1. The cascode in Figure 1 is biased by an ideal current source. Let $R_s = 51 \, \Omega$, $I_S = 1 \times 10^{-15} \, \text{A}$, $V_A = 100 \, \text{V}$, $\beta = 200$, $I_{SUP} = 1 \, \text{mA}$, $T = 300 \, \text{K}$, $v_{OUT,DC} = 3.5 \, \text{V}$, and $V_{BIAS2} = 2 \, \text{V}$. Calculate $V_{BIAS1}$ to match these biasing conditions.

\[ V_{BIAS1} = \]
2. What is the gain of this amplifier?

\[ A_v = \]

Figure 2: Multi-stage amplifier

3. Now construct a SPICE netlist for the multi-stage amplifier shown in Figure 2. Let \( R_C = 10 \, \text{k}\Omega \), \( R_S = 51 \, \text{k}\Omega \), and \( R_{REF} = 200 \, \Omega \). Bias transistor \( Q_1 \) with \( V_{BE1} = 560 \, \text{mV} \). What is the small signal gain \( (A_{v1}) \) between \( v_{IN} \) and \( v_{OUT1} \)? What is the small signal gain \( (A_{v2}) \) between \( v_{OUT1} \) and \( v_{OUT2} \)? Using \( A_{v1} \) and \( A_{v2} \), find the overall gain \( (A_{v, tot}) \) between \( v_{IN} \) and \( v_{OUT2} \). Attach the SPICE netlist to the end of this prelab.

\[ A_{v1} = \]
\[ A_{v2} = \]
\[ A_{v, tot} = \]