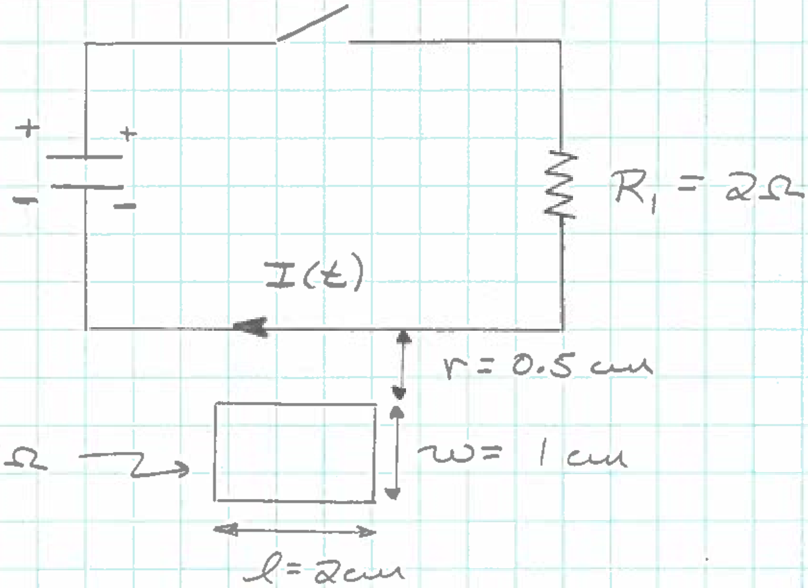
$C = 5\mu F$
$\Delta V = 20V$



When switch is closed, current flows in the RC circuit that is time dependent. Assume that only that part of circuit nearest the loop produces a significant magnetic field.

This time dependent field induces a current in the loop.

a.) When the switch closes at $t = 0$:

$$I(t) = I_0 e^{-t/\tau} \quad \text{where} \quad I_0 = \frac{\Delta V}{R_1} = 10\,A$$

$$\tau = RC = 1 \times 10^{-5} s$$

$I(t)$ is decreasing $\Rightarrow$ flux is decreasing

and $\vec{B}_{in}$ reinforces $\vec{B}$ from $I(t)$

$\therefore$ $\underline{I_{in} \text{ is CCW}}$

b.) $\mathcal{E} = \left|\frac{d\Phi_m}{dt}\right|$

where: $\Phi_m = \int \vec{B} \cdot d\vec{A}$ as we did in whiteboard Prob. WB 30-4

$$\Phi_m = \frac{\mu_0 I(t) l}{2\pi} \ln\left(\frac{r+w}{r}\right)$$

and, $$\frac{d\Phi_m}{dt} = \frac{\mu_0 l}{2\pi} \ln\left(\frac{r+w}{r}\right) \frac{dI(t)}{dt}$$

where: $$\frac{dI(t)}{dt} = I_0\left(-\frac{1}{\tau}\right) e^{-t/\tau} = -\frac{I_0}{\tau} e^{-t/\tau}$$

So: $$I_{in} = \frac{\mathcal{E}}{R_2} = \frac{1}{R_2}\left|\frac{d\Phi_m}{dt}\right| = \frac{\mu_0 l}{2\pi R_2} \ln\left(\frac{r+w}{r}\right) \frac{I_0}{\tau} e^{-t/\tau}$$

$\therefore$ $I_{in} = 0.05345 \text{ A} = 53.45 \text{ mA}$

for $t = 5\,\mu s$