Review the relevant material in the text, chapter 8.

Problems Due: Friday, January 18. **Include Matlab code** with submitted work.

1. (20 points, 25% for the Matlab portion). In the circuit below, the switch has been in position a for a long time, and at time $t = 0$ is moved to position b. Note that moving the switch to position b effectively decouples the circuit into two separate first-order circuits. The component values are $R_1 = 800 \, \Omega$, $R_2 = 200 \, \Omega$, $R_3 = 1,000 \, \Omega$, $L = 0.1 \, H$, and $C = 10 \, \mu F$, with $i(t) = 0.025 \, A$.
   a. Find the initial conditions: $v_C(0^-)$ and $i_L(0^-)$.
   b. Find differential equations for $v_C(t)$ for $t \geq 0$ and for $i_L(t)$ for $t \geq 0$.
   c. By hand calculation, solve for $v_C(t)$ and $i_L(t)$ for $t \geq 0$.
   d. Define state variables and use Matlab to solve numerically for $v_C(t)$ and $i_C(t)$ for $t \geq 0$. Plot the Matlab results. Also plot your hand-calculation result for $v_C(t)$. Obviously, the Matlab result and your hand calculations should match.

![Circuit Diagram](image)

2. (20 points, half for the Matlab portion.) Text, problem 8.32. Solve the problem (find $i_L(t)$ by hand calculation). Then, define state variables, determine the required initial conditions, and use Matlab to solve for the inductor current, $i_L(t)$, the inductor voltage, $v_L(t)$, and the capacitor current, $i_C(t)$. Plot the Matlab results, carefully labeling the curves in the plots (and verify they are consistent with your hand-calculation solution).

3. (20 points, half for the Matlab portion) Text, problems 8.49. Solve the problem (find $v_0(t)$) by hand calculation. Then, define state variables, determine the required initial conditions, and use Matlab to solve for $v_0(t)$, and the inductor current, $i_L(t)$, as well as the inductor voltage, $v_L(t)$, for $t \geq 0$. Plot the Matlab results (and verify they match your hand-calculation solution).