1. The switch is connected to 1 for a long time. At time $t=0$ s, the switch switches to 2. Then, when the capacitor voltage reaches 9 volts, the switch returns to 1 and stays at 1. Give $v_c(t)$ for all time. Sketch $v_c(t)$ for $-\tau \leq t \leq 5\tau$ where $\tau$ is the longer of the two time constants.

2. The switch is connected to 1 for a long time. At time $t=0$ s, the switch switches to 2. Then, when the capacitor voltage reaches two-thirds of $v_b$, the switch returns to 1 and stays at 1. Give $v_c(t)$ for all time. Sketch $v_c(t)$ for $-\tau \leq t \leq 5\tau$ where $\tau$ is the longer of the two time constants.
3. Determine \( R \) if \( v_c(12 \text{ ms}) = 6 \text{ V} \) and the initial capacitor voltage is \(-2\) volts (before the switch closes). The switch closes at time \( t = 0 \text{ s} \).

\[
v_c(t) = A + Be^{-\frac{t}{\tau}}\]

4. Please read pages 7-12 in the XYZ's of Oscilloscopes. See the course web site by lab 7 for the file.

5. Algebraically show (prove) the ratio of \( n \) over \( m \) or \( p \) over \( m \) is the following

\[
\frac{n}{m} = e^{-1} \quad \text{or} \quad \frac{p}{m} = 1 - e^{-1}.
\]

using the fundamental definition for RC circuits

\[
v_c(t) = A + Be^{-\frac{t}{\tau}}.
\]

Show all of your work.

6. Explain the meaning of \( \frac{p}{m} = 1 - e^{-1} \) from the previous problem and how it helps you plot capacitor voltage in RC circuits without a calculator.