Prova 3

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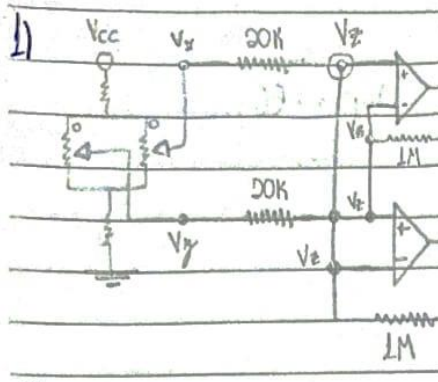
1)



$V_{RL} = V_{o1} - V_{o2}$ *

Nó V_z 1

$$\frac{V_z - V_x}{20K} + \frac{V_z - V_{o2}}{1M} = 0 \qquad 50(V_z - V_x) + V_z - V_{o2} = 0 \qquad \boxed{V_{o2} = 51V_z - 50V_x}$$

Nó V_z 2

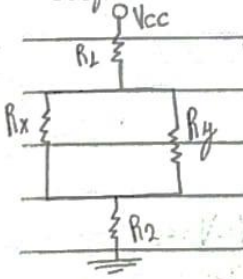
$$\frac{V_z - V_y}{20K} + \frac{V_z - V_{o1}}{1M} = 0 \qquad 50(V_z - V_y) + V_z - V_{o1} = 0 \qquad \boxed{V_{o1} = 51V_z - 50V_y}$$

Substituindo em V_{RL} *

$$V_{RL} = (51V_z - 50V_y) - (51V_z - 50V_x)$$

$$\boxed{V_{RL} = 50(V_x - V_y)}$$

Utilizando $V_{máx}$ do potenciometro (V_x alto e V_y baixo)



$$V_{RL\,MÁX} = 50\left[(V_{CC} - V_{Ry}) - (V_{CC} - V_{Ry} - V_{Rx})\right] = +50V_{Rx}$$

V_{CC} é fixo, logo $V_{Rx} = V_{Ry} = V_{CC}$

$\therefore \Delta RL = \pm 50V_{CC}$, $V_{MÁX} = +50V_{CC}$, $V_{MÍN} = -50V_{CC}$

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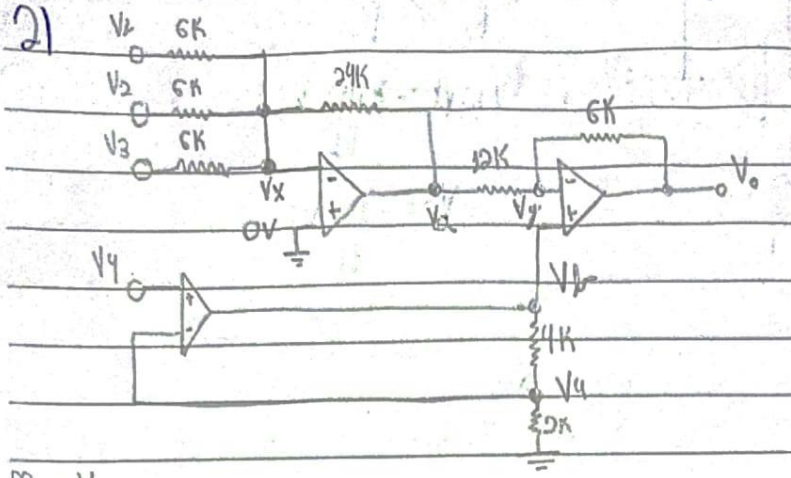


Nó Vx

$$\frac{V_x - V_1}{6K} + \frac{V_x - V_2}{6K} + \frac{V_x - V_3}{6K} + \frac{V_x - V_a}{24} = 0 \qquad V_x = 0$$

$$\frac{V_a}{24} = -\frac{(V_1 + V_2 + V_3)}{6} \qquad \boxed{V_a = -4(V_1 + V_2 + V_3)}$$

Nó Vb

$$\frac{V_4 - V_b}{4K} + \frac{V_4}{2K} = 0 \qquad 3V_4 - V_b = 0 \qquad \boxed{V_b = 3V_4}$$

Nó Vy

$$\frac{V_y - V_a}{12K} + \frac{V_y - V_o}{6K} = 0 \qquad 3V_y - V_a - 2V_o = 0$$

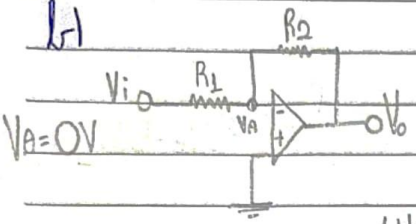
$$\boxed{V_y = \frac{V_a + 2V_o}{3}}$$

Como $V_y = V_b$

$$3V_4 = \frac{V_a + 2V_o}{3} \qquad V_o = \frac{9V_4 + 4(V_1 + V_2 + V_3)}{2} = \frac{9V_4 + 2(V_1 + V_2 + V_3)}{2}$$

3)

4-1



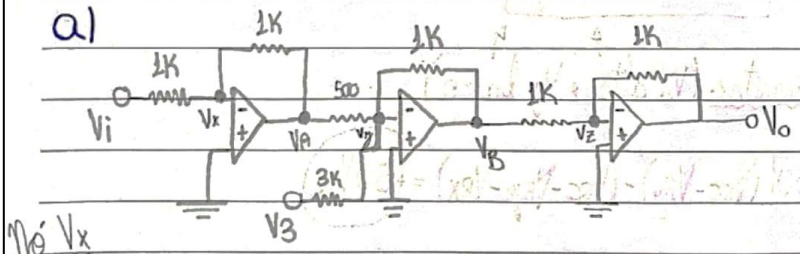
$\frac{V_A - V_i}{R_1} + \frac{V_A - V_o}{R_2} = 0$

$V_o = -\frac{R_2}{R_1} V_i$

- Utilizando $R_2 = 12K$ e $R_1 = 11K$

$$\boxed{V_o = -\frac{12}{11} V_i}$$

a)



Nó V_x

$\frac{V_x - V_i}{1K} + \frac{V_x - V_A}{1K} = 0$

$V_A = -V_i$

Nó V_y

$\frac{V_y - V_A}{0,5K} + \frac{V_y - V_3}{3K} + \frac{V_y - V_B}{1K} = 0$

$V_B = -2V_A - \frac{V_3}{3}$

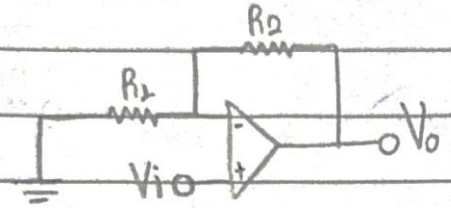
Nó V_z

$\frac{V_z - V_B}{1K} + \frac{V_z - V_o}{1K} = 0$

$V_o = -V_B = 2V_A + \frac{V_3}{3} = -2V_i + \frac{V_3}{3}$

c) $V_o = 9,6V$, $V_i = ?$

$\frac{V_o}{V_i} = 1 + \frac{R_2}{R_1} \Rightarrow V_o = V_i \left[1 + \frac{R_2}{R_1}\right] \Rightarrow V_i = \frac{V_o}{1 + R_2/R_1}$



Supondo $R_2 = 2K$ e $R_1 = 1K$

$$\boxed{V_i = 3,2V}$$