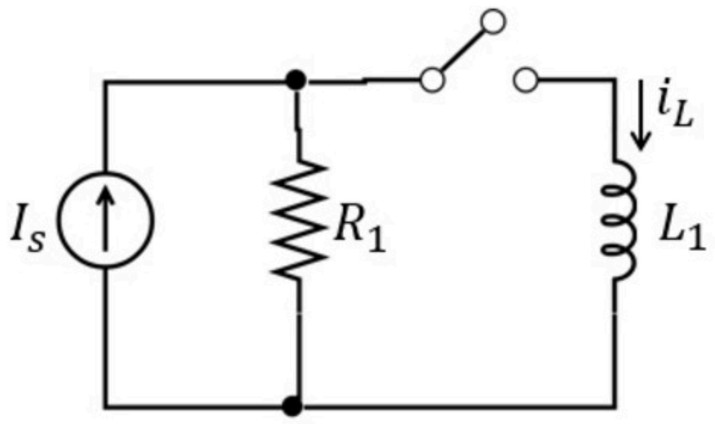
First order circuits 004

Problem has been graded.

The switch closes at time $t = 0$.
Find the current i_L for $t > 0$:

$$i_L(t) = A \cdot e^{-t/\tau} + B$$



Given Variables:

Is : 2 A
R1 : 10 kohm
L1 : 10 mH

Calculate the following:

A (A) :

-2 ✓

B (A) :

2 ✓

tau (ms) :

0.001 ✓

Hint: What is the current iL for t < 0?

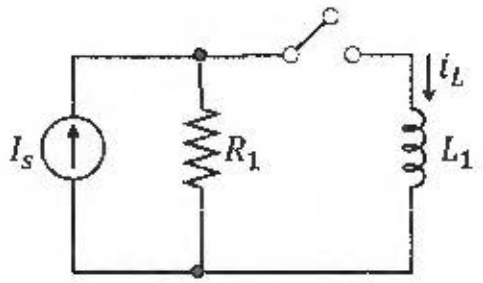
The switch closes at time $t = 0$.
Find the current i_L for $t > 0$:

$$i_L(t) = A \cdot e^{-t/\tau} + B$$

Is : 2 A

R1 : 3 kohm

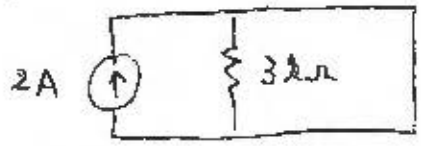
L1 : 30 mH



(a) $t = 0^-$: $i_L = 0$

(b) $t = 0^+$: $i_L(0^+) = i_L(0^-) = 0\,A$

(c) $t = \infty$:



$i_L(\infty) = 2\,A$

(d)

$R_{TH} = 3\,k\Omega$

$$\tau = \frac{L_1}{R_{TH}} = \frac{30 \cdot 10^{-3}}{3 \cdot 10^{3}} = 10 \cdot 10^{-6}\,s$$

$\boxed{\tau = 0.01\,ms}$

$B = i_L(\infty) = 2A \Rightarrow \boxed{B = 2A}$

$A + B = i_L(0^+) = 0A \Rightarrow \boxed{A = -2A}$

$$i_L(t) = 2 - 2e^{\frac{-t}{0.01\,ms}}\ A$$

$$i_L(t) = 2\left(1 - e^{\frac{-t}{0.01\,ms}}\right)\ A$$