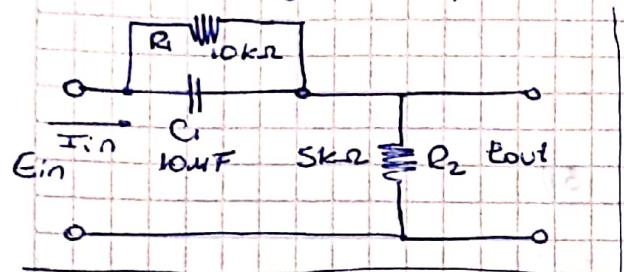


46) Encontrar $F(P)$ y trazar diagrama de BODE de magnitud y fase.



$$E_{in} = I_{in} \left(\frac{R_1 \cdot 1}{C_1 P} + R_2 \right)$$

$$E_{in} = I_{in} \left(\frac{R_1 + R_2 + R_3 R_1 C_1 P}{R_1 C_1 P + 1} \right)$$

$$E_{out} = R_2 \cdot I_{in}$$

$$F(P) = \frac{E_{out}}{E_{in}} = \frac{R_2}{\frac{R_2 R_1 C_1 P}{R_1 C_1 P + 1} + R_1 + R_2} = \frac{R_2 R_1 C_1 P + R_2}{R_2 R_1 C_1 P + R_1 + R_2}$$

$$F(P) = \frac{500P + 5 \times 10^3}{500P + 15 \times 10^3} = \frac{P + 10}{P + 30}$$

$$\boxed{F(P) = \frac{P + 10}{P + 30}}$$

$$F(P) = \frac{10 \left(\frac{P}{10} + 1 \right)}{30 \left(\frac{P}{30} + 1 \right)} = 0,3 \left(\frac{\frac{P}{10} + 1}{\frac{P}{30} + 1} \right)$$

$$|F(P)|_{dB} = \underbrace{20 \log 0,3}_{-10,457 \text{ dB.}} + 20 \log \sqrt{\left(\frac{w}{10}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{w}{30}\right)^2 + 1}$$

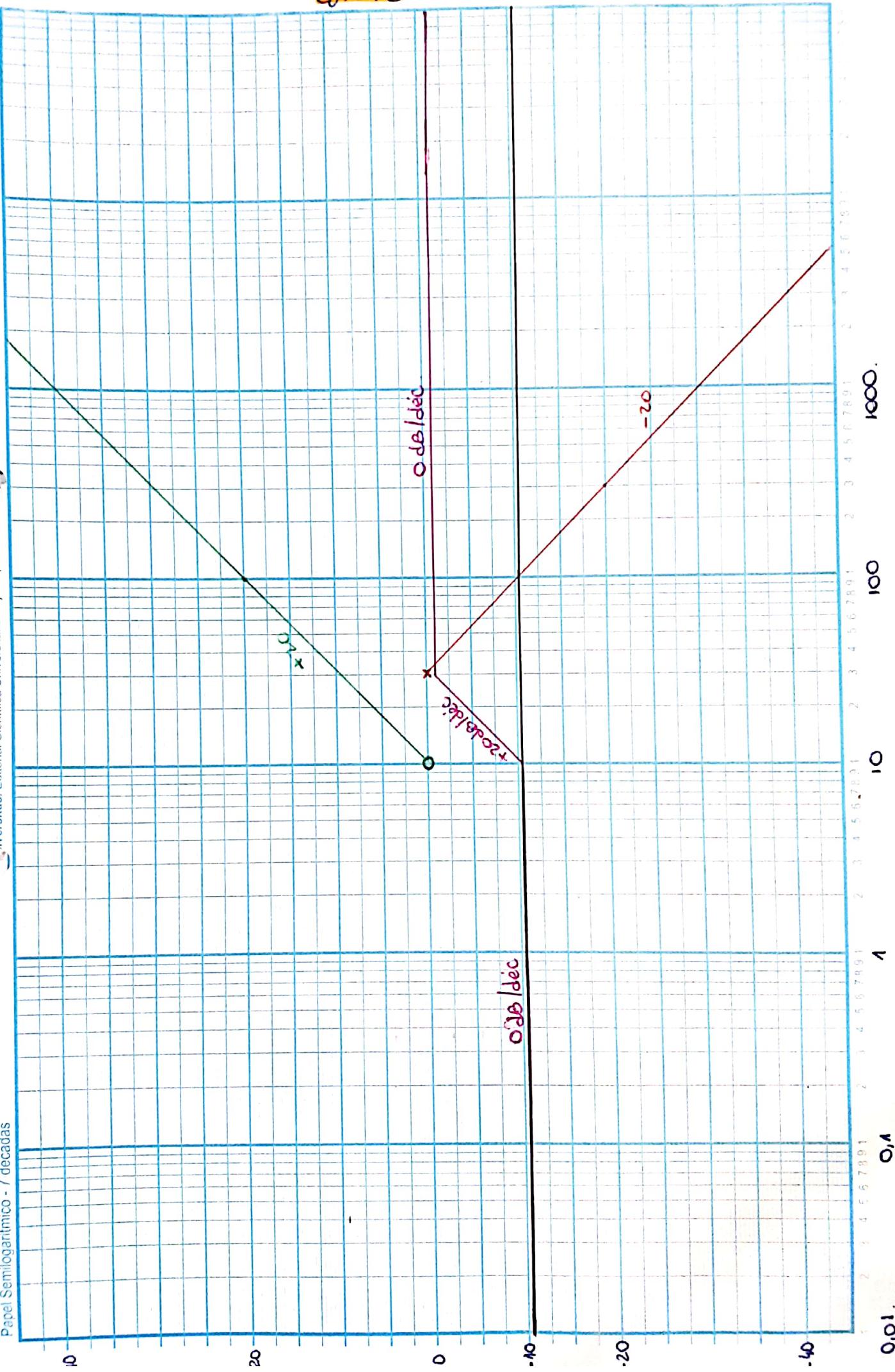
$$\boxed{\underline{|F(P)|} = \operatorname{tg}^{-1} \left(\frac{w}{10} \right) - \operatorname{tg}^{-1} \left(\frac{w}{30} \right)}$$

Ej. 46

3

Ej. 46.

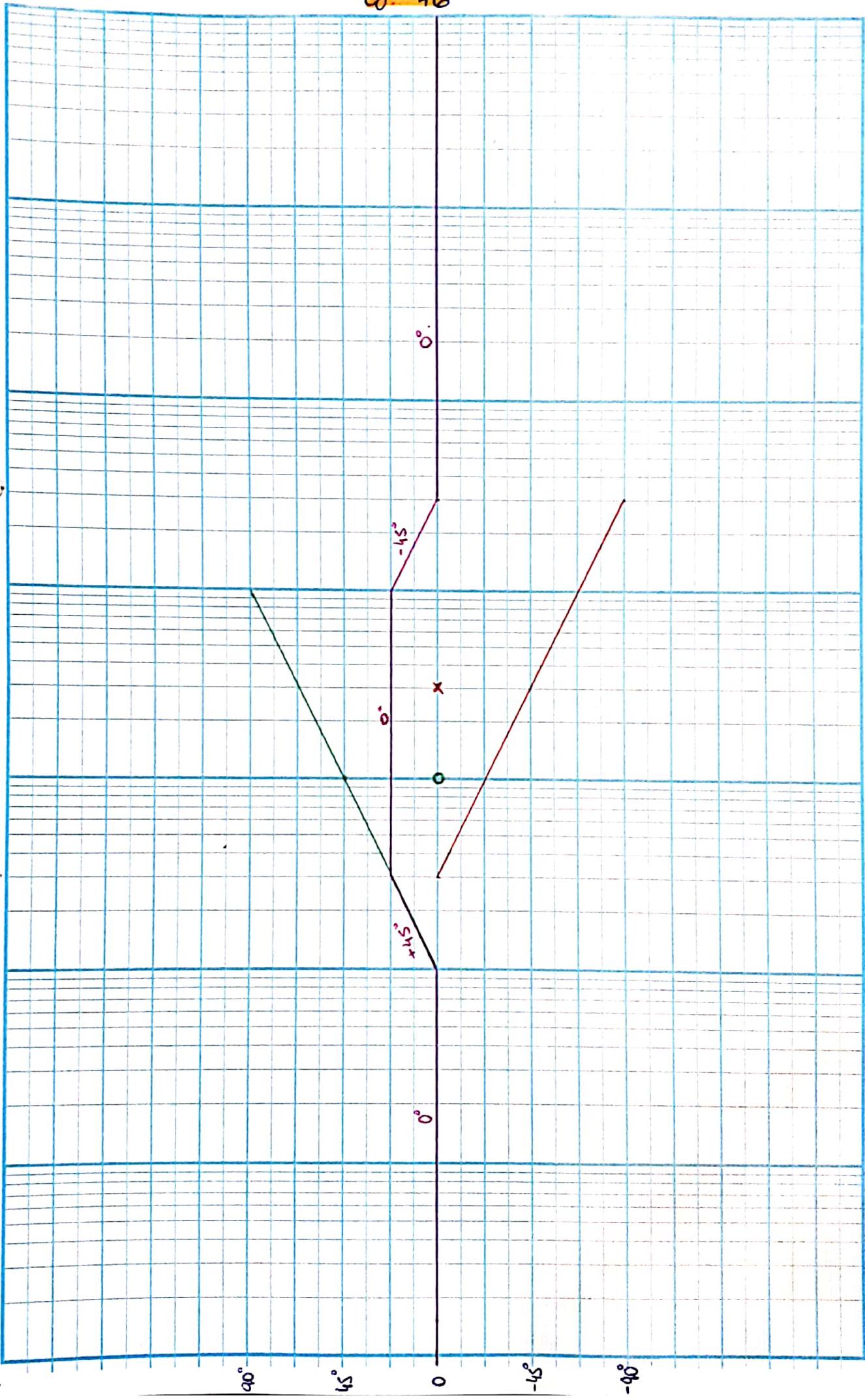
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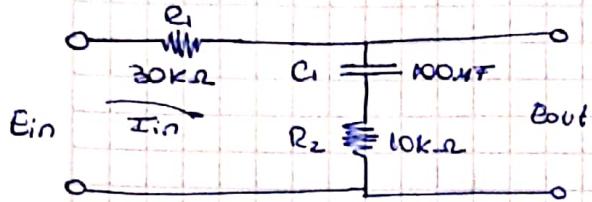
Ej. 46.

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Ej. 46



47) Encontrar $F(P)$ y trazar diagrama de BODE de magn. y fase.



$$E_{in} = I_{in} \left(R_1 + R_2 + \frac{1}{C_1 P} \right)$$

$$E_{in} = I_{in} \left(\frac{R_1 C_1 P + R_2 C_1 P + 1}{C_1 P} \right)$$

$$E_{out} = I_{in} \left(R_2 + \frac{1}{C_1 P} \right) = I_{in} \left(\frac{R_2 C_1 P + 1}{C_1 P} \right)$$

$$F(P) = \frac{E_{out}}{E_{in}} = \frac{R_2 C_1 P + 1}{R_1 C_1 P + R_2 C_1 P + 1}$$

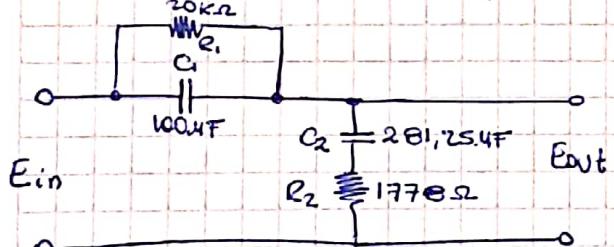
$$F(P) = \frac{P + 1}{4P + 1} = \frac{0,25(P+1)}{(P+0,25)}$$

$$\boxed{F(P) = \frac{\frac{P+1}{1}}{\frac{P}{0,25} + 1}}$$

$$\cdot |F(P)|_{dB} = 20 \log \sqrt{\left(\frac{\omega}{1}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{\omega}{0,25}\right)^2 + 1}$$

$$\cdot \underline{|F(P)|} = \operatorname{tg}^{-1} \left(\frac{\omega}{1} \right) - \operatorname{tg} \left(\frac{\omega}{0,25} \right)$$

48) Encontrar $F(P)$ y trazar BODE de magn. y fase.



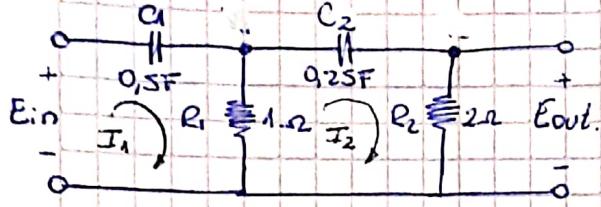
$$F(P) = \frac{(R_2 C_2 P + 1)(R_1 C_1 P + 1)}{R_1 R_2 C_1 C_2 P^2 + R_1 C_2 P + R_1 C_1 P + R_2 C_2 P + 1}$$

$$F(P) = \frac{(P+0,5)(P+2)}{(P+0,125)(P+8)} = \frac{\left(\frac{P}{0,5}+1\right)\left(\frac{P}{2}+1\right)}{\left(\frac{P}{0,125}+1\right)\left(\frac{P}{8}+1\right)}$$

$$\cdot |F(P)| = 20 \log \left(\sqrt{\left(\frac{\omega}{0,5}\right)^2 + 1} \right) + 20 \log \sqrt{\left(\frac{\omega}{2}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{\omega}{0,125}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{\omega}{8}\right)^2 + 1}$$

$$\cdot \underline{|F(P)|} = \operatorname{tg}^{-1} \left(\frac{\omega}{0,5} \right) + \operatorname{tg}^{-1} \left(\frac{\omega}{2} \right) - \operatorname{tg}^{-1} \left(\frac{\omega}{0,125} \right) - \operatorname{tg}^{-1} \left(\frac{\omega}{8} \right)$$

49) Encontrar $F(p)$ y trazar BODE de magnitud y fase.



$$Z_{11} = R_1 + \frac{1}{C_1 P}$$

$$Z_{12} = Z_{21} = -R_1$$

$$Z_{22} = R_1 + R_2 + \frac{1}{C_2 P}$$

$$\begin{bmatrix} R_1 + \frac{1}{C_1 P} & -R_1 \\ -R_1 & R_1 + R_2 + \frac{1}{C_2 P} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} E_{in} \\ 0 \end{bmatrix}$$

$$E_{out} = I_2 \cdot R_2$$

$$E_{out} = \frac{\Delta_2}{\Delta P} \cdot R_2 =$$

$$\Delta_2 = R_1 \cdot E_{in}$$

$$E_{out} = \frac{R_1 \cdot E_{in} \cdot R_2}{\Delta P} \rightarrow F(p) = \frac{E_{out}}{E_{in}} = \frac{R_1 \cdot R_2}{\Delta P}$$

$$\Delta P = \left(R_1 + R_2 + \frac{1}{C_2 P} \right) \left(R_1 + \frac{1}{C_1 P} \right) - R_1^2$$

$$\Delta P = \frac{R_1 C_2 P + R_2 C_2 P + 1}{C_2 P} \cdot \frac{C_1 P + R_1 + 1}{C_1 P} - R_1^2$$

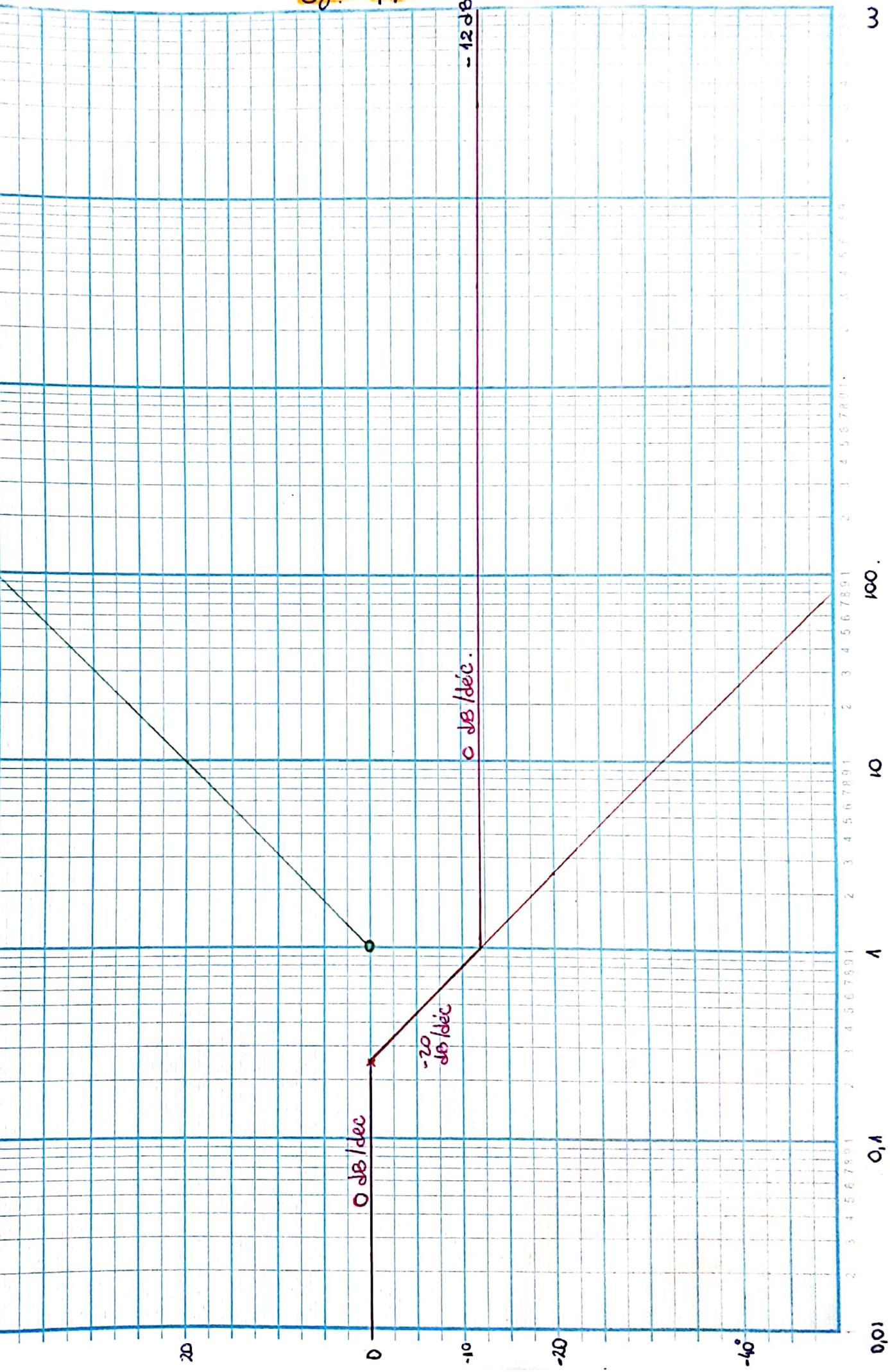
$$\Delta P = \frac{0,25 P + 0,5 P + 1}{0,25 P} \cdot \frac{0,5 P + 1}{0,5 P} - 1 = \frac{(0,75 P + 1)(0,5 P + 1)}{0,125 P^2} - 1 = \frac{0,125 P^2 + 1,25 P + 1}{0,125 P^2} - 1 = \frac{0,125 P^2 + 0,25 P^2 + 1,25 P + 1}{0,125 P^2} - 1 = \frac{0,375 P^2 + 1,25 P + 1}{0,125 P^2} - 1 = \frac{3 P^2 + 10 P + 8}{P^2} - 1 = \frac{2(P+4)(P+1)}{P^2} - 1$$

$$F(p) = \frac{-2 \cdot P^2}{2(P+4)(P+1)} = \frac{P^2}{(P+4)(P+1)} = \frac{0,25}{\left(\frac{P}{4} + 1\right)\left(\frac{P}{4} + 1\right)}$$

$$|F(p)|_{dB} = \underbrace{20 \log 0,25}_{-12,04 \text{ dB}} + 20 \log \omega^2 - 20 \log \sqrt{\left(\frac{\omega}{4}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{\omega}{4}\right)^2 + 1}$$

$$\angle F(p) = 180^\circ - \operatorname{tg}^{-1} \left(\frac{\omega}{4} \right) - \operatorname{tg}^{-1} \left(\frac{\omega}{4} \right)$$

Ej. 47.



Ed. 47.

W

90°

45°

0°

-45°

-90°

0,01

0,1

1

100.

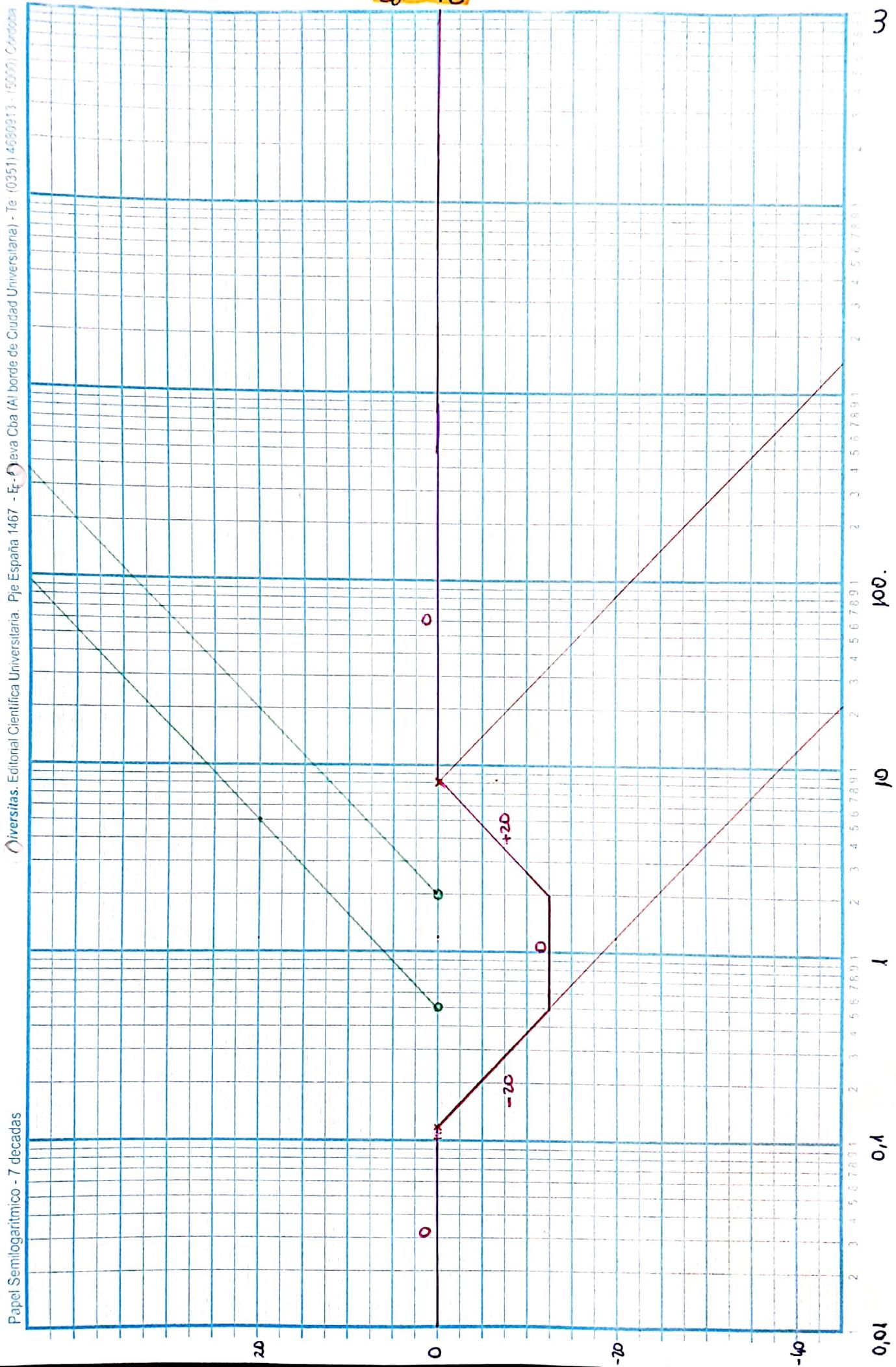
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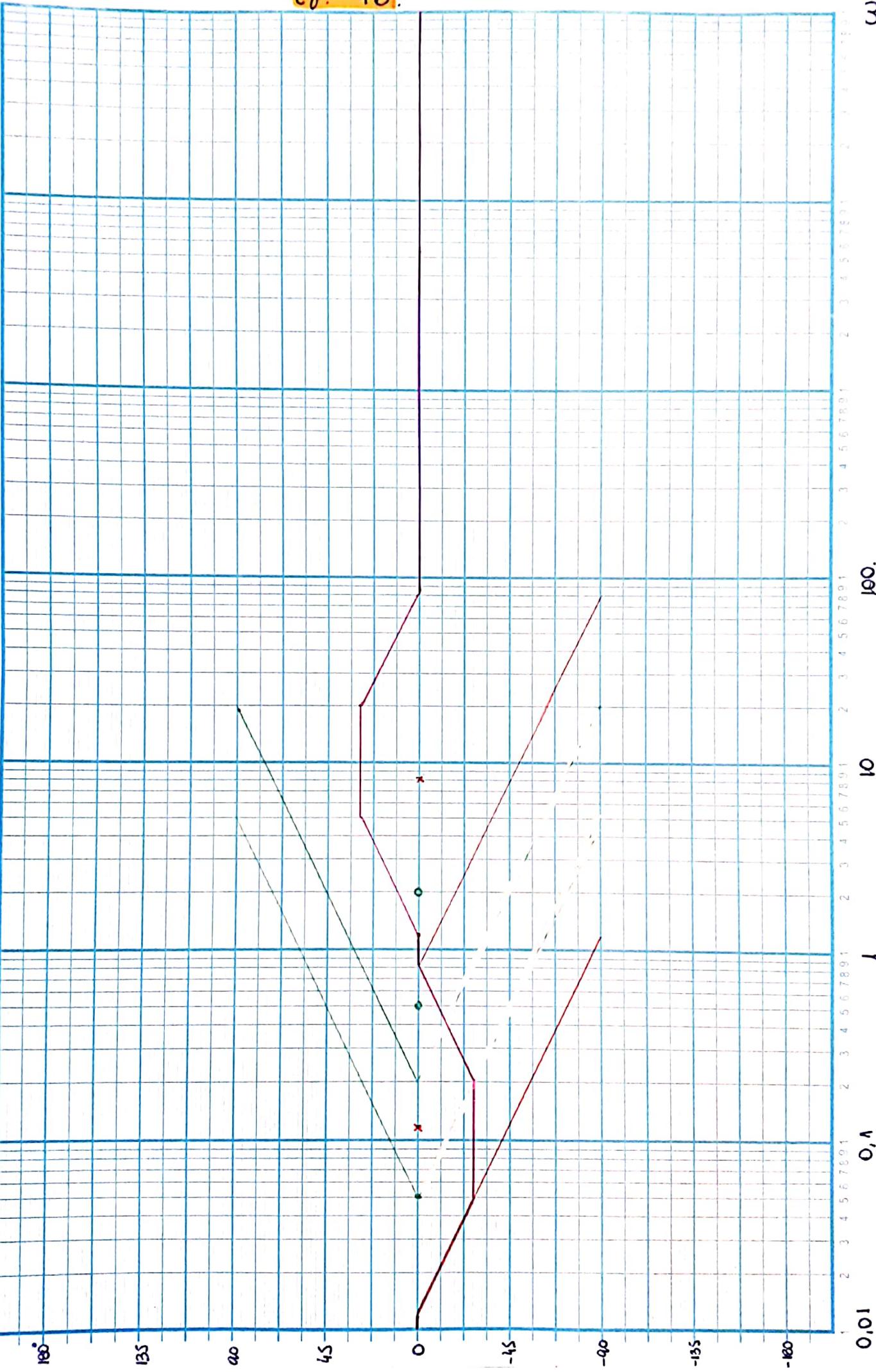
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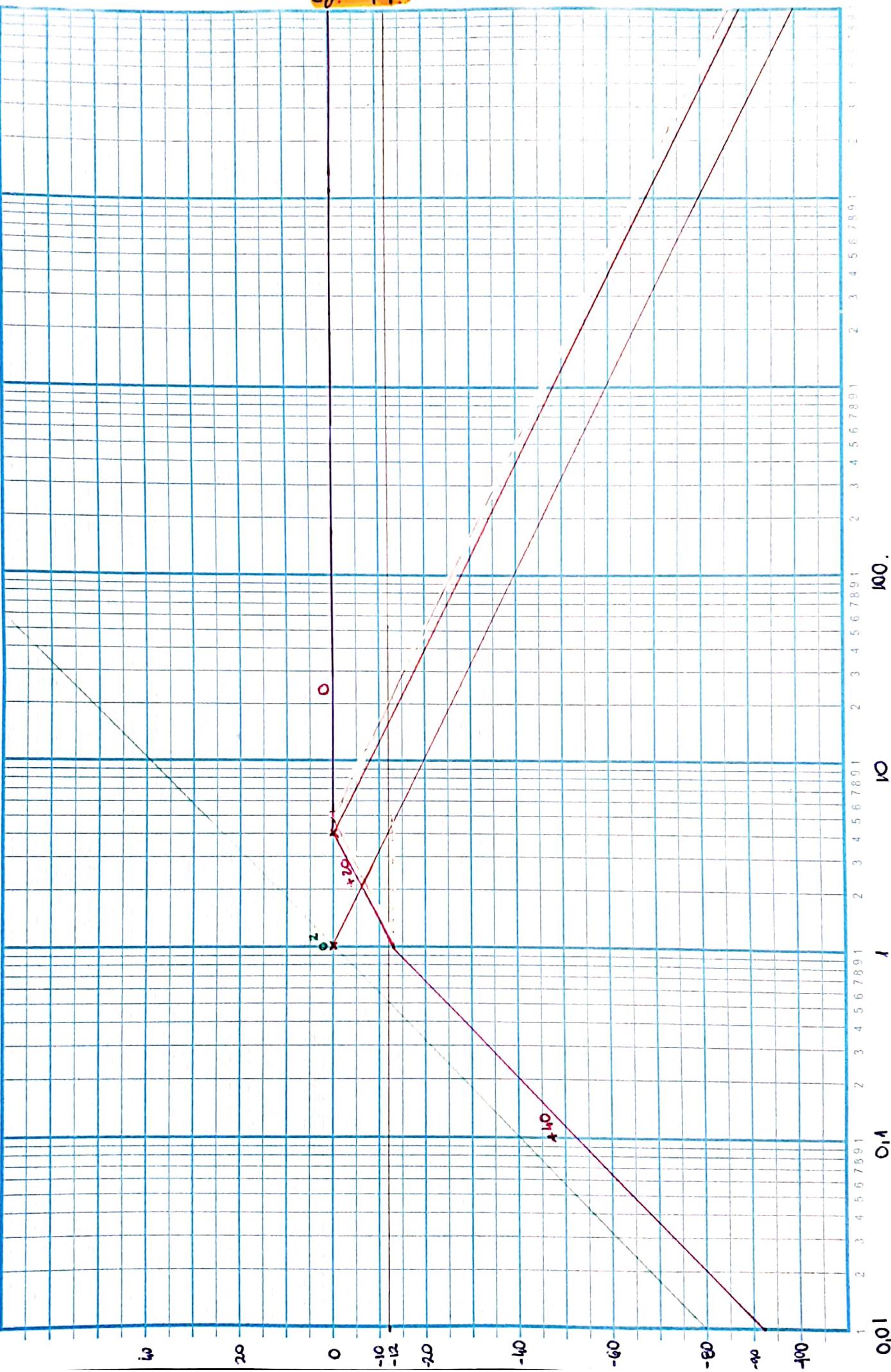
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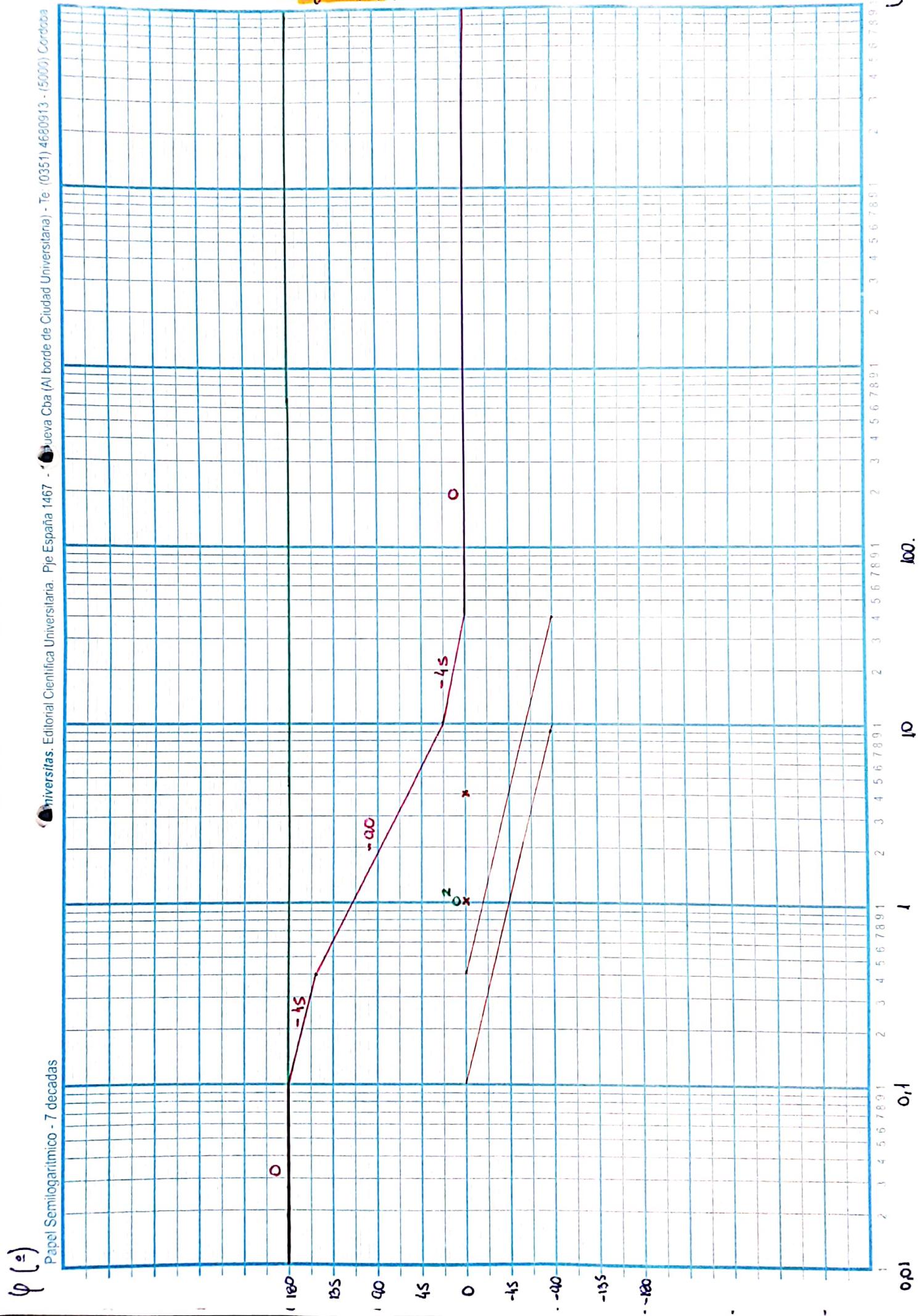


Ej. 48.



Ej. 49.





50) Trazar diagrama de BODE de =.

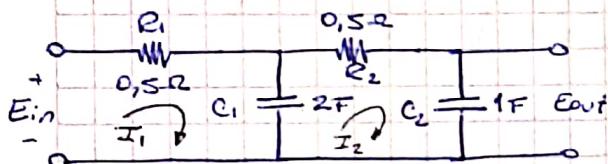
$$F(p) = \frac{10 (p+1) (p+10)}{(p+2) (p+5)} = \frac{10 \times 10 (p+1) \left(\frac{p}{10} + 1\right)}{2 \left(\frac{p}{2} + 1\right) 5 \left(\frac{p}{5} + 1\right)}$$

$$F(p) = \frac{10 \left(\frac{p}{1} + 1\right) \left(\frac{p}{10} + 1\right)}{\left(\frac{p}{2} + 1\right) \left(\frac{p}{5} + 1\right)}$$

$$|F(p)|_{dB} = \underbrace{20 \log 10}_{20dB} + 20 \log \sqrt{\left(\frac{w}{1}\right)^2 + 1} + 20 \log \sqrt{\left(\frac{w}{10}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{w}{2}\right)^2 + 1} - 20 \log \sqrt{\left(\frac{w}{5}\right)^2 + 1}$$

$$\underline{|F(p)|} = +\bar{g}^{-1} \left(\frac{w}{1} \right) + +\bar{g}^{-1} \left(\frac{w}{10} \right) - +\bar{g}^{-1} \left(\frac{w}{2} \right) - +\bar{g}^{-1} \left(\frac{w}{5} \right)$$

51) Encontrar $\bar{F}(p)$ y trazar BODE de magn. y fase.



$$Z_{11} = R_1 + \frac{1}{C_1 p} = 0,5 + \frac{1}{2p} = \frac{p+1}{2p}$$

$$Z_{12} = -\frac{1}{C_1 p} = -\frac{1}{2p}$$

$$Z_{22} = R_2 + \frac{1}{C_2 p} + \frac{1}{C_1 p} = \frac{p+3}{2p}$$

$$\begin{bmatrix} \frac{p+1}{2p} & -\frac{1}{2p} \\ -\frac{1}{2p} & \frac{p+3}{2p} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} E_{in} \\ 0 \end{bmatrix}$$

$$\bar{F}(p) = -\Delta_{12} \cdot \frac{1}{C_2 p} \cdot \frac{1}{\Delta p}$$

$$\Delta_{12} = -\frac{1}{2p}$$

$$\Delta p = \frac{(p+3)(p+1)}{4p^2} - \frac{1}{4p^2} = \frac{p^2 + 4p + 3 - 1}{4p^2} = \frac{p^2 + 4p + 2}{4p^2}$$

$$F(p) = \frac{1}{2p} \cdot \frac{1}{p} \cdot \frac{4p^2}{p^2 + 4p + 2} = \frac{2}{(p+0,586)(p+3,414)}$$

$$\bar{F}(p) = \frac{1}{\left(\frac{p}{0,586} + 1\right) \left(\frac{p}{3,414} + 1\right)}$$

$$|F(p)|_{dB} = -20 \log \left(\sqrt{\left(\frac{w}{0,586}\right)^2 + 1} \right) - 20 \log \sqrt{\left(\frac{w}{3,414}\right)^2 + 1}$$

$$\underline{|F(p)|} = -+\bar{g}^{-1} \left(\frac{w}{0,586} \right) - +\bar{g}^{-1} \left(\frac{w}{3,414} \right)$$

52)

Trazar BODE de magn. y fase de =.

$$\mathcal{F}(P) = \frac{20 \cdot P \cdot (P+5)}{(P+1)(P+10)}$$

$$\mathcal{F}(P) = \frac{20 \cdot 5 \cdot P \left(\frac{P}{5} + 1\right)}{\left(\frac{P}{1} + 1\right) 10 \left(\frac{P}{10} + 1\right)}$$

$$\mathcal{F}(P) = \frac{10 \cdot P \left(\frac{P}{5} + 1\right)}{\left(\frac{P}{1} + 1\right) \left(\frac{P}{10} + 1\right)}$$

$$|\mathcal{F}(P)|_{dB} = \underbrace{20 \log(10)}_{20dB} + 20 \log(w) + 20 \log \left(\sqrt{\left(\frac{w}{5}\right)^2 + 1} \right) - 20 \log \sqrt{\left(\frac{w}{1}\right)^2 + 1} + \dots \\ - 20 \log \sqrt{\left(\frac{w}{10}\right)^2 + 1}$$

$$\underline{\mathcal{F}(P)} = 90^\circ + \operatorname{tg}^{-1} \left(\frac{w}{5} \right) - \operatorname{tg}^{-1} \left(\frac{w}{1} \right) - \operatorname{tg}^{-1} \left(\frac{w}{10} \right)$$

53) Trazar BODE de magn. y fase de =.

$$\mathcal{F}(P) = \frac{4 \cdot (P+2)(P+5)}{P^2(P+10)} = \frac{4 \cdot 2 \left(\frac{P}{2} + 1\right) 5 \left(\frac{P}{5} + 1\right)}{P^2 \cdot 10 \left(\frac{P}{10} + 1\right)}$$

$$\mathcal{F}(P) = \frac{4 \left(\frac{P}{2} + 1\right) \left(\frac{P}{5} + 1\right)}{P^2 \left(\frac{P}{10} + 1\right)}$$

$$|\mathcal{F}(P)|_{dB} = \underbrace{20 \log 4}_{12,04dB} + 20 \log \sqrt{\left(\frac{w}{2}\right)^2 + 1} + 20 \log \sqrt{\left(\frac{w}{5}\right)^2 + 1} - 40 \log w - 20 \log \sqrt{\left(\frac{w}{10}\right)^2 + 1}$$

$$\underline{\mathcal{F}(P)} = -180^\circ + \operatorname{tg}^{-1} \left(\frac{w}{2} \right) + \operatorname{tg}^{-1} \left(\frac{w}{5} \right) - \operatorname{tg}^{-1} \left(\frac{w}{10} \right)$$

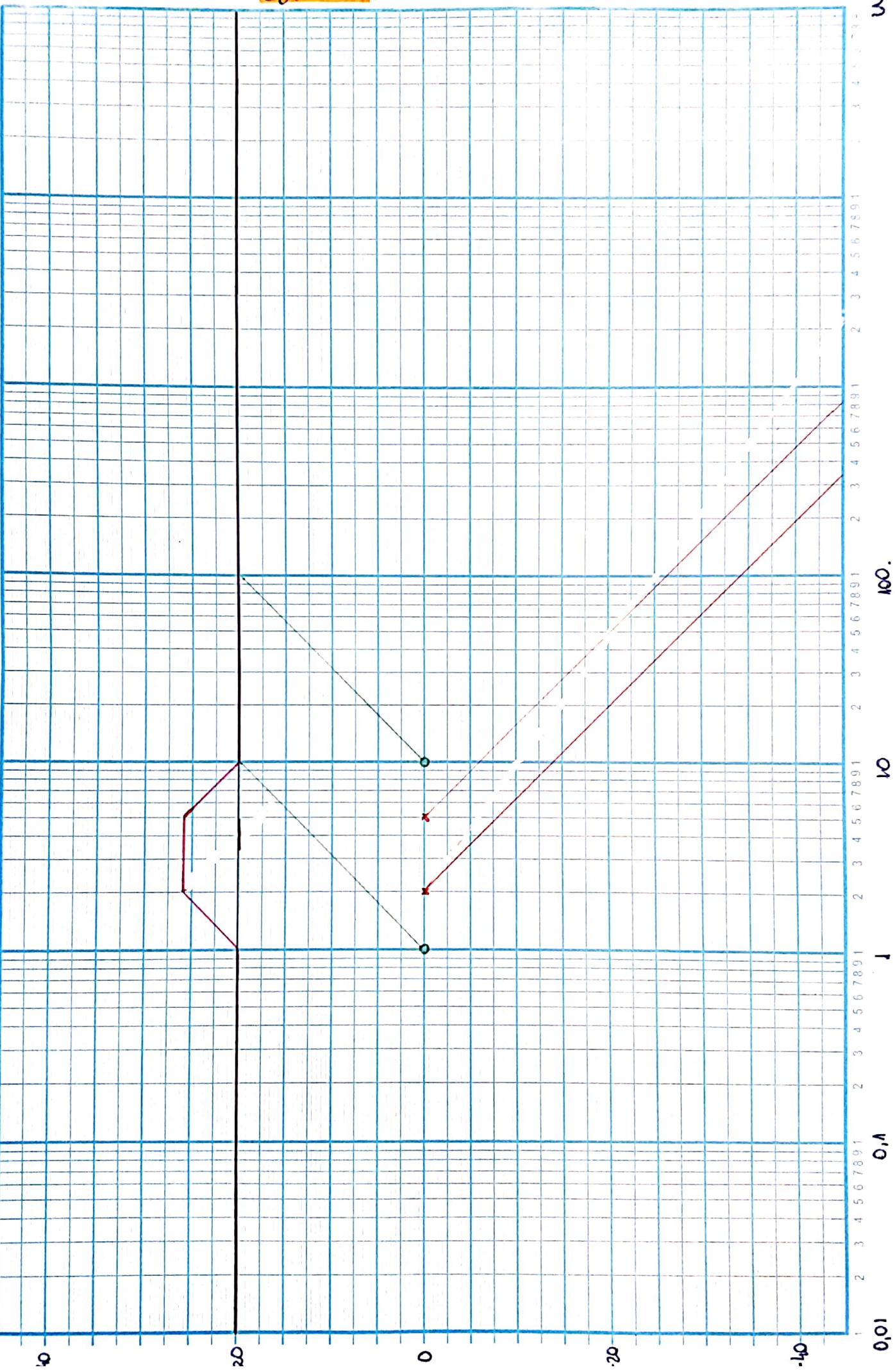
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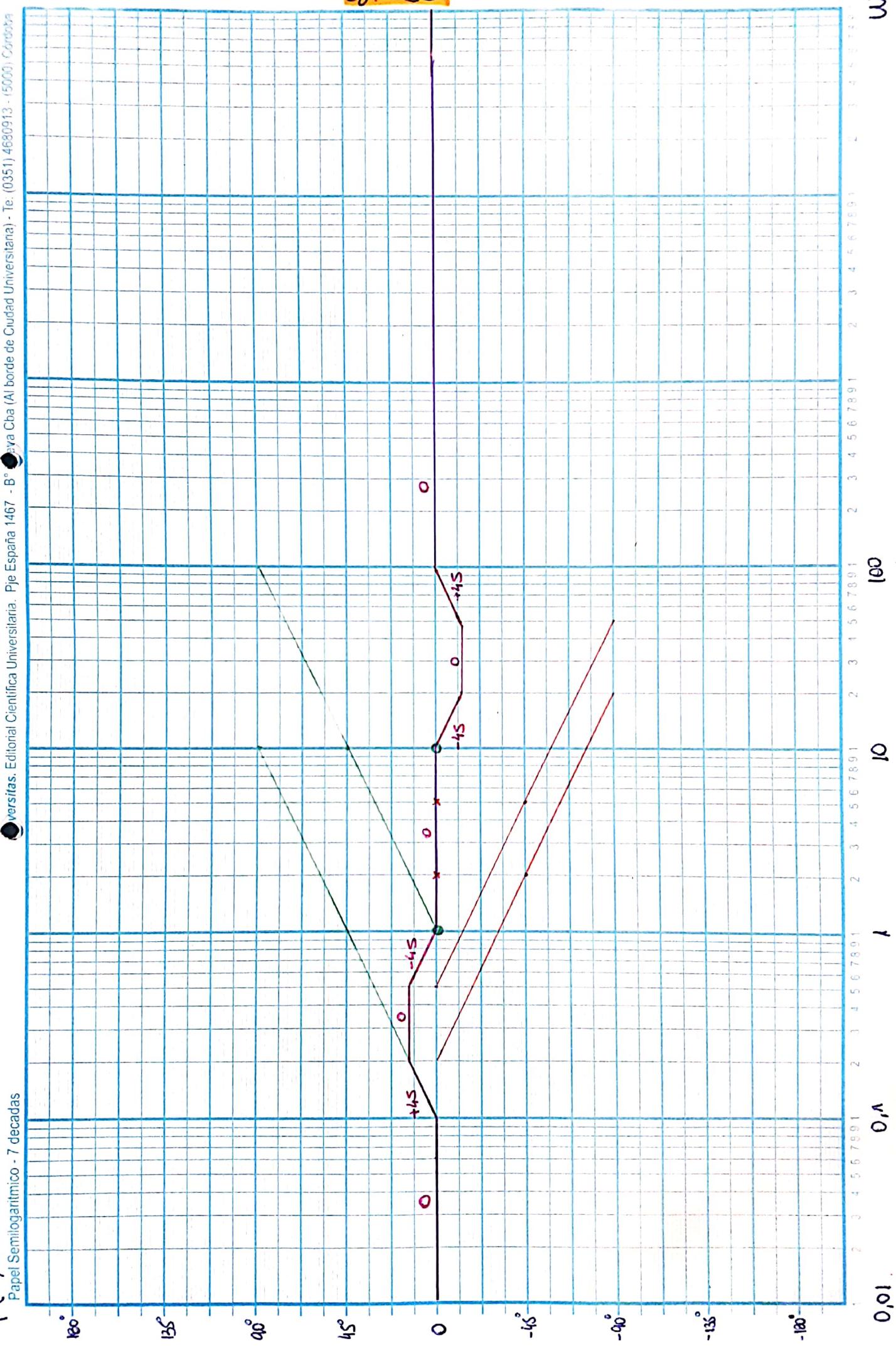
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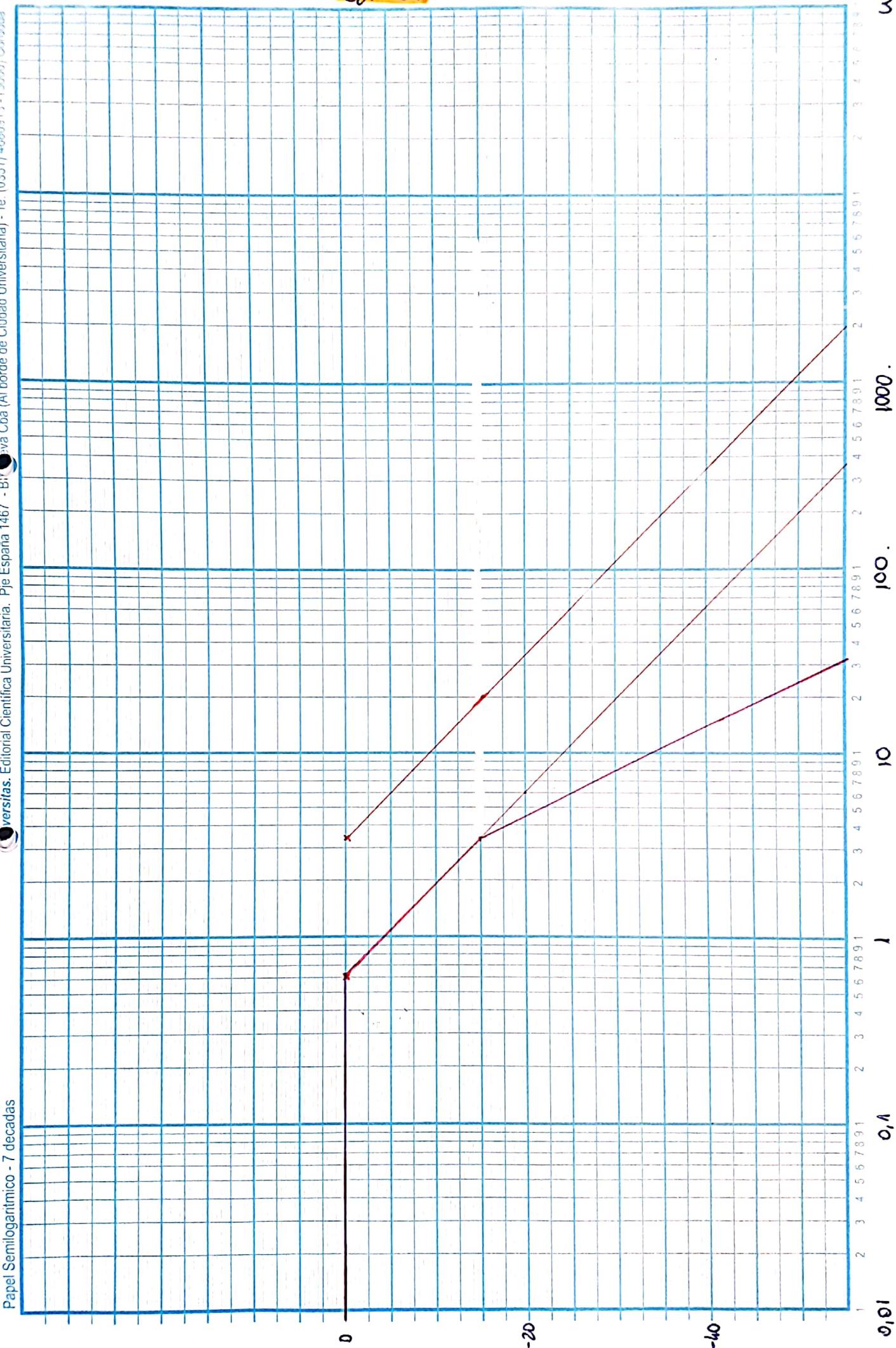


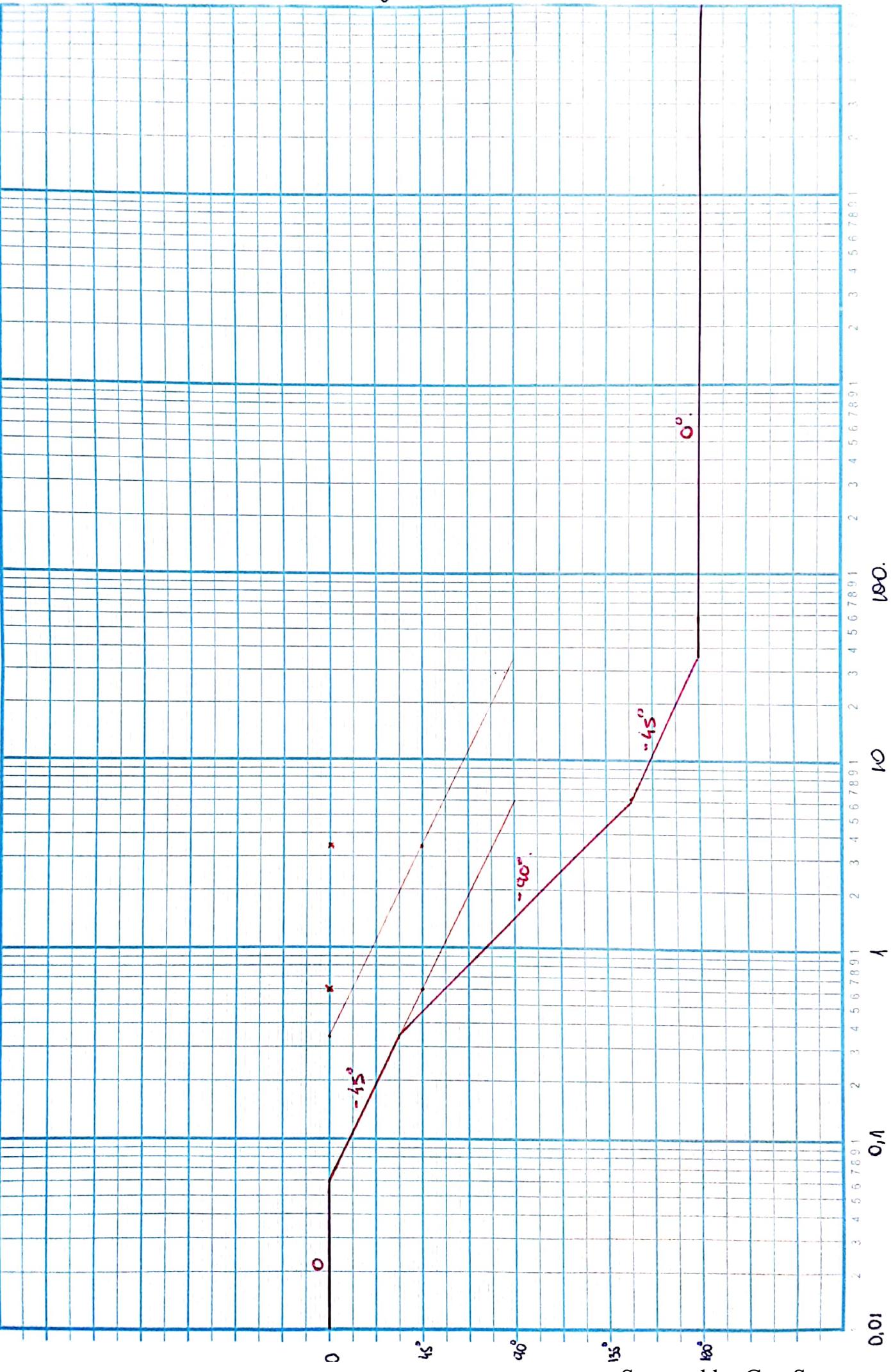
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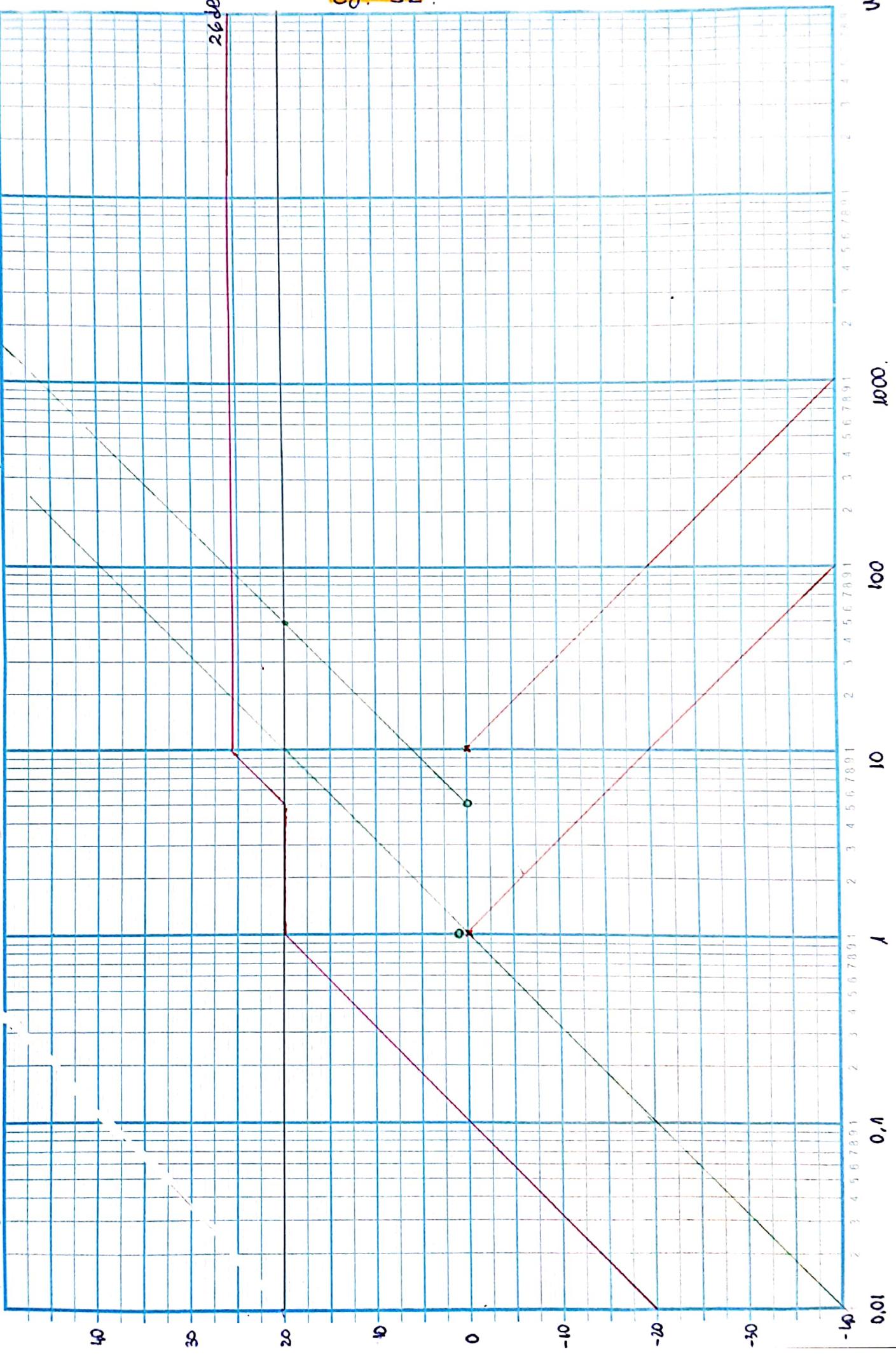
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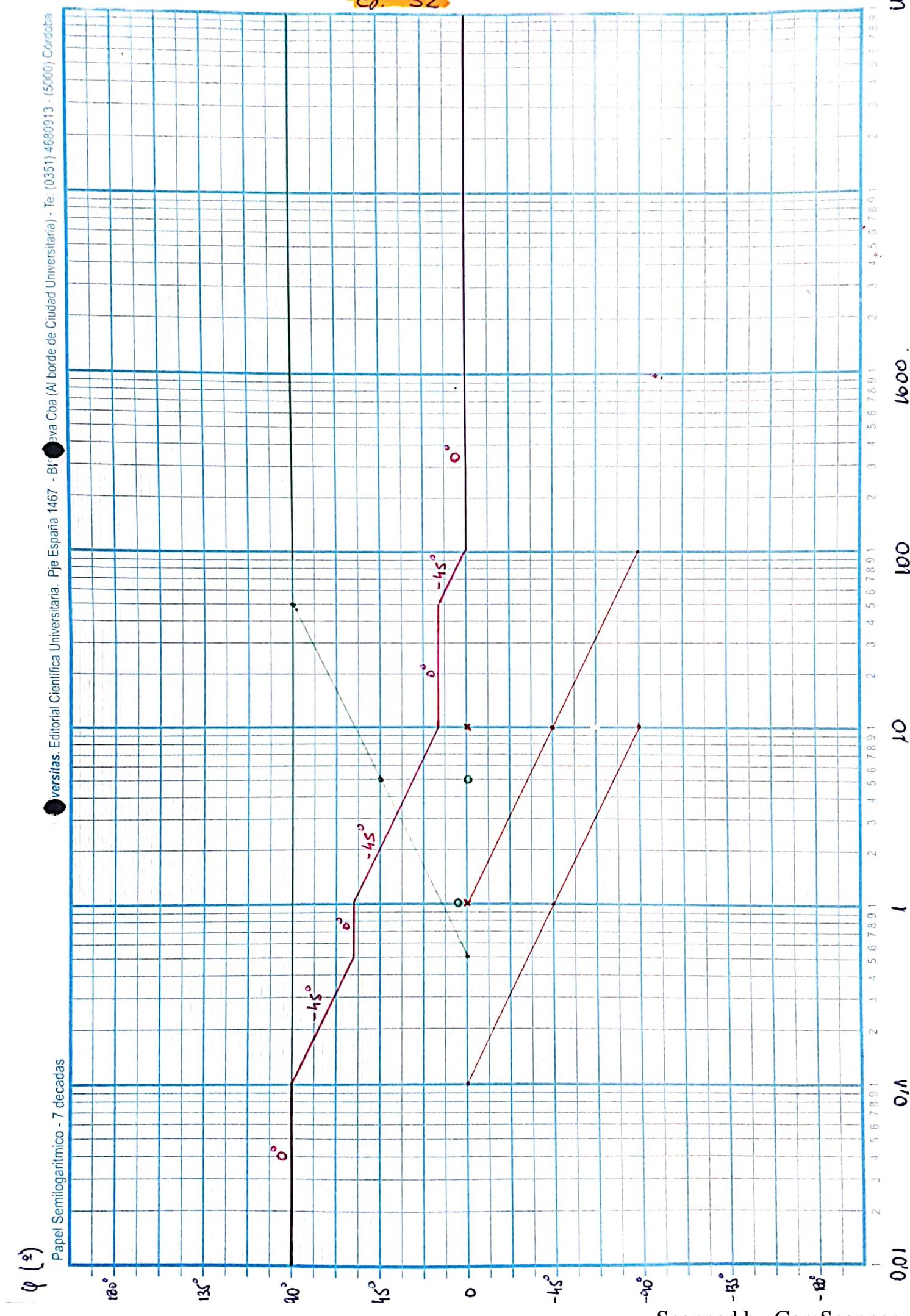
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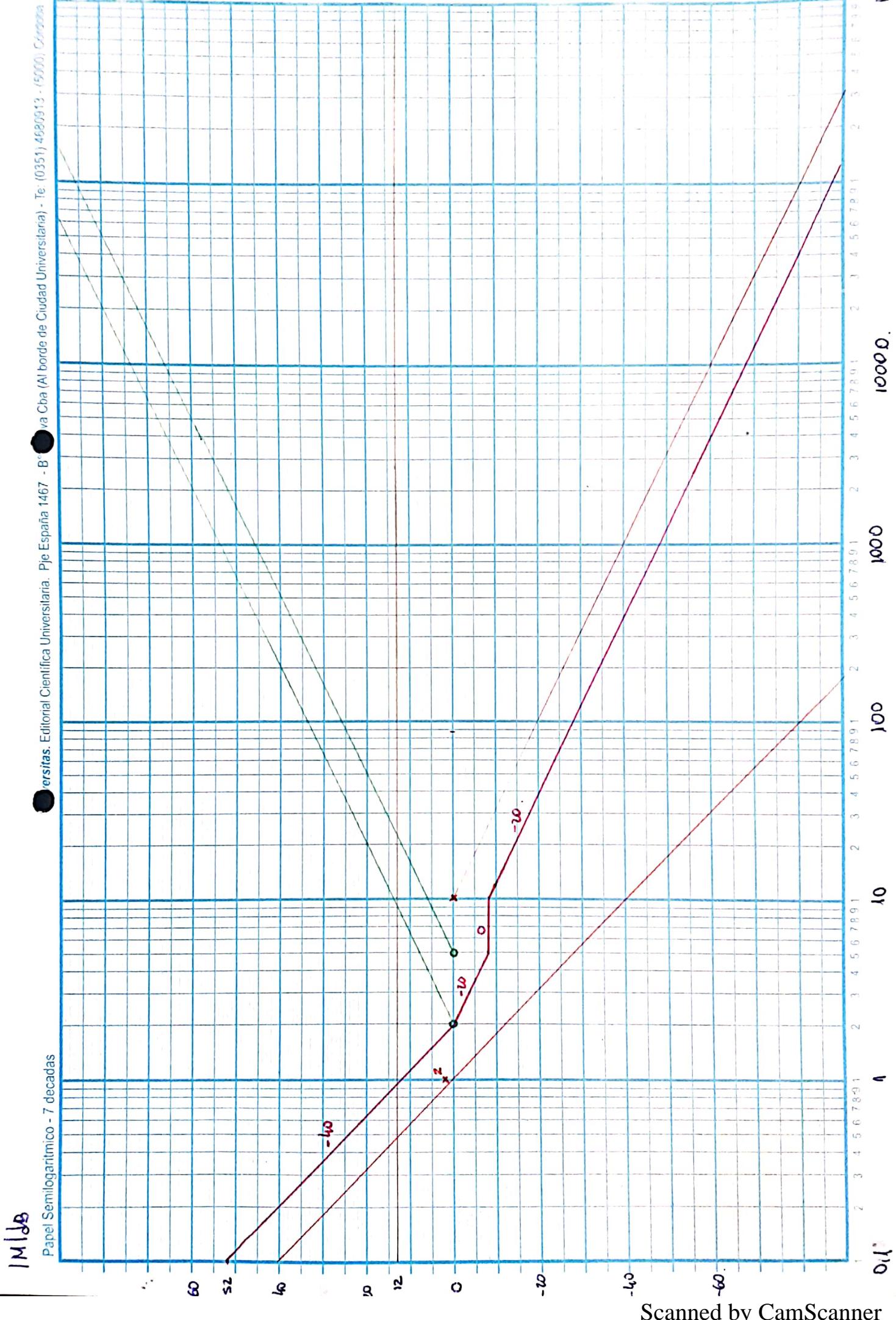
Ej. 52.

W





Ej. 53



Ej. 53.

4 (a)
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