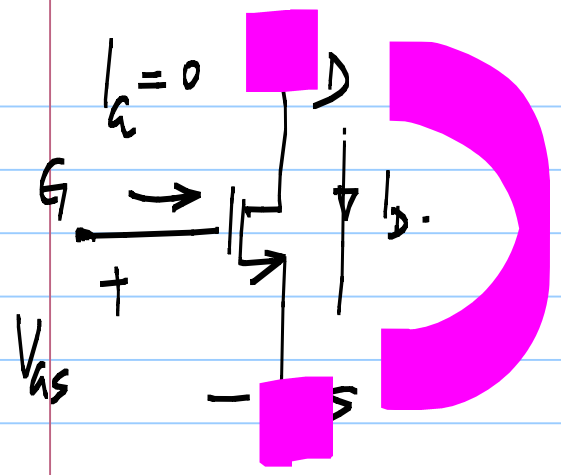


V_T: threshold voltage

μ: mobility

C_{ox}: oxide capacitance density

W: width

L: Length

$\mu C_{ox} \frac{W}{L}$: $= \beta$ Current factor

$I_D = 0 \qquad V_{GS} < V_T$

$$\mu C_{ox} \frac{W}{L} \left((V_{GS} - V_T) V_{DS} - \frac{V_{DS}^2}{2} \right)$$

$V_{GS} > V_T$

$V_{DS} < V_{GS} - V_T$

triode/linear

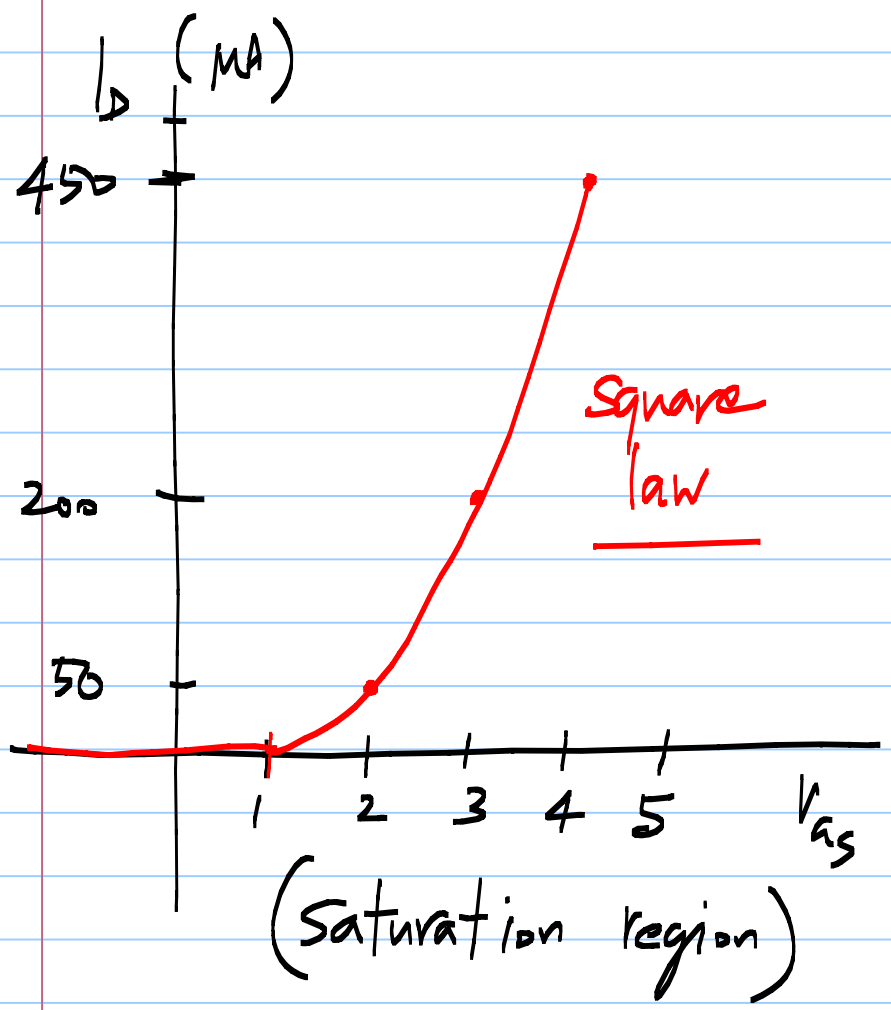
$$\frac{\mu C_{ox}}{2} \frac{W}{L} (V_{GS} - V_T)^2$$

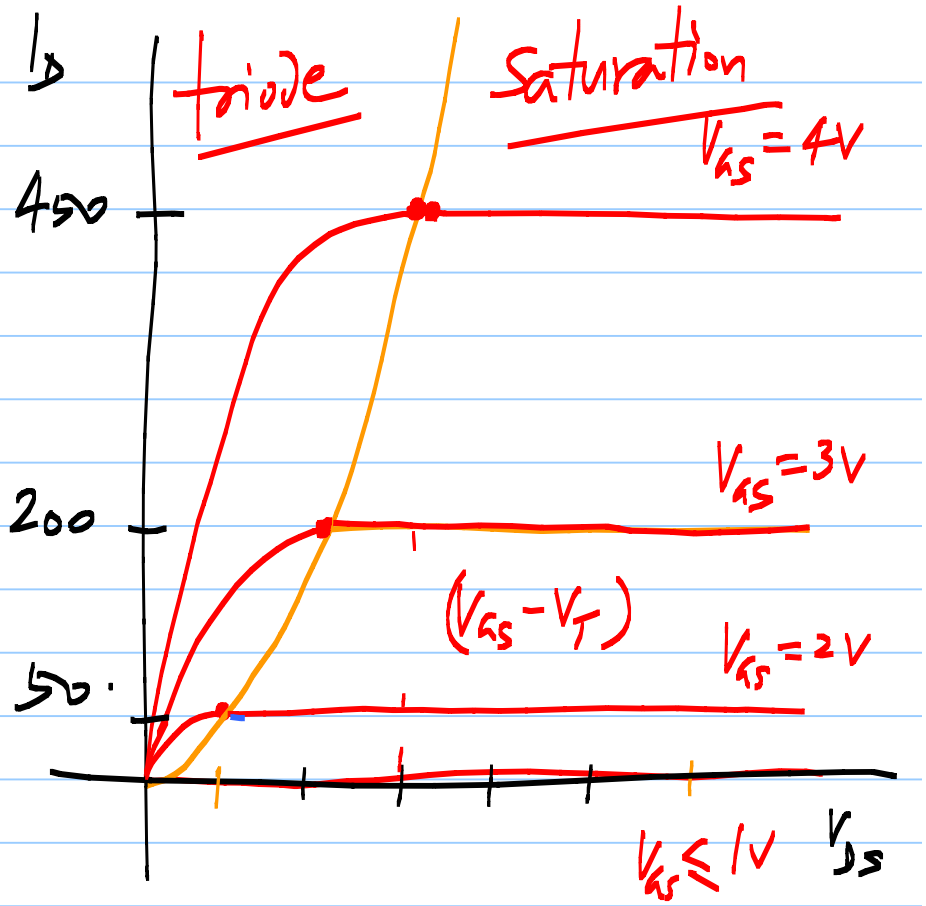
$V_{GS} > V_T$

$V_{DS} > V_{GS} - V_T$

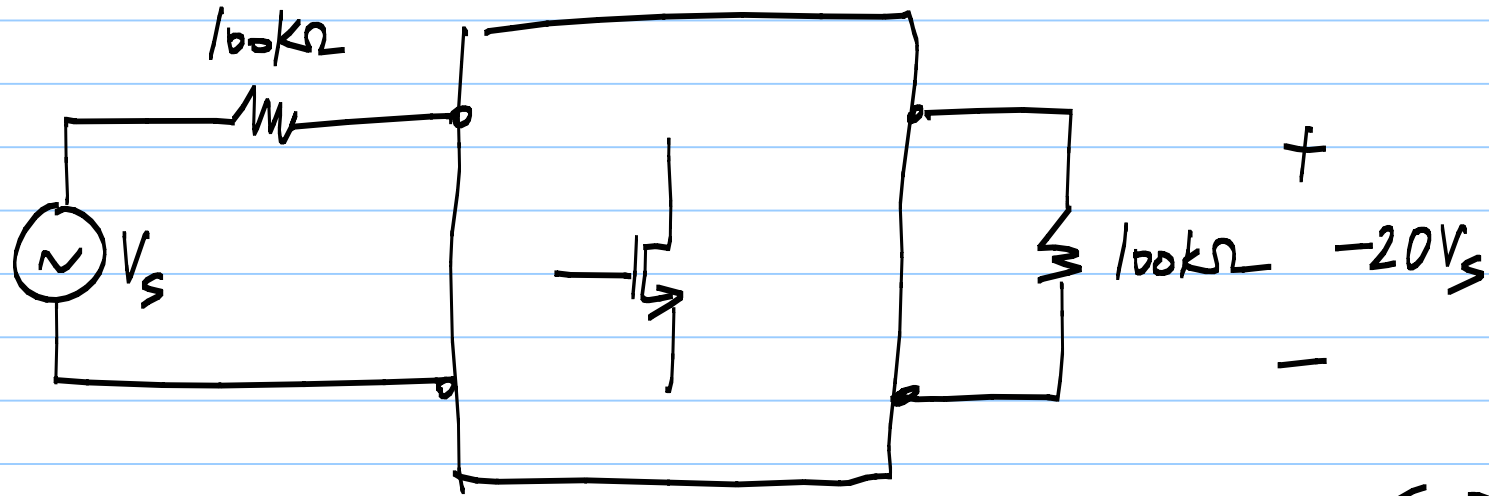
saturation

$V_T = 1V$; $\mu C_{ox} = 100\mu A/V^2$; $\frac{W}{L} = 1$

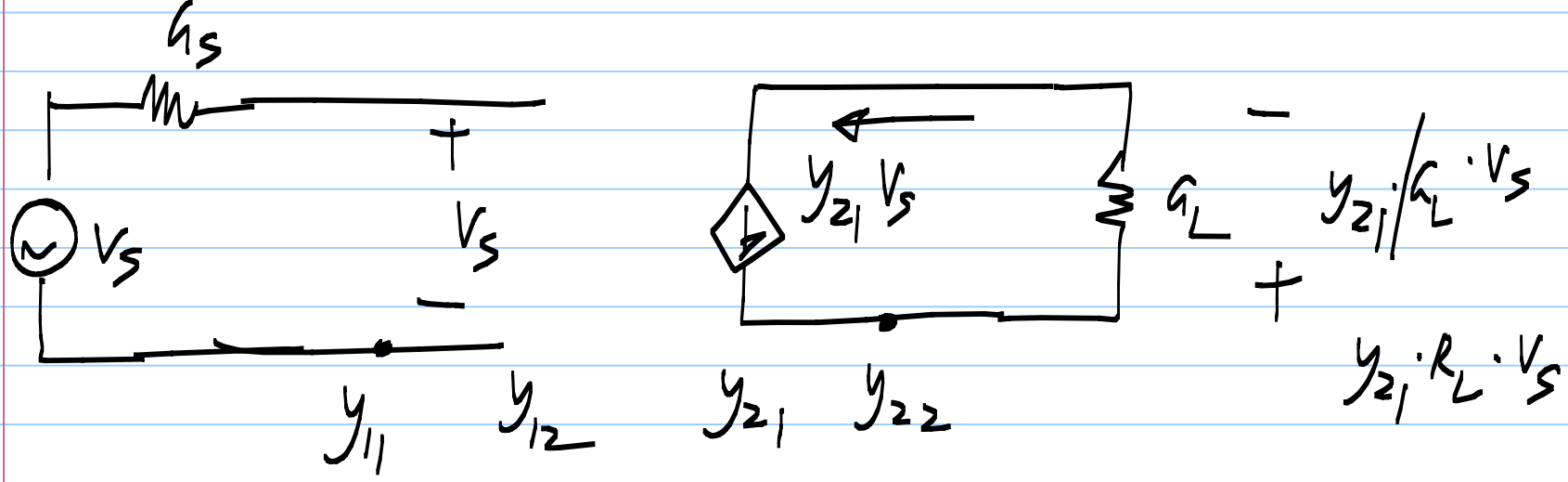




$y_{21} = 0.2\,mS = 200\,\mu S$

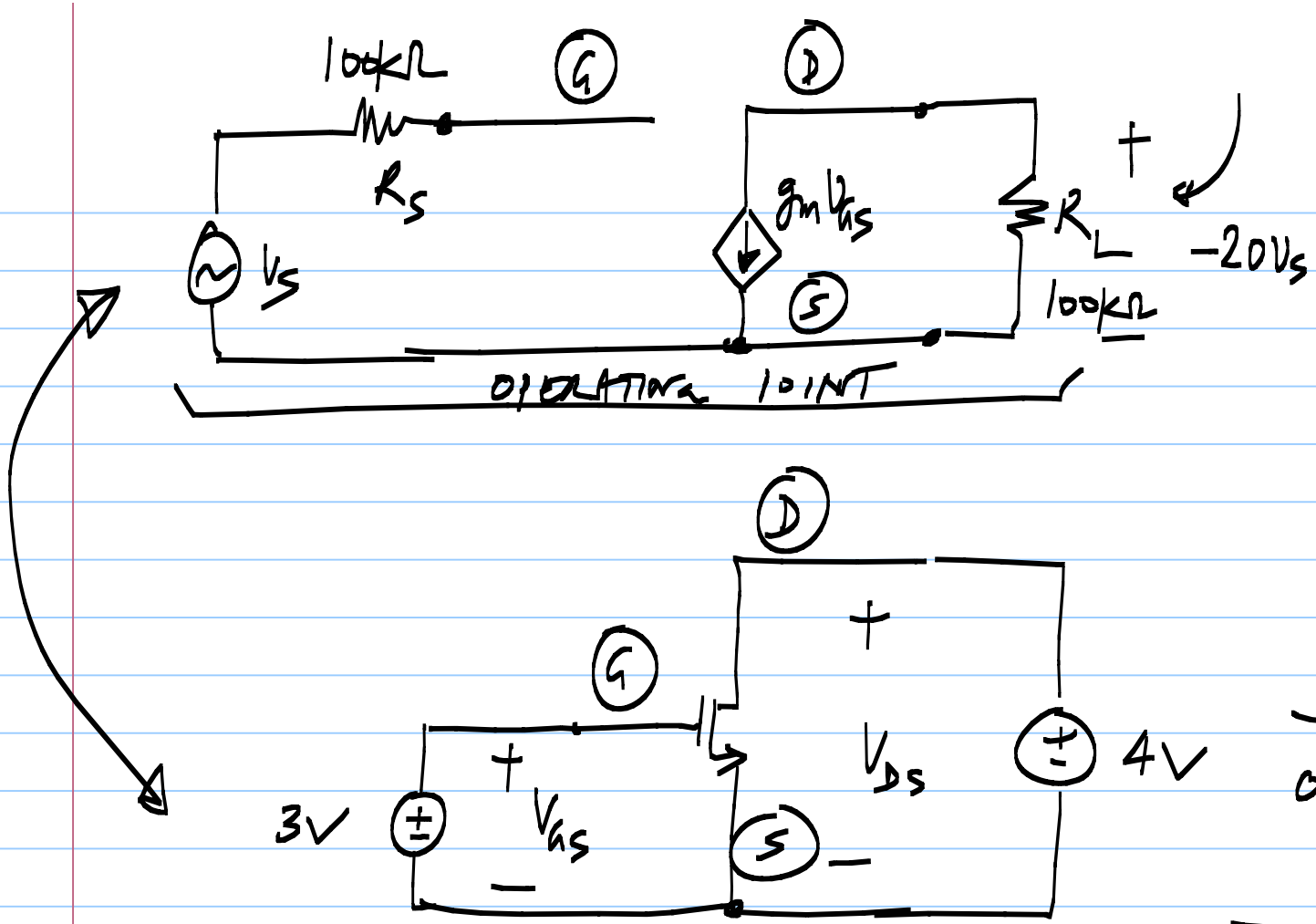


$$\frac{V_o}{V_s} = \frac{-y_{21} G_s}{(y_{11} + G_s)(y_{22} + G_L) - y_{12} y_{21}} = -\frac{y_{21}}{G_L}$$



$$y_{21} = \frac{\partial I_D}{\partial V_{GS}} = \mu C_{ox} \frac{W}{L} (V_{GS} - V_T) = 200\mu S$$

$$\frac{100\mu A}{V^2} \cdot 2V = 200\mu S$$



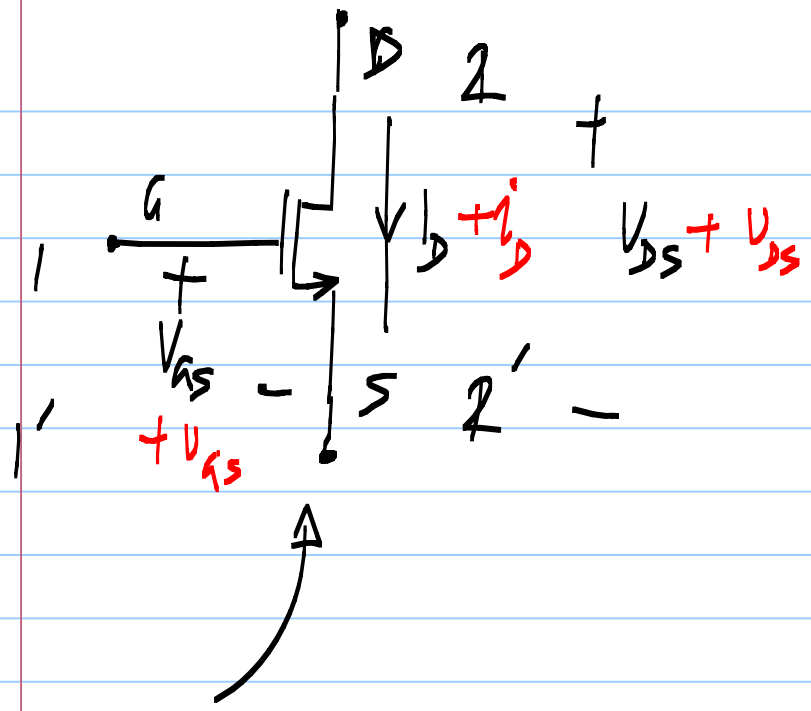
For

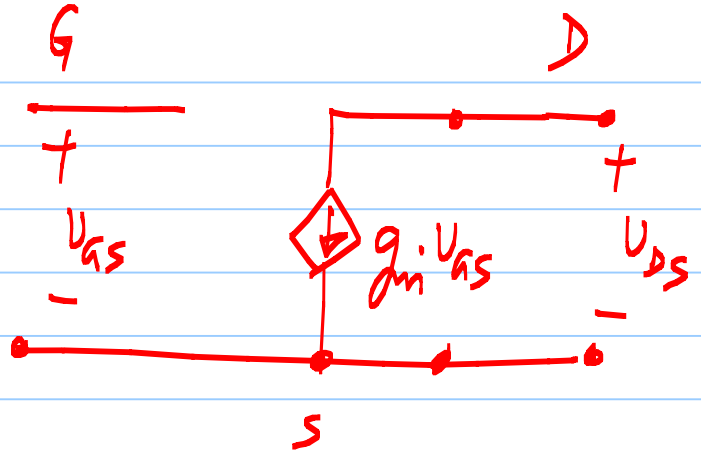
$g_m = 200\mu S$

$V_{GS} = 3V$

$V_{DS} > 2V$

$V_{DS} = 4V$





Source : Common

to pOA3 1 & 2