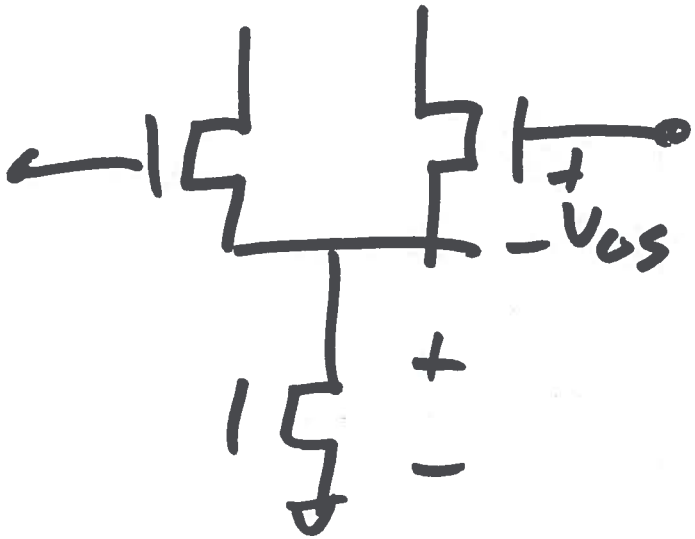
EE 420/ECG 620
Analog IC Design
April 29, 2019
Lecture 23



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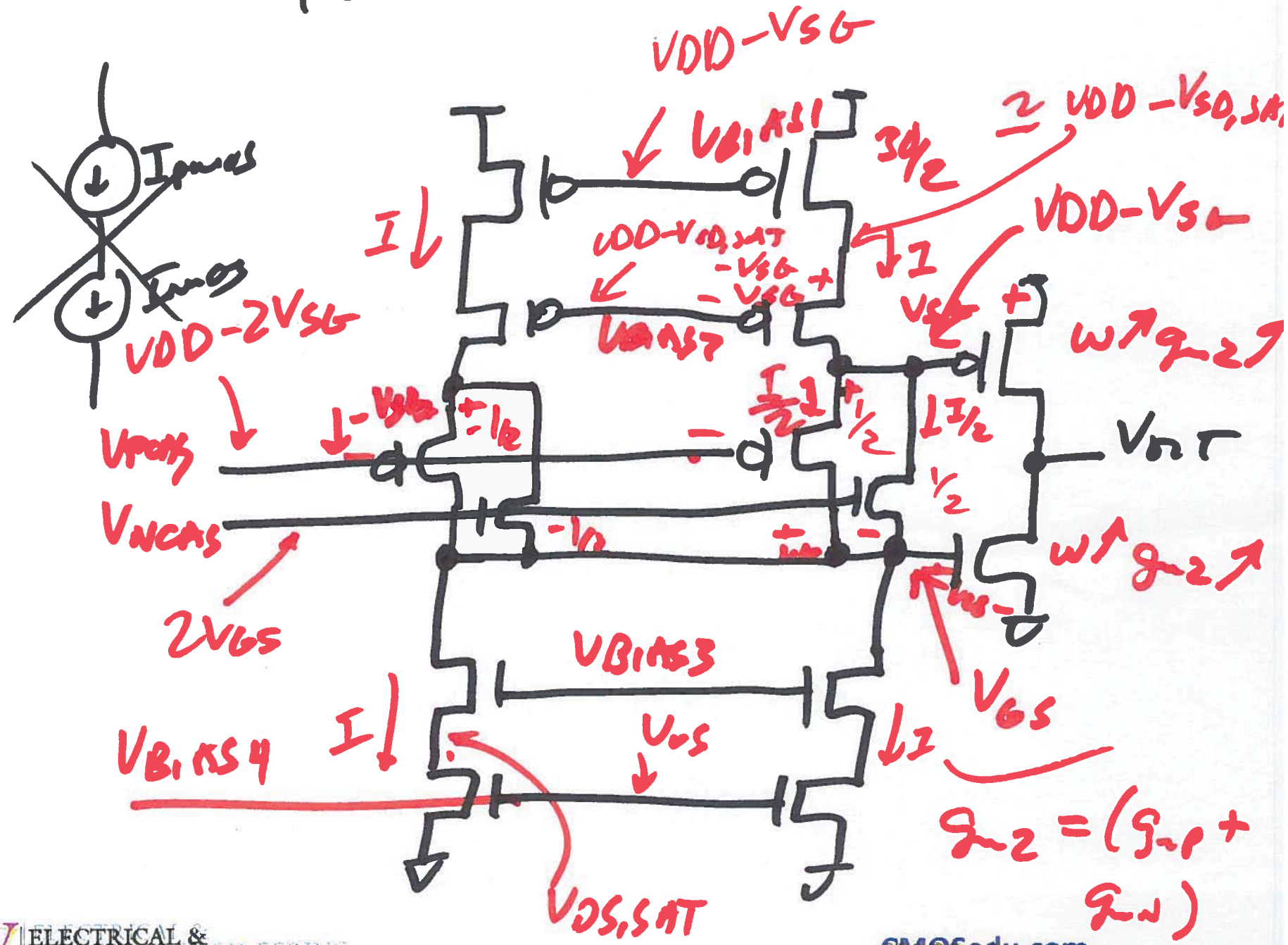
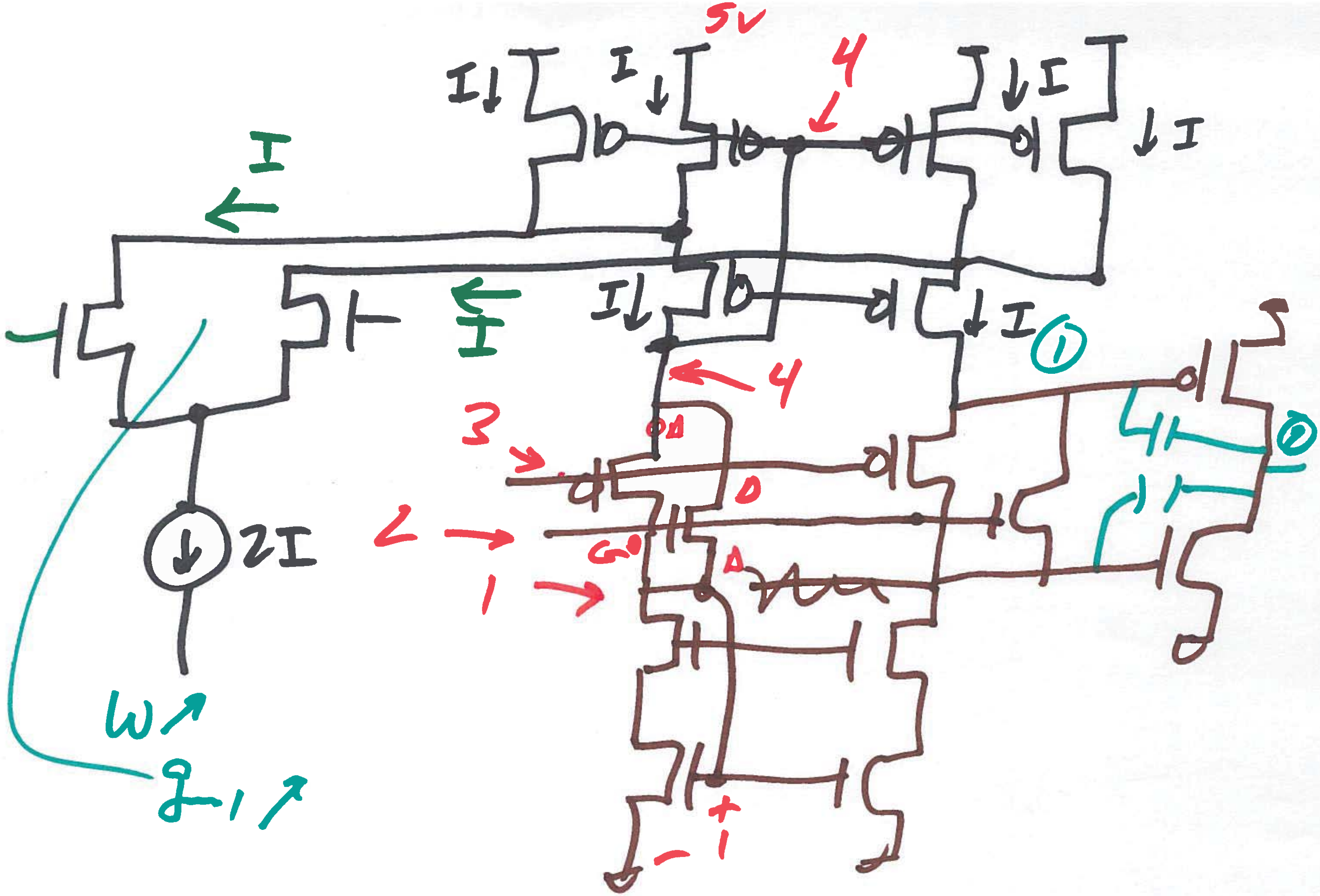




3)

Both NMOS & PMOS on → $A_{OL} = (g_{mN} + g_{mP}) \cdot R_{ocNS} \| R_{ocNSP} \cdot r_{oN} \| r_{oP} \| R_L \cdot (g_{mN} r_{oN} + g_{mP} r_{oP})$

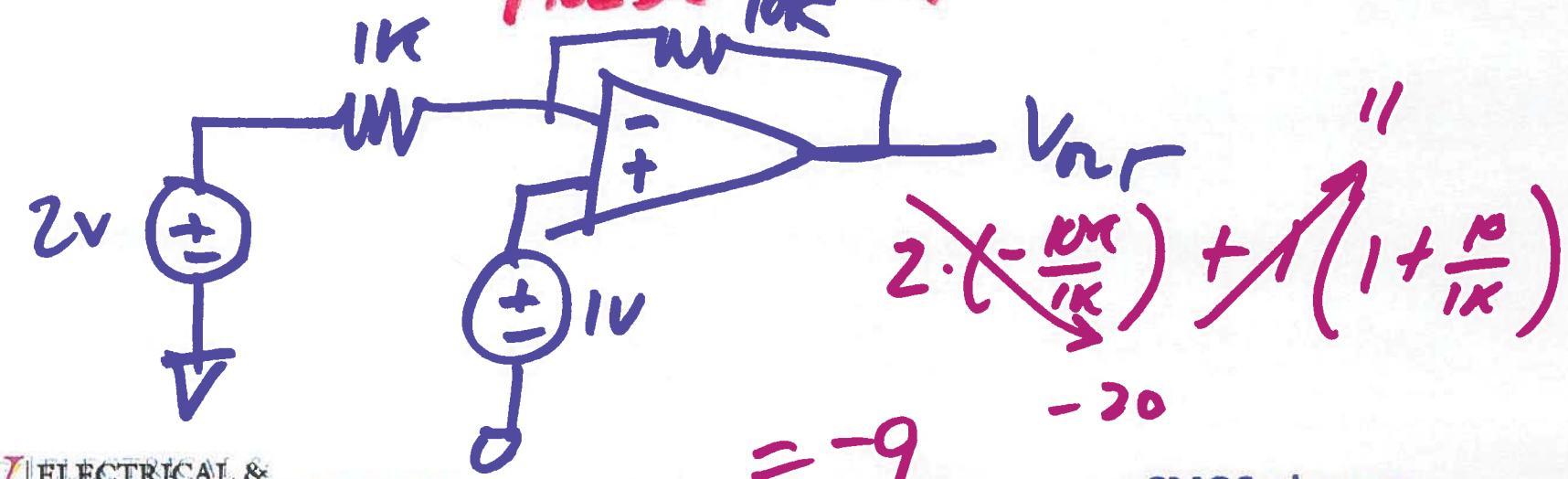
NMOS only $g_{mP} \to 0$

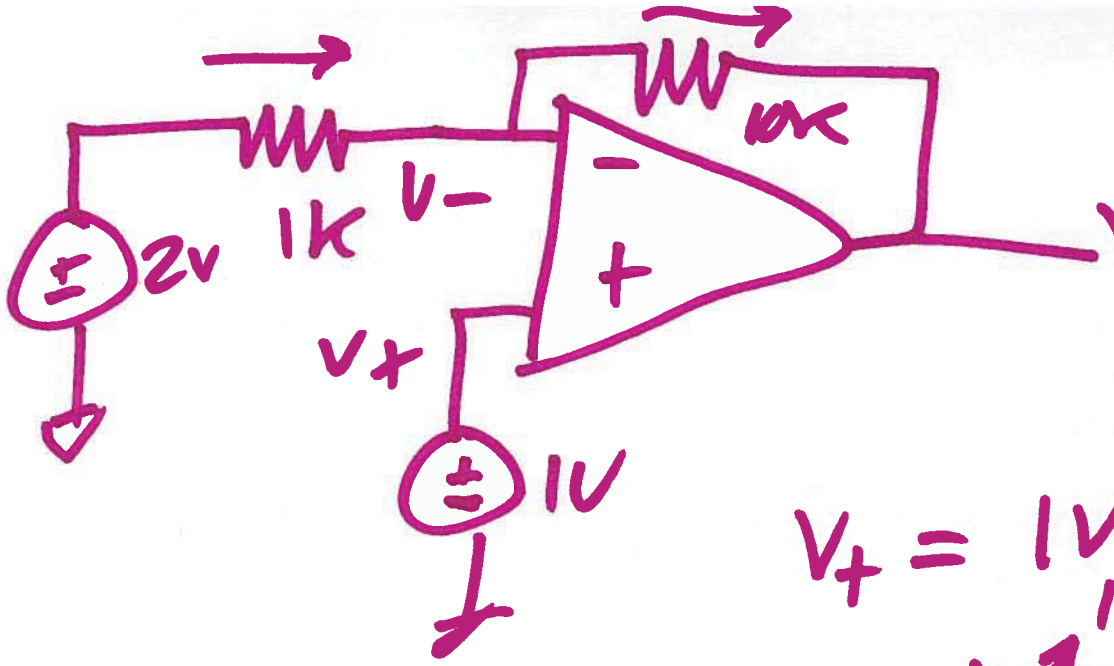
PMOS only $g_{mN} \to 0$

$A_{OLDC} = 10{,}000$

only one diff-amp ~

$A_{OLDC} = 5{,}000$





$V_+ = 1V$

$$\frac{2 - V_-}{1K} = \frac{V_- - A_{OL}(V_+ - V_-) - V_{OUT}}{10K}$$

$$V_- = \frac{20 + A_{OL}}{A_{OL} + 10}$$

$$20 - 10V_- = V_- - A_{OL} \cdot 1 + A_{OL} \cdot V_-$$

$$20 + A_{OL} = V_-(A_{OL} + 10)$$

$$V_{OUT} = A_{OL}\left(1 - \frac{\frac{20}{A_{OL}} + 1}{1 + \frac{10}{A_{OL}}}\right)$$

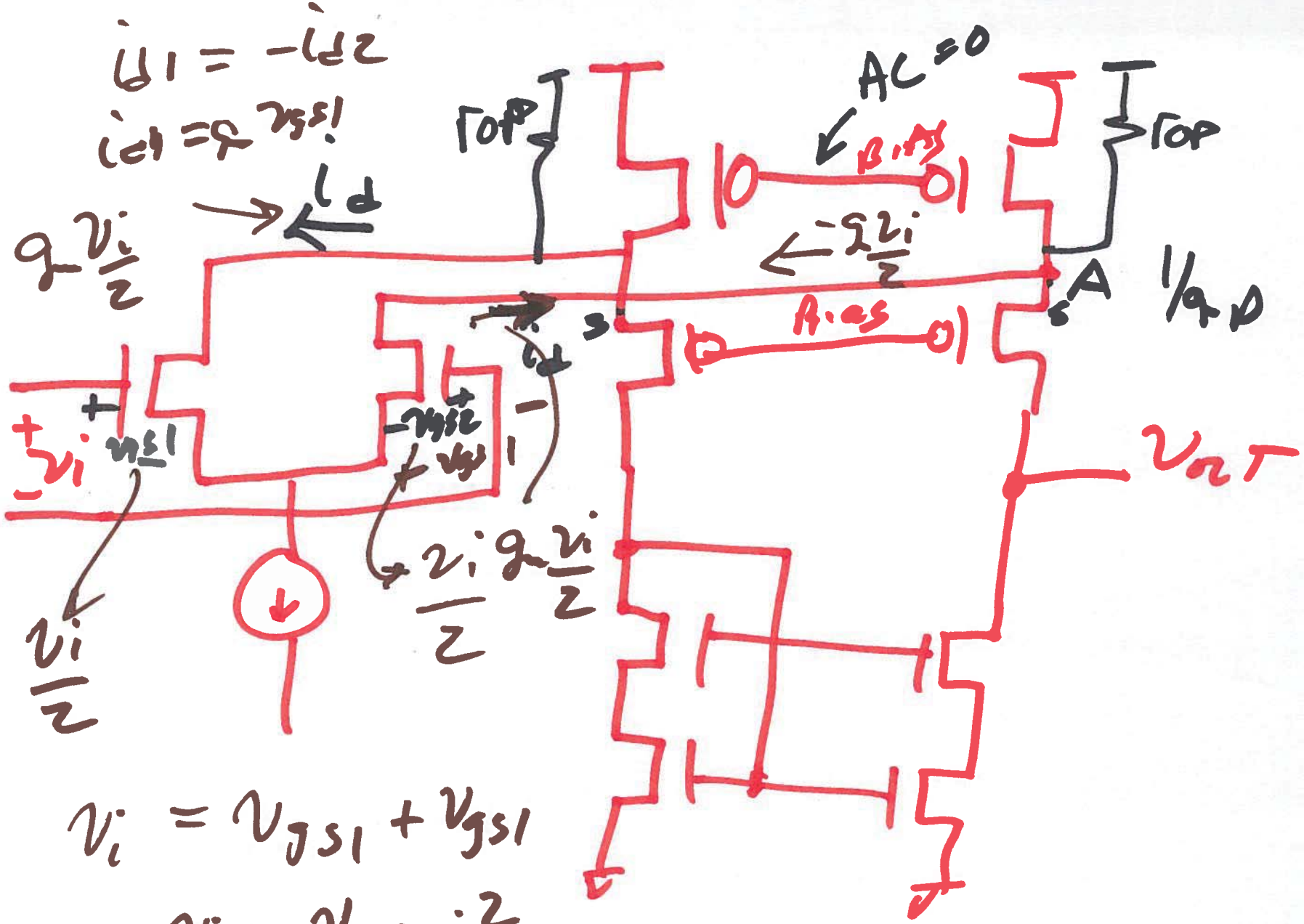
$$= A_{OL}\left(\frac{1 + \frac{10}{A_{OL}} - \frac{20}{A_{OL}} - 1}{1 + \frac{10}{A_{OL}}}\right)$$

$$= \frac{-10}{1 + \frac{10}{A_{OL}}}$$

$A_{OL} \rightarrow -10$

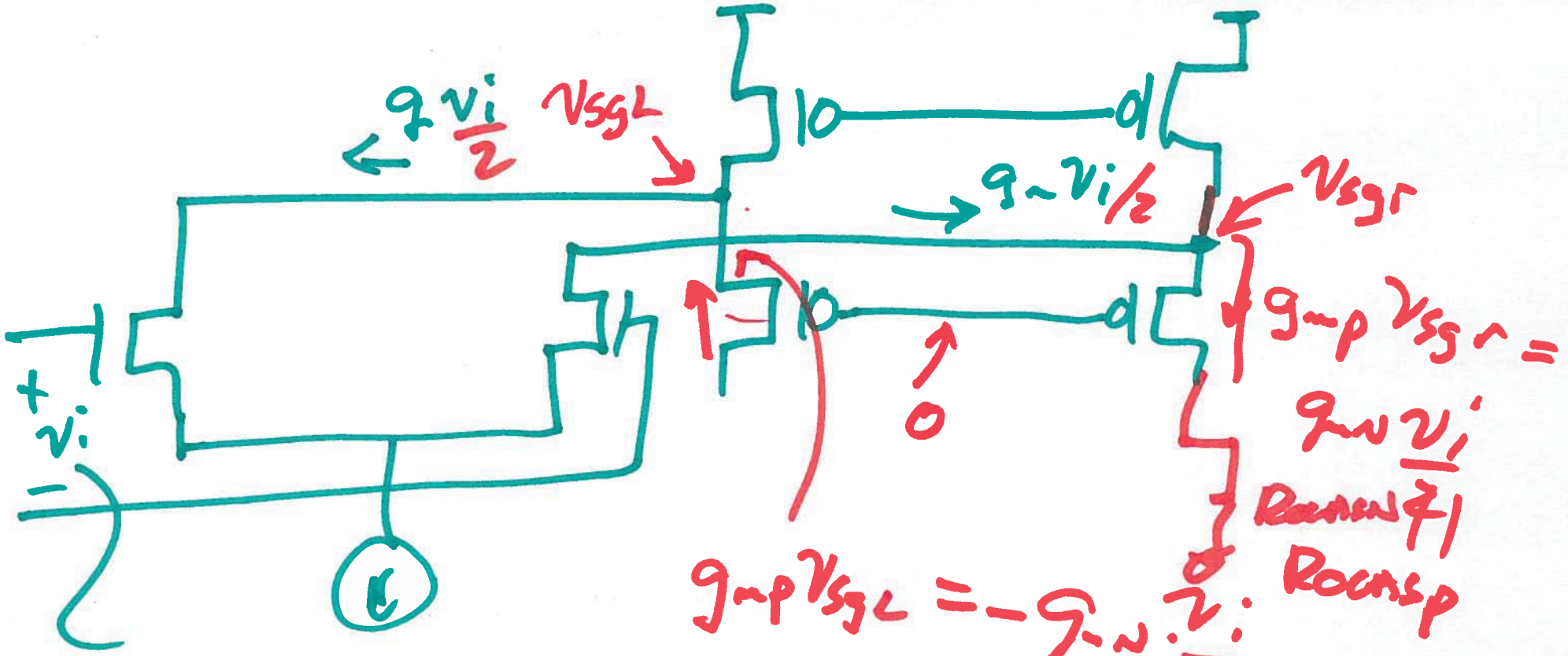
$A_{OL} \rightarrow 10k$

$\rightarrow 5k$



$$v_i = v_{gs1} + v_{gs1}$$

$$v_i = v_{gs1} \cdot 2$$



$$\frac{v_{sgL}}{v_i} = \frac{g_{mN}}{g_{mp}} \cdot \frac{v_i}{2}$$

$$\frac{v_{sgL}}{v_i} = \frac{g_{mN}}{2g_{mp}}$$

$$\frac{v_{sgL}}{v_i} \simeq -\frac{g_{mN}}{2g_{mp}} \simeq -1/2$$

$$\simeq \frac{1}{2}$$