Name: _____ (please print)

Signature: _____

# ECE 2202 – Quiz 4
# October 18, 2022

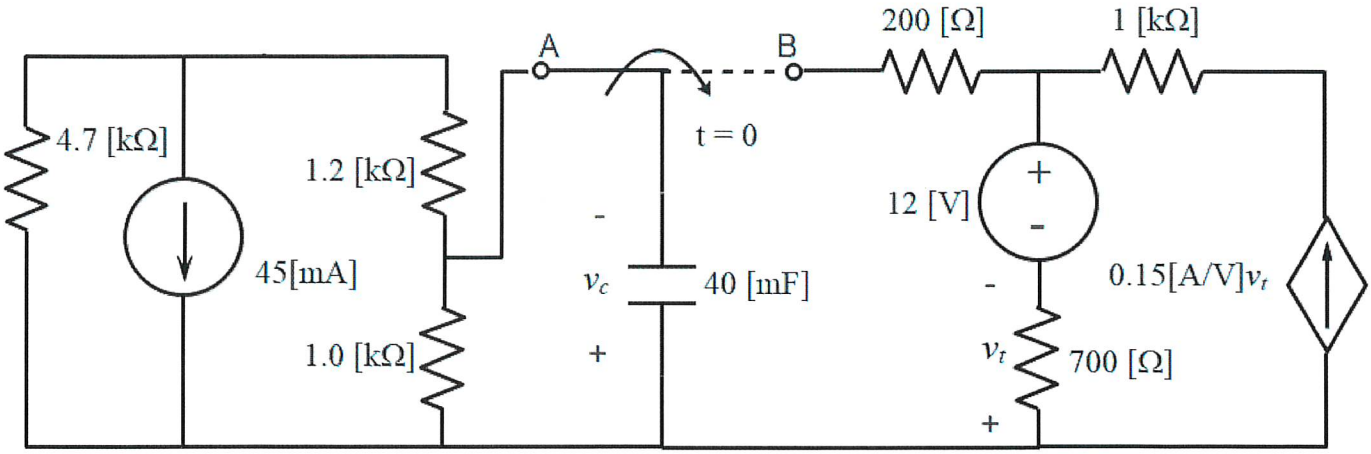
1. This quiz is closed book, closed notes. You may have one 8.5 x 11" crib sheet.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

_____/20

Room for extra work

In the circuit below, the switch was in position A for a long time, and then moved to B at t = 0.

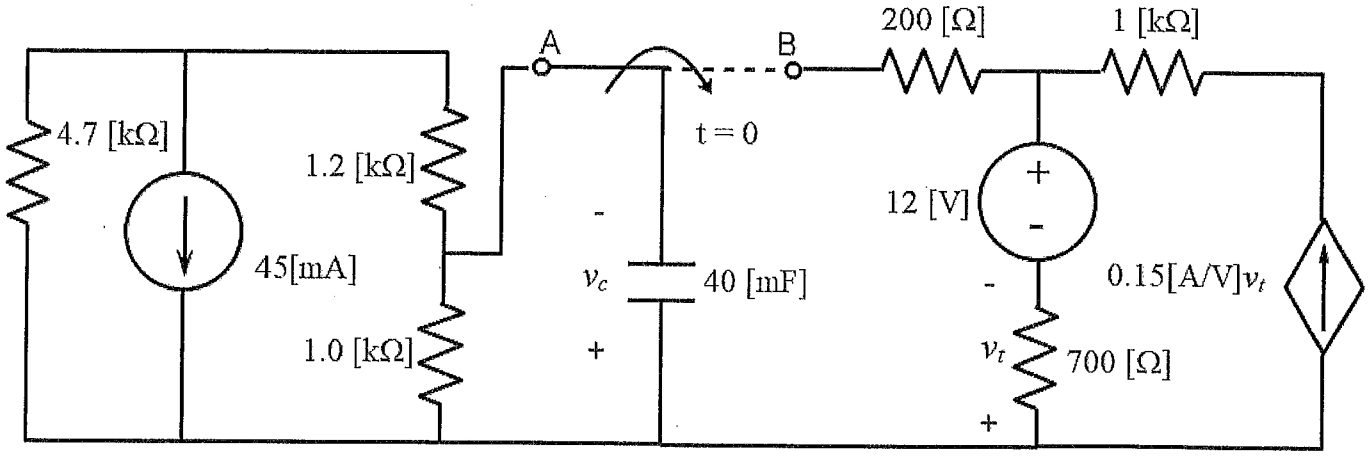
a) Find $v_C(t)$ for $t \geq 0$.
b) Find $v_t(t)$ for $t > 0$.



Room for extra work

In the circuit below, the switch was in position A for a long time, and then moved to B at t = 0.

a) Find $v_C(t)$ for $t \geq 0$.
b) Find $v_t(t)$ for $t > 0$.

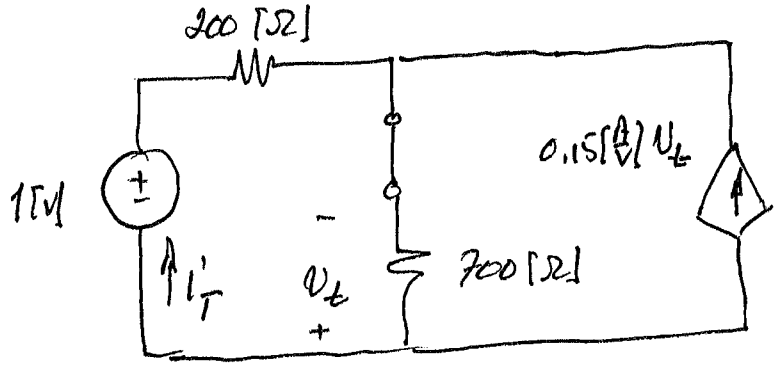



$t<0$ : The capacitor is connected in parallel with the 1 [kΩ] resistor, so...

$$v_c(0) = 0.045 \cdot \frac{47000}{47000 + 2200} \cdot 1000 = 30.65 \text{ [V]}$$

$t>0$

$R_{TH}$: Replace the capacitor with a test source:




We have ignored the 1 [kΩ] resistor.

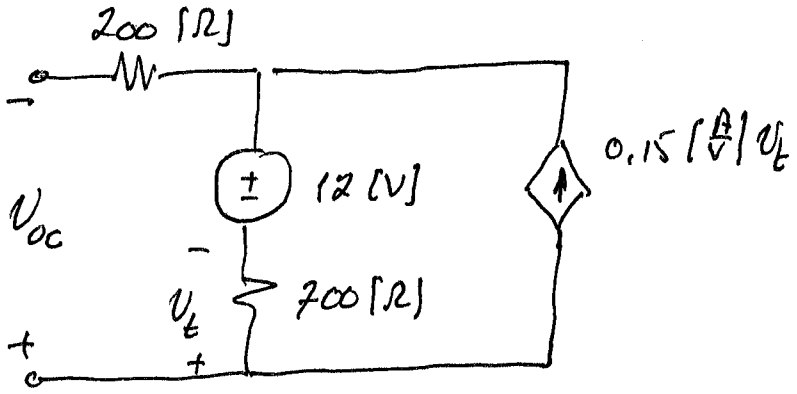
Room for extra work

$$\frac{v_t}{700} + 0.15 v_t + \frac{v_t + 1}{700} = 0 \Rightarrow v_t = -0.03196 \text{ [V]}$$

$$i_T' = -\frac{v_t}{700} - 0.15 v_t \Rightarrow i_T' = 4.8397 \text{ [mA]}$$

$$R_{TH} = \frac{1}{i_T'} = 206.6 \text{ [}\Omega\text{]} \qquad \tau_c = R_{TH} \cdot 40 \times 10^{-3} = 8.265 \text{ [s]}$$

$v_{oc}$:




$v_{oc} = v_{c,f}$

Note polarity of $v_c$ in original drawing.

$$v_{oc} = v_t - 12 \qquad v_t = -700(0.15 v_t) \Rightarrow v_t = 0$$

$$v_{oc} = -12 \text{ [V]}$$

So ...

$$v_c(t) = v_{c,f} + (v_c(0) - v_{c,f}) e^{-t/\tau_c}$$

$$v_c(t) = -12 + (30.65 - (-12)) e^{-t/8.265 \text{ [s]}}$$

a) $$v_c(t) = -12 + 42.65 e^{-t/8.265 \text{ [s]}} \text{ [V]} \quad t \geq 0 \text{ [s]}$$

pg. 2

Room for extra work

$$i_c = C\frac{dv_c}{dt} = (0.04)\cdot(42.65)\left(\frac{-1}{8.265}\right)e^{-t/8.265\ [s]}$$

$$i_c(t) = -0.2060\,e^{-t/8.265\ [s]}\ [A] \quad t>0$$

$$v_t = -700\,(i_c + 0.15\,v_t)$$

$$v_t\,(1 + 700(0.15)) = -700\,i_c$$

$$v_t = \frac{-700}{106}\,i_c = -6.604\,i_c$$

b)

$$v_t(t) = 1.360\,e^{-t/8.265\ [s]}\ [V] \quad t>0$$