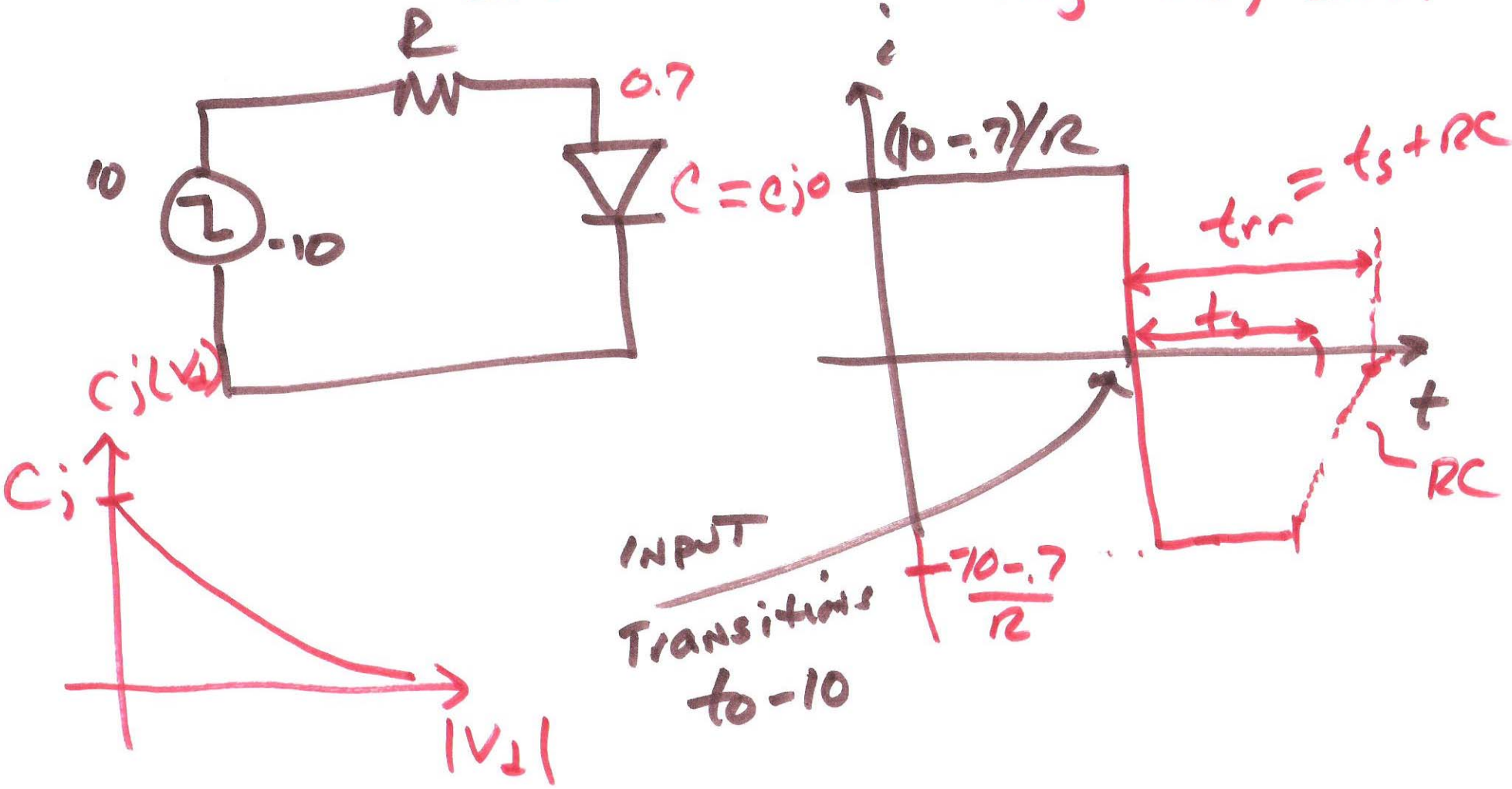
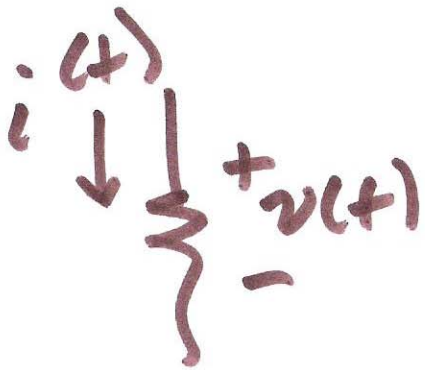
ECE 5/472 Power Electronics

BOISE STATE UNIVERSITY

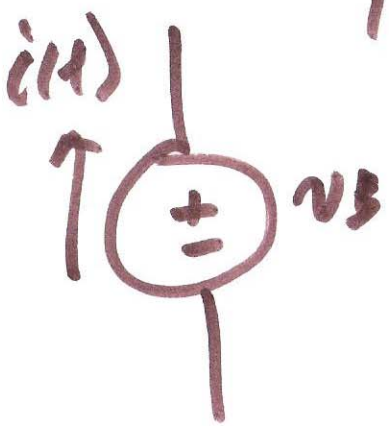
Lecture 2 Aug. 25, 2011



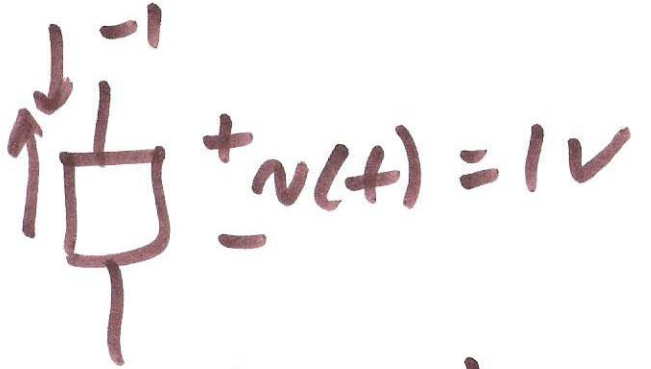
instantaneous power, $p(t)$



$$p(t) = v(t) \cdot i(t)$$



$1A = i(t)$



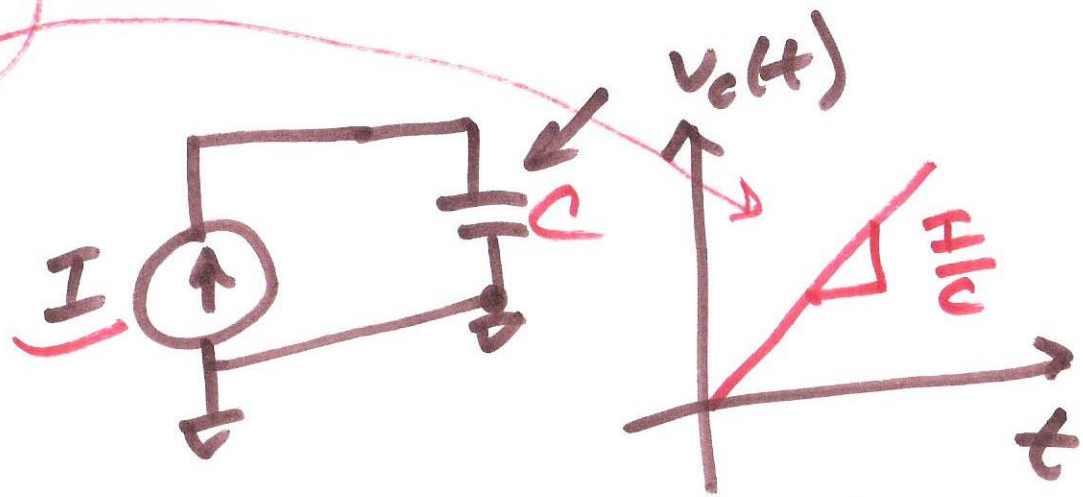
$$\frac{v(t)}{i(t)} = \frac{1}{-1} = -1\,\Omega$$

$\frac{1}{T}$

2)

$$C \cdot \frac{dv_c}{dt} = I$$

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



$$p(t) = \frac{d\varepsilon(t)}{dt} \qquad \frac{p(t)}{\uparrow} = \frac{d\varepsilon}{dt}$$

$$p(t) = v(t) \cdot i(t) = C\,\frac{dv(t)}{dt} \cdot v(t)$$

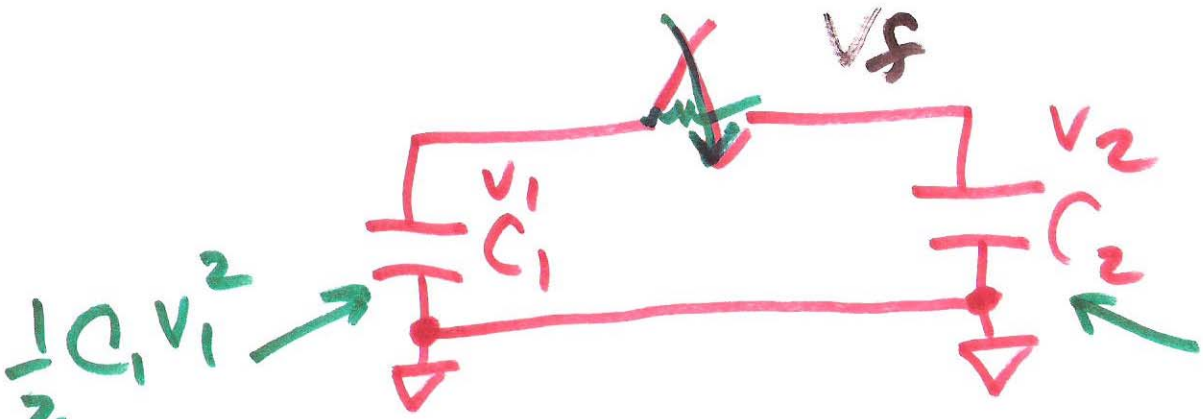
$$\frac{d\varepsilon}{dt} = C\,v \cdot \frac{dv}{dt}$$

$$\int_0^{E_f} dE = \int_0^{V_f} C\, v\, dv$$

$$\boxed{E_f = \frac{1}{2} C V_f^2}$$

$$i \cdot V = L \cdot \frac{di}{dt} \cdot i = \frac{dE}{dt} = p(t)$$

$$\int_0^{E_f} dE = \int_0^{I} L \cdot i \cdot di = \underline{\frac{1}{2} L I^2}$$



$CV = Q$

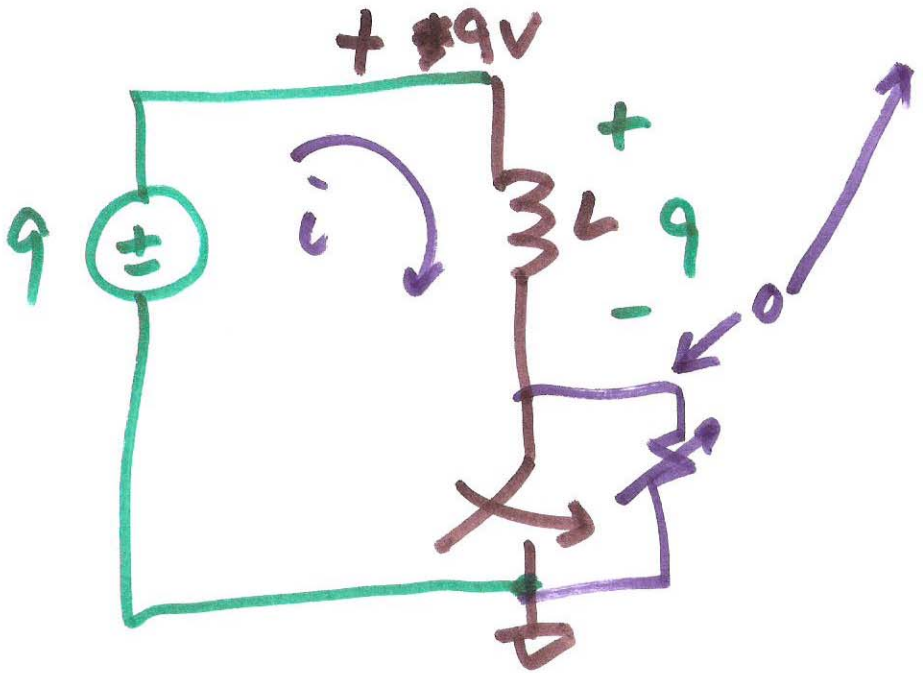
$$C_1V_1 + C_2V_2 = v_f(C_1 + C_2)$$

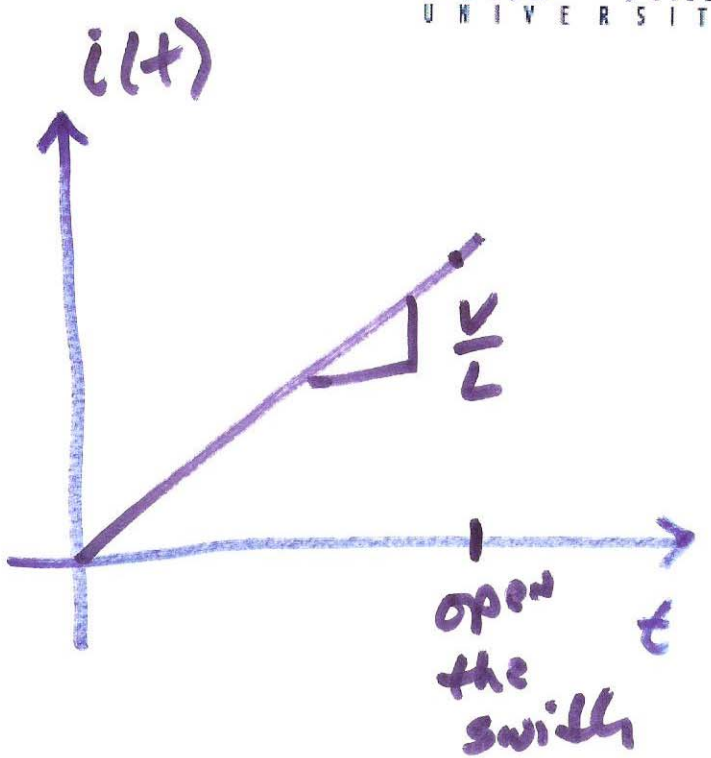
$$v_f = \left(\frac{C_1 + C_2}{C_1V_1 + C_2V_2}\right)^{-1}$$

$$\frac{1}{2}(C_1 + C_2)\left(\frac{C_1V_1 + C_2V_2}{C_1 + C_2}\right)^2 \stackrel{?}{=} \frac{1}{2}(C_1V_1^2 + C_2V_2^2)$$

$$\frac{(C_1V_1)^2 + (C_2V_2)^2 + 2C_1V_1C_2V_2}{(C_1 + C_2)^2}$$

5)

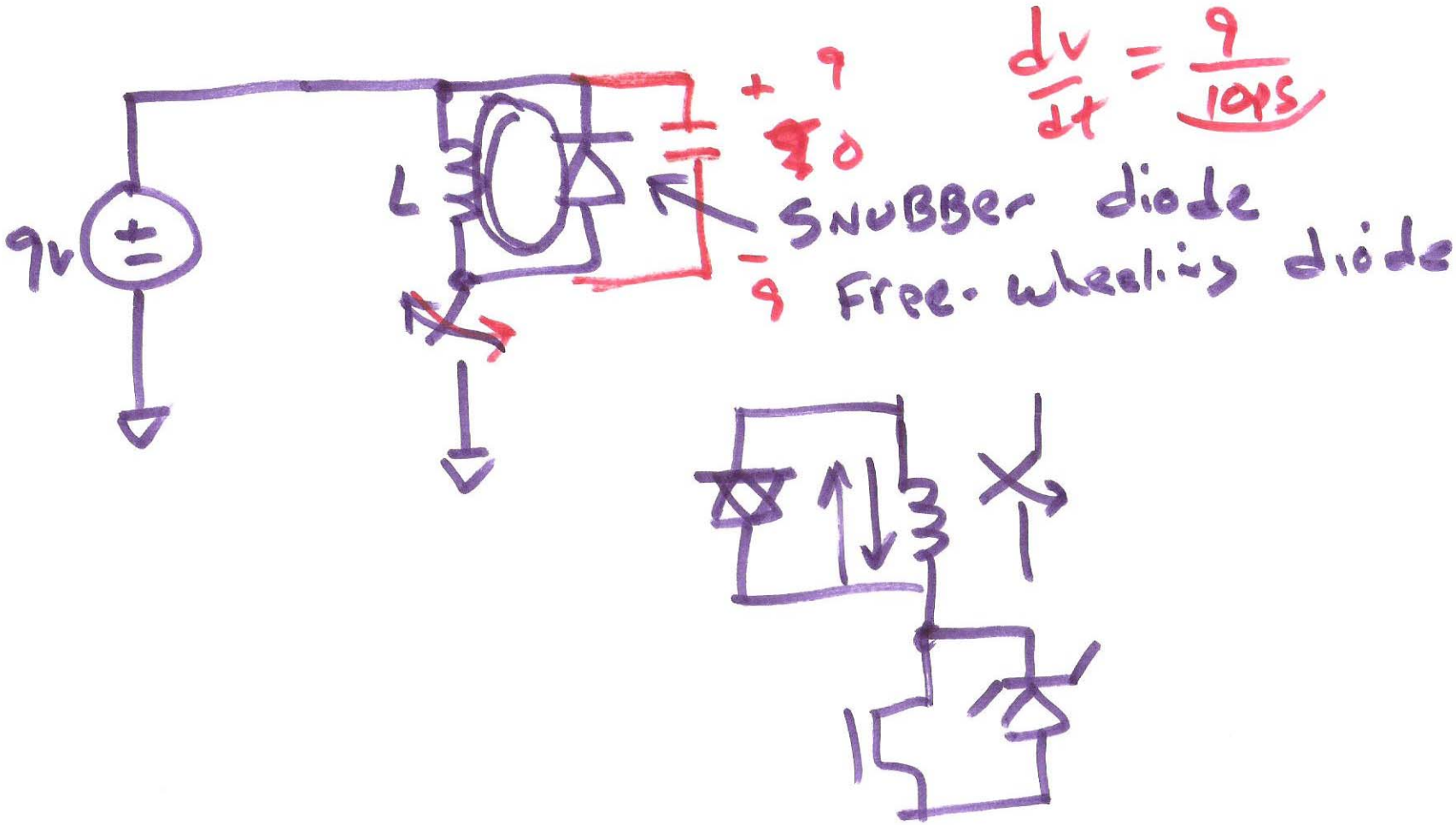




$$V = L \cdot \frac{di}{dt}$$

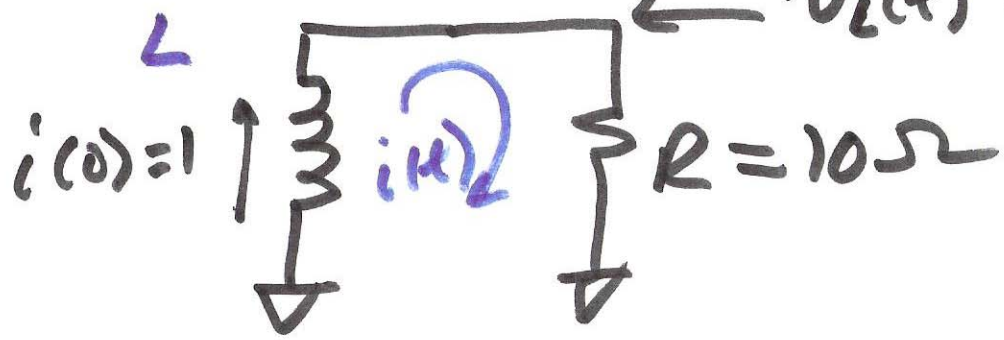
$$\frac{V}{L} = \text{CONST} = \frac{di}{dt}$$

c)


9v
L
+ 9
0
- 9
SNUBBer diode
Free-wheeling diode
dv/dt = 9/10ns

$\frac{V}{L}$

$v_L(t) = v_R(t) =$



$v_L(0) = 10\,V$

$V_L(\infty) = 0$

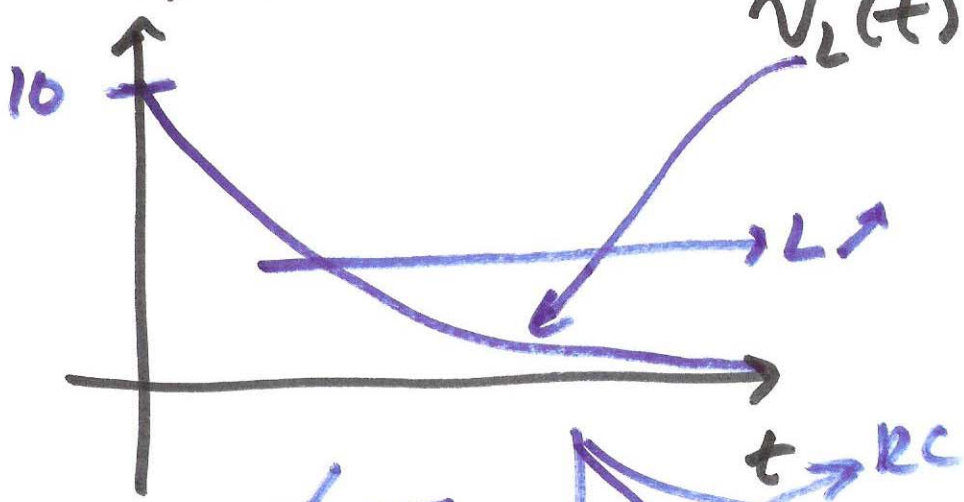
$v_L(t) = i \cdot R$

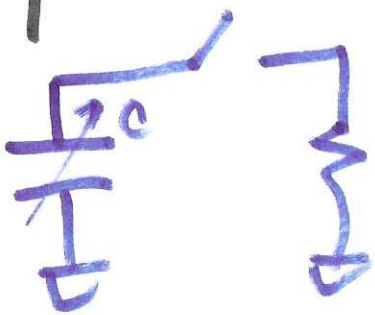
$-t/\frac{L}{R}$

$\frac{L}{R}$

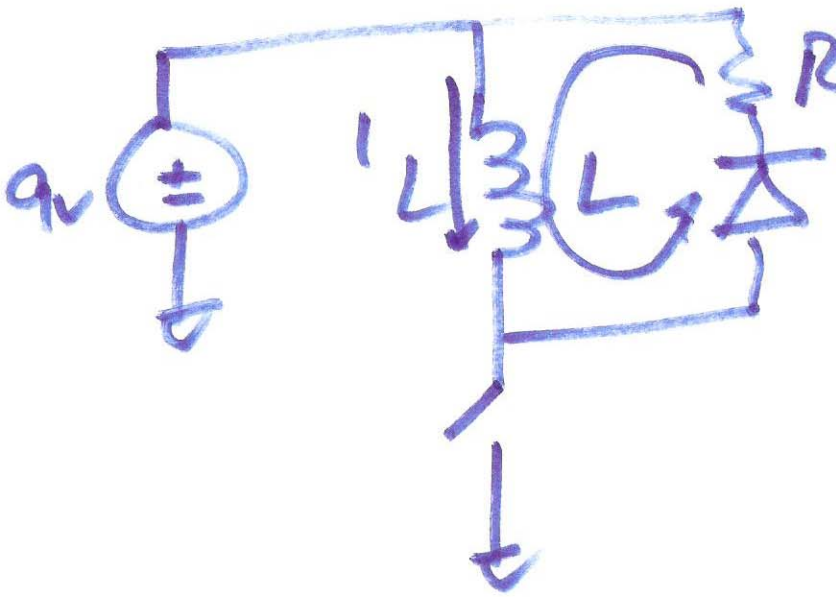
$v_L(t) = 10\,e^{-t/\frac{L}{R}}$

$i(t) = \frac{v_L(t)}{R} = \frac{10}{R} e^{-t/\frac{L}{R}}$





8)

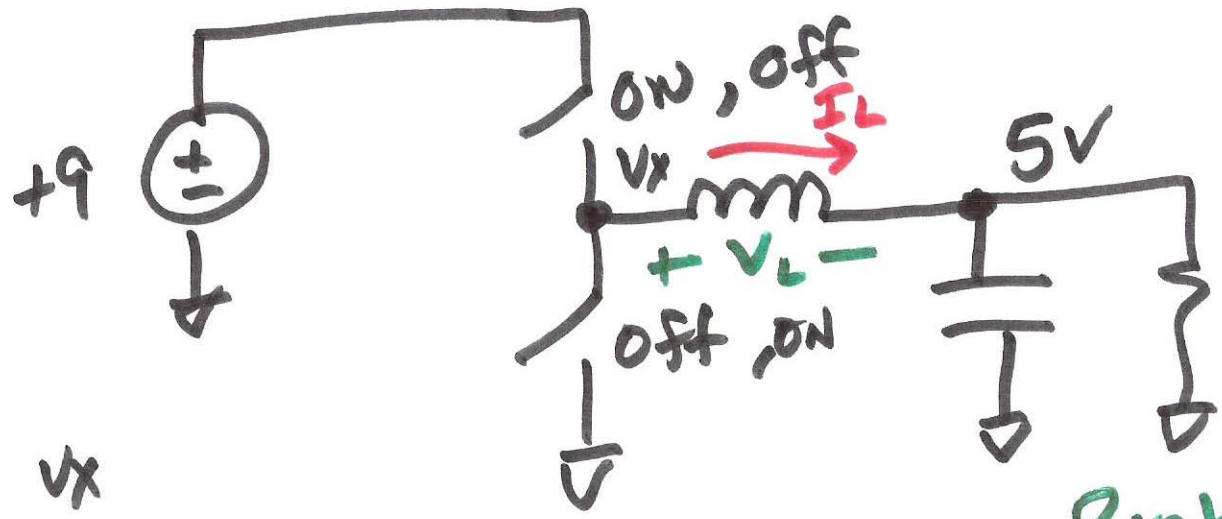


$\frac{1}{2}LI^2$

$P(t) = i^2(t)R = \frac{d\mathcal{E}}{dt}$

$P = \frac{v^2}{R} = i \cdot v$

9)

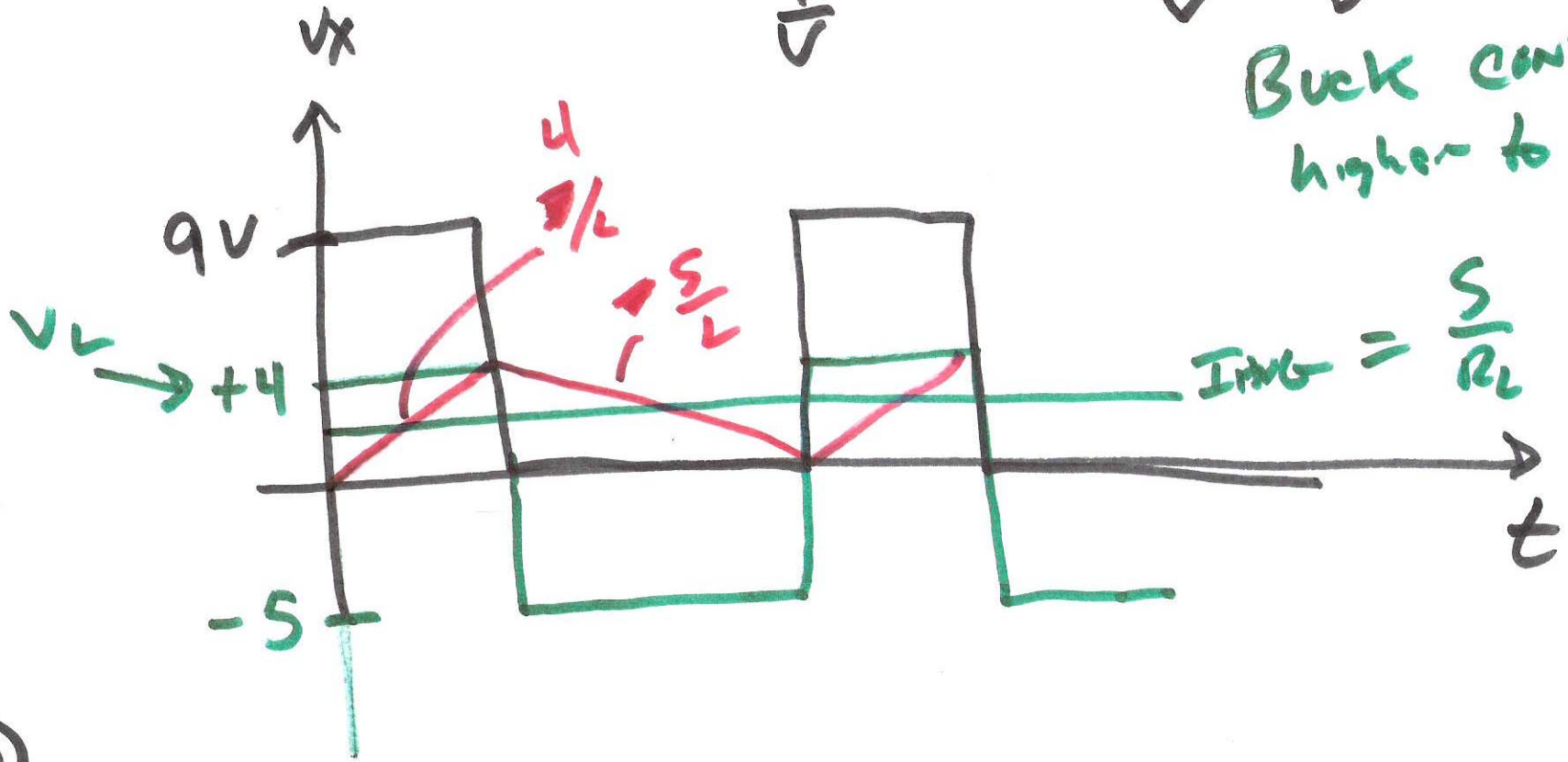


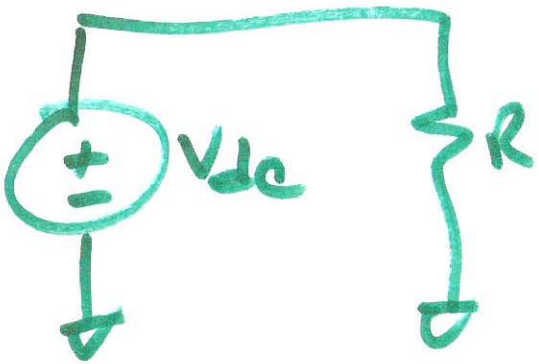
$$\frac{V}{L} = \frac{dI}{dt}$$

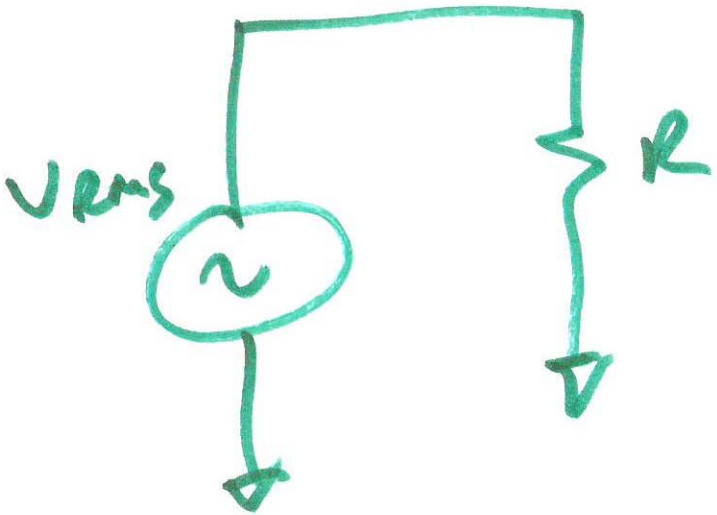
$$\frac{-5}{L} = \frac{dI}{dt}$$

$\frac{5}{R_L}$

Buck converter
higher to a lower voltage







$$\frac{V_{dc}^2}{R}$$

$$\frac{V_{RMS}^2}{R}$$

$$V_{dc} = V_{RMS}$$

$$V_{RMS} = \frac{V_P}{\sqrt{2}}$$