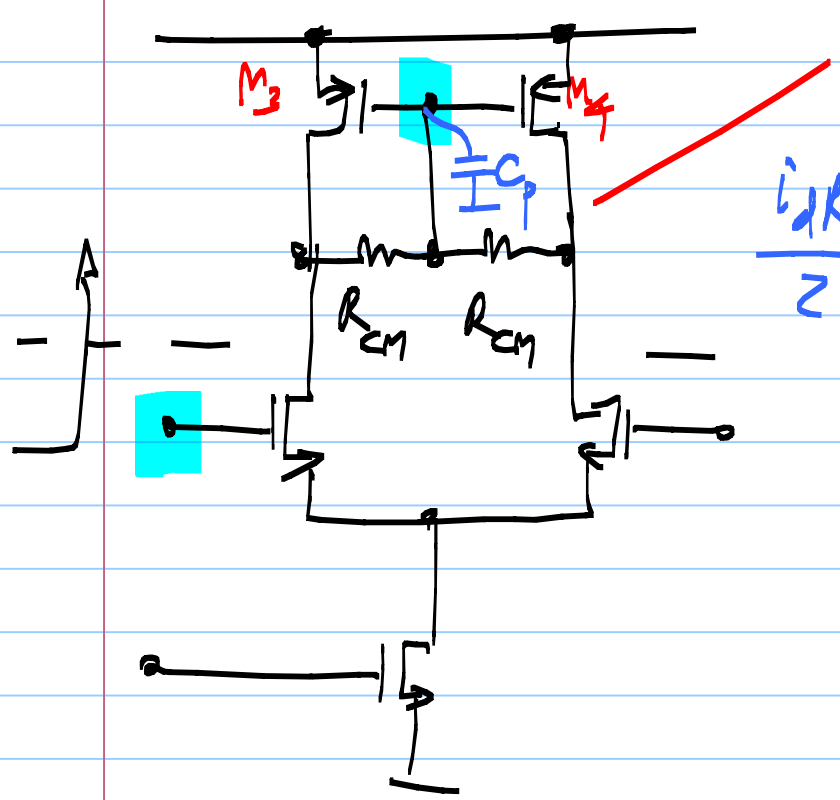
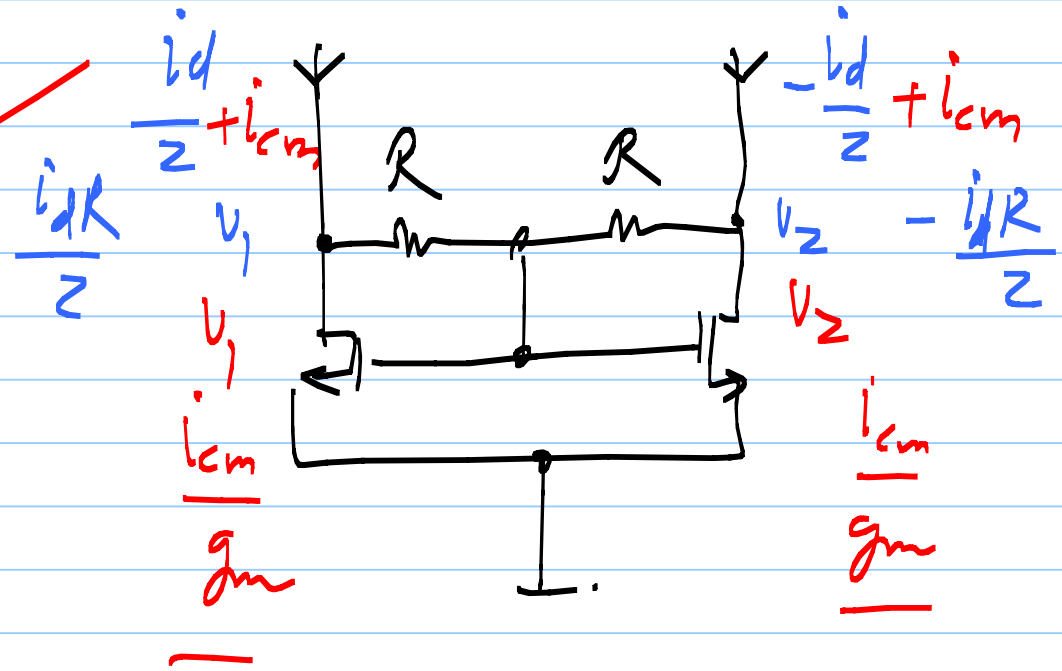
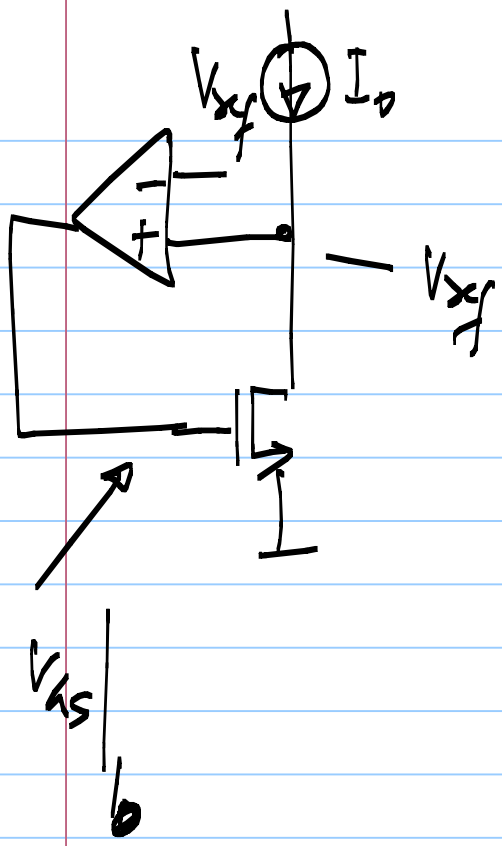
Lecture 35 30/3/2016.

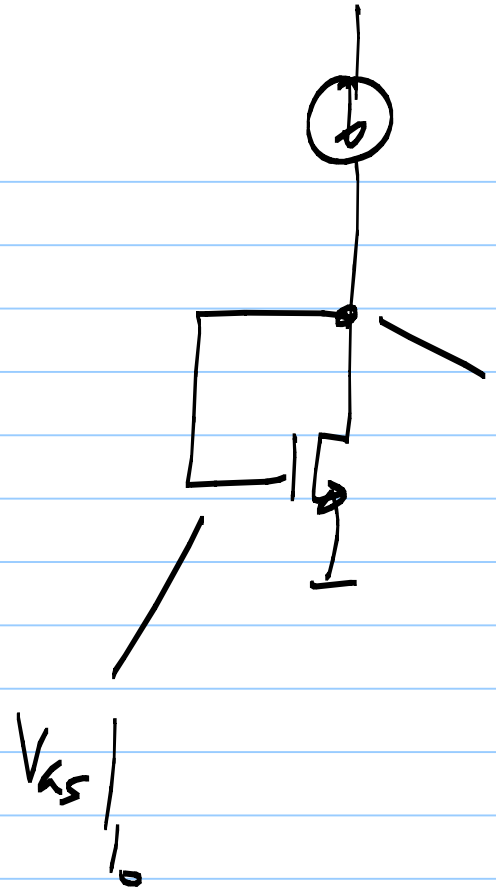
$V_{DD} - |V_{SG3}|$

Common mode feedback:







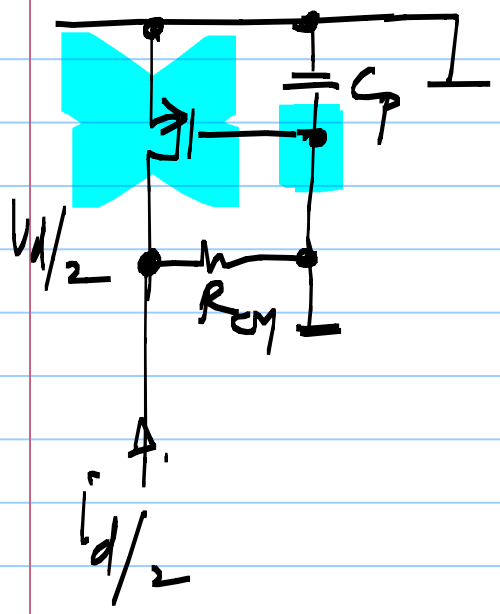


Load with CMFB

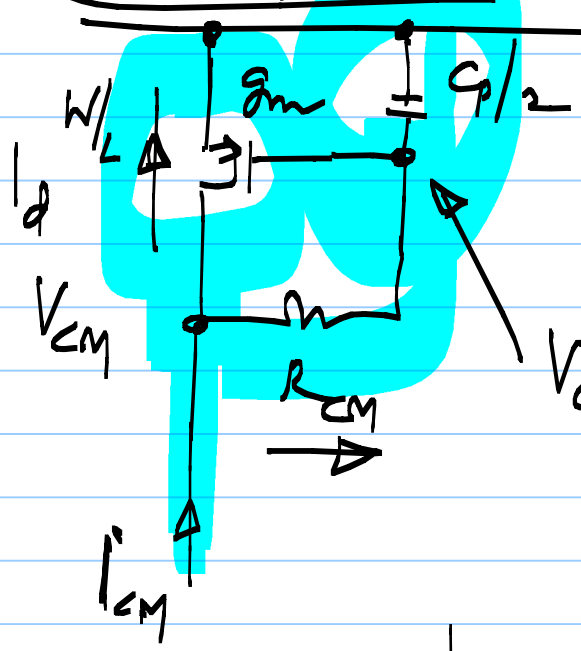
reduces CM impedance compared to differential impedance

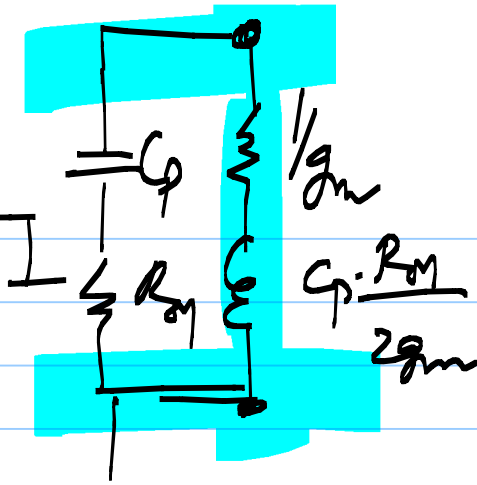
Determine $\frac{V_{cm}(s)}{I_{cm}(s)}$, $\frac{V_d(s)}{I_d(s)}$

Diff. half ckt.



CM half ckt.





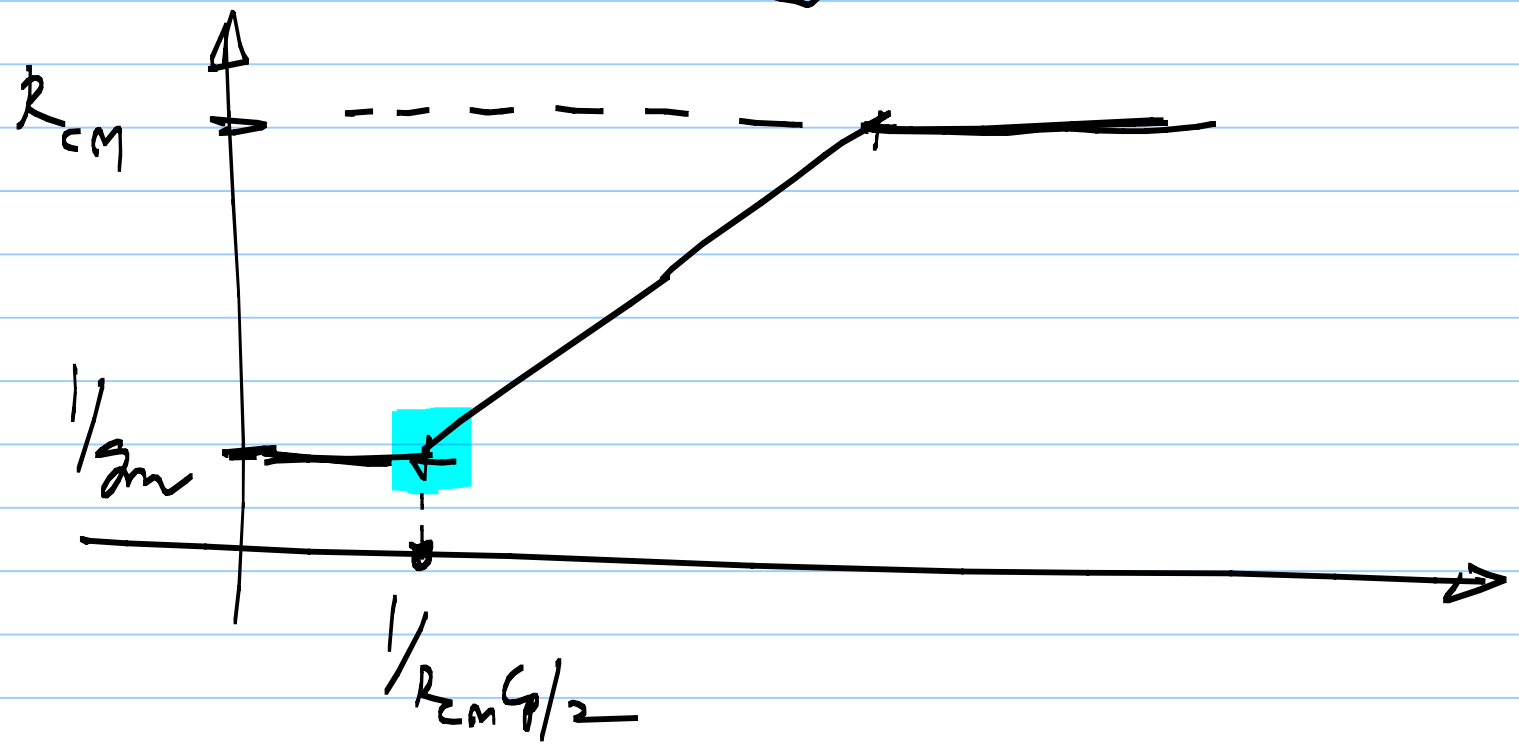
$$V_{CM} \cdot \frac{1}{1 + sC_p R_{CM}/2}$$

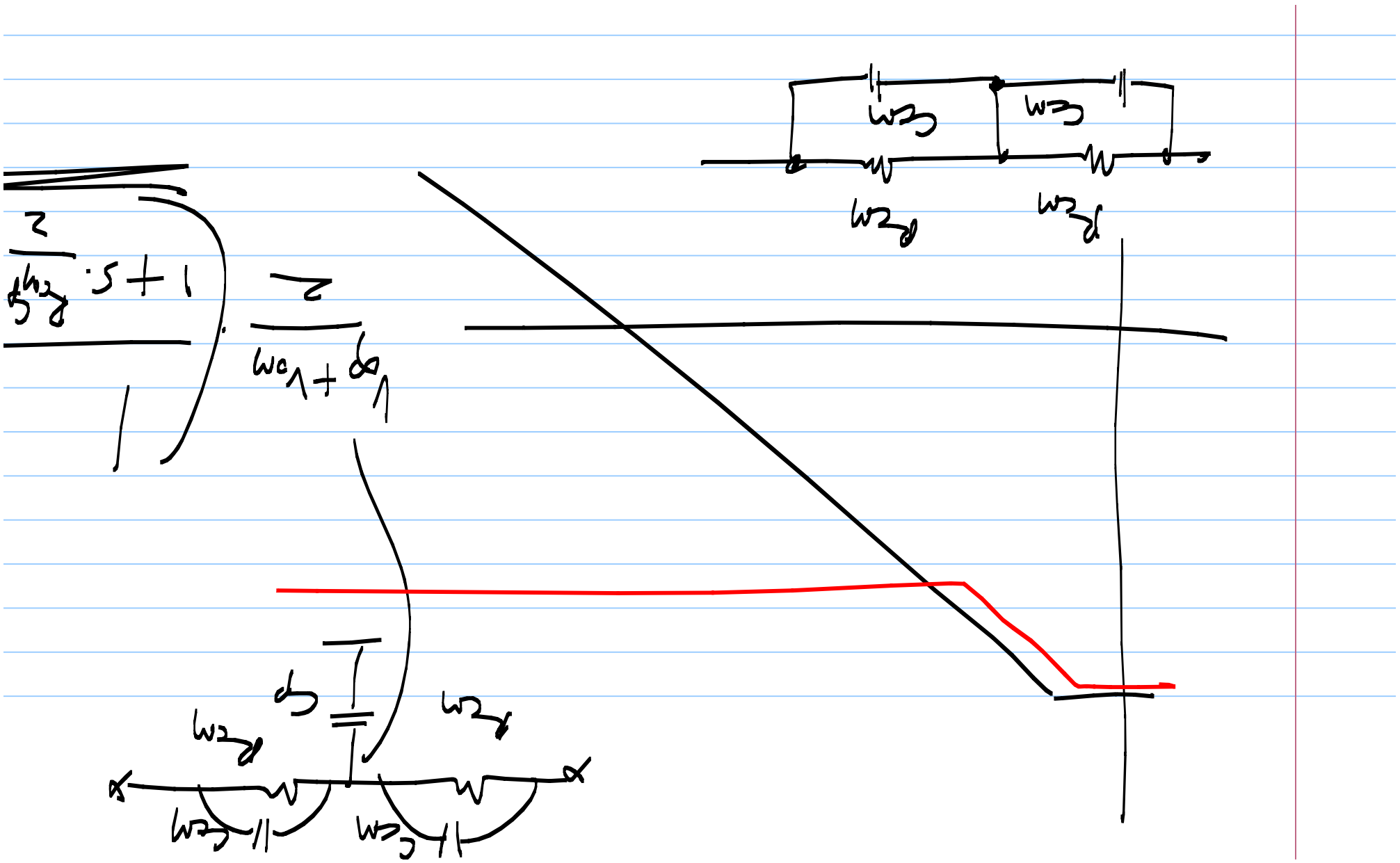
$$\frac{V_d}{I_d} = R_{CM} \left[\frac{g_m \cdot V_{CM}}{1 + sC_p R_{CM}/2} \right]$$

$$I_d = V_{CM} \left[\frac{g_m}{\frac{1}{g_m} + sC_p \frac{R_{CM}}{2g_m}} \right]$$

$$I_d = V_{CM} \cdot g_m$$

$$\frac{I_{cm}}{V_{cm}} = \frac{g_m}{1 + \frac{s \cdot C_p R_{cm}}{2}} + \frac{sC_p/2}{\frac{1}{} + \frac{sC_p R_{cm}}{2}}$$





Single stage opamp:

$$\frac{V_o}{V_{id}} = \frac{g_{m1}}{g_{ds2}+g_{ds4}} = g_{m1}\frac{1}{sC_L}$$

$$\frac{V_o}{V_{id}} = g_{m1}\frac{1}{sC_L}$$

$$\frac{V_o}{V_i} = \frac{g_{m1}}{sC_L}$$

$$G = \frac{g_{m2}g_{m3}}{s \cdot C_{gs2}g_{m3} + 1 + \frac{g_{m2}}{g_{m3}}}$$