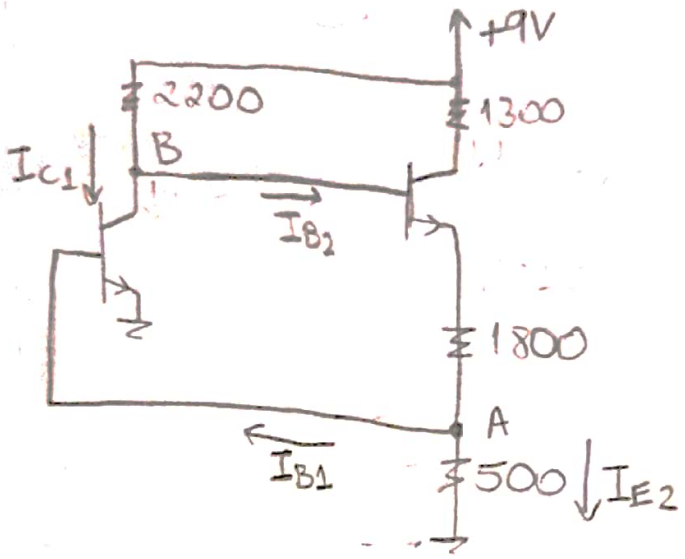
RODRIGO ALVES DE ALMEIDA
ELE 53 — PROVA 1 — COMP 22

01 ANÁLISE DC:



$V_A = V_{BE_1} = 0,7V$

$I_{EQ_2} = \frac{0,7\,V}{500\,\Omega} = 1,4\,mA$

↳ $I_{EQ_2} >> I_{BQ_1}$

$I_{EQ_2} \approx I_{CQ_2}$

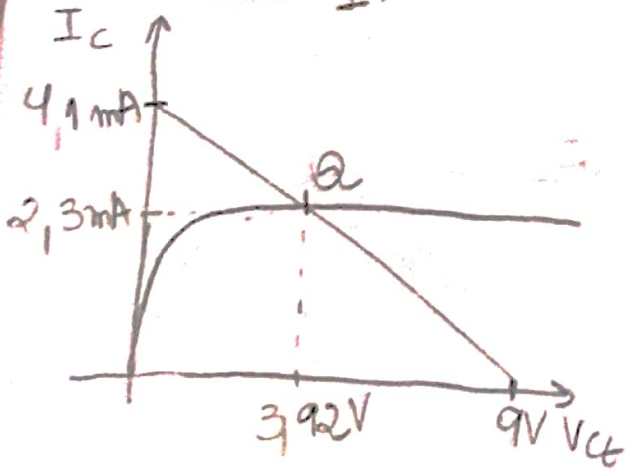
$V_B = V_A + 1800 \cdot I_{EQ_2} + V_{BE_2} =$

$= 3,92\,V$

$I_{CQ_1} = \frac{9 - V_B}{2200} = 2,3\,mA$

↳ $I_{CQ_1} >> I_{BQ_2}$

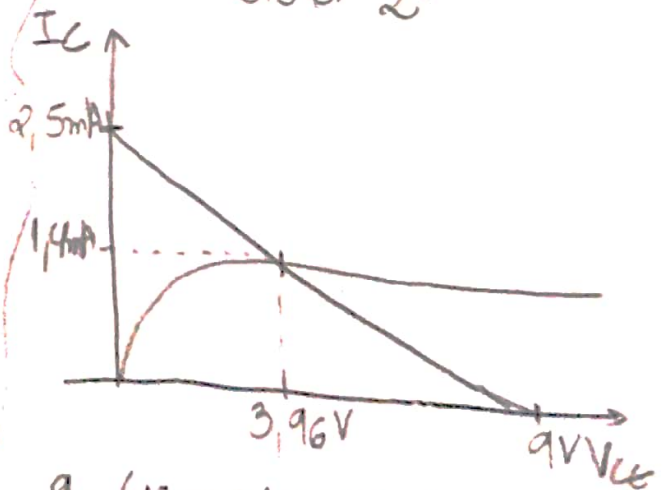
transistor 1:



$9 = 2200 \cdot I_{C_1} + V_{CE_1}$

$I_{C_1} = -\frac{V_{CE1}}{2200} + \frac{9}{2200}$

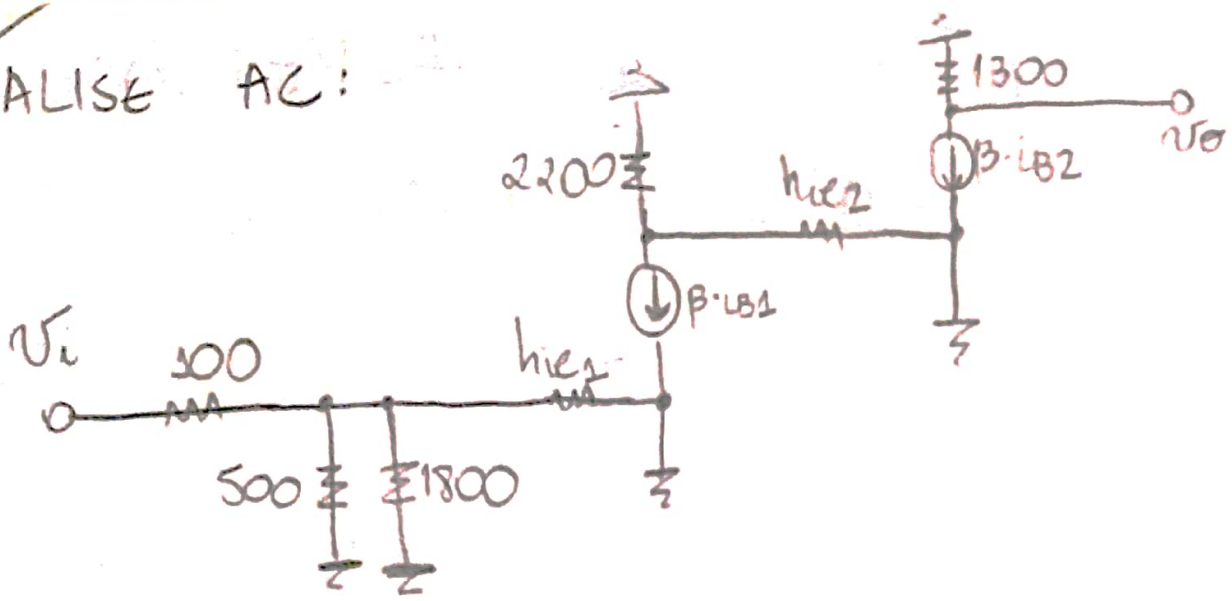
transistor 2:



$9 = (1300 + 1800 + 500)\, I_{C_2} + V_{CE_2}$

$I_{C_2} = \frac{9 - V_{CE2}}{3600}$

ANALISE AC:

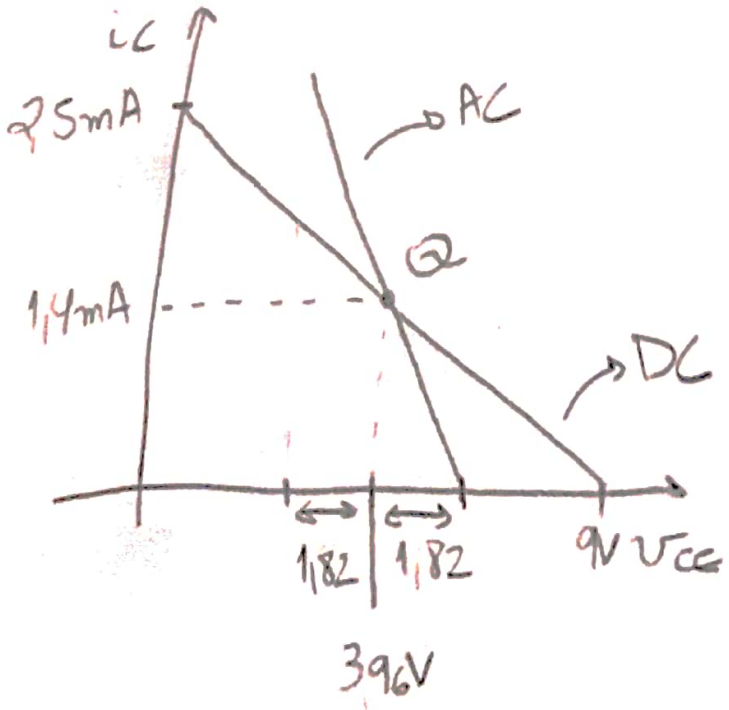


$v_{CE2} = -1300 \cdot i_{C2}$

$|i_{C2}| < I_{CQ2} = 1,4\,mA \Rightarrow |v_{CE2}| < 1,82\,V$

↳ máxima excursão

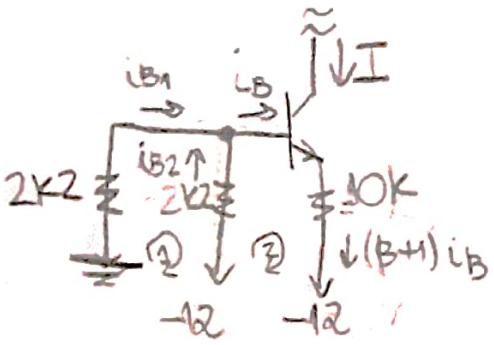
adicionando a influência AC na reta de carga:



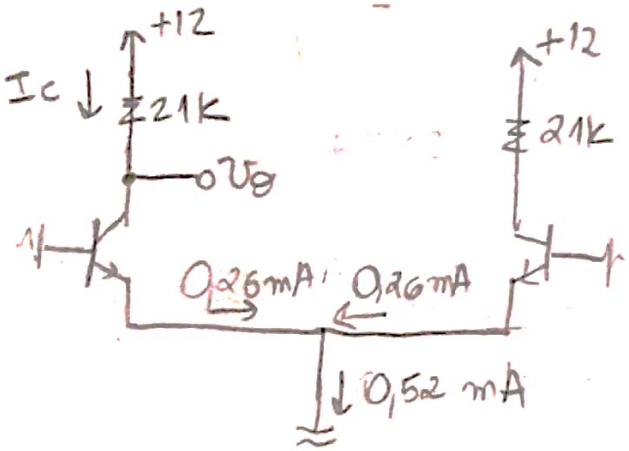
3,96V

Q2 DC:

a) gerador de corrente:



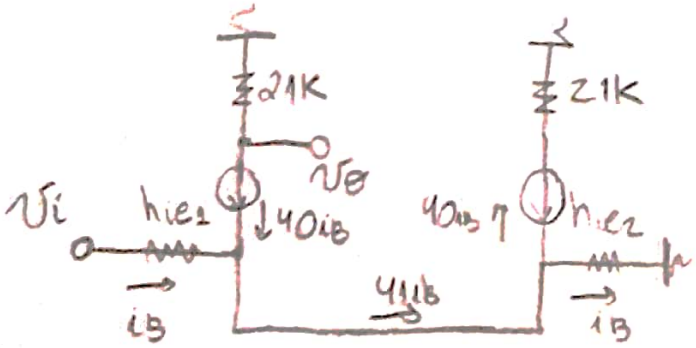
$$\begin{cases} i_{B2} = i_B - i_{B1} \\ 12 = 2200\,(2i_{B1} - i_B) \\ 12 - 0{,}7 = 2200\, i_{B1} + 10000 \cdot 41\, i_B \\ i_B = 12{,}9\ \mu A \\ I = \beta\, i_B = 0{,}52\ mA \end{cases}$$



$$I_{CQ} \approx I_{EQ} = 0{,}26\ mA$$

$$V_{CQ} = 12 - 21K \cdot I_C = 6{,}7\ V$$

AC:



$$h_{ie1} = h_{ie2} = \frac{25mV}{I_{EQ}}(B+1) = 4K1\,\Omega$$

$$V_i = 2 \cdot h_{ie1}\, i_B = 8200\, i_B$$

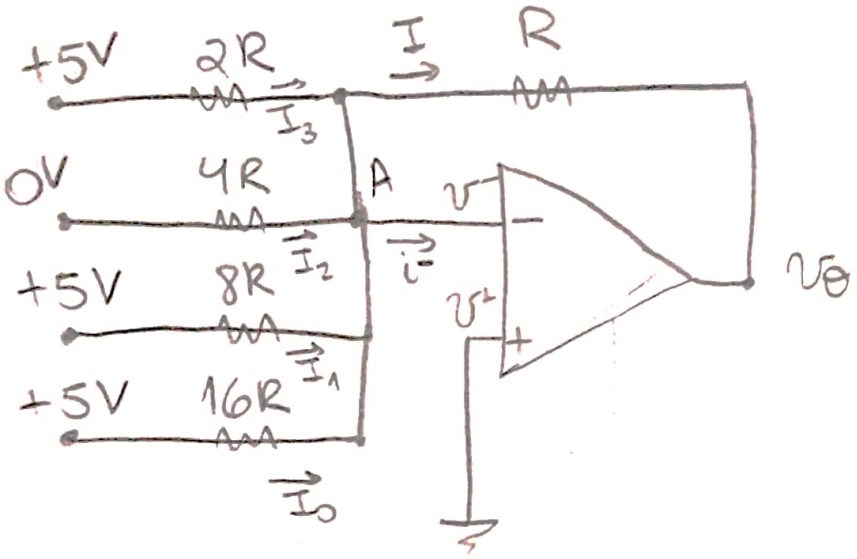
$$V_o = -21K \cdot 40\, i_B$$

$$\frac{V_o}{V_i} = -\frac{21K\ 40}{8200} = -102{,}4$$

$$v_o = -1024\ mV \cos(10^3 t)$$

$$V_o(t) = 6{,}7\ V - 1{,}02\ V \cdot \cos(10^3 t)$$

(03) $D_{3:0} \{ 1\,0\,1\,1 \}$



Sendo $v^+ \approx v^-$ e a resistência de entrada do amplificador muito alta, podemos considerar:

$$V_A \approx 0 \qquad i^- \approx 0$$

$$I = I_0 + I_1 + I_2 + I_3$$

$$-\frac{v_o}{R} = \frac{5}{16R} + \frac{5}{8R} + \frac{5}{2R}$$

$$v_o = -3{,}4375\ V$$