Problem 1 (7 points) Consider the following half-circuit for analyzing the read Static Noise Margin for a memory cell. Find W/L such that node Qb is at 100mV given $V_{DD}=1.8\,\text{V}$, node Q is 1.8V, $V_{T,n}=0.5\,\text{V}$, $\mu_nC_{ox}=3\times10^{-4}\,\text{A/V}^2$, $V_{T,p}=-0.5\,\text{V}$, $\mu_pC_{ox}=1\times10^{-4}\,\text{A/V}^2$, $\lambda=0$, $\gamma=0$. Show all work to receive full credit.

\[
\frac{\mu_nC_{ox}}{2} \left( V_{DD} \right)_1 - \left( \frac{W}{L} \right)_1 \left[ \frac{1}{2} \left( V_{DD} - V_{T,n} \right) \left( V_{DD} - V_{T,n} \right) \right] = \left( \frac{W}{L} \right)_2 \left[ 2 \left( V_{DD} - V_{T,n} \right) V_{Qb} - V_{Qb}^2 \right]
\]

\[
\Rightarrow \left( \frac{W}{L} \right)_2 = \left( \frac{W}{L} \right)_1 \frac{\left( V_{DD} - V_{T,n} \right)^2 \left( 2.1 \right) - \left( V_{DD} - V_{T,n} \right) V_{Qb} - V_{Qb}^2}{2 \left( V_{DD} - V_{T,n} \right) V_{Qb} - V_{Qb}^2}
\]

\[
= \left( \frac{2}{7} \right) \frac{1.7}{2 \left( 1.8 - 0.5 \right) \left( 0.1 \right) - (0.1)^2}
\]

\[
= 11.52
\]

Problem 2 (3 points) For the following 1 transistor DRAM cell, fill in the boxes labeling the corresponding wires with the appropriate signal names:

Q: data storage bit
BL: bit line
WL: word line