Homework #7-1

Problem 1: a) consider a 4mF capacitor voltage $v(t) = Ae^{-100t} + Be^{-600t}$ V for $t \geq 0$ where A and B are constants. Assume initial voltage $v(0) = 50$V and initial current $i(0) = 20$A. Determine A, B, and $i(t)$

$v(t) = Ae^{-100t} + Be^{-600t}$ $t \geq 0$

$v(0) = A + B = 50$

$i_c = C\frac{dv}{dt}$

$i_c(t) = C[-100Ae^{-100t} - 600Be^{-600t}]$

$C = 4 \cdot 10^{-3}$ F $\Rightarrow$ $i_c(t) = -0.4Ae^{-100t} - 2.4Be^{-600t}$

$i_c(0) = 0.4A - 2.4B$

$i_c(0) = 20A \Rightarrow -0.4A - 2.4B = 20$

$A + 6B = -50$

$B = 50 - A =$

$50 - 70 =$ **$-20 = B$**

$A + 6(50 - A) = -50$

$-5A + 300 = -50$

$-5A = -350$

$A = 70$

$i(t) = -0.4Ae^{-100t} - 2.4Be^{-600t}$ A

b) $V_c = \frac{1}{C}\int i(t)dt \Rightarrow \frac{1}{0.5}\int (6 - 6e^{-t})dt + k$

$V_c(t) = 2(6t + 6e^{-t}) + k$

$V_c(0) = 0$V

$V_c(6) = 2(6) + k = 0 \Rightarrow 12 + k = 0$

$k = -12$

$V_c(t) = 12(6 + e^{-t} - 1) \Rightarrow V_c(2) = 12(2 + e^{-2} - 1) = 12(1 + e^{-2})$ ①

$i_c(2) = 6(1 - e^{-2})$ A

$i_d(2) = V_c(2) \cdot i_c(2) \Rightarrow 72(1 + e^{-2})(1 - e^{-2})$

$= 72(1 - e^{-4})$ **$= 70.681$**