EE 420/ECG 620
Analog IC Design
Lecture 7
Feb. 8, 2017

$$g_m = KP \cdot \frac{W}{L}\left(V_{GS} - V_{TH}\right)$$

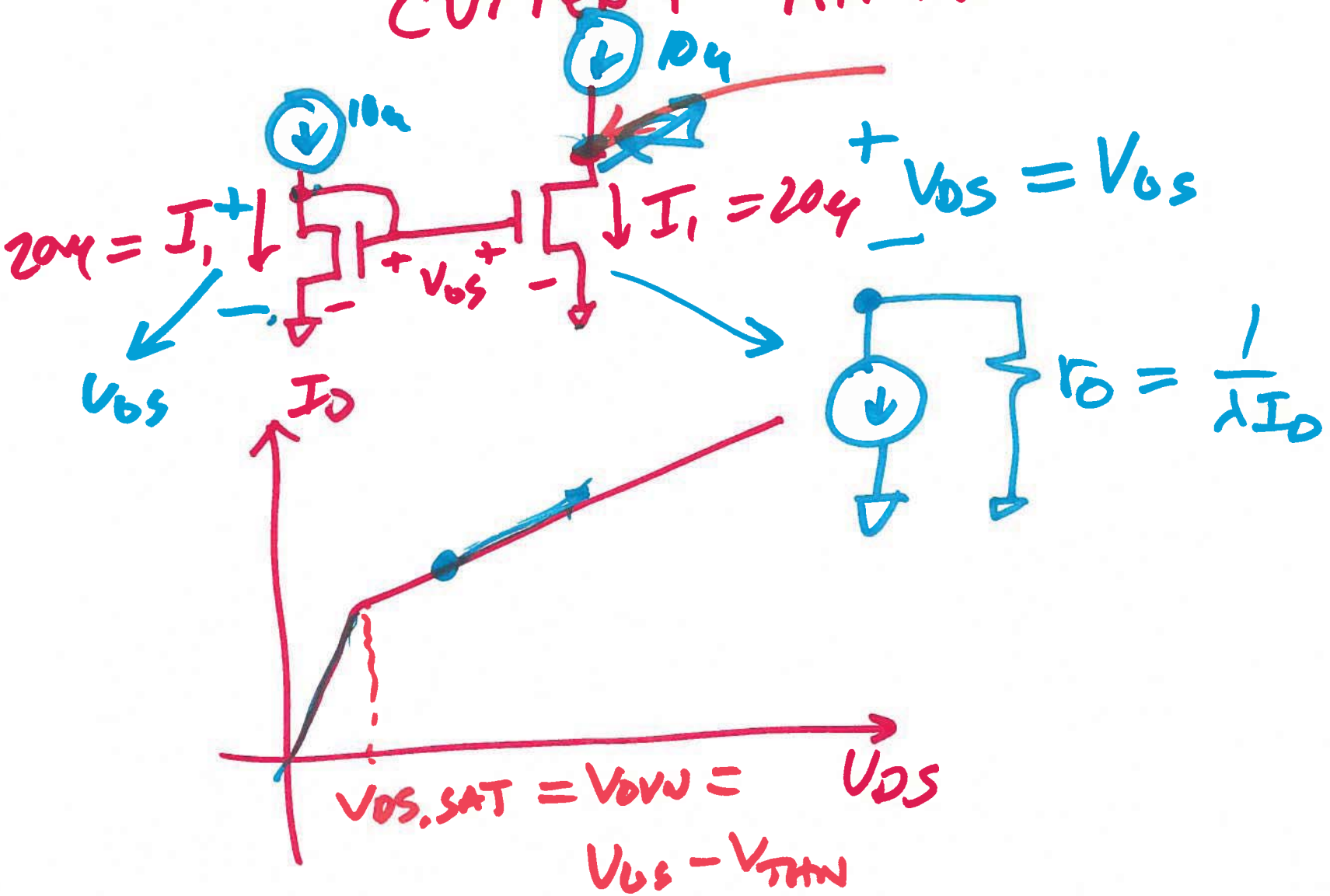
$$2S_4 = \frac{KP_n}{2} \cdot \frac{6}{1.2}\left(1.05 - .8\right)^2$$

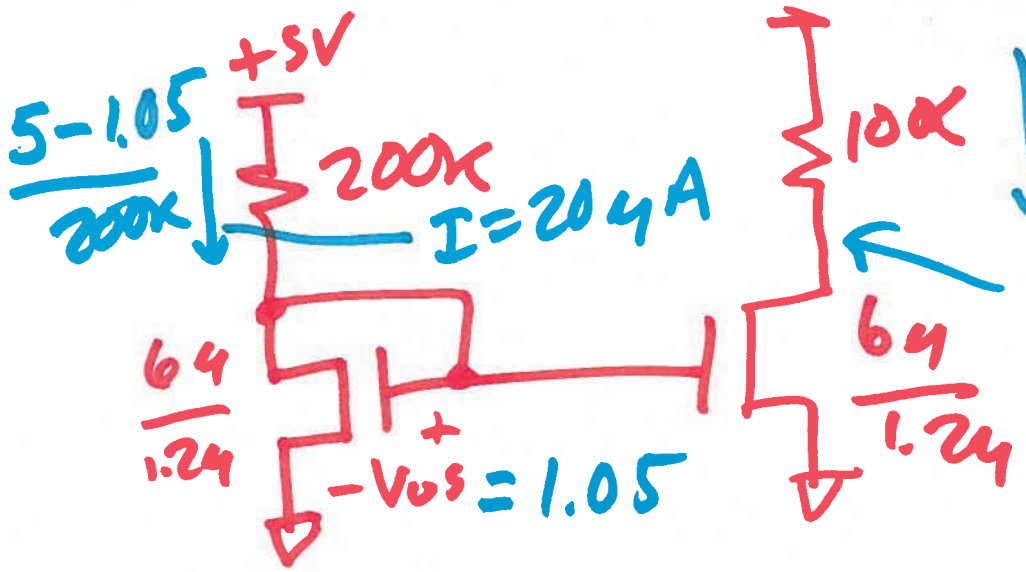
$$KP_n =$$

$$10 = KP \cdot \left(\frac{1}{4}\right)^2$$

$$KP = 160\,\mu A/V^2$$

Current Mirrors





$5 - 20\mu A \cdot 100K = \underline{3V}$

$20 \times 10^{-6} \times 10^{5}$

$20 \times 10^{-1} = 2V$

$$\frac{5 - V_{GS}}{200K} = \frac{160\mu A/V^2}{2} \cdot \frac{6}{1.2}\left(V_{GS} - .8\right)^2$$

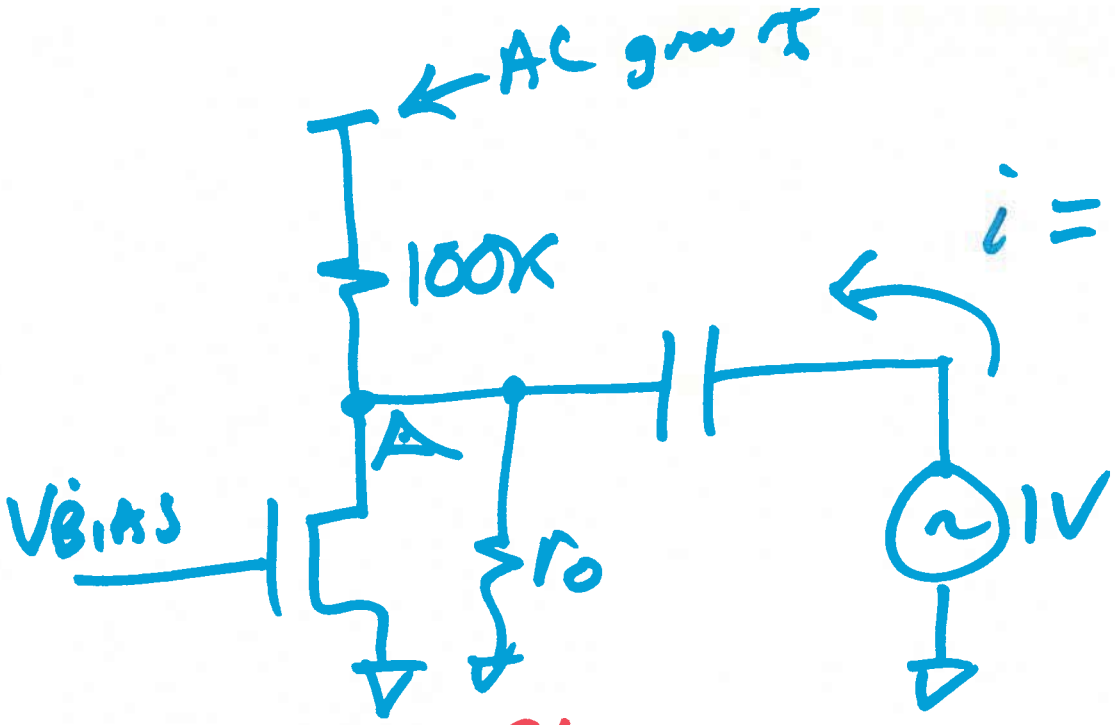
$$5 - V_{GS} = 2\times10^{5} \cdot 400 \times 10^{-6} \cdot (V_{GS} - .8)^2$$

$$= 80(V_{GS}^2 - 1.6V_{GS} + .64)$$

$$0 = 80V_{GS}^2 - 127V_{GS} + 46.2$$

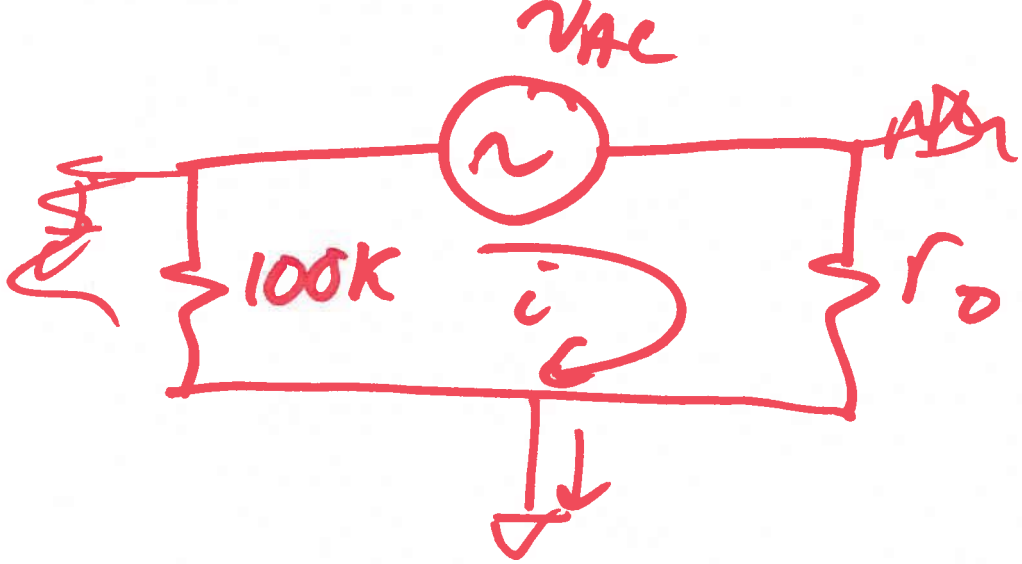
$$V_{GS} = \frac{+127 \pm \sqrt{127^2 - 4 \cdot 80 \cdot 46.2}}{160}$$

$$V_{GS} = 1.05$$



$$i = \frac{1}{100K \parallel r_o} \simeq 10\mu A$$

Assuming $r_o >> 100K$



$$i = \frac{v_{AC}}{100K + r_o}$$