Determine \( V_D \)

\( I_D \), assume diode has current of \( 1 \text{mA} \) @ \( 0.7 \text{V} \)

**Iteration #1**
Assume \( V_D = 0.7 \text{V} \)

\[
I_D = \frac{V_D}{R} = \frac{5 - 0.7}{1K} = 4.3 \text{ mA}
\]

Use diode equations to get better estimate for \( V_D \)

\[
V_2 - V_1 = 2.3V_T \log \left( \frac{I_2}{I_1} \right)
\]

\[
2.3V_T = 0.06 \text{V}
\]

\[
V_2 = V_1 + 0.06 \log \left( \frac{I_2}{I_1} \right)
\]

Substitute

\[
V_1 = 0.7 \text{V} \quad I_1 = 1 \text{mA} \quad I_2 = 4.3 \text{ mA}
\]

\[
\Rightarrow V_2 = 0.763 \text{V}
\]

**Iteration #2**

\[
I_D = \frac{(5 - 0.763 \text{V})}{1K} = 4.237 \text{ mA}
\]

\[
V_2 = 0.763 + 0.1 \log \left( \frac{4.237}{4.3} \right)
\]

\[
V_2 = 0.762 \text{V}
\]

\( \Rightarrow \) stop because results are converging.
Section 4.3.5 Constant Voltage Drop Model

- Use a vertical line to approximate fast rising exponential i-v curve.
- Forward conducting diode exhibits a constant voltage drop $V_D$ (usually $V_D = 0.7\,V$)

Equivalent circuit

For ex 4.4 using this model, will approximate $I_D$ as $I_D = \frac{V_{DD} - V_D}{R}$

$\Rightarrow I_D = 4.3\,mA$

4.3.6 Ideal diode model.
Neglect voltage drop in diode.
- Good for applications w/ voltages $>\$ diode drop.
  \[ V_D = 0 \quad I_D = 5\,mA \] (from ex 4.4)