1. Consider the circuit below.

$V_o \cos \omega t$
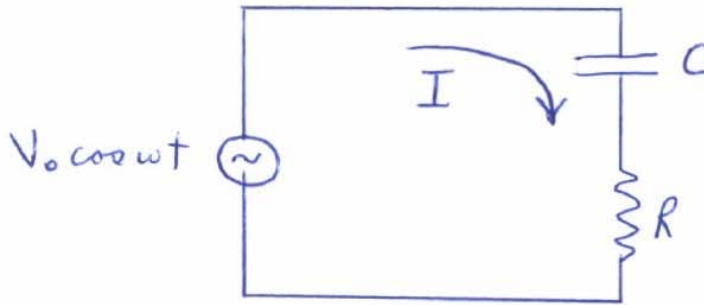
    a) Show that the current is given by:

$$I(t) = \frac{V_o}{\sqrt{R^2 + \frac{1}{\omega^2 C^2}}} \cos\left\{\omega t + \arctan\left(\frac{1}{\omega RC}\right)\right\}$$

    b) Plot the current and the voltage as a function of time.

2. A 2000 ohm resistor and a 1μF capacitor are connected in series across a 120 volt (rms) 60 Hz line.
   a) What is the impedance?

   b) What is the rms value of the current?

   c) What is the power dissipated in the circuit?

   d) What will be the reading of an ac voltmeter connected across the resistor?

   e) What will be the reading of an ac voltmeter connected across the capacitor?

   f) The horizontal plates of a cathode ray tube are connected across the resistor and the vertical plates across the capacitor. Sketch the pattern that you expect to see on the screen.

3. A 1000 ohm resistor, a 500 picofarad capacitor and a 2 millihenry inductor are connected all in parallel.

   a) What is the impedance of this combination at a frequency of i) 10 kHz and ii) 10 MHz?

   b) At what frequency is the absolute value of the impedance the greatest?

4. The coil in the circuit shown in the diagram below has an inductance of 0.01 henry. The oscilloscope sweep is triggered when the switch is closed.
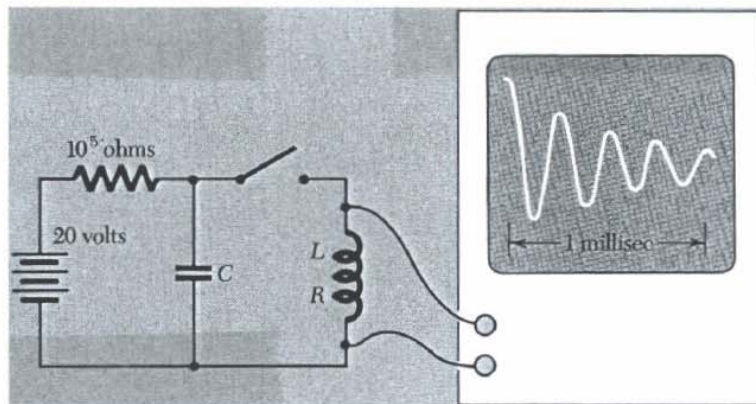
a) Determine as well as you can the value of the capacitance C.

b) Estimate the value of the Resistance R of the coil.

c) What is the magnitude of the voltage across the oscilloscope input a long time say 1 second after the switch has been closed?