Problem 1 (10 points)
The switch in the circuit below has been open for a long time. At $t = 0$, the switch is closed.

(a) Find $v_C(0^-)$, the capacitor voltage just before the switch is closed.

(b) Find $v_C(0^+)$, the capacitor voltage just after the switch is closed.

(c) Find $v_C(\infty)$, the capacitor voltage after the switch has been closed for a long time.

(d) Find $\tau$, the time constant of the circuit for $t \geq 0^+$.

(e) Determine the capacitor voltage $v_C(t)$ for all time and sketch it.
Problem 1 (continued)

\[ v_C(t) = \frac{1}{C} \int \left( i(t) - \frac{1}{2} \cdot \frac{v(t)}{R} \right) dt \]