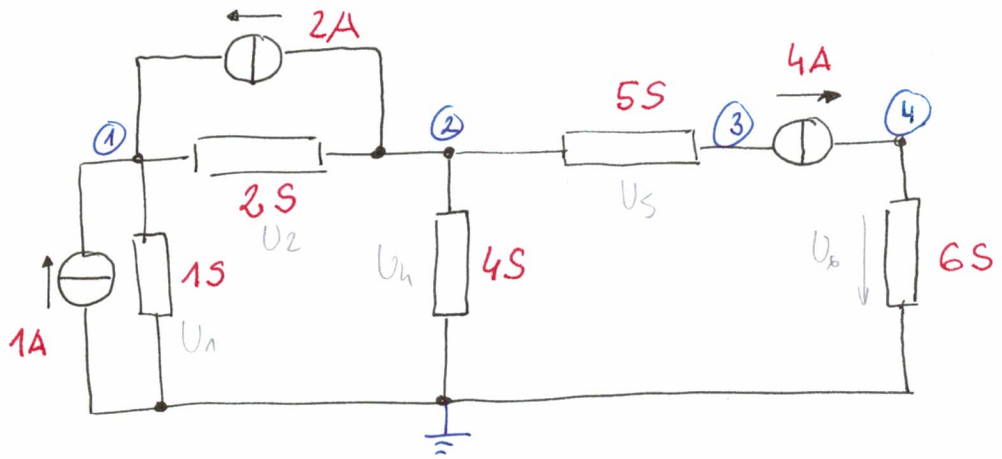
VOZLIŠČNA METODA



Tok, ki teče v vozlišče ima predznak +

$$[I] = [Y] \cdot [U]$$

$$[Y] = \begin{bmatrix} 1+2 & -2 & 0 & 0 \\ -2 & 2+4+5 & -5 & 0 \\ 0 & -5 & 5 & 0 \\ 0 & 0 & 0 & 6 \end{bmatrix} \qquad [I] = \begin{bmatrix} 1+2 \\ -2 \\ -4 \\ 4 \end{bmatrix}$$

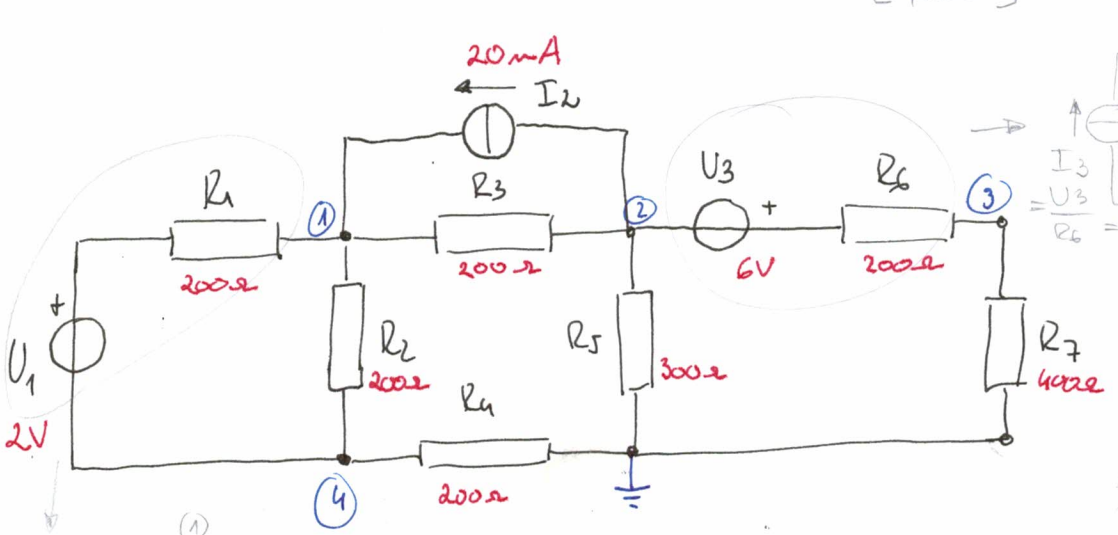
$U_1 = 0{,}429\,V$ $\qquad U_6 = 0{,}666\,V$

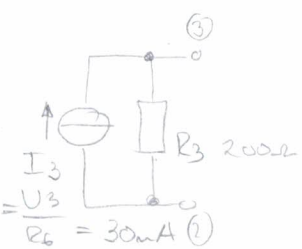
$U_2 = \frac{1}{2} \cdot 2A = 1V$

$U_4 = -0{,}857V$

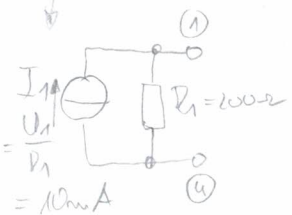
$U_5 =$

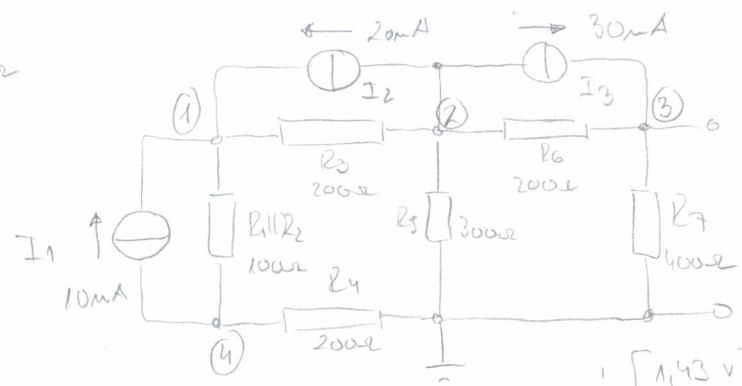
$$I = YX \quad \Rightarrow \quad X = Y^{-1}I \qquad X = \begin{bmatrix} 0{,}429 \\ -0{,}857 \\ -1{,}657 \\ 0{,}666 \end{bmatrix} [V]$$





$U_{R7} = ?$





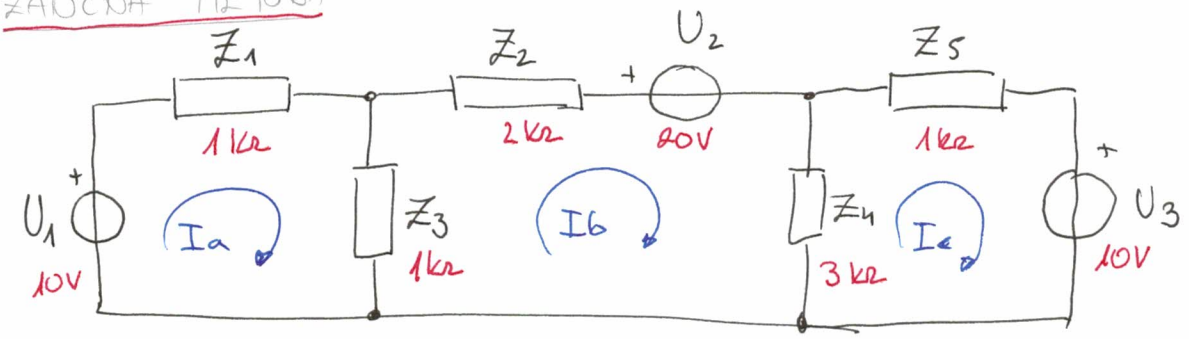
$$[Y] = \begin{bmatrix} 0{,}015 & -0{,}005 & 0 & -0{,}01 \\ -0{,}005 & 13{,}3 \cdot 10^{-3} & -0{,}005 & 0 \\ 0 & -0{,}005 & 0{,}075 & 0 \\ -0{,}01 & 0 & 0 & 0{,}015 \end{bmatrix}$$

$$[I] = \begin{bmatrix} 30mA \\ -50mA \\ 30mA \\ -10mA \end{bmatrix}$$

$$[U] = \begin{bmatrix} 1{,}43\,V \\ -2{,}29\,V \\ 2{,}48\,V \\ 0{,}29\,V \end{bmatrix}$$

$U_{R7} = 2{,}48V$

ZANČNA METODA



$$I_a(Z_1+Z_3) - I_b Z_3 + \emptyset = U_1$$

$$-I_a Z_3 + I_b(Z_3+Z_2+Z_4) - I_c Z_4 = -U_2$$

$$\emptyset - I_b Z_4 + I_c(Z_5+Z_4) = -U_3$$

$$\begin{bmatrix} 2k & -1k & \\ Z_1+Z_3 & -Z_3 & \emptyset \\ -Z_3 & Z_2+Z_3+Z_4 & -Z_4 \\ -1k & 6k & -3k \\ \emptyset & -Z_4 & Z_4+Z_5 \\ & -3k & 4k \end{bmatrix} \cdot \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} U_1 \\ -U_2 \\ -U_3 \end{bmatrix} \begin{matrix} 10 \\ 20 \\ -10 \end{matrix}$$

A X B

$$U_1 = I_a \cdot Z_1 = \boxed{1{,}53\,V}$$

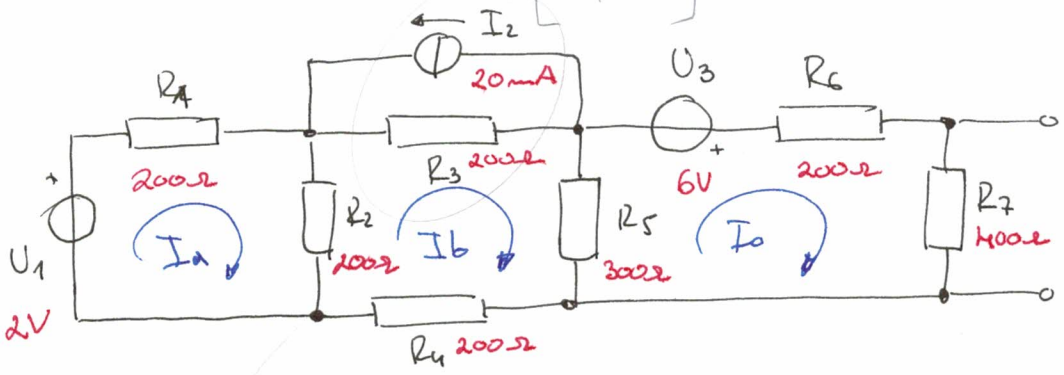
$$U_3 = (I_a - I_b)\cdot Z_3 = \boxed{8{,}46\,V}$$

$$U_2 = I_b \cdot Z_2 = \boxed{-13{,}85\,V}$$

$$U_4 = (I_b - I_c)\cdot Z_4 = \boxed{2{,}31\,V}$$

$$U_5 = I_c \cdot Z_5 = \boxed{-7{,}69\,V}$$

$$X = A^{-1}B = \begin{bmatrix} 1{,}53\cdot10^{-3} \\ -6{,}92\cdot10^{-3} \\ -7{,}69\cdot10^{-3} \end{bmatrix}$$



$$I_a(R_2+R_1) - I_b R_2 + \emptyset = U_1$$

$$-I_a R_2 + I_b(R_2+R_3+R_4+R_5) - I_c R_5 = -U_2$$

$$\emptyset - I_b R_5 + I_c(R_5+R_6+R_7) = U_3$$

$$\begin{bmatrix} 400 & -200 & \\ R_1+R_2 & -R_2 & \emptyset \\ -200 & R_2+R_3+R_4+R_5 & -R_5 \\ -R_2 & 900 & -300 \\ \emptyset & -R_5 & R_5+R_6+R_7 \\ & -300 & 1100 \end{bmatrix} \cdot \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} U_1 \\ -U_2 \\ U_3 \end{bmatrix} \begin{matrix} 2V \\ -4V \\ 6V \end{matrix}$$

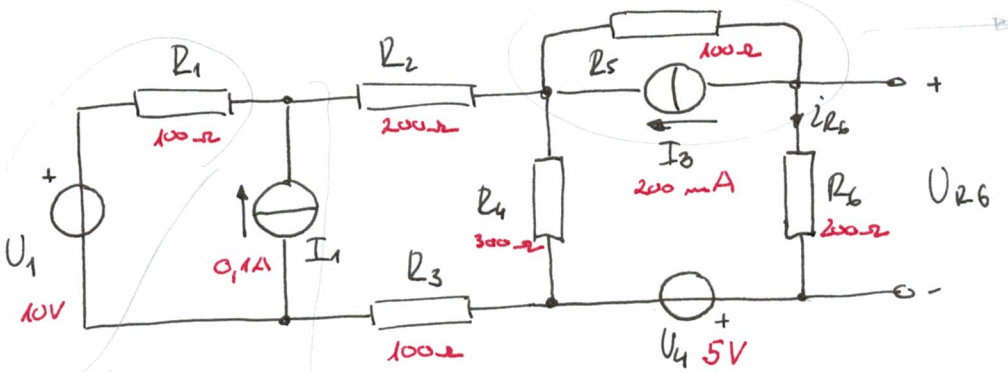
$$I_a = 4{,}051\,mA$$

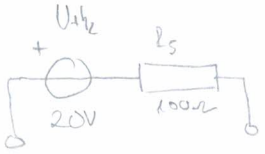
$$I_b = -1{,}899\,mA$$

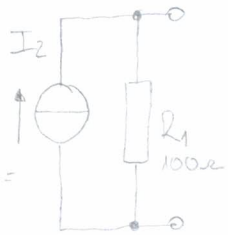
$$I_c = 4{,}937\,mA$$

$$U_{R7} = I_c \cdot R_7 = \boxed{1{,}975\,V}$$

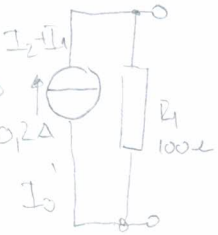
VAJE - PRIMERI ZA KOLOKVIJ 29.10.2012

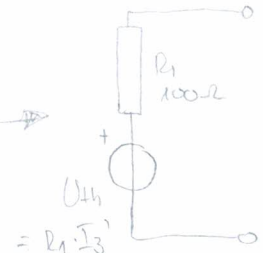


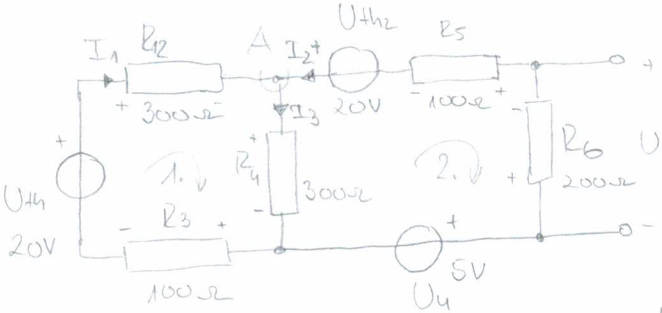




$\frac{U_1}{R_1} = \frac{10}{100} = 0{,}1\,A$







1.) $-U_{th} + I_1(R_{12}+R_3) + I_3 R_4 = 0$

2.) $U_{th2} - I_2(R_5+R_6) - I_3 R_4 + U_4 = 0$

A:) $I_3 - I_1 - I_2 = 0$

$$1.) \Rightarrow I_1 = \frac{U_{th} - I_2 R_4}{R_{12}+R_3} = 12{,}18\,mA$$

$$2.) \Rightarrow I_2 = \frac{U_{th2} + U_4 - I_3 R_4}{R_5+R_6} = 34{,}85\,mA = I_{R6}$$

$U_{R6} = I_2 \cdot R_6 =$

$= 34{,}85\,mA \cdot 200\,\Omega$

$= 6{,}97\,V$

$= -6{,}97\,V$

da jeste v drugo smer

$$I_3 - \left(\frac{U_{th} - I_3 R_4}{R_{12}+R_3}\right) - \left(\frac{U_{th2} + U_4 - I_3 R_4}{R_5+R_6}\right) = 0$$

$$I_2\left(1 + \frac{R_4}{R_{12}+R_3} + \frac{R_4}{R_5+R_6}\right) = \frac{U_{th}}{R_{12}+R_3} + \frac{U_{th}+U_4}{R_5+R_6}$$

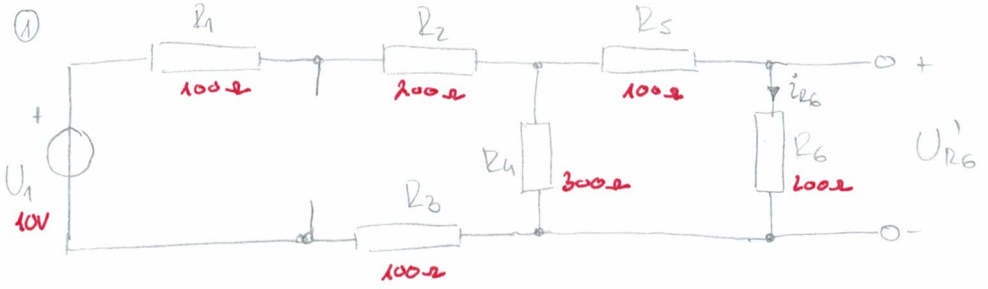
$2{,}75 \qquad\qquad 0{,}133$

$I_3 = 48{,}49\,mA$

$P_{RG} = I_{R6} \cdot U_{RG} = 0{,}243\,W$

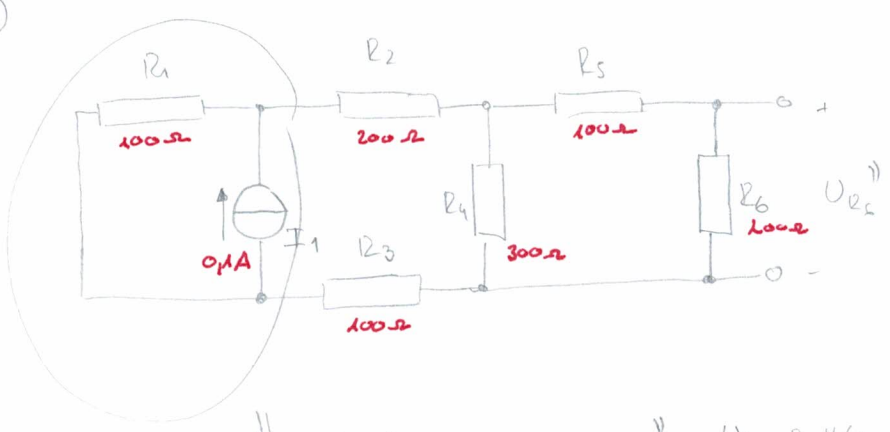
PO METODI SUPERPOZICIJE

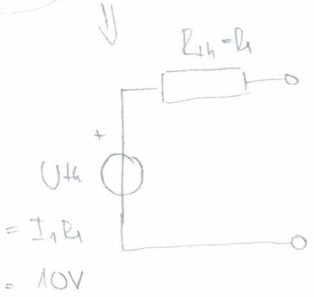
①



$$U'_{R6} = \frac{U_1 \cdot R_4 \| (R_5+R_6) \cdot R_6}{(R_1+R_2+R_3+R_4 \| (R_5+R_6)) \cdot (R_5+R_6)} = \frac{10V \cdot 150\Omega \cdot 200\Omega}{550\Omega \cdot 300\Omega} = \boxed{1,82\ V}$$

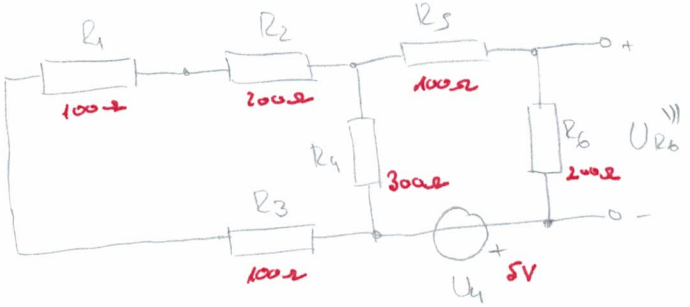
②





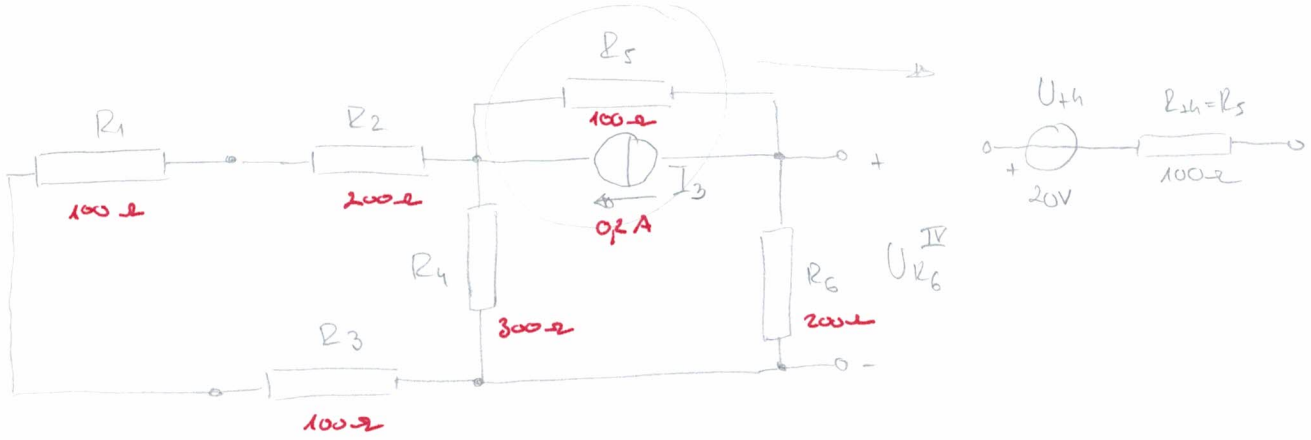
$$U''_{R6} = \frac{U_{th} \cdot R_4 \| (R_5+R_6) \cdot R_6}{R_1+R_2+R_3+R_4 \| (R_5+R_6)} = \boxed{1,82\ V}$$

③



$$U''_{R6} = \frac{-U_4 \cdot R_6}{(R_1+R_2+R_3) \| R_4 + R_5 + R_6} = \boxed{-2,12\ V}$$

(4)



$$U_{R6}^{IV} = \frac{-U_{th} \cdot R_6}{(R_1+R_2+R_3) \| R_4 + R_5 + R_6} = \boxed{-8{,}49\ V}$$

$$U_{R6} = U_{R6}' + U_{R6}'' + U_{R6}''' + U_{R6}^{IV}$$

$$= 1{,}82V + 1{,}82V - 2{,}12V - 8{,}49V$$

$$= \boxed{-6{,}97V} \qquad I_{R6} = \frac{U_{R6}}{R_6} = \boxed{34{,}85\ mA}$$

$$P_{R6} = I_{R6} \cdot U_{R6} = \boxed{0{,}243\ W}$$

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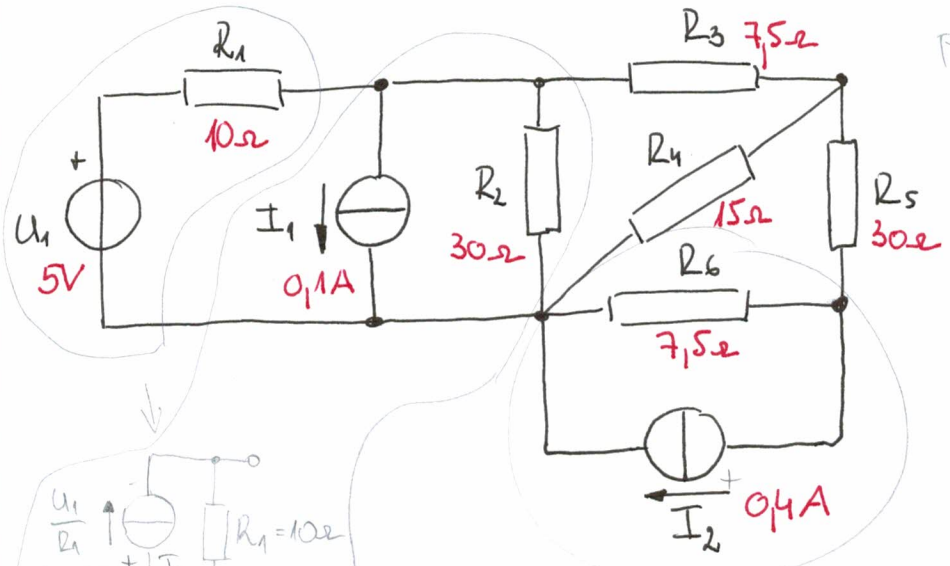
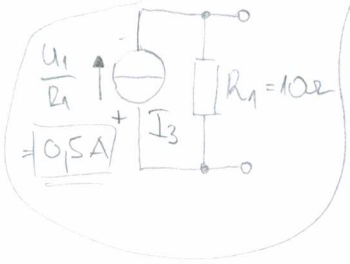
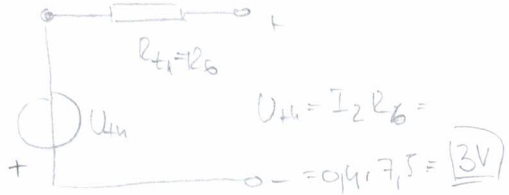
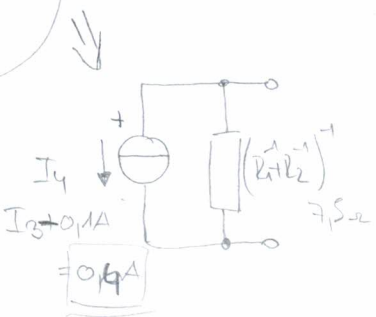
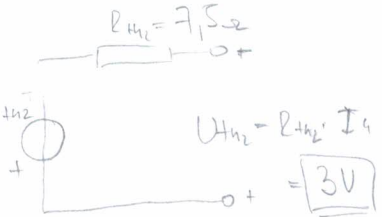
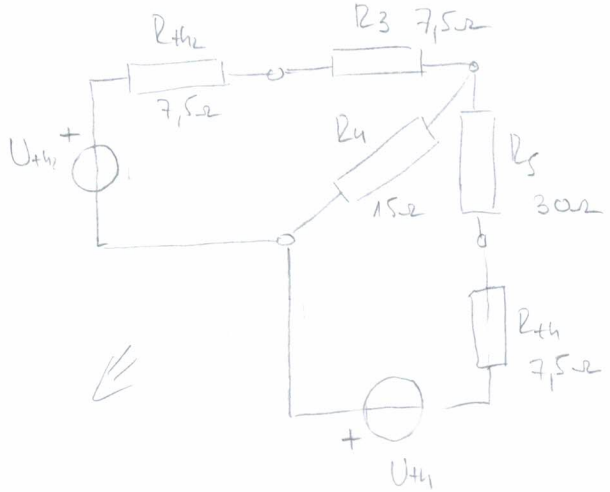


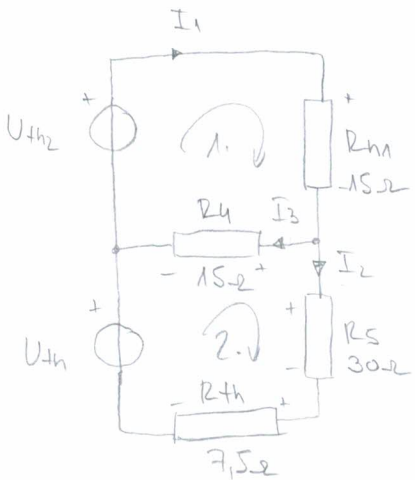












1.) $-U_{th2} + I_1 R_{n1} + I_3 R_4 = 0 \Rightarrow I_1 = \frac{U_{th2} - I_3 R_4}{R_{n1}} = 0,15A$

2.) $-U_{th} + I_2(R_5 + R_{th}) - I_3 R_4 = 0 \Rightarrow I_2 = \frac{+U_{th} + I_3 R_4}{R_5 + R_{th}} = 0,1A$

A:) $I_2 - I_1 + I_3 = 0$

$U_{R5} = R_5 \cdot I_2 =$

$30\Omega \cdot 0,1A = 3V$

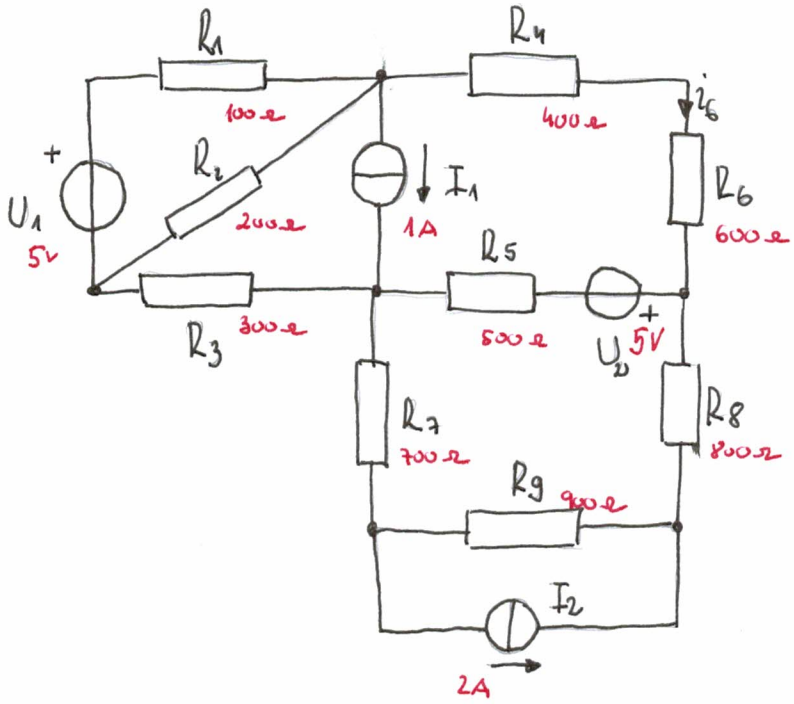
$P_{R5} = U_{R5} \cdot I_2 =$

$= 3V \cdot 0,1A = 0,3W$

$\frac{+U_{th} + I_3 R_4}{R_5 + R_{th}} + \frac{-U_{th2} + I_3 R_4}{R_{n1}} - I_3 = 0$

$I_3 \left(\underbrace{+\frac{R_4}{R_5 + R_{th}} + \frac{R_4}{R_{n1}}}_{2,4} + 1 \right) = \underbrace{\frac{+U_{th2}}{R_{n1}} - \frac{U_{th}}{R_5 + R_{th}}}_{0,12}$

$I_3 = 0,05A$

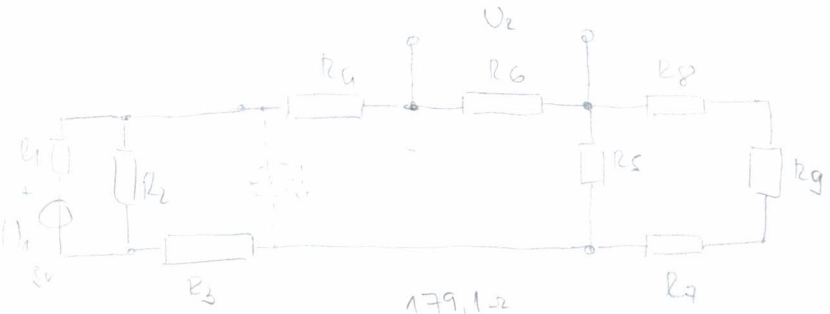


$i_6 = ?$

$U_{R_6} = ?$

$P_{R_6} = ?$

U_2'



179,1Ω

2400

5V

6000Ω

$$U_2' = \frac{U_1 \cdot R_2 \| (R_4 + R_6 + R_3 + R_5 \| (R_8 + R_7 + R_9)) \cdot R_6}{R_1 + (R_2 \| (R_4 + R_6 + R_3 + R_5 \| (R_8 + R_7 + R_9))) \cdot (R_4 + R_6 + R_3 + R_5 \| (R_8 + R_7 + R_9))} = 1{,}123\,V$$

2400

4179

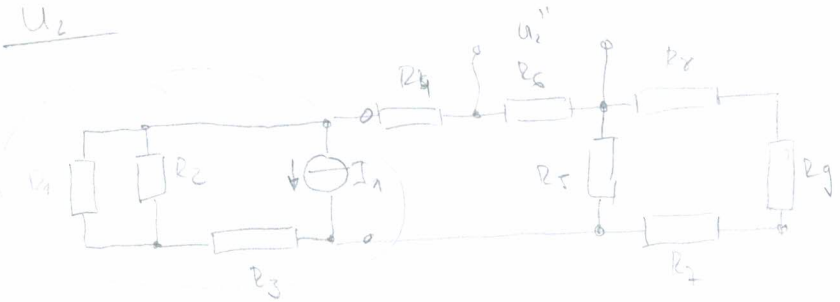
1713,79

179,1

279,1

1713,79Ω

U_2''



$U_{th} = R_{th} \cdot I_1$

$= 366{,}67\,V$

$R_{th} = R_3 + R_1 \| R_2$

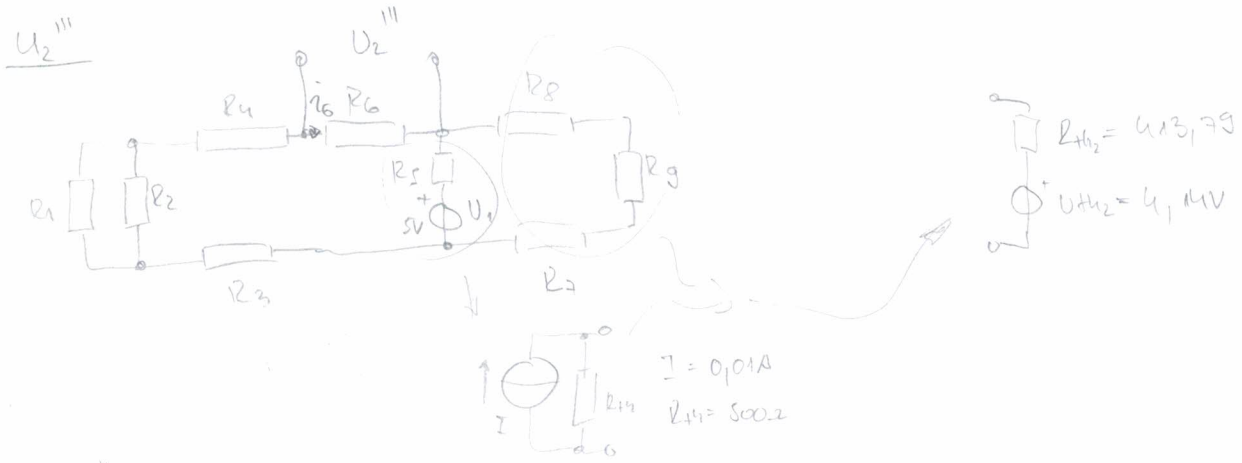
$= 366{,}67\,\Omega$

$$U_2'' = \frac{-U_{th} \cdot R_6}{R_{th} + R_4 + R_2 + R_5 \| (R_7 + R_8 + R_9)} = -123{,}56\,V$$

4179

1750,46Ω

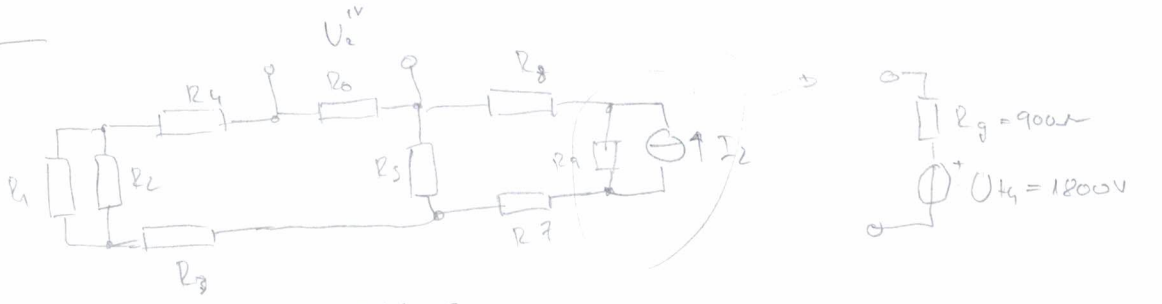
U_2'''



$$U_2''' = \frac{-U_{th2} \cdot R_6}{R_{th2} + R_6 + R_4 + R_3 + R_1 \| R_2} = \boxed{-1,39\,V}$$

$R_1 \| R_2 = 1780,494$

U_2^{IV}



$$U_2^{IV} = \frac{U_{th} \cdot R_5 \| (R_1 \| R_2 + R_3 + R_4 + R_6) \cdot R_6}{((R_1 \| R_2 + R_3 + R_4 + R_6) \| R_5 + R_8 + R_7 + R_9) \cdot (R_6 + R_4 + R_3 + R_1 \| R_2)} = \boxed{-104,58\,V}$$

$R_1 \| R_2 + R_3 + R_4 + R_6 = 1366,67$

$366,07 + 2400 = 2766,07\,\Omega$

$R_5 \| (R_1 \| R_2 + R_3 + R_4 + R_6) = 366,07$

$R_6 + R_4 + R_3 + R_1 \| R_2 = 1366,67$

$$U_{R6} = U_2' + U_2'' + U_2''' + U_2^{IV} =$$

$$= 1,123V - 123,56\,V - 1,39\,V - 104,58\,V =$$

$$= \boxed{-228,407\,V}$$

$$P_{R6} = i_{R6} \cdot U_{R6} = \boxed{85,95\,W}$$

$$i_{R6} = \frac{U_{R6}}{R_6} = \boxed{-0,381\,A}$$