Name: Key
Section:

EE331 Homework PS6 – fall 2012

Problems from Alexander & Sadiku:

CH6

- 6.13
- 6.20 (Ans: 1.333 microF)
- 6.46 ($i_L = 2A$, $W_L = 1J$, W_C=0J)

CH 7

- 7.40 (Just part a) – Also, graph the result – (Ans: 12V and $(4 + 8*e^{-t/6})$ V)
- 7.56 – (hint: first find i(t) through the inductor, then use the relationship from Chapter 6, equation 6.18 for inductors) – Ans: $v(t) = -4*e^{-20t}$ V

Additional Problems (Instructor Option):

- 6.74 (hint: read section 6.6.2 on pgs. 235-236) – What type of operation is accomplished?
- Any as assigned by instructor

Chapter 6, Problem 13.

Find the voltage across the capacitors in the circuit of Fig. 6.49 under dc conditions.

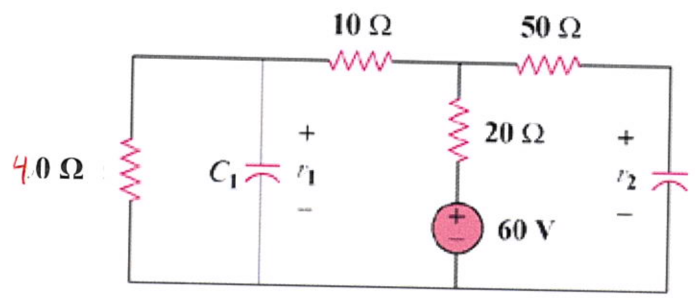
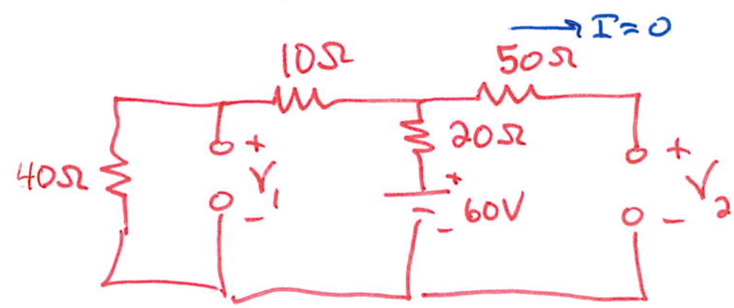


Figure 6.49

- Capacitors Look open to DC



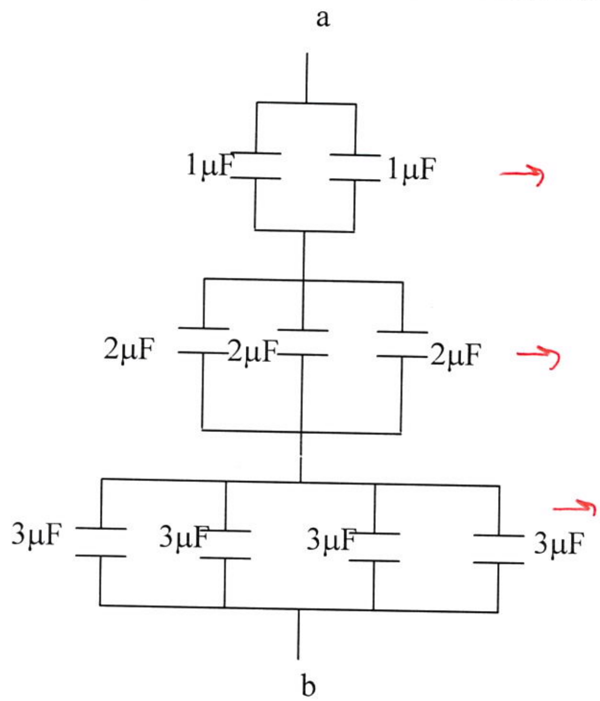
- Use Voltage Divider

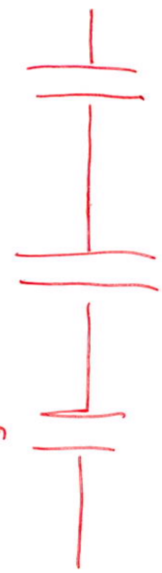
$$V_1 = \frac{60V \cdot 40\Omega}{20\Omega + 10\Omega + 40\Omega} = \boxed{34.3V}$$

$$V_2 = \frac{60V \cdot 50\Omega}{20\Omega + 10\Omega + 40\Omega} = \boxed{42.9V}$$

Chapter 6, Problem 20.

Find the equivalent capacitance at terminals a-b of the circuit in Fig. 6.54.





$C_1 = 2 \mu F$

$C_2 = 6 \mu F$

$C_3 = 12 \mu F$

Figure 6.54 For Prob. 6.20.

$$1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3 = \boxed{1.333 \mu F}$$

Chapter 6, Problem 46.

Find v_C, i_L, and the energy stored in the capacitor and inductor in the circuit of Fig. 6.69 under dc, steady-state, conditions.

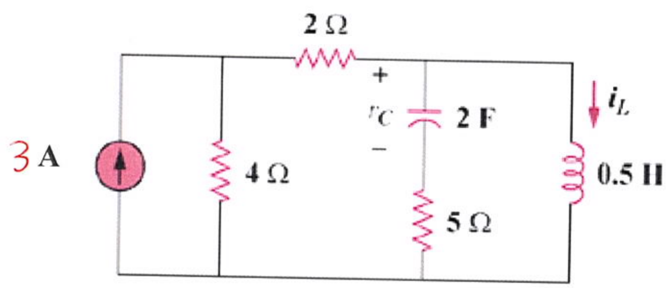
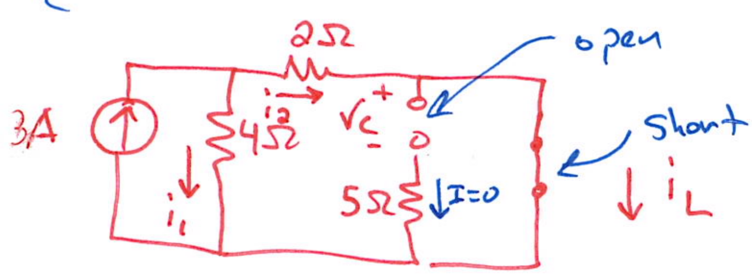


Figure 6.69

* { Capacitor Looks Like open
Inductor Looks Like Short



Current Divider (or could Source Convert) $\Rightarrow$ $i_1 = \dfrac{3A \cdot 2\Omega}{2\Omega + 4\Omega} = 1\ A$

$$\boxed{i_2 = i_L = 3A - 1A = 2A}$$

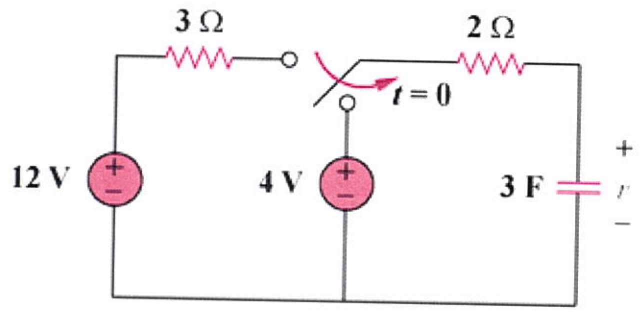
← or could get w/current Divider Straight Away!

- $W_L = \frac{1}{2} L i^2 = \frac{1}{2} (0.5H) \cdot (2A)^2 = \boxed{1J}$
- $W_C = \frac{1}{2} C V^2 = \frac{1}{2} \cdot (2F) \cdot (0V)^2 = \boxed{0J}$

No Voltage Across as inductor Shorted

Chapter 7, Problem 40.

Find the capacitor voltage for $t < 0$ and $t > 0$ for each of the circuits in Fig. 7.107.



(a)

Figure 7.107

(use if want current)

• $i_c(t) = C\dfrac{dV_c(t)}{dt}$

Step 1 → $V_c(t) = V_c(\infty) + [V_c(0) - V(\infty)]e^{-t/\tau}$

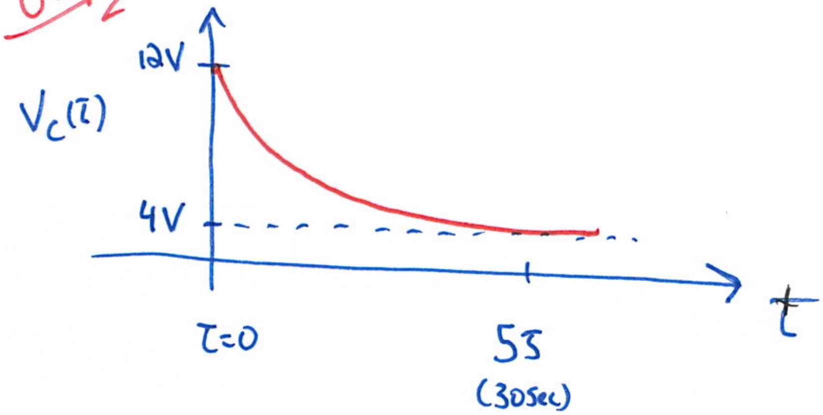
Steps 2→4 ⇒ $V_c(\infty) = 4V$

$V_c(0^-) = V_c(0^+)$ $\quad V_c(0) = 12V$

$\tau = R_{TH}C = (2\Omega)\cdot(3F) = 6\text{ sec}$

Step 5 ⇒ $V_c(t) = \begin{cases} 4V + (8V)e^{-t/6} & \text{for } t > 0 \\ 12V & \text{for } t < 0 \end{cases}$

Graph



Chapter 7, Problem 56.

For the network shown in Fig. 7.122, find $v(t)$ for $t > 0$.

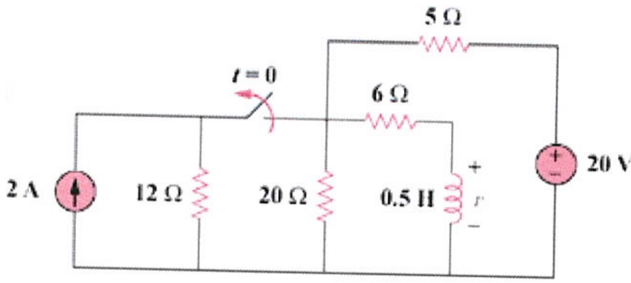
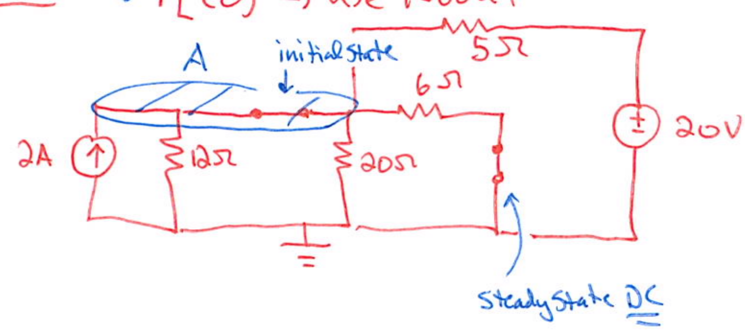


Figure 7.122

Step1 → • $i_L(t) = \underbrace{i_L(\infty)}_{\text{final}} + [\underbrace{i_L(0)}_{\text{initial}} - i_L(\infty)]e^{-t/\tau}$

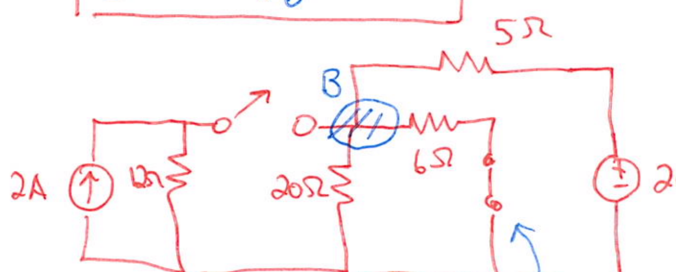
Steps 2→4 → • $i_L(0)$ → use Nodal



$$-2A + \frac{V_A - 0}{12\Omega} + \frac{V_A - 0}{20\Omega} + \frac{V_A - 0}{6\Omega} + \frac{V_A - 20V}{5\Omega} = 0 \rightarrow V_A = 12V$$

$$\Rightarrow \boxed{i_L(0) = V_A/6 = 2A}$$

• $i_L(\infty)$ →



Steady State

• → $V_B = \dfrac{20V \cdot (20 \| 6)}{(20 \| 6) + 5} = 9.6V$

$$\boxed{i_L(\infty) = V_B/6\Omega = 1.6A}$$

• → $R_{eq} = 6 + 20 \| 5 = 10\Omega = R_{TH}$

• $\tau = L/R_{TH} = 0.5H/10\Omega = 0.05$

Step5 → $\boxed{i_L(t) = 1.6 + (2 - 1.6)e^{-t/0.05}A = 1.6 + 0.4e^{-20t}A}$

Final Answer → $\boxed{V_L(t) = L\,di/dt = \tfrac{1}{2}(0.4)(-20)e^{-20t} = -4e^{-20t}}$ ✓

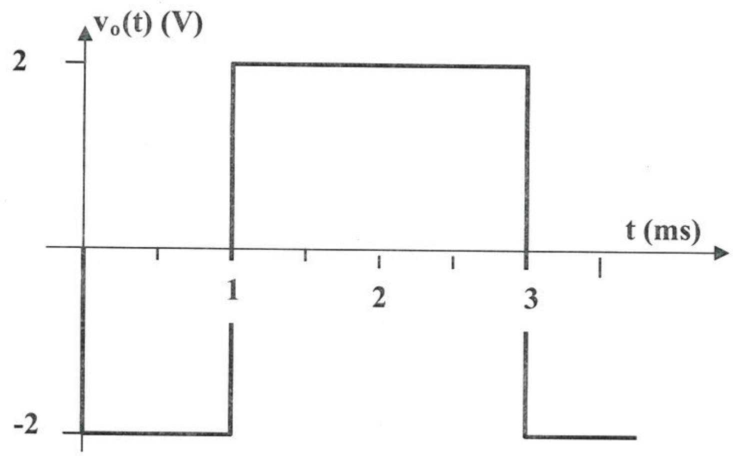
Chapter 6, Solution 74.

RC = 0.01 x 20 x 10^{-3} sec

$$v_o = -RC\frac{dv_i}{dt} = -0.2\frac{dv}{dt}\,\text{m sec}$$

$$v_o = \begin{cases} -2V, & 0 < t < 1 \\ 2V, & 1 < t < 3 \\ -2V, & 3 < t < 4 \end{cases}$$

Thus $v_o(t)$ is as sketched below:



Differentiator