Problem #1:

Two MOS amplifiers are shown above with supply and bias voltages shown with AC ground. Assume that all transistors are sized to be same. Neglect body effect and use the following parameters: $g_m = 1/200 \Omega$, $r_o = 4k \Omega$, $C_{gs} = 0.5pF$, and $C_{gd} = 50fF$. PMOS $g_m$ is half the NMOS $g_m$. Calculate all numerical values approximately.

1. Estimate the low-frequency small-signal driving-point input resistances.
2. Estimate the low-frequency the small-signal gain $v_o/v_i$.
3. Estimate the low-frequency driving-point resistance looking into the node x.
4. If 0.5pF is added to the output node, estimate the $-3dB$ bandwidth in Hz.
5. What is the non-dominant pole frequency in Hz at the node x?

Problem #2:

The AC circuit of a cascade operational amplifier is shown. Use the same parameters as in #1. Assume an ideal negative feedback is applied with a feedback factor of $\frac{1}{4}$.

1. Estimate the low-frequency small-signal open-loop gain $v_o/v_i$.
2. If $C_L = 1pF$, what is the $-3dB$ closed-loop bandwidth in Hz?
3. Estimate the non-dominant pole in Hz at node x.
4. Approximate the phase margin. Use the relation of $\sin x \sim \tan x \sim x$ for small x.
5. What is the common-mode rejection ratio?