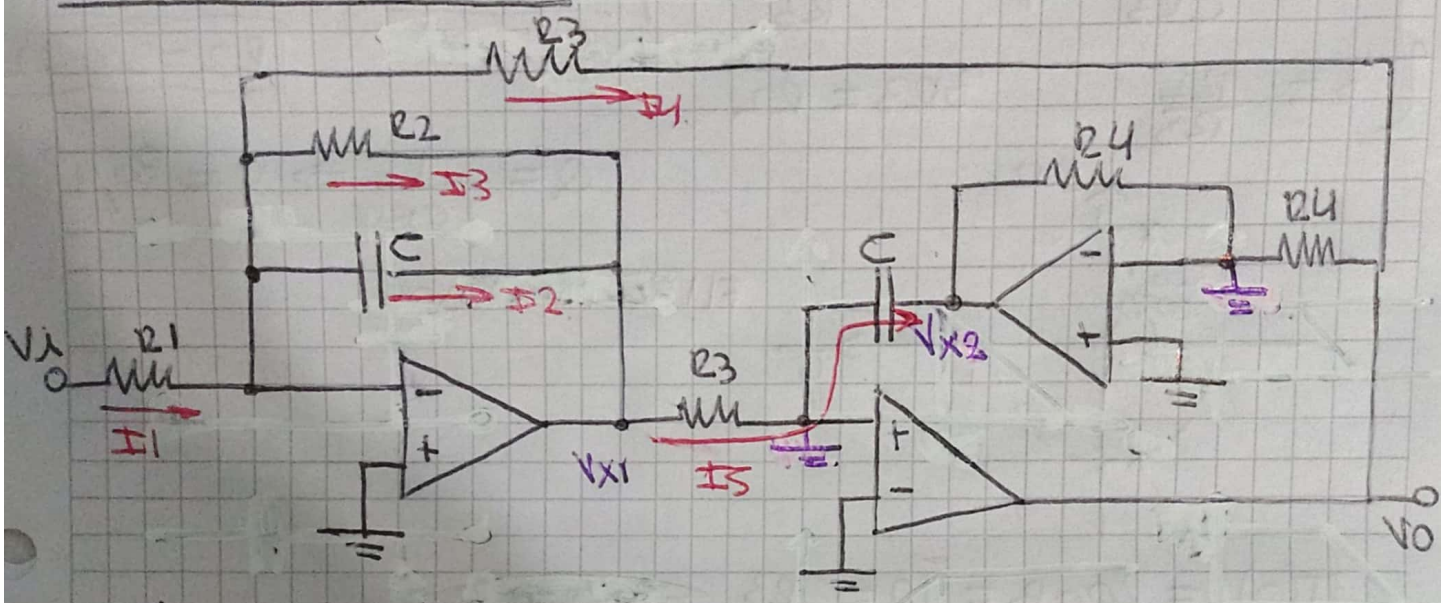
TRABAJO SEMANAL 2



$$V_{X2} = -\frac{R4}{R4} V_O$$

$$V_{X2} = -V_O$$

$$\frac{V_{X1}}{R3} = -V_{X2} \cdot SC$$

$$\bullet \quad \frac{V_{X1}}{SR3C} = V_O$$

$$I_1 = I_2 + I_3 + I_4 = -V_{X1} SC - \frac{V_{X1}}{R2} - \frac{V_O}{R3}$$

$$\frac{V_i}{R1} = -V_{X1}\left(SC + \frac{1}{R2}\right) - \frac{V_O}{R3}$$

$$\frac{V_i}{R1} = -V_O SCR3\left(SC + \frac{1}{R2}\right) - \frac{V_O}{R3}$$

$$\frac{V_i}{R1} = -V_O\left(S^2C^2R3 + SC\frac{R3}{R2} + \frac{1}{R3}\right)$$

$$T(S) = \frac{V_O}{V_i} = \frac{-\frac{1}{R1}}{S^2C^2R3 + SC\frac{R3}{R2} + \frac{1}{R3}}$$

$$T(S) = \frac{-1}{C^2R3} \cdot \frac{-\frac{1}{R1}}{S^2 + S\frac{1}{CR2} + \frac{1}{C^2R3^2}}$$

$$T(S) = -\frac{R3}{R1} \cdot \frac{\frac{1}{C^2R3^2}}{S^2 + S\frac{1}{CR2} + \frac{1}{C^2R3^2}}$$

$$W_O = \frac{1}{CR3}$$

$$\frac{W_O}{Q} = \frac{1}{CR2}$$

$$Q = \frac{R2}{R3}$$

NOTA

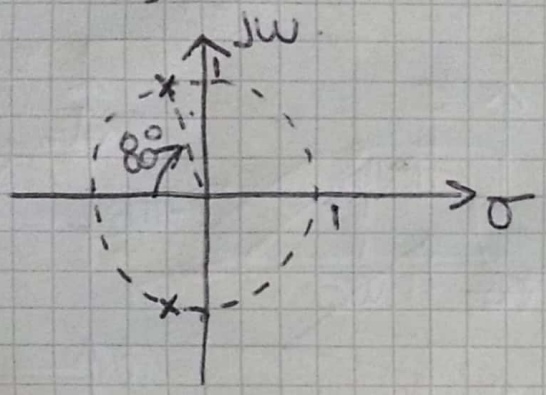
$\omega_0 = 1 \wedge Q = 3.$

$$\begin{cases} 1 = \frac{1}{CR3}, & C = \frac{1}{R3}, \\ 3 = \frac{R2}{R3} & 3R3 = R2. \end{cases}$$

$R3 = 100K \Rightarrow C = 10\mu F$

$R2 = 300K\Omega$

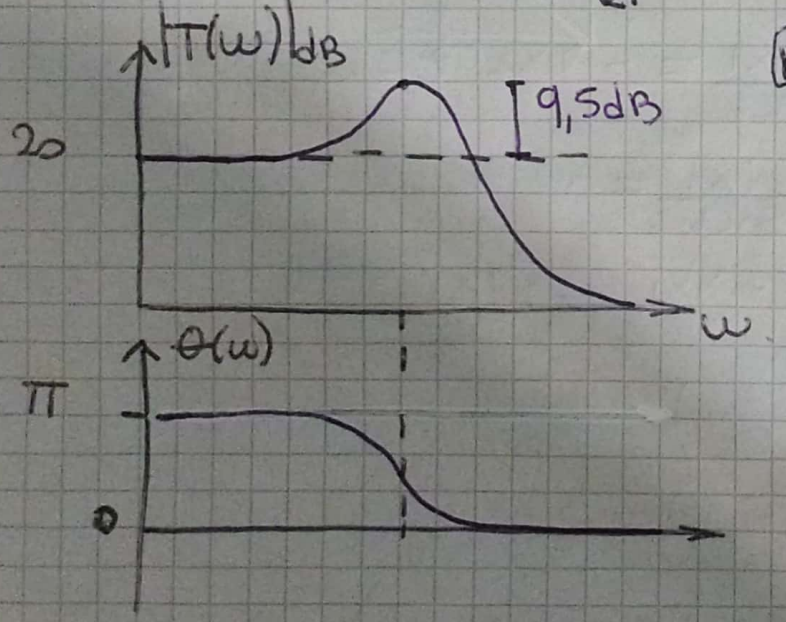
$$Q = \frac{1}{2\cos\psi} \Rightarrow \psi = 80{,}4°$$



FILTRO PASABAJOS

$$|T(0)| = 20dB = 10 = \frac{R3}{R1} \Rightarrow R1 = \frac{100K}{10}$$

$R1 = 10K$



$$\Re w = \omega_0 = \frac{1}{CR3} \Rightarrow \$ = \frac{S}{\frac{1}{CR3}}, \quad S = \$\frac{1}{CR3}$$

$$T(\$) = -\frac{R3}{R1} \frac{\frac{1}{C^2R3^2}}{\left(\$\frac{1}{CR3}\right)^2 + \$\frac{1}{CR3}\frac{1}{CR2} + \frac{1}{C^2R3^2}}$$

$$T(\$) = -\frac{R3}{R1} \frac{1}{\$^2 + S\frac{1}{\frac{R2}{R3}} + 1}$$

NOTA:

$\Omega z = R3$

$$T(\$) = \frac{-\frac{R3}{R3}}{\frac{R1}{R3}} \cdot \frac{1}{\$^2 + s\frac{1}{\frac{\frac{R2}{R3}}{\frac{R3}{R3}}} + 1}$$

$$T(\$) = -\frac{1}{R_1'} \frac{1}{\$^2 + \$\frac{1}{R_2'} + 1}$$

$R_1' = \frac{R1}{R3}$ $\quad R4' = \frac{R4}{R3}$

$R2' = \frac{R2}{R3}$ $\quad Zc'' = \frac{\frac{1}{\$\frac{1}{CR3}C}}{R3}$ $\quad \frac{1}{\$\frac{1}{R3}} \quad \frac{1}{R3}$

$R3' = 1$

$c'' = 1$

$R_1' = 0{,}1$ $\quad c'' = 1$

$R2' = 3$ $\quad R4' = 0{,}1$

$R3' = 1$

$$S_c^{w0} = \frac{c_0}{w0(c_0)} \frac{\partial w0}{\partial c}\Big|_{c=c_0}$$

$$= \frac{c_0}{w0(c_0)} \frac{\partial \frac{1}{CR3}}{\partial c}\Big|_{c=c_0} = \frac{c_0}{w0(c_0)} - \frac{1}{c_0^2 R3}$$

$$S_c^{w0} = -\frac{1}{\frac{1}{c_0 R3} c_0 R3}$$

$$S_c^{w0} = -1$$

$$S_{R3}^{Q} = \frac{R30}{Q(R30)} \left.\frac{\partial Q}{\partial R3}\right|_{R3=R30}$$

$$S_{R3}^{Q} = \frac{R30}{Q(R30)} \left.\frac{-R2}{R3^2}\right|_{R3=R30} = \frac{R30}{\frac{R2}{R30}} \frac{-R2}{R30^2}$$

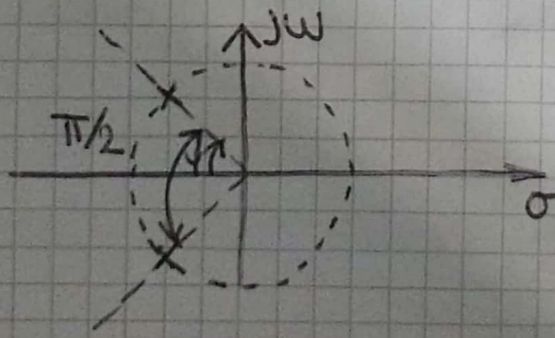
$$\boxed{S_{R3}^{Q} = -1}$$

$$S_{R2}^{Q} = \frac{R20}{Q(R20)} \left.\frac{\partial Q}{\partial R2}\right|_{R2=R20} = \frac{R20}{Q(R20)} \frac{1}{R3}$$

$$S_{R2}^{Q} = \frac{R20}{\frac{R20}{R3}} \frac{1}{R3}$$

$$\boxed{S_{R2}^{Q} = 1}$$

PARA QUE SE BUTTERWORTH de 2 do ORDEN, los polos deben estar separados $\frac{\pi}{n}$, donde $n=2 \Rightarrow \frac{\pi}{2}$.



$$\Rightarrow Q = \frac{1}{2\cos\varphi} = \frac{1}{2\cos\left(\frac{\pi}{4}\right)}$$

$$Q = \frac{1}{\sqrt{2}}$$

si mantengo $w_0 = 1 \frac{rad}{s}$ ∧ $\varphi = 1$

$$\Rightarrow \alpha_{MAX} = -20 \log \frac{1}{\sqrt{2}}$$

$$\alpha_{MAX} = 3\,dB$$

$$\frac{1}{\sqrt{2}} = \frac{R2}{R3}$$

$$R2 = \frac{R3}{\sqrt{2}} = \frac{100K}{\sqrt{2}}$$

$$\boxed{R2 = 70K}$$

NOTA

PARA hacer un PASABANDAS el numerador debe quedar multiplicado por s.

$$V_{X2} = -V_O$$

$$V_{X2} = T(s) \cdot V_i$$

$$V_{X1} = -SCR_3 V_{X2}$$

$$\frac{V_{X1}}{-SCR_3} = V_{X2} \quad ; \Rightarrow \quad -\frac{V_{X1}}{SCR_3} = T(s) V_i$$

$$+\frac{V_{X1}}{V_i} = T(s) SCR_3$$

$$\frac{V_{X1}}{V_i} = -\frac{R_3}{R_1} \frac{\frac{1}{C^2R_3^2} SCR_3}{s^2 + s\frac{1}{CR_2} + \frac{1}{C^2R_3^2}}$$

$$\frac{V_{X1}}{V_i} = -\frac{1}{R_1 C} \frac{1}{s^2 + s\frac{1}{CR_2} + \frac{1}{C^2R_3^2}}$$

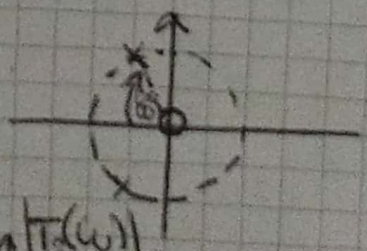
$$T_2(s) = -\frac{R_2}{R_1} \frac{\frac{s}{CR_2}}{s^2 + s\frac{1}{CR_2} + \frac{1}{C^2R_3^2}}$$

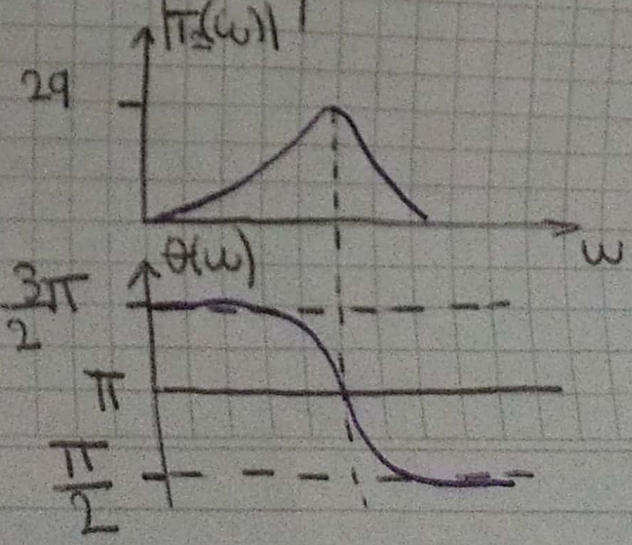
$$|T(\omega_0)| = -\frac{R_2}{R_1} \frac{\frac{1}{CR_2}}{\frac{1}{CR_3}\frac{1}{CR_2}} = -\frac{R_2}{R_1} R_3 C$$

$$|T(\omega_0)| = -\frac{R_2}{R_1} R_3 C = 30$$

$$B = \frac{\omega_0}{Q} = \frac{1}{\frac{1}{\sqrt{2}}}$$

$$B = \sqrt{2}$$





NOTA