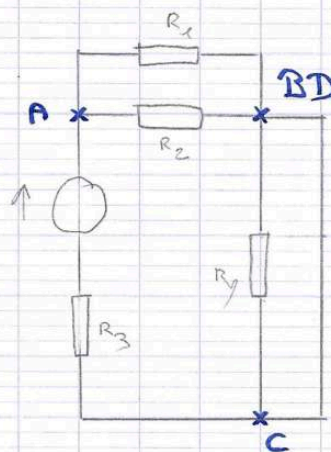
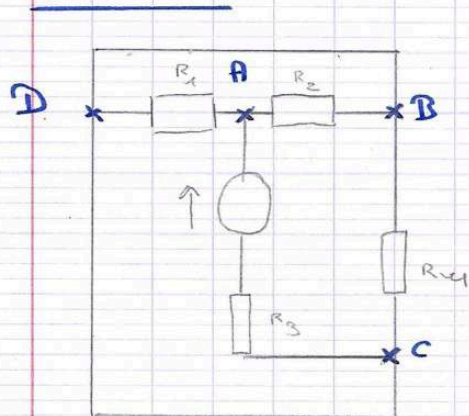


Exercice 1



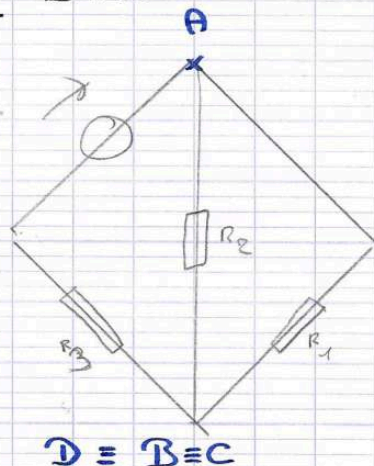
A : $R_1, R_2, R_3 + R_4$
 B : R_1, R_2, R_4
 C : $R_4, R_3 + R_4, R_2, R_1$

Deux circuits sont équivalents si les intensités et les potentiels électriques sont équivalents.

On peut dire aussi que 2 circuits sont équivalents si :

- m même principaux
- branches identiques

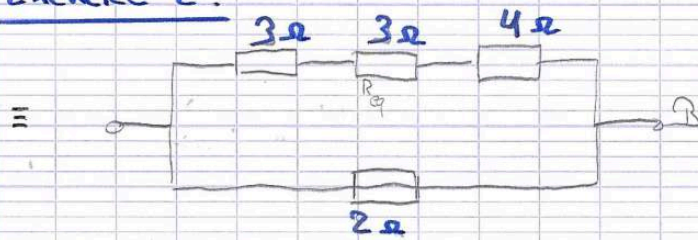
1) $B \equiv D$



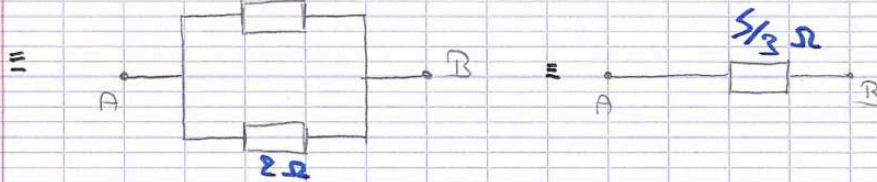
2) a n'est pas équivalent à b (sens du générateur $\mathcal{E}_2$)

Exercise 2:

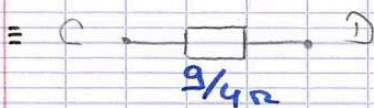
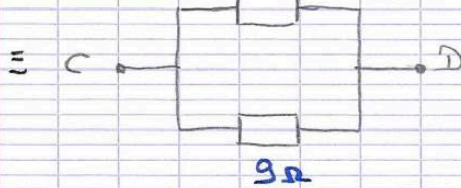
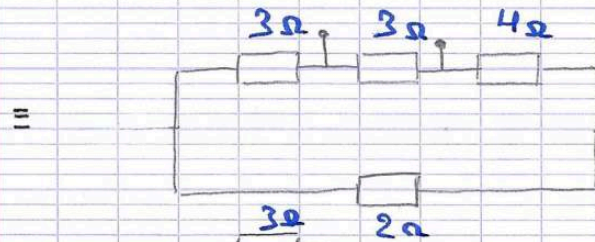
AB



$$R_{eq} = \frac{1}{\frac{1}{3} + \frac{1}{3} + \frac{1}{3}} = 3$$



CD



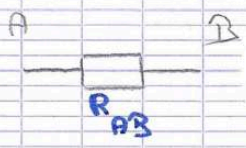
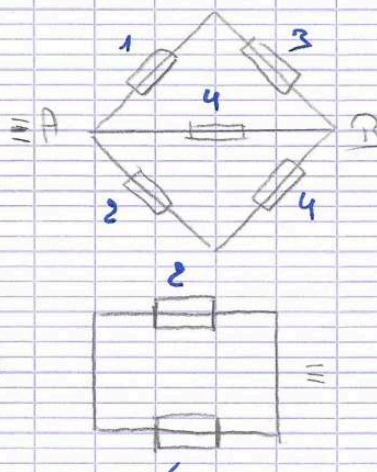
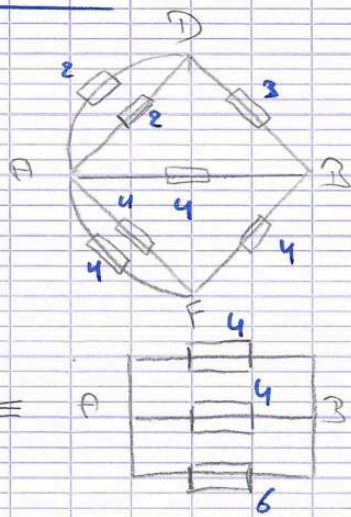
$$R = \frac{1}{\frac{1}{3} + \frac{1}{9}} = \frac{9}{4}$$

$$\frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3} = \frac{3}{2}$$

Exercise 3:

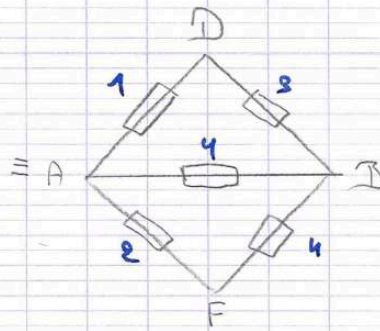
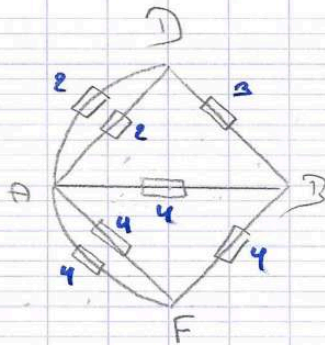
$$R_{AB} = \frac{1}{\frac{1}{2} + \frac{1}{6}} = \frac{6}{4} = \frac{3}{2} \Omega$$

1)

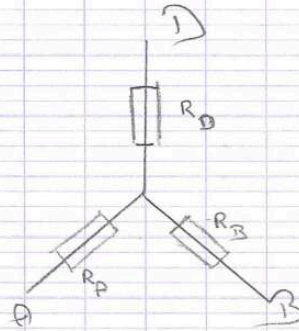
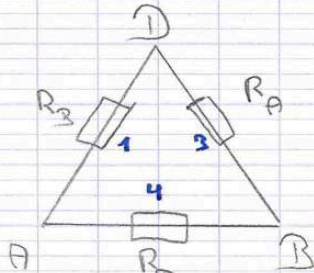


Correction
TD.

2)



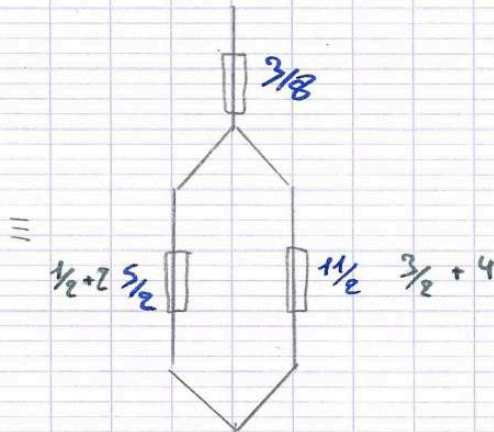
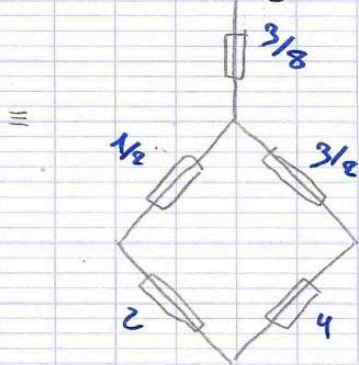
Transformation $\Delta \rightarrow Y$



$$R_A = \frac{R_B \times R_D}{R_A + R_B + R_D} = \frac{4}{8} = \frac{1}{2} \Omega$$

$$R_B = \frac{R_A \times R_D}{R_A + R_B + R_D} = \frac{12}{8} = \frac{3}{2} \Omega$$

$$R_D = \frac{R_A \times R_B}{R_A + R_B + R_D} = \frac{3}{8} \Omega$$

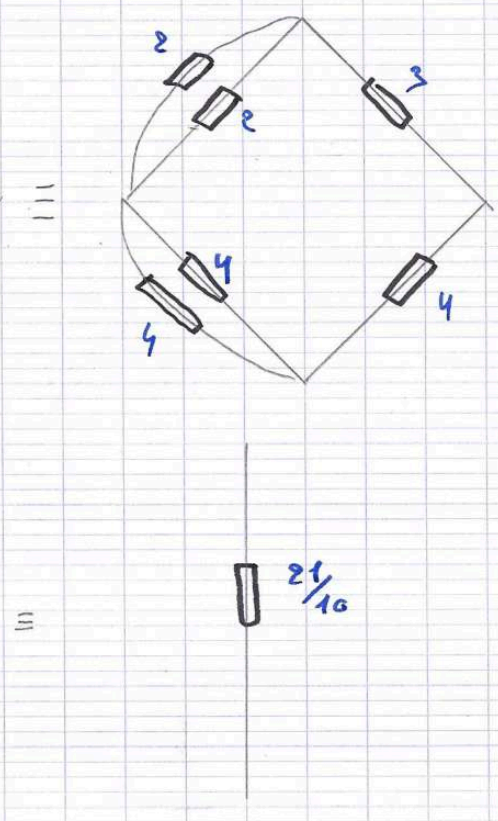
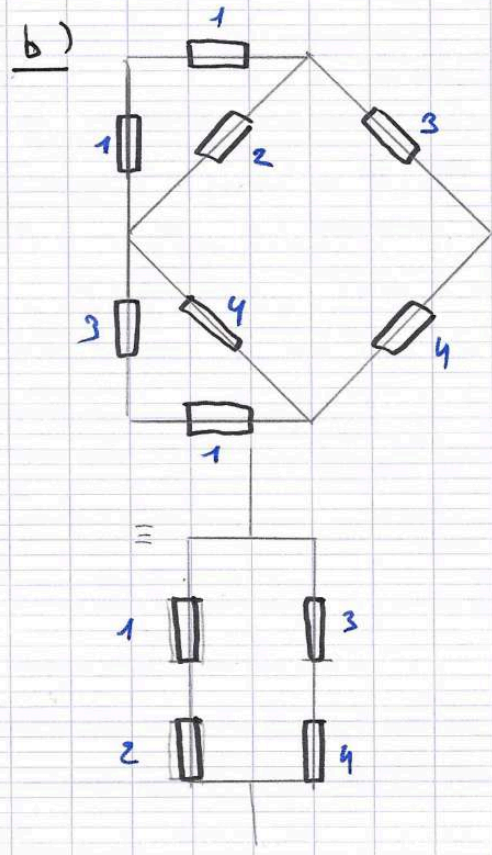
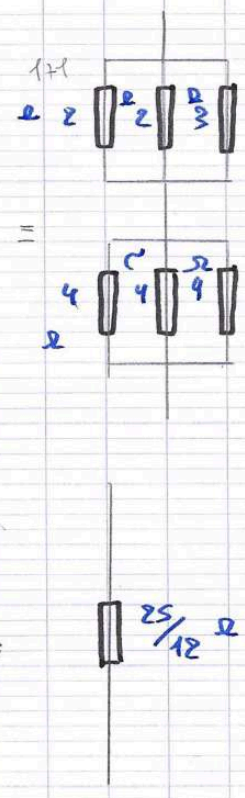
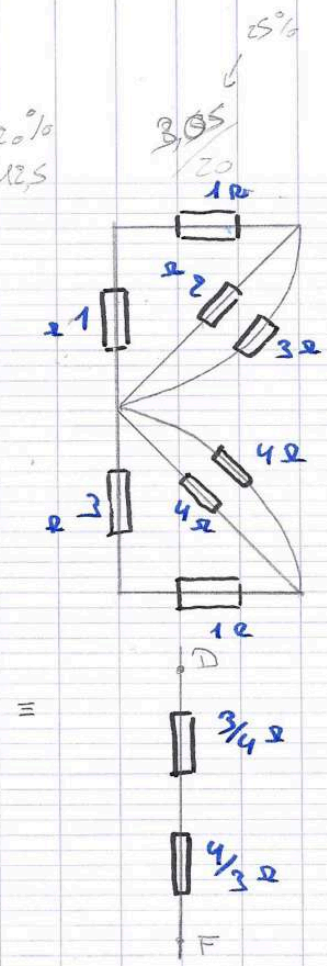


$$R_{eq} = \frac{1}{\frac{1}{\frac{5}{2}} + \frac{1}{\frac{11}{2}}} = \frac{55}{32} \Omega$$

$$\frac{3}{8} + \frac{55}{32} = \frac{67}{32} \Omega$$



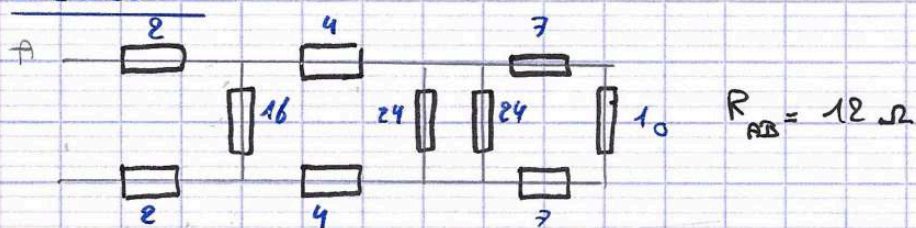
$\frac{3}{5.5} = 10$
 $\frac{5}{11} = 10$
 $\frac{20}{12.5} = 10$



Correction

Exercice 4

TD
électro



Exercice 5:

$$U_{BC} = R \cdot I_{BC} = 4V \Rightarrow P_{BC} = U_{BC} \cdot I_{BC} = 8W$$

$$U_{CD} = \mathcal{E} = 4V \Rightarrow P_{CD} = 8W$$

$$U_{DA} = R \cdot I_{DA} = 6V \Rightarrow P_{DA} = 12W$$

$$U_{BA} = U_{BC} + U_{CD} + U_{DA} = 14V \Rightarrow P_{BA} = -28W$$

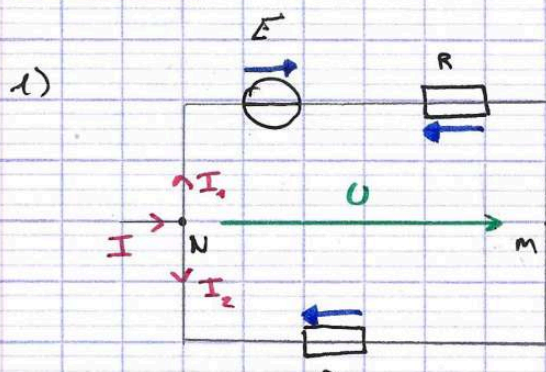
$$U_{BC} = R \cdot I_{BC} = 4V, P_{BC} = 8W$$

$$U_{CD} = -\mathcal{E} = -4V, P_{BC} = -8W$$

$$U_{DA} = R \cdot I_{DA} = 6V, P_{BC} = 12W$$

$$U_{BA} = U_{BC} + U_{CD} + U_{DA} = 6V, P_{BA} = U_{BA} \times I_0 = -12W$$

Exercice 6:



1st loi de Kirchhoff

$$I = I_1 + I_2$$

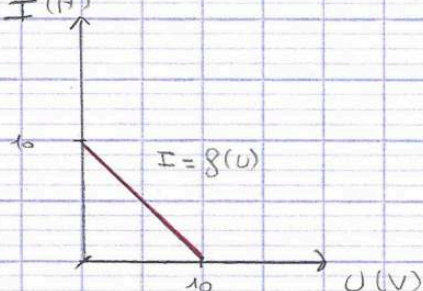
pour I_1 :

$$U = \mathcal{E} - R \cdot I_1 \Rightarrow I_1 = \frac{\mathcal{E} - U}{R}$$

pour I_2 :

$$U = -R \cdot I_2 \Rightarrow I_2 = -\frac{U}{R}$$

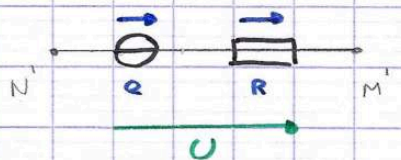
$$I = \frac{\mathcal{E} - U}{R} - \frac{U}{R} = \frac{\mathcal{E} - 2U}{R} \Rightarrow I = \frac{\mathcal{E}}{R} - \frac{2U}{R} = 10 - U$$



2) a) $I = 0,5 A$. Puissance du dipôle $M'N'$:

$$P = U_{M'N'} I_{M'N'} = U_{N'M'} I_{N'M'}$$

un moteur et 1 dipôle passif.



$$P = (e + R \cdot I) \cdot I$$

$$= \underline{2,2 \text{ W}}$$

$$R = \frac{\text{Puissance utile}}{\text{Puissance totale}}$$

$$R = \frac{e \cdot I}{U \cdot I} = 0,91 = \underline{91\%}$$

$$P = \frac{W}{\Delta t}$$

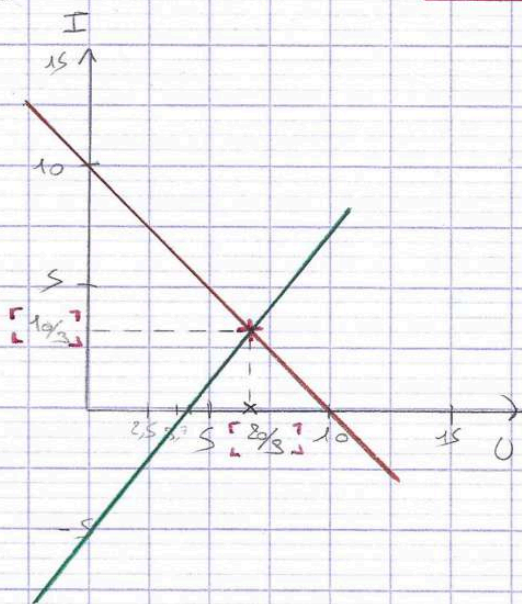
$$\Rightarrow W = P \cdot \Delta t$$

$$= 26400 \text{ J} = \underline{26,4 \text{ kJ}}$$

$$= 2,2 \left(3 + \frac{1}{3}\right)$$

$$= \underline{7,3 \text{ Wh}}$$

b) $U = 4 + 0,8I \Rightarrow \underline{I = -5 + 1,25U}$

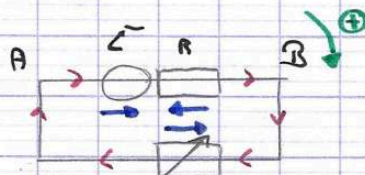


$$10 - U = 1,25U - 5$$

$$U = \frac{20}{3}$$

$$I = \frac{10}{3}$$

Exercice 7 $(E, R), R$



$P = U_R \cdot I_R$ On dit que R est adapté au montage quand P est maximale. On a: $U_R = R \cdot I_R \Rightarrow P_R = R \cdot I_R^2$

$$P_R = P(R)$$

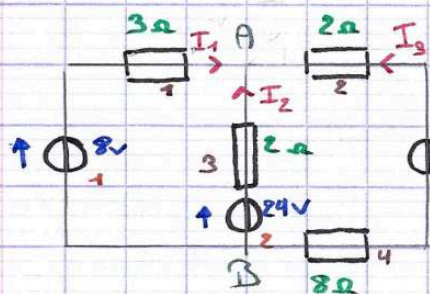
$$\text{On pose } R = \infty \Rightarrow P(R) = f(\infty)$$

Correction

Prépa TD Exercice 2:
electro

20mmation ②+④ = $\frac{1}{R_2+R_4}$

Noeud: $G_1 (\bar{U}_1 + U_{BA}) + G_3 (\bar{U}_2 + U_{BA}) + (G_4 + G_2) (-\bar{U}_3 + U_{BA}) = 0$

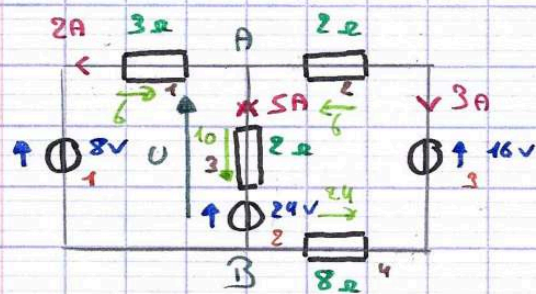


$$\frac{1}{3} (8 + U_{BA}) + \frac{1}{2} (24 + U_{BA}) + \frac{1}{10} (-16 + U_{BA}) = 0$$

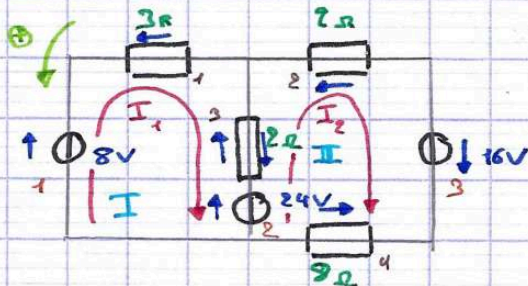
$$\frac{8}{3} + \frac{1}{3} U_{BA} + 12 + \frac{1}{2} U_{BA} - \frac{16}{10} + \frac{1}{10} U_{BA} = 0$$

$$\frac{14}{15} U_{BA} = -\frac{196}{15} \Rightarrow U_{BA} = -14 \text{ V}$$

$I_1 = -2 \text{ A}, I_2 = 5 \text{ A}, I_3 = -3 \text{ A}$



Maille:

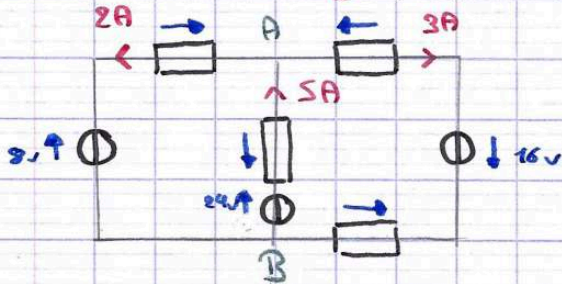


Maille I: $R_1 \cdot I_1 - \bar{U}_1 + R_3 \cdot I_1 - R_3 \cdot I_2 + \bar{U}_2 = 0$
 $3 I_1 - 8 + 2 \cdot I_1 - 2 \cdot I_2 + 24 = 0$
 $5 I_1 - 2 I_2 = -16$

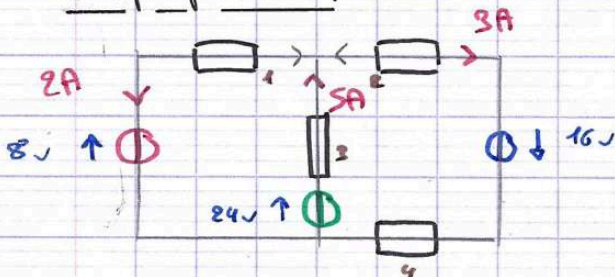
Maille II: $R_3 \cdot I_2 - R_3 \cdot I_1 - \bar{U}_2 + R_4 \cdot I_2 - \bar{U}_3 + R_2 \cdot I_2 = 0$
 $2 \cdot I_2 - 2 \cdot I_1 - 24 + 8 \cdot I_2 - 16 + 2 \cdot I_2 + 8 I_2 = 0$
 $12 I_2 - 2 I_1 = 40$

On résout :
$$\begin{cases} 5I_1 - 2I_2 = -16 \\ 12I_2 - 2I_1 = 40 \end{cases} \Rightarrow \begin{cases} 30I_1 - 12I_2 = -96 \\ 28I_1 = -56 \end{cases}$$

$$\Rightarrow \begin{cases} I_2 = 3A \\ I_1 = -2A \end{cases}$$



Superposition:



Ainsi :
$$\begin{aligned} I_1 &= -2A \\ I_2 &= 5A \\ I_3 &= -3A \end{aligned}$$

① :
$$\frac{1}{3}(8 + U_{BA}) + \frac{1}{2}U_{BA} + \frac{1}{10}U_{BA} = 0$$

$$U_{BA} = -20/7V$$

$$I_1 = 12/7, I_2 = -10/7, I_3 = -2/7$$

② :
$$\frac{1}{3}U_{BA} + \frac{1}{2}(24 + U_{BA}) + \frac{1}{10}U_{BA} = 0$$

$$U_{BA} = -90/7V$$

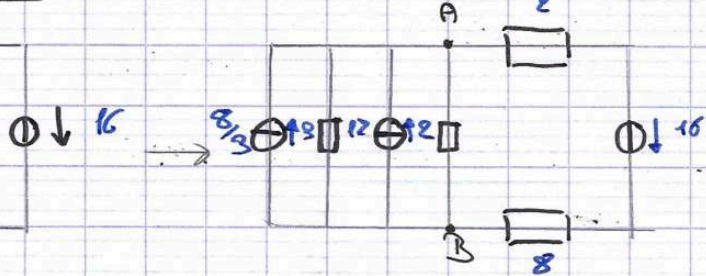
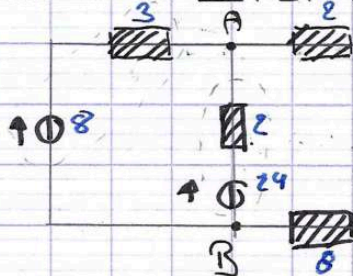
$$I_1 = -30/7, I_2 = 39/7, I_3 = -9/7$$

③ :
$$\frac{1}{3}U_{BA} + \frac{1}{2}U_{BA} + \frac{1}{10}(-16 + U_{BA}) = 0$$

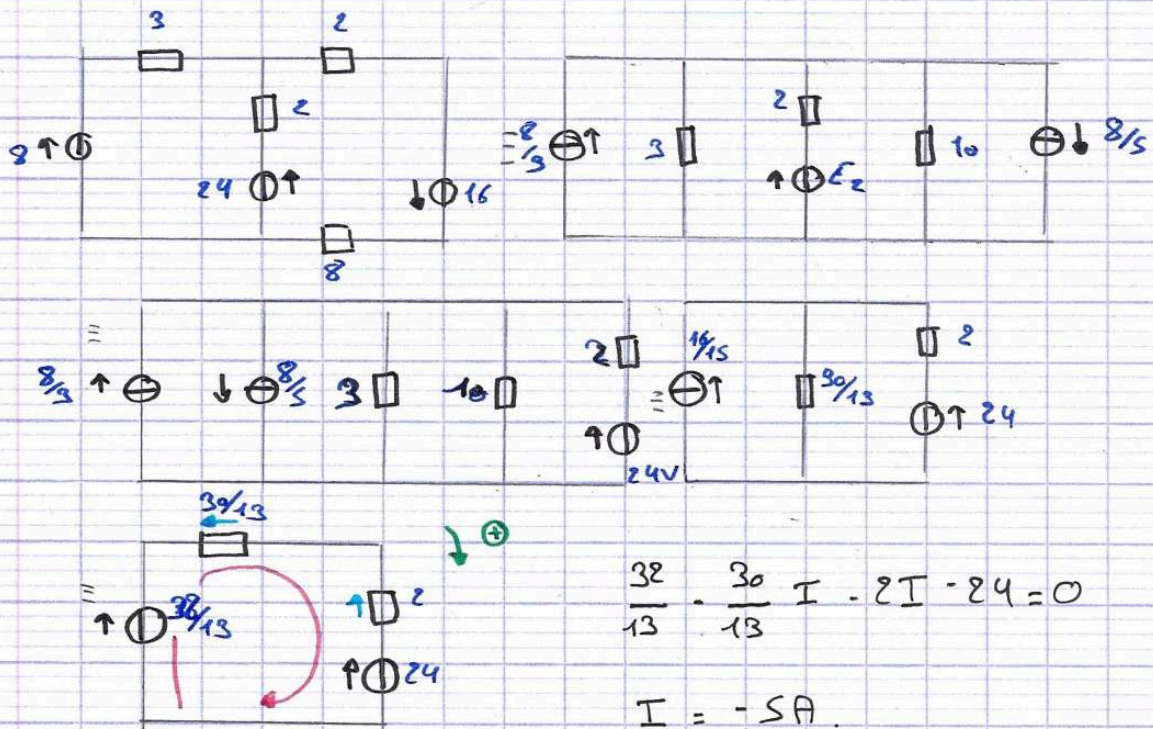
$$\frac{14}{15}U_{BA} = 16/10 \Rightarrow U_{BA} = 12/7V$$

$$I_1 = 4/7, I_2 = 6/7, I_3 = -10/7$$

Thévenin Superposition



Correction
TD électro



$$\frac{32}{13} - \frac{30}{13} I - 2I - 24 = 0$$

$$I = -5A$$

$$U_{AB} = U_{BC} + U_{CB} = -10 + 24 = \underline{14V}$$

Exercice 3:

Théorème de Thévenin:

rendre passif le circuit

gt → g.p

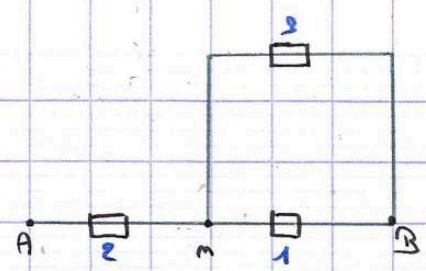
gc → déconnecte

$$R_{TH} = R_{AB}$$

$$E_{TH} = U_{AB} \text{ (à vide)}$$

$$I = \frac{R}{U}$$

$$U = R \cdot I$$



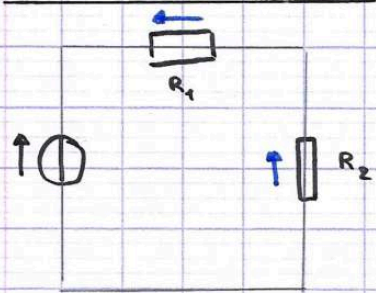
$$R_{AB} = 2 + \frac{3}{4} = \frac{11}{4} \Omega$$

$$4 - 3I_1 - I_1 = 0$$

$$I_1 = 1A$$

$$U_{MB} = 1V$$

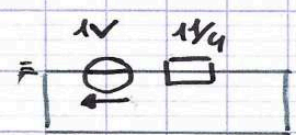
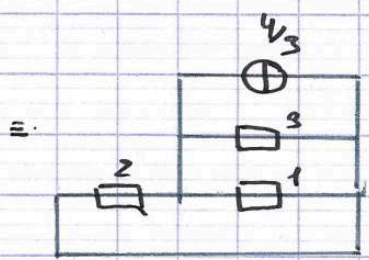
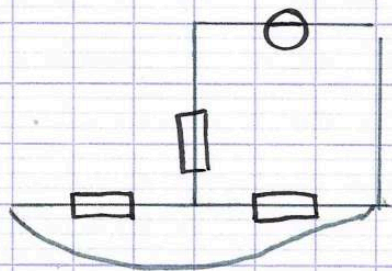
Diviseur de tension : un gf en série avec 2 résistances $R_1 \wedge R_2$



$$U_{R1} = \frac{R_1}{R_1 + R_2} E \quad U_{R2} = \frac{R_2}{R_1 + R_2} E$$

Théorème de Norton

- $R_N = R_{AB}$ (circuit passif) = $11/4 \Omega$
- I_N = rajouter un gf entre A et B (parcouru par I_{cc}) puis calculer I_{cc}



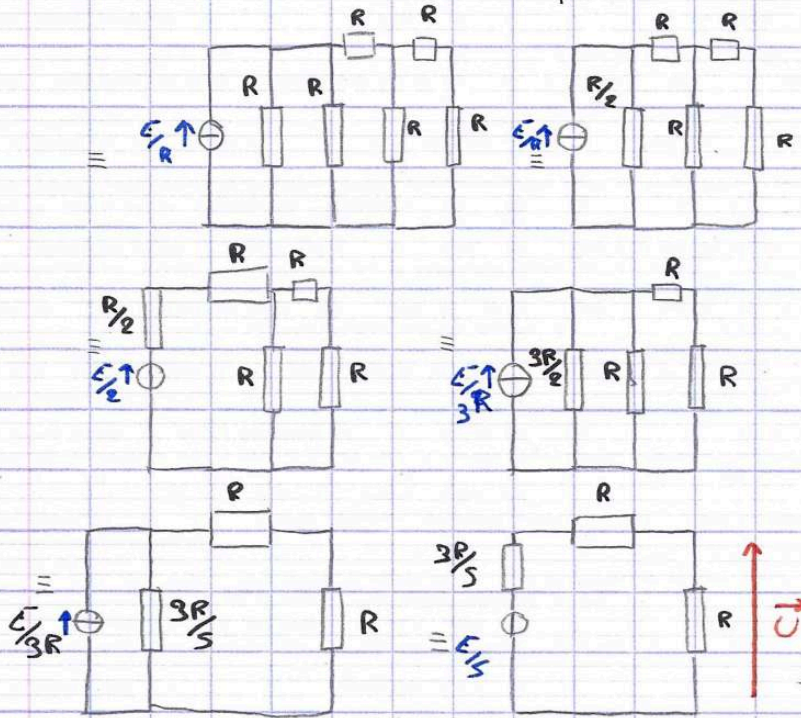
$$I_{cc} \text{ (méthode mailles)} = \underline{4/11 A}$$

Correction Exercice 4:
TD electro

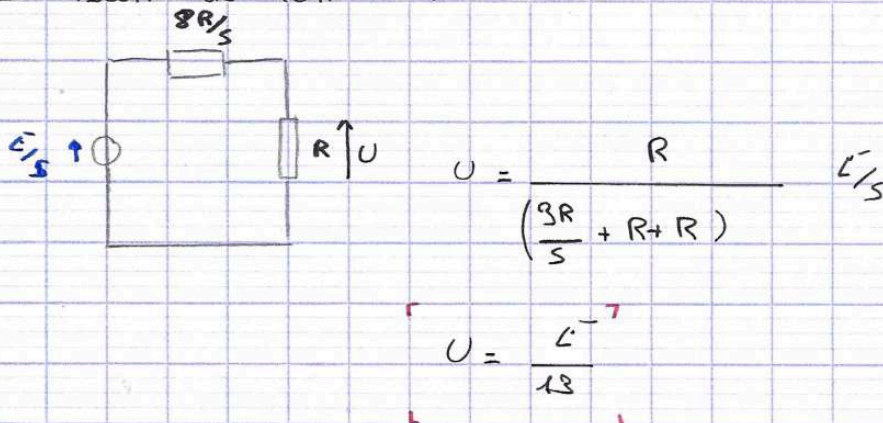
Trouver une relation entre U et $\mathcal{E}$

méthode $g^r \leftrightarrow g^c$

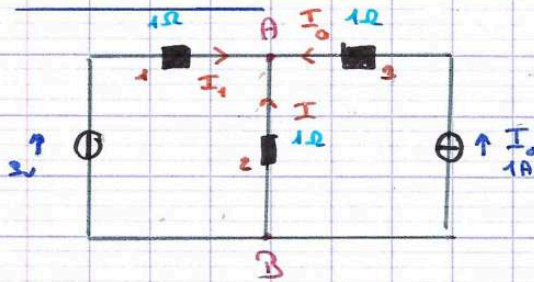
Transformation possible uniquement avec des générateurs réels



Diviseur de tension :



Exercice 5:



$$\text{Au point A: } G_2 (\mathcal{E} + U_{BA}) + G_3 U_{BA} + I_0 = 0$$

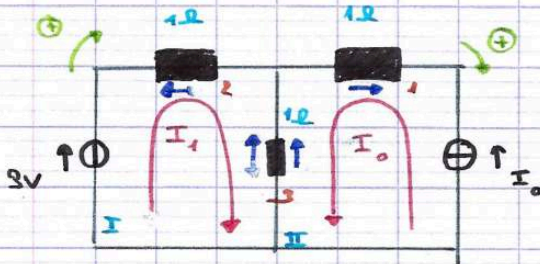
$$\Rightarrow 2U_{BA} = -4$$

$$U_{BA} = -2V$$

$$I = -2A$$

$$I_1 = 1A$$

$$I_0 = 1A$$



$$\text{Maille I: } \mathcal{E} - R_2 I_1 - R_3 I - R_3 I_0 = 0$$

$$3 - 2I_1 - I_0 = 0 \Rightarrow I_1 = 1A$$

$$\text{Maille II: } I_0 = 1A$$

$$I = I_{AB}^{(1)} + I_{AB}^{(2)} \\ = I_1 + I_0 = 2A$$

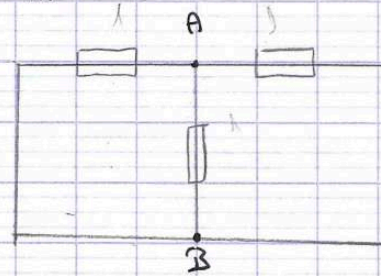
$$R_1 \text{ coup} \Rightarrow I_0 = 0$$

$$R_2 \text{ coup} \Rightarrow \mathcal{E} - 2I_1 - I_0 = 0$$

$$\text{1P faut que } I_1 = 0$$

$$\Rightarrow I_0 = 3A$$

R_m :

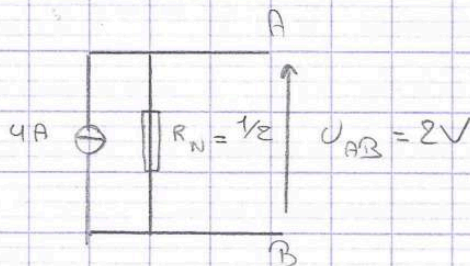


$$R_{AB} = \frac{1}{2} \Omega$$

Au nœud A:

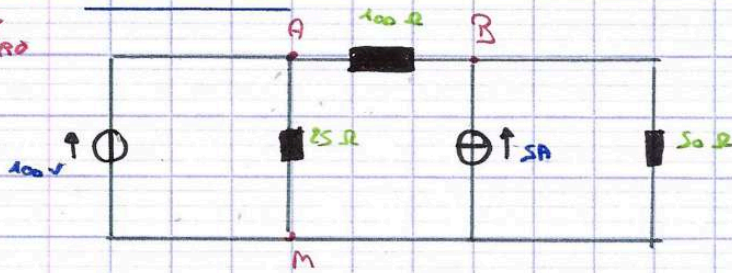
$$\frac{\mathcal{E} + U_{BA}}{1\Omega} - I_{cc} + I_0 = 0$$

$$\Rightarrow I_{cc} = \mathcal{E} + I_0 \\ = 4$$



Correction
TD electro

Exercice 6:



Au nœud B: $\frac{1}{10} (U_{AM} + U_{MB}) + 5 + \frac{1}{50} U_{MB} = 0$

$$\frac{1}{10} (100 + U_{MB}) + 5 + \frac{1}{50} U_{MB} = 0$$

$$U_{AM} = 100 \quad \underline{U_{MB} = -925 \text{ V}}$$

$$I_{AM}^{(1)} = 4 \text{ A}$$

$$U_{AB} = U_{AM} + U_{MB} = -825 \text{ V} \Rightarrow I_{AB} = 2,5 \text{ A}$$

$$I_{AM}^{(2)} = 1,5 \text{ A}$$