EE 206: Lab #9

Phasors and RC Circuits

Note: The phasor impedance of resistors, inductors, and capacitors are

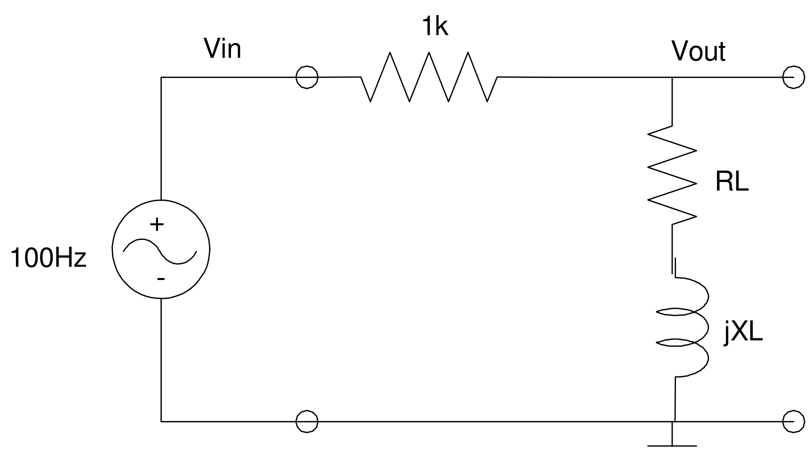
$$R \to R \qquad L \to j\omega L \qquad C \to \frac{1}{j\omega C}$$

1) Pick a resistor, inductor, and capacitor from the bin. Record it's value and compute its impedance at 100Hz (628 rad/sec). Note that the inductor has a resistance (due to the length of wire used) as well as an inductance.

	R	L		C
		R (DC resitance)	L	
Value				
Impedance at 100Hz				

2a) Using phasor analysis, compute the voltage at Y

2b) Build this circuit and compute the gain and phase shift from Vin to Vout

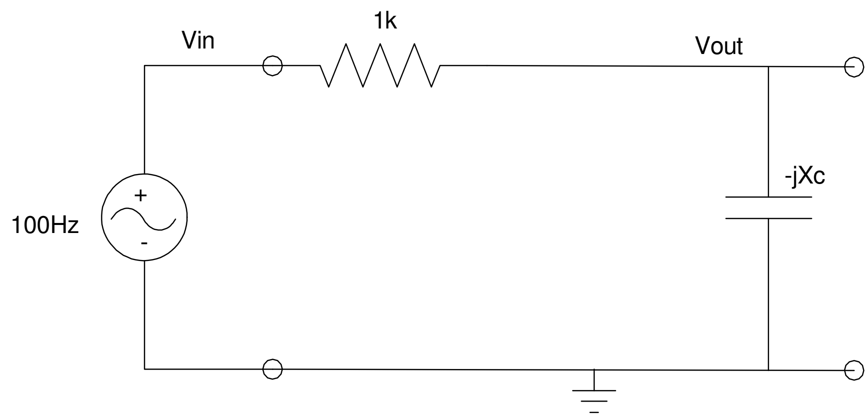


Circuit for part 2. Note: the inductor produces RL and jXL
(you don't have to add a resistor in series with the inductor: it has a resistance RL built in.)

	Calculated	Measured
Gain Vout / Vin		
Phase Shift Vout / Vin		

3a) Using phasor analysis, compute the voltage at Y

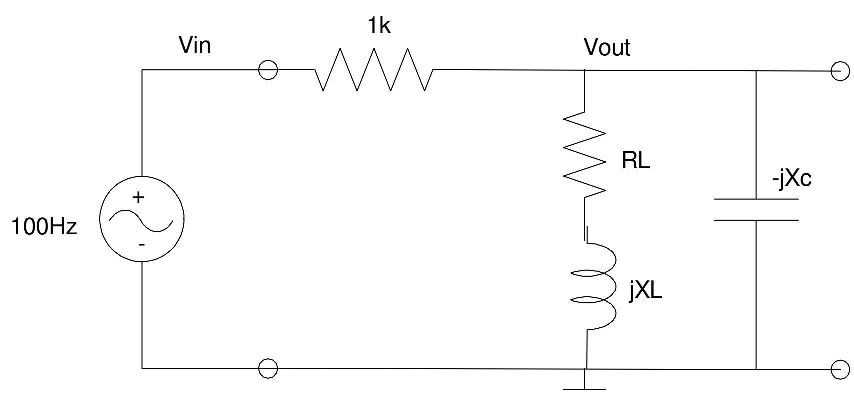
3b) Build this circuit and compute the gain and phase shift from Vin to Vout



	Calculated	Measured
Gain Vout / Vin		
Phase Shift Vout / Vin		

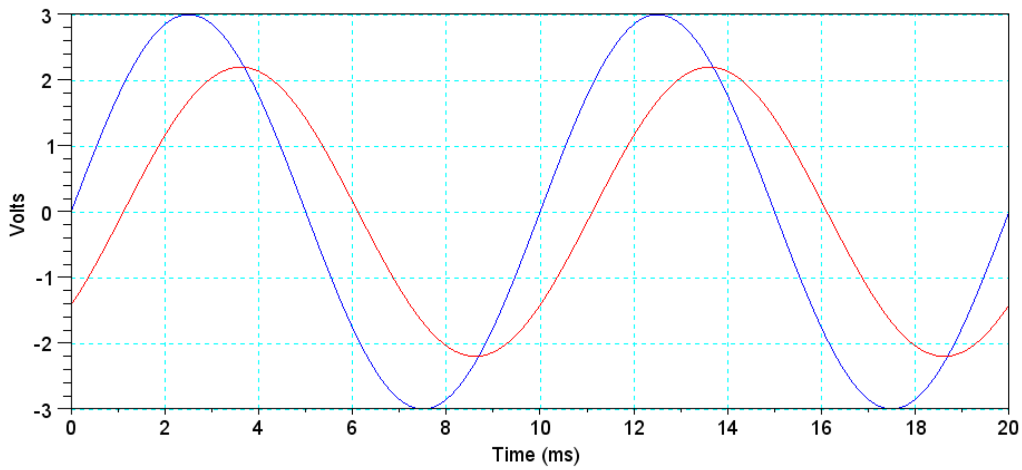
4a) Using phasor analysis, compute the voltage at Y

4b) Build this circuit and compute the gain and phase shift from Vin to Vout



	Calculated	Measured
Gain Vout / Vin		
Phase Shift Vout / Vin		

Sample Calculations: To measure the gain and phase shift at 100Hz, display both Vin and Vout on the oscilloscope. For example, if the traces look like the following:



Sample Voltages: Vin (blue) and Vout (red)

Gain Calculations:

Output = Gain * Input

If you use the peak votlages

$$gain = \left(\frac{3V}{2.2V}\right) = 1.36$$

Phase Calculations:

One cycle is 360 degrees. The output (red line) is delayed from the input by

$$\theta = \left(\frac{\text{1ms delay}}{\text{10ms period}}\right) \cdot 360^0 = -36^0$$

(negative phase is a delay, positive phase is a time advance)

The gain at 100Hz for this graph is thus

$$V_{out} = (1.36\angle -36^0) \cdot V_{in}$$