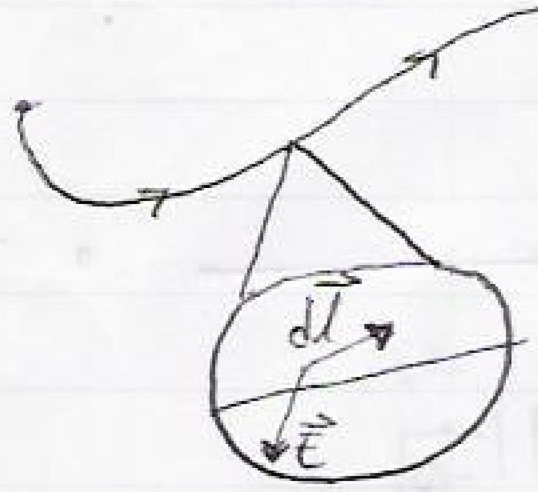
Physics II

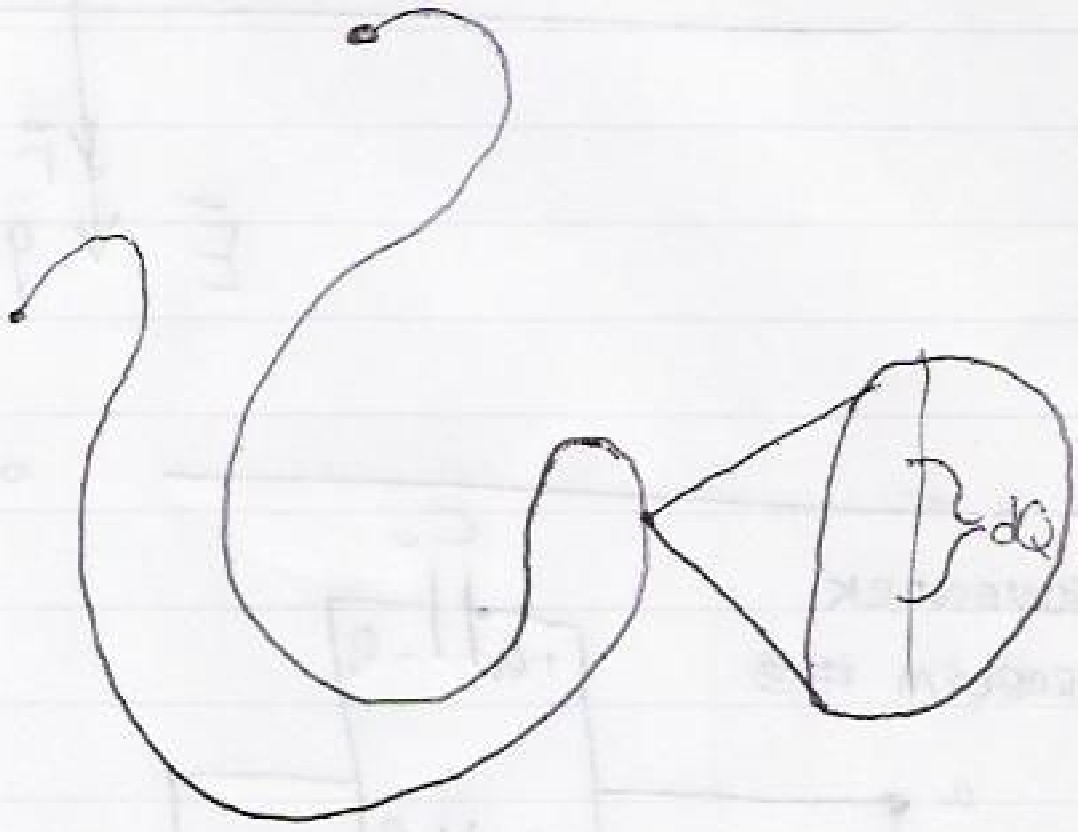
September 29, 2010

Alex

When to use integrals?

$$V_{ab} = V_a - V_b = -\int_b^a \vec{E} \cdot d\vec{l}$$





Charge wire

$$Q = \int_{wire} dQ = \lambda \int dL = \lambda L$$

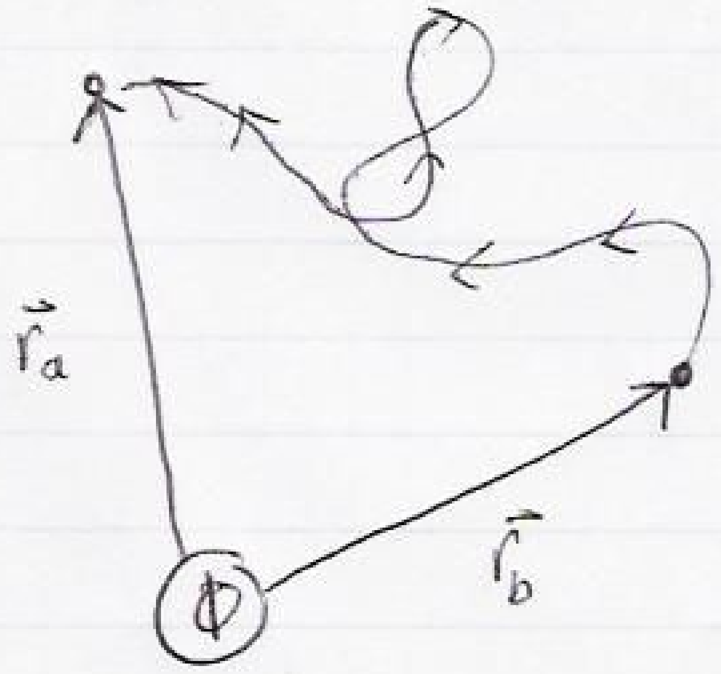
↑ if L = length of wire &

$\lambda = dQ/dL$ = charge/length is constant for all segments of wire.

For an infinitely long straight wire with

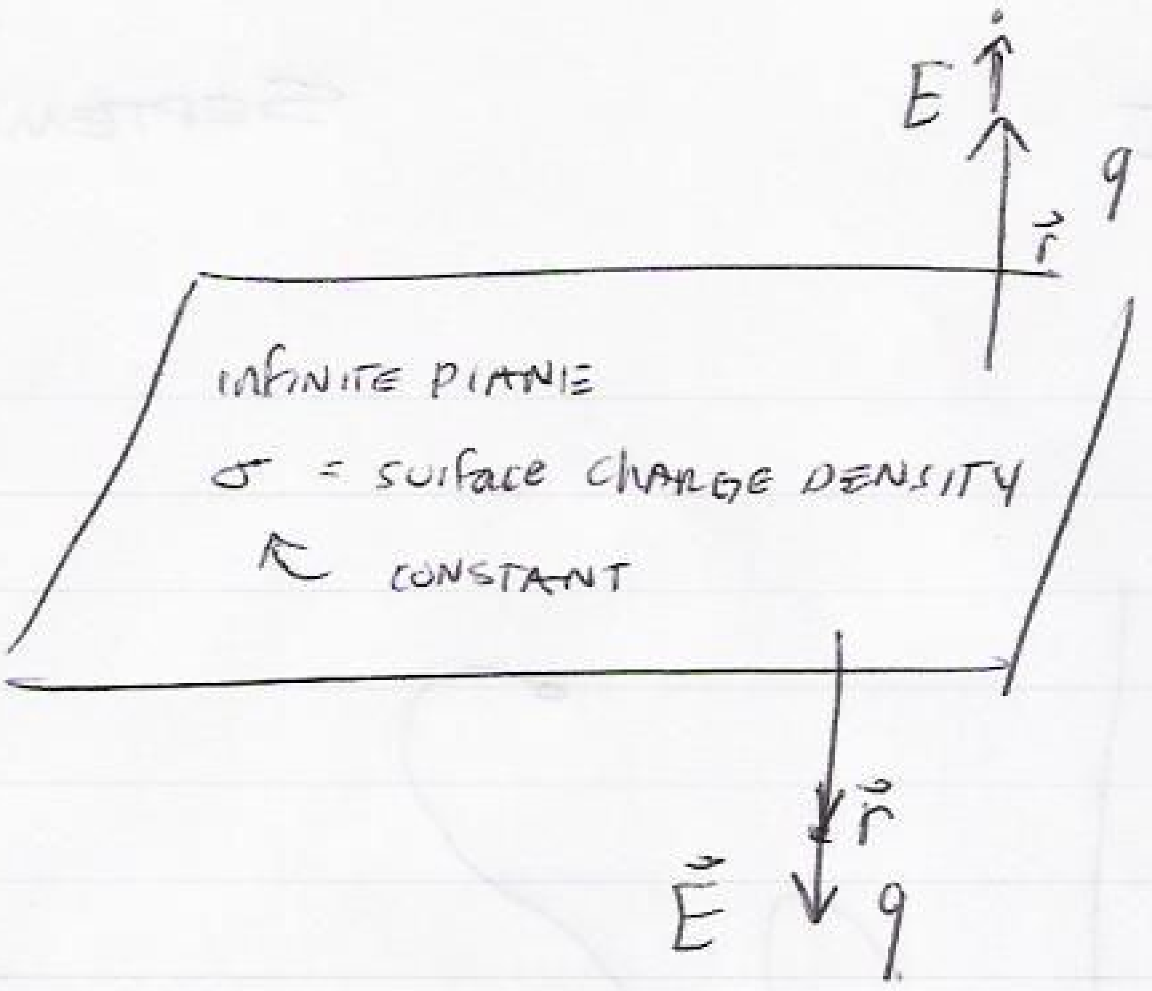
$\lambda = \frac{\text{charge}}{\text{length}}$; q ↑ $\vec{E}$, $\vec{r}$; wire

$$\vec{E} = \frac{k\lambda\hat{r}}{r}$$



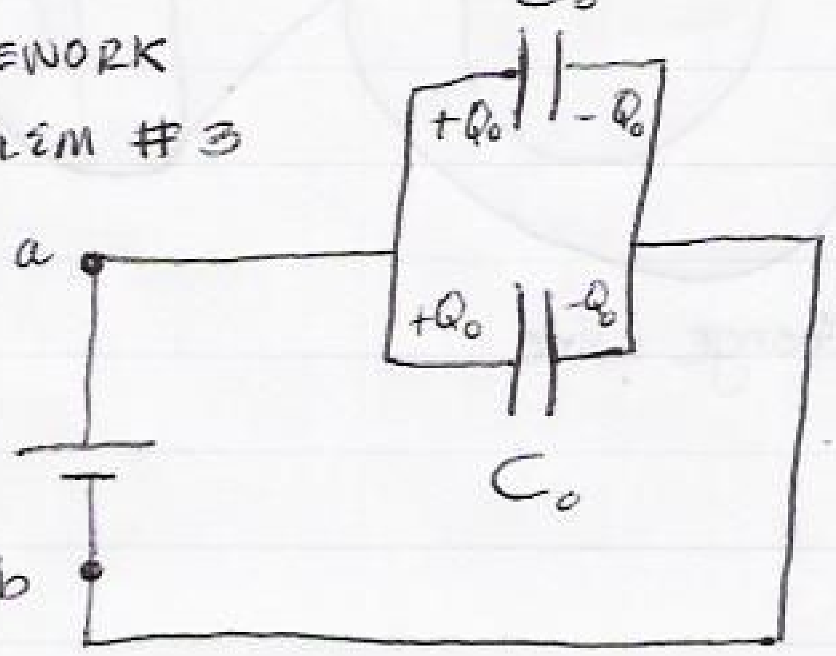
$$V_{ab} = V_a - V_b = \frac{kQ}{r_a} - \frac{kQ}{r_b}$$

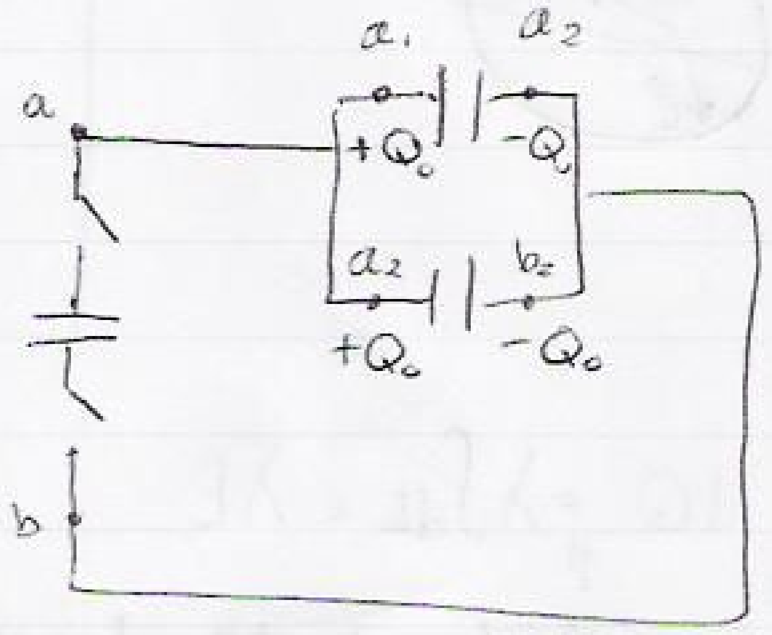
$$V_{ab} = -\int_b^a \vec{E} \cdot d\vec{l}$$



$$E = \frac{\sigma}{2\varepsilon_0}\hat{r} = 2\pi k \sigma \hat{r}$$

HOMEWORK PROBLEM #3





* open

$$C_0 = \frac{Q_0}{V_0}$$

$$V_0 = V_{ab} = V_a - V_b$$

$$V_a - V_b = V_{ab} = V_0 = \frac{Q_0}{C_0}$$

$$V_{ab} = V_{a_1 b_1} = V_{a_2 b_2}$$

$$V_0 = \frac{Q_0}{C_0}$$

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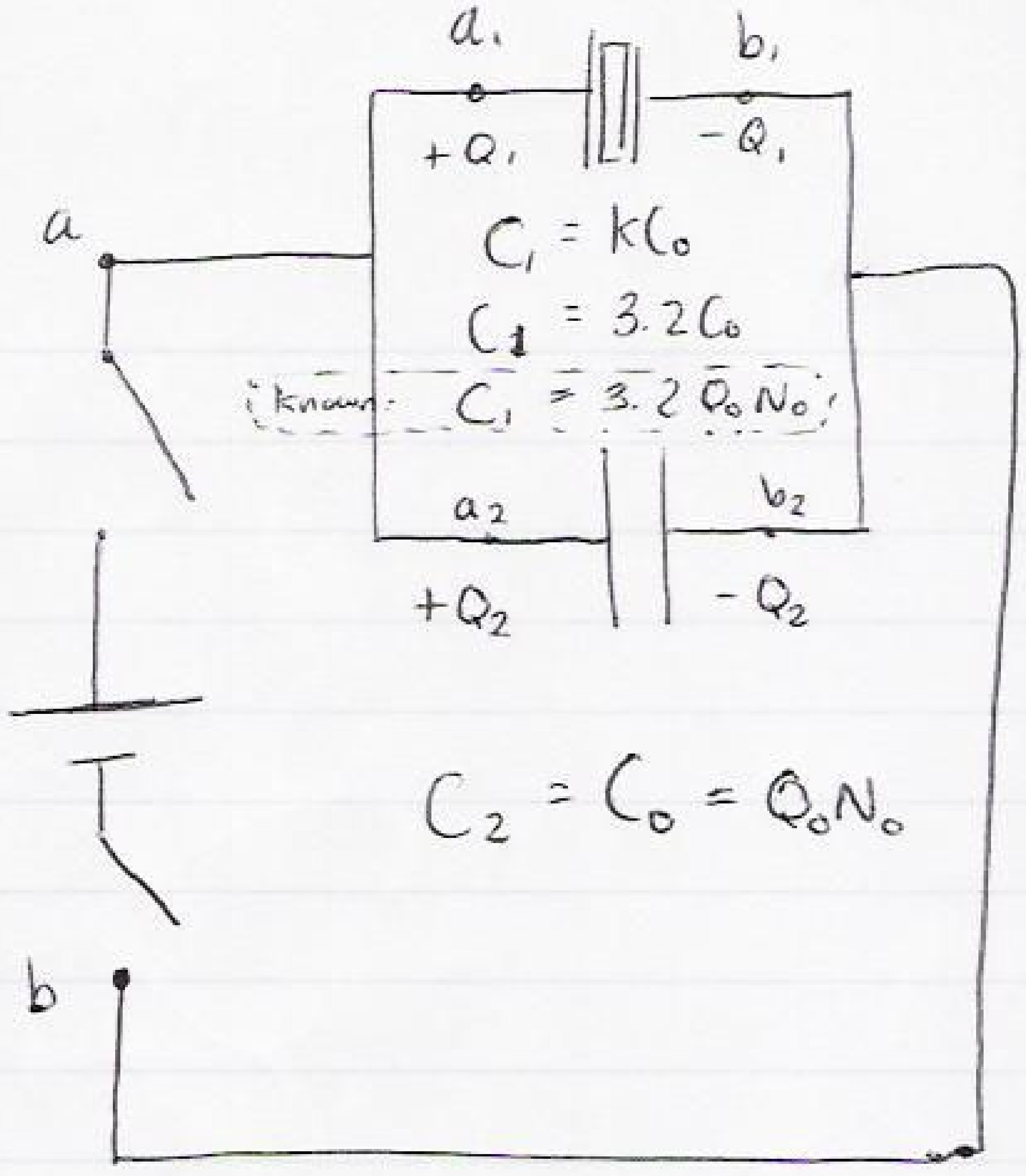

$$V_1 = V_{a_1} V_{b_1} \neq V_0$$

$$V_2 = V_{a_2} V_{b_2} \neq V_0$$

$$Q_1 \neq Q_0$$
$$Q_2 \neq Q_0$$

$$C_1 = \frac{Q_1}{V_1}$$

$$C_2 = \frac{Q_2}{V_2}$$

* NO MATTER WHAT PATH YOU TAKE, YOU ALWAYS GET THE SAME VOLTAGE

$$V_{ab} = -\int \vec{E} \cdot d\vec{l} = -\int \vec{E} \cdot d\vec{l}$$

$b \to b_1 \to a_1 \to a$ $\qquad$ $b \to b_2 \to a_2 \to a$

$V_{b_1 b} = 0$ $\qquad$ $V_{a a_1} = 0$

$$V_{a_2 b_2} = V_2 = \frac{Q_2}{C_2}$$

$$V_{a_1 b_1} = V_1 = \frac{Q_1}{C_1}$$

$$\frac{Q_1}{C_1} = \frac{Q_2}{C_2}$$

~ IN PARALLEL CIRCUITS, CHARGES & CURRENTS ADD & VOLTAGES EQUAL

~ IN SERIES CIRCUITS, CHARGES & CURRENTS EQUAL & VOLTAGES ADD

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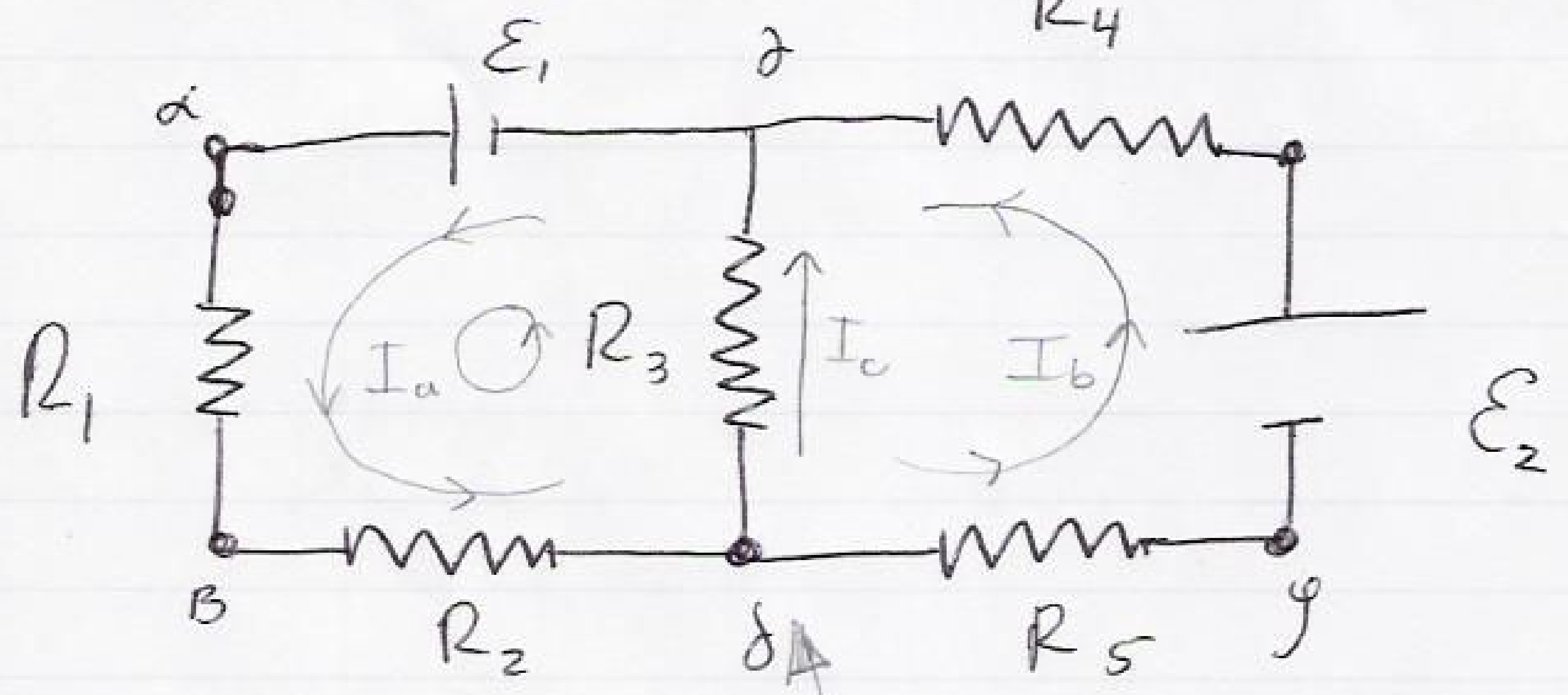
CONSERVATION OF CHARGE = $Q_0 + Q_0 = Q_1 + Q_2$

SOLVE FOR Q_1, Q_2. THEN $V_1 = \frac{Q_1}{C_1}$, $V_2 = \frac{Q_2}{C_2}$

PROBLEM #10

HOMEWORK #5

$I_c + I_b = I_a$



* SHORCUTS

~ TWO RESISTORS = R_1 & R_2 SAME CURRENT (IN SERIES)

* THERES ONLY 3 CURRENTS TO FIND

~ USE KIRKOFS RULE

① "JUNCTION RULE" = $I_a = I_c + I_b$

② "LOOP RULE"

$V_{\gamma\delta} = V_\gamma - V_\delta = -\int_\delta^\gamma \vec{E} \cdot d\vec{l} = I_c R_3$

$V_{\alpha\gamma} = V_\alpha - V_\gamma = \mathcal{E}_1$

$V_{\beta\alpha} = V_\beta - V_\alpha = -\int_\alpha^\beta \vec{E} \cdot d\vec{l} = -I_a R_1$

$V_{\delta\beta} = V_\delta - V_\beta = -\int_\beta^\delta \vec{E} \cdot d\vec{l} = -I_a R_2$

⇐ ALL ADD UP TO ZERO

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$$0 = -I_a R_1 - I_a R_2 - I_c R_3 + \mathcal{E}$$

2ND LOOP

$$\underline{x} \qquad\qquad\qquad \underline{\checkmark}$$

$$V_{\not\gamma\not\delta} = +I_c R_3 = V_{\delta\gamma}$$

$$V_{\not\delta\not\xi} = -I_b R_5 = V_{\xi\delta}$$

$$V_{\not\xi\not\varepsilon} = \mathcal{E}_2 = \mathcal{E}_2$$

$$+ \quad V_{\not\varepsilon\not\gamma} = -I_\beta R_4 = V_{\gamma\varepsilon}$$

ALL ADD UP TO ZERO (0).

$$0 = I_c R_3 - I_b R_5 + \mathcal{E}_2 - I_b R_4$$

3^{RD} EQUATION