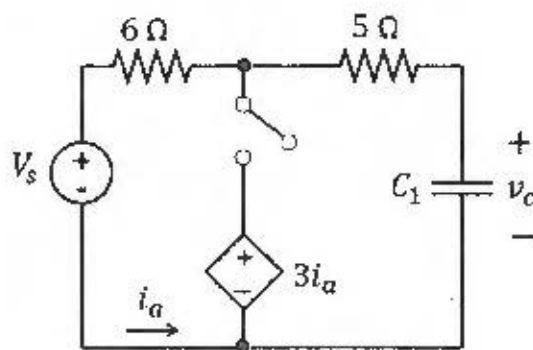


The switch has been open for a long time before it closes at time $t = 0$.

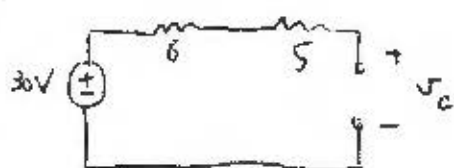
Find the capacitor voltage $v_c = A + B \cdot e^{-t/\tau}$ for $t > 0$.

$V_s : 30 \text{ V}$

$C_1 : 0.2 \text{ nF}$



(a) $t = 0^-$

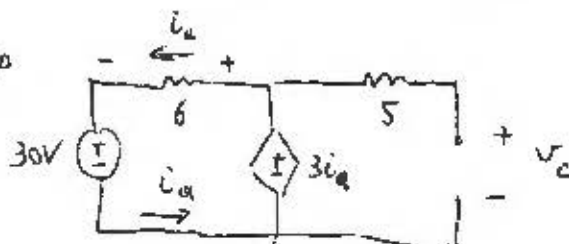


$$v_c(0^-) = 30 \text{ V}$$

\Downarrow

$$(b) v_c(0^+) = 30 \text{ V}$$

(c) $t = \infty$



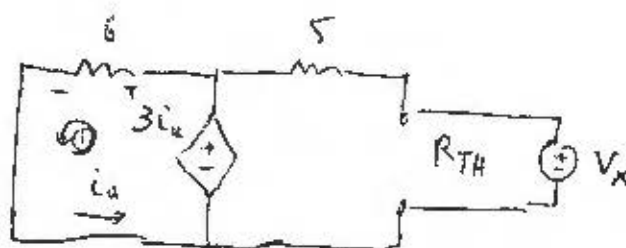
$$30 + 6i_a - 3i_a = 0$$

$$3i_a = -30$$

$$i_a = -10 \text{ A}$$

$$\Rightarrow v_c(\infty) = 3i_a = -30 \text{ V}$$

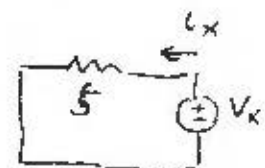
(d)



$$\text{KVL } \textcircled{1}: 3i_a - 6i_a = 0$$

$$\Rightarrow i_a = 0$$

\Rightarrow



$$\frac{V_x}{5} = i_x \Rightarrow R_{TH} = 5 \Omega$$

$$\tau = RC = 1 \text{ ns}$$

$$A = v_c(\infty) \Rightarrow A = -30 \text{ V}$$

$$A + B = v_c(0^+) \Rightarrow B = 60 \text{ V}$$