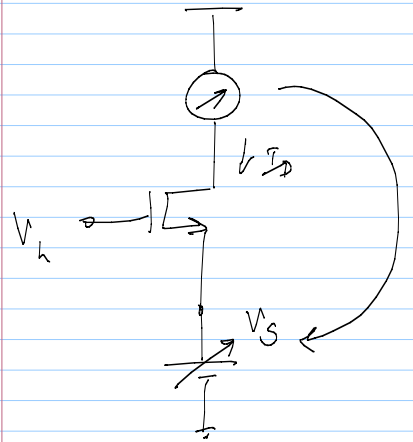
17/9/14

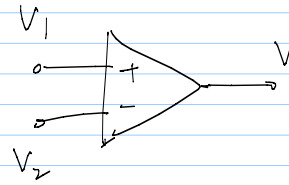
lec 23

Measured Values	Driven Values
I_D	V_h ✓
I_S	V_S ✓
I_D	V_S
I_S	V_h



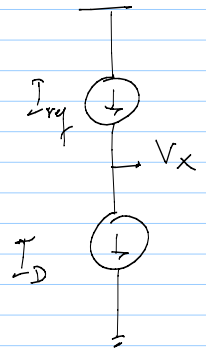
If $I_D > I_{ref} \Rightarrow \uparrow V_S$

$I_D < I_{ref} \Rightarrow \downarrow V_S$



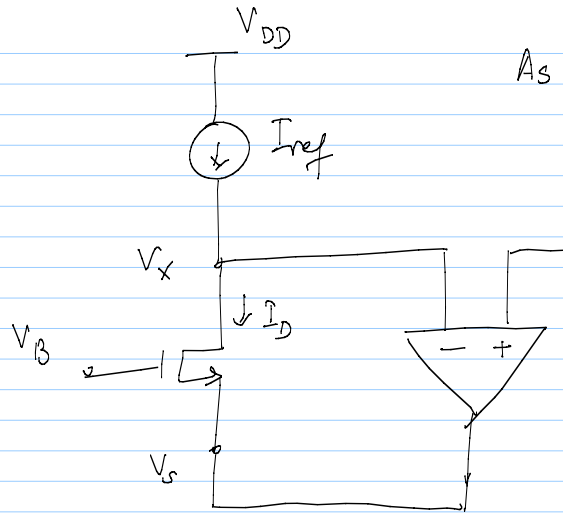
$V_o = A(V_1 - V_2)$

$A \to \infty$



$I_D > I_{ref} \Rightarrow V_x \downarrow$

$I_D < I_{ref} \Rightarrow V_x \uparrow$



As $V_x \uparrow \Rightarrow V_S \downarrow$

$V_x \downarrow \Rightarrow V_S \uparrow$

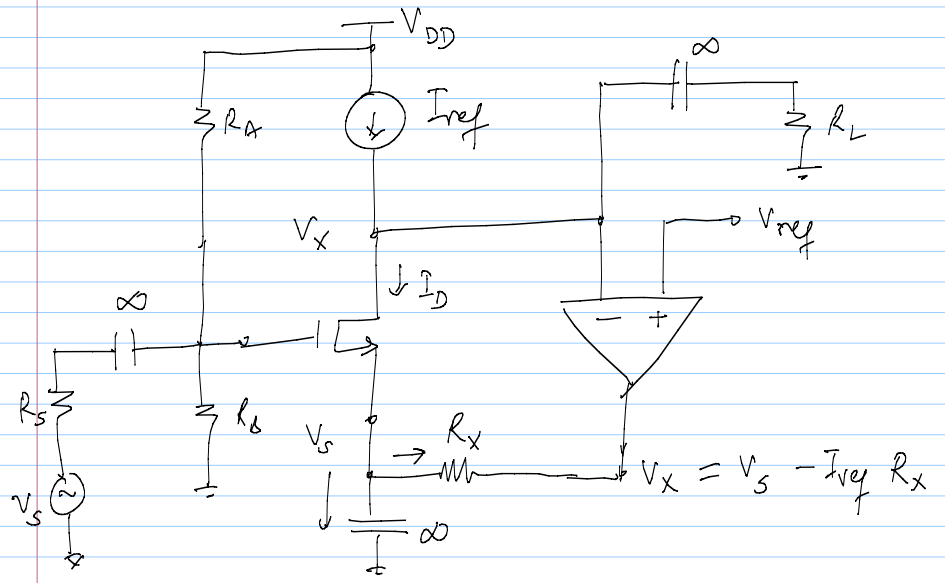
$A \to \infty$

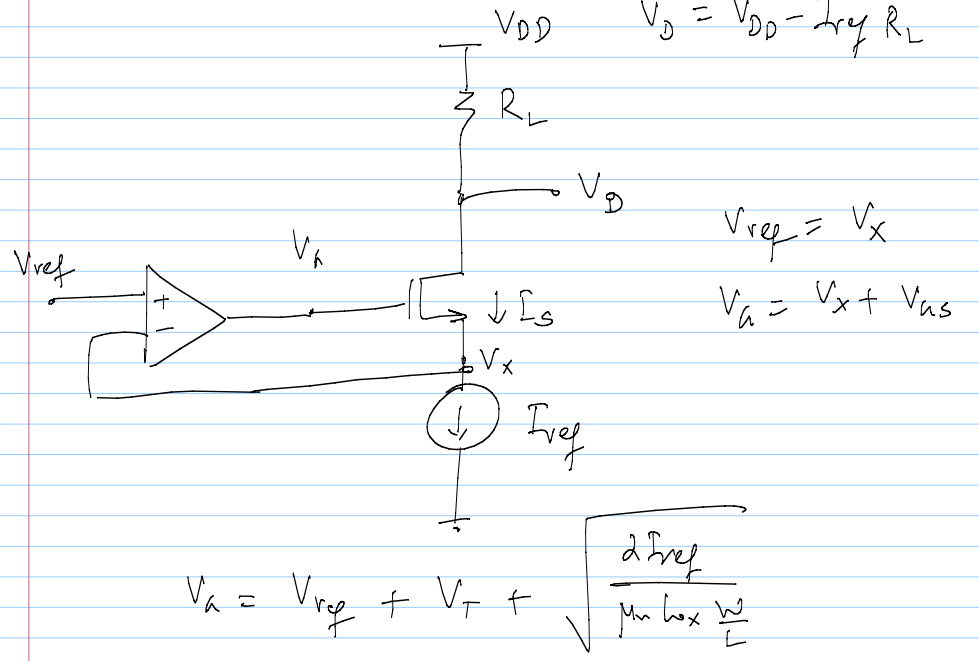
$\Rightarrow V_x \to V_{ref}$

For sat. operation $\Rightarrow$ $V_D > V_h - V_T$

$V_{ref} > V_B - V_T$

$$V_S = V_B - V_{GS}\Big|_{I_{ref}} = V_B - \left[V_T + \sqrt{\frac{2I_{ref}}{\mu_n C_{ox}\left(\frac{W}{L}\right)}}\right]$$



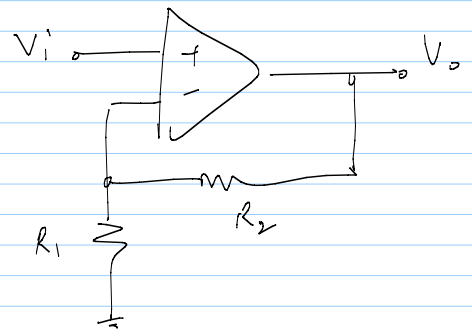


Controlled Sources

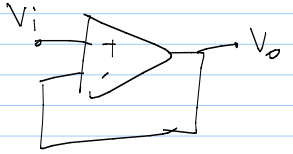
	Z_{in}	Z_{out}
VCVS	∞	0
VCCS	∞	∞
CCVS	0	0
CCCS	0	∞

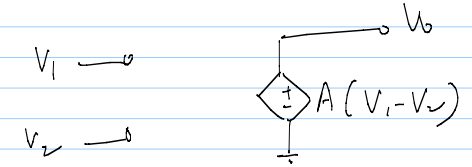
Opamp

VCVS



VCVS = 1

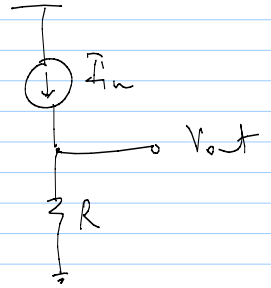




CCVS

We have I_{in}

We want $V_{out} = R I_{in}$

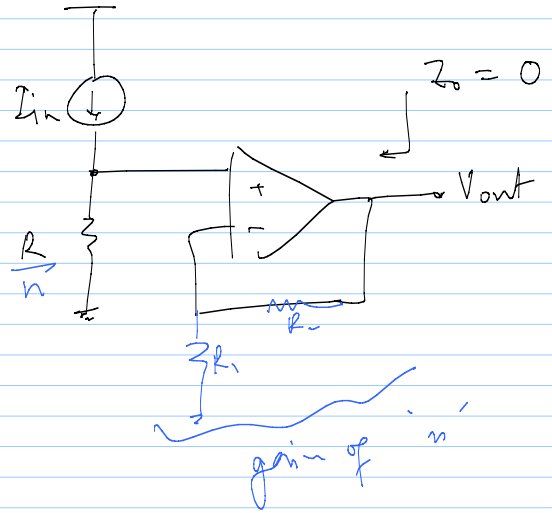


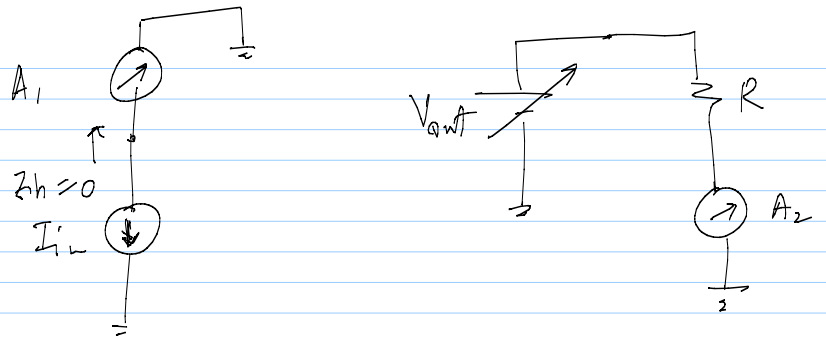
we want

$Z_{in} = 0$

$Z_{out} = 0$

$V_{out} = R I_{in} \Rightarrow I_{in} = \frac{V_{out}}{R}$

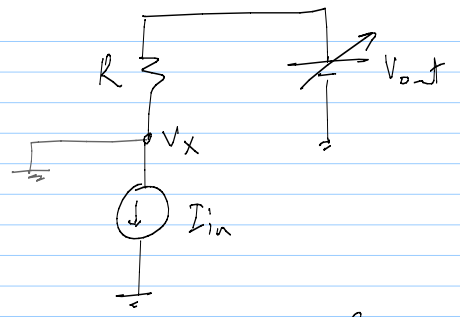


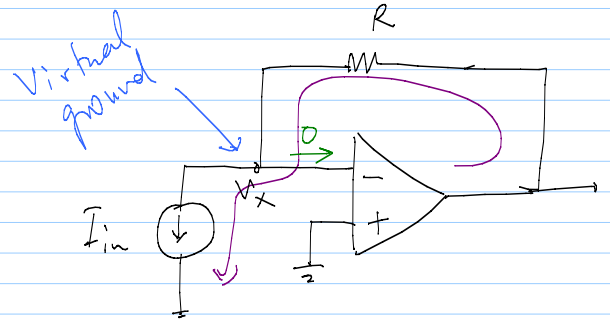


Compare A_1 & A_2

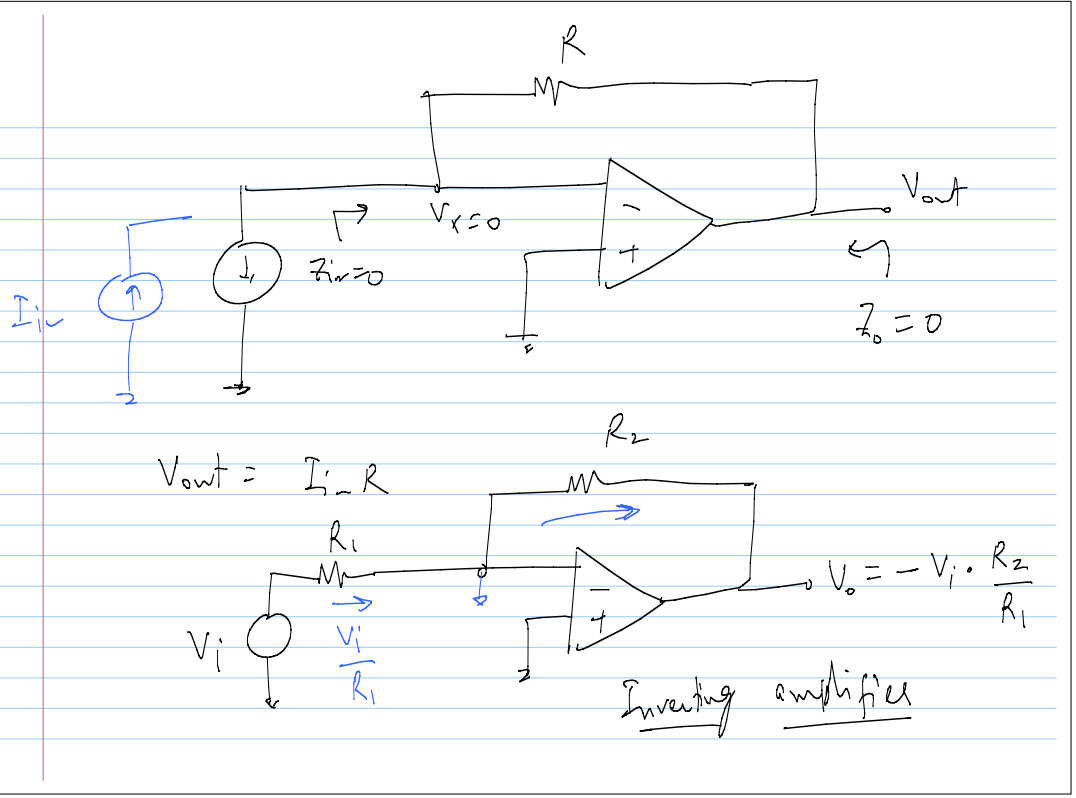
Drive V_{out} such that $A_1 = A_2$

put them in series





$V_x = 0$ when negative fb.



$V_{out} = I_i \cdot R$

Inverting amplifier