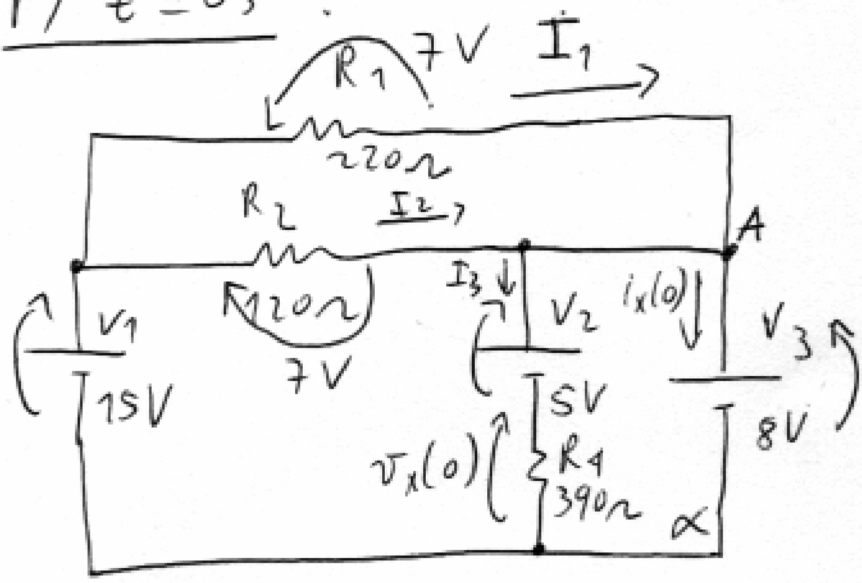
# ETE103/N – PS/2020 – GABARITO

① P/ t = 0s :




$\underline{\alpha}: v_x(0) + V_2 = V_3$

$\therefore \boxed{v_x(0) = 3V}$ //

$\underline{A}: I_1 + I_2 = I_3 + i_x(0)$

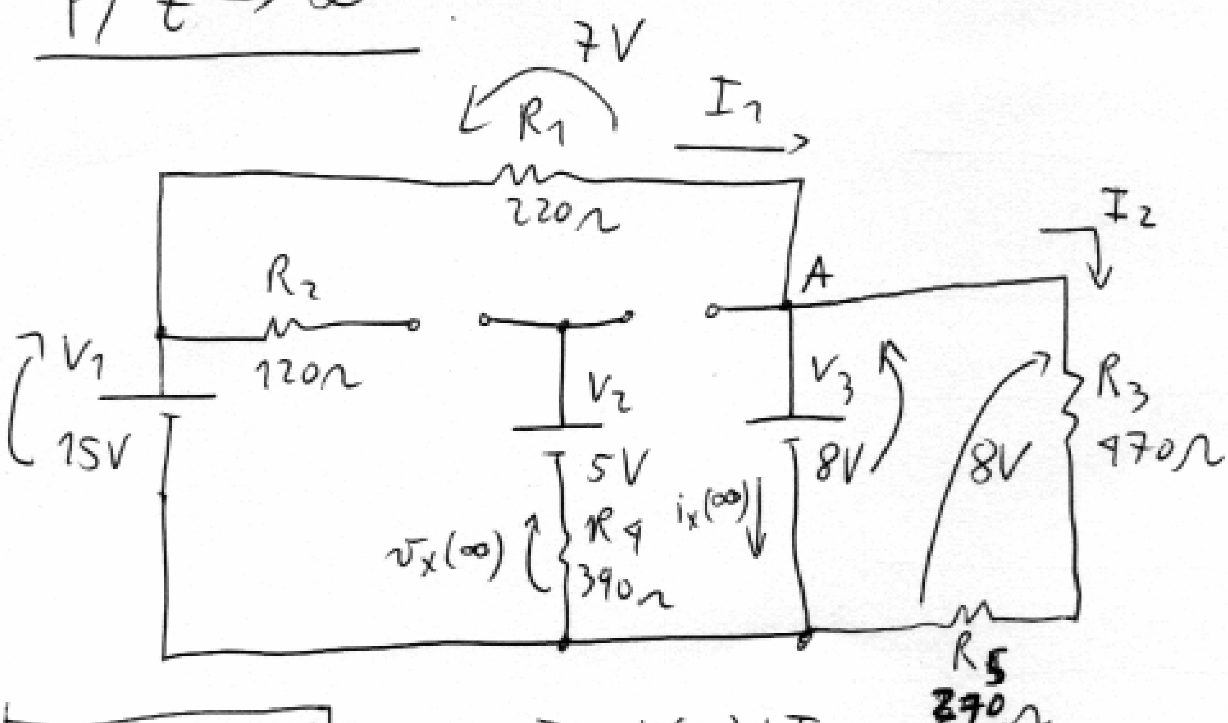
$I_1 = 31{,}8\,mA$

$I_2 = 58{,}3\,mA$

$I_3 = 7{,}69\,mA$

$\therefore \boxed{i_x(0) = 82{,}5\,mA}$ //

P/ t → ∞ :




$\boxed{v_x(\infty) = 0V}$ //

$A: I_1 = i_x(\infty) + I_2$

$I_1 = 31{,}8\,mA$

$I_2 = 10{,}8\,mA$

$\therefore \boxed{i_x(\infty) = 21{,}0\,mA}$ //

A

② $\tau_1 = 3{,}929\,\mu s$ $\quad 5\tau_1 = 19{,}64\,\mu s$

$\tau_2 = 2{,}200\,\mu s$ $\quad 5\tau_2 = 11{,}00\,\mu s$

$\tau_3 = 3{,}235\,\mu s$ $\quad 5\tau_3 = 16{,}18\,\mu s$

$I_{f_1} = 2{,}679\,mA$

$I_{f_2} = -1{,}200\,mA$

$I_{f_3} = 0{,}000\,mA$

$$\boxed{i_L(t) = I_i + (I_f - I_i)(1 - e^{-t/\tau})}$$

P/ $0 \leq t \leq 4\,\mu s$ : $\Delta t = 4\,\mu s$

$i_L(4 \cdot 10^{-6}) = 2{,}679 \cdot 10^{-3}(1 - e^{-4 \cdot 10^{-6}/3{,}929 \cdot 10^{-6}})$

$\therefore \boxed{i_L(4 \cdot 10^{-6}) = 1{,}71\,mA}$

P/ $4\,\mu s \leq t \leq 8\,\mu s$ : $\Delta t = 4\,\mu s$

$I_i = 1{,}71\,mA$ ; $I_f = -1{,}2\,mA$ ; $\tau = 2{,}2\,\mu s$

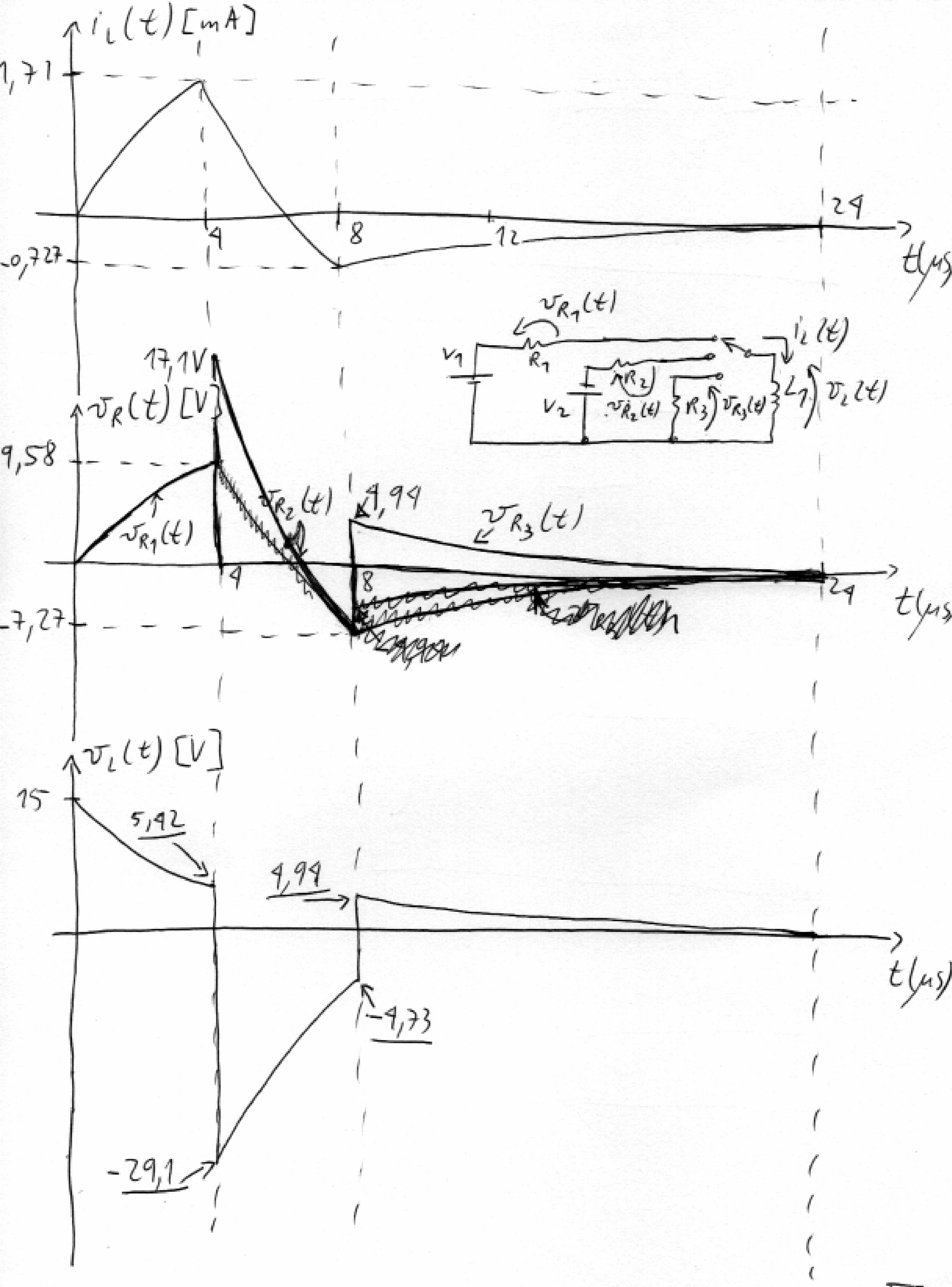
$\therefore \boxed{i_L(4 \cdot 10^{-6}) = -0{,}727\,mA}$

P/ $8\,\mu s \leq t \leq 24\,\mu s$ : $\Delta t = 16\,\mu s$

$I_i = -0{,}727\,mA$ ; $I_f = 0\,mA$ ; $\tau = 3{,}235\,\mu s$

$\therefore \boxed{i_L(16 \cdot 10^{-6}) = -5{,}18\,\mu A}$ $(\cong 0{,}0\,mA)$

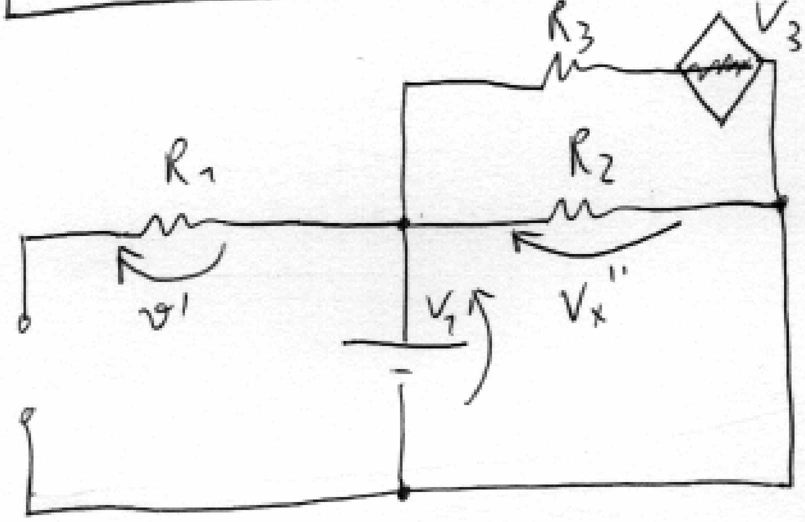
B


$i_L(t)$ [mA]
1,71
-0,727
4
8
12
24
t(µs)
$v_{R_1}(t)$
$i_L(t)$
$V_1$
$R_1$
$R_2$
$V_2$
$v_{R_2}(t)$
$R_3$
$v_{R_3}(t)$
$L$
$v_L(t)$
$v_R(t)$ [V]
17,1V
9,58
-7,27
$v_{R_1}(t)$
$v_{R_2}(t)$
4,94
$v_{R_3}(t)$
4
8
24
t(µs)
$v_L(t)$ [V]
15
5,42
4,94
-4,73
-29,1
t(µs)

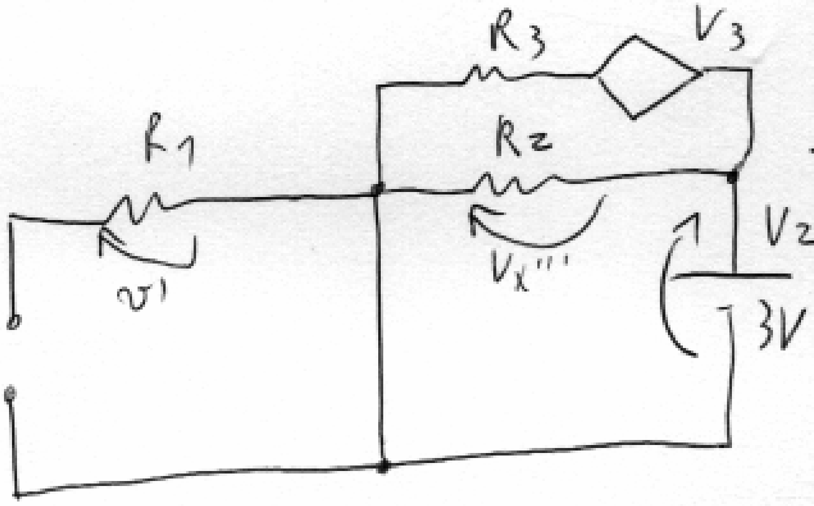
C

3


$\boxed{V_x' = 0V}$




$V_x'' = V_1 \Rightarrow \boxed{V_x'' = 1,5V}$



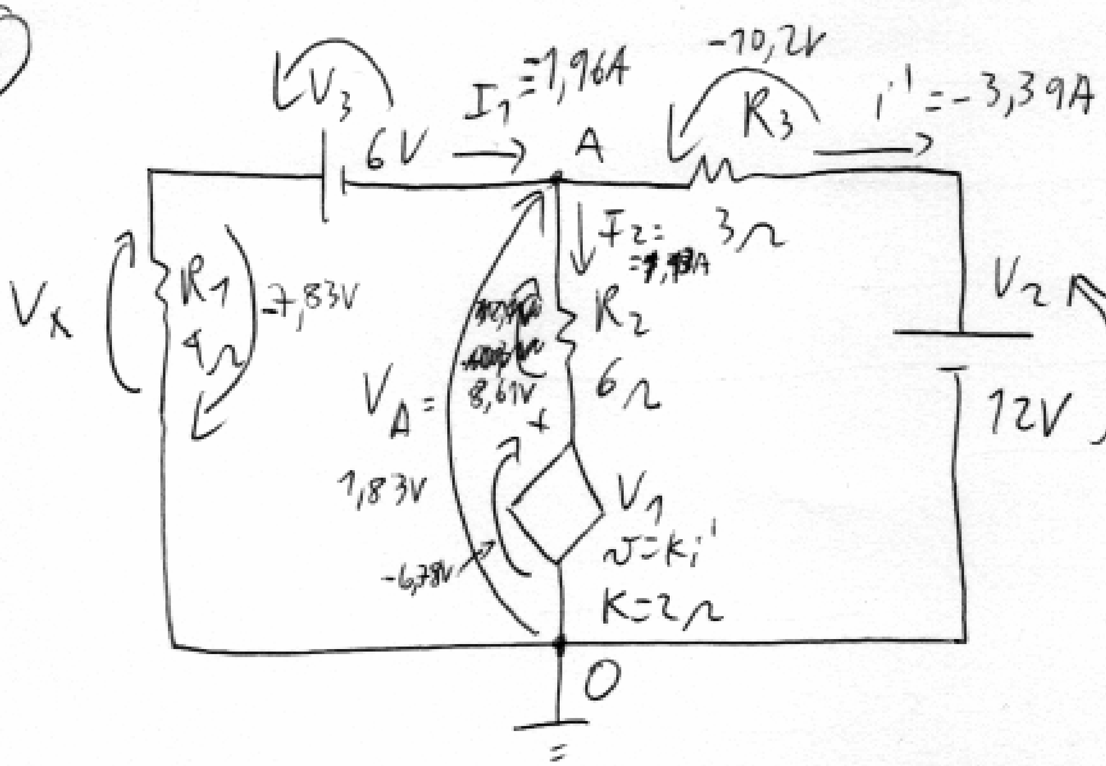

$\boxed{V_x''' = -3V}$

$V_x = V_x' + V_x'' + V_x'''$

$\therefore \boxed{V_x = -1,5V}$

D

4




a)

<u>A</u>: $I_1 - I_2 - i' = 0$

$$\frac{-V_3 - V_A}{R_1} - \frac{-V_1 + V_A}{R_2} - \frac{-V_2 + V_A}{R_3} = 0$$

$$V_1 = K i' = K \frac{-V_2 + V_A}{R_3}$$

$$\frac{-V_1 + V_A}{R_2} = \frac{-K\frac{V_A - V_2}{R_3} + V_A}{R_2} =$$

$$= \frac{K(V_2 - V_A)}{R_2 R_3} + \frac{V_A}{R_2}$$

$$\left(-\frac{1}{R_1} + \frac{K}{R_2 R_3} - \frac{1}{R_2} - \frac{1}{R_3}\right) V_A =$$

$$= \left(\frac{V_3}{R_1} + \frac{K V_2}{R_2 R_3} - \frac{V_2}{R_3}\right)$$

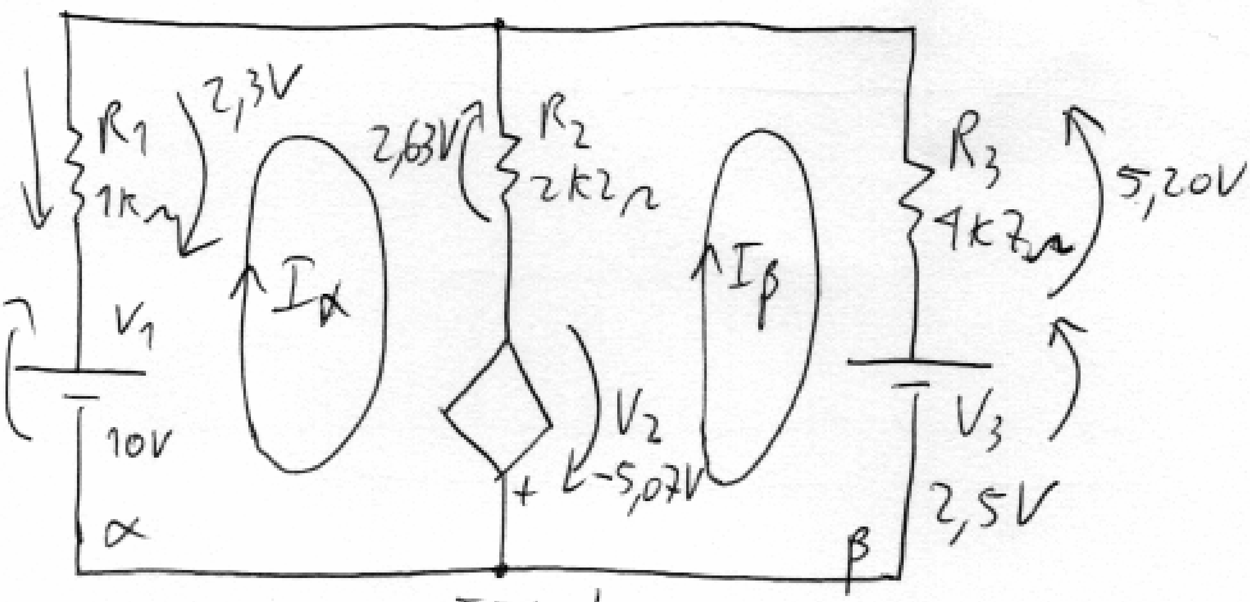
$\boxed{E}$

$$\therefore \boxed{V_A = \frac{\dfrac{V_3}{R_1} + \dfrac{kV_2}{R_2R_3} - \dfrac{V_2}{R_3}}{-\dfrac{1}{R_1} + \dfrac{k}{R_2R_3} - \dfrac{1}{R_2} - \dfrac{1}{R_3}}}$$

b) $\boxed{V_A = 1{,}83V}$

$$V_x = V_A + V_3 \Rightarrow \boxed{V_x = 7{,}83V}$$

5




$v = ki'$

$K = 2k2\Omega$

a)

$\alpha$: $V_1 - R_1 I_\alpha - (I_\alpha - I_\beta)R_2 + V_2 = 0$

$$V_2 = k i' = -K I_\alpha$$

$$\therefore \boxed{(-R_1 - R_2 - K)I_\alpha \pm R_2 I_\beta = -V_1}$$

F

$\beta: -V_2 + (I_\alpha - I_\beta)R_2 - R_3 I_\beta - V_3 = 0$

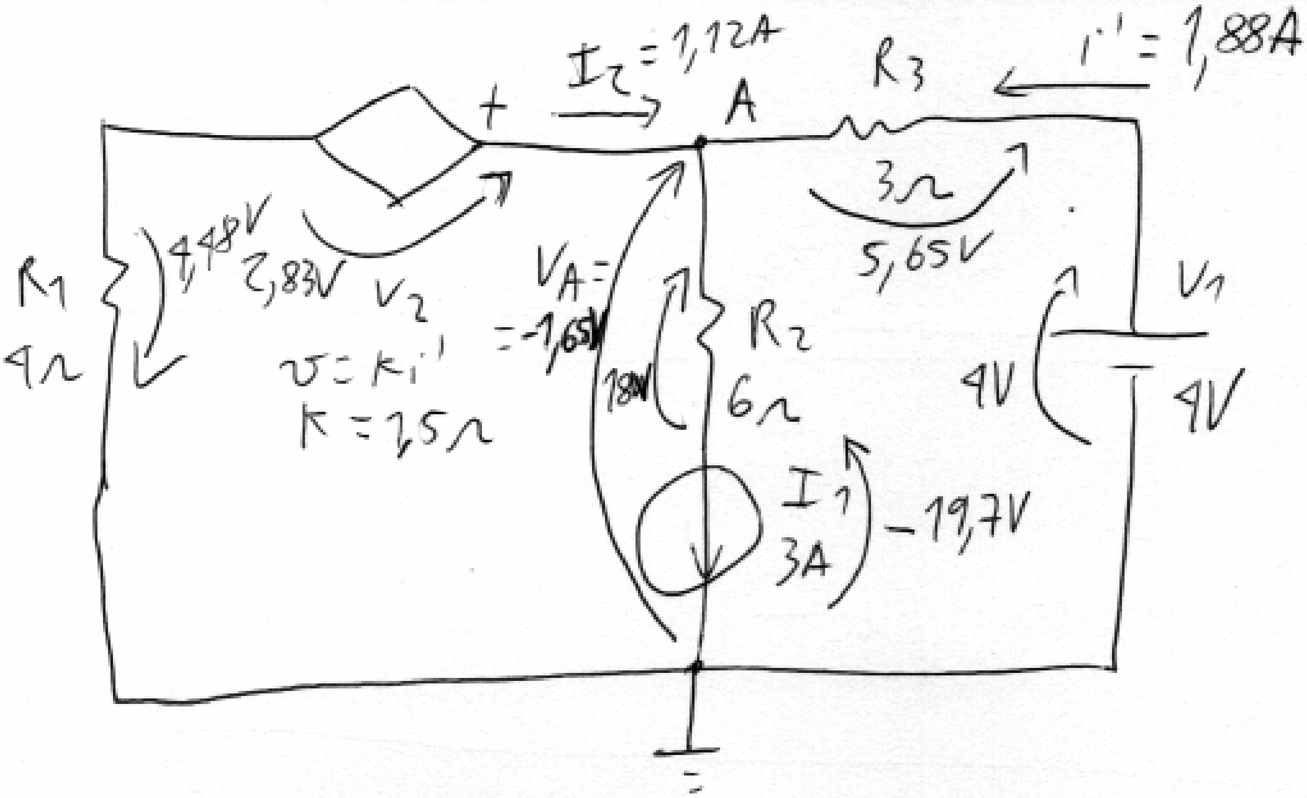
$(+k + R_2)I_\alpha + (-R_2 - R_3)I_\beta = V_3$

$$\therefore \boxed{\begin{cases} \alpha: (R_1 + R_2 + k)\,I_\alpha - R_2\,I_\beta = V_1 \\ \beta: (-R_2 \cancel{+} - k)\,I_\alpha + (R_2 + R_3)\,I_\beta = -V_3 \end{cases}}$$

b) $$\boxed{\begin{cases} \alpha: 5{,}4 \cdot 10^3\, I_\alpha - 2{,}2 \cdot 10^3\, I_\beta = 10 \\ \beta: -4{,}4 \cdot 10^3\, I_\alpha + 6{,}9 \cdot 10^3\, I_\beta = -2{,}5 \end{cases}}$$

c) $\boxed{I_\alpha = 2{,}30\,mA}$ $\boxed{I_\beta = 1{,}11\,mA}$

6




$P_{R_1} = 5,07W$ $P_{R_2} = 54,0W$ $P_{R_3} = 10,6W$

$P_{V_2} = 3,16W$ $P_{V_1} = 7,53W$ $P_{I_1} = +58,9W$

$V_2, V_1$ e $I_1$ : geradores

$\therefore \sum P_{gerada} - \sum P_{consumida} = 0$

$P_{V_2} + P_{V_1} + P_{I_1} - P_{R_1} + P_{R_2} + P_{R_3} = 0$

$\therefore \underline{-3,44 \cdot 10^{-3} \cong 0W}$

( Menor potência / 100 : 31,6mW )

H