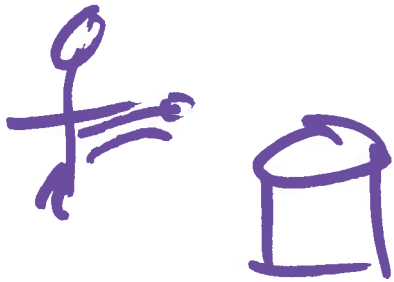


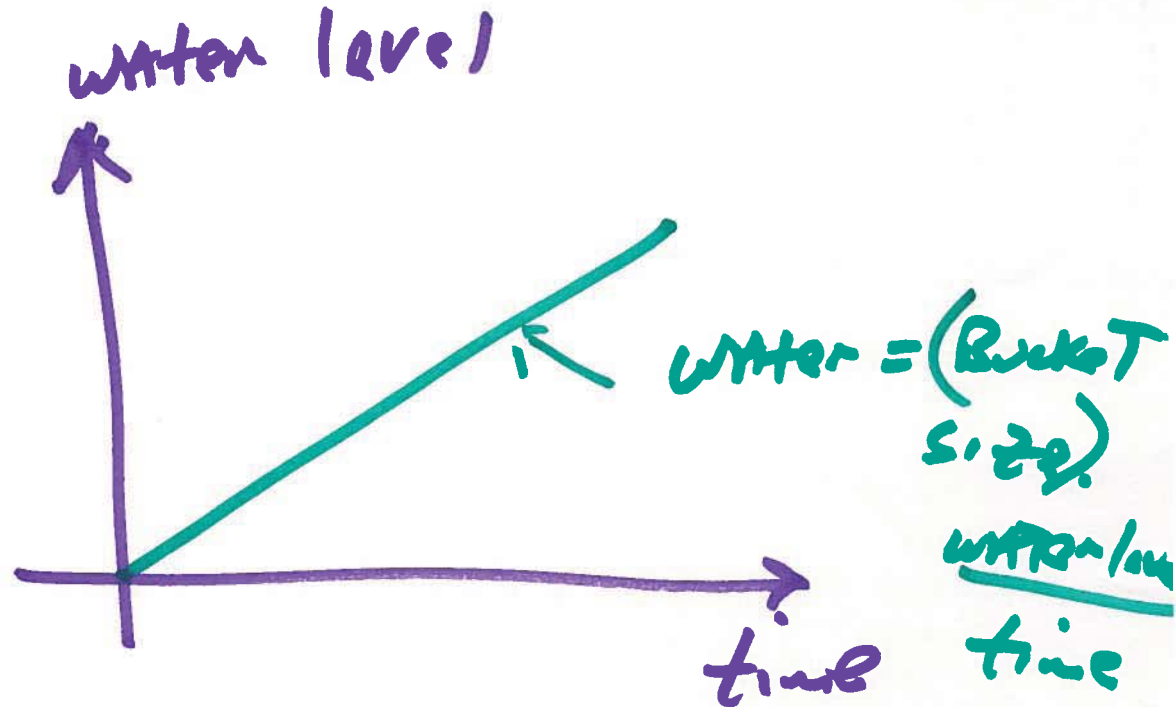
EE 220 CIRCUITS 1

Lecture 15

OCT. 23, 2017



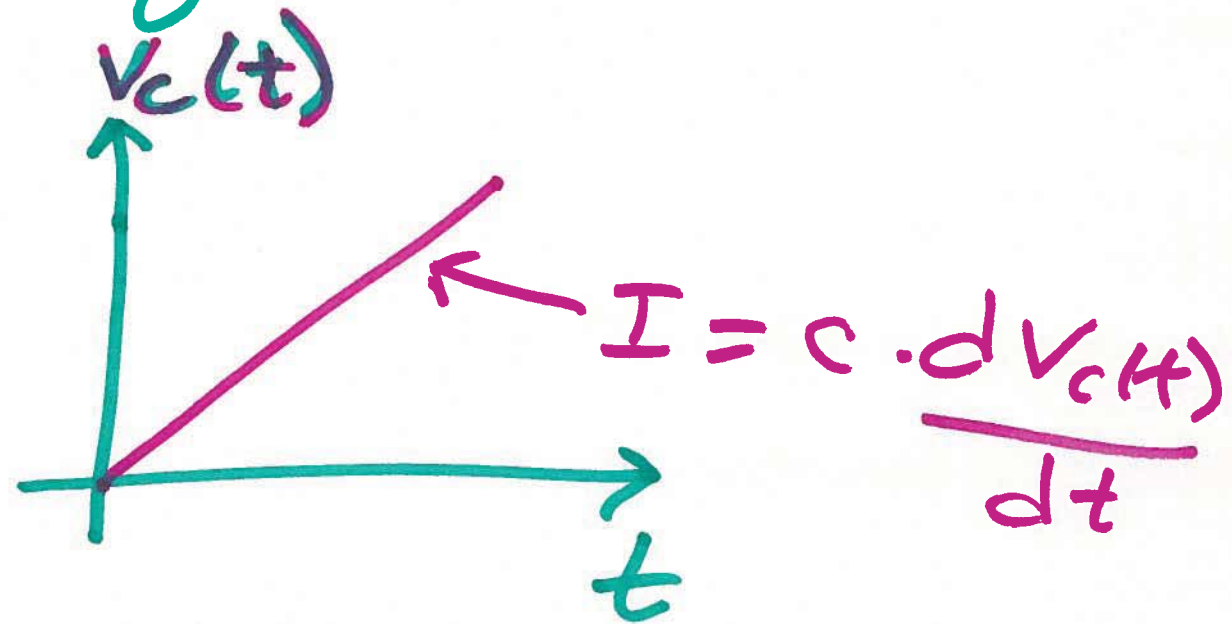
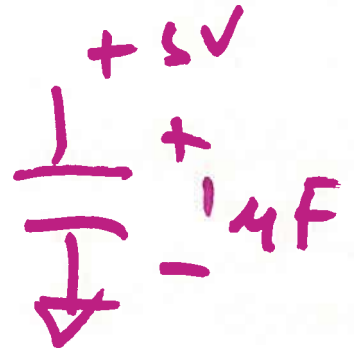
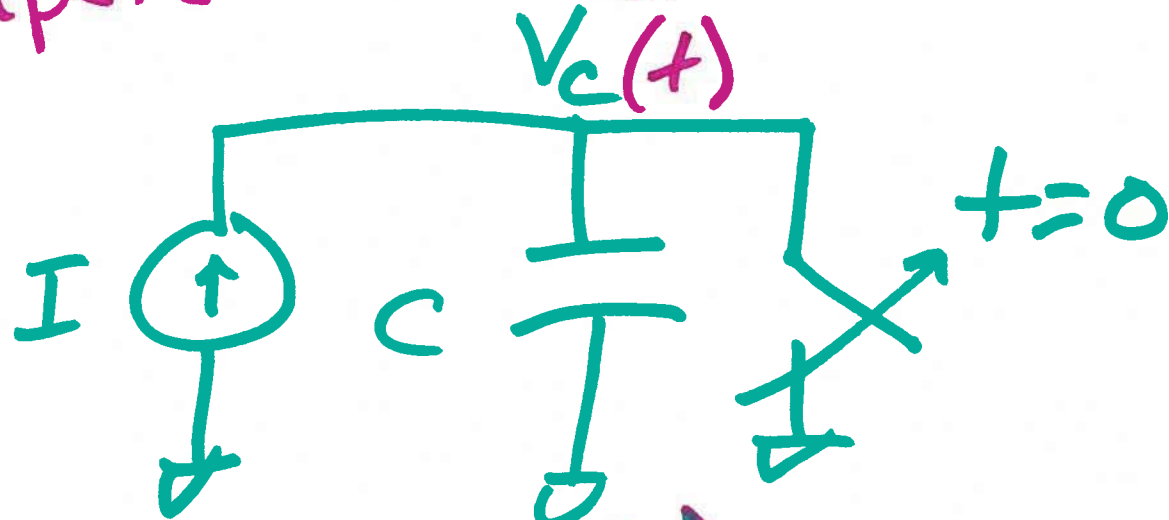
$$I = C \cdot \frac{dv}{dt}$$



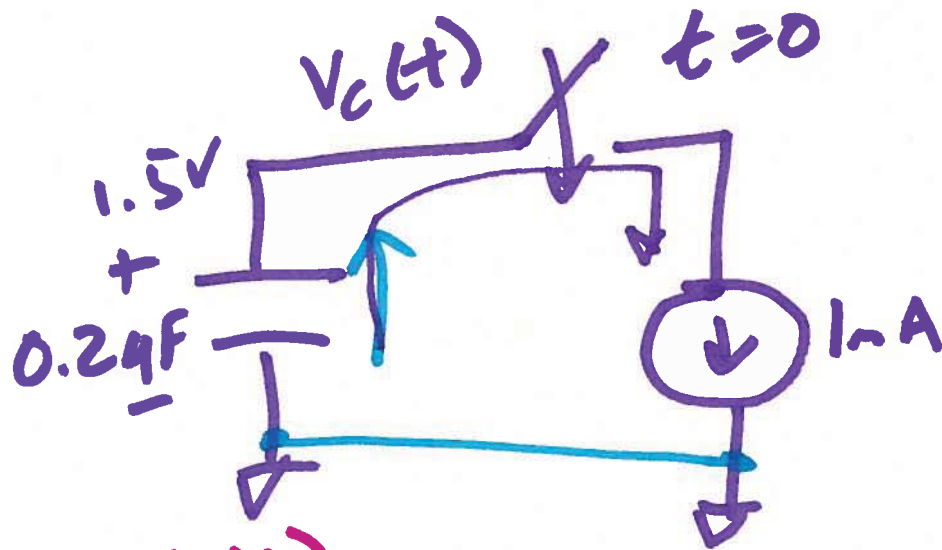
Ampere = $\frac{\text{Coulombs}}{\text{time}}$

$$CV = Q$$

$$1.4F \cdot 5V = Q = 54C$$

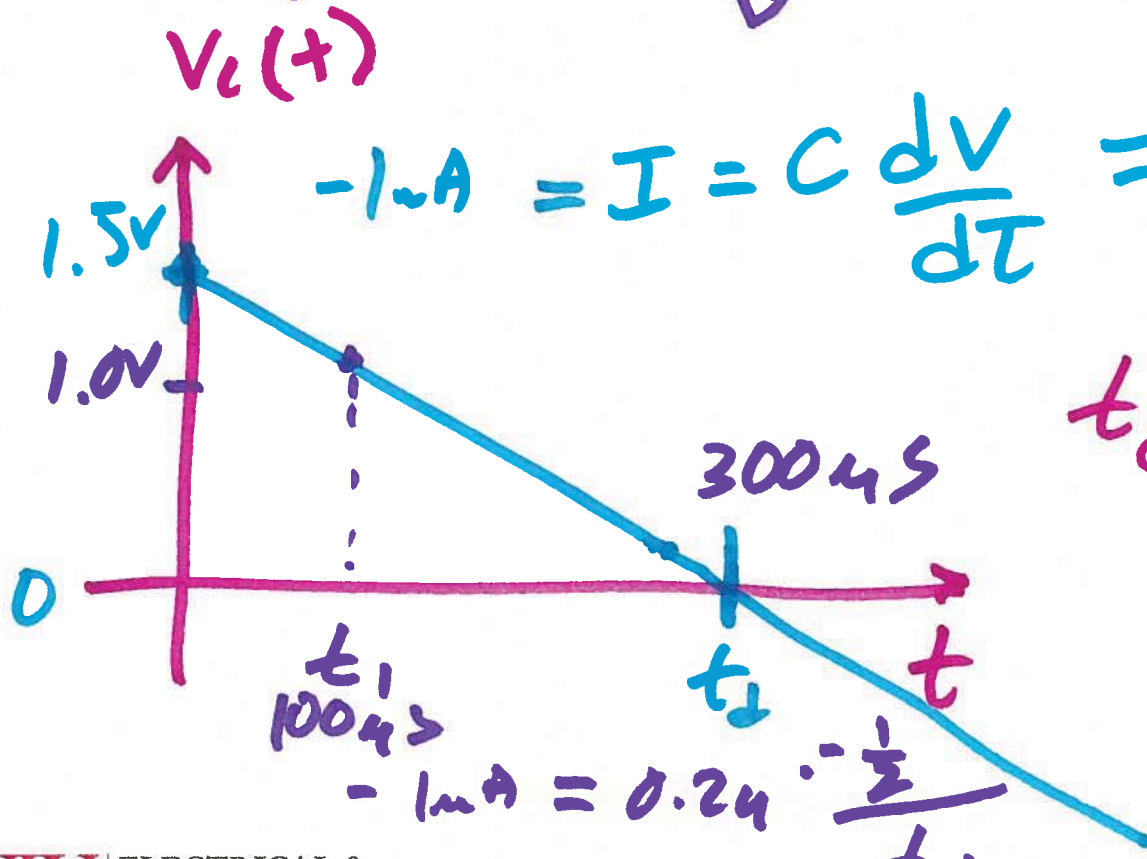


2)



$$I \downarrow \frac{1}{C} \uparrow V \uparrow I = C \frac{dV}{dt}$$

$$-I = \frac{cdv}{dt}$$



$$t_d = \frac{0.2 \times 10^{-6} \cdot 1.5}{10^{-3}}$$

$$= 0.3 \times 10^{-3}$$

$$= 300 \mu s$$

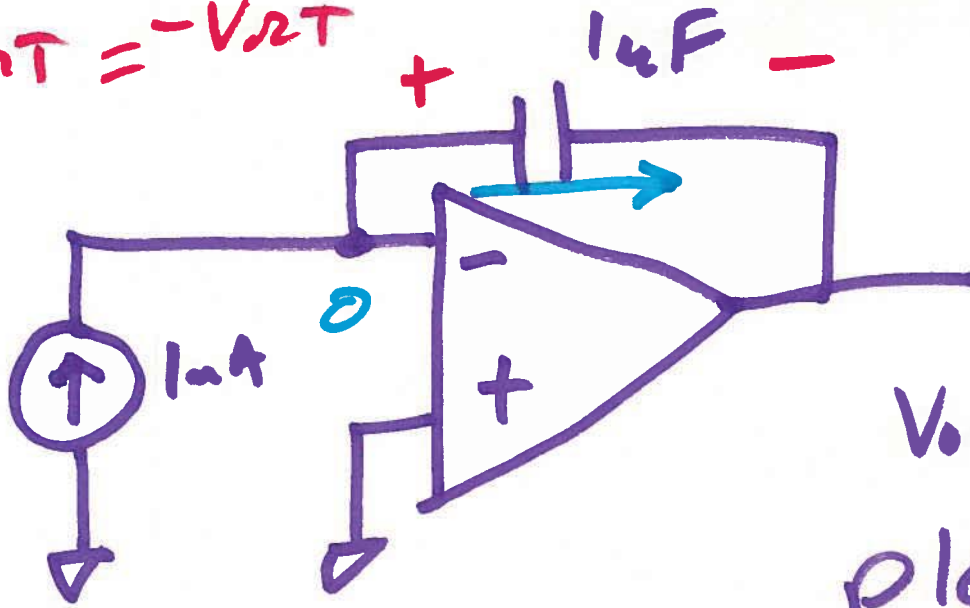
$$= 0.3 \text{ ms}$$

$$-1 \text{ mA} = 0.2 \mu \text{ F} \cdot \frac{-1.5}{t_1}$$

$$t_1 = \frac{0.1 \cdot 10^{-6}}{10^{-3}} = 100 \mu \text{ s} \cdot 3 \text{ ms}$$

3)

$$0 - V_{out} = -V_{out}$$

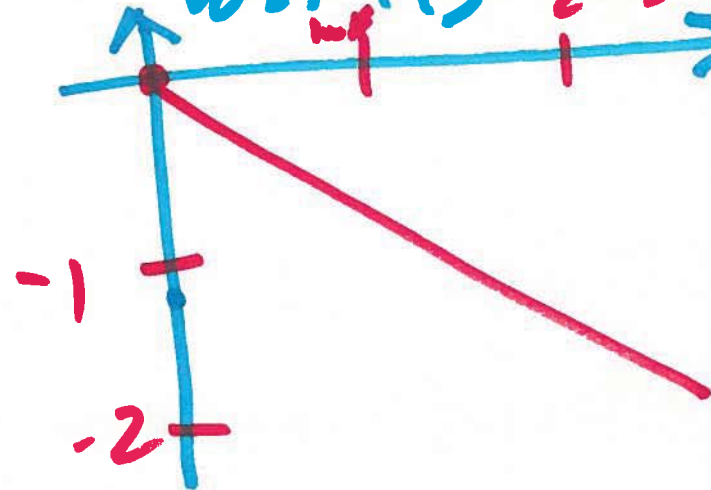


$$\int \frac{1}{T} \downarrow I = C \frac{dV}{dT}$$

V_{out} Track!

$$V_{out}(0^-) = 0$$

plot V_{out}
 $V_{out}(t)$ vs t

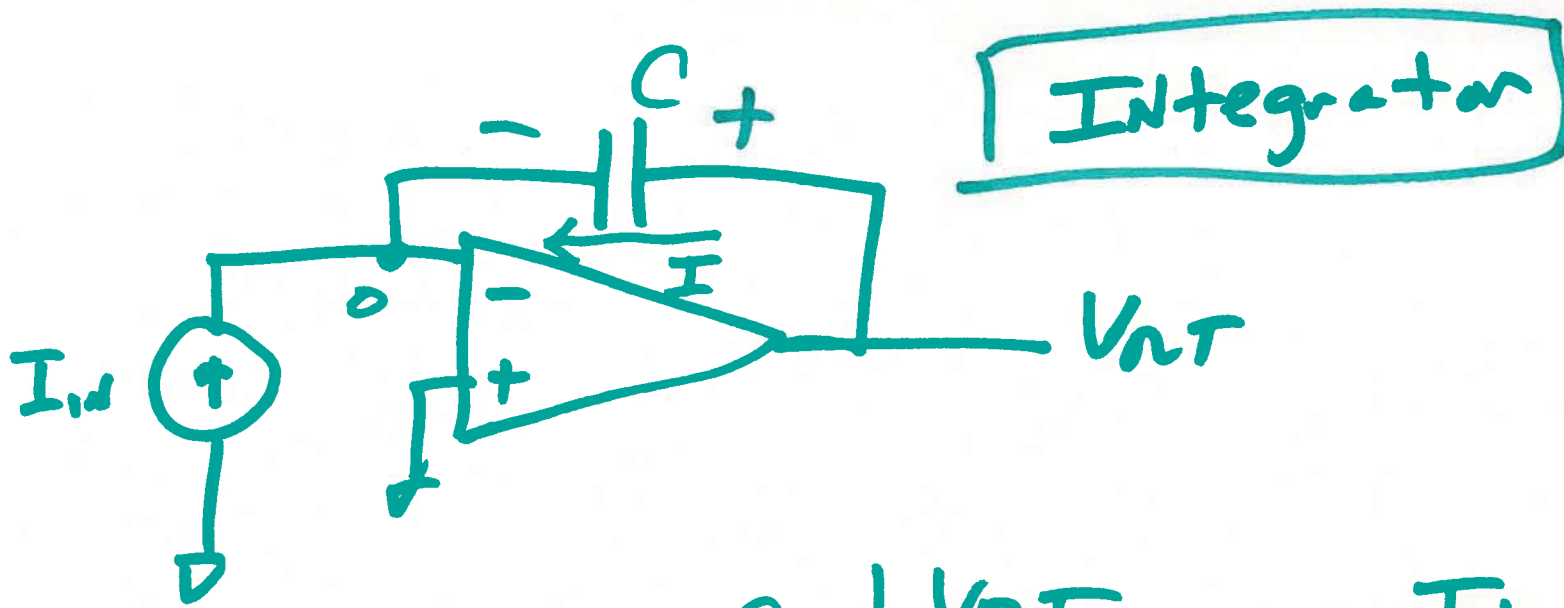


$$-I = C \frac{dV}{dT} =$$

$$1\mu A = -1\mu F \cdot \frac{dV_{out}}{dt}$$

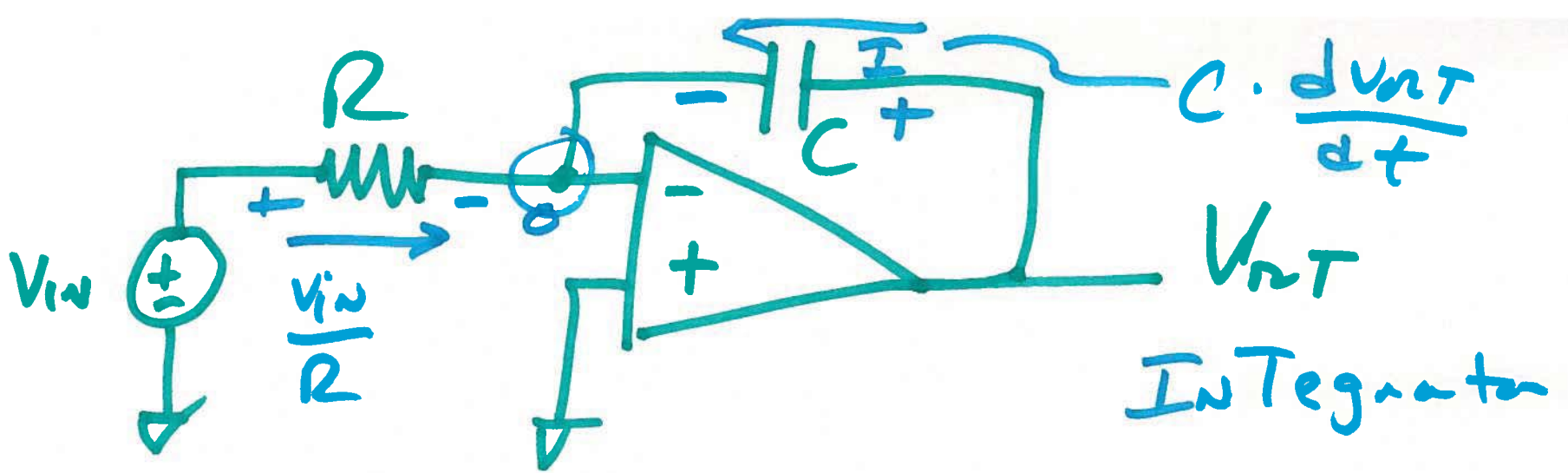
$$\frac{dV_{out}}{dT} = -\frac{10^{-3}}{\frac{10^{-6}}{1,000}} = -\frac{1V}{ms}$$

4)



$$I = C \frac{dV_{out}}{dt} = -I_{in}$$

$$V_{out} = -\frac{1}{C} \int I_{in} \cdot dt$$



$$\frac{V_{in}}{R} + C \frac{dv_{out}}{dt} = 0$$

$$\int dv_{out} = \int -\frac{V_{in}}{RC} \cdot dt$$

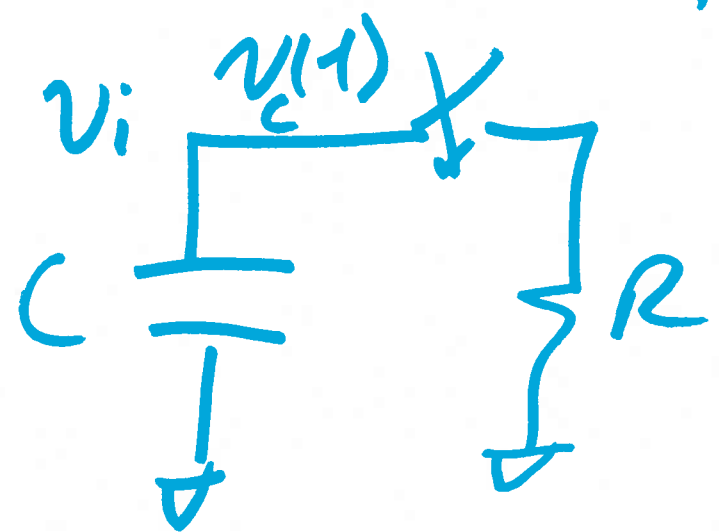
$$v_{out} = -\frac{1}{RC} \int V_{in} \cdot dt$$

$$v(t) = v_f + (v_i - v_f)e^{-t/\tau}$$

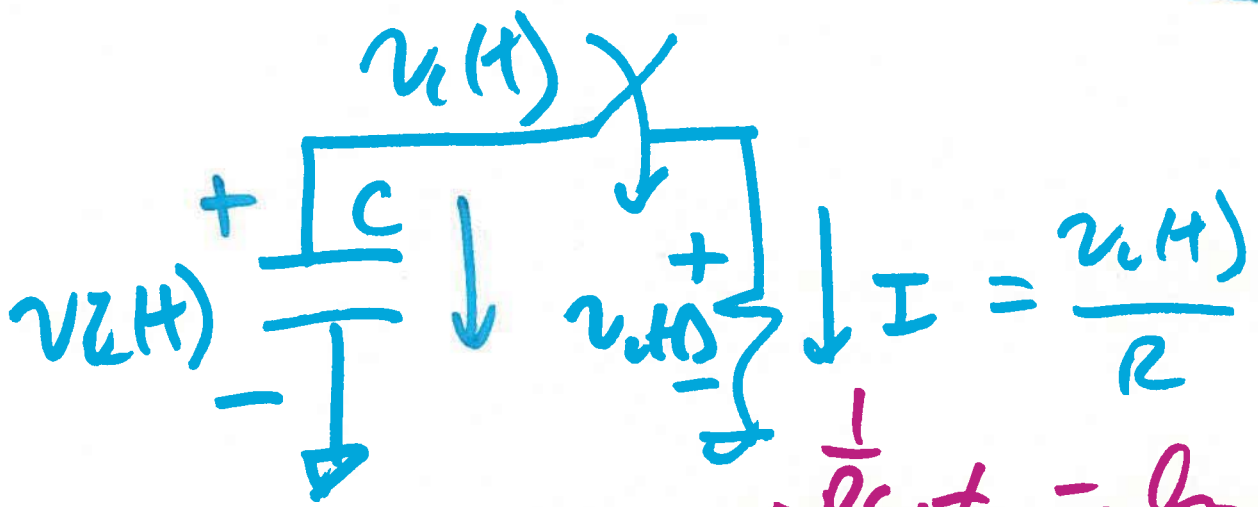
$$\tau = RC \text{ (time)}$$

$$v_f = 0$$

$$v_c(t) = v_i e^{-t/\tau}$$



$$C \cdot \frac{dv_c(t)}{dt} + \frac{v_c(t)}{R} = 0$$



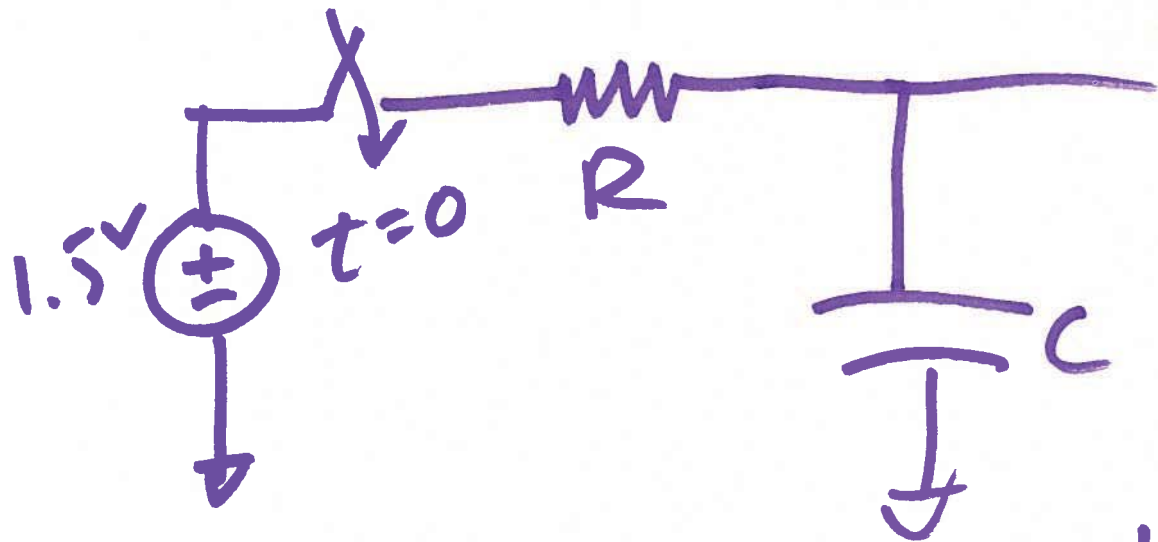
$$\int -RC \cdot dt = \int \frac{dv_c(t)}{v_i}$$

$$-RC \cdot t = \ln v_c(t)$$

$$-RC \cdot t = \ln \frac{v_c(t)}{v_i}$$

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

7)



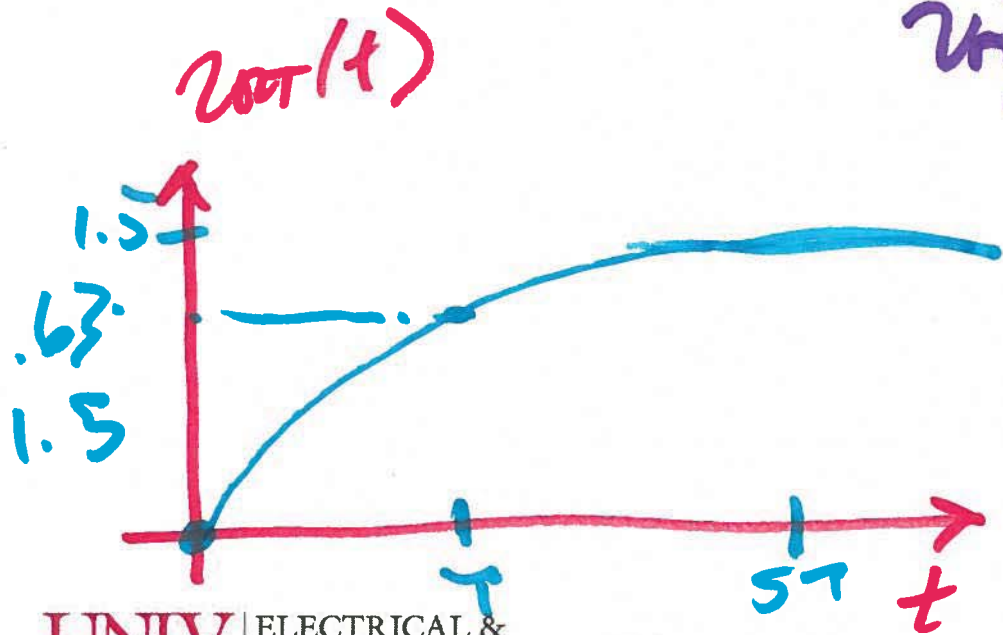
$$v_{out}(t) =$$

$$v_{out}(t) = \frac{v_i}{s} + \left(\frac{v_i}{s} - \frac{v_f}{s} \right) e^{-t/RC}$$

$\frac{1.5}{s}$ $\frac{1.5}{s}$ $\frac{0}{s}$ $\frac{1.5}{s}$

~~$v_{out}(t) =$~~

$$v_{out}(t) = 1.5(1 - e^{-t/RC})$$



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

$$v_{out}(t) = 1.5 \left(1 - e^{-\frac{(t - \ln s)}{RC}} \right)$$

$t > \ln s$

8)