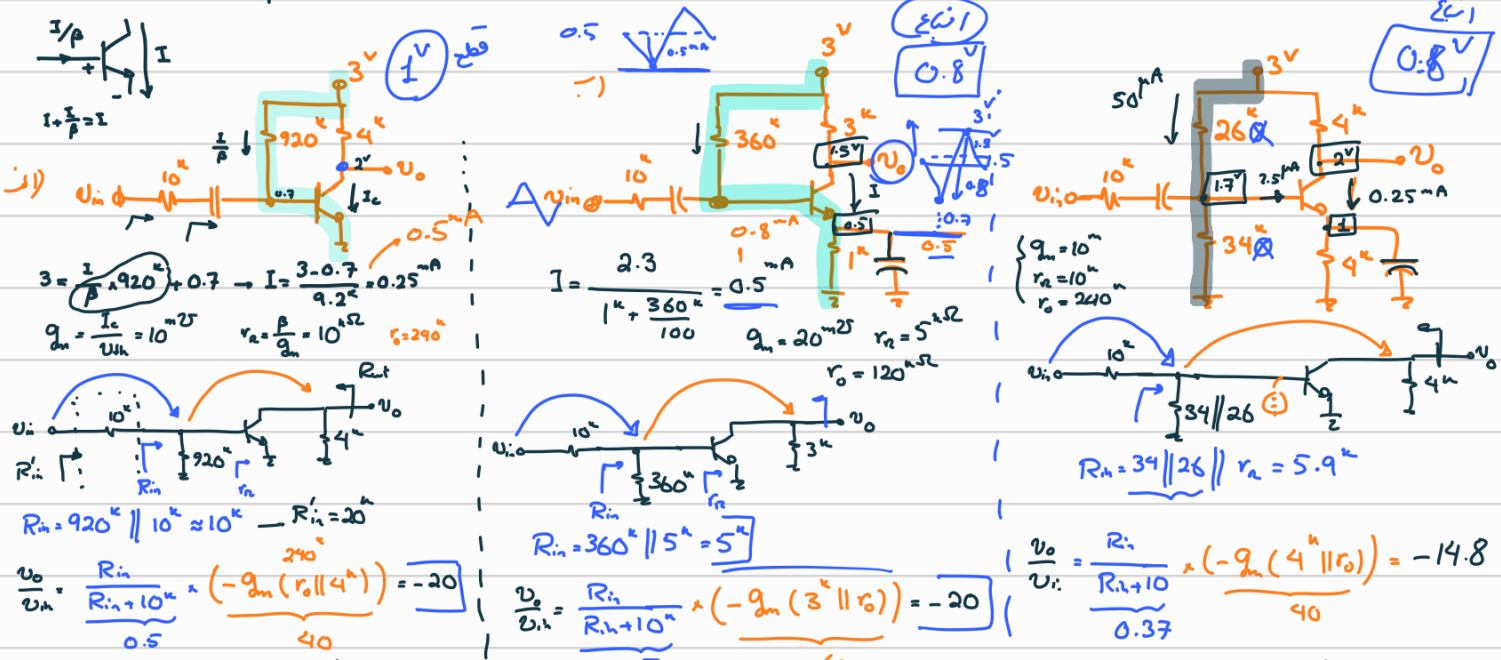
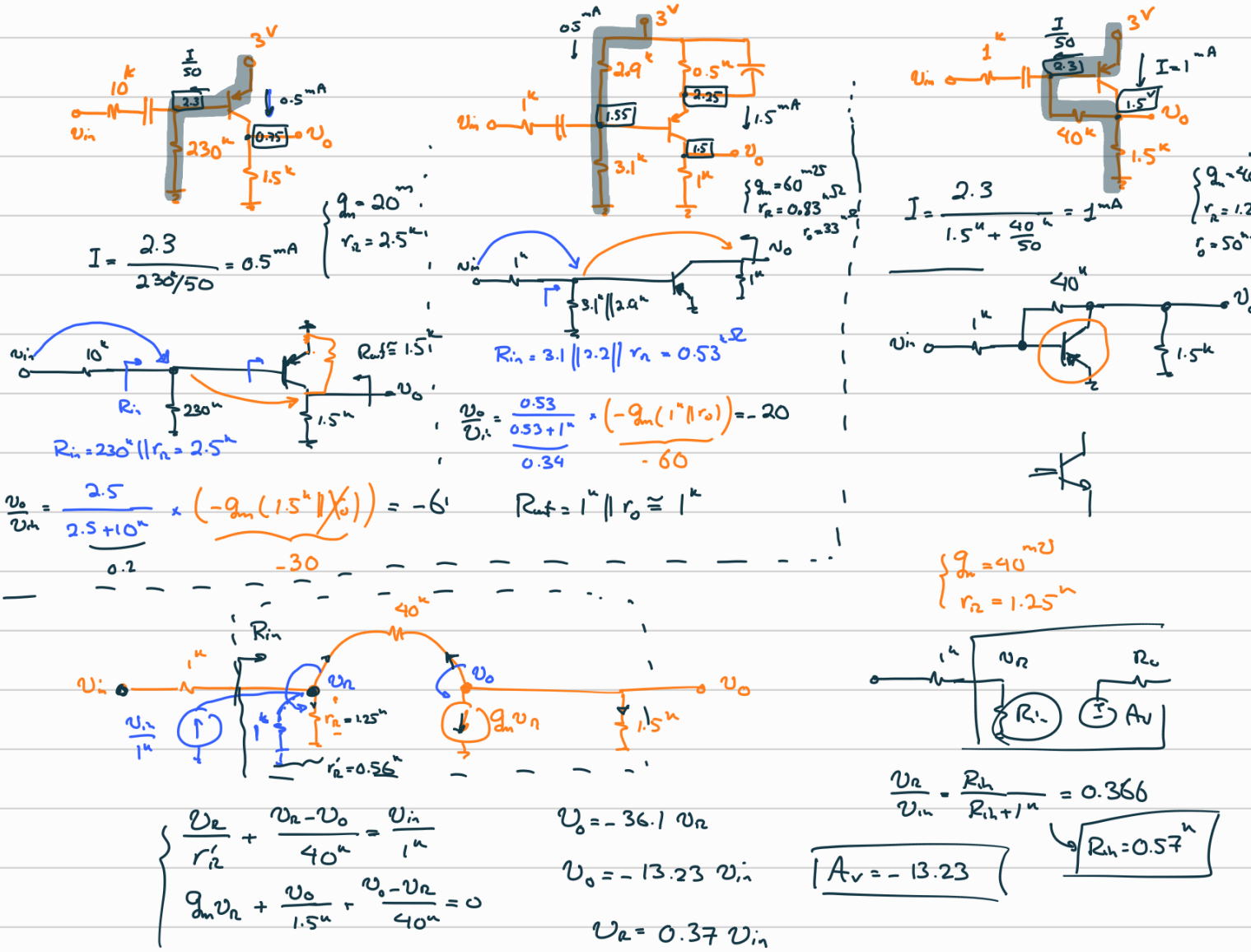
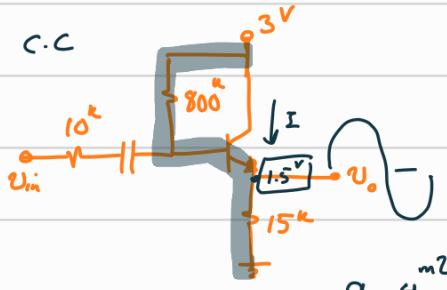
تمرین سری هشتم (*) اختیاری (sp) اساسی

$V_{A_{pnp}} = 50^V$, $\beta_{pnp} = 50$, $V_{A_{npn}} = 60^V$, $\beta_{npn} = 100$, $|V_{CE_{sat}}| = 0.2^V$, $|V_{BE_{ON}}| = 0.7^V$ در تمامی سوال‌ها





C.C

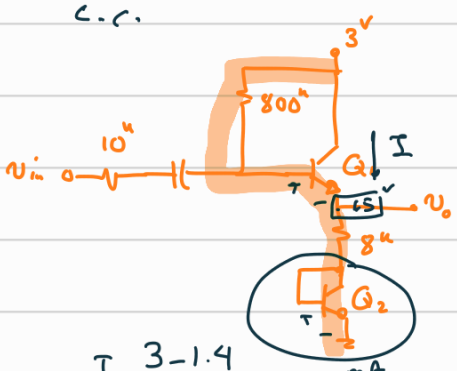


$$I = \frac{2.3}{15 + \frac{800}{100}} = 0.1\ mA$$

$g_m = 4\ mV$

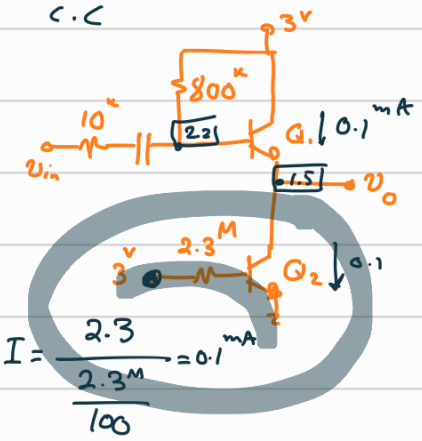
$r_\pi = 25\ k\Omega$

C.C.

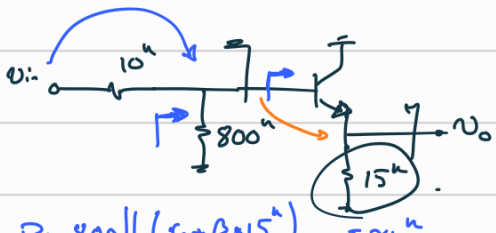


$$I = \frac{3 - 1.4}{8 + \frac{800}{100}} = 0.1\ mA$$

C.C



$$I = \frac{2.3}{\frac{2.3^M}{100}} = 0.1\ mA$$



$R_{in} = 800 \parallel (r_\pi + \beta \times 15^k) = 524^k$

($r_\pi + \beta \times 15^k = 1525^k$)

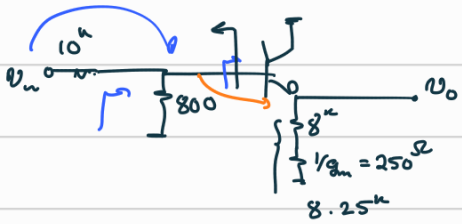
$$\frac{v_o}{v_{in}} = \frac{R_{in}}{R_{in} + 10^k} \times \frac{15^k}{15^k + \frac{1}{g_m}} \approx 1 = 0.965$$

($\frac{1}{g_m} = 0.25^k$)

0.9812 0.9836

$$R_{out} = 15^k \parallel \frac{10^k + 25^k}{100} \cong 0.35^k$$

($\frac{10^k + 25^k}{100} = 0.35^k$)



$R_{in} = 800 \parallel (r_\pi + \beta \times 8.25^k) = 412^k$

($r_\pi + \beta \times 8.25^k = 850$)

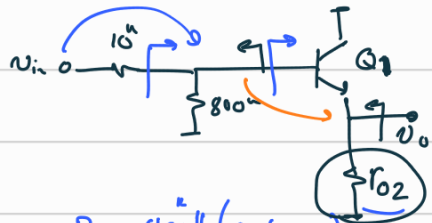
$$\frac{v_o}{v_{in}} = \frac{R_{in}}{R_{in} + 10^k} \times \frac{8.25^k}{8.25^k + 0.25^k}$$

0.976 0.97

$0.947 \approx 1$

$$R_{out} = 8.25^k \parallel \frac{10^k + 25^k}{100}$$

$= 0.35^k$



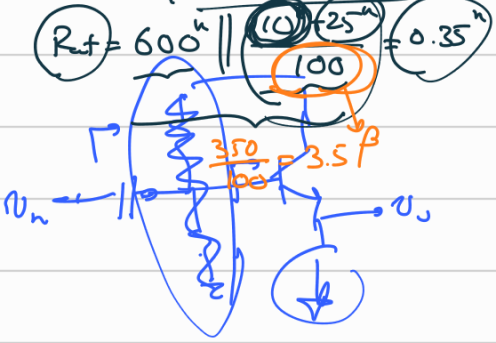
$R_{in} = 800^k \parallel (r_\pi + 600 \times 100) \approx 800^k$ (600^k)

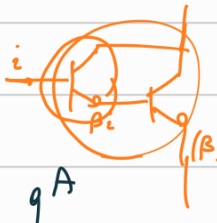
$$\frac{v_o}{v_{in}} = \frac{R_{in}}{R_{in} + 10^k} \times \frac{600^k}{600^k + \frac{1}{g_m}}$$

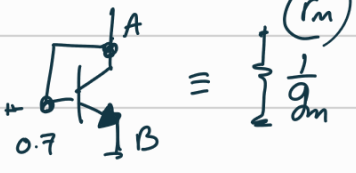
0.9876 0.9996

0.987 ≈ 1

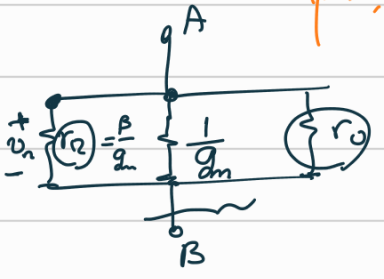
$R_{out} = 600^k \parallel \frac{10^k + 25^k}{100} = 0.35^k$

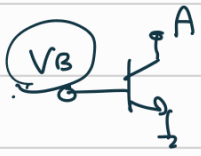


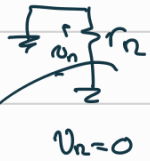




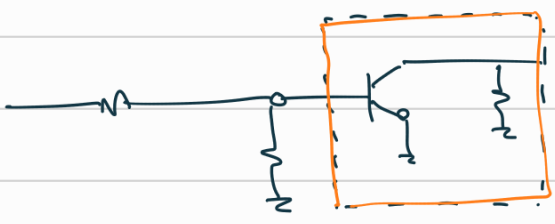
$\equiv$ r_π $\frac{1}{g_m}$

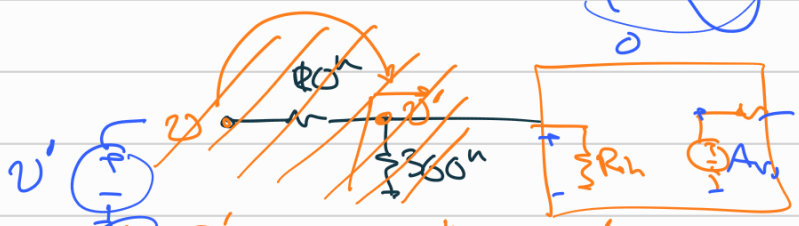






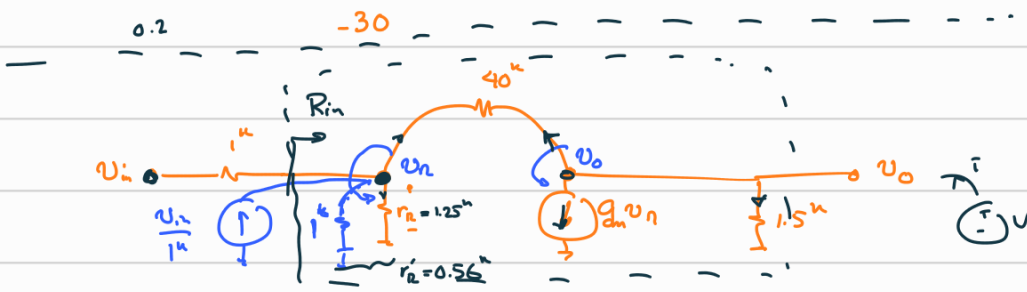
$v_\pi = 0$





$\frac{v'}{v} = \frac{R'_{in}}{R'_{in} + 10^k}$

$R_{in} \parallel 360^k = R'_{in}$



$$\begin{cases} \frac{v_R}{r'_R} + \frac{v_R - v_o}{40^k} = \frac{v_{in}}{1^k} \\ g_m v_R + \frac{v_o}{1.5^k} + \frac{v_o - v_R}{40^k} = 0 \end{cases}$$

$$v_o = -36.1\, v_R$$

$$v_o = -13.23\, v_{in}$$

$$v_R = 0.37\, v_{in}$$

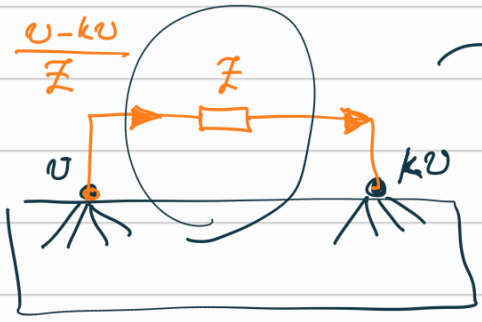
$$\begin{cases} g_m = 40 \\ r_R = 1.25^k \end{cases}$$

$$\frac{v_R}{v_{in}} = \frac{R_{in}}{R_{in}+1^k} = 0.366$$

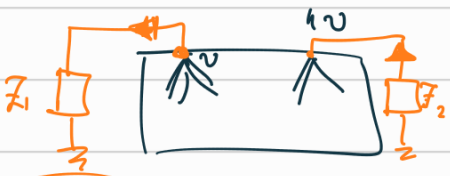
$$R_{in} = 0.57^k$$

$$A_v = -13.23$$

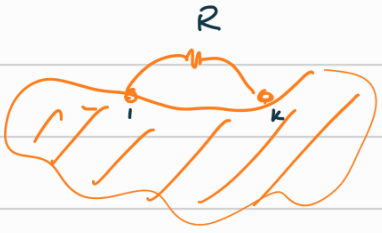
(مبرهنة ميلر) :



$$\frac{v}{Z_1} = \frac{v-kv}{Z}$$



$$Z_1 = \frac{Z}{1-k}$$

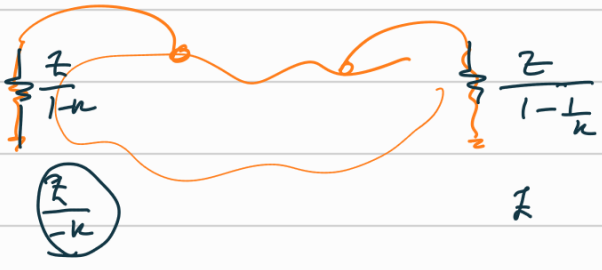


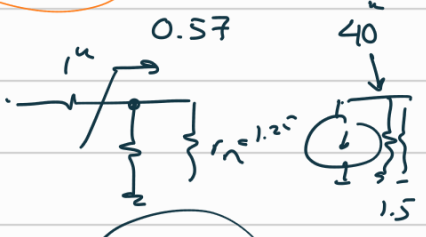
$$\frac{-kv}{Z_2} = \frac{v-kv}{Z}$$

$$Z_2 = \frac{Zk}{k-1}$$

$$Z_2 = \frac{Z}{1-\frac{1}{k}}$$

$k \gg 1$





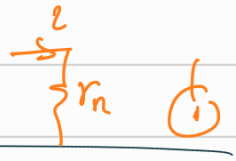
$$\frac{40}{1+36.1}^k$$

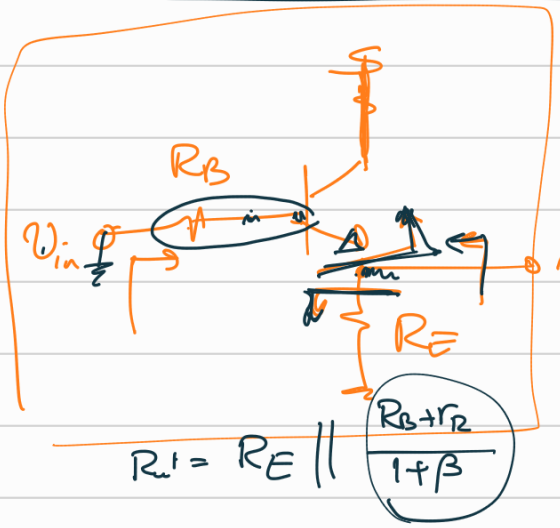
1.08

$k = -36.1$

$$R_{out} = 1.5^k \,\|\, 40^k \simeq 1.5^k$$

$$= 1.44^k$$



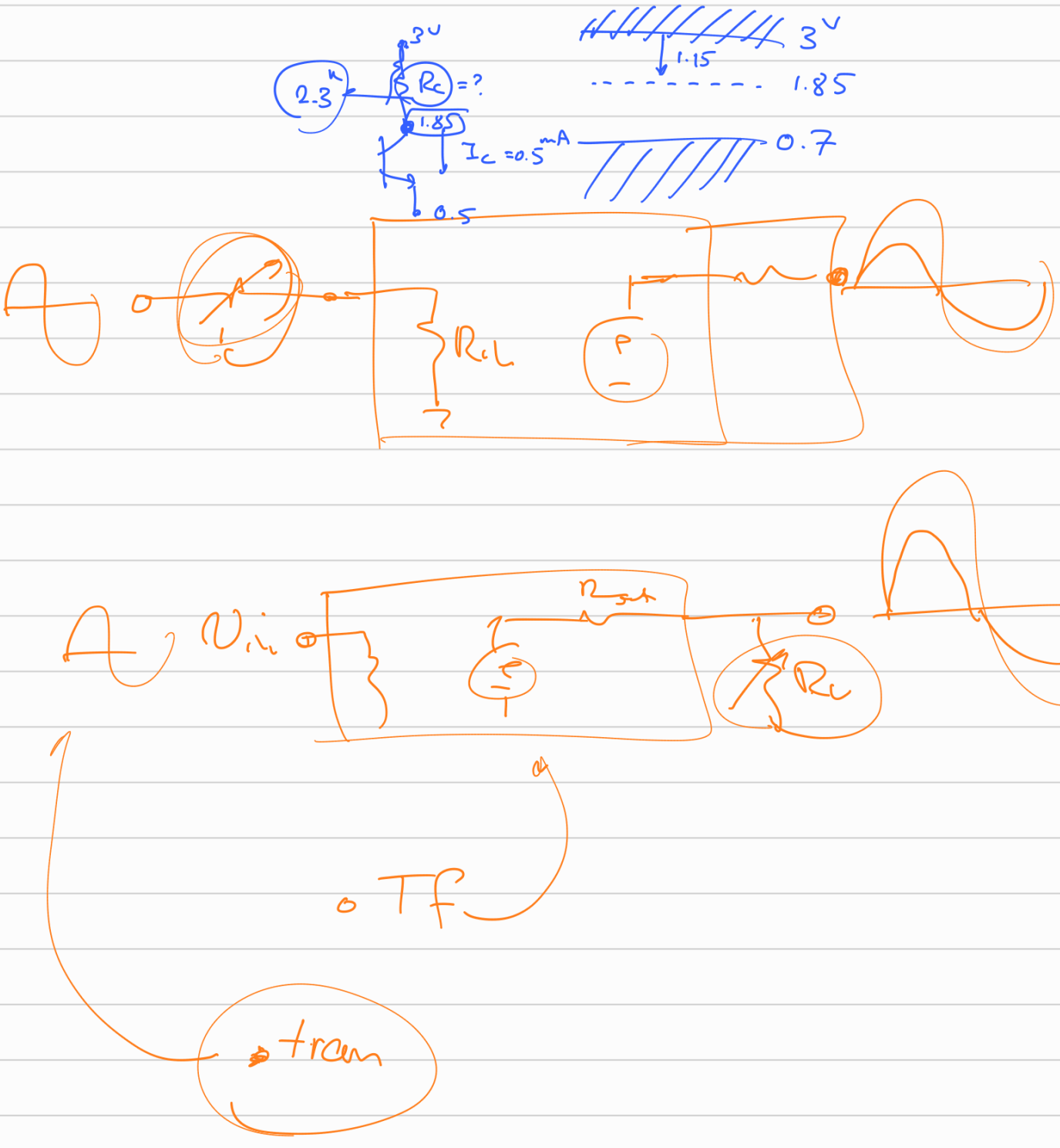


$$R_{in} = R_E \,\|\, \frac{R_B + r_R}{1+\beta}$$

$$\frac{v_o}{v_{in}} = \frac{R_E}{R_E + \frac{R_B + r_R}{\beta}}$$

$$R_{in} = R_B + r_R + (1+\beta) R_E$$

$$R_{out} = R_E \,\|\, \frac{R_B + r_R}{1+\beta}$$


3V
2.3K
Rc =?
1.85
Ic =0.5mA
0.5
3V
1.15
1.85
0.7
RcL
P
Vin
Rsh
P
RL
Tf
tran