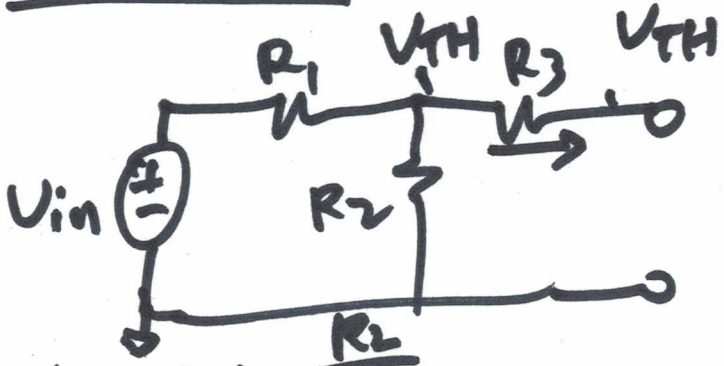
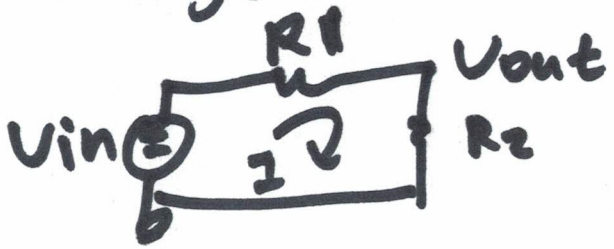
Thevenin:



$$V_{TH} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$$

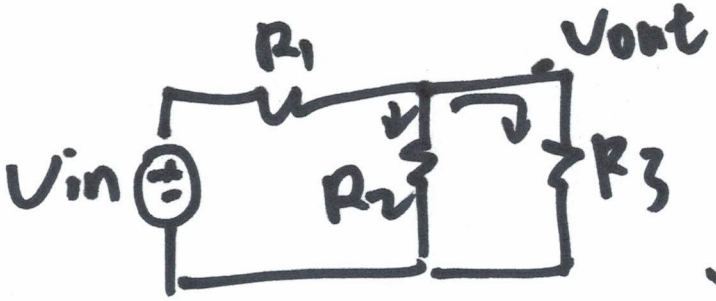
$$R_{TH} = R_3 + R_1 \parallel R_2$$

Voltage Divider



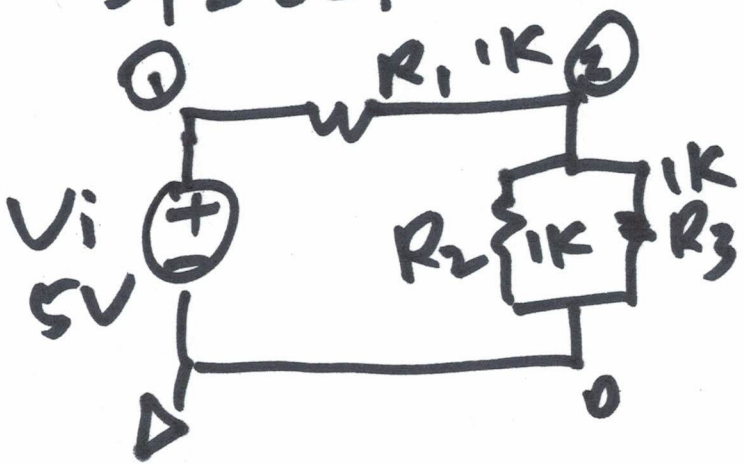
$$\frac{V_{in}}{R_1 + R_2} \cdot R_2 = V_{out}$$

$$V_{out} = \frac{R_2}{R_1 + R_2} \cdot V_{in}$$



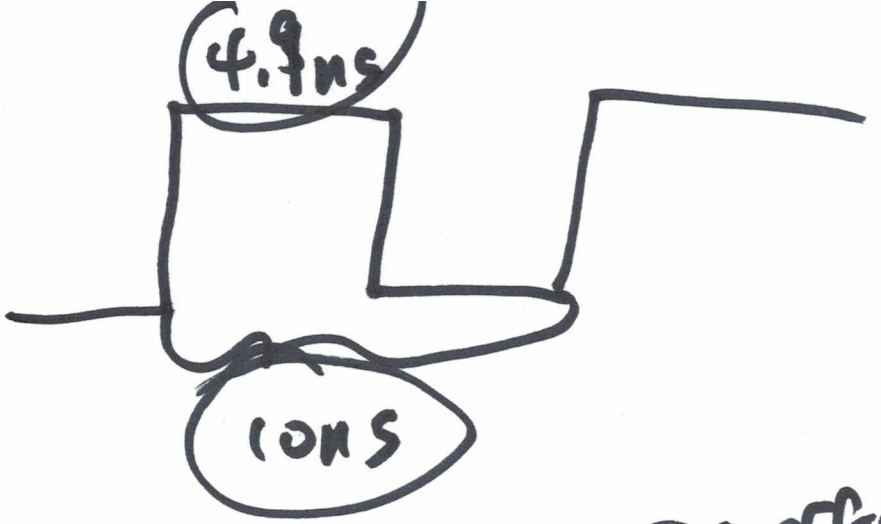
$$V_{out} = \frac{R_2}{R_1 + R_2} \cdot V_{in}$$

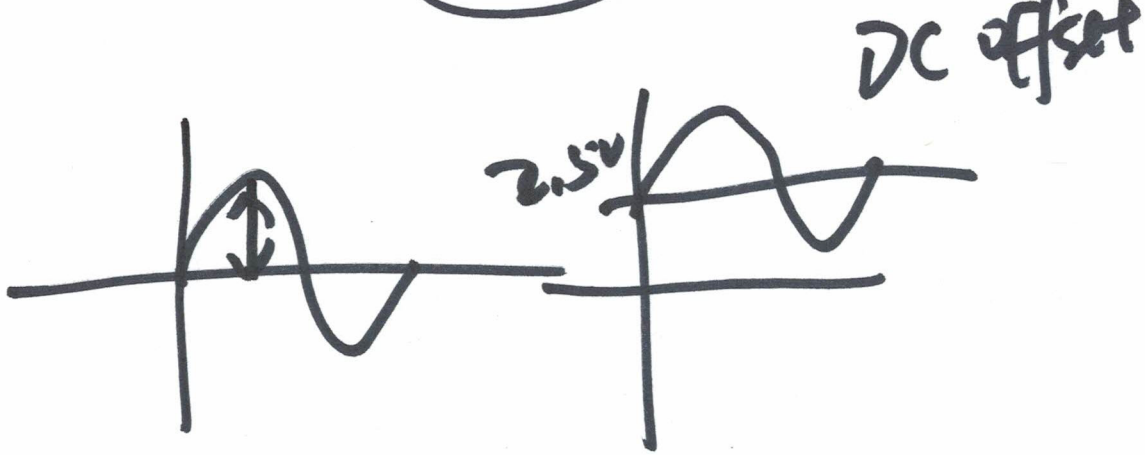
SPICE:

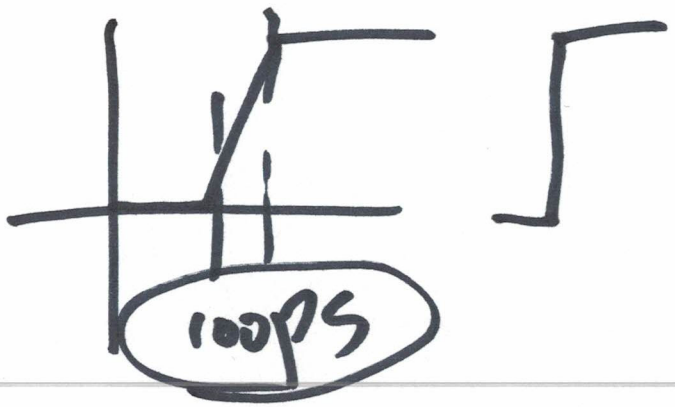


Vi	1	0	5V
R_1	1	2	1K
R_2	2	0	1K
R_3	2	0	1K

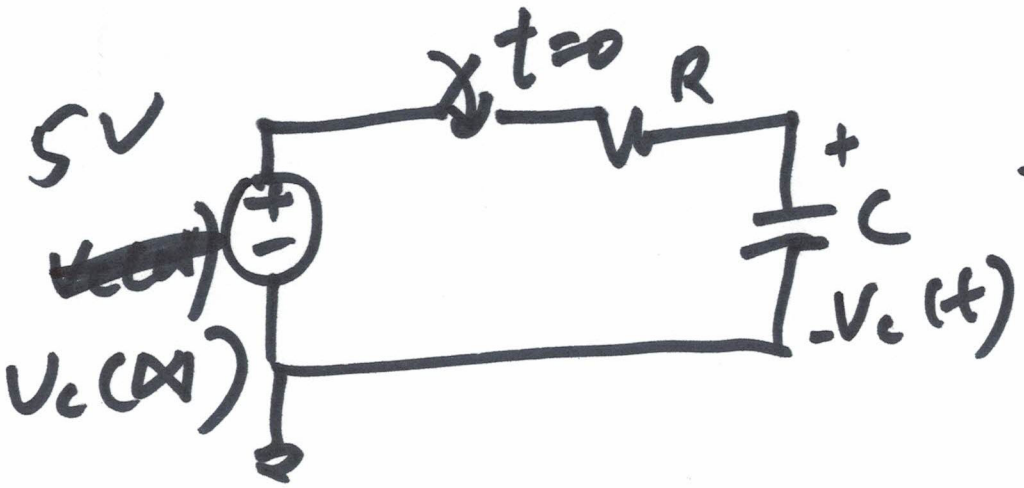
.tran 0 | 0.00|

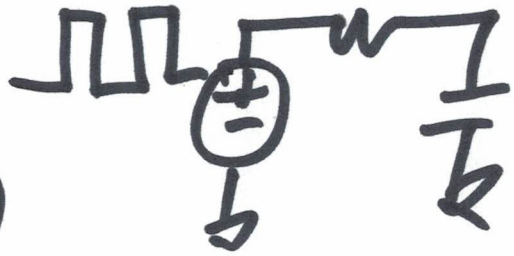






(2)





$$V_c(t) = V_c(\infty) + (V_c(0) - V_c(\infty))\, e^{-t/RC}$$

① $V_c(0) \neq 0$ forced response. Step response

$$V_c(t) = V_c(\infty) + (V_c(0) - V_c(\infty))\, e^{-t/RC}$$

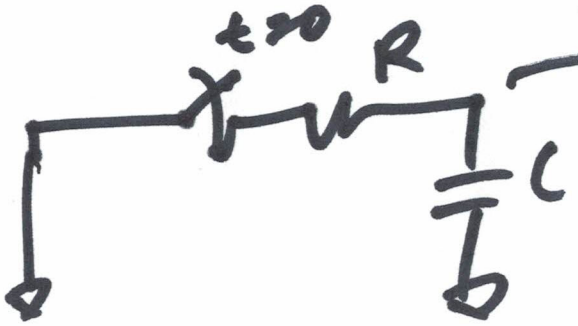
② $V_c(0) = 0$

$$V_c(t) = V_c(\infty) - V_c(\infty)\, e^{-t/RC}$$

$$= V_c(\infty)\,(1 - e^{-t/RC})$$

③

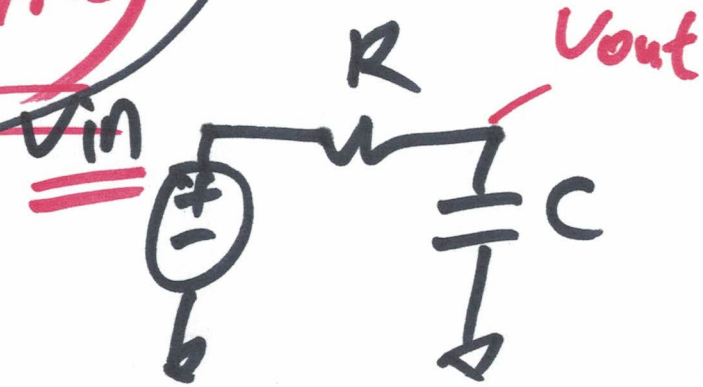
③ $v_c(\infty) = 0$ natural response



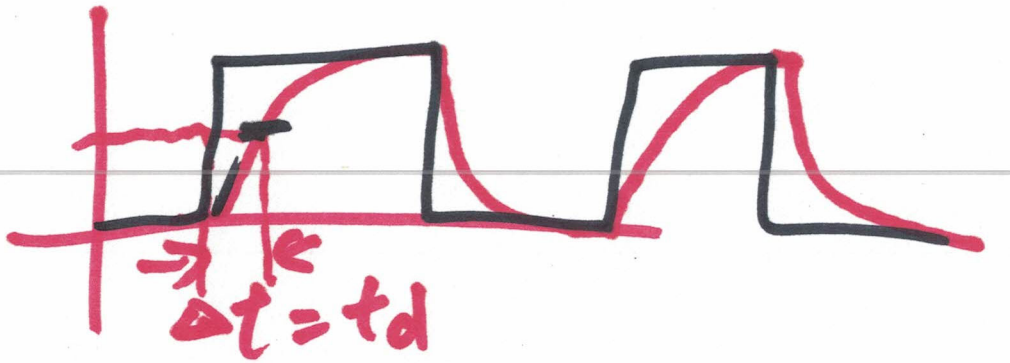
$$v_c(t) = v_c(0)\, e^{-t/RC}$$

$$v_c(t) = v_c(\infty)\left(1 - e^{-t/RC}\right)$$

$$= V_{in}\left(1 - e^{-t/RC}\right)$$



④



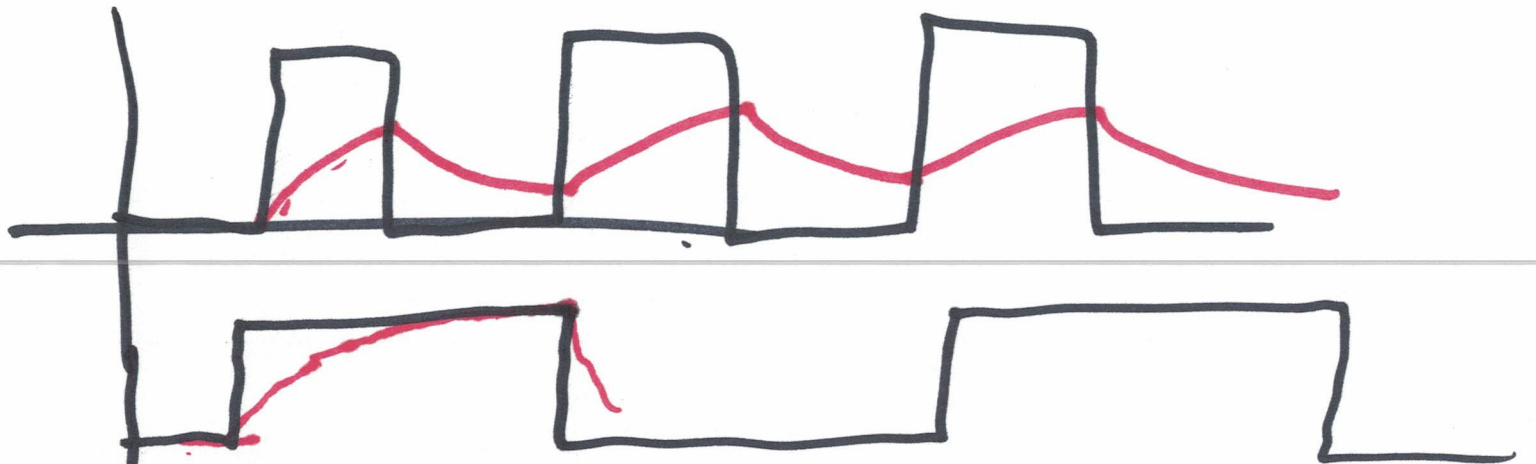
$$\frac{1}{2}V_{in} = V_{in}\left(1 - e^{-t/RC}\right)$$

$$e^{-t/RC} = 0.5$$

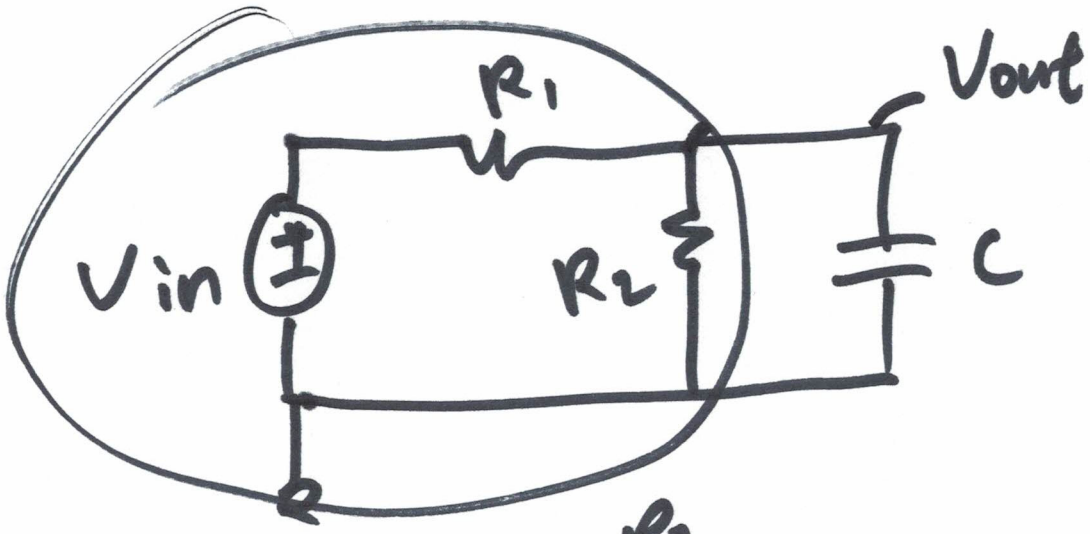
$$\ln e^{-t/RC} = \ln 0.5$$

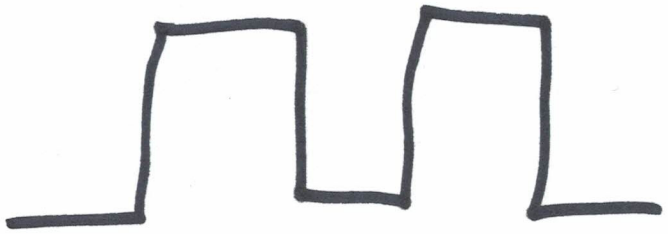
$$\frac{t}{RC} = +0.7$$

$$t_0 = 0.7RC$$



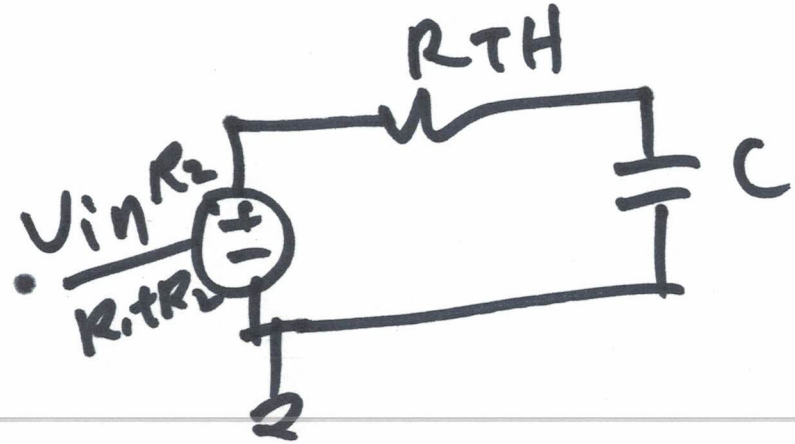
(4)



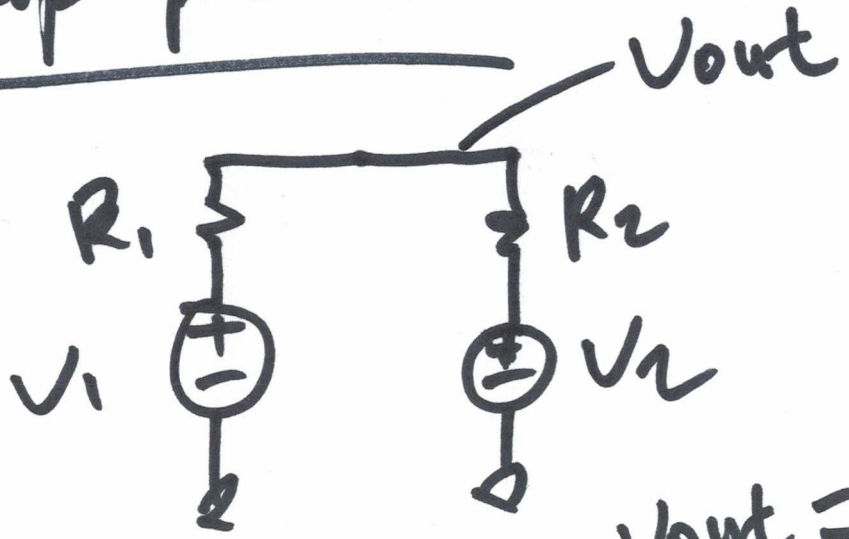


$$V_{TH} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$$

$$R_{TH} = R_1 \,//\, R_2$$

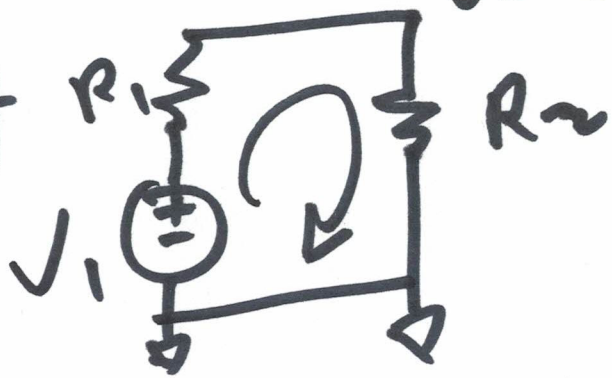


Superposition



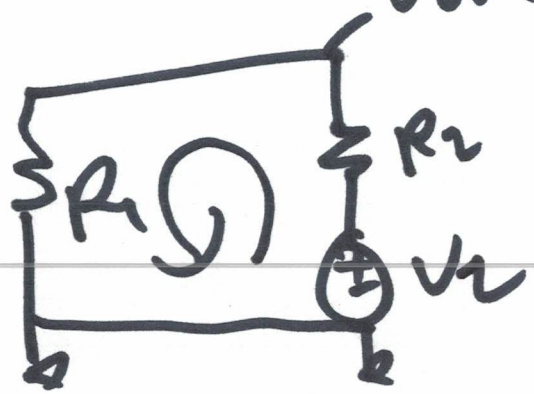
$$V_{out} = V_1 \frac{R_2}{R_1+R_2}$$

V_1 only



$$V_{out} = V_2 \frac{R_1}{R_1+R_2}$$

V_2 only



Overall:

$$V_{out} = V_1 \frac{R_2}{R_1+R_2} + V_2 \frac{R_1}{R_1+R_2}$$