1. An FE style problem
A 10-microfarad capacitor has been charged to a potential of 150 volts. A resistor of 25 $\Omega$ is then connected across the capacitor through a switch. When the switch has been closed for 10 time constants the total energy dissipated by the resistor is most nearly

- (A) $1.0 \times 10^{-7}$ joules
- (B) $1.1 \times 10^{-1}$ joules
- (C) $9.0 \times 10^1$ joules
- (D) $9.0 \times 10^3$ joules

2. a) The switch is closed at time $t = 0$ and $v_C(0) = 0V$, find $v_C(t)$.
   b) What is the value of the voltage across C at $t = 40 \mu s$

3. The switch has been in the upper position for a long time and is switched down at time $t = 0$. What is the capacitor voltage ($V_C$) at $t = 4 \text{ ms}$

4. The switch has been in the upper position for a long time and is switched down at time $t = 0$. At what time is $v_C = 4 \text{ V}$?

5. a) What is the time constant of this circuit? Hint: Use a Thevenin equivalent circuit.
   b) What will be the final value of $v_C$? (After the switch has been closed for a long time)

6. a) Problem 3.16 (p. 153 in textbook). You may derive your DE for $v_C(t)$ or $v_C(t)$ if you want, but that's a hard way in this case. It's easier to write an equation in terms of $i$ and integrals of $i$, then differentiate that whole equation.
   b) Find $i(t)$ given $C_1 = 12 \mu F$, $C_2 = 6 \mu F$, $R = 100 \Omega$, $v_{C1}(0) = 15 \text{ V}$, $v_{C2}(0) = 0 \text{ V}$
   c) Find $v_{C2}(t)$ for the same values. Hint: The trick here will be finding the final condition. Realize that charge will be conserved. If $C_1$ discharges $x$ coulombs, then $C_2$ will charge $x$ coulombs. Charges will stop flowing when $v_{C1} = v_{C2}$.
   d) Find the initial and final stored energy of the system ($W_{C1} + W_{C2}$) to find the total "loss". What happened to that energy?

**Answers**

1. B
2. a) $12 \text{ V} - 12 \text{ V} \cdot e^{-0.16 \text{ ms}}$
   b) $2.65 \text{ V}$
3. $6.61 \text{ V}$
4. $6.44 \text{ ms}$
5. a) $5.876 \text{ ms}$
   b) $5 \text{ V}$
   c) 1.35 mJ
   d) $0.9 \text{ mJ}$