

## Exercises for Tutorial 1: Single Ended Amplifiers

1. Problem 3.20 in the course book
2. Problem 3.21(h) in the course book
3. Problem 3.27 in the course book. Assume  $\mu_n C_{ox} = 200 \mu A/V^2$ ,  $V_{t0,n} = 0.5 V$ ,  $|2\Phi_f| = 0.9 V$  and  $V_{DD} = 3 V$ . Also assume that in part (a) both transistors are in saturation region.
4. A two-stage single-ended amplifier is shown in Figure 1. Calculate the small-signal voltage gain and the output resistance. Assume  $g_m \gg 1/r_{o1}$  and  $R_D \ll r_{o2}$ . ( $\lambda \neq 0$  and  $\gamma = 0$ ).

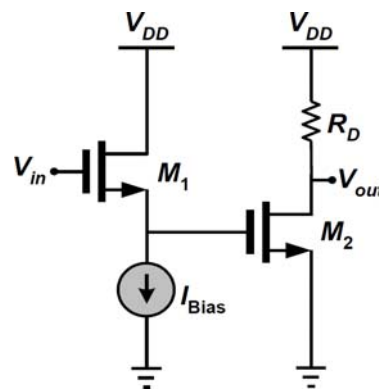


Figure 1 A two-stage amplifier

5. Using the small-signal model, calculate the voltage gain of the cascade stage shown in Figure 2. For both transistors we assume  $g_m \gg g_{mb}$  and  $r_o \rightarrow \infty$ .

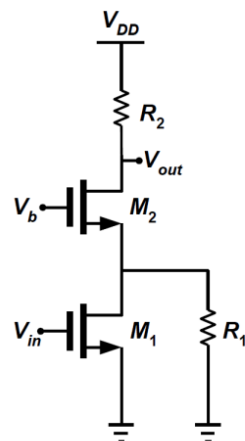


Figure 2 A cascode amplifier stage