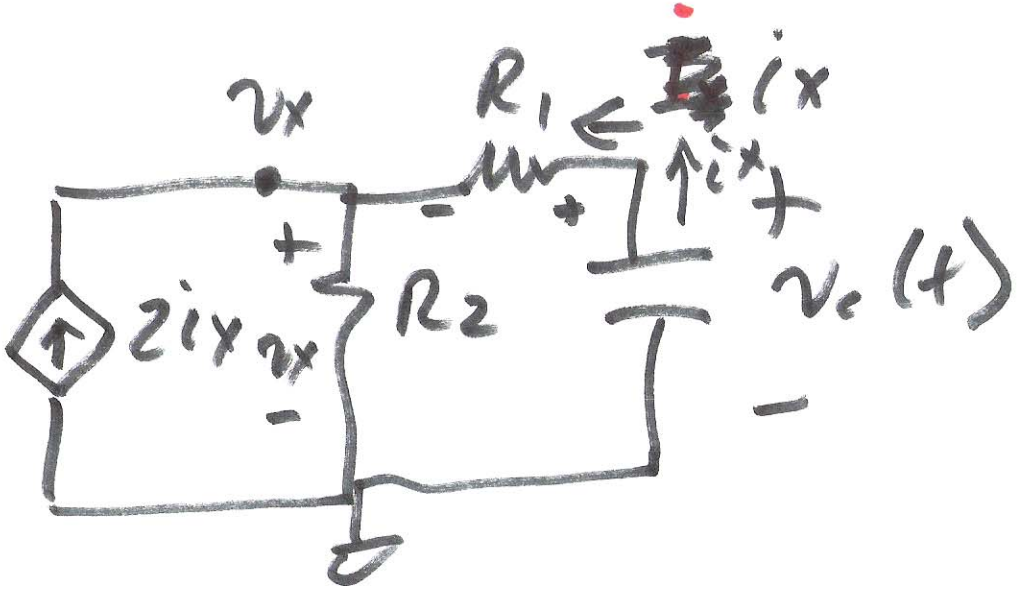
Lecture 18

July 3, 2014

EE 220

8.3



$C = ?$ $V_c(0^-) = ?$

$i_x(0^-) = 0$

$2i_x(0^-) = 0$

$v_c = v_x = 0$

$$v_c - i_x R_1 - v_x = 0$$

$$i_x + 2i_x = \frac{v_x}{R_2}, \quad v_x = 3i_x R_2$$

$$i_x = -C\frac{dv_c}{dt}$$

$$v_c = i_x \cdot R_1 + v_x = i_x R_1 + 3i_x R_2$$

$$v_c = i_x (R_1 + 3R_2)$$

$$v_c = -(R_1 + 3R_2)C\frac{dv_c}{dt}$$

$$\frac{t-0}{-(R_1+3R_2)C} = \int_0^t \frac{dt}{-(R_1+3R_2)C} = \int_{v_c(0^-)}^{v_c(t)} \frac{dv_c}{v_c} = \ln v_c(t) - \ln v_c(0^-)$$

$$= \ln \frac{v_c(t)}{v_c(0^-)}$$

$$e^{-t/(R_1+3R_2)C} = \frac{v_c(t)}{V_c(0^-)}$$

$$v_c(t) = V_c(0^-)\, e^{-t/(R_1+3R_2)C}$$

$$i_c(t) = C\frac{dv_c}{dt} = \frac{C V_c(0^-)}{-(R_1+3R_2)C}\, e^{-t/(R_1+3R_2)C}$$

Assume $C = 1mF$

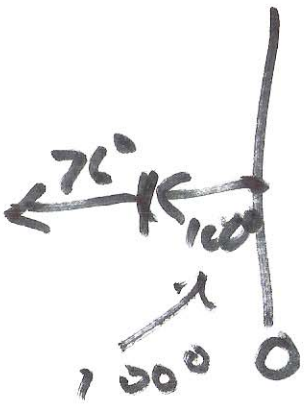
$V(0^-) = 1V$

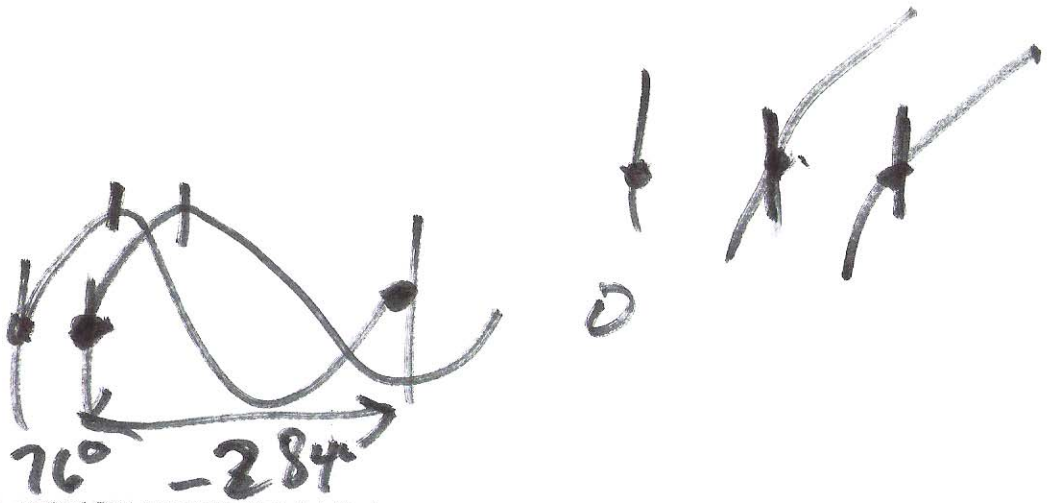
$$\angle \frac{V_{out}}{V_{in}} = 76^\circ = \frac{\angle V_{out}}{\angle V_{in}} = \frac{\angle V_{out}}{\angle 0^\circ}$$

$$0 + 76 \rightarrow \angle V_{out} = 76^\circ$$

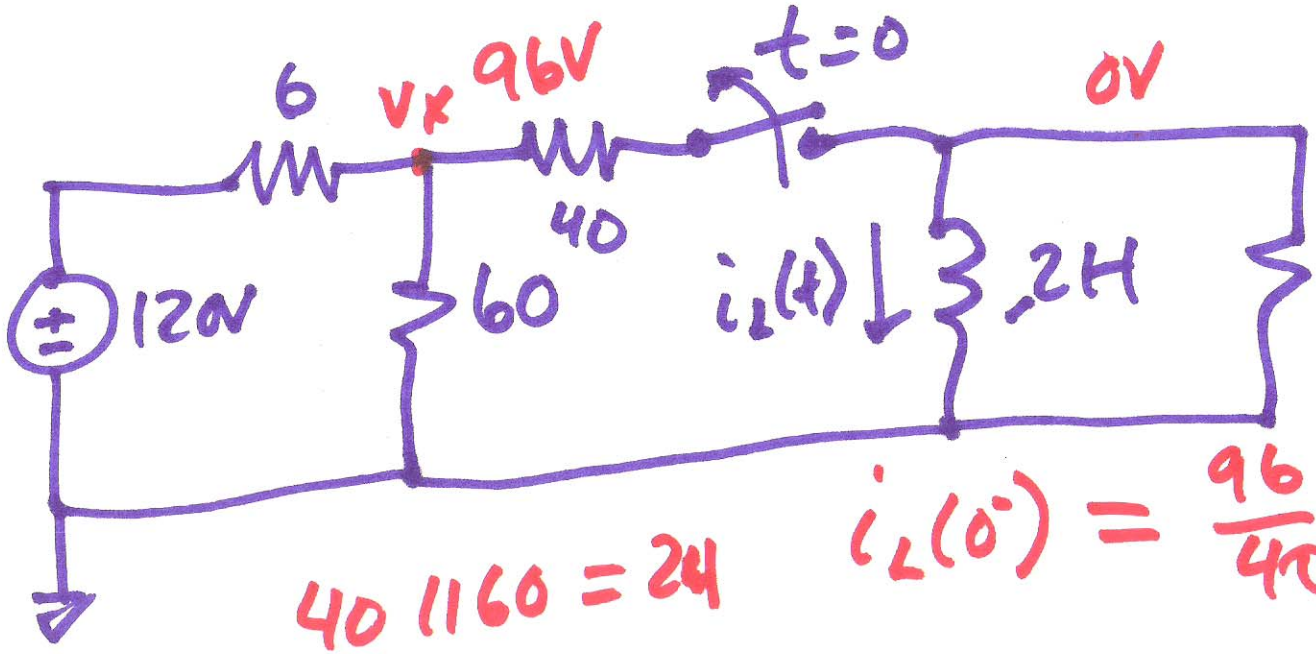
$$\frac{\angle V_{out}}{\angle V_{in}} = 76^\circ$$

$$\angle V_{in} = 100^\circ$$





$$\angle 76^\circ = \angle -284^\circ$$



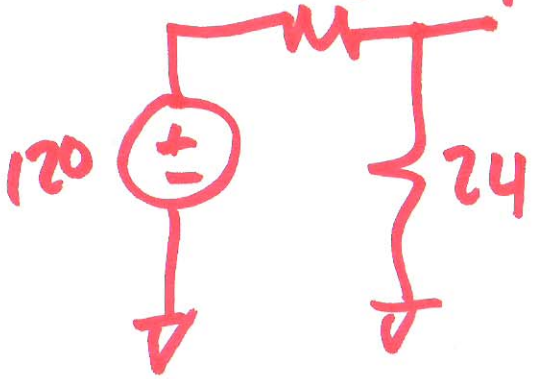
$40 \| 160 = 24$

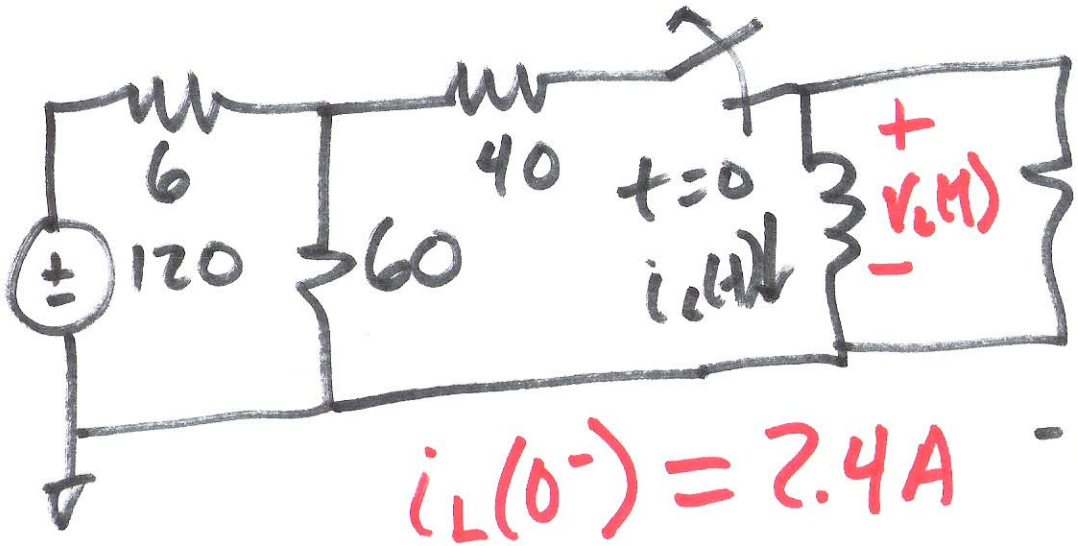
$i_L(0^-) = \frac{96}{40} = 2\frac{16}{40} = 2\frac{2}{5}$

$= 2.4\,A$

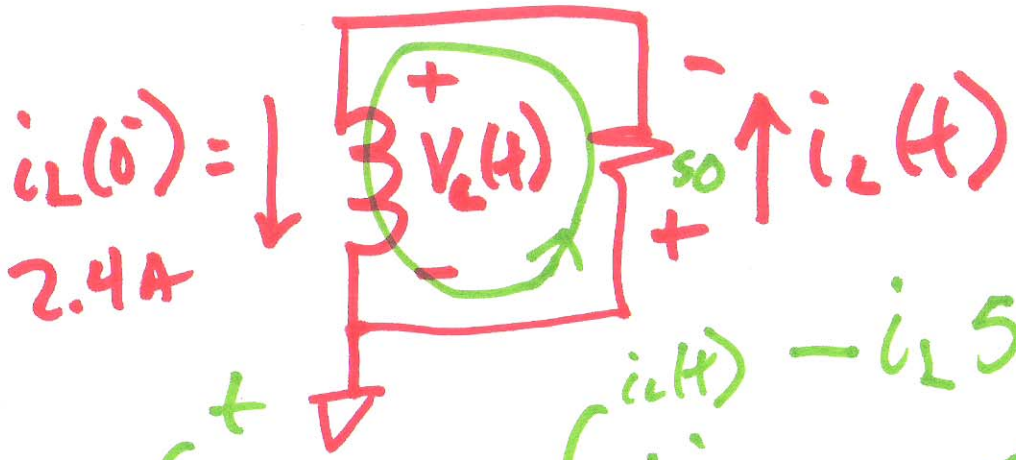
$\frac{40 \cdot 60}{100} = \frac{2400}{100}$

$6\,V_x = 120 \cdot \frac{24}{6+24} = 96V$





$i_L(0^-) = 2.4A$ $\quad -10m \le t \le 10m$



$$-i_L 50 - V_L(t) = 0$$

$$V_L = L \cdot \frac{di_L}{dt}$$

$$\int_0^t \frac{dt}{-L/50} = \int_{I_L(0^-)}^{i_L(t)} \frac{di_L}{i_L}$$

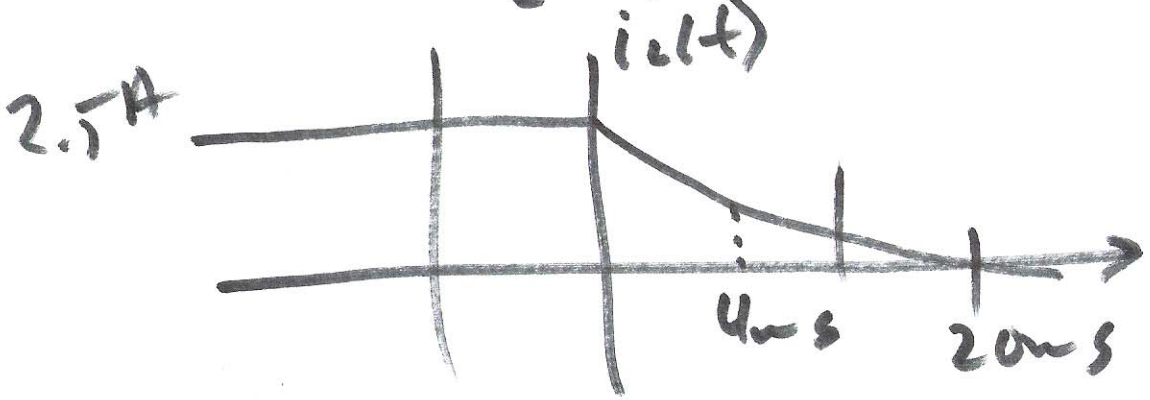
$$-50 \cdot i_L = L\frac{di}{dt}$$

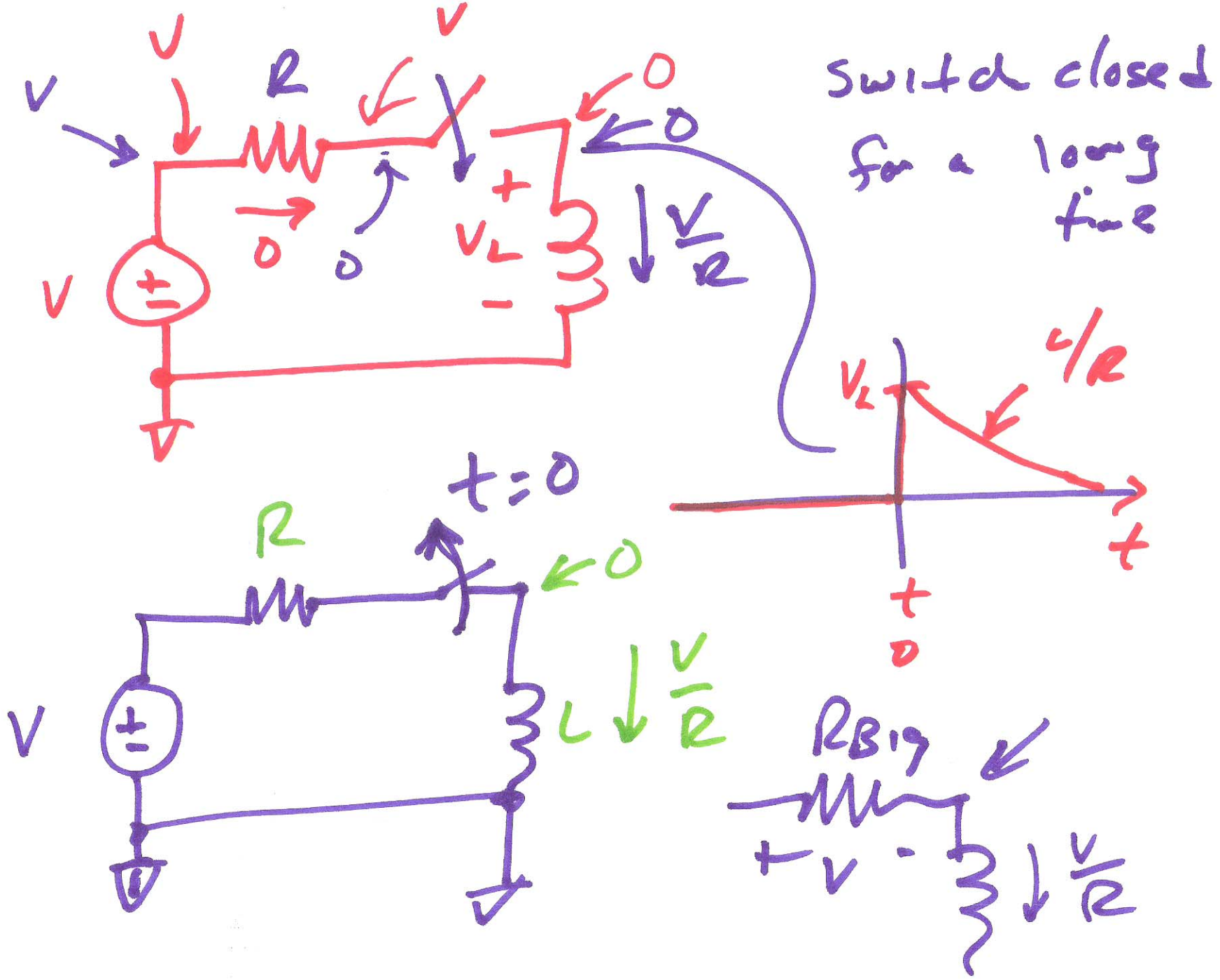
$$-\frac{t}{L/R} = \ln \frac{i_L(t)}{I_L(0^-)}$$

$$i_L(t) = I_L(0^-)\, e^{-t/L/R}$$

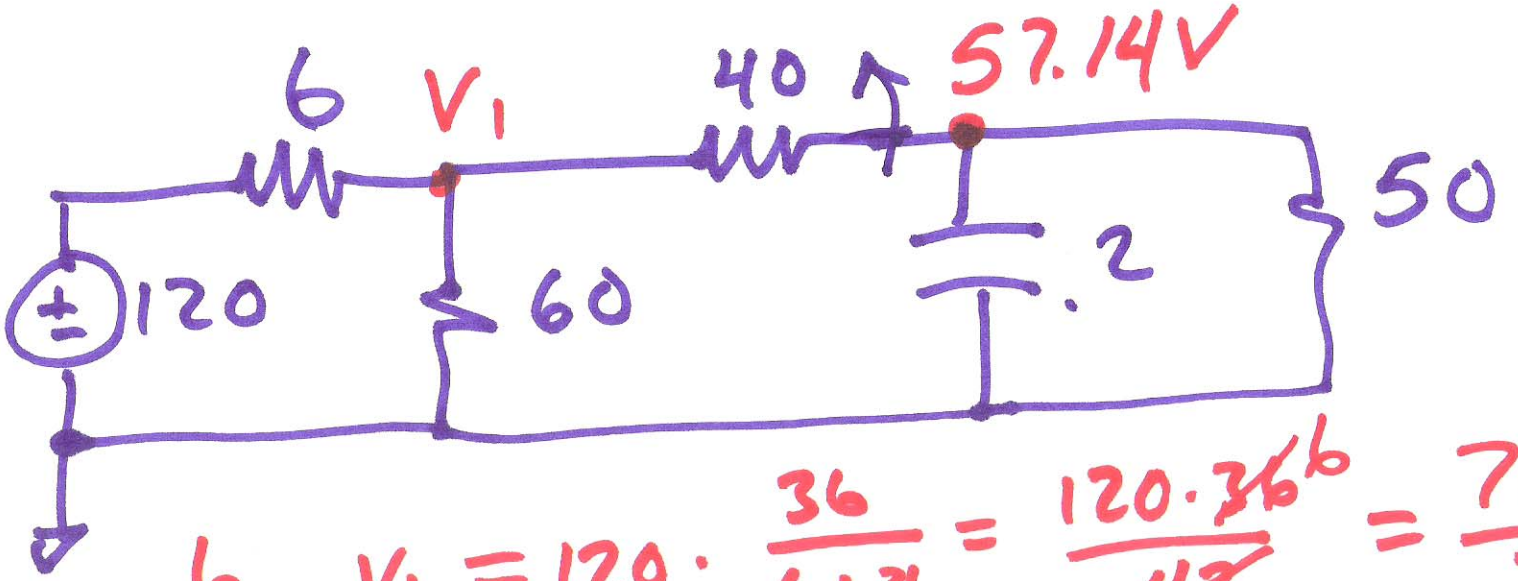
$$L/R = \frac{-2}{50} = \frac{4}{1000}$$

$$i_L(t) = 2.5A\, e^{-t/4ms}$$

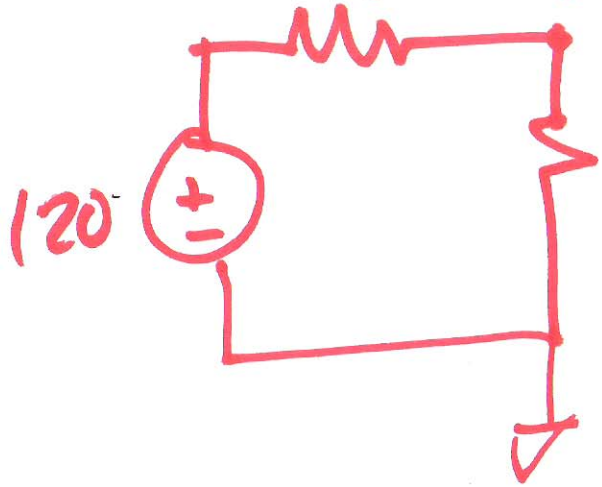



V
V
R
V
0
0
+
V_L
−
$\frac{V}{R}$
V
Switch closed
for a long
time
V_L
L/R
t
t
0
t=0
R
0
V
L
$\frac{V}{R}$
R_{Big}
+ V −
$\frac{V}{R}$

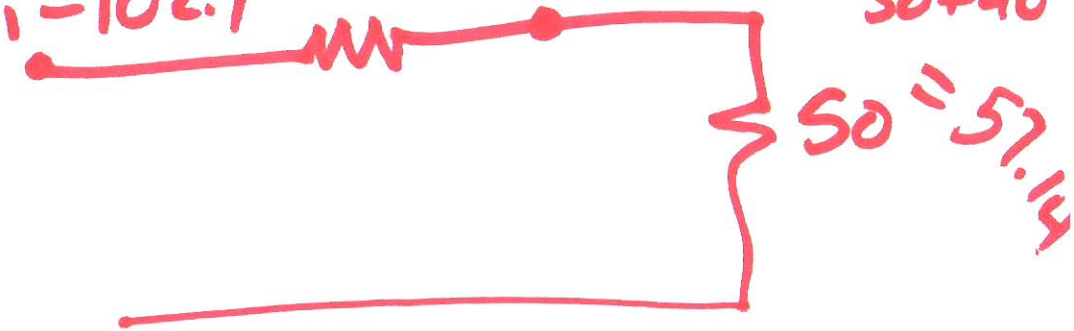
96



$$V_1 = 120 \cdot \frac{36}{6+36} = \frac{120 \cdot 36^{6}}{42_{7}} = \frac{720}{7}$$

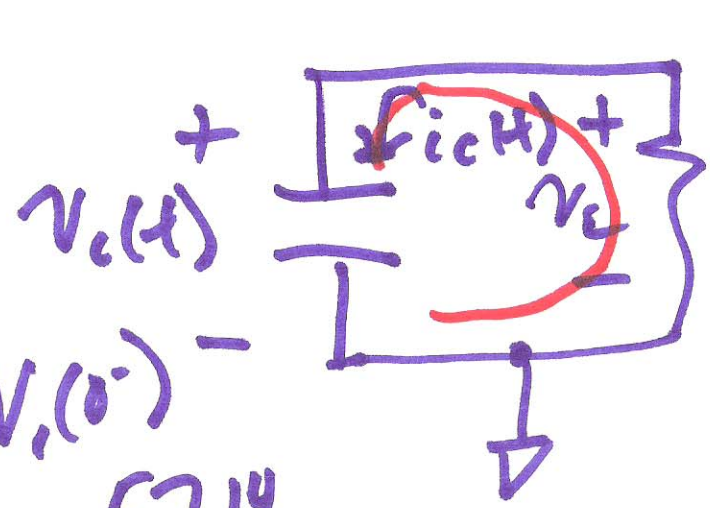


$$V_1 = 102.9$$

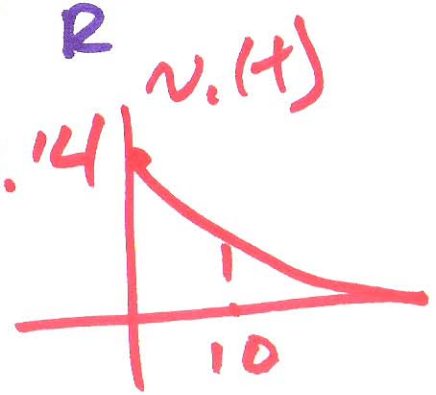


$$V_c = 102.9 \cdot \frac{50}{50+40}$$

$$50 = 57.14$$



$$\frac{v_c(t)}{R} = -i_c(t)$$



$$+ v_c$$

$$v_c = RC\frac{dv_c}{dt}$$

$$50(-i_c(t)) - v_c(t) = 0$$

$$-\frac{1}{RC}\int_0^t dt = \int_{v_c(0^-)}^{v_c(t)} \frac{dv_c}{v_c}$$

$$v_c(t) = 50\cdot(-i_c(t))$$

$$i_c = C\frac{dv_c}{dt}$$

$$-\frac{t}{RC} = \ln\frac{v_c}{v_c(0^-)}$$

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

50:2 $= 10$