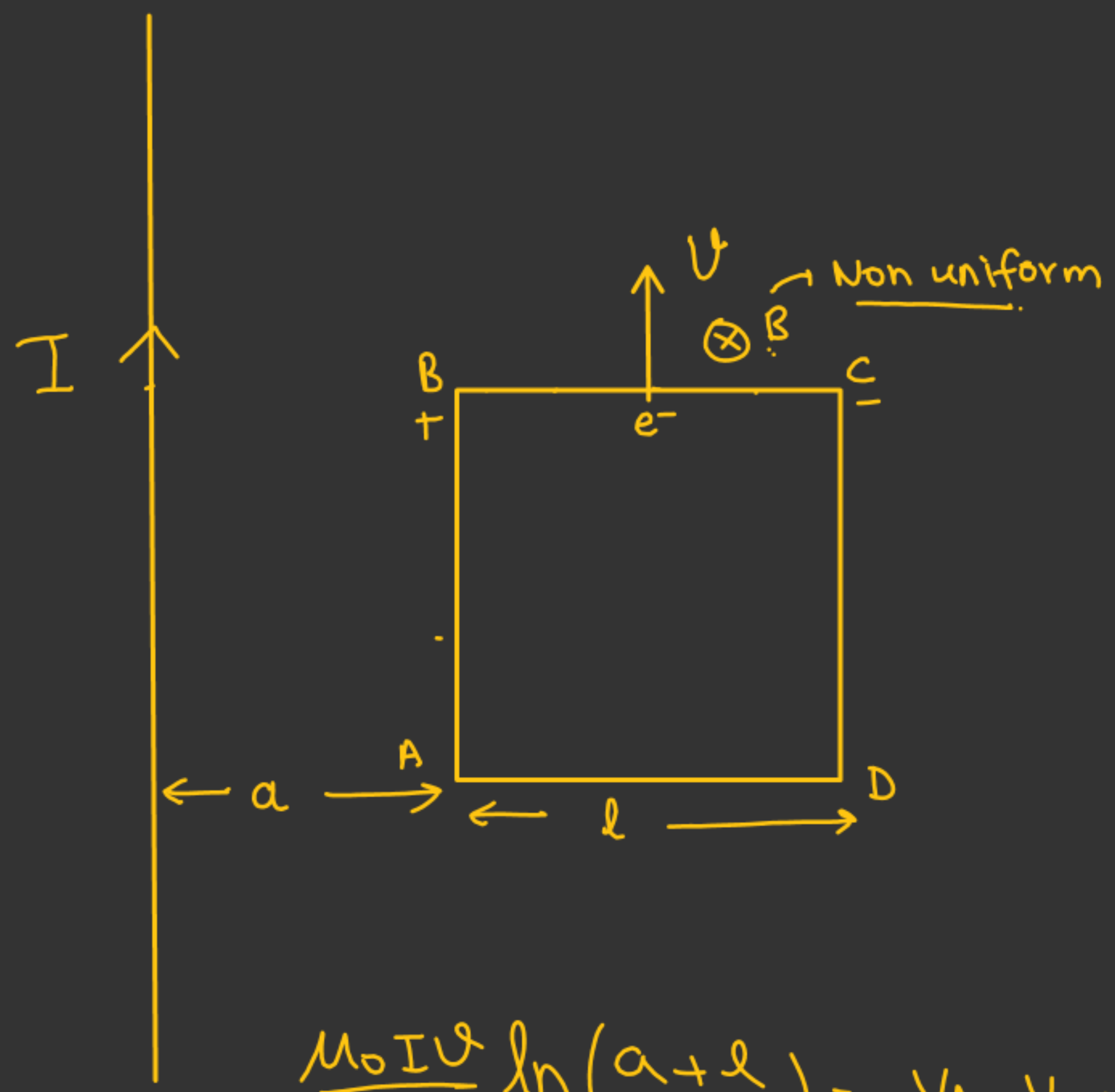
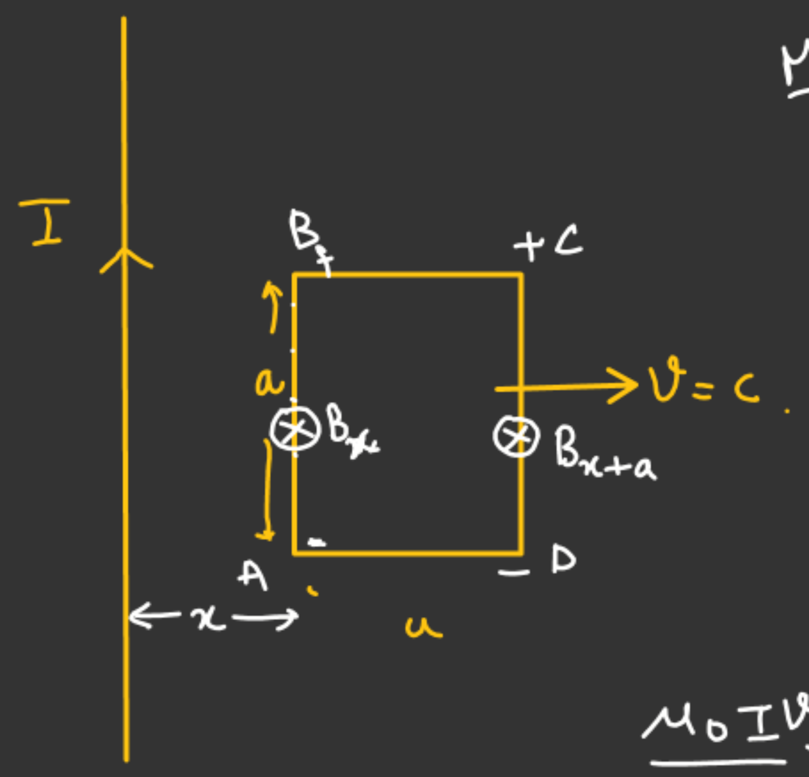
Nishant Jindal



$$\frac{\mu_0 I v}{2\pi}\ln\left(\frac{a+l}{a}\right) = V_A - V_D = V_B - V_C$$

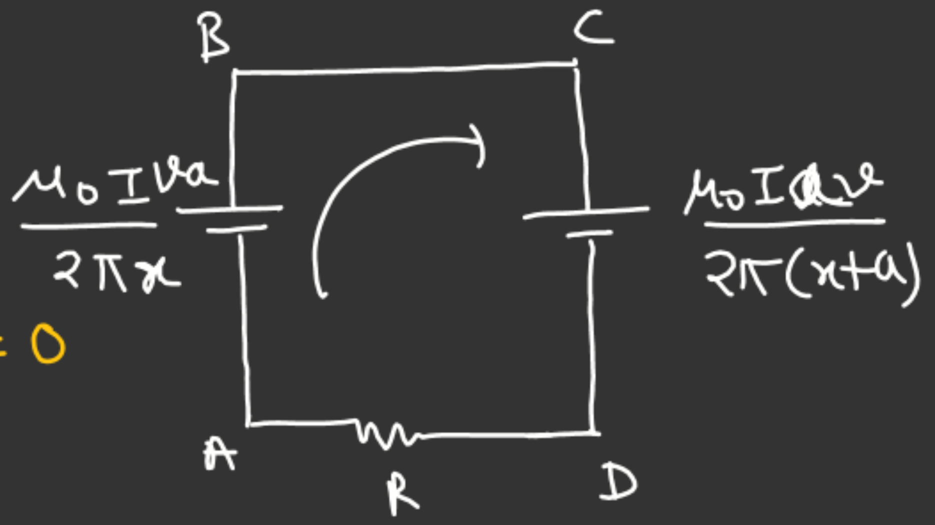
$\mathcal{E}_{net} = 0$

M-1



$(\mathcal{E}_{ind})_{BC} = (\mathcal{E}_{ind})_{AD} = 0$

$v \parallel L$



$$V_B - V_A = B_x a v = \frac{\mu_0 I a v}{2\pi x}$$

$$V_C - V_D = \frac{\mu_0 I a v}{2\pi(x+a)}$$

$$\mathcal{E}_{net} = \frac{\mu_0 I a v}{2\pi}\left[\frac{1}{x} - \frac{1}{x+a}\right] = \frac{\mu_0 I a v}{2\pi}\left[\frac{a}{x(x+a)}\right]$$

$$I = \left(\mathcal{E}_{net}/R\right)$$

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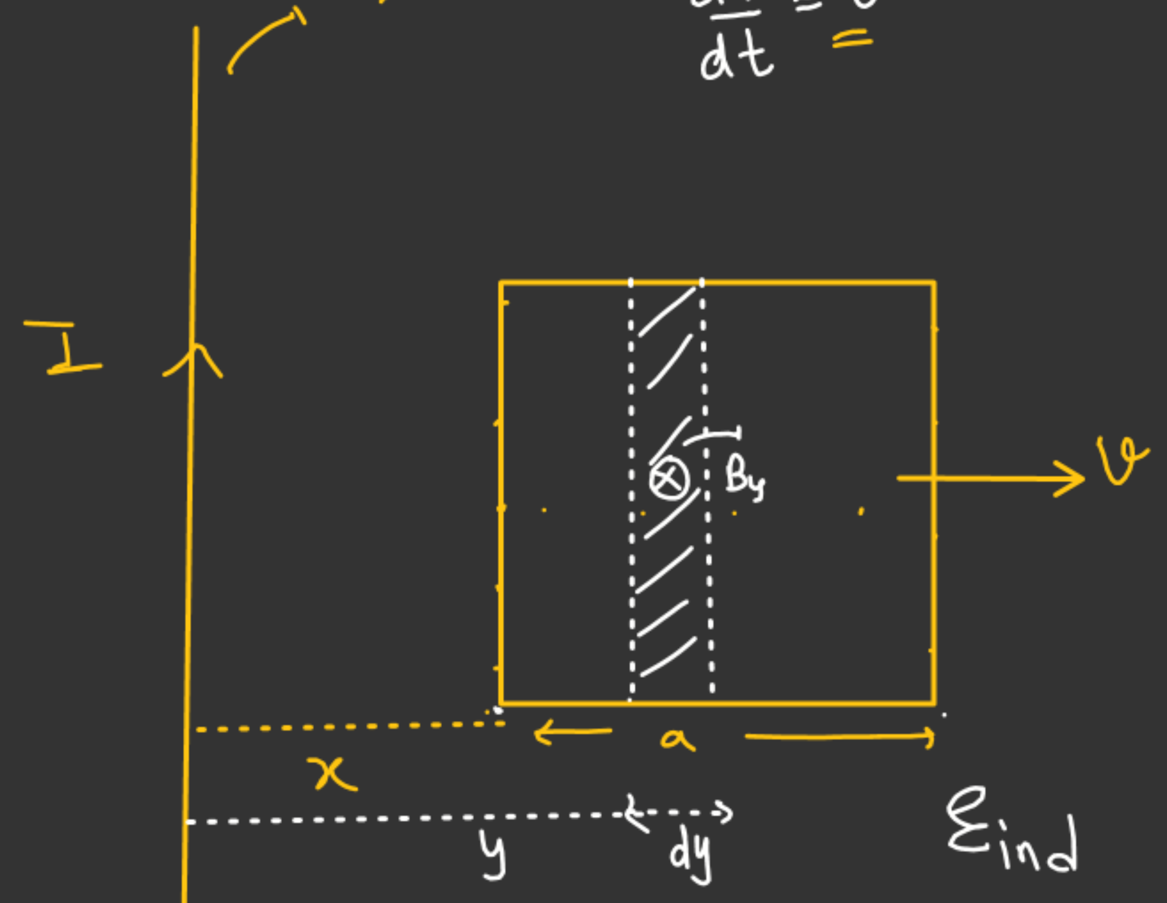
M-2

$B \to f(x)$

$\frac{dx}{dt} = v$



$$d\phi = B_y \,(\text{Area of strip})$$

$$\int_0^{\phi} d\phi = \int_x^{x+a} \frac{\mu_0 I}{2\pi y}\, a\, dy$$

$$\phi = \frac{\mu_0 I a}{2\pi} \int_x^{x+a} \frac{dy}{y} = \frac{\mu_0 I a}{2\pi} \ln\left[\frac{x+a}{x}\right]$$

$$\mathcal{E}_{ind} = \frac{-d\phi}{dt} = \left(\frac{d\phi}{dx}\right) \times \left(\frac{dx}{dt}\right)$$

$$\mathcal{E}_{ind} = \frac{-\mu_0 I a}{2\pi}\left[\left(\frac{x}{x+a}\right) \frac{d}{dt}\left(1+\frac{a}{x}\right)\right]$$

$$\mathcal{E}_{ind} = \frac{-\mu_0 I a}{2\pi}\left[\left(\frac{x}{x+a}\right)\left[0 - \frac{a}{x^2}\left(\frac{dx}{dt}\right)\right]\right]$$

$$\mathcal{E}_{ind} = \left[\frac{\mu_0 I a^2 v}{2\pi x (a+x)}\right]$$

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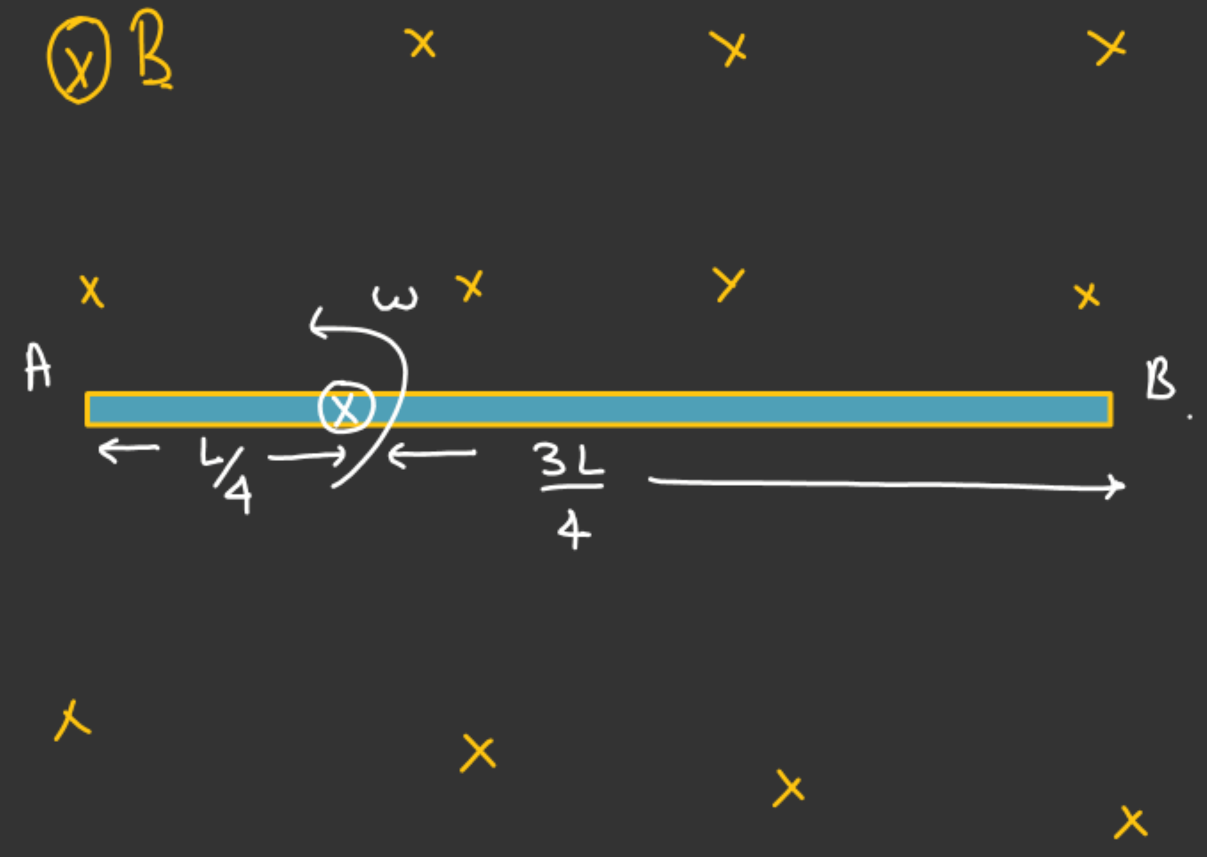
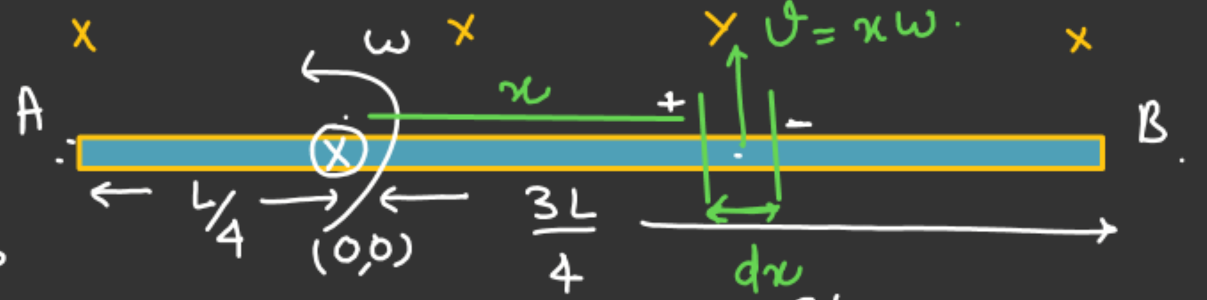
Q. $V_A - V_B = ??$

$\otimes B$



N-I.



$$\int_{V_A}^{V_B} d\mathcal{E}_{ind} = -Bv\,dx = -B\omega\int_{-L/4}^{3L/4} x\,dx$$

$$V_B - V_A = -\frac{B\omega}{2}\left[x^2\right]_{-\frac{L}{4}}^{\frac{3L}{4}}$$

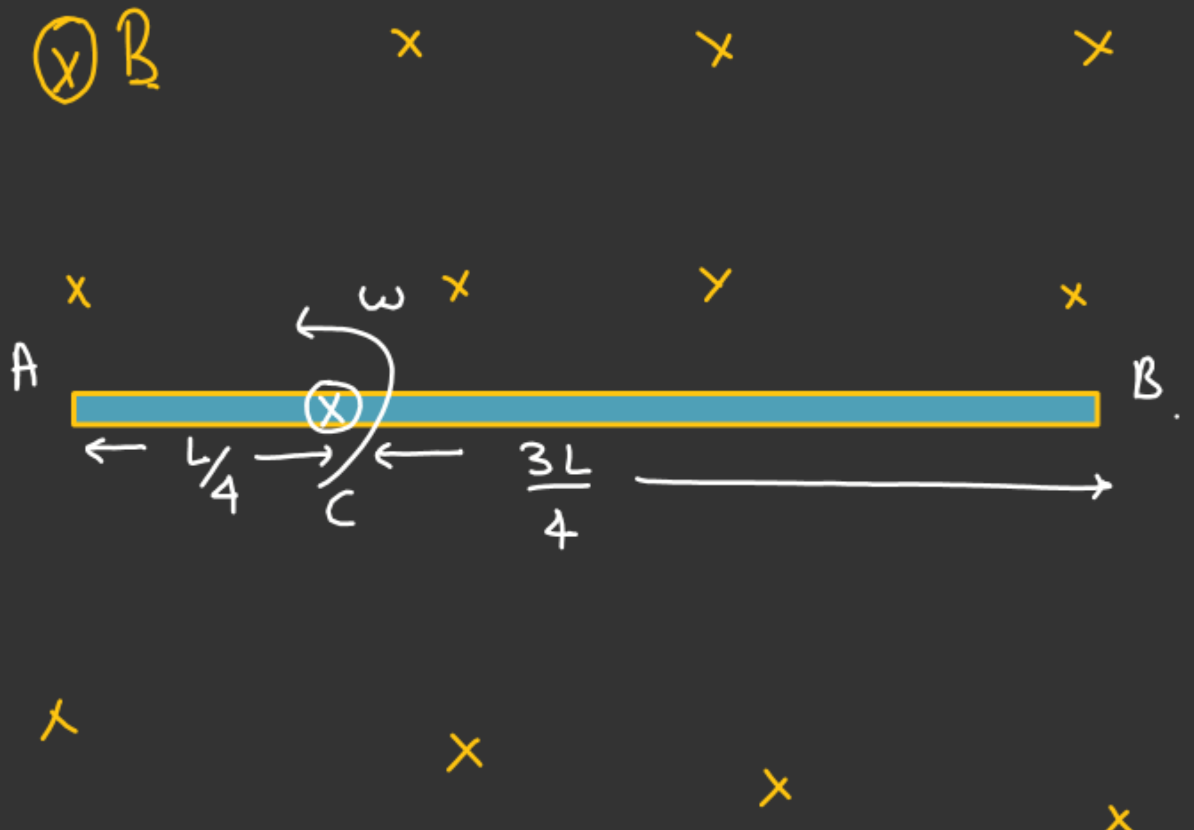
$$= -\frac{B\omega}{2}\left[\frac{9L^2}{16} - \frac{L^2}{16}\right]$$

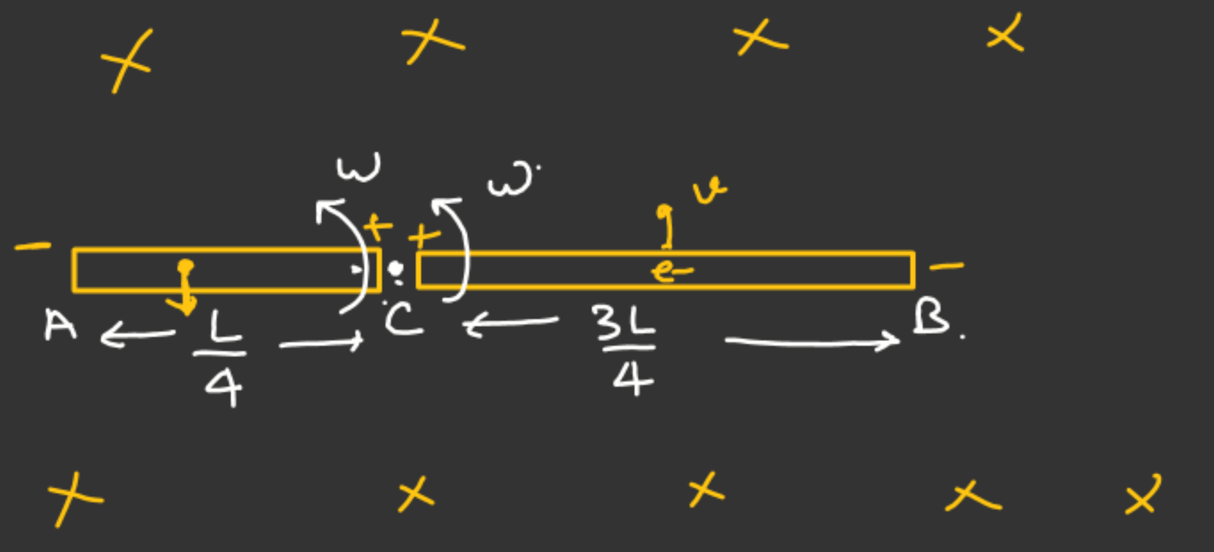
$$= -\left(\frac{B\omega L^2}{4}\right) \text{ Volt}$$

Nishant Jindal

$V_A - V_B = ??$

M-2





$$V_C - V_A = \frac{B\omega}{2}\left(\frac{L}{4}\right)^2 = \frac{B\omega L^2}{32} \quad -①$$

$$V_C - V_B = \frac{B\omega}{2}\left(\frac{9L^2}{16}\right) = \frac{9B\omega L^2}{32} \quad -②$$

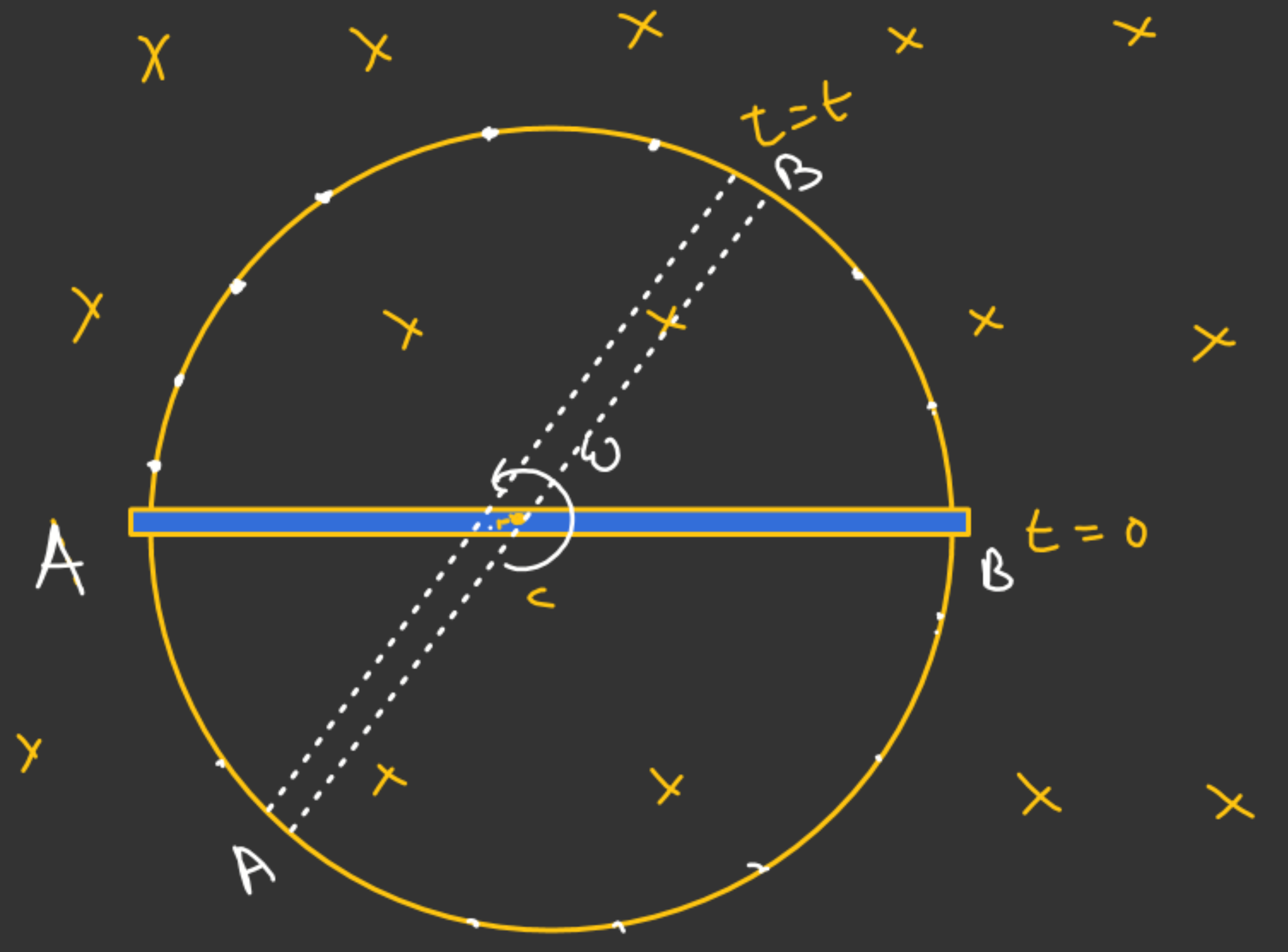
② − ①

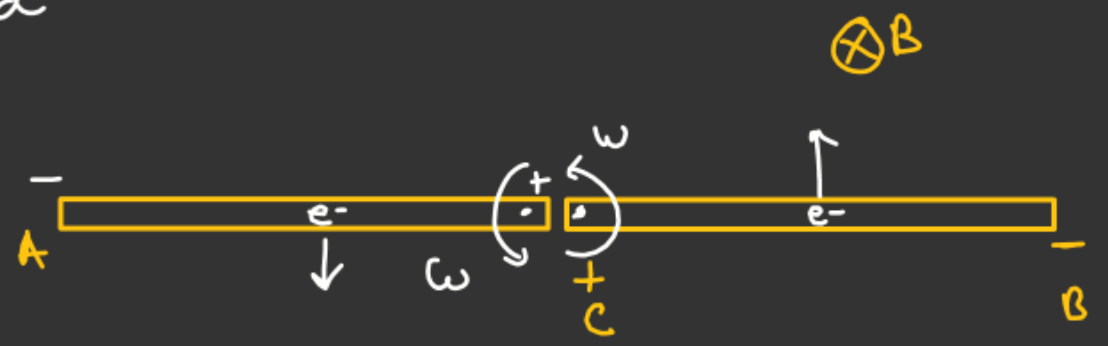
$$V_A - V_B = \frac{9B\omega L^2}{32} - \frac{B\omega L^2}{32} = \frac{B\omega L^2}{4} \text{ Ans}$$

Nishant Jindal

Rod and hoop conducting.
No friction b/w rod and hoop.
Rod moving with constant angular velocity ω.
Find I_{ind} if resistance (r) only in the rod

Q. Place on horizontal table



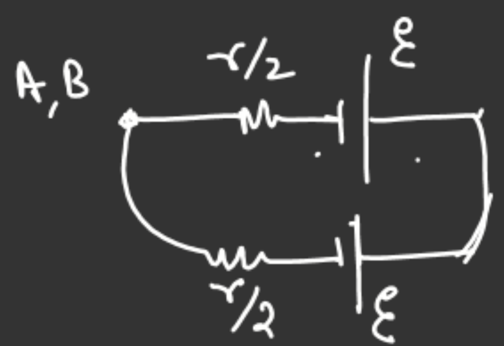


$$V_c - V_A = \frac{B\omega R^2}{2}$$

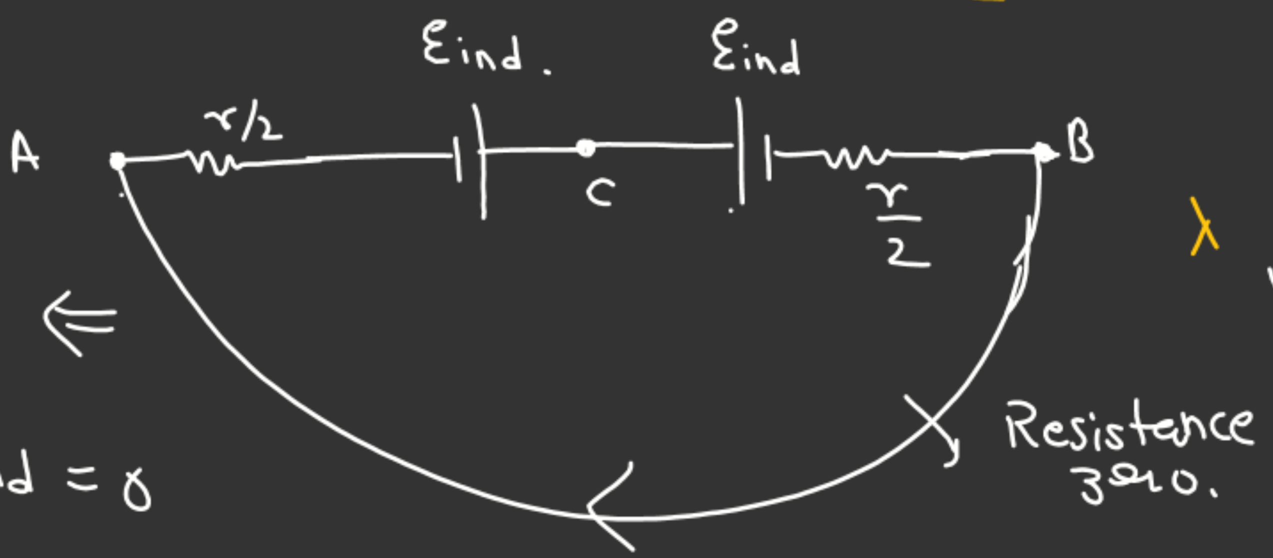
$$V_c - V_B = \frac{B\omega R^2}{2}$$

$V_A = V_B$

Eq. Ckt diagram



$\Leftarrow$



$I_{ind} = 0$

Nishant Jindal

Rod and hoop conducting.

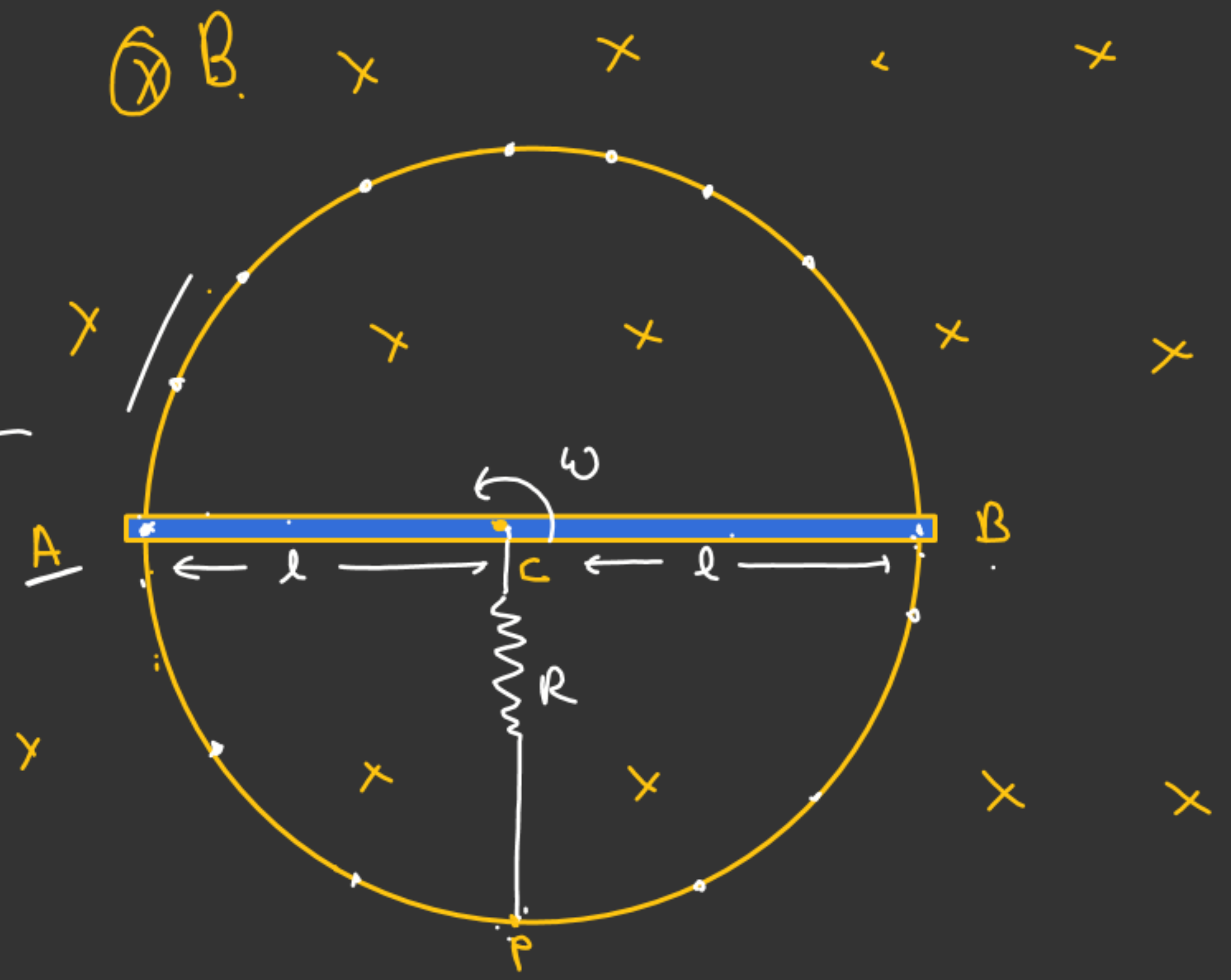
No friction b/w rod and hoop.

Rod moving with constant angular velocity ω.

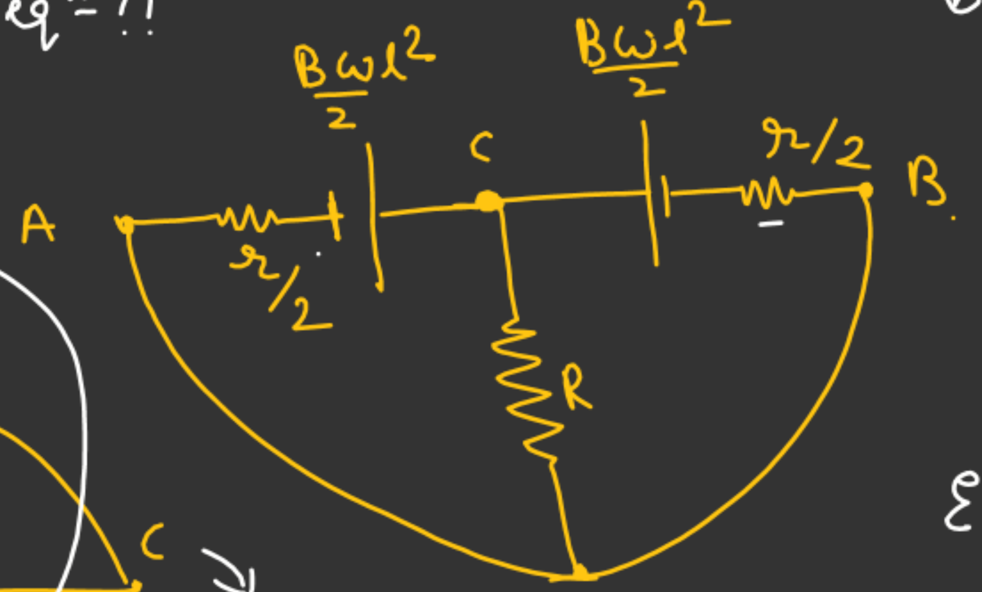
R = External resistance.

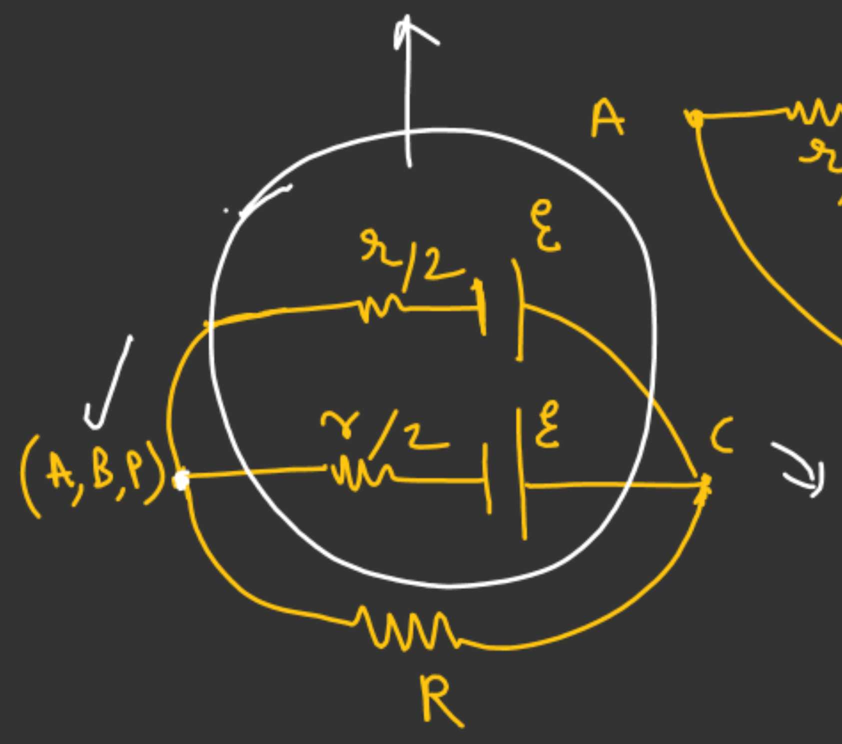
r = resistance of the rod.

No resistance in the hoop



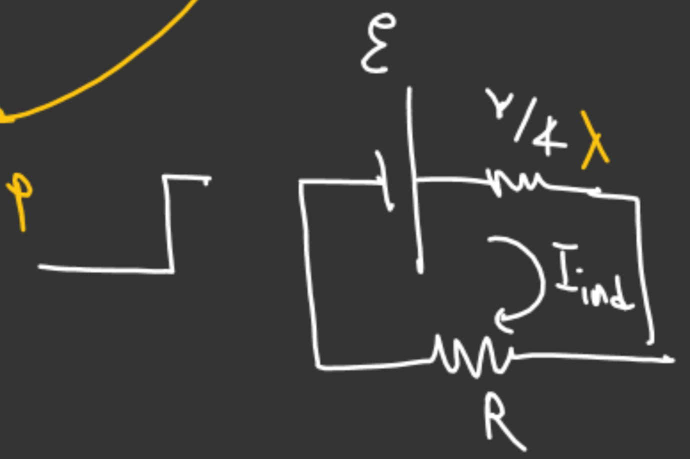
$\mathcal{E}_{eq} = ??,\ r_{eq} = ??$





$\mathcal{E}_{eq} = \mathcal{E}$

$r_{eq} = r/4$



$$I_{ind} = \frac{\mathcal{E}}{\left(R+\frac{r}{4}\right)} = \frac{B\omega l^2}{2\left(R+\frac{r}{4}\right)}$$ Ans

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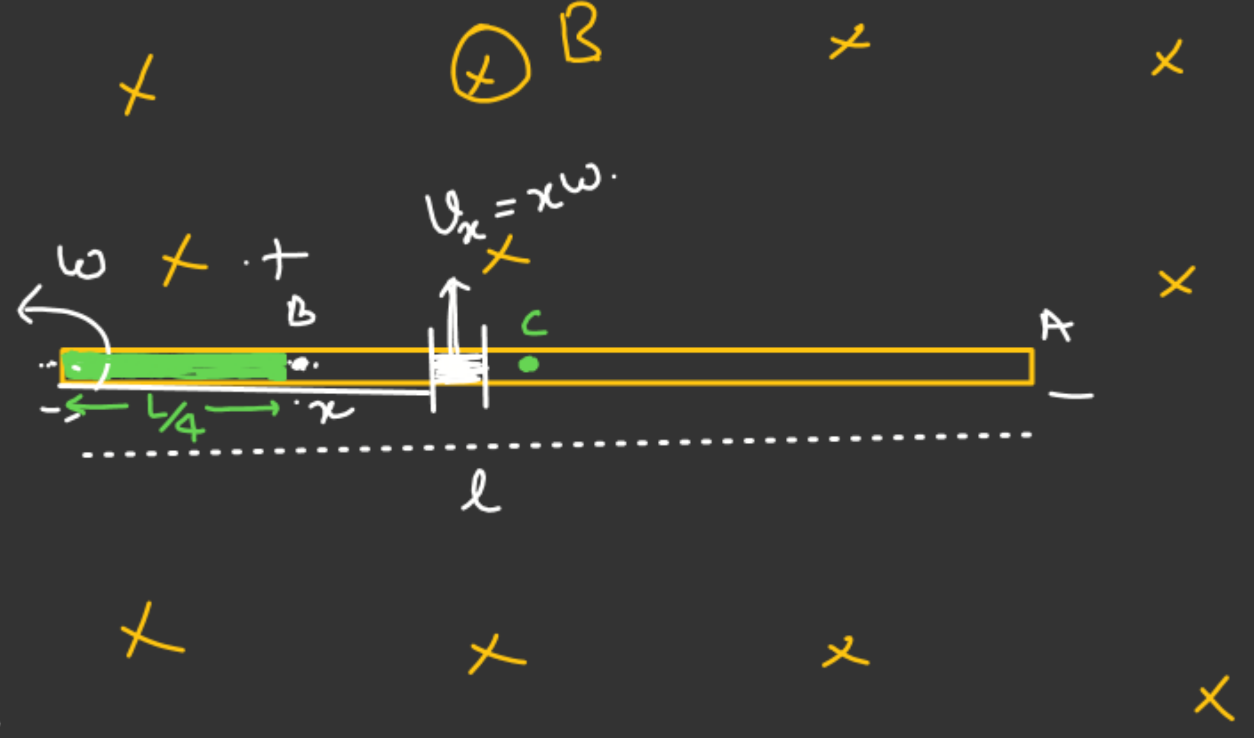
Rod of $l/4$ length is insulated.

$V_A - V_B = ??$

$$\int_{V_B}^{V_A} d\varepsilon_{ind} = B\omega \int_{L/4}^{L} x\, dx$$



$$|V_A - V_B| = \frac{B\omega}{2}\left[x^2\right]_{L/4}^{L}$$

$$= \frac{B\omega}{2}\left[L^2 - \frac{L^2}{16}\right]$$

$$= \left(\frac{15 B\omega L^2}{32}\right)$$

$$V_B - V_A = \left(\frac{15 B\omega L^2}{32}\right)$$

$$V_A - V_B = \left(-\frac{15 B\omega L^2}{32}\right)$$

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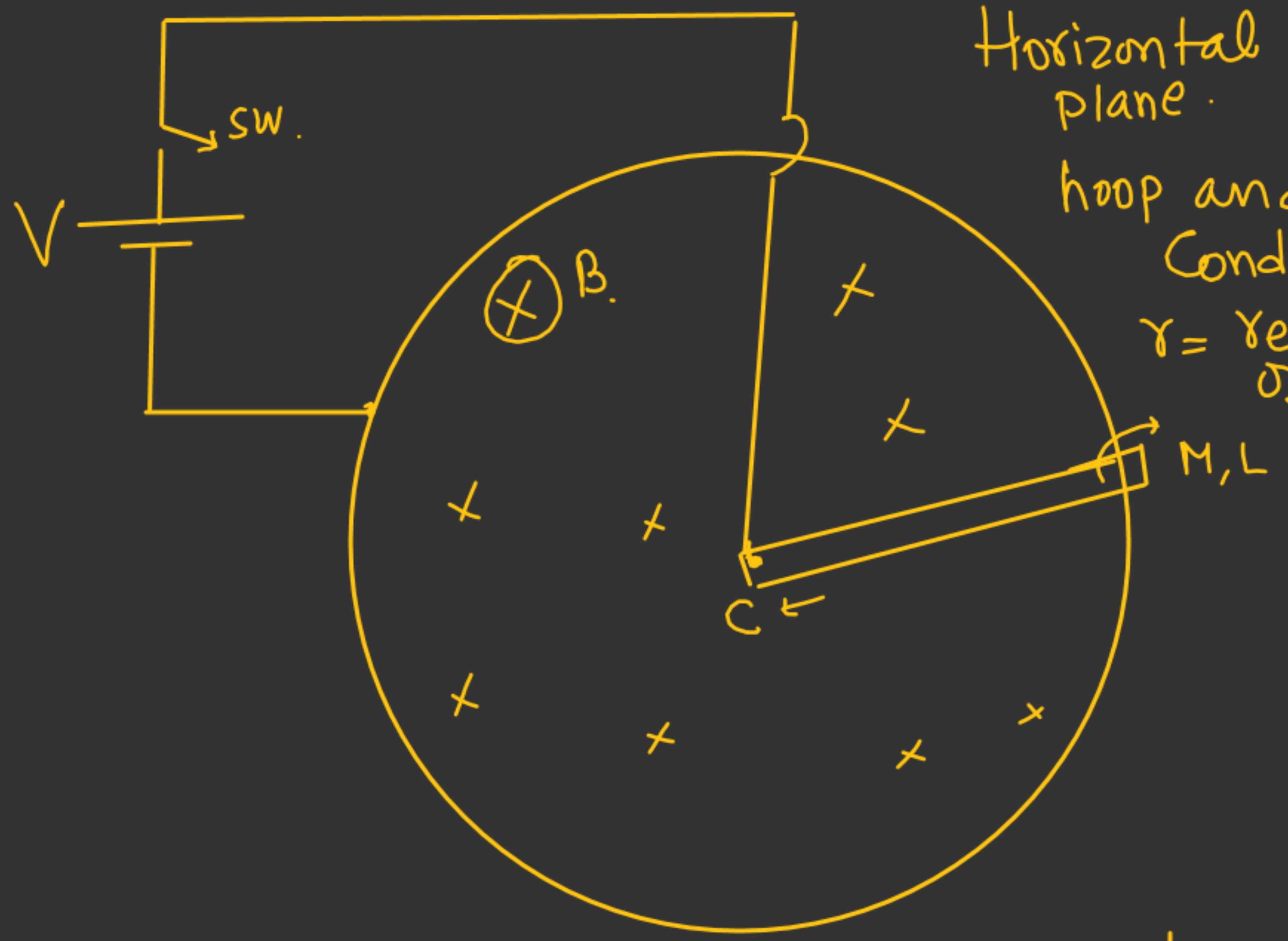
At $t=0$, SW is closed.

Find.

a) $\omega \rightarrow f(t)$



Horizontal plane.

hoop and rod Conducting.

r = resistance of hoop.

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