1) Given the circuit in Figure 1, assume M1 and M2 are transistors with the same parameters: $K'$, W/L, $r_o$, $\gamma=0$, $V_{to}$. A current source $I_{ss}$ with output impedance $R_{ss}$ drives the differential pair. Input CM voltage is $V_{ic}$ and supply voltage is $V_{dd}$. Answer the following questions in terms of these parameters and resistor values given in the figure.

a) Calculating the DC operation points of all the nodes. (Assume $R_{ss} >> R_2$, $1/gm$ of M1 and M2, both transistors in saturation)

b) What is the maximum $V_{ic}$ such that M1 and M2 stay in saturation region?

c) What is the small-signal voltage gain $(V_{o1}-V_{o2})/(V_{i1}-V_{i2})$? (Assume M1, M2 in saturation)

d) If the input CM changes from $V_{ic}$ to $(V_{ic}+\Delta V)$, what happens to output voltages? Quantify it. (Assume M1, M2 in saturation, $\Delta V<<V_{ic}$)