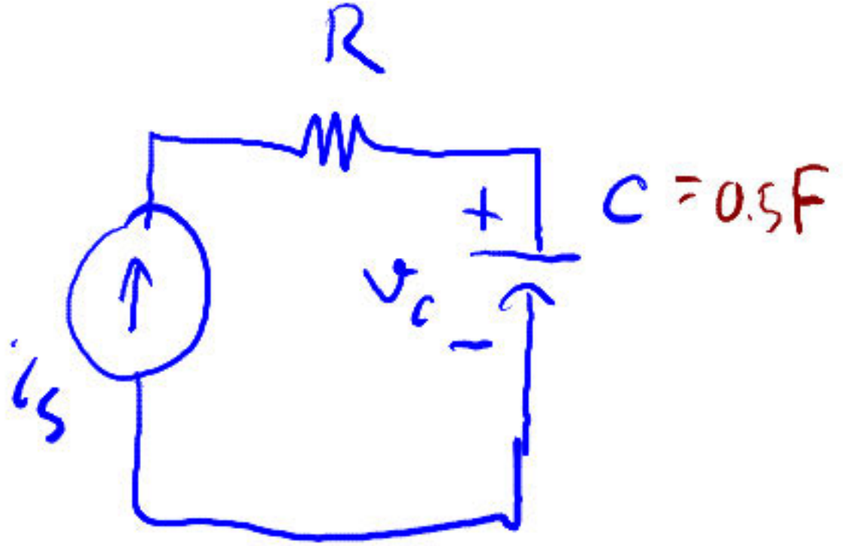
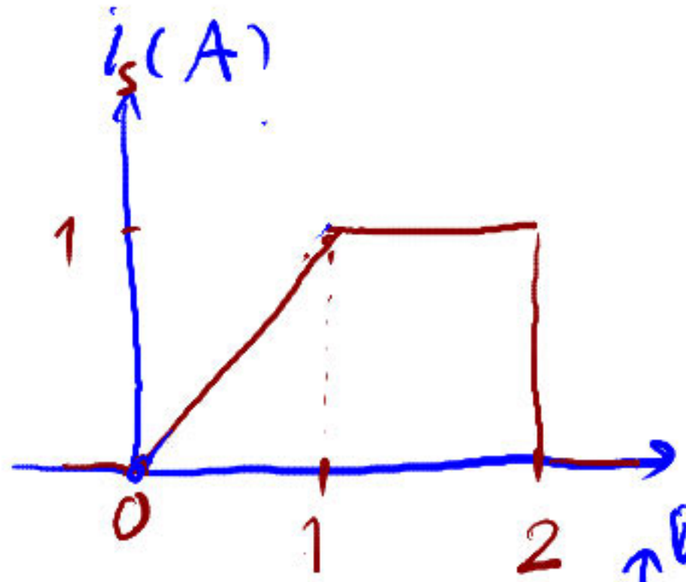
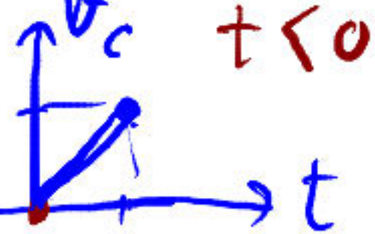


$C = 0.5F$



$$\int t\,dt \qquad \frac{t^2}{2}$$



$$i = \begin{cases} 0 & ; t \le 0 \\ t & ; 0 \le t < 1 \\ 1 & ; 1 < t < 2 \\ 0 & ; t > 2 \end{cases}$$

$$v_c = \frac{1}{C}\int i\,d\tau + v(t_0)$$

$0 < t < 1$

$$v_c = \frac{1}{0.5}\int_0^t \tau\,d\tau + 0$$

$$= 2\,\frac{\tau^2}{2}\Big|_0^t$$

$$= t^2 - 0^2 = t^2$$

①

ขั้นตอนการหาวงจร RL (RL + Source)

1. หาค่า $\tau = L_{eq}/R_{eq}$ ที่ $t > 0$

2. หาค่า $i_L(0^+) = i_L(0^-)$; โดย $i_L(0^-)$ จากวงจร $t<0$
   คือ $t = 0^-$ (ที่มีแหล่งจ่าย DC , L = Short วงจร)

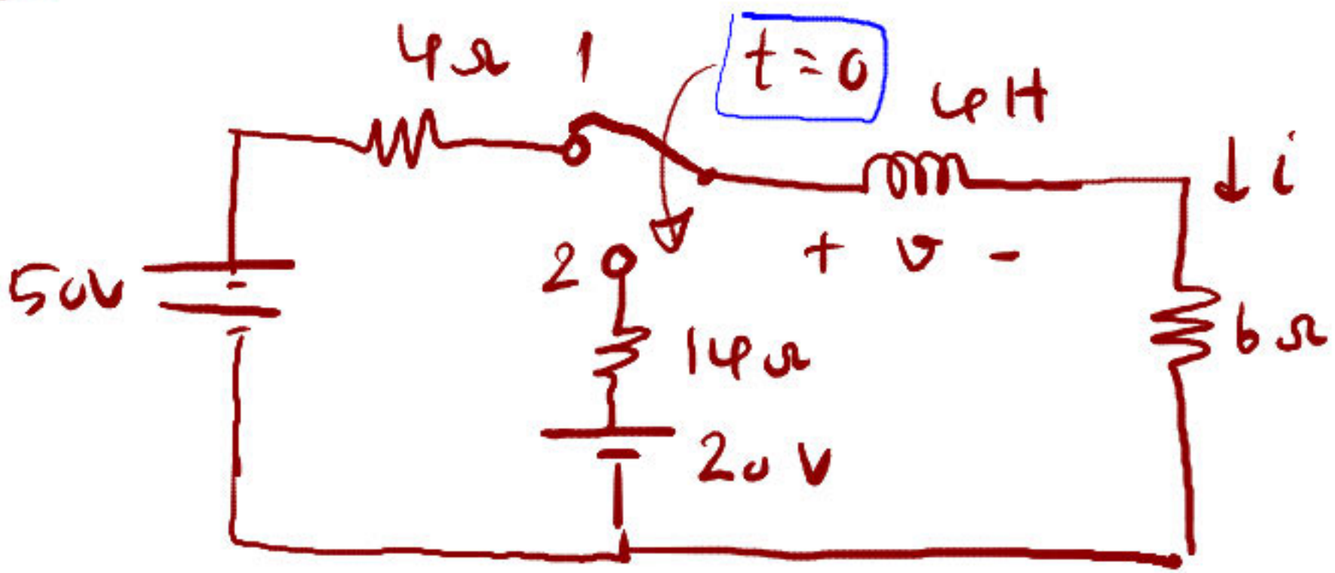
3. หา $f(0^+)$ จากวงจร $t = 0^+$ โดยแทน $L = i_L(0^+)$
   ที่ $i_L(0^+) = 0$ ให้เป็นวงจร

4. หาค่า Final Value , $f(\infty)$ จากวงจร ที่ $t = \infty$
   (ที่มี DC Source , L = Short วงจร)

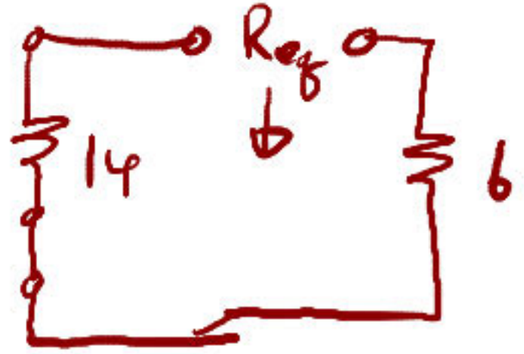
5. $f(t) = f(\infty) + [f(0^+) - f(\infty)]e^{-t/\tau}$, $t > 0$

(2)

Ex(1) จงหา v และ i ที่ $t>0$



Step① $\tau = L/R_{eq}$; $t>0$

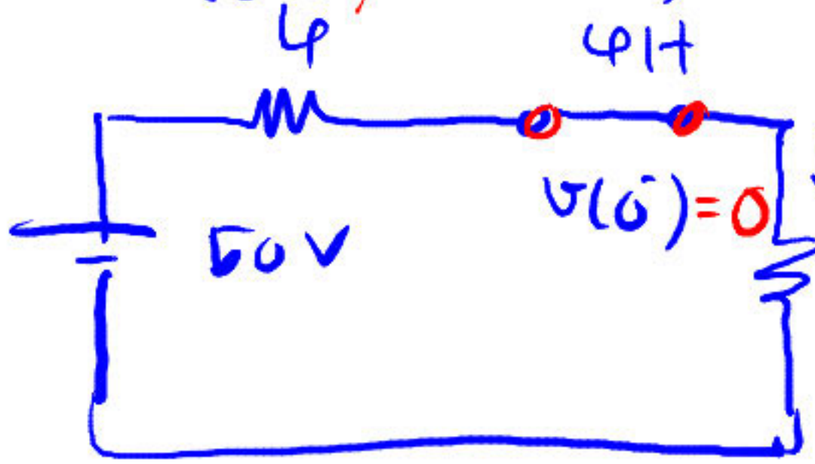


$R_{eq} = 20$

$\tau = \frac{4}{20} = 0.2\ s$

Step ① در $v_c(0^+)$, $i(0^+)$ وقتی $t<0$

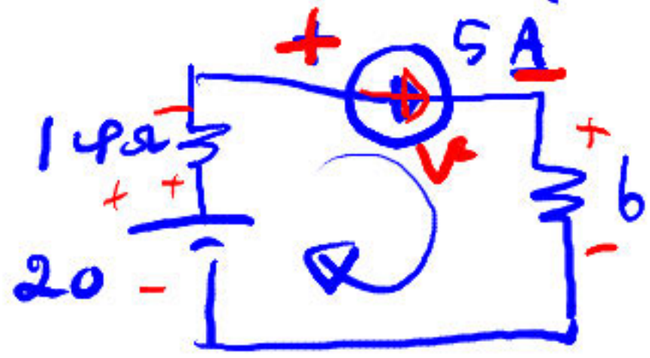
$v_c(0^+) \neq v_c(0^-)$, $i(0^+) = i(0^-)$



$i(0^-) = \frac{50}{10} = 5A$

$\therefore i(0^+) = 5A$

Step ② وقتی $t=0^+$ (sw = 2)



$v = 70V \Leftarrow$

$\Rightarrow v = 30V$

KVL $\Rightarrow 30+70+v(0^+)=20$

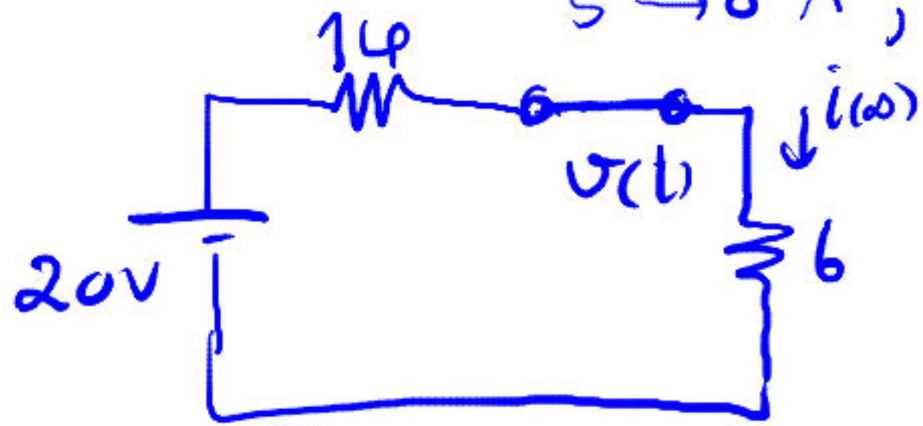
$\therefore v(0^+) = -80\,V$

$\tau = 0.5t$

$\tau_{0.2} = 0.5t$

Step ④ $t = \infty$ (sw = 2)

$5 \to 0$ A, $v(\infty) = 0$



$$i(\infty) = \frac{20}{20} = 1A$$

Step ⑤ $\boxed{v(t) = v(\infty) + [v(0^+) - v(\infty)]\, e^{-t/\tau};\ t>0}$

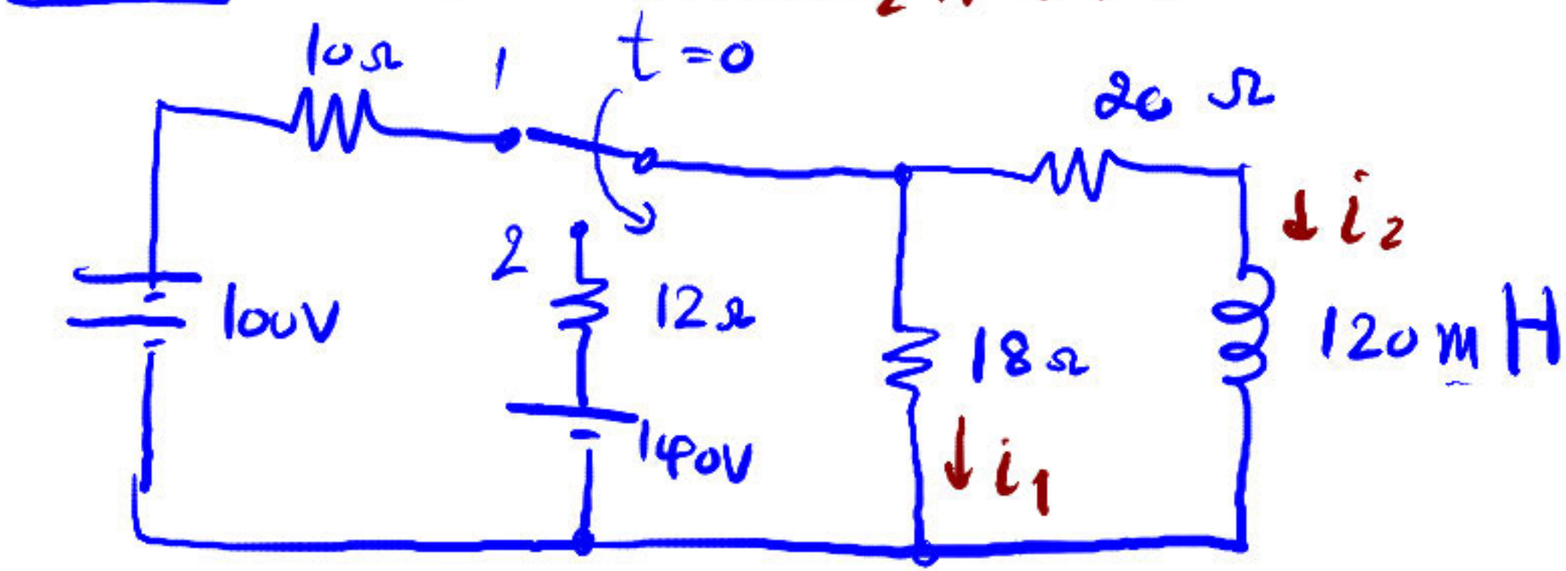
$$= 0 + [-80 - 0]\, e^{-t/0.2};\ t>0$$

$$= -80 e^{-t/0.2} = -80\, e^{-5t}\ V;\ t>0$$

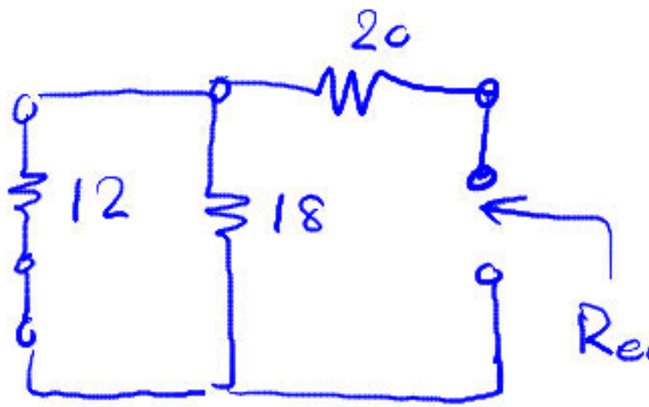
$$i(t) = 1 + [5 - 1]\, e^{-t/\tau} = 1 + 4e^{-t/0.2}$$

$$= 1 + 4e^{-5t}\ A$$

ตัวอย่าง จงหา i_1 และ i_2 ที่ $t > 0$



Step (1) หา $\tau = L_{eq}/R_{eq}$ ที่ $t > 0$



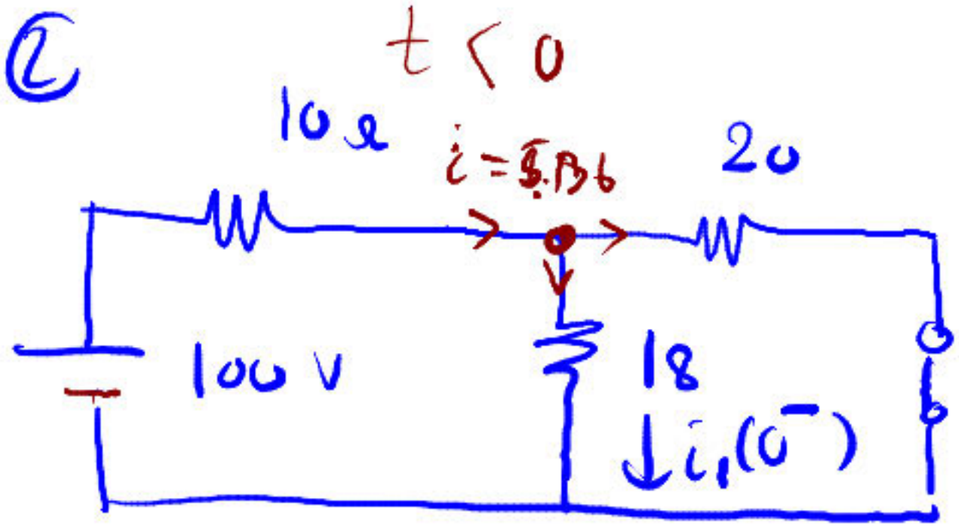
$R_{eq} = (12 // 18) + 20$

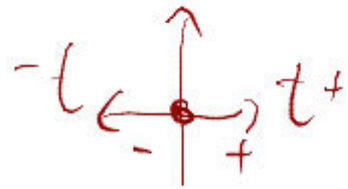
$\tau = \frac{120 \times 10^{-3}}{21.47}$

Step (2) $i_1(0^-)$, $i_2(0^-)$

Step ②

$t < 0$





$18 // 20 = 9.47\ \Omega$

$$i = \frac{100}{10 + 9.47} = 5.136\ A$$

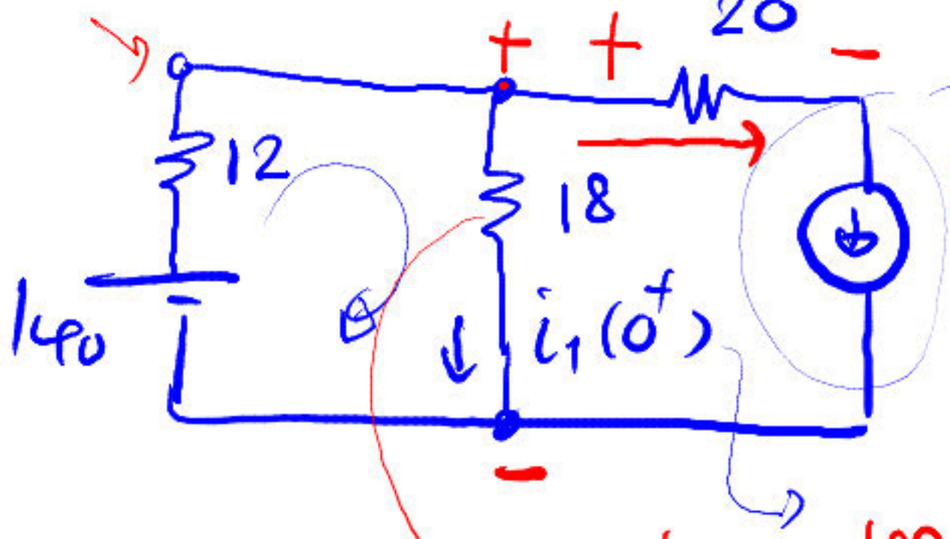
$$i_1(0^-) = 5.136\left(\frac{20}{20+18}\right) = 2.7\ A$$

$$i_2(0^-) = 5.136\left(\frac{18}{20+18}\right) = 2.43\ A$$

$i_1(t) = i_1(\infty) + [i_1(0^+) - i_1(\infty)]\, e^{-t/\tau}\ ;\ t>0$

$= 3.43 + [2.7 - 3.43]\, e^{-t/5.58\times10^{-3}}$ A

Step ② Ler $i_1(0^+)$, $i_2(0^+)$: $t>0$



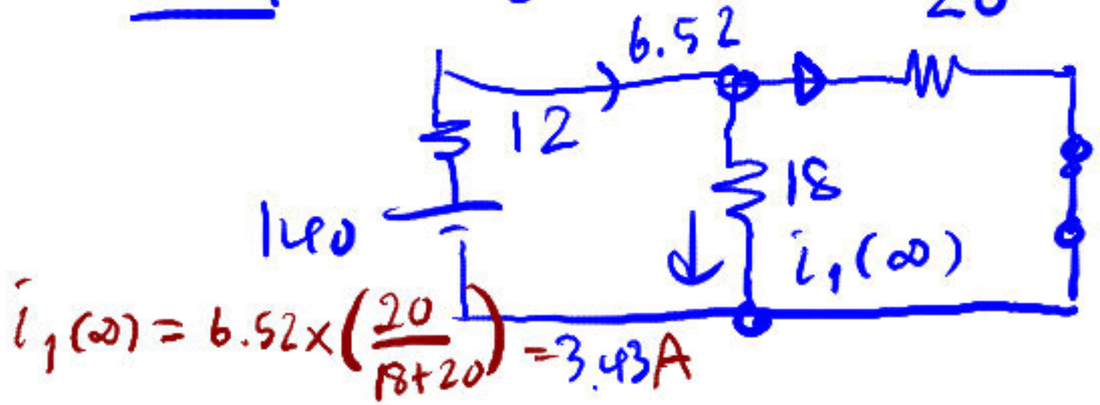
$\rightarrow V = i \cdot R = 2.43 \times 20 = 48.6$ V

$i_2(0^+) = 2.43$

$i_1(0^-) = 2.7$ A

$i_1(0^+) = \frac{48.6}{18} = 2.7$ A

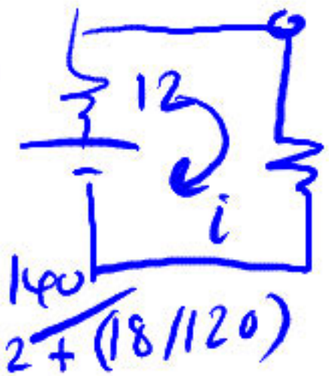
Step ③ $t = \infty$



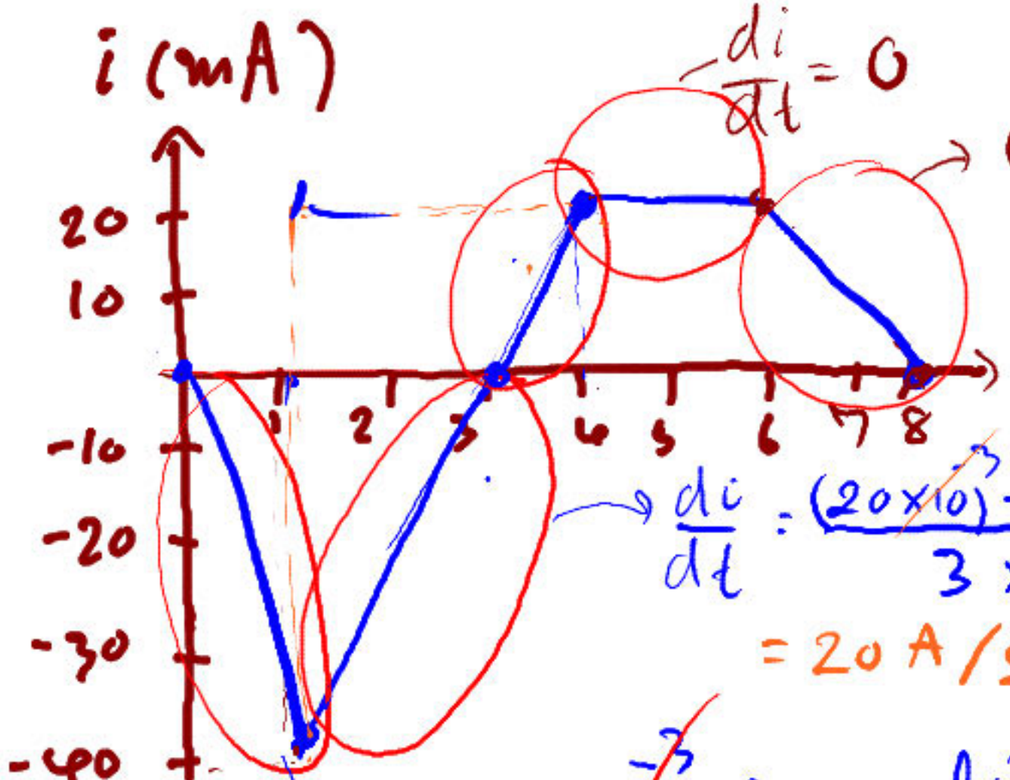
$i_1(\infty) = 6.52 \times \left(\frac{20}{18+20}\right) = 3.43$A

$6.52\left(\frac{18}{18+20}\right) = 3.09$ A

$i_2(\infty)$



$i = \frac{140}{12 + (18 // 120)} = 6.52$ A



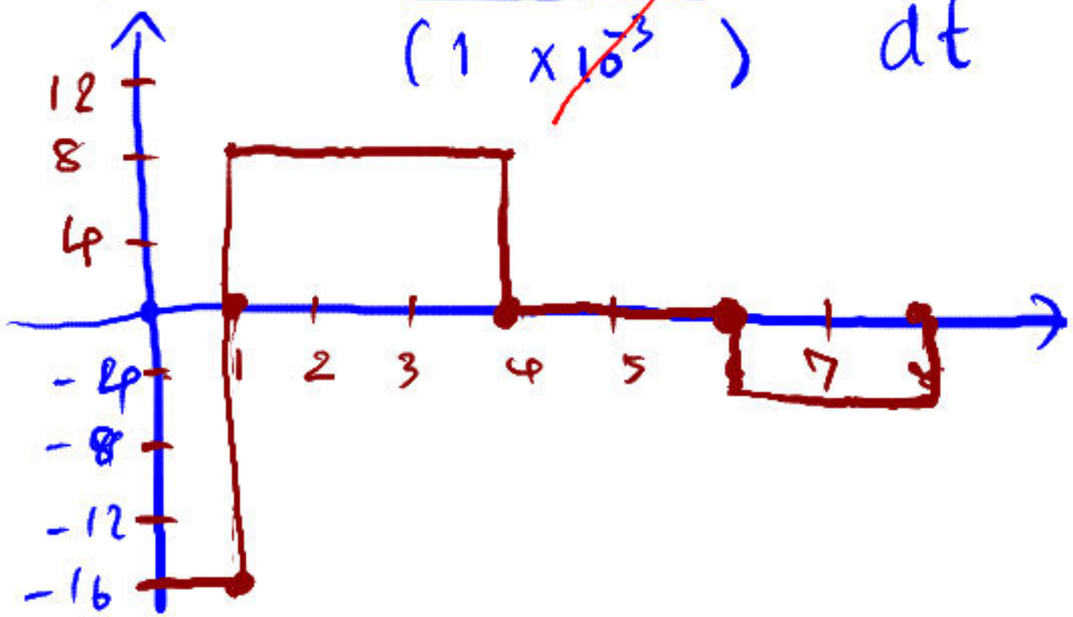
$\frac{di}{dt} = 0$

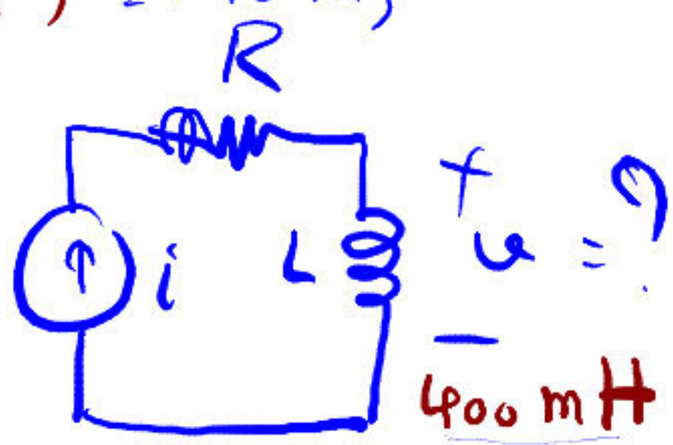
$\left(\frac{0 - 20\times10^{-3}}{2\times10^{-3}}\right) = -10\ A/s$

$\frac{di}{dt} = \frac{(20\times10^{-3}) - (-40\times10^{-3})}{3\times10^{-3}}$

$= 20\ A/s$

$\left(\frac{-40\times10^{-3} - 0}{1\times10^{-3}}\right) = \frac{di}{dt} = -40\ A/s$





$t_c = ?$

$$v_{(L)} = L\,\frac{di}{dt} \quad ****$$

$t=0$, $0 < t < 1 \Rightarrow V = ?$

$v = 400\times10^{-3}\times(-40)$

$= -16\ \frac{H\cdot A}{s} \Rightarrow V$