ECE 300
Spring Semester, 2008
HW Set #8

Desk Copy

Due: March 11, 2008

Name wlg
Print (last, first)

wlg

Use engineering paper. Work only on one side of the paper. Use this sheet as your cover sheet, placed on top of your work and stapled in the top left-hand corner. Number the problems at the top of the page, in the center of the sheet. **Do neat work. Underline your answers. Show how you got your equations. Be sure to show how you got your answers. Each problem 20 points.**

Check according to your section: _____ 8:10 AM; _____ 11:10 AM

From the text for problem 7.50.

7.50 Work using the step-by-step method. Ans: $I_x(t) = 22.5 - 7.5e^{-4t}\ u(t)$ mA

7.xx You are given the circuit of Figure 7.xx. Find $v_c(t)$ for $t>0$ using the step-by-step method.

Ans: $v_c(t) = 12e^{-\frac{t}{1.2}}\ u(t)\ \ V$

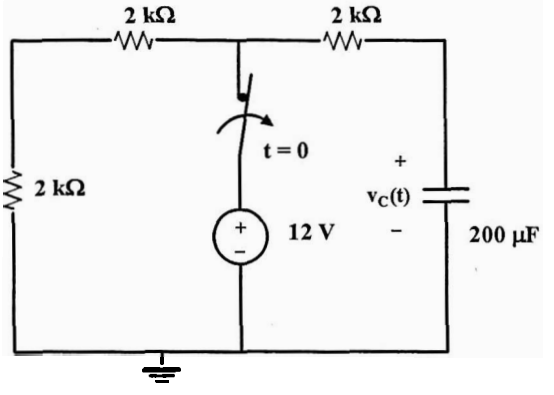


Figure 7.xx: Circuit for Problem 7.xx

7.yy Find $i_o(t)$ in the circuit below using the step-by-step method.

Ans: $i_o(t) = 3 - \frac{1}{3}e^{-\frac{t}{0.6}}\ u(t)\ \ mA$

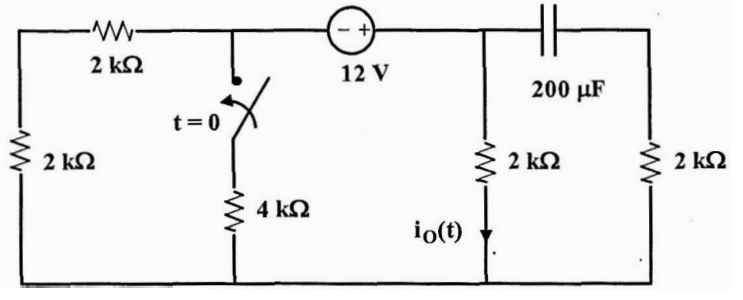


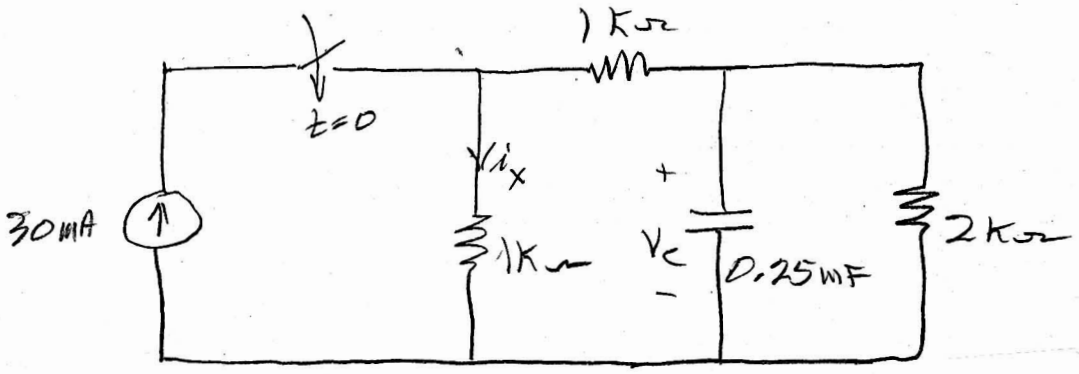
Figure 7.yy: Circuit for Problem 7.yy.

ECE 300
HW # 8

From The Text:

7.50

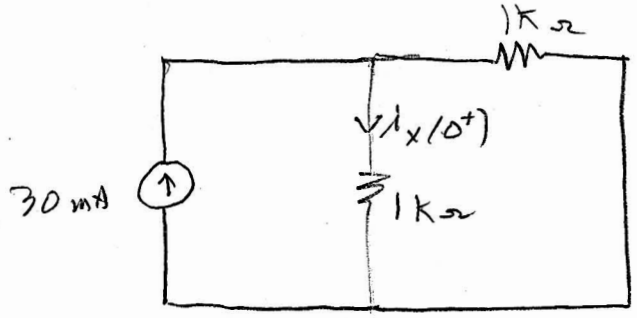
Use the step-by-step method to find $i_x(t)$ for the following circuit.



$t < 0$

$v_c(0^-) = 0 \quad \therefore \quad v_c(0^+) = 0$

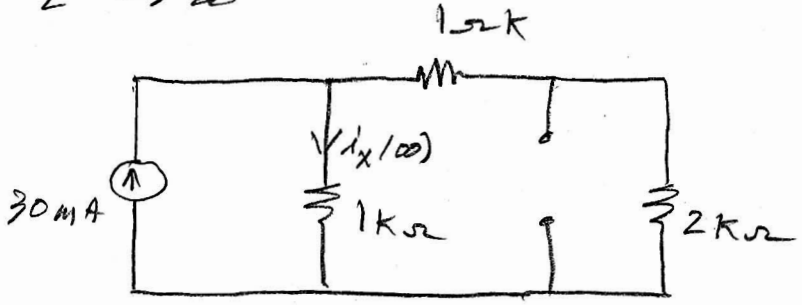
$t = 0^+$



$i_x(0^+) = 15 \text{ mA}$

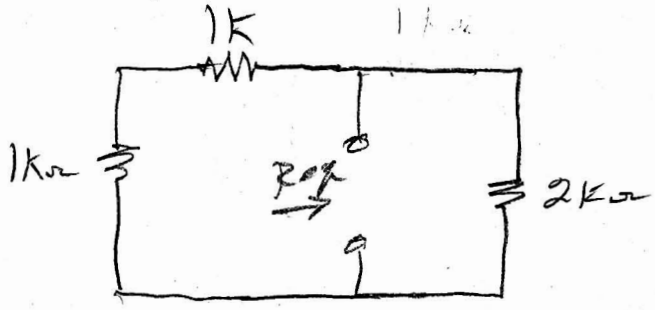
7.50 cont.

$t \to \infty$



$$i_x(\infty) = \frac{(30mA)\,3k}{4k} = 22.5\ mA$$

To find R_{eq}



$$R_{eq} = 2k \| 2k = 1k\Omega$$

$$\tau = R_{eq} C = 1k \times \frac{1}{4} \times 10^{-3} = 0.25\ sec$$

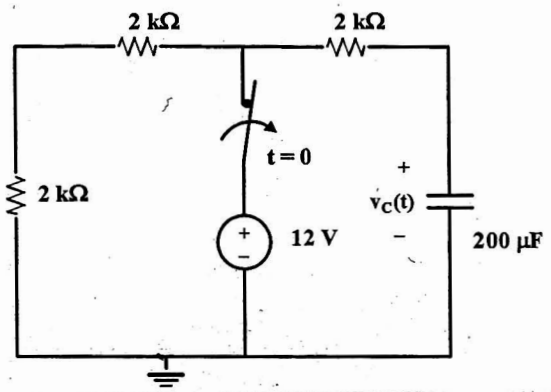
$$i_x(t) = i_x(\infty) + [i_x(0^+) - i_x(\infty)]e^{-\frac{t}{\tau}}$$

$$i_x(t) = [22.5 + [15 - 22.5]\,e^{-4t}\ mA$$

$$\boxed{i_x(t) = [22.5 - 7.5\,e^{-4t}]\ mA}$$

7.xx You are given the circuit of Figure 7.xx. Find $v_c(t)$ for t>0 using the step-by-step method.

Ans: $v_c(t) = 12e^{-\frac{t}{1.2}}\ u(t)\ \ V$



For $t<0$

$V_c(0^-) = 12V$

$\therefore\ V_c(0^+) = 12V$

$V_c(\infty) = 0$

$R_{eq} = 6\ k\Omega$

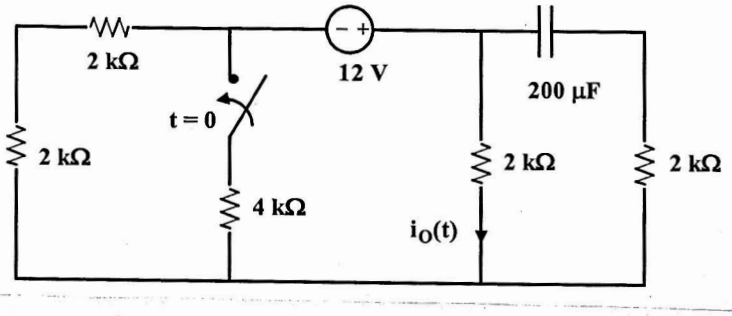
$\tau = 6 \times 10^3 \times 0.2 \times 10^{-3} = 1.2\ sec$

$V_c(t) = [V_c(\infty) + [V_c(0^+) - V_c(\infty)]e^{-\frac{t}{\tau}}$

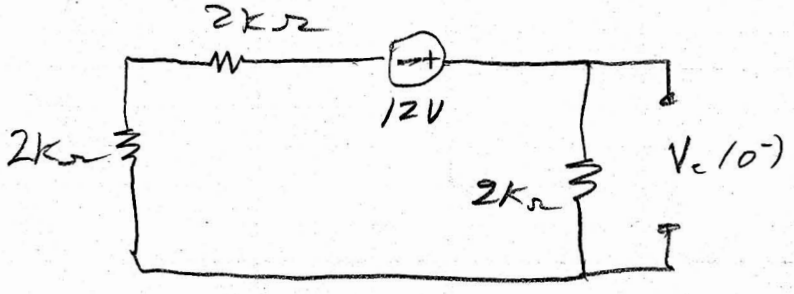
$V_c(t) = 12\, e^{-\frac{t}{1.2}}\, u(t)\ \ V$

7.yy Find $i_o(t)$ in the circuit below using the step-by-step method.

Ans: $i_o(t) = 3 - \frac{1}{3} e^{-\frac{t}{0.6}} u(t)$ mA



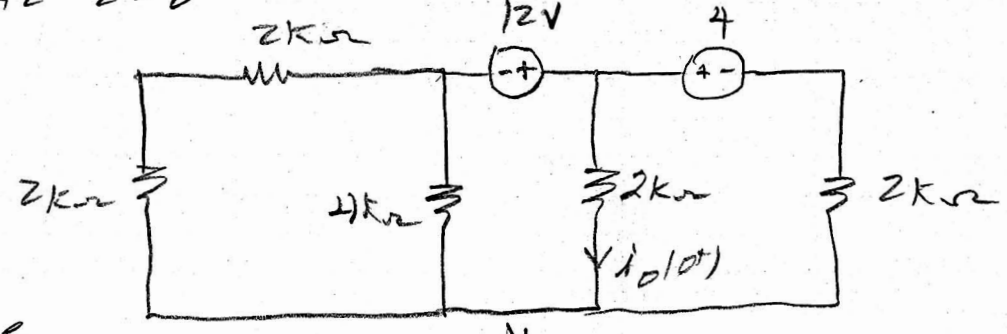
FOR $t < 0$



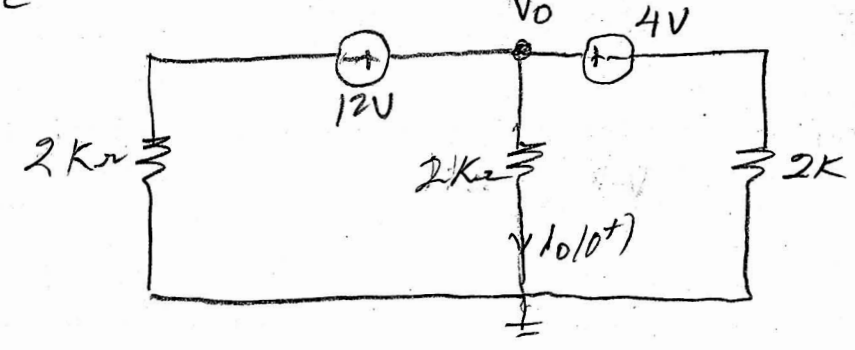
$$V_c(0^-) = \frac{12 \times 2k}{6k} = 4V$$

$\therefore V_c(0^+) = 4V$

At $t = 0^+$



Reduce to:



7.yy cont.

Using nodal analysis

$$\frac{V_o - 12}{2k} + \frac{V_o - 4}{2k} + \frac{V_o}{2k} = 0$$

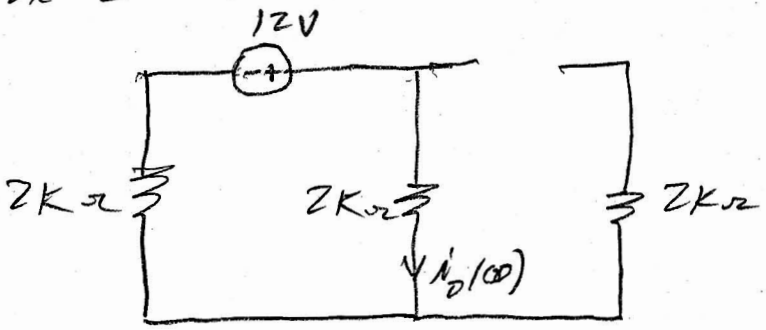
$$3V_o = 16$$

$$V_o = \frac{16}{3}$$

$$\therefore i_o(0^+) = \frac{V_o}{2k} = \frac{16}{2k} = \frac{8}{3}\ mA$$

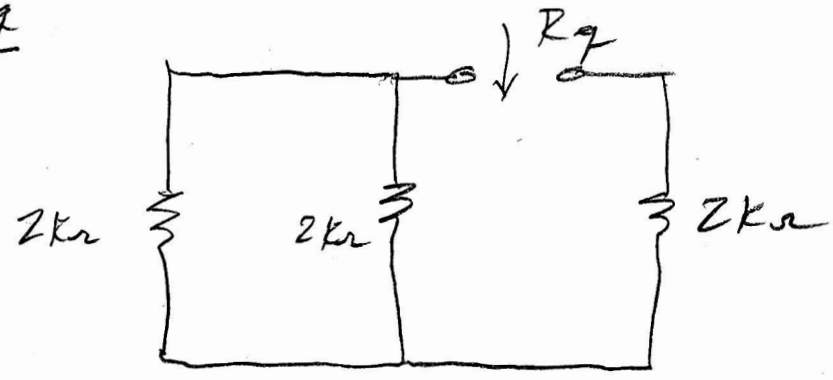
$$i_o(0^+) = \frac{8}{3}\ mA$$

For $t = \infty$



$$i_o(\infty) = \frac{12}{4k} = 3\ mA$$

Req



7.99 cont

$$R_{eq} = 2k + 2k \| 2k = 3k.$$

$$\tau = 3k \times 0.2\mu = 0.6\ ms$$

$$i_0(t) = i_0(\infty) + [i_0(0^+) - i_0(\infty)]e^{-\frac{t}{.6}}$$

$$i_0(t) = \left[3 + \left[\frac{8}{3} - 3\right]e^{-\frac{t}{.6}}\right) mA$$

$$= \left[3 - \frac{1}{3}e^{-\frac{t}{0.6}}\right] u(t)\ mA$$