1. (16%) In Fig. 1, please calculate the value of R_{out} for maximum power, and determine the maximum power absorbed by R_{out}.
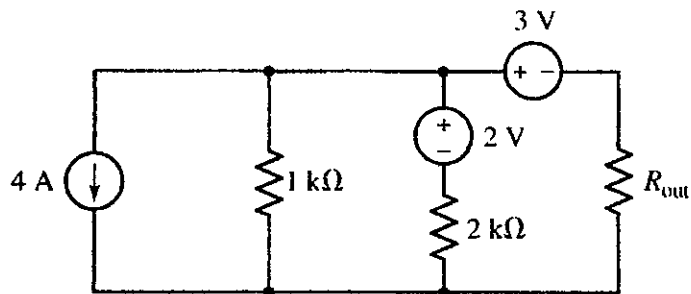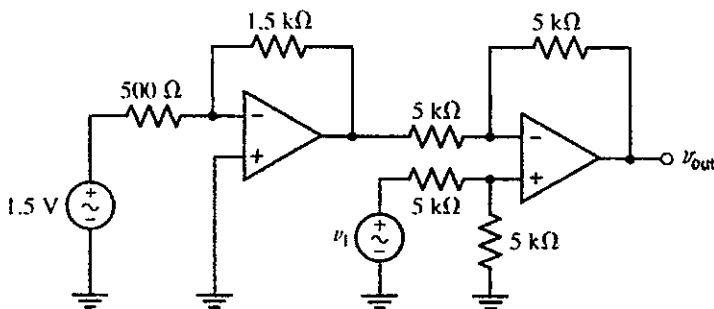2. (14%) In Fig. 2, please find v_{out} if v_1 equals -5 V.

Fig. 1.

Fig. 2.

3. (24%) In Fig. 3, let $i_s = 60e^{-200t}$ mA with $i_1(0) = 20$ mA. (a) Find $v(t)$ for all t. (b) Find $i_1(t)$ for $t \geq 0$. (c) Find $i_2(t)$ for $t \geq 0$.
4. (12%) Please plot the input/output characteristics of the circuits depicted in Figs. 4(a) and 4(b) using an ideal model for the diodes. Assume $V_B = 2$ V.
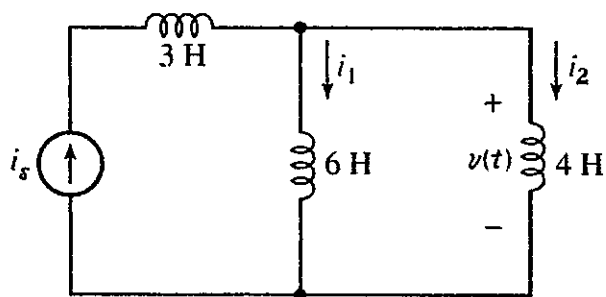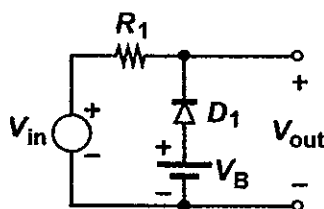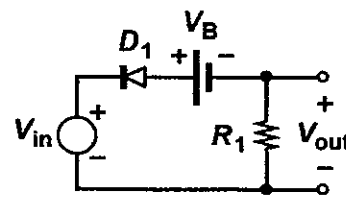
Fig. 3.

Fig. 4(a).

Fig. 4(b).

5. (16%) The transistor in Fig. 5 is biased with a constant current source $I = 1$ mA and has $\beta = 100$ and $V_A = 100$ V. Please calculate the overall voltage gain v_y / v_{sig}.
6. (18%) The NMOS and PMOS transistors in the circuit of Fig. 6 are matched with $k'_n(W_n/L_n) = k'_p(W_p/L_p) = 1$mA/V^2 and $V_{tn} = -V_{tp} = 1$ V. Assuming $\lambda = 0$ for both devices, find the drain currents i_{DN} and i_{DP} and the voltage v_O for $v_I = 0$ V, +2.5 V, and –2.5 V.
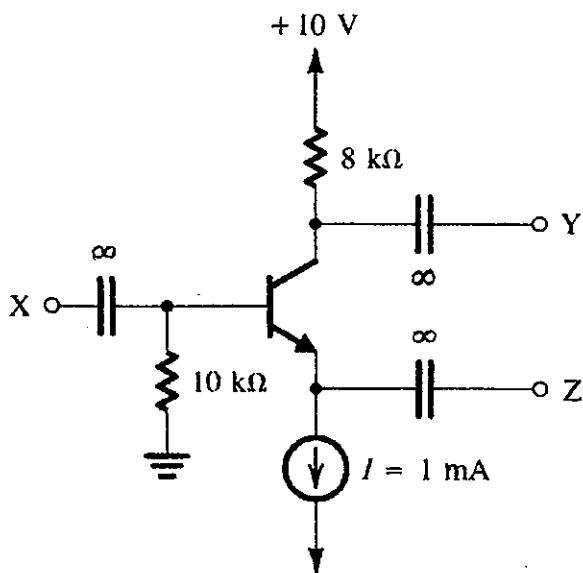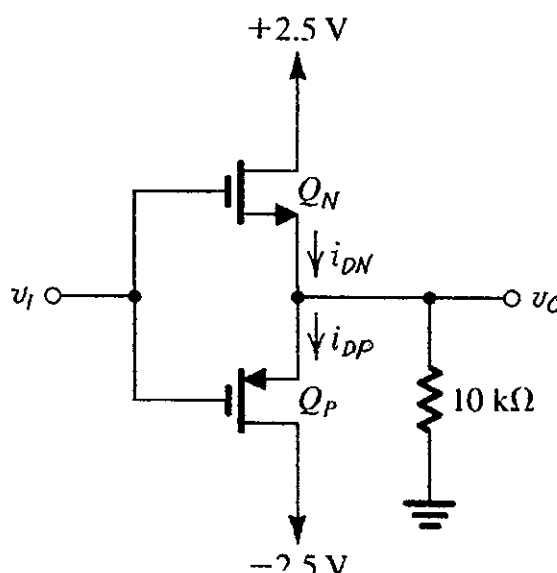
Fig. 5.

Fig. 6.

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