1-)

a-) $H(s) = \dfrac{K}{\tau s+1} \Longrightarrow$ Open loop

$$H_{CL} = \frac{K}{\tau s+1+K} = \frac{\frac{K}{1+K}}{\frac{\tau}{1+K}s+1} \Longrightarrow \text{CLOSE LOOP}$$

$$K_{CL} = \frac{K}{1+K} \qquad \tau_{CL} = \frac{\tau}{1+K}$$

$$K_{CL} = \frac{4}{2} = 2 = \frac{K}{1+K} \Longrightarrow 2+2K = K$$

$$2 = -K$$

$$\boxed{K = -2}$$

$$4\tau_{CL} = 0.4$$

$$\tau_{CL} = \frac{0.4}{4} = 0.1 = \frac{\tau}{1+K}$$

$$\boxed{\tau = -0.1}$$

$$\boxed{H(s) = \frac{-2}{-0.1s+1}}$$

b-)

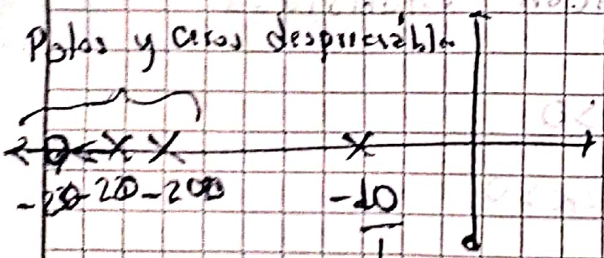
$$H(s) = \frac{K(\tau_3 s+1)}{(\tau s+1)(\tau_1 s+1)(\tau_2 s+1)}$$

$$4\tau = 0.4$$

$$\boxed{\tau = 0.1}$$

$$\boxed{K = \frac{4}{5}}$$

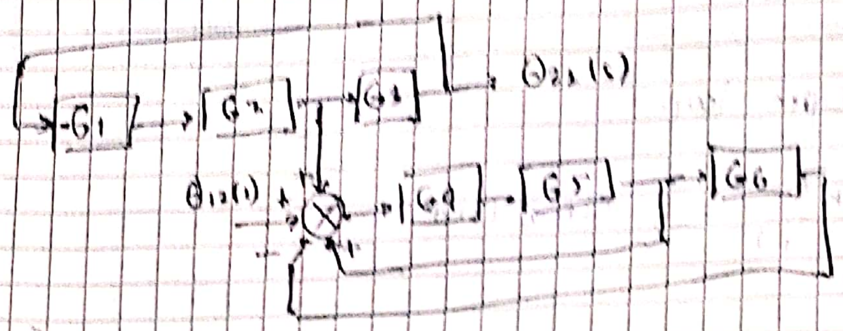
Polos y ceros despreciables

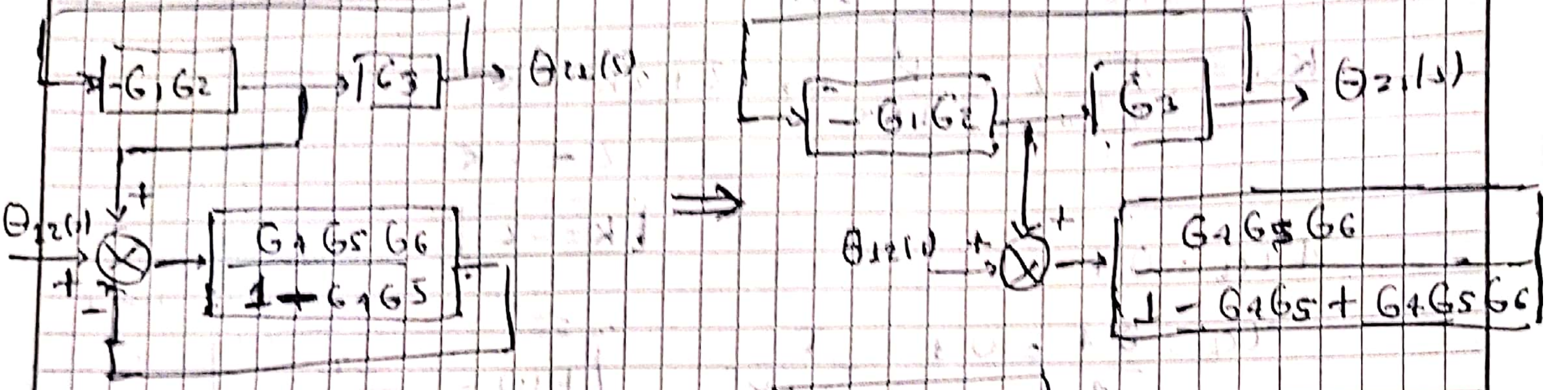


polo dominante

$$\boxed{\begin{aligned} \tau_1 &= \frac{1}{200} \\ \tau_2 &= \frac{1}{220} \\ \tau_3 &= \frac{1}{230} \end{aligned}}$$

b-) $H(s) = \dfrac{\Theta_{21}(s)}{\Theta_{12}(s)} = ?$





$$\boxed{\frac{\Theta_{21}(s)}{\Theta_{12}(s)} = 0}$$

La entrada Θ_{12} no influye en Θ_{21}

3-) Cerrando el lazo, el polinomio característico es:

$$D(s) = s^4 + 2s^3 + 3s^2 + 4s + K$$

a-)

s^4	1	3	K
s^3	2	4	0
s^2	A	B	
s	C		
s^0	K		

$$A = -\frac{(4-6)}{2} = 1$$

$$B = -\frac{(-2K)}{2} = K$$

$$C = -\frac{(2K-4)}{1} = 4-2K$$

Condición estabilidad:

$K > 0$

$4 - 2K > 0$

$4 > 2K$

$2 > K$

$$\boxed{0 < K < 2}$$

rango de valores de K para garantizar estabilidad

-) $K = 1$

Sistema es tipo 2 por lo tanto el $e_{ss} = 0$ cuando se ingrese un escalón