Reading: Sections 8.1 - 8.3 in Hayt/Kemmerly/Durbin. Do all of the Practice problems in the Reading assignment (but do not hand them in).

Note: For the first two problems in this assignment, I simply want you to write the differential equation for the given circuit variable for the given time interval. You should note that, in all cases, the form of the differential equation is the same as the form given in Lecture 13.

1. Using Figure 8.55 on p. 310, write the differential equation for $i_L$ for $t > 0$, assuming that the switch has been closed for a very long time, then opened at $t = 0$. Notice that for $t < 0$, we have a DC circuit (since the switch is closed for a long time), and so the inductor acts as a short circuit. This will allow you to find the current $i_L(0)$ very easily. Note also that for $t > 0$, the voltage source is not connected to the rest of the circuit and so has no current flowing through it. Because of this, it does not affect the rest of the circuit and can be ignored for $t > 0$.

2. For this problem, use Figure 8.59 on p. 311, but change it so that the switch is open for $t < 0$, then closes at $t = 0$, and assume that the switch has been open for a very long time before $t = 0$. Write the differential equation for $v$ (a capacitor voltage) for $t > 0$. As with the last problem, for $t < 0$ we have a DC circuit (since the switch is open for a long time), but this time the capacitor acts like an open circuit, so there is no current in any of the resistors for $t < 0$. This should allow you to find the voltage $v(0)$ very easily (KVL).

3. For each of the following functions, give the value of the time constant and specify the time at which the transient has effectively finished (according to class notes).
   a. $v_0(t) = 8 e^{-t/0.02}$ V for $t \geq 0$ s
   b. $v_1(t) = 12 \left( 1 - e^{-500(t-0.04)} \right)$ V for $t \geq 0.04$ s
   c. $i_2(t) = 20 - 30 e^{-333(t-20\text{ms})}$ µA for $t \geq 20$ ms

4. For each function in the last problem, provide a sketch of the function for the specified time interval. For this class, a sketch must include:
   — A label for each axis (horizontal and vertical), indicating what is being plotted along that axis, with appropriate units
   — Numerical labels for each important time instant on the horizontal axis and each important function value on the vertical axis
   — A dashed horizontal line indicating the asymptotic (final) value of the function
   — A hand-drawn sketch of the function value vs. time
   — Some indication of the time constant of the function