4.24

Connecting an identical diode in parallel would reduce the current in each diode by a factor of 2. Writing expressions for the currents, we have:

$$I_D = I_S e^{V_D/V_T}$$

$$\frac{I_D}{2} = I_S e^{(V_D - \Delta V)/V_T} = I_S e^{V_D/V_T} \cdot e^{-\Delta V/V_T}$$

Taking the ratio of the above two equations, we have:

$$2 = e^{\Delta V/V_T} \Rightarrow \Delta V = 17.6 \text{ mV}$$

Thus the result is a decrease in the diode voltage by 17.6 mV.

4.26

We can write the following KCL equations for the diode currents:

$$I_{D2} = 10\text{ mA} - V / R$$

$$I_{DI} = V / R$$

We can write the following KVL equations for the diode voltages:

$$V = V_{D2} - V_{DI}$$

We can write the following diode equations:

$$I_{D2} = I_S e^{V_{D2}/V_T}$$

$$I_{D1} = I_S e^{V_{D1}/V_T}$$

Taking the ratio of the two equations above,we have:

$$\frac{I_{D2}}{I_{DI}} = \frac{10\text{ mA} - V / R}{V / R} = e^{(V_{D2} - V_{DI})/V_T} = e^{V/V_T}$$

To achieve $V = 80$ mV, we need:

$$\frac{I_{D2}}{I_{DI}} = \frac{10\text{ mA} - 0.08 / R}{0.08 / R} = e^{0.08/0.0254} = 23.3$$

Solving the above equation we have

$$R = 194\ \Omega.$$