1. Assumed values:

$$V_{\text{tn, short}} \approx 0.35\text{V}$$
$$\lambda_{\text{n, short}} \approx 0.75\frac{1}{\text{V}}$$
$$C_{\text{ox}}v_{\text{max, n}} \approx 1300\frac{\mu\text{A}}{\text{V}\cdot\mu\text{m}}$$

2. 4.30b

$$\frac{V_{DS2}}{L} = \frac{0.8\text{V}}{0.065\mu\text{m}} \approx 12.3\frac{\text{V}}{\mu\text{m}} > 5\frac{\text{V}}{\mu\text{m}}$$

$$\boxed{M_2 \text{ is velocity saturated}}$$

$$I_{D2} = W_2 V_{ov2} C_{\text{ox}} v_{\text{max}}(1+\lambda V_{DS2})$$
$$10\mu\text{A} = (0.65\mu\text{m})(V_{GS2} - 0.35\text{V})\left(1300\frac{\mu\text{A}}{\text{V}\cdot\mu\text{m}}\right)(1+0.75(0.8))$$
$$V_{GS2} \approx 0.357\text{V}$$

$$\frac{V_{DS1}}{L} = \frac{0.357\text{V}}{.065\mu\text{m}} \approx 6.26\frac{\text{V}}{\mu\text{m}} > 5\frac{\text{V}}{\mu\text{m}}$$

$$\boxed{M_1 \text{ is velocity saturated}}$$

$$I_{D1} = W_1 V_{ov1} C_{\text{ox}} v_{\text{max}}(1+\lambda V_{DS1})$$
$$= (0.65\mu\text{m})\left(1300\frac{\mu\text{A}}{\text{V}\cdot\mu\text{m}}\right)(0.007\text{V})(1+(0.75)(0.357))$$
$$\approx 7.5\mu\text{A}$$
$$R = \frac{V_{DD} - V_{D1}}{I_{D1}}$$
$$\approx \frac{1.6 - 0.357}{7.5\mu} \Longleftarrow \text{Why is this consistent with 1.6??}$$
$$\approx 170\text{k}\Omega$$

3. 4.36b

We don't want V_{S2} to be so low that T_1 falls out of a predictable operating region, so we know that it has to be at least V_{tn} (0.35V). Similarly, we don't want it to be too high because then I_{D1} will be high and V_G2 will likely be too low and T_2 will fall out of a predictable operating region. Start with a safe number:

$$V_{S2} = 0.4\text{V}$$

From this, we know

$$\boxed{T_2 \text{ is velocity saturated}}$$

Working from this point:

$$\begin{aligned}
R_2 &= \frac{V_{S2}}{I_{OUT}} \\
&\approx \frac{0.4}{10\mu} \\
&= 40\text{k}\Omega \\
I_{OUT} &= \text{W}_2 V_{ov2} C_{\text{ox}} v_{\text{max}} (1 + \lambda V_{DS2}) \\
V_{ov2} &\approx 0.01\text{V} \\
\Rightarrow V_{GS2} &\approx 0.36\text{V} \\
\Rightarrow V_{G2} &\approx 0.76\text{V}
\end{aligned}$$

The gate of T_2 is tied to the drain of T_1, and from the above,

$$\boxed{T_1 \text{ is velocity saturated}}$$

$$\begin{aligned}
I_{D1} &= \frac{V_{DD} - V_{D1}}{R_1} \\
W_1 V_{ov1} C_{\text{ox}} v_{\text{max}} (1 + \lambda V_{D1}) &= \frac{V_{DD} - V_{D1}}{R_1} \\
R_1 &\approx \frac{V_{DD} - 0.76}{66.3\mu} \\
&\approx 2\text{k}\Omega
\end{aligned}$$