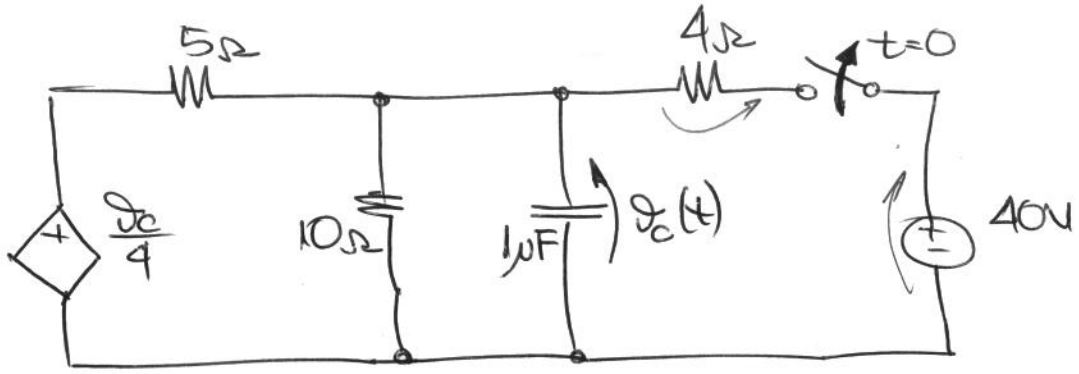
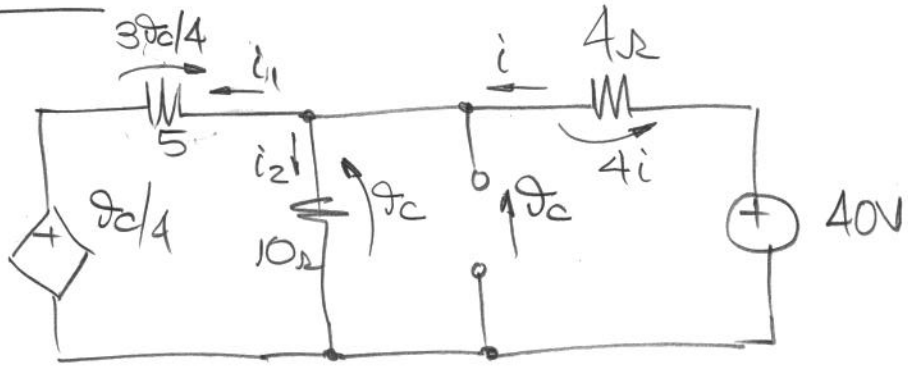
QUESTÃO 2 — EA 513 – 2ª PROVA – 1ºSEM 2010

DETERMINE $v_c(t)$ PARA TODO t.



$t<0$



DO CIRCUITO, TIRAMOS

$$\frac{3v_c}{4} = i_1 . 5 \rightarrow \boxed{i_1 = \frac{3v_c}{20}\ A}$$

$$v_c = i_2 . 10 \rightarrow \boxed{i_2 = \frac{v_c}{10}\ A}$$

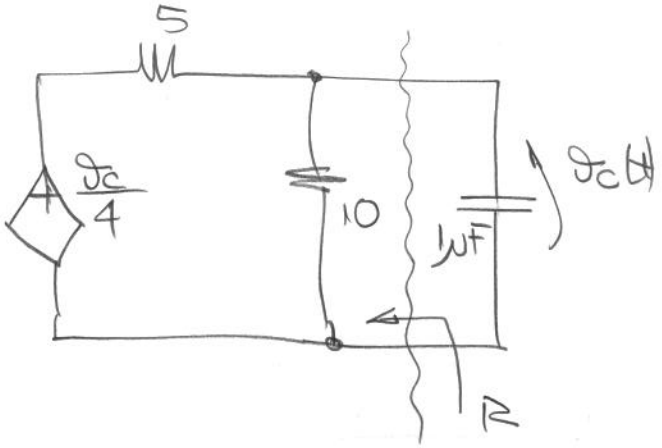
$$\boxed{i = i_1 + i_2 = v_c/4\ A}$$

$$v_c + 4i = 40$$

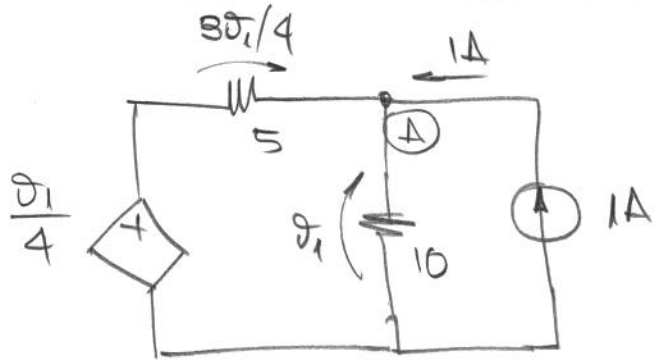
$$v_c + 4 . \frac{v_c}{4} = 40 \rightarrow \boxed{v_c = 20V}$$

$$\therefore \boxed{v_c(t) = 20V \text{ p/ } t \leq 0}$$

$t>0$



VAMOS CALCULAR A ~~RESISTÊNCIA DE~~ THEVENIN R



$R = \frac{\vartheta_1}{1A}$

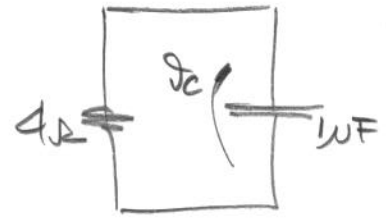
$\vartheta_1 = ?$

LKC NO NÓ A: $\frac{3\vartheta_1}{4}/5 + \vartheta_1/10 = 1$

$\frac{3\vartheta_1}{20} + \frac{\vartheta_1}{10} = \frac{\vartheta_1}{4} = 1 \rightarrow \boxed{\vartheta_1 = 4V}$

$\therefore \boxed{R = 4\Omega}$

$\Rightarrow$



$\vartheta_c(t) = A\, e^{-1/RC}$

$RC = 4.10^{-6}\ s^{-1}$

$A = ?$ $\quad \vartheta_c(0) = 20 = A.e^0 \rightarrow \boxed{A = 20}$

$$\therefore \boxed{\vartheta_c(t) = \begin{cases} 20 & p/\ t \leq 0 \\ 20\, e^{-t/4.10^{-6}} & t > 0 \end{cases}}$$

FINALMENTE:

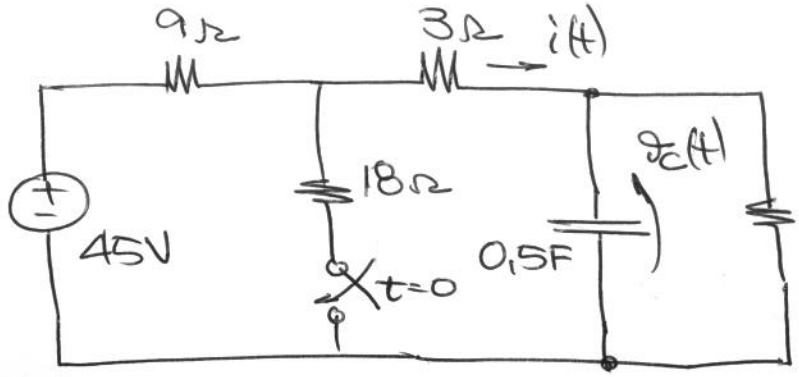
$$\begin{cases} i(t) = 2 - \frac{1}{3} e^{-t/1.8} \text{ A} & t > 0 \\ v_c(t) = 12 + 3 e^{-t/1.8} \text{ V} & t \geq 0 \end{cases}$$

RISPOSTA COMPLETA

$$v_c(t) = \begin{cases} 15\text{V} & t < 0 \\ 12 + 3 e^{-t/1.8} \text{ V} & t > 0 \end{cases}$$

$$i(t) = \begin{cases} 2.5\text{ A} & t < 0 \\ 2 - \frac{1}{3} e^{-t/1.8} \text{ A} & t > 0 \end{cases}$$

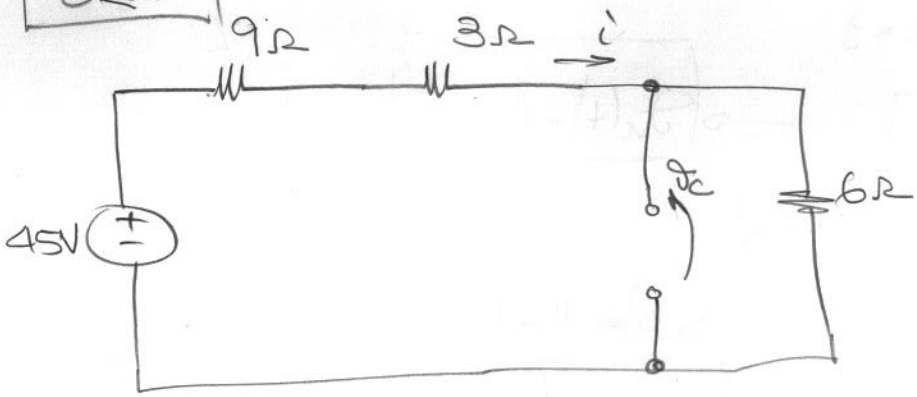
QUESTÃO 3



$i(t) = ?$

$v_c(t) = ?$

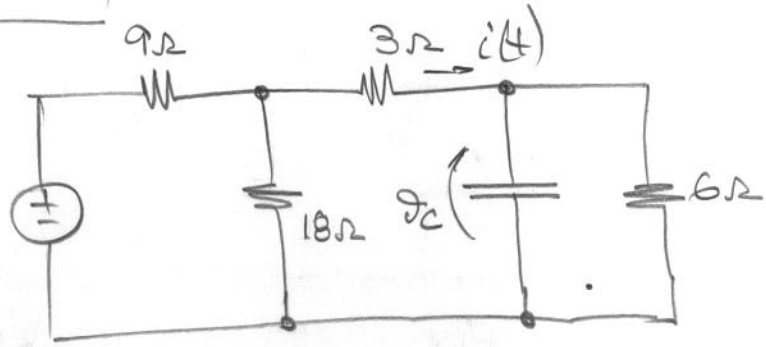
t≤0



$i = \frac{45}{18} = 2{,}5A \qquad v_c = i \cdot 6 = 15V$

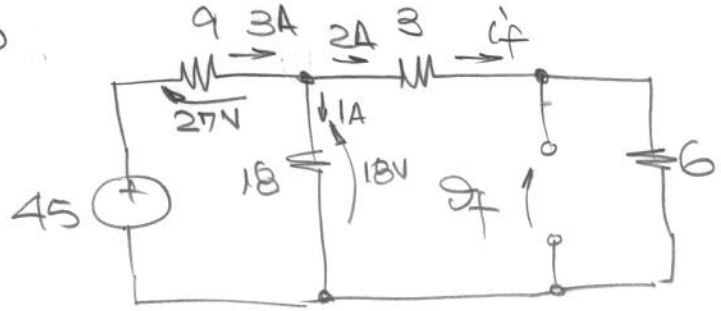
$\boxed{i(t) = 2{,}5A \text{ p/ } t<0} \qquad \boxed{v_c(t) = 15V \text{ p/ } t\leq 0}$

t>0



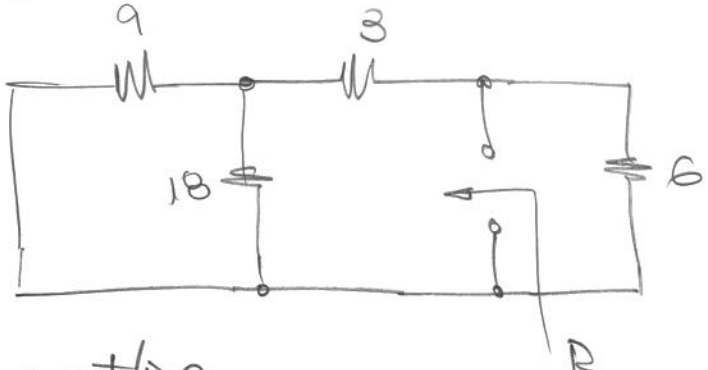
$v_c(t) = v_f + v_n(t)$

$v_f = 0$



$\boxed{v_f = 2.6 = 12V}$

$v_n(t) = ?$



$v_n(t) = A e^{-t/RC}$

$C = 0{,}5F$, $R = ?$

$\boxed{R = 3{,}6\Omega}$ $\rightarrow$ $\boxed{v_n(t) = A e^{-t/1.8} \ V}$

$RC = 0{,}5 \times 3{,}6 = 1.8 \ s$

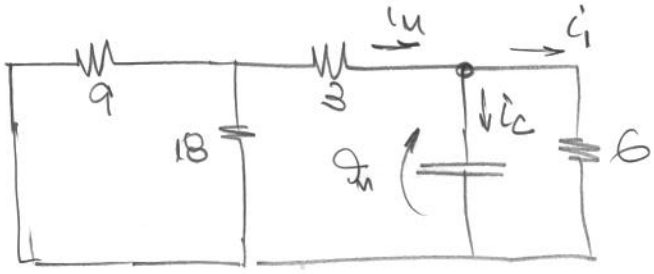
$v_c(t) = 12 + A e^{-t/1.8}$ $\quad v_c(0) = 15V = 12 + A \rightarrow \boxed{A = 3}$

$\therefore \boxed{v_c(t) = 12 + 3e^{-t/1.8} \ V} \quad t \geq 0$

$i(t) = i_f + i_n(t)$

$\boxed{i_f = 2A}$ $\rightarrow$ (da análise de v_f)

$i_n(t) = ?$



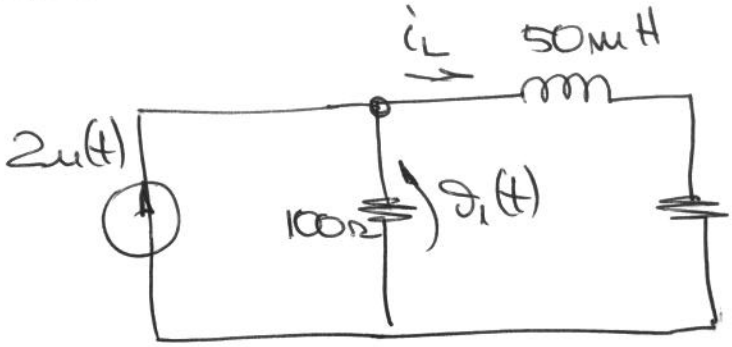
$i_n(t) = i_c(t) + i_1(t)$

$\boxed{i_c(t) = C \frac{dv_n(t)}{dt} = 0{,}5 \frac{d}{dt} 3e^{-t/1.8} = \underline{0{,}5 \times 3 \times \left(\frac{-1}{1.8}\right) e^{-t/1.8}} = \frac{-5}{6} e^{-t/1.8}}$

$\boxed{i_1(t) = \frac{v_n(t)}{6} = \frac{3}{6} e^{-t/1.8} \ A}$

$\therefore \ i_n(t) = i_c(t) + i_1(t) = \left(\frac{3}{6} - \frac{5}{6}\right) e^{-t/1.8} = -\frac{1}{3} e^{-t/1.8}$

QUESTÃO 4



$i_L(t) = ?$

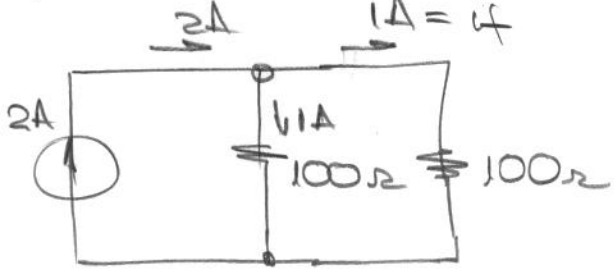
$\vartheta_1(t) = ?$

$t<0 \rightarrow \boxed{\vartheta_1(t) = 0} \quad \boxed{i_L(t) = 0}$

$t \geq 0$

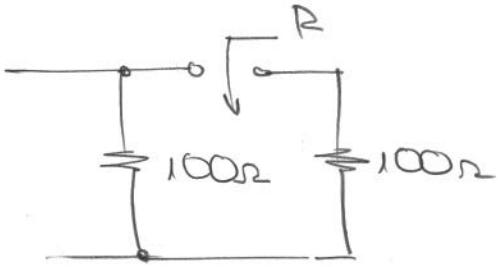
$\rightarrow i_L(t) = i_f + i_n(t)$

$i_f = ?$



$\boxed{i_f = 1A}$

$i_n(t) = ?$ $\quad i_n(t) = A e^{-Rt/L}$ $\quad R = ?$



$\boxed{R = 200\Omega}$ $\quad \frac{R}{L} = 4\,10^3$

$i_n(t) = A e^{-4000t}$ A

$i_L(t) = 1 + A e^{-4000t}$ $\quad i_L(0) = 0 = 1 + A \rightarrow \boxed{A = -1}$

$\therefore \boxed{i_L(t) = 1 - e^{-4000t} \text{ A}} \quad t \geq 0$

$\rightarrow \vartheta_1(t) = [2 - i_L(t)] \times 100 = 100(1 + e^{-4000t})$

$\therefore \boxed{\vartheta_1(t) = 100(1 + e^{-4000t}) \text{ V}} \quad t > 0$.