

$\frac{dt}{dt} = 1$  EE 220  
circuits 2

OCT. 21, 2020

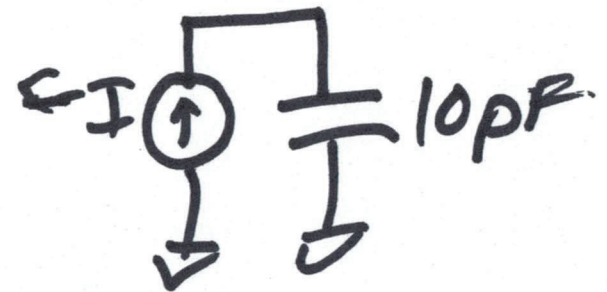
Lecture 16  $\frac{dv}{dt} = \frac{I}{C}$

$CV = Q$

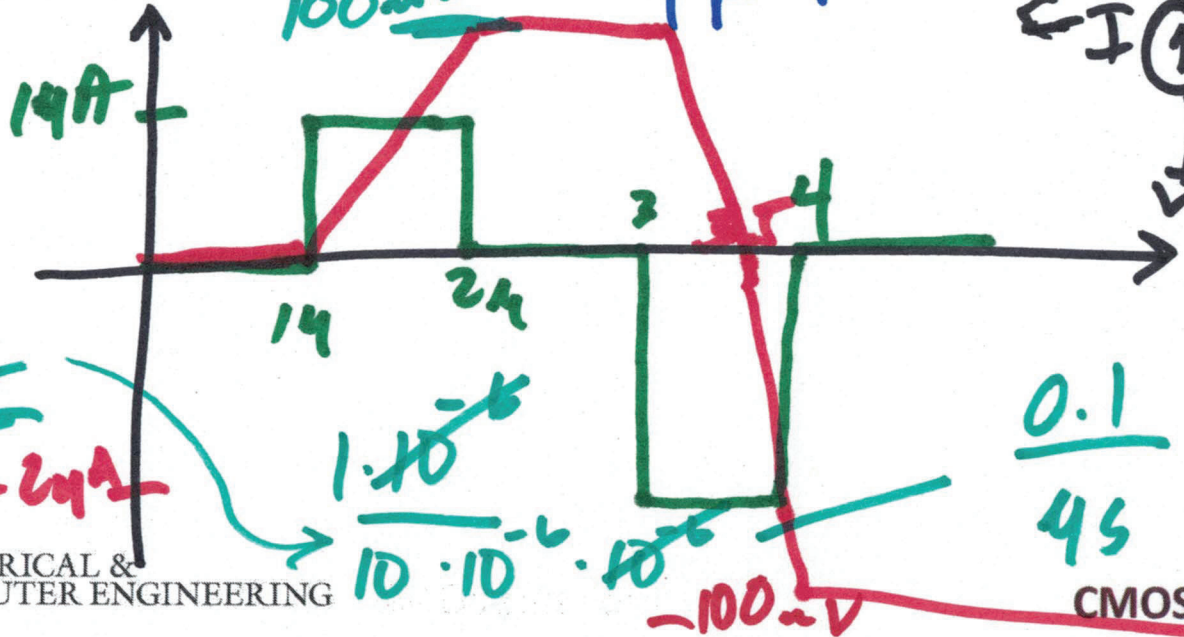
$I = C \frac{dv}{dt}$

$V = \frac{1}{C} \int I dt$

SAaturday study session



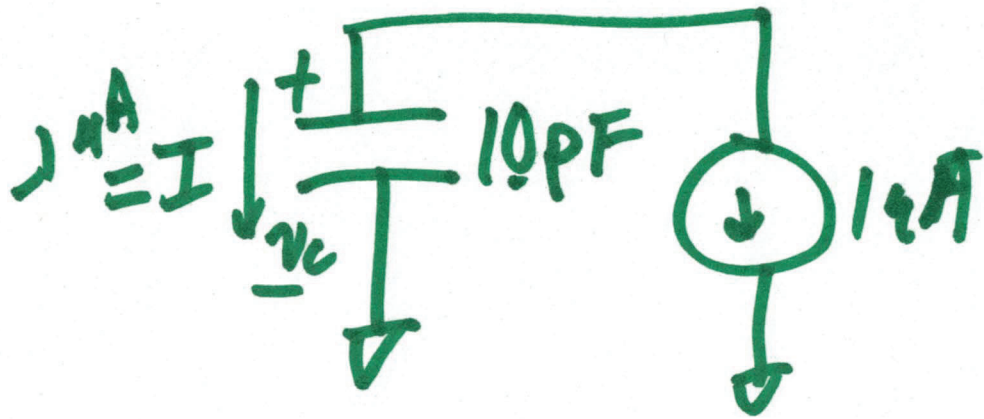
$\frac{dk \cdot t}{dt} = k$



$\frac{dv}{dt} = \frac{14A}{10pF}$

$\frac{dv}{dt} = \frac{-24A}{45} = -\frac{.2V}{45}$

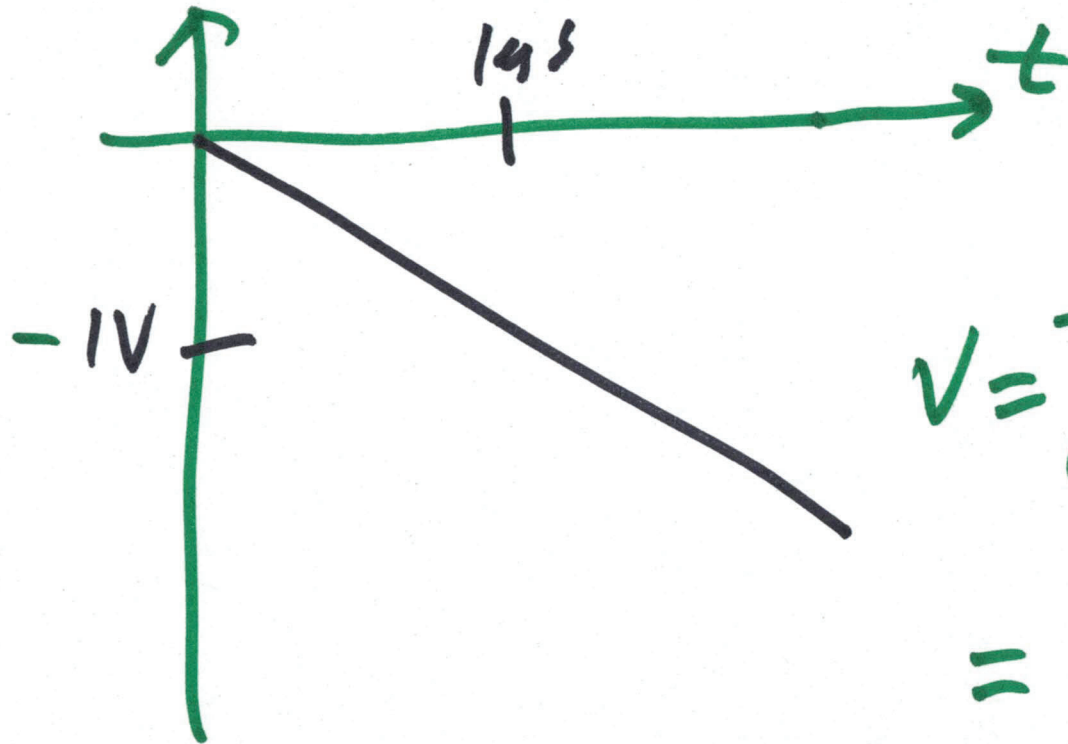
1)



$$I = C \frac{dv}{dt}$$

$$\frac{dv}{dt} = -\frac{14A}{1pF}$$

$$= -\frac{1V}{45}$$



$$V = \frac{-1}{10pF} \int_0^t 14A \cdot dt$$

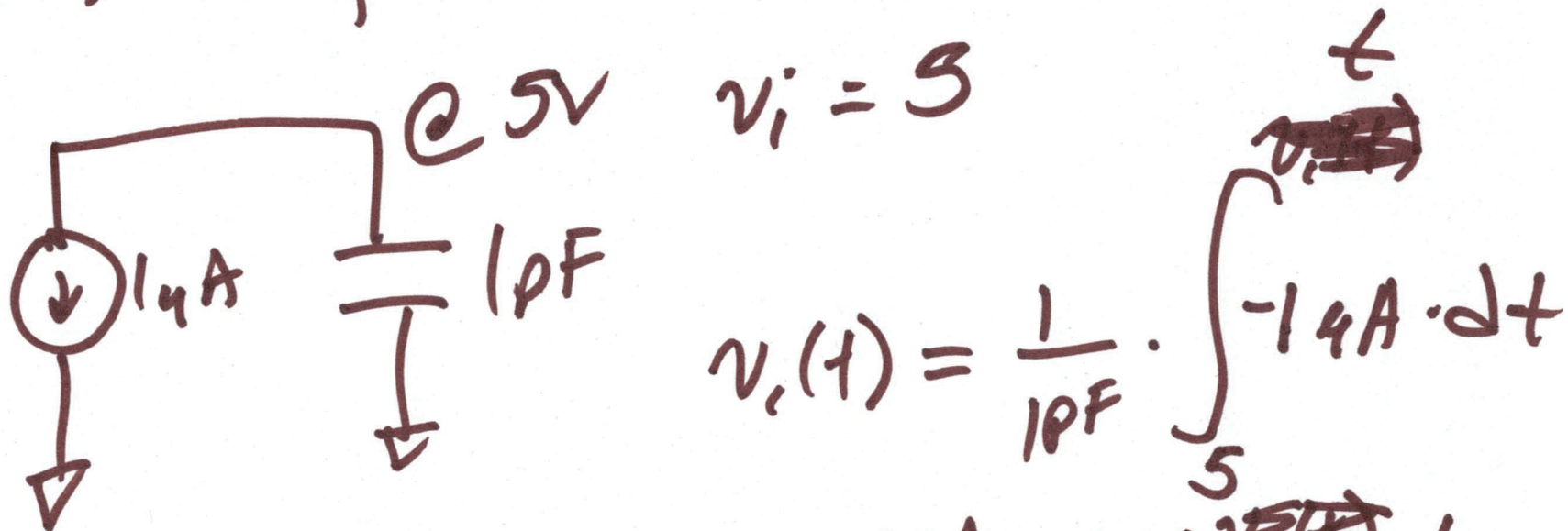
$$= \frac{14}{1p} \cdot (t - 0)$$

$$V = -\frac{1 \cdot t}{45}$$

2)

$$I \downarrow \frac{1}{T} \overset{+}{V_c} \quad I = C \frac{dV_c}{dt} \quad CV = Q \quad V_c = \frac{1}{C} \int_{\cancel{v_i(0)}}^{v_c(t)} i(t) dt$$

$$v_c(t) = v_f + (v_i - v_f)e^{-t/RC}$$



$$v_c(t) = \frac{1}{1pF} \cdot \int_5^t -14A \cdot dt$$

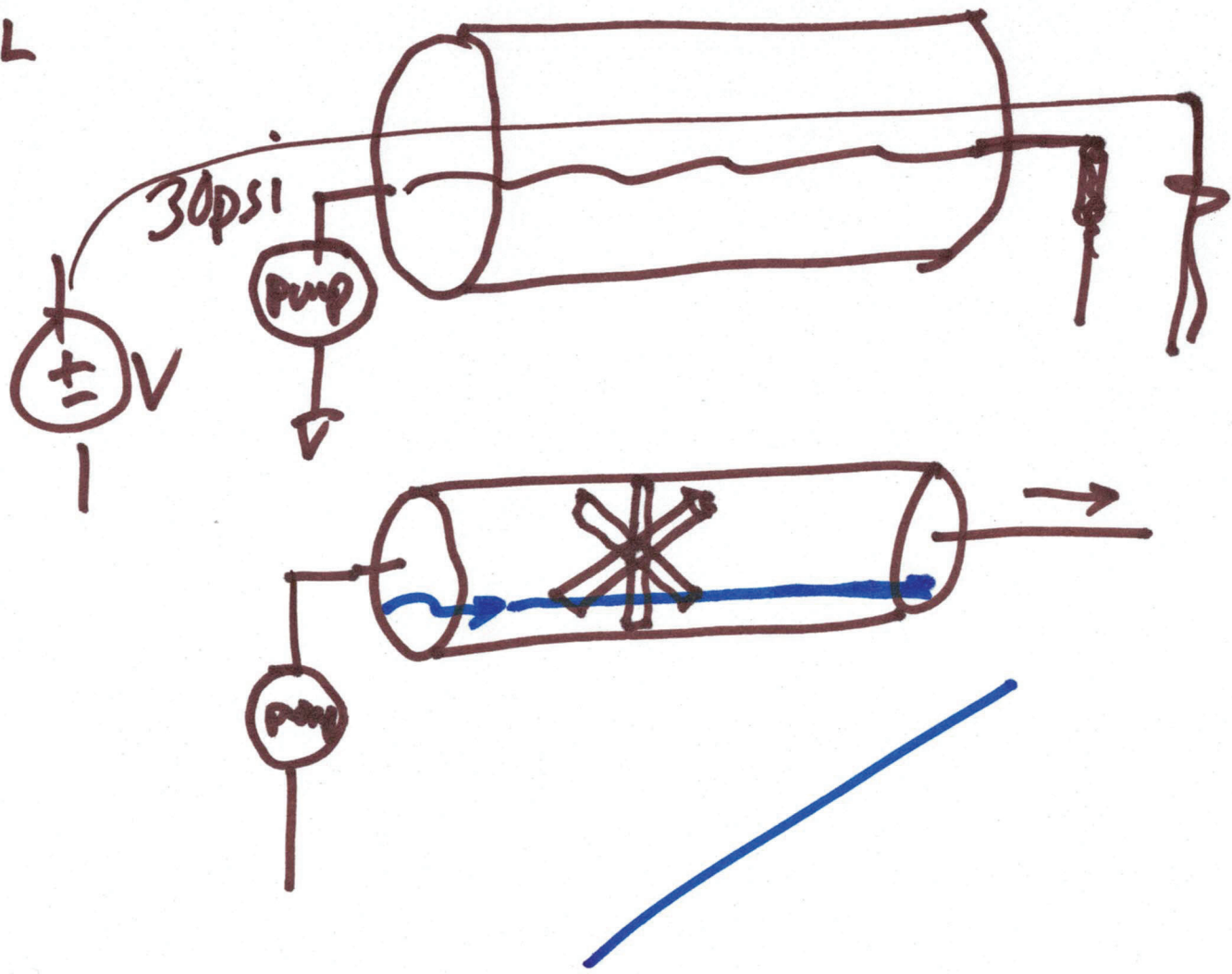
$$v_c(t) = \frac{-14A}{1pF} \cdot (t) \Big|_5^t$$

$$v_c(t) = -\frac{1V}{4s} (t - 5)$$

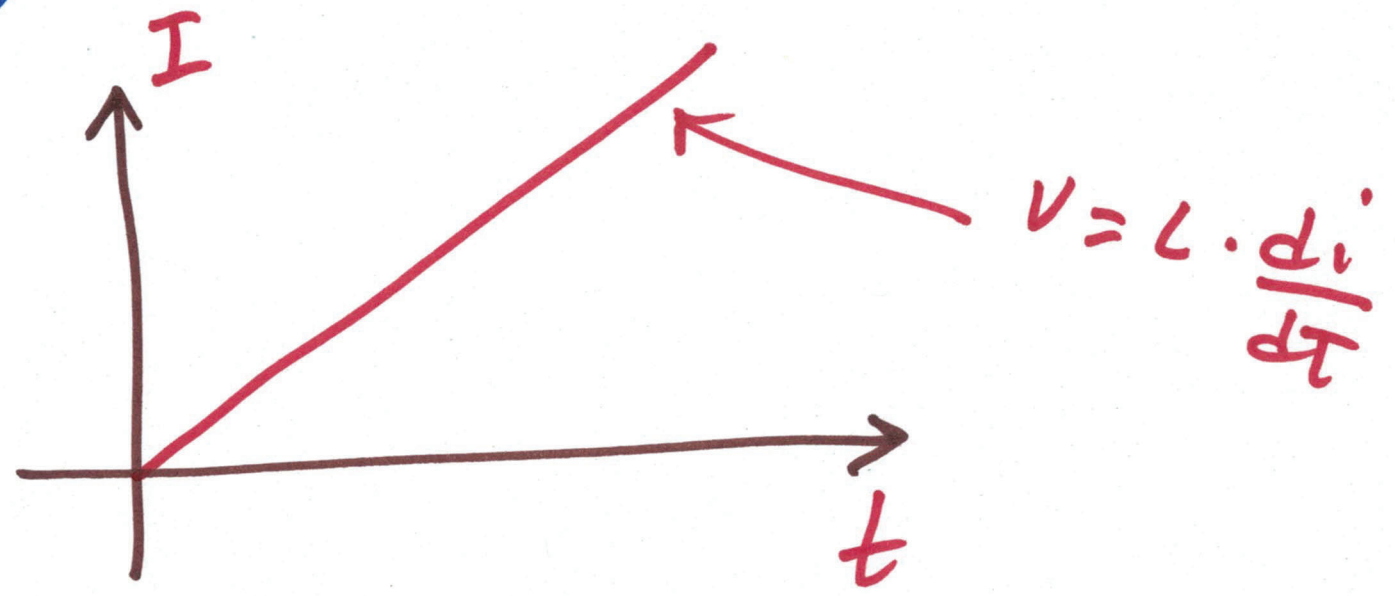
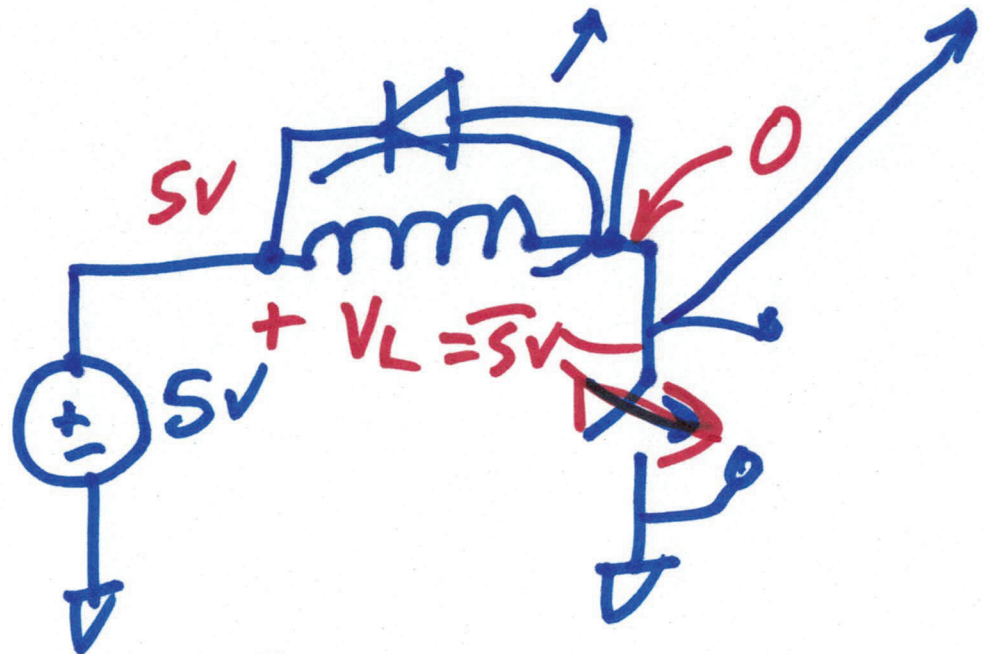
3)

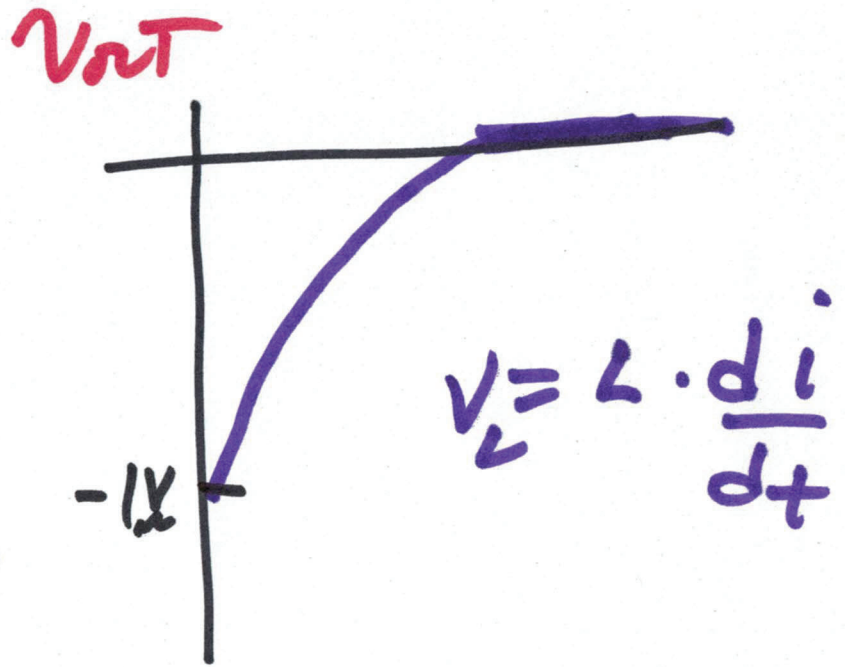
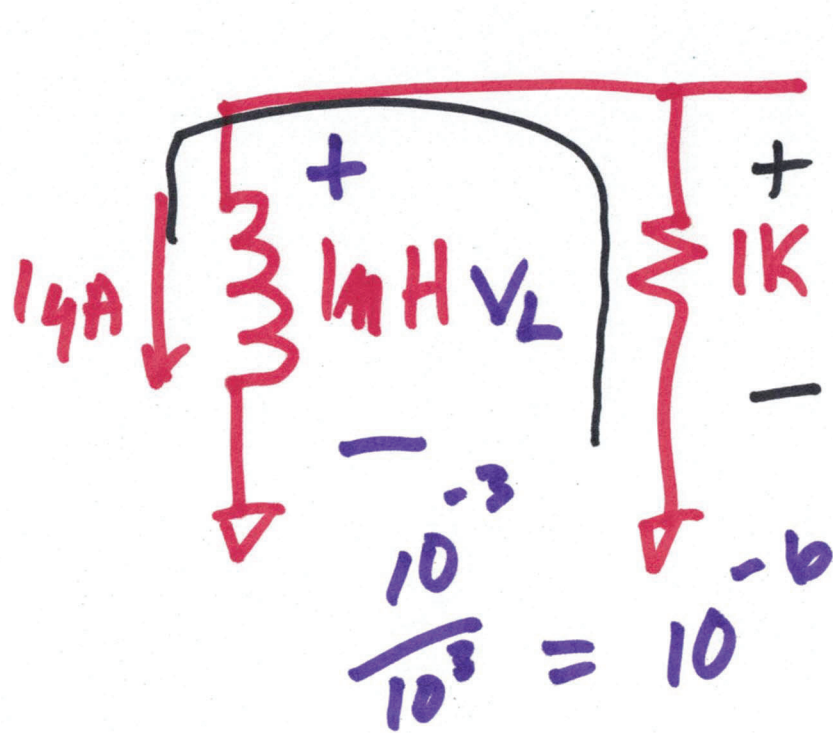


$I \downarrow$   
 $V_L$   
+



4)





$$V_{out} = -i \cdot 1K = 1mH \cdot \frac{di}{dt} = V_L = V_{out}$$

$$\frac{-(t-0)}{L/R} = \int_0^t \frac{-dt}{L/R} = \int_{i_{limit}}^{i(t)} \frac{di}{i} = \ln i \Big|_{i_{limit}}^{i(t)}$$

$$\tau = \frac{L}{R}$$

b)

$$-\frac{t}{\tau} = \ln i(t) - \ln i_{\text{init}}$$

$$e^{-\frac{t}{\tau}} = \frac{i(t)}{i_{\text{init}}}$$

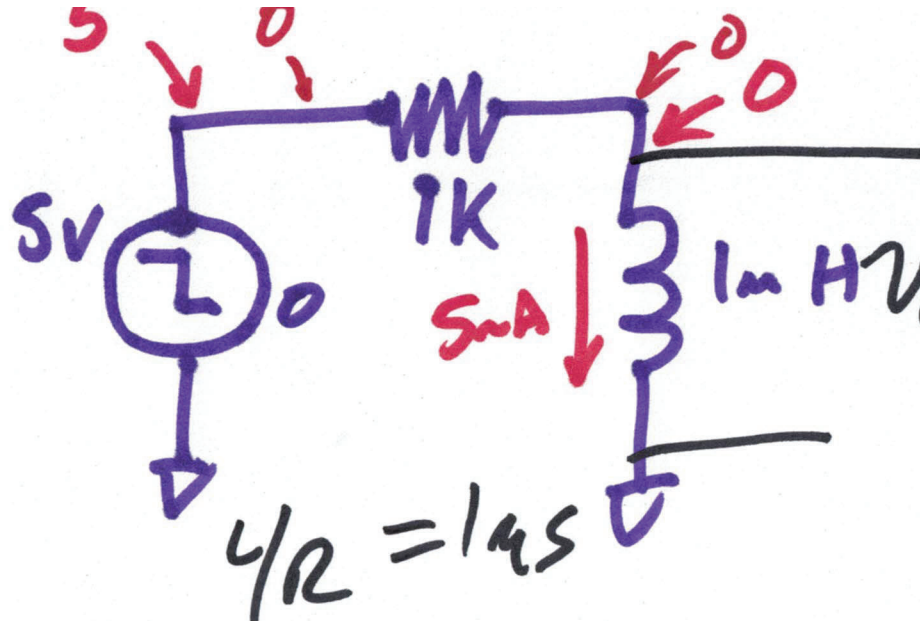
$$i(t) = i_{\text{init}} \cdot e^{-t/\tau}$$

$\tau \rightarrow 63\%$

$$i(t) = 14A \cdot e^{-t/143}$$

7)





$$i_i = 5mA = \frac{5-0}{1k}$$

$$i_f = 0mA$$

$$i_L(t) = i_f + (i_i - i_f)e^{-t/4R}$$

$$i_L = 5mA e^{-t/1\mu s}$$

$$i_L(t) = 5mA \quad t \leq 2\mu s$$

$$i_L = 5mA e^{-(t-2\mu s)/1\mu s} \quad t \geq 2\mu s$$

8)



$$i_L(t) = 5mA e^{-t/145}$$

$$V_L = L \cdot \frac{di_L}{dt} = 1mH \cdot 5mA \cdot e^{-t/145}$$

$$\frac{dAe^{t/B}}{dt} = A \cdot \frac{de^{t/B}}{dt} = A e^{t/B} \cdot \left(-\frac{1}{145}\right) \cdot \frac{dt/B}{dt}$$

$$v_L(t) = -5 e^{-t/145} = A \cdot e^{t/B} \cdot \frac{1}{B} \cdot \frac{dt}{dt}$$