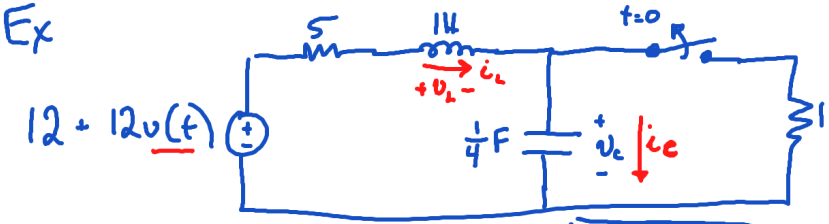
Ex

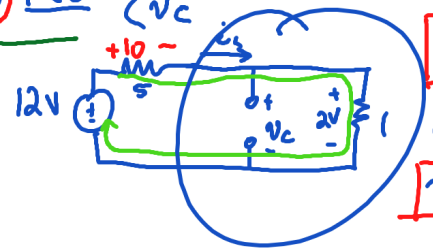


$i_c = C v_c'$
$v_L = L i_L'$

Find v_c, all time

① Find IC

ⓐ $t<0$ { i_L, v_c



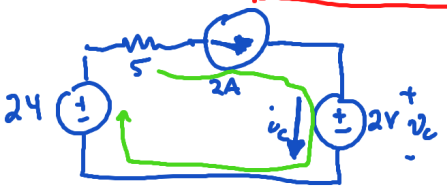
$i_L = \frac{V}{R} = 2A$ $\frac{12}{6}=2A$

$v_c = 12 \cdot \frac{1}{5+1} = 2V$

$v_c = 2V$ (2A)(1Ω)=2V

ⓑ $t=0^+$ { x, x'

$v_c = 2V$
$v_c' = 8$ V/s



$v_c' = \frac{1}{C} i_c$
$= 4(2)$
$= 8$ V/s

② $v_n = x_n$

- $\alpha = \frac{R}{2L} = 2.5$
- $\omega_0 = \frac{1}{\sqrt{LC}} = 2$
- $s = -\alpha \pm \sqrt{\alpha^2 - \omega_0^2} = \begin{cases} -1 \\ -4 \end{cases}$

$\omega_d = \text{Im}\{s\}$
$\alpha = \text{Re}\{s\}$

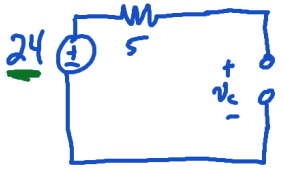
$\alpha > \omega_0$ not osc over damp •
$\alpha = \omega_0$ " critically damp
$\alpha < \omega_0$ oscil underdamped

$t>0$

$v_n(t) = C_1 e^{s_1 t} + C_2 e^{s_2 t}$ ← over d. •
$v_n(t) = C_1 e^{st} + C_2 t e^{st}$ ← crit.
$v_n(t) = e^{-\alpha t}[C_1 \cos(\omega_d t) + C_2 \sin(\omega_d t)]$ ← underd.

$v_n = C_1 e^{-t} + C_2 e^{-4t}$

③ v_f x_f $t=\infty$



$v_f = 24V$

$x = x_n + x_f$

④ $v_c(t) = v_n + v_f$, sub IC

$v_c(t) = C_1 e^{-t} + C_2 e^{-4t} + 24$

$v_c(0) = 2 = C_1 + C_2 + 24 \Rightarrow C_1 + C_2 = -22$

$v_c'(0^+) = 8 = -C_1 - 4C_2 \Rightarrow -C_1 - 4C_2 = 8$

$-3C_2 = -14$

$C_2 = 14/3 = 4.67$

$C_1 = -22 - C_2$
$= -22 - 14/3$
$= -26.7$

$v_c(t) = \begin{cases} 2V, & t<0 \\ -26.7e^{-t} + 4.67e^{-4t} + 24\ V, & t>0 \end{cases}$

$v_c(t) = 2 + (\quad + 22)u(t)$

$v_c'(t) = -C_1 e^{-t} - 4C_2 e^{-4t}$
$v_c'(0) = -C_1 - 4C_2 = 8$