Physics Lab 206 — Mar 2016
Quiz #4 — RLC Circuits

Name:

1) Pieter van Musschenbroek connects his capacitor with capacitance $C = 2.2$ mF to a battery with emf $\mathcal{E} = 4.0$ V and a resistor $R = 20$ kΩ in series. The capacitor was free of charge before connecting the circuit, at time $t = 0$.
a) Calculate the time constant, τ. **[2 pts]**
b) How long it takes for the capacitor to get charged with $Q = 4.4$ mC?
Remember that $V_C(t) = \mathcal{E}(1 - e^{-t/\tau})$ and $Q = CV$. How much is the current at this time? **[3 pts]**
c) Pieter measures the resistor voltage through time and fits a curve $y = 3.89e^{-0.023x} + 0.03$. Write down the units of these numerical fit parameters and compare them to the theoretical values. **[4 pts]**

2) Hertha Ayrton uses the same setup that we had in 'RLC Circuits' lab, part B, (R and L and C in series connected to a battery) and measures the current I (or voltage V_R) vs time as shown in fig. 1. She knows $R = 100\Omega$ and wants to find L and C.
a) Roughly measure the period of oscillations, T. Calculate f and ω. **[3 pts]**
b) Roughly measure the time constant, τ. Remember that the peaks are roughly decaying like $e^{-t/\tau}$. **[3 pts]**
c) Find L and C. **[2 pts]**

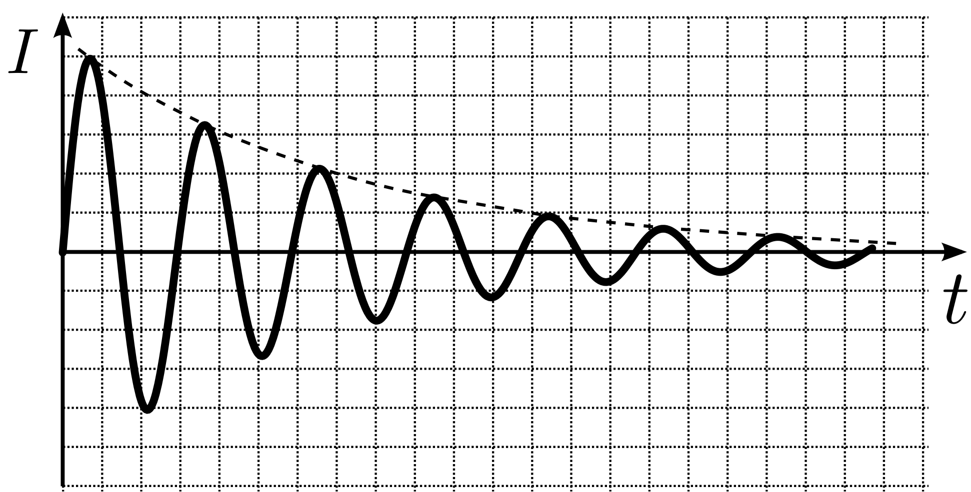

Figure 1: A series RLC circuit's current vs time. Each square in the grid is 10 mA by 10 ms.