Desk Copy

ECE 300
Spring Semester, 2006
HW Set #8:

Due: March 9, 2006
wlg

Name wlg
Print (last, first)

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 counts 10 points.

7.41 $v(t) = 10(1 - e^{-0.2t})\, u(t)$ V

7.44 $i(t) = -3e^{-0.25t}\, u(t)$ A

7.52 $i(t) = 2\, u(t)$ A

7.63 $i(t) = 2e^{-8t}\, u(t)$ A

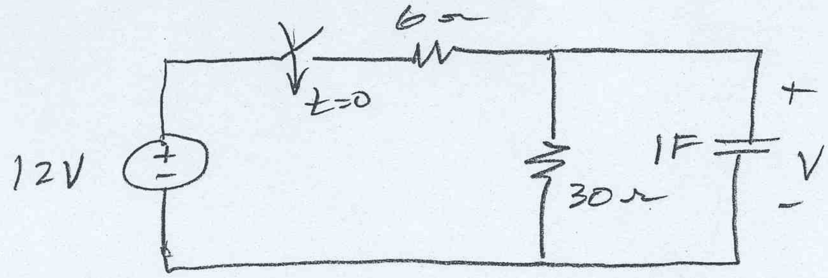
$v(t) = -8e^{-8t}\, u(t)$ A

7.66 $v(t) = 2.5(e^{-40t} - 1)\, u(t)$ V

H.W. #8

7.41

Find $v(t)$ for $t > 0$



$$v(t) = v(\infty) + (v(0) - v(\infty))\, e^{-\frac{t}{\tau}}$$

$$v(\infty) = \frac{12 \times 30}{36} = 10\,V$$

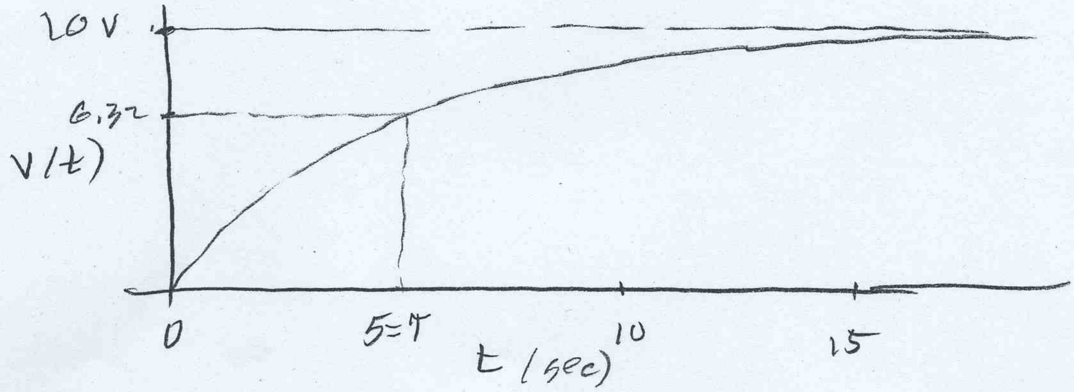
$$v(0^-) = 0 = v(0^+)$$

$$\tau = R_{eq} C \quad ; \quad R_{eq} = 30 \| 6 = \frac{30 \times 6}{36} = 5\,\Omega$$

$$\tau = 5 \times 1 = 5 \text{ sec}$$

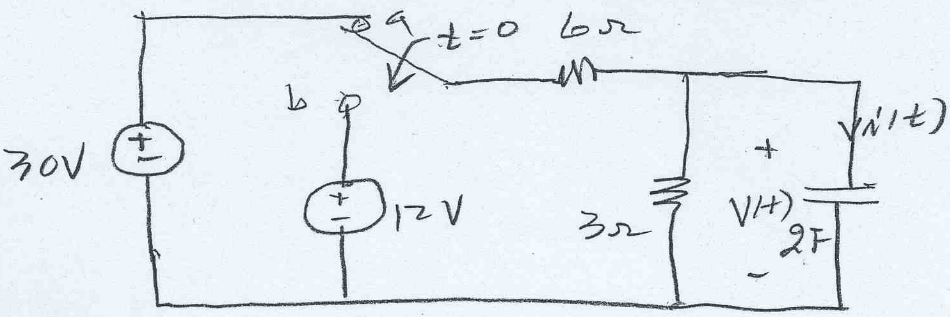
$$v(t) = 10 + (0 - 10)\, e^{-0.2t}\, u(t)\ V$$

$$v(t) = \left[10 - 10e^{-0.2t}\right] u(t)\ V$$



7.44

Switch has been closed for a long time. At $t=0$ it is moved from position a to position b. Find $i(t)$ for $t>0$.



Find the values for the form

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

$$v(0^-) = \frac{30 \times 3}{9} = 10V = v(0^+)$$

$$v(\infty) = \frac{12 \times 3}{3+6} = 4V$$

$$R_{eq} = \frac{6 \times 3}{6+3} = 2\Omega \qquad \tau = 2 \times 2 = 4$$

$$v(t) = 4 + [10-4]e^{-\frac{t}{4}}$$

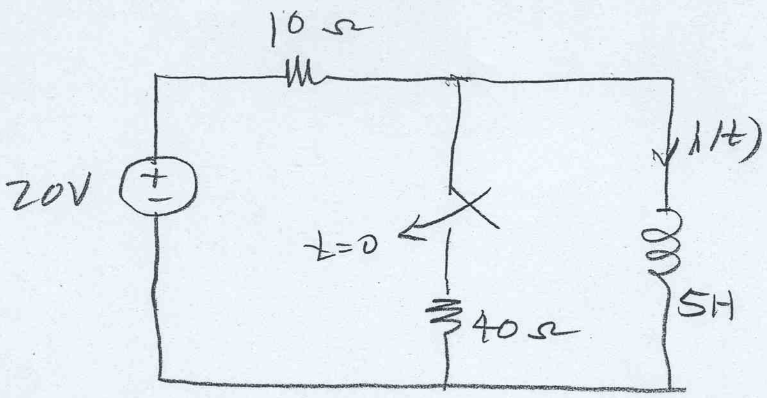
$$v(t) = [4 + 6e^{-0.25t}]u(t)\ V$$

$$i = C\frac{dV}{dt} = 2 \times 6 \times (-.25)e^{-0.25t}$$

$$\boxed{i(t) = -3e^{-0.25t}\ u(t)\ A}$$

7.52

FIND $i(t)$ for $t \geq 0$.



FOR $t < 0$

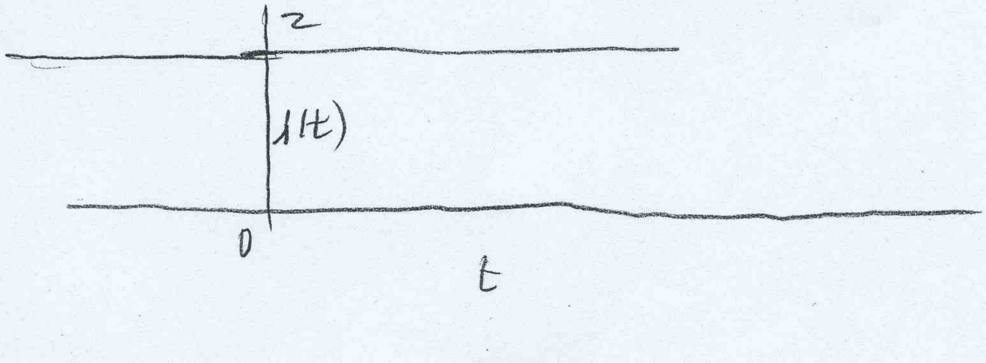
$$i(0^-) = i(0^+) = \frac{20}{10} = 2A$$

$$i(\infty) = 2A$$

$$\tau = \frac{L}{R_{eq}} = \frac{5}{8}$$

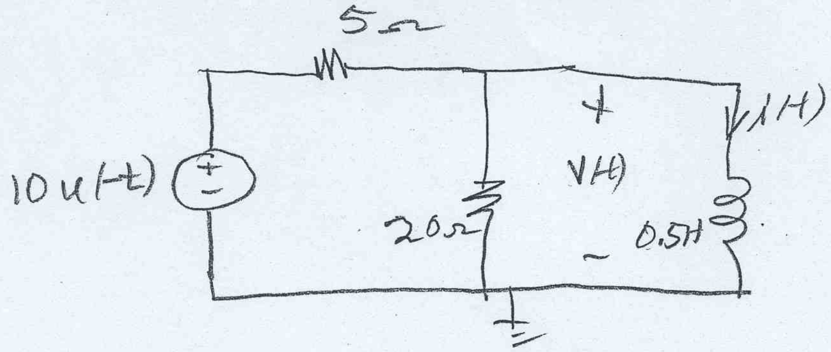
$$i(t) = i(\infty) + [i(0) - i(\infty)]e^{-\frac{8t}{5}}u(t)\ A$$

$$\boxed{i(t) = 2A}$$



7.63

FIND $V(t)$ and $i(t)$



$t < 0$,

$$i(0^-) = i(0^+) = \frac{10}{5} = 2A$$

$$V(0^-) = 0.$$

$t > 0$

$$i(\infty) = 0$$

$$R_{eq} = 5 \| 20 = 4\Omega.$$

$$\tau = \frac{L}{R_{eq}} = \frac{0.5}{4} = \frac{1}{8} \text{ sec}$$

$$i(\infty) = 0$$

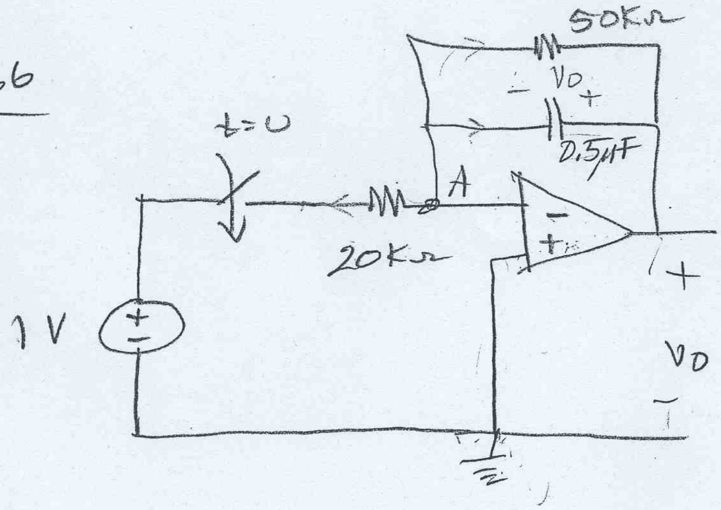
$$i(t) = i(\infty) + [i(0) - i(\infty)]e^{-\frac{t}{\tau}}$$

$$\boxed{i(t) = 2e^{-8t}u(t) A}$$

$$V(t) = L\frac{di}{dt} = 0.5 \times 2(-8)e^{-8t}$$

$$\boxed{V(t) = -8e^{-8t}u(t) V}$$

7.66



At A

$$\frac{(0-1)}{20K} + \frac{(0-V_0)}{50K} - 0.5\times10^{-6}\frac{dV_0}{dt} = 0$$

$$0.5\times10^{-6}\frac{dV_0}{dt} + \frac{V_0}{50\times10^3} = \frac{-1}{20\times10^3}$$

$$\frac{dV_0}{dt} + \frac{2\times10^6 V_0}{50\times10^3} = -\frac{2\times10^6}{20\times10^3}$$

$$\frac{1}{40} = RC$$

$$\frac{dV_0}{dt} + 40V_0 = -100$$

$$V_0 = V_{0t} + V_{0ss}$$

$$V_{0t} = K_t e^{-40t} \;; \qquad V_{0ss} = \frac{-100}{40} = -2.5$$

$$V_0 = K_t e^{-40t} - 2.5$$

cap looks like a short at 0^+

$$V_0(0^-) = V_0(0^+) = 0 \qquad \therefore\; K_t = 25$$

$$\boxed{V_0(t) = 25\left(e^{-40t} - 1\right)u(t)\ \text{V}}$$