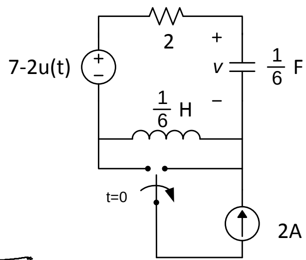
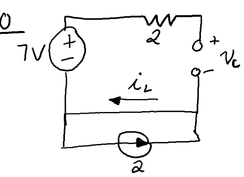
1) Find *v(t)*

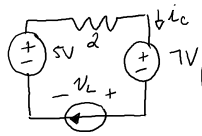


① $\underline{t<0}$



by inspection $i_L = 2A$
$v_c = 7V$

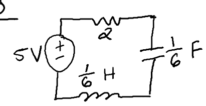
② $\underline{t=0^+}$



$v_c' = \frac{1}{C} i_c = 6(2) = 12 V/s$

$\boxed{\begin{aligned} v(0^+) &= 7V \\ v'(0^+) &= 12 V/s \end{aligned}}$

③ $\underline{t>0}$



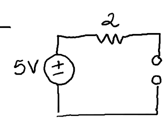
$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{1/36}} = 6$$

$$\alpha = \frac{R}{2L} = \frac{2}{2/6} = 6$$

$$S = -\alpha \pm \sqrt{\alpha^2 - \omega_0^2}$$

$$= -6\ \ -6 \quad \boxed{\Rightarrow v_n(t) = C_1 e^{-6t} + C_2 t e^{-6t}}$$

④ $\underline{t' = \infty}$



$v = 5V$ by inspection $\Rightarrow v_f(t) = 5$

⑤ $v(t) = v_n + v_f = C_1 e^{-6t} + C_2 t e^{-6t} + 5$

$v(0) = C_1 + 5 = 7 \Rightarrow C_1 = 2$

$v'(t) = -6C_1 e^{-6t} + C_2 e^{-6t} + C_2 t (-6) e^{-6t}$

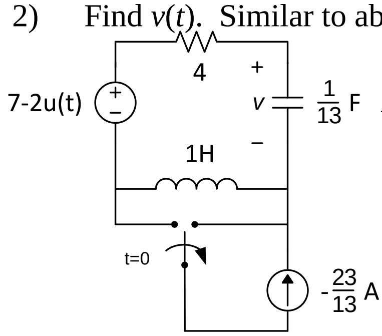
$v'(0) = -6C_1 + C_2 = 12$

$-12 + C_2 = 12$

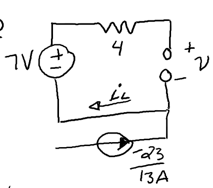
$C_2 = 24$

$$\boxed{v(t) = 2e^{-6t} + 24t e^{-6t} + 5}$$

2) Find *v*(*t*). Similar to above, but solutions look quite different.



$\underline{t<0}$



$v = 7V$

$i_L = -\frac{23}{13}$ A

$\underline{t=0^+}$

$v_c' = \frac{1}{C} i_c = 13\left(-\frac{23}{13}\right) = -23 V/s$

so $\boxed{\begin{aligned} v(0^+) &= 7V \\ v'(0^+) &= -23 V/s \end{aligned}}$

$\underline{t>0}$

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{1/13}} = \sqrt{13}$$

$$\alpha = \frac{R}{2L} = 4/2 = 2$$

$$S = -\alpha \pm \sqrt{\alpha^2 - \omega_0^2}$$

$$= -2 \pm \sqrt{4 - 13} = -2 \pm j3 \Rightarrow \text{underdemped}$$

$$v_n(t) = e^{-2t}(C_1 \cos(3t) + C_2 \sin(3t))$$

$\underline{t = \infty}$

$v_f = v_\infty = 5V$

$v(t) = v_f + v_n = e^{-2t}[C_1 \cos(3t) + C_2 \sin(3t)] + 5$

$v(0) = 7 = C_1 + 5 \Rightarrow C_1 = 2$

$v(t) = e^{-2t}[2\cos(3t) + C_2 \sin(3t)] + 5$

$v'(t) = [e^{-2t}][-6\sin(3t) + 3C_2 \cos(3t)] - 2e^{-2t}[2\cos(3t) + C_2 \sin(3t)]$

$v'(0) = 3C_2 - 2 \cdot 2 = 3C_2 - 4 = -23 \Rightarrow 3C_2 = -19 \Rightarrow C_2 = -19/3$

$$\boxed{v(t) = e^{-2t}\left[2\cos(3t) - \frac{19}{3}\sin(3t)\right] + 5\ V}$$