# Physics 536 - First Exam
February 12, 2007

1. A circuit is being constructed using a 5 volt power supply, but part of the circuit, which draws negligible current, needs to be held at voltage of 2 volts.

(a) Design a voltage divider that will provide this voltage and will draw 1 mA of current.

(b) What is the output impedance of this voltage source?

2. In the following circuit, calculate the voltage at point "A", in the limit $t \to \infty$ when the switch is closed at $t = 0$.
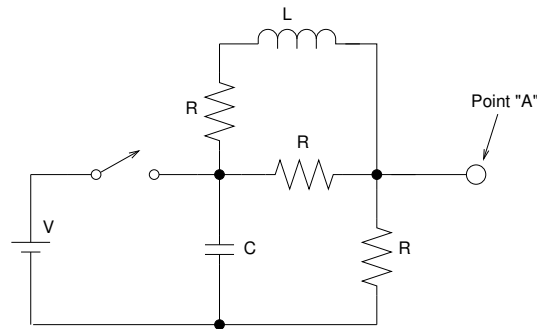
3. Consider the circuit shown below:
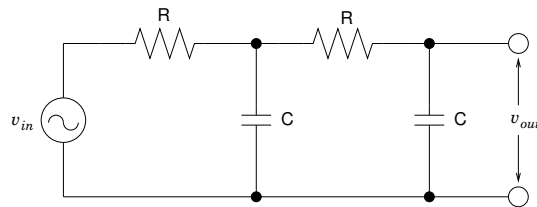
(a) Apply Kirchoff's rules to derive the system of differential equations satisfied by the currents in the two loops in response to an arbitrary voltage source $v_{in}(t)$. Assume that the capacitors are initially uncharged.

(b) When $v_{in}(t) = Ve^{i\omega t}$ is an AC voltage source with frequency $f = 2\pi\omega$, the currents in the two loops can be written $I_1 e^{i\omega t}$ and $I_2 e^{i\omega t}$. Solve the resulting system of algebraic equations to determine I_1 and I_2.

(c) Calculate the magnitude and relative phase of the voltage, v_{out}, across the second capacitor in the limit $\omega \to \infty$.