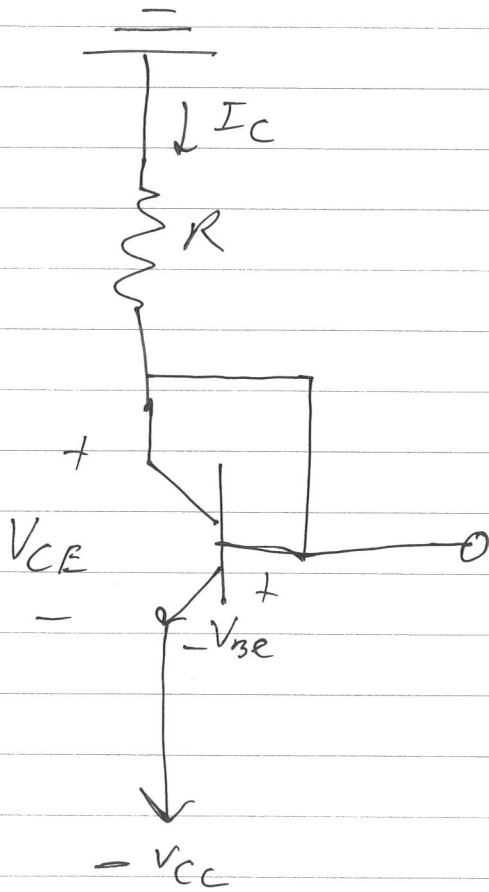


(20)

next  
circuit !!



can we figure  
this one out?

If active

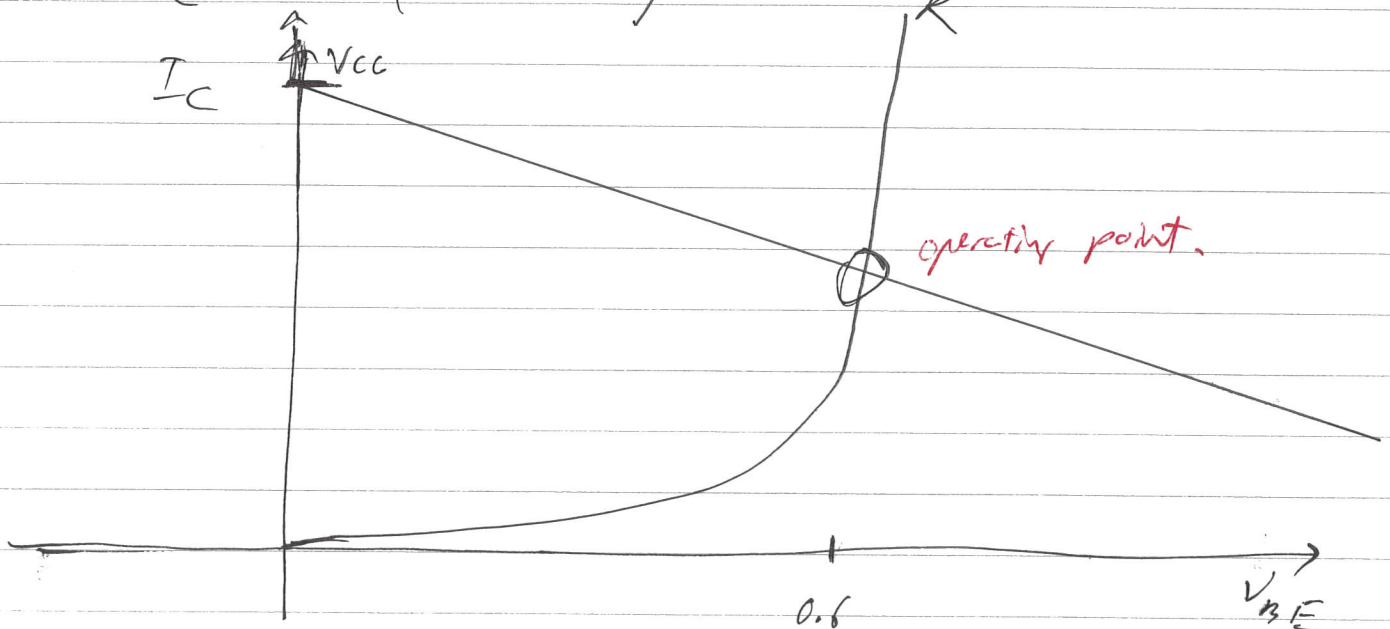
$$V_{be} = -V_{cc} + 0.6 \text{ V}$$

$$= V_{ce}$$

so 
$$I_c = \frac{(V_{cc} - 0.6)}{R}$$

It must operate there!

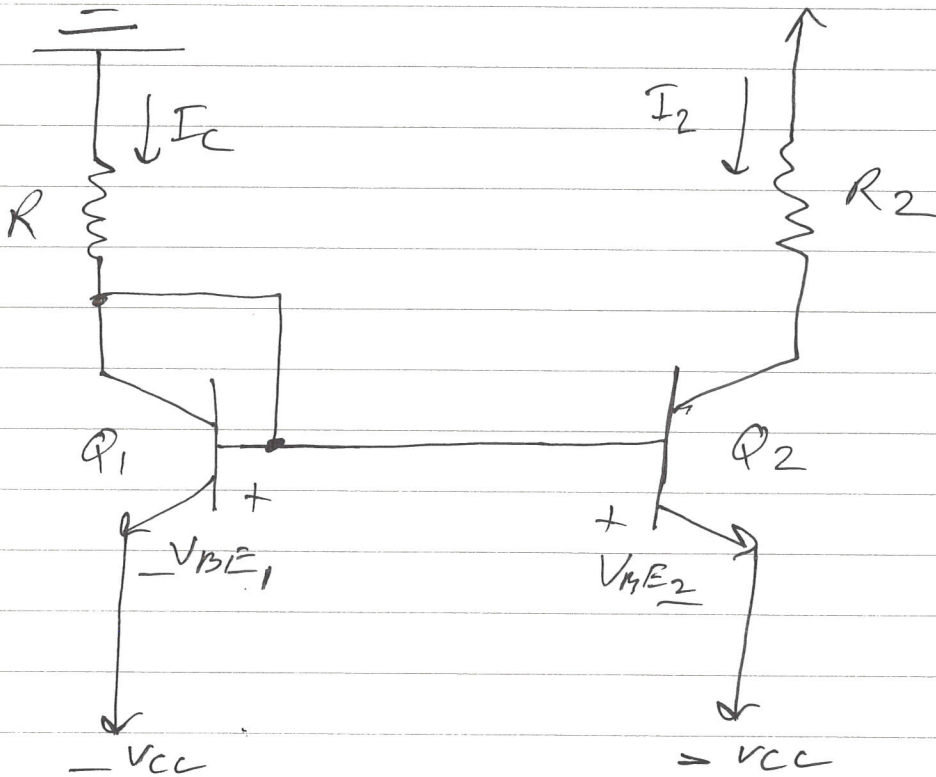
$$I_c = I_s \left( e^{\frac{V_{be}}{V_T}} - 1 \right) = \frac{V_{cc} - 0.6}{R} \quad (V_{BE})$$



(21)

$$\frac{V_{CC} - V_{BE}}{R} = I_S \left( e^{\frac{V_{BE}}{V_T}} - 1 \right) \rightarrow \text{Given } T \text{ is } V_{BE} \text{ we know } I_C$$

So what about  $I_2$ ?



$Q_2 \Rightarrow$  matched Transistor

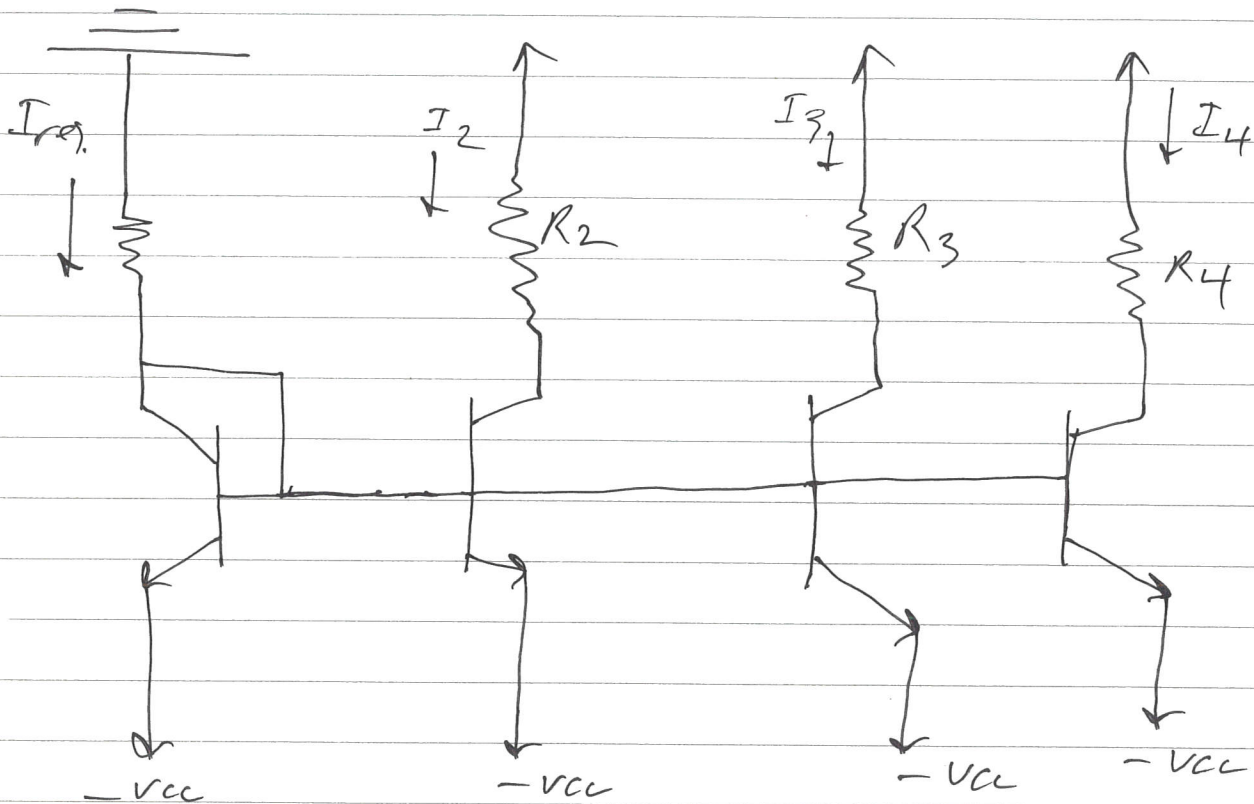
What is  $I_2$ ?

$$I_2 = I_S \left( e^{\frac{V_{BE2}}{V_T}} - 1 \right)$$

What is  $V_{BE2}$ ? Do we know it?

Ans:  $V_{BE2} = V_{BE1}$  so  $I_2 = I_C !!$

called "current mirror"



$$I_{ref} = I_2 = I_3 = I_4$$

can put these all over circuit & refer to a reference current.

