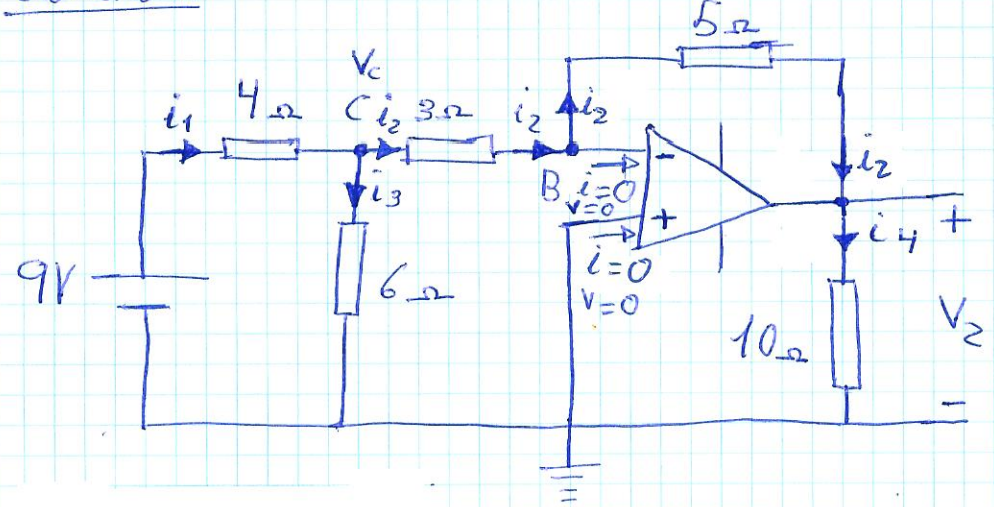
Problemas temas 5 e 6

Problema 1:



Nodo C ⇒ $i_1 = i_2 + i_3$

$$\frac{9 - V_c}{4} = \frac{V_c}{3} + \frac{V_c}{6}$$

$$3 \cdot (9 - V_c) = 4 \cdot V_c + 2 \cdot V_c$$

$$27 - 3V_c = 6 \cdot V_c$$

$$9V_c = 27$$

$$\boxed{V_c = \frac{27}{9} = 3V}$$

$$\boxed{i_1 = \frac{9-3}{4} = 1{,}5\,A}$$

Nodo B ⇒ $\frac{V_c - 0}{3} = \frac{0 - V_2}{5}$

$$\frac{3}{3} = -\frac{V_2}{5}$$

$$\boxed{V_2 = -5\,V}$$

$$\boxed{i_4 = \frac{V_2}{10} = \frac{-5}{10} = -0{,}5\,A}$$

Potencia da fonte:

$P_f = V_f \cdot I_1$

$\boxed{P_f = 9 \cdot 1,5 = 13,5\ W}$

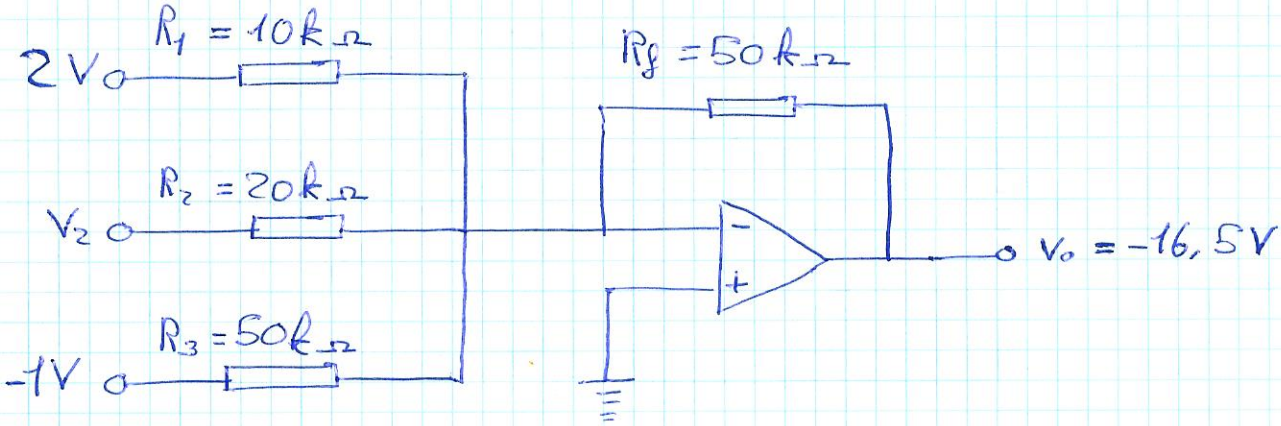
Resistencia de entrada:

$$R = \frac{V_f}{I_1}$$

$$R = \frac{9}{1,5}$$

$\boxed{R = 6\ \Omega}$

Problema 2:



$$V_o = -\left(\frac{50}{10}\cdot 2 + \frac{50}{20}\cdot V_2 + \frac{50}{50}\cdot(-1)\right)$$

$$-16,5 = -\left(10 + 2,5V_2 - 1\right)$$

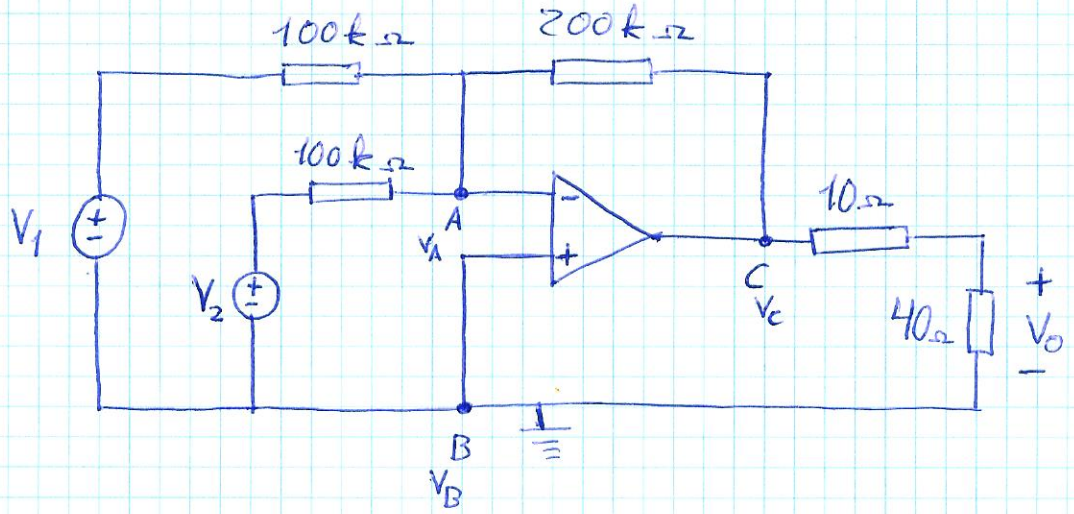
$$-16,5 = -10 - 2,5V_2 + 1$$

$$2,5V_2 = 16,5 - 9$$

$$V_2 = \frac{16,5-9}{2,5}$$

$$\boxed{V_2 = 3\ V}$$

Problema 3:



$V_B = 0\ V = V_A$

Nodo A:

$$\frac{V_A - V_1}{10^5} + \frac{V_A - V_2}{10^5} + \frac{V_A - V_C}{2 \cdot 10^5} = 0$$

$$-\frac{V_1}{10^5} - \frac{V_2}{10^5} - \frac{V_C}{2 \cdot 10^5} = 0$$

$$\frac{V_C}{2 \cdot 10^5} = -\frac{V_1}{10^5} - \frac{V_2}{10^5}$$

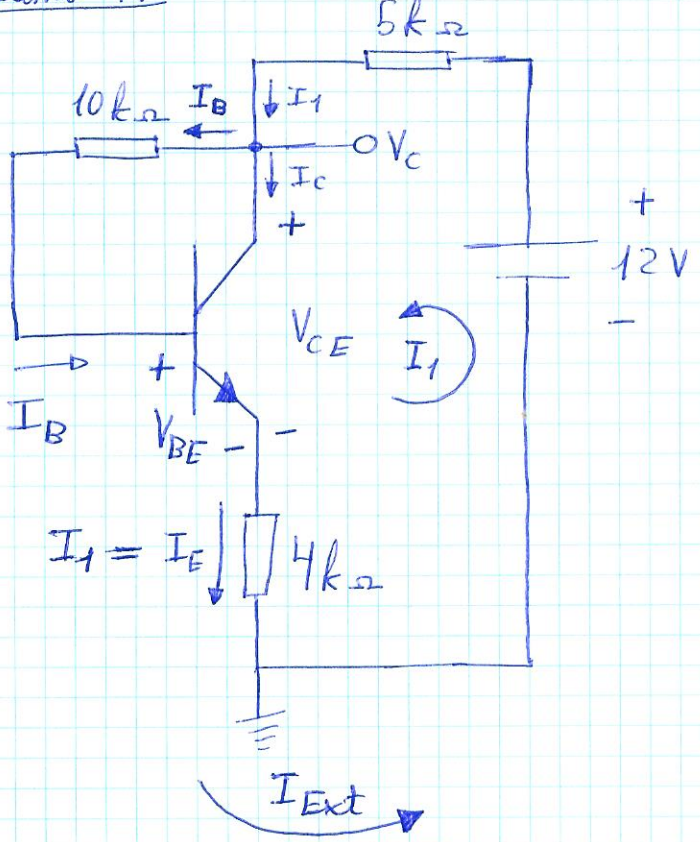
$$V_C = -2V_1 - 2V_2$$

$$V_O = \frac{V_C - 0}{50} \cdot 40$$

$$V_O = \frac{-2V_1 - 2V_2}{50} \cdot 40$$

$$\boxed{V_O = -1{,}6\,V_1 - 1{,}6\,V_2}$$

Problema 4:



$\beta = 100$

$V_{BE} = 0,7\,V$

$I_C = \beta \cdot I_B$

$I_E = I_C + I_B$

$I_E = I_C + I_B \Rightarrow \beta \cdot I_B + I_B \Rightarrow 100 \cdot I_B + I_B \Rightarrow 101\, I_B = I_1$

Malla exterior $\Rightarrow -12 + I_1 \cdot 5000 + I_B \cdot 10000 + V_{BE} + I_E \cdot 4000 = 0$

$-12 + 0,7 + 101 \cdot 5000 \cdot I_B + 10000\, I_B + 101 \cdot 4000 \cdot I_B = 0$

$-11,3 + 919000\, I_B = 0$

$$\boxed{I_B = \frac{11,3}{919000} = 12,296\,\mu A}$$

$I_1 = 101 \cdot 12,296 \cdot 10^{-6} = 1241,896 \cdot 10^{-6}\,A$

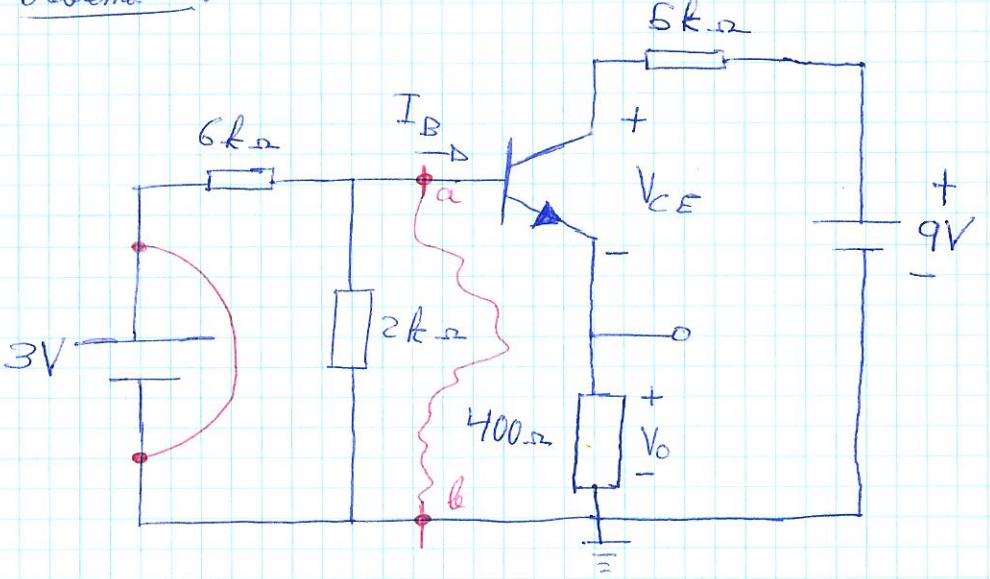
Para averiguar V_C, como tenemos el valor de I_1, podemos calcular cuanto potencial absorve la resistencia de 5kΩ y restarselo al potencial inicial de 12V.

$V = I_1 \cdot R$

$V = 1241,896 \cdot 10^{-6} \cdot 5000 = 6,21\,V$

$$\boxed{V_C = 12 - 6,21 = 5,79\,V}$$

Problema 5:



$\beta = 200$

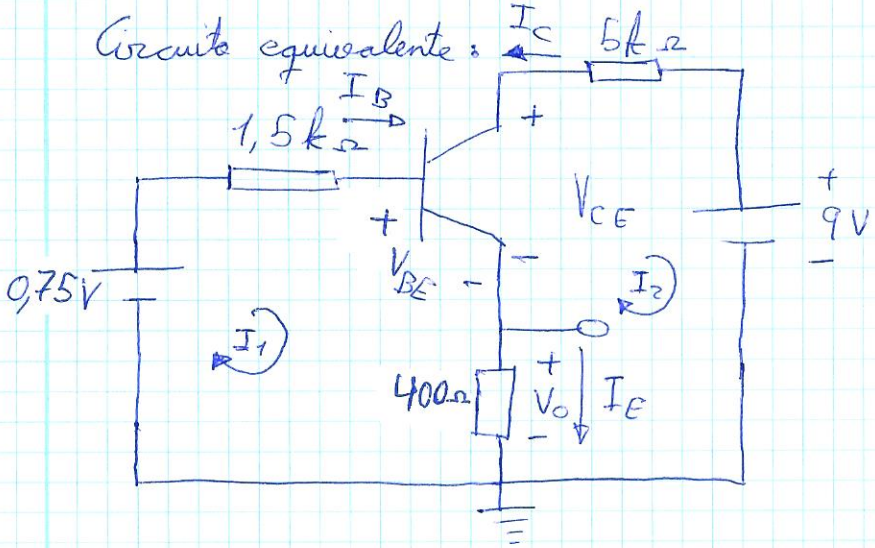
$V_{BE} = 0,7\,V$

Aplicamos Thevenin para reducir o circuito a 2 mallas:

$$R_{Th} = \frac{6 \cdot 2}{8} = 1,5\,k\Omega$$

$$V_{Th} = \frac{2}{8} \cdot 3 = 0,75\,V$$

Circuito equivalente:



$$I_E = I_B + I_C \Rightarrow I_B + \beta \cdot I_B \Rightarrow (1+\beta) \cdot I_B$$

Malla 1 $\Rightarrow -0,75 + 1,5 \cdot 10^3 \cdot I_B + V_{BE} + V_o = 0$

$$-0,75 + 1,5 \cdot 10^3 \cdot I_B + 0,7 + 400 \cdot I_E = 0$$

$$-0,75 + 1,5 \cdot 10^3 \cdot I_B + 0,7 + 400 \cdot (1+\beta) \cdot I_B = 0$$

$$1,5 \cdot 10^3 \cdot I_B + 80400 \cdot I_B = 0,05$$

$$\boxed{I_B = \frac{0,05}{81900} = 6,105 \cdot 10^{-7}\,A}$$

$$V_o = 400 \cdot (1+\beta) \cdot I_B$$

$$V_o = 400 \cdot (1+200) \cdot 6,105 \cdot 10^{-7}$$

$$\boxed{V_o = 0,0491 V}$$

Malla 2 $\Rightarrow$ $-V_o - V_{CE} - 5000 \cdot I_c + 9 = 0$

$$-0,0491 - V_{CE} - 5000 \cdot \beta \cdot I_B + 9 = 0$$

$$V_{CE} = -0,0491 - 5000 \cdot 200 \cdot 6,105 \cdot 10^{-7} + 9$$

$$\boxed{V_{CE} = 8,3404 V}$$