1. $\beta = 150$

$V_T = 26\,mV$

$R_{ee} = 20\,K\Omega$

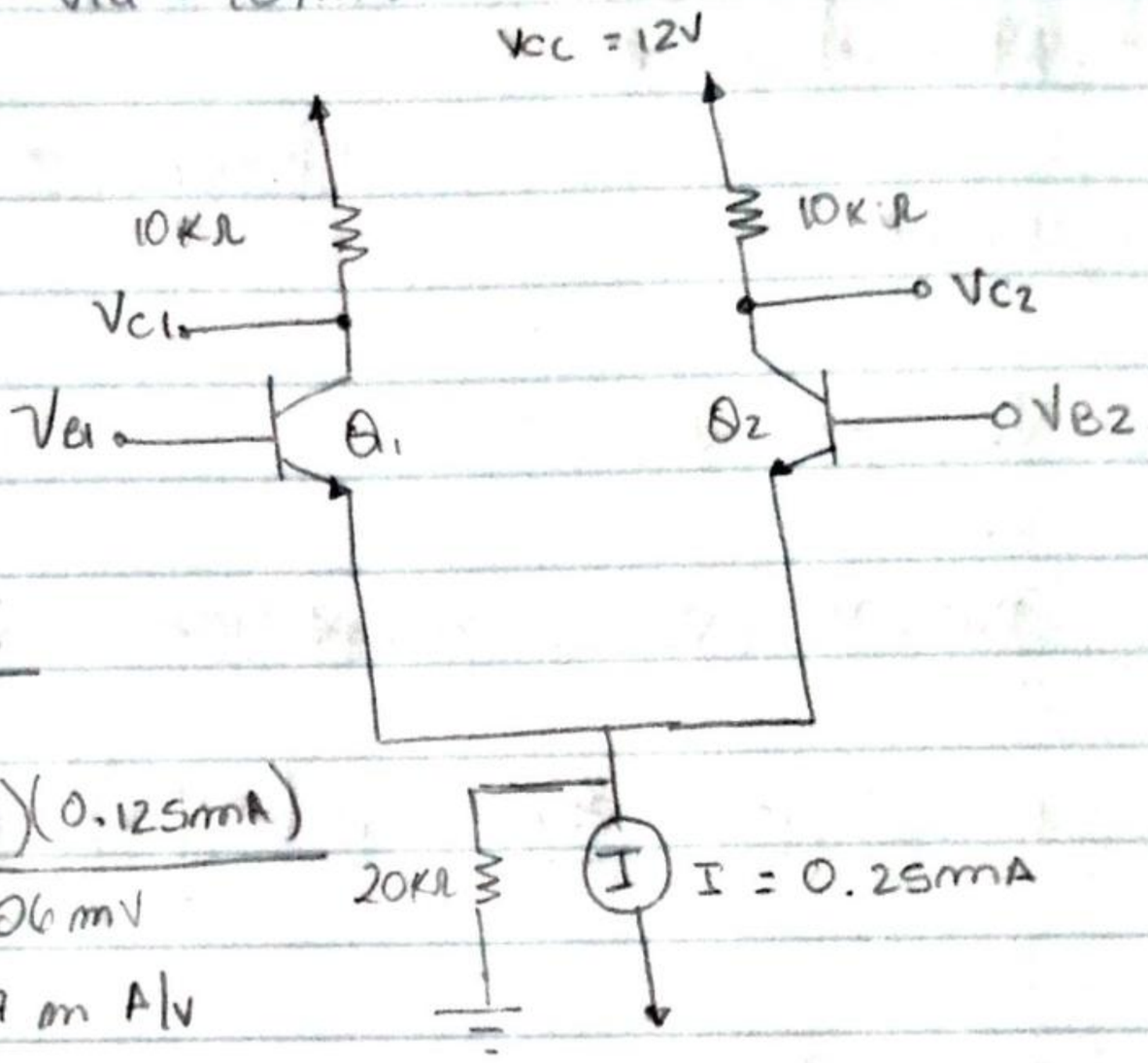
$I = 0.25\,mA$

$V_{cc} = 12\,V$

$R_c = 10\,K\Omega$

a) Cálcule la corriente de colector de cc a través de los transistores si

$V_{id} = 10\,mV$



$I = \frac{i_1}{2} = \frac{i_2}{2}$

$I = 0.25\,mA$

$i_{D1} = 0.125\,mA$

$i_{D2} = 0.125\,mA$

$V_{id} = 10\,mV$

$g_m = \frac{\alpha i_D}{V_T}$

$g_m = \frac{(150/151)(0.125mA)}{26\,mV}$

$g_m = 4.77\,mA/V$

a)

$i_C = \frac{\alpha I}{2} \pm \frac{\alpha I}{2 V_T} \cdot \frac{V_{id}}{2}$

$\alpha = \frac{\beta}{\beta+1}$

$i_C = \frac{(150/151)(0.25mA)}{2} \pm \frac{(150/151)(0.25mA)}{2(26mV)} \cdot \frac{10\,mV}{2}$

$i_{C1} = 0.148\,mA$

$i_{C2} = 0.100\,mA$

b) $i_{C1} = i_{C2}$

$A_{MC} = \frac{-\alpha R_C}{2R_{EE}} = \frac{-(150/151)(10K\Omega)}{2(20K\Omega)} = -0.248\,V/V$

$A_{MD} = \frac{-g_m R_C}{2} = \frac{(-4.776\,mA/V)(10K\Omega)}{2} = -23.8\,V/V$

$RRMC = \frac{23.88}{0.248} = 96.3$

Dе Modo Diferencial

$A_{MC} = 0$

$Ad = -g_m R_C = -(4.776\ mA/V)(10\ K\Omega)$

$Ad = -47.76\ V/V$

$RR\ MC = \infty$

c) $V_{b1} = 30\ mV$

$V_{b2} = 10\ mV$

$V_{id} = V_{b1} - V_{b2} = 30\ mV - 10\ mV = 20\ mV$

$$i_C = \frac{(150/151)(0.25\ mA)}{2} \pm \frac{(150/151)(0.25\ mA)}{2(26\ mV)} \cdot \frac{20\ mV}{2}$$

$i_{C1} = 0.172\ mA$

$i_{C2} = 0.0764\ mA$

$V_{S1} = (12 - (0.076\ mA)(10\ K\Omega)) - (12 - (0.172\ mA)(10\ K\Omega)) = 0.96\ V$

2.

$$V_0 = (V_2 - V_1)\left(1 + \frac{2}{D}\right) \qquad D = \frac{R_6}{R}$$

$$\frac{V_0}{V_2 - V_1} = 1 + \frac{2}{R_6/R}$$

$A_V = 100$ $\qquad R_3 = 404.04\ \Omega$

$A_V = 50$ $\qquad 60 = 1 + \dfrac{2}{R6/20K}$

$$R_6 = 816.32\ \Omega$$

$A_V = 20$

$$20 = 1 + \frac{2}{R6/20K}$$

$R_6 = 2105.2631$

$A_V = 10$

$$10 = 1 + \frac{2}{R6/20K}$$

$R_6 = 4444.4$

3. Amp (1)

Nodo V_2

$$\frac{V_2 - V_1}{R_1} + \frac{V_2 - V_{o1}}{R_2} = 0$$

$$V_{o1} = R_2 \left(\frac{V_2 - V_1}{R_1} + \frac{V_2}{R_2} \right) \quad \text{ecua. 1}$$

Amp (2)

Nodo V_4

$$\frac{V_4 - V_3}{R_3} + \frac{V_4 - V_{o2}}{R_4} = 0$$

$$V_{o2} = R_4 \left(\frac{V_4 - V_3}{R_3} + \frac{V_4}{R_4} \right) \quad \text{ecua. 2}$$

Amp (2)

Nodo V_{o2}

$$\frac{V_{o2} - V_{o1}}{R_5} + \frac{V_{o2} - V_o}{R_6} = 0$$

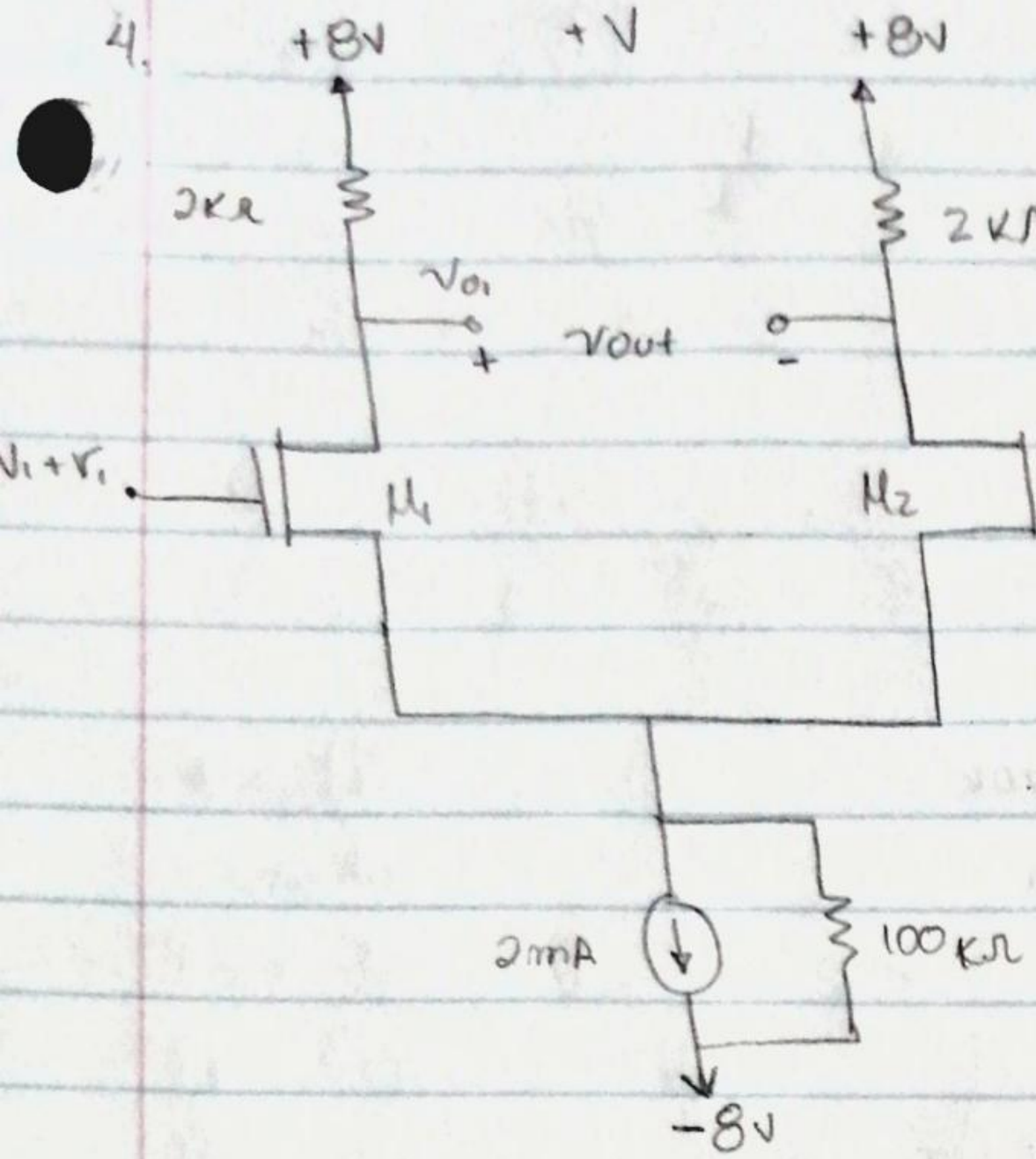
$$V_o = R_6 \left(\frac{V_{o2} - V_{o1}}{R_5} + \frac{V_{o2}}{R_6} \right) \quad \text{ecua. 3}$$

Se reemplaza en la ecua. 3

$$V_o = R_5 \left[\frac{V_4 R_3 + (V_4 - V_3) R_4}{R_3} \right] + R_6 \left[\frac{V_4 R_3 + (V_4 - V_3) R_4}{R_3} - \frac{V_2 R_1 + (V_2 - V_1) R_2}{R_1} \right]$$

$$V_o = \frac{V_4 R_3 + (V_4 - V_3) R_4}{R_3} \left[\frac{R_6}{R_5} - \frac{V_2 R_1 + (V_2 - V_1) R_2}{R_1 R_5} \right]$$

4.



$V_{DD} = 8V$

$K_n = 2mA/V^2$

$V_t = 1V$

$V_{ON} = 2V$

$R_D = 2K\Omega$

$R_{SS} = 100K\Omega$

$I_D = 2mA$

$i_{D1} = 1mA$

$i_{D2} = 1mA$

$V_{SS} = -8V$

$$I_D = \frac{1}{2} K_n (V_{GS} - V_t)^2 \left(\frac{W}{L}\right)$$

$$V_{ON} = V_{GS} - V_t$$

b) Modo Diferencial

$$1mA = \frac{1}{2}(2mA/V^2) V_{ON}^2$$

$$\frac{(2)(1mA)}{2mA/V^2} = V_{ON}^2$$

$$V_{ON} = \sqrt{1V^2} = 1V$$

$$g_m = \frac{I}{V_{ON}} = \frac{2mA}{1V} = 2mA/V$$

$$A_d = -g_m \frac{R_D}{2} = 2mA/V, \frac{2K\Omega}{2}$$

$$A_d = 2V/V$$

d) $$A_{MC} = \frac{V_{sal}}{V_{cm}} = \frac{-g_m R_D}{(1 + g_m \cdot 2R_{SS})} = \frac{2K\Omega}{200K\Omega} = 0.01\ V/V$$

e) $$RRMC = \frac{|A_{md}|}{|A_{mc}|} = \frac{2V/V}{0.01V/V} = 200$$