1. Sketch $V_{out}$ versus $V_{in}$ as $V_{in}$ varies from 0 to $V_{DD}$. Indicate and calculate all the breakpoints (the values of $V_{in}$ and $V_{out}$) and corresponding operation regions (cutoff, linear or saturation) of transistors $M_1$ and $M_2$.
Assume $V_{t0}$ (NMOS) = 0.5V, $V_{t0}$ (PMOS) = -0.6V, $k'W/L$ (NMOS) = 8mA/ $V^2$, $k'W/L$ (PMOS) = 3mA/ $V^2$. $V_{DD}$ = 3V, $R_1$=$R_2$=10K$\Omega$. 

![Circuit Diagram]
2. For each of the two circuits below, perform the calculations (a) and (b) by hand. Assume $V_{t0} = 0.5V$, $k'W/L$ (NMOS) = 8mA/V$^2$, $\lambda = 0.1V^{-1}$, $\gamma = 0.2V^{1/2}$. $R_s = 200\Omega$, $R_{L1} = 10K\Omega$, $R_{L2} = 10k\Omega$, $V_{bias} = 1.2V$ and $V_{DD} = 3V$.

a) Determine the dc voltage $V_{in}$, so that the output $V_{out}$ is at 1.5V. Assume that $V_{in}$ is between 0 and $V_{DD}$.

b) Calculate the operating point parameters $I_{DS}$, $V_T$ and $V_{DSAT}$ and the small signal parameters $g_m$, $g_{mbs}$ and $r_o$. 

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**Circuit Diagrams:**

![Circuit Diagram 1](image1)

![Circuit Diagram 2](image2)