The problem statement of **3.37** often causes confusion in students, so here is a detailed explanation of what is saying, and what it is asking for.

1. There exists a specific **junction** diode. We know two things about this junction diode:

a. its ideality factor is ***n*** **=2**.

b. when **700 mV** is placed across this junction diode, the resulting current will be **exactly 1.0 mA** (i.e., $i_D = 1.0\ mA$ when $v_D = 0.7\ V$).

Note statements *a* and *b* are sufficient to **completely characterize** this **junction** diode.

2. We **now** would like to construct a **PWL model** for this junction diode. The criteria for determining V_{D0} and r_D for this model are:

a. The **model** must **match exactly** the junction diode behavior **at** $i_D = 1.0\ mA$. In other words, the voltage across the **model** when 1.0 mA is flowing through the **model** must be exactly the **same** (i.e., no error!) as the voltage across the **junction diode** when 1.0 mA is flowing through the **junction diode**.

b. Likewise, the **model** must also **match exactly** the junction diode behavior **at** $i_D = 10.0\ mA$. In other words, the voltage across the **model** when 10.0 mA is flowing through the **model** must be exactly the **same** (i.e., no error!) as the voltage across the **junction diode** when 10.0 mA is flowing through the **junction diode**.

Note the above set of criteria is one of the two methods **we discussed in class** for constructing a PWL model. Specifically, we want the PWL "curve" to **intersect exactly two specific points** ($i_D = 1.0\,mA$ and $i_D = 10.0\,mA$) **on the junction diode curve**.

You must find a PWL model (i.e., find the values of V_{D0} and r_D) that satisfies these criteria.

3. Recall that the PWL "curve" is actual a line, and thus can intersect an exponential junction diode curve at **only two points** (see above), as a result, the **PWL model** will almost always provide an **approximate** answer—the answer will be in **error**!

But, this error (**if** we have wisely constructed the PWL model) will typically be **small**. How small? This problem asks **you** to find out. You must:

a. Use the PWL **model** you determined above (i.e., using the values of V_{D0} and r_D that provided a perfect match at $i_D = 1.0\,mA$ and $i_D = 10.0\,mA$) to determine the **approximate** voltage across the junction diode at each of three different currents ($i_D = 0.5\,mA$, $i_D = 5.0\,mA$, and $i_D = 14.0\,mA$). You of course achieve these **approximate** values by determining the voltage across the **PWL model** at each of these three currents.

b. Use the exponential **junction diode** curve for this junction diode to determine **exactly the voltage** across the junction diode for each of these same three currents.

c. **Subtract** the two results (model voltage minus junction diode voltage) to determine the **voltage error** provided by the **model** (remember, the **PWL model** is the **approximation**!)for each of the three currents. Does this error seem **significant** to you?