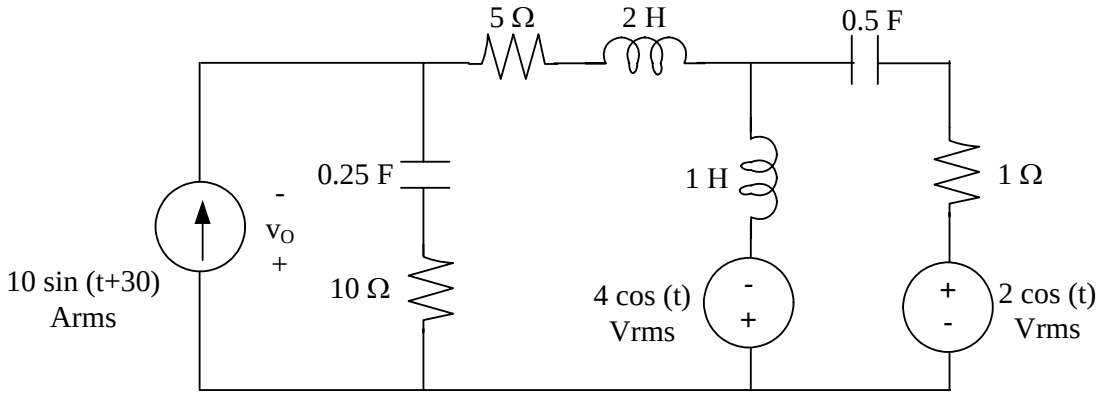
Print Your Name_____

1. [40 points] Consider the following circuit given in the time domain. Note the sources are given in RMS units



(a) [5 points] Convert the circuit to the frequency domain label each element.

Print Your Name_____

(b) [15 points] Using any method you like, solve for the voltage, $\mathbf{V_O}$.

(c) [5 points] What is the time domain voltage $v_O(t)$. Give the real part only.

Print Your Name_____
Problem 1 continued.

(d) [15 points] Find the average power and the reactive power delivered by each source and absorbed by each impedance. Tabulate your answers below.

Element	**P**	**Q**
1 ohm		
5 ohm		
10 ohm		
1 Henry		
2 Henry		
0.25 Farad		
0.50 Farad		
10 sin(t+30º) Arms		
4 cos t Vrms		
2 cos t Vrms		

Print Your Name_____

2. [10 points] Consider the unknown impedance below. You are given that the current leads the voltage by 30º. Will the reactive power absorbed by this element be positive or negative? Explain why.

3. [40 points] Three parallel loads are connected to a voltage source (also in parallel). The voltage source, $\mathbf{V}_S$, is equal to **250∠0° Vrms**. The system is operating at 377 rad/s. The two loads are described below.

Load 1: absorbs 12 kW at PF=0.4 lagging
Load 2: absorbs –6 kVAR at PF = 0.2 leading.
Load 3: absorbs 20∠50º kVA

(a) [3 points] Draw an equivalent circuit using boxes for load elements and label the load current phasors and the source current phasor.

Print Your Name_____
Problem 3 continued.

(b) [9 points] Determine each load impedance. (put your answer in polar form)

(c) [6 points] Find the magnitude of the source current.

(d) [6 points] Find the power factor of the combined loads

Print Your Name_____
Problem 3 continued.

(e) [4 points] Find the total reactive power that is delivered by the source.

(f) [6 points] Find the average power absorbed by all three loads.

(g) [6 points] If a corrective load were added to lower the source current magnitude to a minimum, determine the power factor of the combined loads (1-3 and corrective). What is the source current magnitude? Assume that the average power delivered by the source and the source voltage do not change. Note: You do not find the corrective load.

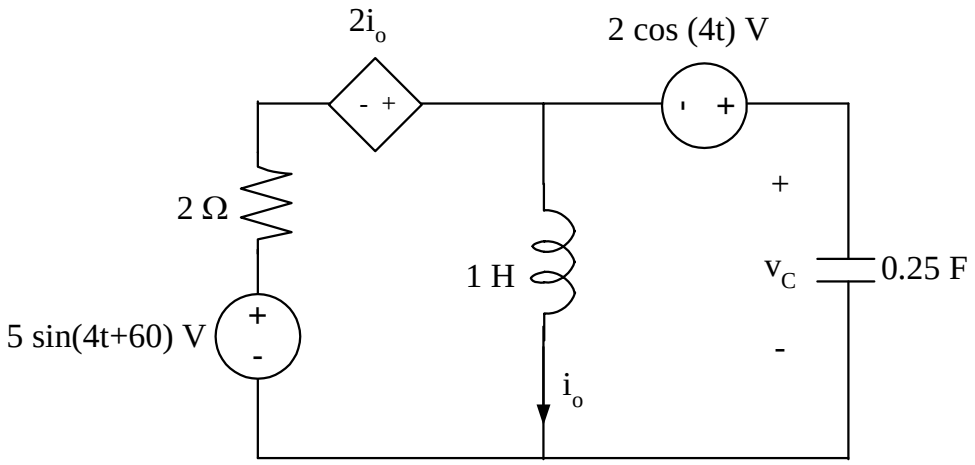
Print Your Name_____

4. [10 points] You are given the following unknown impedance. The voltage and current associated with this impedance are given below, in the time domain. What is the power factor of this impedance? Is the impedance inductive or capacitive? Explain.

Name_____

1. [40 points]

Consider the following circuit given in the time domain, assuming AC steady state conditions:



a. [10 points] Transfer the circuit from the time domain to the frequency domain (i.e. phasor domain)

Name_____

b. [20 points] Using any method you like, solve for phasor voltage $\mathbf{V_C}$, the voltage drop across the capacitor. Clearly state the method you use. (Hint: start with what you know)

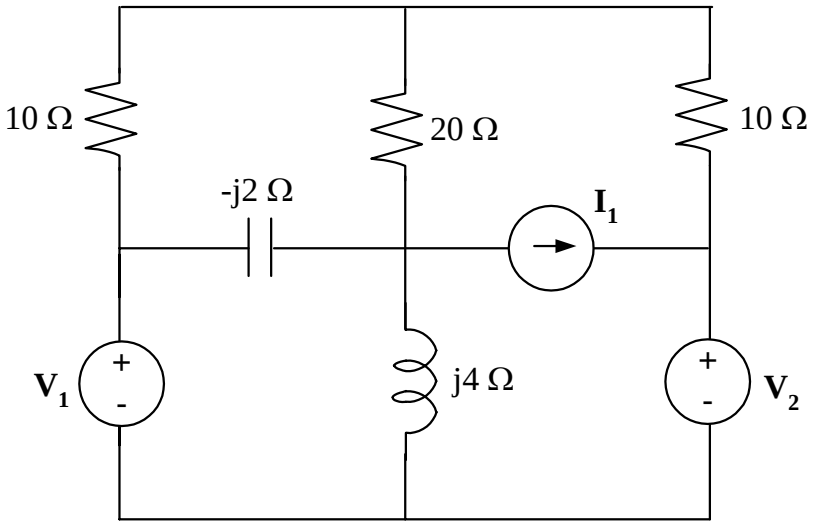
Name_____

c. [10 points] Find the real or average power ***delivered*** by the 2 cos(4t) volt source.

Name_____

2. [15 points]

Consider the following circuit given in the frequency domain, assuming AC steady state conditions:

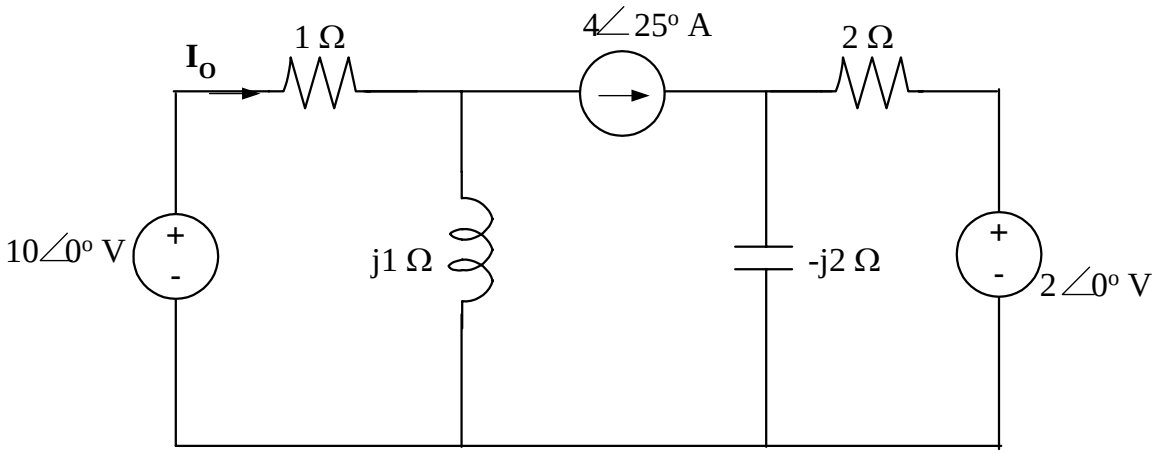


Using the quick method (i.e. turning off all the sources), determine the Thevenin equivalent impedance, Z_{TH}, for the circuit network assuming the load is the 20 Ω resistor. Show the circuit you use and all your work.

Name_____

3. [45 points]

Consider the following circuit given in the frequency domain, assuming AC steady state conditions:



a. [25 points] Using any method **EXCEPT** what you used for problem 1, solve for the phasor current, $\mathbf{I_O}$. State the method that you use to solve the circuit.

Name_____

3a. continued.

b. [20 points] Determine the real or average power delivered or absorbed by each element in the circuit. Show that your total power delivered equals the total power absorbed.

Name_____

3c. continued.