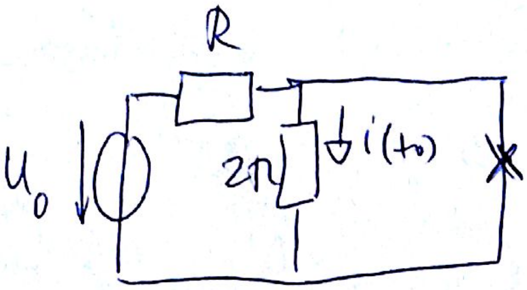
1)

a) $t=+0$

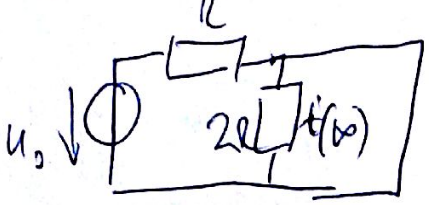


$i_L(0)=0 \Rightarrow$ szakadás

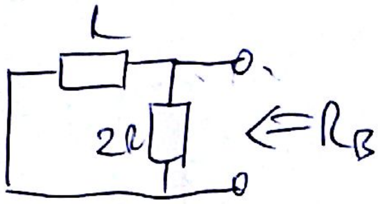
2015 APR 0 5

$i(+0) = \frac{U_0}{3R} = \frac{10}{15} = \frac{2}{3}$ mA

$t \to \infty$



$i(\infty)=0$



$R_B = R \times 2R = \frac{2R}{3}$

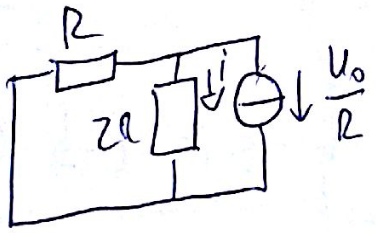
$\tau = L/R_B = \frac{3L}{2R} = \frac{3\cdot 2}{2\cdot 5} = \frac{3}{5}\ \mu s$

$$i(t) = \varepsilon(t)\left(0 + \left(\frac{2}{3}-0\right)e^{-t/0{,}6}\right) \text{ mA}$$

b.) $t=-0$ (megegyezik a)-beli ∞-nel)

$i_L = \frac{U_0}{R}$ $\quad i(-0)=0$

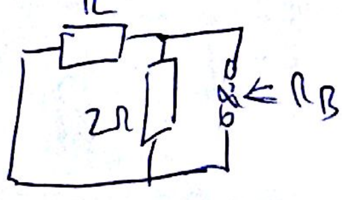
$t=+0$



$i(+0) = \frac{R \times 2R}{2R}\cdot\frac{U_0}{R} = \frac{2R/3}{2R}\cdot\frac{U_0}{R} = \frac{U_0}{3R} = \frac{2}{3}$ mA

$i_\infty = 0$ ([illegible] forrás!)

∞



$R_B = R \times 2R = \frac{2R}{3}$

$\tau = \frac{L}{R_B} = \frac{3L}{2R} = 0{,}6\ \mu s$

$$i(t) = \begin{cases} 0 & t<0 \\ \frac{U_0}{3R} e^{-t/\tau} = \frac{2}{3} e^{-t/0{,}6}, & t>0 \end{cases}$$

2/a.) $t<0$ energiamentes, $u_C(0)=0$; $u=0$

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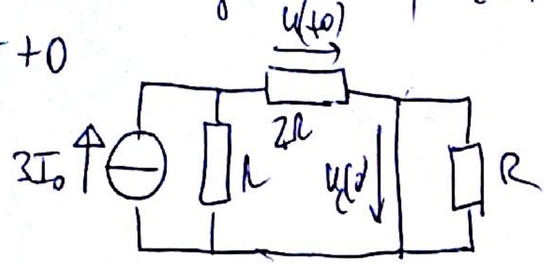
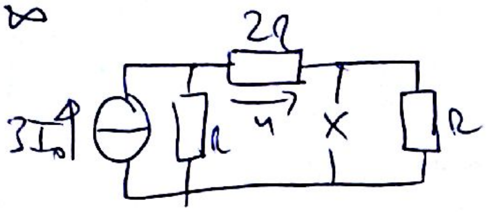
$t=+0$



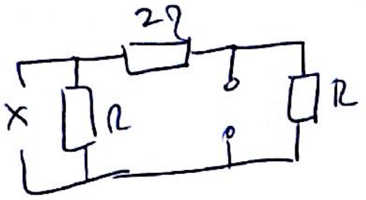
$u(+0) = (2R \times R)\cdot 3I_0 = \frac{2R}{3}\cdot 3I_0 = 2RI_0 = 40V$

$t \to \infty$



$u_\infty = 3I_0 \cdot \underbrace{(3R\times R)}_{\frac{3R}{4}} \cdot \underbrace{\frac{2R}{2R+R}}_{\frac{2}{3}} = \frac{I_0 R\, 3}{2} = 30V$

R_B:



$R_B = R\times(2R+R) = \frac{3R}{4} = \frac{3}{2}k\Omega$

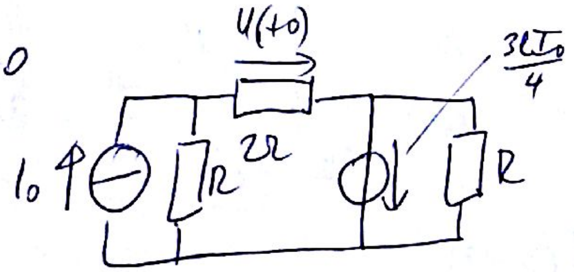
$T = C\cdot R_B = \frac{3RC}{4} = \frac{9}{20}\,\mu s = 0{,}45\,\mu s$

$u(t) = \left(30 + (40-30)\cdot e^{-t/0{,}45}\right)\varepsilon(t)$

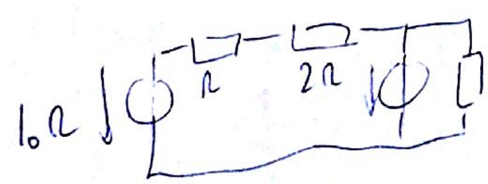
1/b. átkapcsolás ($t<0$ megegyezik az a)-beli állandósult állapottal)

$u_C(0) = 3I_0\cdot\frac{3R}{4}\cdot\frac{1}{3} = \frac{3RI_0}{4}$

$t=+0$

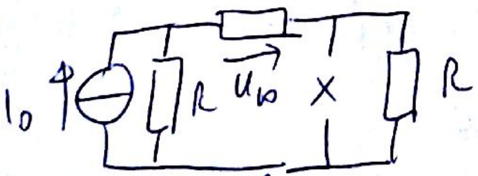


$u(+0) = \frac{2}{3}\cdot\overbrace{\left(I_0R - \frac{3RI_0}{4}\right)}^{\frac{I_0R}{4}} = \frac{2I_0R}{12} = \frac{20}{6}V$ ($\simeq 3{,}33V$)

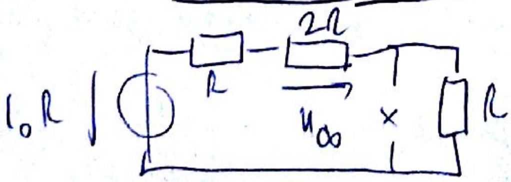


$R_B = \frac{3R}{4}$; $T = C\cdot R_B = \ldots = 0{,}45\,\mu s$

$t \to \infty$



$u_\infty = \frac{2}{4}\cdot I_0R = \frac{I_0R}{2} = 10V$



$$u(t) = \begin{cases} 30, & t<0 \\ 10 + \underbrace{\left(\frac{20}{6}-10\right)}_{-\frac{40}{6}\simeq 6{,}66} e^{-t/0{,}45} \end{cases}$$

3.) ávl-ből

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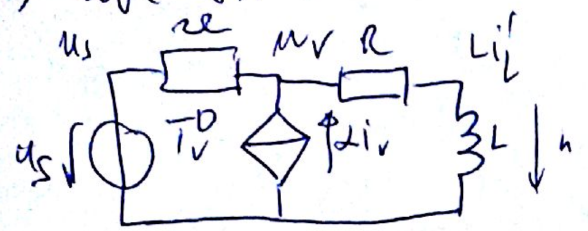


① $u_v = Li_L' + R\cdot i_L$

② $i_L - \alpha i_v - i_v = 0$

③ $u_v = U_s - 2R\cdot i_v$

④ $u = Li_L'$

ismeretlenek: i_v, i_L', u_v, u ② → $\boxed{i_v = \frac{i_L}{1+\alpha}}$; $u_v = ..$ nem érdekes számunkra

$$Li_L' + R\cdot i_L = u_s - 2R\cdot \frac{i_L}{1+\alpha}$$

$$u = Li_L' = -\underbrace{\left(1+\frac{2}{1+\alpha}\right)}_{\frac{3+\alpha}{1+\alpha}} R\, i_L + u_s$$

$$\boxed{i_L' = -\frac{3+\alpha}{1+\alpha}\,\frac{R}{L}\, i_L + \frac{1}{L}\, u_s}$$

$\lambda = -\frac{3+\alpha}{1+\alpha} < 0$ $\quad \frac{3+\alpha}{1+\alpha} > 0$ → $\left.\begin{matrix} 3+\alpha>0 \\ 1+\alpha>0 \end{matrix}\right\} \left.\begin{matrix} \alpha>-3 \\ \alpha>-1 \end{matrix}\right\} \boxed{\alpha>-1}$

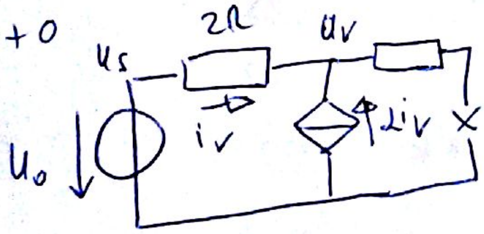
↓

$\left.\begin{matrix} 3+\alpha<0 \\ 1+\alpha<0 \end{matrix}\right\} \left.\begin{matrix} \alpha<-3 \\ \alpha<-1 \end{matrix}\right\} \boxed{\alpha<-3}$

Stabilitás: $\boxed{\alpha<-3 \text{ vagy } \alpha>-1}$

válasz kiszámítása alapján
$t<0$ energiamentes ⇒ $i_L = 0$

$t = +0$

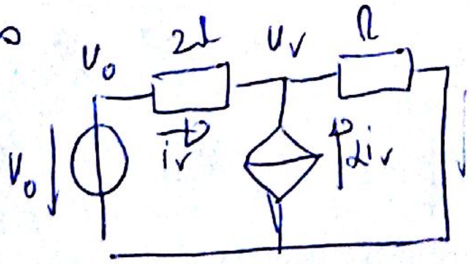


$i_v = 0$ mert $u = 0$

$-i_v - \alpha i_v = 0$

i_L

$t \to \infty$



$u_v = R\cdot(1+\alpha)\, i_v$

$i_v = \frac{U_0 - U_v}{2R}$

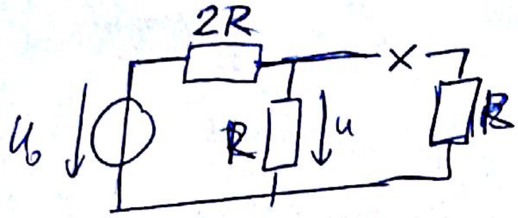
$2R i_v = U_0 - (1+\alpha) R i_v$

$(3+\alpha) R i_v = U_0$

$i_v = \frac{U_0}{R(3+\alpha)}$

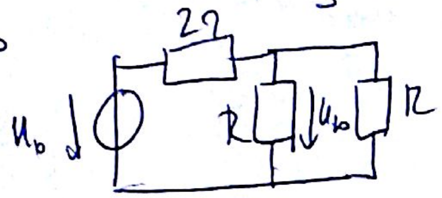
4.) $i_L(0)=0$ 2016 ÁPR 0 5.

$t=+0$



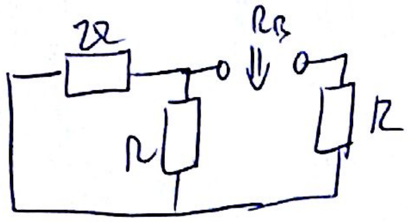
$u(+0)=\frac{1}{3}u_0$

$t\to\infty$



$u_\infty = \frac{R/2}{2R+R/2}u_0 = \frac{1}{5}u_0$

R_B:



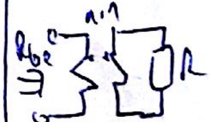
$R_B = (R\times 2R)+R = \frac{2R}{3}+R = \frac{5R}{3}$

$\tau = \frac{L}{R_B} = \frac{0,1\cdot 3}{0,01\cdot 5} = \frac{30}{5} = 6\,\mu s$

$$u(t) = \varepsilon(t)\cdot\left(\frac{u_0}{5} + \underbrace{\left(\frac{u_0}{3}-\frac{u_0}{5}\right)}_{\frac{u_0\cdot 2}{15}} e^{-t/\tau}\right) = \varepsilon(t)\left(\frac{u_0}{5}+\frac{2u_0}{15}e^{-t/\tau}\right)$$

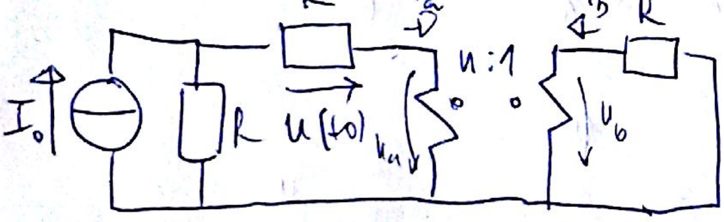
$$y(t) = \varepsilon(t)\cdot\left(\frac{u_0}{5}+\frac{2u_0}{15}\cdot e^{-t/\tau}\right) - \varepsilon(t-T)\cdot\left(\frac{u_0}{5}+\frac{2u_0}{15}e^{-(t-T)/\tau}\right)$$

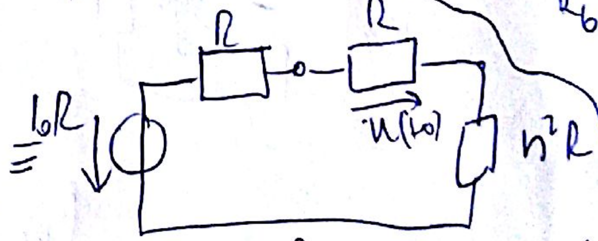
Felhasználva hogy



$R_{be} = n^2R$

5.) $t=+0$-ra ($t<0$-ra energiamentes $u_C(0)=0$)





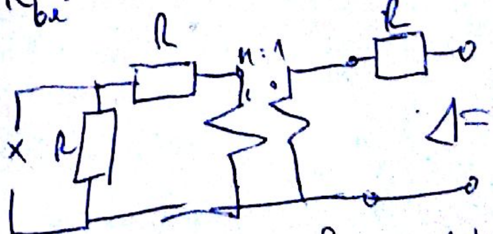
$u(+0) = \frac{R}{R+R+n^2R} I_0 R = \frac{1}{n^2+2} I_0 R$

$t\to\infty$ kondenzátor → szakadás, ekkor $i_b=0 \Rightarrow i_a=0$

$u(\infty)=0$

$$u(t) = \left(0 + \left(I_0 R\cdot\frac{1}{2+n^2}\right)e^{-t/\tau}\right)\varepsilon(t)$$

R_{be}:



$R_{be} = R + \frac{R}{n^2} = \frac{1+n^2}{n^2}R$

$\tau = C\cdot R_{be} = RC\cdot\frac{n^2+1}{n^2}$