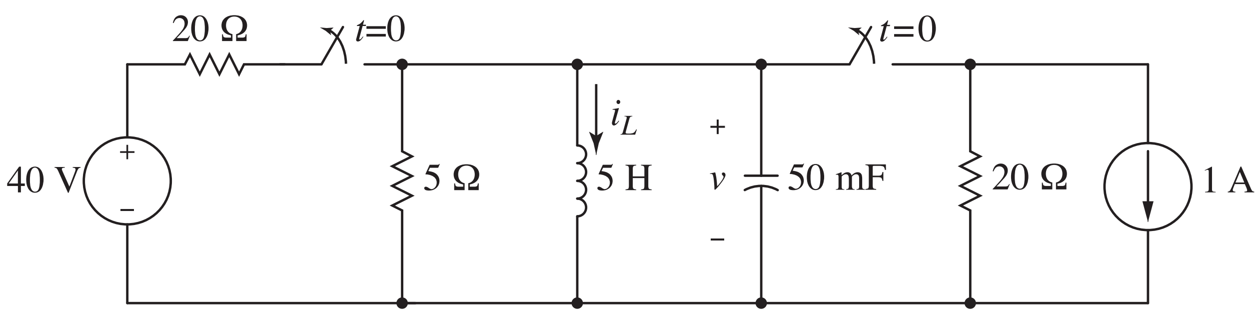
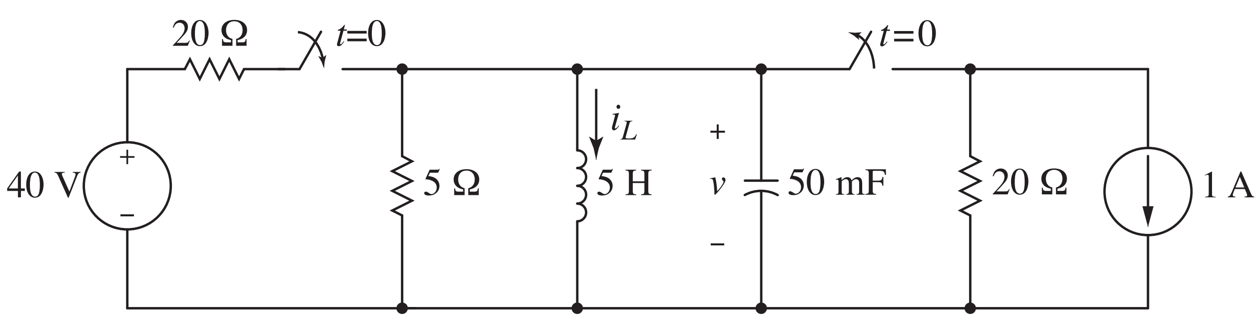
Due Sunday, Apr. 13, 2025 by 11:59 p.m.

NOTE: This is only the "handwritten" portion of Homework 11. There are also problems you must do online via the Mastering site. For this handwritten portion you must submit a PDF scan of your work at Canvas. Please ensure your work is contained in a single file and is legible.

1. Consider the circuit shown below. The circuit is in steady state prior to $t = 0$.
   (a) What is $v(t \geq 0)$?
   (b) What is $i_L(t \geq 0)$?



2. Consider the circuit shown below. The circuit is in steady state prior to $t = 0$.
   (a) What is $v(t \geq 0)$?
   (b) What is $i(t > 0)$?



(continued)

3. For the circuit below, obtain the differential equation that governs $v_2(t)$.

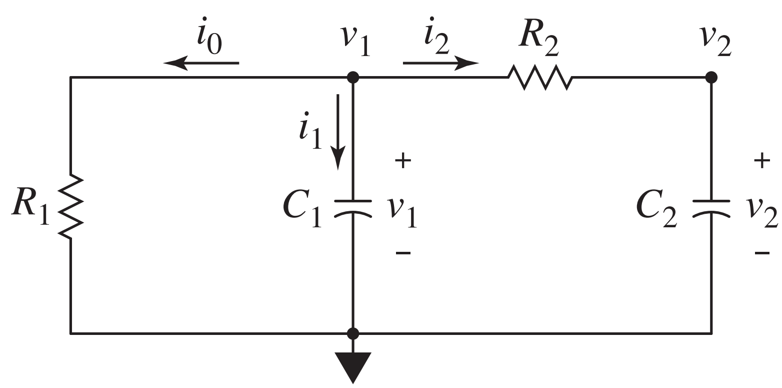
   This can be obtained relatively easily by thinking in terms of KCL applied to the v_1 node. Express all the currents in terms of the voltages. Then, consider the current i_2. There are two ways to express this current. One way involves Ohm's law. The other way employs the i-v relationship for the capacitor C_2. Equating these two expressions for i_2 allows you to obtain an expression for v_1 in terms of v_2. Using that (and returning to the KCL expression) allows you to obtain a differential equation that only involves v_2.

   You should obtain a second-order differential equation with constant coefficients. We could, if we so desired, write the equation in the form:

$$\frac{d^2 v_2(t)}{dt^2} + 2\alpha \frac{dv_2(t)}{dt} + \omega_0^2 v_2(t) = 0.$$

   The α and ω_0 depend on R_1, R_2, C_1, and C_2 (in a way that is distinct from what we have with parallel or serial RLC circuits), but the way in which $v_2(t)$ behaves would be no different from what we've seen before. It would be either underdamped, critically damped, or underdamped (depending on the relative sizes of α and ω_0).

   Finally, you can be fairly confident that you have the right differential equation if, when you set R_2 to zero, you get a first-order differential equation with an equivalent capacitance of $C_1 + C_2$ (i.e., the time constant is $R_1(C_1 + C_2)$ if R_2 goes to zero).



4. For each of the following, provide the corresponding phasor. Your answer should be a complex number in *polar form*. You can use either $re^{j\theta}$ or $r\underline{/\theta}$ notation.

   (a) $-42\cos(200\pi t - 0.4)$ V

   (b) $6.2\sin(200\pi t + 35°)$ mA

5. Given the following phasors and the information related to the frequency of that phasor, provide the corresponding time-domain representation. (It is somewhat hard to tell the difference, but the terms on the left in bold are the symbols for the phasors, e.g., $\mathbf{V}$, while the terms preceding the frequency information provide the units, e.g., V is volts.)

   (a) $\mathbf{V} = 8e^{-j\pi/6}$ V, $\quad \omega = 200$ rad/s

   (b) $\mathbf{V} = \sqrt{2}e^{j0.25}$ V, $\quad f = 10$ kHz

   (c) $\mathbf{I} = 42\underline{/\pi/6}$ A, $\quad T = 10^{-6}$ s