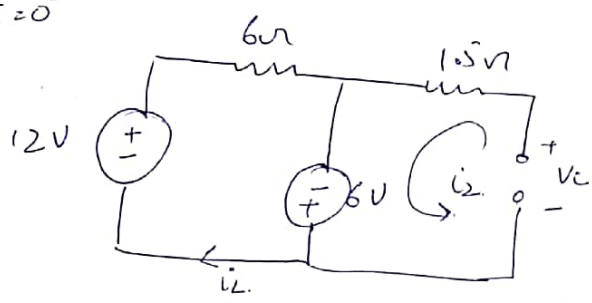
EE240 Circuits I

Quiz 8 - Section 2.

Solution

In stable circuit inductor is short circuit and Capacitor is open circuit. Hence at $t = 0^-$ the equivalent circuit is:

$t = 0^-$



$i(t(0^-)) = i_L$

$\frac{18}{6} = i(t) = i_L$

$\boxed{3A = i(t) = i_L}$

$i_L(0^+) = i_L(0^-) = 3A$

$V_c = 1.5 i_2 - 6$

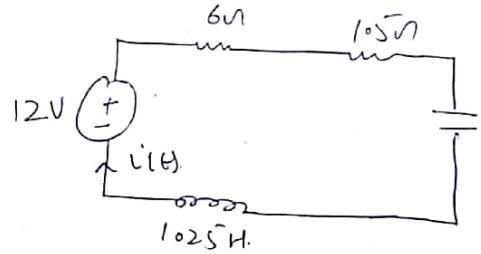
but $i_2 = 0$.

Hence.

$\boxed{V_c(0^-) = -6}$

$V_c(0^-) = V_c(0^+) = -6V$

For $t > 0$:



Loop Analysis:

$$\boxed{1.25\frac{di}{dt} + 7.5i + \frac{1}{0.1}\int i\,dt = 12}$$

$$\frac{d^2i}{dt} + \frac{6di}{dt} + 8i = 0.$$

$$\Downarrow$$

$$s^2 + 6s + 8 = 0.$$

$$\boxed{s = -2, \; -4.}$$

$i(t) = K_1 e^{-2t} + K_2 e^{-4t}$

$i(0) = K_1 + K_2 = 3.$ — (1)

$$1.25\frac{di}{dt} + 7.5\,i + \underbrace{\frac{1}{0.1}\int i\,dt}_{V_C} = 12$$

$i_L(0^-) = i_L(0^+) = 3.$

hence;

$$1.25\frac{di}{dt} + 7.5(3) - 6 = 12$$

$$\boxed{\frac{di}{dt}(0^+) = \frac{-18}{5}}$$

$$i(t) = K_1 e^{-2t} + K_2 e^{-4t}$$

$$\frac{di(t)}{dt} = -2K_1 e^{-2t} - 4K_2 e^{-4t}$$

$$\frac{di(0^+)}{dt} = -2K_1 - 4K_2 = \frac{-18}{5} \quad \text{(2)}$$

after solving (1) and (2) we get:

$$K_1 = \frac{21}{5} \text{ and } K_2 = \frac{-6}{5}$$

$$i(t) = \begin{cases} \frac{21}{5}e^{-2t} - \frac{6}{5}e^{-4t}\ A & t \geq 0 \\ 3\ A & ;\ t < 0 \end{cases}$$