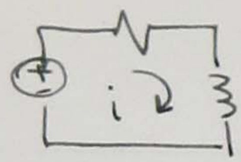
EEE 202 HW 3 SOLUTIONS

6.46 $E = \frac{1}{2} L i^2$

At ss, the inductor acts as a short so the effective circuit is

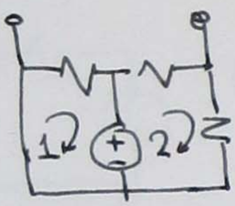


... → irrelevant

Then, $i = \frac{20}{1k} = 20\ mA$

$$\Rightarrow E = \frac{1}{2}\, 200\ mH \cdot (20\ mA)^2 = 40\ \mu J.$$

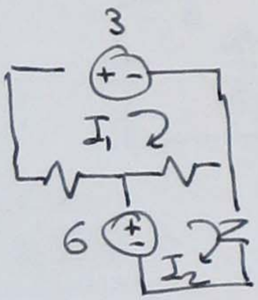
7.30 $t<0$



$$\left.\begin{array}{l} 6k\, I_1 + 6 = 0 \\ 6k\, I_2 + 6k\, I_2 - 6 = 0 \end{array}\right\} \Rightarrow \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} -1m \\ \frac{1}{2}m \end{pmatrix} A$$

KVL: $V_c(0^-) = -\left(\frac{1}{2}m \cdot 6k - 1m \cdot 6k\right) = 3\,V.$

$t > 0^+$



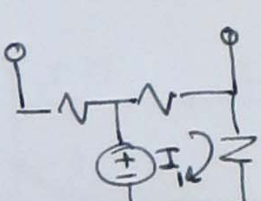
$$3 + (I_1 - I_2)6k + I_1 6k = 0$$

$$(I_2 - I_1)6k + I_2 6k - 6 = 0$$

$$\Rightarrow \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} 0 \\ \frac{1}{2}m \end{pmatrix} A$$

$$\Rightarrow i_o(0^+) = I_2 - I_1 (0^+) = \underline{\underline{\tfrac{1}{2}\ mA.}}\ (IC)$$

$t > 0\ (\to \infty)$

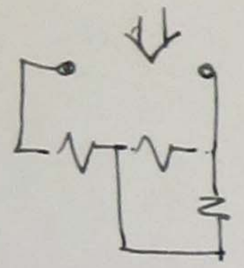


$$i_o(\infty) = \frac{6}{12k} = \frac{1}{2}\ mA.$$

$$\Rightarrow i_o(t) = \frac{1}{2}\ mA,\ \text{constant}.$$

For the computation of the time constant $\tau = R_{TH}C$, where

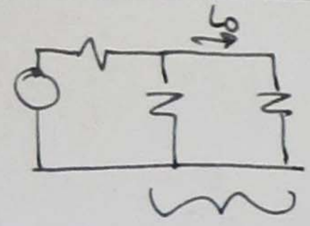
R_{TH} :



$= 6k + (6k \,\|\, 6k) = 9k$

$\Rightarrow \tau = 0.45$ s.

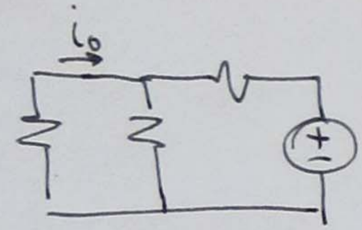
7.60 $t<0$



$2\|2 = 1$

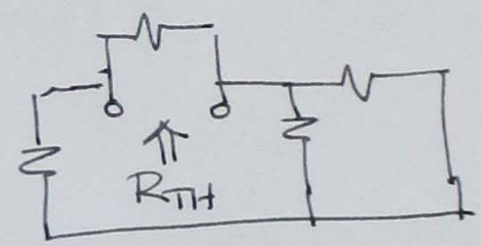
i_o is also the inductor current so it is continuous across $t=0$.
By symmetry, $i_o(0^-) = \frac{1}{2}\left(\frac{-30}{5+1}\right)$
$= -2.5$ A.

$t>0$



Again, by symmetry, $i_o = -\frac{1}{2} i_s$
$= -\frac{1}{2}\left(\frac{30}{2+1}\right) = -5$ A.

$\tau = \frac{L}{R_{TH}}$, where



$R_{TH} = 6 \,\|\, (2 + (2\|2))$
$= 2\,\Omega$

$\Rightarrow \tau = \frac{0.5}{2} = 0.25$ s.

Collecting the various terms $\left(FV + (IC - FV)e^{-t/\tau}\right)$

$i_o(t) = -5 + (-2.5+5)\,e^{-t/0.25}$ (A)