1.

In the circuit given below, $R = 30\ \Omega$, $V = 30$ V, and $L = 1/6$ H.
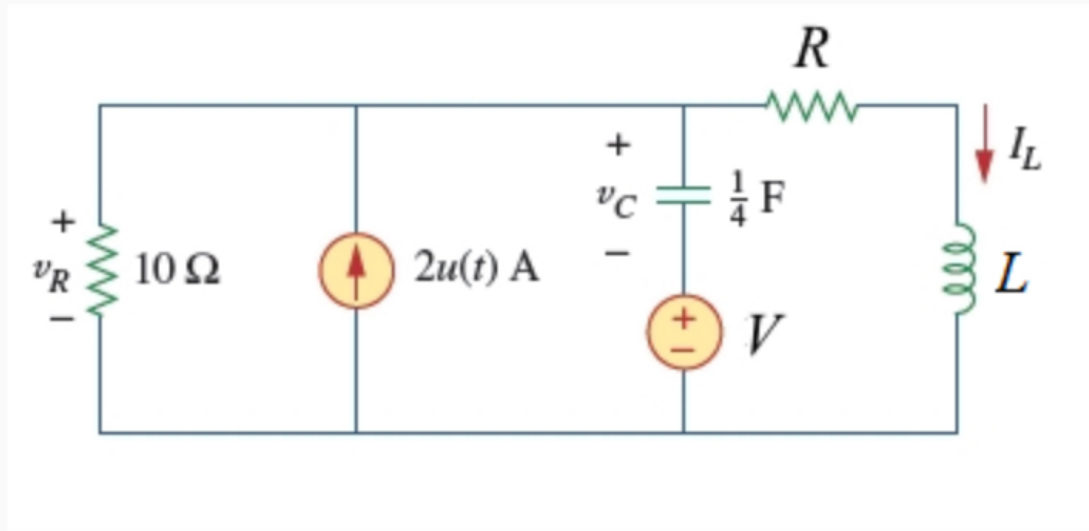
Calculate $i_L(0^+)$, $v_C(0^+)$, and $v_R(0^+)$.

The value of $i_L(0^+)$ is 0 ± 0 A.

The value of $v_C(0^+)$ is -30 V.
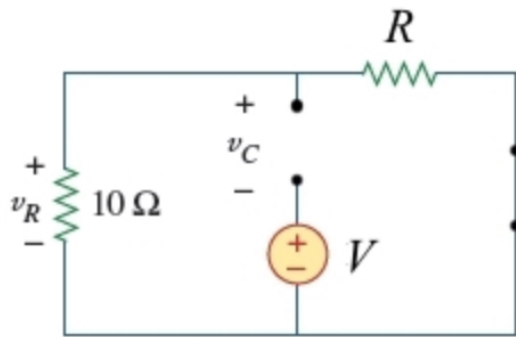
The value of $v_R(0^+)$ is 0 ± 0 V.

Explanation:

At $t = 0^-$, $u(t) = 0$.

Consider the circuit shown in Fig. (a).
$i_L(0^-) = 0$ V and $v_R(0^-) = 0$ V.
But, $-v_R(0^-) + v_C(0^-) + 15 = 0$ $\rightarrow$ $v_C(0^-) = -15$ V.

(a)

At $t = 0^+$, the inductor current and capacitor voltage cannot change abruptly.
Hence, the inductor current must still be equal to 0 A and the capacitor has a voltage equal to -15 V.
Since the capacitor is in series with the $+15$ V source, together they represent a direct short at $t = 0^+$. This means that the entire 2 A from the current source flows through the capacitor and not the resistor. Therefore, $v_R(0^+) = 0$ V.
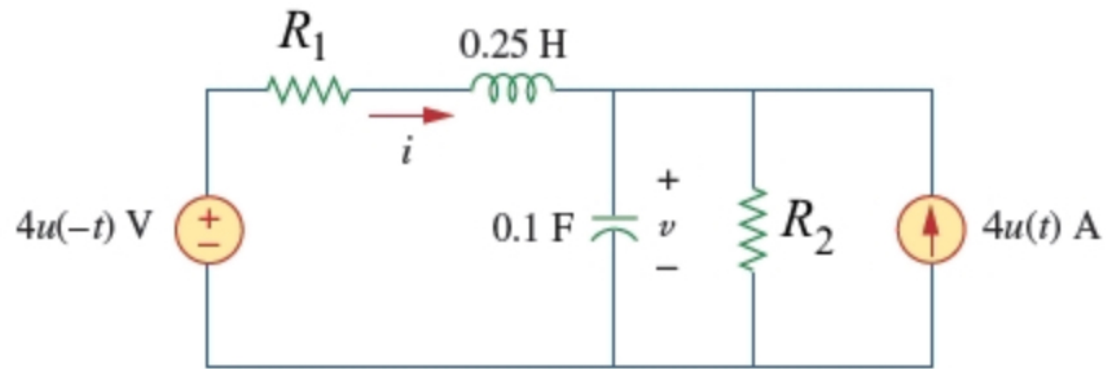
The value of $i_L(0^+)$ is 0 A.
The value of $v_C(0^+)$ is -15 V.
The value of $v_R(0^+)$ is 0 V.

2.

In the circuit given below, $R_1 = 4\ \Omega$ and $R_2 = 7\ \Omega$.
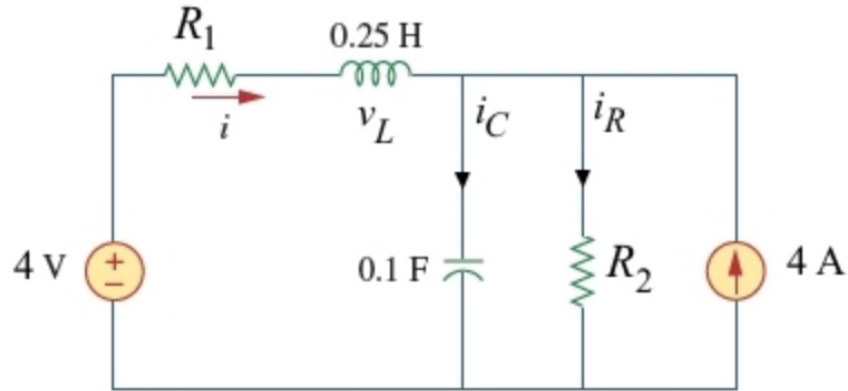

Find $dv(0^+)/dt$ and $di(0^+)/dt$.

The value of $dv(0^+)/dt$ is $\boxed{40.00 \pm 3\%}$ V/s.

The value of $di(0^+)/dt$ is $\boxed{-16.00 \pm 3\%}$ A/s.

Explanation:

$$i_C = C\frac{dv}{dt} \quad \leftrightarrow \quad \frac{dv(0^+)}{dt} = \frac{i_C(0^+)}{C}$$

For $t = 0$, $4u(t) = 4$ and $4u(-t) = 0$. The equivalent circuit is shown in Fig.(b).

(b)

Since i and v cannot change abruptly,

$$i_R = \frac{v}{5} = \frac{2.55 \text{ V}}{7.00 \text{ }\Omega} = 0.36 \text{ A}$$

$i(0^+) + 4 = i_C(0^+) + i_R(0^+) \quad \rightarrow \quad 0.36 + 4 = i_C(0^+) + 0.36$, which leads to $i_C(0^+) = 4.00$ A

$$\frac{dv(0^+)}{dt} = \frac{4.00 \text{ A}}{0.1 \text{ F}} = 40.00 \text{ V/s}$$

Similarly, $v_L = L\frac{di}{dt} \quad \rightarrow \quad \frac{di(0^+)}{dt} = \frac{v_L(0^+)}{L}$

$V_L = -V_C - 4i_L = -4.00$ V

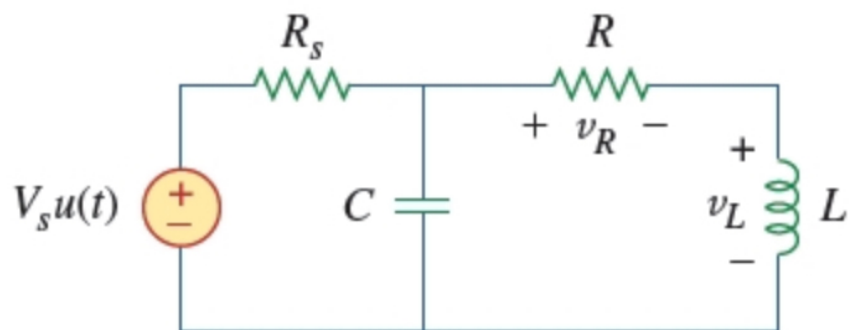$$\frac{di(0^+)}{dt} = \frac{-4.00 \text{ V}}{0.25 \text{ H}} = -16.00 \text{ A/s}$$

The value of $dv(0^+)/dt$ is 40.00 V/s.
The value of $di(0^+)/dt$ is -16.00 A/s.

3.

value:
10.00 points

Consider the circuit given below.

Determine $v_R(0^+)$ and $v_L(0^+)$.

The value of $v_R(0^+)$ is [0] V.

The value of $v_L(0^+)$ is [0] V.

Explanation:

Let i = the inductor current. For $t < 0$, $u(t) = 0$ so that
$i(0) = 0$ and $v(0) = 0$.

For $t > 0$, $u(t) = 1$. Since $v(0^+) = v(0^-) = 0$ and $i(0^+) = i(0^-) = 0$,
$v_R(0^+) = R_i(0^+) = 0$ V.

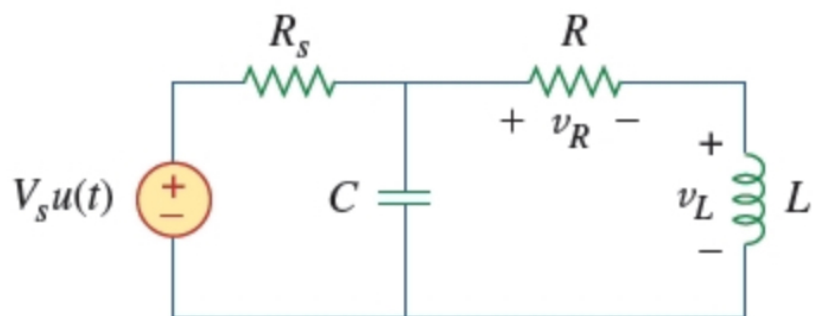Also, since $v(0^+) = v_R(0^+) + v_L(0^+)$ $\rightarrow$ $0 = 0 + v_L(0^+)$ or $v_L(0^+) = 0$ V --(1)

The value of $v_R(0^+)$ is 0 V.
The value of $v_L(0^+)$ is 0 V.

4.

Consider the circuit given below.

Find $dv_R(0^+)/dt$ and $dv_L(0^+)/dt$.

- ○ $\dfrac{dv_R(0^+)}{dt} = 0$ V/s, $\dfrac{dv_L(0^+)}{dt} = \dfrac{V_s}{R_s}$

- ○ $\dfrac{dv_R(0^+)}{dt} = \dfrac{V_s}{R_s}$, $\dfrac{dv_L(0^+)}{dt} = \dfrac{V_s}{CR_s}$

- → ○ $\dfrac{dv_R(0^+)}{dt} = 0$ V/s, $\dfrac{dv_L(0^+)}{dt} = \dfrac{V_s}{CR_s}$

- ○ $\dfrac{dv_R(0^+)}{dt} = \dfrac{V_s}{CR_s}$, $\dfrac{dv_L(0^+)}{dt} = 0$ V/s

Explanation:

Since $v(0^+) = v_R(0^+) + v_L(0^+) \quad \rightarrow \quad 0 = 0 + v_L(0^+)$ or $v_L(0^+) = 0$ V _____ (1)

Since $i(0^+) = 0$, $i_C(0^+) = \frac{V_s}{R_s}$

But, $i_C = C\frac{dv}{dt} \quad \rightarrow \quad \frac{dv(0^+)}{dt} = \frac{V_s}{CR_s}$ _____ (2)

From Eq.(1),

$$\frac{dv(0^+)}{dt} = \frac{dv_R(0^+)}{dt} + \frac{dv_L(0^+)}{dt}$$ _____ (3)

$v_R = iR \quad \rightarrow \quad \frac{dv_R}{dt} = \frac{R di}{dt}$ _____ (4)

But, $v_L = L\frac{di}{dt} \quad \rightarrow \quad v_L(0^+) = 0 = L\frac{di(0^+)}{dt} \quad \rightarrow \quad \frac{di(0^+)}{dt} = 0$ _____ (5)

From Eq.(4) and Eq.(5),

$$\frac{dv_R(0^+)}{dt} = 0 \text{ V/s}$$

From Eq.(2) and Eq.(3),

$$\frac{dv_L(0^+)}{dt} = \frac{dv(0^+)}{dt} = \frac{V_s}{CR_s}$$

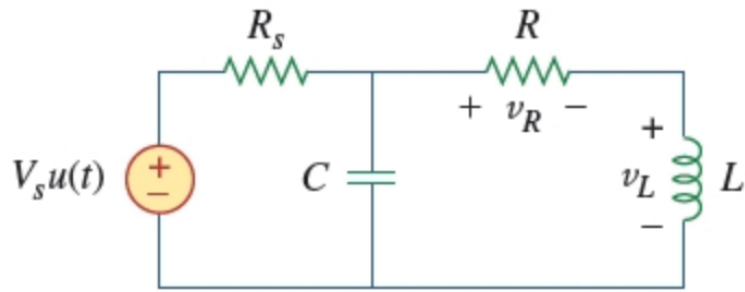The values of $dv_R(0^+)/dt$ and $dv_L(0^+)/dt$ are

$$\frac{dv_R(0^+)}{dt} = 0 \text{ V/s}$$

$$\frac{dv_L(0^+)}{dt} = \frac{V_s}{CR_s}$$

5.

Consider the circuit given below.

Find $v_R(\infty)$ and $v_L(\infty)$.

○ $v_R(\infty) = 0\ \text{V},\ v_L(\infty) = \left(\frac{R}{R+R_s}\right)V_s$

○ $v_R(\infty) = \left(\frac{R}{R_s}\right)V_s,\ v_L(\infty) = 0\ \text{V}$

→ ○ $v_R(\infty) = \left(\frac{R}{R+R_s}\right)V_s,\ v_L(\infty) = 0\ \text{V}$

○ $v_R(\infty) = 0\ \text{V},\ v_L(\infty) = \left(\frac{R_s}{R}\right)V_s$

Explanation:

As *t* approaches infinity, the capacitor acts like an open circuit, while the inductor acts like a short circuit.

The values of $v_R(\infty)$ and $v_L(\infty)$ are

$$v_R(\infty) = \left(\frac{R}{R+R_s}\right)V_s$$

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

6.

The current in an *RLC* circuit is described by

$$\frac{d^2i}{dt^2} + 10\frac{di}{dt} + 25\,i = 0$$

If $i(0) = 10$ A and $di(0)/dt = 0$, then for $t > 0$, $i(t) = (A + Bt)e^{st}$ A,

where **A** = $\boxed{10 \pm 2\%}$, **B** = $\boxed{50 \pm 2\%}$, and **s** = $\boxed{-5 \pm 2\%}$.

Explanation:

The characteristic equation of the given differential equation can be written as $s^2 + 10s + 25 = 0$.

$$s_{1,2} = \frac{-10 \pm \sqrt{100 - (4 \times 1 \times 25)}}{2} = -5$$

Here, *s* has repeated roots.

$i(t) = (A + Bt)e^{-5t}$

$i(0) = 12$ A $\qquad \rightarrow \qquad A = 12$

$$\frac{di}{dt} = \left(Be^{-5t}\right) + \left(-5(A + Bt)\,e^{-5t}\right)$$

$$\frac{di(0)}{dt} = 0 = B - 5A \qquad \rightarrow \qquad B = (5 \times 12) = 60$$
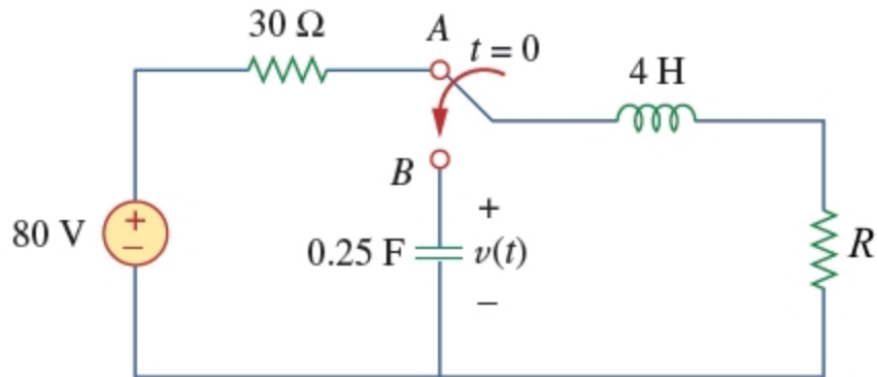
Therefore, $i(t) = (12 + 60\,t)e^{-5t}$ A.

The equation of current is $i(t) = (12 + 60\,t)e^{-5t}$ A.

In the circuit given below, $R = 10 \, \Omega$. The switch in the circuit moves from position A to position B at $t = 0$ (please note that the switch must connect to point B before it breaks the connection at A, a make-before-break switch). Let $v(0) = 0$. Find $v(t)$ for $t > 0$.

○ $v(t) = -(5.333)e^{-(-0.50)t} + (-5.333)e^{-(-2.00)t}$ V

→ ○ $v(t) = (5.333)e^{-0.50t} + (-5.333)e^{-2.00t}$ V

○ $v(t) = -(5.333)e^{-(-0.50)t} - (-5.333)e^{-(-2.00)t}$ V

○ $v(t) = (5.333)e^{-0.50t} - (-5.333)e^{-(-2.00)t}$ V

Explanation:

When the switch is in position A,

$v(0^-) = 0$ and $i_L = \dfrac{80\ V}{50\ \Omega} = 1.60\ A$

When the switch is in position B, we have a source-free series RCL circuit.

$\alpha = \dfrac{R}{2L} = \dfrac{20\ \Omega}{2 \times 4\ H} = 2.50$

$\omega_o = \dfrac{1}{\sqrt{LC}} = \dfrac{1}{\sqrt{\frac{1}{4}F \times 4\ H}} = 1$

Since $\alpha > \omega_o$, we have an overdamped case.

$s_{1,2} = -\alpha \pm \sqrt{\alpha^2 - \omega_o^2} = -2.50 \pm \sqrt{2.50^2 - 1} = -0.21,\ -4.79$

$v(t) = Ae^{-0.21t} + Be^{-4.79t}$ _____ (1)

$v(0) = 0 = A + B$ _____ (2)

$i_C(0) = C\dfrac{dv(0)}{dt} = 1.60 \leftrightarrow \dfrac{dv(0)}{dt} = \dfrac{1.60}{C} = 6.40$

But $\dfrac{dv(t)}{dt} = (-0.21)Ae^{-0.21t} + (-4.79)Be^{-4.79t}$

$\dfrac{dv(0)}{dt} = (-0.21)A + (-4.79)B = 6.40$ _____ (3)

Solving Eq.(2) and Eq.(3), $A = 1.397$ and $B = -1.397$.

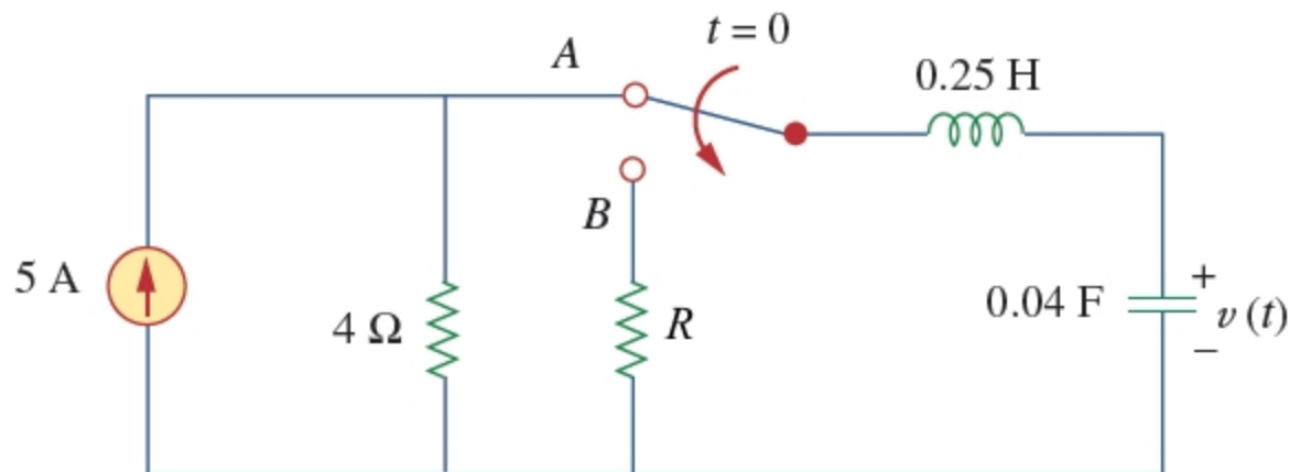Therefore, $v(t) = (1.397)e^{-0.21t} + (-1.397)e^{-4.79t}\ V$

The velocity equation is $v(t) = (1.397)e^{-0.21t} + (-1.397)e^{-4.79t}\ V$.

8.

In the circuit given below, $R = 20\ \Omega$ and the switch moves (a make-before-break switch) from position A to B at $t = 0$. Find $v(t)$ for all $t \geq 0$.

The voltage equation is $v(t) = Ae^{s1t} + Be^{s2t}$,

where $A =$ [20.328 ± 3%] , $B =$ [-0.328 ± 3%] , $s1 =$ [-1.270 ± 3%] , and $s2 =$ [-78.730 ± 3%] .

Explanation:

$i(0) = I_0 = 0$, $v(0) = V_0 = 4\,\Omega \times 5\,A = 20\,V$

$$\frac{dv(0)}{dt} = -\frac{1}{L}(RI_0 + V_0) = -4(0 + 20) = -80$$

$$\omega_o = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{\frac{1}{4}\frac{1}{25}}} = 10$$

$$\alpha = \frac{R}{2L} = \frac{10}{2 \times \frac{1}{4}} = 20 > \omega_o$$

$$s = -\alpha \pm \sqrt{\alpha^2 - \omega_o^2} = -20 \pm \sqrt{20^2 - 10^2} = -2.679, \; -37.321$$

$$i(t) = A_1 e^{-2.679t} + A_2 e^{-37.321t}$$

$i(0) = 0 = A_1 + A_2 \qquad \rightarrow \qquad A_2 = -A_1$

$$\frac{dv(0)}{dt} = -2.679A_1 - 37.321A_2 = -80$$

This leads to $A_1 = -2.309$ and $A_2 = 2.309$.

$$i(t) = 2.309(-e^{-2.679t} + e^{-37.321t})$$

Since $v(t) = \frac{1}{C}\int_0^t i(t)\,dt$, we get

$v(t) = 21.547e^{-2.679t} - 1.547e^{-37.321t}$

The voltage equation is $v(t) = 21.547e^{-2.679t} - 1.547e^{-37.321t}$.

9.

Assuming R = 12 kΩ, design a parallel RLC circuit that has the characteristic equation $s^2 + 100s + 10^6 = 0$.

The value of L is ⟦ *120 ± 2%* ⟧ H.

The value of C is ⟦ *8.333 ± 2%* ⟧ nF.

Explanation:

Comparing the characteristic equation with the following equation:

$$s^2 + \frac{R}{L}s + \frac{1}{LC} = 0,$$

we obtain

$$\frac{R}{L} = 100 \qquad \rightarrow \qquad L = \frac{R}{100} = \frac{16000}{100} = 160 \text{ H}$$

$$\frac{1}{LC} = 10^6 \qquad \rightarrow \qquad C = \frac{1}{10^6 L} = \frac{10^{-6}}{160} = 6.250 \text{ nF}$$

The value of L is 160 H.
The value of C is 6.250 nF.

10.

A branch voltage in an *RLC* circuit is described by

$$\frac{d^2v}{dt^2} + 4\frac{dv}{dt} + 8v = 24$$

If the initial conditions are $v(0) = 8 = dv(0)/dt$, find $v(t)$.

→ ○ $v(t) = (3 + (5\cos(2t) + 9.0\sin(2t))e^{-2t})$ volts

○ $v(t) = (3 + (\cos(2t) + \sin(2t))e^{-2t})$ volts

○ $v(t) = ((5\cos(2t) + \sin(2t))e^{-2t})$ volts

○ $v(t) = (3 + (5\cos(2t) - 9.0\sin(2t))e^{-2t})$ volts

Explanation:

$s^2 + 4s + 8 = 0$, which leads to

$$s_{1,2} = \frac{-4 \pm \sqrt{16 - 32}}{2} = -2 \pm j2$$

$v(t) = V_s + (A_1 \cos(2t) + A_2 \sin(2t))e^{-2t}$

$8V_s = 24$ means that $V_s = 3$

$v(0) = 9 = 3 + A_1$ leads to $A_1 = 6$

$$\frac{dv}{dt} = -2(A_1\cos(2t) + A_2\sin(2t))e^{-2t} + -2(A_1\cos(2t) + A_2\sin(2t))e^{-2t}$$

$$\frac{dv(0)}{dt} = 9 = -2A_1 + 2A_2 \rightarrow A_2 = 10.5$$

Therefore, $v(t) = (3 + (6\cos(2t) + 10.5\sin(2t))e^{-2t})$ volts.

The voltage equation is $v(t) = (3 + (6\cos(2t) + 10.5\sin(2t))e^{-2t})$ volts.

A series *RLC* circuit is described by

$$L\frac{d^2i}{dt^2} + R\frac{di}{dt} + \frac{i}{C} = 10$$

Find the response when *L* = 0.5 H, *R* = 4 Ω, and *C* = 0.2 F. Let *i*(0) = 1, *di*(0)/*dt* = 0.

The current equation is *i*(*t*) = **E** + [**A**e^s1 + **B**e^s2] A,

where **A** =   -1.3165 , **B** =   0.3165 ± 2% , **s1** =   -1.5505 ± 2% , **s2** =   -6.4500 ± 2% , and **E** =   2 .

Explanation:

The characteristic equation is

$$Ls^2 + Rs + \tfrac{1}{C} = 0 \quad \rightarrow \quad \tfrac{1}{2}s^2 + 4s + \tfrac{1}{0.2} = 0 \quad \rightarrow \quad s^2 + 8s + 10 = 0$$

$$s_{1,2} = \frac{-8 \pm \sqrt{64 - 40}}{2} = -1.5505, \ -6.45$$

$i(t) = i_s + Ae^{-1.5505t} + Be^{-6.45t}$

But $[i_s / C] = 10$ or $i_s = 0.2 \times 10 = 2$

$i(t) = 2 + Ae^{-1.5505t} + Be^{-6.45t}$

$i(0) = 0 = 2 + A + B \quad \rightarrow \quad A = -2 - B \qquad \underline{\quad\quad}$ (1)

$$\frac{di(t)}{dt} = -1.5505Ae^{-1.5505t} - 6.45Be^{-6.45t}$$

$$\frac{di(0)}{dt} = 2 = -1.5505A - 6.45B \qquad \underline{\quad\quad}\ (2)$$

Solving Eq.(1) and Eq.(2), $-1.5505(-2 - B) - 6.45B = 2 \quad \rightarrow \quad B = 0.2247$ and $A = -2.2247$

Therefore, $i(t) = 2 + (-2.2247)e^{-6.45t} + (0.2247)e^{-1.5505t}$ A.

The current equation is $i(t) = 2 + (-2.2247)e^{-6.45t} + (0.2247)e^{-1.5505t}$ A.

12.

Solve the following differential equation subject to the specified initial conditions.

$\frac{d^2 i}{dt^2} + 5\frac{di}{dt} + 4i = 8$

Given that the initial conditions are $i(0) = -2$ and $di(0)/dt = 2$.

The current equation is $i(t) = (E - Ae^{s1t} + Be^{s2t})$ A,

where A = $\boxed{4.667 \pm 2\%}$, B = $\boxed{0.667 \pm 0.000\%}$, s1 = $\boxed{-1.000 \pm 2\%}$, s2 = $\boxed{-4.000 \pm 2\%}$, and E = $\boxed{2.000 \pm 2\%}$.

Explanation:

$s^2 + 5s + 4 = 0$, which leads to $s_{1,2} = -1, -4$

$i(t) = I_s + Ae^{-t} + Be^{-4t}$

$4I_s = 8 \quad \rightarrow \quad I_s = 2$

$i(0) = -1 = 2 + A + B \qquad \rightarrow \qquad A = -3 - B \qquad \qquad$ --(1)

$\frac{di}{dt} = -Ae^{-t} - 4Be^{-t}$

$\frac{di(0)}{dt} = 2 = -A - 4B \qquad \qquad$ --(2)

From Eq.(1) and Eq.(2), $2 = -(-3 - B) - 4B \qquad \rightarrow \qquad B = 0.333$
$A = -3 - 0.333 = -3.333$

Therefore, $i(t) = (2 - 3.333e^{-t} + 0.333e^{-4t})$ A.

The current equation is $i(t) = (2 - 3.333e^{-t} + 0.333e^{-4t})$ A.

13.

Solve the following differential equation subject to the specified initial conditions.

$$\frac{d^2v}{dt^2} + 2\frac{dv}{dt} + v = 3$$

Given that the initial conditions are $v(0) = 4$ and $dv(0)/dt = 1$.

The voltage equation is $v(t) = [D + (A + Bt)e^{s3t}]$ V,

where **A** = $1 \pm 2\%$, **B** = $2 \pm 2\%$, **s3** = -1 , and **D** = 3 .

Explanation:

$s^2 + 2s + 1 = 0$, which leads to $s_{1,2} = -1, -1$

$v(t) = V_s + (A + Bt)e^{-t}$ and $V_s = 3$

$v(0) = 5 = 3 + A \qquad \rightarrow \qquad A = 2$
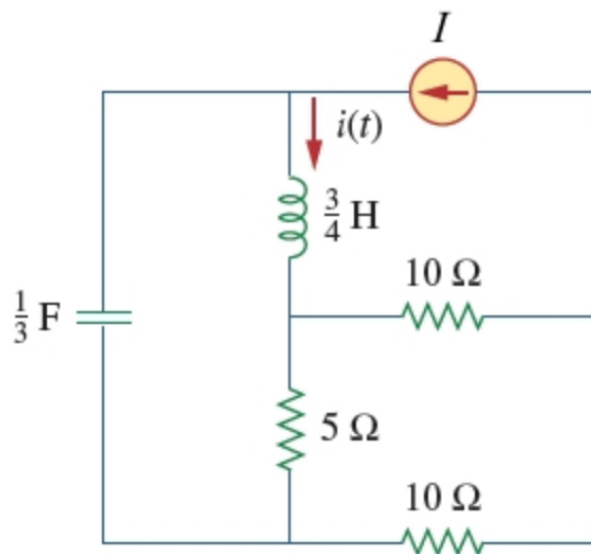
$\frac{dv(0)}{dt} = 1 = -A + B \qquad\qquad B = 3$

Therefore, $v(t) = (3 + (2 + 3t)e^{-t})$ V.

The voltage equation is $v(t) = (3 + (2 + 3t)e^{-t})$ V.

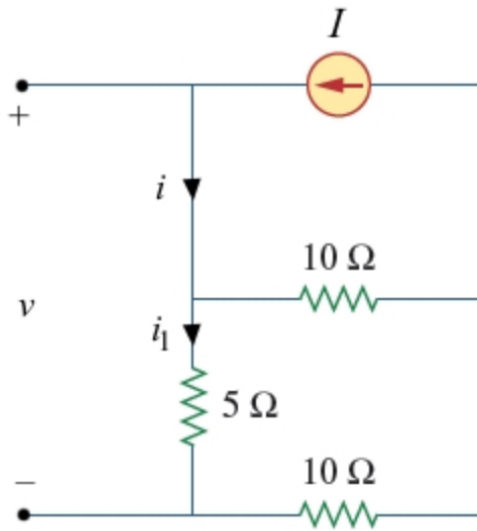In the circuit given below, $I = 15[1 - u(t)]$ A. Calculate $i(t)$ for $t > 0$.

The current equation is $i(t) = [Ae^{s1t} + Be^{s2t}]$ A,

where $A = $ | $7.5 \pm 2\%$ |, $B = $ | $7.5 \pm 2\%$ |, $s1 = $ | $-0.903 \pm 2\%$ |, and $s2 = $ | $-4.431 \pm 2\%$ |.

Explanation:

At $t = 0^-$, the equivalent circuit is as shown below.

$i(0) = 20$ A

$i_1(0) = (20\ \text{A})\left(\frac{10\ \Omega}{15\ \Omega + 10\ \Omega}\right) = 8$ A

$v(0) = 5i_1(0) = 40$ V

For $t > 0$, we have a source-free series *RLC* circuit.

$R = 5 \parallel 20 = 4$ ohms

$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(3/4)\ \text{H} \times (1/3)\ \text{F}}} = 2$ rad/s

$\alpha = \frac{R}{2L} = \frac{4\ \Omega}{2 \times (3/4)\text{F}} = 8/3 = 2.6667$

$s_{1,2} = -\alpha \pm \sqrt{\alpha^2 - \omega_0^2} = -2.6667 \pm 1.76834 = -0.90283,\ -4.4305$

$i(t) = [Ae^{-0.903t} + Be^{-4.431t}]$ A

$i(0) = 20 = A + B \qquad \rightarrow \qquad B = 20 - A \qquad \text{--(1)}$

$\frac{di(0)}{dt} = \frac{1}{L}(-Ri(0) + v(0)) = \frac{4}{3}(-4 \times 20 + 40) = \text{-53.3333}$

Hence, $-53.3333 = -0.90283A - 4.4305B$ \qquad \text{--(2)}

From Eq.(1) and Eq.(2),

$-53.3333 = -18.0566 + 0.90283B - 4.4305B \qquad \rightarrow \qquad B = 10$ and $A = 10$

Therefore, $i(t) = [10e^{-0.903t} + 10e^{-4.431t}]$ A.

The current equation is $i(t) = [10e^{-0.903t} + 10e^{-4.431t}]$ A.

15.

The step response of a parallel *RLC* circuit is

$$v = 10 + 20e^{-300t}(\cos(400t) - 2\sin(400t)) \text{ V}, \ t \geq 0$$

when the inductor is 10 mH. Find *R* and *C*.

The value of *C* is $400.00 \pm 3\%$ μF.

The value of *R* is $4.167 \pm 3\%$ Ω.

Explanation:

$$\alpha = 300 = \tfrac{1}{2RC} \qquad\qquad \text{--(1)}$$

$$\omega_d = \sqrt{\omega_o^2 - \alpha^2} = 400 \qquad \rightarrow \qquad \omega_o^2 = \omega_d^2 + \alpha^2 = 160,000 + 90,000 = \tfrac{1}{LC} \qquad \text{--(2)}$$

From (2),

$$C = \frac{1}{250,000 \times 15 \times 10^{-3}} = 266.67 \ \mu F$$

From (1),

$$R = \tfrac{1}{2\alpha C} = \frac{1}{2 \times 300 \times 266.67 \times 10^{-6} \, F} = 6.250 \ \Omega$$

The value of *C* is 266.67 μF.
The value of *R* is 6.250 Ω.

16.

In the circuit given below, V = 50 V. The switch in the circuit has been positioned at 1 for $t < 0$. At $t = 0$, it is moved from position 1 to the top of the capacitor. Please note that the switch is a make-before-break switch, and it stays in contact with position 1 until it makes contact with the top of the capacitor and then breaks the contact at position 1. Given that the initial voltage across the capacitor is equal to zero, determine $v(t)$.
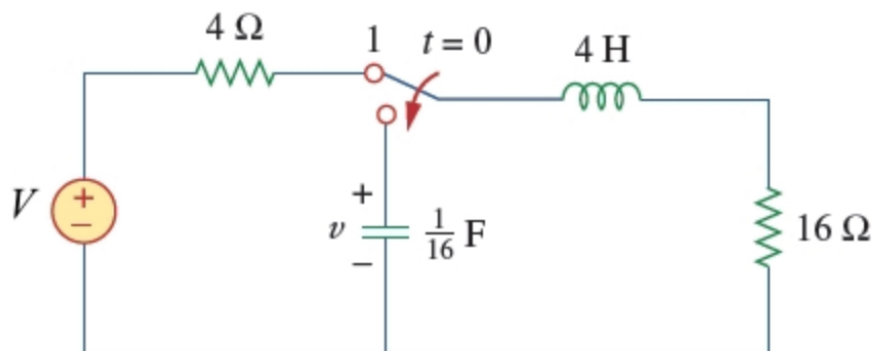
The voltage equation is $v(t) = D + [A + Bf]e^{-st}$ V,

where **A** =   0 ± 2% , **B** =   -40 ± 2% , **s** =   2.00 ± 2% , and **D** =   0 ± 2% .

Explanation:

Let i = inductor current and v = capacitor voltage.

$v(0) = 0$, $i(0) = \dfrac{30\ V}{4\ \Omega + 16\ \Omega} = 1.5\ A$

For $t > 0$, the circuit becomes a source-free series RLC with

$\alpha = \dfrac{R}{2L} = \dfrac{16\ \Omega}{2 \times 4\ H} = 2$

$\omega_o = \dfrac{1}{\sqrt{LC}} = \dfrac{1}{\sqrt{4\ H \times \frac{1}{16}\ F}} = 2$

$i(t) = [Ae^{-2t}] + [Bte^{-2t}]$

$i(0) = 2 = A$

$\dfrac{di}{dt} = -2Ae^{-2t} + Be^{-2t} - 2Bte^{-2t}$

$\dfrac{di(0)}{dt} = -2A + B = -\dfrac{1}{L}(Ri(0) + v(0)) \qquad \rightarrow \qquad -2A + B = -6 \qquad \rightarrow \qquad B = -3.00$

Thus, $i(t) = [2e^{-2t}] - [3te^{-2t}]$ A.

$v = \dfrac{1}{C}\int_0^t v(0) - i\, d\tau$

$v = -(16 \times 2)\int_0^t e^{-2\tau}\, d\tau + (16 \times 3)\int_0^t \tau e^{-2\tau}\, d\tau$

$v = 12e^{-2\tau}\,\big|_0^t + 12e^{-2\tau}(-2\tau - 1)\big|_0^t$

Therefore, $v(t) = (0) + [0Ae^{-2t}] - [24te^{-2t}]$ V.

The voltage equation is $v(t) = (0) + [0Ae^{-2t}] - [24te^{-2t}]$ V.