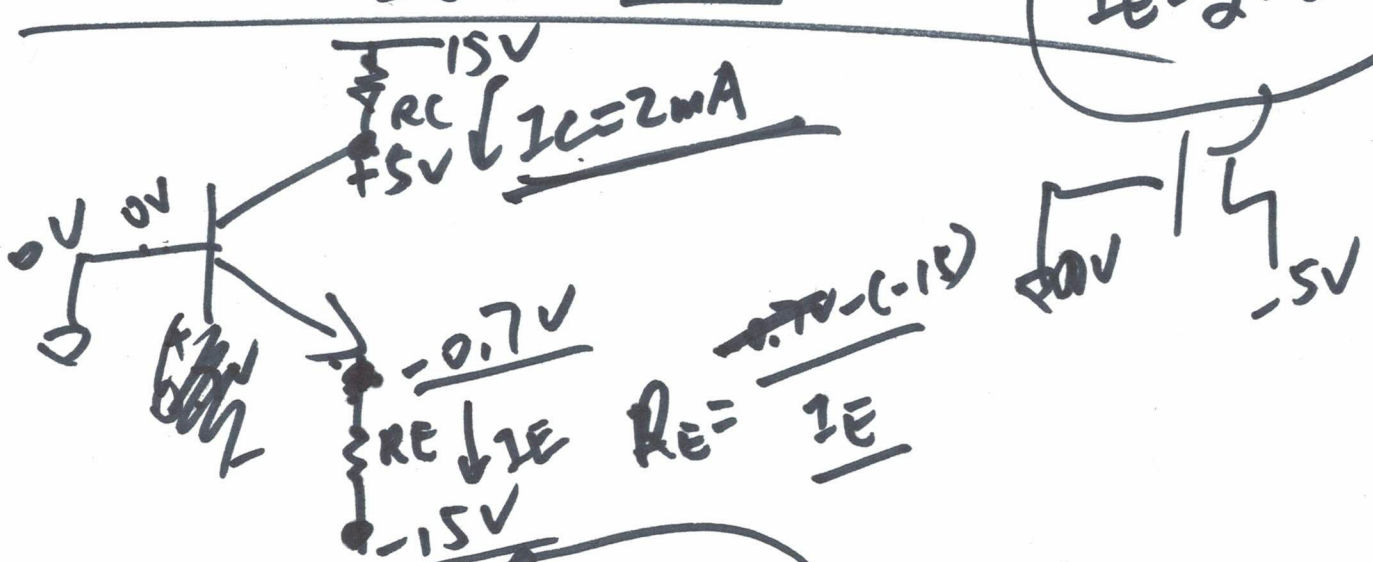
BJTs III

$I_E = \frac{1}{\alpha} I_C$



$R_E = \frac{0.7 - (-15)}{I_E}$

$\beta = 100$, $V_{BE} = 0.7V$ at $I_C = 1mA$. Design the circuit so that $I_C = 2mA$, $V_C = +5V$

$$R_C = \frac{15-5}{I_C} = \frac{10V}{2mA} = 5K\Omega$$

$I_C = I_S \cdot e^{V_{BE}/V_T}$

$$\frac{I_{C1}}{I_{C2}} = \frac{I_S e^{V_{BE1}/V_T}}{I_S e^{V_{BE2}/V_T}}$$

$$0.5 = \frac{1mA}{2mA} = e^{(V_{BE1} - V_{BE2})/V_T} = e^{(0.7 - V_{BE2})/V_T}$$

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

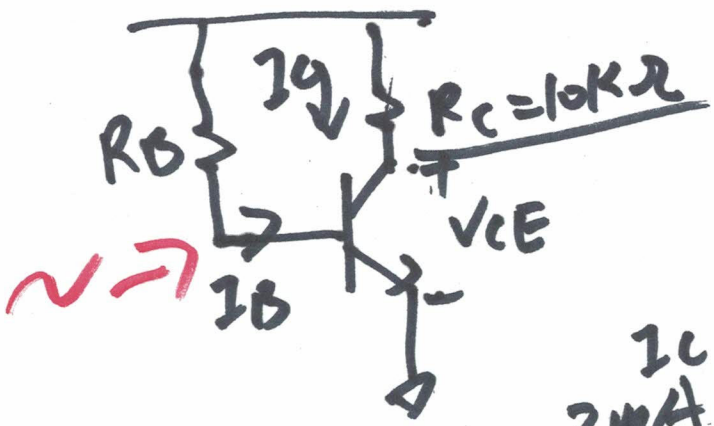
$\beta = \frac{\alpha}{1-\alpha}$

$V_B = 0$, $V_E = ?$ $V_{BE} = 0 - V_E \Rightarrow V_E = \_\_\_$

(1)

$$\begin{cases} R_E = \dfrac{V_E - (-15)}{I_E} \\ I_E = \dfrac{1}{2} I_C \end{cases}$$

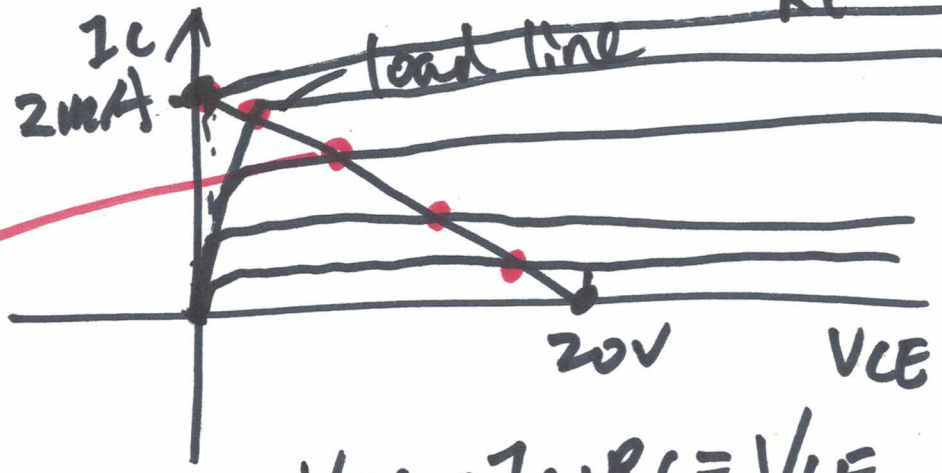
V_{CC}=20V BJT Load Line, and Quiescent Point



C(load) (Q Point)

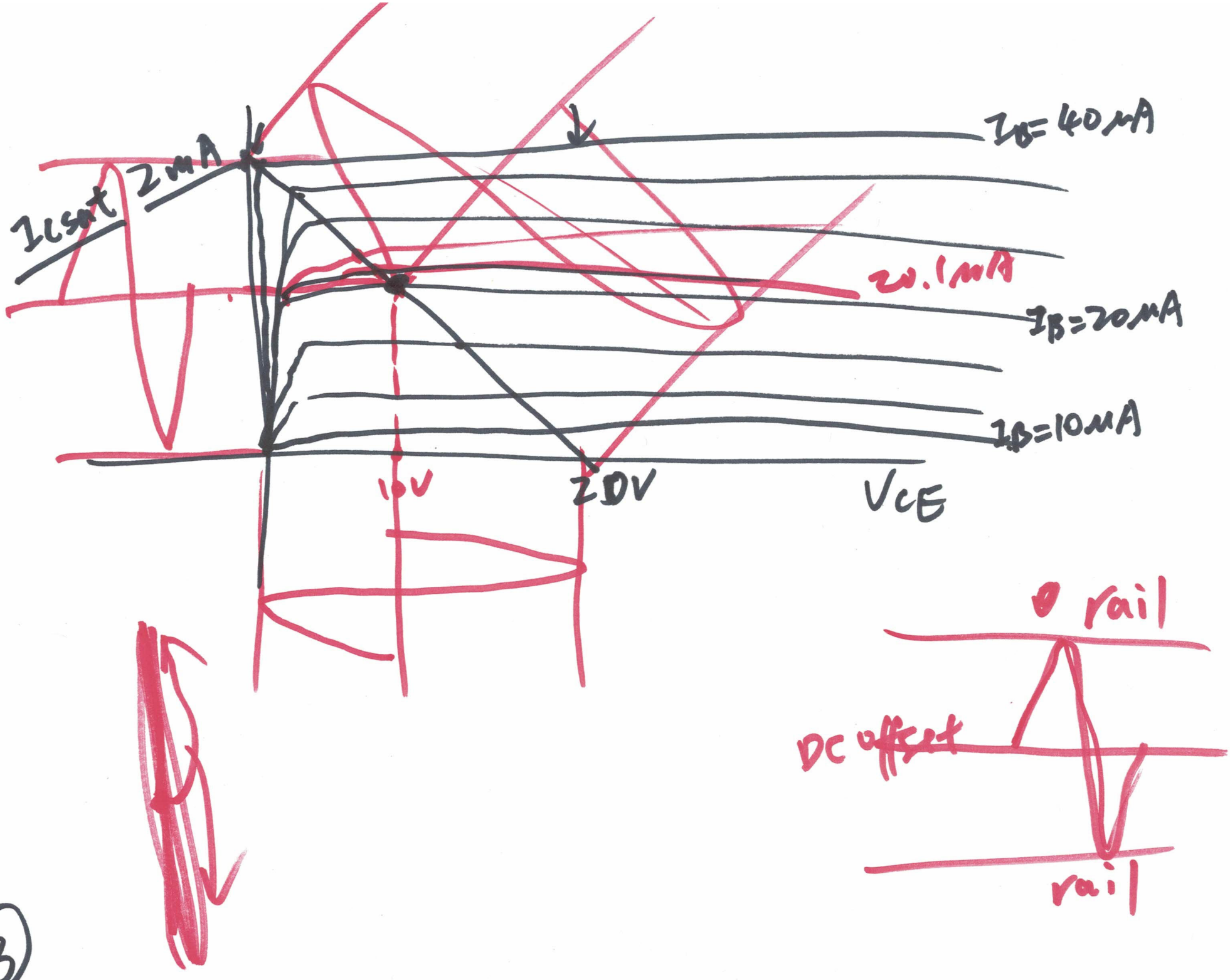
① If $I_C = 0$, $V_{CE} = V_{CC} = 20V$

If $V_{CE} = 0$, $I_C = \dfrac{V_{CC}}{R_C} = 2mA$



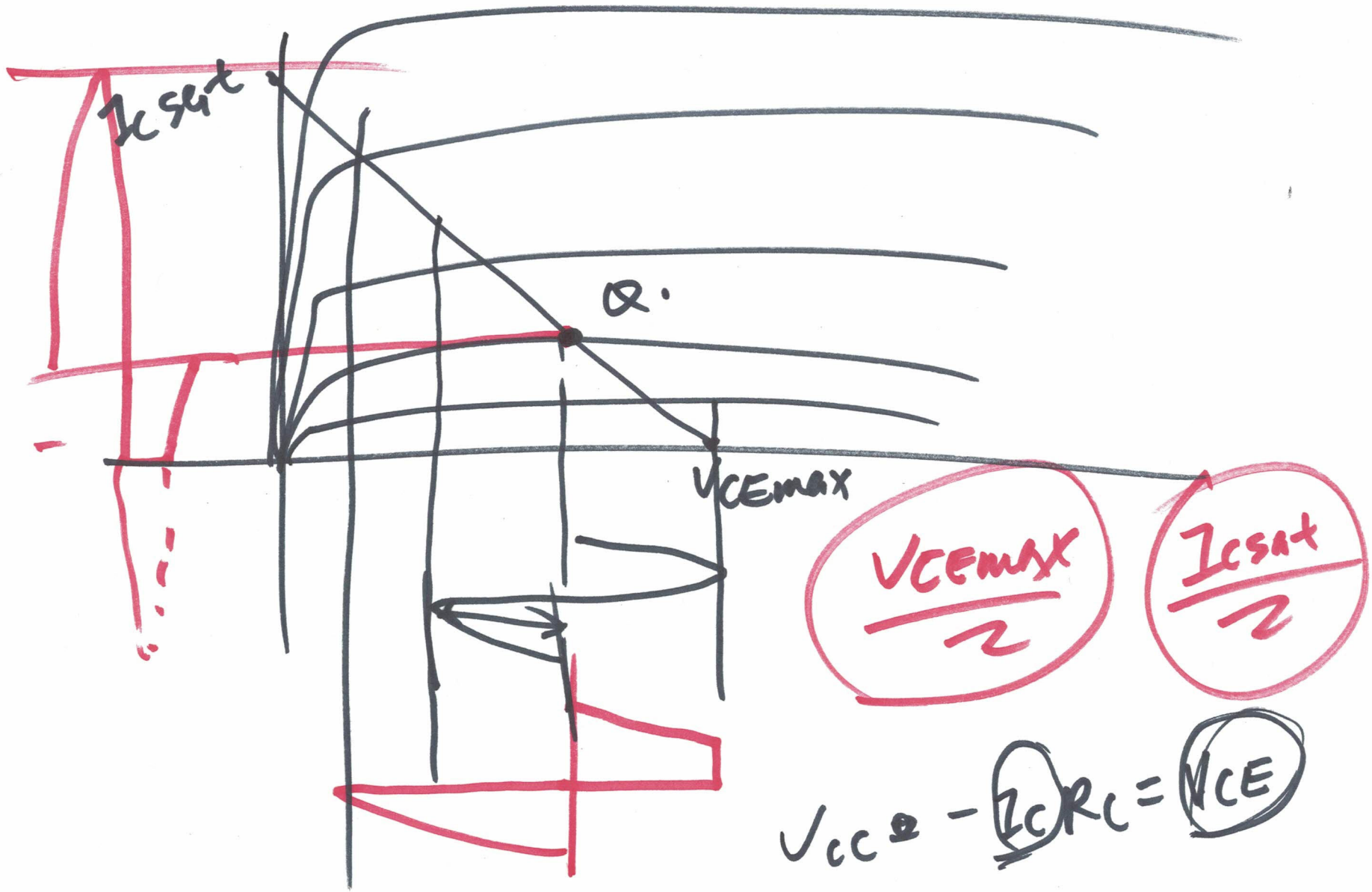
Q point

$$V_{CC} - I_C \cdot R_C = V_{CE}$$


2mA
$I_{C(sat)}$
I_B=40mA
20.1mA
I_B=20mA
I_B=10mA
10V
20V
V_{CE}

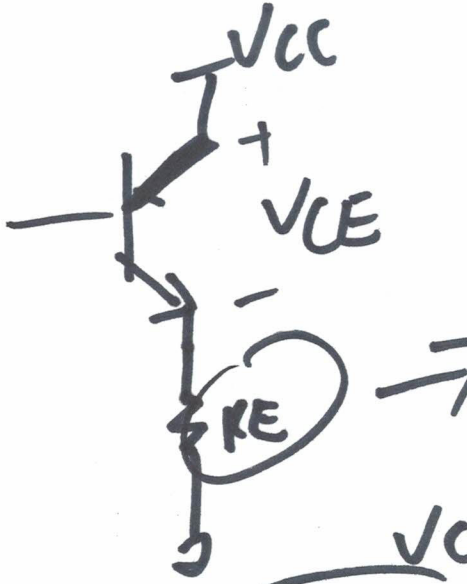
0 rail
DC offset
rail

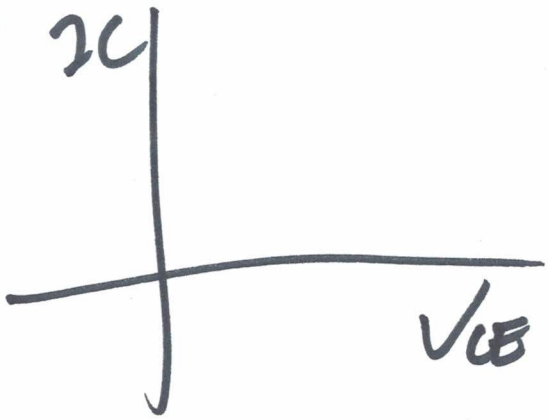
(3)


Icsat
Q.
VCEmax
VCEmax / 2
Icsat / 2
Vcc = - IcRc = VCE

△Effect of the emitter resistor

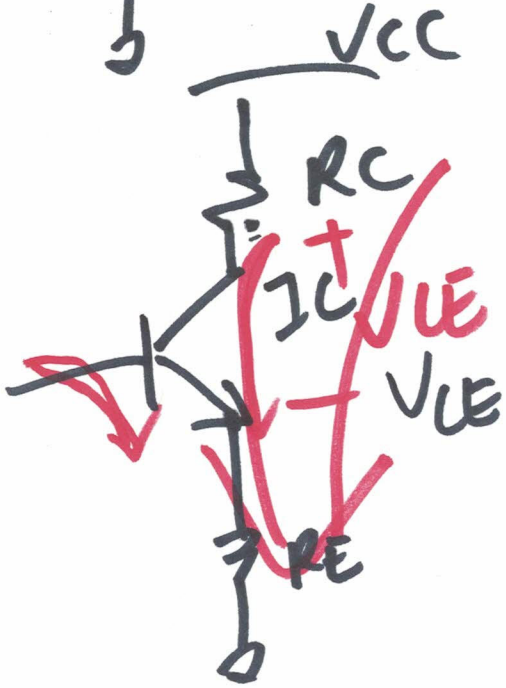
$V_{CC} - V_{CB} = I_E R_E$





$I_E = I_C + I_B$

$I_E \approx I_C$



$V_{CE} = V_{CC} - I_C(R_C + R_E)$

$\beta = 100, 200$

$I_E = \left[\frac{1}{\alpha}\right] I_C$

$I_C = [\alpha]\, I_E$

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

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