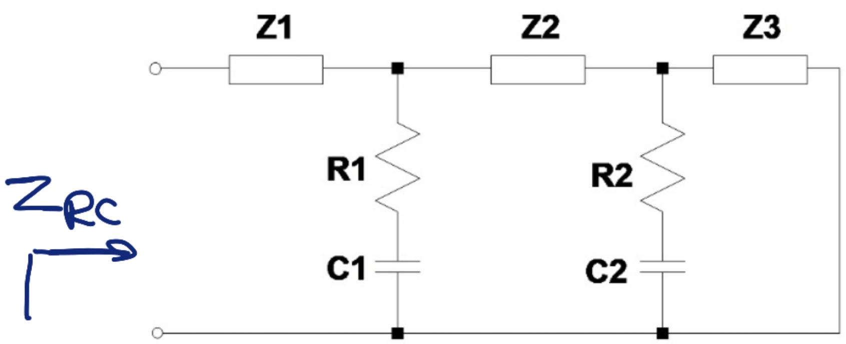
1) Encuentre el valor de los componentes del siguiente circuito:



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

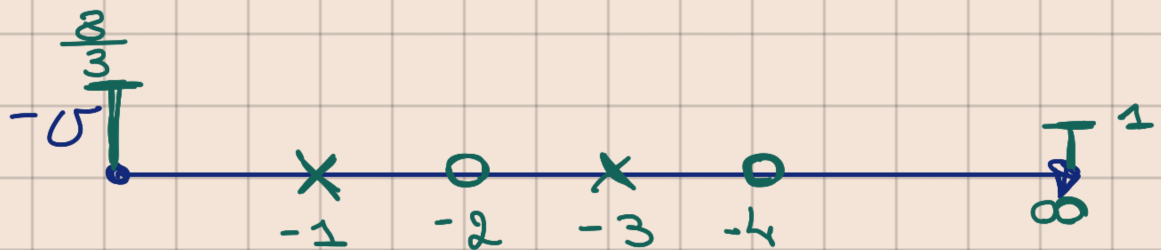
$$R1.C1 = \frac{1}{6}$$

$$R2.C2 = \frac{2}{7}$$

$$Z(s) = \frac{(s^2+6s+8)}{(s^2+4s+3)}$$

1) $$Z(s) = \frac{s^2+6s+8}{s^2+4s+3} = \frac{(s+2)(s+4)}{(s+1)(s+3)}$$

Vemos que la $Z(s)$ es unicamente disipativa ya que tiene todas las singularidades sobre $-\sigma$

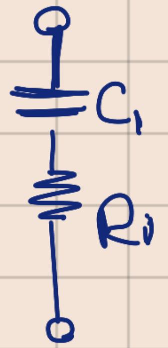


Vemos que se cumple la altennancia.

- $Z_{RC}(0) > Z_{RC}(\infty) \rightarrow$ es condición necesania

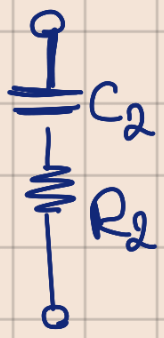
Se deberá cumplir:

$$\tau_1 = R_1C_1 = \frac{1}{6} \quad ; \quad R_2C_2 = \frac{2}{7} = \tau_2$$



$$\to Y_1 = \frac{G_1\, s}{s + \frac{G_1}{C_1}} = \frac{G_1 \cdot s}{\underbrace{s + \frac{1}{\tau_1}}} = \frac{1}{\frac{1}{G_1} + \frac{1}{s\,\underbrace{\tau_1 G_1}_{C_1}}}$$

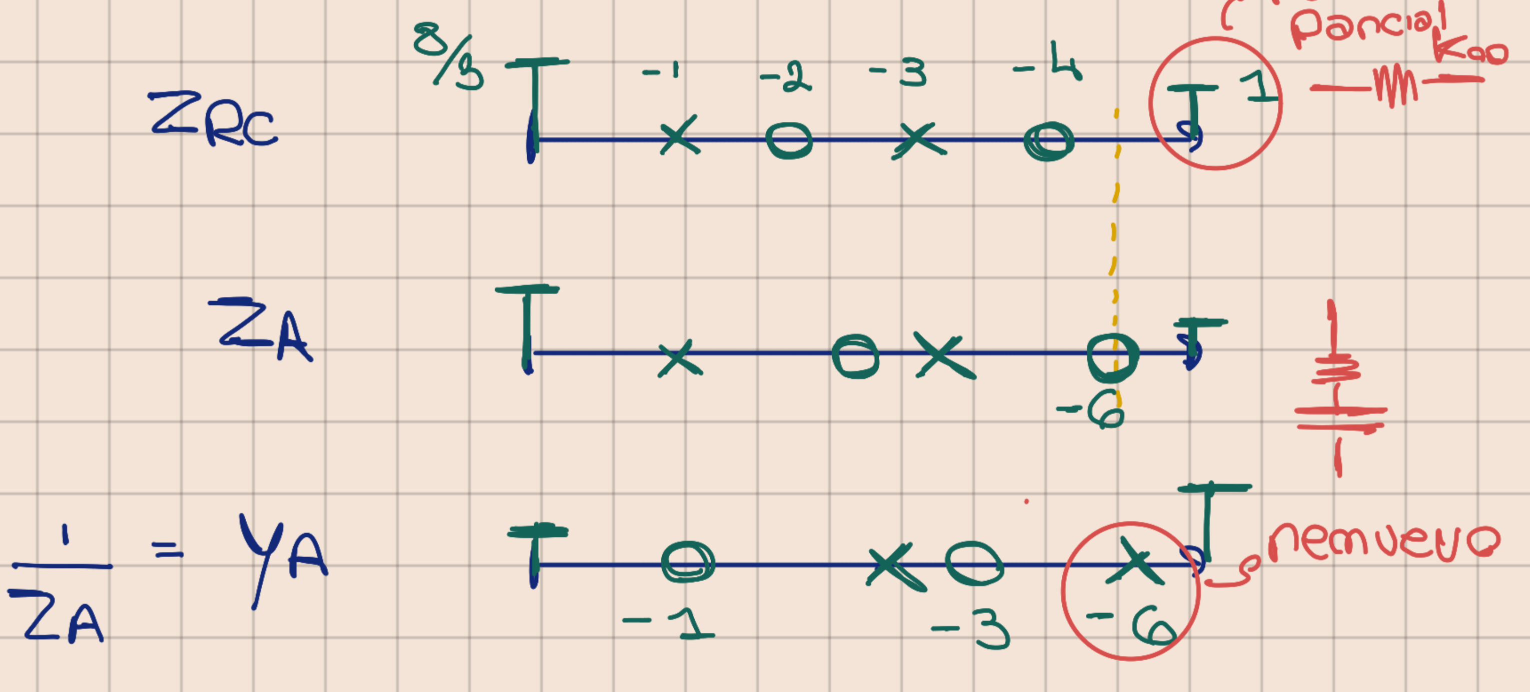
necesita remover polo en $\frac{1}{\tau_1} = 6$

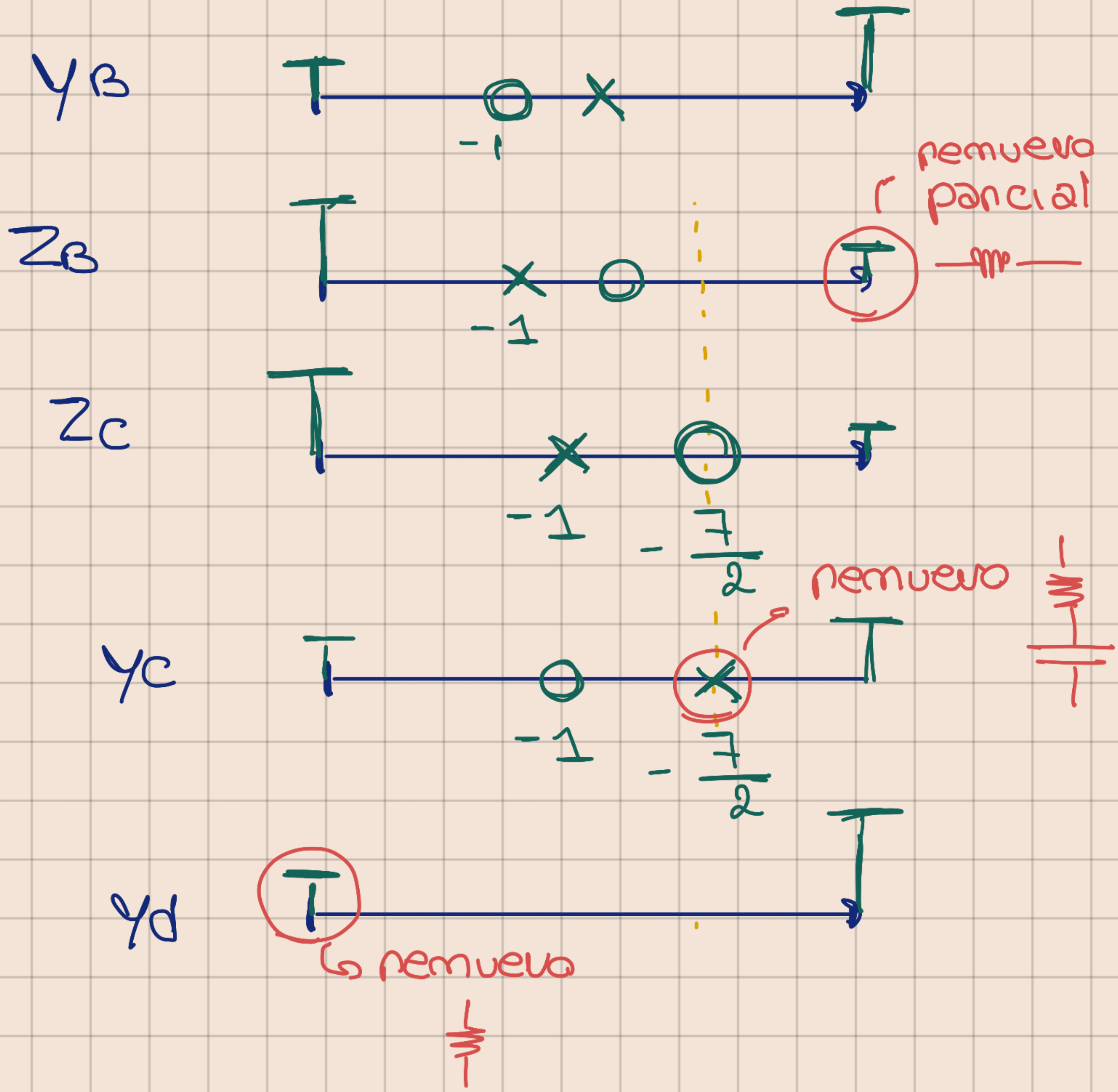


$$\to Y_2 = \frac{G_2\, s}{s + \frac{G_2}{C_2}} = \frac{G_2\, s}{\underbrace{s + \frac{1}{\tau_2}}} = \frac{1}{\frac{1}{G_2} + \frac{1}{s\,\tau_2 G_2}}$$

necesita remover en $\frac{1}{\tau_2} = \frac{7}{2}$

Comienzo síntesis en forma gráfica:





Y_B
-1
Z_B
-1
remueve parcial
Z_C
-1
$-\frac{7}{2}$
Y_C
remueve
-1
$-\frac{7}{2}$
Y_d
remueve

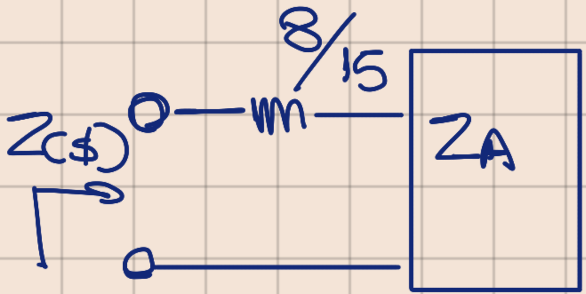
Síntesis numérica:

$$Z(s) = \frac{s^2+6s+8}{s^2+4s+3}$$

$$Z_A = Z(s) - K'_\infty \Big|_{s=-6} = 0$$

$$\frac{s^2+6s+8}{s^2+4s+3} - K'_\infty \Big|_{s=-6} = 0$$

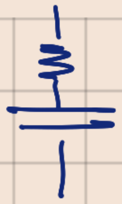
$$K'_\infty = \frac{36-36+8}{36-24+3} = \frac{8}{15}$$ → saco una $R = \frac{8}{15}$



$$Z_A = \frac{s^2+6s+8-\frac{8}{15}\left(s^2+4s+3\right)}{s^2+4s+3}$$

$$Z_A = \frac{\frac{7}{15}s^2+\frac{58}{15}s+\frac{32}{5}}{s^2+4s+3}$$

$$Y_A = \frac{1}{Z_A} = \frac{s^2+4s+3}{\frac{7}{15}\left(s^2+\frac{58}{7}s+\frac{96}{7}\right)} = \frac{s^2+4s+3}{\frac{7}{15}\left(s+\frac{16}{7}\right)\left(s+6\right)}$$

$$\frac{s k'}{s+\sigma} \longrightarrow$$  donde $\sigma = 6$

$$k' = \lim_{s \to -6} \frac{(s+6)}{s} Y_A = \frac{36-24+3}{\frac{7}{15}\left(-6+\frac{16}{7}\right)\cdot(-6)} = \frac{75}{52}$$

$$\frac{G_1 \cdot s}{s+\frac{1}{\tau_1}} = \frac{k' s}{s+6} \longrightarrow G_1 = \frac{75}{52} \longrightarrow R_1 = \frac{52}{75}$$

$$\frac{1}{\tau_1} = 6 \longrightarrow C = \frac{1}{R \cdot 6}$$

$$C = \frac{25}{104}$$

$$Y_B = Y_A - \frac{s \cdot \frac{75}{52}}{s+6}$$

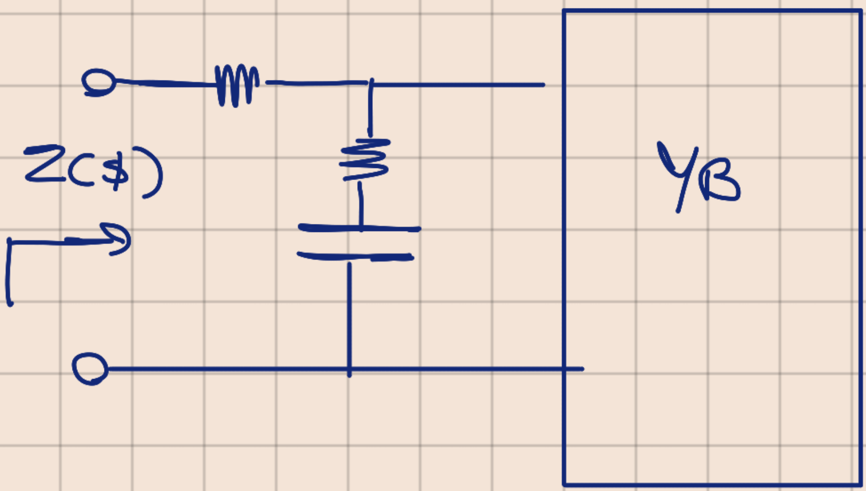
$$Y_B = \frac{s^2+4s+3}{\frac{7}{15}\left(s+\frac{16}{7}\right)\left(s+6\right)} - \frac{s \cdot \frac{75}{52}}{s+6}$$

$$Y_B = \frac{s^2+4s+3 - \frac{7}{15}\left(s+\frac{16}{7}\right)\left(s \frac{75}{52}\right)}{\frac{7}{15}\left(s+\frac{16}{7}\right)\left(s+6\right)}$$

$$Y_B = \frac{\frac{17}{52}s^2 + \frac{32}{13}s + 3}{\frac{7}{15}\left(s+\frac{16}{7}\right)\left(s+6\right)} = \frac{255}{364}\,\frac{\left(s^2+\frac{128}{17}s+\frac{156}{17}\right)}{\left(s+\frac{16}{7}\right)\left(s+6\right)}$$

$$Y_B = \frac{255}{364} \frac{\left(\$ + \frac{26}{17}\right)\cancel{(\$+6)}}{\left(\$ + \frac{16}{7}\right)\cancel{(\$+6)}}$$

$$Y_B = \frac{255}{364} \frac{\left(\$ + \frac{26}{17}\right)}{\left(\$ + \frac{16}{7}\right)}$$



$$Z_B = \frac{364}{255} \frac{(\$ + 16/7)}{(\$ + 26/17)}$$

$$Z_C = Z_B - K'_{\infty} \Big|_{\$ = -\frac{7}{2}} = 0$$

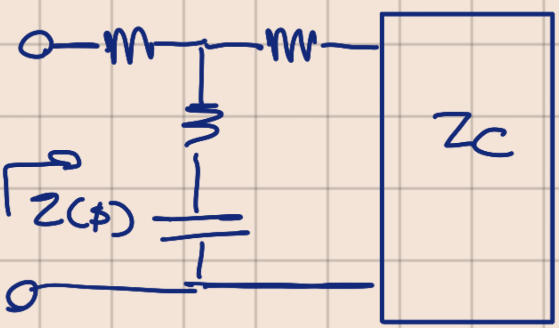
$$Z_B \Big|_{\$ = -\frac{7}{2}} = K'_{\infty} = \frac{884}{1005} \rightarrow \text{R que remuevo}$$

$$R = \frac{884}{1005}$$

$$Z_c = \frac{364}{255} \frac{(\$ + 16/7)}{(\$ + 26/17)} - \frac{884}{1005}$$

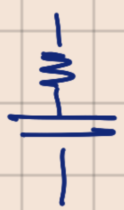
$$Z_c = \frac{364}{255} \frac{\left(\$ + 16/7 - \frac{289}{469} \$ - \frac{289}{469} \cdot \frac{26}{17} \right)}{(\$ + 26/17)}$$

$$Z_c = \frac{364}{255} \frac{\left(\frac{180}{469} \$ + \frac{90}{67} \right)}{(\$ + 26/17)}$$



$$Z_c = \frac{624}{1139} \cdot \frac{(\$ + 7/2)}{\$ + 26/17}$$

$$Y_c = \frac{1139}{624} \frac{\$ + 26/17}{(\$ + 7/2)}$$

$$\frac{\$ k'}{\$ + \sigma} \longrightarrow$$  donde $\sigma = 7/2$

$$k' = \lim_{\$ \to -7/2} \frac{(\$ + 7/2)}{\$} Y_c = \frac{1139}{624} \frac{-7/2 + 26/17}{-7/2}$$

$$k' = \frac{4489}{4368}$$

$$\frac{G_2 \cdot s}{s+\frac{1}{\tau_2}} = \frac{k' s}{s+\frac{7}{2}} \longrightarrow G_2 = \frac{4489}{4368} \longrightarrow R_2 = \frac{4368}{4489}$$

$$\frac{1}{\tau_1} = \frac{7}{2} \longrightarrow C = \frac{1}{R_2 \cdot \tau_{o2}}$$

$$\tau = R.C$$

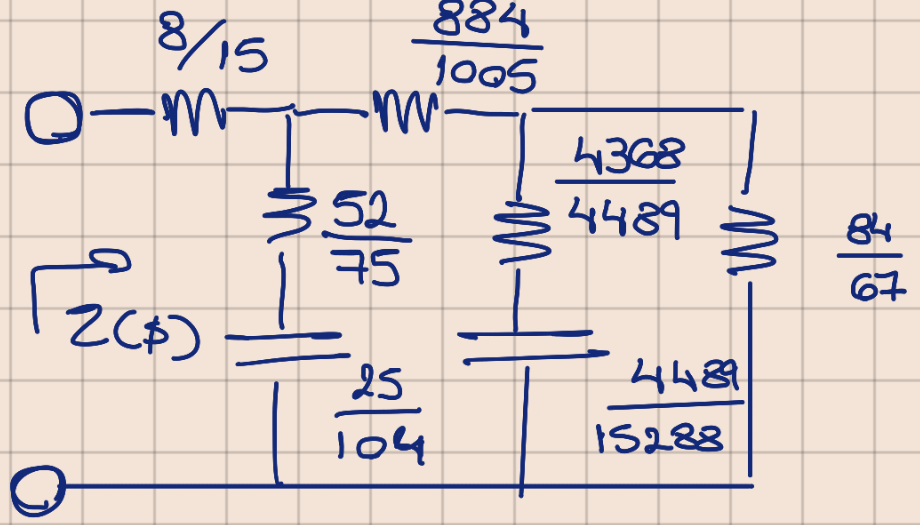
$$\frac{1}{\tau} = \frac{1}{RC} \rightarrow C_2 = \frac{\tau}{R} = \frac{1}{R \cdot \frac{7}{2}} = \frac{4489}{15288}$$

$$Yd = Yc - \frac{k' s}{s + 7/2}$$

$$Yd = \frac{1139}{624} \, \frac{s + 26/17}{(s + 7/2)} - \frac{4489/4368 \cdot s}{(s + 7/2)}$$

$$Yd = \frac{\frac{67}{84} s + \frac{67}{24}}{s + 7/2} = \frac{67}{84} \, \frac{\cancel{s + 7/2}}{\cancel{s + 7/2}}$$

$$Yd = \frac{67}{84} \longrightarrow \text{resistencia en derivacion}$$



Verifico:

$$Z(s) = \frac{s^2 + 6s + 8}{s^2 + 4s + 3}$$

$Z(0) = \frac{8}{3} \rightarrow$ Cumple

$Z(\infty) = 1 \longrightarrow$ Cumple

$R_1 . C_1 = 1/6 \rightarrow$ Cumple

$R_2 . C_2 = 2/7 \rightarrow$ Cumple

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

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

En este caso no se puede aplicar metodo grafico ya que hay singularidades fuera de los ejes:

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

Comienzo removiendo C1 en derivacion:

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

$$\lim_{\$\to\infty} \frac{Y(\$)}{\$} = 1 \longrightarrow$$ Saco un cap en derivacion $C=1$

$$Y_A(\$) = Y(\$) - \$ = \frac{2\$^2+6\$+5}{\$^2+\$+1}$$

Remuevo la R en derivacion:

$$Y_A(0) = 5$$

$$Y_A(\infty) = 2 \longrightarrow$$ remuevo en ∞

$$\lim_{\$\to\infty} Y_A(\$) = 2 \longrightarrow$$ Saco en derivacion una $R = \frac{1}{2}$

$$Y_B(\$) = Y_A(\$) - 2 = \frac{2\$^2+6\$+5}{\$^2+\$+1} - 2$$

$$Y_B(\$) = \frac{4\$+3}{\$^2+\$+1}$$

Como ahora debo remover en serie convierto a impedancia.

$$Z_B(\$) = \frac{\$^2+\$+1}{4\$+3}$$

remuevo el inductor en serie: (es un polo en ∞)

$$\lim_{\$\to\infty} \frac{Z_B(\$)}{\$} = \frac{1}{4} \longrightarrow$$ inductor en serie $L = \frac{1}{4}$

$$Z_C(\$) = Z_B(\$) - \$L$$

$$Z_C(\$) = \frac{\$^2+\$+1-\$\frac{1}{4}(4\$+3)}{4\$+3} = \frac{\$\cdot\frac{1}{4}+1}{4\$+3}$$

$$Z_C(\$) = \frac{1}{4}\,\frac{(\$+4)}{4(\$+\frac{3}{4})} = \frac{1}{16}\,\frac{(\$+4)}{(\$+3/4)}$$

Remuevo la Resistencia en serie:

$$Z_C(0) = \frac{1}{12}$$

$Z_C(\infty) = \frac{1}{16} \longrightarrow$ remuevo en ∞
R en serie de valor $R = 1/16$

$$Z_D(\$) = Z_C(\$) - \frac{1}{16}$$

$$Z_D(\$) = \frac{1}{16}\left(\frac{\$+4}{\$+3/4} - 1\right)$$

$$Z_D(\$) = \frac{1}{16}\left(\frac{13/4}{\$+3/4}\right) = \frac{13}{64} \; \frac{1}{\$+3/4}$$

Como ahora debo remover en derivacion convierto a admitancia.

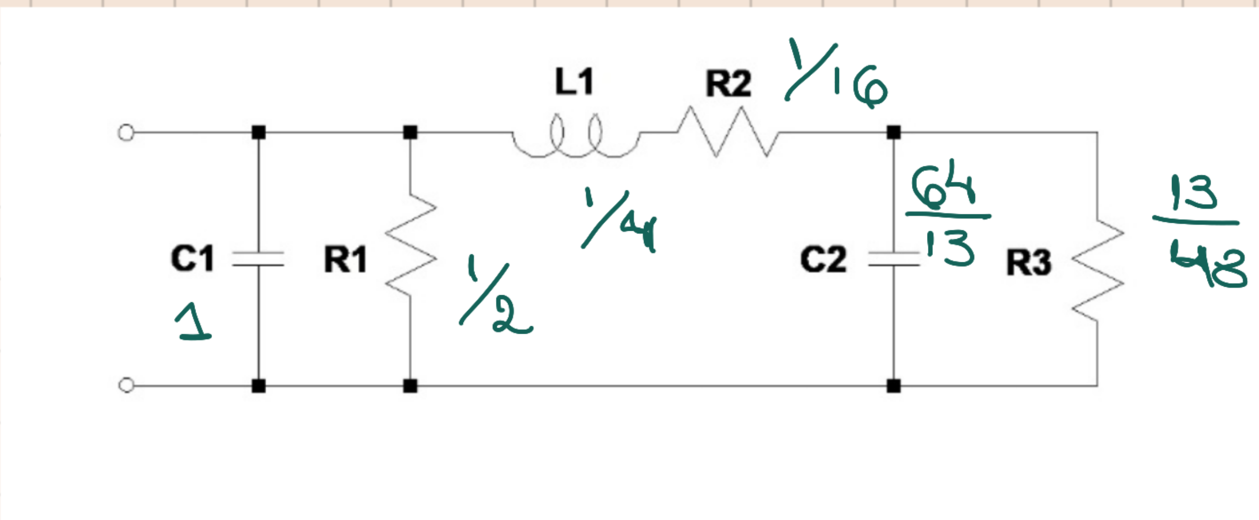
$$Y_D(\$) = \frac{64}{13} \cdot \frac{\$+3/4}{1}$$

remuevo en derivacion un capacitor (en ∞)

$$\lim_{\$\to\infty} \frac{Y_D(\$)}{\$} = k' = \frac{64}{13}$$

$$Y_e(\$) = Y_D(\$) - 64.\$ = \frac{64}{13} \frac{\left(\$+3/4 - \$\right)}{1}$$

$$Y_e(\$) = \frac{64}{13} \cdot \frac{3}{4}$$ $\rightarrow$ R en derivacion de valor $R = \frac{13}{48}$



Verifico:

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

$Z(0) = \frac{1}{5} \longrightarrow$ verifica $(R_1 \,//\, (R_2 + R_3))$

$Z(\infty) = 0 \longrightarrow$ verifica (C_1 se pone en CC.)