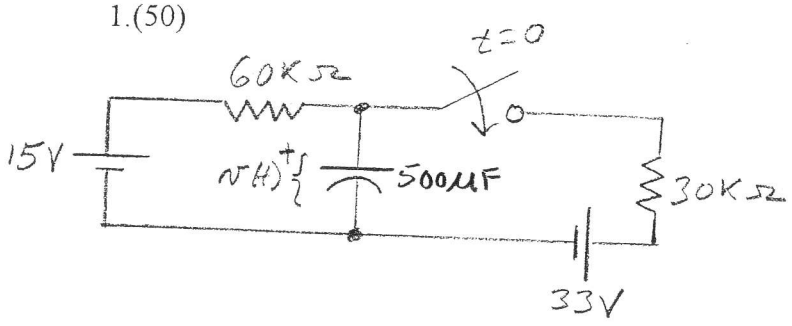
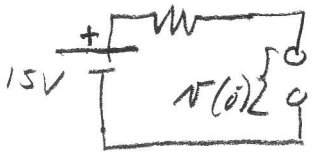
ECE 252 | **Introduction to Electrical Engineering** | **Quiz 8P**
100 Points | **Show your work.** | **Practice Solution**

1.(50)



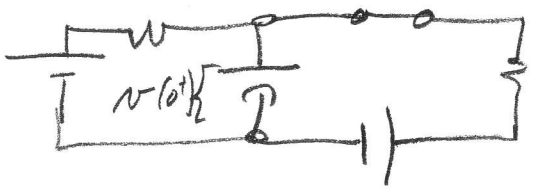
The switch has been open for a long time. The switch is closed at t = 0. Find $v(t)$ for t > 0.

$t = 0^-$ $\quad v_C$ = constant $\therefore i_C = C\frac{dv_C}{dt} = 0$



Since no current flows in the open circuit, $v_R = 0$. $\therefore v_C(0^-) = 15V$

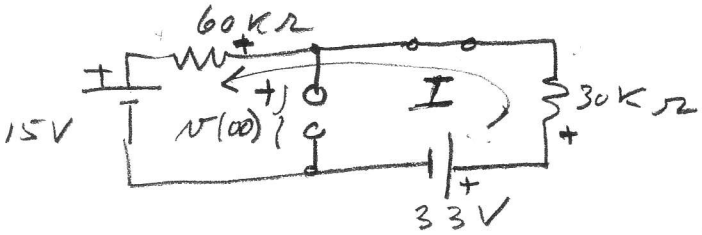
$t = 0^+$



Since v_C can't change instantaneously.

$v(0+) = v(0^-) = 15V = V_0$

$t = \infty$



KVL:

$-15 - 60KI - 30KI + 33 = 0$

$18 = 90KI$

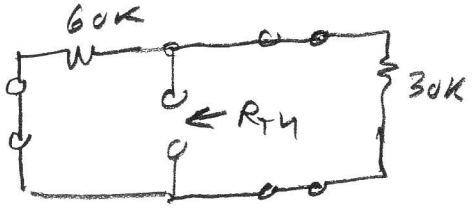
$I = \frac{18}{90K} = 0.2ma$

KVL:

$-15 - 60KI + v(\infty) = 0$

$v(\infty) = 15 + 60K(0.2) = 27V = V_F$

Determining R_{TH}



$R_{TH} = \frac{60K \cdot 30K}{60K + 30K} = 20K$

$\tau = RC = (20K)(500 \times 10^{-6}) = 10\ s$

$v(t) = V_F + (V_0 - V_F)\, e^{-t/\tau}$

$v(t) = 27 + (15 - 27)\, e^{-t/10}$

$v(t) = 27 - 12e^{-t/10}\ V$