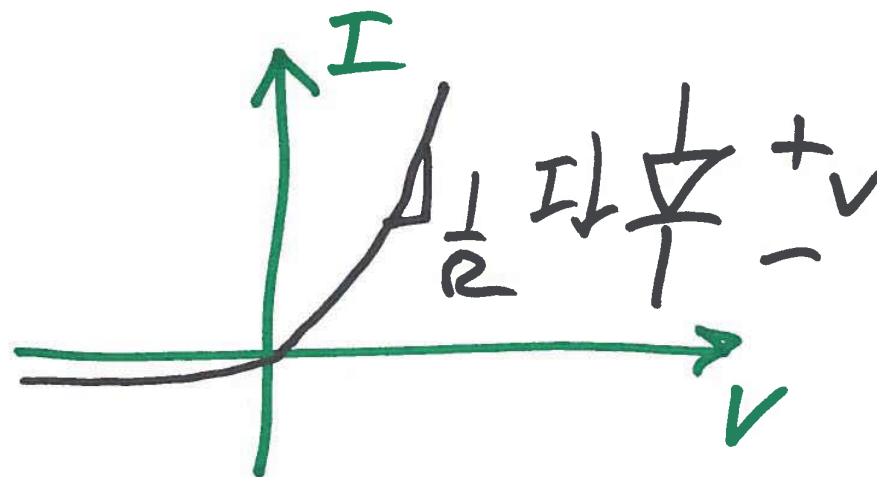


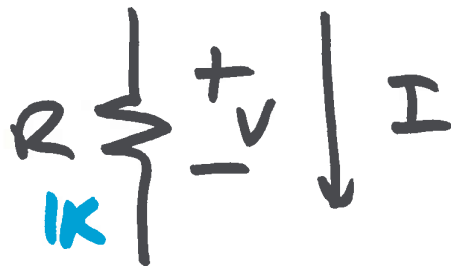
EE 420 / ECG 620

Analog IC Design

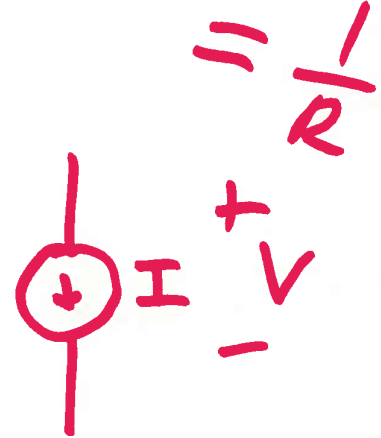
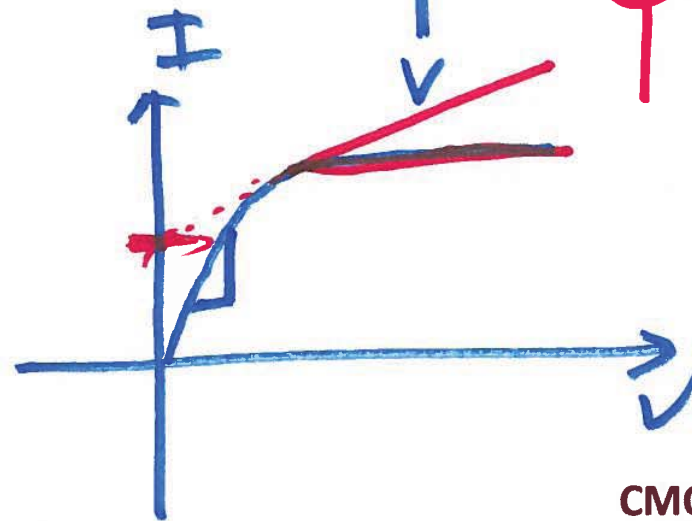
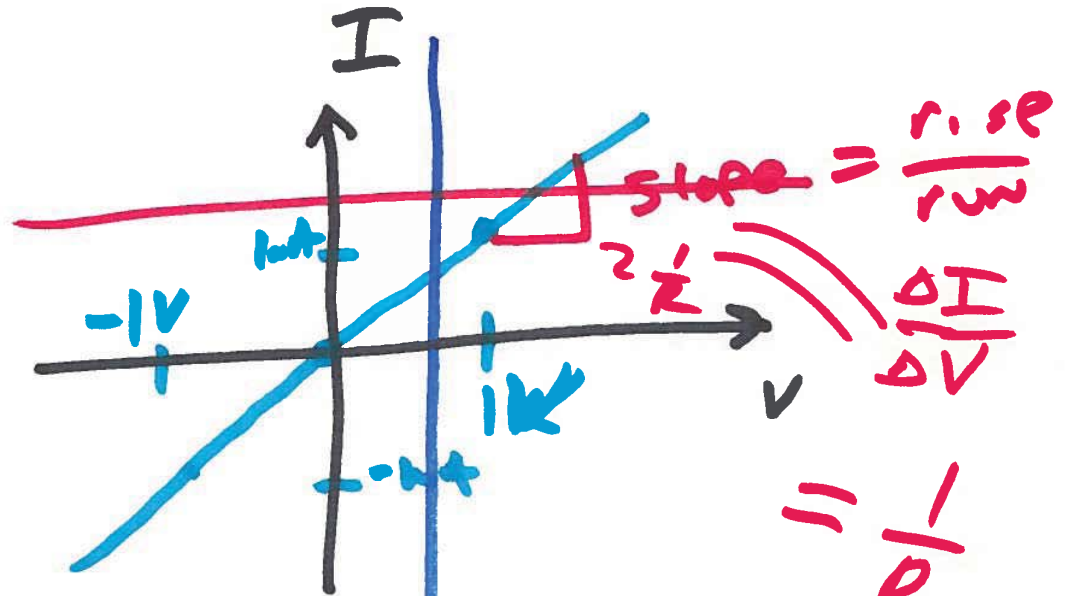
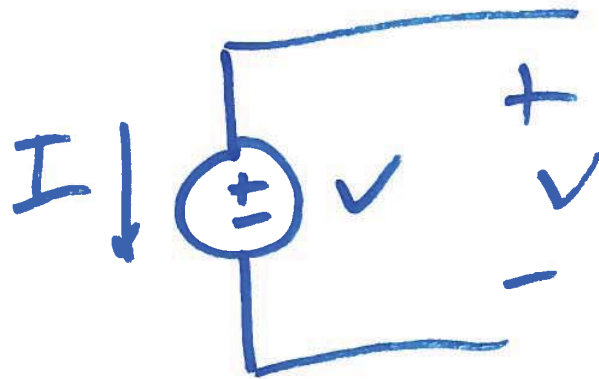
Lecture 1

IV plots

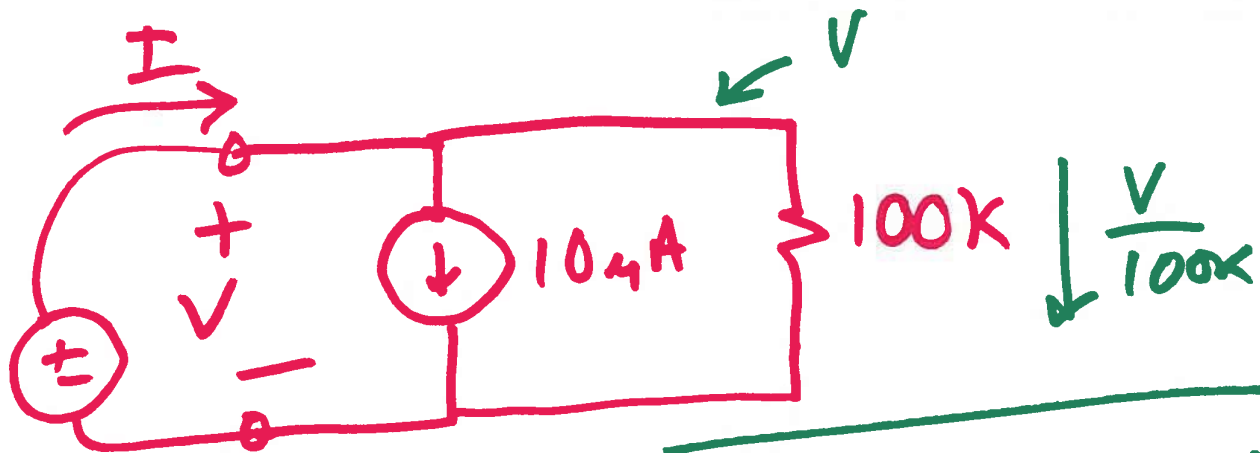




$$R = \frac{V}{I}$$

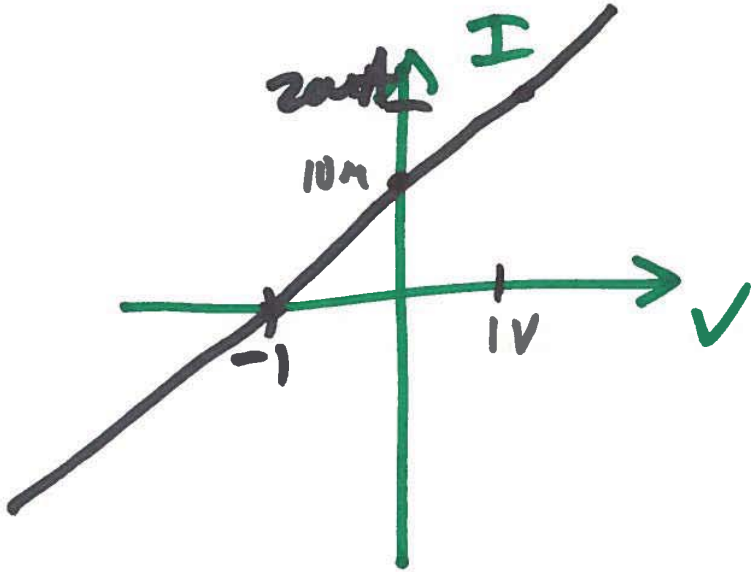


2.)

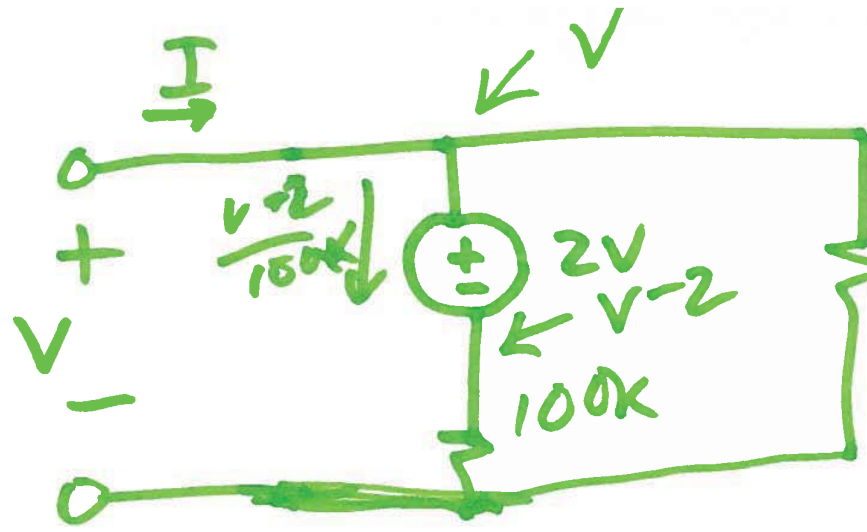


$$I = 10\text{mA} + \frac{V}{100\text{k}}$$

$$\begin{aligned} & \frac{1}{10^5} \\ &= 10^{-5} \\ &= 10 \cdot 10^{-6} \\ & 10\text{mA} \end{aligned}$$



3)



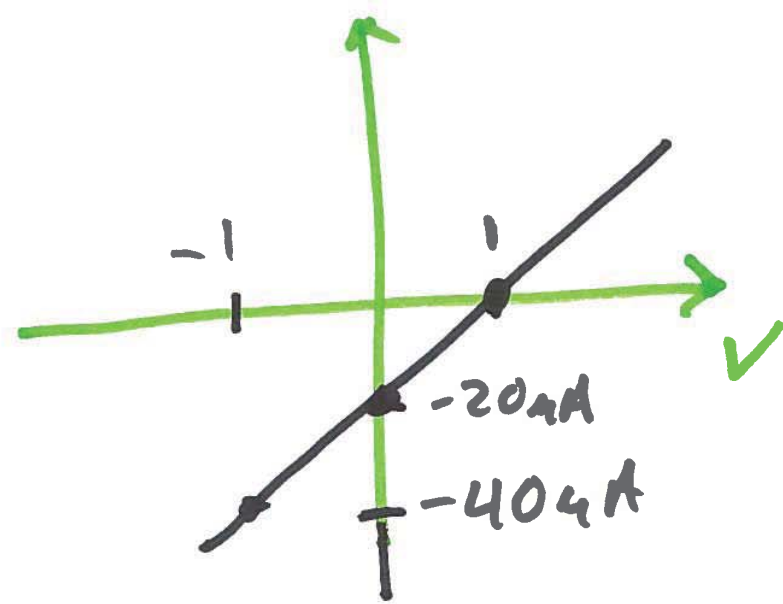
$$I = \frac{V}{100k}$$

$$r_1 = \frac{1}{\frac{1}{150k} + \frac{1}{100k}} = 10k$$

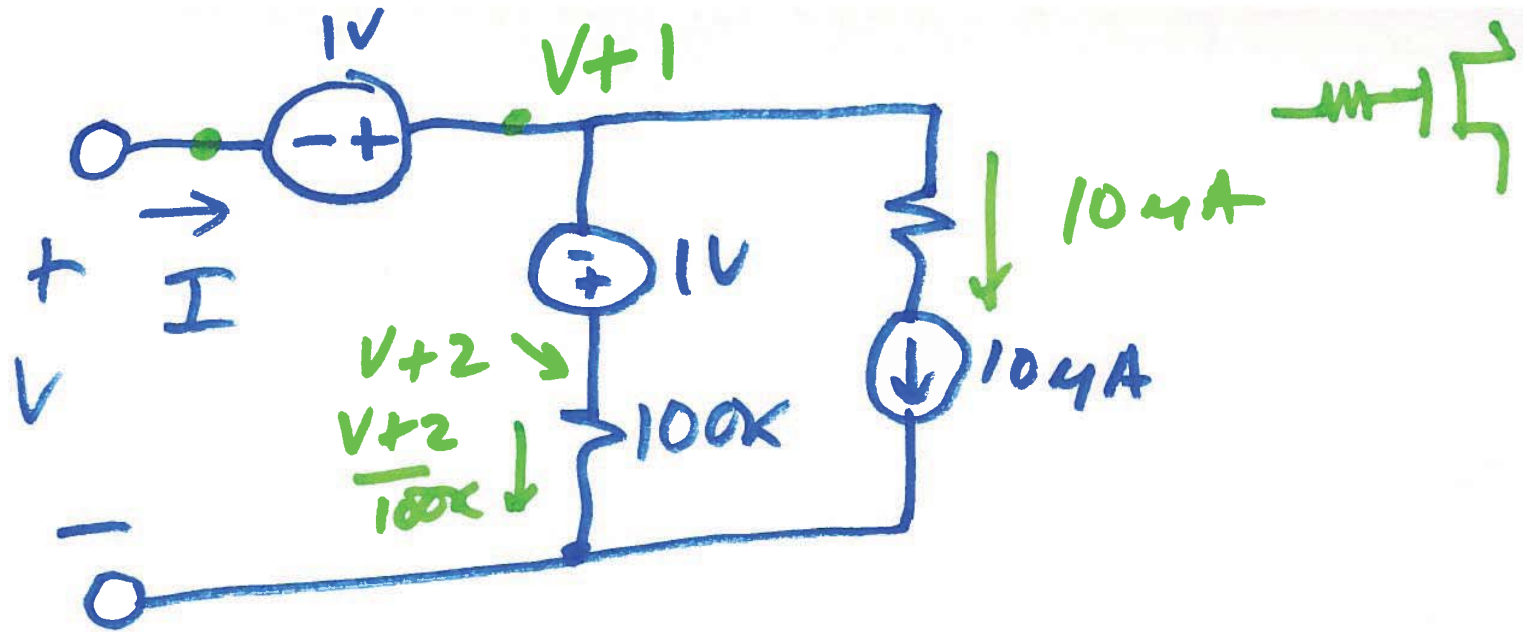
$$I = \frac{V-2}{100k} + \frac{V}{100k}$$

$$= \frac{2V-2}{100k}$$

$$I = \frac{V-1}{50k}$$



4)



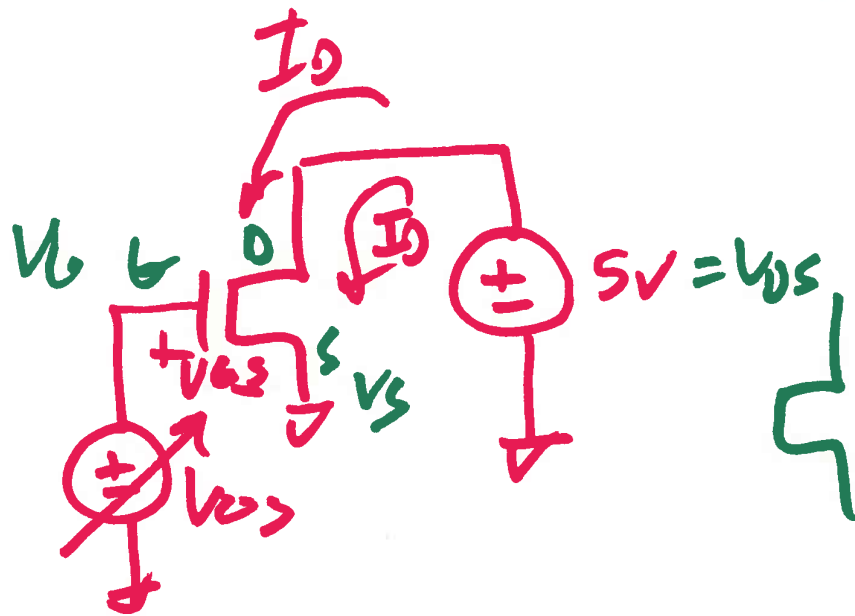
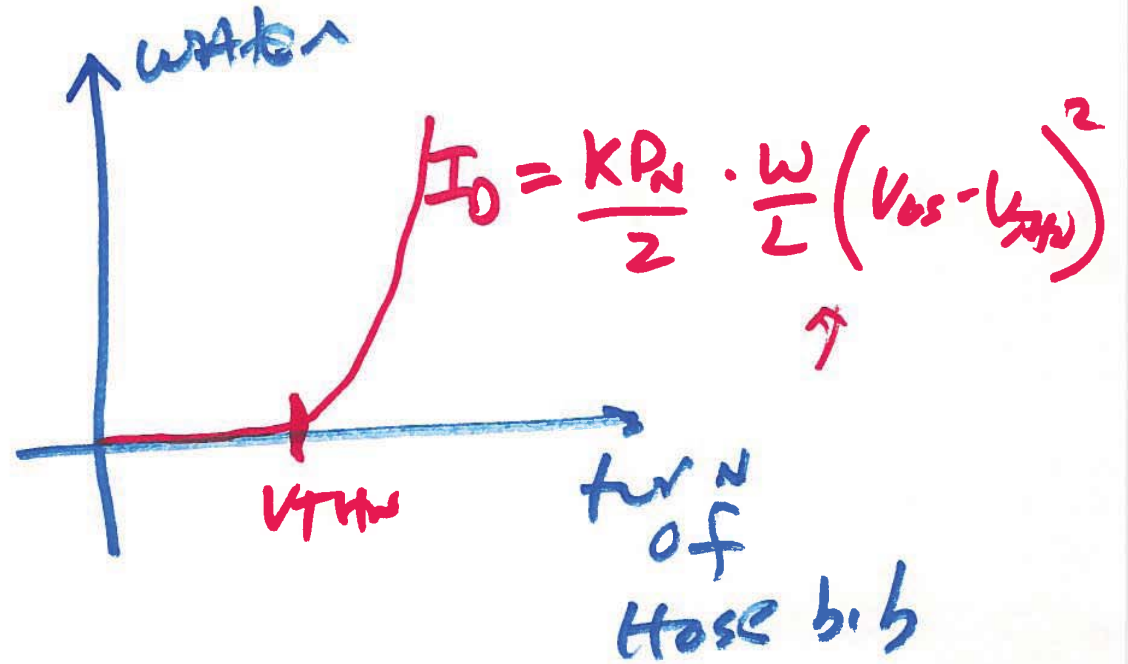
$$I = \frac{V+2}{100k} + 10\mu A$$

$$I = V \cdot (10\mu) + 30\mu A$$

5)

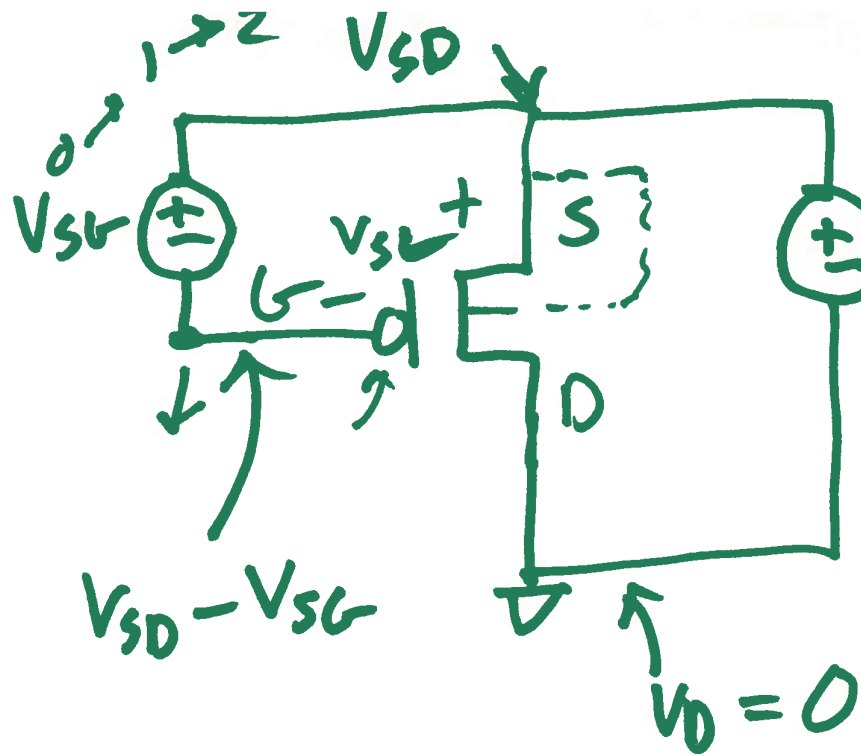


Hose bib

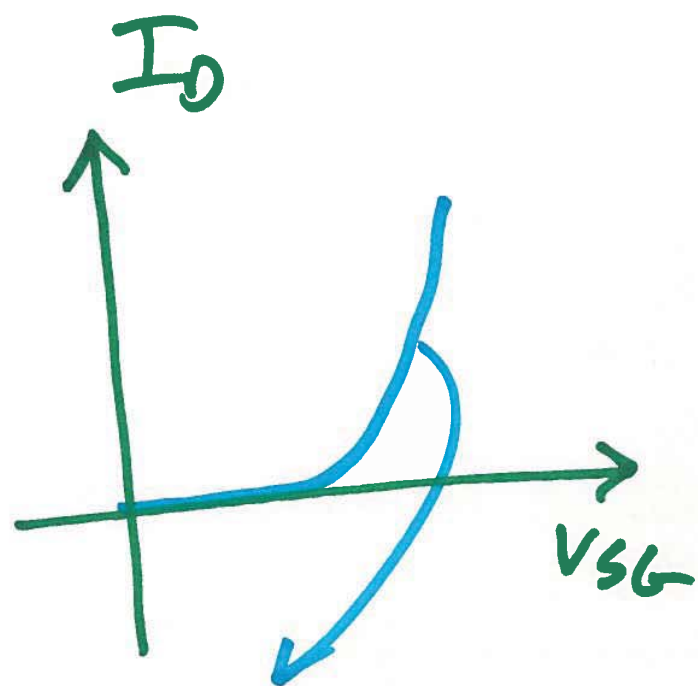


$$V_{DS} > V_{TTHW}$$

$$V_{DS} \geq V_{DS} - V_{TTHW}$$



$$V_{SD} = V_S - V_0 = V_S$$



$$I_D = \frac{K_P}{2} \cdot \frac{W}{L} (V_{SG} - V_{th})^2$$

7)

14

$$V_{TN} = 0.8V \quad k_p = 120 \mu A/V^2$$

$$V_{GS} - V_{TN} = \cancel{I_D} S - I \cdot R$$

$$I_D = \frac{120 \mu A/V^2}{2} \cdot \frac{10}{10} (2.8 - 0.8)^2$$

$$= \underline{\underline{240 \mu A}}$$

$$V_{DS} = 5 - 1k \cdot 240 \mu A$$

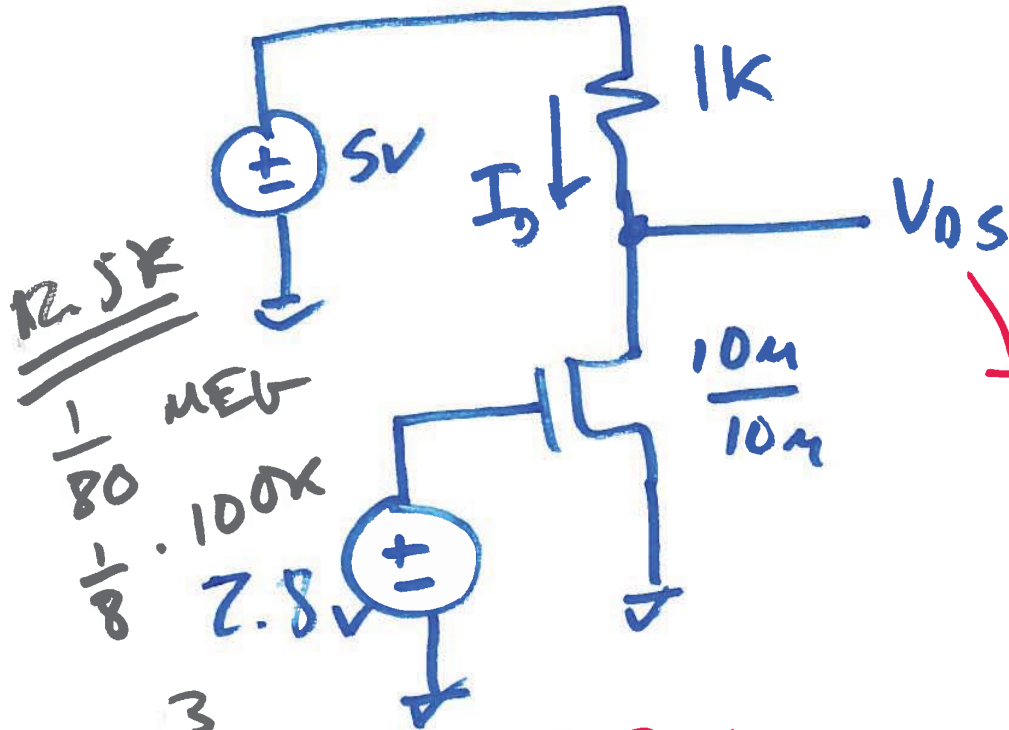
$$= \underline{\underline{4.76V}}$$

$$V_{DS} \stackrel{?}{\geq} V_{GS} - V_{TN}$$

$$4.76 \geq 2.8 - 0.8$$

yes!

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12.5k

$\frac{1}{80} \text{ MEF}$
 $\frac{1}{8} \cdot 100k$
2.8V

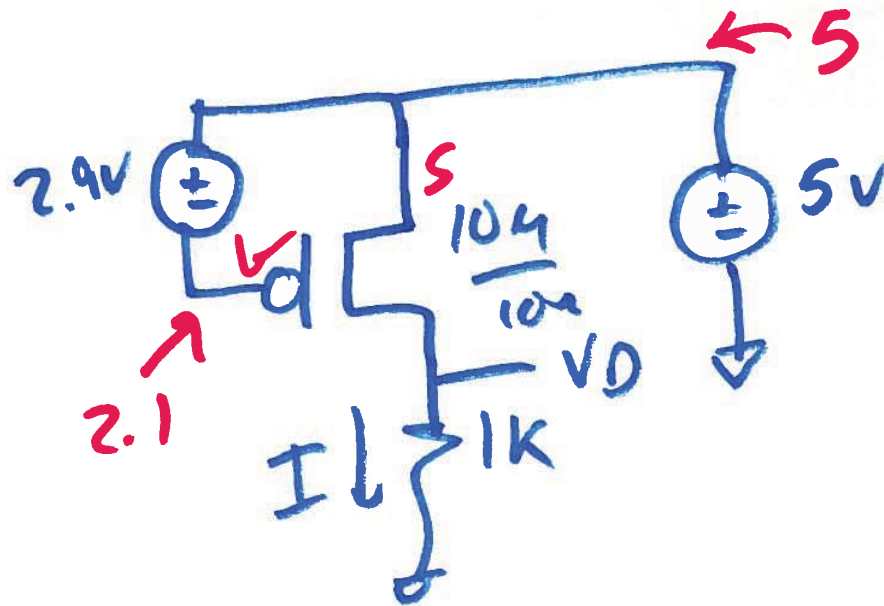
$\frac{10\mu}{10\mu}$

$$R = \frac{3}{240 \mu} \quad V_{GS} = 2.8V$$

$$= \frac{1}{80 \mu} \quad V_{GS} > V_{TN}?$$

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$$2 = 5 - 240 \mu \cdot R$$



$$V_{SG} = 2.9$$

$$I_D = \frac{40\mu}{2} \cdot \frac{10}{10} (2.9 - .9)^2$$

$$= 80\mu$$

$$V_{SG} > V_{THP} \text{ ? yes } V_D = 80\mu \cdot 1K$$

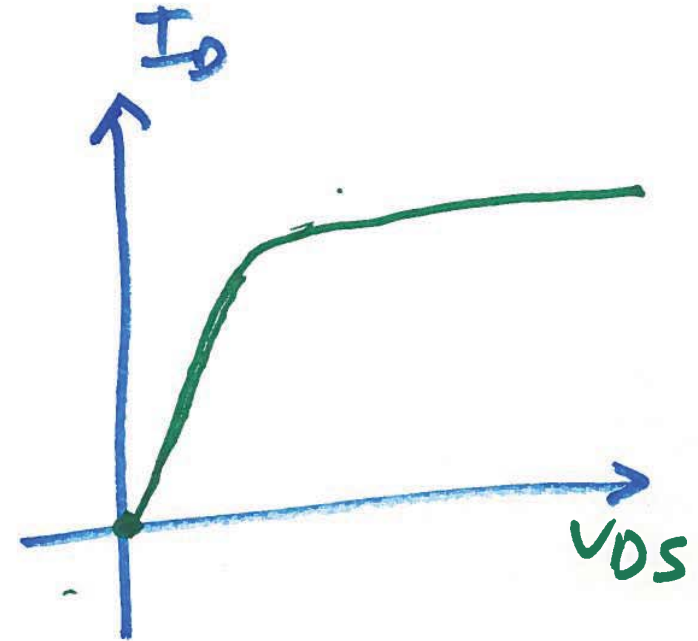
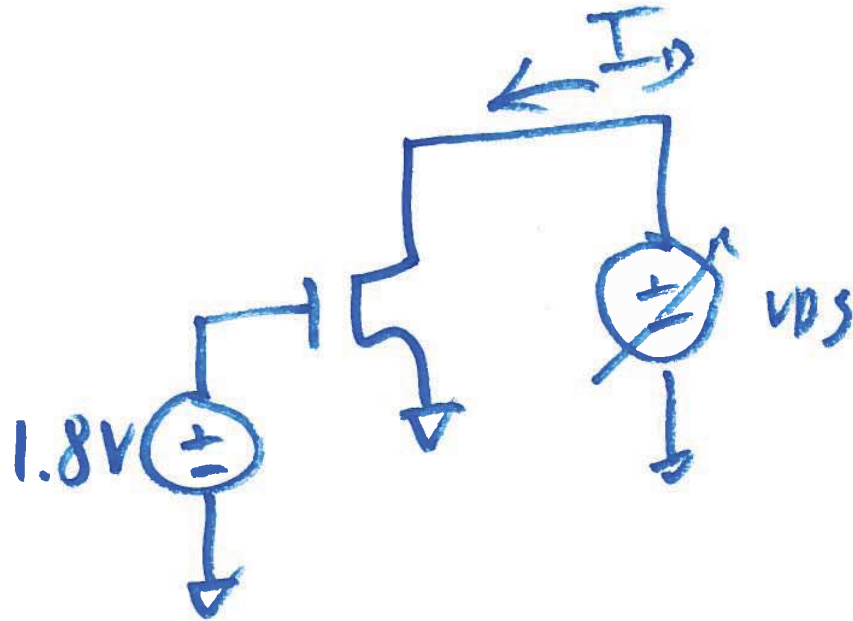
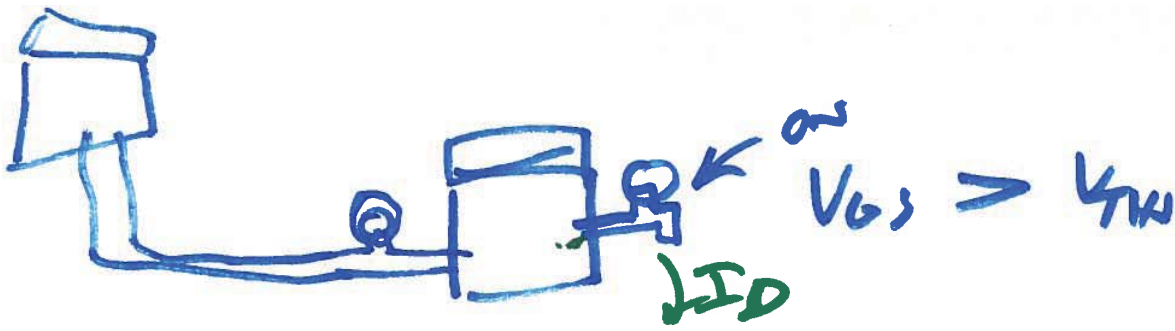
$$= 80\mu V$$

$$V_{SD} \cong V_{SG} - V_{THP}$$

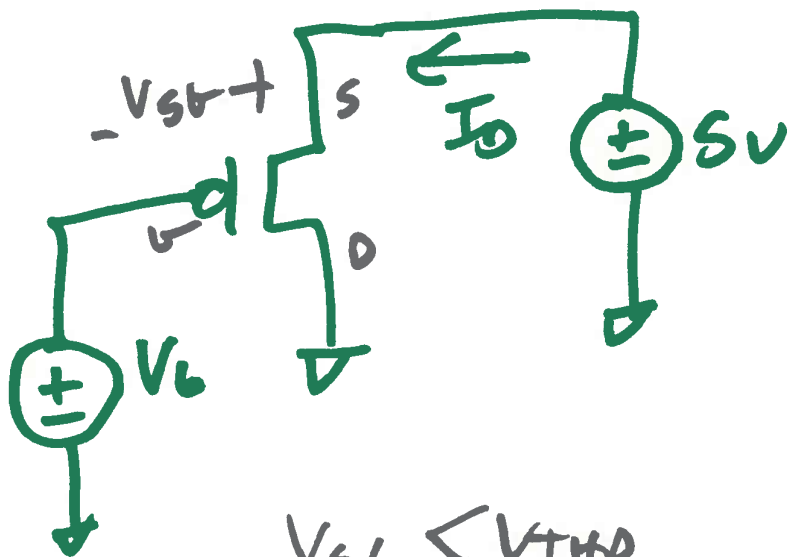
$$V_{SD} = 5 - 80\mu V$$

$$= 4.92$$

9)



10)



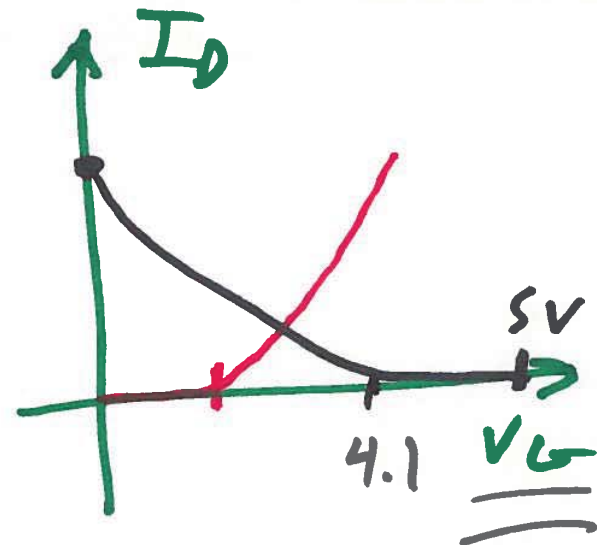
$$V_{DS} < V_{THP}$$

$$0.9$$

$$V_G = 0$$

$$V_{DS} = 5V$$

$$V_G \uparrow \quad V_{DS} \downarrow$$



$$V_{DS}$$

$$V_{DS} = 5 - V_G$$