

①

PROBLEMS 2A

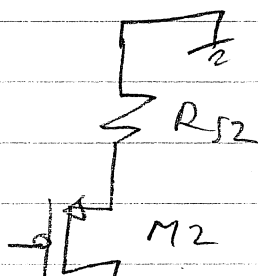
SOLUTIONS

$$\underline{Q1} \quad g_m = \frac{2I_D}{V_{OV}} = \frac{2(100 \mu A)}{0.2} = 1 \text{ mA/V}$$

$$r_o = \frac{V_A}{I_D} = \frac{10}{100 \mu A} = 100 \text{ k}$$

$$\frac{v_i}{v_s} = -g_{m1} (R_{D1} \parallel r_o) = -(1 \text{e-}3) (10 \text{ k} \parallel 100 \text{ k})$$

$$\frac{v_i}{v_s} = -9.09 \text{ V/V}$$

FOR $\frac{v_o}{v_i}$ 

$$R_x = (1 + g_{m2} R_{S2}) r_{o2}$$

$$R_x = 600 \text{ k}$$

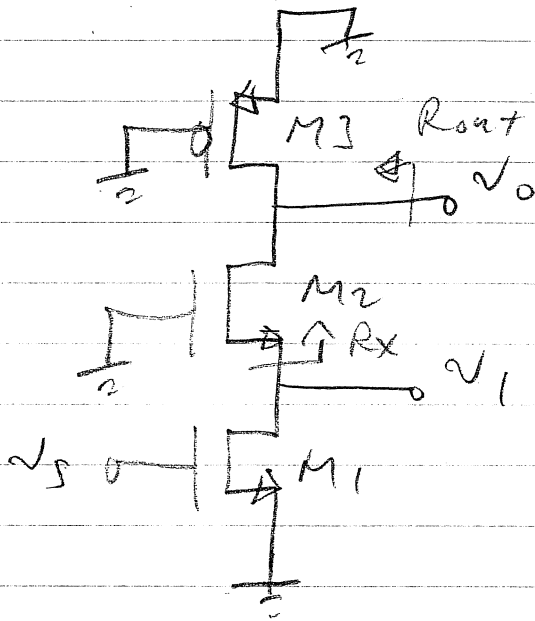
$$\text{SO } R_{out} = R_x \parallel r_o = 85.7 \text{ k}$$

$$\frac{v_o}{v_i} = - \left(\frac{1}{g_m} + R_S \right)^{-1} R_{out} = \frac{-R_{out}}{r_s + R_S} = -14.3 \text{ V/V}$$

$$\frac{v_o}{v_s} = \frac{v_o}{v_i} \times \frac{v_i}{v_s} = +130 \text{ V/V}$$

(2)

Q2 $g_m = \frac{2I_D}{V_{ov}} = 1 \text{ mA/V}$ $r_o = \frac{V_A}{I_D} = 100 \text{ k}$



$$R_x = \frac{r_{o3}}{g_{m2} r_{o2}} + \frac{1}{g_{m2}}$$

$$R_x = \frac{2}{g_m} = 2 \text{ k}$$

$$\frac{v_1}{v_5} = -g_{m1} (R_x \parallel r_{o1}) \approx -2 \text{ V/V}$$

$$\frac{v_0}{v_1} = g_{m2} (r_{o3} \parallel r_{o2}) = 50 \text{ V/V}$$

$$\frac{v_0}{v_5} = \frac{v_0}{v_1} \times \frac{v_1}{v_5} = -100 \text{ V/V}$$