**ADDITIONAL PROBLEM**

\[ V_D = 7.0 \text{ V} \]

\[ V_T = 2.5 \text{ V} \]

\[ k = 4 \text{ mA/}\text{V}^2 \]

\[ V_{G1} = V_{G2} \]

M1 and M2 both saturated since

\[ V_{G2} = V_{G1} \quad V > 0 \quad \text{therefore} \quad V_D = V_{G1} - V_T \]

\[ V_{D3} = V_{G3} \]

By KVL

\[ V_{D3} + V_{G3} + V_D = V_{G3} + V_{G2} = V_D \]

\[ I_{D3} = I_{D2} \quad \text{by KCL} \]

\[ K(V_{G2} - V_T)^2 = K(V_{G3} - V_T)^2 \]

\[ \Rightarrow \text{same } k \quad \text{and} \quad V_{G3} = V_{G2} \]

\[ V_{G3} = V_{G2} = V_{G1}/2 \]

And \( V_{G3} = V_{G2} \)

\[ \Rightarrow I_{D3} = K(V_{G3} - V_T)^2 \quad \text{while saturated} \]

\[ -I_{D3} = 25 \text{ mA} \]
ADDITION PROBLEM CONTINUED

\[ E_0 \text{ will be constant as long as } M_3 \text{ is saturated.} \]

\[ \text{New } M_3 \text{ is saturated at } V_{o3} = V_{o3} \text{ max} \]

\[ V_{o5} = V_{o3} - V \implies V_{o5} = 2.5V \]

\[ \text{Now } V_{o5} = V_{o0} - E_0 R \]

\[ R = \frac{V_{o0} - V_{o5\text{ max}}}{E_0} \]

\[ R \approx 500 \Omega \]