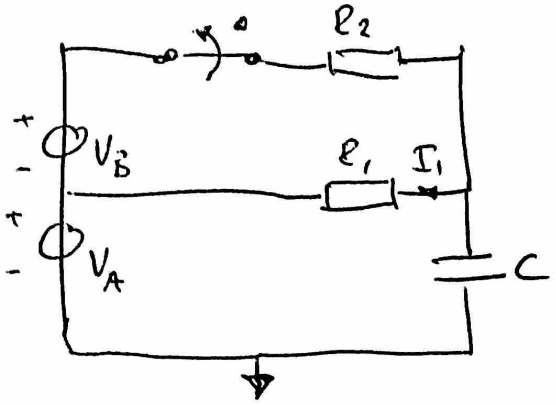
PROBLEM 1



$V_A = 1\ V$

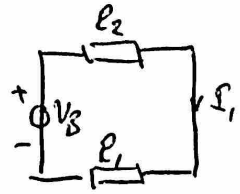
$V_B = 2\ V$

$R_1 = 1000\ \Omega$

$R_2 = 3000\ \Omega$

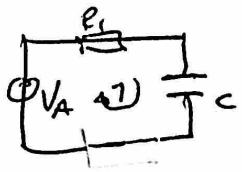
$C = 0.5\ nF$

$t < 0$



$I_1 = \frac{V_B}{R_1 + R_2} - I_1 \Rightarrow \frac{2}{1000+3000} = 0.5 \cdot 10^{-3}\ A = 0.5\ mA$

$0 < t < 5 \cdot 10^{-9}\ s$



$I = \left(V_c(\infty) + (V_c(0) - V_c(\infty)) \cdot e^{-\frac{t}{\tau}} \right) \cdot \frac{1}{\tau}$

$R_{TH} = R_1$

$\tau = R_{TH} \cdot C \Rightarrow 1000 \cdot 0.5\ nF = 0.5 \cdot 10^{-6}\ s$

$V_c(0) = -V_c + V_A + R_1 \cdot I_1 = 0 \Rightarrow V_c = 1 + 1000 \cdot 0.0005 = 1.5\ V$

$V_c(\infty) = V_A = 1\ V$

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

$I(5 \cdot 10^{-6}) = \left(\frac{(1-1.5) \cdot e^{\frac{-5 \cdot 10^{-6}}{0.5 \cdot 10^{-6}}}}{\tau} \right) - 0.5 \cdot 10^{-9} = 2.27 \cdot 10^{-8}\ A$

$0.5 \cdot 10^{-3} < I_1 < 2.27 \cdot 10^{-8}$