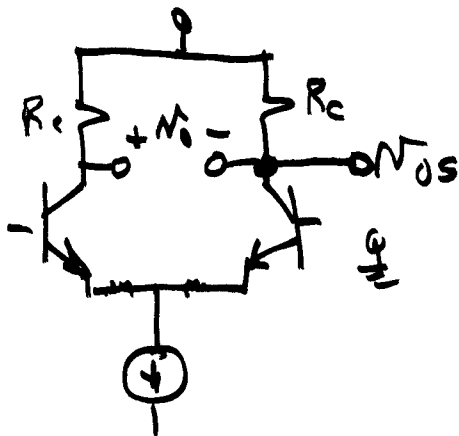


DIFFERENTIAL
AMPLIFIER
(FIRST STAGE)



$$A_{N0} = \frac{-I_c R_c}{V_T}$$

$$R_{in} = 2r_{\pi}$$

$$R_{out} = 2R_c$$

SINGLE-ENDED OUTPUT:

$$\frac{N_{0s}}{N_{i1} - N_{i2}} = \frac{+I_c R_c}{2V_T}$$

$$R_{in} = 2r_{\pi}$$

$$R_{out} = R_c$$

WITH R_E

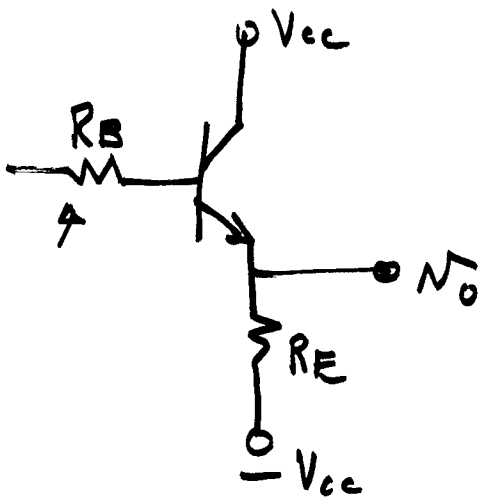
$$R_{in} = 2[r_{\pi} + (\beta + 1)R_E] \quad \text{--- } \triangleright \quad R_{out} \quad R_c$$

$$R_{out} = 2R_c$$

$$A_{N0} = \frac{-\beta R_c}{r_{\pi} + (\beta + 1)R_E}$$

Textbook:

$$A_{N0} \approx \frac{-\beta R_c}{r_{\pi} + \beta R_E} = \frac{-g_m R_c}{1 + g_m R_E}$$



$$A_{NO} \approx 1$$

$$R_{out} = R_E \parallel \frac{(r_{\pi} + R_B) \leftarrow R_B}{\beta + 1}$$

$R_B = R_{out}$ OF THE PREVIOUS STAGE

