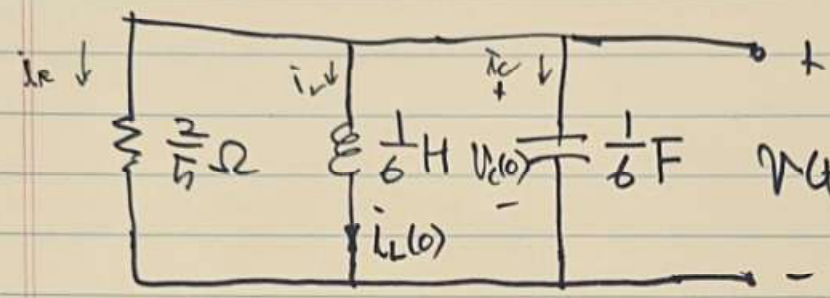
Ex. 4.1 Determine the voltage $v(t)$ for $t>0$.



here $v_c(0) = 2\,V$

$i_L(0) = 2\,A$

i) $\frac{d^2v(t)}{dt^2} + \frac{1}{RC}\frac{dv(t)}{dt} + \frac{1}{LC}v(t) = 0$: differential eq.

ii) $s^2 + \frac{1}{RC}s + \frac{1}{LC} = 0$: characteristic eq.

$s^2 + 15s + 36 = 0 \quad (s^2 + 2\alpha s + \omega_0^2 = 0)$

$\therefore \alpha = \frac{15}{2} \quad \omega_0 = 6$

$\Rightarrow (s+3)(s+12) = 0$

iii) $\therefore v(t) = A_1 e^{-3t} + A_2 e^{-12t}$

iv) $v(t)|_{t=0} = 2V \Rightarrow A_1 + A_2 = 2$

v) at the top node $i_R + i_C + i_L = 0$ (KCL)

$\frac{v(t)}{R} + C\frac{dv(t)}{dt} + i_L(t) = 0$

$\Rightarrow t=0, \quad \frac{dv(0)}{dt} = -\frac{v(0)}{RC} - \frac{i_L(0)}{C}$

$= -30 - 12 = -42$

vi) $\frac{dv(t)}{dt} = -3A_1 e^{-3t} - 12A_2 e^{-12t}$

$\frac{dv(0)}{dt} = -3A_1 - 12A_2 = -42$

$\therefore A_1 = -2 \quad A_2 = 4,$ $\boxed{v(t) = -2e^{-3t} + 4e^{-12t}\,[V],\ t>0}$