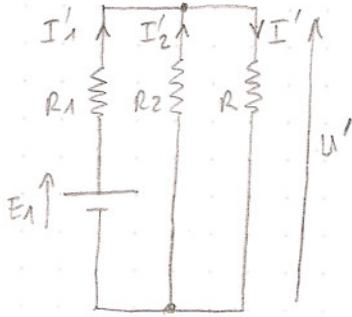$\begin{cases} R_1 = 10\,\Omega \\ y_1 = 0,1\,S \end{cases}$ $\begin{cases} R_2 = 20\,\Omega \\ y_2 = 0,05\,S \end{cases}$ $\begin{cases} R = 30\,\Omega \\ y = 0,033\,S \end{cases}$ $E_1 = 10V \; ; \; E_2 = 20V.$

Q1

a/ Equation du noeud A:

$$I'_1 + I'_2 = I' \qquad y = \frac{1}{R} \; ; \; y_1 = \frac{1}{R_1} \; ; \; y_2 = \frac{1}{R_2}$$

$$\begin{cases} V_A = E_1 - R_1 I'_1 \\ V_A = -R_2 I'_2 \\ V_A = u' = +R I' \end{cases} \Rightarrow \begin{cases} V_A = E_1 - \dfrac{I'_1}{y_1} \\ V_A = -\dfrac{I'_2}{y_2} \\ V_A = u' = \dfrac{I'}{y} \end{cases}$$

$$\Rightarrow \begin{cases} I'_1 = (E_1 - V_A)\,y_1 \\ I'_2 = -V_A\,y_2 \\ I' = V_A\,y \end{cases}$$

b/ $u' = V_A = \dfrac{I'}{y} = \dfrac{I'_1 + I'_2}{y} = \dfrac{(E_1 - V_A)y_1 - V_A\,y_2}{y}$

$$\Rightarrow u' = \frac{(E_1 - u')y_1 - u'y_2}{y}$$

$$\Rightarrow u'(y + y_1 + y_2) = E_1 y_1$$

$$\Rightarrow \boxed{u' = \frac{E_1 y_1}{y + y_1 + y_2}} \qquad \underline{AN:} \; \boxed{u' = 5,45V}$$

Soit $I' = V_A y = u'y = 5,45 \times 0,33 = \boxed{0,182\,A}$

$I'_1 = (E_1 - u')y_1 = \boxed{0,454\,A}$

$I'_2 = -u'y_2 = \boxed{-0,272\,A}$

$\underline{Vérification} \Rightarrow I' = I'_1 + I'_2 \Rightarrow I' = 0,454 - 0,272 = 0,182\,A$