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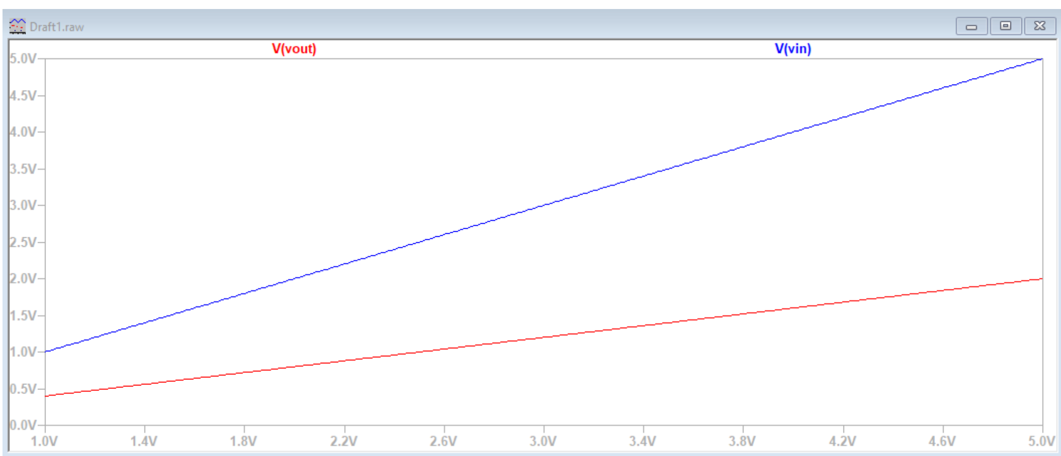
ELEN 164 Lab

22 September 2021

Lab 1 - Passives: Introduction and Current-Voltage Relationships

Part 1:

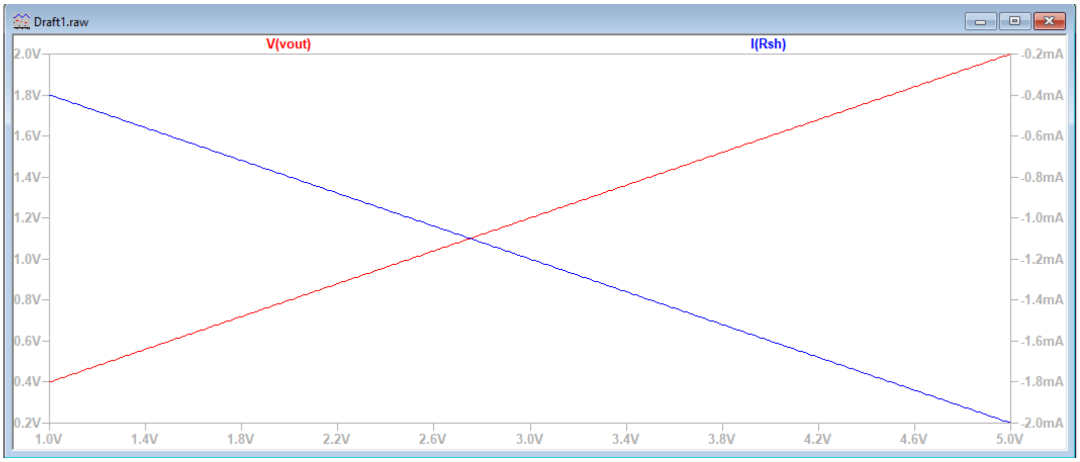
1. Yes our results are what we expected because we expect the voltage output to be less than the input since there are many different factors that contribute to loss over the system, such as the resistors.



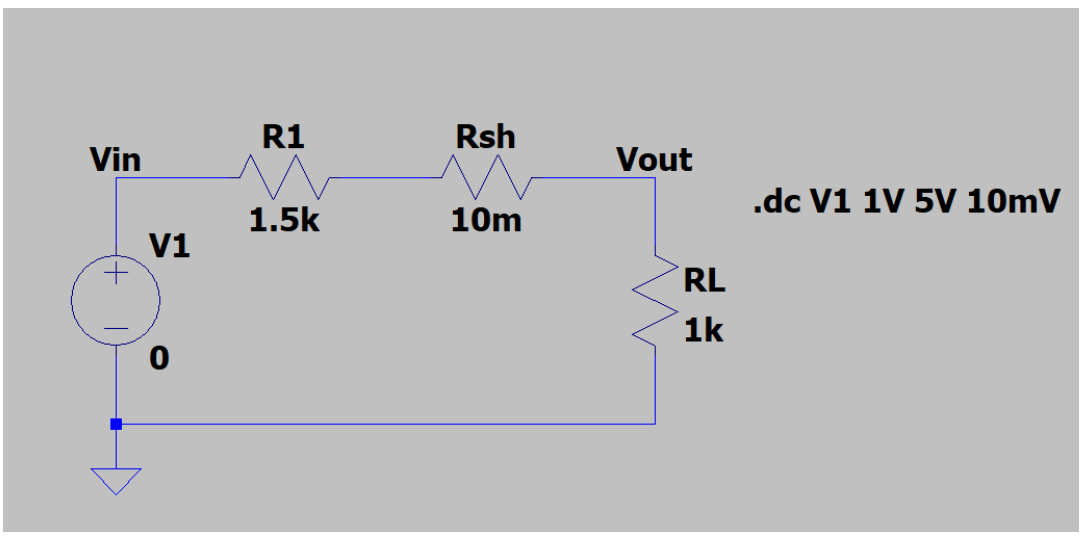
This shows the graph for the voltage divider. With Vout being displayed in red and Vin being displayed in blue.

2. Using a shunt resistor can be useful because it allows for a better reading. This is because by having the shunt resistor a larger more readable amount of current flows through it

giving you a larger number to read.



This shows the graph for the voltage divider. With Vout being displayed in red and the current through the shunt resistor being displayed in blue.

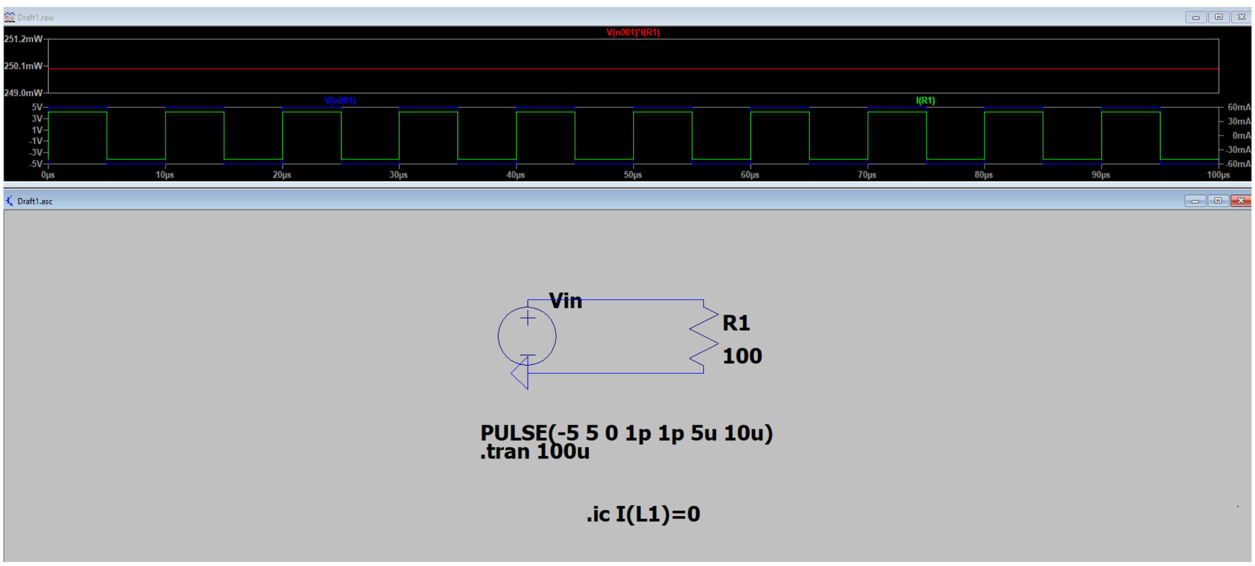
3. 

This shows the circuit for the voltage divider.

Part 2:

Section 1:

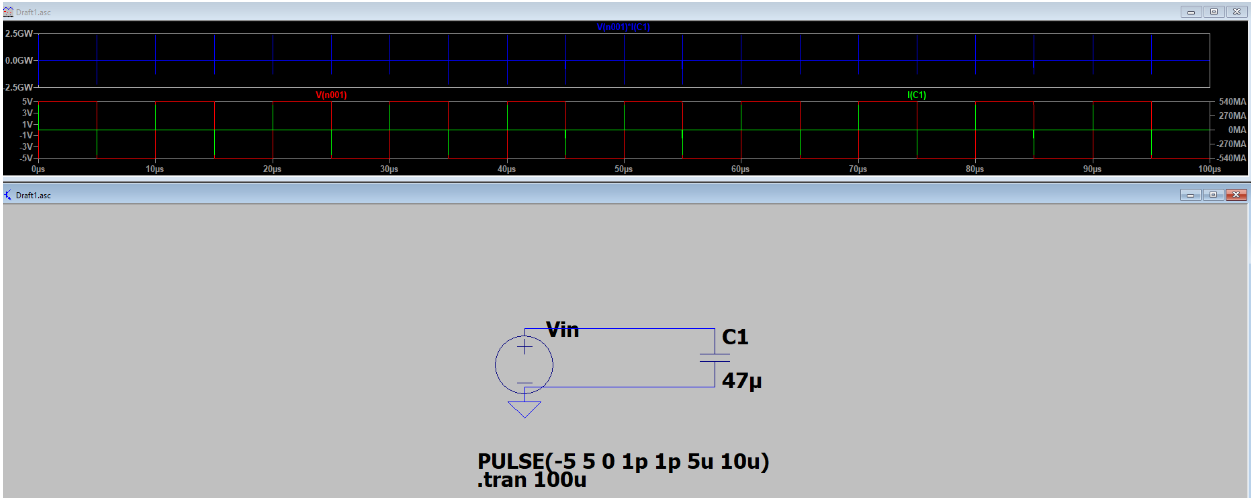
Resistor:



This shows the diagram and graph for the square wave resistor, power being in red, voltage in green, and current in blue

The voltage produces a square wave, this results in the current also being a square wave since V/R=I due to Ohm’s law. 250.1mW is the peak, this makes sense then that power would be a constant since resistor doesn’t absorb any current, the voltage and current change constantly at the same rate, keeping the power constant

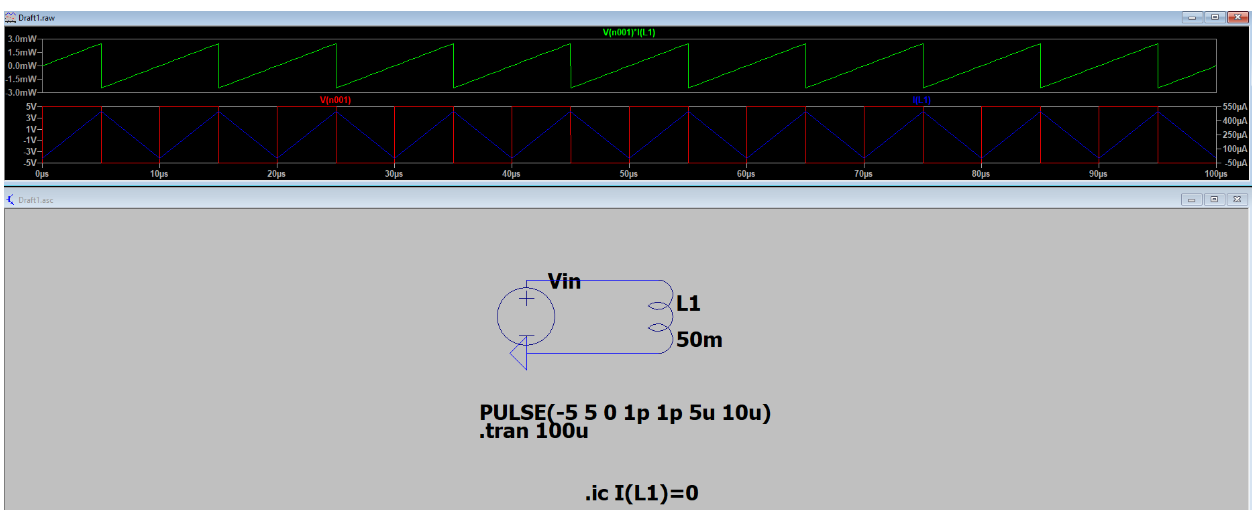
Capacitor:



This shows the diagram and graph for the square wave resistor, power being in blue, voltage in red, and current in green.

The voltage is a square wave, while the current has spikes. This makes sense as the capacitor has to charge, so it charges up quickly, and then doesn't let anymore in, then it discharges all. Peak is 2.35GW, this makes sense because the current is very high when it is charging or discharging, but 0 everywhere else. So as a result power follows the current pattern.

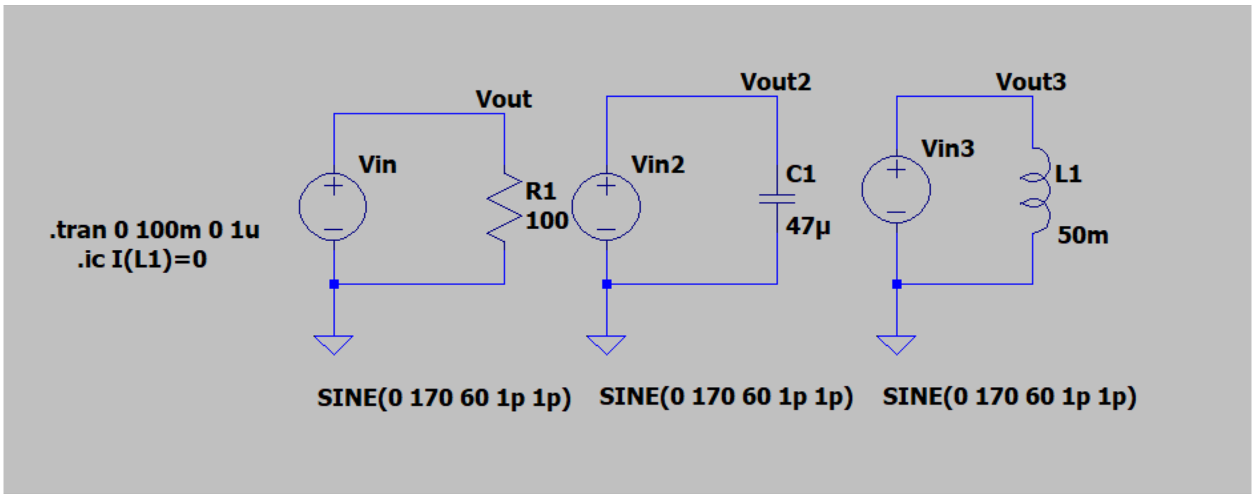
Inductor:



This shows the diagram and graph for the square wave resistor, power being in green, voltage in red, and current in blue

Voltage is a square wave, while current linearly increases/decreases over the period the magnitude of the current increases over the interval since the amount of energy through the inductor is increasing. 2.48mW is the peak for the inductor, this shape makes sense given the voltage is constant and current increases/decreases so it would follow this pattern.

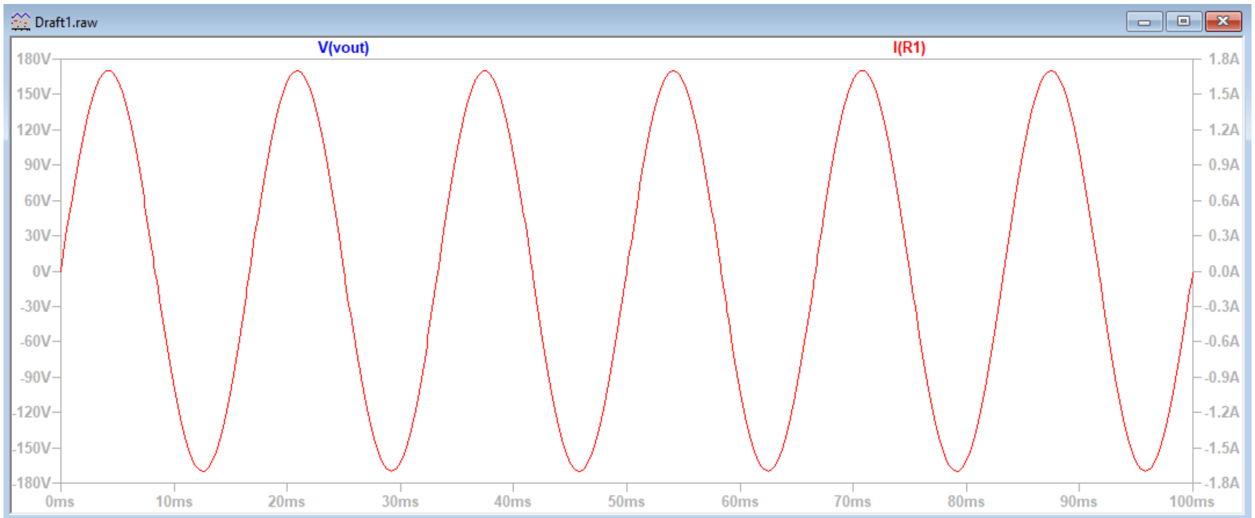
Section 2:



This shows the circuits for each of our passive devices. From left to right; resistor, capacitor, and inductor.

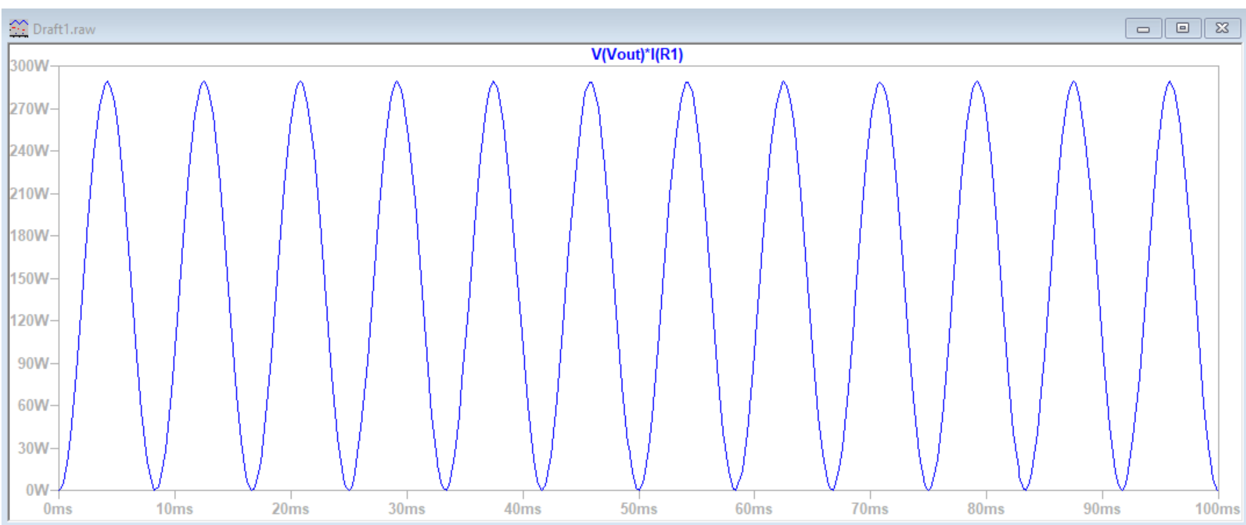
Resistor:

We know that current and voltage are directly proportional due to Ohm's law which is why it makes sense that both waveforms are going to be very close to each other.



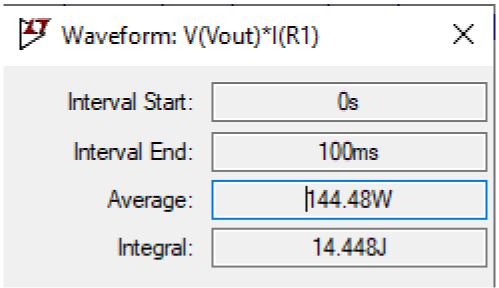
This shows the graph for the resistor. With both the voltage and the current overlapping each other.

In this graph we see that the current and voltage perfectly overlap each other. This makes sense because we are measuring a resistor.



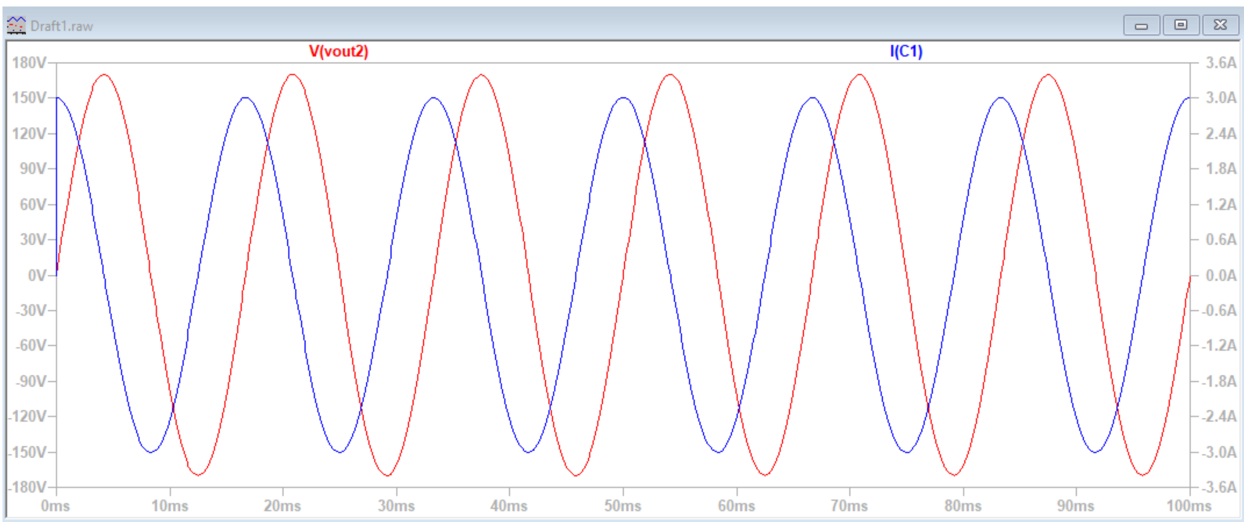
This shows the graph for the power of the resistor.

We know that due to a resistor's nature it is always absorbing power which explains why our power graph is only in the positive region. This also explains why the average power is 144.8W because the resistor does absorb a good amount of power.



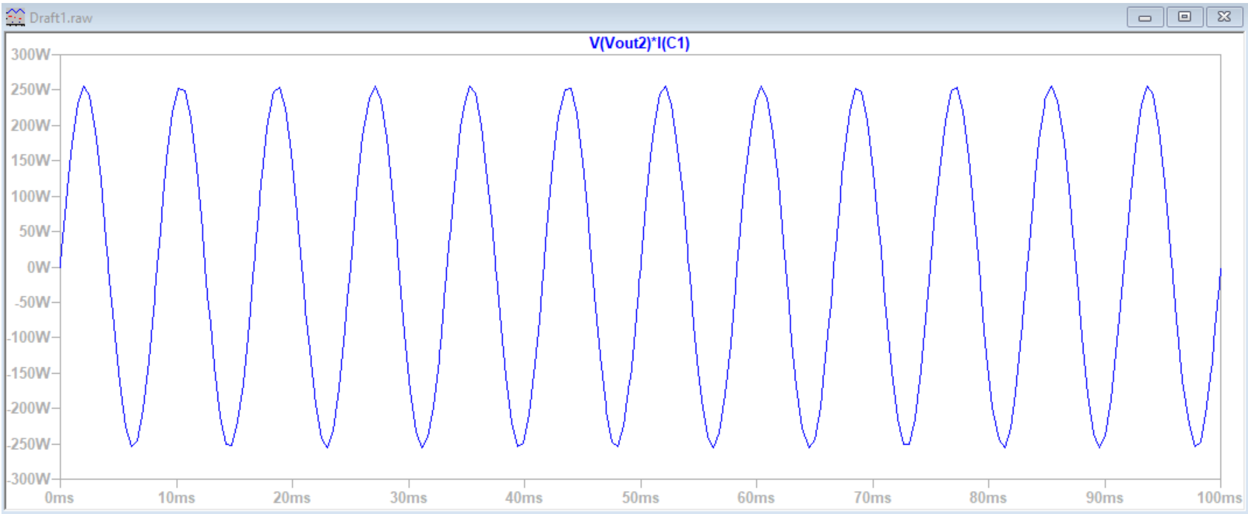
This shows the average power of the resistor.

Capacitor:



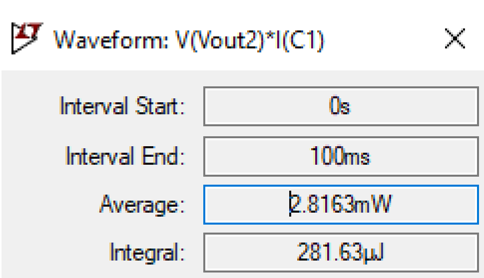
This shows the graph for the capacitor. With the current leading in blue and the voltage trailing in red.

In this graph we see that the current leads the voltage so according to “ELI the ICE man’ we know that this is what should be happening for a capacitor.



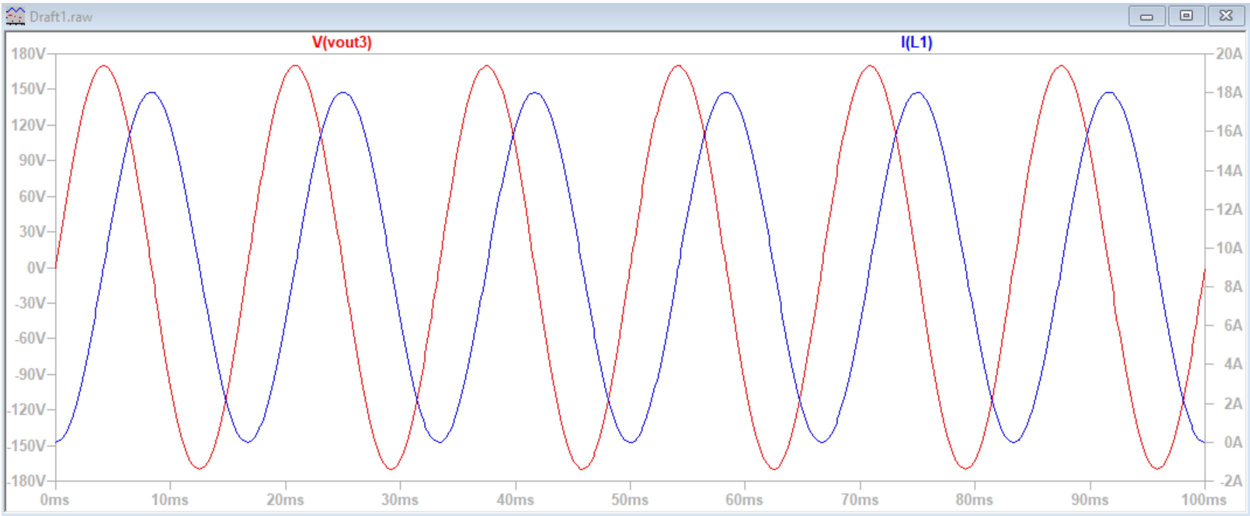
This shows the graph for the power of the capacitor.

We know that a capacitor has the ability to both absorb and deliver power; this explains why our average power is almost 0. Because in a circuit a capacitor will charge for a period of time then expel the energy it has saved up.



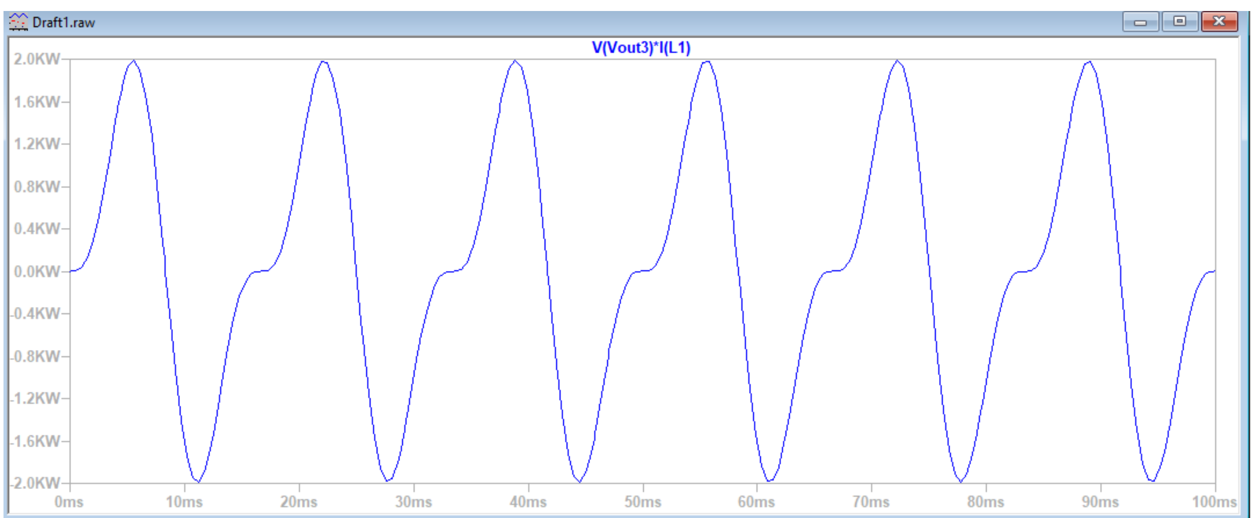
This shows the average power of the capacitor.

Inductor:



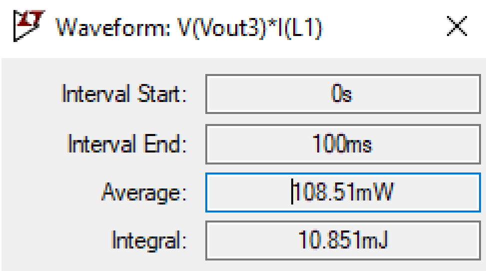
This shows the graph for the inductor. With the current trailing in blue and the voltage leading in red.

In this graph we see that the voltage leads the current so according to "ELI the ICE man' we know that this is what should be happening for a inductor.



This shows the graph for the power of the inductor.

We know that an inductor has the ability to both absorb and deliver power, but not at the same rate; this explains why our average power is small but not exactly 0. Because in a circuit an inductor stores and transfers energy, but only as needed. Which explains why its power delivery and absorption are not exactly the same.



This shows the average power of the inductor.

Part 3:

Section 1:

Resistor:

The first resistor we measured was the one with the bands on it. This one came up to 989.3Ω and 0° The gray resistor came out to 47.38kΩ and 0°. While the little box resistor came out to 335.11mΩ and -.04°

Capacitor:

The blue capacitor measured to be 205.18nF and -89.34°. The red capacitor .94µF -88.9°. The gold capacitor 9.405nF -89.41°.

Inductor: 10.8H and 80.74°

Section 2:

Mystery box 1: we measured .04° and there concluded that was a resistor, when we measured resistance .99

Mystery box 2: we measured -89.81° and therefore concluded it was a capacitor, when we measured capacitance. We got 4.53nF

Mystery box 3: we measured 71.54° and therefore concluded it was an inductor, when we measured inductance. We got 1mH.

Additional Questions:

Part 2 Section 1: If square wave voltage magnitude was increased, then the current would follow a similar pattern, where it would increase/decrease linearly, it would have greater magnitude since $I=1/L\int v dt$. So if Vmax is greater, then Imax is greater. If the inductor increased ten times then the current would decrease ten fold given $I=1/L\int v dt$

Part 2 Section 2: The input signal represents the sin wave that is being inputted into the circuit.

Part 3: That the phasor angle can easily be observed when measuring passives. It's often useful then to use combinations of inductors and resistors in order to reduce phase shift and therefore increase the power that is actually delivered.