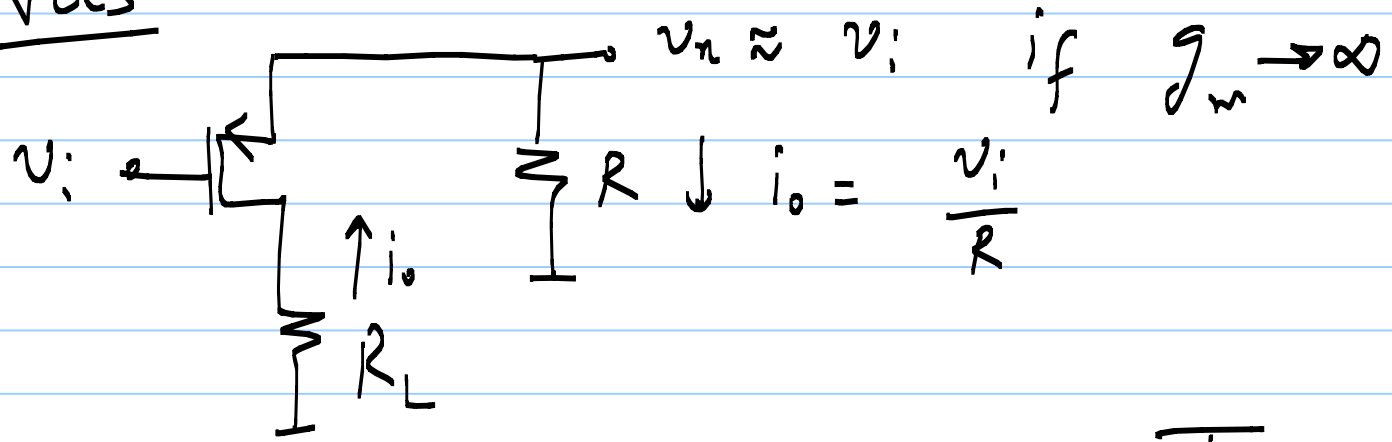
17/9/2020

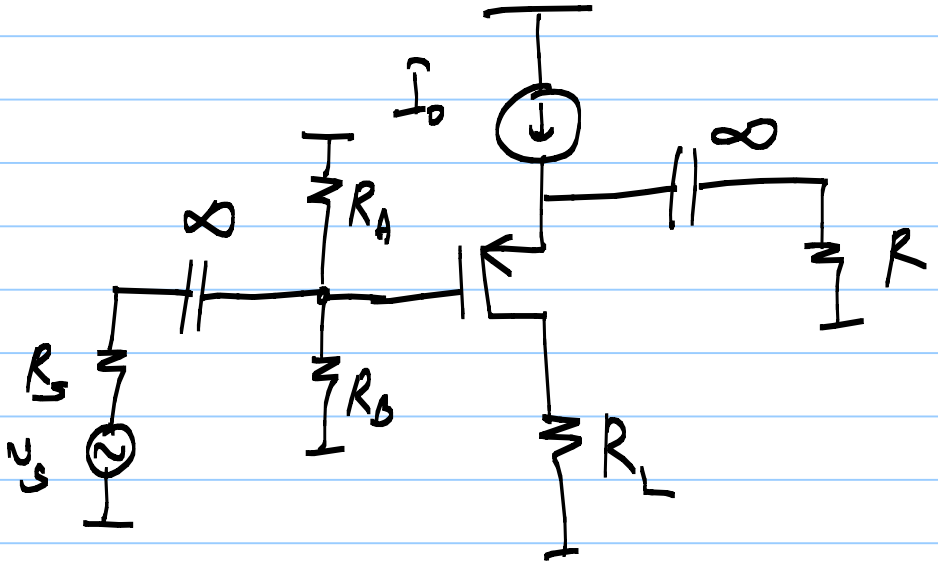
Lecture 26

PMOS based controlled sources

2) VCCS

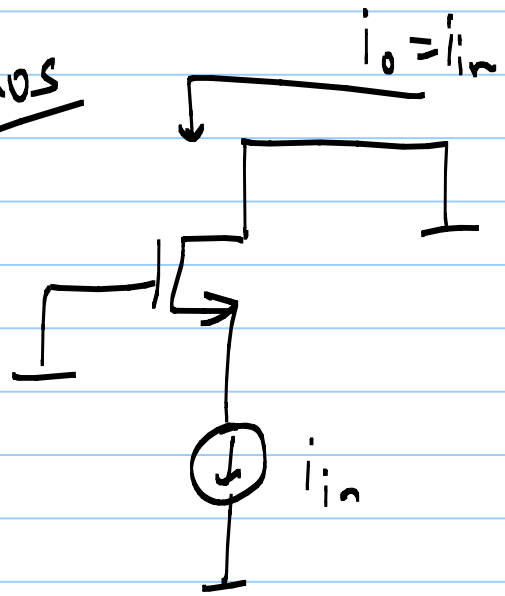


PMOS Transadmittance amplifier

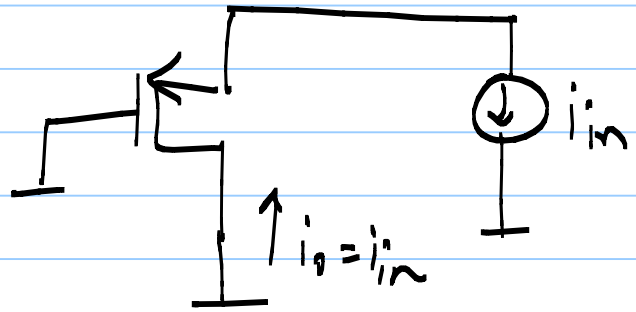


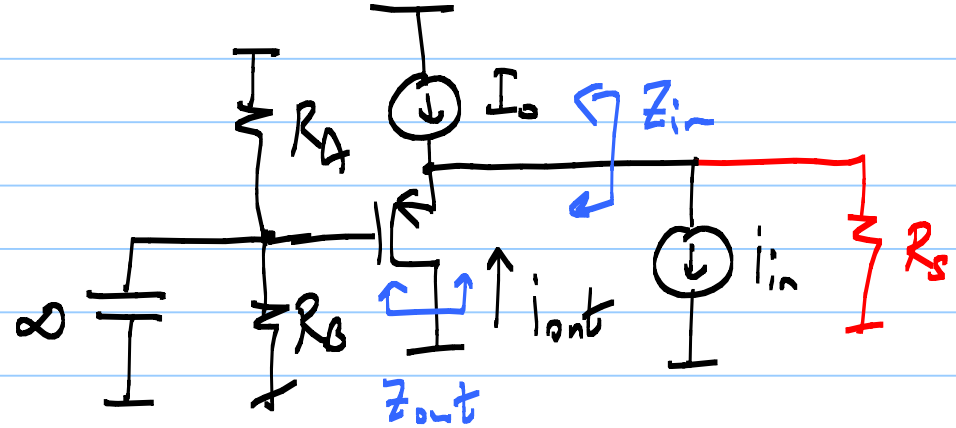
3) CCCS - Common Gate Amplifier

NMOS



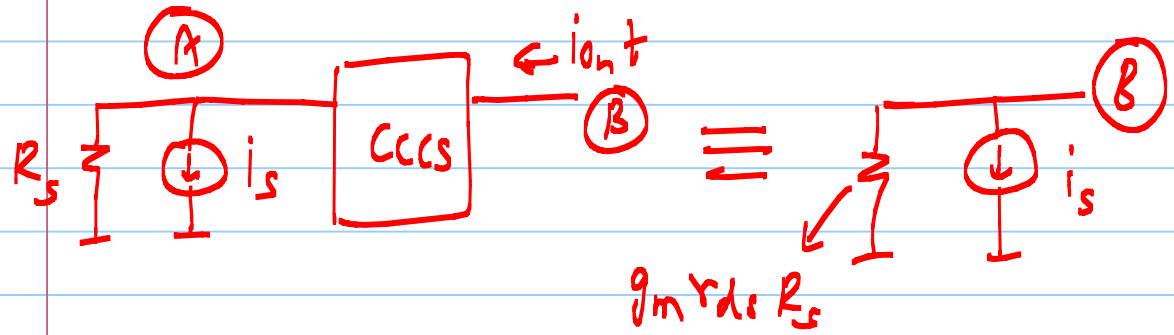
PMOS





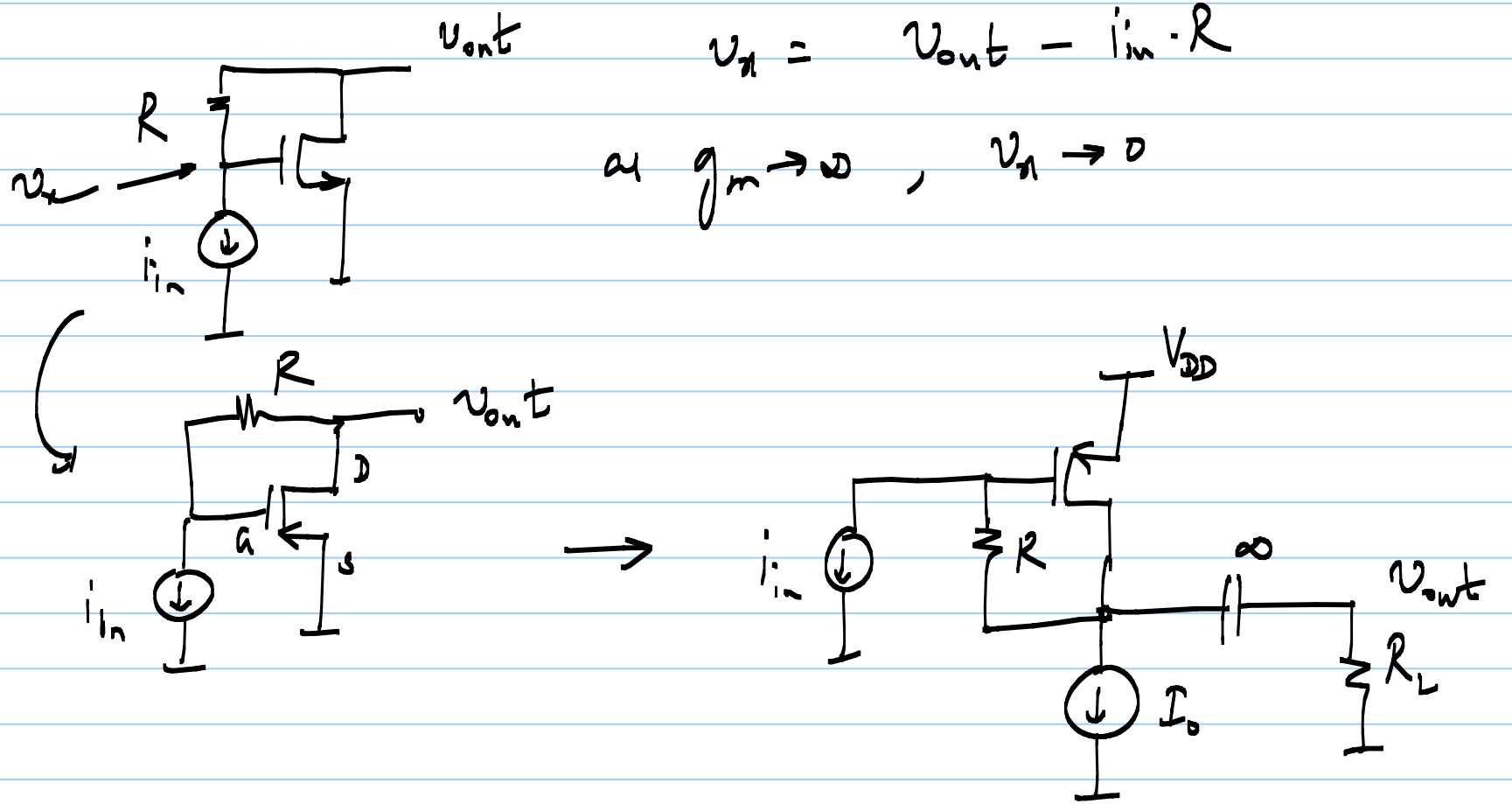
$$Z_{in} = \frac{1}{g_m + g_{ds}} \simeq \frac{1}{g_m}$$

$$Z_{out} = \infty$$



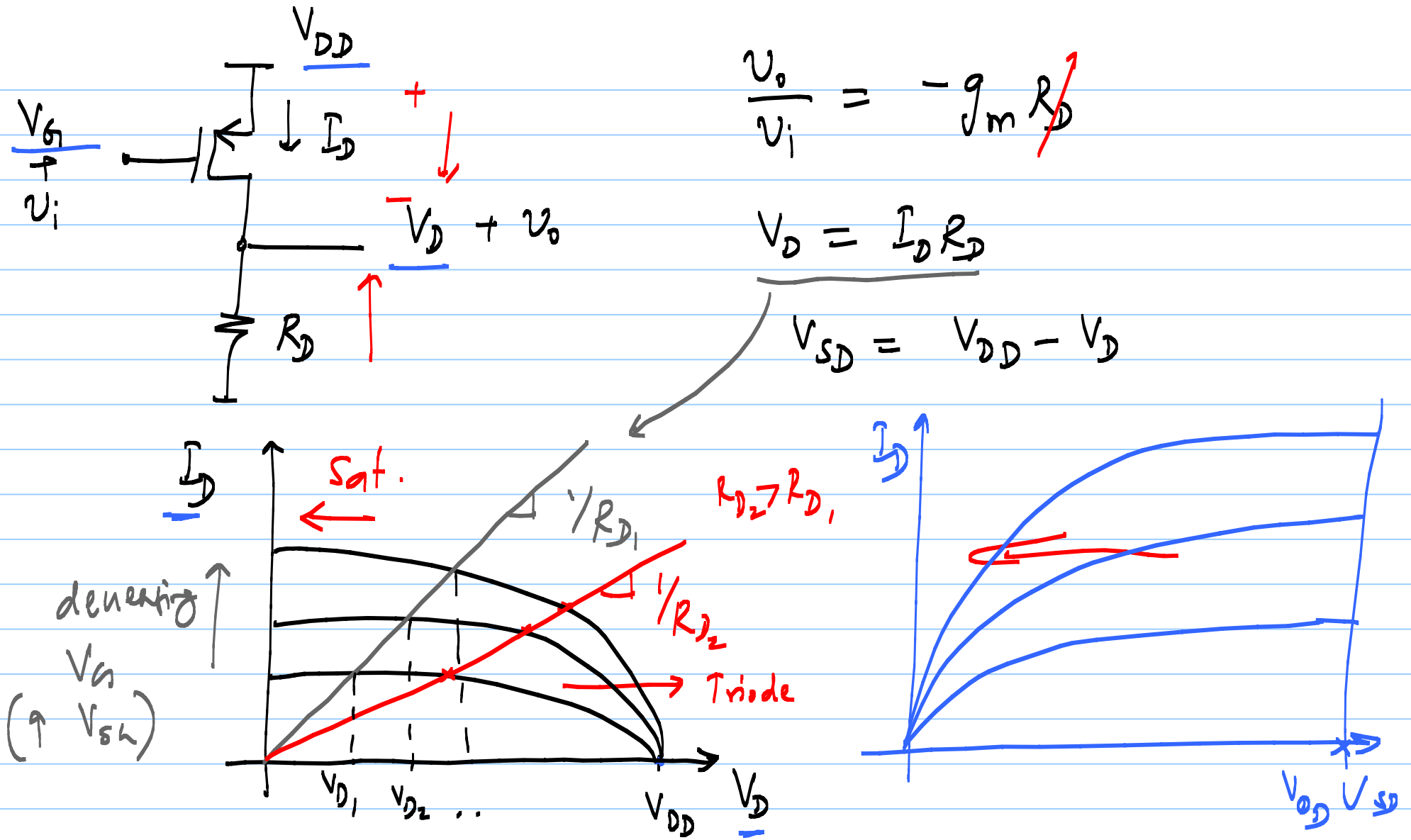
$$Z_{out} = R_s + r_{ds} + g_m r_{ds} R_s \simeq g_m r_{ds} R_s$$

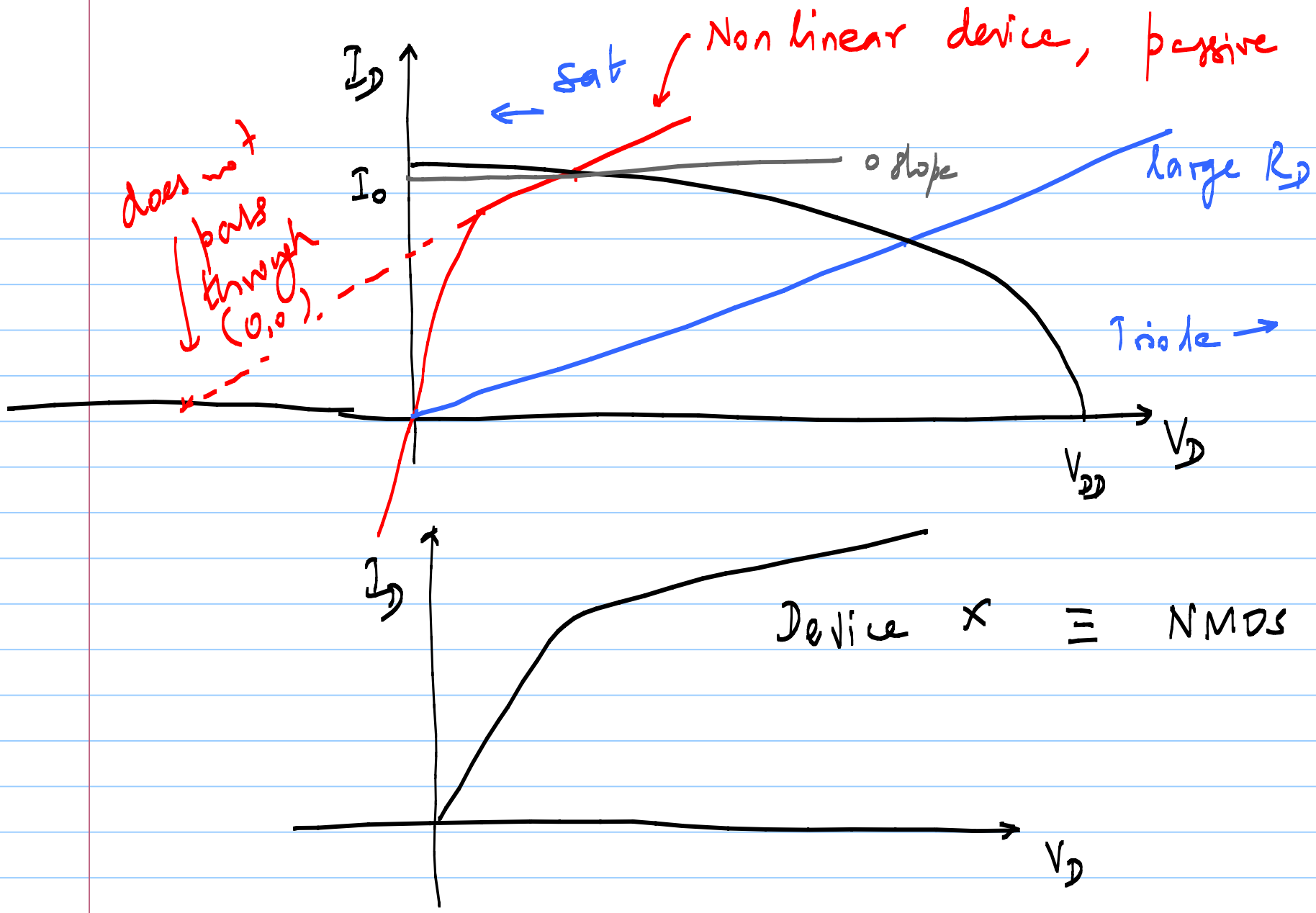
4) CCVS (Trans impedance amplifier) $v_{out} = R \cdot i_{in}$



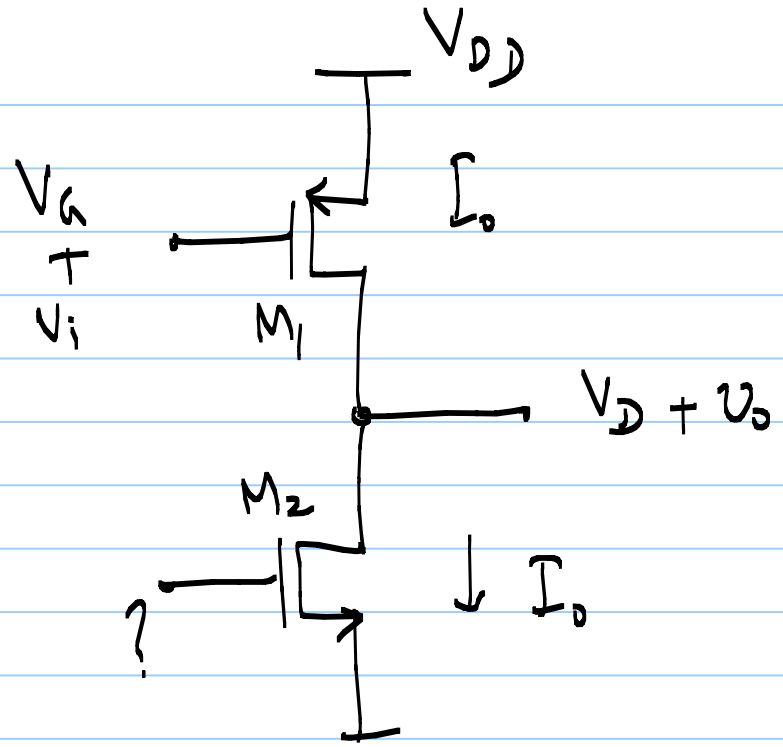
$v_x = v_{out} - i_{in} \cdot R$

at $g_m \to \infty$, $v_x \to 0$

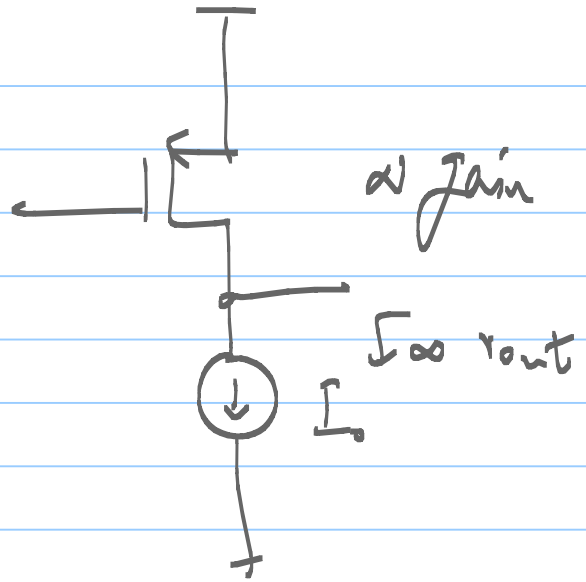

V_{DD}
V_G
v_i
I_D
+
$V_D + v_o$
R_D
$\frac{v_o}{v_i} = -g_m R_D$
$V_D = I_D R_D$
$V_{SD} = V_{DD} - V_D$
I_D
Sat.
$1/R_{D_1}$
$R_{D_2} > R_{D_1}$
$1/R_{D_2}$
Triode
decreasing V_G
($\uparrow V_{SG}$)
V_{D_1} V_{D_2} ..
V_{DD}
V_D
I_D
V_{OD} V_{SD}

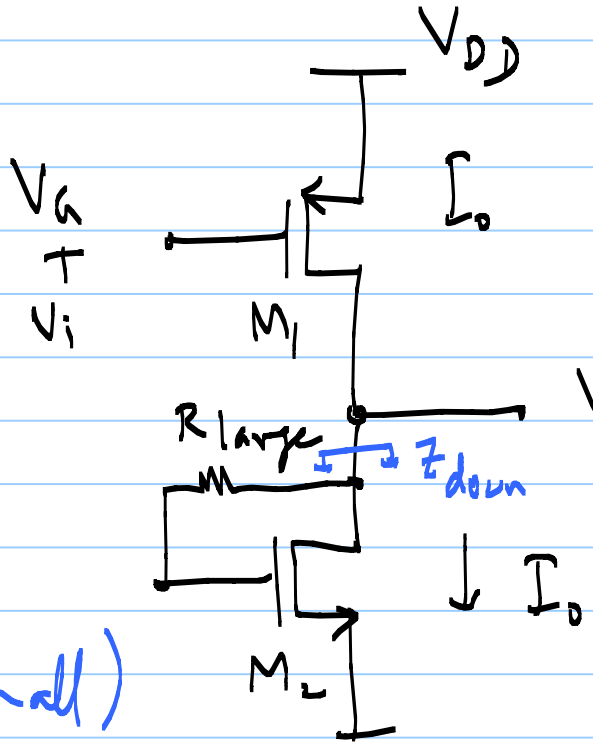

Non linear device, passive
sat
I_D
I_0
0 slope
large R_D
does not pass through (0,0)
Triode
V_D
V_{DD}

I_D
Device x ≡ NMOS
V_D



≡





$V_{SG2} = V_{DD} - V_G$

↳ decides I_0

(I)

$V_D = V_{G2}$ | I_0

$$Z_{down} = \frac{1}{g_{m2}}$$

$$gain = -\frac{g_{m1}}{g_{m2}} \quad (small)$$