Practice 1: For a capacitor with C=2F, given i(t) = 6sin4t A, v(0)=1V. Find v(t) for $t \geq 0$.

$$v(t) = v(0) + \frac{1}{C}\int_0^t i(t)dt = 1 + \frac{1}{2}\int_0^t 6sin4t\ dt\ = 1 + \frac{1}{2}\left(-\frac{6}{4}\right)cos4t\Big|_0^t$$
$$= 1 + \left(-\frac{3}{4}cos4t\ - \left(-\frac{3}{4}\right)\cos 0\right)\ = \frac{7}{4} - \frac{3}{4}cos4t\ V$$

Practice 2: For an inductor with L=0.1H, given $i(t) = 10t\, e^{-5t}$ A. Find v(t), w(t).

$$v(t) = L\frac{di}{dt} = 0.1(10t(-5)e^{-5t} + 10e^{-5t}) = (-5t+1)e^{-5t}V$$
$$w(t) = \frac{1}{2}Li^2(t) = \frac{1}{2}(0.1)100t^2e^{-10t} = 5e^{-10t}J$$

Practice 3: Given C= 4mF, i(0)=2A, and

$$v(t) = \begin{cases} 50V, & t<0 \\ Ae^{-100t} + Be^{-600t}, & t \geq 0 \end{cases}$$

Find A and B.

Use initial condition and continuity to form two equations for A and B:
By continuity,

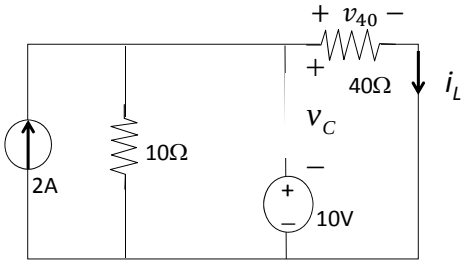
$$v(0) = Ae^0 + Be^0 = A + B = 50 \qquad (1)$$

Use the initial condition i(0)=2A and i=Cdv/dt, we obtain

$$C\frac{dv}{dt}\Big|_{t=0} = 4 \times 10^{-3}(-100A - 600B) = 2$$
$$-0.4A - 2.4B = 2 \qquad (2)$$

Solve (1) and (2), we have A=61, B=-11

Practice 4: Find v_c, i_L under DC condition. Replace C with open circuit, L with short circuit:



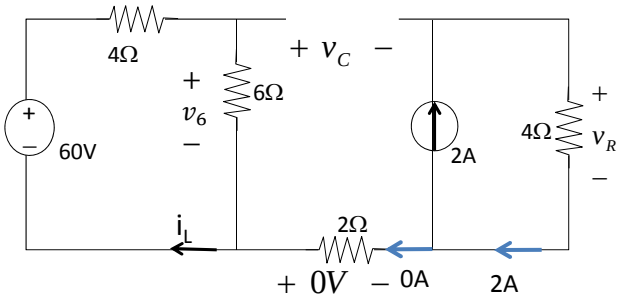
Since 10V is not connected, 10ohm and 4ohm share 2A, in parallel

By current division, $i_L = \frac{10}{40+10} * 2 = 0.4A,\ v_{40} = 0.4 \times 40 = 16V$

By KVL $v_{40} - 10 - v_c = 0,$

$$v_c = 16 - 10 = 6V$$

Practice 5: Find i_L, v_C, v_R under DC condition. Replace C with open, L with short.



Since capacitor is open, all 2A runs through 4ohm (on the right hand side). Thus no current and voltage across 2ohm. Thus by KVL,

$$v_c = v_6 - v_R$$

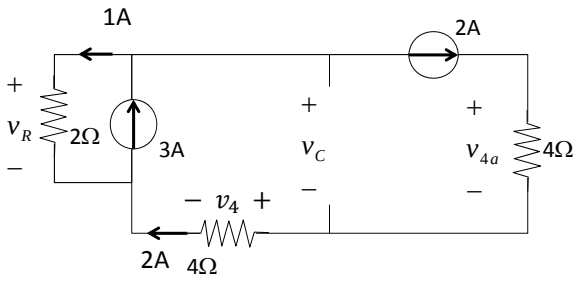
$$v_R = 2 \times 4 = 8V$$

Again, since capacitor is open, 4ohm (on top) and 6ohm are in series,

By voltage division, $v_6 = \frac{6}{4+6}60 = 36V,\ Thus\ v_c = 36 - 8 = 28V$

i_L can be obtained by ohm's law: $i_L = \frac{60}{4+6} = 6A$

Practice 6: Find v_C and v_R under DC condition. Replace C with open, L with short.



Because C is open, same 2A current through the two 4ohm resistors.

$$v_4 = 2 \times 4 = 8V$$

By KCL, 1A through 2ohm resistor. Thus $v_R = 1 \times 2 = 2V$

By KVL, $v_c = v_R - v_4 = 2 - 8 = -6V$

A common mistake is make $v_c = v_{4a} = 8V$. This is incorrect since the voltage across 2A is not 0.