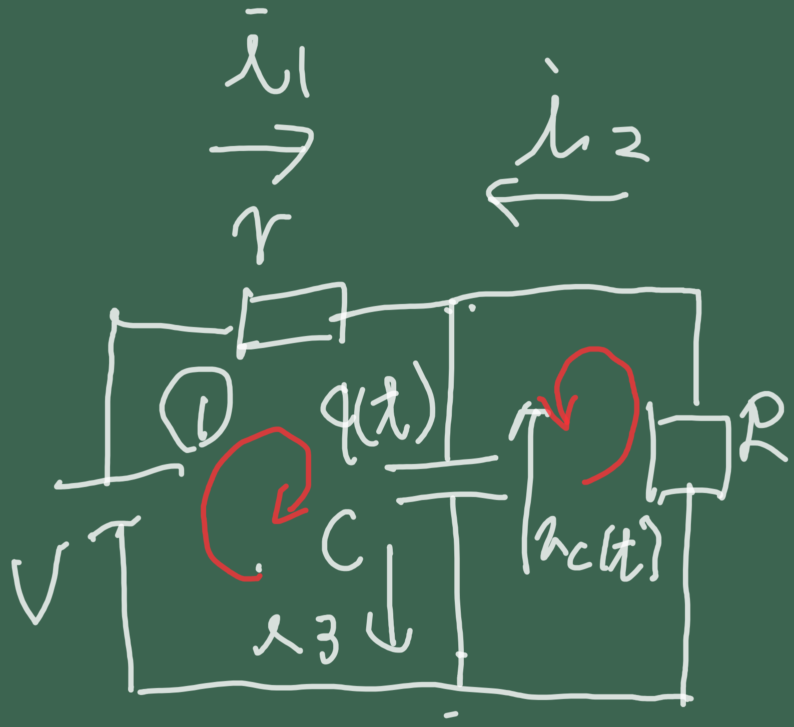


(1) $v_c = \dfrac{R}{R+r} V$

(2)

① $V = r i_1 + \dfrac{1}{C}\int i_3 \, dt$

② $0 = R i_2 + \dfrac{1}{C}\int i_3 \, dt$

③ $i_1 + i_2 = i_3$

$$\frac{V - \frac{1}{C}\int i_3 \, dt}{r} \rightarrow i_1$$

$$i_2 = \frac{-1}{RC}\int i_3\,dt$$

$$\frac{v - \frac{1}{c}\int i_3\,dt}{r} - \frac{1}{RC}\int i_3\,dt = i_3$$

$$i_3 = \frac{dq}{dt} \rightarrow$$

$$\frac{V}{r} - \frac{1}{rC}\underbrace{\int \frac{dq}{\cancel{dt}}\,\cancel{dt}} - \frac{1}{RC}\underbrace{\int \frac{dq}{\cancel{dt}}\,\cancel{dt}} = \frac{dq}{dt}$$

$$\frac{V}{r} - \frac{1}{rC}q(t) - \frac{1}{RC}q(t) = \frac{dq(t)}{dt}$$

$q(t) = CV \leftarrow rc$

$$\boxed{\frac{V}{r} - q(t)\left(\frac{1}{rC} + \frac{1}{RC}\right)} = \frac{dq(t)}{dt}$$

$= 0$

$$\frac{dq(t)}{dt} + q(t)\left(\frac{1}{rC} + \frac{1}{RC}\right) = \boxed{} \rightarrow 0$$

$\neq 0$

$=$ 特殊解 + 非同次の一般解

定常解 $\frac{dq}{dt} = 0$

$$\frac{dq(t)}{dt} + q(t)\left(\frac{1}{rC} + \frac{1}{RC}\right) = \underbrace{\frac{V}{r} = 0}$$

$V = 0$

$$\frac{dq(t)}{dt} = -\left(\frac{1}{rC} + \frac{1}{RC}\right) q(t)$$

$$\left(\frac{R+r}{rCR}\right) \qquad \hookrightarrow q(t) = C_1 e^{-\frac{R+r}{rCR}t}$$

$$\int \frac{dq(t)}{q(t)} = \int -\left(\frac{R+r}{rCR}\right) dt$$

$$\boxed{\log_e |q(t)|} = -\frac{R+r}{rCR}t + A$$

$$q(t) = e^{\left(-\frac{R+r}{rCR}t + A\right)}$$

$$\cancel{e^{\log(q(t))} = q(A)}$$

$$e^{-\frac{R+r}{rCR}t} \cdot e \cdot e$$

$$\boxed{q(t) = C_1 e^{-\frac{R+r}{rCR}t}}$$

C_1

$$\frac{V}{r} = +q(t)\left(\frac{r+R}{rCR}\right)$$

$$q(t) = \frac{CR}{r+R}V$$

$$q(t) = \frac{CR}{r+R}V + \boxed{C_1}\,e^{-\frac{r+R}{rCR}t}$$

$t=0$ Sが閉じたときの定常

$r \to K$

$$\boxed{q(t) = CV}$$

$$q(0) = CV$$

$$CV = \frac{CR}{r+R}V + C_1 e^{-\frac{r+R}{rCR}t}$$

$t=0$

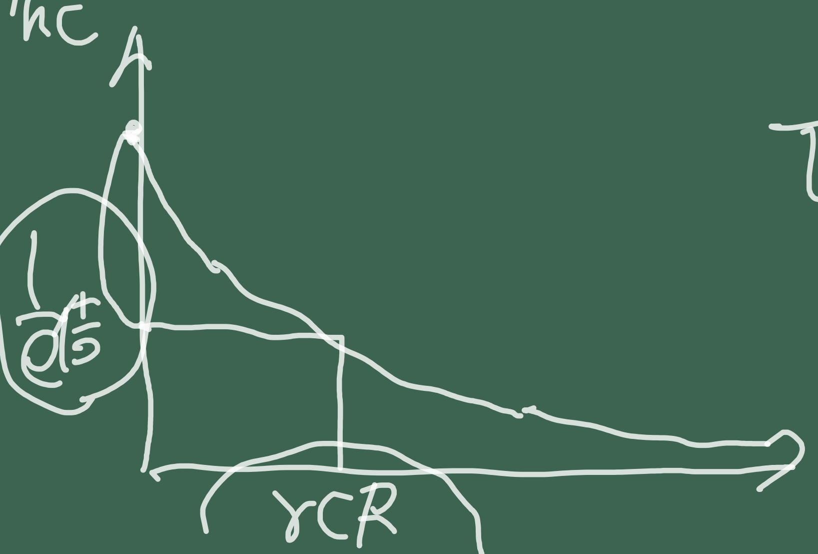
$$C_1 = \left(CV - \frac{CR}{r+R}V\right)\underbrace{\exp\left(\cancel{\frac{r+R}{rCR}t}\right)}_{1}$$

$$\frac{q(t)}{C} = \frac{CR}{r+R}V + CV\left(1-\frac{R}{r+R}\right)\exp\left(-\frac{r+R}{rCR}t\right)$$

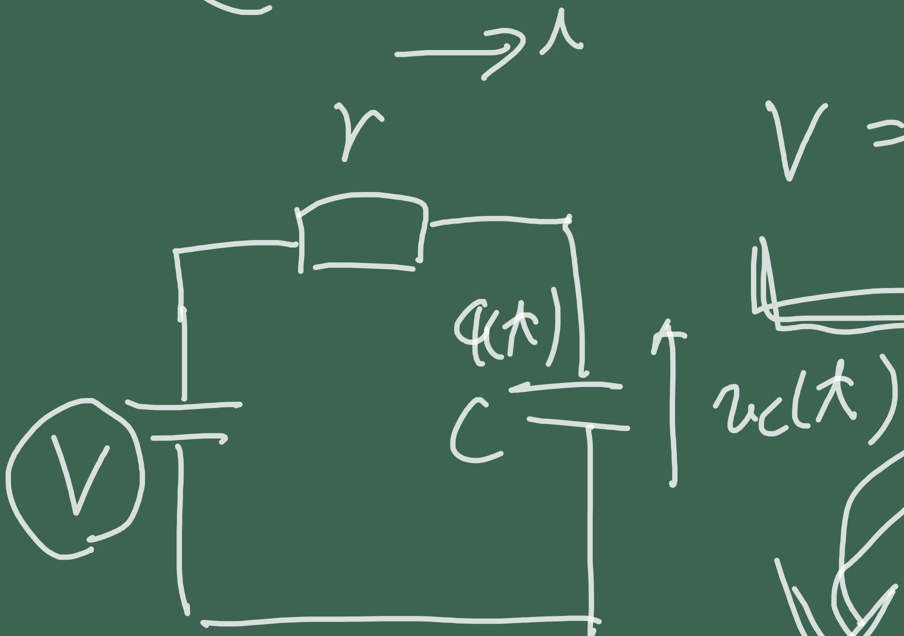
$$v_c(t) \to Q = CV \qquad V = \frac{Q}{C}$$

$$v_c(t) = \frac{R}{r+R}V + \boxed{V\left(1-\frac{R}{r+R}\right)\exp\left(\frac{-(r+R)}{rCR}t\right)}$$

$$\tau_1 = \frac{rCR}{r+R}$$



$r+R$



$$V = ri + \frac{1}{C}\int i\,dt$$

$$i = \frac{dq(t)}{dt}$$

$$V = r\frac{dq(t)}{dt} + \frac{1}{C}q(t)$$

$$-\frac{q(t)}{rC} = \frac{dq(t)}{dt}$$

$$q(t) = A e^{-\frac{1}{rC}t}$$

A → 積分定数 → 過渡解

$$\frac{q(t)}{C} = V \qquad q(t) = CV$$

$$q(t) = CV + A e^{-\frac{1}{rc}t}$$

$$t = t_0 \quad q(t_0) = \frac{CR}{r+R} V$$

$$\frac{CR}{r+R} V = CV + A e^{-\frac{1}{rc}t}$$

$$t = t_0$$

$$A = -\frac{Cr}{r+R} V e^{\frac{1}{rc}t_0}$$

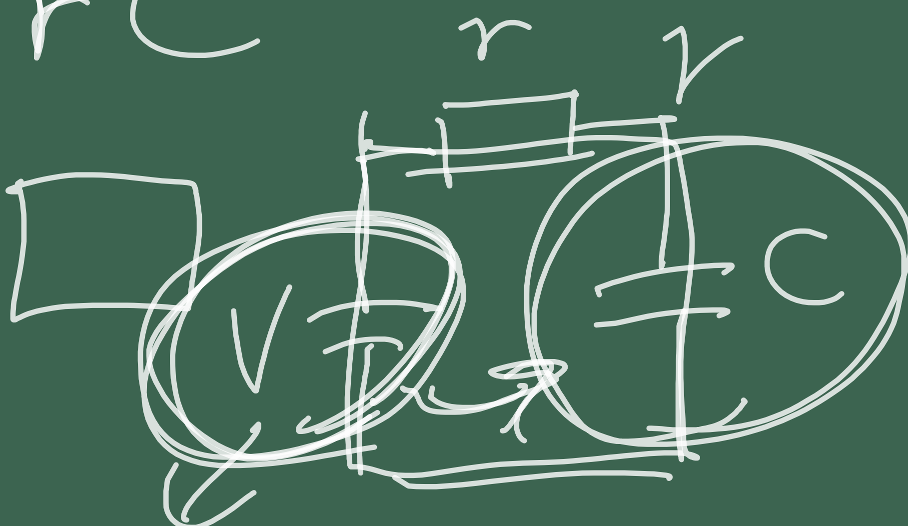
$$q(t) = CV - \frac{Cr}{r+R} V e^{\frac{1}{rC}t_0} e^{-\frac{1}{rC}t}$$

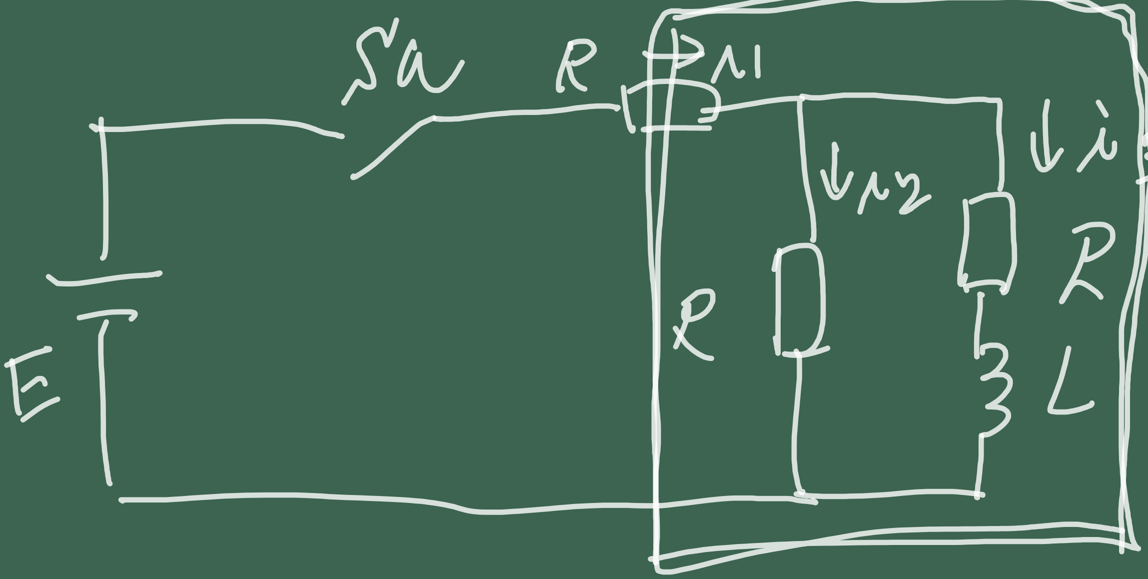
$$= CV - \frac{Cr}{r+R} V e^{-\frac{1}{rC}(t-t_0)}$$

$$v_C(t) = \frac{q(t)}{C} = V - \frac{\cancel{C}r}{r+R} V e^{-\frac{1}{rC}(t-t_0)}$$

$T_2 - rC$

$t \to \infty$





$t < 0$

SがOFF

$t \geq 0$

SがON

$$i_1 = i_2 + i_3 \quad ①$$

$$R i_2 = R i_3 + L\frac{di_3}{dt} \quad ②$$

$$E = R i_1 + R i_2 \quad ③$$

$$\frac{E - R i_2}{R} = i_1$$

$$i =$$

$$\frac{E - R i_2}{R} = i_2 + i_3$$

$$\frac{E}{R} - i_2 = i_2 + i_3$$

$$\boxed{\frac{E}{R} - 2 i_2 = i_3}$$

$$\frac{E}{2R} - \frac{i_3}{2} = i_2$$

$$i_1 = \frac{2E}{2R} - \frac{E}{2R} + \frac{i_3}{2}$$

$$\boxed{i_1 = \frac{1}{2R}E + \frac{i_3}{2}}$$

$$R i_2 = \frac{E}{2} - \frac{R}{2} i_3$$

$$= R i_3 + L \frac{di_3}{dt}$$

$$\frac{E}{2} = \frac{3}{2} R i_3 + \frac{L}{\cancel{R}} \frac{di_3}{dt}$$

$$\boxed{E = 3R i_3 + \frac{2L}{\cancel{R}} \frac{di_3}{dt}}$$

$$\cancel{L} \frac{di_3}{dt} = -\frac{3R}{2L} i_3 \qquad i_3 = \underline{C_1} e^{-\frac{3R}{2L}t}$$

$$\frac{di_3}{dt} = 0 \qquad E = 3Ri_3 \qquad i_3 = \frac{E}{3R}$$

$$\boxed{i_3(t) = \frac{E}{3R} + C_1 e^{-\frac{3R}{2L}t}}$$

$$\cancel{C_1} \quad 0 = \frac{E}{3R} + C_1 e^{-\frac{3R}{2L}t}$$

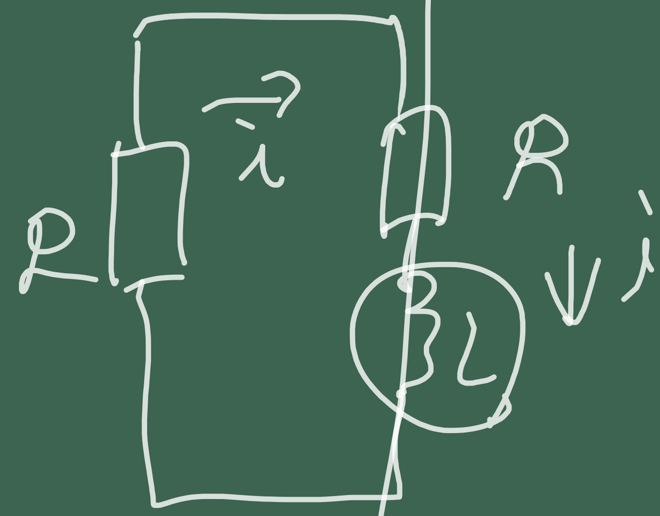
$$C_1 = -\frac{E}{3R}\,\boxed{e^{\frac{3R}{2L}0}} \to 1$$

$$C_1 = \frac{-E}{3R}$$

$$\boxed{i_3(t) = \frac{E}{3R}\left(1 - e^{-\frac{3R}{2L}t}\right)}$$

$$\tau_1 = \frac{2L}{3R}$$

$$i_3(T) = \frac{E}{3R}$$



$$0 = 2Ri + L\frac{di}{dt}$$

$$-\frac{2R}{L}i = \frac{di}{dt}$$

$$i = C_1 e^{-\frac{2R}{L}t}$$

$$\frac{E}{3R} = C_1 e^{-\frac{2R}{L}T}$$

$t \to T$

$t \to T$

$$C_1 = \frac{E}{3R}$$

$C_1 \cancel{\frac{E}{3R}} = \frac{E}{3R} e^{\frac{2R}{L}T}$

$$\boxed{i_3 = \frac{E}{3R} e^{-\frac{2R}{L}(t-T)}}$$

(5) $\frac{L}{2R}$