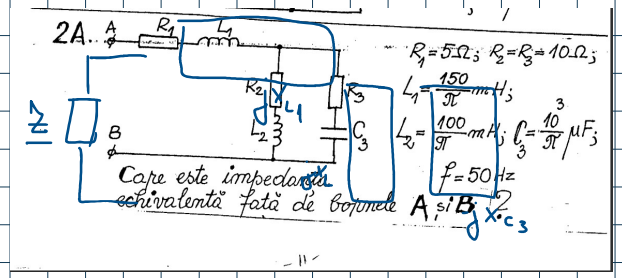



$\omega = 2\pi f$

$= \frac{2\pi}{T}$

$f = \frac{1}{T}$

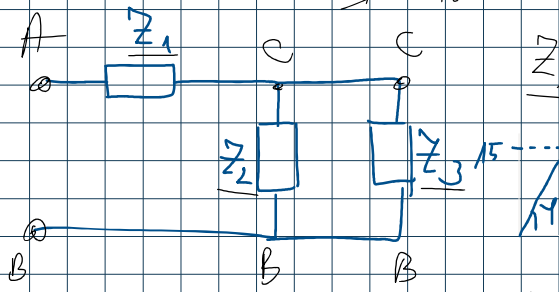
$\omega = 100\pi \frac{rad}{s}$

$X_{L_1} = \omega L_1 = 100\pi \cdot \frac{150}{\pi} \cdot 10^{-3} = 15\,\Omega$

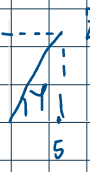
$X_{L_2} = \omega L_2 = 100\pi \cdot \frac{100}{\pi} \cdot 10^{-3} = 10\,\Omega$

$X_{C_3} = \frac{1}{\omega C_3} = \frac{1}{100\pi \cdot \frac{10^3}{\pi} \cdot 10^{-6}} = \frac{1}{10^{-1}} = 10\,\Omega$

$jX_{L_2}$




$\underline{Z}_1 = R_1 + jX_{L_1} = 5 + j15$




$= \sqrt{5^2 + 15^2}\, e^{j \operatorname{arctg} \frac{15}{5}} =$

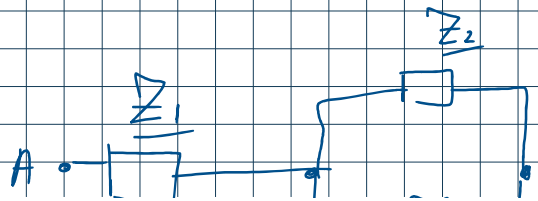
$= 5\sqrt{10}\, e^{j72^0}$

$\underline{Z}_1 = 5\sqrt{10}\,\Omega$

$\underline{Z}_2 = R_2 + jX_{L_2} = 10 + j10 = 10\sqrt{2}\, e^{j45^\circ} = \boxed{10\sqrt{2} \angle 45^\circ}$

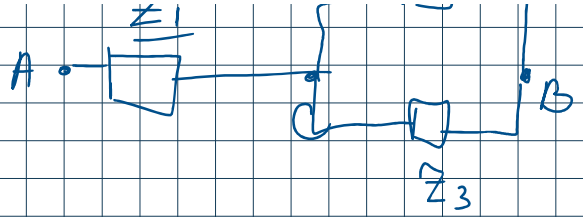
$\underline{Z}_3 = R_3 - jX_{C_3} = 10 - j10 = 10\sqrt{2}\, e^{-j45^\circ}$

$j^2 = -1$




$\underline{Z}_{ech} = \underline{Z}_1 + \frac{\underline{Z}_2 \underline{Z}_3}{\underline{Z}_2 + \underline{Z}_3} =$

$= \ldots \cdot \frac{100 + 100}{\ldots}$




$= 5 + j15 + \frac{100 + 100}{20} =$

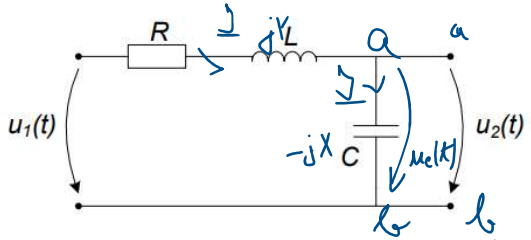
$= 5 + j15 + 10 =$

$= 15 + j15$

$\underline{Z} = \underline{Z_{eq}}^{*} = 15 - j15$

**3-16** *For the circuit below we know* $R = 10\Omega$, $X_L = \omega L = 5\Omega$, $X_C = \frac{1}{\omega C} = 15\Omega$ *and the voltage* $u_1(t) = 100\sqrt{2}\sin 100\pi t\ V$. *Find the output voltage,* $u_2(t)$.

$U = \frac{U_m}{\sqrt{2}} = 100$




Problem 3-16

$X_L < X_C$ - capacitive circuit

$\varphi = \operatorname{arctg}\frac{X_L - X_C}{R} = \operatorname{arctg} -1 = -45^\circ$

$\underline{U_1} = 100 e^{j0^\circ} = 100\cos 0^\circ + j100\sin 0^\circ = 100$

$\underline{Z} = R + jX_L - jX_C = 10 + j5 - j15 = 10 - 10j = 10\sqrt{2}\, e^{-j45^\circ}$

$I = \frac{U}{R} \longrightarrow \underline{I} = \frac{\underline{U_1}}{\underline{Z}} = \frac{100}{10\sqrt{2}\, e^{-j45^\circ}} = 5\sqrt{2}\, e^{j45^\circ}$

$-j = e^{-j90^\circ}$

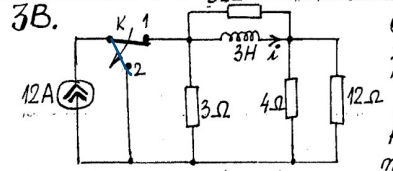
$j = e^{j90^\circ}$

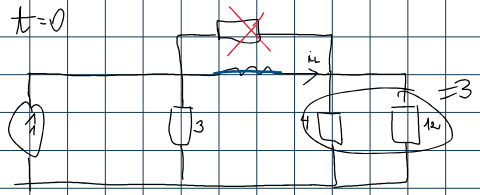
$\underline{U_2} = \underline{U_C} = \underline{I}(-jX_C) = 5\sqrt{2}\, e^{j45^\circ} e^{-j90^\circ} 15 = 75\sqrt{2}\, e^{-j45^\circ}$

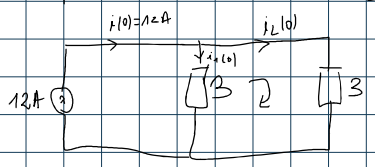
$$\underline{U_2} = \underline{U_C} = \underline{I}\,(-jX_C) = 5\sqrt{2}\,e^{j45^\circ}\,e^{-j90^\circ}\,15 = 75\sqrt{2}\,e^{-j45^\circ}$$

$$u_2(t) = 150\sin(100\pi t - 45^\circ)\ [V]$$

**3B.** Circuitul din fig. funcționează în regim staționar cu întrerupătorul K în poziția **1**. La momentul $t=0$ întrerupătorul K se trece brusc în poziția **2**. Să se determine variația în timp a curentului $i$ prin bobină.



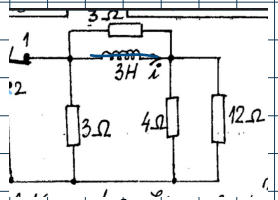



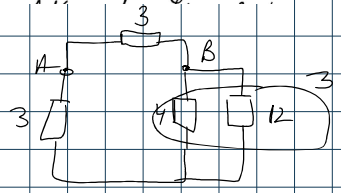

$$3i_L(0) - 3\cdot 1 \cdot i(0) = 0$$

$$i_L(0) = i(0)$$

$$2i_L(0) = 12 \Rightarrow i_L(0) = 6\ A$$



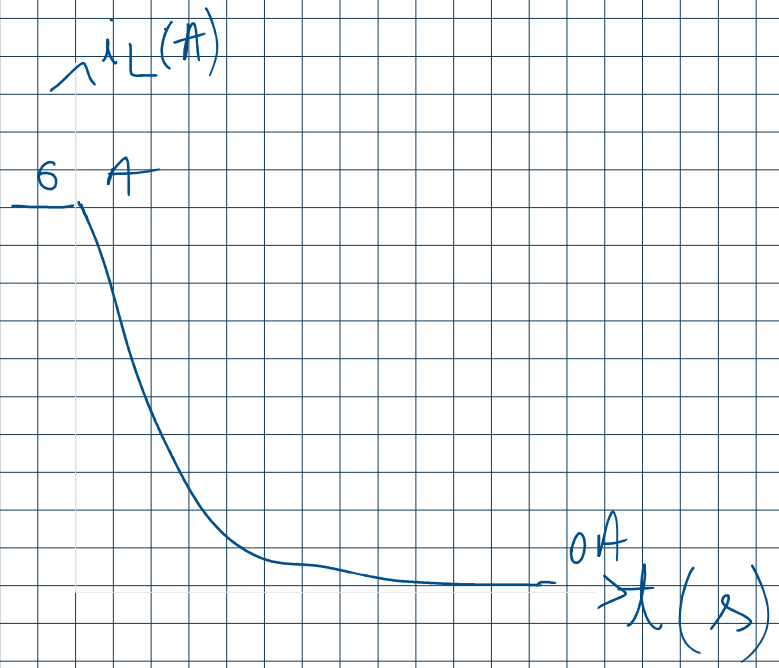

$i_L(\infty) = 0$




$$R_e = \frac{6}{9} = 2\Omega$$

$$\tau = \frac{L}{R_e} = \frac{3}{2} = 1{,}5\ s$$

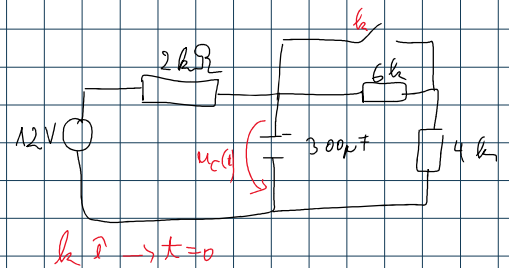
$$i_L(t) = i_L(\infty) + \left(i_L(\infty) - i_L(0)\right)e^{-\frac{t}{\tau}} =$$



$= 0 - (0-6)\, e^{-\frac{2}{3}t} =$

$= 6\, e^{-\frac{2}{3}t}$

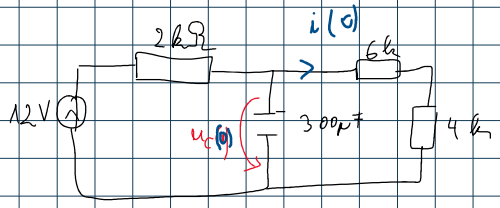
$$u_L(t) = L\frac{di_L}{dt} = 3 \cdot 6 \cdot \left(-\frac{2}{3}\right) e^{-\frac{2}{3}t}$$

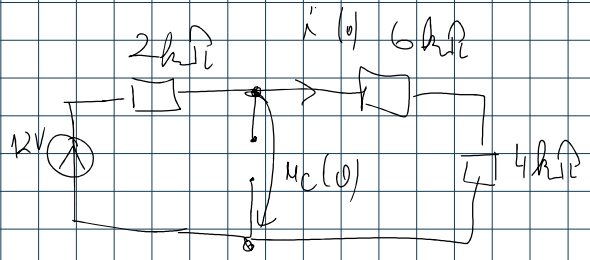



k închis $\rightarrow t = 0$

? $u_C(t)$, apoi $i_C(t)$

$t = 0$

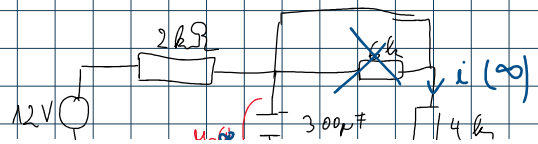


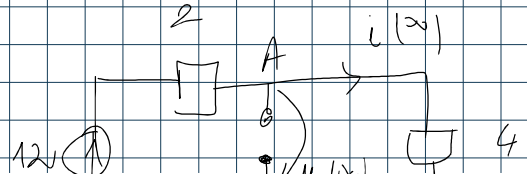



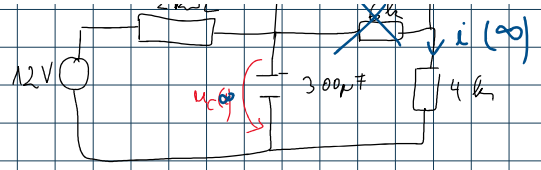

$$i(0) = \frac{12}{12\,k\Omega} = 1\,mA = 10^{-3}A$$

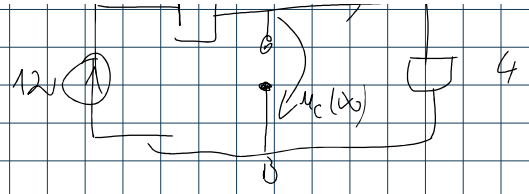
$$u_C(0) = i(0) \cdot (6+4) = 10\,V$$

$t = \infty$



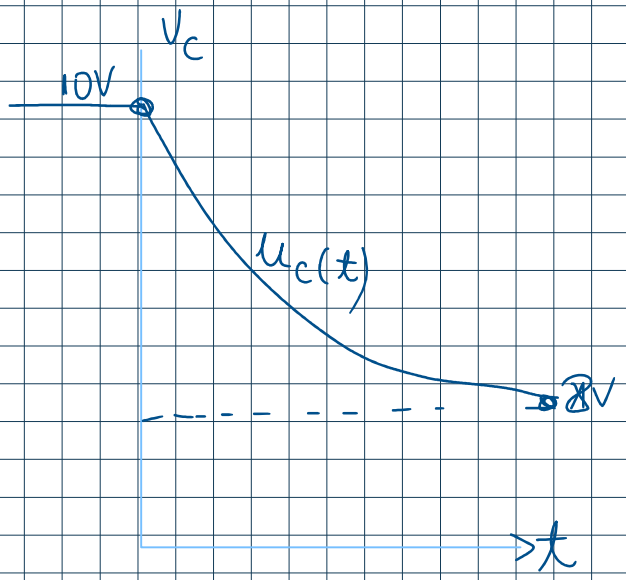


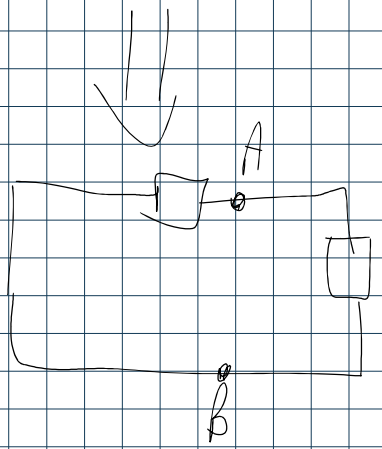



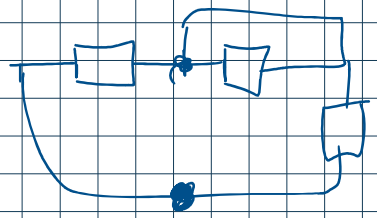

$$i(\infty) = \frac{12}{2+4} = 2\,mA$$

$$u_C(\infty) = i(\infty) \cdot 4 = 8V$$

$$V_{AB} = 12 - 2 \cdot 2 = 8\,V$$



$$R_e = \frac{4 \cdot 2}{6} = \frac{4}{3}\,k\Omega \Rightarrow$$

$$\Rightarrow C = \frac{4}{3} \cdot 300\,\mu F =$$

$$\tau = R_e C = \frac{4}{3} 300 \cdot 10^{-6} \cdot 10^{3} =$$

$$= \frac{4}{10} = \frac{2}{5}$$

$\Rightarrow C = \frac{4}{3} \cdot 300\,\mu F =$

$= \frac{4}{10} = \frac{2}{5}$

$= \frac{4}{10} = \frac{2}{5}$

$u_C(t) = 8 - (8-10)e^{-2,5t}$

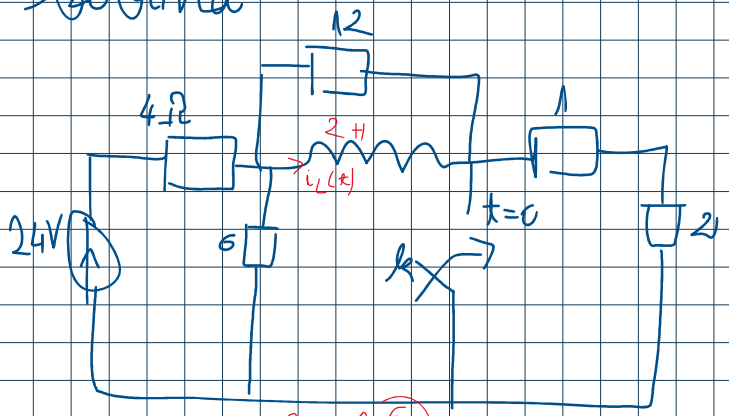
$u_C(t) = u(\infty) - (u_C(\infty) - u(0))\, e^{-\frac{t}{\tau}}$

$u_C(t) = 8 + 2\, e^{-2,5t}$

$i_C(t) = C \dfrac{du}{dt} = 0,3 \cdot 10^{-3} (-2,5) 2 \cdot e^{-2,5t}$

---

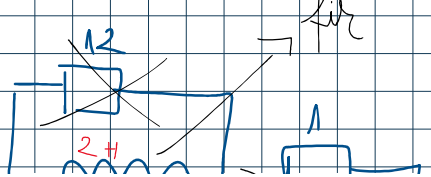
Labină




$i_L(t)$ + grafic (?)

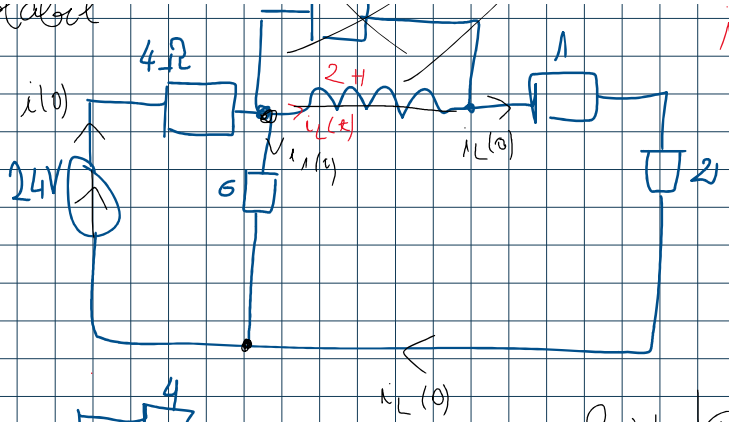
$t = 0$

stabil



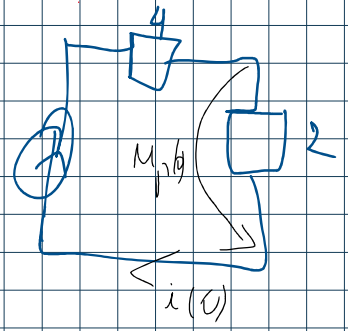

fir

$i_L(t) = i_L(\infty) -$

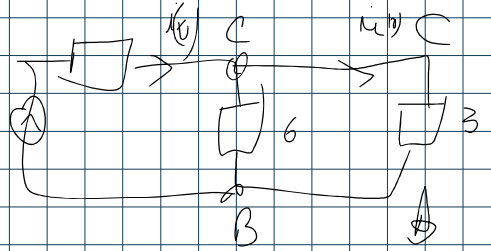



$$i_L(t) = i_L(\infty) - \left(i_L(\infty) - i_L(0)\right) e^{-\frac{t}{\tau}}$$

$$\tau = \frac{L}{R_{eq}}$$




$$3 i_L(0) = 6\, i_1(0)$$

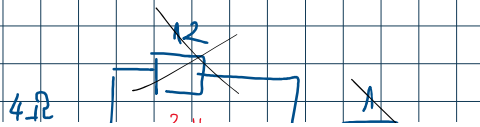


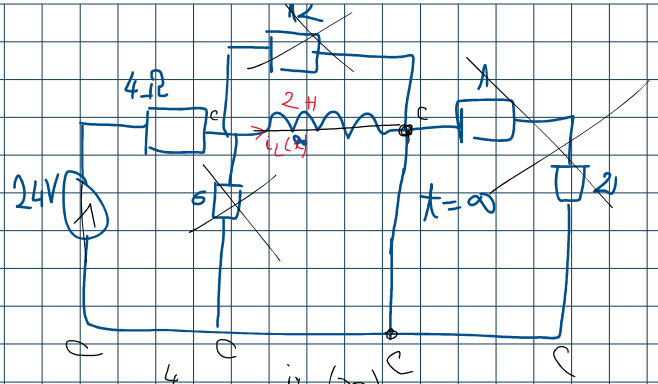

$$\Rightarrow i(0) = \frac{24}{6} = 4\,A$$

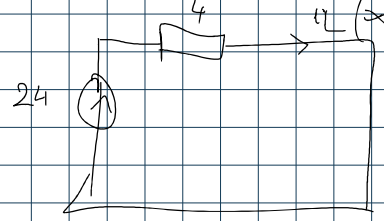
$$u_p(0) = 2\, i(0) = 8V = U_{CB}(0)$$

$$\text{dar } u_p(0) = i_L(0)\cdot(1+2) \Rightarrow i_L(0) = \frac{8}{3}\,A$$

$$t = \infty$$

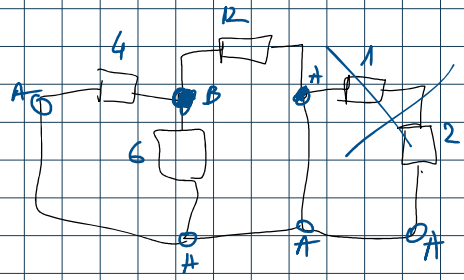





$$i_L(\infty) = \frac{24}{4} = 6\,A$$

Pasivizăm față de bobină

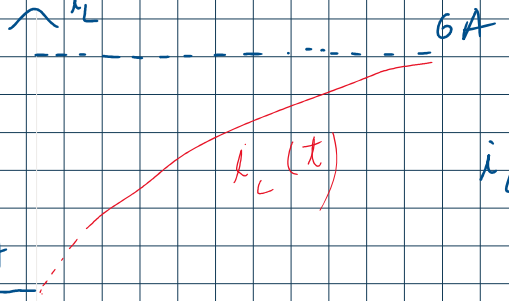



$$\frac{4 \cdot 6}{10} = 2{,}4$$

$$\frac{1}{R_e} = \frac{1}{12} + \frac{1}{4} + \frac{1}{6} = \frac{1}{2}$$

$$R_e = 2$$

$$\tau = \frac{L}{R_{eq}} = 1\,s$$



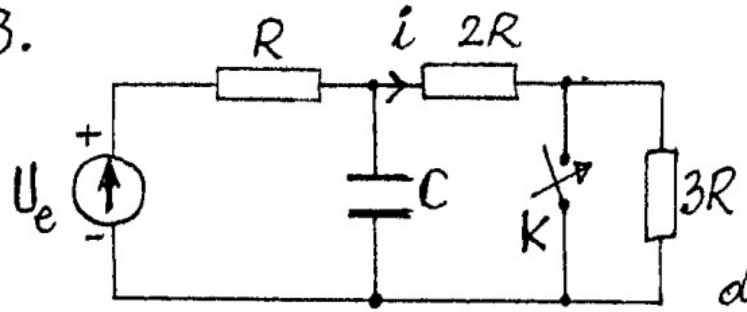

$$i_L(\infty) = 6\,A \qquad i(t) = i(\infty) - (i(0) - i(0))\,e^{-\frac{t}{\tau}}$$

$$i_L(t) = 6 - \left(6 - \frac{8}{3}\right)e^{-t}$$

$$= 6 - \frac{10}{3}\,e^{-t}$$

$$u_L(t) = L\frac{di_L}{dt} = 2\left(-\frac{10}{3}\right)\cdot(-1)e^{-t} \quad \rightarrow t$$

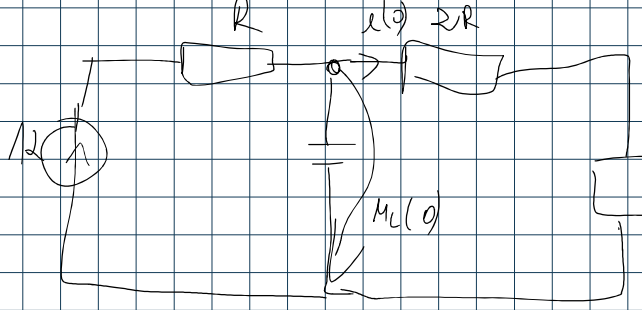
**3B.**




$R = 2k\Omega$;
$C = 200\mu F$;
$U_e = 12V$.

Se consideră circ. din figură, care este în regim staționar cu întrerupătorul K deschis. La momentul $t=0$ se închide K. Să se determine $i$ pentru $t \geq 0$.

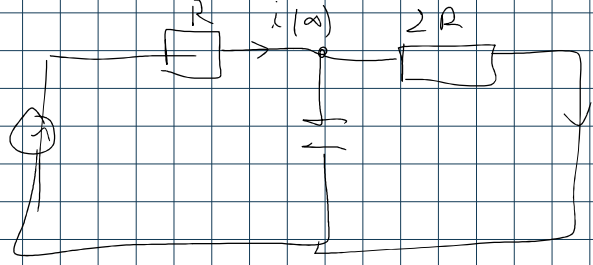
$t=0^-$ K - deschis




$$i(0) = \frac{12}{6\cdot 2\cdot 10^3} = 1mA = 10^{-3}A$$

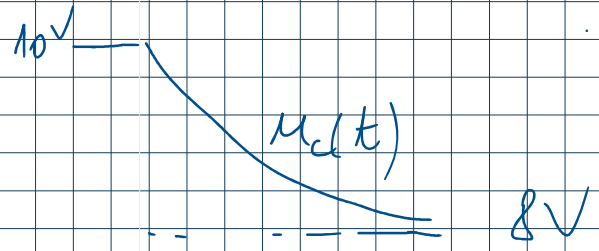
$$u_C(0) = i(0)\cdot 5\cdot R = 10^{-3}\cdot 5\cdot 2\cdot 10^3 = 10V$$

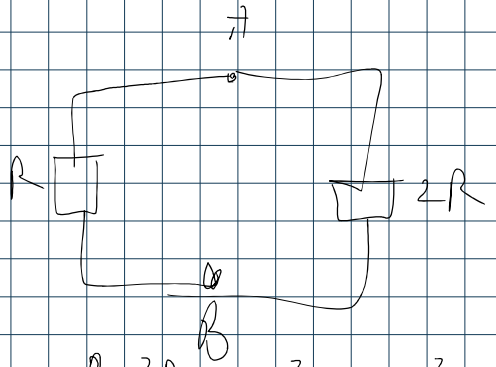
$t \to \infty$ $R - \hat{L}$




$$i(\infty) = \frac{12}{3 \cdot 2} = 2\,mA$$

$$u_c(\infty) = i(\infty)\, 2R = 8V$$




$$R_e = \frac{R \cdot 2R}{3R} = \frac{2}{3} \cdot 2 \cdot 10^3 = \frac{4 \cdot 10^3}{3}$$

$$\tau = R_e \cdot C = \frac{4 \cdot 10^3}{3} \cdot 200 \cdot 10^{-6} \cdot 10^{-1} = \frac{0{,}8}{3} = \frac{8}{30}$$

$$u_c(t) = 8 - (8 - 10)\, e^{-\frac{30}{8} t} = 8 + 2\, e^{-3{,}75 t}$$

$$i_c(t) = C \cdot \frac{du_c}{dt} = 200 \cdot 10^{-6} \cdot 2 \,(-3{,}75)\, e^{-3{,}75 t} =$$

$$= \ldots \cdot 10^{-3} \cdot e^{-3{,}75 t}$$

$$= -1,5 \cdot 10^{-3} e^{-3,75t}$$

$$\lambda(t) = 2 - (2-1) e^{-3,75t} = 2 - 1 e^{-3,75t}$$ ✓