# Quiz for Lesson 30

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# <u>Prob. 1</u>

(a) Determine the bias voltage V<sub>GS</sub> required for the following CS amplifier to have the small-signal voltage gain of -10. (b) What is the minimum voltage for V<sub>DD</sub> that can maintain this voltage gain? Use  $\mu_n C_{ox} = 200\mu A/V^2$ , (W/L)=20/0.2, V<sub>TH</sub> = 0.4V,  $\lambda$  = 0.

$$V_{DD} = 1.8$$

$$R_{D} \ge 2 k\Omega$$

$$V_{in} \circ V_{out}$$

$$M_{1}$$

v

### Prob. 2

Determine the drain current for M<sub>1</sub> and M<sub>2</sub> so that the following CS amplifier has the small-signal voltage gain of -20 assuming both transistors are in saturation. M<sub>1</sub> has  $\mu_n C_{ox} = 200\mu A/V^2$ , (W/L)=20/0.2, V<sub>TH</sub> = 0.4V,  $\lambda = 0.1 V^{-1}$ , and M<sub>2</sub> has  $\mu_p C_{ox} = (200/3)\mu A/V^2$ , (W/L)=60/0.2, V<sub>TH</sub> = -0.4V,  $\lambda = 0.1 V^{-1}$ . Consider the channel modulation effect only for the small-signal analysis and not for the large signal analysis.



### Prob. 3

Determine  $V_{GS1}$ ,  $V_b$  that provide the drain current determined in Prob. 2 using the same conditions given in Prob. 2.