Ex:

After being closed for a long time, the switch opens at $t = 0$. Find $i_1(t)$ for $t > 0$.

\[
\begin{align*}
\text{given:} & \quad t = 0^- \text{ model:} \quad (\text{to find } i_L(0^-)) \quad \text{L acts like wire} \\
\text{we see that the } 12V \text{ source is across the } 20 \text{ m}\Omega \text{ and the } 4 \text{ m}\Omega.
\end{align*}
\]

\[
\begin{align*}
i_b &= \frac{12V}{20 \text{ m}\Omega} = 600 \text{ A} \\
\text{and } 100i_b &= 100 \cdot 600 \text{ A} = 60 \text{ kA}. \\
i_1 &= \frac{12V}{4 \text{ m}\Omega} = 3 \text{ kA}
\end{align*}
\]

We find $i_L$ from a current sum at the center node.
\[-100i_y + i_1 - i_L(0^-) = 0 \text{ A}\]
\[-60\text{ kA} + 3\text{ kA} = i_L(0^-)\]

or \[i_L(0^-) = -57\text{ kA}\]

\[t = 0^+ \text{ model: } i_L(0^+) = i_L(0^-) = -57\text{ kA}\]

L modeled as current source

Because of the open circuit on the left, we have \(i_y = 0\) and \(100i_y = 0\).

From a current summation at the center node, we have \(i_1(0^+) = i_L(0^+) = -57\text{ kA}\).

\[i_1(0^+) = -57\text{ kA}\]

\(t \to \infty\) model: (to find \(i_1(t \to \infty)\)) L acts like wire
We have 12V across the 4 mΩ.

\[ i_1(t+\infty) = \frac{12V}{4 \text{ mΩ}} = 3 \text{ kA} \]

Model for \( t = L / R_{\text{Th}} \):

We observe that the Thevenin equivalent seen from the terminals where the \( L \) is connected is just the 4 mΩ and 12V:

We find \( R_{\text{Th}} \) by turning off the 12V source, causing it to be a wire. We see \( R_{\text{Th}} = 4 \text{ mΩ} \). (The circuit is already a Thevenin equivalent.)

\[ \tau = \frac{L}{R_{\text{Th}}} = \frac{5 \text{ mH}}{4 \text{ mΩ}} = 1.25 \mu\text{s} \]
Now we use the general form of solution:

\[ i_1(t) = i_1(t \to \infty) + \left[ i_1(0^+) - i_1(t \to \infty) \right] e^{-t/t} \]

or

\[ i_1(t) = 3kA + \left[ -57kA - 3kA \right] e^{-t/1.25\mu s} \]

or

\[ i_1(t) = 3kA + -60kA e^{-t/1.25\mu s} \]