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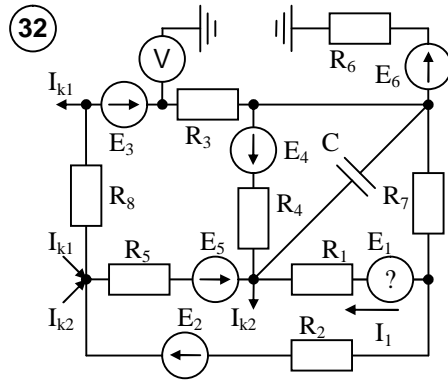
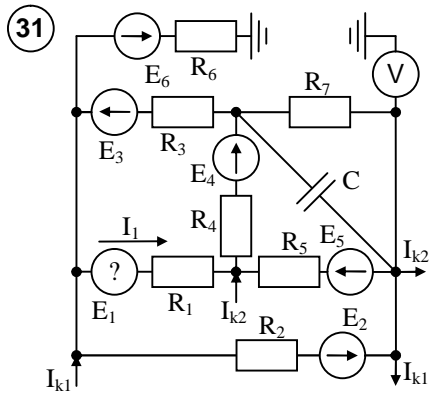
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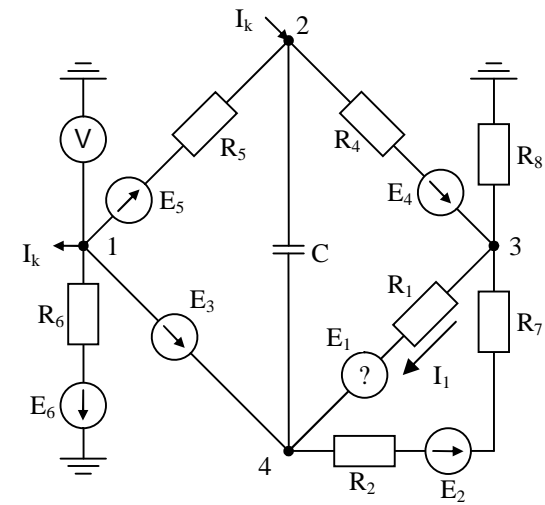
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1. ()
2. $I_1 = 2A$, E_1 ,
3. E_1 .
4. (E_1
5. .
6. .

R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	E_1	E_2	E_3	E_4	E_5	E_6	I_k	I_1
4	4	5	3	2	3	2	3	?	40	50	60	30	15	4	2

$I_K -$



1.

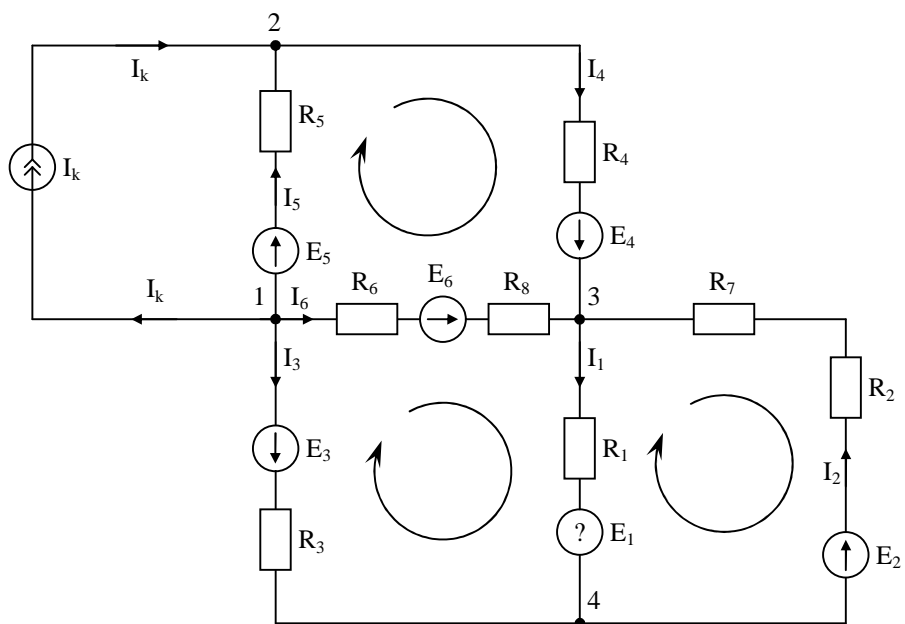
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R₆, R₈
. 2

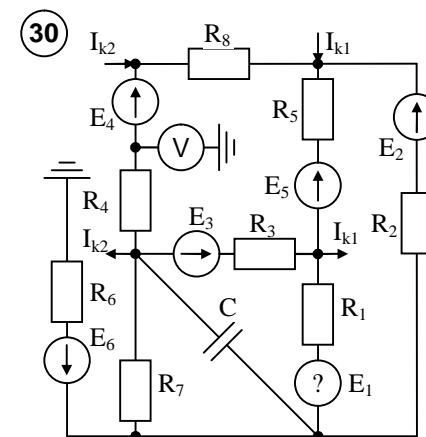
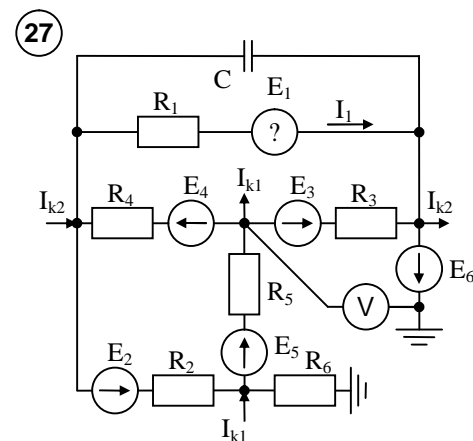
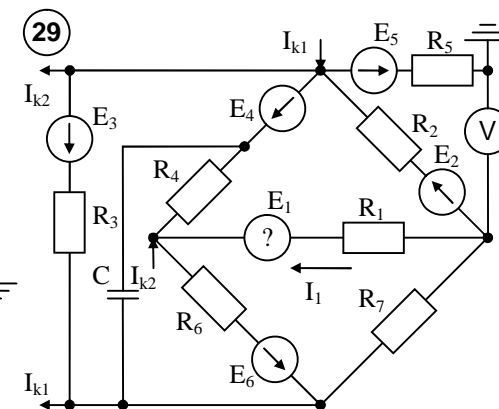
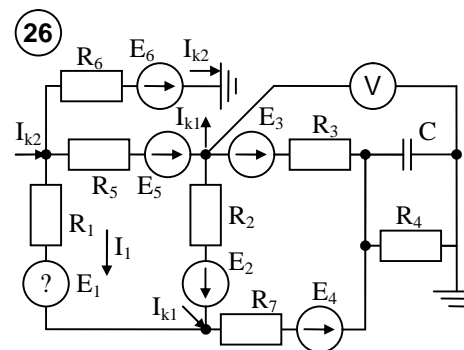
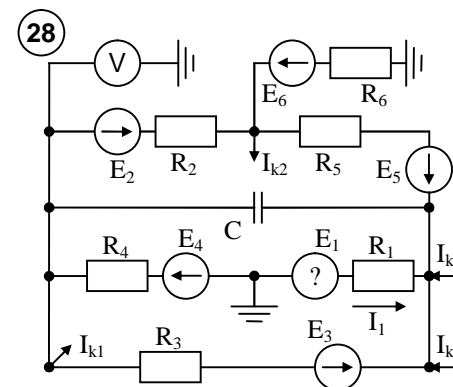
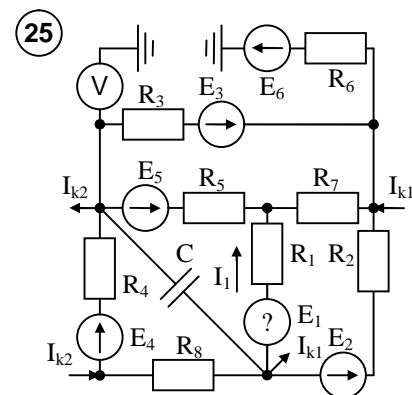
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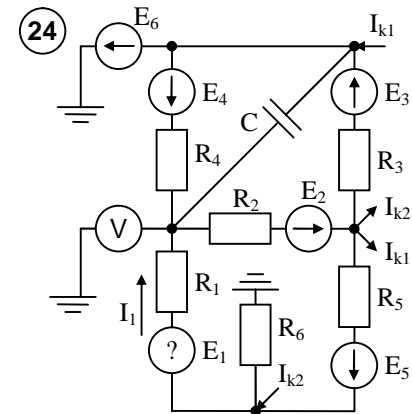
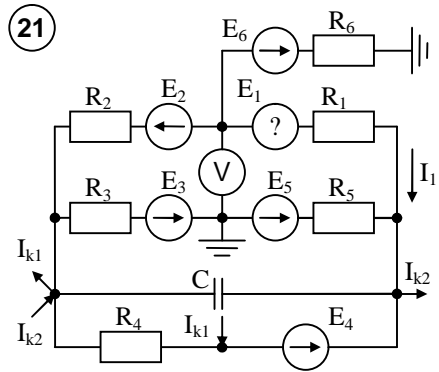
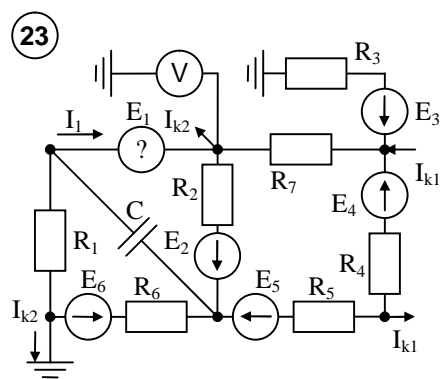
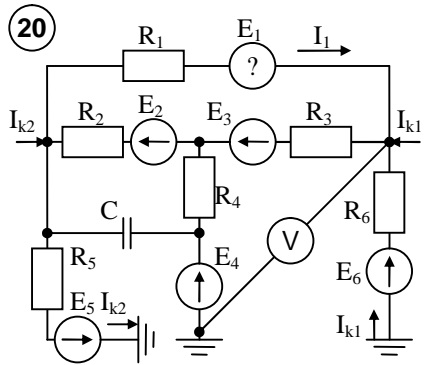
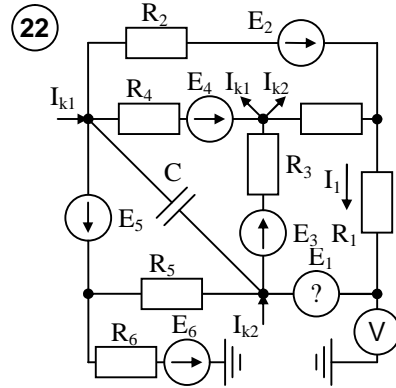
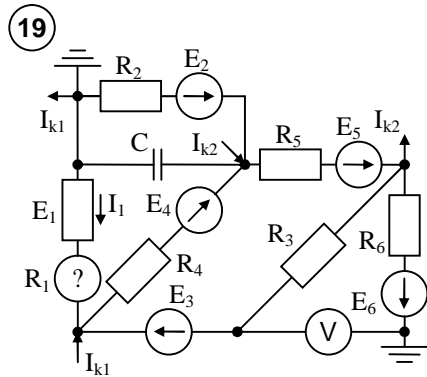
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$$n = y - 1 = 4 - 1 = 3$$



. 2





$$\begin{array}{ll} 1 & -\mathbf{I}_k - \mathbf{I}_5 - \mathbf{I}_3 - \mathbf{I}_6 = 0 \\ & \mathbf{I}_k + \mathbf{I}_5 + \mathbf{I}_3 + \mathbf{I}_6 = 0 \end{array}$$

$$2 \quad I_k + I_5 - I_4 = 0$$

$$3 \quad \mathbf{I}_2 + \mathbf{I}_6 - \mathbf{I}_1 = 0$$

$$7 \quad (= 7) (\quad).$$

$$= (7 - 1) - (y - 1) = 7 - 1 - (4 - 1) = 3$$

3 4.

$$I_5 \cdot R_5 + I_4 \cdot R_4 - I_6 \cdot R_8 + I_6 \cdot R_6 = E_5 + E_4 - E_6$$

$$I_6 \cdot R_6 + I_6 \cdot R_8 + I_1 \cdot R_1 - I_3 \cdot R_3 = E_6 + E_1 - E_3$$

$$-I_1 \cdot R_1 - I_2 \cdot R_7 - I_2 \cdot R_2 = -E_1 - E_2$$

$$: \quad \quad \quad \mathbf{E}_1.$$

$$(\quad).$$

2. E_1

$$E'_5$$

$$E'_5 = I_k \cdot R_5 = 4 \cdot 2 = 8$$

$$1 \quad 2 \quad \quad \quad E_5.$$

$$E_5', \quad (I_k).$$

(. 3).

$$\mathbf{I}_{11}, \mathbf{I}_{22} \quad \mathbf{I}_{33}$$

$$\begin{array}{ccccccc} & & I_{22} & & I_1 & & I_{33}. \\ I_1 = I_{22} - I_{33}; & I_{22} = I_1 + I_{33} = 2 + I_{33}. & & & & & \end{array}$$

$$I_{11}(R_5 + R_4 + R_8 + R_6) - I_{22}(R_6 + R_8) = E_5 + E'_5 + E_4 - E_6$$

$$I_{22}(R_3 + R_6 + R_8 + R_1) - I_{11}(R_6 + R_8) - I_{33}R_1 = E_1 + E_6 - E_3$$

$$I_{33}(R_1 + R_2 + R_7) - I_{22} \cdot R_1 = -E_1 - E_2$$

$$11I_{11} - (2 + I_{33}) \cdot 6 = 83$$

$$-6I_{11} + (2 + I_{33}) \cdot 15 - 4I_{33} = -35 + E_1$$

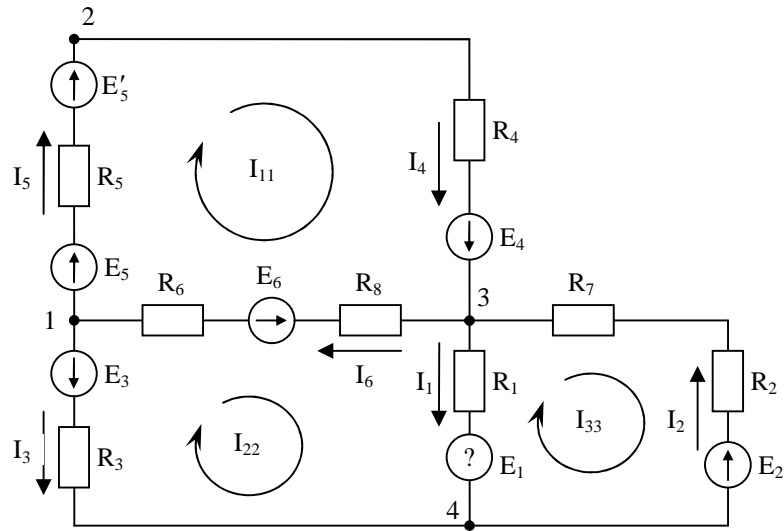
$$-(2 + I_{33}) \cdot 4 + 10I_{33} = -E_1 - 40$$

$$, \quad \mathbf{I}_1$$

$$11I_{11} - 6I_{33} = 95$$

$$-6I_{11} + 11I_{33} = -65 + E_1$$

$$6I_{33} = -32 - E_1$$



$$\left. \begin{array}{l} I_{33} \quad I_{11} \\ 1I_{11} - 6I_{33} = 95 \\ -6I_{11} + 17I_{33} = -97 \end{array} \right\} I_{33} = -3,29A; I_{11} = 6,84A; I_{22} = 2 + I_{33} = -1,29A$$

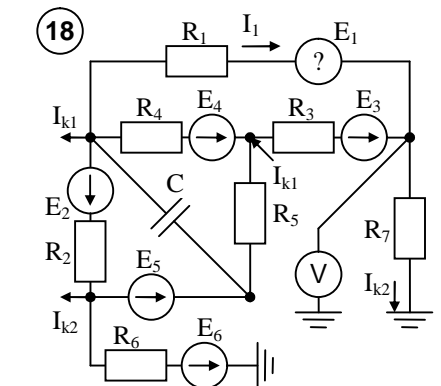
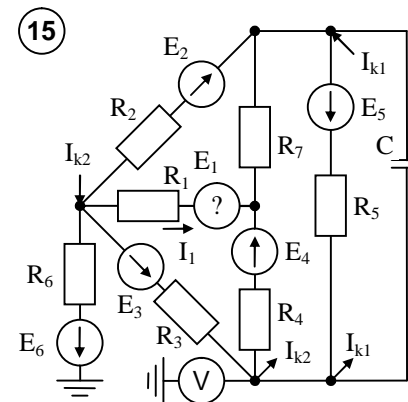
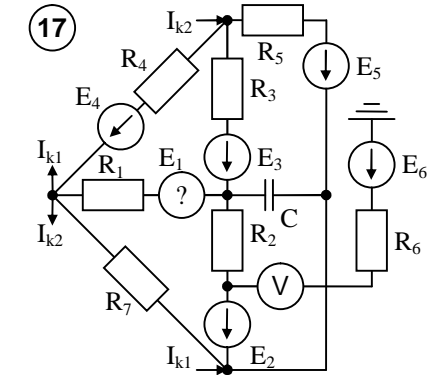
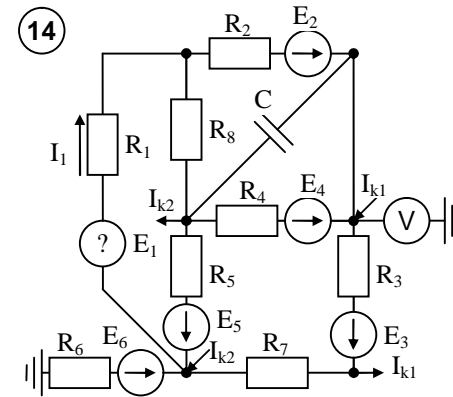
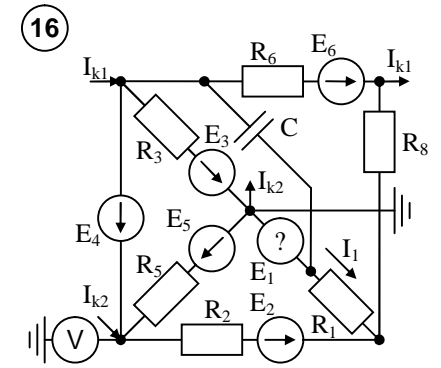
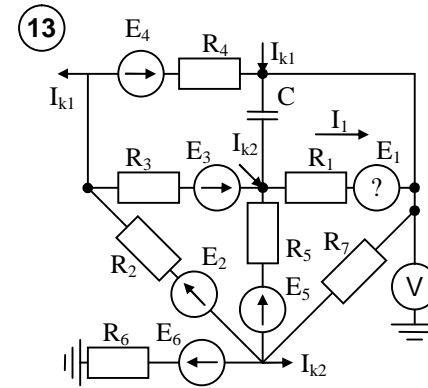
$$6I_{33} = -32 - E_1; \quad E_1 = -32 - 6I_{33} = -12,26 \text{ B}; \quad E_1 = -12,26 \text{ B}$$

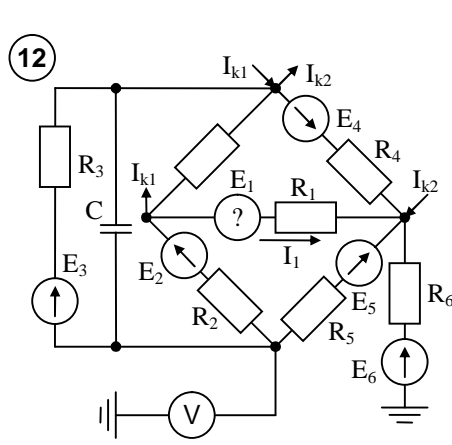
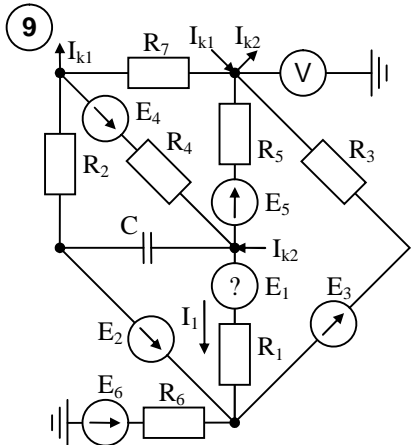
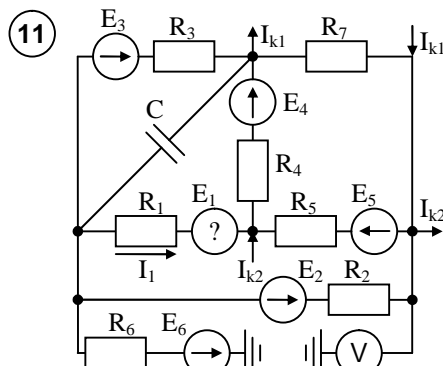
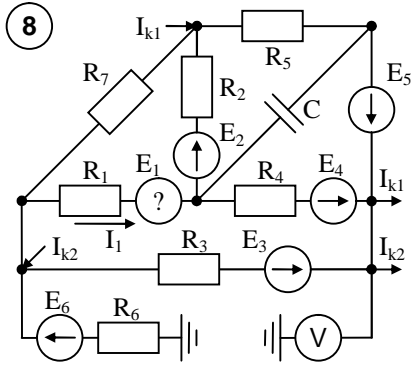
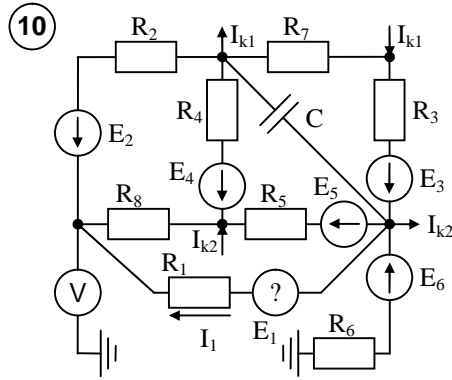
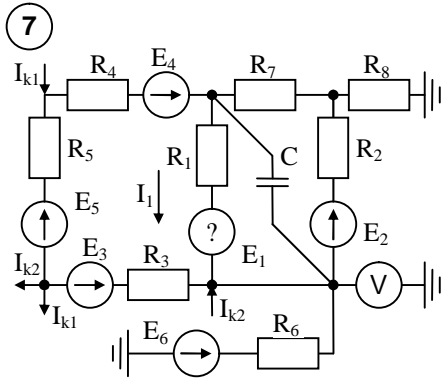
$$\begin{array}{l} 3 \\ 2 \\ I_2 = -I_{33} = 3,29A; I_3 = -I_{22} = 1,29A; I_4 = I_{11} = 6,84A; \\ I_5 = I_{11} - I_k = 6,84 - 4 = 2,84; \quad I_6 = I_{22} - I_{11} = -1,29 - 6,84 = -8,13A. \\ (\quad I_6 \quad , \dots \quad 3 \end{array}$$

3.

$$\sum E_i \cdot I_i + U_{21} \cdot I_k = \sum I_i^2 \cdot R_i$$

$$\underline{\quad 1. \quad}, \quad I_1 \quad I_6$$





2.

$$P_{21} = U_{21} \cdot I_k = (\varphi_2 - \varphi_1) \cdot I_k = (E_5 - I_5 \cdot R_5) \cdot I_k = (30 - 2,84 \cdot 2) \cdot 4 = 97,28$$

$$\sum E_i \cdot I_i + U_{21} \cdot I_k = E_5 \cdot I_5 + E_4 \cdot I_4 - E_6 \cdot I_6 + E_3 \cdot I_3 - E_1 \cdot I_1 + E_2 \cdot I_2 + U_{21} \cdot I_k = 30 \cdot 2,84 + 60 \cdot 6,84 - 15 \cdot 8,13 + 50 \cdot 1,29 - 12,26 \cdot 2 + 40 \cdot 3,29 + 97,28 = 642,51$$

$$\sum I_i^2 \cdot R_i = I_1^2 \cdot R_1 + I_2^2 \cdot (R_2 + R_7) + I_3^2 \cdot R_3 + I_4^2 \cdot R_4 + I_5^2 \cdot R_5 + I_6^2 \cdot (R_6 + R_8) = 16 + 64,945 + 8,32 + 140,35 + 16,14 + 396,6 = 642,36$$

4.

$$(4) \quad (2) \quad , \quad \dots \quad \varphi_4 = 0.$$

$$\begin{cases} \varphi_1 \cdot (g_3 + g_5 + g_{68}) - \varphi_2 \cdot g_5 - \varphi_3 \cdot g_{68} = -E_3 \cdot g_3 - E_5 \cdot g_5 - E_6 \cdot g_{68} - I_k \\ \varphi_2 \cdot (g_5 + g_4) - \varphi_1 \cdot g_5 - \varphi_3 \cdot g_4 = E_5 \cdot g_5 - E_4 \cdot g_4 + I_k \\ \varphi_3 \cdot (g_{68} + g_4 + g_1 + g_{27}) - \varphi_1 \cdot g_{68} - \varphi_2 \cdot g_4 = E_1 \cdot g_1 + E_2 \cdot g_{27} + E_6 \cdot g_{68} + E_4 \cdot g_4 \end{cases}$$

$$(g_i) \quad ; \quad g_{68} = \frac{1}{R_6 + R_8}, \quad g_{27} = \frac{1}{R_2 + R_7}.$$

$$g_1=0,25, \quad g_{27}=0,166666, \quad g_3=0,2, \quad g_4=0,333333, \quad g_5=0,5, \quad g_{68}=0,166666.$$

$$\begin{cases} \varphi_1 \cdot 0,866666 & -\varphi_2 \cdot 0,5 & -\varphi_3 \cdot 0,166666 & = -31,5 \\ -\varphi_1 \cdot 0,5 & +\varphi_2 \cdot 0,833333 & -\varphi_3 \cdot 0,333333 & = -1 \\ -\varphi_1 \cdot 0,166666 & -\varphi_2 \cdot 0,333333 & +\varphi_3 \cdot 0,91666666 & = 32,2 \end{cases}$$

$$(\varphi_1, \varphi_2, \varphi_3)$$

$$(\Delta, \Delta 1, \Delta 2, \Delta 3).$$

$$\Delta = \begin{vmatrix} 0,866666 & -0,5 & -0,166666 \\ -0,5 & 0,833333 & -0,333333 \\ -0,166666 & -0,333333 & 0,916666 \end{vmatrix} = 0,25787$$

$$\Delta 1 = \begin{vmatrix} -31,5 & -0,5 & -0,166666 \\ -1 & 0,833333 & -0,333333 \\ 32,23 & -0,333333 & 0,916666 \end{vmatrix} = -11,228222$$

$$\Delta 2 = \begin{vmatrix} 0,866666 & -31,5 & -0,166666 \\ -0,5 & -1 & -0,333333 \\ -0,166666 & 32,23 & 0,916666 \end{vmatrix} = -4,957446$$

$$\Delta 3 = \begin{vmatrix} 0,866666 & -0,5 & -31,5 \\ -0,5 & 0,833333 & -1 \\ -0,166666 & -0,333333 & 32,23 \end{vmatrix} = 5,222501$$

$$\varphi_1 = \frac{\Delta 1}{\Delta} = -43,54218 ; \varphi_2 = \frac{\Delta 2}{\Delta} = -19,224593 ; \varphi_3 = +20,252413$$

$$I_{12} = \frac{\pm E_{12} - (\varphi_2 - \varphi_1)}{R_{12}}$$

$$\begin{matrix} I_{12} - & (1 \ 2), & (1) & (2); \\ E_{12} - & (1 \ 2), & (+), & \end{matrix}$$

$$\varphi_1 \ \varphi_2 - \quad (1 \ 2),$$

$$R_{12} - \quad (1 \ 2).$$

$$I_1 = \frac{E_1 - (\varphi_3 - \varphi_4)}{R_1} = \frac{12,26 - 20,252413}{4} = -1,9918 \text{ A}$$

$$(3) \quad (4).$$

$$I_2 = \frac{E_2 - (\varphi_3 - \varphi_4)}{R_2 - R_7} = \frac{40 - 20,252413}{4 + 2} = 3,29 \text{ A}$$

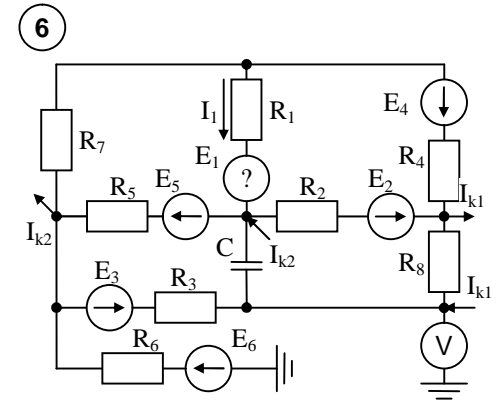
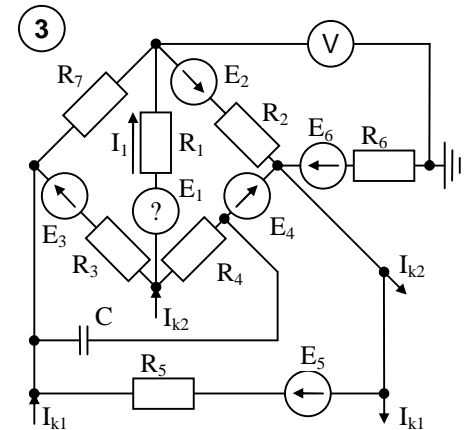
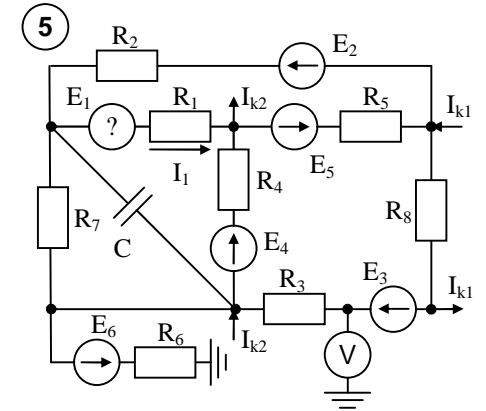
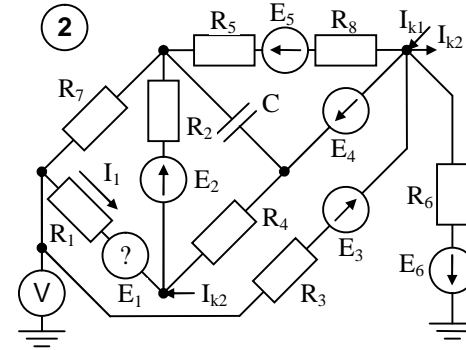
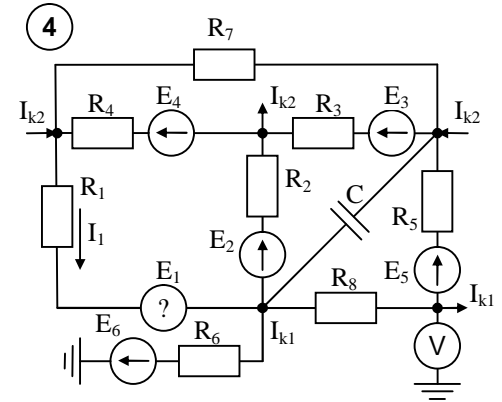
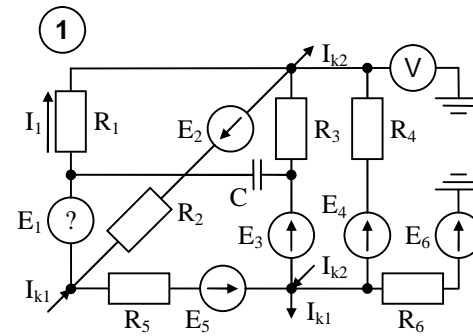
$$I_3 = \frac{E_3 - (\varphi_4 - \varphi_1)}{R_3} = \frac{50 - 43,54218}{5} = 1,29 \text{ A}$$

$$I_4 = \frac{E_4 - (\varphi_2 - \varphi_1)}{R_4} = \frac{60 - (-19,224593 + 43,54218)}{3} = 6,84 \text{ A}$$

$$I_5 = \frac{E_5 - (\varphi_2 - \varphi_1)}{R_5} = \frac{30 - (-19,224593 + 43,54218)}{2} = 2,84 \text{ A}$$

$$I_6 = \frac{-E_6 - (\varphi_1 - \varphi_3)}{R_6 + R_8} = \frac{-15 - (-43,54218 - 20,252413)}{3 + 3} = -8,13 \text{ A}$$

	I_1	I_2	I_3	I_4	I_5	I_6
	2	3,29	1,29	6,84	2,84	-8,13
	1,9981	3,29	1,29	6,84	2,84	-8,13
, %	0	0	0	0	0	0



- 1.
2. $I_1 = 2$, E_1 ,
3. E_1 .
4. (I_1) .
- 5.
- 6.

	1	2	3	4	5	6
R_1	8	6	5	4	3	2
R_2	5	4	5	4	4	3
R_3	4	5	6	5	4	4
R_4	6	4	5	3	5	6
R_5	6	5	2	2	6	4
R_6	7	8	2	3	7	4
R_7	2	3	2	2	8	7
R_8	3	2	2	3	2	8
E_1	?	?	?	?	?	?
E_2	50	40	50	40	20	30
E_3	30	30	40	50	30	40
E_4	40	20	30	60	40	50
E_5	50	50	20	30	50	60
E_6	30	20	10	15	20	20

- 1.
2. «A»: $I_{K1} = 4$, $I_{K2} = 0$, $I_1 = 2$;
«B»: $I_{K1} = 0$, $I_{K2} = 4$, $I_1 = 2$;

5.

$$(m, m') \quad (I_2) \quad U$$

$$R_1(I_1')$$

$$\begin{cases} I_{11}(R_4 + R_5 + R_6 + R_8) - I_{22}(R_6 + R_8) = (E_5 + E'_5 + E_4 - E_6) \\ I_{22}(R_6 + R_8 + R_1 + R_3) - I_{11}(R_6 + R_8) = E_6 - E_1 - E_3 \end{cases}$$

$$\begin{cases} 11I_{11} - 6I_{22} = 83 \\ -6I_{11} + 15I_{22} = -47,26 \end{cases}$$

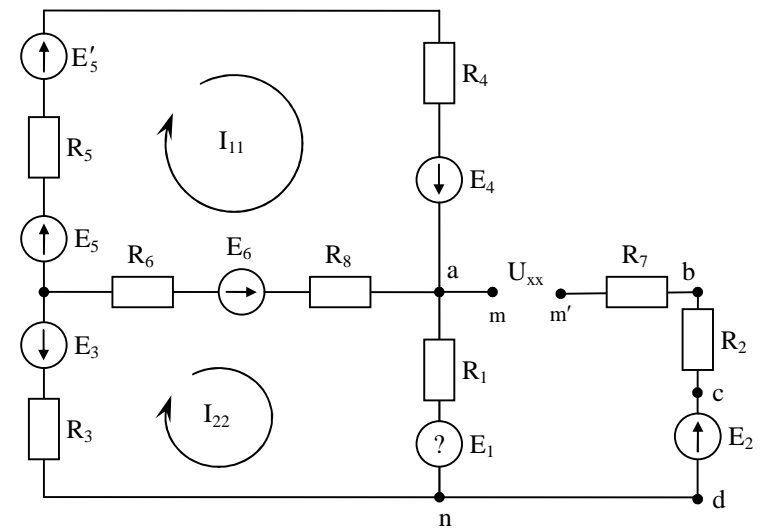
$$\begin{cases} I_{11} = \frac{83 + 6I_{22}}{11} \\ \frac{-6(83 + 6I_{22})}{11} + 15I_{22} = -47,26 \end{cases}$$

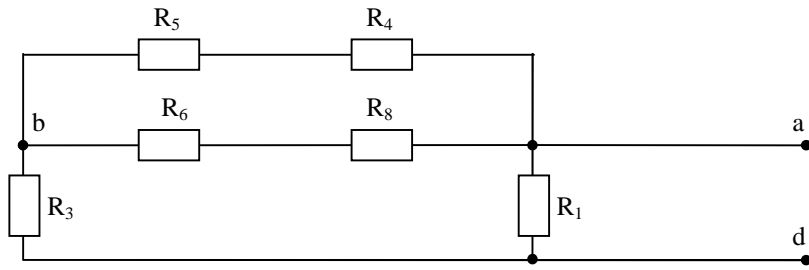
$$-45,2727 - 3,272727 I_{22} + 15 I_{22} = -47,26 \quad I_{22} = -0,169459 \text{ A}$$

$$I_1' = -I_{22} = 0,169459$$

$$U_{xx} - I_1' \cdot R_1 = E_2 - E_1$$

$$U_{xx} = E_2 - E_1 + I_1' \cdot R_1 = 40 - 12,26 + 0,169459 \cdot 4 = 27,9095 \text{ B}$$





. 5

(ad).

$$R_{ab} = \frac{(R_5 + R_4) \cdot (R_6 + R_8)}{R_5 + R_4 + R_6 + R_8} = 2,7272727$$

$$R = R_{ab} + R_3 = 2,7272727 + 5 = 7,7272727$$

$$R = \frac{R \cdot R_1}{R + R_1} = \frac{7,7272727 \cdot 4}{7,7272727 + 4} = 2,635659$$

 I_2

$$I_2 = \frac{U_{xx}}{R + R_2 + R_7} = \frac{27,9095}{2,635659 + 4 + 2} = 3,23 \text{ A}$$

$$\varepsilon_{\%} = \frac{3,29 - 3,23}{3,23} \cdot 100 = 1,8\%$$

6.

. 6

(1)

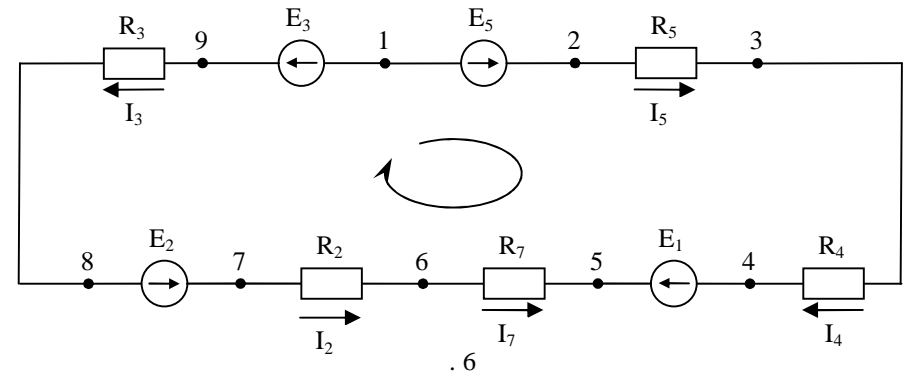
, . . $\varphi_1 = 0$

(. 6).

$$E'_5$$

$$\varphi_2 = \varphi_1 + E_5 = 0 + 30 = 30\text{B}$$

$$\varphi_3 = \varphi_2 - I_5 \cdot R_5 = 30 - 2,84 = 24,32\text{B}$$



. 6

$$\varphi_1 = \varphi_3 - I_4 \cdot R_4 = 24,32 - 6,84 = 3,8\text{B}$$

$$\varphi_5 = \varphi_4 + E_4 = 3,8 + 60 = 63,8\text{B}$$

$$\varphi_6 = \varphi_5 + I_5 \cdot R_7 = 63,8 + 3,29 \times 2 = 70,38\text{B}$$

$$\varphi_7 = \varphi_6 - I_2 \cdot R_2 = 70,38 - 3,29 = 83,54\text{B}$$

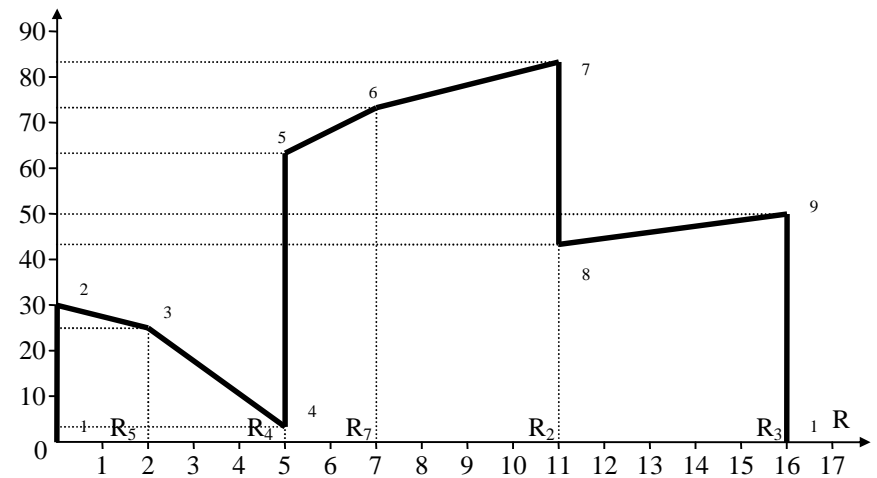
$$\varphi_8 = \varphi_7 - E_2 = 83,54 - 40 = 43,54\text{B}$$

$$\varphi_9 = \varphi_8 + I_3 \cdot R_3 = 43,54 + 1,29 \cdot 5 = 49,99\text{B}$$

$$\varphi_1 = \varphi_9 - E_3 = 49,99 - 50 = 0\text{B}$$

$$m_U = 10 \quad / \quad m_R = 1 \quad /$$

(1),



. 7