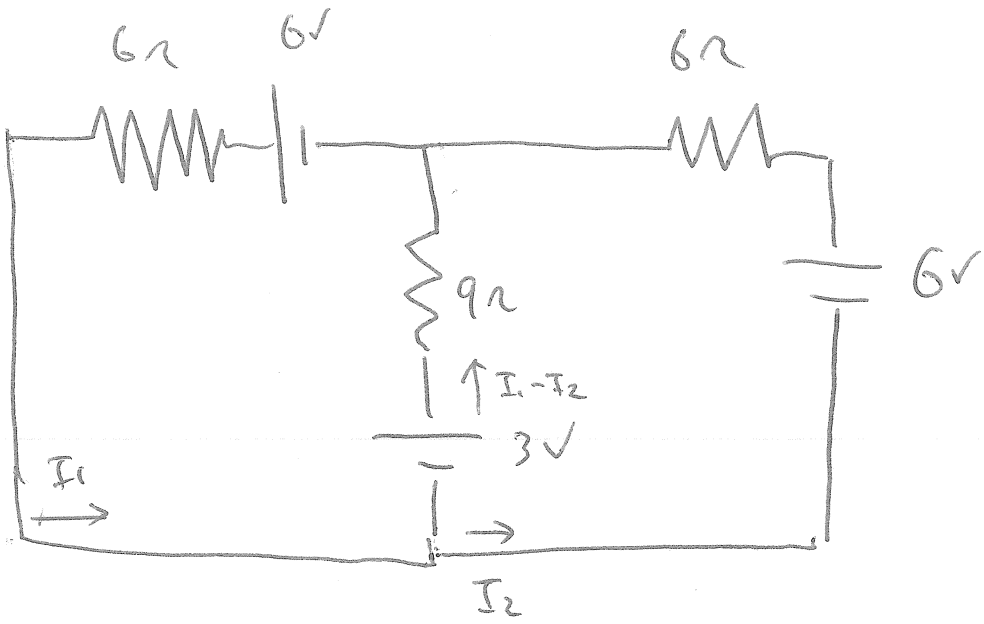
#1



CALCULATE I_1 AND I_2.

$$3 - 9(I_1 - I_2) + 6 - 6I_1 = 0$$

$$9 - 9I_1 + 9I_2 - 6I_1 = 0$$

$$\boxed{9 - 15I_1 + 9I_2 = 0} \quad \ldots (i)$$

$$6 - 6I_2 + 9(I_1 - I_2) - 3 = 0$$

$$\boxed{3 + 9I_1 - 15I_2 = 0} \quad \ldots (2)$$

$$\boxed{I_2 = 7/8\ A}$$

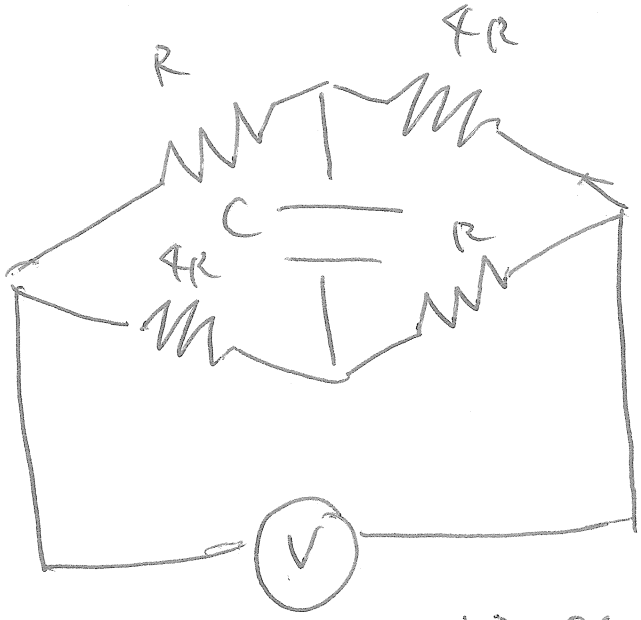
$$3 + 9I_1 - 15\frac{7}{8} = 0$$

$$9I_1 = \frac{105}{8} - \frac{24}{8}$$

$$9I_1 = \frac{81}{8}$$

$$\boxed{I_1 = \frac{9}{8} A}$$

#2



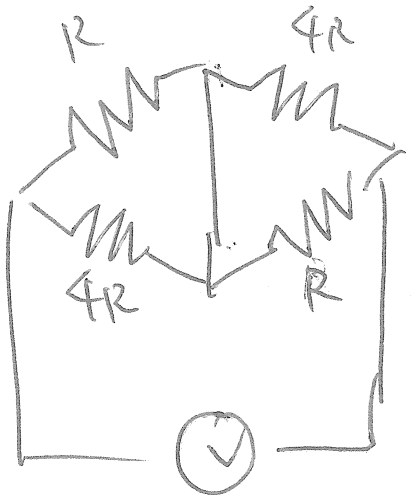
CALCULATE

a) ~~FOR~~ TOTAL CURRENT THRU THE CIRCUIT AT $t=0$

b) CALCULATE CHARGE ON CAPACITOR AT $t=\infty$

$Q = CV_C$

AT $t=0$ $\quad Q=0 \quad V_C = 0$



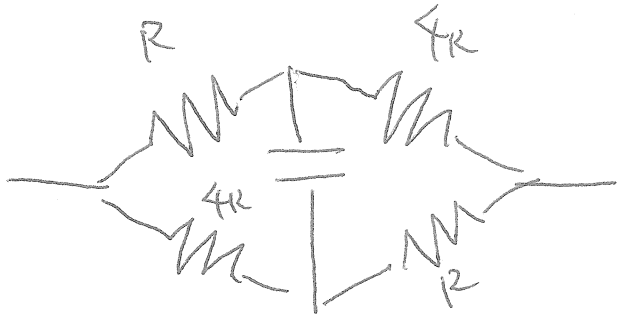
a) $\frac{1}{R} + \frac{1}{4R} = \frac{5}{4R} \Rightarrow \frac{4R}{5}$

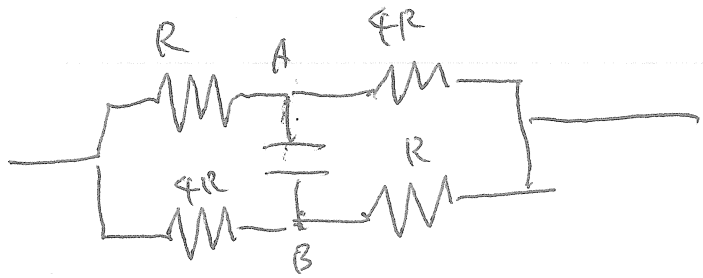
$\therefore$ ~~SERIES~~ $R_{TOTAL} \quad \frac{8R}{5}$

$V = I R_{TOTAL}$

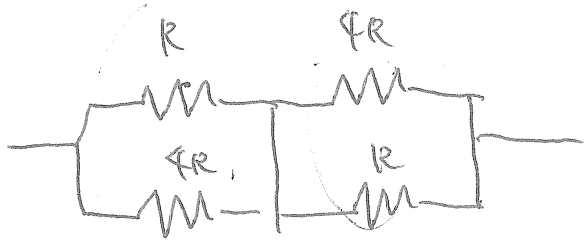
$V = I \frac{8R}{5}$

$$I = \frac{V5}{8R} = \frac{5V}{8R}$$

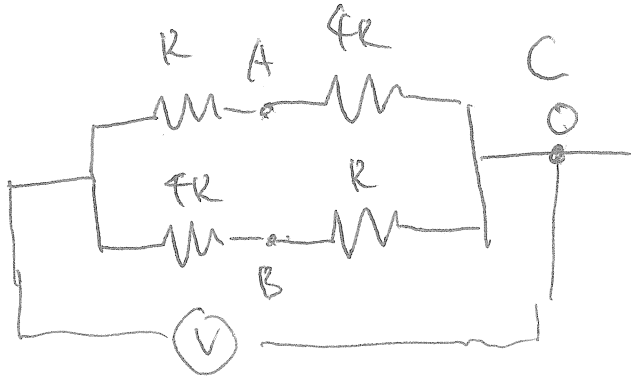




$V_A - V_B = 0$



$\leftarrow T = 0$



$V_A - V_B$

$R_{TOTAL} = 5R$

$\frac{1}{5R} + \frac{1}{5R} = \frac{1}{R_{TOTAL}}$

$\frac{2}{5R} = \frac{1}{R_{TOTAL}}$

$R_{TOTAL} = R_{TH} = \frac{5R}{2}$

$I_{TOTAL} = \frac{2V}{5R}$

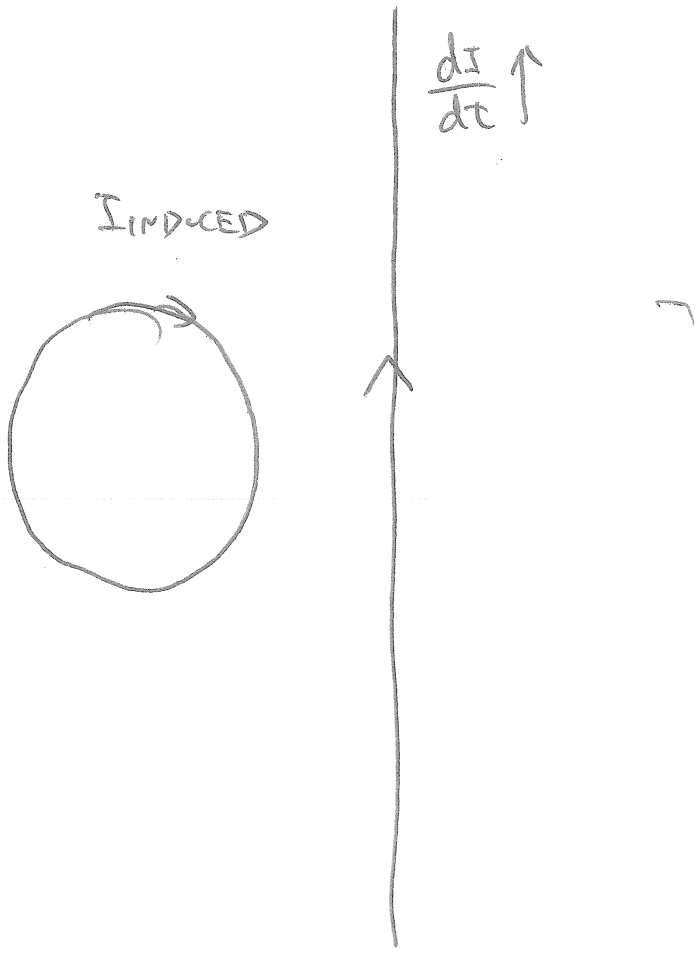
CURRENT THRU TOP AND BOTTOM

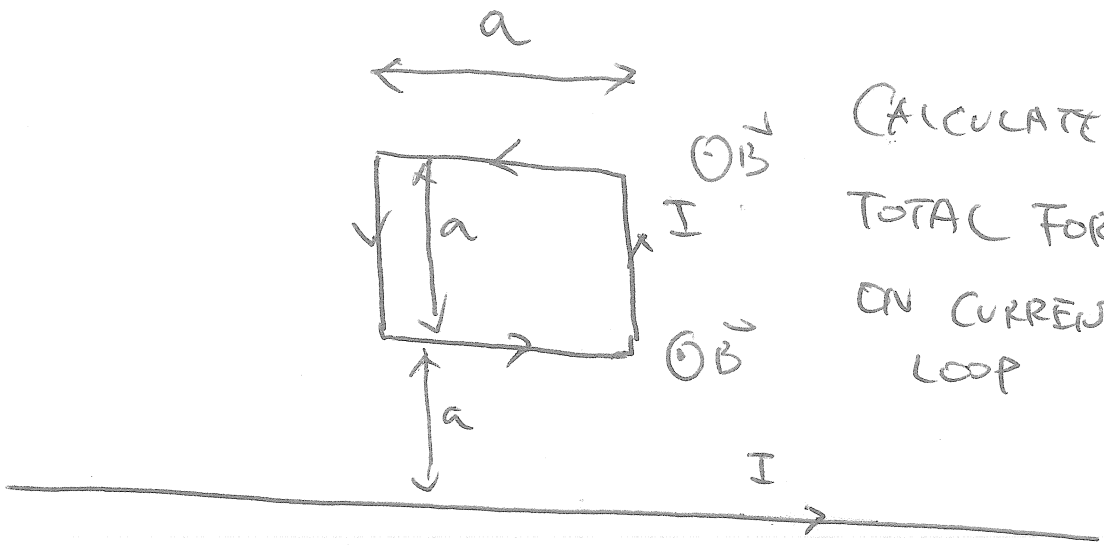
$\frac{V}{5R}$ EACH

$V_A - V_C = \frac{4}{5}V$ $\quad V_A - V_B = \frac{3}{5}V$

$V_B - V_C = \frac{1}{5}V$ $\quad Q = CV$

$$\boxed{Q = \frac{3}{5}CV}$$


$\frac{dI}{dt}$
$I_{INDUCED}$

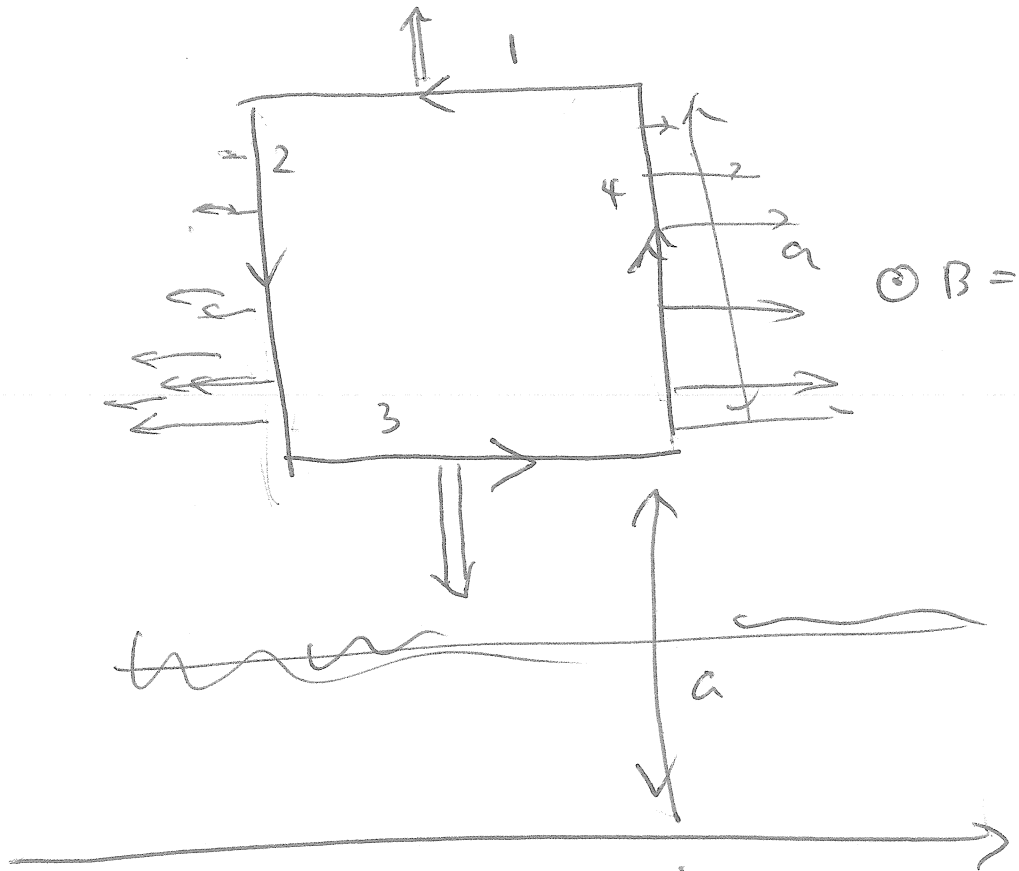


CALCULATE TOTAL FORCE ON CURRENT LOOP

$$\oint B \cdot ds = \mu_0 I$$

$$B \cdot 2\pi r = \mu_0 I \Rightarrow B = \frac{\mu_0 I}{2\pi r}$$

$$\vec{F} = I \vec{L} \times \vec{B}$$



$$\textcircled{3}\ B = \frac{\mu_0 I}{2\pi r}$$

$$|\vec{F}_3| = |I\vec{L}\times\vec{B}|$$

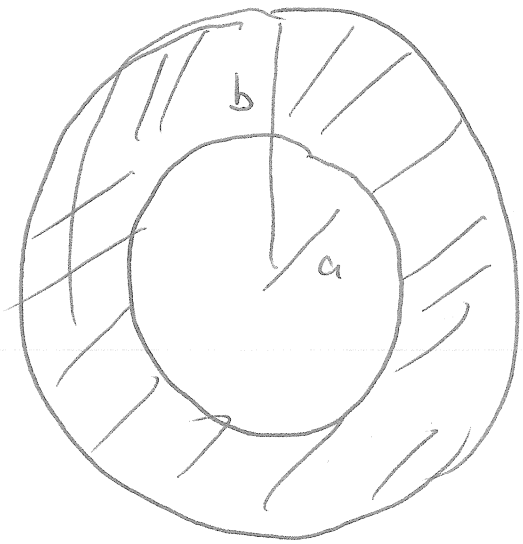
$$\vec{F}_2 + \vec{F}_4 = 0$$

$$= I\,\frac{\mu_0 I}{2\pi a}\cdot a$$

$$= \frac{\mu_0 I^2}{2\pi}$$

$$|\vec{F}_1| = I\,\frac{\mu_0 I}{4\pi a}\cdot a = \frac{\mu_0 I^2}{4\pi}$$

$$|F_{TOTAL}| = \frac{\mu_0 I^2}{4\pi}$$ POINTING IN TOWARDS THE OTHER WIRE



TOTAL CURRENT I

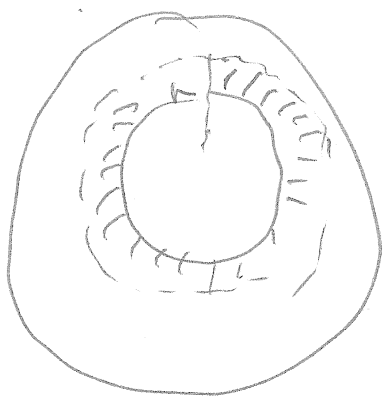
CALCULATE $\vec{B}$

FOR $a < r < b$

UNIFORM CURRENT DENSITY

CURRENT DENSITY

$$\frac{I}{\pi(b^2-a^2)}$$



$$\oint \vec{B} \cdot d\vec{s} = B \cdot 2\pi r = \mu_0 I_{enc}$$

$$B \cdot 2\pi r = \mu_0 I \frac{\pi(r^2-a^2)}{\pi(b^2-a^2)}$$

$$= \frac{\mu_0 I \pi (r^2-a^2)}{\pi(b^2-a^2)}$$