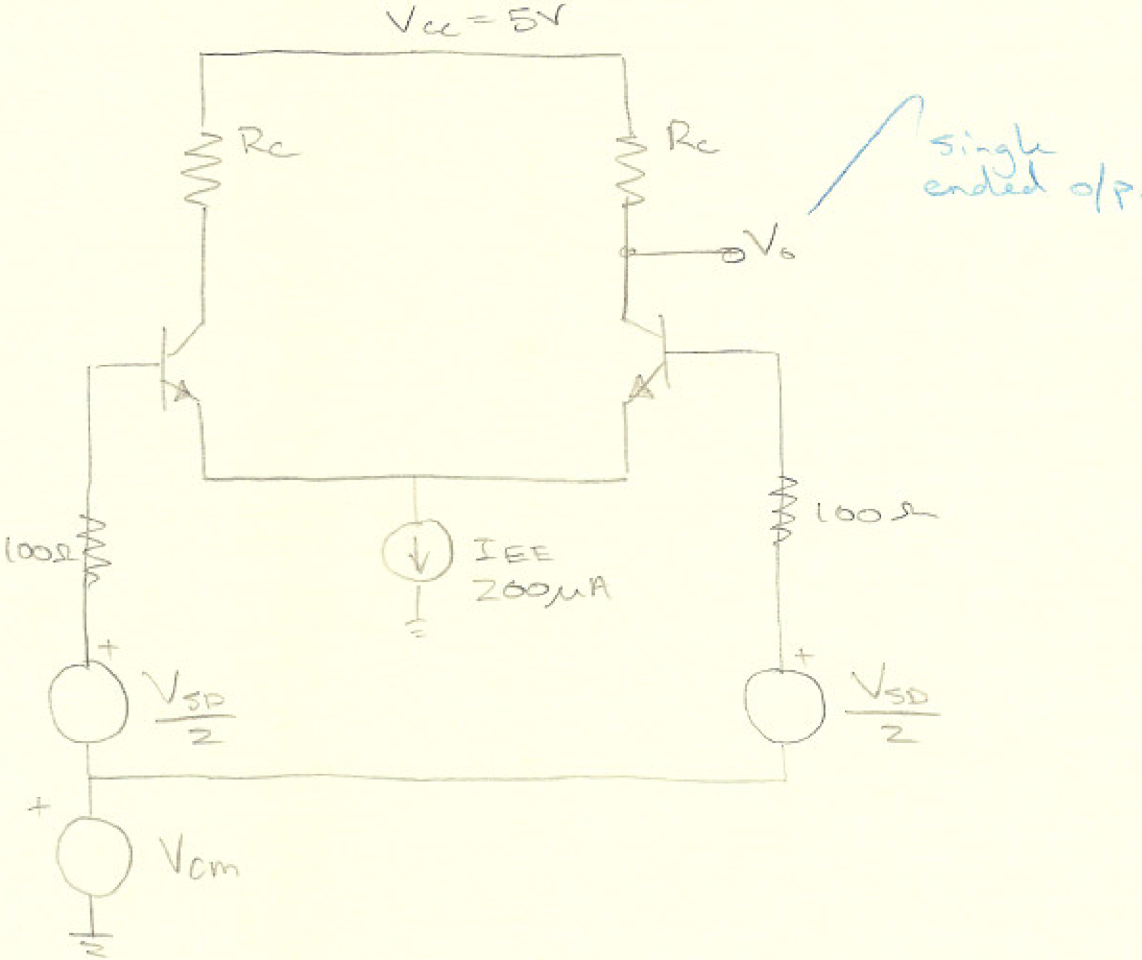
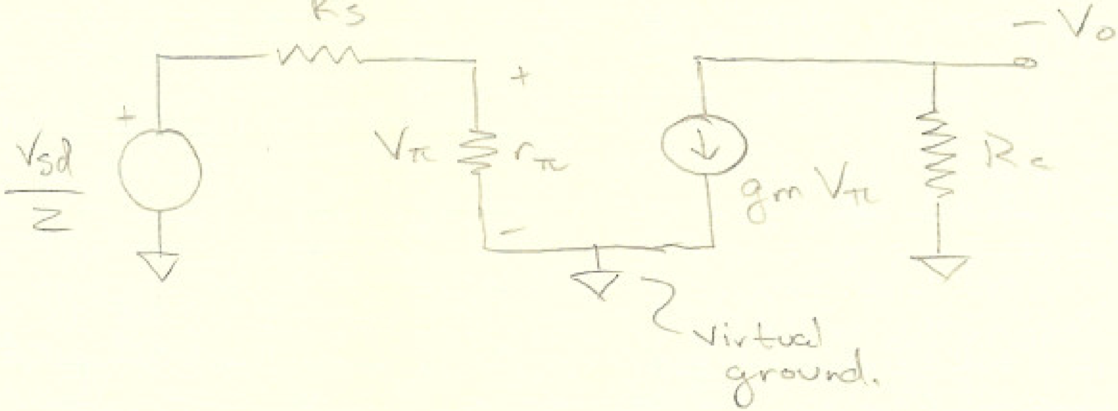
DP 8.103

A. $A_{dm} = 100$ B. $V_{cm\,max} = ?$



A.

Differential mode Small Signal Circuit



$$A_{dm} = \frac{V_o}{V_{sd}}$$

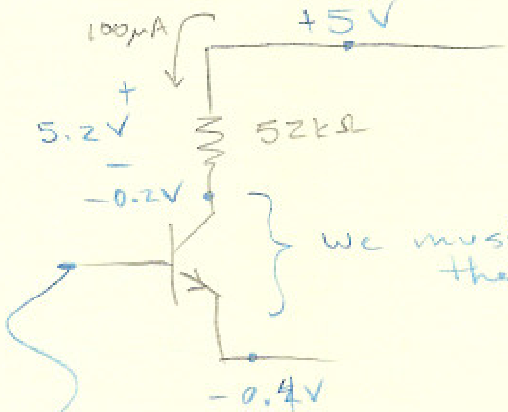
$$-V_o = -g_m V_\pi R_c$$

$$V_o = g_m \overbrace{\left(\frac{r_\pi}{r_\pi + R_S}\right)}^{\approx 1} V_{sd} \cdot \frac{1}{2} R_c$$

$$A_{dm} = \frac{\beta R_c}{(R_S + r_\pi)2} = 100$$

$$\therefore \quad R_c = 52\,k\Omega$$

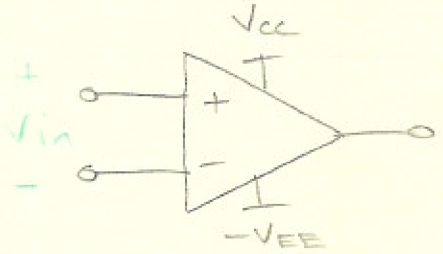
B.



we must have a drop greater the 0.2V (V_{CESAT})

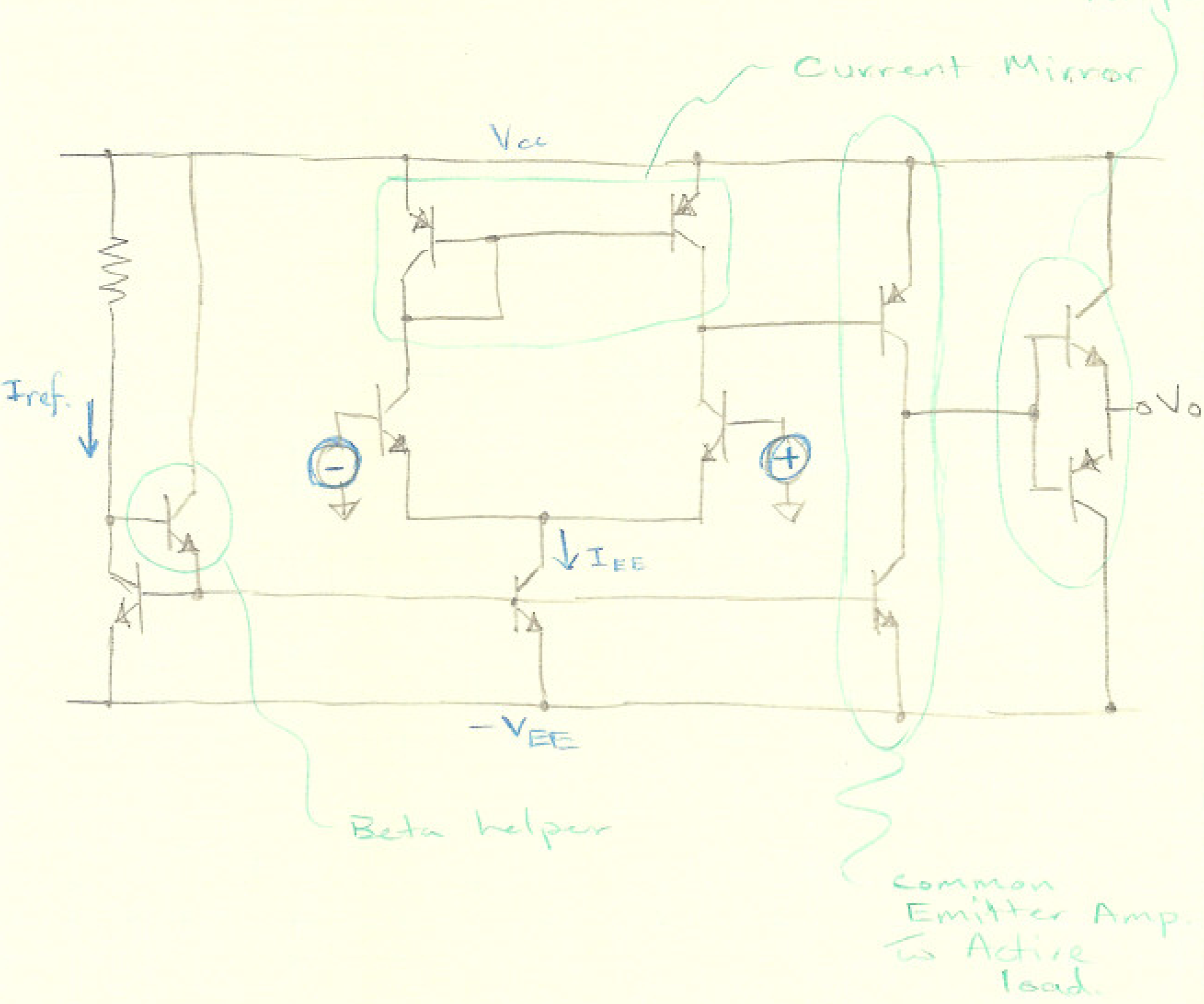
Since we need 0.7 drop V_{BE}
$V_{B\,max} < 0.3V$

Operational Amplifier

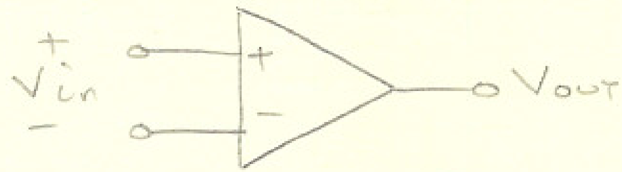


$V_o = a V_{ID}$, $a >> 1$

note: In practice: 2 gain stages
Use active loads

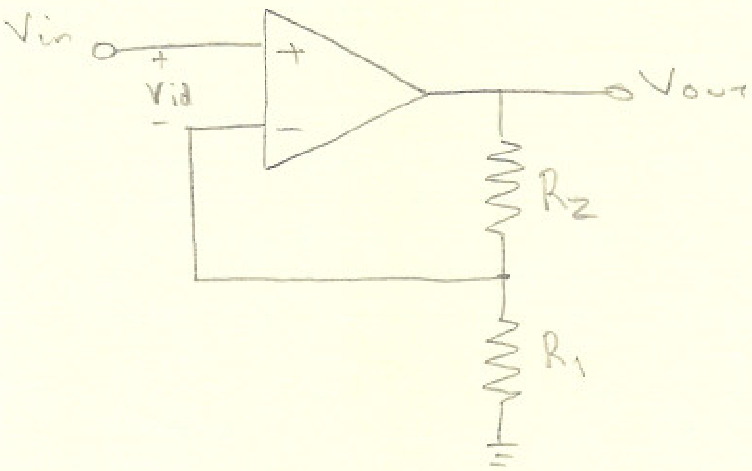


Finite Gain

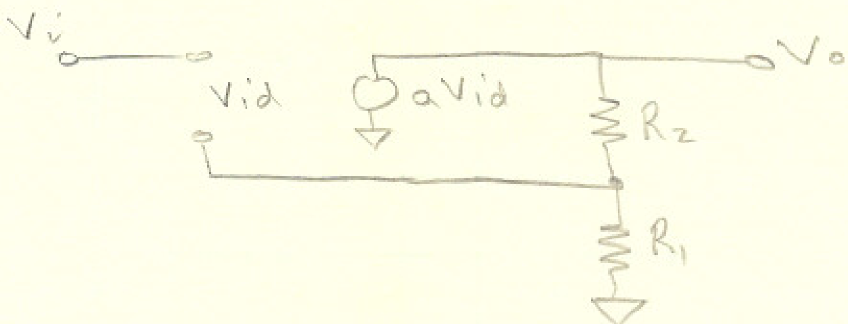


$V_{out} = a V_{in}$ amp gain.

Non inverting configuration



$V_o(V_i) = ?$



$$V_{id} = V_i - V_o \frac{R_2}{R_1+R_2}$$

$$V_{id} = \frac{V_o}{a}$$

$$\frac{V_o}{a} = V_i - V_o \frac{R_2}{R_1+R_2}$$

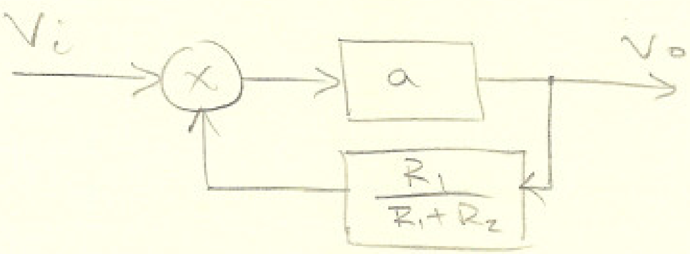
$$V_o \left(\frac{1}{a} + \frac{R_2}{R_1+R_2} \right) = V_i$$

$$\frac{V_o}{V_i} = \frac{1}{\frac{1}{a} + \frac{R_1}{R_1+R_2}}$$

as $a \to \infty$

$$\left.\frac{V_o}{V_i} = 1 + \frac{R_2}{R_1}\right\}$$

commonally known equ.



equ feedback circuit,

How do we solve the circuit assuming $a \to \infty$

Rules

* Make sure that there is negative feedback.
* The op amp will $V_{id} = 0$
* OP AMP i/p's take no current