In class problem, Jan 14th, 2012 (ECE 322)

An NMOS transistor with $V_{TN}=1V$ has a drain current $i_D=0.8mA$ when $v_{GS}=3V$. Calculate the drain current when $v_{GS}=3V$ and $v_{DS}=1V$?

Solution:

$V_{TN} = 1\ V,\ V_{GS} = 3\ V,\ V_{DS} = 4.5\ V$

$V_{DS} = 4.5 > V_{DS}(sat) = V_{GS} - V_{TN} = 3 - 1 = 2\ V$

Transistor biased in the saturation region

$I_D = K_n(V_{GS} - V_{TN})^2 \Rightarrow 0.8 = K_n(3-1)^2 \Rightarrow K_n = 0.2\ mA/V^2$

(b) $V_{GS} = 3\ V,\ V_{DS} = 1\ V$

Nonsaturation region:

$I_D = (0.2)\left[2(3-1)(1) - (1)^2\right] \Rightarrow \underline{I_D = 0.6\ mA}$