Homework 3 Sinusoidal Steady-State

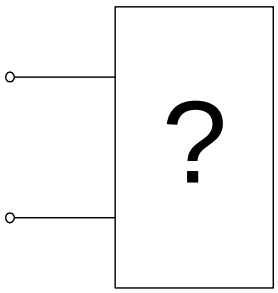
HW11:

A square wave, a triangle (sawtooth) wave, and a sine wave all have the same RMS voltage, and all have zero average value.

a) Without computing anything, figure out which of the three waves has the largest and smallest peak voltage? Explain your reasoning.
b) PROVE your answer quantitatively.

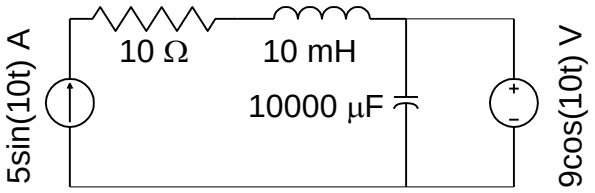
HW12:

When a voltage source v(t) =120$\sqrt{2}$ sin(377t) V is connected to the box shown on the right, the current flowing into the box is measured to be i(t) = 662 sin (377t+75°) mA. If the box contains a *series* combination of two passive components, what are the values of the components in the box. DRAW a picture of the circuit and label the component values clearly!



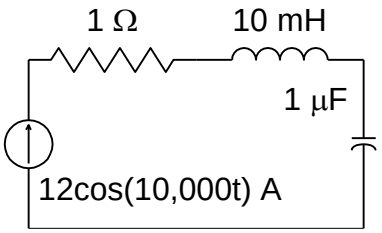
HW13:

Consider the circuit shown below. How many (a) non-trivial nodes, (b) trivial nodes, (c) non-trivial meshes, and (d) trivial meshes are there in the circuit.? Simplify any of the trivial nodes/meshes that you can and then write all the linearly-independent, steady-state KCL and KVL equations for the circuit that would be needed to solve the problem.



HW14:

One day, John and Amparo, a senior ECE student, were trying to fix Jasmine's old-fashioned (projection) TV, which contained the circuit shown below, apparently with a bad connection. John said that the RLC series branch had an impedance of 1Ω since the impedances of the inductor and capacitor cancelled out, so that the largest voltage in the circuit was 12 V. Before Amparo could correct him, John touched both ends of the inductor to try to improve the connection.



a) What was the shocking result of this action? (I.e. what was the peak voltage across the inductor? Across the capacitor? Across the current source?)
b) Explain what's wrong with John's "cancellation" reasoning.

HW15:

Write the complete set of sinusoidal steady-state equations for the following circuit: