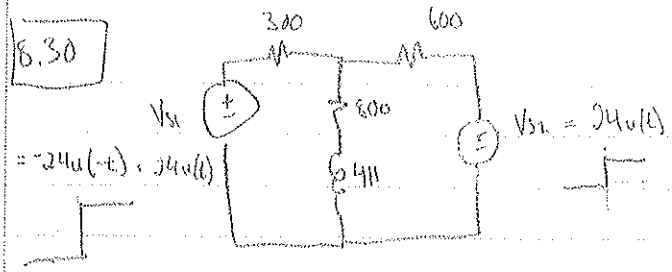
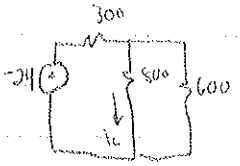
HW #17 Solution

8.30



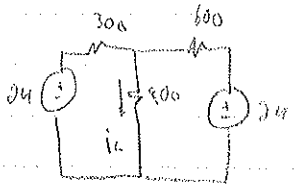
a) @ $t = 0^-$,



$$V_L(0^-) = -24\left(\frac{800//600}{800//600 + 300}\right) = -12.8\text{ V}$$

$$i_L(0^-) = -12.8\text{ V}/800\,\Omega = \boxed{16\text{ mA}} = i_L(0^+).$$

@ $t = \infty \rightarrow$



$$V_L(\infty) = 24\left(\frac{800}{800 + 300//600}\right) = 19.2\text{ V}$$

$$i_L(\infty) = 19.2\text{ V}/800\,\Omega = \boxed{24\text{ mA}}$$

$$\tau = L/R = \frac{4\text{ H}}{800 + 300//600} = 4\times10^{-3}$$

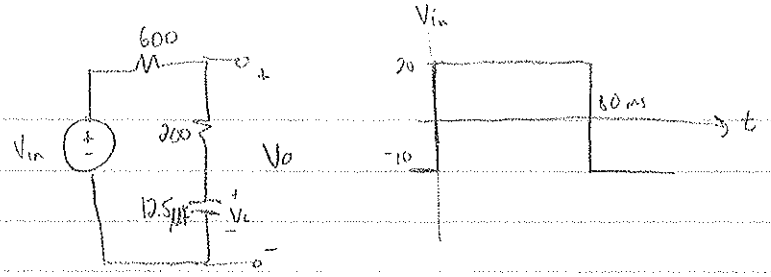
So $i_L(t) = 24 + (16-24)e^{-250t}$ mA $= \boxed{24 - 8e^{-250t}\text{ mA}}$

b) $\boxed{V_L(t) = 8e^{-250t}\text{ volts.}}$

c) double sources:

$$\boxed{\begin{aligned} i_L(t) &= 48 - 16e^{-250t}\text{ mA} \\ V_L(t) &= 16e^{-250t}\text{ volts} \end{aligned}}$$

8.32



a) $V_c(0^+) = V_c(0^-) = V_{in}(0^-) = \boxed{-10\text{v}}$ $(i=0)$

$\tau = RC = (600+200)(12.5\mu) = 10\times10^{-3}$

b) from 0 to 80 ms: $V_c(0^+) = -10$

$V_c(\infty) = 20$, assuming no other switching events.

$V_c(t) = 20 - 30\,e^{-100t}$ volts. $(0<t<80\text{ms})$

$V_R = i_R \cdot 200$. $i_R = C\,dV_c/dt = 37.5\,e^{-100t}$ mA

$V_R = 7.5\,e^{-100t}$ V

$V_{out} = V_c + V_R = 20 - 22.5\,e^{-100t}$ volts $(0<t<80\text{ms})$

from 80ms+ on: $V_c(80^+) = V_c(80^-) = 20 - 30\,e^{-100(80\text{ms})} \simeq 20$ volts

$V_c(\infty) = -10$v.

$V_c(t) = -10 + 30\,e^{-100(t-80\text{ms})}$ volts

$V_R = 200\,i_R = 200\left(-37.5\,e^{-100(t-80\text{ms})}\right) = -7.5\,e^{-100(t-80\text{ms})}$ volts

$V_{out} = V_c + V_R = -10 + 22.5\,e^{-100(t-80\text{ms})}$ volts $(t>80\text{ms})$

$$V_{out}(t) = \begin{cases} 20 - 22.5\,e^{-100t}, & 0<t<80\text{ms} \\ -10 + 22.5\,e^{-100(t-80\text{ms})}, & t>80\text{ms} \end{cases}$$