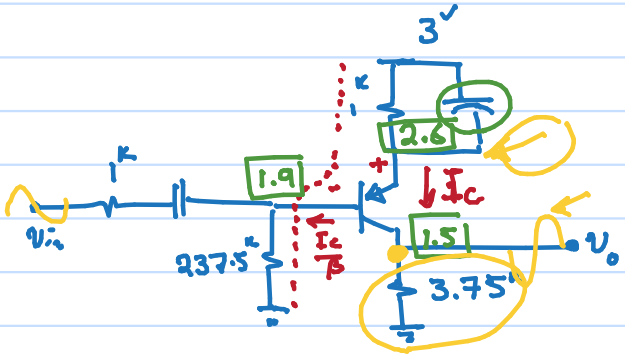


$$3 = 1^k I_C + 0.7 + 237.5^\Omega \frac{I_C}{50}$$

$$I_C = \frac{2.3}{1^k + \frac{237.5^\Omega}{50}} = 0.4^{mA}$$

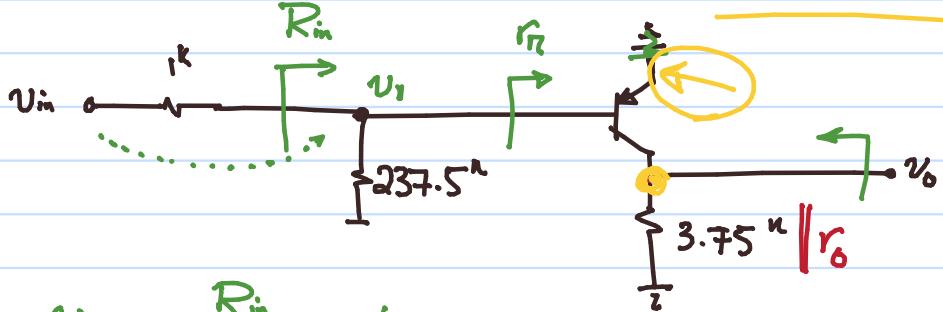
$g_m = 16^{mA/V}$

$r_\pi = 62.5^\Omega$

$r_o = 125^k$

2.4 − 0.9 = 1.5V

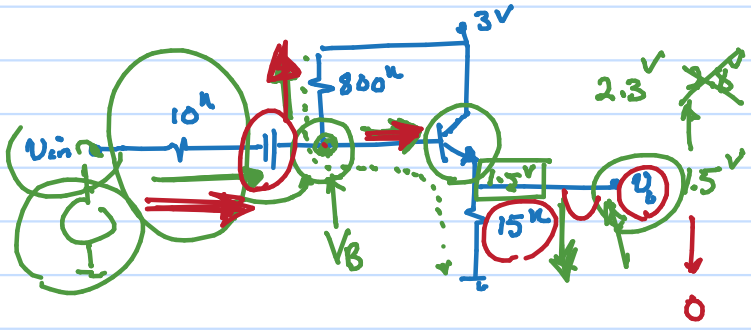
max Swing = 0.9V

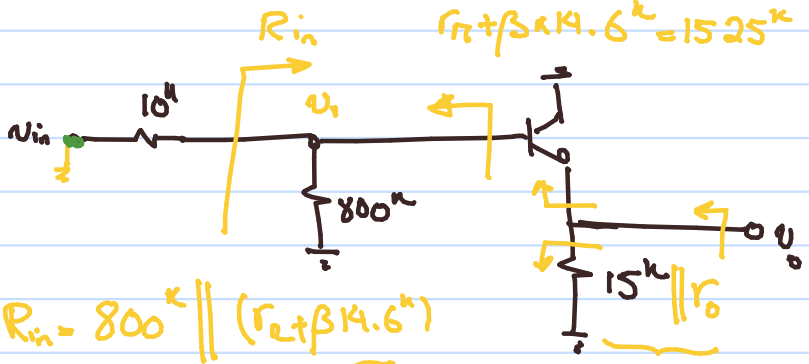


$$R_{in} = 237.5^\Omega \parallel 3.12^k = 3.1^k$$

$$R_{out} = 3.7^k$$

$$\frac{v_o}{v_{in}} = \underbrace{\frac{R_{in}}{R_{in} + 1^k}}_{0.75} \times \left(-g_m \underbrace{(3.75^k \parallel r_o)}_{3.7^k}\right) = -45.3$$

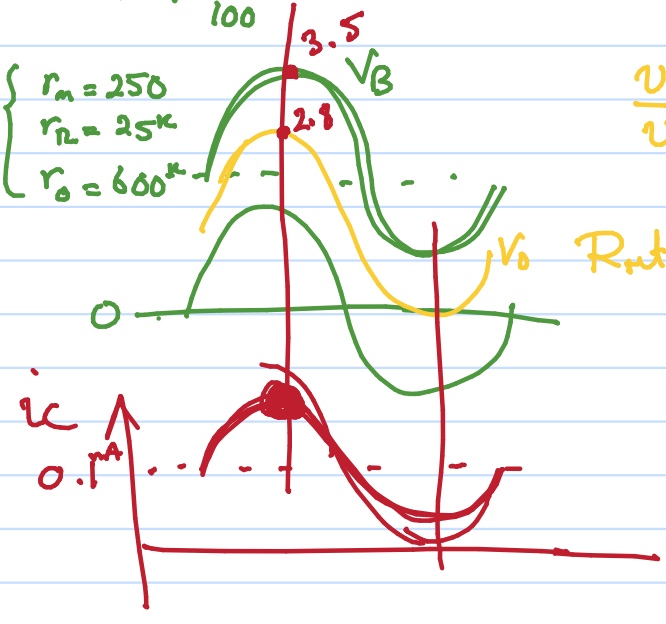




$$R_{in} = 800^k \| (r_\pi + \beta 14.6^k) = 524^k$$

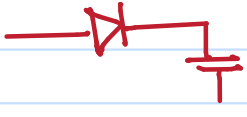
$$I_C = \frac{2.3}{15^k + \frac{800^k}{100}} = 0.1^{mA}$$

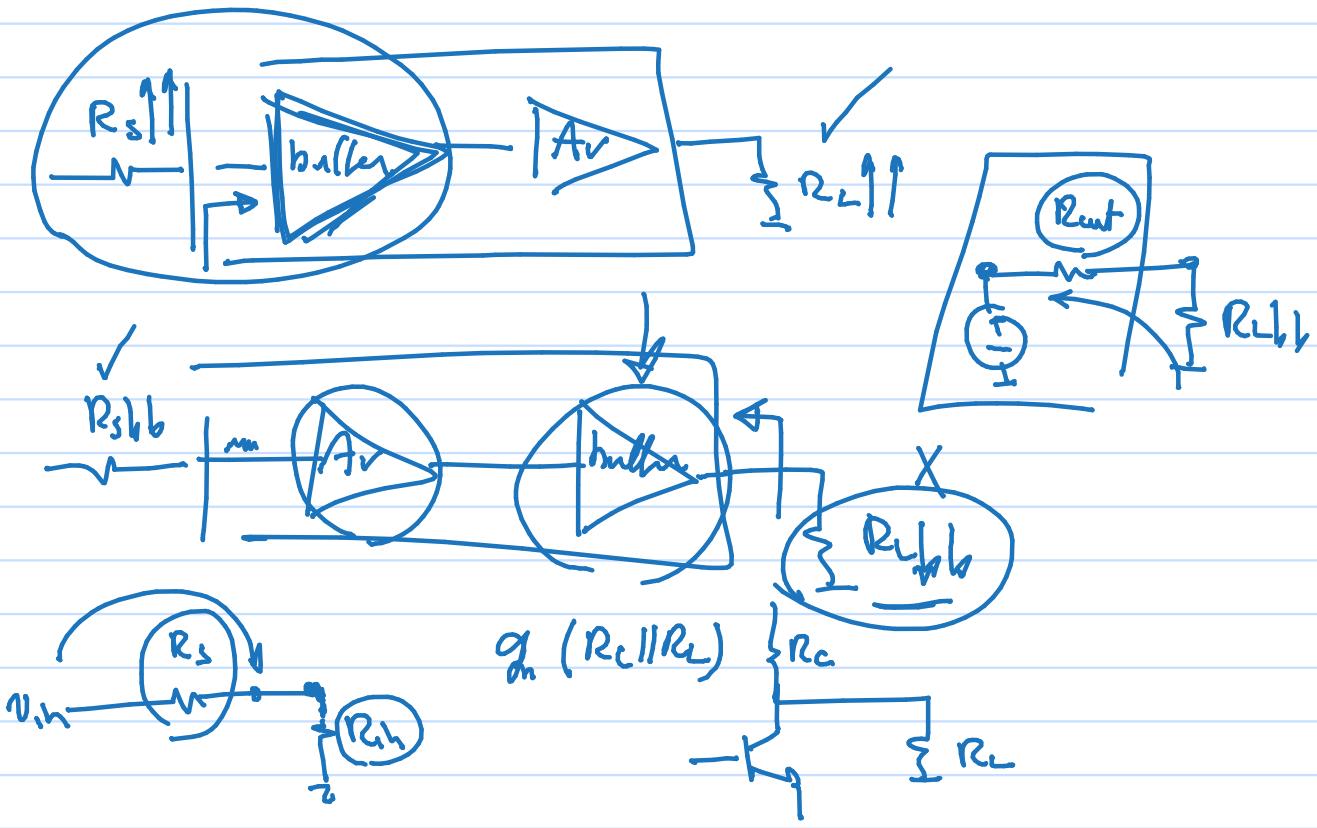
$$\begin{cases} r_m = 250 \\ r_\pi = 25^k \\ r_o = 600^k \end{cases}$$

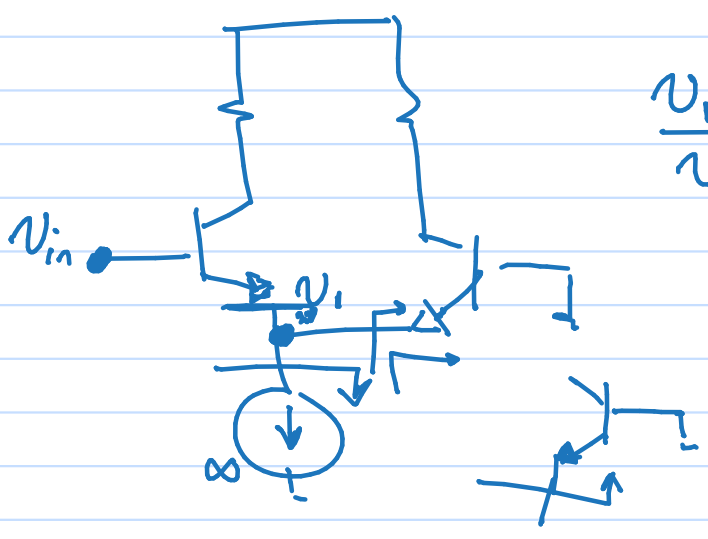


$$\frac{v_o}{v_{in}} = \left(\frac{R_{in}}{R_{in} + 10^k}\right) \frac{14.6^k}{14.6^k + r_m} = 0.98$$

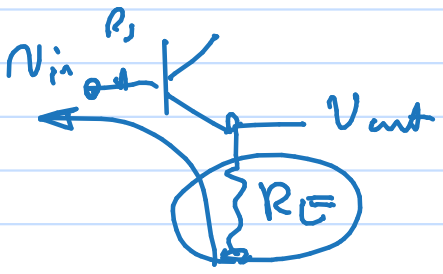
$$R_{out} = 14.6^k \| \frac{+r_\pi}{\beta} = 348^\Omega \qquad (R_B = 10^k \| 800^k)$$



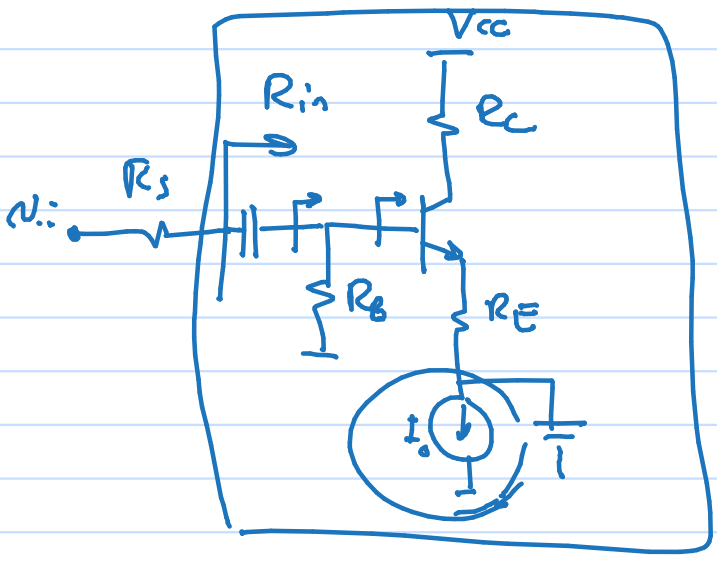




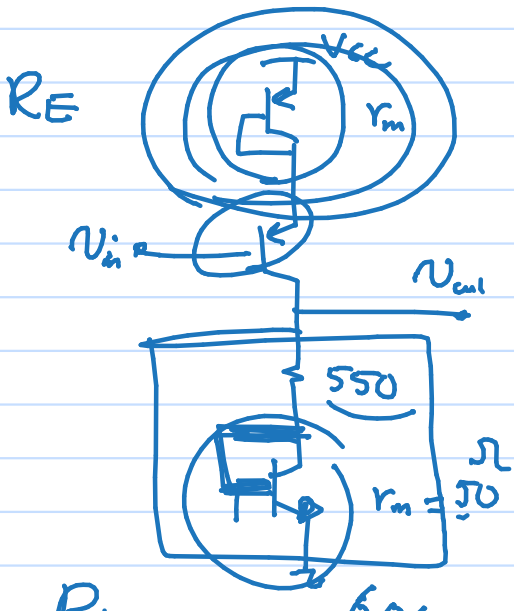
$$\frac{v_1}{v_{in}} = \frac{R_E}{R_E + r_m} = \frac{r_m}{r_m + r_m} = \frac{1}{2}$$



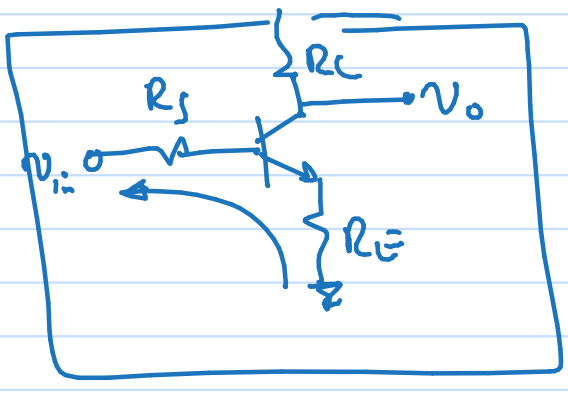
$$A_v = \frac{R_E}{R_E + \frac{r_\pi + R_s}{\beta}}$$



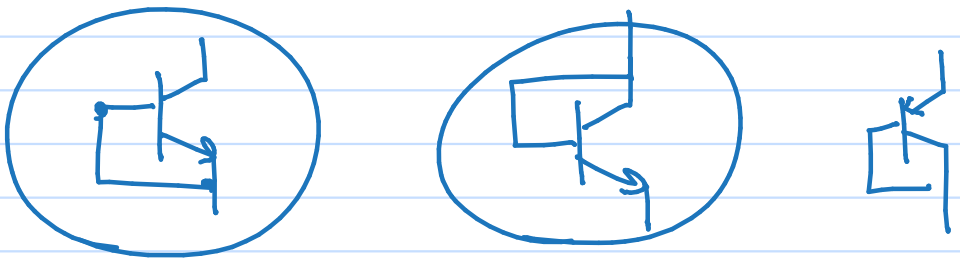
✓ R_s
✓ V_{CC}
✓ R_C

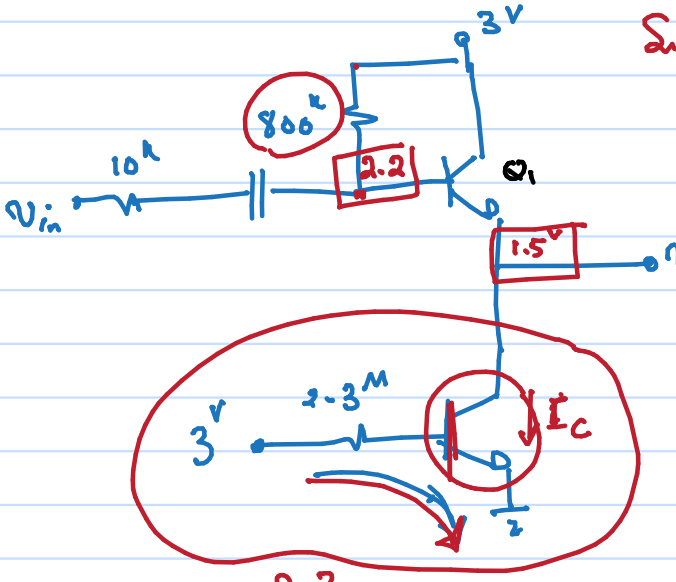


$$\frac{-R_C}{R_E + \frac{r_\pi}{\beta}} = \frac{-600}{50 + 50} = -6$$



$$\frac{v_o}{v_{in}} = \frac{-R_C}{R_E + \frac{R_s + r_\pi}{\beta}}$$





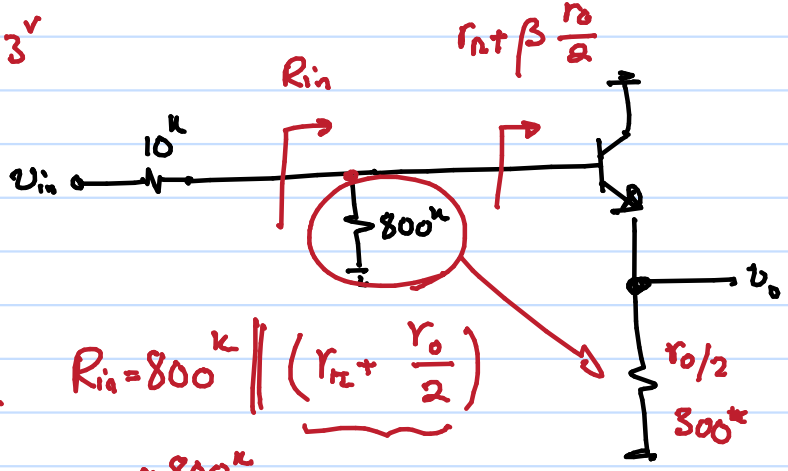
Swing = 1.3 V

2.8

1.5

0.2

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

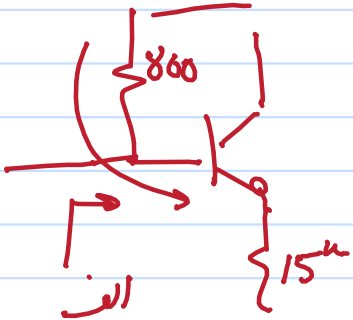


$$R_{in} = 800^k \parallel \left(r_\pi + \frac{r_o}{2}\right)$$

$$\approx 800^k$$

$$\frac{v_o}{v_{in}} = \frac{R_{in}}{R_{in} + 10^k} \times \frac{r_{o/2}}{r_{o/2} + r_m} = 0.99$$

$$R_{out} = 300^k \parallel \frac{R_B + r_\pi}{1} = 348^\Omega$$



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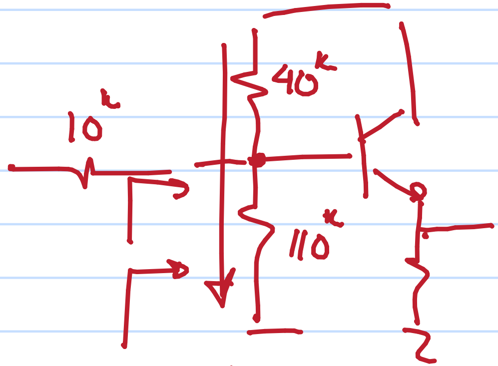
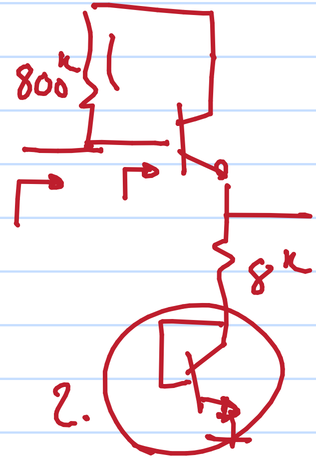


ب 30k



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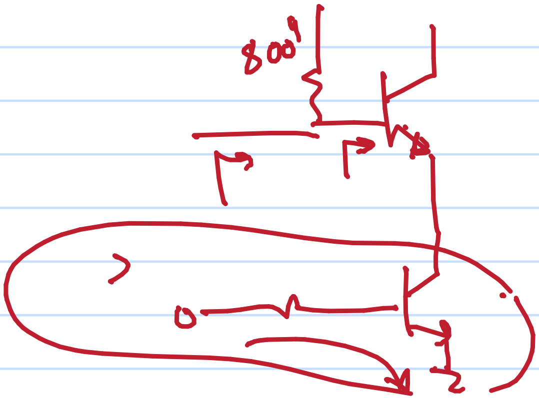
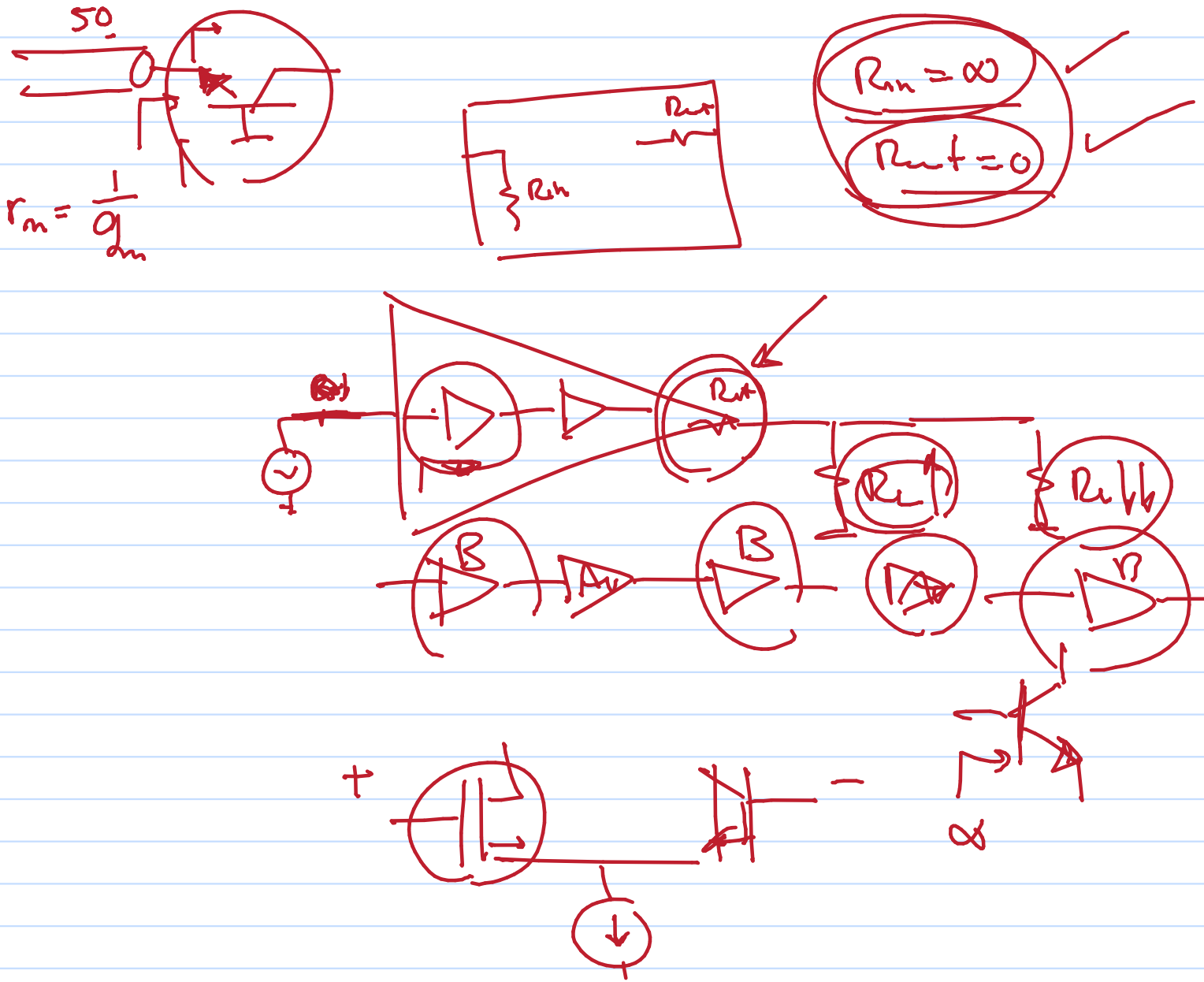


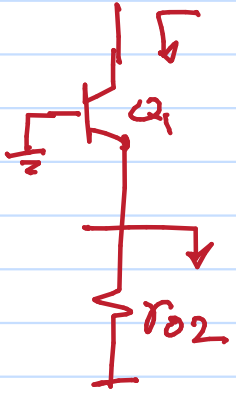
بدترین

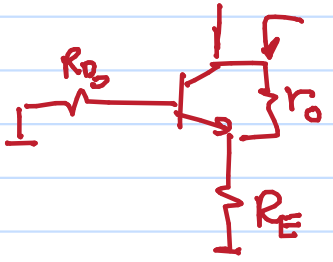
(ب)

بهترین

(د)


50
$r_m = \frac{1}{g_m}$
R_{out}
R_{in}
$R_{in} = \infty$
$R_{out} = 0$
R_{out}
R_L
R_{load}
B
A_V
B
+
−
α





$$r_o\left(1+\frac{\beta R_E}{R_B+R_E+r_o}\right)$$

$$r_{o1}\left(1+\frac{\beta\, r_{o2}}{r_{o2}+r_2}\right)=\beta r_{o1}$$