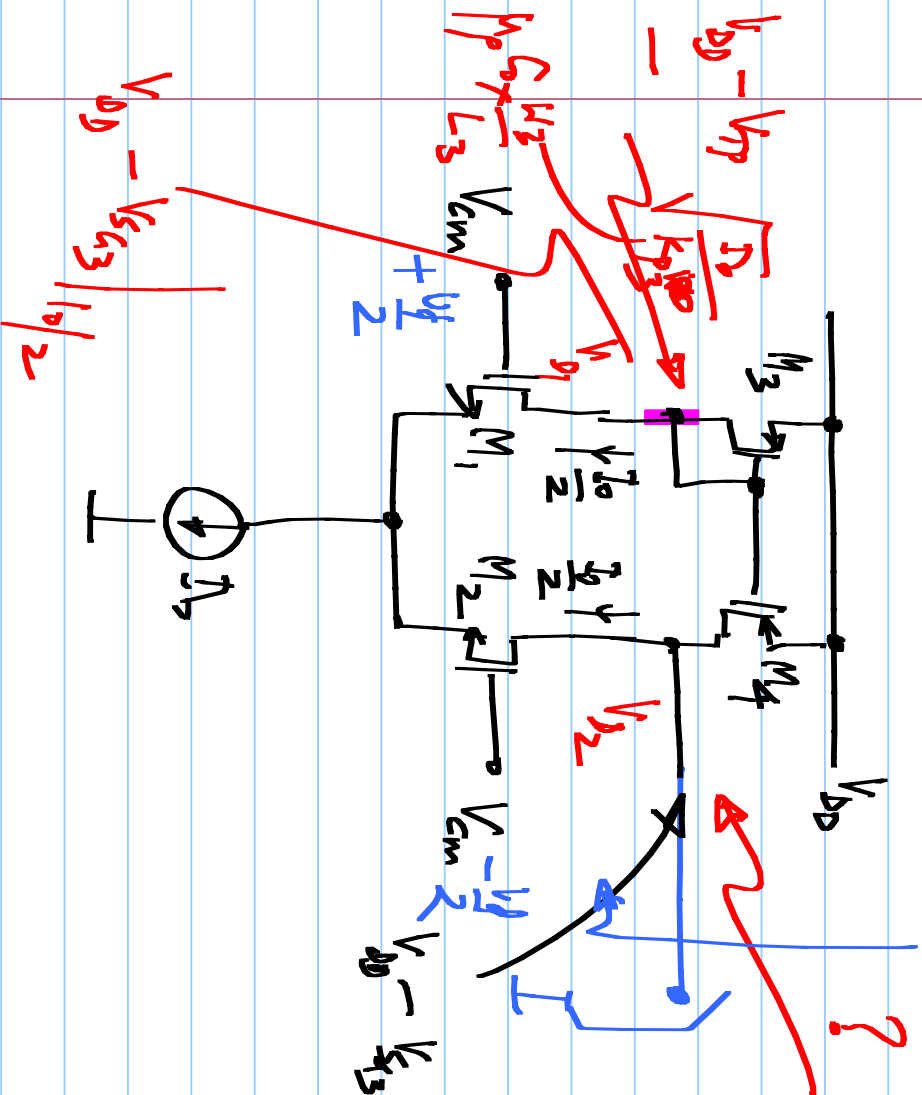


# Lecture 34

$$M_1 = M_2$$

$$M_3 = M_4$$



$$V_{D2} > V_{D1} \quad ;$$

$$V_{GS2} > V_{GS1} \quad ;$$

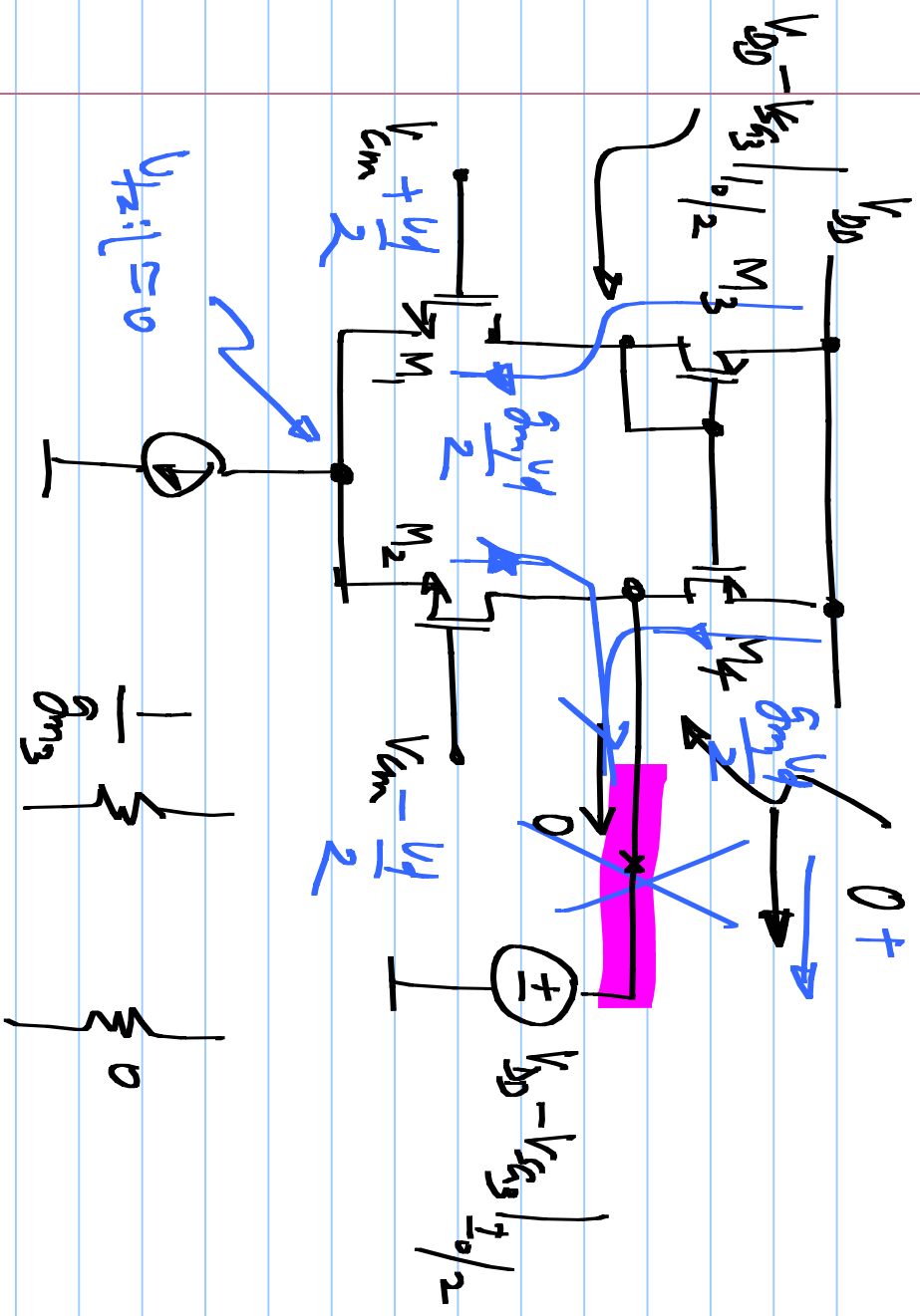
$$V_{S4} < V_{S3} \quad ;$$

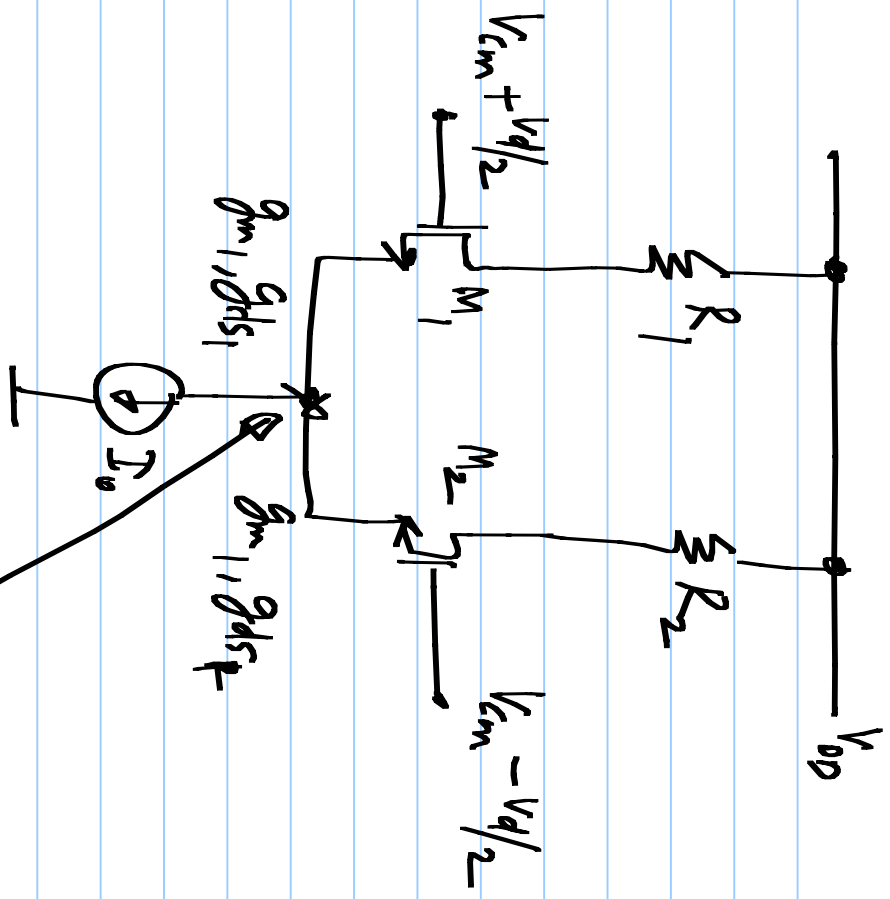
$$I_{D2} > I_{D1}$$

$$I_{D4} < I_{D3}$$

$$V_{DD} - V_{GS3} \quad | \quad + \quad ( \quad ) \quad v_q$$

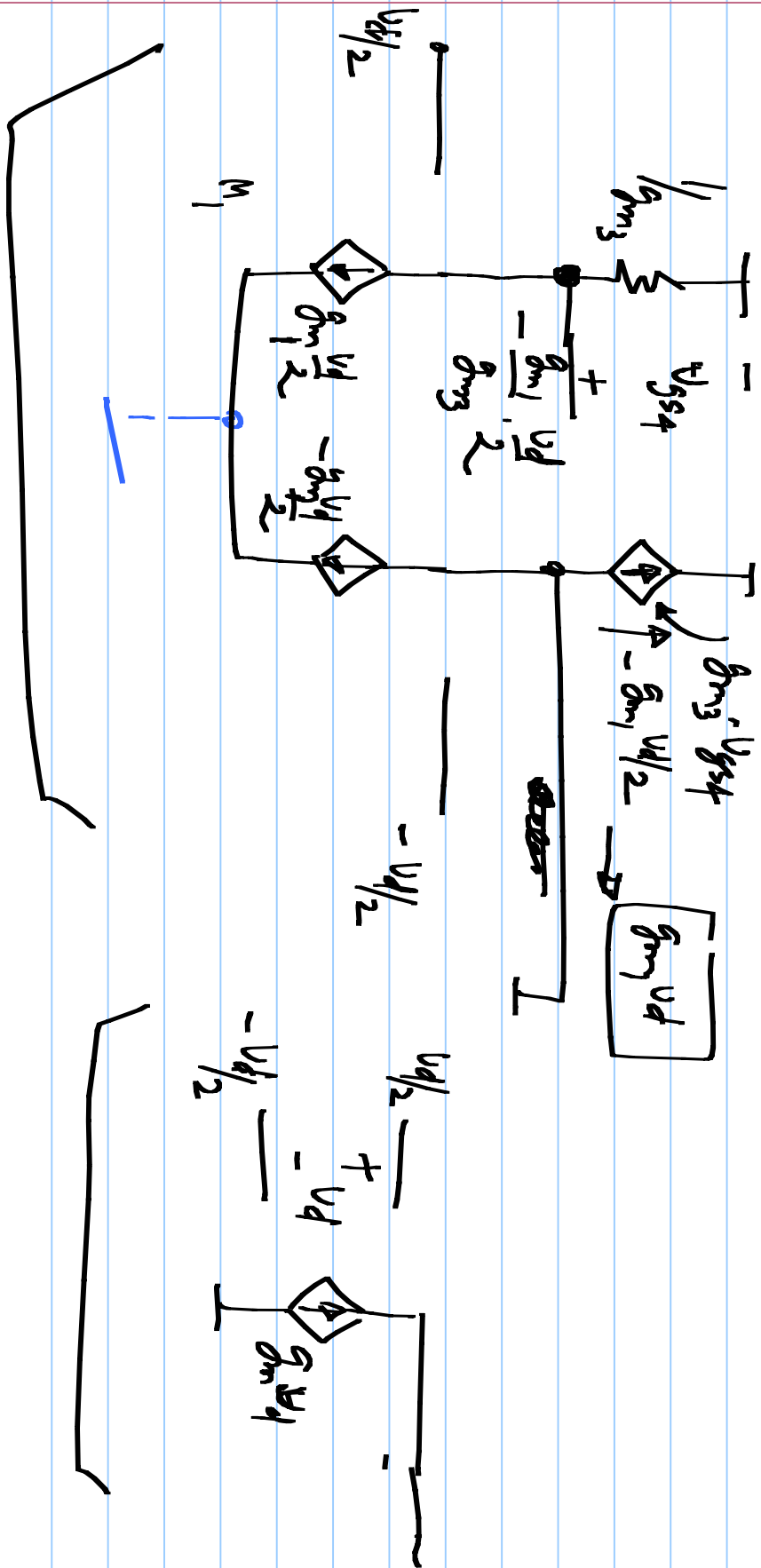
Gain

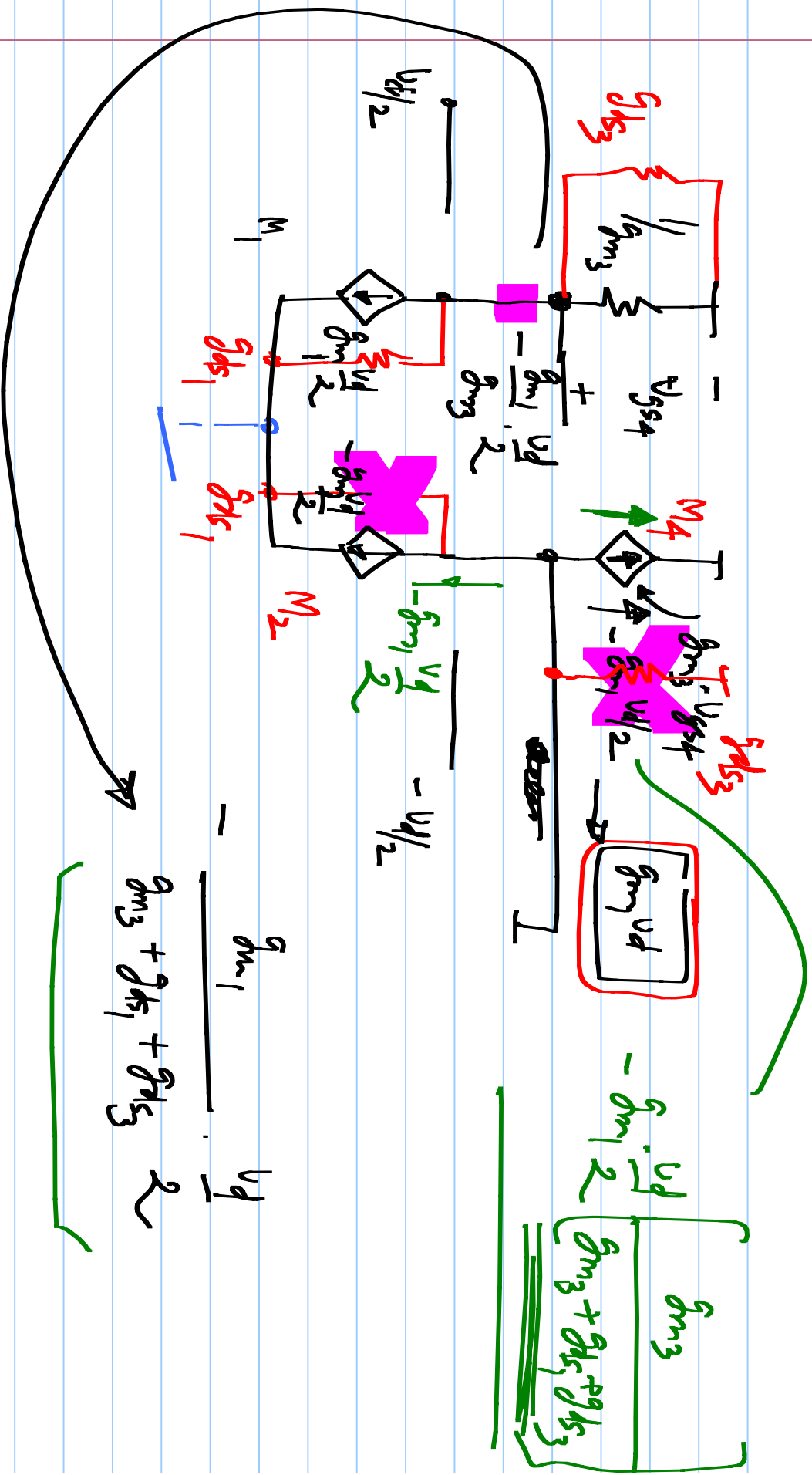




$V_{tail} =$

$R_1$  &  $R_2$  : Very small  
 $V_{tail} \approx 0$

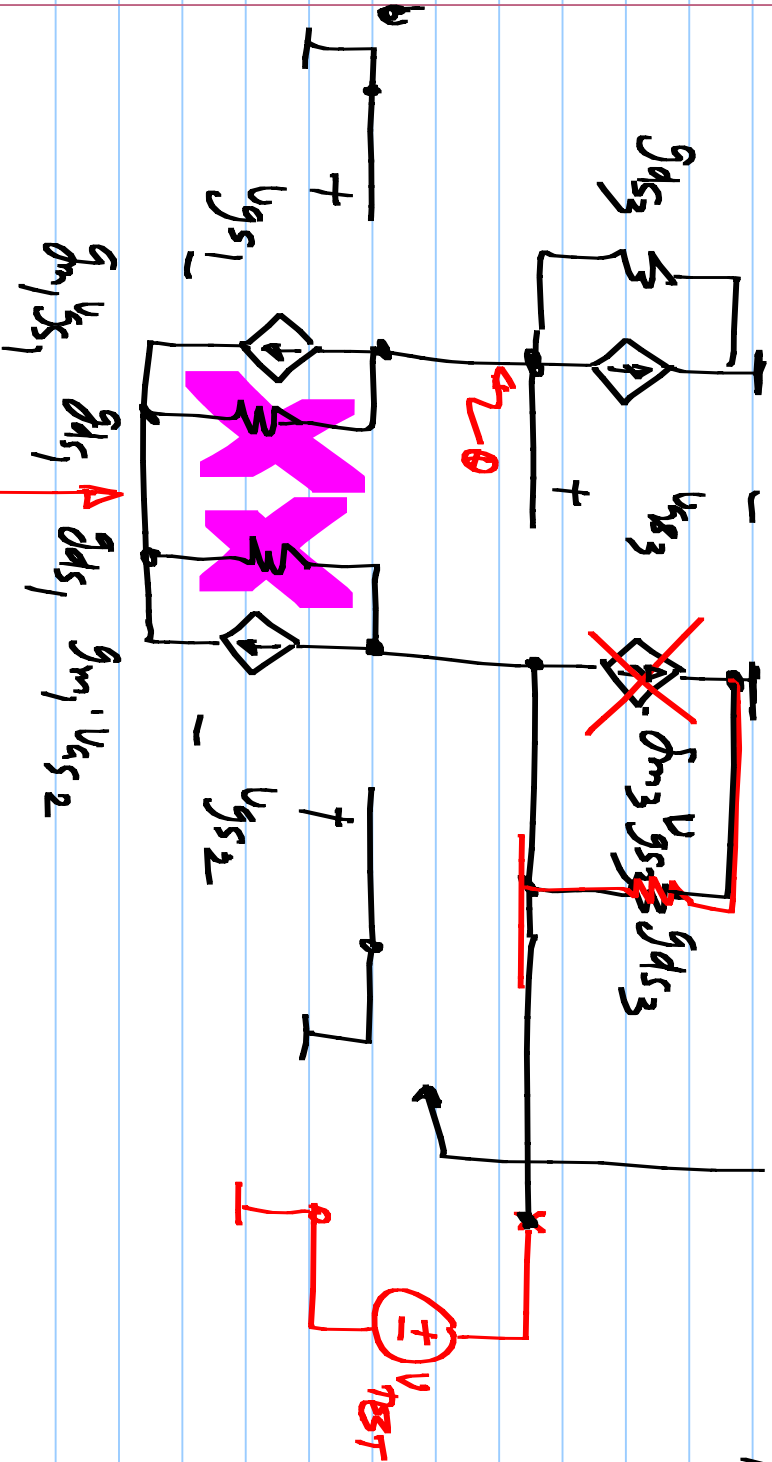




$$g_{m1} \cdot \frac{v_d}{g_{m3} + g_{ds1} + g_{ds3}}$$

$$g_{m3} \left[ \frac{g_{m1} v_d}{g_{m3} + g_{ds1} + g_{ds3}} \right]$$

$$g_{m3} \cdot v_{gs3}$$



$$g_{m1} v_{gs1} \quad g_{ds1} \quad g_{m1} v_{gs2}$$

$$\textcircled{1} \quad g_{ds} = 0$$

$$R_{out} = \frac{1}{g_{ds3}}$$

