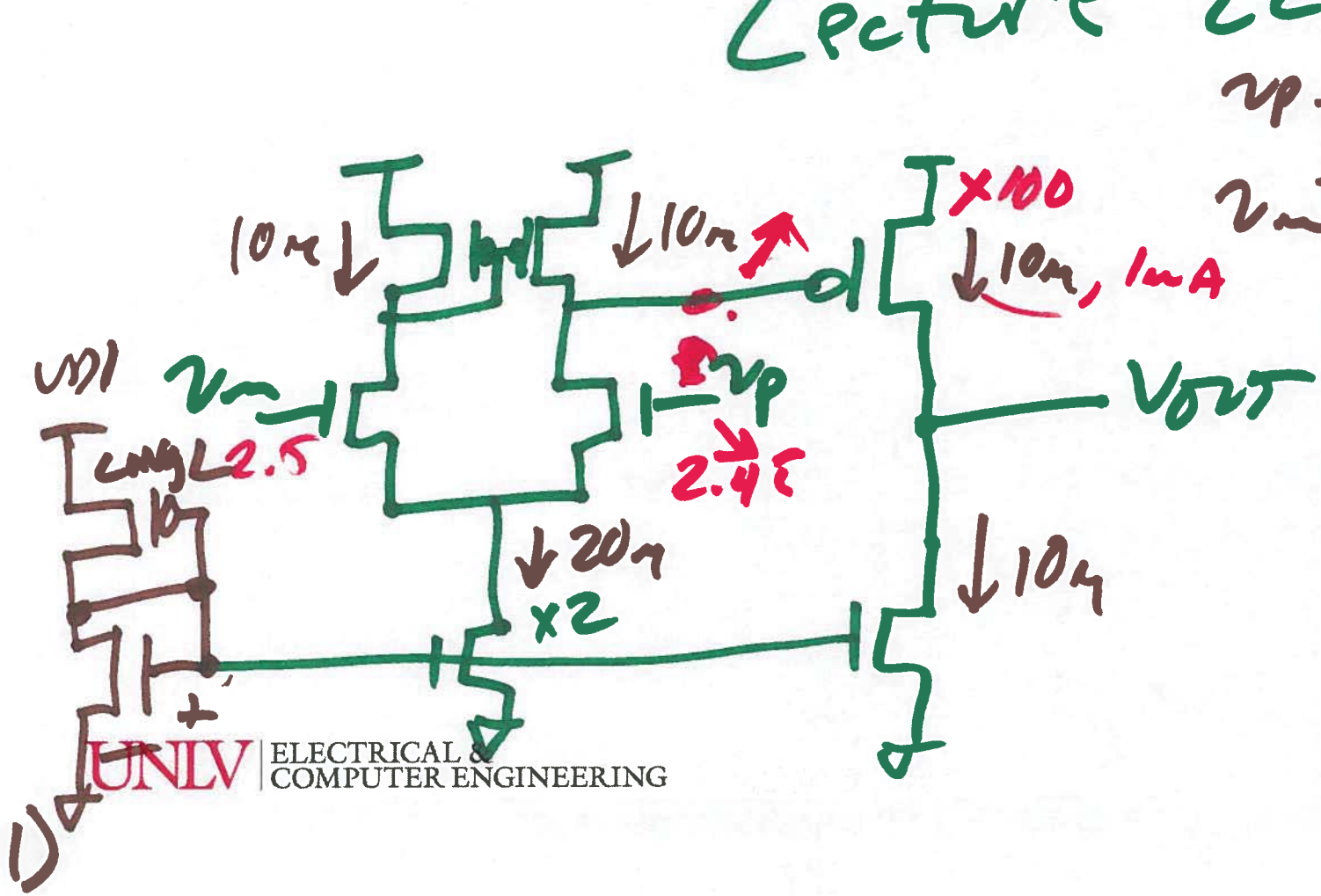
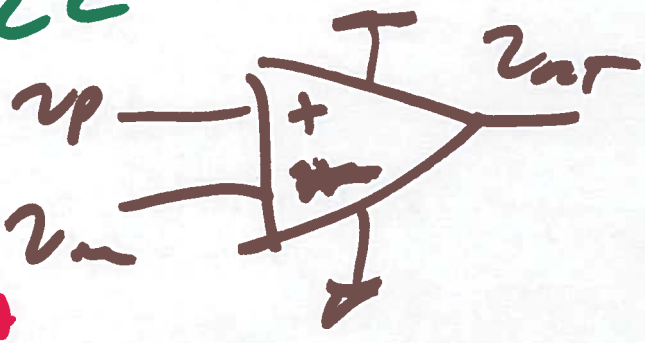
EE420/ECG 620
Analog IC Design
April 24, 2019
Lecture 22





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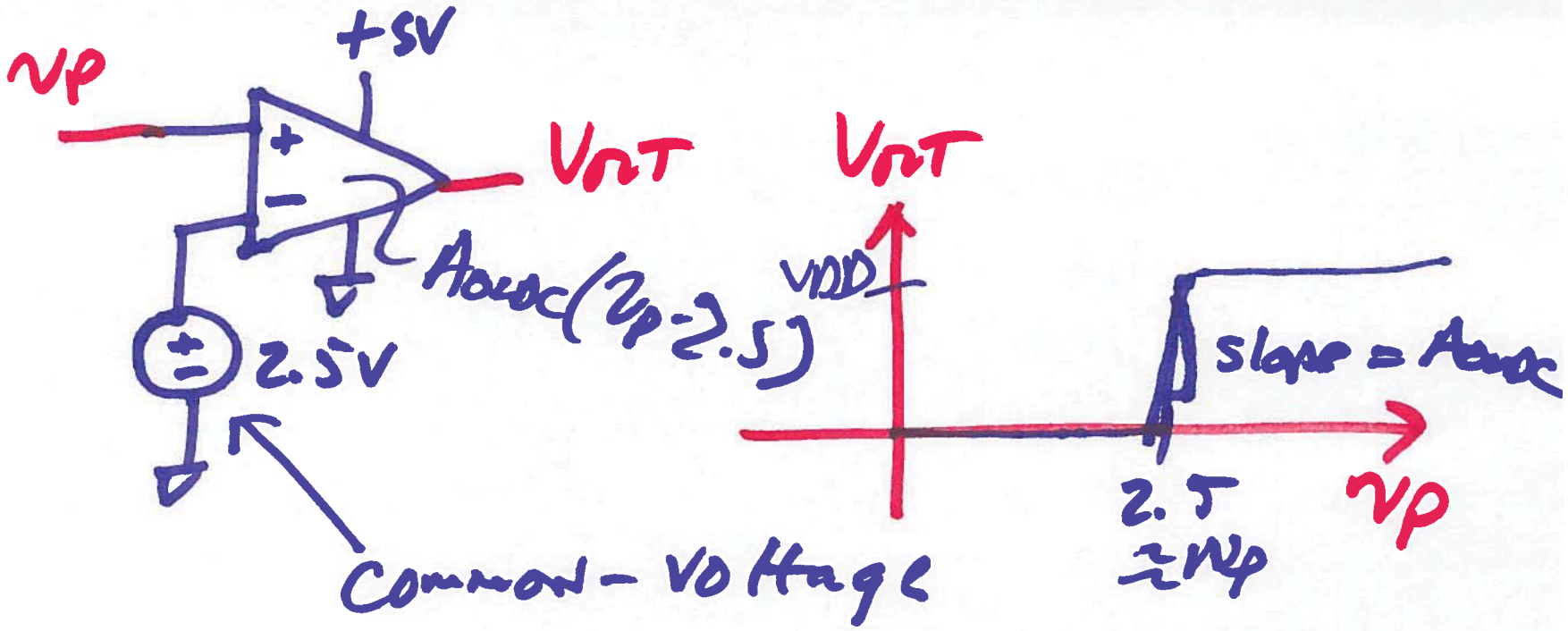
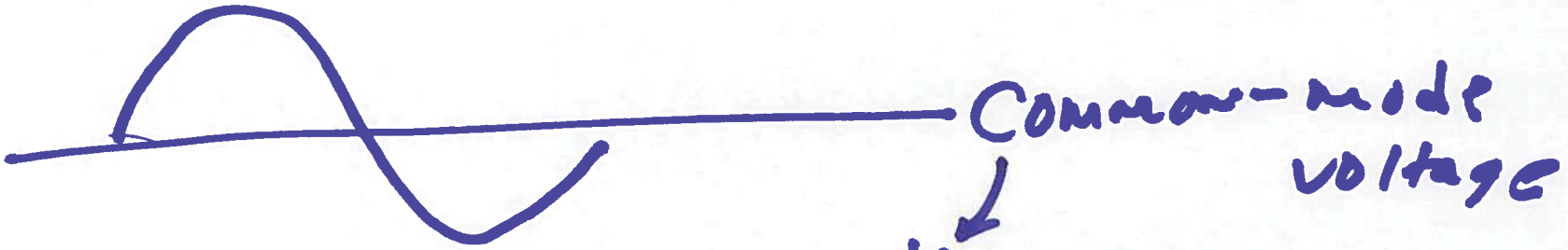
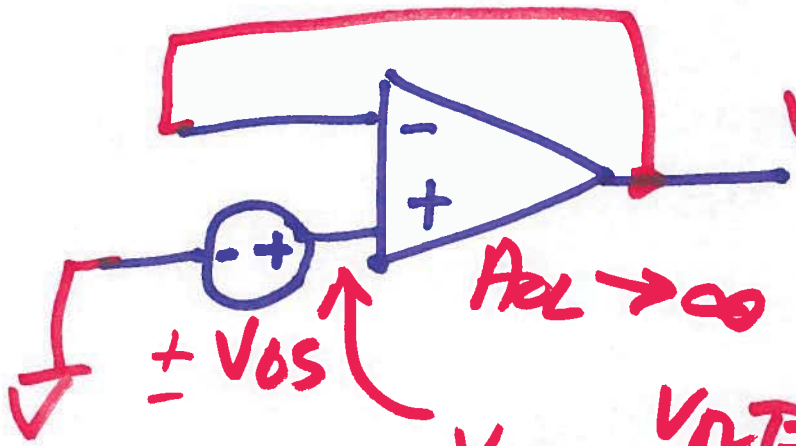
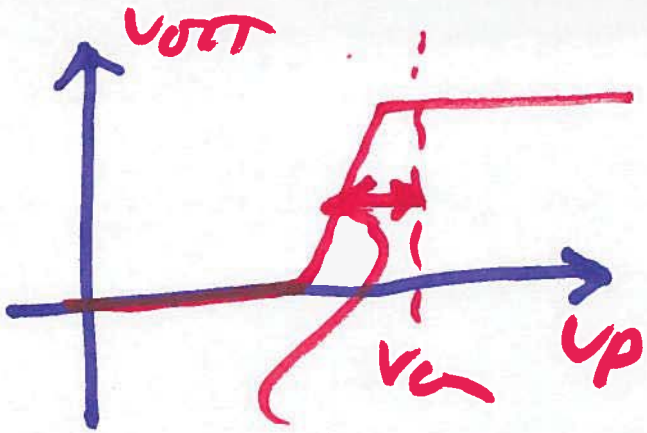




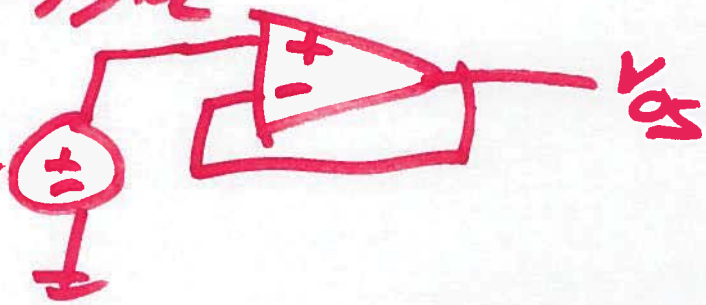
$$V_{CM} = \frac{VDD}{2}$$





$V_{OUT} = (V_{OUT} - V_{OS}) \cdot A_{OL}$

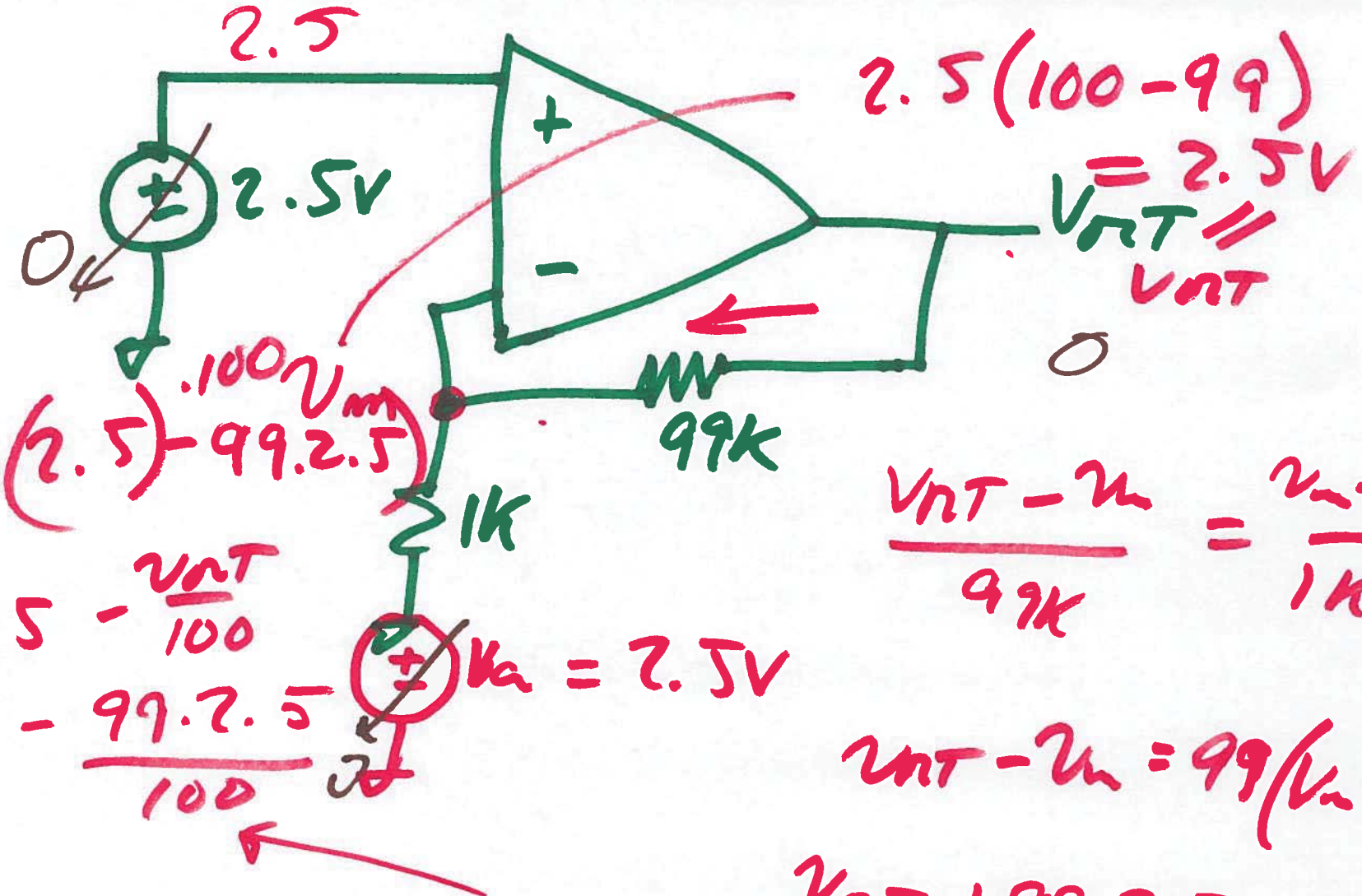
$V_{OUT} \to V_{OS}$



$$V_{OUT} = A_{OL} \cdot (V_P - V_m)$$

$$= A_{OL} \cdot (V_{OS} - V_{OUT}) = \text{finite}$$

$A_{OL} \to \infty$, $V_{OUT} \to V_{OS}$, $V_{OS} \to 0$



$2.5(100-99) = 2.5V$

$V_{OUT} = V_{OUT}$

$V_{OUT} = (2.5) - 99.2.5$

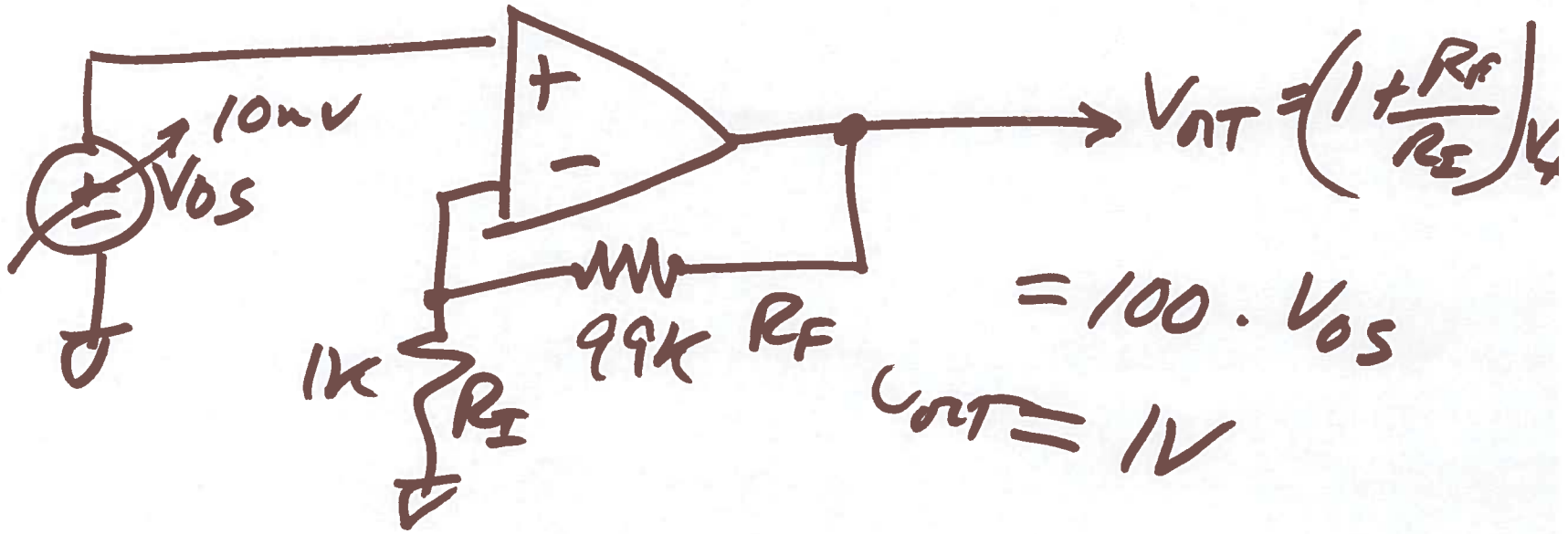
$\frac{V_{OUT} - V_m}{99k} = \frac{V_m - 2.5}{1k}$

$0 = 2.5 - \frac{V_{OUT}}{100} - \frac{99.2.5}{100}$

$V_{OUT} - V_m = 99(V_m - 2.5)$

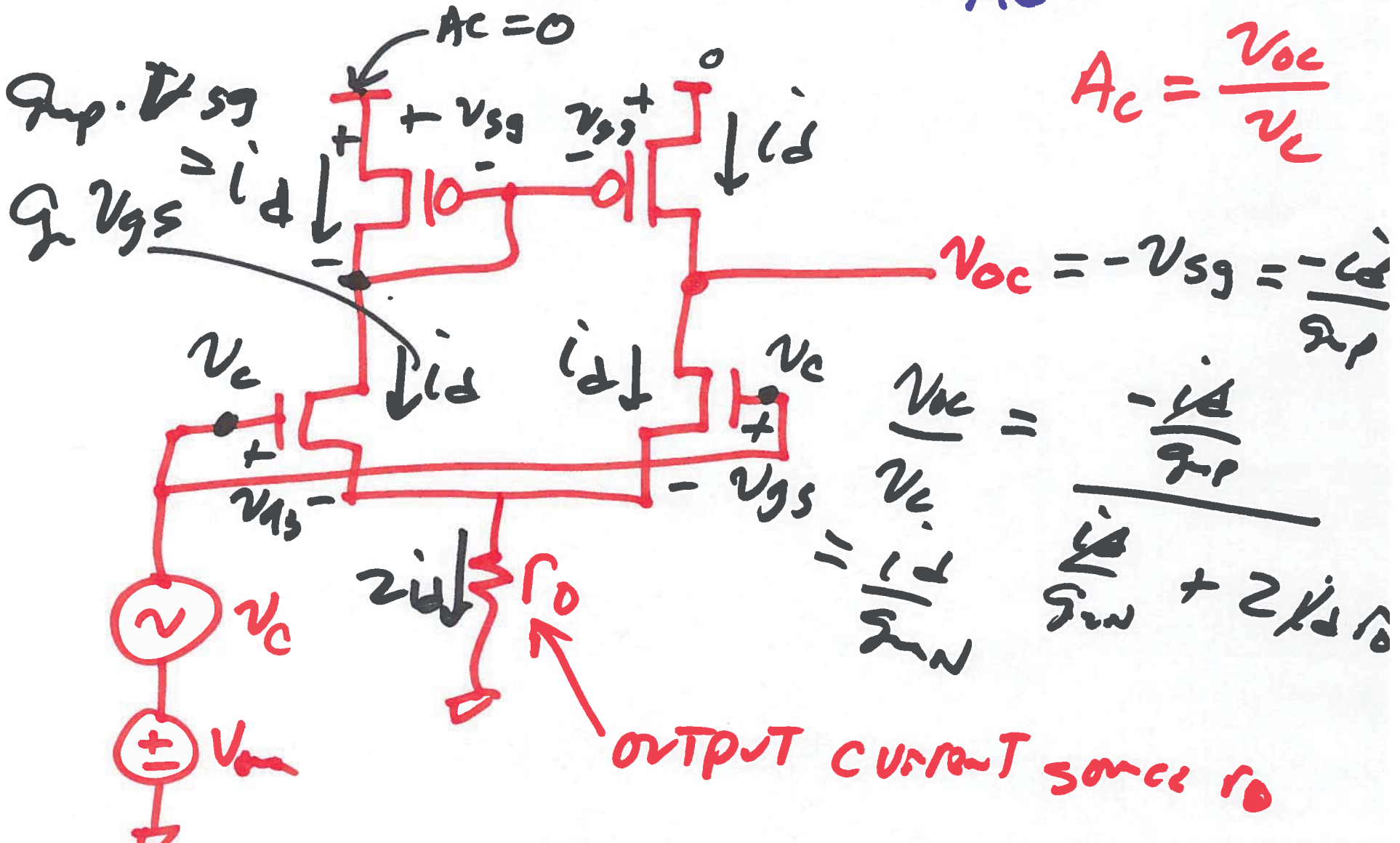
$V_{OUT} + 99.2.5 = 100 V_m$

$V_{OUT} = A_{OL}\left(2.5 - \frac{V_{OUT}}{100} - \frac{99.2.5}{100} - V_m\right)$


10mV
V_{OS}
+
−
$V_{OUT} = \left(1 + \frac{R_F}{R_I}\right) V_{IN}$
$= 100 \cdot V_{OS}$
$V_{OUT} = 1V$
99K
R_F
1K
R_I

5)

$$CMRR = \frac{A_d}{A_c} = \frac{g_m(r_{on} \| r_{op})}{A_c}$$



$$A_c = \frac{v_{oc}}{v_c}$$

$$\frac{v_{oc}}{v_c} = \frac{\frac{-i_d}{g_{mp}}}{\frac{i_d}{g_{mN} + 2g_{ds}r_o}}$$

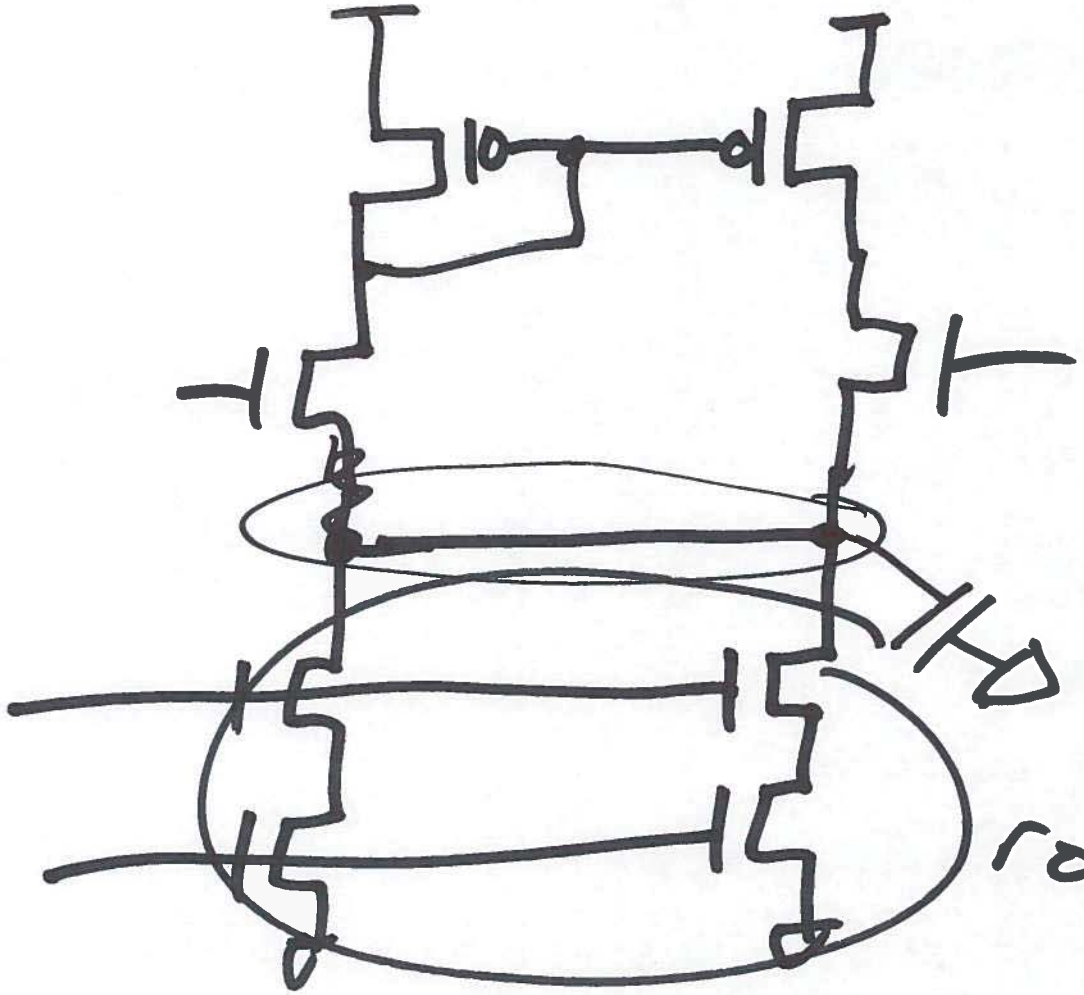
$$A_c = \frac{v_{oc}}{v_c} = \frac{-\frac{1}{g_{mp}}}{\frac{1}{g_{mN}} + 2r_o}$$

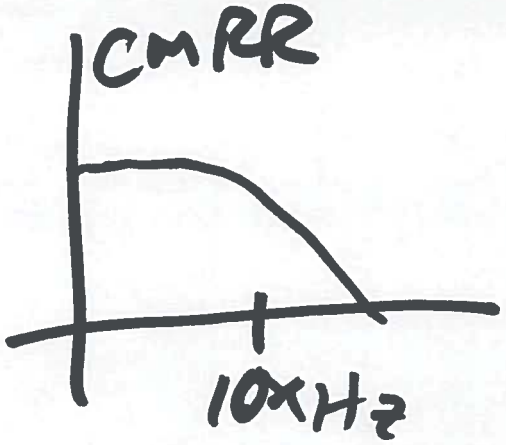
$$\simeq -\frac{\frac{1}{g_{mp}}}{2r_o}$$

maximize r_o (output resistance) of current bias of diff amp

$$= -\frac{1}{g_{mp} \cdot 2r_o}$$

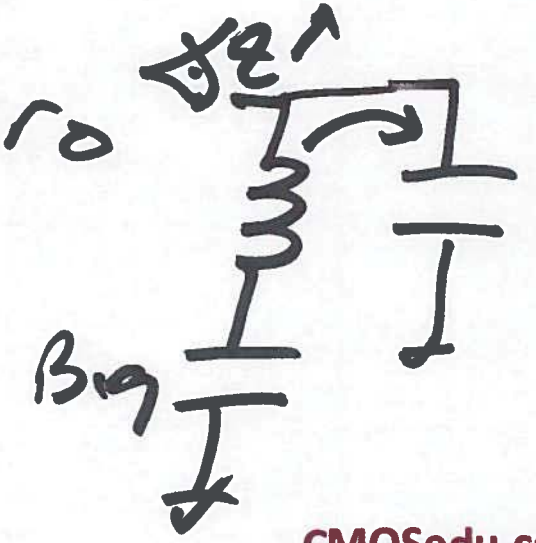
$$CMRR = 20 \log \left| \frac{g_{mN} \cdot r_{oN} \| r_{op}}{\frac{1}{g_{mp} \cdot 2r_o}} \right|$$

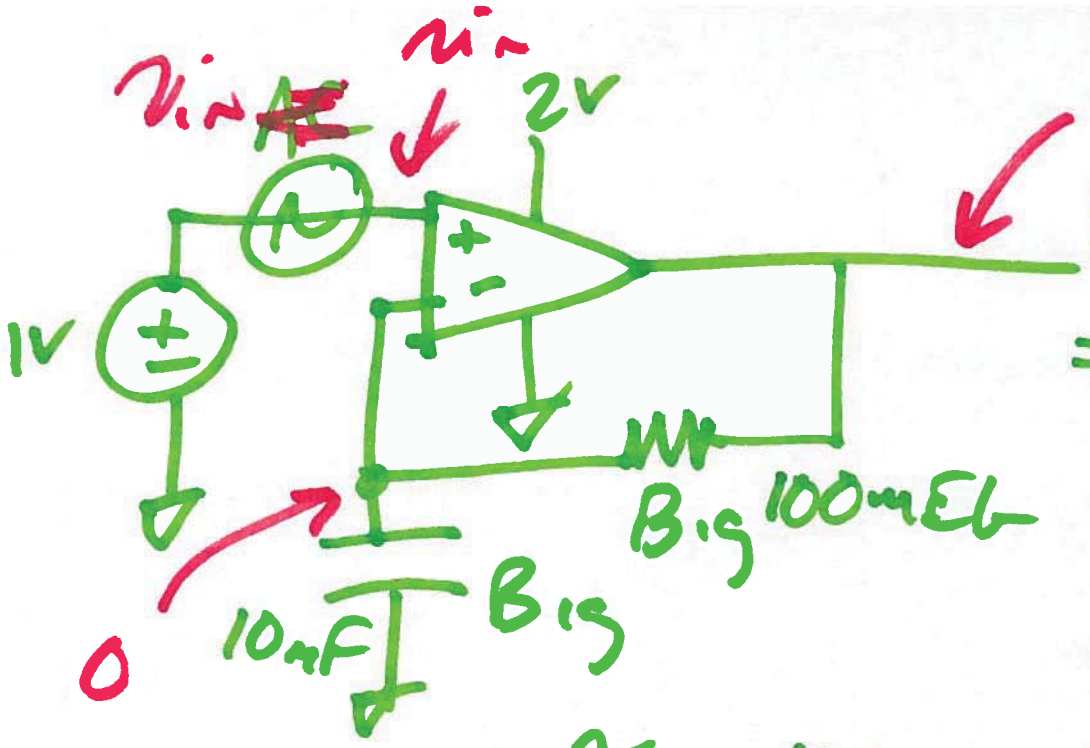




$|Z| \ll r_o$

r_o





$A_{OL} \cdot v_{in} = 2_{mV}$

$\Rightarrow A_{CL} = AC \cdot g_{m1}$

$\tau = 100\,m\Omega \cdot 10\,mF = 1{,}000\ seconds$