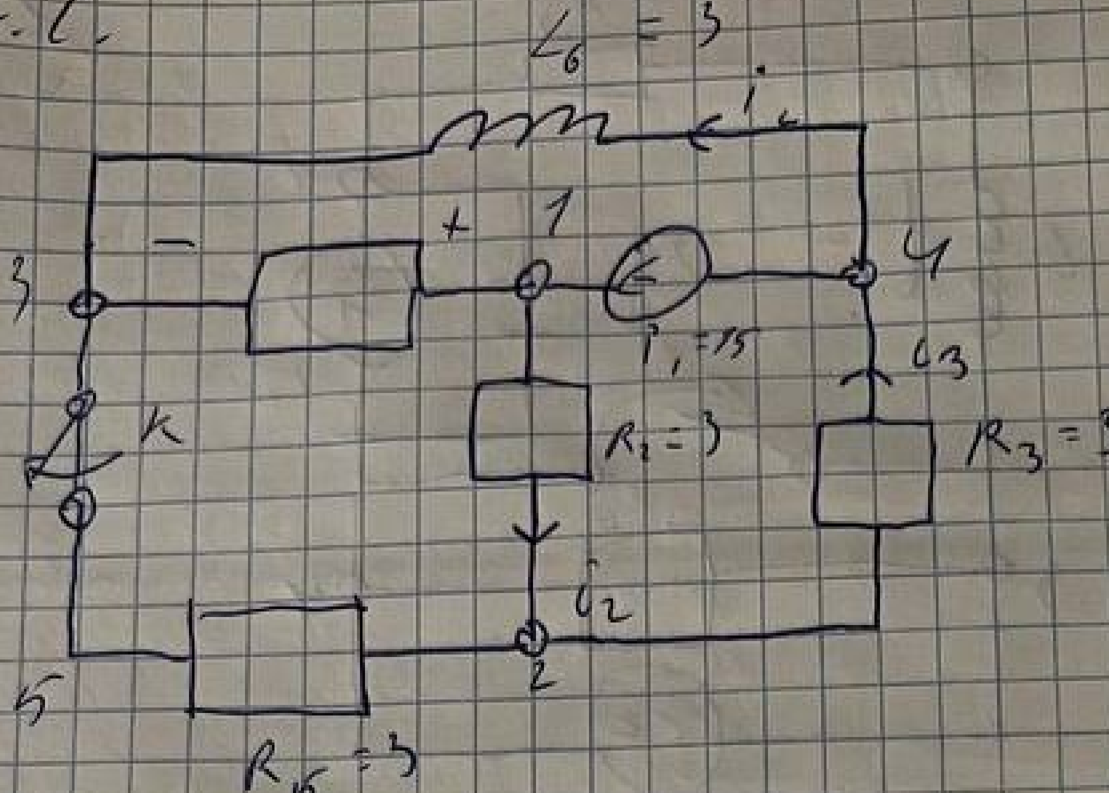
Зад 1.2.7.

Москв 17 вр



U_4

1. $t = 0^-$

$$i_2 = \frac{i_1 R_4}{R_4 + R_2 + \frac{R_3 R_5}{R_3 + R_5}} = \frac{15 \cdot 3}{3 + 3 + 1.5} = 6$$

$$i_3 = \frac{i_2 R_5}{R_5 + R_3} = \frac{6 \cdot 3}{3 + 3} = 3; \quad i_L(0^-) = i_3 - i_1 = -12$$

2. $0 < t < \infty$

$$R_э = R_3 + R_2 + R_4 = 9 \qquad \tau = \frac{L}{R_э} = \frac{3}{9} = \frac{1}{3}$$

3. $t \to +\infty$

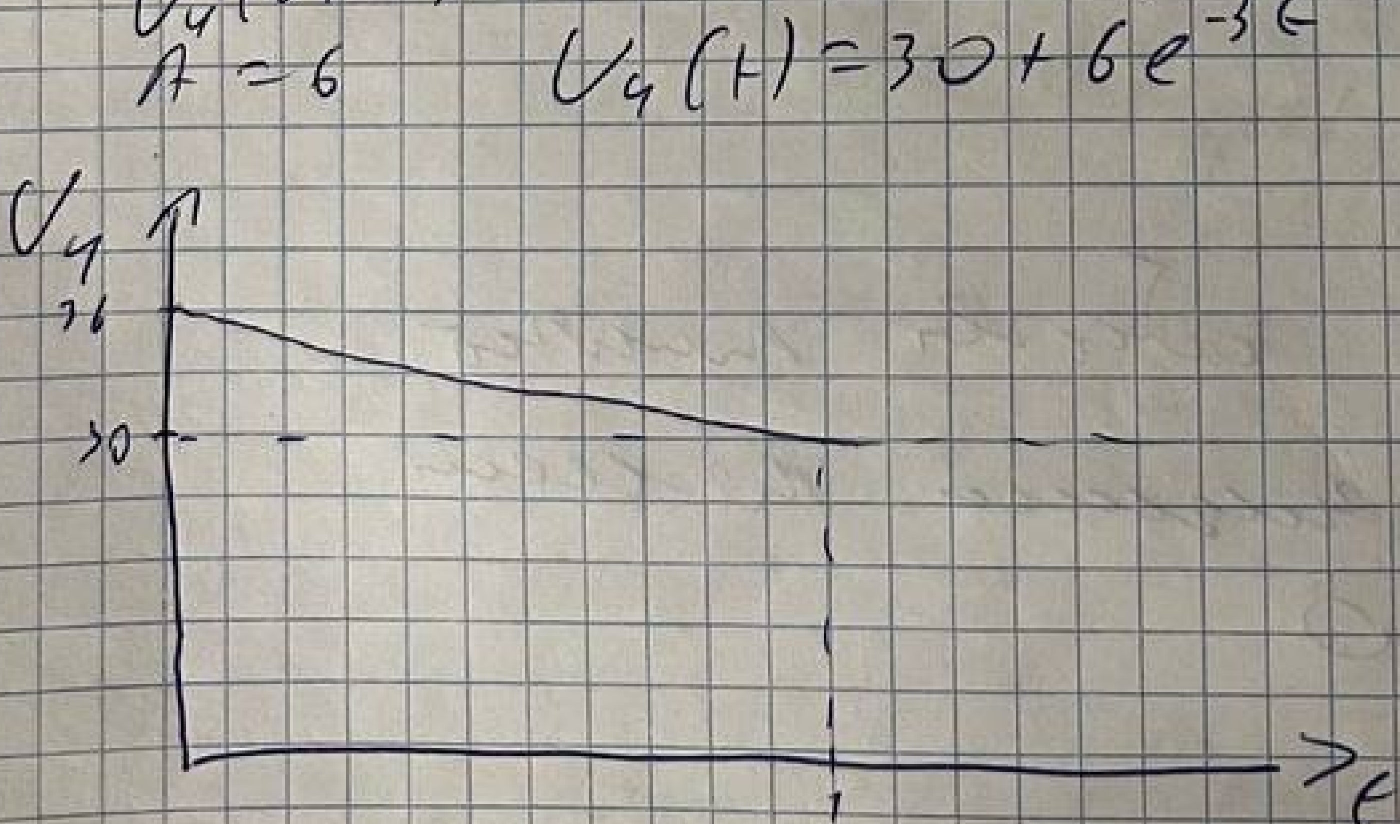
$$U_{4б} = i \frac{R_4 (R_2 + R_3)}{R_4 + R_2 + R_3} = 15 \frac{3 \cdot 6}{3 + 6} = 30$$

4. $t = 0^+$

$$i(0^+) = i_L(0^-) = -12 \qquad U_4(0^+) = -i_L(0^+) \cdot R_4 = 36$$

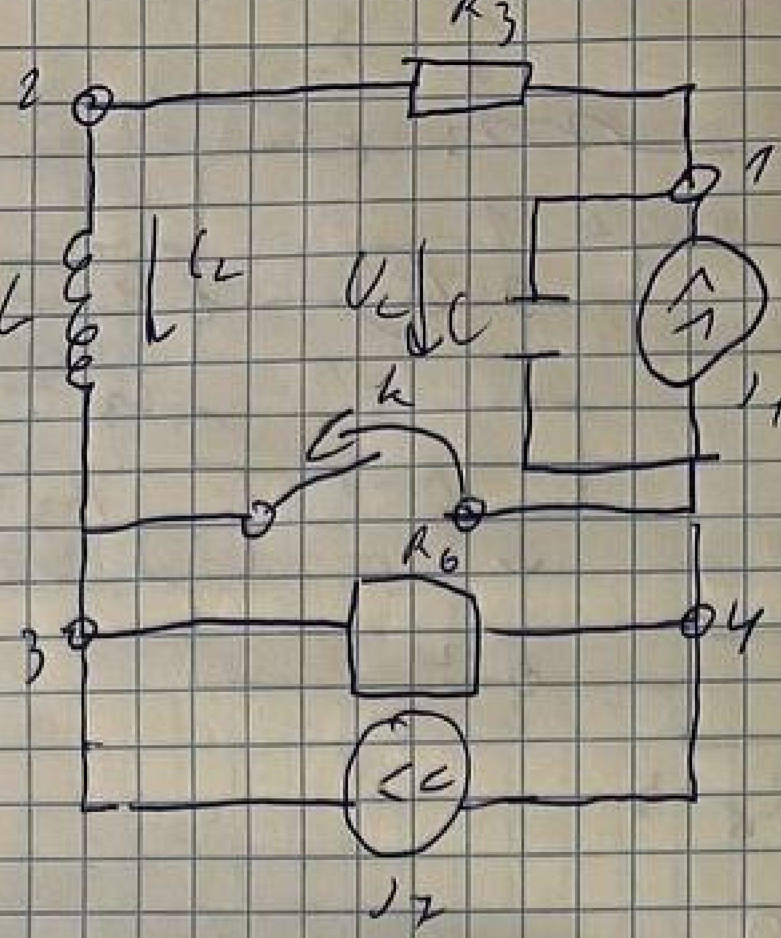
$$U_4(t) = U_{4б} + A e^{-\frac{t}{\tau}} = 30 + A e^{-3t} \qquad t = 0^+: \; 36 = 30 + A;$$

$$A = 6 \qquad U_4(t) = 30 + 6 e^{-3t}$$



1.23

11 вар.



$I_L(0) = J_1 = 2A$

$U_C(0) = J_1 \cdot R_3 = 2 \cdot 6 = 12В$

$i_L' = \frac{U_L}{L}$

$U_C' = \frac{i_C}{C}$

$U_C = U_L + i_L \cdot R_3 + (i_L + J_2) \cdot R_6$

$i_C = J_1 - i_L$

$$\begin{cases} U_L = U_C - i_L \cdot (R_3 + R_6) - J_2 \cdot R_6; \\ i_C = J_1 - i_L \end{cases}$$

$$\begin{cases} U_C' = \frac{J_1 - i_L}{C} = \frac{2}{0,1} - \frac{i_L}{0,1} = 20 - 10 i_L \\ i_L' = \frac{U_C - i_L \cdot (R_3 + R_6) - J_2 \cdot R_6}{L} = 0,4 U_C - 6 i_L - 12 \end{cases}$$

в матричном виде

$\begin{pmatrix} U_C' \\ i_L' \end{pmatrix} = (A) \cdot \begin{pmatrix} U_C \\ i_L \end{pmatrix} + (B) \cdot \begin{pmatrix} J_1 \\ J_2 \end{pmatrix};$

$(A) = \begin{pmatrix} 0 & -10 \\ 0,4 & -6 \end{pmatrix}$

$(B) = \begin{pmatrix} 10 & 0 \\ 0 & -3 \end{pmatrix}$

Для нахождения собственных чисел матрицы решим уравнение

$\det((A) - p[E]) = 0$

$\begin{vmatrix} -p & -10 \\ 0.5 & -6-p \end{vmatrix}$ — $p^2+6p+5=0$ $\quad p_{1,2} = -1; -5;$

$U_{C\,св}(t) = A_1\cdot e^{p_1 t} + A_2\cdot e^{p_2 t}$

$i_L(t) = B_1\cdot e^{p_1 t} + B_2\cdot e^{p_2 t}$

[illegible]

$U_C' = i_L' = 0$, [illegible] $t=\infty$ [illegible]

[illegible]

$\begin{pmatrix}0 & -10\\0.5 & -6\end{pmatrix}\cdot\begin{pmatrix}U_C\\i_L\end{pmatrix} + \begin{pmatrix}10 & 0\\0 & -3\end{pmatrix}\cdot\begin{pmatrix}2\\4\end{pmatrix} = \begin{pmatrix}0\\0\end{pmatrix}$

$\begin{pmatrix}0 & -10\\0.5 & -6\end{pmatrix}\cdot\begin{pmatrix}U_C\\i_L\end{pmatrix} = \begin{pmatrix}-20\\12\end{pmatrix}$

$\begin{pmatrix}U_{C\,пр}\\i_{L\,пр}\end{pmatrix} = \begin{pmatrix}0 & -10\\0.5 & -6\end{pmatrix}^{-1}\cdot\begin{pmatrix}-20\\12\end{pmatrix} = \begin{pmatrix}48\\2\end{pmatrix}$

[illegible]

$\begin{pmatrix}U_C'(0)\\i_L'(0)\end{pmatrix} = (A)\cdot\begin{pmatrix}U_C(0)\\i_L(0)\end{pmatrix} + B\cdot\begin{pmatrix}\lambda_1\\\lambda_2\end{pmatrix}$

$\begin{pmatrix}U_C'(0)\\i_L'(0)\end{pmatrix} = \begin{pmatrix}0 & -10\\0.5 & -6\end{pmatrix}\cdot\begin{pmatrix}12\\2\end{pmatrix} + \begin{pmatrix}10 & 0\\0 & -3\end{pmatrix}\cdot\begin{pmatrix}2\\4\end{pmatrix} = \begin{pmatrix}0\\18\end{pmatrix}$

$\begin{cases}U_C(0) = U_{C\,пр} + A_1 + A_2\\ U_C'(0) = A_1 p_1 + A_2 p_2\end{cases}$

$\begin{cases}12 = 48 + A_1 + A_2\\ 0 = -1\cdot A_1 - 5\cdot A_2\end{cases}$

$A_1 = -45;\ A_2 = 9$

$\begin{cases}i_L(0) = i_{L\,пр} + B_1 + B_2\\ i_L'(0) = B_1 p_1 + B_2 p_2\end{cases}$

$\begin{cases}2 = 2 + B_1 + B_2\\ -18 = -1\cdot B_1 - 5\cdot B_2\end{cases}$

$B_1 = -4.5 \quad B_2 = 4.5$

[illegible]

$U_C(t) = 48 - 45\cdot e^{-t} + 9\cdot e^{-5t}$ В

$i_L(t) = 2 - 4.5\cdot e^{-t} + 4.5\cdot e^{-5t}$ А

[illegible]

$T_{пп} = \frac{3}{|p_{min}|} = \frac{3}{1} = 3c$