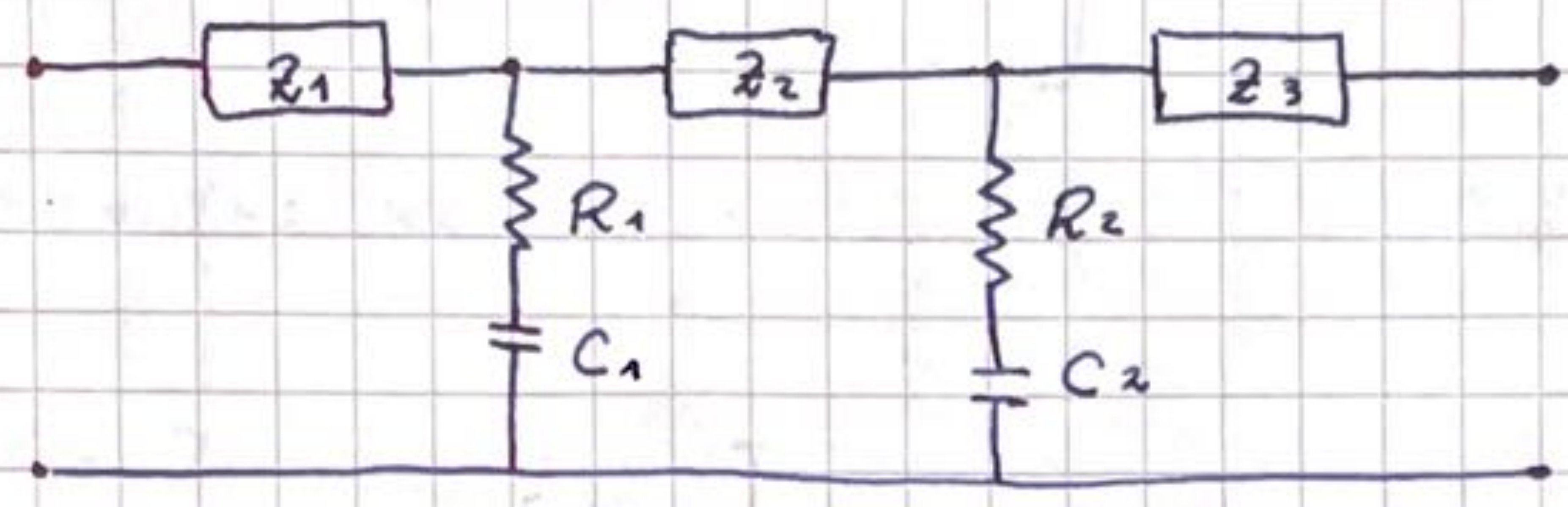
Giuliana Ruffa

TS11

HOJA Nº 1

FECHA

① Encuentre el valor de los componentes del siguiente circuito:

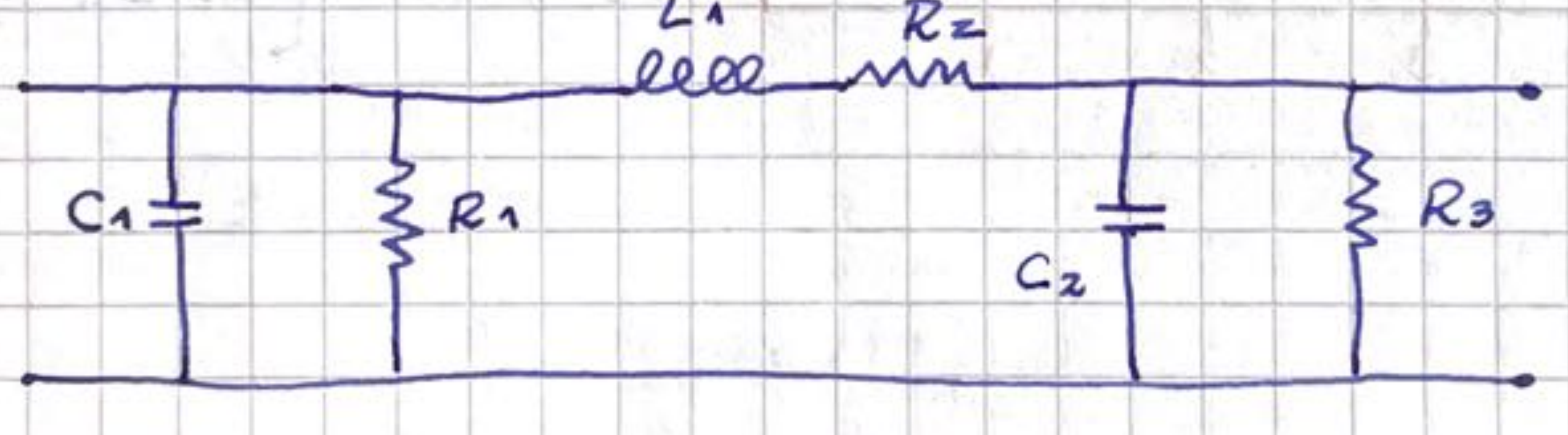


sabiendo que está caracterizado por la siguiente función de excitación y constantes de tiempo:

$R_1 \cdot C_1 = \frac{1}{6}$; $R_2 C_2 = \frac{2}{7}$; $Z(s) = \frac{s^2+6s+8}{s^2+4s+3}$

② Determine el valor de los componentes que integran el siguiente dipolo, sabiendo que satisface la impedancia propuesta:

$$Z(s) = \frac{s^2+s+1}{(s^2+2s+5)(s+1)}$$



Resolución:

①

$$Z(s) = R + \frac{1}{sC} = \frac{sRC+1}{sC} = \frac{RC\,(s+1/RC)}{sC} \rightarrow Z(s) = \frac{R\,(s+1/RC)}{s}$$

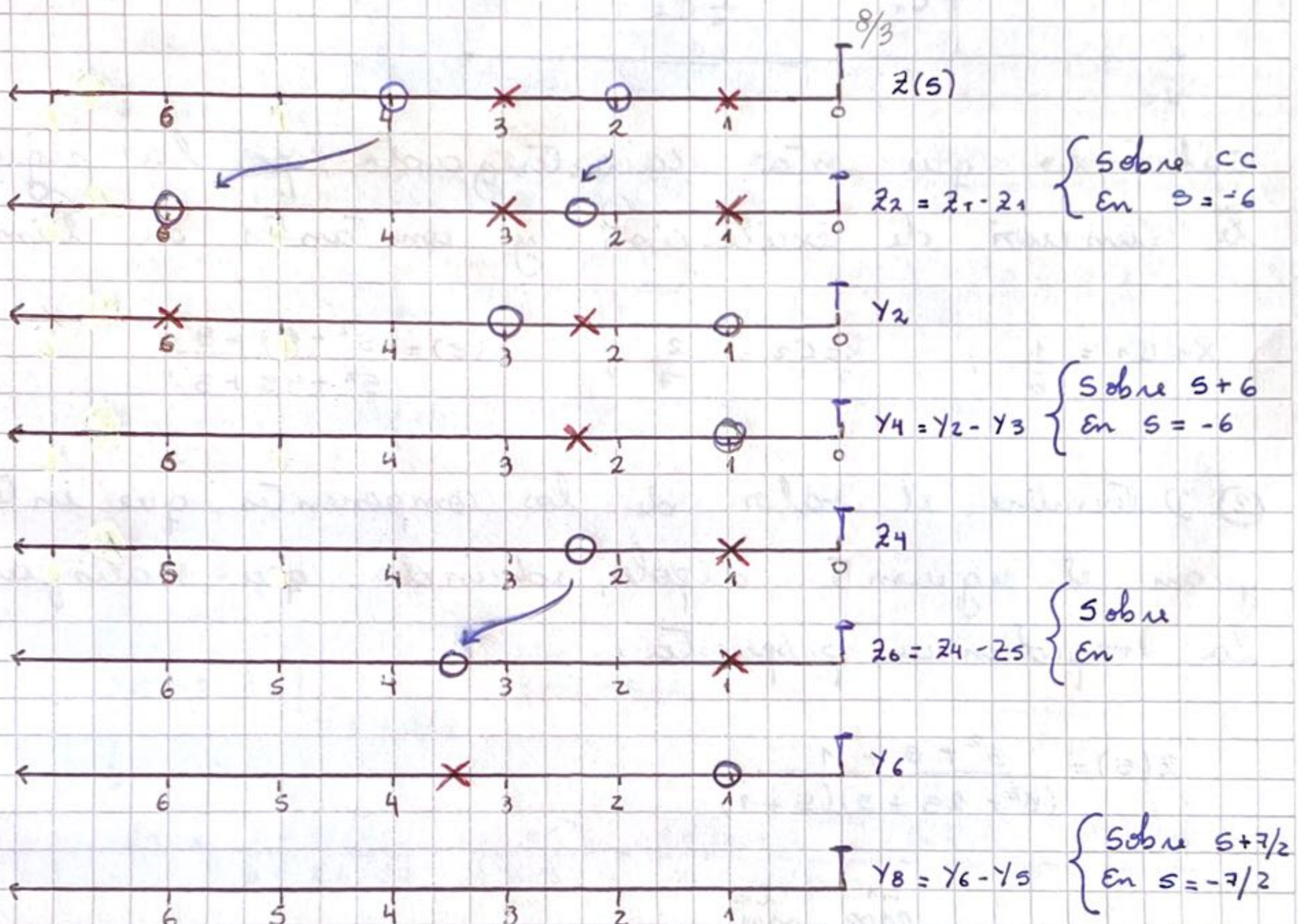
$$\boxed{Y(s) = \frac{1}{R}\,\frac{s}{s+1/RC}}$$

NOTA

Sabemos que: $Z(s) = \dfrac{(s+2)(s+4)}{(s+1)(s+3)}$

Y a su vez: $\begin{cases} Z_1 \\ Z_2 \\ Z_3 \end{cases}$ $\begin{cases} Y_1 = \dfrac{1}{R_1} \dfrac{s}{s + 1/R_1C_1} \rightarrow R_1C_1 = 1/6 \\ Y_2 = \dfrac{1}{R_2} \dfrac{s}{s + 1/R_2C_2} \rightarrow R_2C_2 = 2/7 \end{cases}$

Remoción gráfica:



Analíticamente:

$Z(s) = \dfrac{(s+2)(s+4)}{(s+1)(s+3)}$

$*\ Z_2 = Z_T - Z_1 = Z_T - K$

$\cdot\ K_0 = Z_T \Big|_{s=-6} = \dfrac{(-6+2)(-6+4)}{(-6+1)(-6+3)} = \dfrac{8}{15}$

$Z_2 = \dfrac{s^2+6s+8}{(s+1)(s+3)} - \underbrace{\dfrac{8}{15}}_{Z_1} = \dfrac{s^2+6s+8 - 8/15\, s^2 - 32/15\, s - 8/5}{(s+1)(s+3)}$

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$$z_2 = \frac{7/15\, s^2 + 58/15\, s + 32/5}{(s+1)(s+3)} = \frac{(s+16/7)(s+6)}{(s+1)(s+3)}$$

$$\Rightarrow Y_2 = \frac{(s+1)(s+3)}{(s+16/7)(s+6)}$$

$$* \; Y_4 = Y_2 - K_2 \frac{s}{s+6}$$

$$\cdot \; K_2 = Y_2 \cdot \frac{(s+6)}{s}\Big|_{s=-6} = \frac{(s+1)(s+3)}{(s+16/7)\cancel{(s+6)}} \frac{\cancel{(s+6)}}{s}\Big|_{s=-6} = \frac{35}{52}$$

$$Y_4 = \frac{s^2+4s+3}{(s+16/7)(s+6)} - \overset{Y_2}{\frac{35}{52}\frac{s}{s+6}} = \frac{s^2+4s+3-[35/52\, s\,(s+16/7)]}{(s+16/7)(s+6)}$$

$$Y_4 = \frac{s^2+4s+3 - 35/52\, s^2 - 20/13 \cdot s}{(s+16/7)(s+6)} = \frac{17/52\, s^2 + 32/13\, s + 3}{(s+16/7)(s+6)} = \frac{(s+26/17)\cancel{(s+6)}}{(s+\frac{16}{7})\cancel{(s+6)}}$$

$$\Rightarrow z_4 = \frac{s+16/7}{s+26/17}$$

$$* \; z_6 = z_4 - K_3$$

$$\cdot \; K_3 = z_4\Big|_{s=-7/2} = 289/469$$

$$z_6 = \frac{s+16/7}{s+26/17} - \overset{z_3}{\frac{289}{469}} = \frac{s+16/7 - 289/469 . s - 442/469}{s+26/17}$$

$$z_6 = \frac{180/469 \cdot s + 90/67}{s+26/17} = \frac{180}{469}\frac{(s+7/2)}{s+26/17}$$

$$\Rightarrow Y_6 = \frac{469}{180}\frac{(s+26/17)}{s+7/2}$$

$$* \; Y_8 = Y_6 - K_4 \frac{s}{s+7/2}$$

$$\cdot \; K_4 = Y_6 \cdot \frac{(s+7/2)}{s}\Big|_{s=-7/2} = \frac{469}{180}\frac{(s+26/17)}{\cancel{s+7/2}} \cdot \frac{\cancel{(s+7/2)}}{s} = \frac{-\frac{31423}{34}}{-630}$$

$$Y_8 = \frac{469}{180}\frac{(s+26/17)}{s+7/2} - \overset{Y_4}{1{,}47 \cdot \frac{s}{s+7/2}} = \frac{469/180\, s + \frac{12194}{3060} - \frac{31423}{34}/630 \cdot s}{(s+7/2)}$$

$$Y_8 = \frac{871/765\, s + \frac{12194}{3060}}{s + 7/2} = \frac{871}{765} \frac{\cancel{s + 7/2}}{\cancel{s + 7/2}} = \frac{871}{765}$$ Y_5

Finalmente :

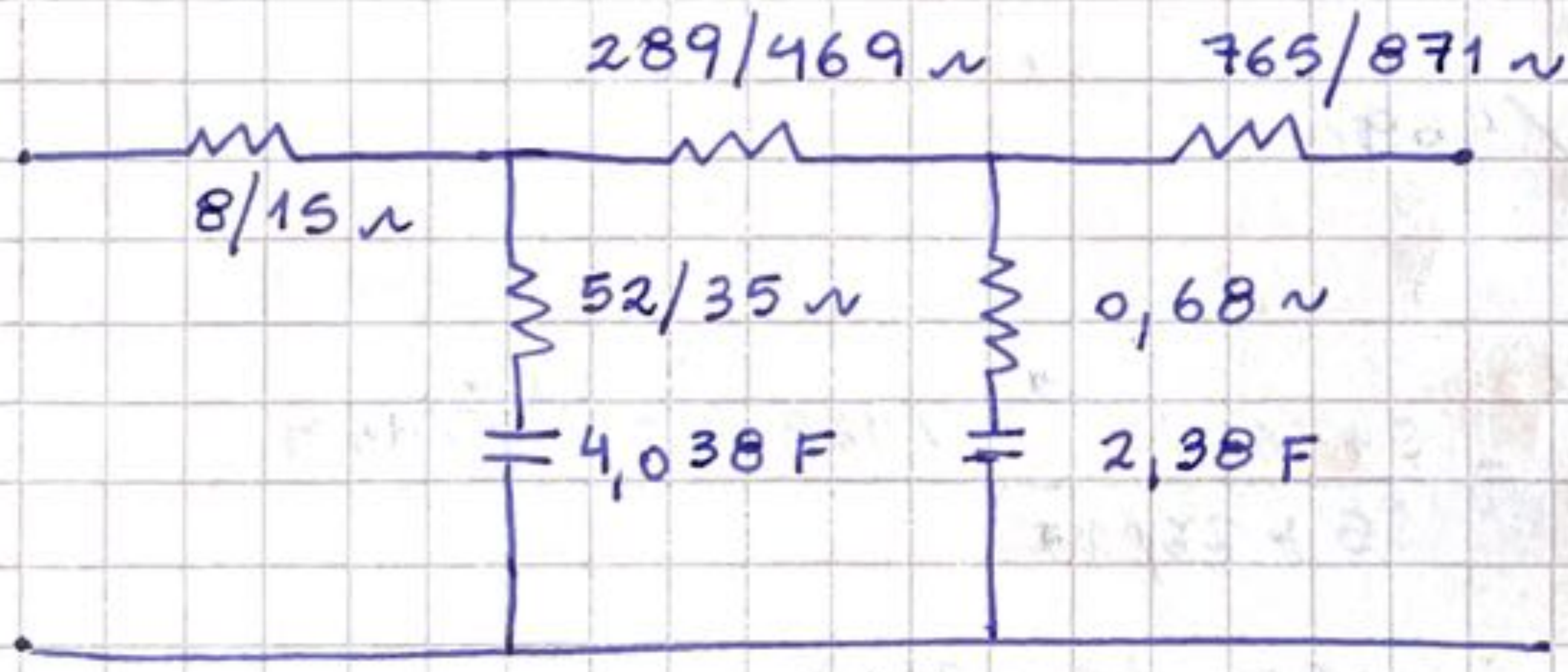
$$\begin{cases} Z_1 = R_1 = 8/15\, \Omega \\ Z_2 = R_2 = 289/469\, \Omega \\ Z_3 = R_3 = 765/871\, \Omega \end{cases}$$

Bloques RC :

- $\frac{35}{52} \frac{s}{s+6} = \frac{1}{R_1} \frac{s}{s + 1/R_1C_1}$. $\begin{cases} R_1 = 52/35\, \Omega \\ C_1 \cong 4{,}038\ F \end{cases}$

- $1{,}47 \frac{s}{s + 7/2} = \frac{1}{R_2} \frac{s}{s + 1/R_2C_2}$ $\begin{cases} R_2 \cong (1/1{,}47)\, \Omega \simeq 0{,}68 \\ C_2 \simeq 2{,}38\ F \end{cases}$

Implementación circuital :



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② Observamos que por las conexiones de la red, podemos resolver por Cauer.

$$Z(s) = \frac{s^2+s+1}{(s^2+2s+5)(s+1)} = \frac{s^2+s+1}{s^3+2s^2+5s+s^2+2s+5}$$

$$Z(s) = \frac{s^2+s+1}{s^3+3s^2+7s+5} \longrightarrow Y(s) = \frac{s^3+3s^2+7s+5}{s^2+s+1}$$

Entonces:

$$s^3+3s^2+7s+5 \;\big|\; s^2+s+1$$
$$\underline{s^3+s^2+s} \qquad s \quad Y_1$$
$$2s^2+6s+5$$

$\Rightarrow$

$$2s^2+6s+5 \;\big|\; s^2+s+1$$
$$\underline{2s^2+2s+2} \qquad 2 \quad Y_2$$
$$4s+3$$

$\Rightarrow$

$$s^2+s+1 \;\big|\; 4s+3$$
$$\underline{s^2+3/4\,s} \qquad \frac{1}{4}s \quad Z_3$$
$$\frac{1}{4}s+1$$

$$1/4 \cdot s+1 \;\big|\; 4s+3$$
$$\underline{1/4\,s+3/16} \qquad 1/16 \quad Z_4$$
$$13/16$$

$\Rightarrow$

$$4s+3 \;\big|\; 13/16$$
$$\underline{4s} \qquad {}^{64}/_{13}\,s \quad Y_5$$
$$3$$

$$3 \;\big|\; 13/16$$
$$48/13 \quad Y_6$$

Finalmente: