Electrotècnia

Circuits de corrent continu

Solucions · 76 exercicis

Proves d'accés a la universitat (PAU) de Catalunya. Ordenats del més recent al més antic.
Retalls dels exàmens i pautes oficials (selecat.cat / universitats.gencat.cat).

Exercici 2

a)

$$A_1 = \frac{U_1}{R_1} = \frac{24}{15} = 1{,}6\ \text{A}$$

b)

$$A_2 = \frac{U_2}{R_2} = \frac{12}{10} = 1{,}2\ \text{A}$$

c)

$$W = \frac{(U_1 + U_2)^2}{R_3} = \frac{(24 + 12)^2}{15} = 86{,}4\ \text{W}$$

d)

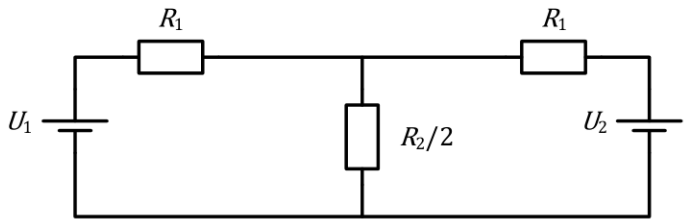
$$I_{\text{R3}} = \frac{U_1 + U_2}{R_3} = \frac{24 + 12}{15} = 2{,}4\ \text{A}$$

$$P_{\text{U1}} = U_1\, I_{\text{U1}} = U_1\, (A_1 + I_{\text{R3}}) = 24\ (1{,}6 + 2{,}4) = 96\ \text{W}$$

$$P_{\text{U2}} = U_2\, I_{\text{U2}} = U_2\, (A_2 + I_{\text{R3}}) = 12\ (1{,}2 + 2{,}4) = 43{,}2\ \text{W}$$

Exercici 2

a)



$$\begin{cases} U_1 = R_1\, I_1 + \dfrac{R_2}{2}\,(I_1 + I_2) \\ U_2 = R_1\, I_2 + \dfrac{R_2}{2}\,(I_1 + I_2) \end{cases} \rightarrow \begin{cases} U_1 = \left(R_1 + \dfrac{R_2}{2}\right) I_1 + \dfrac{R_2}{2}\, I_2 \\ U_2 = \dfrac{R_2}{2}\, I_1 + \left(R_1 + \dfrac{R_2}{2}\right) I_2 \end{cases}$$

$$\begin{bmatrix} \left(R_1 + \dfrac{R_2}{2}\right) & \dfrac{R_2}{2} \\ \dfrac{R_2}{2} & \left(R_1 + \dfrac{R_2}{2}\right) \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_1 \\ U_2 \end{bmatrix} \rightarrow \begin{bmatrix} 11 & 5 \\ 5 & 11 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 24 \\ 48 \end{bmatrix}$$

$$\begin{cases} I_1 = 0{,}25\ \text{A} \\ I_2 = 4{,}25\ \text{A} \end{cases}$$

$$P_{\text{U1}} = U_1\, I_1 = 24 \cdot 0{,}25 = 6\ \text{W}$$

$$P_{\text{U2}} = U_2\, I_2 = 48 \cdot 4{,}25 = 204\ \text{W}$$

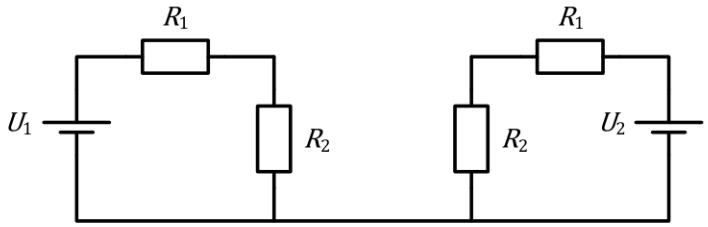
b)

$$P_{\text{R2 Esquerra}} = P_{\text{R2 Dreta}} = P_{\text{R2}} = \frac{U_{\text{R2}}^2}{R_2} = \frac{(U_1 - R_1\, I_1)^2}{R_2} = \frac{(24 - 6 \cdot 0{,}25)^2}{10} = 50{,}625\ \text{W}$$

Alternativament:

$$P_{\text{R2 Esquerra}} = P_{\text{R2 Dreta}} = P_{\text{R2}} = \frac{U_{\text{R2}}^2}{R_2} = \frac{(U_2 - R_1\, I_2)^2}{R_2} = \frac{(48 - 6 \cdot 4{,}25)^2}{10} = 50{,}625\ \text{W}$$

c)



$$P_{\text{U1}} = \frac{U_1^2}{R_1 + R_2} = \frac{24^2}{6 + 10} = 36\ \text{W}$$

$$P_{\text{U2}} = \frac{U_2^2}{R_1 + R_2} = \frac{48^2}{6 + 10} = 144\ \text{W}$$

d)

$$P_{\text{R2 Esquerra}} = R_2\, I_1^2 = R_2 \left(\frac{U_1}{R_1 + R_2}\right)^2 = 10 \left(\frac{24}{6 + 10}\right)^2 = 22{,}5\ \text{W}$$

$$P_{\text{R2 Dreta}} = R_2\, I_2^2 = R_2 \left(\frac{U_2}{R_1 + R_2}\right)^2 = 10 \left(\frac{48}{6 + 10}\right)^2 = 90\ \text{W}$$

Exercici 2

a)

$$A_1 = I_1 = \frac{U_1}{R_1 + \frac{R_3\,(R_2+R_4)}{R_2+R_3+R_4} + \frac{R_5\,R_6}{R_5+R_6}} = \frac{48}{5 + \frac{10\,(5+10)}{5+10+10} + \frac{15\cdot 15}{15+15}} = 2{,}595\ \text{A}$$

b)

$$P_{\text{U1}} = U_1\,I_1 = 48 \cdot 2{,}595 = 124{,}56\ \text{W}$$

c)

$$W = P_{\text{U1}} - P_{\text{R1}} = P_{\text{U1}} - R_1\,I_1^2 = 124{,}56 - 5 \cdot 2{,}595^2 = 90{,}89\ \text{W}$$

d)

$$U_{\text{R3}} = \frac{\frac{R_3\,(R_2+R_4)}{R_2+R_3+R_4}}{\frac{R_3\,(R_2+R_4)}{R_2+R_3+R_4} + \frac{R_5\,R_6}{R_5+R_6}}\,(U_1 - R_1\,I_1)$$

$$U_{\text{R3}} = \frac{\frac{10\,(5+10)}{5+10+10}}{\frac{10\,(5+10)}{5+10+10} + \frac{15\cdot 15}{15+15}}\,(48 - 5 \cdot 2{,}595) = 15{,}57\ \text{V}$$

$$A_2 = I_2 = \frac{U_{\text{R3}}}{R_3} = \frac{15{,}57}{10} = 1{,}557\ \text{A}$$

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e)

$$U_{\text{R6}} = (U_1 - R_1\,I_1) - U_{\text{R3}} = (48 - 5 \cdot 2{,}595) - 15{,}57 = 19{,}46\ \text{V}$$

$$I_{\text{R5}} = I_{\text{R6}} = \frac{U_{\text{R6}}}{R_6} = \frac{19{,}46}{15} = 1{,}297\ \text{A}$$

$$A_3 = I_3 = I_2 - I_{\text{R6}} = 1{,}557 - 1{,}297 = 0{,}26\ \text{A}$$

Alternativament,

$$I_{\text{R2}} = \frac{U_{\text{R3}}}{R_2+R_4} = \frac{15{,}57}{5+10} = 1{,}038\ \text{A} \qquad I_{\text{R2}} = I_1 - I_2 = 2{,}595 - 1{,}557 = 1{,}038\ \text{A}$$

$$A_3 = I_3 = I_{\text{R5}} - I_{\text{R2}} = 1{,}297 - 1{,}038 = 0{,}259\ \text{A}$$

4. PAU 2023 · Juny · Sèrie 5 · Exercici 4

Exercici 4

a)

$$P = \frac{t_{\text{Connectat}}}{T}\,(P_{\text{N Davantera}} + P_{\text{N Posterior}}) = \frac{0{,}5\,T}{T}\,(10 + 10) = 10\ \text{W}$$

b)

$$R = \frac{U^2}{P_{\text{N Davantera}}} = \frac{12^2}{10} = 14{,}4\ \Omega$$

c)

$$I_{\text{NL}} = \frac{12 - 5 \cdot U_{\text{ak}}}{R_{\text{NL}}} = \frac{12 - 5 \cdot 1{,}2}{240} = 25\ \text{mA}$$

d)

$$P_{\text{mitjana NL}} = \frac{t_{\text{Connectat}}}{T}\,(2\,P_{\text{NL}}) = \frac{0{,}5\,T}{T}\,(2\,U\,I_{\text{NL}}) = 0{,}5 \cdot 2 \cdot 12 \cdot 0{,}025 = 0{,}3\ \text{W}$$

e)

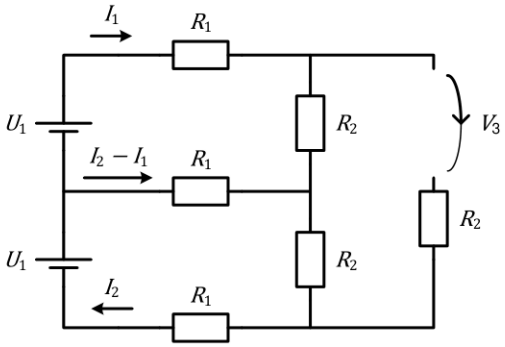
$$P_{\text{mitjana R Consum}} = P - P_{\text{mitjana NL}} = 10 - 0{,}3 = 9{,}7\ \text{W}$$

$$R_{\text{Consum}} = \frac{U^2}{P_{\text{mitjana R Consum}}} = \frac{12^2}{9{,}7} = 14{,}85\ \Omega$$

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5. PAU 2022 · Setembre · Sèrie 3 · Exercici 2

Exercici 2



a)

$$\begin{cases} U_1 = R_1\, I_1 + R_2\, I_1 - R_1\,(I_2 - I_1) \\ U_1 = R_1\,(I_2 - I_1) + R_2\, I_2 + R_1\, I_2 \end{cases} \rightarrow \begin{cases} U_1 = (2\,R_1 + R_2)\, I_1 - R_1\, I_2 \\ U_1 = -R_1\, I_1 + (2\,R_1 + R_2)\, I_2 \end{cases}$$

$$\begin{bmatrix} (2\,R_1 + R_2) & -R_1 \\ -R_1 & (2\,R_1 + R_2) \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_1 \\ U_1 \end{bmatrix} \rightarrow \begin{bmatrix} 9 & -2 \\ -2 & 9 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 12 \\ 12 \end{bmatrix}$$

$$\begin{cases} A_1 = I_1 = 1{,}714\ \text{A} \\ A_2 = I_2 = 1{,}714\ \text{A} \end{cases}$$

Alternativament, per simetria es pot veure que $A_1 = A_2$ i, per tant, no circula corrent per la R_1, que està en la posició central. Llavors:

$$I_1 = I_2 = \frac{U_1 + U_2}{2\,R_1 + 2\,R_2} = \frac{12 + 12}{2 \cdot 2 + 2 \cdot 5} = 1{,}714\ \text{A}$$

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b)

$$V_3 = R_2\, I_1 + R_2\, I_2 = 2\,R_2\, I_1 = 2 \cdot 5 \cdot 1{,}714 = 17{,}14\ \text{V}$$

c)

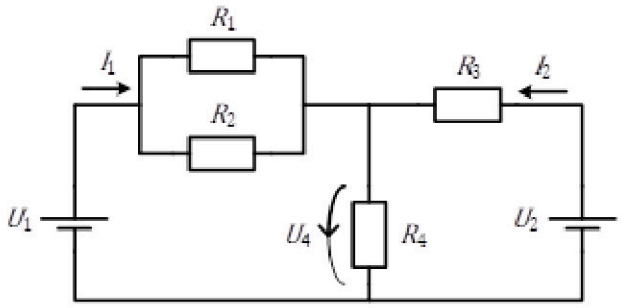
$$P_{\text{U1U2}} = 2\,U_1\, I_1 = 2 \cdot 12 \cdot 1{,}714 = 41{,}136\ \text{W}$$

d)

$$P_{\text{R1}} = 2\,R_1\, I_1^2 = 2 \cdot 2 \cdot 1{,}714^2 = 11{,}751\ \text{W}$$

6. PAU 2022 · Juny · Sèrie 2 · Exercici 2

Exercici 2



a)

$$R_{\text{Eq12}} = \frac{R_1\,R_2}{R_1 + R_2} = \frac{5 \cdot 10}{5 + 10} = 3{,}333\ \Omega$$

$$\begin{cases} U_1 = R_{\text{Eq12}}\,I_1 + R_4\,(I_1 + I_2) \\ U_2 = R_3\,I_2 + R_4\,(I_1 + I_2) \end{cases} \rightarrow \begin{cases} U_1 = \left(R_{\text{Eq12}} + R_4\right) I_1 + R_4\,I_2 \\ U_2 = (R_3 + R_4)\,I_2 + R_4\,I_1 \end{cases}$$

$$\begin{cases} 24 = 13{,}333\,I_1 + 10\,I_2 \\ 12 = 15\,I_2 + 10\,I_1 \end{cases} \rightarrow \begin{bmatrix} 13{,}333 & 10 \\ 10 & 15 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 24 \\ 12 \end{bmatrix} \rightarrow \begin{cases} I_1 = 2{,}4\ \text{A} \\ I_2 = -0{,}8\ \text{A} \end{cases}$$

$$A_1 = \frac{R_2}{R_1 + R_2}\,I_1 = \frac{10}{5 + 10}\,2{,}4 = 1{,}6\ \text{A}$$

$$A_2 = \frac{R_1}{R_1 + R_2}\,I_1 = \frac{5}{5 + 10}\,2{,}4 = 0{,}8\ \text{A}$$

Alternativament,

$$A_2 = I_1 - A_2 = 2{,}4 - 1{,}6 = 0{,}8\ \text{A}$$

b)

$$W = U_4\,A_2 = R_4\,(I_1 + I_2)\,A_2 = 10\,(2{,}4 - 0{,}8)\,0{,}8 = 12{,}8\ \text{W}$$

c)

$$P_{\text{U1}} = U_1\,I_1 = 24 \cdot 2{,}4 = 57{,}6\ \text{W}$$

$$P_{\text{U2}} = U_2\,I_2 = 12 \cdot (-0{,}8) = -9{,}6\ \text{W}$$

Exercici 6

a)

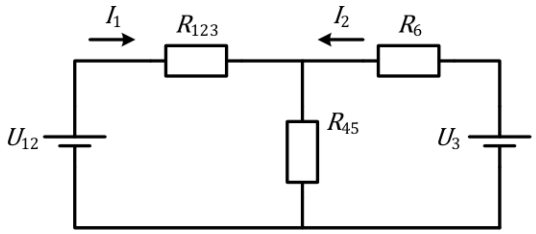
$$P_{U3} = 0\ \text{W}$$

$$P_{U1} = P_{U2} = U_1\, I = U_2\, I$$

$$I = \frac{U_1 + U_2}{R_1 + R_2 + R_3 + \dfrac{R_4\, R_5}{R_4 + R_5}} = \frac{12 + 12}{0{,}2 + 0{,}2 + 1 + \dfrac{1 \cdot 1}{1 + 1}} = 12{,}63\ \text{A}$$

$$P_{U1} = P_{U2} = 12 \cdot 12{,}63 = 151{,}56\ \text{W}$$

b)



$$U_{12} = U_1 + U_2 = 12 + 12 = 24\ \text{V}$$

$$R_{123} = R_1 + R_2 + R_3 = 0{,}2 + 0{,}2 + 1 = 1{,}4\ \Omega$$

$$R_{45} = \frac{R_4\, R_5}{R_4 + R_5} = \frac{1 \cdot 1}{1 + 1} = 0{,}5\ \Omega$$

$$\begin{cases} U_{12} = R_{123}\, I_1 + R_{45}\, (I_1 + I_2) \\ U_3 = R_6\, I_2 + R_{45}\, (I_1 + I_2) \end{cases} \rightarrow \begin{cases} U_{12} = (R_{123} + R_{45})\, I_1 + R_{45}\, I_2 \\ U_3 = R_{45}\, I_1 + (R_6 + R_{45})\, I_2 \end{cases}$$

$$\begin{bmatrix} R_{123} + R_{45} & R_{45} \\ R_{45} & R_6 + R_{45} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_{12} \\ U_3 \end{bmatrix} \rightarrow \begin{bmatrix} 1{,}4 + 0{,}5 & 0{,}5 \\ 0{,}5 & 1 + 0{,}5 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 24 \\ 12 \end{bmatrix}$$

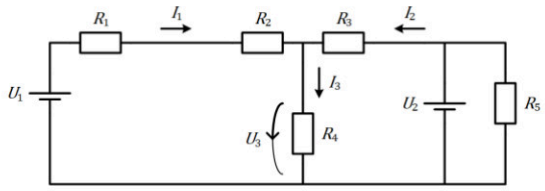
$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 11{,}54 \\ 4{,}15 \end{bmatrix}\ \text{A}$$

$$P_{U3} = U_3\, I_2 = 12 \cdot 4{,}15 = 49{,}8\ \text{W}$$

$$P_{U1} = P_{U2} = U_1\, I_1 = U_2\, I_1 = 12 \cdot 11{,}54 = 138{,}5\ \text{W}$$

8. PAU 2021 · Setembre · Sèrie 1 · Exercici 2

Exercici 2



a)

$$W = U_{R2}\, I_1 = R_2\, I_1^2 \quad \rightarrow \quad I_1 = \sqrt{\frac{W}{R_2}} = \sqrt{\frac{0{,}2}{5}} = 0{,}2\ \text{A}$$

$$P_{U1} = U_1\, I_1 = 12 \cdot 0{,}2 = 2{,}4\ \text{W}$$

b)

$$U_3 = U_1 - (R_1 + R_2)\, I_1 = 12 - (5 + 5)\, 0{,}2 = 10\ \text{V}$$

$$I_3 = \frac{U_3}{R_4} = \frac{10}{10} = 1\ \text{A}$$

$$I_1 + I_2 = I_3 \quad \rightarrow \quad I_2 = I_3 - I_1 = 1 - 0{,}2 = 0{,}8\ \text{A}$$

$$U_2 = U_3 + R_3\, I_2 = 10 + 10 \cdot 0{,}8 = 18\ \text{V}$$

c)

$$P_{U2} = U_2\, I_{U2} = U_2\, (I_2 + I_{R5}) = U_2 \left(I_2 + \frac{U_2}{R_5}\right) = 18 \left(0{,}8 + \frac{18}{15}\right) = 36\ \text{W}$$

d)

Si $W = 0$ W, llavors $I_1 = 0$ A i, per tant, $U_3 = U_1 = 12$ V

$$U_3 = 12\ \text{V} = R_4\, I_3 \quad \rightarrow \quad I_3 = \frac{U_3}{R_4} = \frac{12}{10} = 1{,}2\ \text{A}$$

$$U_2 = (R_3 + R_4)\, I_3 = (10 + 10)\, 1{,}2 = 24\ \text{V}$$

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9. PAU 2021 · Juny · Sèrie 2 · Exercici 4

Exercici 4

a)

$$I_1 = \frac{U_1}{R_1 + R_3} = \frac{12}{5 + 5} = 1{,}2\ \text{A}$$

$$P_{\text{R1}} = R_1\, I_1^2 = 5 \cdot 1{,}2^2 = 7{,}2\ \text{W}$$

b)

$$P_{\text{R1}} = 0\ \text{W} \quad \rightarrow \quad I_1 = 0\ \text{A} \quad \rightarrow \quad U_{\text{R3}} = U_1 = 12\ \text{V}$$

$$I_{\text{R3}} = \frac{U_{\text{R3}}}{R_3} = \frac{12}{5} = \frac{U_1 + U_2}{R_2 + R_3} = \frac{12 + 12}{R_2 + 5} = \frac{24}{R_2 + 5} = 2{,}4\ \text{A}$$

$$2{,}4\ (R_2 + 5) = 24 \quad \rightarrow \quad R_2 = \frac{24}{2{,}4} - 5 = 5\ \Omega$$

c)

$$P_{\text{U1}} = U_1\, I_{\text{R3}} = 12 \cdot 2{,}4 = 28{,}8\ \text{W}$$

d)

$$P_{\text{R3}} = R_3\, I_{\text{R3}}^2 = \frac{U_{\text{R3}}^2}{R_3} = 5 \cdot 2{,}4^2 = \frac{12^2}{5} = 28{,}8\ \text{W}$$

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10. PAU 2021 · Juny · Sèrie 5 · Exercici 2

Exercici 2

a)

$$R_{\mathrm{EqO}} = \frac{(R + 3\,R)\,(2\,R + 4\,R)}{(R + 3\,R) + (2\,R + 4\,R)} = \frac{24}{10}\,R \qquad \rightarrow \qquad U = R_{\mathrm{EqO}}\,I_{\mathrm{O}} = 2{,}4\,R\,3 = 7{,}2\,R$$

$$R_{\mathrm{EqT}} = \frac{(R)\,(2\,R)}{(R) + (2\,R)} + \frac{(3\,R)\,(4\,R)}{(3\,R) + (4\,R)} = \left(\frac{2}{3} + \frac{12}{7}\right) R = \frac{50}{21}\,R \qquad P_{\mathrm{T}} = \frac{U^2}{R_{\mathrm{EqT}}}$$

$$413{,}68 = \frac{(7{,}2\,R)^2}{\frac{50}{21}\,R} \qquad \rightarrow \qquad R = \frac{413{,}68\,\frac{50}{21}}{7{,}2^2} = 19\,\Omega$$

$$U = 7{,}2\,R = 7{,}2 \cdot 19 = 136{,}8\,\mathrm{V}$$

b)

$$I_{\mathrm{SW}} = I_{\mathrm{R}} - I_{3\mathrm{R}}$$

$$I_{\mathrm{R}} = \frac{U_{\mathrm{R}}}{R} = \frac{\frac{\frac{(R)\,(2\,R)}{(R) + (2\,R)}}{\frac{(R)\,(2\,R)}{(R) + (2\,R)} + \frac{(3\,R)\,(4\,R)}{(3\,R) + (4\,R)}}\,U}{R} = \frac{\frac{2}{3}\,136{,}8}{\frac{50}{21}} = 2{,}016\,\mathrm{A}$$

$$I_{3\mathrm{R}} = \frac{U_{3\mathrm{R}}}{3R} = \frac{\frac{\frac{(3\,R)\,(4\,R)}{(3\,R) + (4\,R)}}{\frac{(R)\,(2\,R)}{(R) + (2\,R)} + \frac{(3\,R)\,(4\,R)}{(3\,R) + (4\,R)}}\,U}{3R} = \frac{\frac{12}{7}\,136{,}8}{\frac{50}{21}} = 1{,}728\,\mathrm{A}$$

$$I_{\mathrm{SW}} = I_{\mathrm{R}} - I_{3\mathrm{R}} = 2{,}016 - 1{,}728 = 0{,}288\,\mathrm{A}$$

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c)

$$P_{\mathrm{O}} = U\,I_{\mathrm{O}} = 136{,}8 \cdot 3 = 410{,}4\,\mathrm{W}$$

Exercici 2

a)

$$A_3 = I_{R_5} + I_{R_6} = \frac{U_2}{R_5} + \frac{U_2}{R_6} = \frac{12}{10} + \frac{12}{20} = 1{,}8\ \text{A}$$

$$\begin{cases} U_1 = (R_1 + R_2)\, I_1 + R_3\, (I_1 + I_2) \\ U_3 = R_3\, (I_1 + I_2) + R_4\, I_2 \end{cases} \rightarrow \begin{cases} U_1 = (R_1 + R_2 + R_3)\, I_1 + R_3\, I_2 \\ U_3 = R_3\, I_1 + (R_3 + R_4)\, I_2 \end{cases}$$

$$\begin{bmatrix} R_1 + R_2 + R_3 & R_3 \\ R_3 & R_3 + R_4 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_1 \\ U_3 \end{bmatrix}$$

$$\begin{bmatrix} 35 & 15 \\ 15 & 30 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 12 \\ 36 \end{bmatrix} \rightarrow \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} -0{,}218 \\ 1{,}309 \end{bmatrix} \text{A}$$

$$A_1 = I_1 = -0{,}218\ \text{A} \qquad A_2 = I_2 = 1{,}309\ \text{A}$$

b) $W_1 = U_2 \left(I_2 + I_{R_6} \right) = 12 \left(1{,}309 + \frac{12}{20} \right) = 22{,}91\ \text{W}$

c)

$P_{U_1} = U_1\, I_1 = 12\ (-0{,}218) = -2{,}616\ \text{W}$

$P_{U_2} = U_2\, I_3 = 12\ (1{,}8) = 21{,}6\ \text{W}$

$P_{U_3} = U_3\, I_2 = 36\ (1{,}309) = 47{,}124\ \text{W}$

12. PAU 2020 · Juny · Sèrie 1 · Exercici 4

Exercici 4

a)

$$P_{R3} = \frac{U_2^2}{R_3} \quad \rightarrow \quad U_2 = \sqrt{P_{R3}\, R_3} = \sqrt{28{,}8 \cdot 5} = 12 \text{ V}$$

b)

$$P_{R3} = R_3\, I_{R3}^2 \quad \rightarrow \quad I_{R3} = \sqrt{\frac{P_{R3}}{R_3}} = \sqrt{\frac{28{,}8}{5}} = 2{,}4 \text{ A}$$

$$\frac{1}{2}\, P_{R3} = U_2\, I_2 \quad \rightarrow \quad I_2 = \frac{\frac{1}{2}\, P_{R3}}{U_2} = \frac{\frac{1}{2}\, 28{,}8}{12} = 1{,}2 \text{ A}$$

$$I_1 + I_2 = I_{R3} \quad \rightarrow \quad I_1 = I_{R3} - I_2 = 2{,}4 - 1{,}2 = 1{,}2 \text{ A}$$

$$I_1 = \frac{U_1 - U_2}{R_1 + R_2} \quad \rightarrow \quad U_1 - U_2 = R_1\, I_1 + R_2\, I_1 \quad \rightarrow \quad R_2 = \frac{U_1 - U_2 - R_1\, I_1}{I_1}$$

$$R_2 = \frac{24 - 12 - 6{,}5 \cdot 1{,}2}{1{,}2} = 3{,}5\ \Omega$$

c)

$$P_{U1} = U_1\, I_1 = 24 \cdot 1{,}2 = 28{,}8 \text{ W}$$

d)

$P_{U2} = U_2\, I_2 = 0$ vol dir $I_2 = 0$ i, per tant, $I_1 + I_2 = I_{R3} = I_1$

$$I_1 = \frac{U_1 - U_2}{R_1 + R_2} = \frac{24 - 12}{6{,}5 + 3{,}5} = 1{,}2 \text{ A} = I_{R3}$$

$$U_2 = R_3\, I_1 = R_3\, I_{R3} \quad \rightarrow \quad R_3 = \frac{U_2}{I_1} = \frac{U_2}{I_{R3}} = \frac{12}{1{,}2} = 10\ \Omega$$

13. PAU 2020 · Juny · Sèrie 3 · Exercici 2

Exercici 2

b) $I_1 = \frac{U_2 - U_1}{R_1 + R_4} = \frac{12-10}{5+5} = 0{,}2\ \text{A}$

$I_3 = \frac{U_3 - U_2}{R_2 + R_3} = \frac{14-12}{5+5} = 0{,}2\ \text{A}$

$I_3 = I_1 + I_2 \quad \rightarrow \quad I_2 = I_3 - I_1 = 0{,}2 - 0{,}2 = 0\ \text{A}$

b)

Com $I_1 = I_3$,

$$P_\text{R} = (R_1 + R_2 + R_3 + R_4)\, I_1^2 = (5+5+5+5)\, 0{,}2^2 = 0{,}8\ \text{W}$$

c)

$P_{\text{U1}} = -U_1\, I_1 = -10 \cdot 0{,}2 = -2\ \text{W}$

$P_{\text{U2}} = -U_2\, I_2 = -12 \cdot 0 = 0\ \text{W}$

$P_{\text{U3}} = U_3\, I_3 = 14 \cdot 0{,}2 = 2{,}8\ \text{W}$

d)

$I_3 = \frac{U_3 - U_2}{R_2 + R_3}$ i, per tant, si $U_2 = U_3 = 14\ \text{V}$, llavors $I_3 = 0\ \text{A}$

14. PAU 2019 · Setembre · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $\begin{cases} R_1\,(I_1 + I_2) + R_3\, I_1 = U_1 \\ R_2\, I_2 + R_1\,(I_1 + I_2) = U_2 \end{cases} \rightarrow \begin{cases} (R_1 + R_3)\, I_1 + R_1\, I_2 = U_1 \\ R_1\, I_1 + (R_1 + R_2)\, I_2 = U_2 \end{cases}$

$$\begin{bmatrix} R_1 + R_3 & R_1 \\ R_1 & R_1 + R_2 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_1 \\ U_2 \end{bmatrix} \quad \rightarrow \quad \begin{bmatrix} 10+30 & 10 \\ 10 & 10+20 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 36 \end{bmatrix}$$

$$\begin{bmatrix} 40 & 10 \\ 10 & 30 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 36 \end{bmatrix} \quad \rightarrow \quad \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 0{,}982 \\ 0{,}873 \end{bmatrix} \text{A}$$

b) $P_\text{Total} = U_1\, I_1 + U_2\, I_2 = 48 \cdot 0{,}982 + 36 \cdot 0{,}873 = 78{,}56\ \text{W}$

Alternativament,

$P_\text{Total} = R_1\,(I_1 + I_2)^2 + R_2\, I_2^2 + R_3\, I_1^2$

$P_\text{Total} = 10 \cdot (0{,}982 + 0{,}873)^2 + 20 \cdot 0{,}873^2 + 30 \cdot 0{,}982^2 = 78{,}58\ \text{W}$

c) $P_{R_2} = \frac{U_{R_2}^2}{R_2} = \frac{48^2}{20} = 115{,}2\ \text{W}$

d) $P_{R_3} = \frac{U_{R_3}^2}{R_3} = \frac{36^2}{30} = 43{,}2\ \text{W}$

15. PAU 2019 · Juny · Sèrie 1 · Exercici 4 (Opció A)

Exercici 4

a) $\begin{cases} U_1 = (R_1 + R_3)\, I_1 + R_4\,(I_1 + I_2) \\ U_2 = R_2\, I_2 + R_4\,(I_1 + I_2) \end{cases} \rightarrow \begin{cases} 48 = (6+6)\, I_1 + 15\,(I_1 + I_2) \\ 12 = 6\, I_2 + 15\,(I_1 + I_2) \end{cases}$

$$\begin{cases} 48 = 27\, I_1 + 15\, I_2 \\ 12 = 15\, I_1 + 21\, I_2 \end{cases} \rightarrow \begin{bmatrix} 27 & 15 \\ 15 & 21 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 12 \end{bmatrix} \rightarrow \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 2{,}42\ \text{A} \\ -1{,}16\ \text{A} \end{bmatrix}$$

b)

$$P_{R_1} = P_{R_3} = R_1\, I_1^2 = R_3\, I_1^2 = 6 \cdot 2{,}42^2 = 35{,}14\ \text{W}$$

$$P_{R_2} = R_2\, I_2^2 = 6 \cdot (-1{,}16)^2 = 8{,}07\ \text{W}$$

$$P_{R_4} = R_4\,(I_1 + I_2)^2 = 15 \cdot (2{,}42 - 1{,}16)^2 = 23{,}81\ \text{W}$$

$$P_{R_{1a4}} = P_{R_1} + P_{R_2} + P_{R_3} + P_{R_4} = 35{,}14 + 8{,}07 + 35{,}14 + 23{,}81 = 102{,}16\ \text{W}$$

c)

$$P_{U_2} = U_2\, I_{U_2} = 12\ \text{W} \quad \rightarrow \quad I_{U_2} = \frac{P_{U_2}}{U_2} = \frac{12}{12} = 1\ \text{A}$$

$$I_2 + I_{U_2} + I_{R_5} = 0 \quad \rightarrow \quad I_{R_5} = -I_2 - I_{U_2} = 1{,}16 - 1 = 0{,}16\ \text{A}$$

$$R_5 = \frac{U_2}{I_{R_5}} = \frac{12}{0{,}16} = 75\ \Omega$$

d)

$$P_{U_1} = U_1\, I_1 = 48 \cdot 2{,}42 = 116{,}16\ \text{W}$$

Alternativament,

$$P_{U_1} = P_{R_{1a4}} + P_{R_5} + P_{U_2} = P_{R_{1a4}} + U_2\, I_{R_5} + P_{U_2}$$

$$P_{U_1} = 102{,}16 + 12 \cdot 0{,}16 + 12 = 116{,}08\ \text{W}$$

Alternativament,

$$P_{U_1} = P_{R_{1a4}} - U_2\, I_2$$

$$P_{U_1} = 102{,}16 - 12 \cdot (-1{,}16) = 116{,}08\ \text{W}$$

16. PAU 2019 · Juny · Sèrie 4 · Exercici 4 (Opció B)

Exercici 4

a)

$I_{R_4} = 0\ \text{A} \ \rightarrow \ P_{R_4} = 0\ \text{W}$

$I_{R_3} = \frac{U_1}{R_3} = \frac{48}{15} = 3{,}2\ \text{A} \ \rightarrow \ P_{R_3} = R_3\, I_{R_3}^2 = 15 \cdot 3{,}2^2 = 153{,}6\ \text{W}$

$I_{R_2} = \frac{U_2}{R_2} = \frac{24}{30} = 0{,}8\ \text{A} \ \rightarrow \ P_{R_2} = R_2\, I_{R_2}^2 = 30 \cdot 0{,}8^2 = 19{,}2\ \text{W}$

$I_{R_1} = \frac{U_1 - U_2}{R_1} = \frac{48-24}{10} = 2{,}4\ \text{A} \ \rightarrow \ P_{R_1} = R_1\, I_{R_1}^2 = 10 \cdot 2{,}4^2 = 57{,}6\ \text{W}$

$$P_{\text{Total}} = P_{R_1} + P_{R_2} + P_{R_3} + P_{R_4} = 57{,}6 + 19{,}2 + 153{,}6 + 0 = 230{,}4\ \text{W}$$

b)

$I_{U_1} = I_{R_1} + I_{R_3} = 2{,}4 + 3{,}2 = 5{,}6\ \text{A}$

$P_{U_1} = U_1\, I_{U_1} = 48 \cdot 5{,}6 = 268{,}8\ \text{W}$

$P_{U_2} = P_{\text{Total}} - P_{U_1} = 230{,}4 - 268{,}8 = -38{,}4\ \text{W}$

c)

$$P_{\text{Total}} = \frac{U_1^2}{R_{\text{Eq}}} = \frac{U_1^2}{\frac{(R_1 + R_2)\,(R_3 + R_4)}{(R_1 + R_2) + (R_3 + R_4)}} = \frac{48^2}{\frac{(10 + 30)\,(15 + 5)}{10 + 30 + 15 + 5}} = 172{,}8\ \text{W}$$

17. PAU 2018 · Setembre · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) Per simetria, $A_3 = 0$ A

Alternativament,

$$\begin{cases} U_1 = (R_1 + R_4)\, I_{U_1} + R_2 \left(I_{U_1} - I_{U_2}\right) \\ U_2 = -R_2 \left(I_{U_1} - I_{U_2}\right) + (R_3 + R_5)\, I_{U_2} \end{cases} \rightarrow \begin{cases} U_1 = (R_1 + R_2 + R_4)\, I_{U_1} - R_2\, I_{U_2} \\ U_2 = -R_2\, I_{U_1} + (R_2 + R_3 + R_5)\, I_{U_2} \end{cases}$$

$$\begin{bmatrix} R_1 + R_2 + R_4 & -R_2 \\ -R_2 & R_2 + R_3 + R_5 \end{bmatrix} \begin{bmatrix} I_{U_1} \\ I_{U_2} \end{bmatrix} = \begin{bmatrix} U_1 \\ U_2 \end{bmatrix}$$

$$\begin{bmatrix} 35 & -10 \\ -10 & 35 \end{bmatrix} \begin{bmatrix} I_{U_1} \\ I_{U_2} \end{bmatrix} = \begin{bmatrix} 24 \\ 24 \end{bmatrix} \rightarrow \begin{bmatrix} I_{U_1} \\ I_{U_2} \end{bmatrix} = \begin{bmatrix} 0{,}96 \\ 0{,}96 \end{bmatrix} \text{ A}$$

$$A_3 = I_{U_2} - I_{U_1} = 0 \text{ A}$$

b) Com que $A_3 = 0$ A, $W_1 = \frac{U_1^2}{R_1 + R_4} = \frac{24^2}{25} = 23{,}04$ W

Alternativament,

$W_1 = U_1\, I_{U_1} = 24 \cdot 0{,}96 = 23{,}04$ W

c) Per simetria, $P_{\text{total}} = 2\, W_1 = 2 \cdot 23{,}04 = 46{,}08$ W

Alternativament,

$$P_{\text{total}} = (R_1 + R_4)\, I_{U_1}^2 + (R_3 + R_5)\, I_{U_2}^2 + R_2 \left(I_{U_1} - I_{U_2}\right)^2$$

18. PAU 2018 · Juny · Sèrie 1 · Exercici 4 (Opció A)

Exercici 4

a) $$\begin{cases} U_1 = \left(R_1 + \frac{R_2\, R_3}{R_2 + R_3}\right) I_1 + R_4\, (I_1 + I_2) \\ U_2 = R_5\, I_2 + R_4\, (I_1 + I_2) \end{cases} \rightarrow \begin{cases} 48 = \left(2 + \frac{10 \cdot 15}{10 + 15}\right) I_1 + 10\, (I_1 + I_2) \\ 12 = 3\, I_2 + 10\, (I_1 + I_2) \end{cases}$$

$$\begin{cases} 48 = 18\, I_1 + 10\, I_2 \\ 12 = 10\, I_1 + 13\, I_2 \end{cases} \rightarrow \begin{bmatrix} 18 & 10 \\ 10 & 13 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 12 \end{bmatrix} \rightarrow \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 3{,}761 \text{ A} \\ -1{,}97 \text{ A} \end{bmatrix}$$

b)

$$P_{U_1} = U_1\, I_1 = 48 \cdot 3{,}761 = 180{,}53 \text{ W}$$

$$P_{U_2} = U_2\, I_2 = 12 \cdot (-1{,}97) = -23{,}64 \text{ W}$$

c)

$$U_{R_4} = \frac{\cdots}{R_1 + \frac{R_2\,R_3}{R_2+R_3} + R_4}\,U_1 \quad \rightarrow \quad 12 = \frac{\cdots}{2 + \frac{10\cdot 15}{10+15} + R_4}\,48$$

$$12\,(8 + R_4) = 48\,R_4 \quad \rightarrow \quad R_4 = \frac{12\cdot 8}{48-12} = 2{,}67\ \Omega$$

19. PAU 2018 · Juny · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $$\begin{cases} R_1\,I_1 + \frac{R_3\,R_4}{R_3+R_4}\,(I_1+I_2) = U_1 \\ R_2\,I_2 + \frac{R_3\,R_4}{R_3+R_4}\,(I_1+I_2) = U_2 \end{cases} \rightarrow \begin{cases} 5\,I_1 + \frac{12\cdot 12}{12+12}\,(I_1+I_2) = 48 \\ 5\,I_2 + \frac{12\cdot 12}{12+12}\,(I_1+I_2) = 36 \end{cases}$$

$$\begin{cases} 5\,I_1 + 6\,(I_1+I_2) = 48 \\ 5\,I_2 + 6\,(I_1+I_2) = 36 \end{cases} \rightarrow \begin{cases} 11\,I_1 + 6\,I_2 = 48 \\ 6\,I_1 + 11\,I_2 = 36 \end{cases} \rightarrow \begin{bmatrix} 11 & 6 \\ 6 & 11 \end{bmatrix}\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 48 \\ 36 \end{bmatrix}$$

$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 3{,}67 \\ 1{,}27 \end{bmatrix}\ \text{A}$$

b) $P_{U_1} = U_1\,I_1 = 48\cdot 3{,}67 = 176{,}2\ \text{W}$

$P_{U_2} = U_2\,I_2 = 36\cdot 1{,}27 = 45{,}72\ \text{W}$

c) $P_{R_3} = R_3\left(\frac{I_1+I_2}{2}\right)^2 = 12\left(\frac{3{,}67+1{,}27}{2}\right)^2 = 73{,}21\ \text{W}$

20. PAU 2017 · Setembre · Sèrie 2 · Exercici 2 (Primera part)

Exercici 2

a) $R_2 = R_3 = \frac{W_1}{\left(\frac{A_1}{2}\right)^2} = \frac{16{,}875}{\left(\frac{1{,}5}{2}\right)^2} = 30\ \Omega$

b) $U = R_1\,A_1 + R_3\,\frac{A_1}{2} + R_4\,A_1 \quad \rightarrow \quad R_4 = \frac{U}{A_1} - R_1 - \frac{R_3}{2} = \frac{75}{1{,}5} - 30 - \frac{30}{2} = 5\ \Omega$

c) $P_{\text{R1}} = R_1\,A_1^2 = 30\cdot 1{,}5^2 = 67{,}5\ \text{W}$

d) $P_{\text{Total}} = U\cdot A_1 = 75\cdot 1{,}5 = 112{,}5\ \text{W}$

21. PAU 2017 · Juny · Sèrie 1 · Exercici 4 (Opció A)

Exercici 4

a) $R_{34} = \frac{R_3\,R_4}{R_3+R_4} = \frac{10\cdot15}{10+15} = 6\ \Omega$

$U_1 = R_1\,I_1 + R_{34}\,(I_1 + I_2) = (R_1 + R_{34})\,I_1 + R_{34}\,I_2$

$I_1 = \frac{U_1 - R_{34}\,I_2}{R_1+R_{34}} = \frac{48-6\cdot0{,}96}{10+6} = 2{,}64\ \text{A}$

b) $U_1 - R_1\,I_1 = U_2 - R_2\,I_2 \quad \rightarrow \quad R_2 = \frac{U_2 - U_1 + R_1\,I_1}{I_2} = \frac{36-48+10\cdot2{,}64}{0{,}96} = 15\ \Omega$

c) $P_{\text{Total}} = R_1\,I_1^2 + R_2\,I_2^2 + R_{34}\,(I_1 + I_2)^2$

$P_{\text{Total}} = 10\cdot2{,}64^2 + 15\cdot0{,}96^2 + 6\cdot(2{,}64+0{,}96)^2 = 161{,}28\ \text{W}$

Alternativament,

$P_{\text{Total}} = U_1\,I_1 + U_2\,I_2 = 48\cdot2{,}64 + 36\cdot0{,}96 = 161{,}28\ \text{W}$

22. PAU 2017 · Juny · Sèrie 5 · Exercici 4 (Opció B)

Exercici 4

a) $I_6 = 0 \quad \rightarrow \quad U_3 = U_2 + R_3\,I_3 = 5 + 5\cdot1 = 10\ \text{V}$

b) $I_2 = I_3 + I_6 = I_3 = 1\ \text{A} \qquad I_5 = I_4 + I_6 = I_4$

$R_2\,I_2 = R_4\,I_4 \quad \rightarrow \quad I_5 = I_4 = \frac{R_2\,I_2}{R_4} = \frac{5\cdot1}{10} = 0{,}5\ \text{A}$

$I_1 = I_2 + I_4 = 1 + 0{,}5 = 1{,}5\ \text{A}$

d) $R_1 = \frac{U_1 - U_2 - R_3\,I_3 - R_2\,I_2}{I_1} = \frac{24-5-5\cdot1-5\cdot1}{1{,}5} = 6\ \Omega$

e) $P_{\text{U1}} = U_1\,I_1 = 24\cdot1{,}5 = 36\ \text{W} \qquad P_{\text{U2}} = -U_2\,I_3 = -5\cdot1 = -5\ \text{W}$

$P_{\text{U3}} = -U_3\,I_5 = -10\cdot0{,}5 = -5\ \text{W}$

23. PAU 2016 · Setembre · Sèrie 1 · Exercici 4 (Opció A)

Exercici 4

a) $\begin{cases} R_1I_1 + R_2(I_1+I_2) = U_1 \\ R_3I_2 + R_2(I_1+I_2) = U_2 \end{cases} \rightarrow \begin{cases} (R_1+R_2)I_1 + R_2I_2 = U_1 \\ R_2I_1 + (R_2+R_3)I_2 = U_2 \end{cases}$

$\begin{cases} (10+20)I_1 + 20I_2 = 48 \\ 20I_1 + (20+10)I_2 = 36 \end{cases} \rightarrow \begin{cases} 30I_1 + 20I_2 = 48 \\ 20I_1 + 30I_2 = 36 \end{cases} \rightarrow \begin{cases} I_1 = 1{,}44\ \text{A} \\ I_2 = 0{,}24\ \text{A} \end{cases}$

b) $P(R_2) = R_2(I_1+I_2)^2 = 20(1{,}44+0{,}24)^2 = 56{,}448\ \text{W}$

c) $I_1 = \frac{U_1}{R_1} = \frac{48}{10} = 4{,}8\ \text{A};\ I_2 = \frac{U_2}{R_3} = \frac{36}{10} = 3{,}6\ \text{A}$

24. PAU 2016 · Juny · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $I_1 = \frac{U_1 - U_2}{R_1} = \frac{48-36}{24} = 0{,}5\ \text{A}$

b) $I_{R_4} = \frac{U_2}{\frac{R_2 R_3}{R_2+R_3} + R_4} = \frac{36}{\frac{24 \cdot 24}{24+24} + 24} = 1\ \text{A}$

c) $P_{R_3} = R_3 I_{R_3}^2 = R_3 \left(\frac{I_{R_4}}{2}\right)^2 = 24 \left(\frac{1}{2}\right)^2 = 6\ \text{W}$

d) $I_{R_4} = \frac{U_2}{R_2 + R_4} = \frac{36}{24+24} = 0{,}75\ \text{A}$

e) $P_{R_3} = 0\ \text{W}$

25. PAU 2016 · Juny · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $R_1 = \frac{U^2}{W_1} = \frac{50^2}{250} = 10\ \Omega$

b) $R_2 = \frac{U^2}{W_2 - W_1} = \frac{50^2}{350-250} = 25\ \Omega$

c) $A_1 = \frac{U}{R_1} + \frac{U}{R_2} + \frac{U}{R_3} \quad \rightarrow \quad R_3 = \frac{U}{A_1 - \frac{U}{R_1} - \frac{U}{R_2}} = \frac{50}{17 - \frac{50}{10} - \frac{50}{25}} = 5\ \Omega$

d) $W_3 = U \cdot A_1 = 50 \cdot 17 = 850\ \text{W}$

26. PAU 2015 · Setembre · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $I_1 = \frac{P_{U_1}}{U_1} = \frac{60}{24} = 2{,}5\ \text{A}$

b)

$$\begin{cases} R_1 I_1 + R_3 (I_1 - I_2) = U_1 \\ R_3 (I_1 - I_2) - R_2 I_2 = U_2 \end{cases} \rightarrow \begin{cases} 5 \cdot 2{,}5 + R_3 (2{,}5 - I_2) = 24 \\ R_3 (2{,}5 - I_2) - 7 I_2 = 10{,}1 \end{cases} \rightarrow$$

$$\begin{cases} 2{,}5 R_3 - R_3 I_2 = 11{,}5 \\ 2{,}5 R_3 - R_3 I_2 - 7 I_2 = 10{,}1 \end{cases} \rightarrow \begin{cases} I_2 = \frac{2{,}5 R_3 - 11{,}5}{R_3} \\ 2{,}5 R_3 - R_3 \frac{2{,}5 R_3 - 11{,}5}{R_3} - 7 \frac{2{,}5 R_3 - 11{,}5}{R_3} = 10{,}1 \end{cases}$$

$$\begin{cases} I_2 = \frac{2{,}5 R_3 - 11{,}5}{R_3} \\ 11{,}5 - 7 \frac{2{,}5 R_3 - 11{,}5}{R_3} = 10{,}1 \end{cases} \rightarrow \begin{cases} I_2 = \frac{2{,}5 R_3 - 11{,}5}{R_3} \\ \frac{2{,}5 R_3 - 11{,}5}{R_3} = 0{,}2 \end{cases} \rightarrow \begin{cases} I_2 = 0{,}2\ \text{A} \\ R_3 = 5\ \Omega \end{cases}$$

27. PAU 2015 · Juny · Sèrie 2 · Exercici 4 (Opció B)

Exercici 4

a) $I_2 = 0 \quad \rightarrow \quad P_{\mathrm{R2}} = 0\ \mathrm{W}$

$I_3 = \frac{U_2}{R_3} = \frac{12}{10} = 1{,}2\ \mathrm{A} \quad \rightarrow \quad P_{\mathrm{R3}} = R_3 I_3^2 = 10 \cdot 1{,}2^2 = 14{,}4\ \mathrm{W}$

$I_1 = I_4 = \frac{U_1 - U_2}{R_1 + R_4} = \frac{24-12}{1+5} = 2\ \mathrm{A} \quad \rightarrow \quad \begin{cases} P_{\mathrm{R1}} = R_1 I_1^2 = 1 \cdot 2^2 = 4\ \mathrm{W} \\ P_{\mathrm{R4}} = R_4 I_4^2 = 5 \cdot 2^2 = 20\ \mathrm{W} \end{cases}$

b) $P_{\mathrm{U1}} = U_1 I_1 = 24 \cdot 2 = 48\ \mathrm{W}$

$P_{\mathrm{U2}} = U_2 I_5 = U_2 (I_3 - I_4) = 12 \cdot (1{,}2 - 2) = -9{,}6\ \mathrm{W}$

c) $I_3 = \frac{U_2}{R_3} = \frac{12}{10} = 1{,}2\ \mathrm{A}$

$I_1 = I_2 = \frac{U_1 - U_2}{R_1 + R_2} = \frac{24-12}{1+20} = 0{,}571\ \mathrm{A}$

$P_{\mathrm{U2}} = U_2 I_5 = U_2 (I_3 - I_2) = 12 \cdot (1{,}2 - 0{,}571) = 7{,}55\ \mathrm{W}$

28. PAU 2015 · Juny · Sèrie 4 · Exercici 2 (Primera part)

Exercici 2

a) $I_1 = \frac{U_1}{R_1 + \frac{R_2 R_3}{R_2 + R_3}} = \frac{10}{5 + \frac{15 \cdot 10}{15+10}} = 0{,}9091\ \mathrm{A}$

b) $I_3 = \frac{U_1 - R_1 I_1}{R_3} = \frac{10 - 5 \cdot 0{,}9091}{10} = 0{,}5455\ \mathrm{A}$

c) $P_{R_2} = \frac{(U_1 - R_1 I_1)^2}{R_2} = \frac{(10 - 5 \cdot 0{,}9091)^2}{15} = 1{,}984\ \mathrm{W}$

d) $P_{U_1} = U_1 I_1 = U_1 \frac{U_1 - U_2}{R_1} = 10 \frac{10-15}{5} = -10\ \mathrm{W}$

e) $P_{U_2} = P_{R_1} + P_{R_3} - P_{U_1} = \frac{(U_1 - U_2)^2}{R_1} + \frac{U_2^2}{R_3} - P_{U_1} = \frac{(10-15)^2}{5} + \frac{15^2}{10} + 10 = 37{,}5\ \mathrm{W}$

29. PAU 2014 · Setembre · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $I(R_1) = I_1 = \frac{U_1}{R_1} = \frac{20}{10} = 2\ A; \quad I(R_2) = I_2 = \frac{U_1}{R_2} = \frac{20}{10} = 2\ A; \quad I(R_3) = I_3 = 0\ \mathrm{A}$

b) $P(U_1) = U_1 \cdot (I_1 + I_2) = 20 \cdot (2 + 2) = 80\ \mathrm{W}; \quad P(U_2) = 0\ \mathrm{W}$

c) $I(U_1) = I_1 + I_2 = 2 + 2 = 4\ \mathrm{A}$

d) $P(R_3) = \frac{U_2^2}{R_3} = \frac{30^2}{2} = 450\ \mathrm{W}$

30. PAU 2014 · Juny · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $A_1 = \frac{U_1}{R_1} = \frac{100}{100} = 1\ \text{A}$

b) $A_2 = \frac{U_1}{R_2} = \frac{100}{200} = 0{,}5\ \text{A}$

c) $A_3 = 0\ \text{A}$

d) $W_1 = U_1 \cdot I = U_1 \cdot (A_1 + A_2) = 100 \cdot (1 + 0{,}5) = 150\ \text{W}$

31. PAU 2014 · Juny · Sèrie 4 · Exercici 2 (Primera part)

Exercici 2

a)

$$\begin{cases} R_1 I_1 + R_2(I_1 + I_2) = U_1 + U_2 + U_3 \\ R_3 I_2 + R_2(I_1 + I_2) = U_4 \end{cases} \rightarrow \begin{cases} (R_1 + R_2) I_1 + R_2 I_2 = U_1 + U_2 + U_3 \\ R_2 I_1 + (R_2 + R_3) I_2 = U_4 \end{cases}$$

$$\begin{bmatrix} R_1 + R_2 & R_2 \\ R_2 & R_2 + R_3 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} U_1 + U_2 + U_3 \\ U_4 \end{bmatrix} \rightarrow \begin{bmatrix} 13 & 10 \\ 10 & 15 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 22 \\ 10 \end{bmatrix}$$

$$I_1 = 2{,}421\ \text{A}$$
$$I_2 = -0{,}947\ \text{A}$$

b) $P_{\text{R2}} = R_2(I_1 + I_2)^2 = 10(2{,}421 - 0{,}947)^2 = 21{,}73\ \text{W}$

c)

$$P_{\text{U1}} = U_1 I_1 = 5 \cdot 2{,}421 = 12{,}105\ \text{W}$$
$$P_{\text{U2}} = U_2 I_1 = 7 \cdot 2{,}421 = 16{,}947\ \text{W}$$
$$P_{\text{U3}} = U_3 I_1 = 10 \cdot 2{,}421 = 24{,}21\ \text{W}$$
$$P_{\text{U4}} = U_4 I_2 = 10 \cdot (-0{,}947) = -9{,}47\ \text{W}$$

32. PAU 2014 · Juny · Sèrie 4 · Exercici 4 (Opció A)

Exercici 4

b) $I = \frac{P}{U} = \frac{12}{15} = 0{,}8\ \text{A}$

$$230 = RI + 12 \cdot U \quad \rightarrow \quad R = \frac{230 - 12 \cdot U}{I} = \frac{230 - 12 \cdot 15}{0{,}8} = 62{,}5\ \Omega$$

b) $P_{\text{R}} = RI^2 = 62{,}5 \cdot 0{,}8^2 = 40\ \text{W}$

c) $P_{\text{Total}} = P_{\text{R}} + 12 \cdot P_{\text{Làmpada}} = 40 + 12 \cdot 12 = 184\ \text{W}$

d) $P = 0\ \text{W}$

33. PAU 2013 · Setembre · Sèrie 1 · Exercici 4 (Opció B)

Exercici 4

a) $I(U_1) = \frac{U_1}{R_1+R_3} = \frac{36}{12+12} = 1{,}5\ \text{A}$

b) $V_1 = 36\ \text{V}$

c) $I(U_1) = \frac{U_1}{\frac{R_1 \cdot R_2}{R_1+R_2}+R_3} = \frac{36}{\frac{12 \cdot 12}{12+12}+12} = 2\ \text{A}$

d) $V_1 = R_3 \cdot I(U_1) = 12 \cdot 2 = 24\ \text{V}$

e) $P = U_1 \cdot I(U_1) = 36 \cdot 2 = 72\ \text{W}$

34. PAU 2013 · Juny · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $A_1 = \frac{U_1}{\frac{R_1 R_3}{R_1+R_3}+R_2} = \frac{36}{\frac{12 \cdot 12}{12+12}+30} = 1\ \text{A}$

b) $A_2 = \frac{A_1}{2} = \frac{1}{2} = 0{,}5\ \text{A}$

c) $V_{\text{FH}} = R_2 A_1 = 30 \cdot 1 = 30\ \text{V}$

d) $A_1 = \frac{U_1}{\frac{R_1 R_3}{R_1+R_3}+\frac{R_2 R_4}{R_2+R_4}} = \frac{36}{\frac{12 \cdot 12}{12+12}+\frac{30 \cdot 120}{30+120}} = 1{,}2\ \text{A}$

e) $V_{\text{FH}} = \frac{R_2 R_4}{R_2+R_4} A_1 = \frac{30 \cdot 120}{30+120} 1{,}2 = 28{,}8\ \text{V}$

35. PAU 2013 · Juny · Sèrie 4 · Exercici 2 (Primera part)

Exercici 2

a) $A_1 = \frac{U_1}{\frac{R_1 R_3}{R_1+R_3}+\frac{R_2 R_4}{R_2+R_4}+R_5} = \frac{100}{\frac{37{,}5 \cdot 75}{37{,}5+75}+\frac{75 \cdot 37{,}5}{75+37{,}5}+50} = 1\ \text{A}$

b) $V_1 = \frac{R_1 R_3}{R_1+R_3} A_1 = \frac{37{,}5 \cdot 75}{37{,}5+75} 1 = 25\ \text{V}$

c) $V_2 = U_1 - V_1 = 100 - 25 = 75\ \text{V}$

d) $V_{\text{R2}} = V_2 - R_5 A_1 = 75 - 50 \cdot 1 = 25\ \text{V}$

$$I_{\text{R1}} = \frac{V_1}{R_1} = \frac{25}{37{,}5} = 0{,}667\ \text{A}; \quad I_{\text{R2}} = \frac{V_{\text{R2}}}{R_2} = \frac{25}{75} = 0{,}333\ \text{A}$$

$$W_1 = V_{\text{R2}}(I_{\text{R1}} - I_{\text{R2}}) = 25(0{,}667 - 0{,}333) = 8{,}35\ \text{W}$$

36. PAU 2012 · Setembre · Sèrie 4 · Exercici 3 (Opció A)

OPCIÓ A

Exercici 3

a) $A_1 = \frac{U_1}{R_1+R_2} = \frac{36}{12+30} = 0{,}857\ \text{A}$

b) $V_{\text{GF}} = V(R_1) = R_1 \cdot A_1 = 12 \cdot 0{,}857 = 10{,}28\ \text{V}$

c) $V_{\text{FH}} = \frac{\frac{R_2 \cdot R_4}{R_2+R_4}}{\frac{R_2 \cdot R_4}{R_2+R_4}+R_1} \cdot U_1 = \frac{\frac{30 \cdot 120}{30+120}}{\frac{30 \cdot 120}{30+120}+12} \cdot 36 = 24\ \text{V}$

$$A_2 = \frac{V_{\text{FH}}}{R_4} = \frac{24}{120} = 0{,}2\ \text{A}$$

37. PAU 2012 · Juny · Sèrie 1 · Exercici 2 (Primera part)

Exercici 2

a) $P(R_2) = \frac{U_1^2}{R_2} = \frac{36^2}{12} = 108\ \text{W}$

b) $U_{R_1} = \frac{R_1}{R_1+\frac{R_3 \cdot R_4}{R_3+R_4}} U_1 = \frac{12}{12+\frac{36 \cdot 72}{36+72}} 36 = 12\ \text{V}$

$U_{R_3} = U_{R_4} = U_1 - U_{R_1} = 36 - 12 = 24\ \text{V}$

$A_1 = I_{R_2} + I_{R_4} = \frac{U_1}{R_2} + \frac{U_{R_4}}{R_4} = \frac{36}{12} + \frac{24}{72} = 3{,}333\ \text{A}$

c) $P(R_1) = \frac{U_1^2}{R_1} = \frac{36^2}{12} = 108\ \text{W}$

d) $A_1 = I_{R_1} + I_{R_2} = \frac{U_1}{R_1} + \frac{U_1}{R_2} = \frac{36}{12} + \frac{36}{12} = 6\ \text{A}$

38. PAU 2012 · Juny · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $P(U_1)=\dfrac{U_1^2}{R_1+R_2}=\dfrac{50^2}{20}=125\ \text{W}$ $\qquad P(U_2)=0\ \text{W}$

b) $P(R_2)=V(R_2)I_1=\dfrac{R_2}{R_1+R_2}U_1\dfrac{U_1}{R_1+R_2}=\dfrac{U_1^2}{R_1+R_2}\dfrac{R_2}{R_1+R_2}=\dfrac{R_2}{R_1+R_2}P(U_1)$

$P(R_2)=\dfrac{1}{2}125=62{,}5\ \text{W}$

c) $V'(R_2)=U_2=20\ \text{V}$

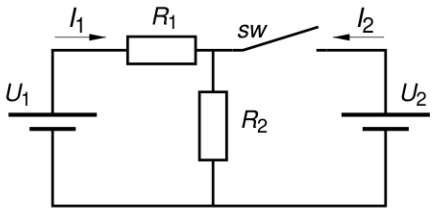
$I_1=\dfrac{U_1-U_2}{R_1}=\dfrac{50-20}{10}=3\ \text{A}$

$I(R_2)=\dfrac{U_2}{R_2}=\dfrac{20}{10}=2\ \text{A}$

$I_2=I(R_2)-I_1=-1\,\text{A}$

$P_2=U_2I_2=20\cdot(-1)=-20\ \text{W}$

$P_1'=U_1I_1=50\cdot 3=150\ \text{W}$



d) $P'(R_2)=\dfrac{U_2^2}{R_2}=\dfrac{20^2}{10}=40\ \text{W}$

39. PAU 2011 · Setembre · Sèrie 2 · Exercici 4 (Opció B)

Exercici 4

a) $P(R_1)=2\cdot R_1\cdot I_1^2$ $\qquad I_1=\dfrac{2\cdot U_1}{2\cdot R_1+\frac{(R_2+R_3)\cdot R_4}{(R_2+R_3)+R_4}}=\dfrac{2\cdot 48}{2\cdot 0{,}5+\frac{(14{,}5+20{,}25)\cdot 68}{(14{,}5+20{,}25)+68}}=4\ \text{A}$

$P(R_1)=2\cdot 0{,}5\cdot 4^2=16\ \text{W}$

b) $P(R_2,R_3,R_4)=R_{\text{Eq.}}\cdot I_1^2=\dfrac{(R_2+R_3)\cdot R_4}{(R_2+R_3)+R_4}\cdot I_1^2=\dfrac{(14{,}5+20{,}25)\cdot 68}{(14{,}5+20{,}25)+68}\cdot 4^2=368\ \text{W}$

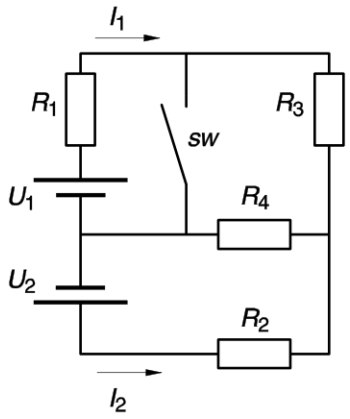
c) $\eta(\%)=100\cdot\dfrac{P_{\text{Útil}}}{P_{\text{Total}}}=100\cdot\dfrac{368}{368+16}=95{,}83\ \%$

d) $I_1'=\dfrac{2\cdot U_1}{2\cdot R_1+\frac{R_2\cdot R_4}{R_2+R_4}}=\dfrac{2\cdot 48}{2\cdot 0{,}5+\frac{14{,}5\cdot 68}{14{,}5+68}}=7{,}41\ \text{A}$

e) $I_{\text{SW}}=\dfrac{R_4}{R_2+R_4}\cdot I_1'=\dfrac{68}{14{,}5+68}\cdot 7{,}41=6{,}11\ \text{A}$

40. PAU 2011 · Juny · Sèrie 1 · Exercici 2 (Primera part)

Exercici 2



a) $P(R_4) = R_4 \cdot (I_1 + I_2)^2$

$$\left.\begin{matrix} U_1 = (R_1 + R_3) \cdot I_1 + R_4 \cdot (I_1 + I_2) \\ U_2 = R_2 \cdot I_2 + R_4 \cdot (I_1 + I_2) \end{matrix}\right\} \Rightarrow \left.\begin{matrix} 44{,}4 = 12 \cdot I_1 + 10 \cdot (I_1 + I_2) \\ 25{,}4 = 2 \cdot I_2 + 10 \cdot (I_1 + I_2) \end{matrix}\right\} \Rightarrow$$

$$\left.\begin{matrix} 44{,}4 = 22 \cdot I_1 + 10 \cdot I_2 \\ 25{,}4 = 10 \cdot I_1 + 12 \cdot I_2 \end{matrix}\right\} \Rightarrow \left.\begin{matrix} I_1 = 1{,}7 \text{ A} \\ I_2 = 0{,}7 \text{ A} \end{matrix}\right\}$$

$$P(R_4) = 10 \cdot (2{,}4)^2 = 57{,}6 \text{ W}$$

b) $P(U_2) = U_2 \cdot I_2 = 25{,}4 \cdot 0{,}7 = 17{,}78 \text{ W}$

c) $P(U_1) = U_1 \cdot I_1' = 44{,}4 \cdot \frac{44{,}4}{2} = 985{,}7 \text{ W}$

d) $P(R_2) = \frac{U_{R_2}^2}{R_2} = \frac{\left(\frac{2}{2+5} \cdot 25{,}4\right)^2}{2} = 26{,}33 \text{ W}$

41. PAU 2011 · Juny · Sèrie 4 · Exercici 3 (Opció A)

OPCIÓ A

Exercici 3

a) $I_1 = \frac{U_1}{\frac{(R_1+R_2)\cdot(R_3+R_4)}{(R_1+R_2)+(R_3+R_4)}} = \frac{100}{\frac{(27+73)\cdot(50+50)}{(27+73)+(50+50)}} = 2 \text{ A}$

b) $I_{R_1} = I_{R_3} = \frac{I_1}{2} = 1 \text{ A} \quad (R_1 + R_2 = R_3 + R_4)$

$$V_{FG} = V_{FH} + V_{HG} = V_{FH} - V_{GH} = R_2 \cdot \frac{I_1}{2} - R_4 \cdot \frac{I_1}{2} = 73 - 50 = 23 \text{ V}$$

c) $V_{FH} = \frac{\frac{R_2 \cdot R_4}{R_2+R_4}}{\frac{R_2 \cdot R_4}{R_2+R_4} + \frac{R_1 \cdot R_3}{R_1+R_3}} \cdot U_1 = \frac{\frac{73 \cdot 50}{73+50}}{\frac{73 \cdot 50}{73+50} + \frac{27 \cdot 50}{27+50}} \cdot 100 = 62{,}86 \text{ V}$

$$I_{R_1} = \frac{U_1 - V_{FH}}{R_1} = \frac{100 - 62{,}86}{27} = 1{,}38 \text{ A} \qquad I_{R_2} = \frac{V_{FH}}{R_2} = \frac{62{,}86}{73} = 0{,}86 \text{ A}$$

$$I_2 = I_{R_1} - I_{R_2} = 1{,}38 - 0{,}86 = 0{,}52 \text{ A}$$

42. PAU 2010 · Setembre · Sèrie 2 · Exercici 2 (Primera part)

Exercici 2

a) $R_1 = \dfrac{V_1}{I_1} = \dfrac{20}{2} = 10\ \Omega$

b) $R_2 = \dfrac{V_2}{I_2} = \dfrac{10}{5} = 2\ \Omega$

c) $I(R_3) = I_3 = I_1 - I_2 = 2 - 5 = -3\ \text{A}$

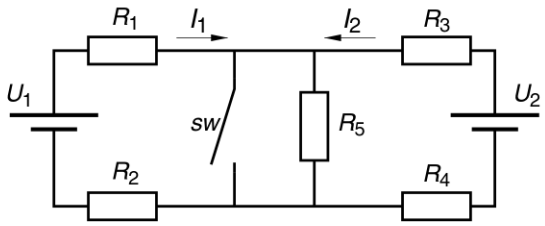
d) $U_1 = V_1 + R_3 \cdot I_3 = 20 - 3 = 17\ \text{V}$

e) $U_2 = V_2 - R_3 \cdot I_3 = 10 + 3 = 13\ \text{V}$

43. PAU 2010 · Juny · Sèrie 1 · Exercici 4 (Opció B)

Exercici 4

a)



$$\begin{cases} U_1 = (R_1 + R_2) I_1 + R_5 (I_1 + I_2) \\ U_2 = (R_3 + R_4) I_2 + R_5 (I_1 + I_2) \end{cases} \quad \begin{cases} 24 = 4I_1 + 6(I_1 + I_2) \\ 10 = 2I_2 + 6(I_1 + I_2) \end{cases} \rightarrow \quad \begin{matrix} I_1 = 3\ \text{A} \\ I_2 = -1\ \text{A} \end{matrix} \qquad I_1 + I_2 = 2\ \text{A}$$

b) $P_1 = U_1 I_1 = 24 \cdot 3 = 72\ \text{W}$ $\qquad P_2 = U_2 I_2 = 10 \cdot (-1) = -10\ \text{W}$

c) $I_1' = \dfrac{U_1}{R_1 + R_2} = \dfrac{24}{4} = 6\ \text{A}$ $(R_1 \text{ i } R_2)$ $\qquad I_2' = \dfrac{U_2}{R_3 + R_4} = \dfrac{10}{2} = 5\ \text{A}$ $(R_3 \text{ i } R_4)$

$I(R_5) = 0$

44. PAU 2010 · Juny · Sèrie 4 · Exercici 3 (Opció A)

OPCIÓ A

Exercici 3

a) $I_1 = I_2 = \dfrac{U_1 + U_2}{R_1 + R_2 + R_3} = \dfrac{36}{24} = 1{,}5\text{A}$ $\qquad I(R_1) = I(R_2) = I(R_3) = I_1 = 1{,}5\ \text{A}$

b) $P_1 = U_1 I_1 = 24 \cdot 1{,}5 = 36\ \text{W}$ $\qquad P_2 = U_2 I_2 = 12 \cdot 1{,}5 = 18\ \text{W}$

c) $I_1 = \dfrac{U_1}{R_2} = \dfrac{24}{12} = 2\ \text{A}$ $\qquad I_2 = \dfrac{U_2}{R_1 + R_3} = \dfrac{12}{12} = 1\ \text{A}$

d) $P_1 = U_1 I_1 = 24 \cdot 2 = 48\ \text{W}$ $\qquad P_2 = U_2 I_2 = 12 \cdot 1 = 12\ \text{W}$

45. PAU 2009 · Setembre · Sèrie 1 · Exercici 2 (Primera part)

Exercici 2

a) $I_2 = \dfrac{U_1 + U_2}{R_2 + R_3} = \dfrac{50}{12} = 4{,}17\ \text{A}$

b) $I(U_1) = I_1 + I_2 = \dfrac{U_1}{R_1} + I_2 = \dfrac{20}{10} + 4{,}17 = 6{,}17\ \text{A}$

$P(U_1) = U_1 \cdot I(U_1) = 20 \cdot 6{,}17 = 123{,}3\ \text{W}$;

$P(U_2) = U_2 \cdot I(U_2) = 30 \cdot 4{,}17 = 125\ \text{W}$

c) $R_{12} = \dfrac{R_1 \cdot R_2}{R_1 + R_2} = \dfrac{10 \cdot 10}{10 + 10} = 5\,\Omega$; $I(U_1)' = I_1' = \dfrac{U_1}{R_{12}} = \dfrac{20}{5} = 4\ \text{A}$

d) $P(R_3) = \dfrac{U_2^2}{R_3} = \dfrac{30^2}{2} = 450\ \text{W}$

46. PAU 2009 · Juny · Sèrie 3 · Exercici 3 (Opció B)

OPCIÓ B

Exercici 3

a) $I_1 = \dfrac{U_1}{R_1} = \dfrac{40}{10} = 4\ \text{A}$

b) $I_2 = \dfrac{2 \cdot U_1}{2 \cdot R_2} = \dfrac{U_1}{R_2} = \dfrac{40}{4} = 10\ \text{A}$

c) $V_2 = R_2 \cdot I_2 = 4 \cdot 10 = 40\ \text{V}$

d) $P(U_1) = U_1 \cdot (I_1 + I_2) = 40 \cdot 14 = 560\ \text{W}$

47. PAU 2009 · Juny · Sèrie 4 · Exercici 2 (Primera part)

Exercici 2

a) $\left\{ \begin{matrix} U_1 = R_1 \cdot I_1 + R_3 (I_1 + I_2) \\ U_2 = R_2 \cdot I_2 + R_3 (I_1 + I_2) \end{matrix} \right\}; \left\{ \begin{matrix} 40 = 12 \cdot I_1 + 10 \cdot I_2 \\ 10 = 10 \cdot I_1 + 11 \cdot I_2 \end{matrix} \right\}; \left\{ \begin{matrix} I_1 = 10{,}625\ \text{A} \\ I_2 = -8{,}75\ \text{A} \end{matrix} \right\}$

b) $P(U_1) = U_1 \cdot I_1 = 40 \cdot 10{,}625 = 425\ \text{W}$; $P(U_2) = U_2 \cdot I_2 = 10 \cdot (-8{,}75) = -87{,}5\ \text{W}$

c) $I(R_1) = I_1 = \dfrac{U_1}{R_1} = \dfrac{40}{2} = 20\ \text{A}$; $I(R_2) = I_2 = \dfrac{U_2}{R_2} = \dfrac{10}{1} = 10\ \text{A}$

48. PAU 2008 · Setembre · Sèrie 4 · Exercici 2 (Primera part)

Exercici 2

a) $\left.\begin{matrix} U_1 = (R_1 + R_3) I_1 + R_5 (I_1 + I_2) \\ U_2 = (R_2 + R_4) I_2 + R_3 (I_1 + I_2) \end{matrix}\right\} \rightarrow \left.\begin{matrix} 50 = 3I_1 + 4(I_1 + I_2) \\ 40 = 3I_2 + 4(I_1 + I_2) \end{matrix}\right\} \rightarrow \begin{matrix} I_1 = 5{,}758 \text{ A} \\ I_2 = 2{,}424 \text{ A} \end{matrix}$

b) $P_1 = U_1 I_1 = 287{,}9 \text{ W} \; ; \; P_2 = U_2 I_2 = 96{,}97 \text{ W}$

c) $I_1' = \frac{U_1}{R_1 + R_3} = \frac{50}{3} = 16{,}66 \text{ A}$

$I_2' = \frac{U_2}{R_2 + R_4} = \frac{40}{3} = 13{,}33 \text{ A}$

$I'(R_5) = I_1' + I_2' = 30 \text{ A}$

49. PAU 2008 · Juny · Sèrie 2 · Exercici 3 (Opció A)

OPCIÓ A

Exercici 3

a) $P(U_2) = 0 \Rightarrow I(U_2) = 0 \Rightarrow I(R_1) = I(R_2) \Rightarrow U_2 = U_1 \frac{R_2}{R_1 + R_2} = 60 \frac{8}{12} = 40 \text{ V}$

b) $I(R_2) = \frac{U_2}{R_2} = \frac{20}{8} = 2{,}5 \text{ A} \; ; \; I(R_1) = \frac{U_1 - U_2}{R_1} = \frac{40}{4} = 10 \text{ A}$

c) $P(U_1) = U_1 \cdot I(R_1) = 60 \cdot 10 = 600 \text{ W}$
$P(U_2) = U_2 \cdot I(U_2) = U_2 \cdot \left(I(R_2) - I(R_1)\right) = 20 \cdot \left(2{,}5 - 10\right) = -150 \text{ W}$

50. PAU 2007 · Setembre · Sèrie 3 · Exercici 3 (Opció B)

OPCIÓ B

Exercici 3

a) $\left.\begin{matrix} U_1 = R_1 I_1 + R_3 (I_1 + I_2) \\ U_2 = R_2 I_2 + R_3 (I_1 + I_2) \end{matrix}\right\} \rightarrow \left.\begin{matrix} 50 = 10I_1 + 10(I_1 + I_2) \\ 50 = 10I_2 + 10(I_1 + I_2) \end{matrix}\right\} \rightarrow I_1 = I_2 = I = 1{,}667 \text{ A}$

b) $P_1 = P_2 = U_1 I = 83{,}33 \text{ W}$

c) $P(R_3) = 0 \;\; \Rightarrow \;\; I_1 + I_2 = 2I = 0 \;\; \Rightarrow \;\; I = 0 \;\; \Rightarrow \;\; U_3 = U_1 = 50 \text{ V} \; ;$

51. PAU 2007 · Juny · Sèrie 1 · Exercici 3 (Opció B)

OPCIÓ B

Exercici 3

a) $-U_1 + (R_1 + R_2 + R_3 + R_4)I + U_2 = 0 \;\Rightarrow\; I = \dfrac{U_1 - U_2}{R_1 + R_2 + R_3 + R_4} = \dfrac{50}{15} = 3{,}333\ \text{A}$

b) $P_1 = U_1 I = 333{,}3\ \text{W}\ ;\ P_2 = -U_2\ I = -166{,}7\ \text{kW}$

c) $P_1 = \dfrac{U_1^2}{R_1 + R_2} = \dfrac{100^2}{5} = 2\ \text{kW}\ ;\ P_2 = \dfrac{U_2^2}{R_3 + R_4} = \dfrac{50^2}{10} = 250\ \text{W}$

52. PAU 2007 · Juny · Sèrie 2 · Exercici 2 (Primera part)

Exercici 2

a) $\left.\begin{matrix} U_1 = R_1 I_1 + R_3(I_1 + I_2) \\ U_2 = R_2 I_2 + R_3(I_1 + I_2) \end{matrix}\right\} \rightarrow \left.\begin{matrix} 100 = 10 I_1 + 5(I_1 + I_2) \\ 50 = 10 I_2 + 5(I_1 + I_2) \end{matrix}\right\} \rightarrow \begin{matrix} I_1 = 6{,}25\ \text{A} \\ I_2 = 1{,}25\ \text{A} \end{matrix}$

b) $P_1 = U_1 I_1 = 625\ \text{W}\ ;\ P_2 = U_2 I_2 = 62{,}5\ \text{W}$

c) $P_2' = 0 \;\Rightarrow\; I_2' = 0 \;\Rightarrow \left\{\begin{matrix} (R_3 + R_4) I_1 = U_2 \\ I_1 = \dfrac{U_1 - U_2}{R_1} \end{matrix}\right. \Rightarrow (R_3 + R_4)(U_1 - U_2) = R_1 U_2$

$$R_4 = \frac{R_1 U_2 - R_3 (U_1 - U_2)}{U_1 - U_2} \qquad R_4 = \frac{10 \cdot 50 - 5 \cdot 50}{50} = 5\ \Omega$$

53. PAU 2006 · Setembre · Sèrie 4 · Exercici 2 (Primera part)

Exercici 2

a) $\left.\begin{matrix} U_2 = R_2 I_2 + R_3(I_1 + I_2) \\ U_1 = R_1 I_1 + R_3(I_1 + I_2) \end{matrix}\right\};\ \left.\begin{matrix} 50 = 20 \cdot I_2 + 30(I_1 + I_2) \\ 40 = I_1 + 30(I_1 + I_2) \end{matrix}\right\} \Rightarrow \left.\begin{matrix} I_1 = 0{,}7692 \\ I_2 = 0{,}5384 \end{matrix}\right\}$

$A_1 = I_1 = 0{,}7692\ \text{A}$

b) $P_1 = U_1 I_1 = 40 \cdot 0{,}7692 = 30{,}77\ \text{W}\ ;\qquad P_2 = U_2 I_2 = 50 \cdot 0{,}5384 = 26{,}92\ \text{W}$

c) $A_1 = 0 \;\Rightarrow \left\{\begin{matrix} I_2 = \dfrac{U_2}{R_2 + R_3} \\ U_1' = R_3 I_2 \end{matrix}\right\};\ U_1' = 30 \dfrac{50}{20 + 30} = 30\ \text{V}$

54. PAU 2006 · Juny · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $U_1 = V_1 \dfrac{R_1 + R_3}{R_3} = 10 \dfrac{2+4}{4} = 15 \text{ V}$ $\qquad$ $U_2 = V_2 \dfrac{R_2 + R_4}{R_4} = 10 \dfrac{3+6}{6} = 15 \text{ V}$

b) $P_1 = \dfrac{U_1^2}{R_1 + R_3} = \dfrac{15^2}{6} = 37{,}5 \text{ W}$ $\qquad$ $P_2 = \dfrac{U_2^2}{R_2 + R_4} = \dfrac{15^2}{9} = 25 \text{ W}$

c) Com la tensió de l'interruptor és nul·la, no canvia res si es tanca.

$I_1 = \dfrac{V_1}{R_3} = 2{,}5 \text{ A} \; ; \quad I_2 = \dfrac{V_2}{R_4} = 1{,}667 \text{ A}$

Alternativament

$$\left\{ \begin{matrix} U_1 = R_1 I_1 + R_{34}(I_1 + I_2) \\ U_2 = R_3 I_2 + R_{34}(I_1 + I_2) \end{matrix} \right\} \; ; \; \left\{ \begin{matrix} 15 = 2I_1 + R_{34}(I_1 + I_2) \\ 15 = 3I_2 + R_{34}(I_1 + I_2) \end{matrix} \right\} \Rightarrow \left\{ \begin{matrix} I_1 = 2{,}5 \text{ A} \\ I_2 = 1{,}667 \text{ A} \end{matrix} \right\}$$

d) $V_1' = V_2' = R_3 I_1 = R_4 I_2 = R_{34}(I_1 + I_2) = 10 \text{ V}$

55. PAU 2005 · Setembre · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $I = \dfrac{U_1}{R_1 + R_2} = \dfrac{20}{10+10} = 1 \text{ A}$

b) $U(R_2) = R_2 I = 10 \text{ V}$

c) $U(R_2) = U_2 = 10 \text{ V}$

Alternativament

$$\left\{ \begin{matrix} U_1 = R_1 I + R_2(I_2 + I) \\ U_2 = R_3 I_2 + R_2(I_2 + I); \\ I_2 = 0 \end{matrix} \right. \quad \left\{ \begin{matrix} 20 = 10I + 10(I_2 + I) \\ U_2 = 5I_2 + 10(I_2 + I) \\ I_2 = 0 \end{matrix} \right. \Rightarrow \left\{ \begin{matrix} U_2 = 10 \text{ V} \\ I = 1 \text{ A} \\ I_2 = 0 \end{matrix} \right.$$

d) $P_1 = U_1 I = 20 \text{ W}; \quad P_2 = U_2 I_2 = 0$

56. PAU 2005 · Juny · Sèrie 1 · Exercici 3 (Opció B)

OPCIÓ B

Exercici 3

a) $I_1 = \dfrac{U_1}{R_1 + R_2} = \dfrac{24}{10} = 2{,}4 \ \text{A}$; $I_2 = \dfrac{U_2}{R_3 + R_4} = \dfrac{12}{12} = 1 \ \text{A}$

b) $P_1 = U_1 I_1 = 57{,}6 \ \text{W}$; $P_2 = U_2 I_2 = 12 \ \text{W}$

c) $R_{13} = \dfrac{R_1 R_3}{R_1 + R_3} = 3 \ \Omega$;

$$\begin{cases} U_2 = R_4 I_2' + R_{13}(I_1' + I_2') \\ U_1 = R_2 I_1' + R_{13}(I_1' + I_2') \end{cases} ; \quad \begin{cases} 12 = 6 I_2' + 3(I_1' + I_2') \\ 24 = 4 I_1' + 3(I_1' + I_2') \end{cases} \Rightarrow \begin{matrix} I_1' = 3{,}333 \ \text{A} \\ I_2' = 0{,}2222 \ \text{A} \end{matrix}$$

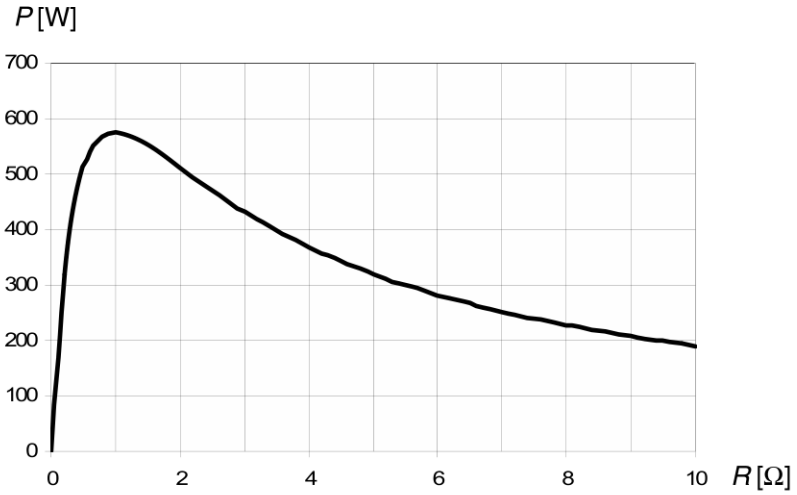
$P_1' = U_1 I_1' = 80 \ \text{W}$; $P_2' = U_2 I_2' = 2{,}667 \ \text{W}$

57. PAU 2005 · Juny · Sèrie 4 · Exercici 4 (Opció B)

Exercici 4

a) $P(R) = R I^2 = R\left(\dfrac{2U}{R + 2R_i}\right)^2 = 4U^2 \dfrac{R}{(R + 2R_i)^2} = 2304 \dfrac{R}{(R+1)^2}$ W

b)



c) $R = 2R_i = 1 \ \Omega$

58. PAU 2004 · Setembre · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $\frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3} \Rightarrow R_p = 3\Omega$ $\qquad V_{23} = R_p I_1 = 30$ V

b) $I_2 = \frac{V_{23}}{R_2} = 2{,}5$ A

$I_3 = \frac{V_{23}}{R_3} = 7{,}5$ A

c) $U_1 - R_1 I_1 + U_2 - V_{23} = 0 \Rightarrow U_2 = 25$ V

d) $P_1 = U_1 I_1 = 250$ W

59. PAU 2004 · Juny · Sèrie 1 · Exercici 2 (Primera part)

Exercici 2

a) $R_3 = \frac{V_3}{A_3} = 2\,\Omega$

b) $U_2 = R_2(A_3 - A_1) + V_3 = 16\,\mathrm{V}$

c) $U_1 = R_1 A_1 + V_3 \Rightarrow \mathrm{R}_1 = 1\Omega$

60. PAU 2004 · Juny · Sèrie 3 · Exercici 2 (Primera part)

Exercici 2

a) $I = \frac{U}{R_1 + R_2} = 3\,\mathrm{A}$

b) $I = \frac{U}{R + \frac{R_2(R_3 + R_4)}{R_2 + R_3 + R_4}} = 4\mathrm{A}$

c) $V_2 = U - R_1 I = 20\,\mathrm{V}$

$V_1 = V_2 \frac{R_4}{R_3 + R_4} = 10\mathrm{V}$

61. PAU 2003 · Setembre · Sèrie 3 · Exercici 3 (Opció A)

OPCIÓ A

Exercici 3

a) $I_2 = -\dfrac{U_2}{R_2} = -8\,\text{A}$

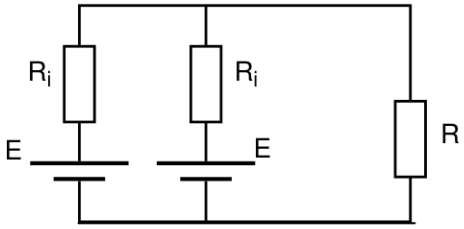
b) $U_1 + U_2 = (R_1 + R_3)I_1 \Rightarrow I_1 = 50\ \text{A}$

c) $P_1 = U_1 I_1 = 6\,\text{kW}\,;\quad P_2 = U_2 (I_1 - I_2) = 4{,}64\,\text{kW}$

62. PAU 2003 · Setembre · Sèrie 3 · Exercici 4 (Opció B)

Exercici 4

a)



b) $R_{eq} = \dfrac{R_i}{2} = 0{,}25\Omega\,;\quad E = R_{eq} I + RI \Rightarrow I = 1{,}171\ \text{A}$

c) $P = RI^2 = 13{,}71\,\text{W}$

63. PAU 2003 · Juny · Sèrie 2 · Exercici 3 (Opció B)

OPCIÓ B

Exercici 3

a) $I = \dfrac{U_1}{R_1 + R_3} = 15{,}38\,\text{A}$

b) $V_3 = R_3 I = 153{,}8\,\text{V}$

c) $\left.\begin{array}{l} U_1 = R_1 I_1 + R_3 I_3 \\ U_2 = R_2 I_2 + R_3 I_3 \\ I_1 + I_2 = I_3 \end{array}\right\} \Rightarrow I_1 = 28{,}99\,\text{A};\quad I_2 = -17{,}68\,\text{A};\quad I_3 = 11{,}31\text{A}$

d) $P_1 = U_1 I_1 = 5797\ \text{W}\,;\quad P_2 = U_2 I_2 = -1061\,\text{W}$

64. PAU 2003 · Juny · Sèrie 5 · Exercici 2 (Primera part)

Exercici 2

a) $P_3 = \dfrac{U_2^2}{R_3} = 250\ \text{W}$

b) $U_1 - R_1 I_1 - R_2 I_1 - U_2 = 0 \Rightarrow I_1 = 2{,}5\ \text{A}$

c) $I_3 = \dfrac{U_2}{R_3} = 5\ \text{A}\ ;\ \ I_1 + I_2 - I_3 = 0 \Rightarrow I_2 = 2{,}5\ \text{A}$

d) $P = U_1 I_1 + U_2 I_2 = 375\ \text{W}$

65. PAU 2002 · Setembre · Sèrie 1 · Exercici 2 (Primera part)

Exercici 2

a) $V_3 = U_1 - U_2 = 70\ \text{V}$

b) $I_1 = \dfrac{U_1}{R_2} + \dfrac{V_3}{R_3} = 20\ \text{A}$

c) $I_1' = I_1 + \dfrac{U_1}{R_1} = 25\ \text{A}$

d) $V_3' = V_3 = 70\ \text{V}$

e) $P_1 = U_1 I_1' = 2500\ \text{W}\ ;\ \ P_2 = -U_2 \dfrac{V_3}{R_3} = -300\ \text{W}$

66. PAU 2002 · Juny · Sèrie 2 · Exercici 2 (Primera part)

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67. PAU 2002 · Juny · Sèrie 3 · Exercici 2 (Primera part)

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68. PAU 2002 · Juny · Sèrie 3 · Exercici 3 (Opció B)

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69. PAU 2001 · Setembre · Sèrie 4 · Exercici 3 (Opció A)

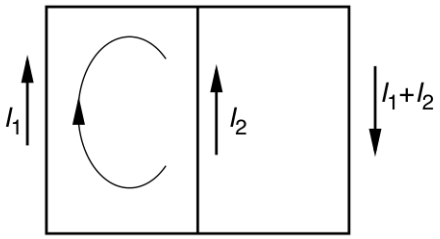
OPCIÓ A

Exercici 3

a) $R_{34} = R_3 + R_4 = 4 + 6 = 10\ \Omega$

$$\frac{1}{R_{234}} = \frac{1}{R_{34}} + \frac{1}{R_2} \Rightarrow R_{234} = \frac{R_{34}R_2}{R_{34} + R_2} = \frac{10 \cdot 10}{10 + 10} = 5\ \Omega$$

b)



$$-U_1 + R_1 I_1 + U_2 = 0 \Rightarrow I_1 = \frac{U_1 - U_2}{R_1} = \frac{60 - 40}{5} = 4\ \text{A}$$

$$I_1 + I_2 = \frac{U_2}{R_{234}} = \frac{40}{5} = 8\ \text{A}$$

$$I_2 = (I_1 + I_2) - I_1 = 8 - 4 = 4\ \text{A}$$

c) $P_1 = U_1 I_1 = 60 \cdot 4 = 240\ \text{W}$

$P_2 = U_2 I_2 = 40 \cdot 4 = 160\ \text{W}$

$P_{\text{tot}} = P_1 + P_2 = 240 + 160 = 400\ \text{W}$

70. PAU 2001 · Setembre · Sèrie 4 · Exercici 4 (Opció B)

Exercici 4

a) $R_2 = \frac{V_{23}}{I_2} = 30\ \ \Omega$

b) $I_3 = I_1 - I_2 = 6\ \ \text{A}\ \ ;\ \ R_3 = \frac{V_{23}}{I_3} = 20\ \ \Omega$

c) $R_1 = \frac{U - V_{23}}{I_1} = 8\ \ \Omega$

d) $I_4 = \frac{U}{R_4} = 20\ \ \text{A}\ \ ;\ \ I = I_4 + I_1 = 30\ \ \text{A}$

e) $P = U \cdot I = 200 \cdot 30 = 6000\ \ \text{W}$

71. PAU 2001 · Juny · Sèrie 2 · Exercici 2 (Primera part)

Exercici 2

a) $I_2 = \dfrac{U_2 - V_3}{R_2} = 10 \text{ A}$

b) $I_1 = \dfrac{U_1 - V_3}{R_1} = 10 \text{ A}$

c) $R_3 = \dfrac{V_3}{I_1 + I_2} = 2\Omega$

72. PAU 2001 · Juny · Sèrie 5 · Exercici 3 (Opció A)

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73. PAU 2000 · Setembre · Sèrie 2 · Exercici 2 (Primera part)

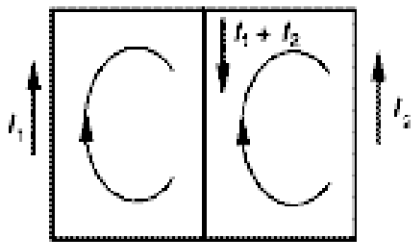
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74. PAU 2000 · Setembre · Sèrie 6 · Exercici 3 (Opció B)

OPCIÓ B

Exercici 3

a)



$$\left.\begin{matrix} -U_1 + R_4 I_1 + R_1(I_1 + I_2) = 0 \\ U_2 - R_2 I_2 - R_3 I_2 - R_1(I_1 + I_2) = 0 \end{matrix}\right\} \Rightarrow \left.\begin{matrix} (R_1 + R_4) I_1 + R_1 I_2 = U_1 \\ R_1 I_1 + (R_1 + R_2 + R_3) I_2 = U_2 \end{matrix}\right\} \Rightarrow \left.\begin{matrix} 12 I_1 + 10 I_2 = 46 \\ 10 I_1 + 12 I_2 = 42 \end{matrix}\right\} \Rightarrow \left.\begin{matrix} I_1 = 3 \text{ A} \\ I_2 = 1 \text{ A} \end{matrix}\right\}$$

b) $V(R_1) = R_1(I_1 + I_2) = 4 \cdot 10 = 40 \text{ V}$

c) $P_1 = U_1 I_1 = 46 \cdot 3 = 138 \text{ W}$

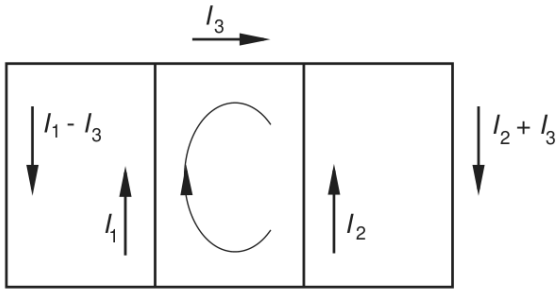
$P_2 = U_2 I_2 = 42 \cdot 1 = 42 \text{ W}$

75. PAU 2000 · Juny · Sèrie 1 · Exercici 2 (Primera part)

Exercici 2

a) $R_{34} = R_3 + R_4 = 6\ \Omega$

$$U_2 - U_1 + R_2 I_3 = 0 \Rightarrow I_3 = \frac{U_1 - U_2}{R_2} = \frac{44 - 36}{4} = 2\text{A}$$



b) $I_2 + I_3 = \frac{U_2}{R_{34}} = \frac{36}{6} = 6\ \text{A}$

$I_2 = (I_2 + I_3) - I_3 = 6 - 2 = 4\ \text{A}$

c) $I_1 - I_3 = \frac{U_1}{R_1} = \frac{44}{8{,}8} = 5\ \text{A}$

$I_1 = (I_1 - I_3) + I_3 = 5 + 2 = 7\ \text{A}$

d) $V_1 = U_2 \frac{R_4}{R_{34}} = 36\frac{4}{6} = 24\ \text{V}$

e) $P_1 = U_1 I_1 = 44 \cdot 7 = 308\ \text{W}$

$P_2 = U_2 I_2 = 36 \cdot 4 = 144\ \text{W}$

76. PAU 2000 · Juny · Sèrie 3 · Exercici 3 (Opció B)

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