EE 320 Electronics

Lecture 12

MARCH 11, 2013

Review the test

TRANSistors

N-channel Metal oxide semiconductor

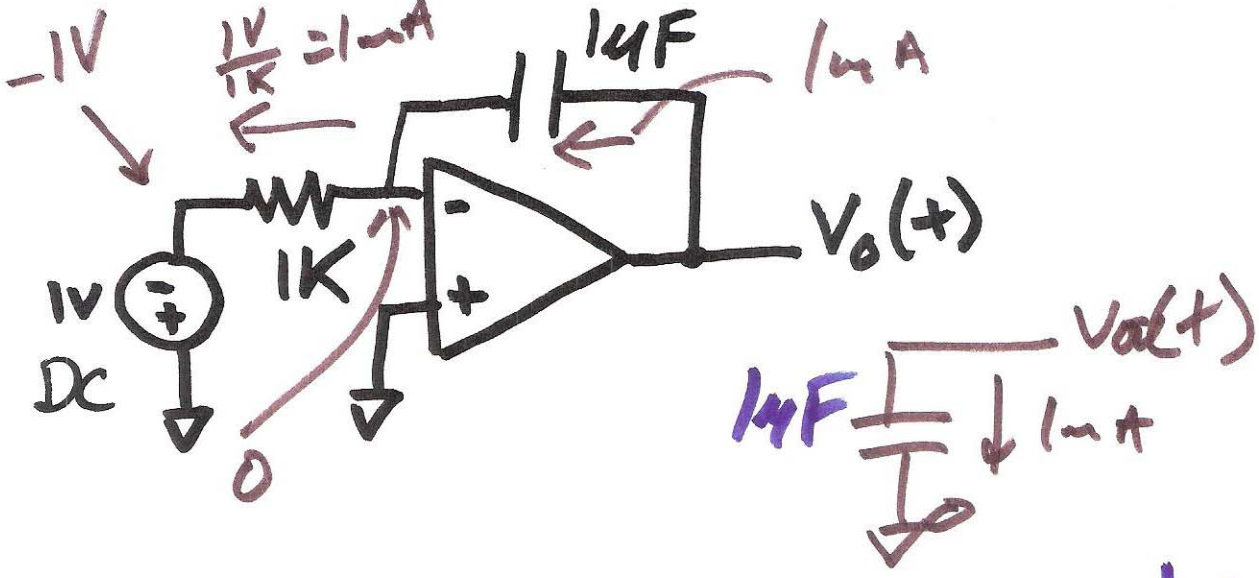
P-channel field effect transistor

MOSFET

Midterm1 EE 320 Electronics, Spring 2013 Name:_____

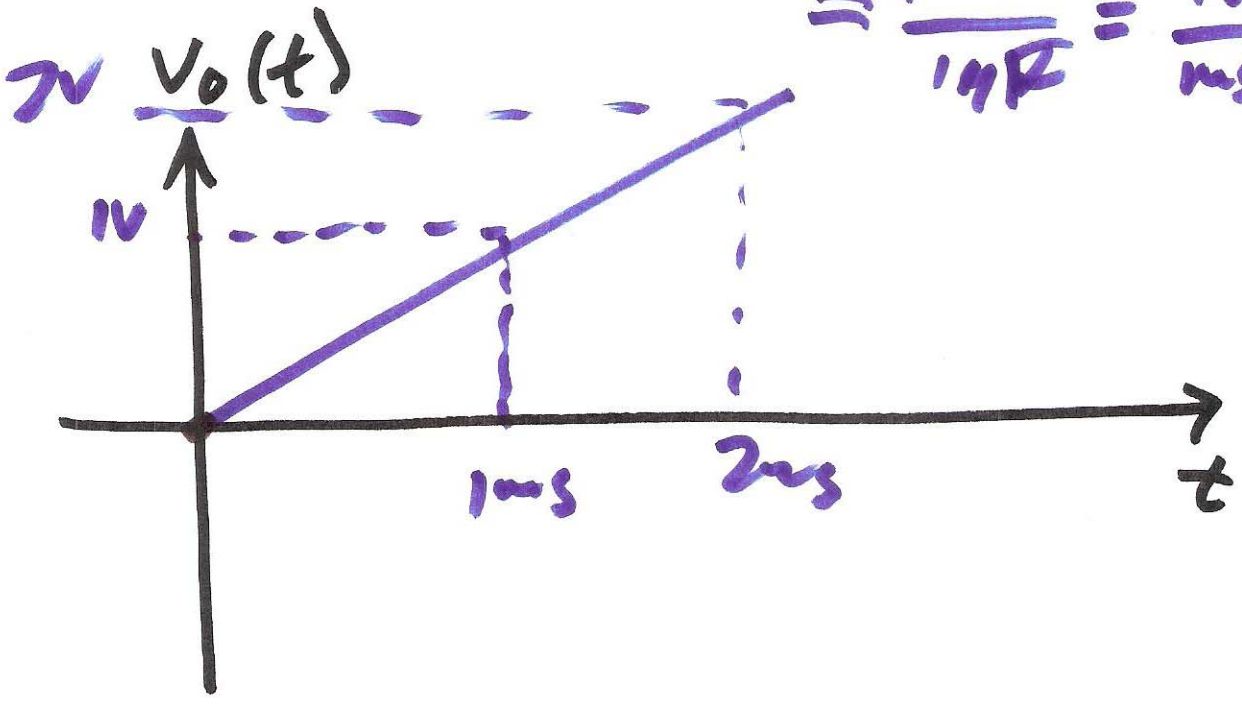
Closed notes, open book, show your work (hand calculations, including algebra) for credit.

1. Sketch the output of the following circuit assuming it's initially at 0V. (15 points)



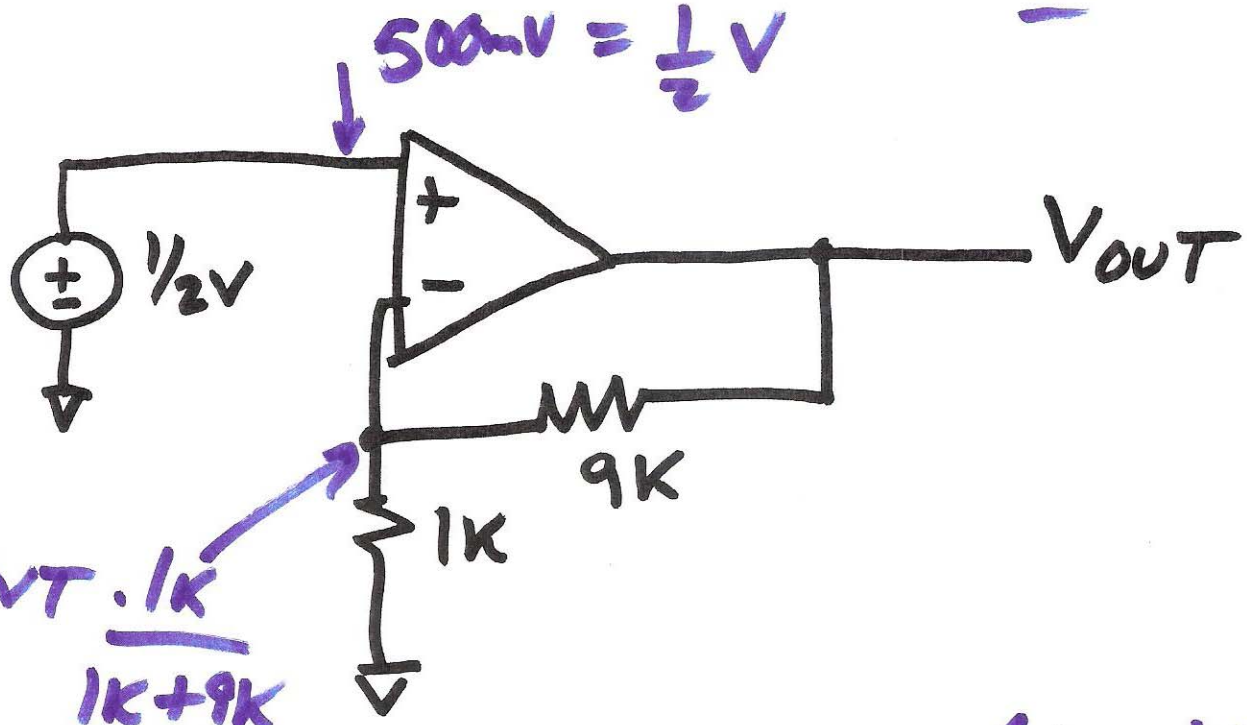
$I = C\frac{dV_o}{dt}$

Const! $= \frac{1mA}{1\mu F} = \frac{1V}{ms} = \frac{dV_o}{dt}$



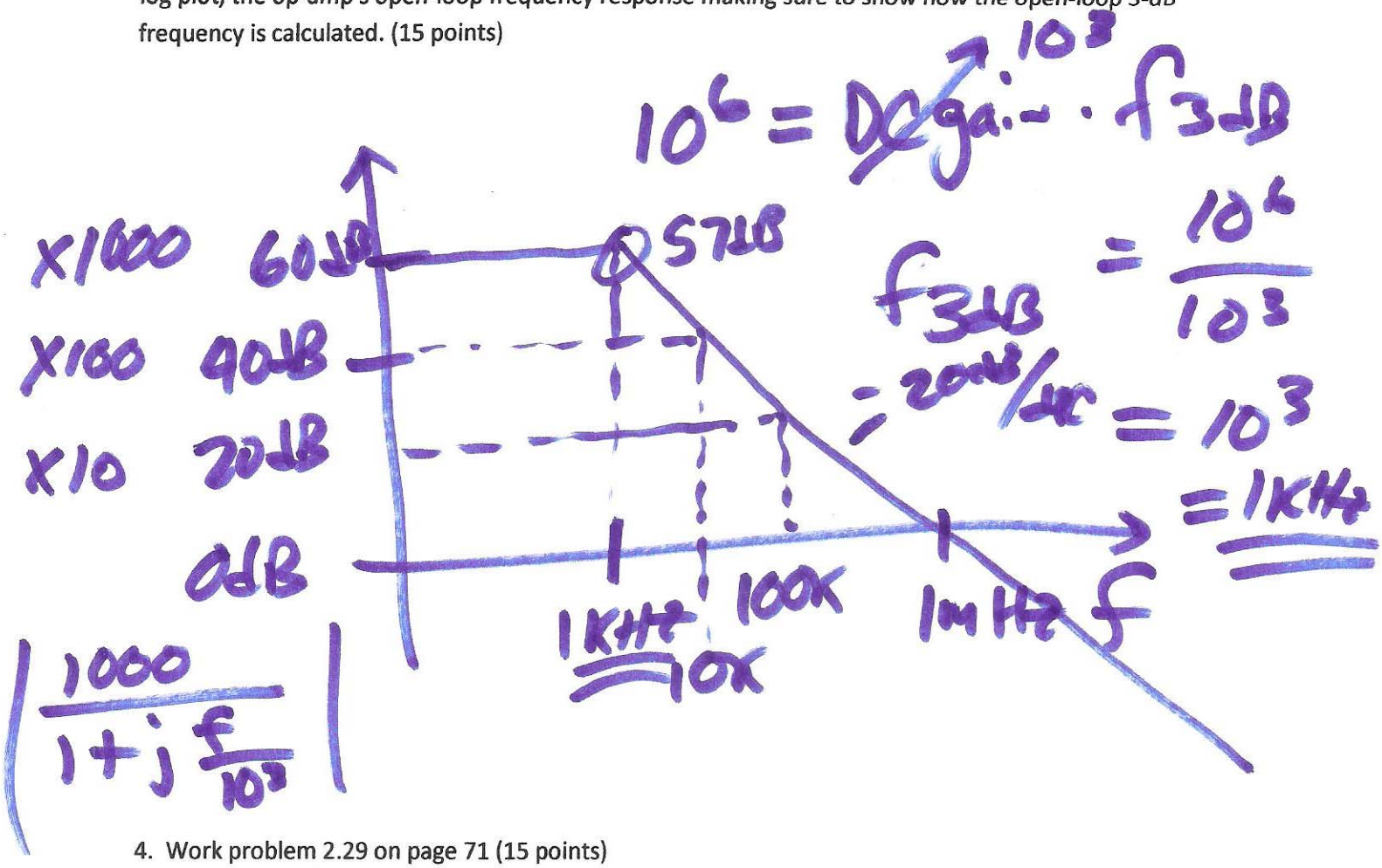
(32)

2. Determine the output voltage in the following circuit if the op-amp open-loop gain is 100. (10 points)



2)

3. An op-amp has a unity-gain frequency of 1 MHz and a DC gain of 1,000 (= 60 dB). Sketch, using a log-log plot, the op-amp's open-loop frequency response making sure to show how the open-loop 3-dB frequency is calculated. (15 points)



4. Work problem 2.29 on page 71 (15 points)

3 4)

5. If Si is doped with Boron having a density of 10^{16} atoms/cm^3 is it n- or p-type? What are n and p assuming $n_i = 10^{11}$ carriers/cm^3? What happens to n and p as temperature increases? Why? (15 points)

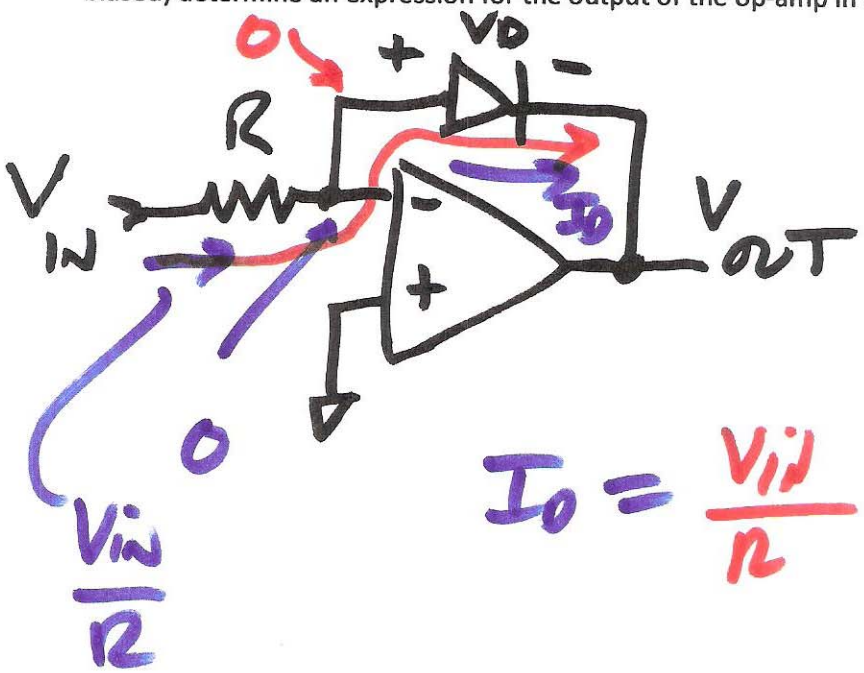
p-type

$p \cong N_A = 10^{16} \frac{\text{holes}}{\text{cm}^3}$

$T \uparrow$ p doesn't change

$T \uparrow$ $N = \frac{N_i^2}{P}$, $N_i \uparrow$ $N \uparrow$

6. Assuming the input signal, in the following circuit, is always positive (so that the diode is forward biased) determine an expression for the output of the op-amp in terms of the input. (15 points)

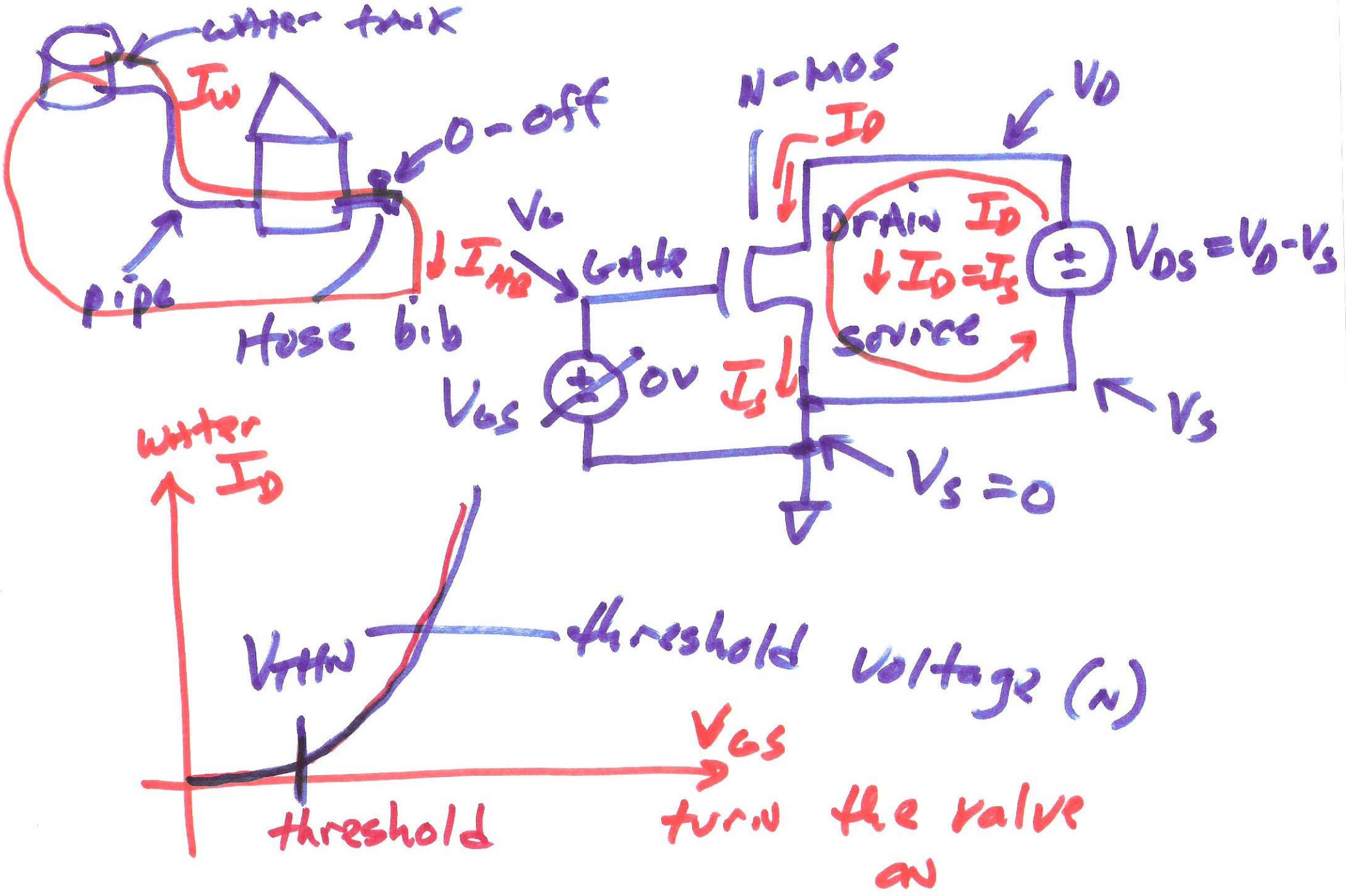


$I_D = \frac{V_{in}}{R}$

$= -V_D$

$= -NV_T \ln \frac{I_D}{I_S}$

$= -NV_T \ln \frac{V_{in}}{R \cdot I_S}$



5)

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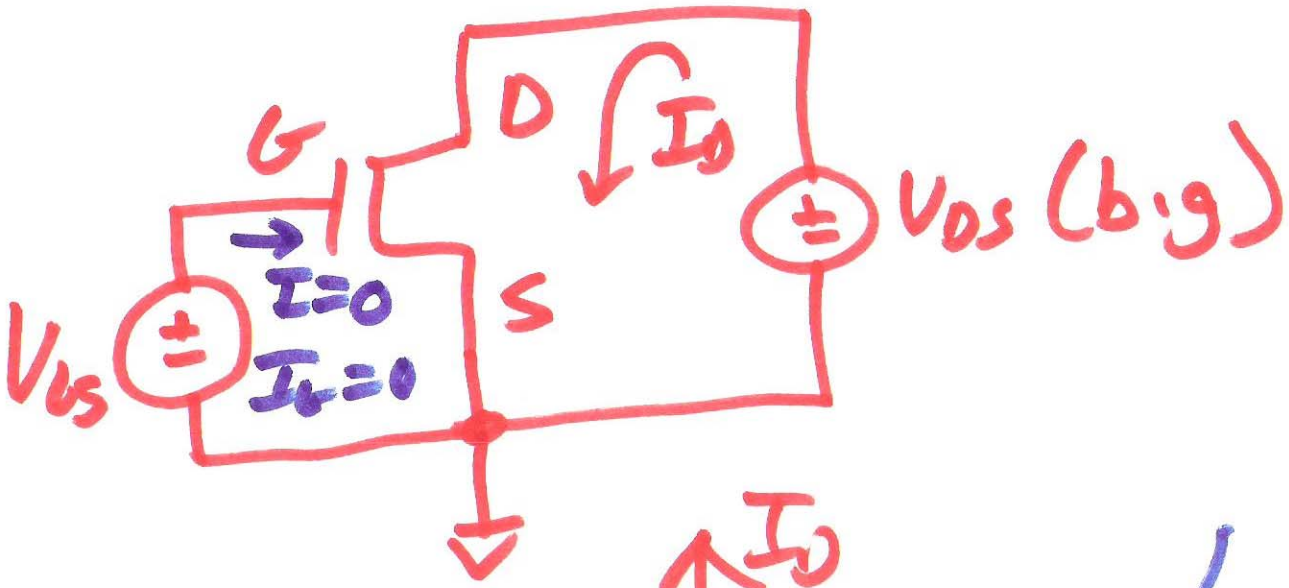

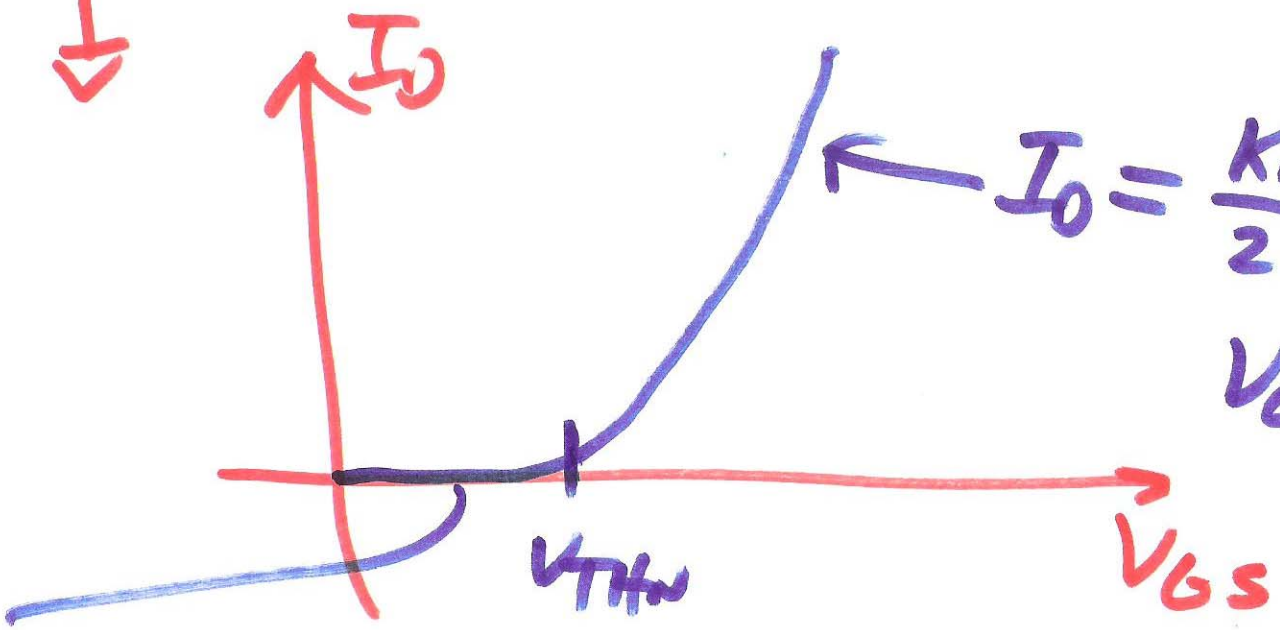

$$I_D = \frac{K_N}{2}\cdot\frac{W}{L}\left(V_{GS}-V_{THN}\right)^2$$

width / length

$I_D = 0,\ V_{GS} \leq V_{THN}$

$$I_D = \frac{K_N}{2}\left(V_{GS}-V_{THN}\right)^2$$

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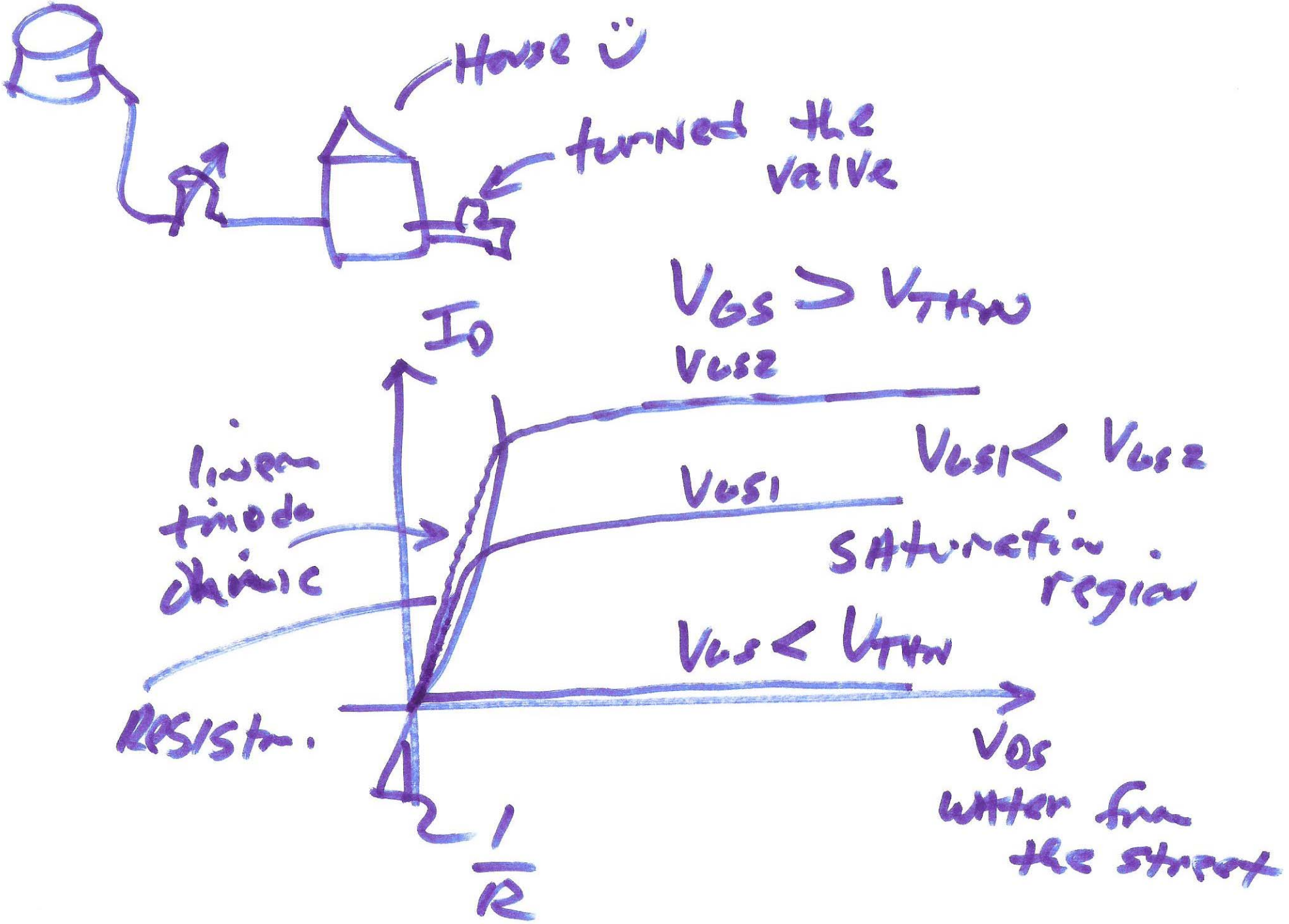

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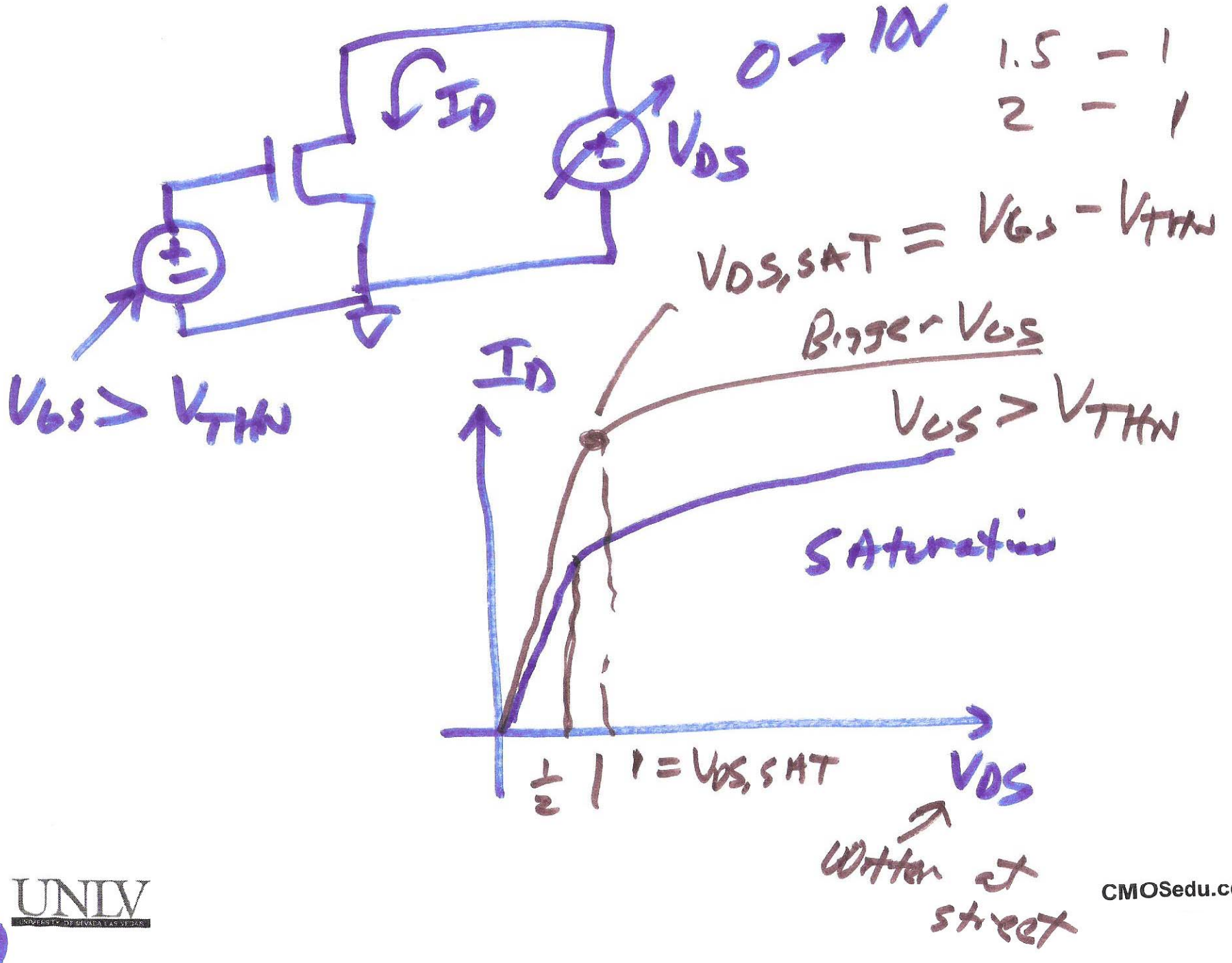

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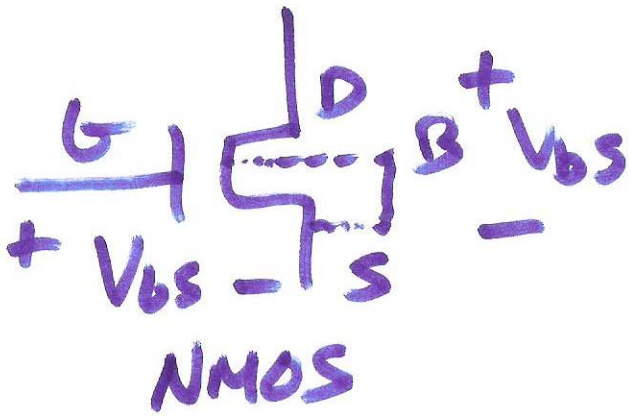
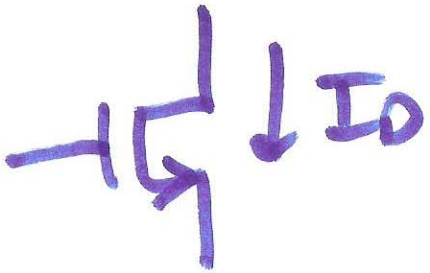
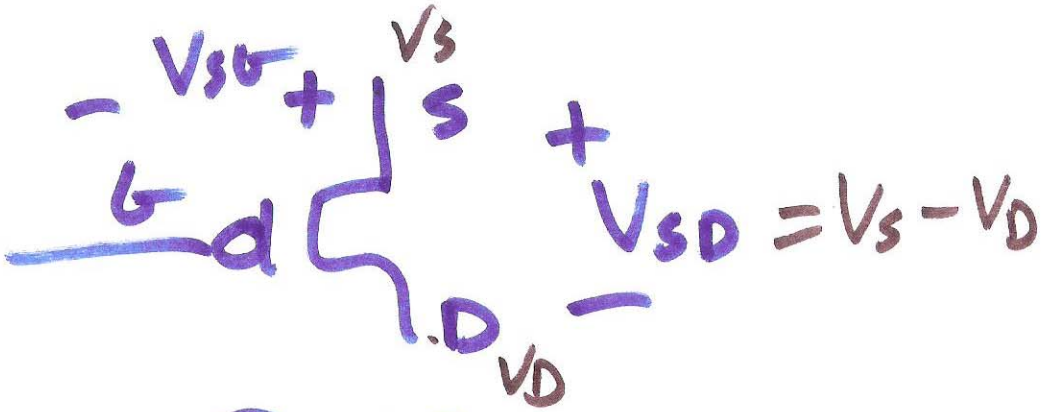
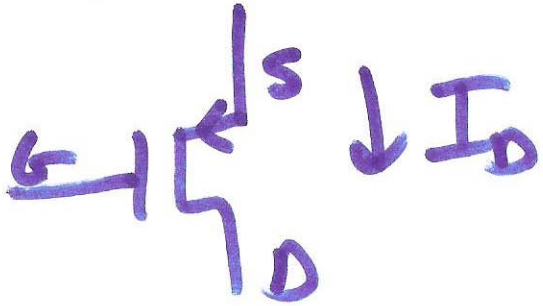


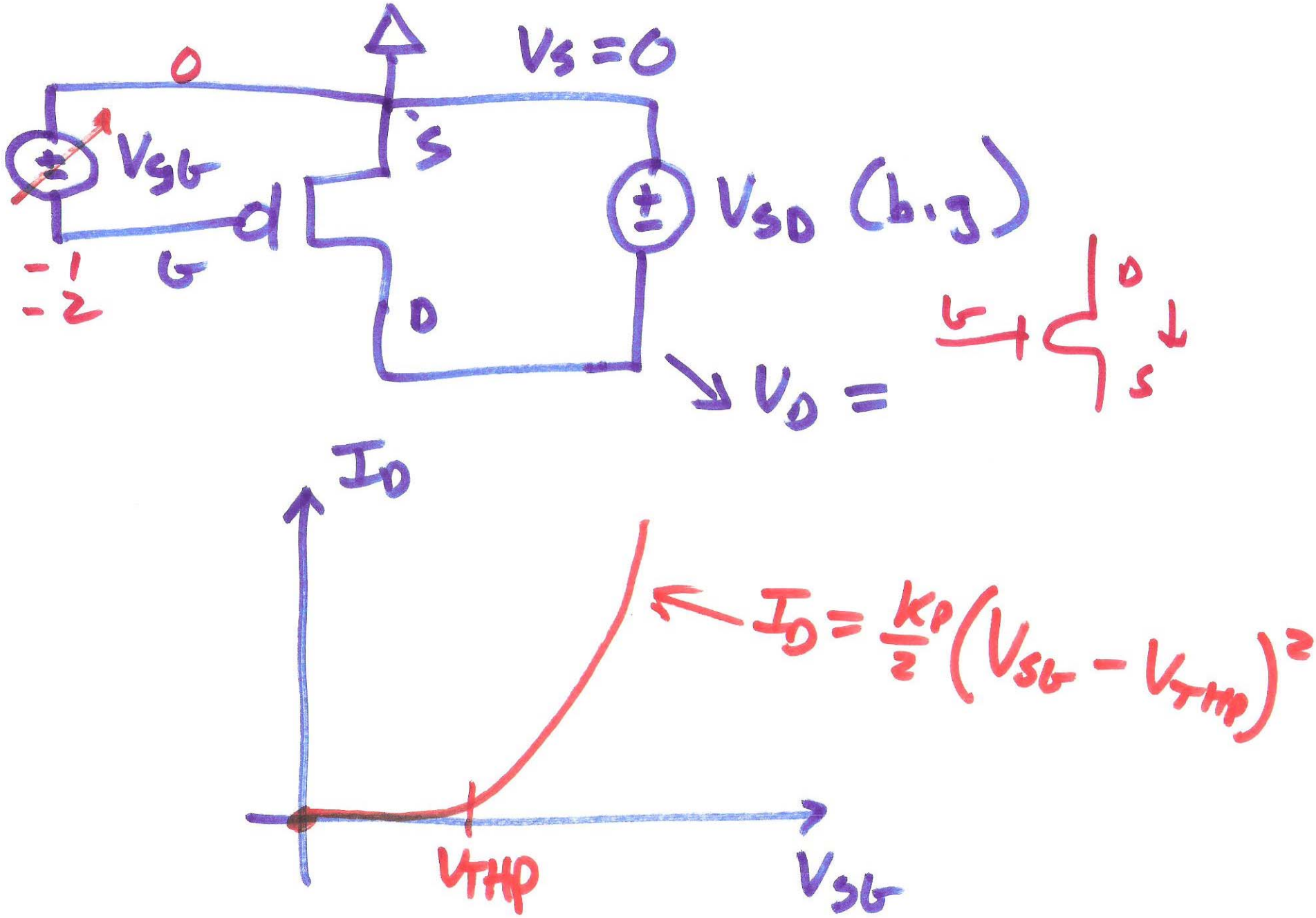
NMOS





PMOS





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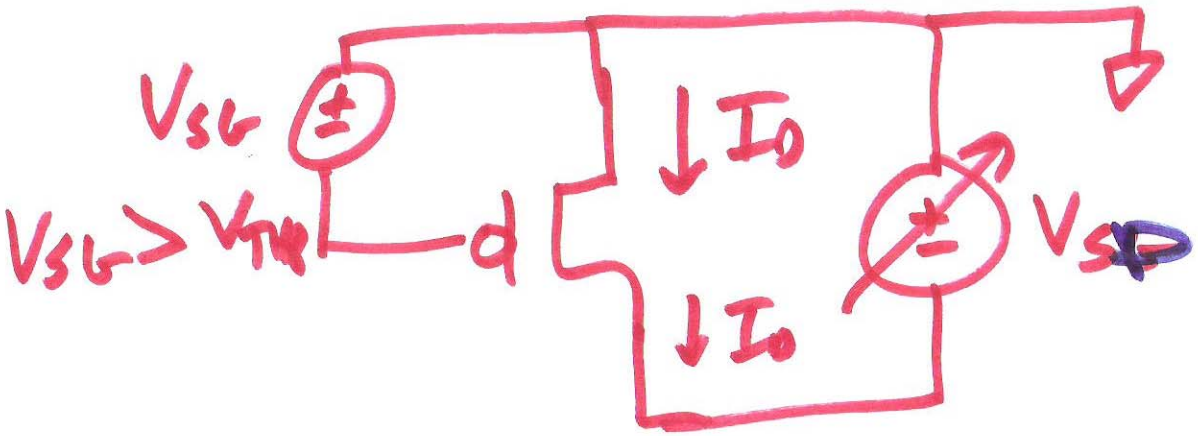

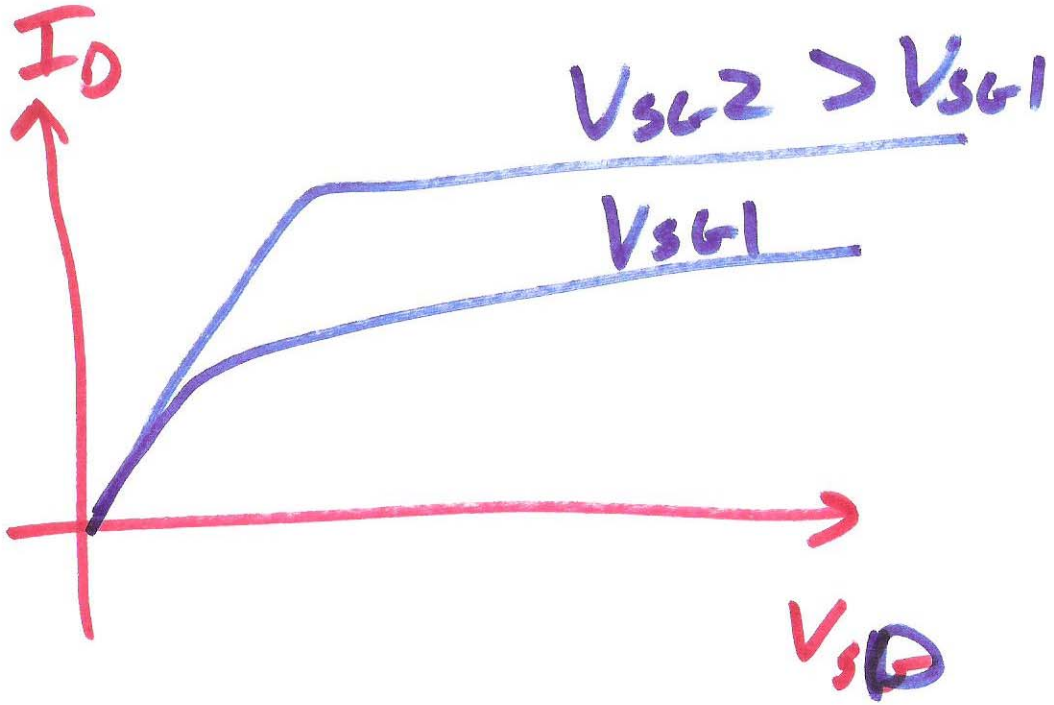

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