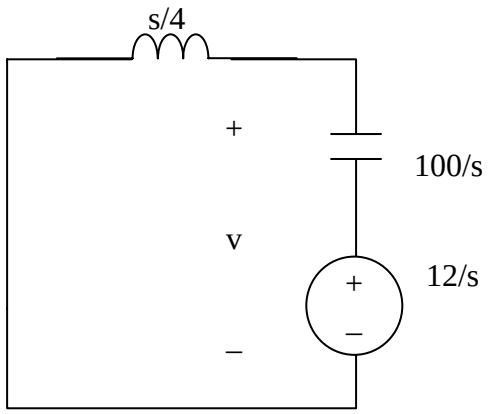
PROBLEM SET #7

Chapter 16, Solution 24.

When the switch is position 1, v(0)=12, and $i_L(0) = 0$. When the switch is in position 2, we have the circuit as shown below.



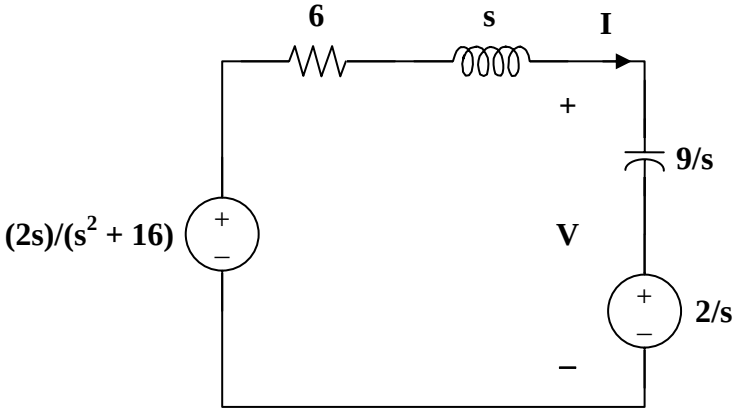
$$10mF = 0.01F \longrightarrow \frac{1}{sC} = \frac{100}{s}$$

$$I = \frac{12/s}{s/4 + 100/s} = \frac{48}{s^2 + 400}, \qquad V = sLI = \frac{s}{4}I = \frac{12s}{s^2 + 400}$$

$$v(t) = \underline{12\cos 20t, \quad t > 0}$$

Chapter 16, Solution 25.

For $t > 0$, the circuit in the s-domain is shown below.



Applying KVL,

$$\frac{-2s}{s^2 + 16} + \left(6 + s + \frac{9}{s}\right)I + \frac{2}{s} = 0$$

$$I = \frac{-32}{(s^2 + 6s + 9)(s^2 + 16)}$$

$$V = \frac{9}{s} I + \frac{2}{s} = \frac{2}{s} + \frac{-288}{s(s+3)^2(s^2+16)}$$
$$= \frac{2}{s} + \frac{A}{s} + \frac{B}{s+3} + \frac{C}{(s+3)^2} + \frac{Ds+E}{s^2+16}$$

$$-288 = A(s^4 + 6s^3 + 25s^2 + 96s + 144) + B(s^4 + 3s^3 + 16s^2 + 48s)$$
$$+ C(s^3 + 16s) + D(s^4 + 6s^3 + 9s^2) + E(s^3 + 6s^2 + 9s)$$

Equating coefficients :

s^0 : $-288 = 144A$ (1)

s^1 : $0 = 96A + 48B + 16C + 9E$ (2)

s^2 : $0 = 25A + 16B + 9D + 6E$ (3)

s^3 : $0 = 6A + 3B + C + 6D + E$ (4)

s^4 : $0 = A + B + D$ (5)

Solving equations (1), (2), (3), (4) and (5) gives

$A = -2$, $B = 2.202$, $C = 3.84$, $D = -0.202$, $E = 2.766$

$$V(s) = \frac{2.202}{s+3} + \frac{3.84}{(s+3)^2} - \frac{0.202s}{s^2+16} + \frac{(0.6915)(4)}{s^2+16}$$

$v(t) =$ **$\{2.202e^{-3t} + 3.84te^{-3t} - 0.202\cos(4t) + 0.6915\sin(4t)\}u(t)$ V**