Problem #1
1. A two-stage amplifier is shown in Figure Q2.1. Values of the BJT parameters for the two devices are given in the figure.
   a. For $V_A = \infty$ and $R_e = 0$, estimate the frequency response of the overall voltage gain, $A_v = \frac{v_o}{v_s}$.
   b. How is the frequency response changed if $V_A = 100V$? (Use approximations to arrive at a conclusion.)
   c. How does the product of the low-frequency gain and the -3dB bandwidth change as $R_e$ is increased from zero to 10ohms?

Note: this problem refers to Figure Q2.1 which is a circuit diagram

Problem #2
2. A feedback amplifier is shown in Figure Q2.2. Bias levels and circuitry are assumed present to produce the specified collector currents, $I_c = 1mA$.
   a. Establish whether the overall feedback is positive or negative.
   b. With respect to the output node $v_{o1}$, what is the value of the open-loop gain, $a_L$?
   c. What is the value of the open-loop gain $a_L$ with respect to the output node $v_{o2}$?
   d. Estimate the value of the output resistance seen from $v_{o1}$ and from $v_{o2}$.

Note: this problem refers to Figure Q2.2 which is a circuit diagram

Problem #3
3. A feedback amplifier is modeled as in Figure Q2.3.
   a. Sketch the locii of the natural frequencies of the closed-loop amplifier as the amplifier gain value, $a_v$, is increased from zero.
   b. For $R_f = 100k$, what value of $a_v$ is required to achieve a maximally flat magnitude response for the closed-loop gain, $A_v(s)$?
   c. If the value of $a_v$ is fixed at -100, and if $a_L$ is varied by changing $R_f$, what value of $R_f$ is needed to achieve the MFM response?

Note: this problem refers to Figure Q2.3 which is a circuit diagram
Problem #4

4. A simple MOS amplifier is shown in Figure Q2.4. The biasing elements provide drain currents of $I_D = 0.1mA$. Device parameters include $W/L = 10$, $K_P = 40uA/v^2$, $\Lambda = 0$.

a. For a 'following' measurement system passband of 2megHz, estimate the value of the minimum detectable signal with respect to $v_s$.

b. If a feedback resistance, $R_f = 100k$, is ac-connected in a shunt-shunt arrangement without changing the bias state, how is the result of Part a changed?

Note: this problem refers to Figure Q2.4 which is a circuit diagram.