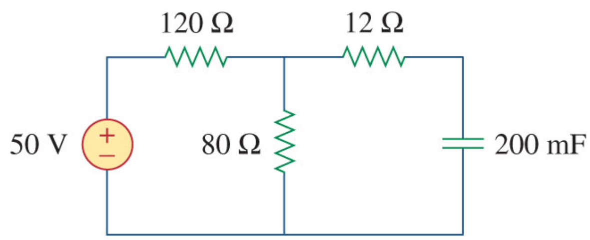
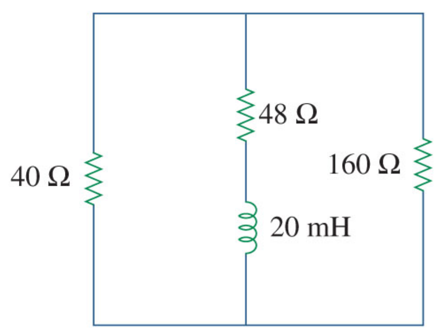
EGR 220 HW 6 Due March 12

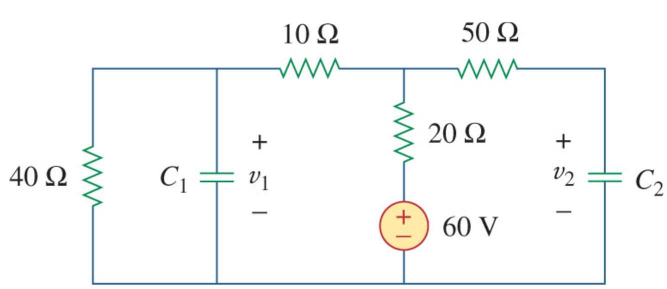
Problem 1:
Find the time constant for the circuit below.



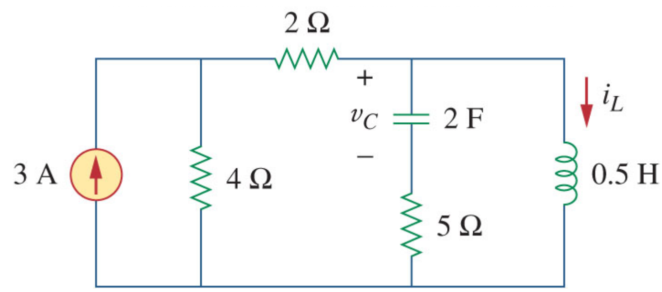
Problem 2:
Find the time constant for the circuit below.



Problem 3:
Find the voltage across the capacitors in the circuit below under dc conditions.



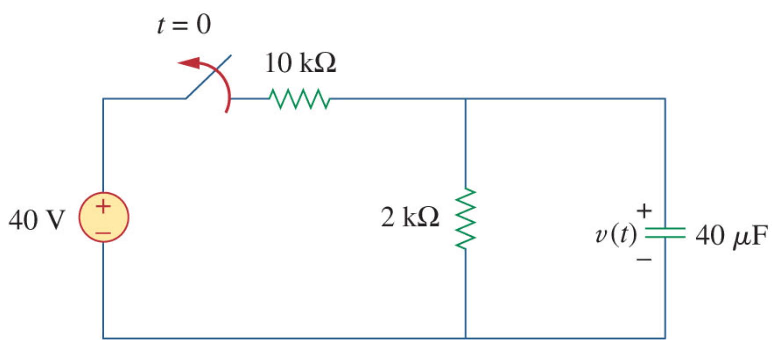
Problem 4:
Find v_C and i_L in the circuit below, under dc steady-state conditions.



Problem 5:
A 100-mH inductor is connected in parallel with a 2kΩ resistor (source-free circuit). The current through the inductor is $i(t) = 50e^{-400t} mA$

(a) Find the voltage v_L across the inductor.
(b) Find the voltage v_R across the resistor.
(c) Does $v_L + v_R = 0$? Provide a brief explanation along with yes/no.
(d) Calculate the current through the inductor at time $t = 5$ seconds.

Problem 6:
The switch has been closed for a long time, and it opens at time $t = 0$.
a) Find v(t) for time $t \geq 0$.
b) Sketch and label a graph of v(t) vs. t.



Problem 7:
A circuit is described by the differential equation:

$$4\frac{dv(t)}{dt} + v(t) = 10$$

a) What is the time constant of this circuit?
b) What is $v(\infty)$, the final value of v(t)?
c) If $v(0) = 2$, find v(t) for $t \geq 0$.
d) Sketch and label a graph of v(t) vs. t.

Note that there is a short discussion in the text on referring a 'describing equation' (*i.e.,* the differential equation) to an actual circuit.

Problem 8:
A simple relaxation oscillator circuit is shown below. The neon lamp fires when its voltage reaches 75 V and turns off when its voltage drops to 30 V. The lamp's resistance is 400Ω when on and infinitely high when off.

a) For how long is the lamp on for each period that it is on?
b) What is the time interval between light flashes?