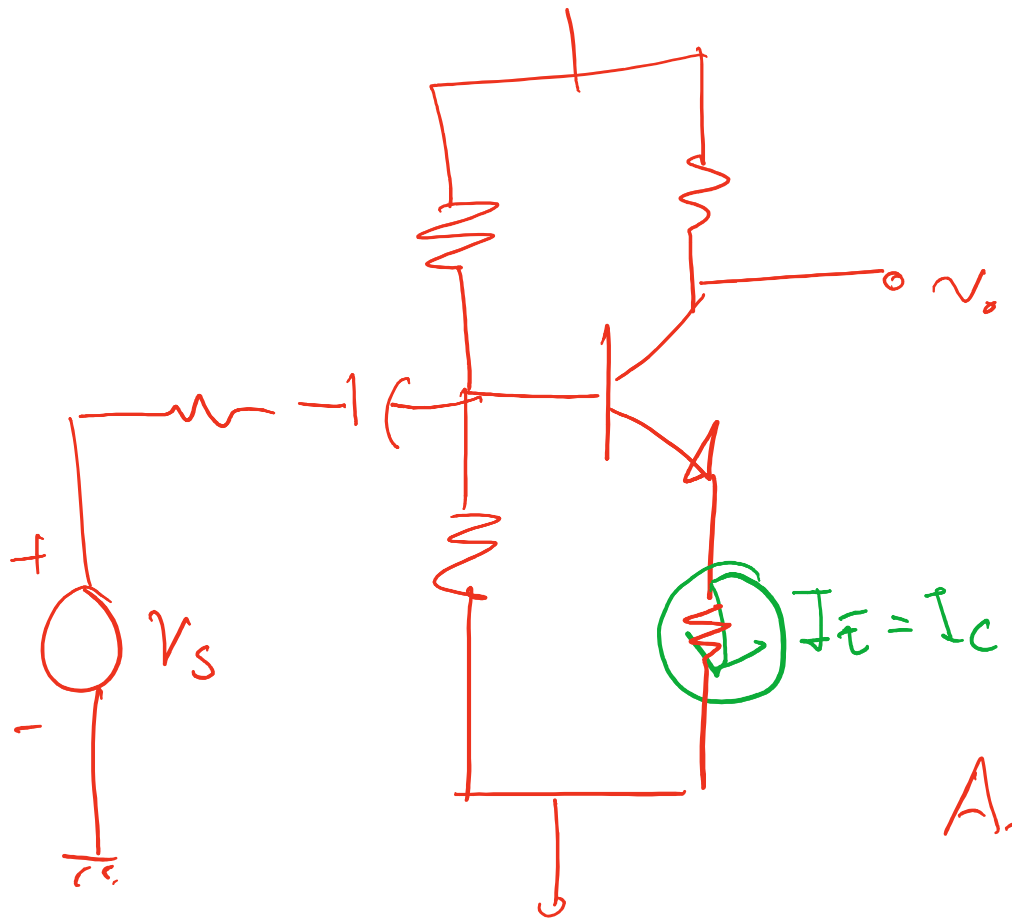
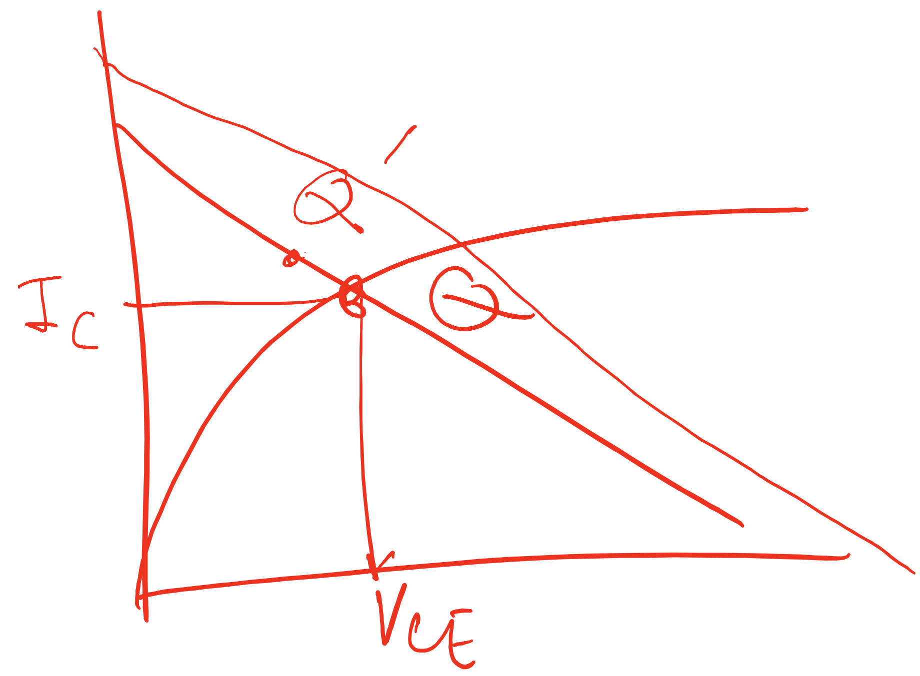
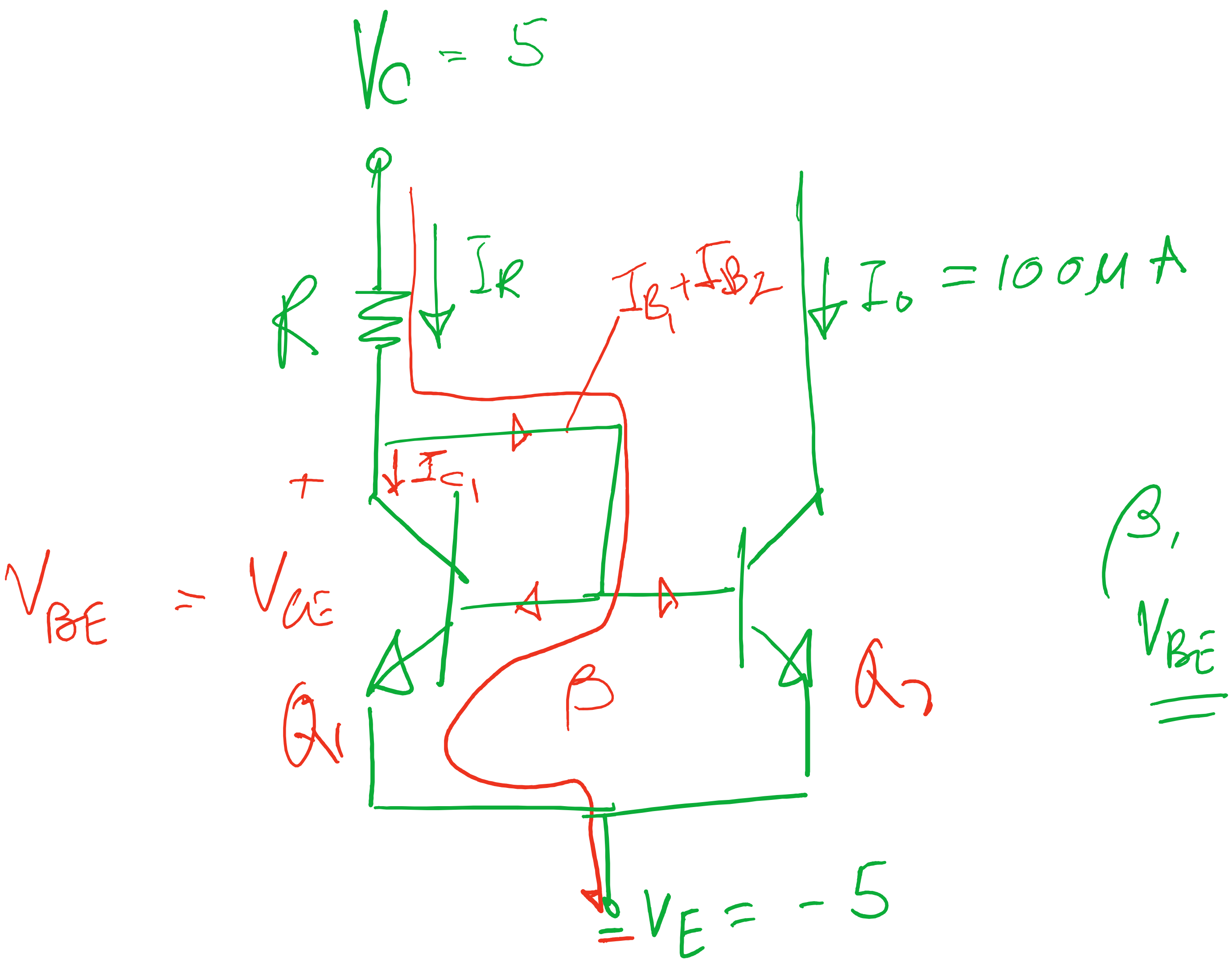
Current Source

Wednesday, March 30, 2016 3:41 PM



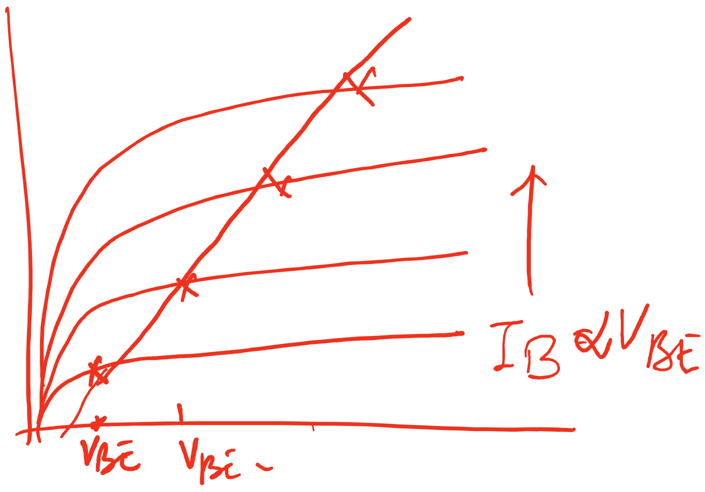


$$A_{v_A} = -\frac{\beta R_L'}{r_\pi + (1+\beta) R_E}$$



$$V_C = I_R R + V_{BE} - V_E$$

$$\therefore R = \frac{V_C + V_E - V_{BE}}{I_R}$$



$$V_{BE_1} = V_{BE_2}$$

$$I_{B_1} = I_{B_2}$$

$$I_{C_1} = I_{C_2} = \beta I_B$$

$$I_R = I_{C_1} + I_{B_1} + I_{B_2} = I_{C_1} + 2I_{B_1}$$

$$= I_{C_2} + 2I_{B_2}$$

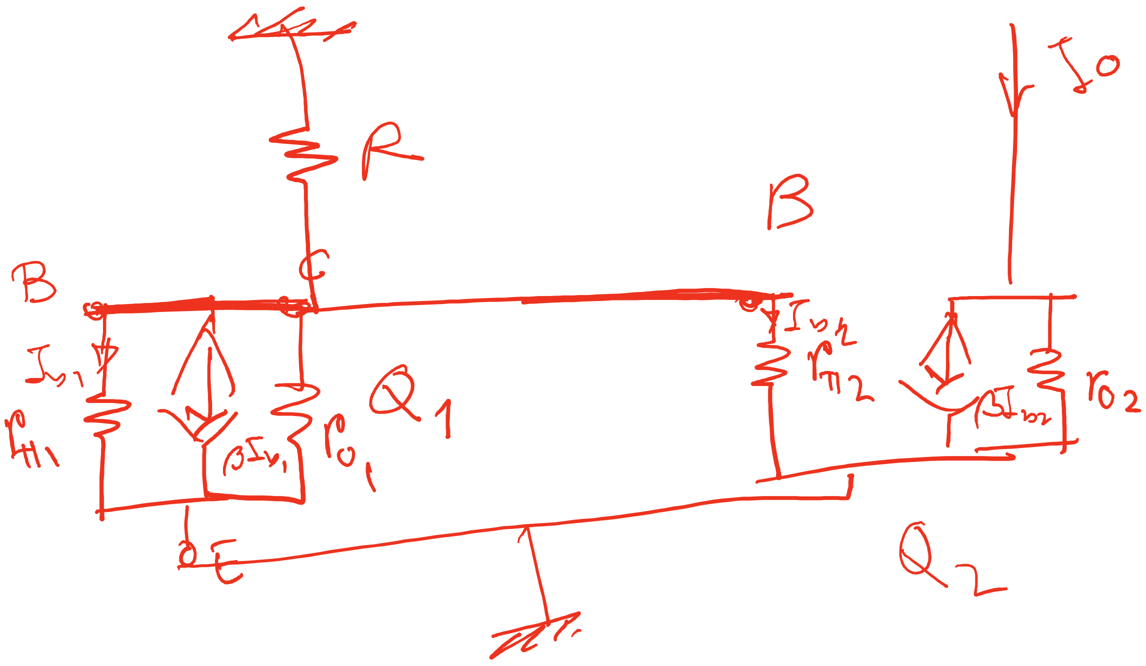
$$= I_{C_2} + \frac{2I_{C_2}}{\beta}$$

$$I_R = I_{C_2}\left(1 + \frac{2}{\beta}\right) = I_B\left(1 + \frac{2}{\beta}\right)$$

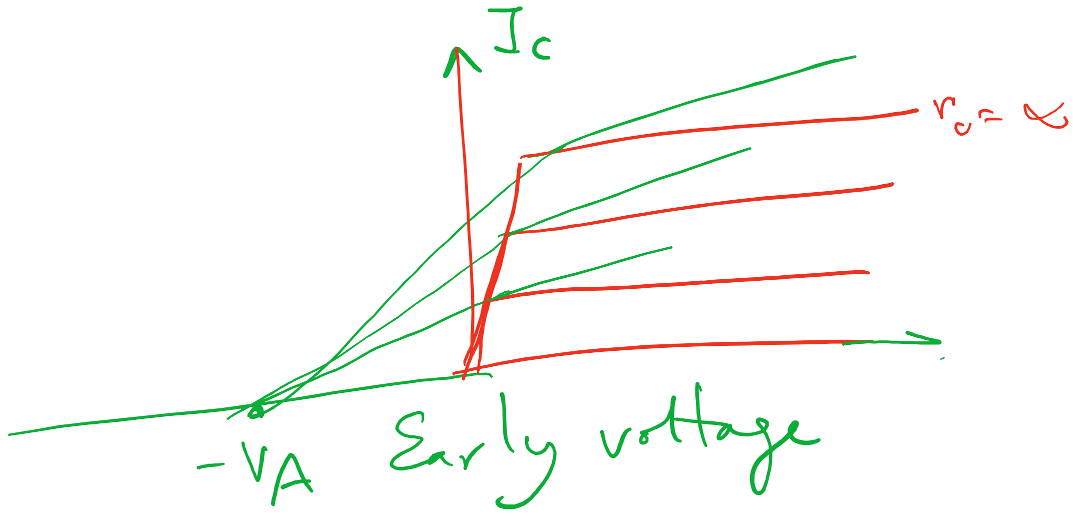
$\beta = 100$, $V_{BE} = 0.7$

$$I_R = 100\mu\left(1 + \frac{2}{100}\right) = 102\mu A$$

$$R = \frac{5+5-0.7}{102\mu A} = 91.17\,k\Omega$$



$$R_o = r_{o2} = \frac{V_A}{I_o}$$



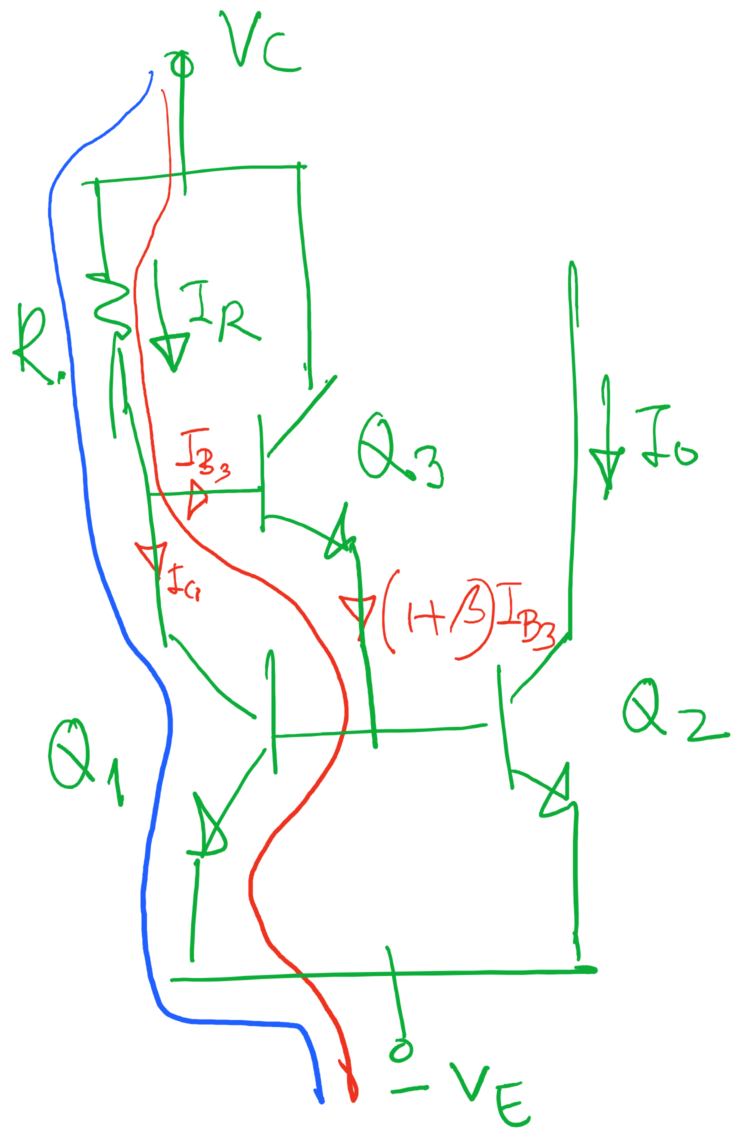
$$I_C = I_S \left(e^{V_{BE}/V_T} - 1 \right) \left(1 + \frac{V_{CE}}{V_A} \right)$$

$$\frac{I_{C1}}{I_{C2}} = \frac{\left(1 + V_{CE1}/V_A\right)}{\left(1 + V_{CE2}/V_A\right)}$$

$$= \frac{1 + \frac{V_{BE}}{V_A}}{\left(1 + \frac{V_{CE2}}{V_A}\right)}$$

Modified Transistor Biasing Circuit

3 - Transistors.



$$R = \frac{V_C + V_E - V_{BE_3} - V_{BE_1}}{I_R}$$

$$= \frac{V_C + V_E - 2V_{BE}}{I_R}$$

$$I_R = I_{C_1} + I_{B_3}$$

$$I_{E_3} = (1+\beta) I_{B_3}$$

$$I_{E_3} = I_{B_1} + I_{B_2} = 2I_{B_1}$$

$$= 2I_{B_2}$$

$$I_R = I_{C_1} + I_{B_3}$$

$$= I_{C_2} + \frac{I_{E_3}}{(1+\beta)}$$

$$= I_{C_2} + \frac{2I_{B_2}}{(1+\beta)}$$

$$= I_{C_2} + \frac{2I_{C_2}}{\beta(1+\beta)}$$

$$= I_{c_2}\left[1+\frac{2}{\beta(1+\beta)}\right]$$

$$I_R = I_o\left[1+\frac{2}{\beta(1+\beta)}\right]$$

$$= 100\mu\left[1+\frac{2}{100\times 101}\right] = 100\,\mu A$$