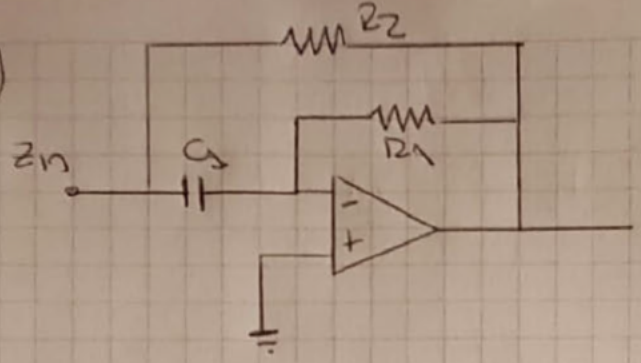
3) a)



$$I_1 = \frac{V_{in} - V_o}{R_2} + V_{in} S C_1 \quad (1) \qquad V_{in} S C_1 = \frac{-V_o}{R_1} \quad (2)$$

$$V_o = -V_{in} S C_1 R_1$$

$$I_1 = \frac{V_{in} + V_{in} S C_1 R_1}{R_2} + V_{in} S C_1$$

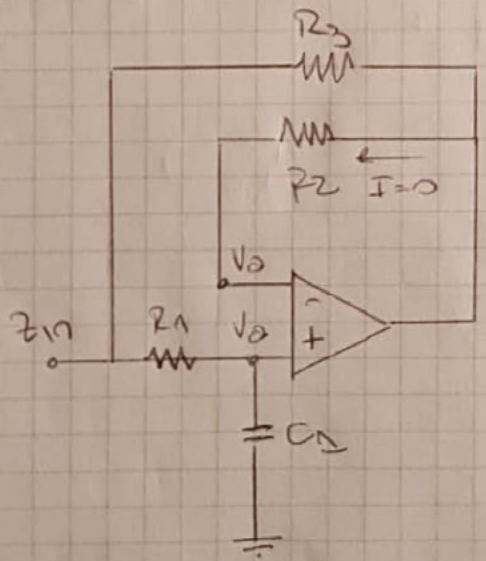
$$I_1 = \frac{V_{in}}{R_2} \left(\frac{1}{R_2} + \frac{S C_1 R_1}{R_2} + S C_1 \right)$$

$$I_1 = V_{in} \left(\frac{1 + S C_1 R_1 + S C_1 R_2}{R_2} \right)$$

$$\frac{V_{in}}{I_1} = \frac{R_2}{1 + S(C_1 R_1 + C_1 R_2)}$$

→ A MEDIDA QUE AUMENTO LA FRECUENCIA EL 1 SE DESPRECIA Y TIENE CARACTER CAPACITIVO

b)



$$\frac{V_{in} - V_o}{R_3} + \frac{V_{in} - V_a}{R_1} = I_1 \quad (1)$$

$$V_a S C_1 = \frac{V_{in} - V_a}{R_1} \quad (2)$$

$$V_o = V_a$$

(2): $V_a S C_1 + \frac{V_a}{R_1} = \frac{V_{in}}{R_1} \rightarrow V_a \left(\frac{S C_1 R_1 + 1}{R_1} \right) = \frac{V_{in}}{R_1}$

(1):

[redacted]

[redacted]

$$\frac{V_{in} - \frac{V_{in}}{SC_1R_1+1}}{R_3} + \frac{V_{in}}{SC_1R_1+1} \cdot SC_1 = I_1$$

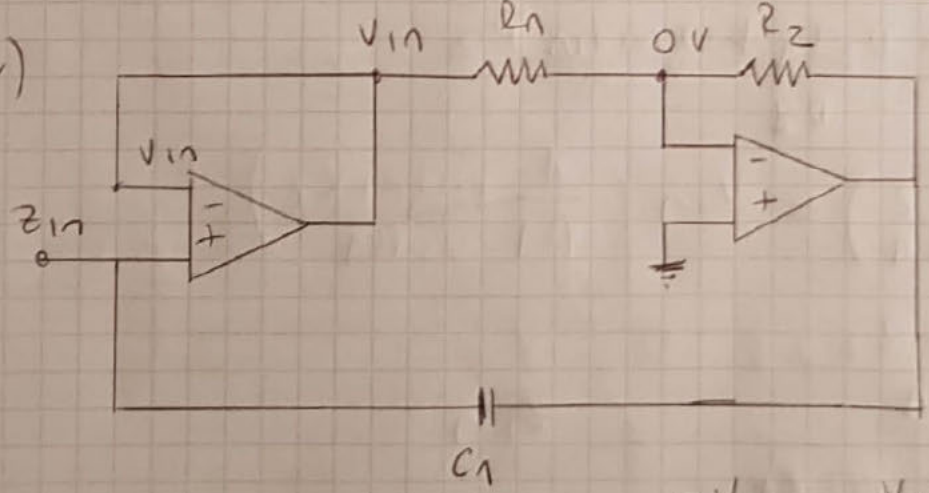
$$V_{in}\left(\frac{1}{R_3} - \frac{1}{(SC_1R_1+1)R_3} + \frac{SC_1}{SC_1R_1+1}\right) = I_1$$

$$V_{in}\left(\frac{SC_1R_1+1-1+R_3SC_1}{R_3(SC_1R_1+1)}\right) = I_1$$

$$Z_{in} = \frac{R_3(SC_1R_1+1)}{SC_1R_1+R_3SC_1} = \frac{R_3(SC_1R_1+1)}{SC_1(R_3+R_1)}$$

RESISTIVO-CAPACITIVO

C)



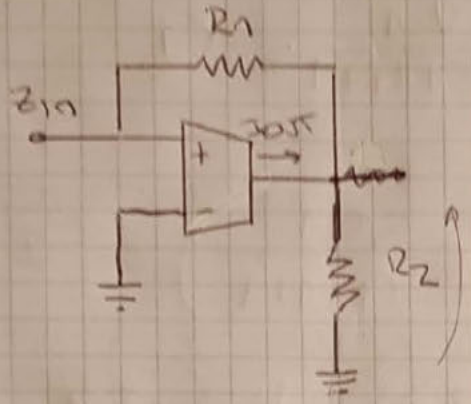
$$\frac{V_{in}-V_0}{} SC_1 = I_1 \qquad \frac{-V_0}{R_2} = \frac{V_{in}}{R_1}$$

$$\left(V_{in} + V_{in}\frac{R_2}{R_1}\right) SC_1 = I_1 \qquad +V_0 = \frac{-V_{in}R_2}{R_1}$$

CAPACITOR

$$V_{in}\left(SC_1 + SC_1\frac{R_2}{R_1}\right) = I_1 \qquad Z_{in} = \frac{R_1}{R_1SC_1+R_2SC_1}$$

d)



[redacted]

$$I_1 = \frac{V_{in} - V_o}{R_1}$$

$$I_{out(ota)} = g_m V_{in}$$

$$\frac{V_o}{R_2} = I_1 + I_{out}$$

$$I_1 = \frac{V_{in} - R_2 I_1 + g_m V_{in} R_2}{R_1}$$

$$I_1 \left(1 + \frac{R_2}{R_1}\right) = V_{in} \left(\frac{1}{R_1} + \frac{g_m R_2}{R_1}\right)$$

$$\frac{\frac{R_1 + R_2}{R_1}}{\frac{1 + g_m R_2}{R_1}} = Z_{in}$$

$$\frac{R_1 + R_2}{1 + g_m R_2}$$

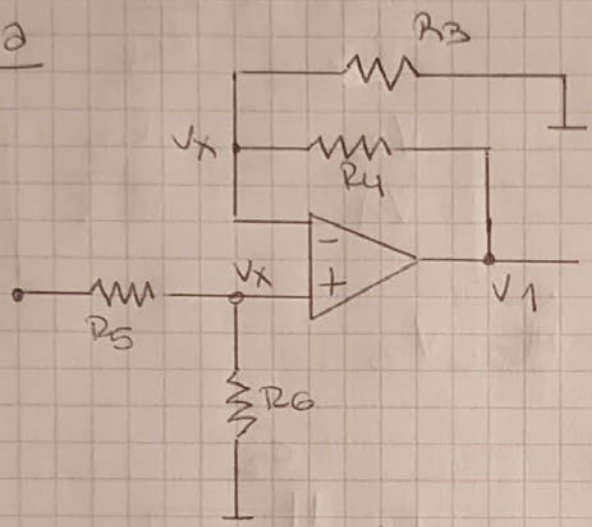
- COMPORTAMIENTO RESISTIVO

NOTA

8) POR SUPERPOSICION

$$V_1 = \underbrace{T_{1a} V_i}_{V_2 = V_3 = 0} + \underbrace{T_{1b} V_2}_{V_i = V_3 = 0} + \underbrace{T_{1c} V_3}_{V_i = V_2 = 0}$$

T_{1a}



$$V_x = V_i \frac{R_6}{R_5 + R_6}$$

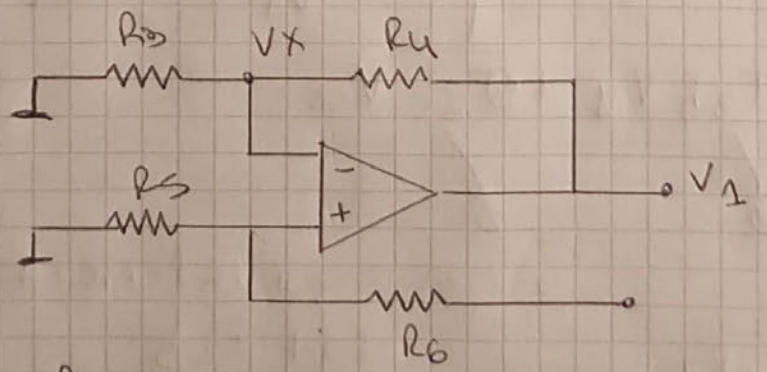
$$V_x = V_1 \frac{R_3}{R_4 + R_3}$$

$$\frac{V_i R_6}{R_5 + R_6} = \frac{V_1 R_3}{R_4 + R_3}$$

$$V_i R_6 (R_4 + R_3) = R_3 (R_5 + R_6) V_1$$

$$\frac{V_1}{V_i} = \frac{R_6}{R_5 + R_6} \left(1 + \frac{R_4}{R_3}\right)$$

T_{1b}

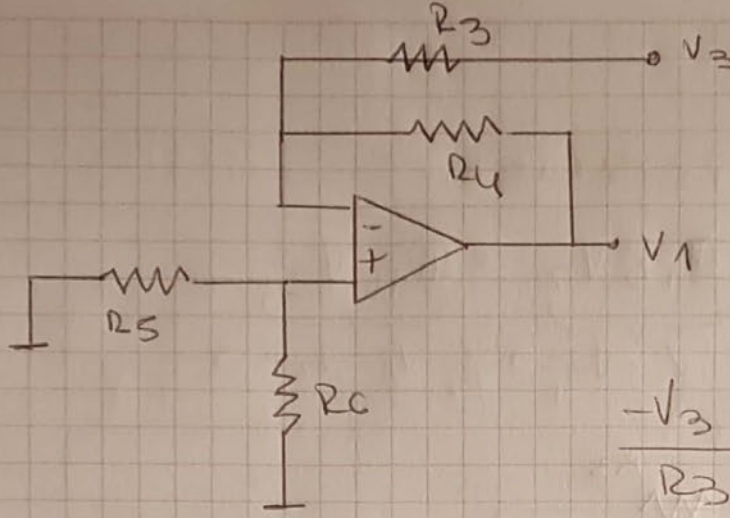


$$V_x = V_2 \frac{R_5}{R_6 + R_5}$$

$$V_x = \frac{R_3 V_1}{R_4 + R_3}$$

$$\frac{V_2}{V_1} = \frac{R_3}{R_4 + R_3} \left(1 + \frac{R_6}{R_5}\right)$$

T.1c



$$\frac{-V_3}{R_3} = \frac{V_1}{R_4}$$

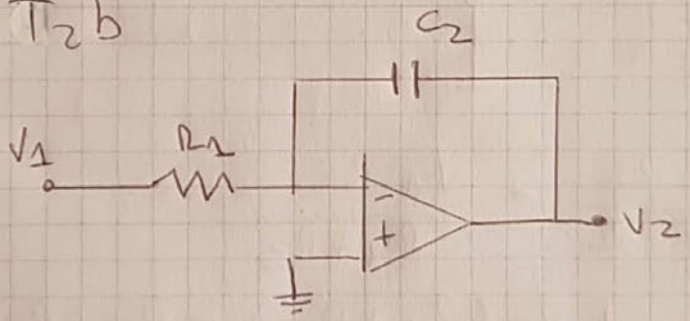
$$\boxed{\frac{V_3}{V_1} = -\frac{R_3}{R_4}}$$

$$V_2 = T_{2a} V_i + \frac{1}{s} T_{2b} V_1 + T_{2c} V_3$$

$T_{2a} \to \phi$

$T_{2c} \to \phi$

T_{2b}



$$\frac{-V_1}{R_1} = V_2 s C_2$$

$$\frac{V_2}{V_1} = -\frac{1}{s C_2 R_1}$$

$$V_3 = T_{3a} V_i + T_{3b} V_1 + \frac{1}{s} T_{3c} V_2$$

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$$T_{3c} = -\frac{1}{s C_2 R_2}$$ → POR EQUIVALENCIA CON T_{2b}

$$V_1 = T_{1a} V_i + T_{1b} V_2 + T_{1c} V_3$$

$$V_2 = \frac{1}{S T_{2b}} V_1$$

$$V_3 = \frac{1}{S T_{3c}} V_2$$

$$V_1 = T_{1a} V_i - T_{1b} \frac{T_{2b}}{S} V_1 - T_{1c} T_{3c} T_{2b} V_1$$

$$V_1 \left(1 + T_{1b} T_{2b} S + T_{1c} (T_{3c} T_{2b} S^2) \right) = T_{1a} V_i$$

$$\frac{V_1}{V_i} = \frac{T_{1a}}{1 + T_{1b} T_{2b} S + T_{1c} (T_{3c} T_{2b} S^2)}$$

[redacted]

$$\frac{V_1}{V_i} = \frac{T_{1a} \cdot T_{3c} T_{2b} S^2}{T_{3c} T_{2b} S^2 + T_{1b} T_{3c} S + T_{1c}}$$

$$\frac{V_1}{V_i} = \frac{S^2 T_{1a}}{S^2 + \frac{S T_{1b}}{T_{2b}} + \frac{T_{1c}}{T_{3c} T_{2b}}}$$

PASA-ALTOS 2DO ORDEN

$$\frac{V_2}{V_i} = \frac{-(T_{1a}/T_{2b}) S}{S^2 + \frac{T_{1b}}{T_{2b}} S + \frac{T_{1c}}{T_{2b} T_{3c}}}$$

PASABANDA 2DO ORDEN

$$\frac{V_3}{V_i} = \frac{\frac{T_{1a}}{T_{1c} T_{2b} T_{3c}}}{S^2 + S \frac{T_{1b}}{T_{2b}} + \frac{T_{1c}}{T_{2b} T_{3c}}}$$

PASABAJOS 2DO ORDEN