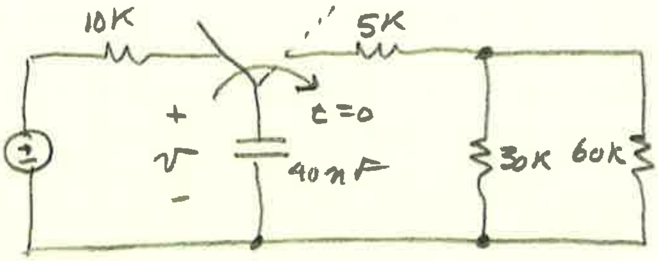


The switch moves to the right at t=0.

a) Find the initial voltage drop across the capacitor.

$$\boxed{v_c(0^-) = 150\,V = v_c(0^+)}$$

b) Find the initial energy stored in the capacitor.

$$\boxed{E = \tfrac{1}{2} C V^2 = 0.45\,mJ}$$

c) Find τ for $t > 0$.

$$\tau = R_{eq} C = (5K + 30K \| 60K) C = \boxed{1\,mS = \tau}$$

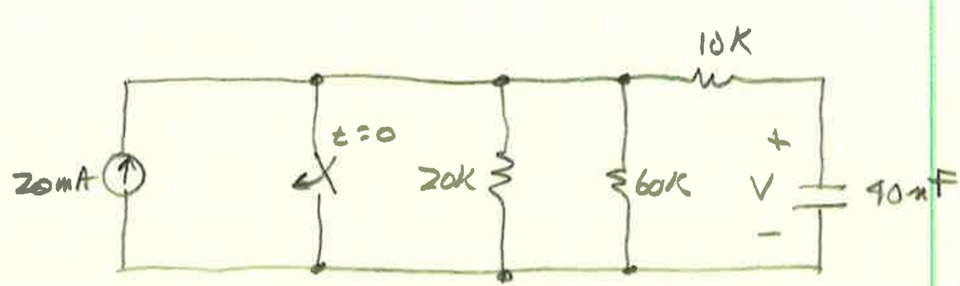
d) Find $v_c(t)$ for $t \geq 0$

$$v_c(t) = v_0(t) e^{-t/RC}$$

$$\boxed{v_c(t) = 150 e^{-1000t}\ V \quad t \geq 0}$$

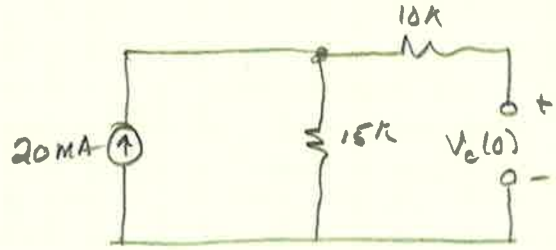
7.24 NILSSON 11th

switch has been open for a long time. find $v(t)$.



Find $V_c(0)$

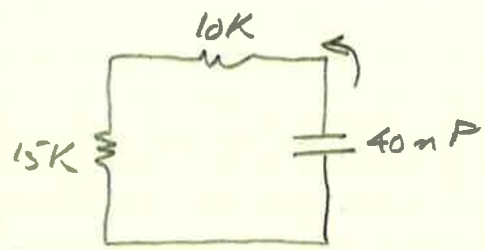
$V_c(0) = 20\,mA(15K)$
$= 300V$



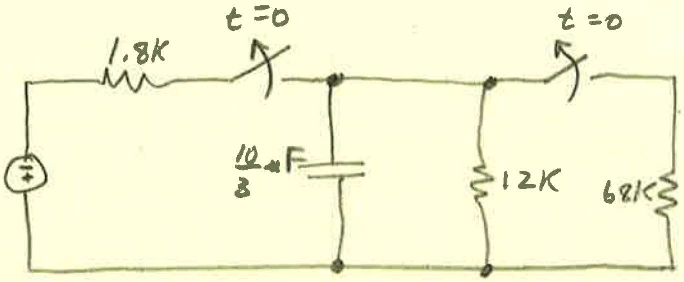
after switch closes,

$R_{eq} = 25K$

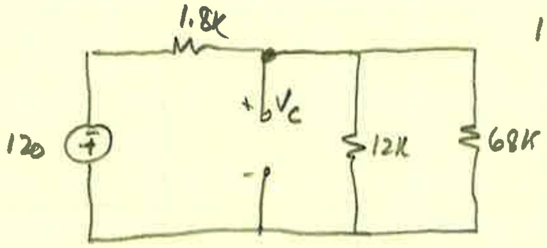
$V_c(t) = V_0 e^{-t/RC}$



$$\boxed{V_c(t) = 300 e^{-1000t} \text{ V}}$$



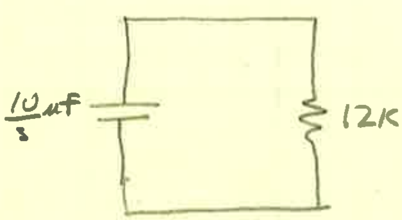
For $t < 0$:



$$V_c(0^-) = \frac{-120\,(12 \| 68)}{(12\|68) + 1.8} = -102\text{V}$$

for $t > 0$:

$$V_c(t) = -102e^{-25t}$$



$$\text{Power} = \frac{V^2}{R} = .867e^{-50t}$$

a) Find how many μ Joules have been dissipated in R 12 ms after the switches open.

$$w = \int_0^{.012} .867e^{-50t}\,dt$$

$$= \frac{.867}{-50}\left(e^{-50t}\Big|_0^{.012}\right) = \frac{.867}{-50}(.5488 - 1)$$

$$\boxed{w = 7.824\ \text{mJ}}$$

b) How long does it take to dissipate 75% of the initial stored energy?

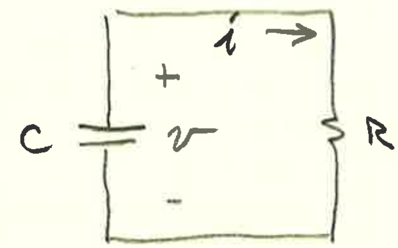
$$w(0) = \tfrac{1}{2}CV^2 = \tfrac{1}{2}\left(\tfrac{10}{3}\times 10^{-6}\right)(-102)^2 = 17.34\ \text{mJ}$$

$$75\%\,(w(0)) = 13\ \text{mJ}$$

$$\int_0^{t_0} .867e^{-50t}\,dt = .013 \Rightarrow \boxed{t = 27.73\ \text{ms}}$$

$v = 48e^{-25t}$ V $t \geq 0$

$i = 12e^{-25t}$ mA $t \geq 0^+$



find :

A) $R = \frac{v}{i} = \boxed{4K\Omega = R}$

B) C $\frac{1}{RC} = 25 \Rightarrow \boxed{C = 10\mu F}$

c) $\tau = RC = \boxed{40 \text{ mS}}$

d) initial energy in capacitor

$E = \frac{1}{2}CV^2 = \boxed{11.52 \text{ mJ}}$

e) the amount of energy dissipated by the resistor after 60 mS

$$E_{60mS} = \int_0^{0.06} \frac{V^2}{R} dt = \int_0^{0.06} \frac{(48e^{-25t})^2}{4K} dt$$

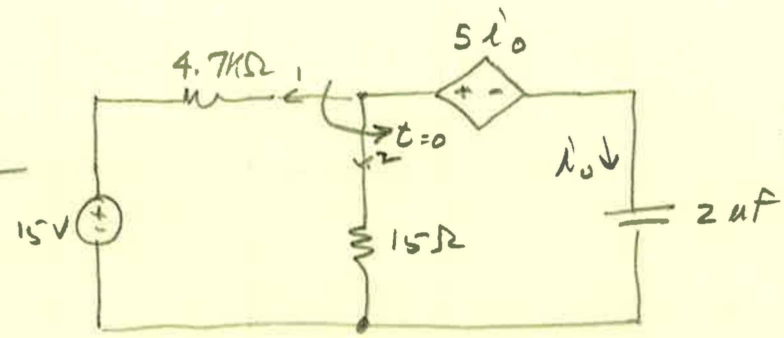
$$= \frac{48^2}{4000} \left(\frac{e^{-50t}}{-50}\right)\Bigg|_0^{0.06}$$

$$= 0.576\left[\frac{e^{-50(.06)}}{-50} - \left(-\frac{1}{50}\right)\right]$$

$$\boxed{E = 10.95 \text{ mJ}}$$

7.29 Nilsson 11th

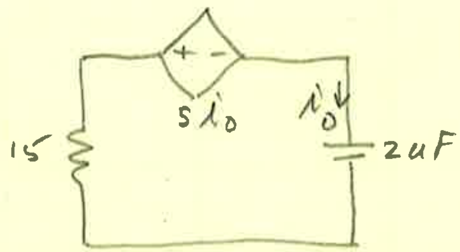
Switch moves @ $t=0$
Find $i_0(t)$ for $t \geq 0^+$



Before $t=0$,

$i_c = 0$ so $V_c(0) = 15V$

after,



writing KVL,

$$15 i_0 + 5 i_0 + \frac{1}{C}\int i_0 \, dt = 0$$

$$20 \frac{di_0}{dt} + \frac{i_0}{C} = 0 \Rightarrow i_0 = i_0(0) e^{-t/20C}$$
$$= i_0(0) e^{-25{,}000t}$$

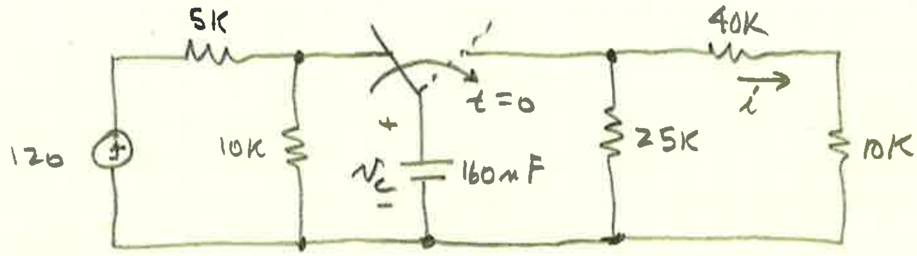
$$V_c = \frac{1}{C}\int i_c(t)\,dt = \frac{1}{C}\int i_0(0) e^{-25{,}000t} dt$$

$$V_c = \frac{i_0(0)}{-25{,}000C} e^{-25000t}$$

$$V_c(0) = 15 = \frac{i_0(0)}{-25{,}000C} e^0 \Rightarrow i_0(0) = -0.75A$$

$$\boxed{i_0(t) = -.75 e^{-25000t} \; A}$$

7.23 Nilsson 10^{th}

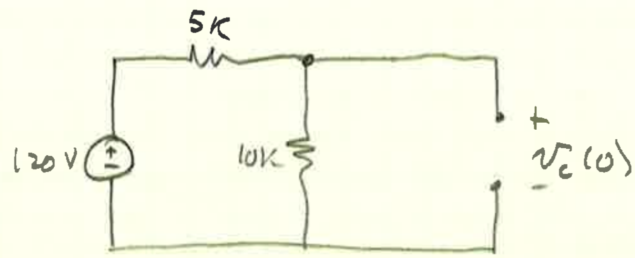


The switch has been in the left position for a long time. at $t=0$ it moves to the right position.

a) Find $V_c(t)$ for $t \geq 0$

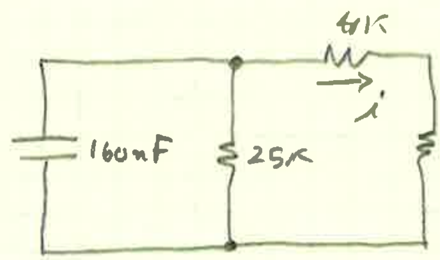
$$v_c(t) = v_c(0)\, e^{-t/RC} \text{ V}$$

The capacitor is an open circuit.



$$V_c(0) = \frac{120(10K)}{10K + 5K} = 80\text{V}$$

For $t > 0$, the capacitor discharges through the circuit shown at the right.



$$R_{eq} = (40K + 10K) \| 25K = 16.667K\Omega$$

$$\tau = RC = (160 \times 10^{-9})(16.667K) = 2.667 \text{ mS}$$

$$\boxed{V_c(t) = 80e^{-375t} \text{ V}}$$

b) Find $i(t)$ for $t \geq 0$

Since $v_c(t) = 80e^{-375t}$,

$$i = \frac{V_c(t)}{40K + 10K} = \boxed{1.6e^{-375t} \text{ mA} = i(t)}$$