Problem A.39. offset voltage calculation

In the differential amplifier of Problem A.38, the input offset voltage $V_{OS}$ is defined as the DC input voltage $V_{IN}$ that equalizes the drain voltages of M3 and M4, $V_3 = V_O$. You can assume that the bias current $I_B$ and the drain current of M2 have the nominal values (equal to 20 $\mu$A).

a) Find an expression for the input offset voltage $V_{OS}$ as a function of $\Delta V_{in}$, $\Delta (W/L)_3/(W/L)_3$, and $\Delta R_L/R_L$.

b) Given $\Delta V_{in} = \pm 3$ mV, $\Delta (W/L)_3/(W/L)_3 = \pm 5\%$, and $\Delta R_L/R_L = \pm 1\%$, find the worst-case $V_{OS}$. 