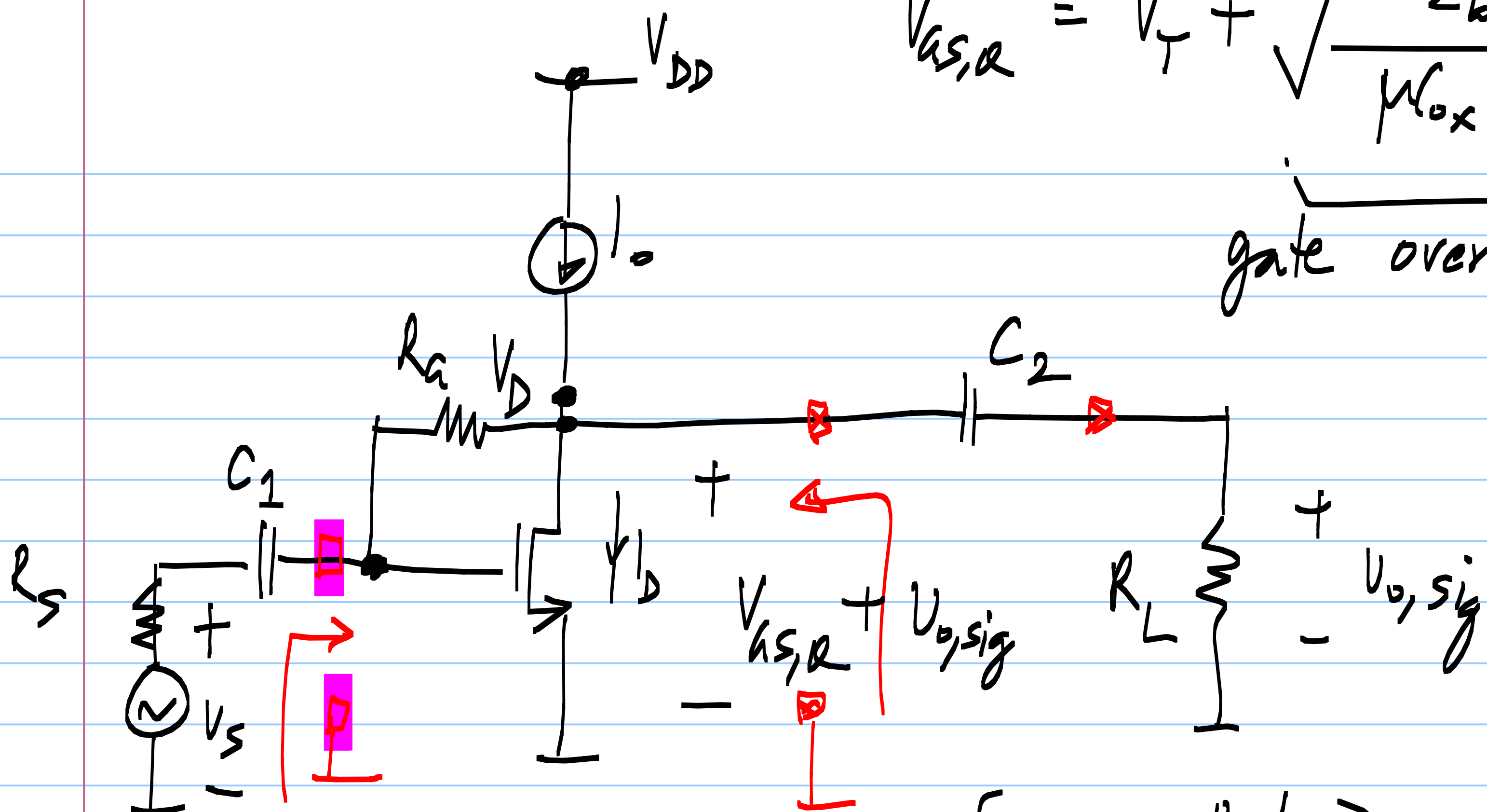
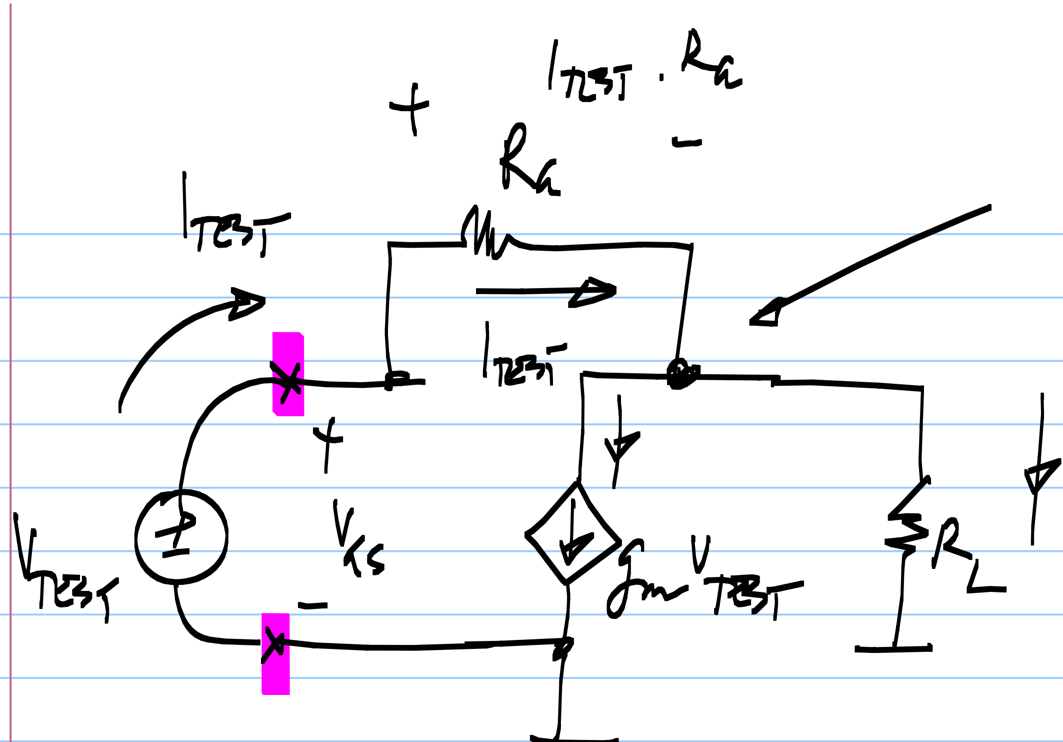



$$V_{GS,Q} = V_T + \underbrace{\sqrt{\frac{2I_o}{\mu C_{ox} W/L}}}_{\text{gate overdrive}}$$

$V_D$ (at dc)

$+ v_s$ (at $\omega_{sig}$)

$$\frac{v_o}{v_s} = -\left[\frac{g_m R_L - R_L/R_G}{1 + R_L/R_G}\right] \simeq -g_m R_L \quad \text{if } R_G \gg R_L$$



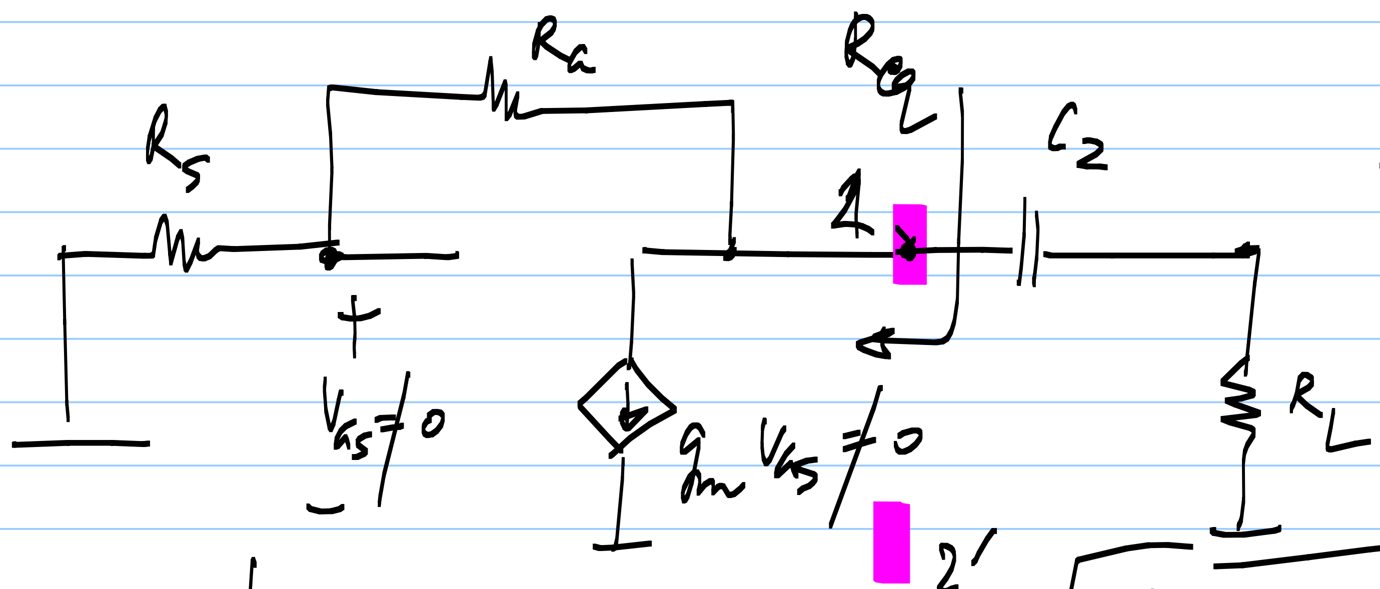

$$V_{TEST} - I_{TEST} \cdot R_a$$

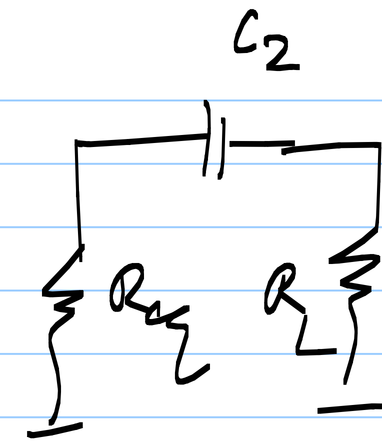
$$\frac{V_{TEST} - I_{TEST} \cdot R_a}{R_L}$$

$$\left(1 + \frac{R_a}{R_L}\right) I_{TEST} = \left(\frac{1}{R_L} + g_m\right) V_{TEST} + \frac{\cancel{V_{TEST}} - I_{TEST} R_a}{\cancel{R_L}}$$

$$V_{TEST} / I_{TEST} = \frac{1 + R_a / R_L}{[g_m + 1/R_L]} \simeq \frac{R_a}{g_m R_L + 1}$$

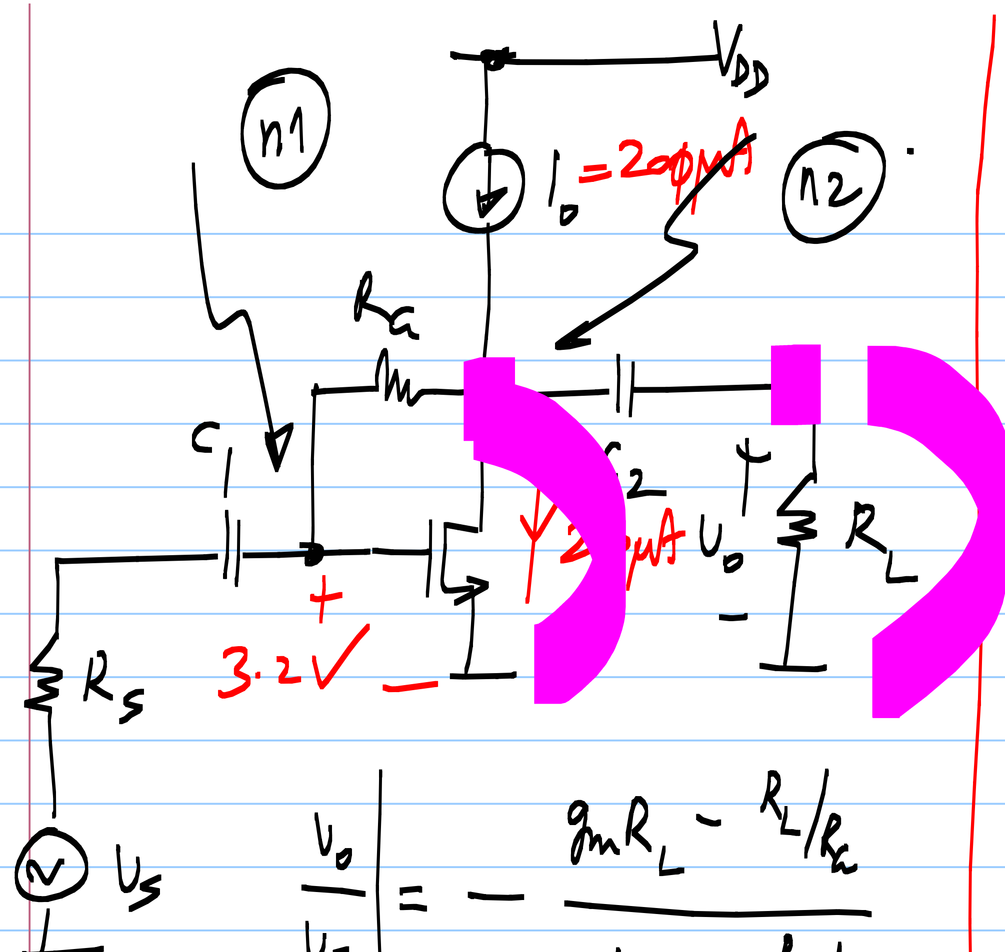
$$\frac{1}{\omega C_1} \ll R_S + \frac{1 + R_a/R_L}{g_m + 1/R_L}$$



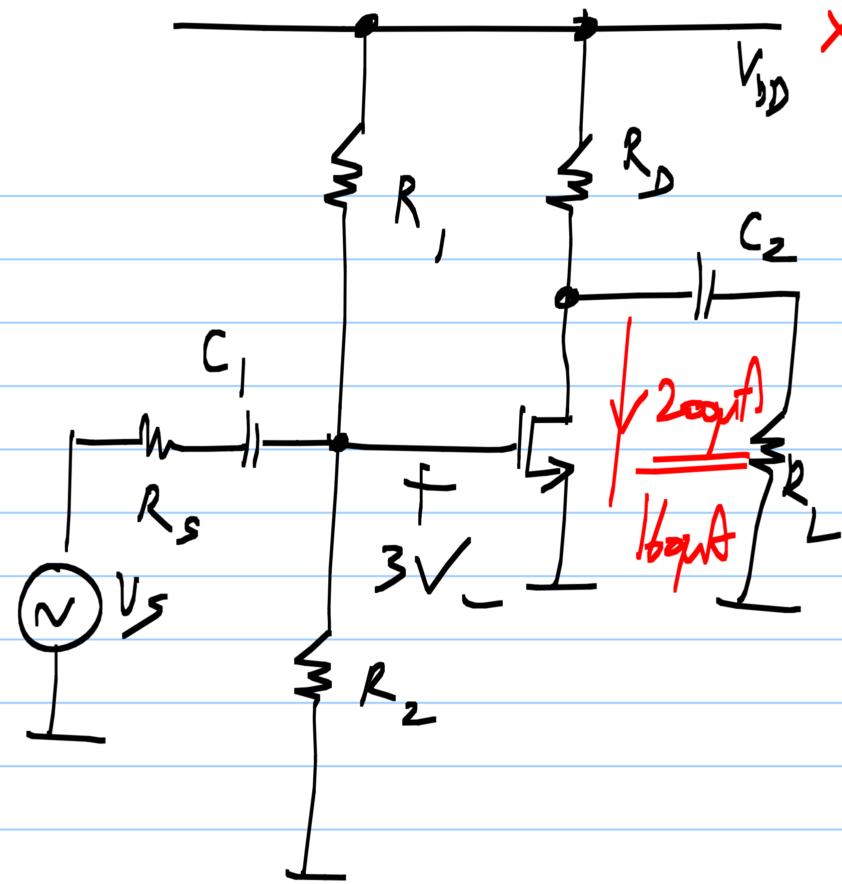

$$\frac{1}{\omega C_2} \ll R + R_{eq}$$

$$\boxed{\frac{1}{\omega C_2} \ll R_L}$$ ✓




$$\left.\frac{v_o}{v_s}\right|_{R_s=0} = -\frac{g_m R_L - R_L/R_G}{1 + R_L/R_G}$$

$$\simeq -g_m R_L$$




$$\left.\frac{v_o}{v_s}\right|_{R_s=0} = -g_m (R_D \| R_L)$$

| | Quiescent | | Increment |
|---|---|---|---|
| $V_{GS}$ | $V_T + \sqrt{\frac{2I_o}{\mu C_{ox} W/L}}$ | $+$ | $v_s$ |
| $V_{DS}$ | $V_T + \sqrt{\frac{2I_o}{\mu C_{ox} W/L}}$ | $+$ | $(-g_m R_L v_s)$ |
| $I_D$ | $I_o$ | $+$ | $g_m v_s$ |

$$-\frac{I_o}{g_m} < v_s < \left(\frac{V_T}{1+g_m R_L}\right) \text{ Total } \left[\begin{array}{l} V_{DS} > V_{GS} - V_T \\ I_D > 0 \end{array}\right.$$

* Calculate $\frac{v_o}{v_s}$, Constraints on $C_1$, $C_2$

$\{R_{in}, R_{out}\}$

with $R_s \neq 0$