AC Analyses

Lecture 19 — April 8, 2013

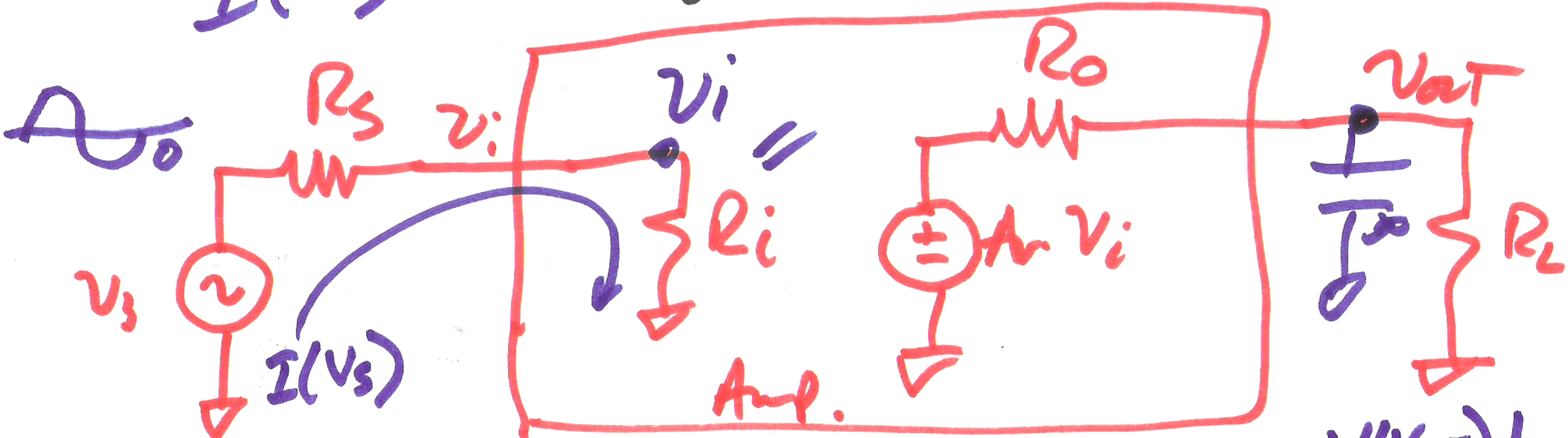
EE 320

$$R_i = \frac{V(v_i)}{I(V_s)}$$

Work Quiz

$R_L \to \infty$

$v_{OUT} = A_v v_i$



$$v_i = v_s \cdot \frac{R_i}{R_i + R_s}, \quad A_v = \frac{v_{OUT}}{v_i}$$

$$R_o = \frac{V(V_{OUT})\big|_{R_L=\infty}}{I(C_L)\big|_{C_L\to\infty}}$$

$$v_{OUT} = A_v \cdot v_i \cdot \frac{R_L}{R_L + R_o}$$

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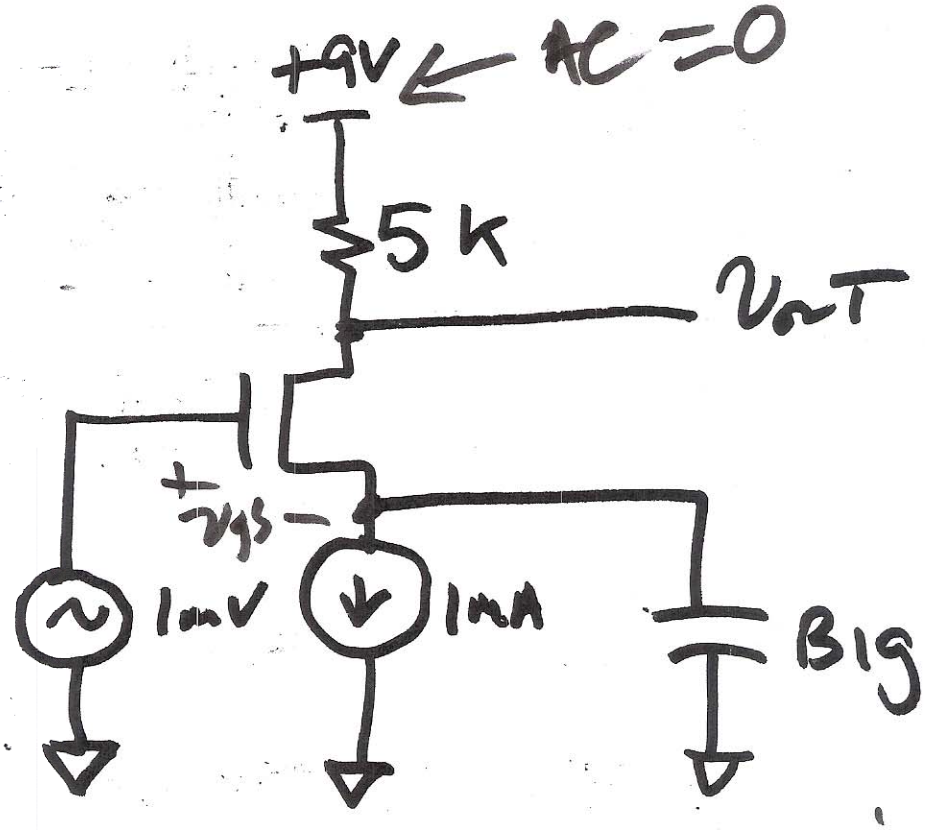
Q10 EE 320 NAME ____________
S13

For the following determine:
I_D, i_d, V_{OUT}, v_{out} if $g_m = 1mA/V$



$\boxed{I_D = 1mA}$

$V_{OUT} =$
$9 - 5K \cdot 1mA$
$\boxed{= 4V}$

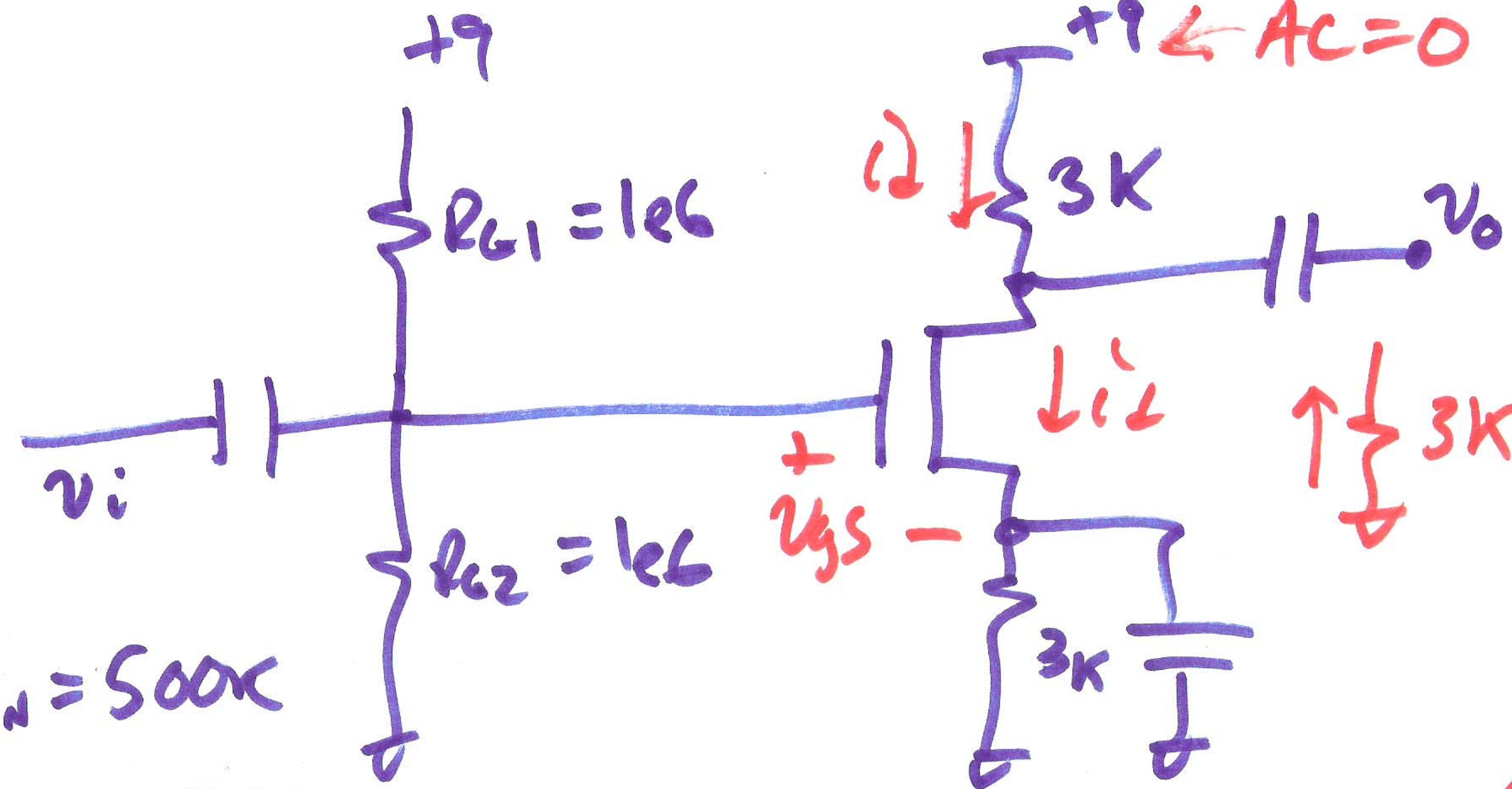
$v_{gs} = 1mV$

$i_d = g_m v_{gs}$
$= 1mV \cdot \frac{1mA}{V}$
$\boxed{i_d = 1\mu A}$

$v_{out} = -i_d \cdot 5K$
$= -1\mu A \cdot 5K$
$\boxed{= -5mV}$

$\frac{v_{out}}{v_{in}} = -5$

2)



$R_{IN} = 500K$

$R_{OUT} = 3K$

$$A_v = \frac{v_o}{v_i} = \frac{-\cancel{i_d}\cdot 3K}{\cancel{i_d}/g_m} = -3k\cdot g_m$$

$$v_i = v_{gs} = \frac{i_d}{g_m}$$

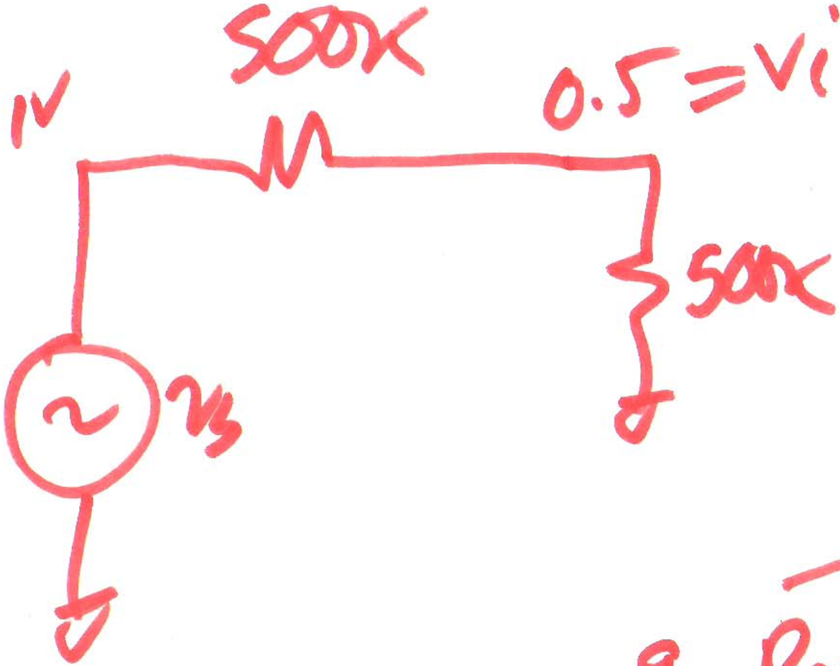
$$4.68\times10^{-3}$$

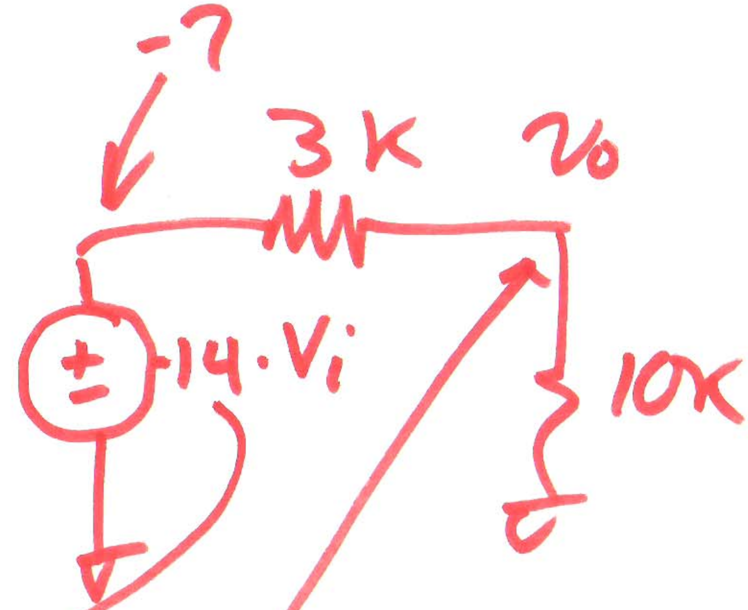
$$1/g_m = \frac{1}{4.68\times10^{-3}} = 213\,\Omega$$

$$= -13.84$$

$$\approx -14.033$$

2)





$-g_m R_{OD} \cdot V_i$

$$-7 \cdot \frac{\overset{R_L}{10K}}{\underset{R_{OD}}{3K} + \underset{R_L}{10K}} = -\frac{70}{13} = -5.38$$

$$v_o = -g_m v_i \cdot \frac{R_{OD} \cdot R_L}{R_{OD} + R_L}$$

$$\frac{v_o}{v_i} = -g_m R_{OD} \| R_L$$

3)

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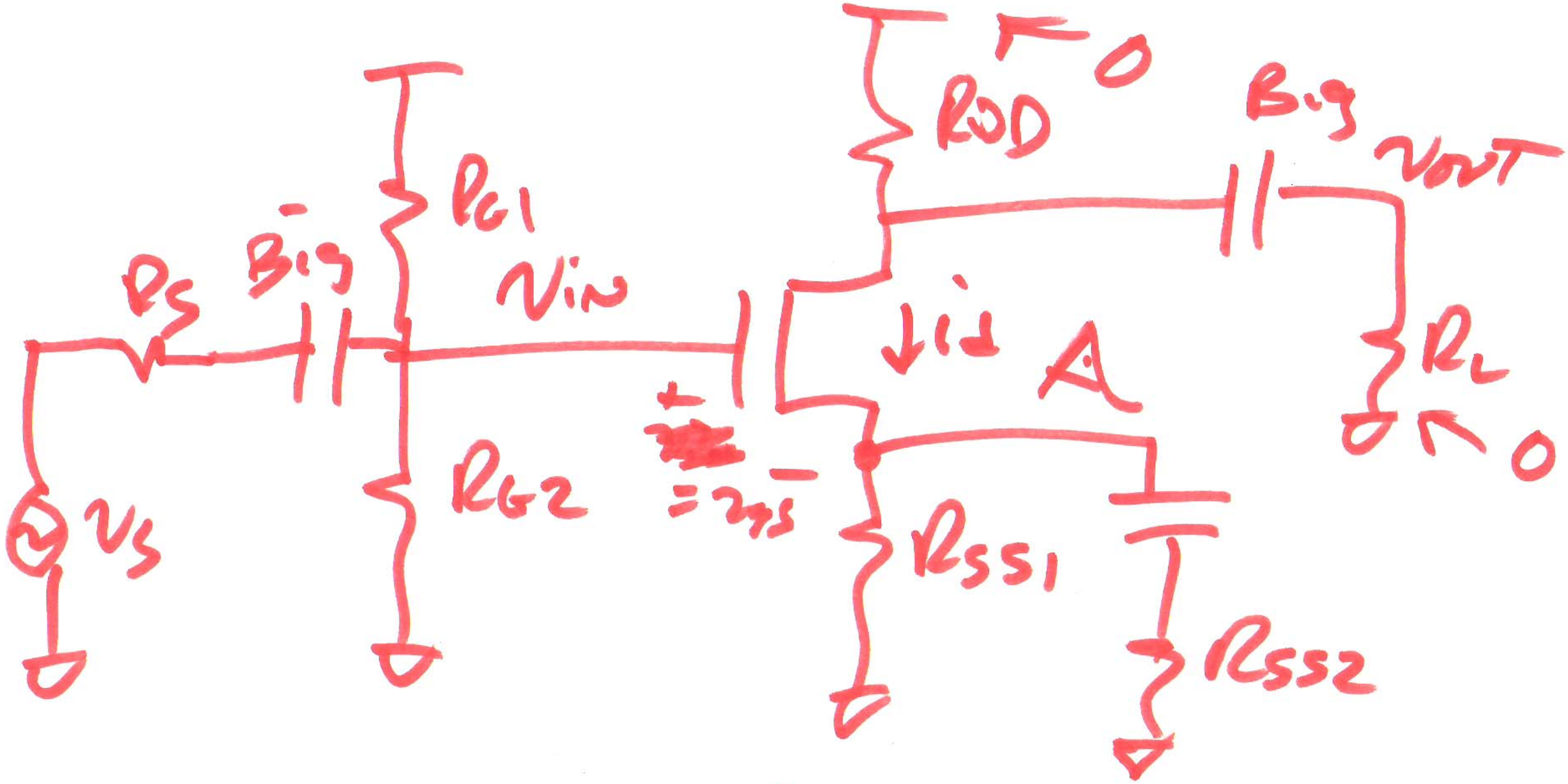

$$\frac{v_{out}}{v_{in}} = \frac{-i_d \cdot R_L \| R_{DD}}{\frac{i_d}{g_m} + \cancel{i_d} \cdot R_{SS1} \| R_{SS2}} = \frac{-R_L \| R_{DD}}{1/g_m + R_{SS1} \| R_{SS2}}$$

v_{gs}

in drain

in source

4)

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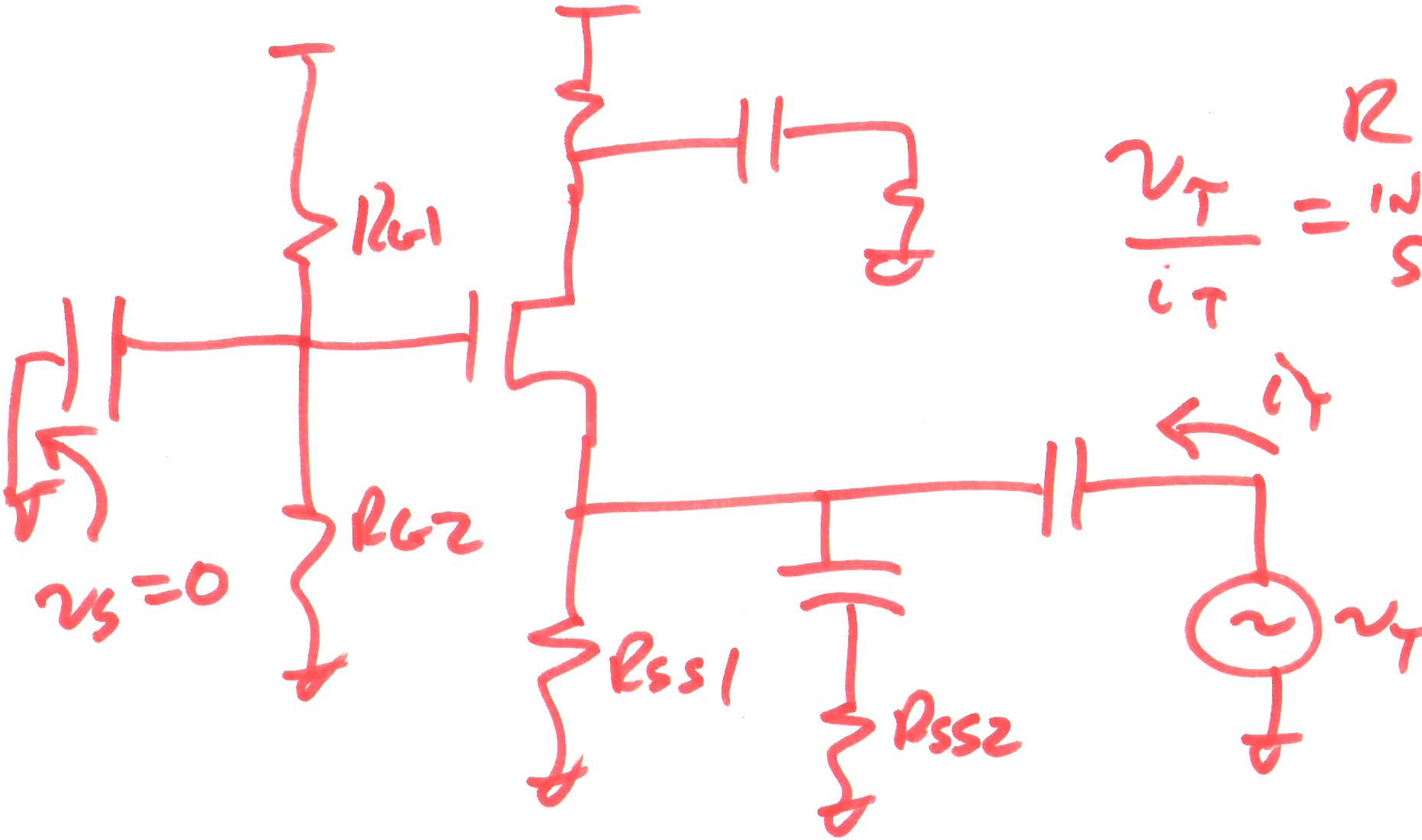
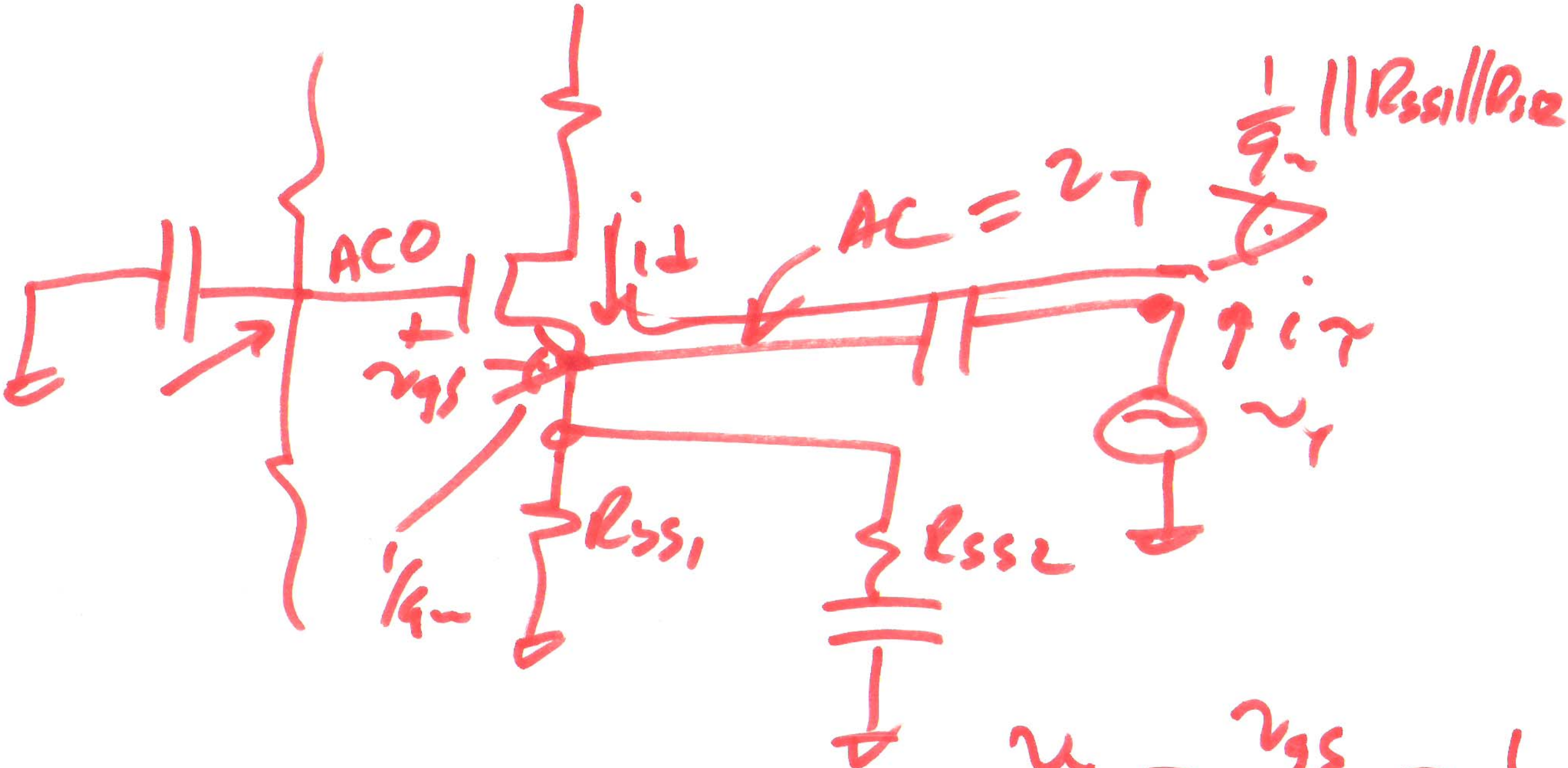


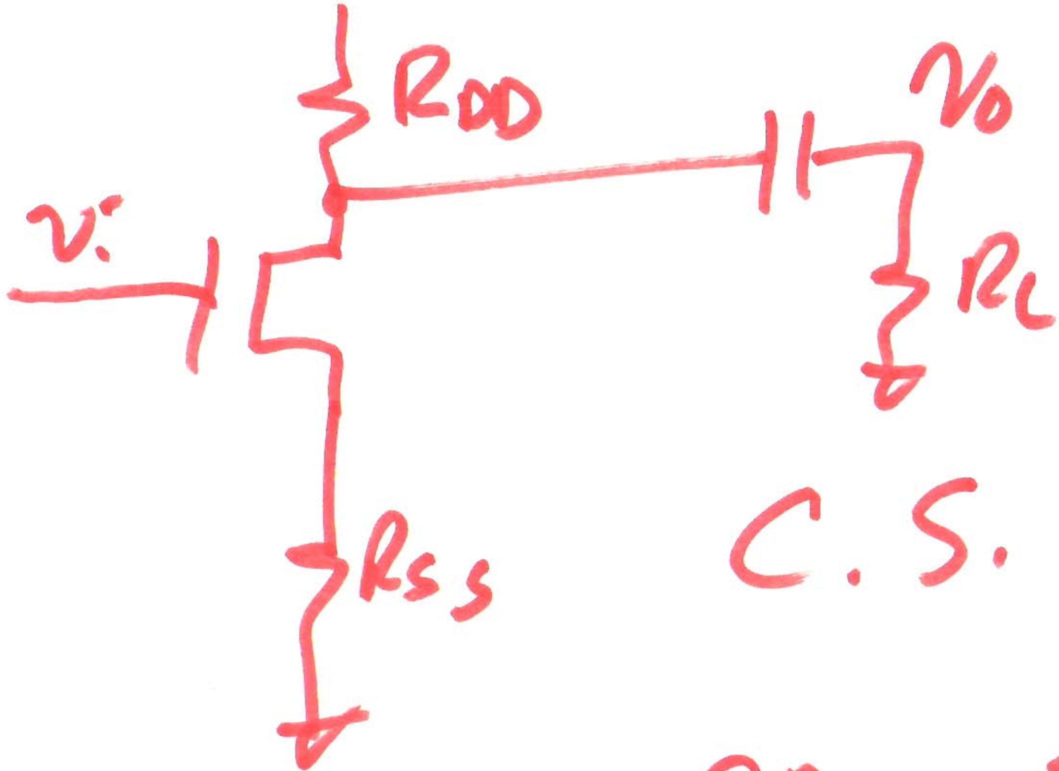
$$\frac{v_T}{i_T} = R_{\text{IN to SOURCE}}$$



$$\frac{v_T}{i_T} = \frac{v_{gs}}{i_d} = \frac{1}{g_m}$$

$$v_{gs} = -v_T$$

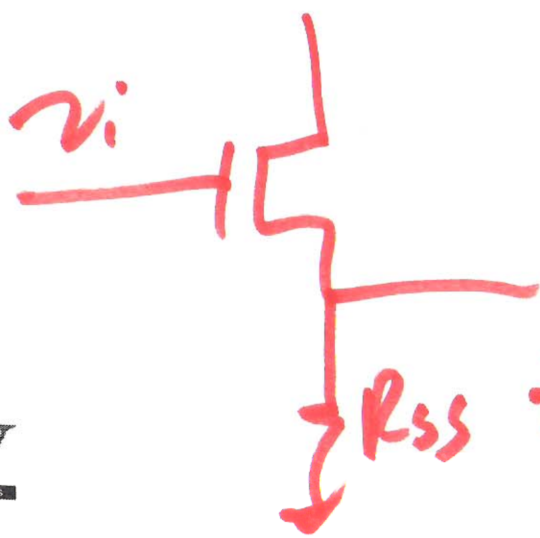
$$i_d = -i_T$$



$$\frac{v_o}{v_i} = \frac{-R_{DD} \| R_L}{1/g_m + R_{SS}}$$

C.S.

CD = SF



$$v_o = v_i \cdot \frac{1/g_m}{R_{SS} + 1/g_m}$$

7 B)

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