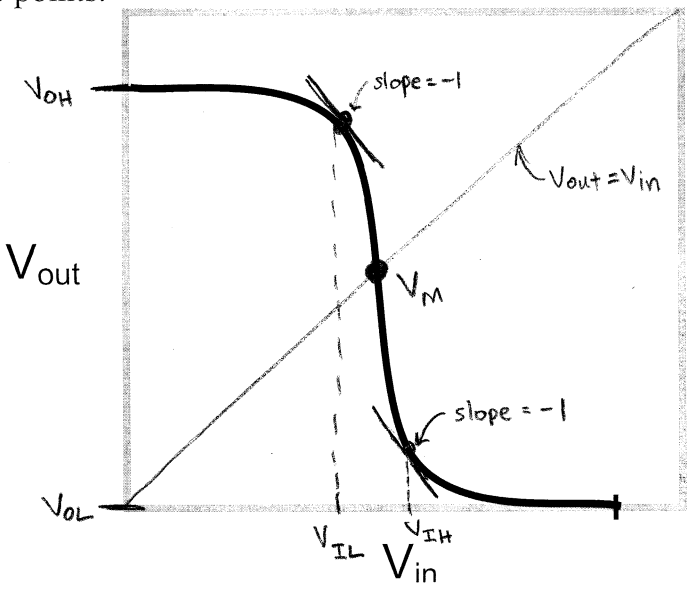
Quiz #1 **EEC116** **Fall 2011**

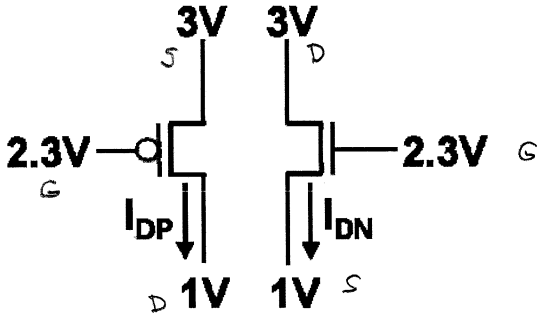
Name: Solutions Lab Section:____

Problem 1 (5 points) Label the following points on the Voltage Transfer Curve below: VOH, VOL, VIH, VIL, and VM. Indicate any other lines that are necessary to define the preceding voltage points.



5 pts. ea.

Problem 2 (5 points) For the following circuit, find the value of W_p/L_p so that currents I_{DN} and I_{DP} are equal, given: $W_n/L_n = 1$, $V_{T,n} = 0.5V$, $\mu_n C_{ox} = 300 \times 10^{-6} A/V^2$, $V_{T,p} = -0.5V$, $\mu_p C_{ox} = 100 \times 10^{-6} A/V^2$, $\lambda = 0$, $\gamma = 0$, $V_{DD} = 3V$. Show all work to receive full credit.



$V_{GS,N} = 2.3V - 1V = 1.3V > V_{Tn} = 0.5V$ NMOS

$V_{DS,N} = 3V - 1V = 2V > V_{GS,N} - V_{Tn} = 0.8V$ sat

$V_{GS,P} = 2.3V - 3V = -0.7V < V_{T,P} = -0.5V$

$V_{DS,P} = 1V - 3V = -2V < V_{GS,P} - V_{Tn} = -0.7V - (-0.5V) = -0.2V$

PMOS sat

$$I_{DS,N} = \frac{\mu_n C_{ox}}{2}\left(\frac{W_n}{L_n}\right)(V_{GS,n} - V_{T,n})^2$$

$$= \frac{300\mu A/V^2}{2}(1)(0.8V)^2 = 96\mu A$$

$$I_{DS,P} = \frac{\mu_p C_{ox}}{2}\left(\frac{W_p}{L_p}\right)(V_{GS,P} - V_{T,P})^2$$

$$= \frac{100\mu A/V^2}{2}\left(\frac{W_p}{L_p}\right)(-0.2V)^2 = 2\mu A$$

$$\left(\frac{W_p}{L_p}\right) = \frac{I_{DS,N}}{I_{DS,P}} = 48$$