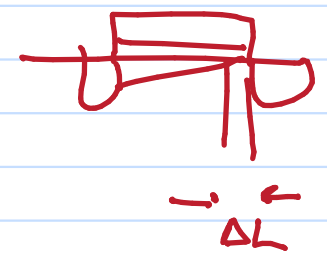
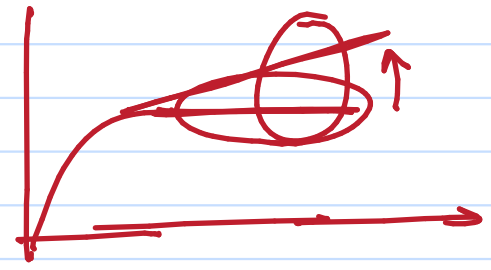
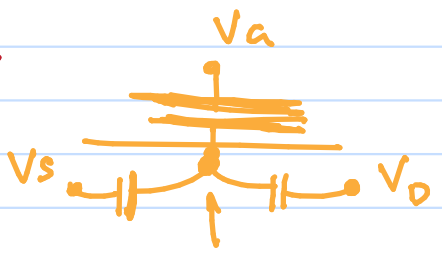
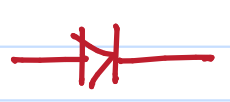
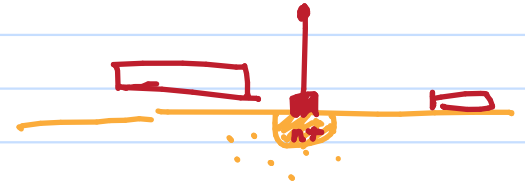
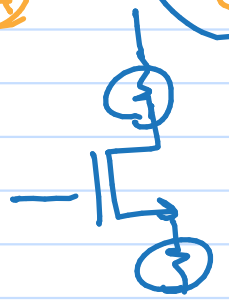
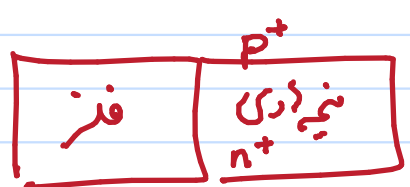
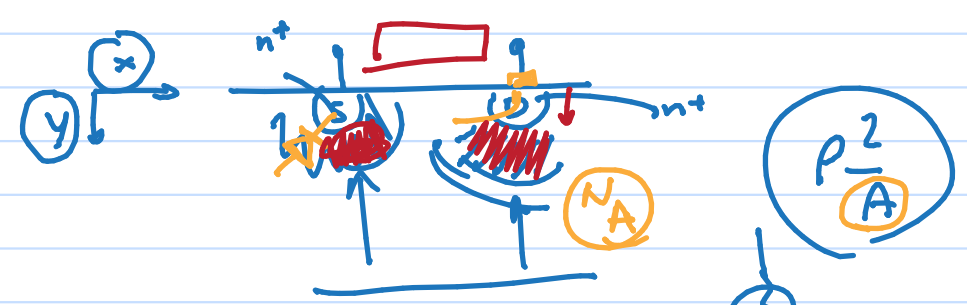
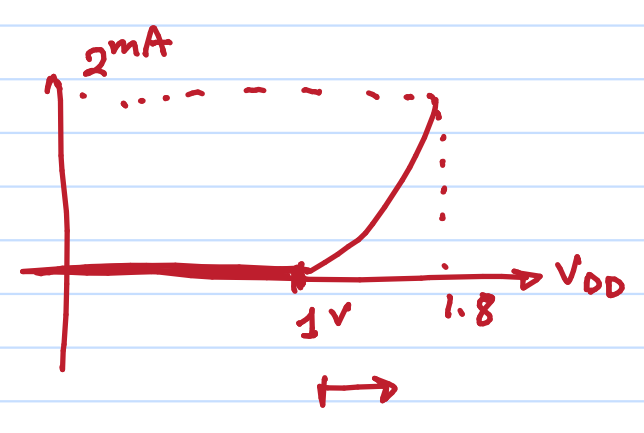
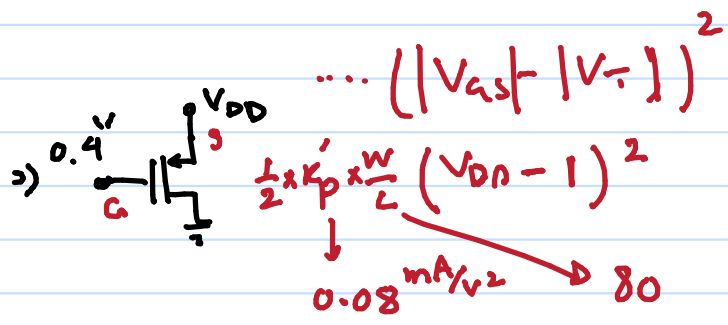
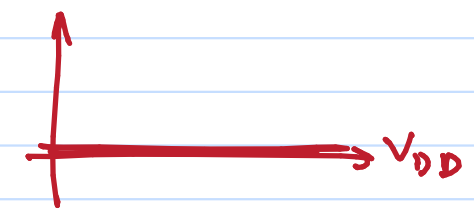
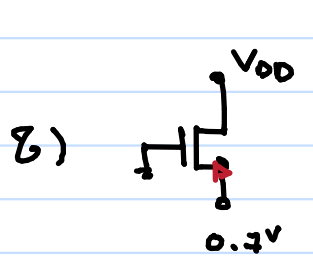
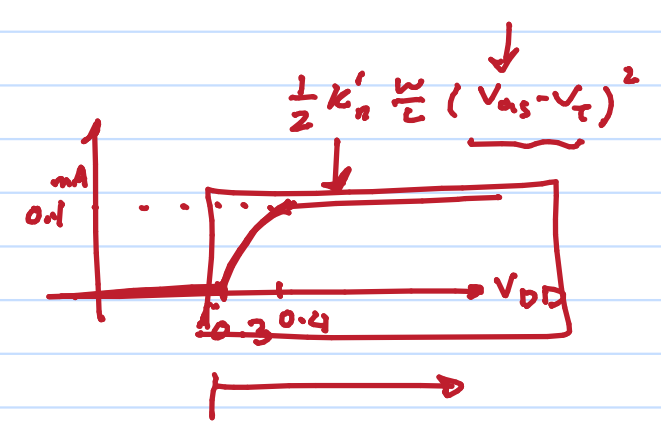
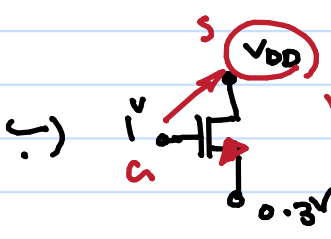
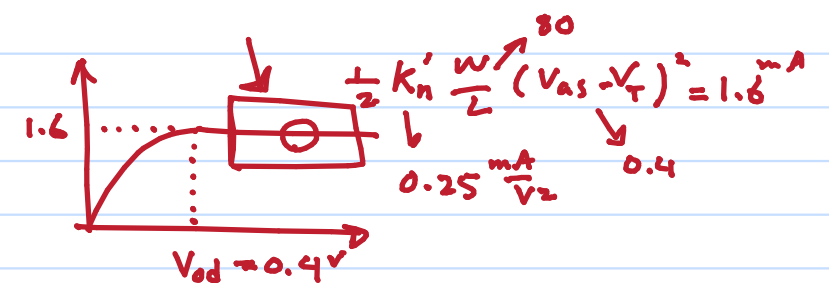
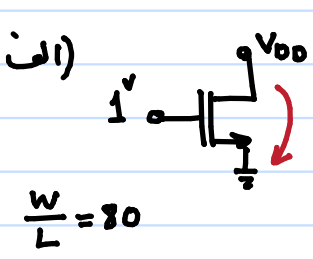
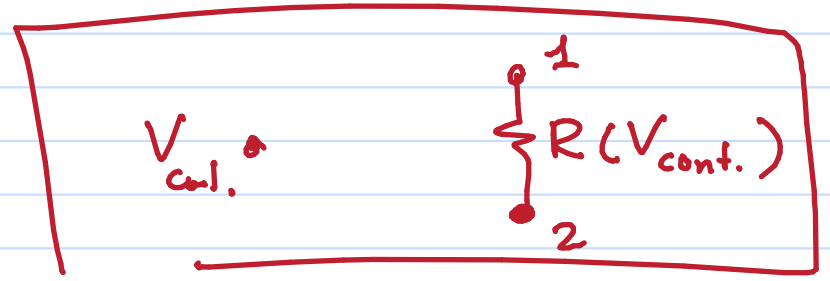


junction



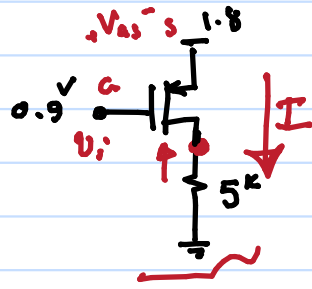


$$\begin{cases} k_n' = 0.25 = \mu_n C_{ox} \\ k_p' = 0.08 = \mu_p C_{ox} \end{cases}$$



$$\frac{W}{L} = 30$$

الف)

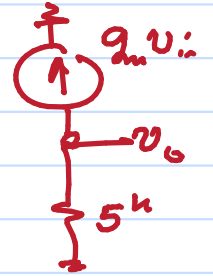


$$I = \frac{1}{2} k_p' \frac{W}{L} (|V_{gs}| - |V_T|)^2$$

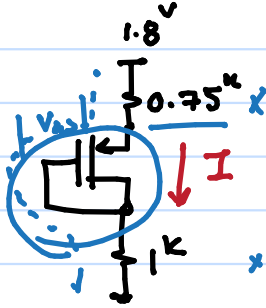
$$= \frac{1}{2} \times 0.08 \times 30 \times (0.9 - 0.6)^2 = 0.108$$

$$g_m = \frac{2i_D}{V_{od=0.3}} = 0.72 \text{ mS}$$

$$-g_m R_D$$



ب)



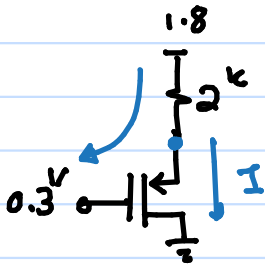
$$I = 1.6 \times (|V_{gs}| - |V_T|)^2$$

$$1.8 = |V_{gs}| + 1.75 I$$

$$\begin{cases} i = 0.4 \text{ mA} \\ |V_{gs}| = 1.1 \text{ V} \end{cases}$$

$$g_m = \frac{2i_D}{V_{od}} = \frac{2 \times 0.4}{0.5} = 1.6 \text{ mS}$$

ج)



$$I = 1.6 \times (|V_{gs}| - 0.6)^2$$

$$1.5 = |V_{gs}| + 2I$$

$$I = 0.255$$

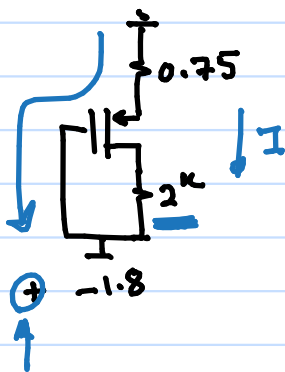
$$|V_{gs}| = 1$$

$$|V_{od}| = 0.9$$

$$g_m = \frac{2I}{V_{od}} = 1.125 \text{ mS}$$

$$\frac{W}{L} = 40$$

د)



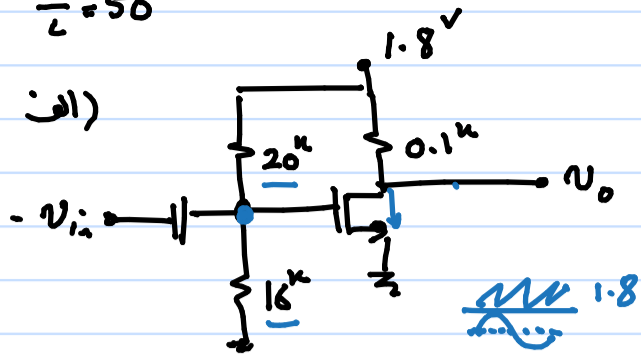
$$I = 1.6 (|V_{gs}| - 0.6)^2$$

$$1.8 = |V_{gs}| + 0.75 I$$

$$\begin{cases} I = 0.72 \text{ mA} \\ |V_{gs}| = 1.25 \end{cases}$$



$$\frac{W}{L} = 50$$



$$V_a = \frac{16}{16+20} \times 1.8 = 0.8$$

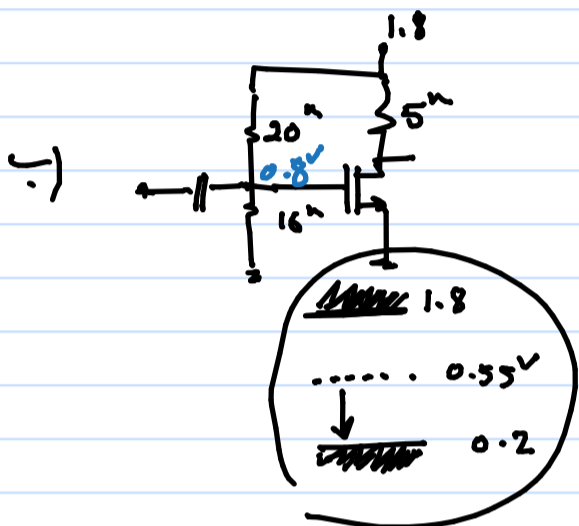
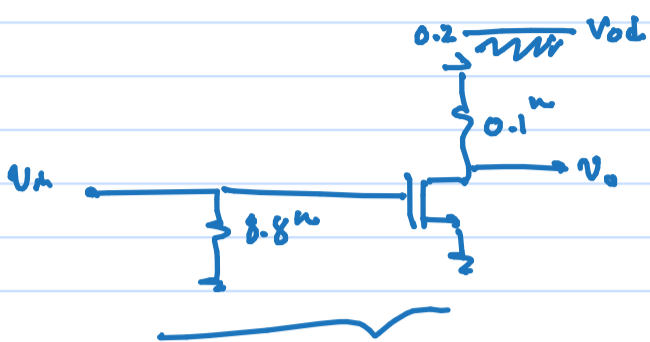
$$i_D = \frac{1}{2} \times k'_n \times \frac{W}{L} \times (V_{gs} - 0.6)^2$$

$$= 0.25 \text{ mA}$$

$$V_{DS} = 1.8 - 0.25 \times 0.1 = 1.725 \text{ V}$$

$$g_m = \frac{2i_D}{V_{DS}} = \frac{2 \times 0.25}{1.725} = 0.29 \text{ mA/V}$$

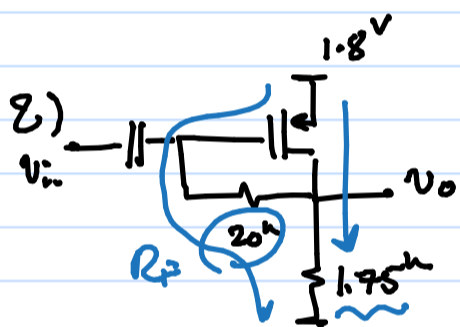
$$A_v = -g_m R_D = -0.29 \times 0.1 = -0.029$$



$$I_D = 6.25 \times (0.8 - 0.6)^2 = 0.25 \text{ mA}$$

$$V_{DS} = 1.8 - 0.25 \times 5 = 0.55 > V_{DD} = 0.2$$

$$A_v = -g_m R_D = -2.5 \times (5 \parallel \frac{20}{10}) = -2.5 \times (\frac{100}{25}) = -10$$



$$I = \frac{1}{2} \times 0.08 \times 50 \times (|V_{gs}| - 0.6)^2$$

$$1.75 \times 0.42$$

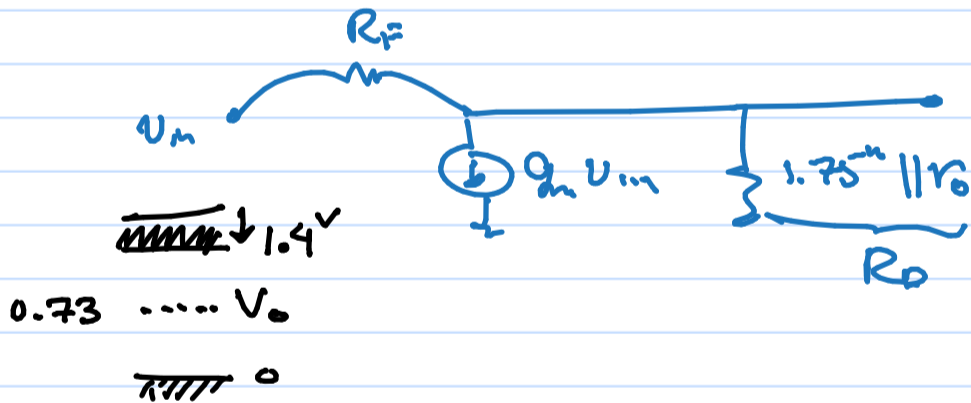
$$1.8 = |V_{gs}| + 1.75 \times I$$

$$I = 0.42 \text{ mA} \checkmark$$

$$|V_{gs}| = 1.06 \text{ V}$$

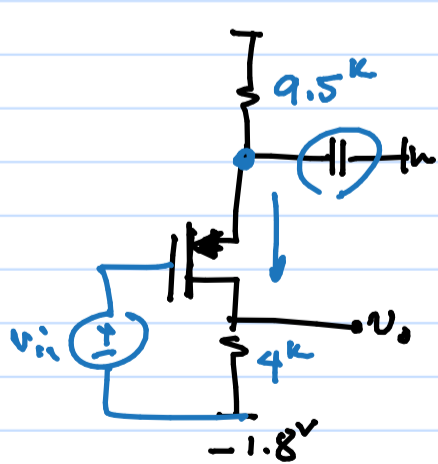
$$g_m = \frac{2I_D}{V_{DS}}$$

$$A_v = \frac{-g_m R_D}{1 + g_m R_f}$$



$$0.73 \dots V_o$$

TTTTT 0



$$I = 2 \times (|V_{gs}| - 0.6)^2$$

$$1.8 = |V_{gs}| + 9.5 I$$

$$\begin{cases} I = 0.1 \text{ mA} \\ |V_{gs}| = 0.82 \text{ V} \end{cases}$$

$$|V_{ds}| = 1.8 - 13.5 I = 0.45 > 0$$

$$|V_{od}| = 0.22 \checkmark$$

$$A_v = -g_m (4 \parallel \frac{4}{50}) = -3.37$$

$$g_m = 0.91 \text{ mA/V}$$

$$V_s = -0.95$$

$$V_D = -1.8 + 4 \times I = -1.4 \text{ V}$$

