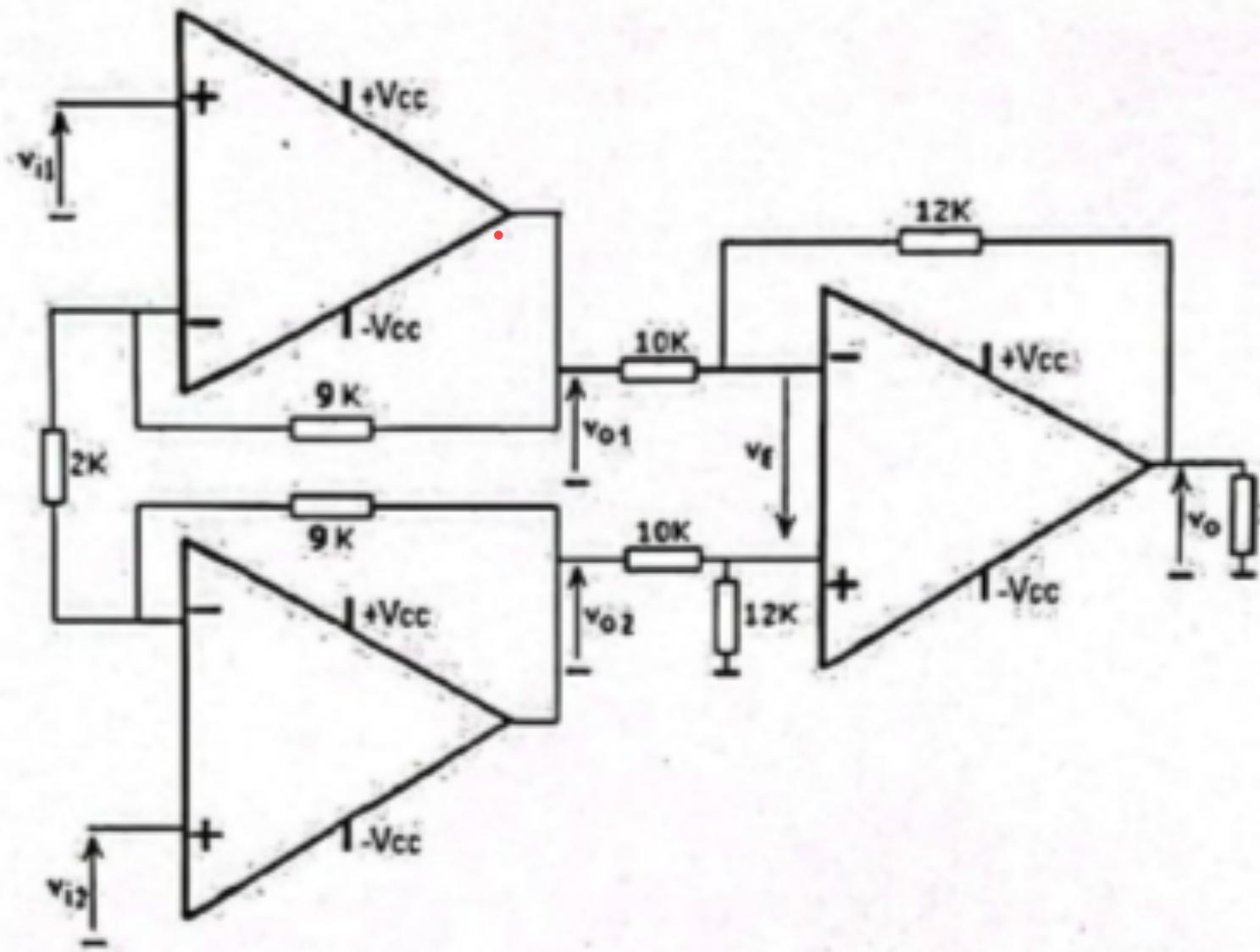


1.- Para el siguiente amplificador de instrumentación, admitiendo opamps ideales obtener:

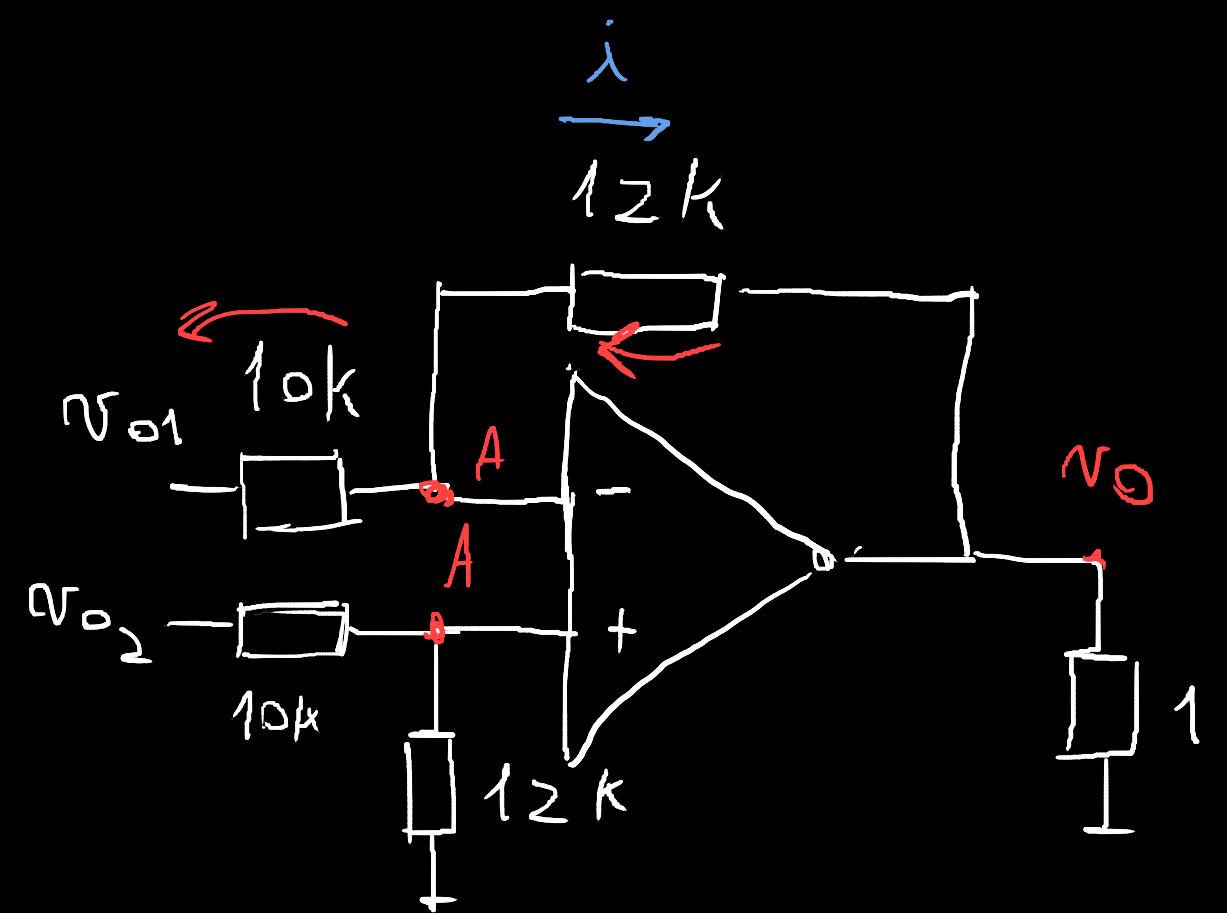
a) Los valores de $v_o/(v_{o1}-v_{o2})$, $v_o/0,5(v_{o1}+v_{o2})$.

b) Los valores de $v_{o1}/(v_{i1}-v_{i2})$, $v_{o1}/0,5(v_{i1}+v_{i2})$. A partir de estos resultados, obtener A_{vd} , A_{vc} totales del amplificador de instrumentación.

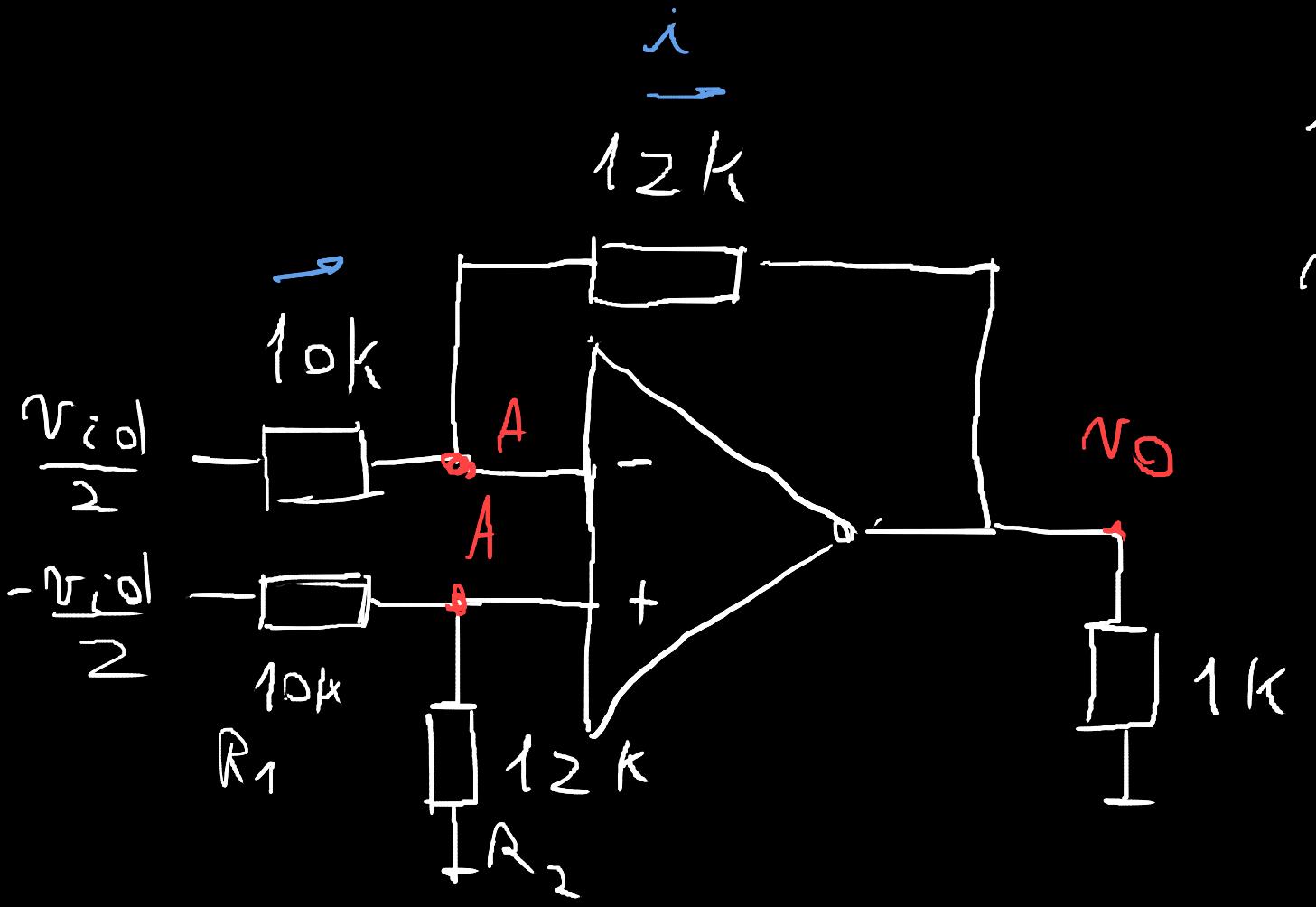
c) Si los opamps son reales e idénticos, de $RRMC = 80$ dB, obtener la RRMC total del amplificador de instrumentación (admitir valores típicos en el resto de parámetros del opamp y resistores idénticos).



Redibujar la última etapa:



$$V_A = \frac{12}{12+10} \cdot V_{o2} = \frac{6}{11} \cdot V_{o2}$$
$$i = \left(r_{o1} - \frac{6}{11} V_{o2} \right) \frac{1}{10k}$$
$$\rightarrow V_o = V_A - 12k \cdot i = \frac{6}{11} V_{o2} - 12k \left(V_{o1} - \frac{6}{11} V_{o2} \right)$$
$$= \frac{6}{11} V_{o2} - \frac{6}{5} r_{o1} - \frac{6}{5} \cdot \frac{6}{11} \cdot V_{o2}$$
$$= \frac{6}{11} V_{o2} - \frac{36}{55} V_{o2} - \frac{6}{5} V_{o1}$$



$$i = \left(\frac{V_{i1}}{2} - V_o \right) \frac{1}{10k + 12k}$$

$$V_A = \frac{12}{22} \cdot \left(-\frac{V_{id}}{2} \right) = -\frac{6}{22} V_{id}$$

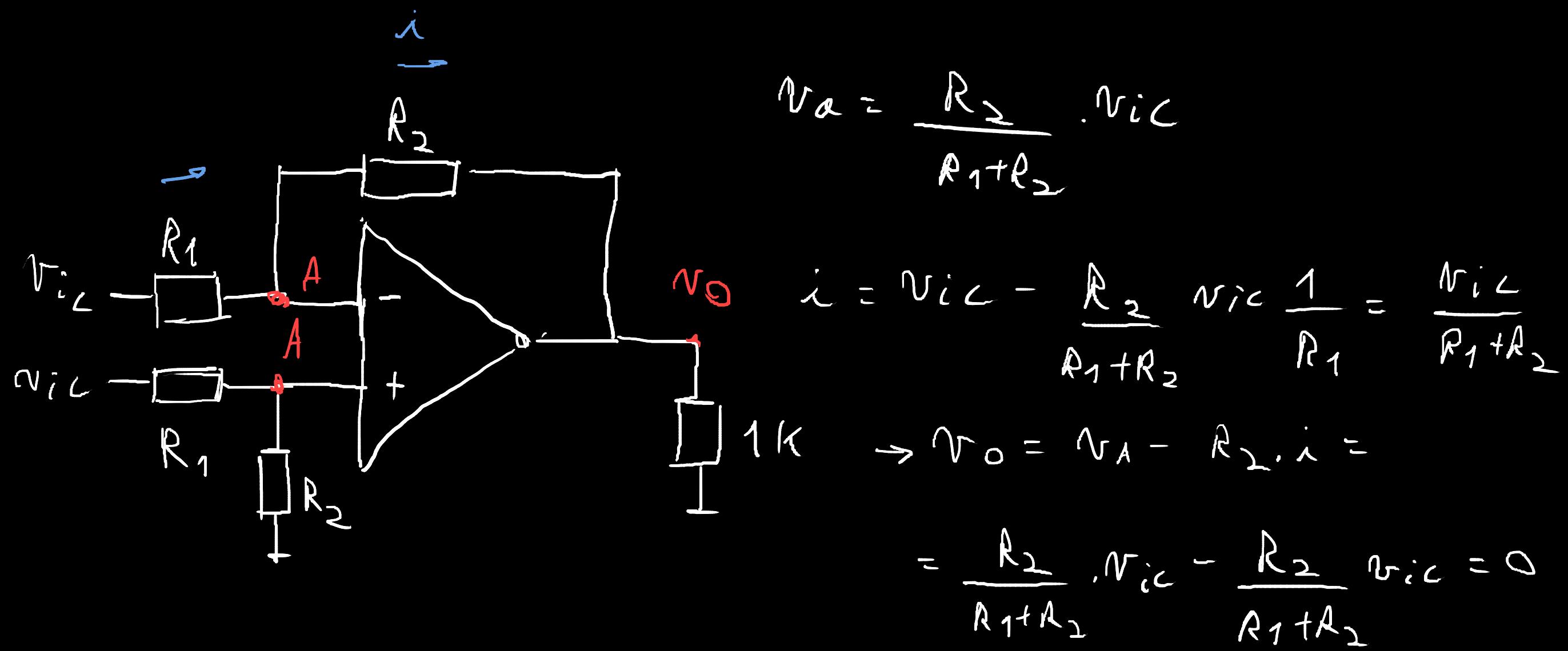
$$i = \left(\frac{V_{i1}}{2} - \frac{6}{22} V_{i1} \right) \frac{1}{10k}$$

$$\rightarrow V_O = V_A - i \cdot 12k =$$

$$= -\frac{6}{22} V_{id} - \frac{12}{10} \left(\frac{V_{id}}{2} - \frac{6}{22} V_{id} \right)$$

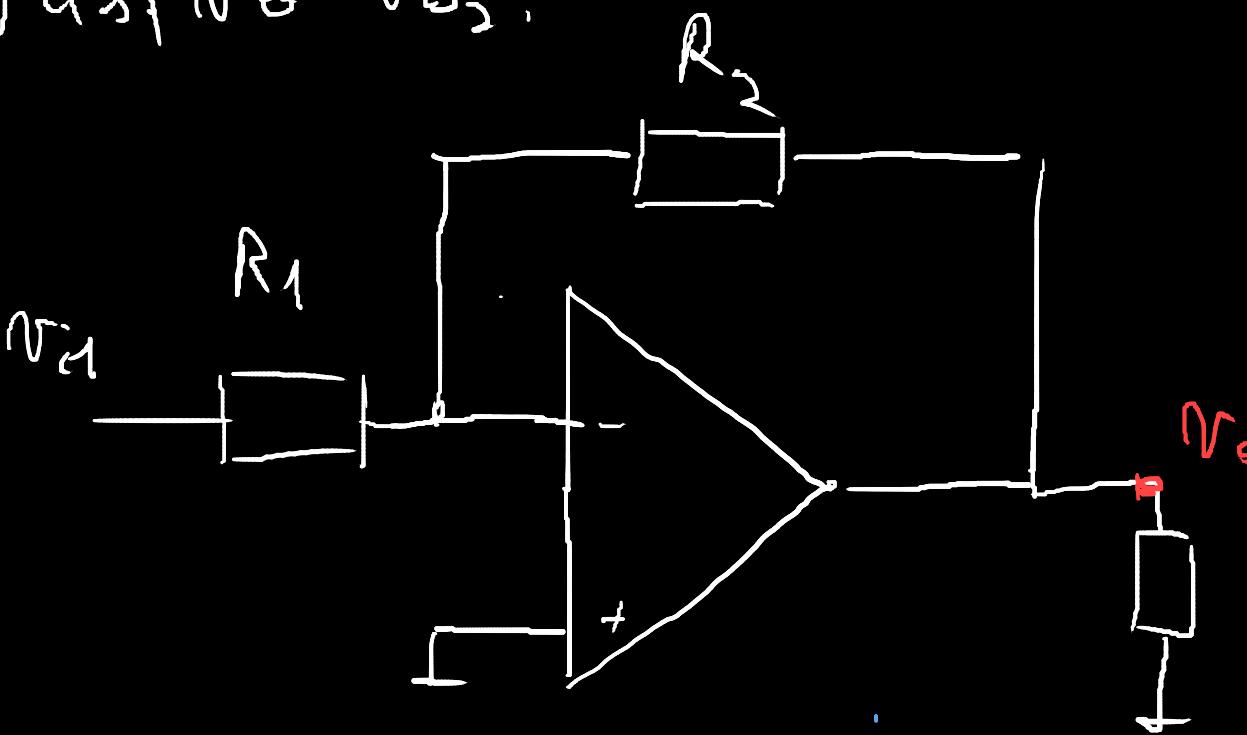
$$= -\frac{6}{22} V_{id} - \frac{6}{5} \frac{V_{id}}{2} - \frac{6}{5} \frac{6}{22} V_{id}$$

$$= \left(-\frac{6}{22} - \frac{6}{10} - \frac{36}{110} \right) V_{id} = -1,2 \cdot V_{id} \Rightarrow A_{v1} = -1,2$$

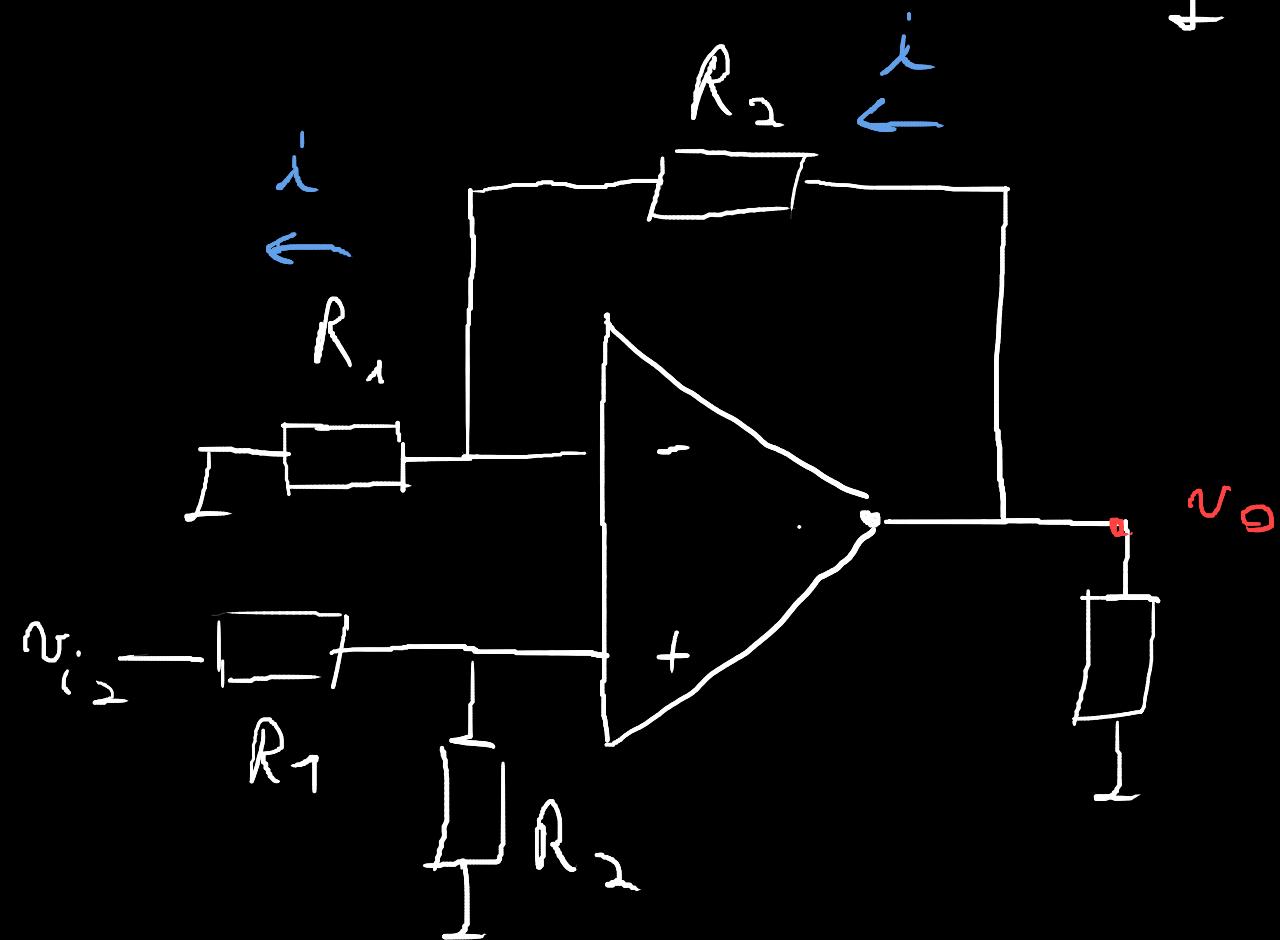


Creo q' era más fácil así:

Pasjene v_{o_2} :



$$\text{Invertor: } v_o = - \frac{R_2}{R_1} \cdot v_{i_1}$$



$$i = \frac{R_2}{R_1 + R_2} v_{i_2} \frac{1}{R_1}$$

$$v_o = \frac{R_2}{R_1 + R_2} v_{i_2} + R_2 \cdot i = \frac{R_2}{R_1 + R_2} v_{i_2} +$$

$$+ \frac{R_2}{R_1} \cdot \frac{R_2}{R_1 + R_2} v_{i_2} = \frac{R_2}{R_1 + R_2} \left(\frac{R_1 + R_2}{R_1} v_{i_2} \right) = \frac{R_2}{R_1} v_{i_2}$$

$$\text{Superposición: } V_0 = - \frac{R_2}{R_1} V_{i1} + \frac{R_2}{R_1} V_{i2}$$

$$\text{Anol: } V_{i1} = \frac{1}{2} V_{id}, \quad V_{i2} = -\frac{1}{2} V_{id} \Rightarrow V_0 = - \frac{R_2}{R_1} \frac{V_{id}}{2} - \frac{1}{2} \frac{R_2}{R_1} V_{id} =$$

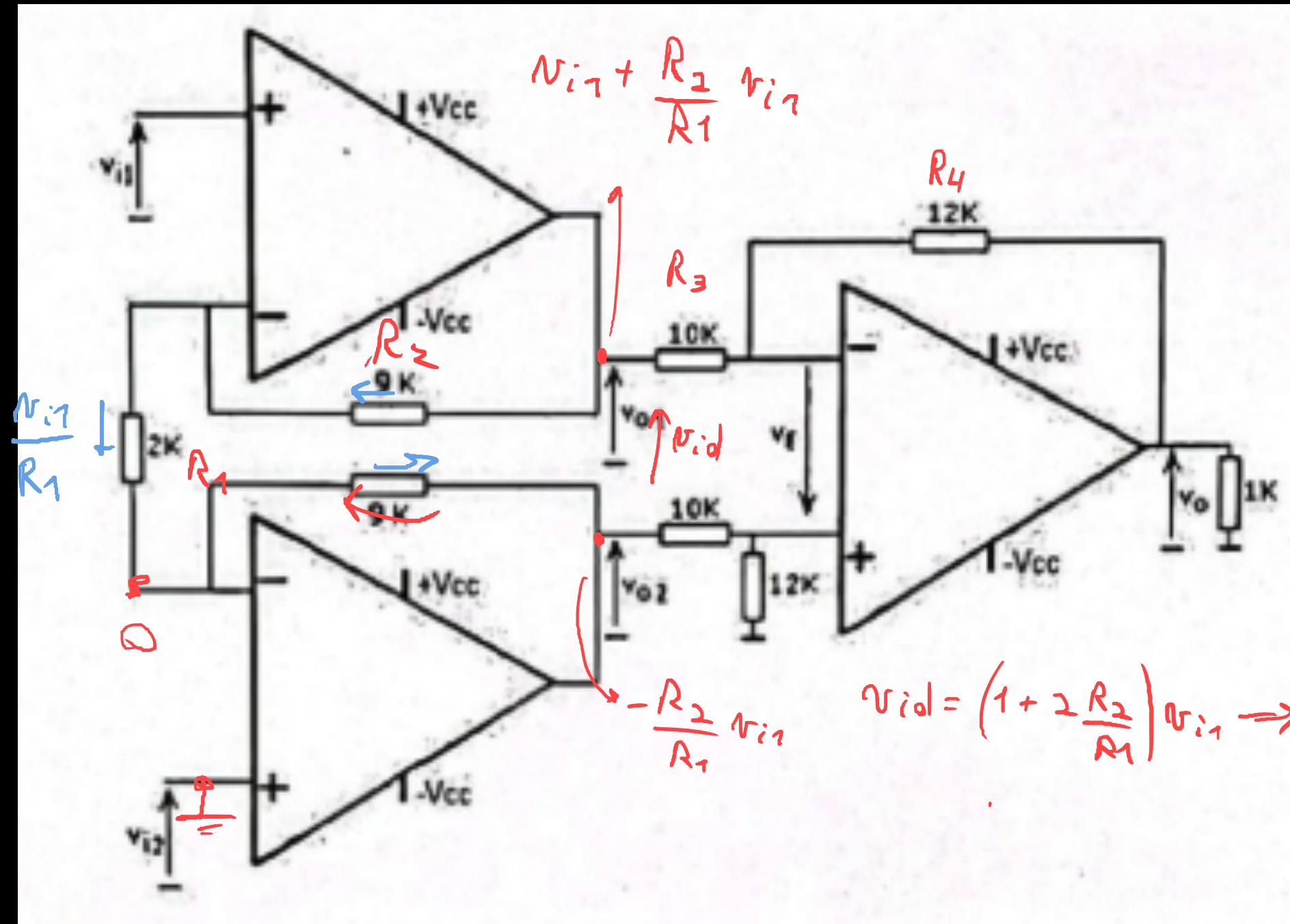
$$= - \left(\frac{R_2}{R_1} \right) V_{id} \Rightarrow An = -1, 2 \quad \text{costó más de lo que esté}$$

dispuestos a recomenzar

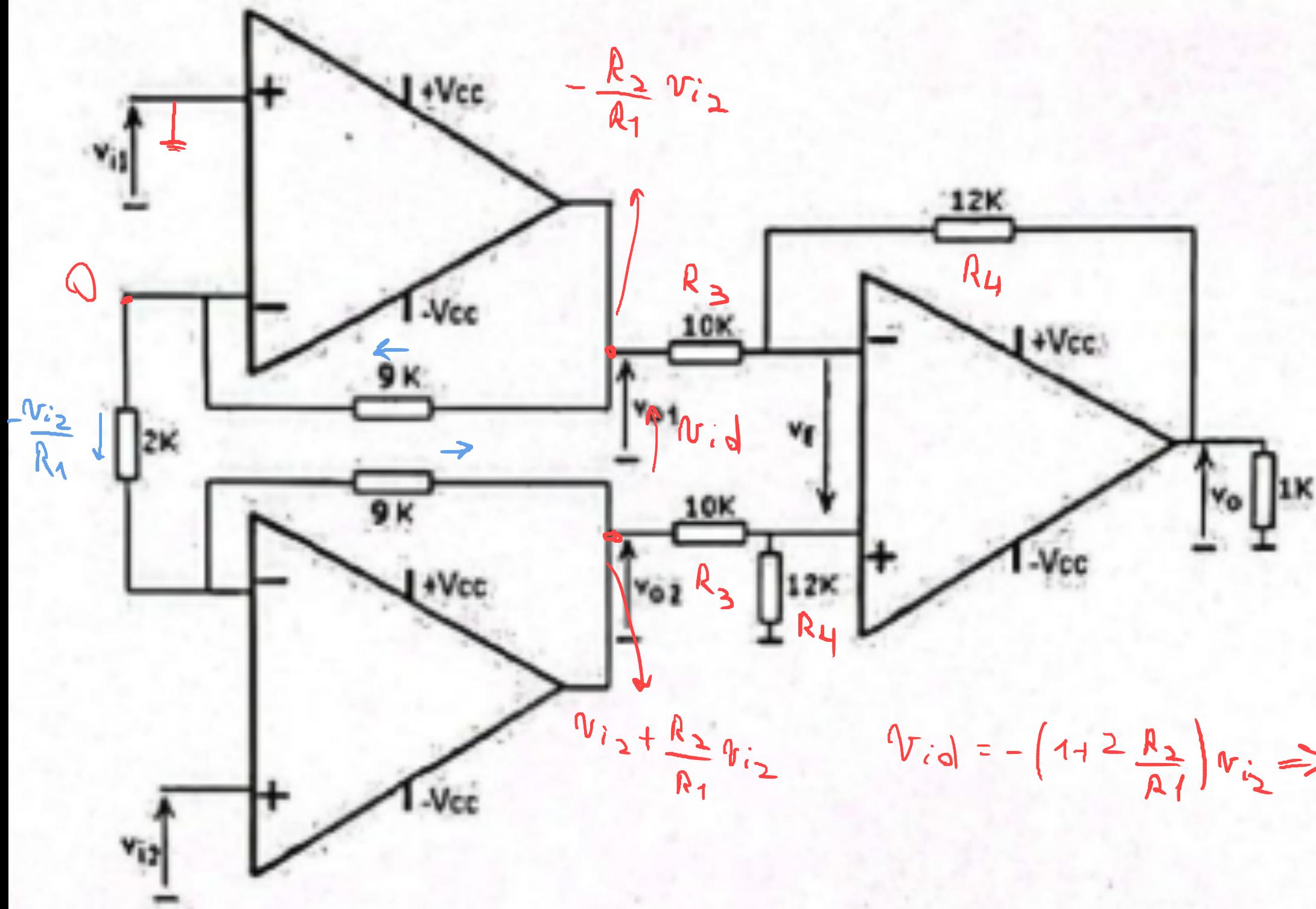
$$An <: V_{i1} = V_{ic}, \quad V_{i2} = V_{ic} : \quad V_0 = 0$$

$$\Rightarrow V_0 = - \frac{R_2}{R_1} (V_{i1} - V_{i2})$$

b)



$$v_{i1} = \left(1 + \frac{R_2}{R_1}\right) v_{i1} \rightarrow v_o = -\frac{R_4}{R_3} \left(1 + \frac{R_2}{R_1}\right) v_{i1}$$



$$-\frac{R_2}{R_1} v_{i2}$$

$$R_3$$

$$10K$$

$$v_{i1}$$

$$v_{i1d}$$

$$R_3$$

$$10K$$

$$v_{i1} + \frac{R_2}{R_1} v_{i2}$$

$$R_4$$

$$12K$$

$$v_o$$

$$1K$$

$$v_o$$

$$v_{i1d} = -\left(1 + 2 \frac{R_2}{R_1}\right) v_{i2}$$

$$v_o = \frac{R_4}{R_3} \left(1 + 2 \frac{R_2}{R_1}\right) v_{i2}$$

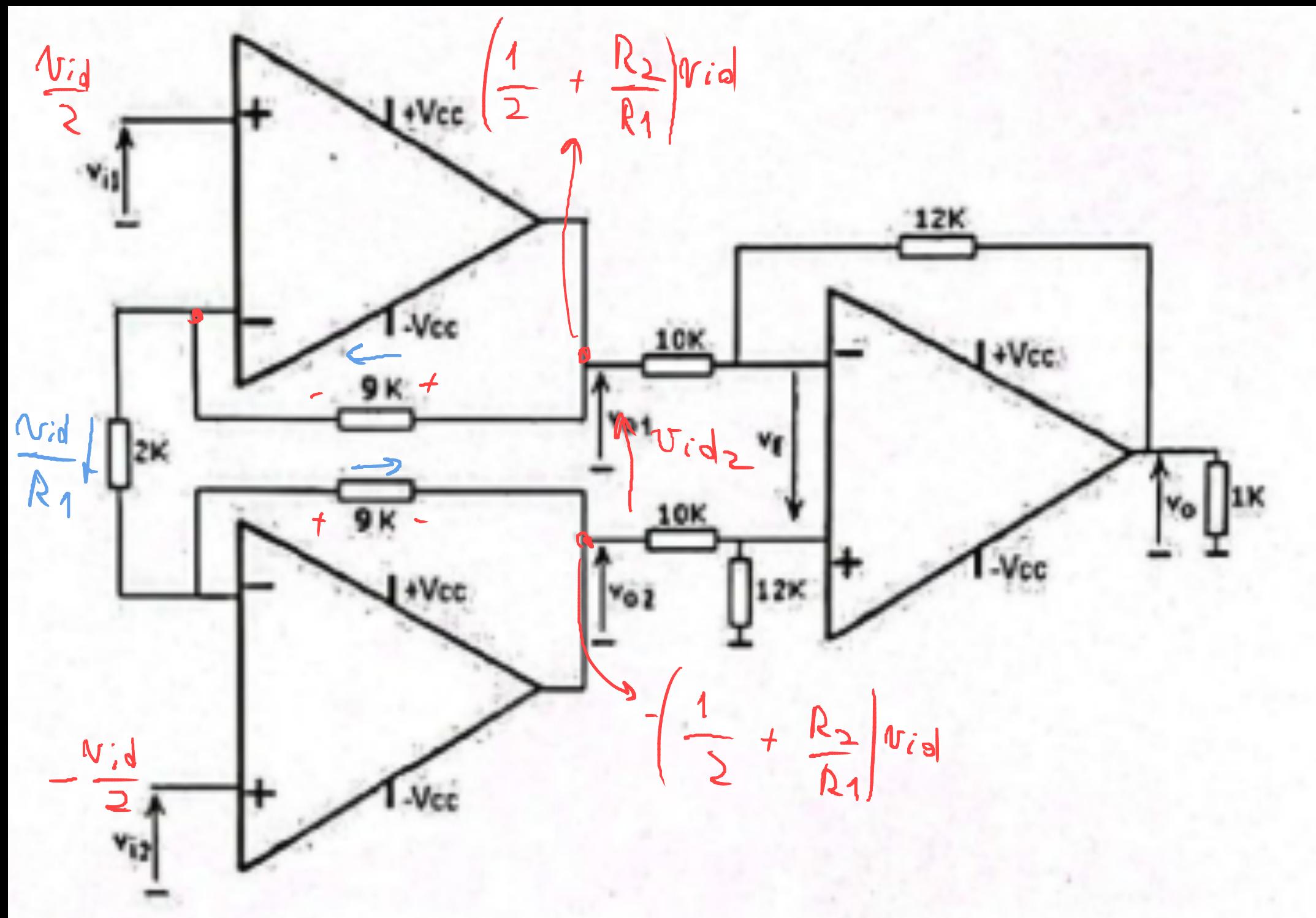
$$\left. \begin{array}{l}
 \text{para } V_{i2} = 0 \Rightarrow V_0 = -\frac{R_4}{R_3} \left(1 + 2 \frac{R_2}{R_1} \right) V_{i1} \\
 \text{para } V_{i1} = 0 \Rightarrow V_0 = \frac{R_4}{R_3} \left(1 + 2 \frac{R_2}{R_1} \right) V_{i2}
 \end{array} \right\} \text{Todo juntado queda:}$$

$$\begin{aligned}
 V_0 &= -\frac{R_4}{R_3} \left(1 + 2 \frac{R_2}{R_1} \right) V_{i1} + \\
 &\quad + \frac{R_4}{R_3} \left(1 + 2 \frac{R_2}{R_1} \right) V_{i2}
 \end{aligned}$$

$$\text{Aval: } V_{i1} = \frac{V_{id}}{2}, V_{i2} = -\frac{V_{id}}{2} \Rightarrow V_0 = -\frac{R_4}{R_3} \left(1 + 2 \frac{R_2}{R_1} \right) V_{id} \Rightarrow A v_d = -12$$

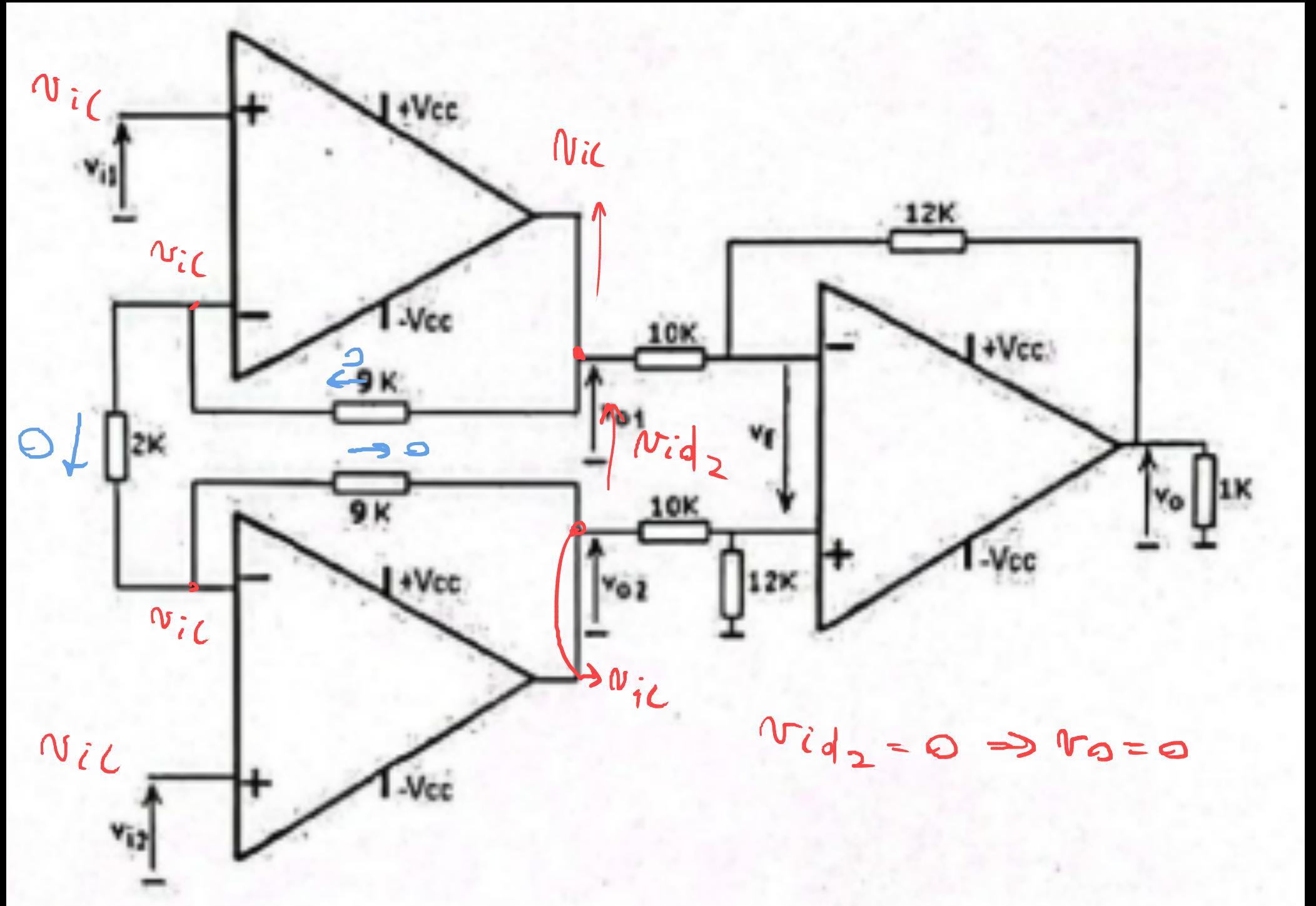
$$\text{Avci: } V_{i1} = V_{iC} = V_{i2} \Rightarrow V_0 = 0$$

Outra forma:



$$\begin{aligned}
 v_{id2} &= \left(1 + \frac{2R_2}{R_1}\right) v_{id} \\
 \rightarrow v_o &= -\frac{R_L}{R_3} \left(1 + \frac{2R_2}{R_1}\right) v_{id}
 \end{aligned}$$

✓



$$n_{id_2} = 0 \Rightarrow r_o = 0$$