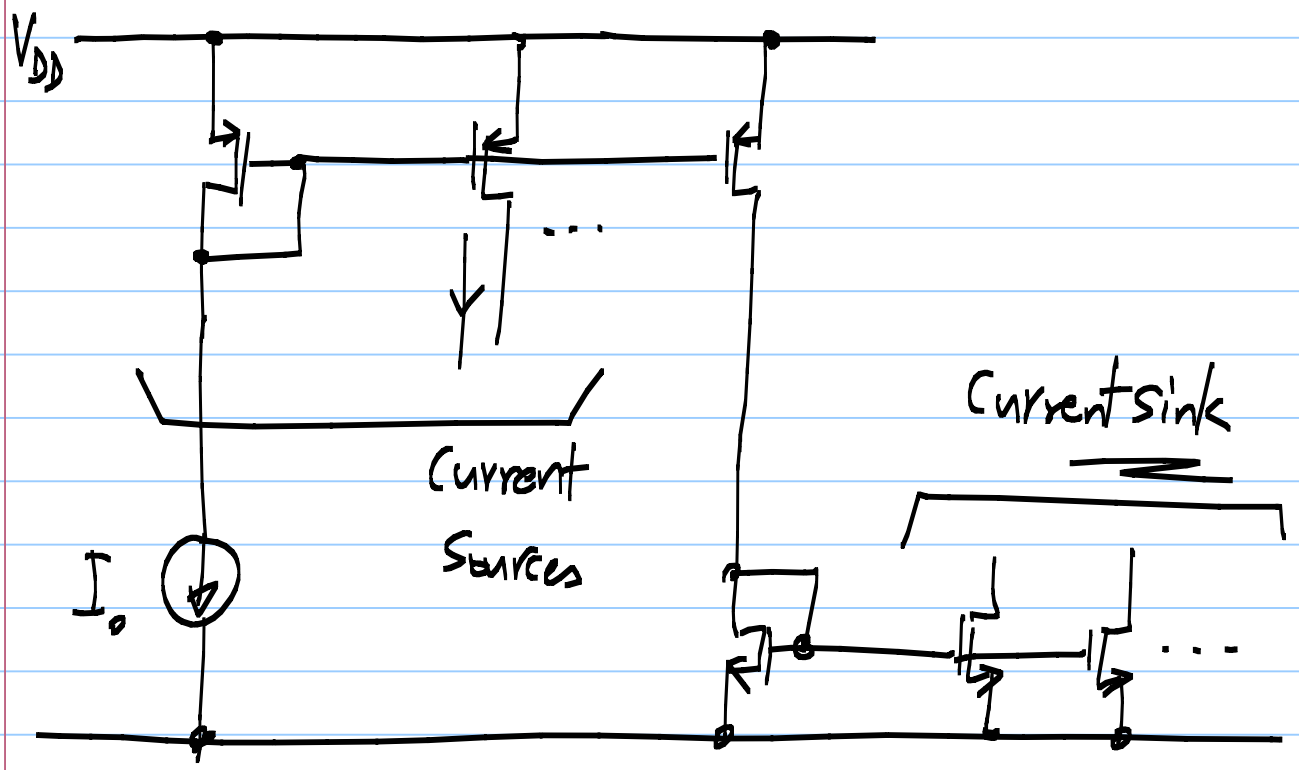
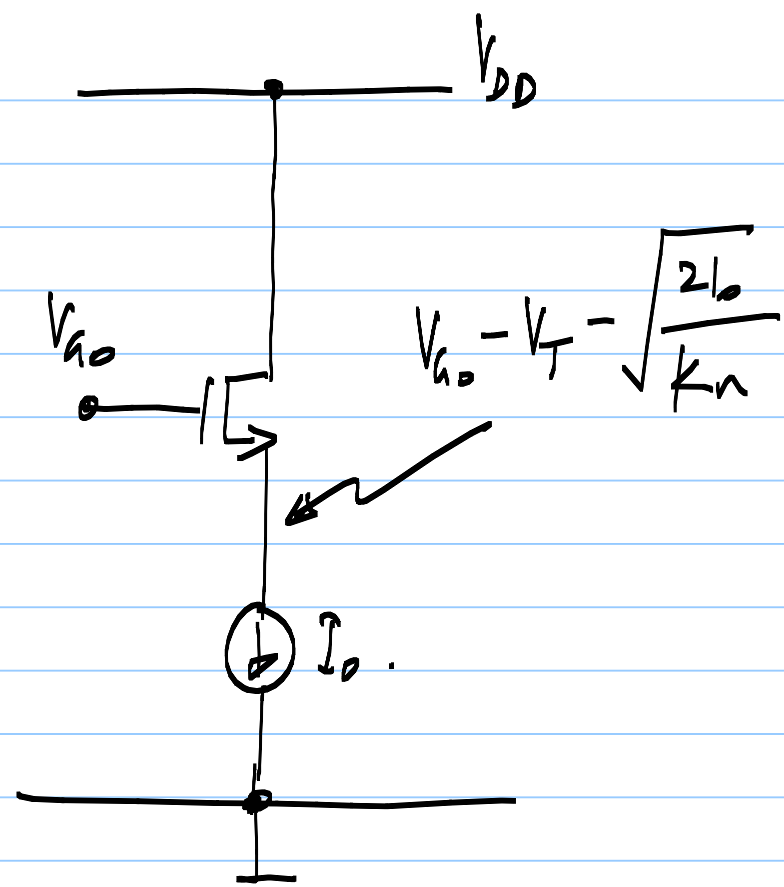
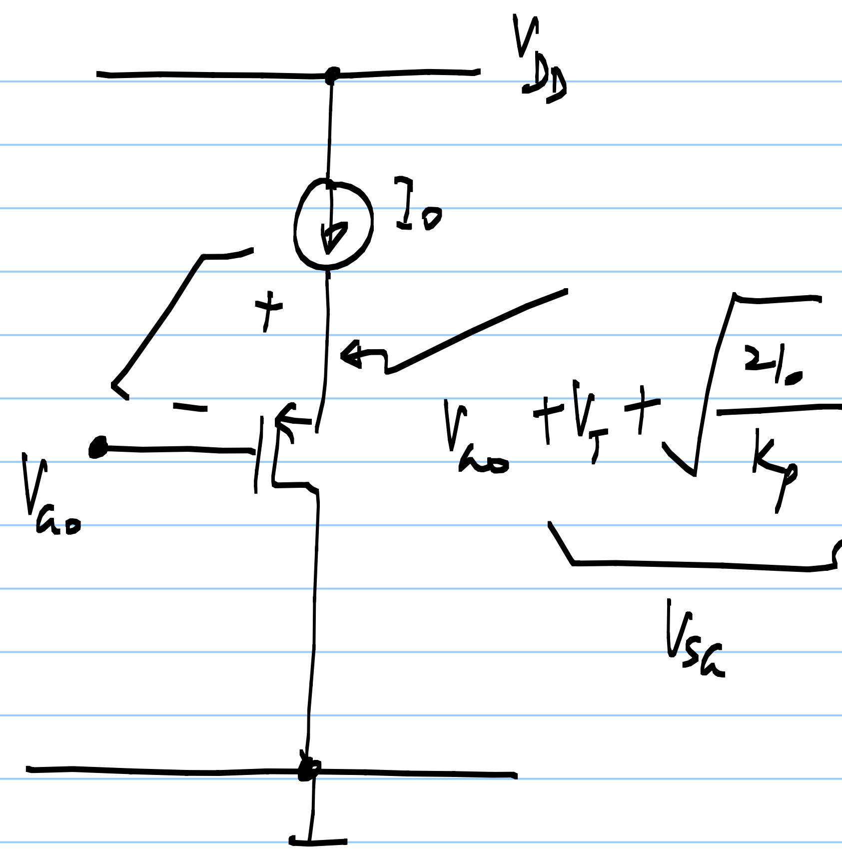
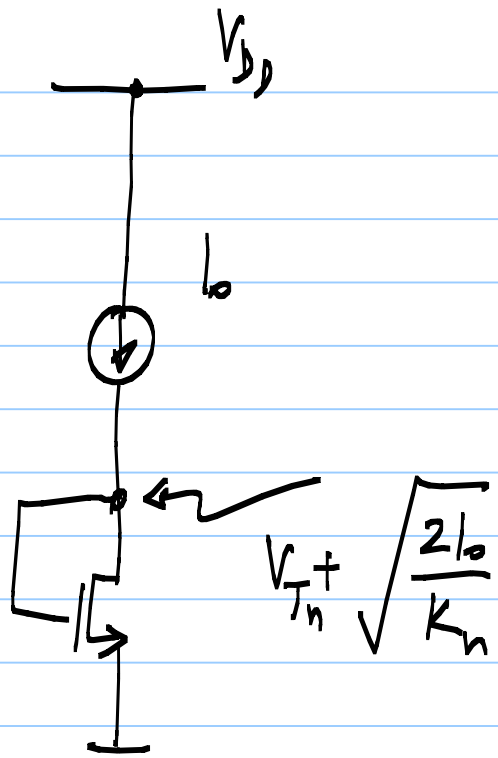
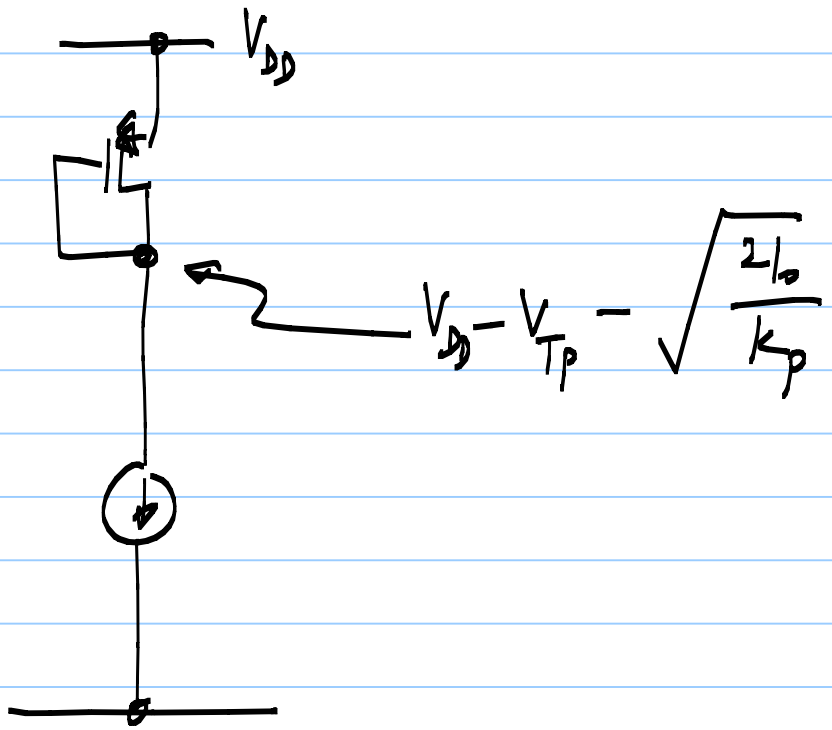
Lecture 28

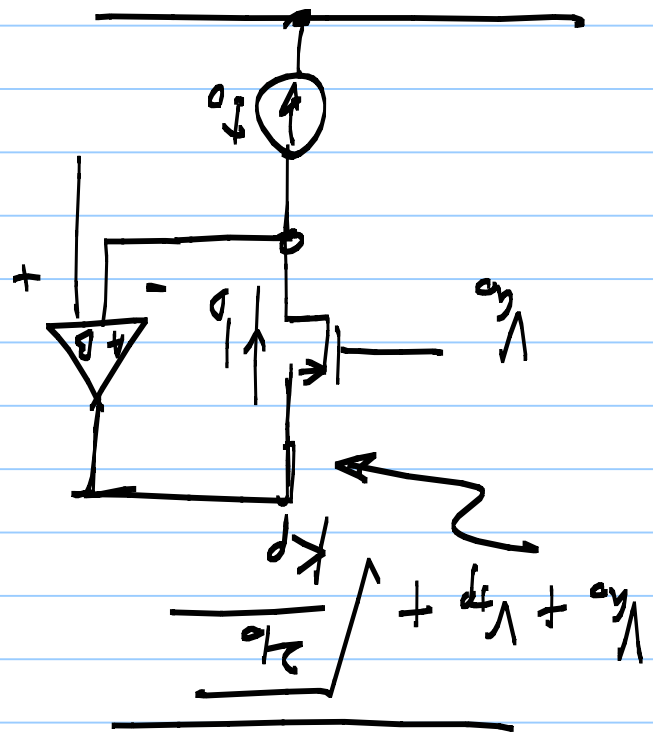


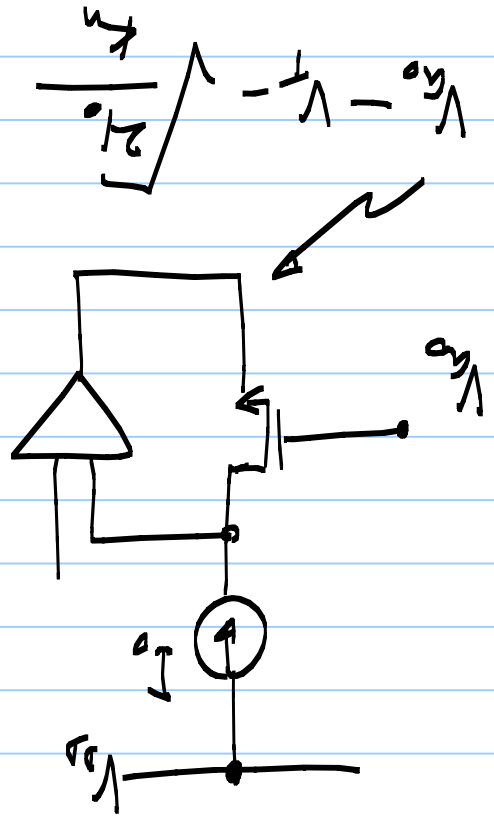

V_{DD}
V_{G0}
$V_{G0} - V_T - \sqrt{\frac{2I_0}{K_n}}$
I_0

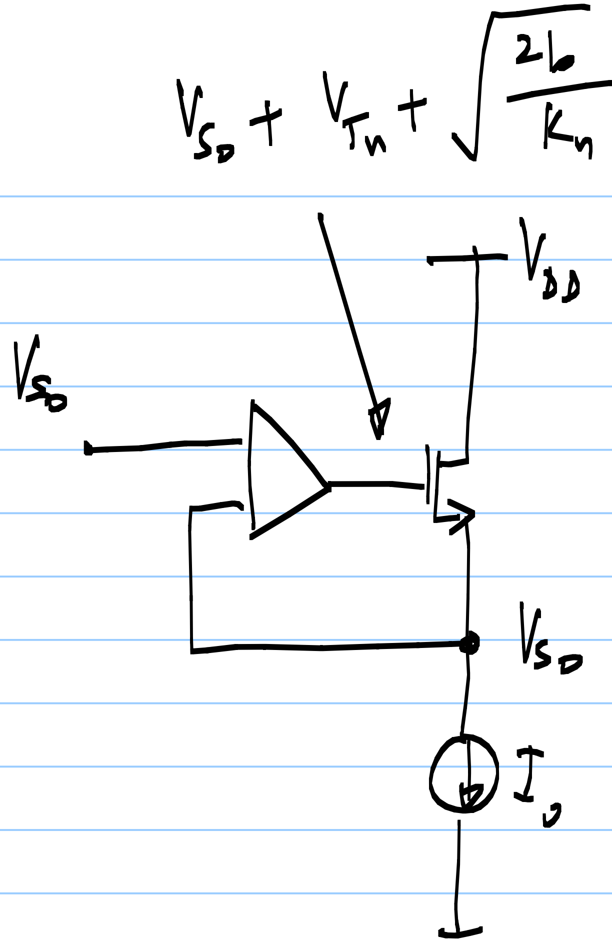

V_{DD}
I_0
+
−
V_{G0}
$V_{G0} + V_T + \sqrt{\frac{2I_0}{K_p}}$
V_{SG}

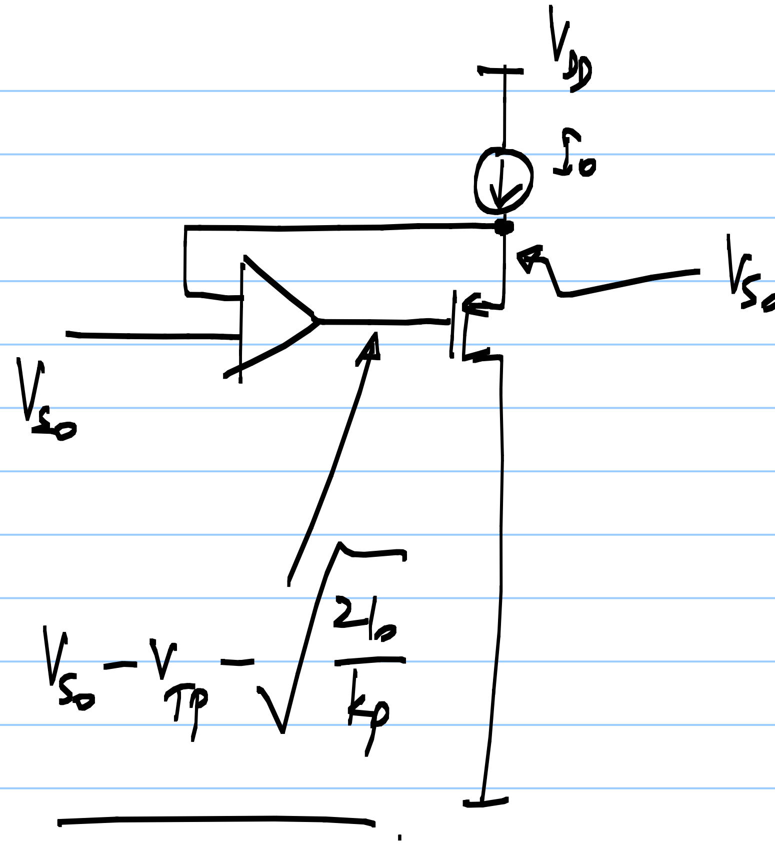

V_{DD}
I_o
$V_{Tn} + \sqrt{\frac{2I_o}{K_n}}$


V_{DD}
$V_{DD} - V_{Tp} - \sqrt{\frac{2I_o}{K_p}}$

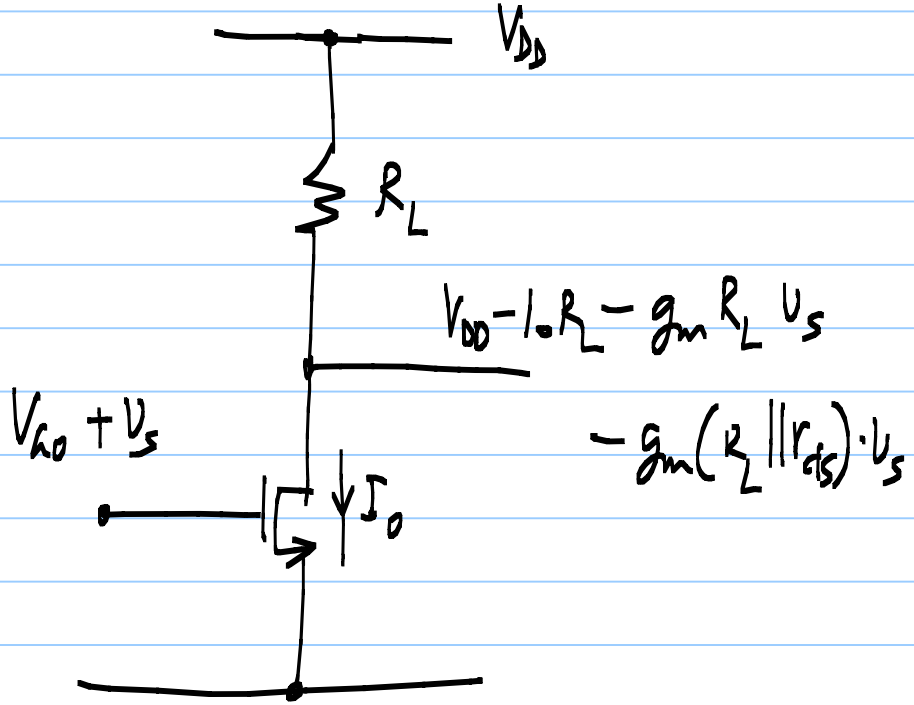





$V_{SO} + V_{Tn} + \sqrt{\frac{2I_0}{K_n}}$
V_{DD}
V_{SO}
V_{SO}
I_0


V_{DD}
I_0
V_{SO}
V_{SO}
$V_{SO} - V_{Tp} - \sqrt{\frac{2I_0}{k_p}}$

Common source amplifier

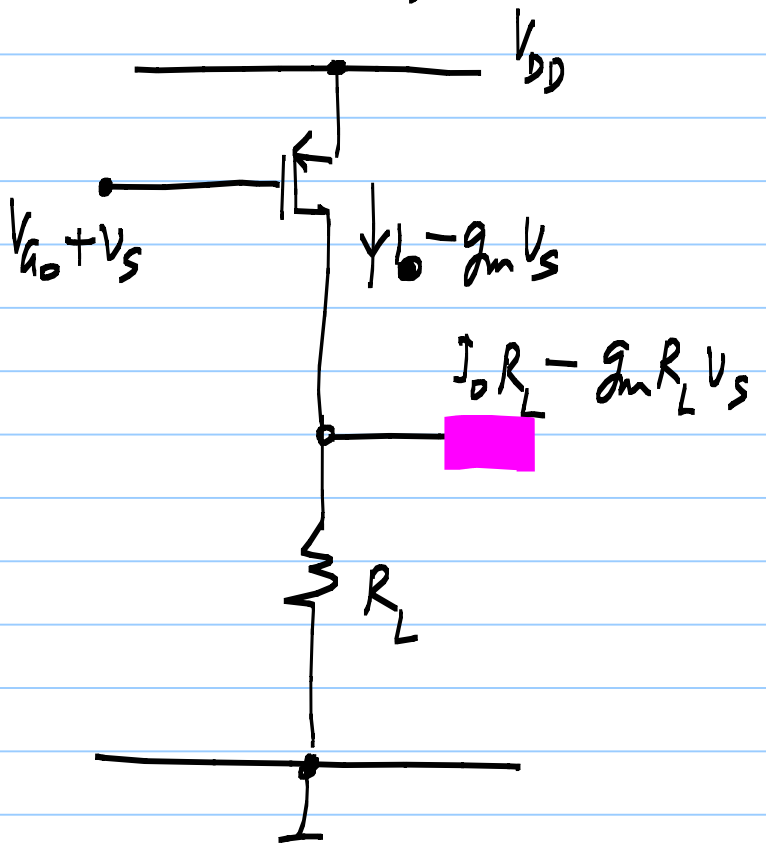


op. point $V_{GS} = V_{G0}$

$I_D = I_0$

op.point $V_{SG} = V_{DD} - V_{G0}$

$I_D = I_0$



$$|\text{gain}| = g_m R_L = \frac{2I_D}{V_{GS}-V_T} \cdot R_L = 2 \cdot \frac{I_D R_L}{(V_{GS}-V_T)}$$

min. $V_{DS,Q}$ (possible)

$$V_{DD} = V_{DS,Q} + I_D R_L$$

$$= 2 \cdot \frac{V_{DD} - (V_{GS}-V_T)}{(V_{GS}-V_T)}$$

$$= 2\left[\frac{V_{DD}}{V_{GS}-V_T} - 1\right] \checkmark$$

$$\sqrt{2I_D \cdot \mu C_{ox} \frac{W}{L}}$$

$$\frac{V_{DS,Q} + I_D R_L}{V_{DS,Q} + I_D R_L}$$

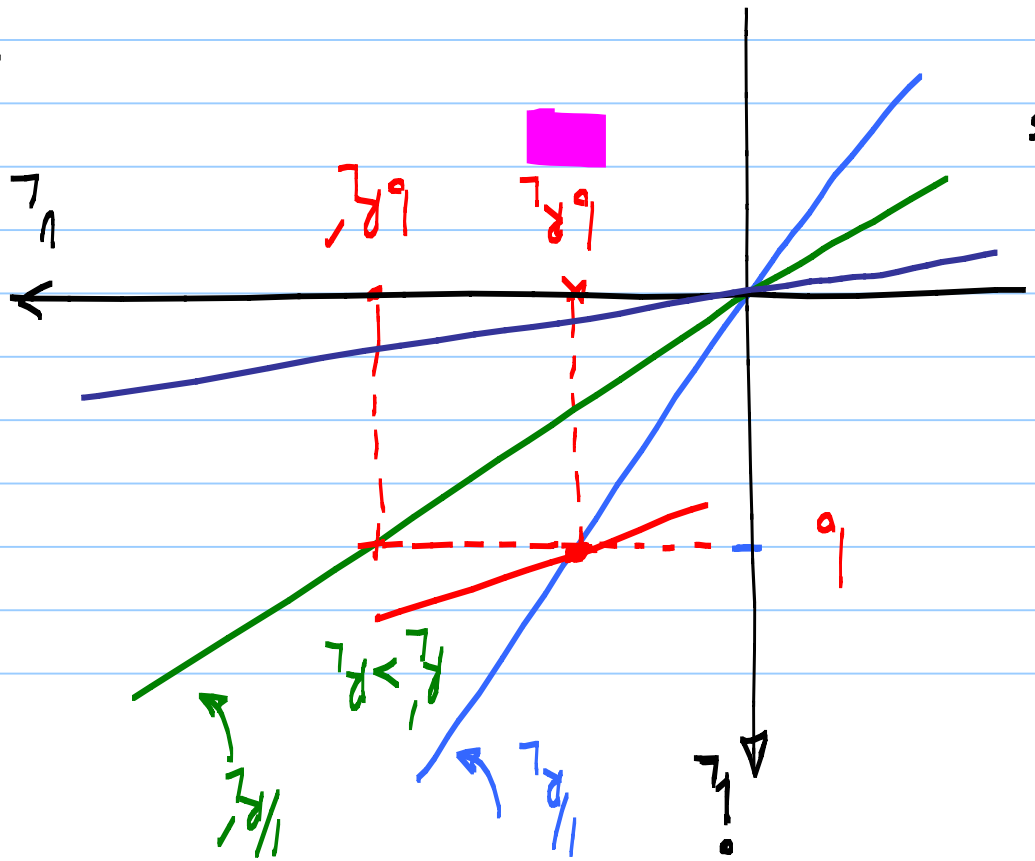
minimize this for maximizing

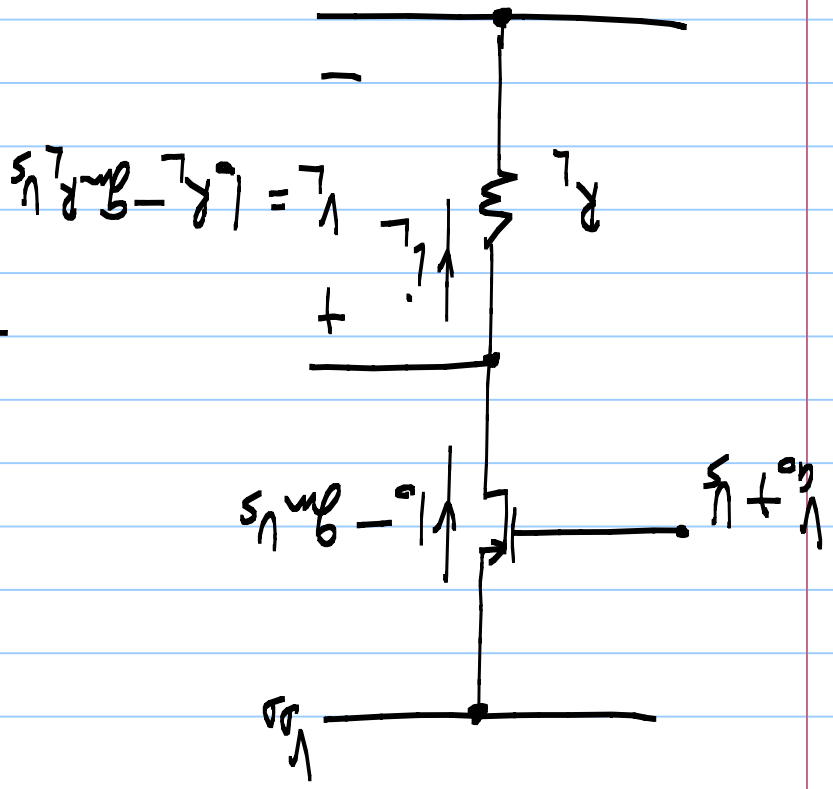
$$V_{GS}-V_T = \sqrt{\frac{2I_D}{K_n}} = \sqrt{\frac{2I_D}{\mu_n C_{ox} W/L}}$$

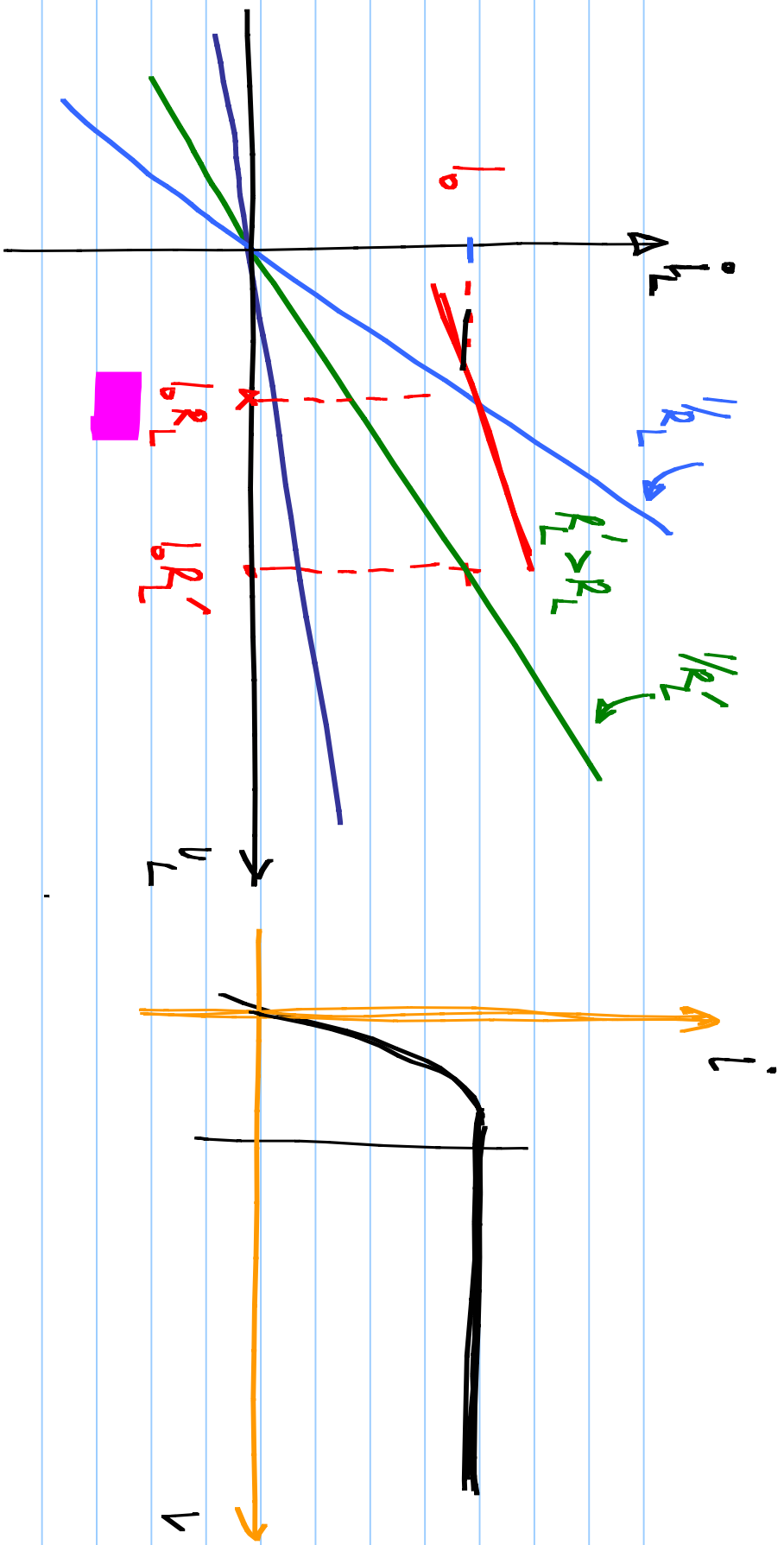
$$V_{GS} - V_T > 6 \cdot V_t = \underline{150\,mV}$$

$$|gain| = 2\left[\frac{V_{DD}}{\min(V_{GS} - V_T)} - 1\right]$$

$$2\left[\frac{1.5V}{0.15V} - 1\right] = \underline{18}$$


v_L
i_L
i_{R_L}
$i_{R_L'}$
i_o
$1/R_L$
$1/R_L'$
$R_L < R_L'$


R_L
$v_L = i_L R_L - g_m R_L v_s$
i_L
$+$
$-$
$v_o + v_s$
$i_o - g_m v_s$
v_{ss}


o
x
$\frac{1}{R_L}$
$\frac{1}{R_L'}$
$\frac{1}{R_L} + \frac{1}{R_L'}$
$\frac{1}{R_L'}$
z
z
1