First order circuits 008

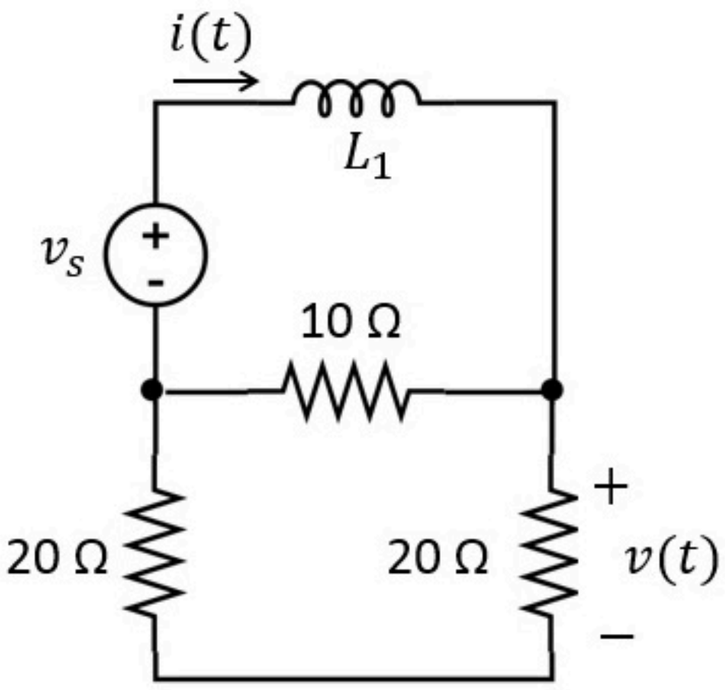
Unlimited Attempts.

When $t < 0$, $v_s = V_0$

When $t > 0$, $v_s = V_1$

Find $i(t) = A_1 + B_1 \cdot e^{-t/\tau 1}$ for $t > 0$

and $v(t) = A_2 + B_2 \cdot e^{-t/\tau 2}$ for $t > 0$



Given Variables:

V0 : 24 V

V1 : 32 V

L1 : 4 mH

Calculate the following:

A1 (A) :

4 ✓

B1 (A) :

-1 ✓

tau1 (ms) :

0.5 ✓

A2 (V) :

16 ✓

B2 (V) :

-4 ✓

tau2 (ms) :

0.5 ✓

Hint: What is the current iL for t < 0? Note where A and B are.

When $t < 0$, $v_s = V_0$

When $t > 0$, $v_s = V_1$

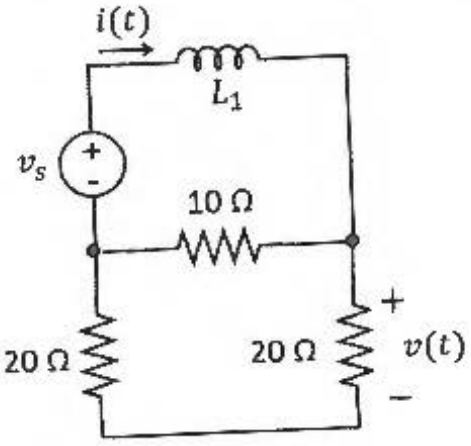
Find $i(t) = A_1 + B_1 \cdot e^{-t/\tau_1}$ for $t > 0$

and $v(t) = A_2 + B_2 \cdot e^{-t/\tau_2}$ for $t > 0$

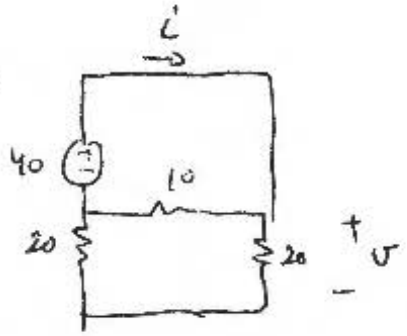
V0 : 40 V

V1 : 64 V

L1 : 2 mH



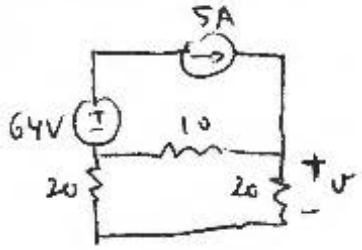
(a) $t = 0^-$



$$i(0^-) = \frac{40}{10 // 40} = \frac{40}{8} = 5\,A$$

$$v(0^-) = 40 \cdot \frac{20}{20+20} = 20\,V$$

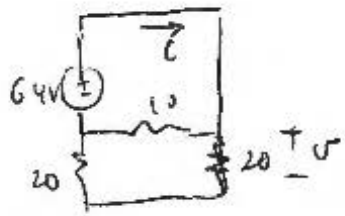
(b) $t = 0^+$



$$i(0^+) = 5\,A$$

$$v(0^+) = (5\,A) \cdot (10 // 40)\ \frac{20}{20+20} = 20\,V$$

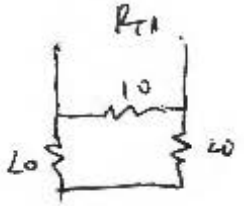
(c) $t = \infty$



$$i(\infty) = \frac{64}{10 // 40} = 8\,A$$

$$v(\infty) = 64 \cdot \frac{20}{20+20} = 32\,V$$

(d)



$$R_{TH} = 10 // 40 = 8\,\Omega$$

$$\tau = \frac{L}{R_{TH}} = \frac{2 \cdot 10^{-3}}{8} = 0.25 \cdot 10^{-3}$$

$A_1 = i(\infty) \Rightarrow$ **$A_1 = 8\,A$**

$B_1 + A_1 = i(0^+) \Rightarrow$ **$B_1 = -3\,A$**

$A_2 = v(\infty) \Rightarrow$ **$A_2 = 32\,V$**

$B_2 + A_2 = v(0^+) \Rightarrow$ **$B_2 = -12\,V$**

$\tau_1 = \tau_2 = 0.25\ ms$