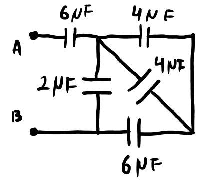
4.1) a)

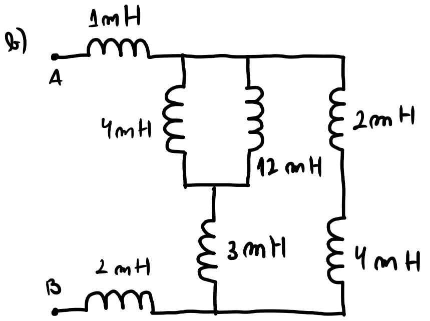


$$\left(\left[(4\mu F // 4\mu F) + 6\mu F\right] // 2\mu F\right) + 6\mu F = \left(\frac{1}{\left(\frac{1}{4+4} + \frac{1}{6}\right)^{-1} + 2} + \frac{1}{6}\right)^{-1} = 2{,}85\ \mu F$$

// - Paralelo

\+ - Série

b)



$$(2mH + 4mH) // \left[(4mH // 12mH) + 3mH\right] + 1mH + 2mH = 6mH$$

4.2) a) $W_C = \frac{1}{2} \cdot C \cdot V_c^2 = \frac{1}{2} \cdot 100 \cdot 10^{-6} \cdot 4^2 = 0{,}8\ mJ$

$C = 100 \times 10^{-6} F$

$V_C = 4V$

b) Em $t = \infty$:

$V_c = 4 \cdot \frac{10}{10+10} = 2V$

$V_{R_L} = V_C \Rightarrow V_{R_L} = 2V$

c) $V_C(t) = K_1 + K_2 e^{-t/\tau}$ (solução tipo)

$\Downarrow$

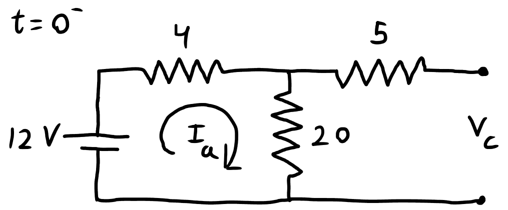
$\begin{cases} V_C(0) = K_1 + K_2 \\ V_c(\infty) = K_1 \end{cases}$ temos tambem que $\begin{cases} V_c(0) = 4V \\ V_c(\infty) = 2V \\ \tau = R_{Th} \cdot C = 5 \times 10^3 \times 100 \times 10^{-6} = 0{,}5 \end{cases}$

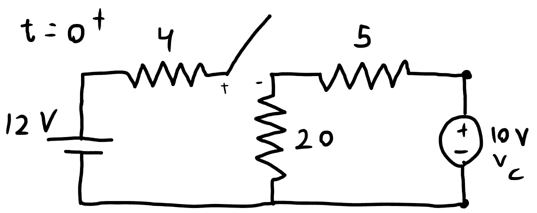
Logo $K_1 = 2$

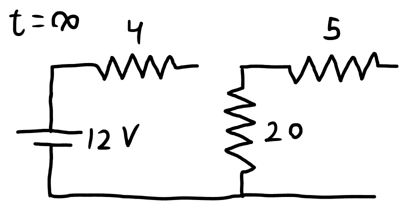
$K_2 = 2$

Temos então: $V_C(t) = 2 + 2e^{-\frac{t}{0.5}}$

4.3) a) $V_C(0^-) = V_C(0^+) = 10V$!







$I_a = \frac{12}{20+4} = 0{,}5A$

$V_c = 20 \cdot 0{,}5 = 10V$

$\tau = R_{Th} \cdot C = 25 \cdot 50m = 1.25$

$V_C(0^+) = 10V$

$V_R(0^+) = 10 \cdot \frac{20}{20+5} = 8V$

$V_{SW}(0^+) = 12 - 8 = 4V$

$V_C(\infty) = 0$

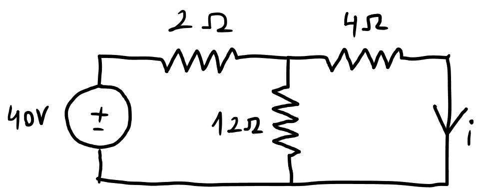
$V_R(\infty) = 0$

$V_{SW}(\infty) = 12V$

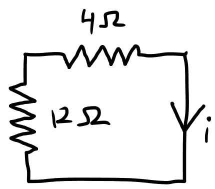
Pelo metodo de K_1 e K_2: $V_C(t) = 10e^{-\frac{t}{1.25}}$ $\quad V_R(t) = 8 \cdot e^{-\frac{t}{1.25}}$ $\quad V_{SW}(t) = 12 - 8e^{-\frac{t}{1.25}}$

$V_c(1) = 4.49V$ $\quad V_R(1) = 3.59V$ $\quad V_{SW}(1) = 8.41V$

4.4) Em $t=0$:



Em $t=\infty$:



$i(0) = 6\,A$ $\qquad \tau = \frac{R}{L} = \frac{8}{2} = 4$

$i(\infty) = 0\,A$

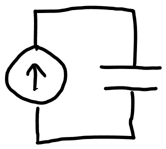
$i(t) = k_1 + k_2\, e^{-\frac{t}{\tau}}$

$i(t) = 6\, e^{-\frac{t}{4}}$

4.5) a) $W_C = \frac{1}{2} \cdot C \cdot V^2 = \frac{1}{2} \cdot (1 \cdot 10^{-6}) \cdot (2 \cdot 10^{-3} \cdot 10 \cdot 10^{3})^2 = 2 \times 10^{-4}\, J$

$P = I \cdot V = 2 \cdot 10^{-3} \cdot (-20) = -0.04\, W$

b)



$i = C \frac{dV}{dt} \Leftrightarrow \frac{i}{C} = \frac{dV}{dt} \Leftrightarrow \frac{dV}{dt} = 2000 \Leftrightarrow V = 2000t + \underbrace{k}_{\text{tensão inicial}}$

$V(t) = 2000t + 20$

$V(t_1) = 2000(15\,ms) + 20 = 50\,V$

c) $V_C(t_1) = 50V$ $\qquad V(t) = k_1 + k_2\, e^{-\frac{t-15ms}{\tau}}$

$V_C(\infty) = 20V$ $\qquad k_1 + k_2 = 50$

$k_1 = 20$

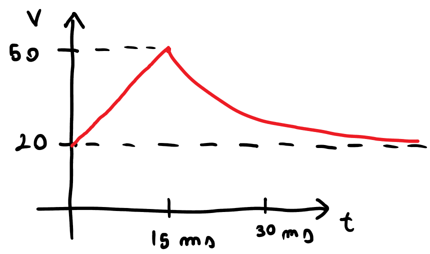
$\tau = 10 \cdot 10^3 \cdot 1 \cdot 10^{-6} = 10 \cdot 10^{-3}$

Logo $V(t) = 20 + 30\, e^{-\frac{t-15ms}{10 \cdot 10^{-3}}}$

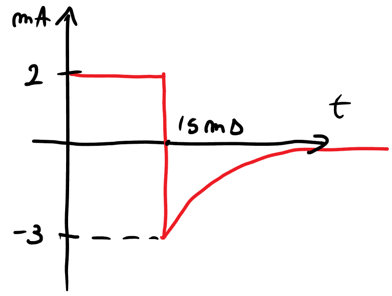
$V(t_2) = V(30\,ms) = 26.69\,V$

d)

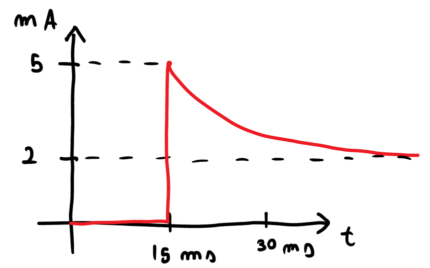
$V_C(t)$



$i_C = \frac{dV_C}{dt} \cdot C$



$i_R(t)$



4.6) De 1 para 5:

$V_c(0^-) = V_c(0^+) = 1$ $\quad V_c(\infty) = 5V$ $\quad \tau = R \cdot C = 10^{-4}$ $\quad$ Logo $V_c(t) = 5 - 4e^{-10^4 t}$

$V_R(0^+) = 4V$ $\quad V_R(\infty) = 0$ $\quad V_R(t) = 4e^{-10^4 t}$

De 5 para -2:

$V_C(150\mu s) = 4.11V$ $\quad V_C(\infty) = -2$ $\quad \tau = 10^{-4}$ $\quad$ Logo $V_C(t) = -2 + 6.11e^{-10^4(t-t_1)}$

$V_R(150\mu s) = -6.11V$ $\quad V_R(\infty) = 0$ $\quad V_R(t) = -6.11e^{-10^4(t-t_1)}$

$$V_C = \begin{cases} 1 & , \ t \leq 0 \\ 5 - 4e^{-10^4 t} & , \ 0 \leq t \leq t_1 \\ -2 + 6.11e^{-10^4(t-t_1)} & , \ t \geq t_1 \end{cases} \qquad V_R = \begin{cases} 0 & , \ t \leq 0 \\ 4e^{-10^4 t} & , \ 0 \leq t \leq t_1 \\ -6.11e^{-10^4(t-t_1)} & , \ t \geq t_1 \end{cases}$$