Show all work in the allotted space for each problem and circle each answer. No other material will be accepted for test answers.

1. Consider the schematic given at the right in which $V_1 = 2V$, rail voltages are $\pm 15V$, $I_1 = 1 \text{ mA}$, $R_1 = R_2 = R_3 = 1k$. Assume that a forward-biased diode has a drop of .7 volt.
   a. (20) Find $V_a$, $V_b$, $V_c$, and $V_d$.
   b. (10) If errors due to input bias currents are to be minimized, how should the circuit be modified?
   c. (10) If $I_1 = 0$, what is $V_c$?
   d. (10) Sketch $V_c$ as $V_1$ varies from $-20$ to $+20 \text{ V}$ if $I_1$ is shorted out.
2. In the following circuit, assume that each diode is ideal unless other information is given. The resistors all have a value of 1K.

a. (10) If $V_1 = -20V$, $V_4 = 0V$, $V_2 = -30V$ and $V_3 = 15V$, find $V_a$ and $V_b$.

b. (10) If $V_1 = 30V$, $V_2 = V_3 = 10V$ and $V_4 = 10V$, find $V_a$ and $V_b$.

c. (10) If $V_1 = -20V$, $V_2 = V_4 = -30V$, and $V_3 = -35V$, find $V_a$ and $V_b$.

d. (10) If $V_1 = -30V$, $V_2 = V_3 = 15V$ and $V_4 = 10V$, find $V_a$ and $V_b$.

e. (10) If one of the diodes has a forward current of 100 mA, how much power does it dissipate?