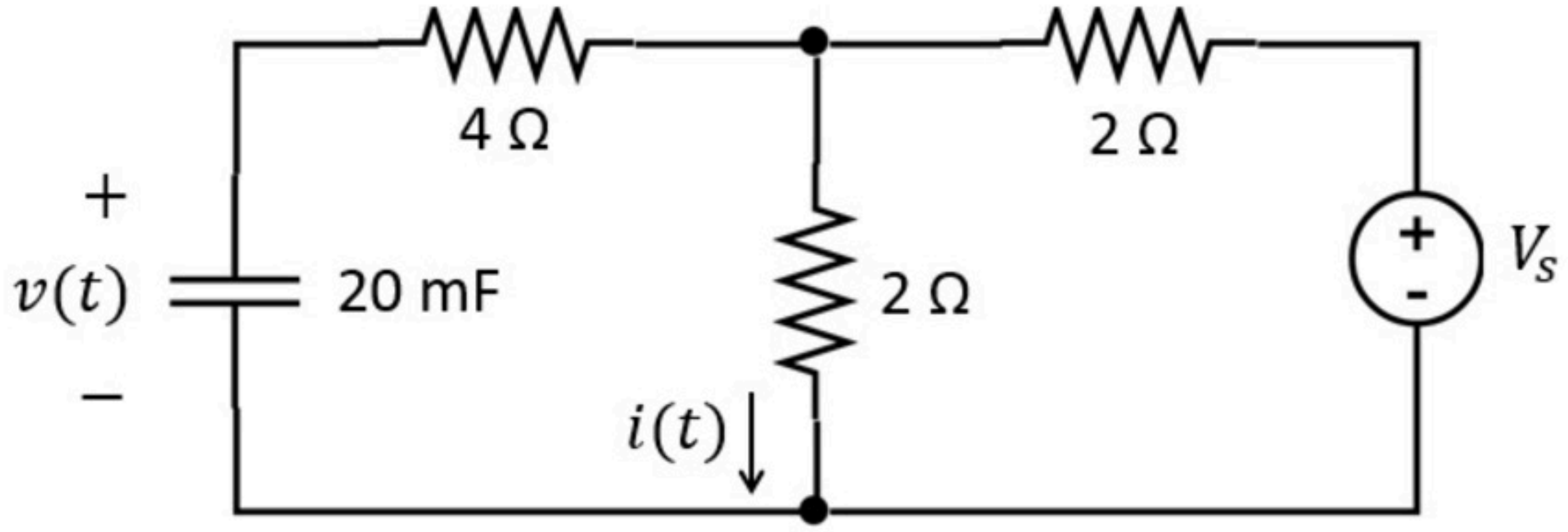
First order circuits 001

Problem has been graded.

Given a voltage $v(t)$, find the current $i(t)$.

$$v(t) = A_1 + B_1 \cdot e^{-10t}$$

$$i(t) = A_2 + B_2 \cdot e^{-10t}$$



Given Variables:

A1 : 10 V

B1 : 10 V

Vs : 20 V

Calculate the following:

A2 (A) :

5

B2 (A) :

1

Given a voltage $v(t)$, find the current $i(t)$.

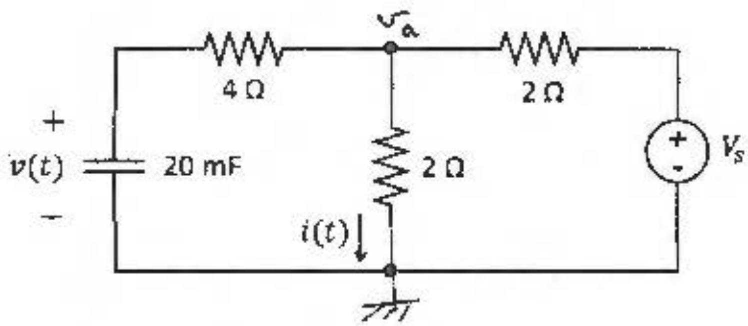
$$v(t) = A_1 + B_1 \cdot e^{-10t}$$

$$i(t) = A_2 + B_2 \cdot e^{-10t}$$

A1 : 10 V

B1 : 10 V

Vs : 20 V



NODAL

$$\frac{v_a - v}{4} + \frac{v_a - V_s}{2} + \frac{v_a}{2} = 0$$

$$v_a - v + 2(v_a - V_s) + 2v_a = 0$$

$$5v_a = v + 2V_s$$

$$v_a = \frac{v}{5} + \frac{2V_s}{5}$$

$$i = \frac{v_a}{2} = \frac{v}{10} + \frac{V_s}{5} = 1 + e^{-10t} + 4$$

$$\boxed{A_2 = 5\text{ A}}$$

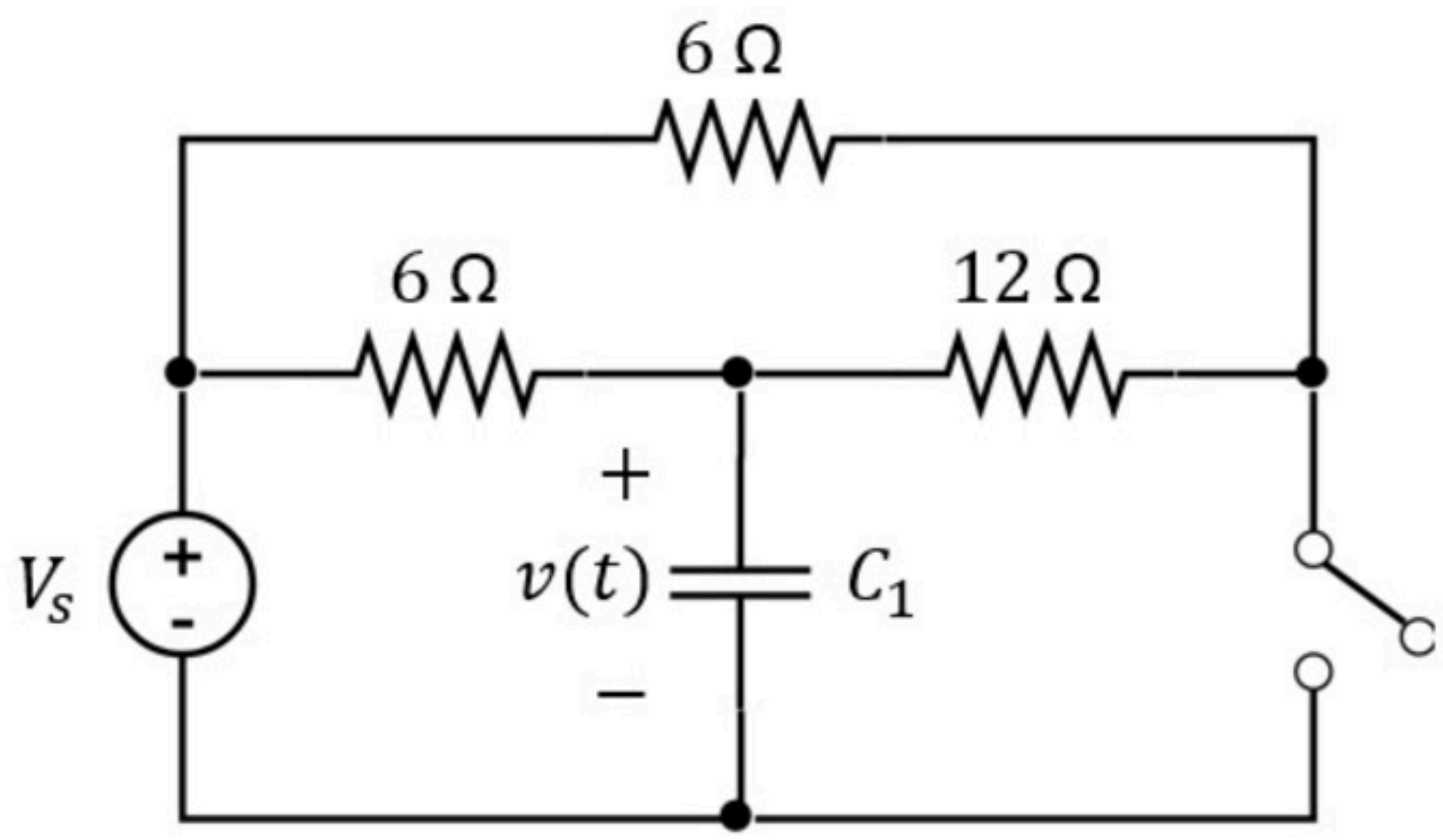
$$\boxed{B_2 = 1\text{ A}}$$

First order circuits 002

Unlimited Attempts.

a) Find the time constant τ_1 and the steady state capacitor voltage $v_1 = v(\infty)$ when the switch is open.

b) Find the time constant τ_2 and the steady state capacitor voltage $v_2 = v(\infty)$ when the switch is closed.



Given Variables:

Vs : 30 V

C1 : 8 nF

Calculate the following:

tau1 (ns) :

36

v1 (V) :

30

tau2 (ns) :

32

v2 (V) :

20

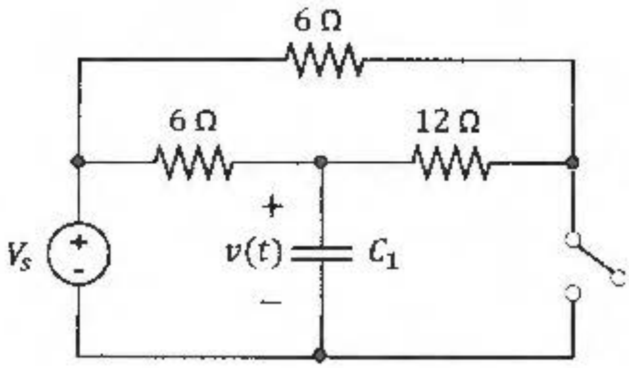
Hint: The circuit is different in the two cases

a) Find the time constant τ_1 and the steady state capacitor voltage $v_1 = v(\infty)$ when the switch is open.

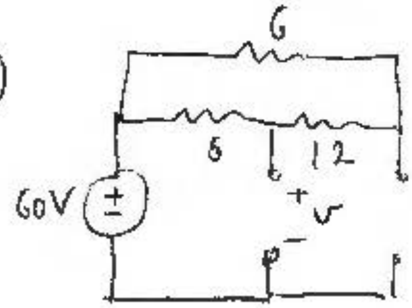
b) Find the time constant τ_2 and the steady state capacitor voltage $v_2 = v(\infty)$ when the switch is closed.

Vs : 60 V

C1 : 6 nF

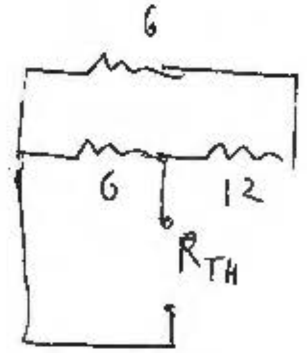


(a)



⇝ No CURRENTS

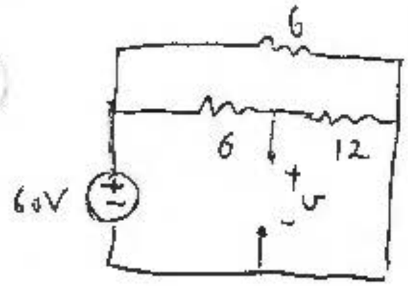
$\boxed{v_1 = 60V}$



$\tau_1 = R_{TH} \cdot C_1 \Rightarrow \boxed{\tau_1 = 27\ ns}$

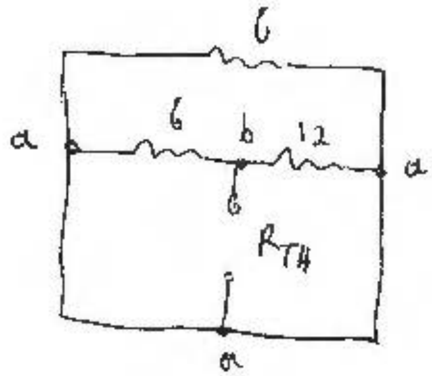
$R_{TH} = 6 \,//\, 18 = \frac{9}{2}\ \Omega$

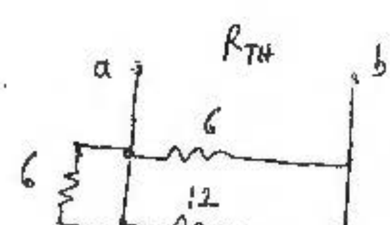
(b)



$v = 60 \cdot \frac{12}{6+12} = 40$

$\boxed{v_2 = 40V}$





$R_{TH} = 6 \,//\, 12 = 4\ \Omega$

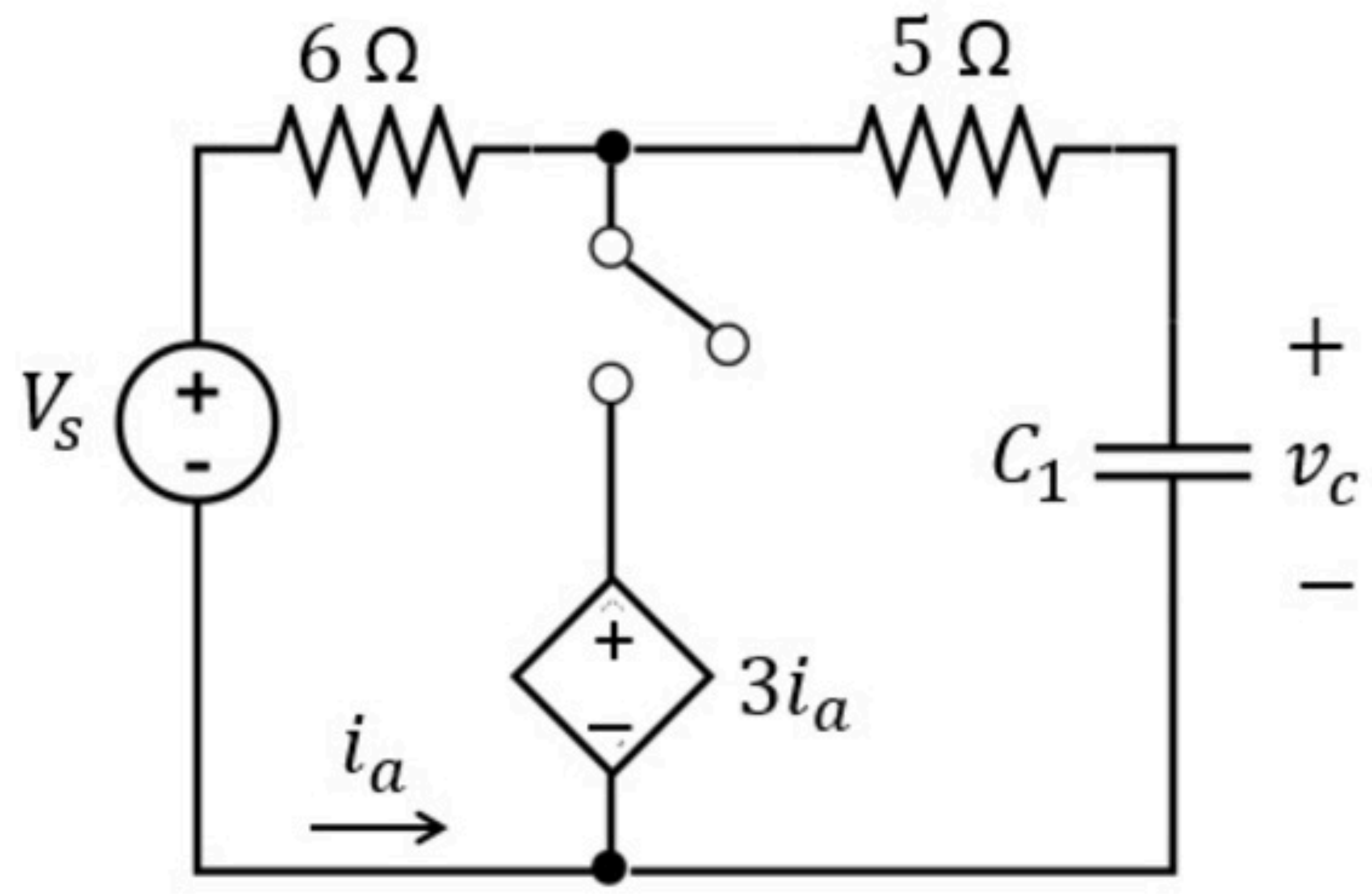
$\tau_2 = R_{TH} \cdot C_1 \Rightarrow \boxed{\tau_2 = 24\ ns}$

First order circuits 003

Problem has been graded.

The switch has been open for a long time before it closes at time $t = 0$.

Find the capacitor voltage $v_c = A + B \cdot e^{-t/\tau}$ for $t > 0$.



Given Variables:

Vs : 15 V

C1 : 0.1 nF

Calculate the following:

A (V) :

-15

B (V) :

30

tau (ns) :

0.5

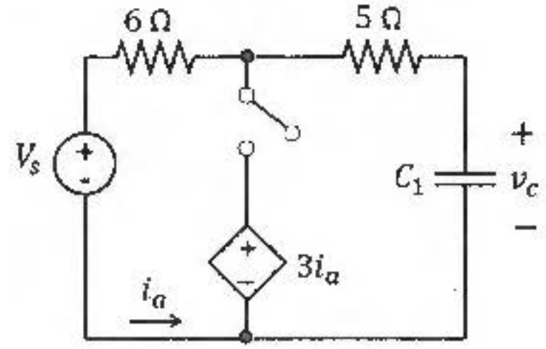
Hint: First find the capacitor voltage at t = 0-. Note where A and B are.

The switch has been open for a long time before it closes at time $t = 0$.

Find the capacitor voltage $v_c = A + B \cdot e^{-t/\tau}$ for $t > 0$.

Vs : 30 V

C1 : 0.2 nF



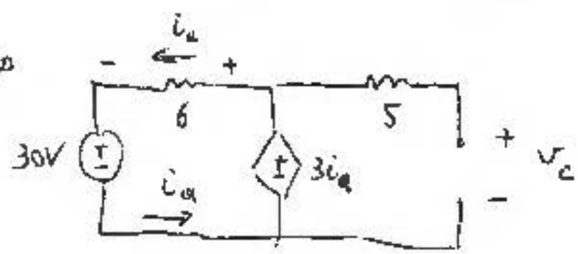
ⓐ $t = 0^-$

$v_c(0^-) = 30V$

$\Downarrow$

ⓑ $v_c(0^+) = 30V$

ⓒ $t = \infty$



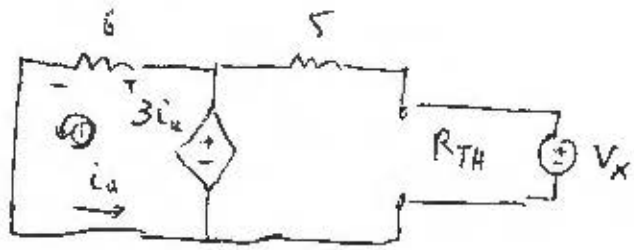
$30 + 6i_a - 3i_a = 0$

$3i_a = -30$

$i_a = -10$ A

$\Rightarrow v_c(\infty) = 3i_a = -30V$

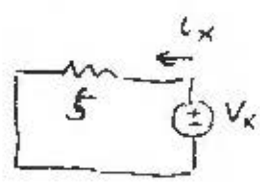
ⓓ



KVL ①: $3i_a - 6i_a = 0$

$\Rightarrow i_a = 0$

$\Rightarrow$



$\frac{V_x}{5} = i_x \Rightarrow R_{TH} = 5\Omega$

$\boxed{\tau = RC = 1\,ns}$

$A = v_c(\infty) \Rightarrow \boxed{A = -30V}$

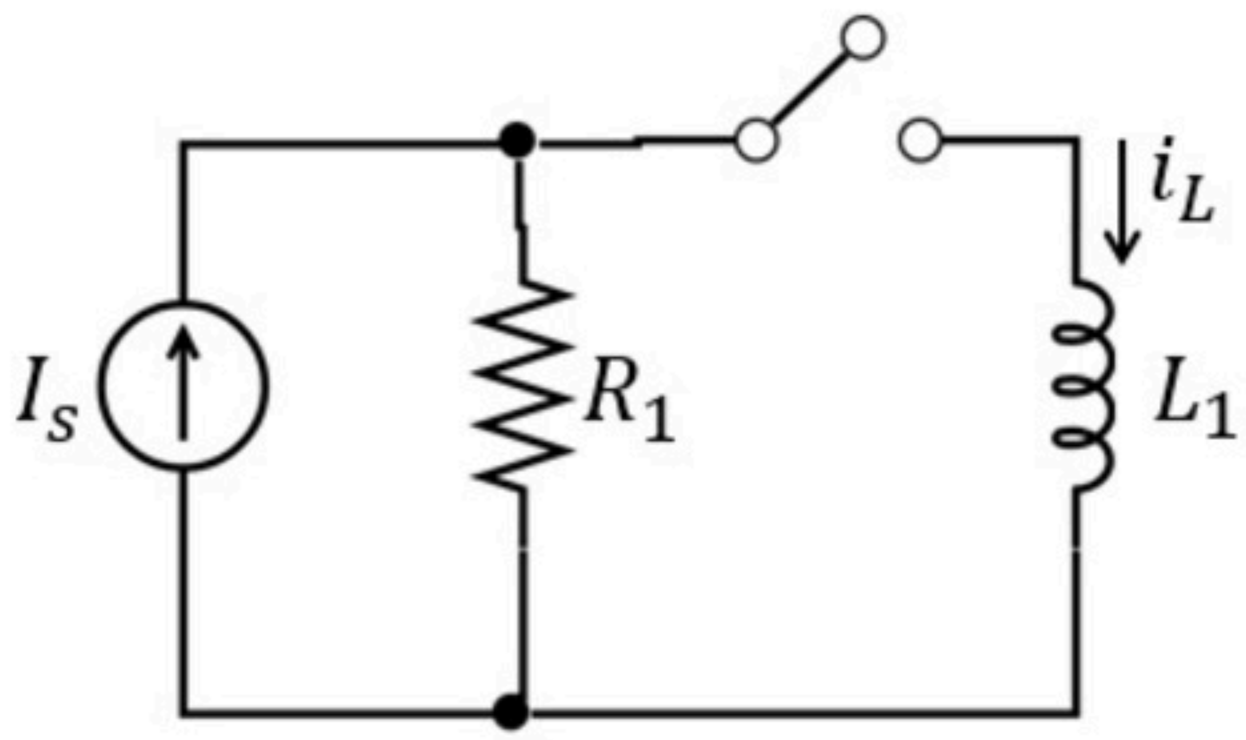
$A + B = v_c(0^+) \Rightarrow \boxed{B = 60V}$

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?

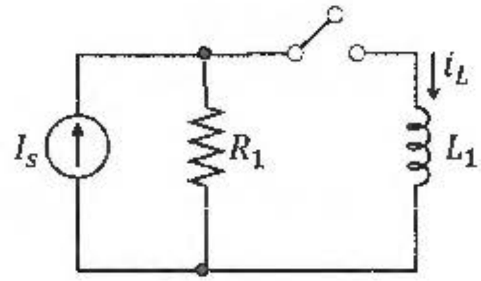
The switch closes at time $t = 0$.
Find the current i_L for t > 0:

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

Is : 2 A

R1 : 3 kohm

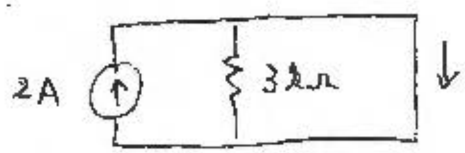
L1 : 30 mH



ⓐ $t = 0^-$: $i_L = 0$

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

ⓒ $t = \infty$:



$i_L(\infty) = 2A$

ⓓ

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

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

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

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

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

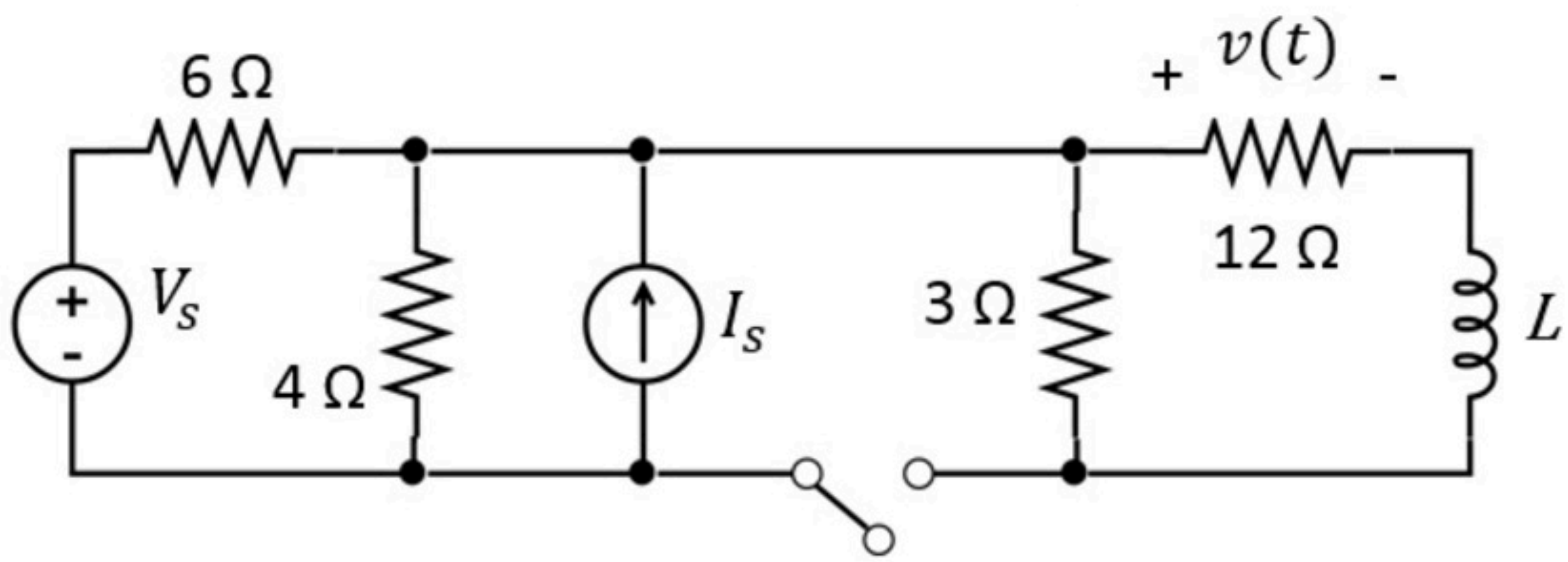
$$i_L(t) = 2 - 2e^{-\frac{t}{0.01 ms}}\ A$$

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

First order circuits 005

Problem has been graded.

The switch has been closed for a long time before it opens at $t = 0$. After the switch opens, find the resistor voltage $v(t) = A \cdot e^{-t/\tau} + B$.



Given Variables:

Vs : 28 V

Is : 2 A

L : 1.5 mH

Calculate the following:

A (V) :

8

B (V) :

0

tau (ms) :

0.1

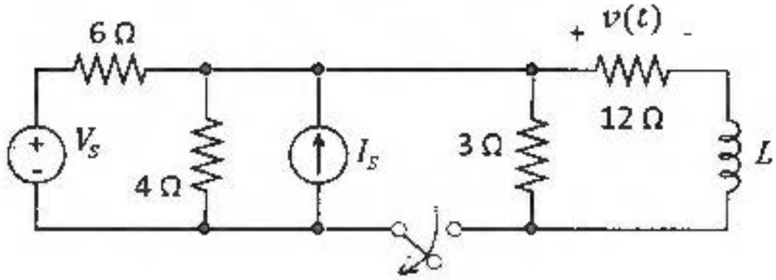
Hint: What is the current iL for t < 0?

The switch has been closed for a long time before it opens at $t = 0$. After the switch opens, find the resistor voltage $v(t) = A \cdot e^{-t/\tau} + B$.

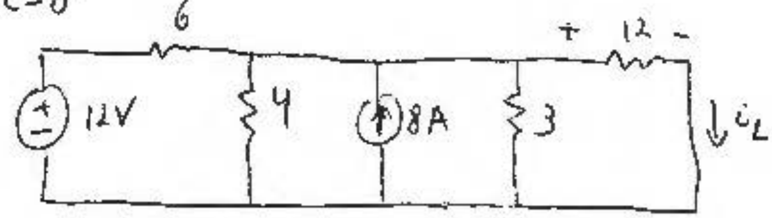
Vs : 12 V

Is : 8 A

L : 15 mH



(a) $t = 0^-$



SUPERPOSITION

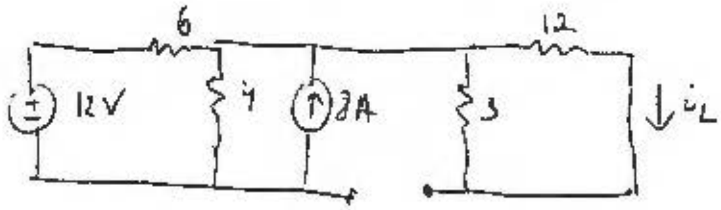
$$i_{L_1} = \frac{12}{6 + 4\|3\|12} \cdot \frac{4\|3}{4\|3 + 12} = \frac{1}{5}\text{ A}$$

$$i_{L_2} = \frac{6\|4\|3}{6\|4\|3 + 12} \cdot 8 = \frac{4}{5}\text{ A}$$

$i_L(0^-) = 1\text{ A}$ $\quad v(0^-) = 12\text{ V}$

(b) $t = 0^+$: $i_L(0^+) = 1\text{ A} \Rightarrow v(0^+) = 12\text{ V}$

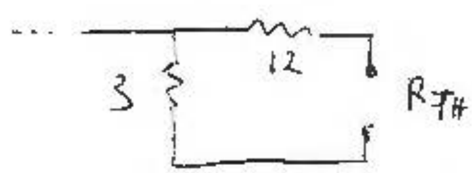
(c)



$i_L(\infty) = 0\text{ A}$

$v(\infty) = 0\text{ V}$

(d)



$R_{TH} = 15\,\Omega$

$$\tau = \frac{L}{R_{TH}} = \frac{15 \cdot 10^{-3}}{15} = 10^{-3}\text{ s}$$

$\boxed{\tau = 1\text{ ms}}$

$B = v(\infty) \Rightarrow \boxed{B = 0\text{ V}}$

$A + B = v(0^+) \Rightarrow \boxed{A = 12\text{ V}}$

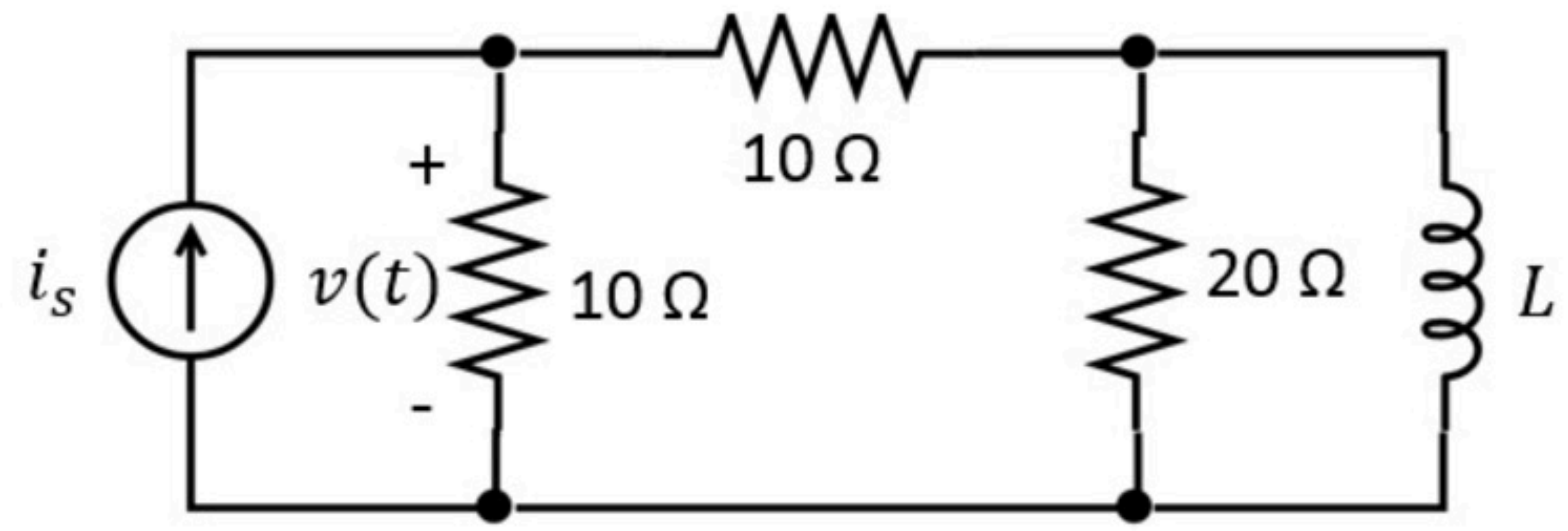
First order circuits 006

Problem has been graded.

When $t < 0$, $i_s = I_0$

When $t > 0$, $i_s = I_1$

Find $v(t) = A \cdot e^{-t/\tau} + B$ for $t > 0$



Given Variables:

I0 : 2 A

I1 : 10 A

L : 0.25 uH

Calculate the following:

A (V) :

20

B (V) :

50

tau (ns) :

25

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

When $t < 0$, $i_s = I_0$

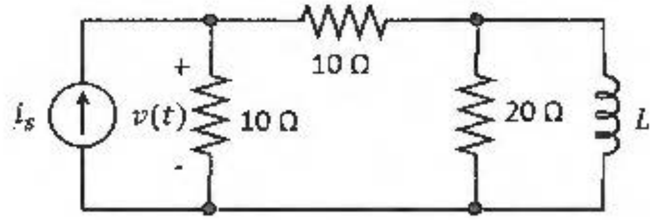
When $t > 0$, $i_s = I_1$

Find $v(t) = A \cdot e^{-t/\tau} + B$ for $t > 0$

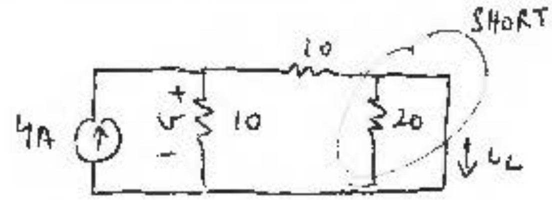
I0 : 4 A

I1 : 6 A

L : 0.25 uH



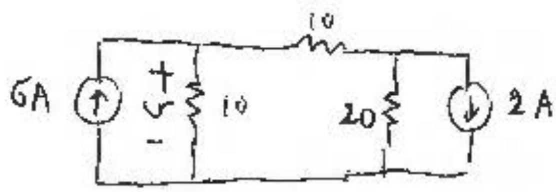
ⓐ $t = 0^-$



$v(0^-) = (4A) \cdot (10 // 10) = 20V$

$i_L(0^-) = (4A) \frac{10}{10+10} = 2A$

ⓑ $t = 0^+$



$i_L(0^+) = 2A$

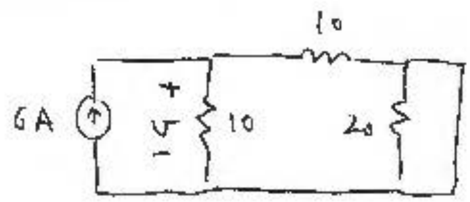
SUPERPOSITION:

$v_1 = 6 \cdot (10 // 30) = 6 \cdot \frac{30}{4} = 45V$

$v_2 = (-2) \cdot (20 // 20) \cdot \frac{1}{2} = -10V$

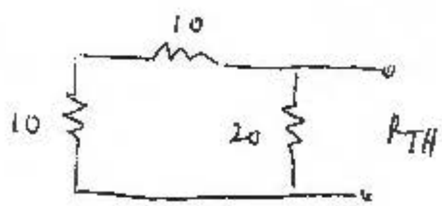
$v(0^+) = v_1 + v_2 = 35V$

ⓒ $t = \infty$



$v(\infty) = 6 \cdot (10 // 10) = 30V$

ⓓ



$R_{TH} = 20 // 20 = 10\ \Omega$

$\tau = \frac{L}{R_{TH}} = \frac{0.25 \cdot 10^{-6}}{10} = 25 \cdot 10^{-9}$

$\boxed{\tau = 25\ ns}$

$B = v(\infty) \Rightarrow \boxed{B = 30V}$

$A + B = v(0^+) \Rightarrow \boxed{A = 5V}$

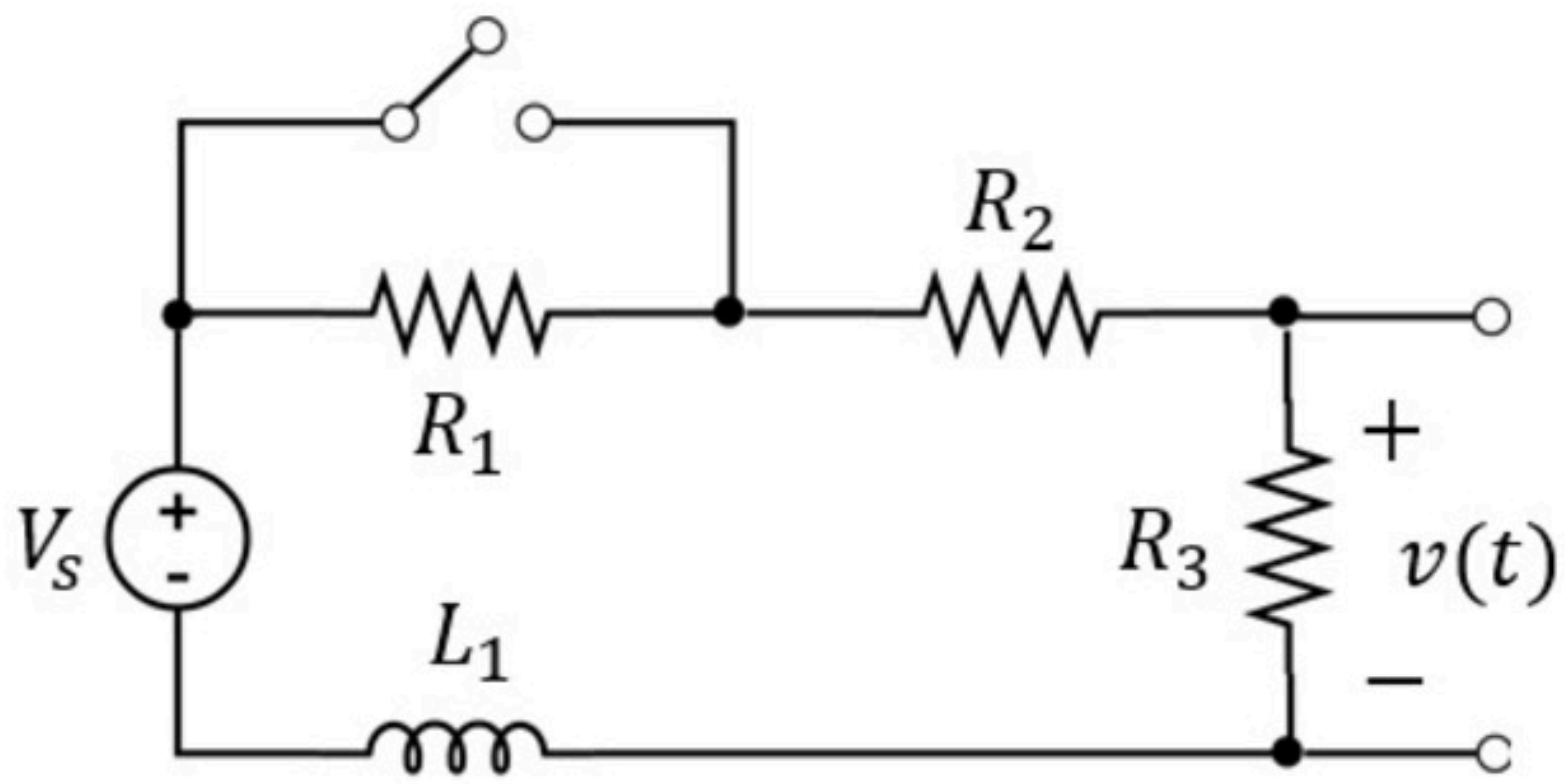
First order circuits 007

Problem has been graded.

The switch closes at time $t = 0$ and we measure

$$v(t) = 24 - 12e^{-t/2\,\mu s}\ \text{V} \qquad \text{for } t > 0$$

Find the values of R_1, R_2, and L_1.



Given Variables:

Vs : 48 V

R3 : 12 kohm

Calculate the following:

R1 (ohm) :

24000 ✓

R2 (ohm) :

12000 ✓

L1 (H) :

0.048 ✓

Hint: Consider v(inf) first. Mind the units.

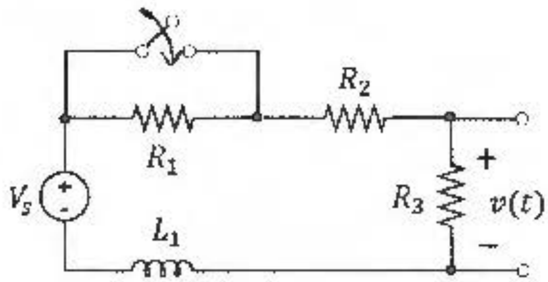
The switch closes at time $t = 0$ and we measure

Vs : 36 V

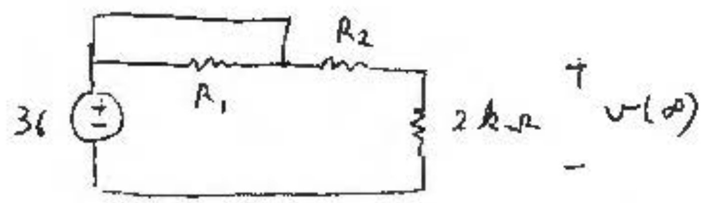
$$v(t) = 24 - 12e^{-t/2\mu s}\ \text{V} \quad \text{for } t > 0$$

R3 : 2 kohm

Find the values of R_1, R_2, and L_1.



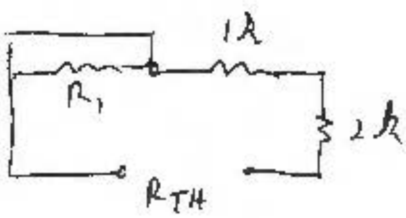
(a) $t = \infty$: $v(\infty) = 24V$.



$$v(\infty) = 36 \cdot \frac{2k}{2k + R_2}$$

$$\Rightarrow 24 R_2 = 36 \cdot 2k - 24 \cdot 2k \Rightarrow R_2 = 1\,k\Omega \Rightarrow \boxed{R_2 = 1000\,\Omega}$$

(b)



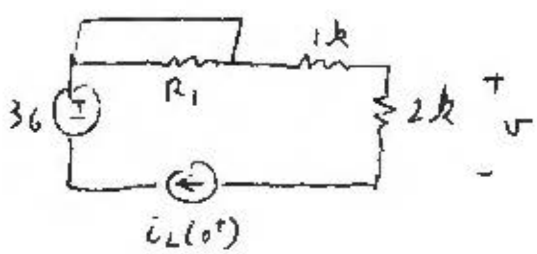
$R_{TH} = 3\,k\Omega$

$\tau = 2 \cdot 10^{-6}\,s = \frac{L_1}{R_{TH}}$

$$\Rightarrow L_1 = \tau \cdot R_{TH} = 2 \cdot 10^{-6} \cdot 3 \cdot 10^{3} = 6 \cdot 10^{-3}$$

$$\boxed{L_1 = 0.006\ H}$$

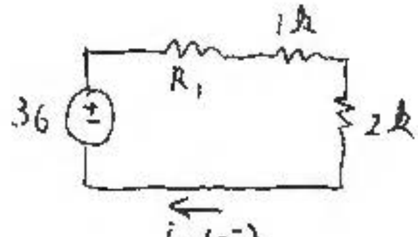
(c) $t = 0^+$. $v(0^+) = 12V$



$v(0^+) = i_L(0^+) \cdot 2k$

$$\Rightarrow i_L(0^+) = \frac{12}{2k} = 6\ mA$$

(d) $t = 0^-$:



$$i_L(0^-) = i_L(0^+) = 6 \cdot 10^{-3} = \frac{36}{R_1 + 1k + 2k}$$

$$R_1 = \frac{36}{6 \cdot 10^{-3}} - 1k - 2k \qquad R_1 = 3k$$

$$\boxed{R_1 = 3000\,\Omega}$$

First order circuits 008

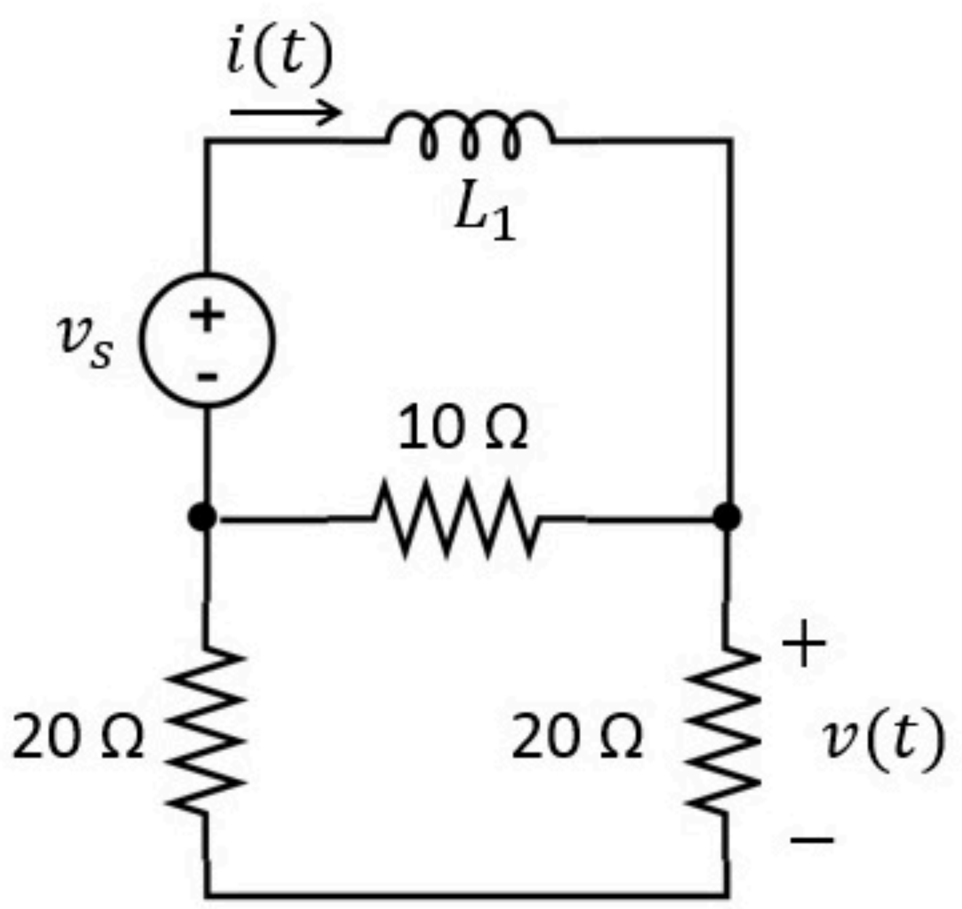
Unlimited Attempts.

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

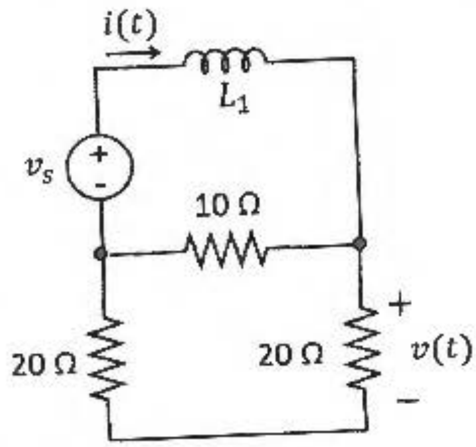
Hint: What is the current iL for t < 0? Note where A and B are.

When $t < 0$, $v_s = V_0$ V0 : 40 V

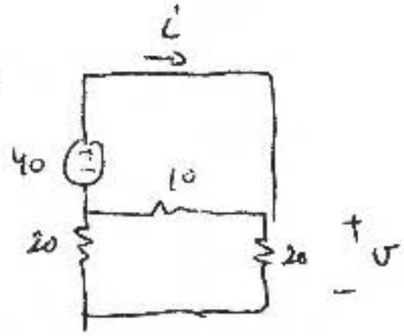
When $t > 0$, $v_s = V_1$ V1 : 64 V

Find $i(t) = A_1 + B_1 \cdot e^{-t/\tau_1}$ for $t > 0$ L1 : 2 mH

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



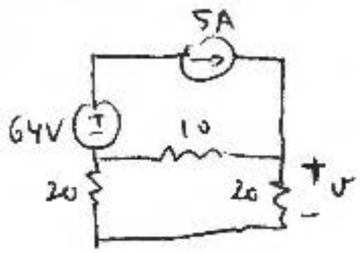
(a) $t = 0^-$



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

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

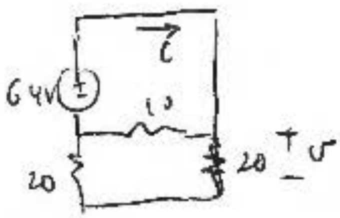
(b) $t = 0^+$



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

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

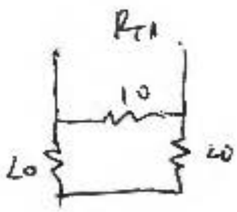
(c) $t = \infty$



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

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

(d)



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

$$\tau = \frac{L_1}{R_{TH}} = \frac{2\cdot 10^{-3}}{8} = 0.25 \cdot 10^{-3}$$

$A_1 = i(\infty) \Rightarrow \boxed{A_1 = 8A}$ $A_2 = v(\infty) \Rightarrow \boxed{A_2 = 32V}$

$B_1 + A_1 = i(0^+) \Rightarrow \boxed{B_1 = -3A}$ $B_2 + A_2 = v(0^+) \Rightarrow \boxed{B_2 = -12V}$

$$\boxed{\tau_1 = \tau_2 = 0.25\ ms}$$

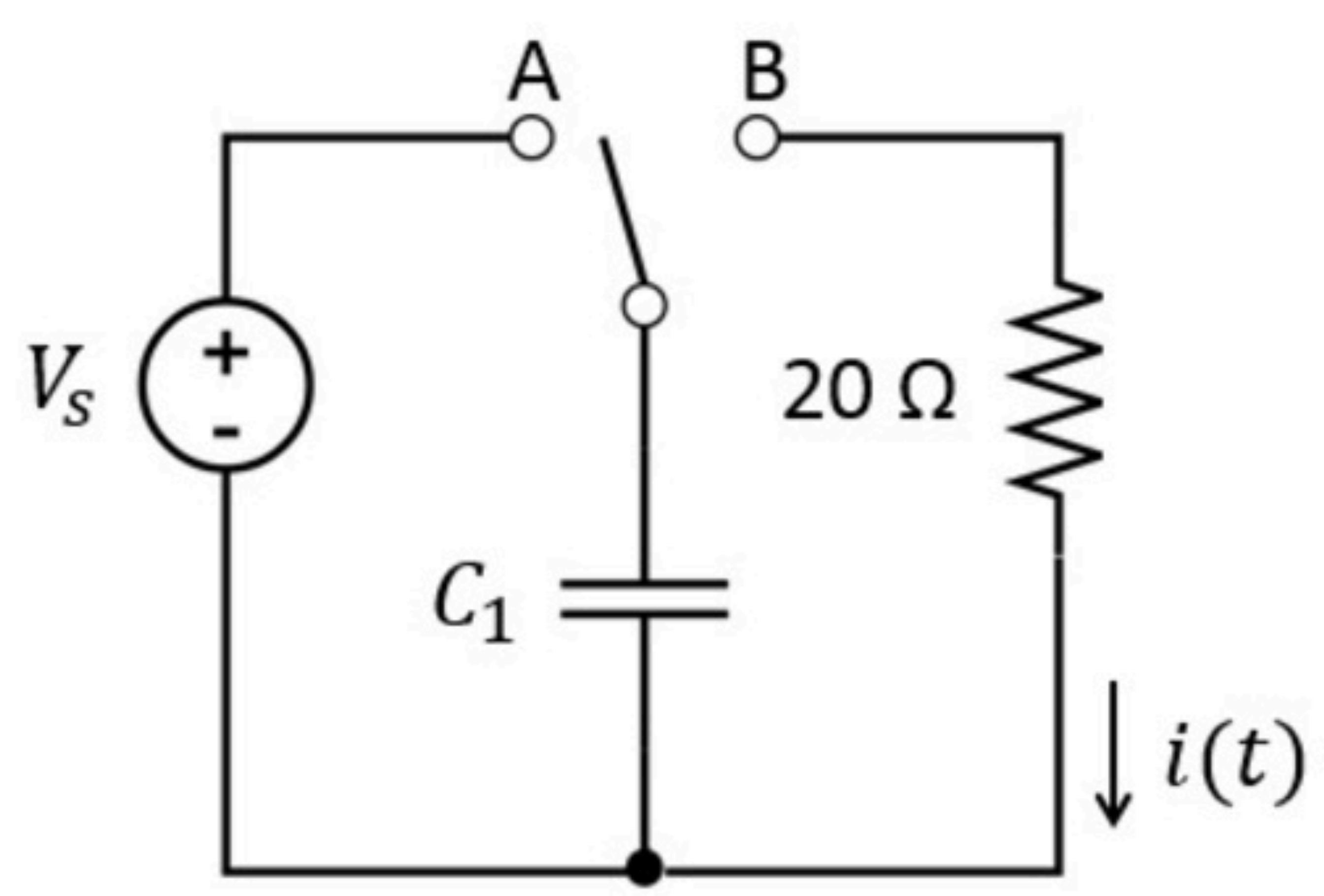
First order circuits 009

Problem has been graded.

For $t < 0$, the switch has been in position *A* for a long time. At time $t = 0$, it moves from *A* to *B*.

Find the time t_1 it takes to reduce the capacitor voltage to 37% of its initial voltage ($\frac{1}{e} \approx .37$).

What is the total energy *E* received by the resistor from the moment the switch is flipped until the capacitor is completely discharged?



Given Variables:

Vs : 12 V

C1 : 2 uF

Calculate the following:

t1 (ms) :

0.04

E (mJ) :

0.144

Hint: To calculate E, consider where the energy is coming from. Verify by integrating the P(t).

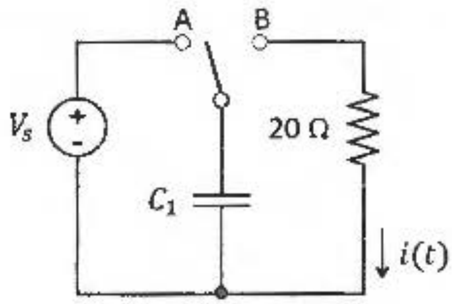
For $t < 0$, the switch has been in position A for a long time. At time $t = 0$, it moves from A to B.

Find the time t_1 it takes to reduce the capacitor voltage to 37% of its initial voltage ($\frac{1}{e} \approx .37$).

What is the total energy E received by the resistor from the moment the switch is flipped until the capacitor is completely discharged?

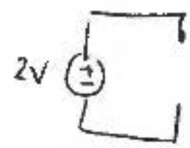
Vs : 2 V

C1 : 2 uF



1

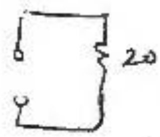
(a) $t = 0^-$:



$v_c(0^-) = 2V$

(b) $t = 0^+$: $v_c(0^+) = 2V$

(c) $t = \infty$



$v_c(\infty) = 0V$

(d) $R_{TH} = 20\,\Omega$

$\tau = R_{TH} \cdot C = 40\,\mu s$

$\Rightarrow v_c(t) = 2e^{-t/\tau}$ $\qquad v_c(t_1) = \frac{1}{e} \cdot v_c(0^+) = \frac{2}{e}$

$\Rightarrow 2e^{-t_1/\tau} = 2e^{-1} \Rightarrow \frac{t_1}{\tau} = 1 \Rightarrow t_1 = \tau = 40\,\mu s$ $\qquad \boxed{t_1 = 0.04\ ms}$

2 $E_{rec.} = E_{supplied} \Rightarrow$ Coming from Capacitor

$E = \frac{1}{2}CV^2 = \frac{1}{2}2 \cdot 10^{-6}\ 2^2 = 4\,\mu J$ $\qquad \boxed{E = 0.004\ mJ}$

OR $\quad i(t) = Ae^{-t/\tau} + B = 0.1e^{-t/\tau}$

$i(0^+) = \frac{2V}{20\Omega} = 0.1\ A$

$i(\infty) = 0$

$E = \int P = \int_0^\infty i^2 R = 20 \cdot (0.1)^2 \int_0^\infty e^{-2t/\tau} dt$

$= -0.2 \frac{\tau}{2} e^{-2t/\tau}\Big|_0^\infty$

$= 0.1\,\tau \quad \Rightarrow E = 4\,\mu J$

PP First order circuits 011

Unlimited Attempts.

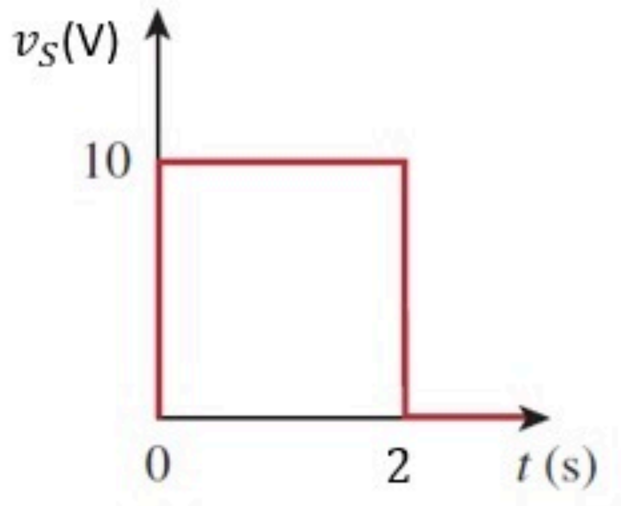
The voltage source behaves as shown (and assume it has been zero for a long time for $t < 0$).

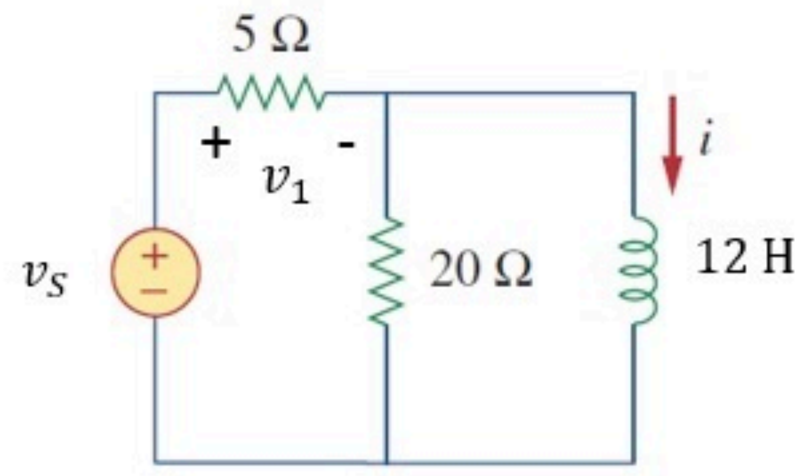
Find $v_1(t) = D$ for $t = 0^-$

$= A_1 \cdot e^{-t/\tau_1} + B_1$ for $0 < t < 2\text{ s}$

$= A_2 \cdot e^{-(t-2\text{ s})/\tau_2} + B_2$ for $2\text{ s} < t$

Note, for your calculations, use: $e^{-1/1.5} \approx 0.5$





Given Variables:

. : . .

Calculate the following:

D (V) :

0 ✓

A1 (V) :

-8 ✓

B1 (V) :

10 ✓

tau1 (s) :

3 ✓

A2 (V) :

4 ✓

B2 (V) :

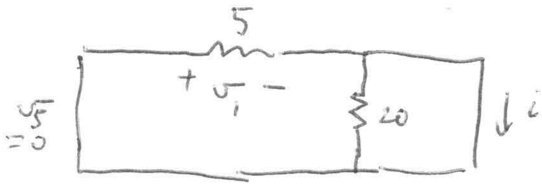
0 ✓

tau2 (s) :

3 ✓

Hint: Find the result of the first transition first.

(a) $\boxed{v_S = 0}$ $\quad t = 0^-$:

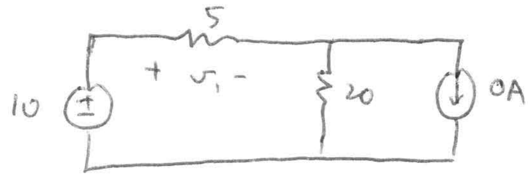


$v_1(0^-) = 0\,V$

$i(0^-) = 0\,A$

$\boxed{D = 0\,V}$

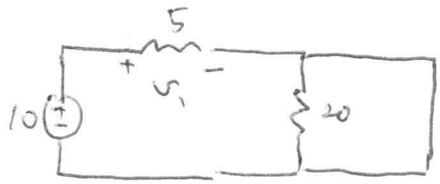
(b) $\boxed{v_S = 10}$ $\quad t = 0^+$:



$i(0^+) = 0\,A \rightsquigarrow$ open

$v_1(0^+) = 10 \cdot \frac{5}{5+20} = 2\,V$

$t = \infty$:



$i(\infty) = \frac{10}{5} = 2\,A$

$v_1(\infty) = 10\,V$

R_{TH}: $\quad R_{TH} = 5 \| 20 = 4\,\Omega \Rightarrow \tau = \frac{L}{R} = \frac{12}{4} = 3\,s$

$v_1(t) = -8e^{-t/3} + 10, \quad 0 < t < 2$

$i(t) = -2e^{-t/3} + 2, \quad 0 < t < 2$

$\boxed{A_1 = -8\,V}$

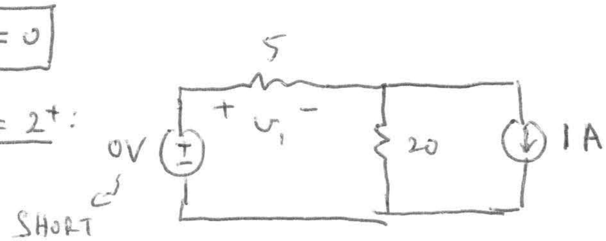
$\boxed{B_1 = 10\,V}$

$\boxed{\tau_1 = 3\,s}$

$t = 2^-$: $\quad i(2^-) = -2e^{-2/3} + 2 = -2e^{-\frac{1}{1.5}} + 2 = -2 \cdot \frac{1}{2} + 2 = 1\,A$

(c) $\boxed{v_S = 0}$

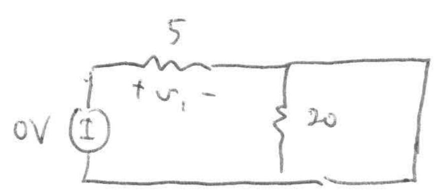
$t = 2^+$:



$i(2^+) = i(2^-) = 1\,A$

$v_1 = 1 \cdot (5 \| 20) = 1 \cdot 4 = 4\,V$

$t = \infty$:



$i(\infty) = 0$

$v_1(\infty) = 0\,V$

R_{TH}: SAME AS BEFORE $\Rightarrow \tau = 3\,s$

$v_1(t) = 4e^{-t/3} + 0$

$\boxed{A_2 = 4\,V}$

$\boxed{B_2 = 0\,V}$

$\boxed{\tau_2 = 3\,s}$

Second order circuits 001

Problem has been graded.

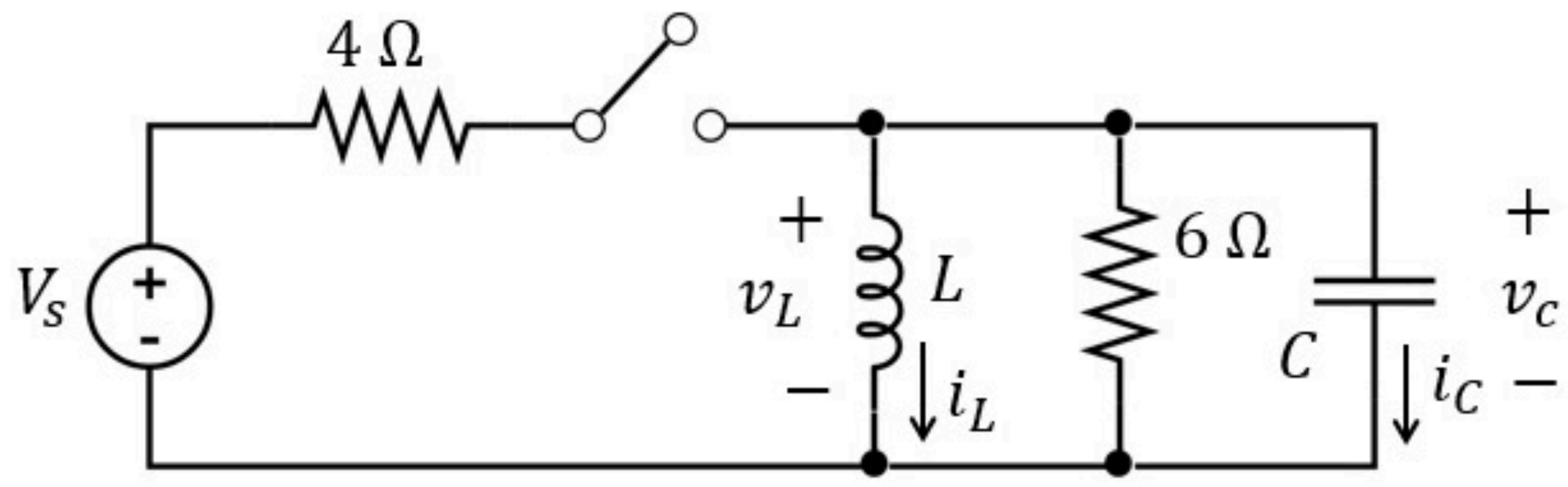
The switch opens at time t = 2 s. Before the switch opens, the system has reached steady state.

Find these voltages and currents (i.e., just before the switch opens):

$$i_{L1} = i_L(2^-) \quad v_{L1} = v_L(2^-) \quad i_{C1} = i_C(2^-) \quad v_{C1} = v_C(2^-)$$

Find these voltages and currents (i.e., just after the switch opens):

$$i_{L2} = i_L(2^+) \quad v_{L2} = v_L(2^+) \quad i_{C2} = i_C(2^+) \quad v_{C2} = v_C(2^+)$$



Given Variables:

Vs : 8 V
C : 2 nF
L : 2 mH

Calculate the following:

iL1 (A) :

2

vL1 (V) :

0

iC1 (A) :

0

vC1 (V) :

0

iL2 (A) :

2

vL2 (V) :

0

iC2 (A) :

-2

vC2 (V) :

0

Hint: In steady state, the capacitor and inductor behave as an open and short respectively.

The switch opens at time $t = 2$ s. Before the switch opens, the system has reached steady state.

Find these voltages and currents (i.e., just before the switch opens):

$$i_{L1} = i_L(2^-) \quad v_{L1} = v_L(2^-) \quad i_{C1} = i_C(2^-) \quad v_{C1} = v_C(2^-)$$

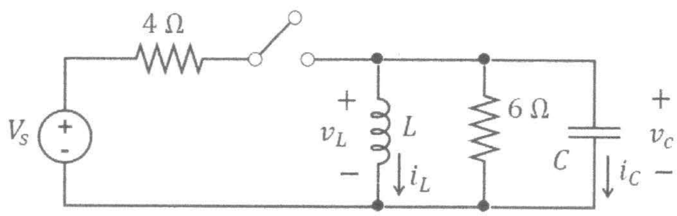
Find these voltages and currents (i.e., just after the switch opens):

$$i_{L2} = i_L(2^+) \quad v_{L2} = v_L(2^+) \quad i_{C2} = i_C(2^+) \quad v_{C2} = v_C(2^+)$$

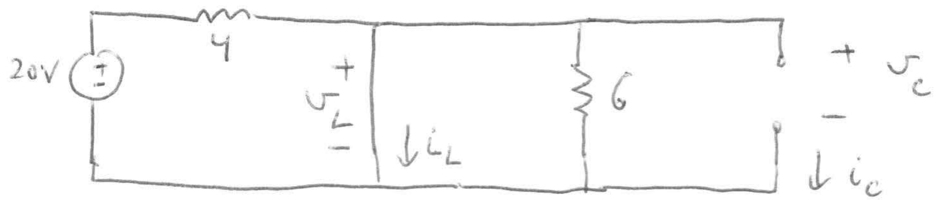
Vs : 20 V

C : 2 nF

L : 1 mH



(a) $t = 2^-$: SWITCH IS CLOSED



$i_L = \frac{20}{4} = 5$

$\boxed{v_L(2^-) = 0V}$ $\boxed{i_c(2^-) = 0A}$ $\boxed{v_c(2^-) = 0V}$ $\boxed{i_L(0^-) = 5A}$

(b) $t = 2^+$

$\boxed{i_L(2^+) = 5A}$ $\boxed{v_c(2^+) = 0V}$ $\boxed{v_L(2^+) = 0V}$ $\boxed{i_c(2^+) = -5A}$

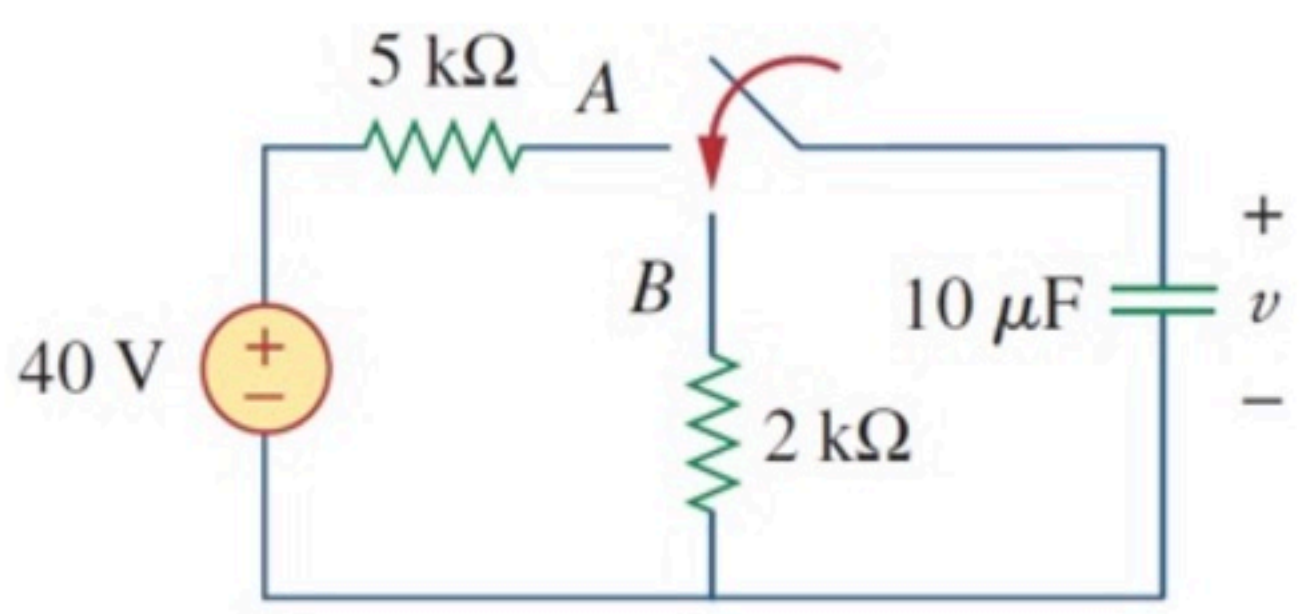
PP First order circuits 001

Unlimited Attempts.

The switch has been in position A for a long time.
At time $t = 0$, the switch moves to position B.

Find $v(t) = D$ for $t = 0^-$

$= A \cdot e^{-t/tau} + B$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (V) :

40

A (V) :

40

B (V) :

0

tau (s) :

0.02

Hint: At steady state, the capacitor is an open circuit

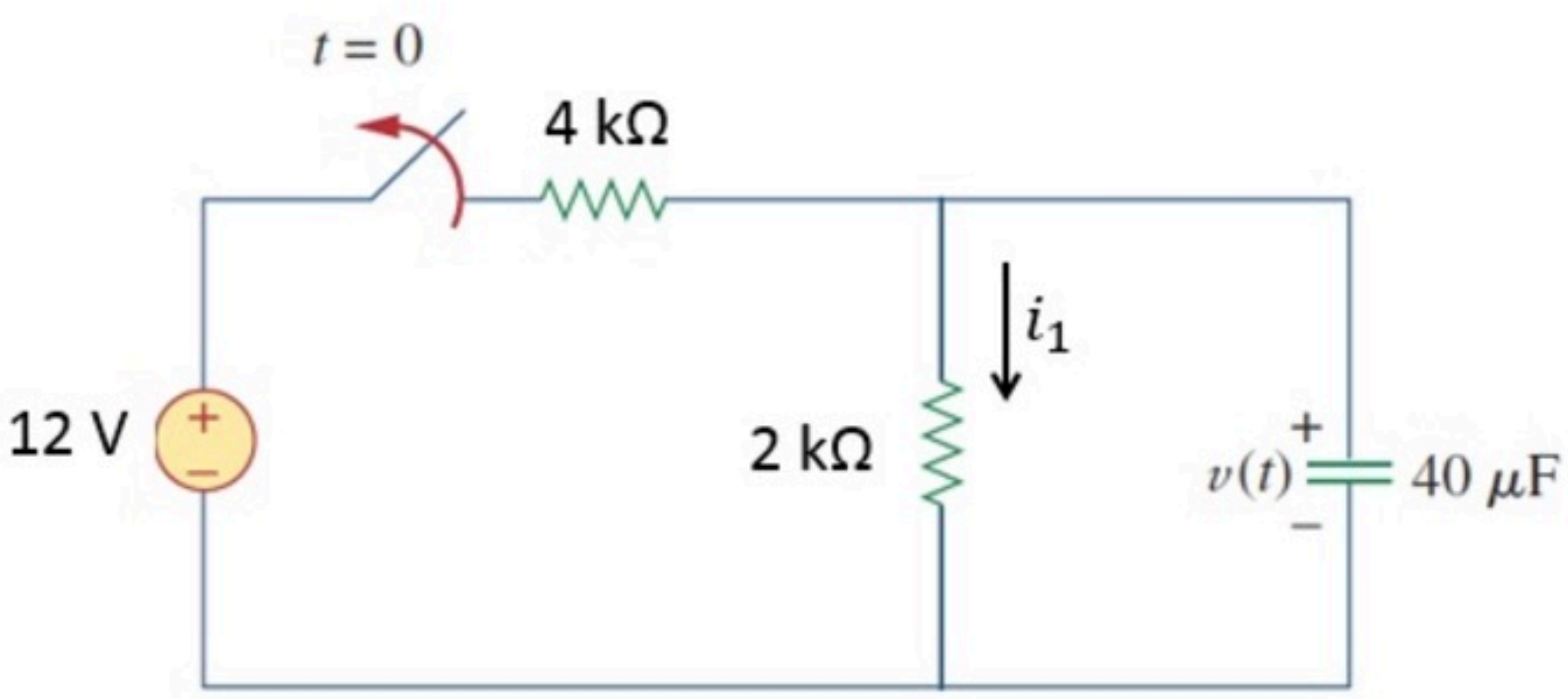
PP First order circuits 002

Unlimited Attempts.

The switch has been closed for a long time.
At time $t = 0$, the switch is opened.

Find $i_1(t) = D$ for $t = 0^-$

$= A \cdot e^{-t/tau} + B$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (mA) :

2

A (mA) :

2

B (mA) :

0

tau (ms) :

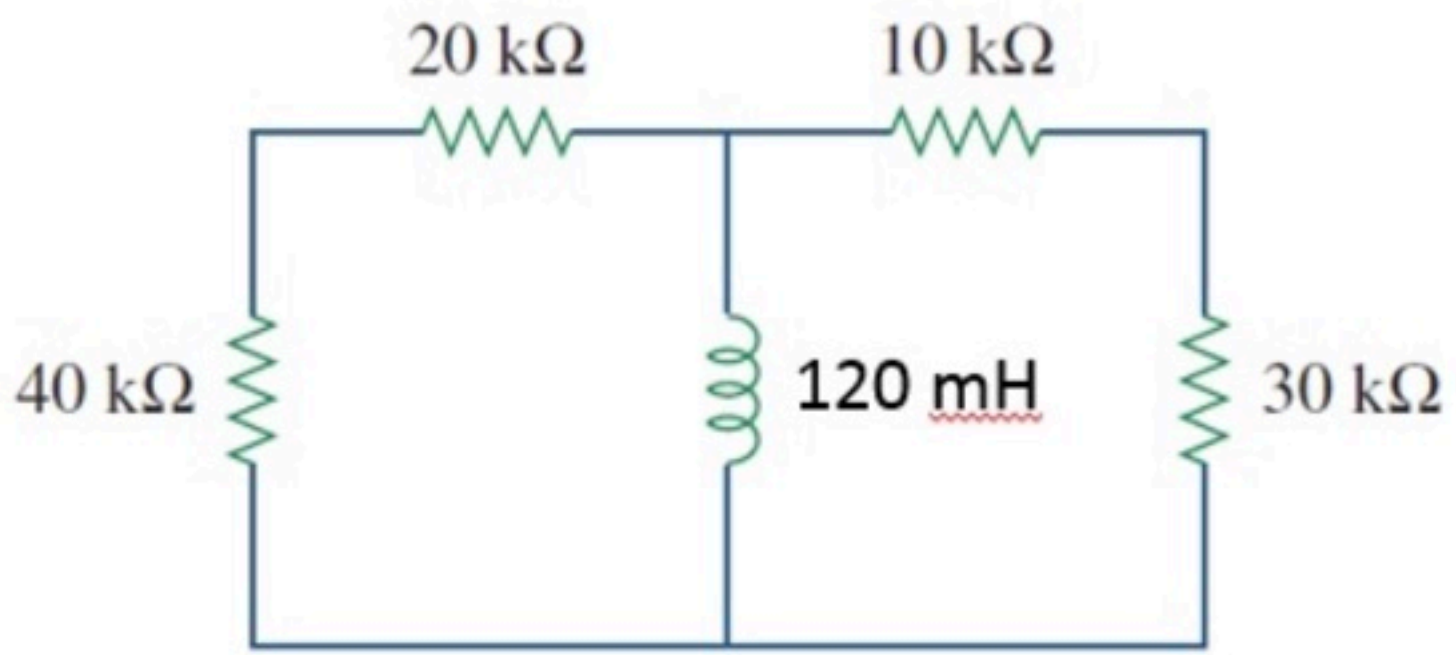
80

Hint: The capacitor voltage does not change instantaneously

PP First order circuits 003

Unlimited Attempts.

What is the time constant tau in this circuit?



Given Variables:

. : . .

Calculate the following:

tau (us) :

5

Hint: Find Req

PP First order circuits 004

Unlimited Attempts.

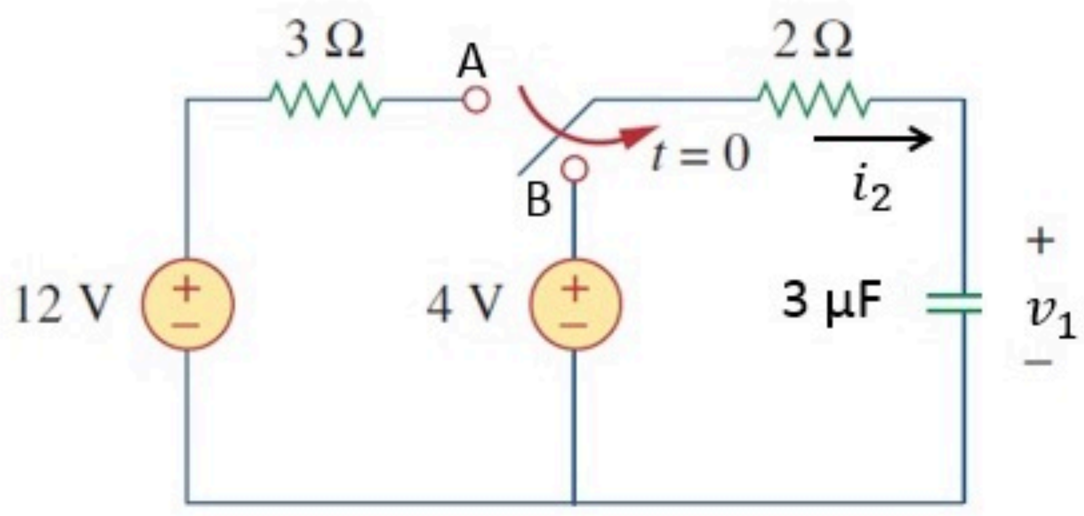
The switch has been in position A for a long time. At time t = 0, the switch moves to position B.

Find $v_1(t) = D1$ for t = 0^-

$= A1 \cdot e^{-t/tau1} + B1$ for $t > 0$

Find $i_2(t) = D2$ for t = 0^-

$= A2 \cdot e^{-t/tau2} + B2$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D1 (V) :

12

A1 (V) :

8

B1 (V) :

4

tau1 (us) :

6

D2 (A) :

0

A2 (A) :

-4

B2 (A) :

0

tau2 (us) :

6

Hint: Find the capacitor voltage before and after the switch

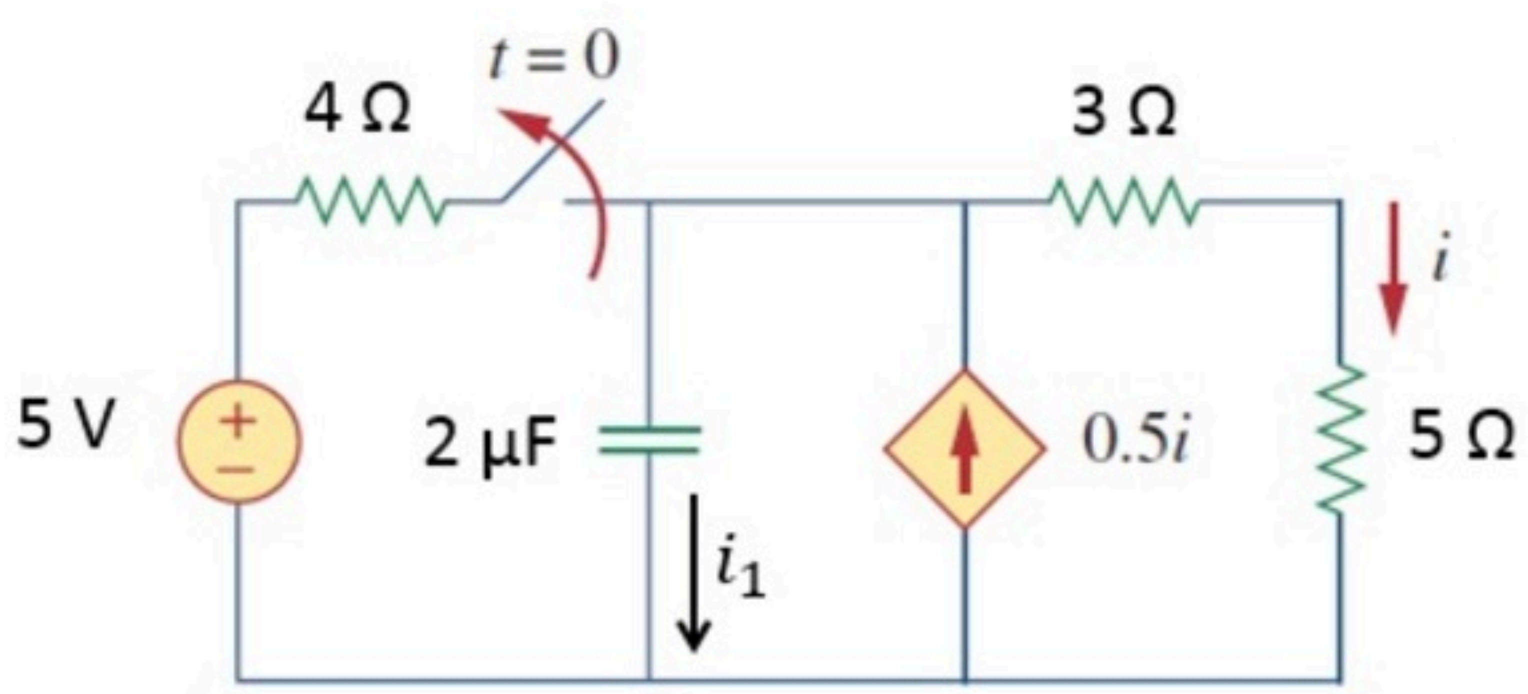
PP First order circuits 005

Unlimited Attempts.

The switch has been closed for a long time.
At time $t = 0$, the switch is opened.

Find $i_1(t) = D$ for $t = 0^-$

$= A \cdot e^{-t/tau} + B$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (A) :

0

A (A) :

-0.25

B (A) :

0

tau (us) :

32

Hint: Use a test source to find Req.

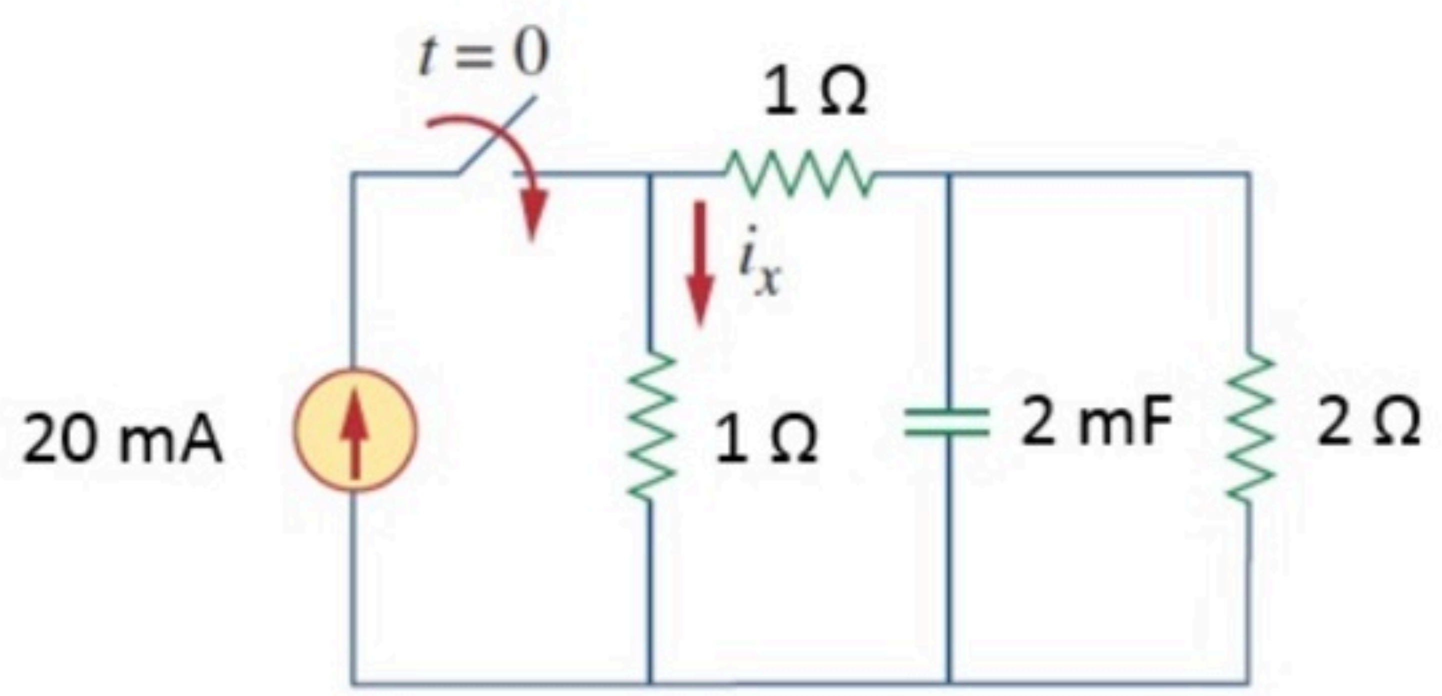
PP First order circuits 006

Unlimited Attempts.

The switch has been open for a long time.
At time $t = 0$, the switch is closed.

Find $\quad i_x(t) = D \quad$ for $t = 0^-$

$\quad\quad = A \cdot e^{-t/tau} + B \quad$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (mA) :

0

A (mA) :

-5

B (mA) :

15

tau (ms) :

2

Hint: What is the capacitor voltage right after the transition?

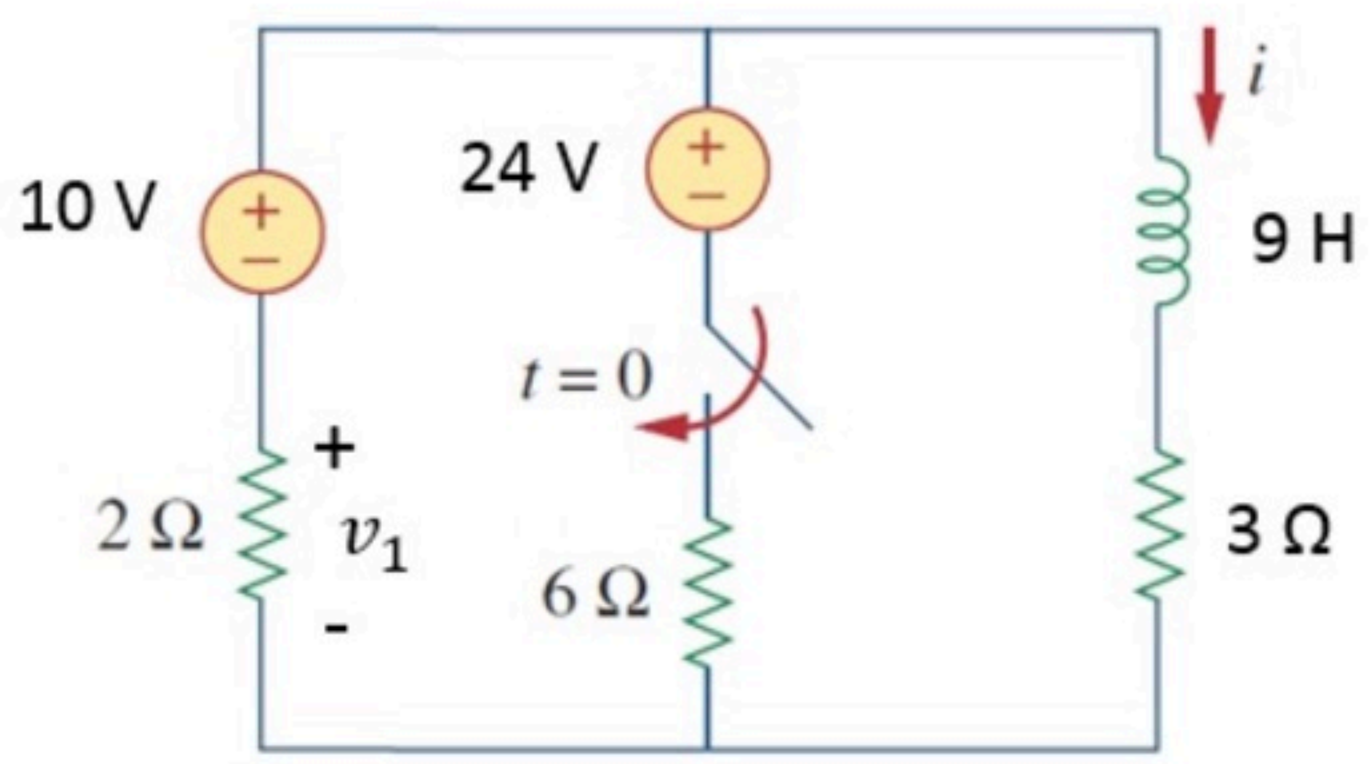
PP First order circuits 007

Unlimited Attempts.

The switch has been open for a long time.
At time $t = 0$, the switch is closed.

Find $v_1(t) = D$ for $t = 0^-$

$= A \cdot e^{-t/tau} + B$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (V) :

-4

A (V) :

1.5

B (V) :

-1

tau (s) :

2

Hint: First find the inductor current just before the switch opens.

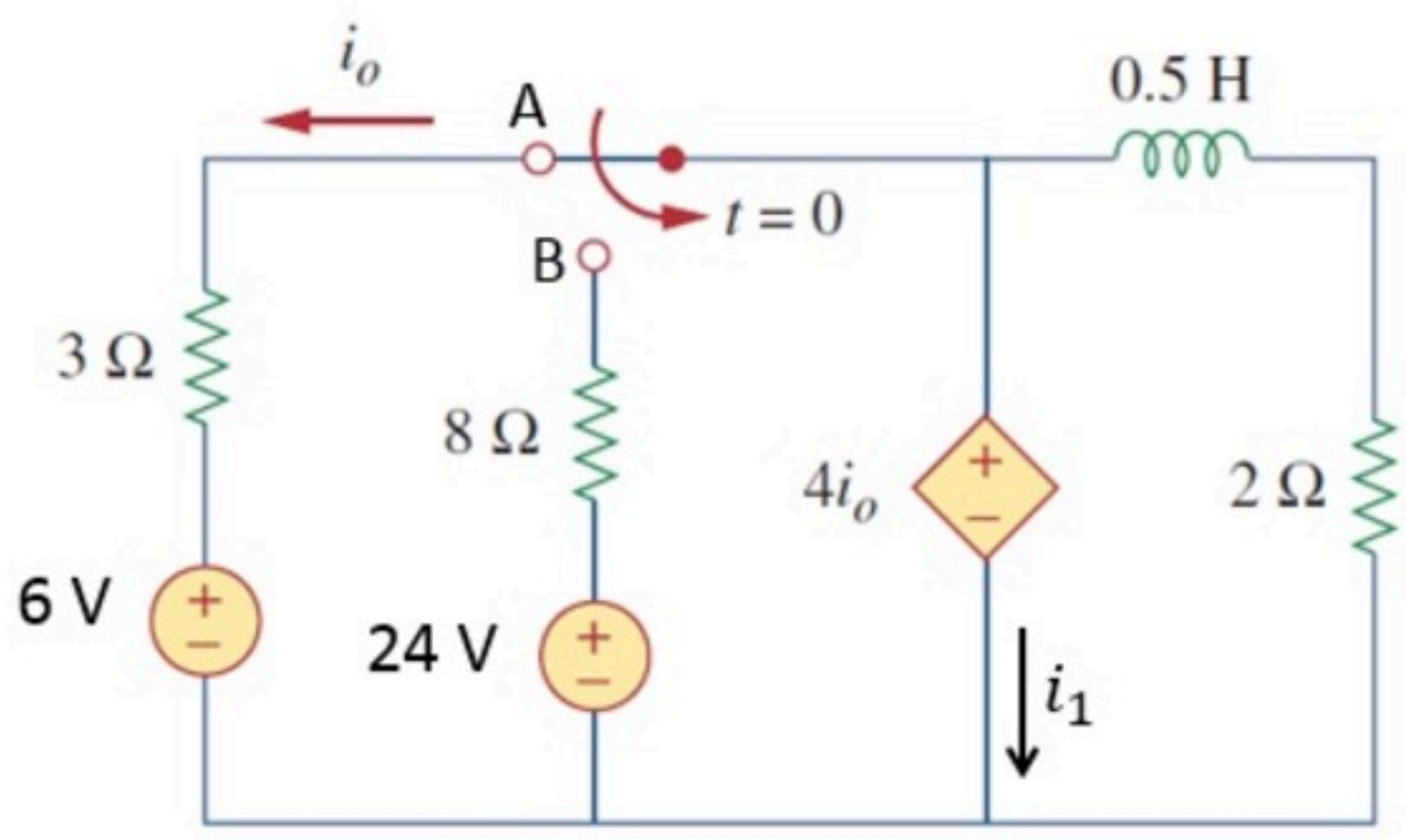
PP First order circuits 008

Unlimited Attempts.

The switch has been in position A for a long time.
At time $t = 0$, the switch moves to position B.

Find $\quad i_1(t) = D \qquad$ for $t = 0^-$

$\qquad = A \cdot e^{-t/tau} + B \qquad$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (A) :

-18

A (A) :

-12

B (A) :

3

tau (s) :

0.25

Hint: What is io after the switch opens?

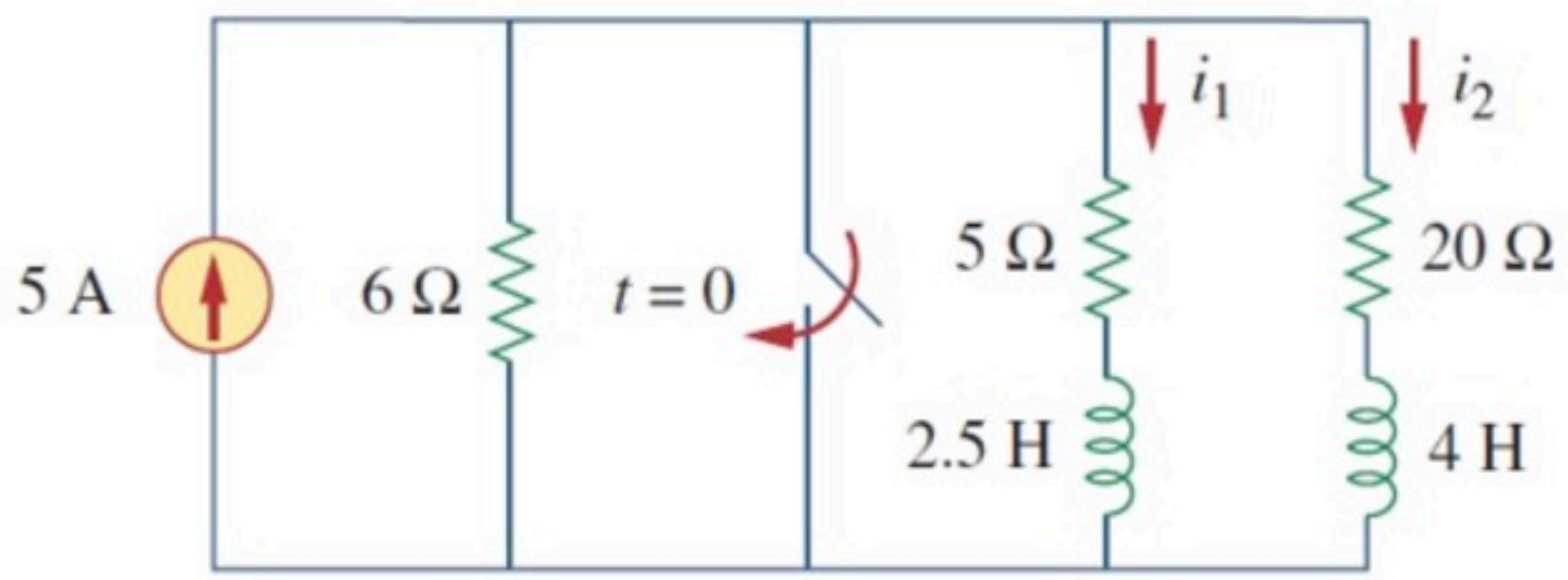
PP First order circuits 009

Unlimited Attempts.

The switch has been open for a long time.
At time $t = 0$, the switch is closed.

Find $\quad i_1(t) = D \qquad$ for $t = 0^-$

$\qquad\qquad = A \cdot e^{-t/tau} + B \qquad$ for $t > 0$



Given Variables:

. : . .

Calculate the following:

D (A) :

2.4

A (A) :

2.4

B (A) :

0

tau (s) :

0.5

Hint: After the switch closes, do the two inductors influence each other?

PP First order circuits 010

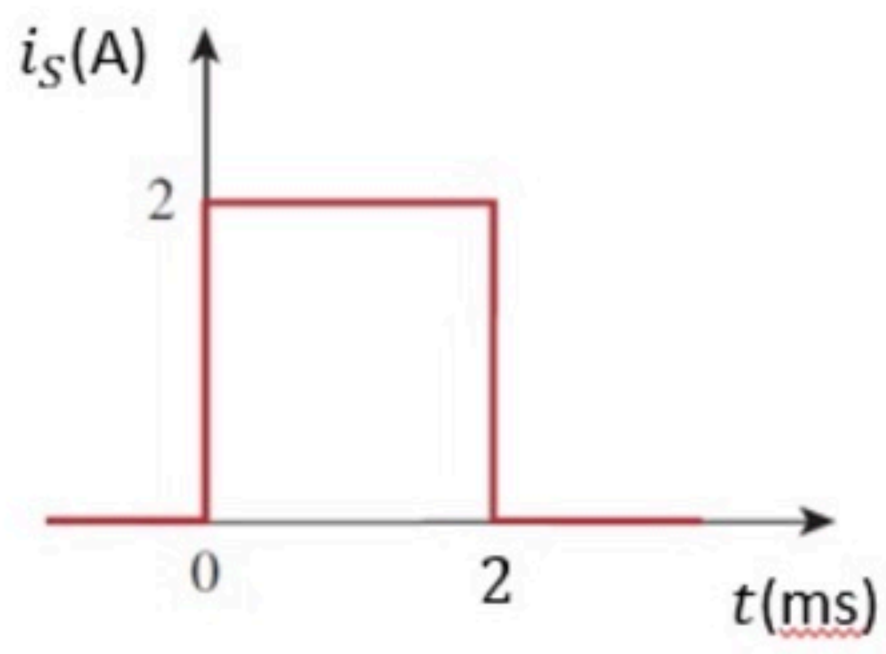
Unlimited Attempts.

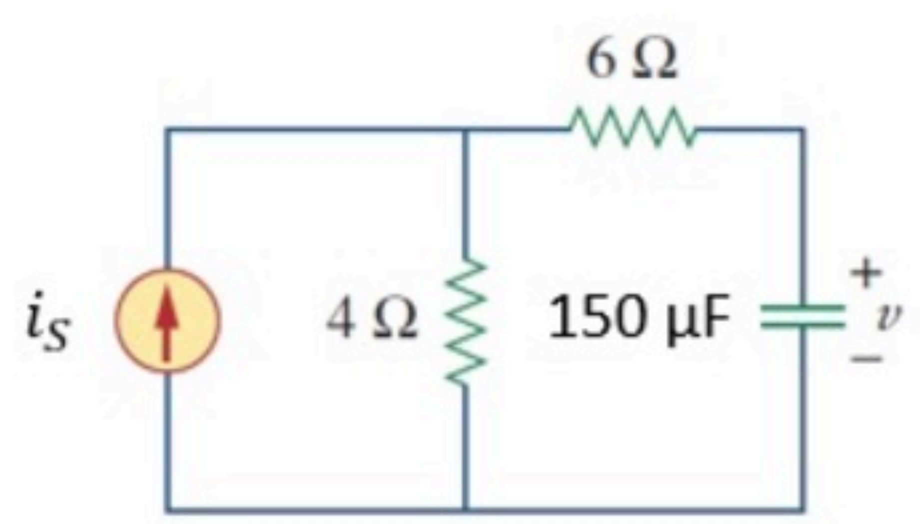
The current source behaves as shown (and assume it has been zero for a long time for $t < 0$).

Find $\quad v(t) = D \qquad$ for $t = 2^-$ ms

$\qquad\qquad = A \cdot e^{-(t-2\ ms)/tau} + B \qquad$ for $t > 2$ ms

Note, for your calculations, use: $e^{-1/1.5} \approx 0.5$





Given Variables:

. : . .

Calculate the following:

D (V) :

6

A (V) :

6

B (V) :

0

tau (ms) :

1.5

Hint: Find the result of the first transition first.

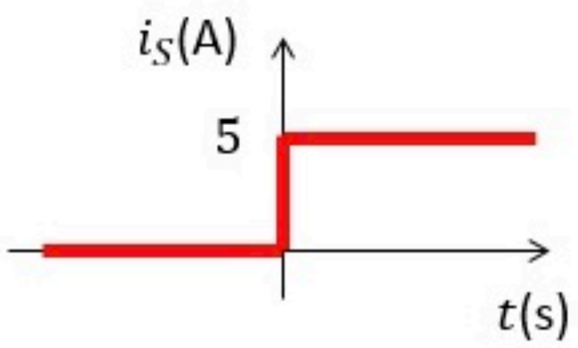
PP Second order circuits 001

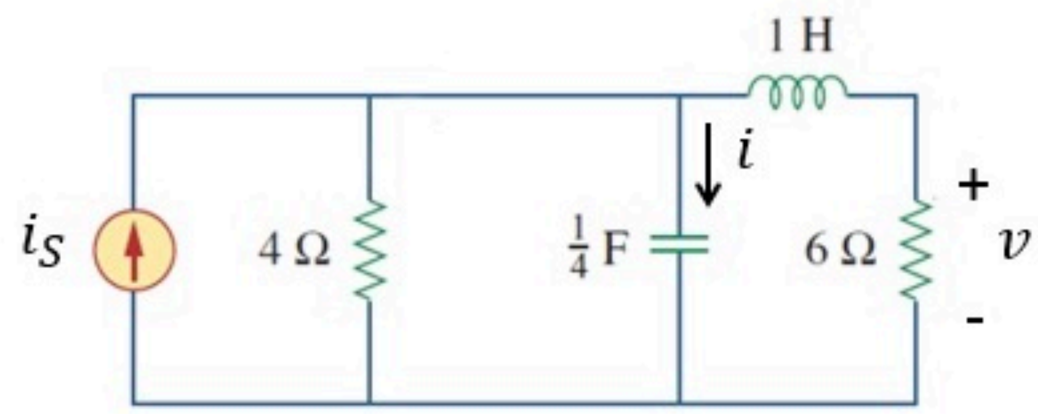
Unlimited Attempts.

Find $i_1 = i(0^-)$ and $v_1 = v(0^-)$

Find $i_2 = i(0^+)$ and $v_2 = v(0^+)$

Find $i_3 = i(\infty)$ and $v_3 = v(\infty)$





Given Variables:

. : . .

Calculate the following:

i1 (A) :

0

v1 (V) :

0

i2 (A) :

5

v2 (V) :

0

i3 (A) :

0

v3 (V) :

12

Hint: Capacitors and inductors in steady state behave as opens and shorts.

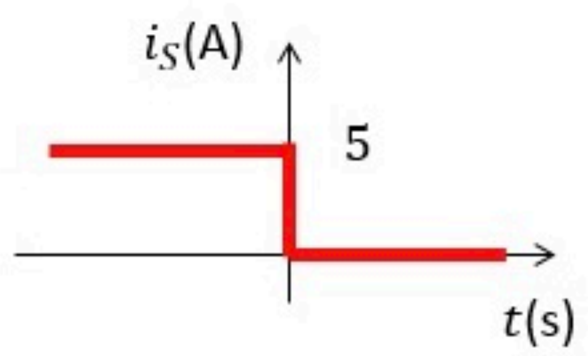
PP Second order circuits 002

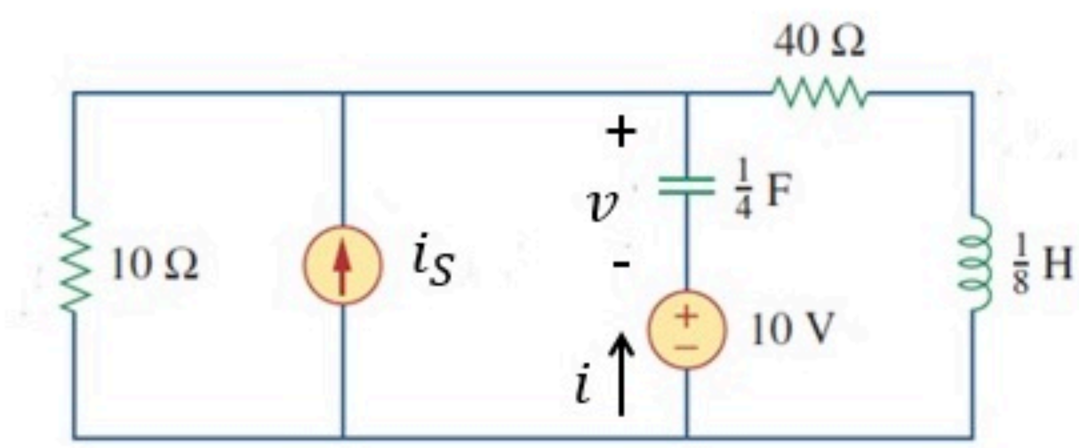
Unlimited Attempts.

Find $i_1 = i(0^-)$ and $v_1 = v(0^-)$

Find $i_2 = i(0^+)$ and $v_2 = v(0^+)$

Find $i_3 = i(\infty)$ and $v_3 = v(\infty)$





Given Variables:

. : . .

Calculate the following:

i1 (A) :

0

v1 (V) :

30

i2 (A) :

5

v2 (V) :

30

i3 (A) :

0

v3 (V) :

-10

Hint: Capacitors and inductors in steady state behave as opens and shorts.