

Write your name at the top right corner of every page (including this cover page).

Copy everything you want counted towards your grade onto the pages that I provided.

Write with a pen that cannot be erased!

No books are allowed!

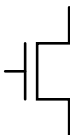
Only the calculators I provided are allowed!


Write down all the steps that lead to your result.

Identify new variables that you may introduce in the circuit diagrams that I provided.

Read all the problems before you start so that you can begin with those that seem easiest to you.

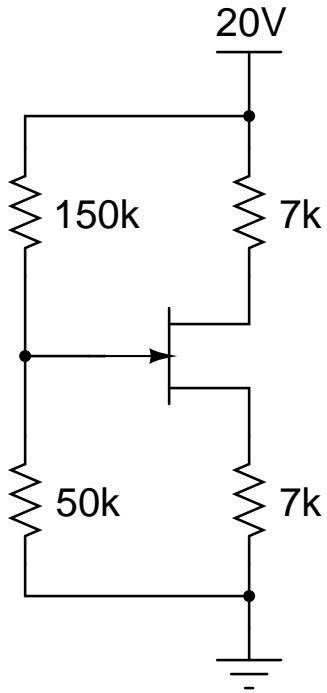
MOSFET circuit symbols:

enhancement mode MOSFET 

depletion mode MOSFET 

Problem 1 (6 pts):

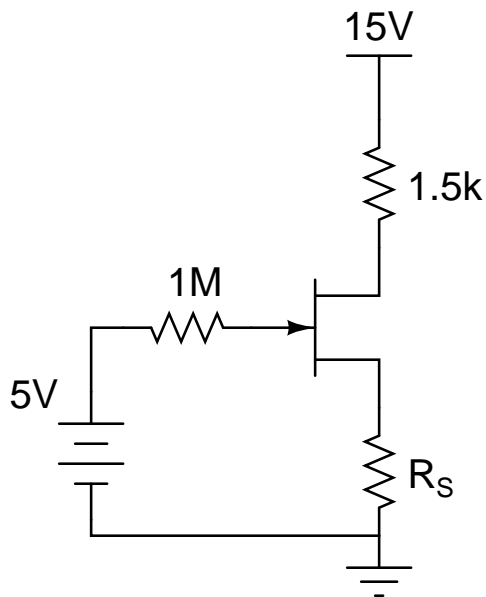
The JFET in the figure has $I_{DSS} = 9 \text{ mA}$ and $V_p = -3 \text{ V}$. Find V_{GS} , i_D , and V_{DS} .



(continuation of problem 1)

Problem 2 (6 pts):

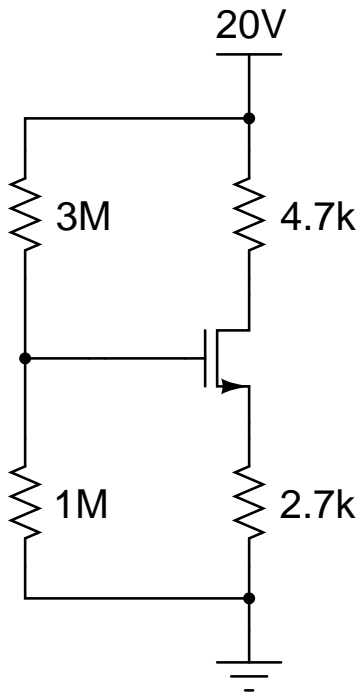
The JFET in the figure has $I_{DSS} = 16 \text{ mA}$ and $V_p = -2 \text{ V}$. Find R_S , V_{GS} , and V_{DS} so that the transistor is biased in the active (saturation) region (verify!) and $i_D = 1 \text{ mA}$.



(continuation of problem 2)

Problem 3 (6 pts):

The NMOS in the figure has $K = 1 \text{ mA/V}^2$ and $V_t = 2 \text{ V}$. Find V_{GS} , i_D , and V_{DS} .



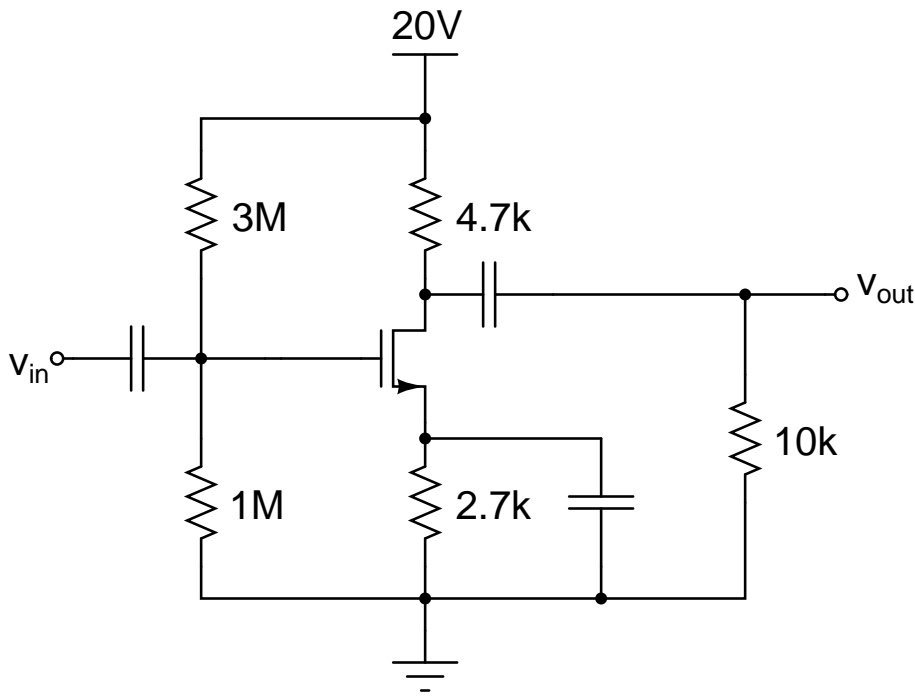
(continuation of problem 3)

Problem 4 (7 pts):

In the circuit below, the $10\text{ k}\Omega$ resistor from v_{out} to GND represents the load resistance R_L . Draw the small signal equivalent circuit for this whole circuit. (including R_L)

Given $g_m = 1.77\text{ mS}$, what is $A_v = v_{out}/v_{in}$? ($r_d = \infty$)

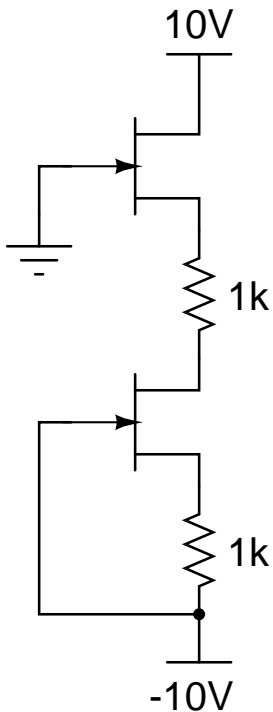
Is the amplifier inverting or not? (check sign!)



(continuation of problem 4)

Problem 5 (7 pts):

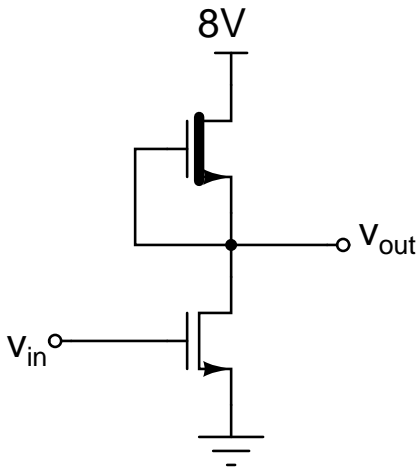
Both JFETs have $I_{DSS} = 4 \text{ mA}$ and $V_p = -2 \text{ V}$. Assume active (saturation) region operation to find i_D and confirm that both JFETs are in the active region.



(continuation of problem 5)

Problem 6 ONLY 6610 students !!! (7 pts):

The MOSFETs below have the following characteristics: $I_{DSS} = 4 \text{ mA}$ and $V_p = -4 \text{ V}$ and $K = 0.25 \text{ mA/V}^2$ and $V_t = 1 \text{ V}$ respectively. What voltage will v_{in} have to be for both MOSFETs to be in the active region? What are i_D and v_{out} under these circumstances?



(continuation of problem 6)