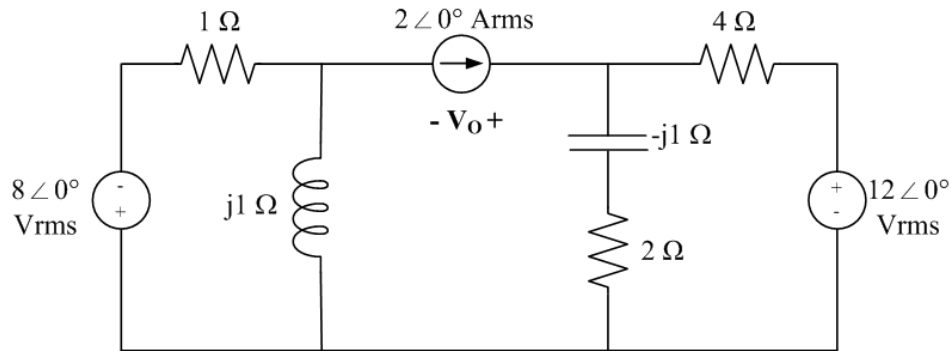Problem Set #3

1. For the following circuit, solve for the average power (P), reactive power (Q) and the complex power (S) delivered or absorbed by each element in the circuit.

2. For the following circuit, convert the circuit to the frequency domain and convert the sources to rms units. Solve for the average power (P), reactive power (Q) and the complex power (S) delivered or absorbed by each element in the circuit.
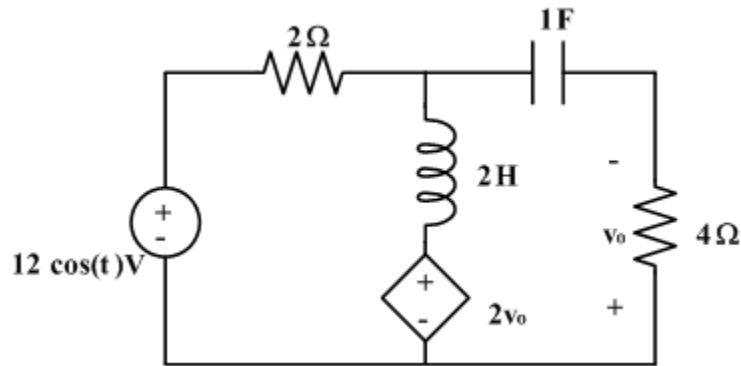

3. A single load is connected to a source. The load consumes 44kW at a power factor of .5 lagging. The source operates at 60 Hz with a voltage of 220 volts rms.

    a) Find the impedance of the load and the source current.
    b) It is desired to raise the power factor to 0.988 lagging. Design a load, Z_C that achieves this new power factor without changing the source voltage magnitude or the real/average power delivered by the source.

4. A voltage source, with a rms voltage magnitude of 208 serves the following loads, which are all connected in parallel:

> Load 1 – 18kW at PF=.5 lagging
> Load 2 – 10kVA at PF=.2 lagging
> Load 3 – 12kW at PF = 1
> Load 4 – 16kVAR at PF=.3 lagging

   a)   Find the phasor impedance of each load and the phasor current of each load.
   b)   Find the **magnitude** of the source current.
   c)   Find the power factor of the combined loads as seen by the source.
   d)   Find the total complex power delivered by the source.
   e)   Design a corrective load that will decrease the source current magnitude by 20%. Is such a load possible? If not, what is the minimum source current magnitude allowed.

5. A single phase source with a magnitude of 100 V rms and frequency of 60 Hz is connected to two (2) loads as shown below.
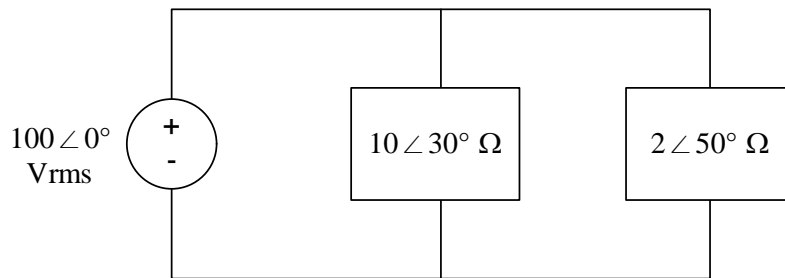
a) Label the source current and the two load currents. What are the load currents?
b) What is the average power absorbed by each load?
c) What is the reactive power absorbed by each load?
d) Design a load for power factor compensation. The power factor of the combined loads should be 0.9 lagging. The voltage source magnitude and the average power delivered by the source may not change. What is the impedance and the component value of the additional load?