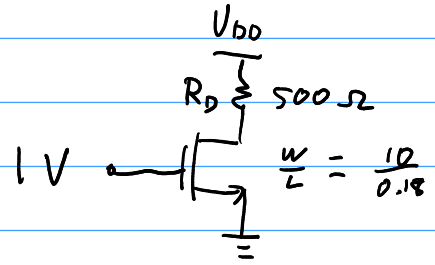
6.24



Given $\lambda = 0$.
What is the minimum V_{DD} to keep the transistor in saturation?

$V_{GS} = 1\ V \quad \therefore \quad V_{GS} - V_{TH} = 0.6\ V.$

$\therefore$ The edge of saturation is $V_{DS} = 0.6\ V.$

Analysing the circuit: $V_{DD} = 500\, I_D + V_{DS}$ (1)

Also $I_D = \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS} - V_{TH})^2$

$= \frac{1}{2} \times 200 \times 10^{-6} \times \frac{10}{0.18} \times (0.6)^2$

$= 2\ mA.$

From Eq. (1): $V_{DD,min} = 500 \times 2 \times 10^{-3} + 0.6$

$= 1.6\ V.$