1. Assuming all the transistors in the following symmetric circuits are in saturation, $\lambda \neq 0$ and $\gamma = 0$, calculate the small-signal differential voltage gain of each circuit.

2. In the following symmetric circuit, assume all transistors are operating in saturation region, $\lambda = 0$, and $\gamma = 0$.
   a) Find an expression for the small-signal differential voltage gain of the following circuit.
   b) What is the small-signal differential voltage gain if $(W/L)_3/(W/L)_5 = 0.5$?
3. In the following circuit all transistors have a W/L of 7µm/0.35µm and M₃ and M₄ are to operate in deep triode region with an on-resistance of 2kΩ. Assuming Iₛ=40µA and λ=γ=0, V_DD=3V, V_{TH(NMOS)} = 0.5V, V_{TH(PMOS)} = -0.6V, μₙC_{ox}=200 µA/V², μₚC_{ox}=100 µA/V².

a) Calculate the dc level of the input (input common-mode level) that yields such an on-resistance for M₃ and M₄.

b) Calculate the required V_{bias} of the gate of M₅.

c) Calculate the small-signal differential gain, i.e., (V_{out1}-V_{out2})/(V_{in1}-V_{in2}), of the circuit when the input common-mode level is equal to value calculated in part a.

Good luck.