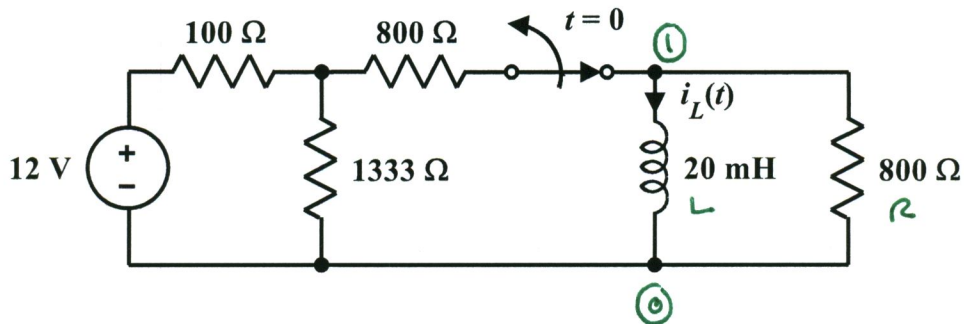# Problem #07

The switch has been closed for a long time before being opened at $t = 0$. Find an analytical expression for $i_L(t)$ for $t \geq 0$. Also use SPICE-based simulation software to plot $i_L(t)$ for $0 \leq t \leq 5\tau$, where τ is the circuit time constant for $t > 0$.

$1333\,\Omega \,\|\, 800\,\Omega = 500\,\Omega$

$$\Rightarrow \quad i_L(0^-) = \frac{\left(\frac{500}{100 + 500}\right)(12\text{V})}{800\,\Omega} = \frac{25}{2}\ \text{mA}$$

For $t \geq 0$:

$$\tau = \frac{20\,\text{mH}}{800\,\Omega} = 25\,\mu s$$

$$i_L(t) = \frac{25}{2}\ e^{-t/25 \times 10^{-6}} \quad \text{mA}$$

$$= 12.5\ e^{-40000\,t} \quad \text{mA}, \quad t \geq 0$$

The input file for PSpice is:

```
Problem #07
L   1   0   20m   IC = 12.5m
R   1   0   800
.TRAN   1u   125u   0   1u   UIC
.PROBE            ↑ 5τ = 125μs
.END
```

See the next page for the output.

Problem #07