Soluções Electrónica II B

$I_{DS} = k\,(V_G - V_T)\,V_{DS}$ (linear. $V_{DS} < V_G - V_T$)

$I_{DS} = \frac{1}{2} k\,(V_G - V_T)^2$ (sat. $V_{DS} \geq V_G - V_T$)

① $V_D = 10\ V$, $V_G = 5V$, $V_S = 0$, $V_T = 1\ V$

a: $r_i = \infty$ (não há corrente de entrada!)

b: $r_o \equiv 1 / \frac{\partial I_{DS}}{\partial V_{DS}}$. Saturação

$$I_{DS} = \frac{1}{2} k\,(V_G - V_T)^2$$

$$\frac{\partial I_{DS}}{\partial V_{DS}} = 0 \Rightarrow r_o = 1/0 = \infty$$

c: $g_m \equiv \frac{\partial I_{DS}}{\partial V_G} = k\,(V_G - V_T)$

$$= 0.1\ \frac{mA}{V^2} \cdot (5V - 1V) = 0.4\ mA/V$$

$$= 400\ \mu S$$

② $V_D = 2V$, $V_G = 5\ V$, $V_S = 0$, $V_T = 1\ V$

a: $r_i = \infty$ (não há corrente de entrada!)

b: linear: $I_{DS} = k\,(V_G - V_T)\,V_{DS}$

$$\frac{\partial I_{DS}}{\partial V_{DS}} = k\,(V_G - V_T) = 0.1\ \frac{mA}{V^2} \cdot (5V - 1V)$$

$$= 0.4\ mA/V$$

$$r_o \equiv \left/ \frac{\partial I_{DS}}{\partial V_{DS}} \right. = \left/ 0.4\ \text{mA/V} \right. = 2500\ \text{V/A} = 2.5\ \text{k}\Omega$$

c: $$g_m \equiv \frac{\partial I_{DS}}{\partial V_G} = k V_{DS} = 0.1\ \frac{\text{mA}}{\text{V}^2} \cdot 2\text{V}$$

$$= 0.2\ \frac{\text{mA}}{\text{V}} = 200\ \mu\text{S}$$