$1^{\text{st}}$ and $2^{\text{nd}}$ stage gain with $C_c=0$

$$A_{v1,0} = g_m R_1$$

$$A_{v2,0} = g_m R_2$$
Overall gain with Cc=0

\[ A_{v_0} = A_{v_{1,0}}A_{v_{2,0}} = g_{m1}R_1g_{m2}R_2 \]

Things to think about:
1. What is the equation for gain between the first two poles?
2. What is the equation for gain after the second pole?
3. What is the gain at the first-stage unity gain frequency?
4. What is the gain at the second-stage unity gain frequency?
5. What is the unity gain frequency?
Example with $C_c=0$

$g_m1 = 1\text{mS}$  
$R_1=100k$  
$C1=10\text{pF}$  
$g_m2 = 10\text{mS}$  
$R_2=1k$  
$C2=10\text{pF}$

$A_{v1,0} = 100$  
$\omega_p1=1\text{M}$  
$\omega_u1=100\text{M}$  
$A_{v2,0} = 10$  
$\omega_p2=100\text{M}$  
$\omega_u2=1\text{G}$

What's the phase margin?
What's the phase margin if I use this amplifier with $f=0.1$?
$Z_{01}$ with $A_{v2,0}C_C > C_1 > C_c$

\[
\frac{1}{\omega A_{v2,0}C_C} \quad \frac{1}{\omega C_C} \quad \frac{1}{\omega C_1} \quad \frac{1}{\omega_{p1,0}} \quad \frac{1}{\omega p_1} \quad \frac{1}{\omega_{p2,0}} \quad \frac{1}{\omega p_2}
\]
$A_{v1} = g_{m1}Z_{o1}$ with $A_{v2,0}C_c > C_1 > C_c$

Things to think about:
1. What’s the equation for the gain in the various sections?
2. What does the curve look like if $C_c > C_1$?
3. What does the curve look like if $\omega_{p2,0} > \omega_{p1,0}$
4. What is the frequency ratio of the old and new first pole?
5. What is the frequency ratio of the old and new second pole?
6. Answer questions 4 & 5 assuming 2 and/or 3.
Overall gain with $C_1 > C_c > 0$

- Original gain w/ $C_c=0$
- Compensated gain w/ $C_c>0$

Overall gain with $\omega_{p2} > \omega_u$

- $A_{v1,0}$
- $A_{v2,0}$
- $A_{v1,0}$

$\omega_{p1}$  $\omega_{p2}$  $\omega_{u1,0}$  $\omega_{u2,0}$

$\omega_{u1,0}$  $\omega_{u2,0}$

$1$

1