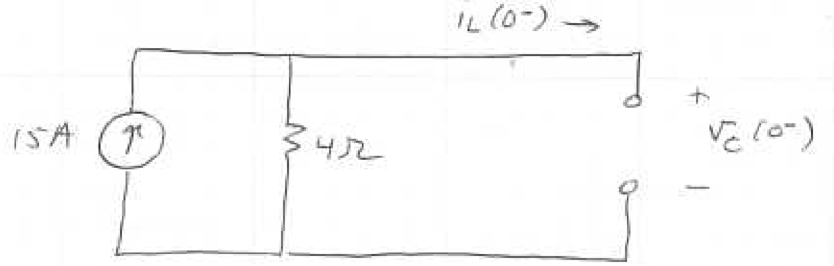
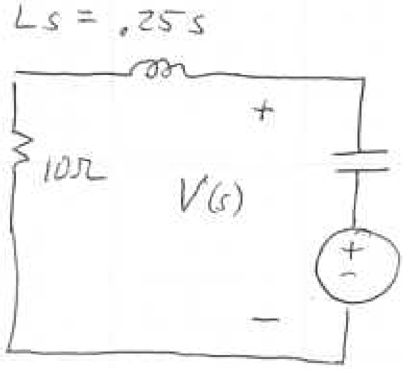
8.17

<u>Step 1</u> Identify initial conditions (replace L → short and C → open)



$i_L(0^-) = 0$ because of the open, all current through 4Ω resistor so $V_{4\Omega} = 15A(4\Omega) = 60V$, then by KVL $V_C(0^-) = 60V$

<u>Step 2</u> Flip switch, place circuit in s-domain



$$\frac{1}{Cs} = \frac{1}{.04s} = \frac{25}{s}$$

$$\frac{V_C(0^-)}{s} = \frac{60}{s}$$

V(s) is voltage across the RL part of circuit

Voltage Divider → $V = \frac{60}{s}\ \frac{0.25s+10}{.25s+10+\frac{25}{s}} = \frac{15s+600}{.25s^2+10s+25}$

or $V = \frac{60s+2400}{s^2+40s+100} = \frac{A}{s+2.679} + \frac{B}{s+37.32}$

$$A = \frac{60(-2.679)+2400}{-2.679+37.32} = 64.64$$

$$B = \frac{60(-37.32) + 2400}{-37.32 + 2.679} = -4.64$$

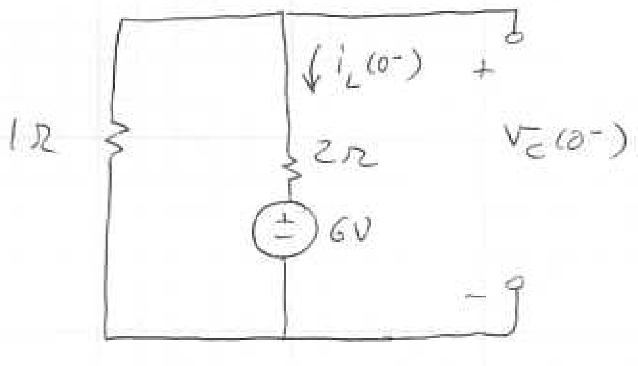
$$V = \frac{64.64}{s+2.679} - \frac{4.64}{s+37.32}$$

$$v(t) = 64.64 e^{-2.679t} u(t) - 4.64 e^{-37.32t} u(t)$$

check $v(0) = 64.64 - 4.64 = 60V$ ✓

8.48

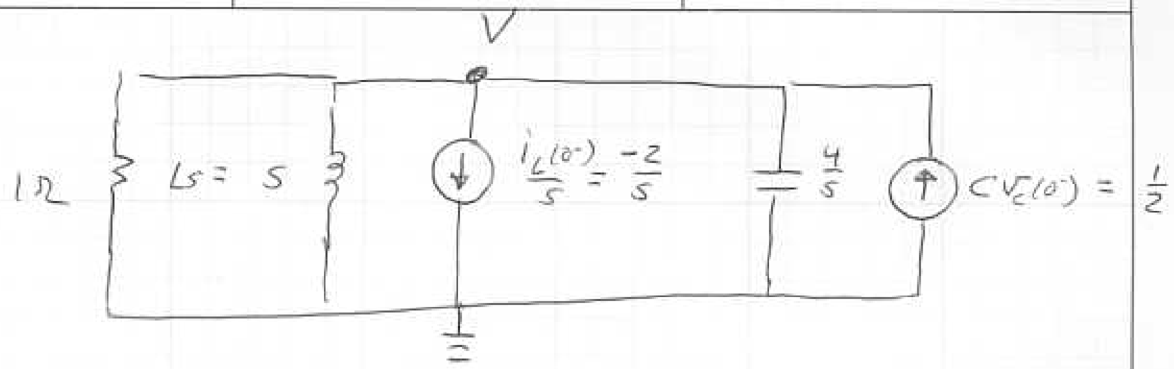
Step 1 Find Initial Conditions : L → short C → open



$$v_C(0^-) = V_{1\Omega} = 6V \frac{1\Omega}{1\Omega+2\Omega} = 2V$$

$$i_L(0^-) = \frac{-6V}{1\Omega+2\Omega} = -2A$$ (current flows opposite direction)

Step 2 Place circuit in s-domain (all elements in parallel so use parallel models)



<u>step 3</u> Perform nodal to get parallel voltage

$$\frac{V}{1} + \frac{V}{s} - \frac{2}{s} + \frac{V}{4/s} - \frac{1}{2} = 0$$

solving with calculator gives

$$V = \frac{2(s+4)}{s^2+4s+4} = \frac{2(s+4)}{(s+2)(s+2)}$$

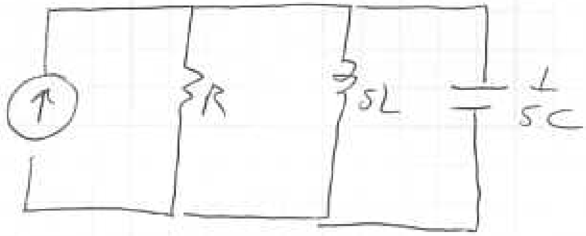
so expanding gives

$$V = \frac{2}{s+2} + \frac{4}{(s+2)^2}$$

Thus

$$v(t) = 2e^{-2t}u(t) + 4te^{-2t}u(t)$$

8.52



$$Z_p = \frac{1}{sC + \frac{1}{R} + \frac{1}{sL}} = \frac{sL}{s^2LC + \frac{L}{R}s + 1} = \frac{s/C}{s^2 + \frac{1}{RC}s + \frac{1}{LC}}$$

Thus the response has the quadratic term

$$s^2 + \frac{1}{RC}s + \frac{1}{LC}$$

The poles of the given response are at

$$s_{1,2} = -300 \pm j400$$

which gives the polynomial

$$(s + 300 + j400)(s + 300 - j400) = s^2 + 600s + 250 \times 10^3$$

matching

$$\frac{1}{RC} = 600 \qquad \frac{1}{LC} = 250 \times 10^3$$

since $L = 50\,mH$ then $C = \frac{1}{.05(250 \times 10^3)} = \underline{80\mu F}$

$$R = \frac{1}{600\,C} = \frac{1}{600(80 \times 10^{-6})} = \underline{20.83\Omega}$$