Q) HW :- A 800 turn coil of effective area $0.05\,m^2$ is kept $\perp$ to a magnetic field $5\times10^{-5}\,T$. when plane of the coil is rotated by 90° in 0.1 sec. find ε_{ind}.

(a) 2V
(b) ~~0.02V~~
(c) 0.2V
(d) 2×10^{-3}V.

Solve :- $N = 800$ turn. $B = 5\times10^{-5}\,T$

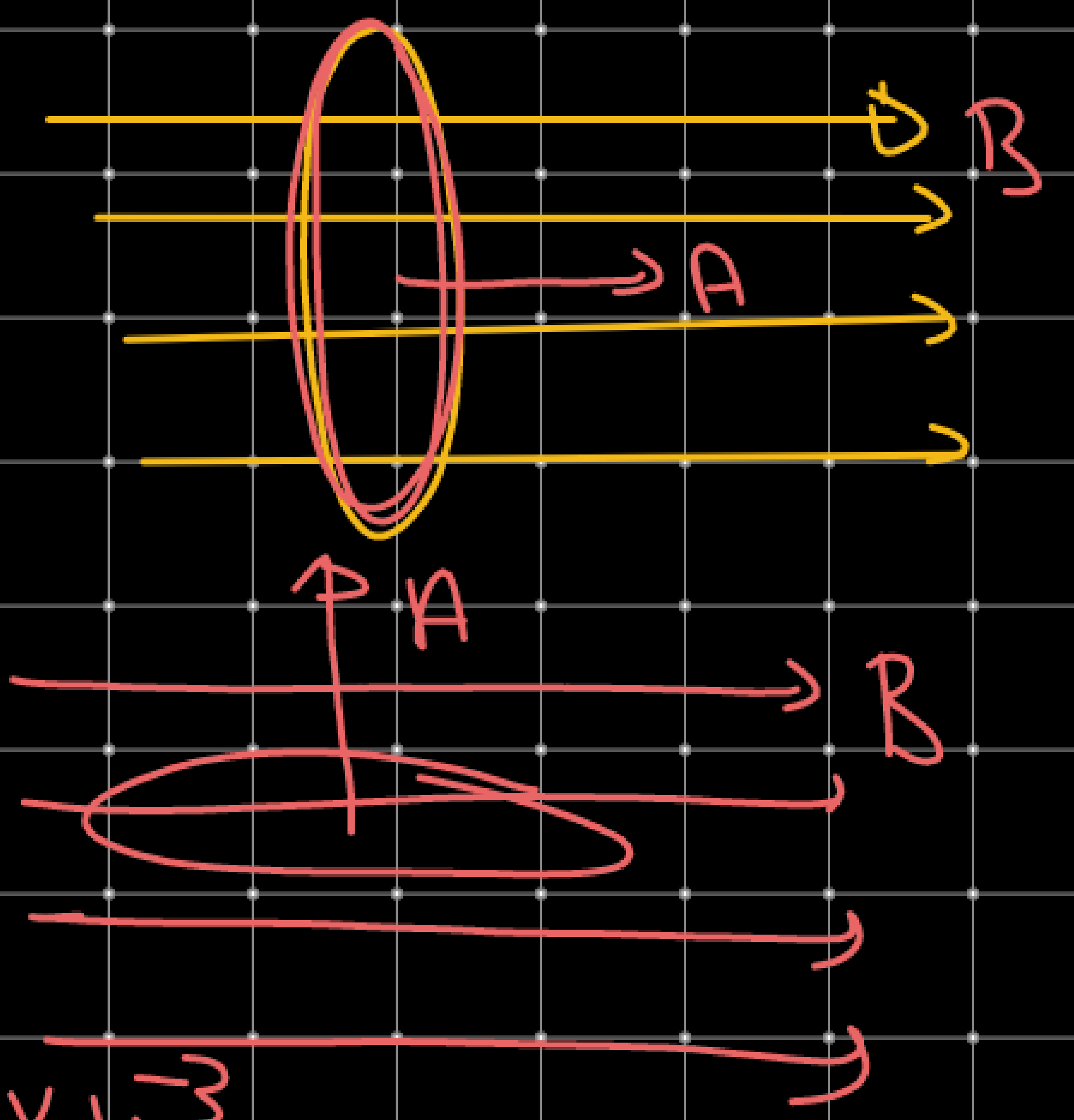
$A = 5\times10^{-2}\,m$

$\phi_i = NBA\cos 0^\circ$

$\phi_i = 8\times10^{2}\times5\times10^{-5}\times5\times10^{-2}$

$\phi_i = 40\times5\times10^{-5}$

$\phi_i = 2\times10^{-3}\,Wb$



$\phi_i = 0$

$|\Delta\phi| = 2\times10^{-3}\,Wb$

$$\varepsilon_{ind} = \left|\frac{\Delta\phi}{dt}\right| = \frac{2\times10^{-3}}{0.1} = \frac{2\times10^{-3}}{1\times10^{-1}} = 2\times10^{-2}\,V = 0.02\,Volt$$

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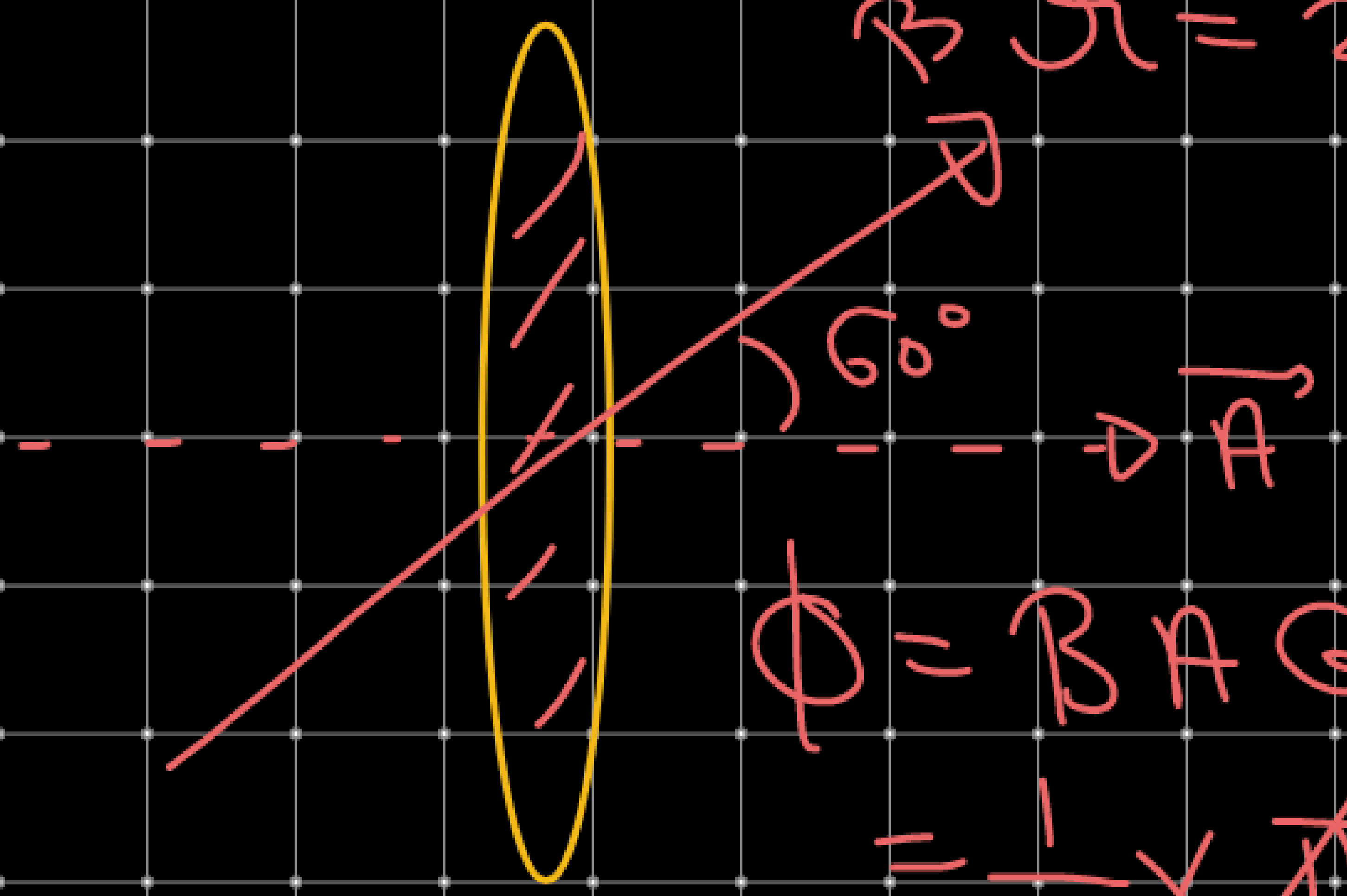
A circular disc of radius 0.2 m is placed in a uniform magnetic field of $\frac{1}{\pi}$ Wb/m^2 in such a way that its axis makes an angle 60° with $\vec{B}$. The magnetic flux linked with the disc is

(a) 0.08 Wb

(b) 0.01 Wb

(c) 0.02 Wb

(d) 0.06 Wb



$r = 2\times10^{-1}$ m

$B = \frac{1}{\pi}$ T

with axis

with plan

$\phi = BA\cos 60$

$= \frac{1}{\cancel{\pi}} \times \cancel{\pi}(\cancel{2}\times10^{-1})^2 \frac{1}{\cancel{2}}$

$= \cancel{4}\times10^{-2}\times\frac{1}{\cancel{2}}$

$= 2\times10^{-2}$

$= 0.02$ Wb

Q3) $\boxed{\text{Coil} \longrightarrow R = 400\,\Omega}$

$\phi = \underline{50t^2} + 4$

$i_{induced}$ at $t = 2\,sec.$

(a) 0.2 Amp

(b) 0.5 Amp

(c) 2×10^{-3} Amp

(d) N.O.T

$$\varepsilon_{ind} = -\frac{d\phi}{dt}$$

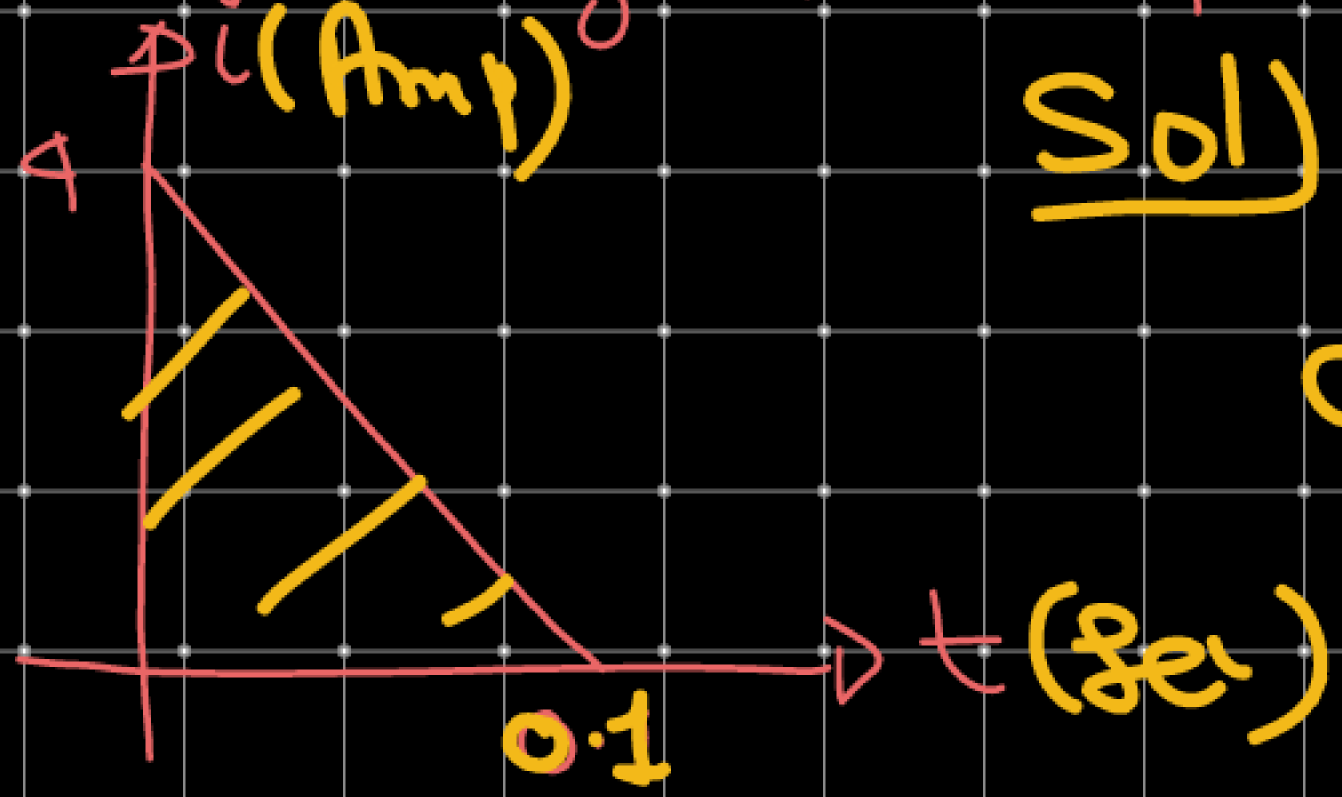
$$\varepsilon_{ind} = \left|\frac{d\phi}{dt}\right|$$

$$\varepsilon_{ind} = 100t + 0$$

$$\varepsilon_{ind\,t=2} \qquad \varepsilon_{ind} = 100 \times 2 = 200\,\text{Volt}$$

$$i_{t=2} = \frac{\varepsilon_{ind}}{R} = \frac{200}{400} = \frac{1}{2} = \underline{\underline{0.5\,\text{Amp}}}$$

Q4) In a coil of resistance 10Ω. the induced current developed by changing magnetic flux through it. Is show in figure as a function of time. The magnitude of Change in flux through the coil in weber is



(a) 6. (b) 4. (c) 8. (d) 2.

Sol) area of i-t graph gives Charge (q)

$$q_{flow} = \frac{1}{\cancel{2}} \times 0.1 \times \cancel{4}2 = \underline{\underline{0.2\ C}}$$

$$q_{flow} = \left| \frac{d\phi}{R} \right|$$

$$0.2 = \frac{d\phi}{10}$$

$$\underline{\underline{d\phi = 2\,Wb}}$$

AIPMT A Conducting circular loop is placed in a uniform magnetic field $B = 0.025\,T$ with plane $\perp$ to the loop. The radius of the loop is shrinking at rate of 1mm/sec. ε_{ind} when $r = 2$ cm.

(a) $2\mu V$

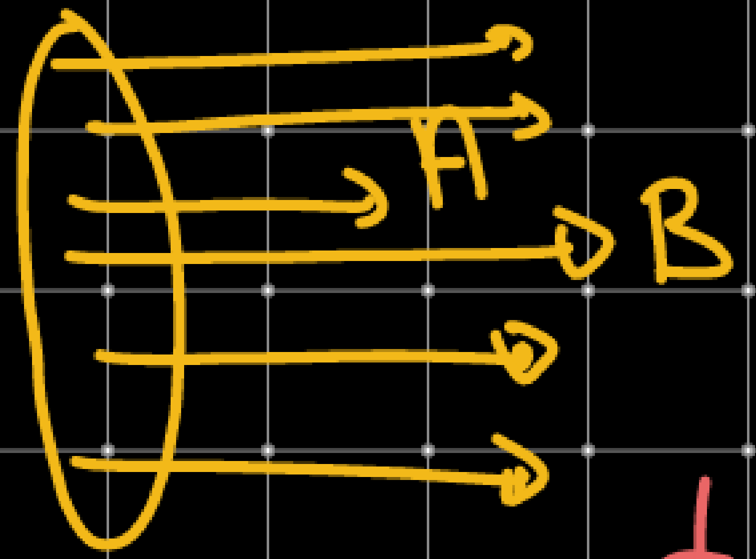
(b) $2\pi\,\mu V$

(c) $\pi\,\mu V$

(d) $\frac{\pi}{2}\,\mu V$

$B = 25\times10^{-3}\,T$

$$\boxed{\phi = BA}\quad A\downarrow\ \phi\downarrow$$



$$\frac{dR}{dt} = -10^{-3}\,m/s$$

$$\phi = 25\times10^{-3}\,\pi R^2$$

$$\phi = B\times\pi R^2$$

$$\varepsilon_{in} = -\frac{d\phi}{dt} = -\left[\frac{d}{dt}25\times10^{-3}\pi R^2\right]$$

$$= -25\times10^{-3}\,\pi\,2R\,\frac{dR}{dt}$$

$$\varepsilon_{in} = -\frac{d\phi}{dt} = -\left(B\pi\times2R\frac{dR}{dt}\right)$$

$$\varepsilon_{ind} = -25\times10^{-3}\times\pi\times2\times2\times10^{-2}\times(-10^{-3})$$

$$\varepsilon_{ind} = 2\pi RB\frac{dR}{dt}$$

$$= 100\pi\times10^{-8}$$

$$= \pi\times10^{-6} = \pi\,\mu V$$

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Q2) A Conduting Circular loop is placed in a UMF 0.04 T with its plane perpendicular to the MF. The radius of loop straining at 2 mm/sec. The induced Emf of the loop when the radius 2 cm.

(a) 1.6π MV (c) 3.2π MV

(b) 4.8π MV (d) 0.8π mV

EMI

EMI

Static Em

$\hookrightarrow \phi \rightarrow$ change

ε_{ind} i_{ind} q_{flow}

$\hookrightarrow \varepsilon_{ind} = \left|\frac{d\phi}{dt}\right|$ $q_{flow} = \left|\frac{d\phi}{R}\right|$

$i_{ind} = \frac{1}{R}\left|\frac{d\phi}{dt}\right|$

$\hookrightarrow$ <u>lenz</u>

$\varepsilon_{ind} = -\frac{d\phi}{dt}$ $\boxed{q_{flow} = \left|\frac{d\phi}{R}\right|}$

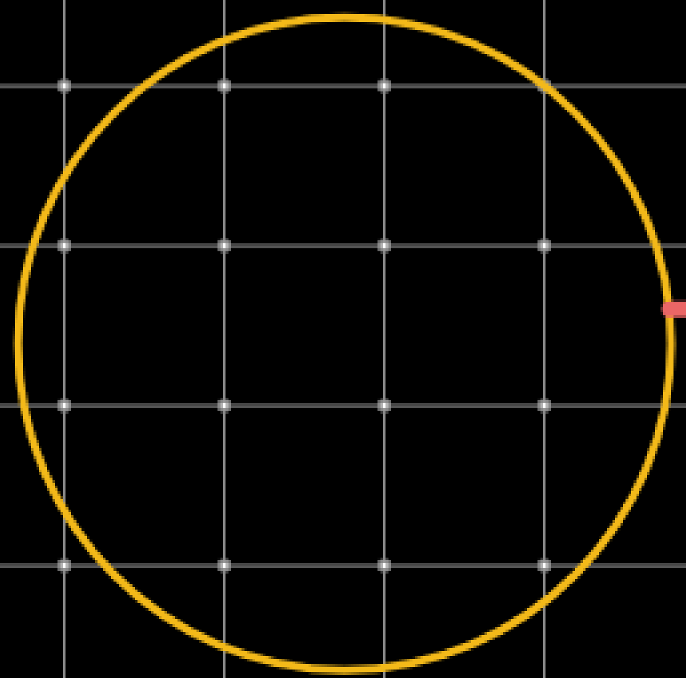
$i_{ind} = -\frac{1}{R}\frac{d\phi}{dt}$

[Self induction] [Mutual Induction] — EMI

$\phi = BA\cos\theta$

Static Induction

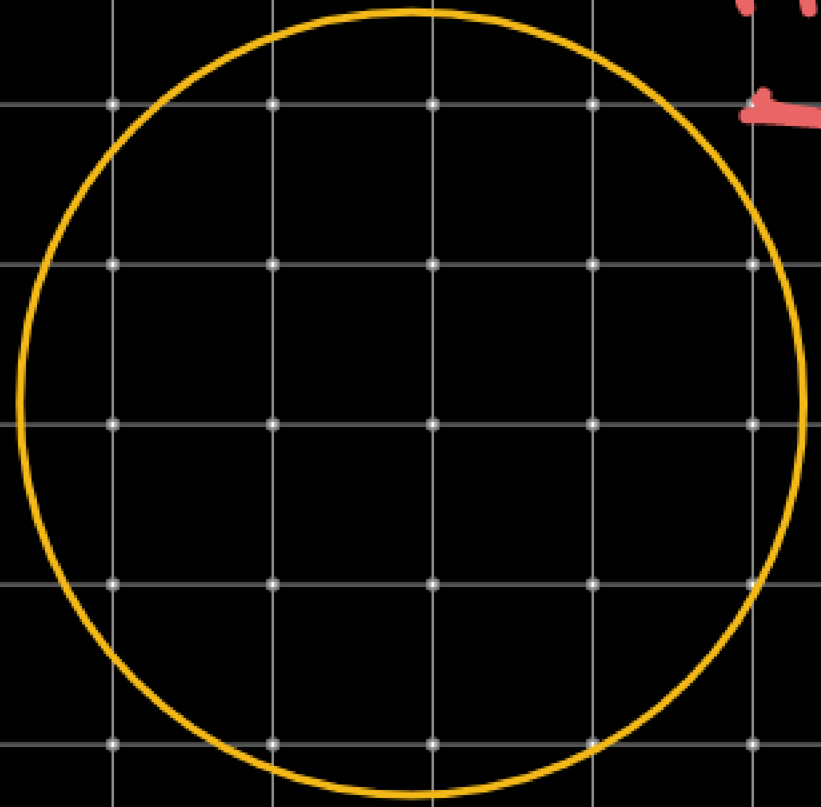
$B \rightarrow$ changes



fix

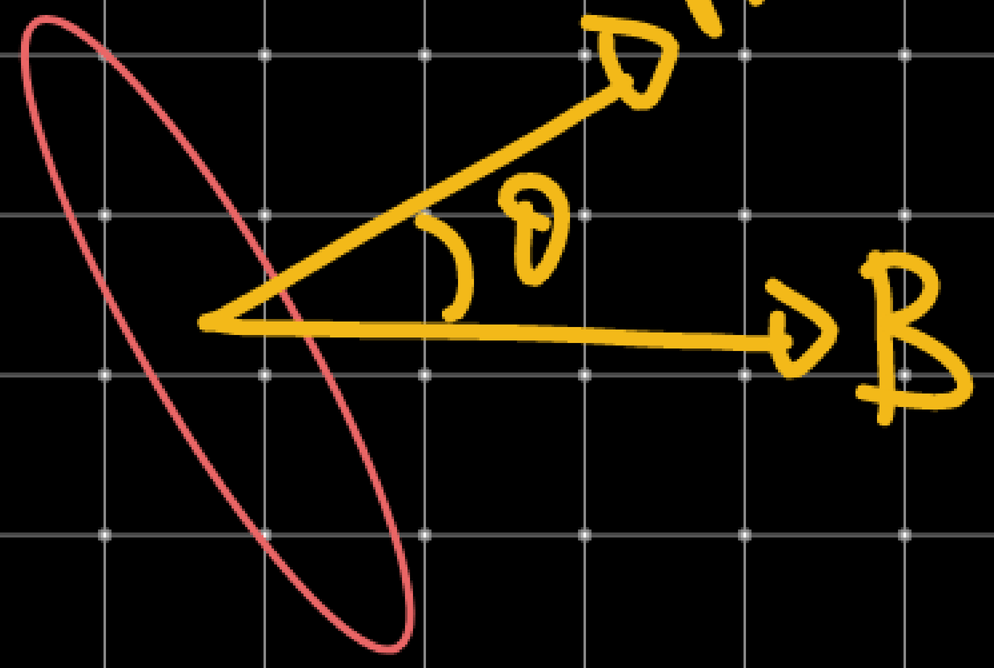
dynamic Induction

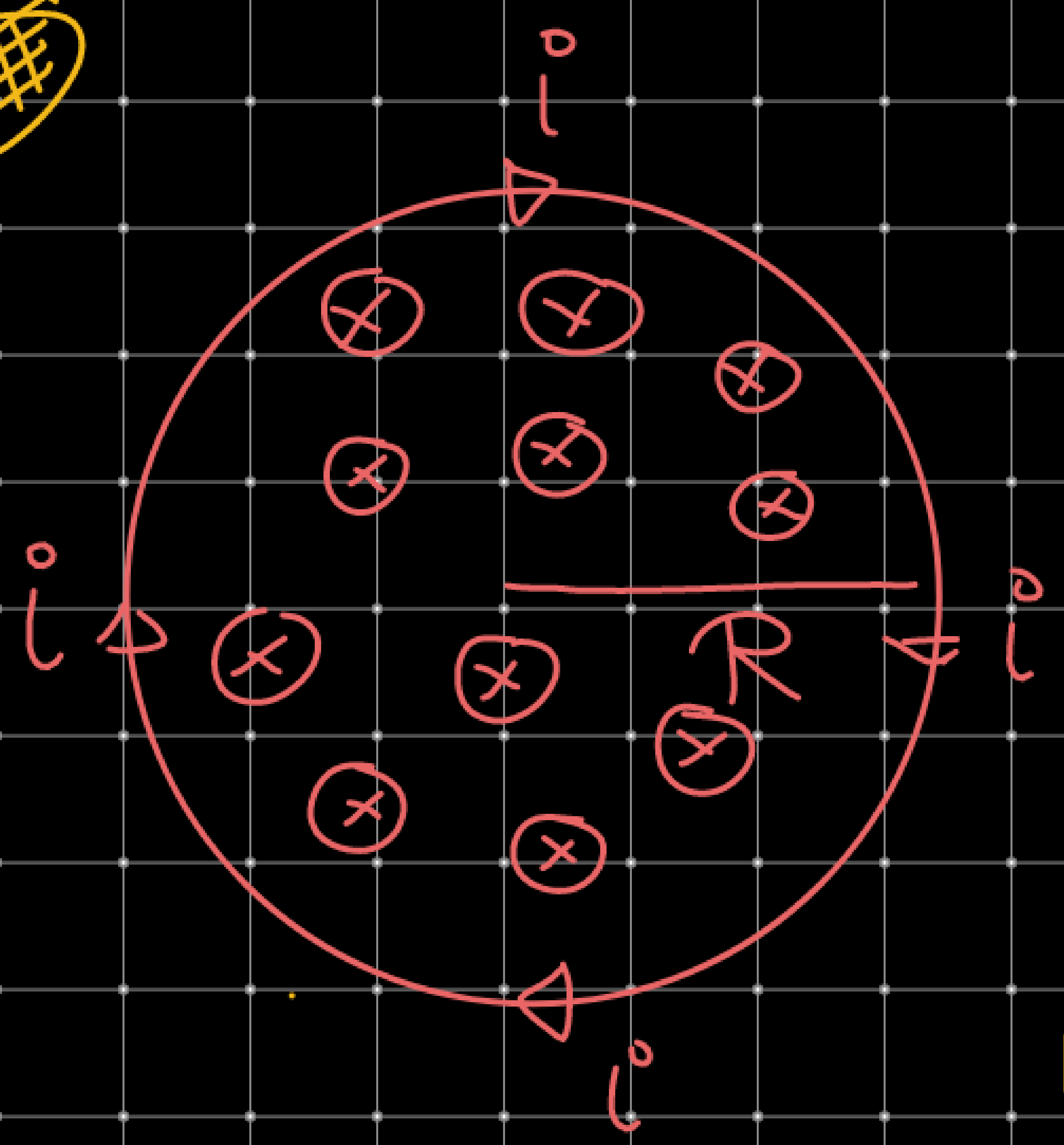
$\rightarrow$ A changes



Periodic Induction

$\theta \rightarrow$ changes





$i \uparrow \quad B \otimes \uparrow \quad \phi \uparrow$

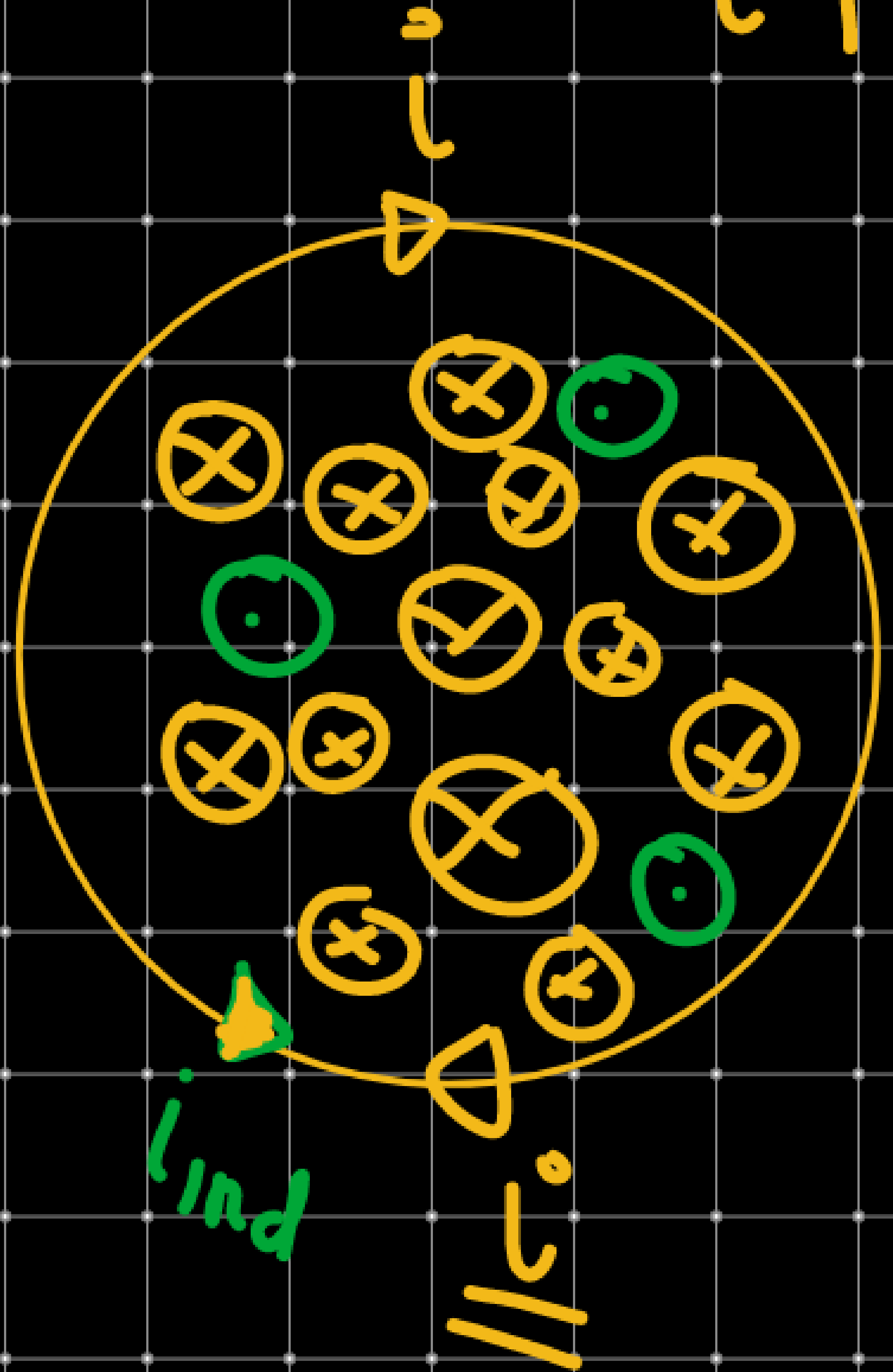
$i \downarrow \quad B \otimes \downarrow \quad \phi \downarrow$

1 min

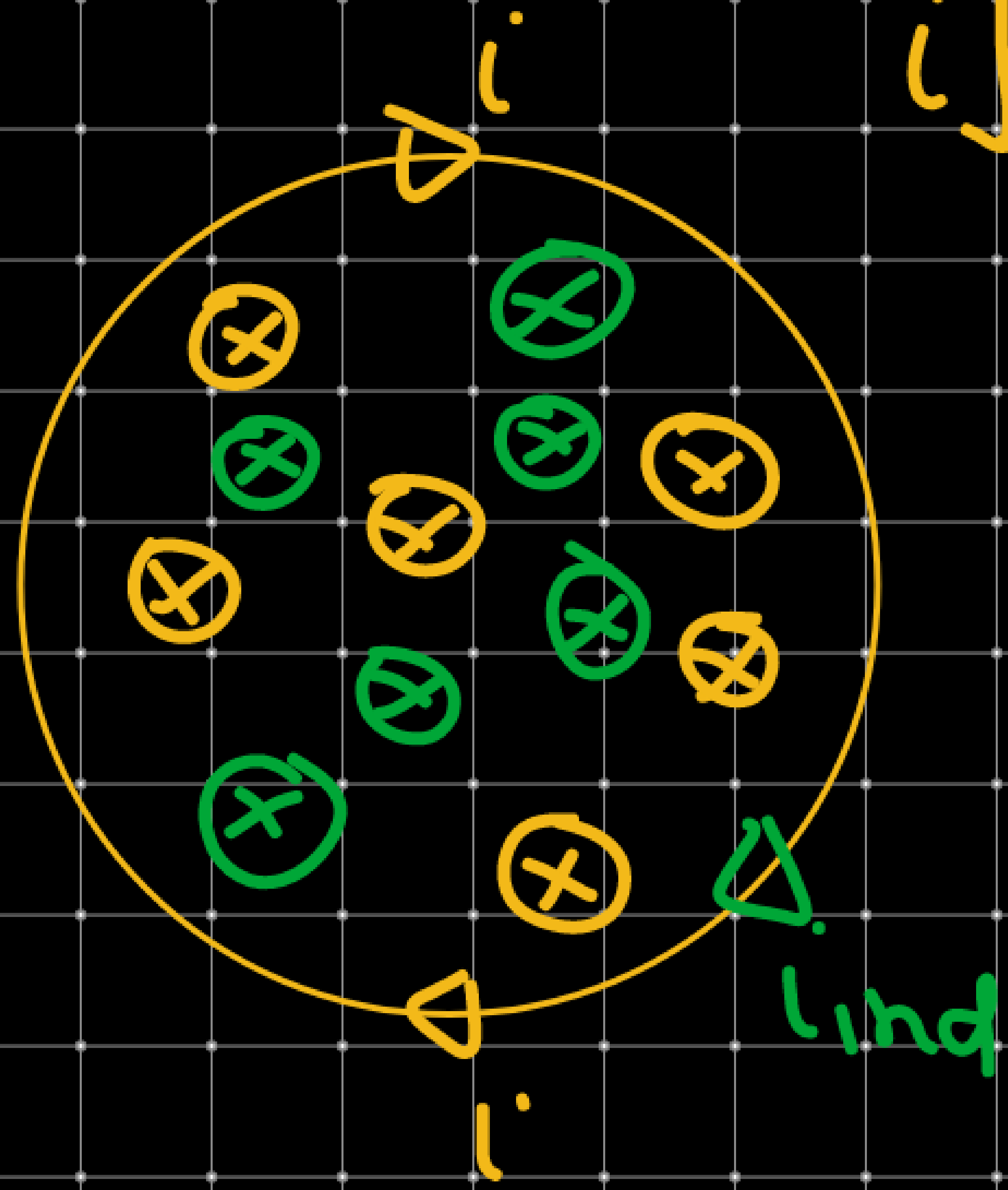
Static Induction :- (B → changes)

(i) **Self Induction :-** When Current in coil changes, due to change of current, magnetic field & Magnetic flux in the coil also changes. & Coil opposes the change & induced Emf, induced current generate in the coil. this phenomenon is known as Self Induction.

$i\uparrow \quad B\uparrow \quad \phi\uparrow$



$i\downarrow \quad B\downarrow \quad \phi\downarrow$



$$i = \frac{dq}{dt}$$

$$\int dq = \int_0^t i\,dt$$

$$\parallel$$

$$q = \underbrace{\int_0^t i\,dt}_{\text{area of } i\text{-}t \text{ graph}}$$

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

$$\int_{x_i}^{x_f} dx = \int_0^t v\,dt$$

$$[x]_{x_i}^{x_f} = \text{area of } v\text{-}t \text{ graph}$$

$$x_f - x_i$$

$$\parallel$$

$$S = \text{area of } v\text{-}t$$

$$\varepsilon_{ind} = -\frac{d\phi}{dt}$$

$$\varepsilon_{ind} \propto \frac{1}{t}$$

$$i_{ind} = -\frac{1}{R}\frac{d\phi}{dt}$$

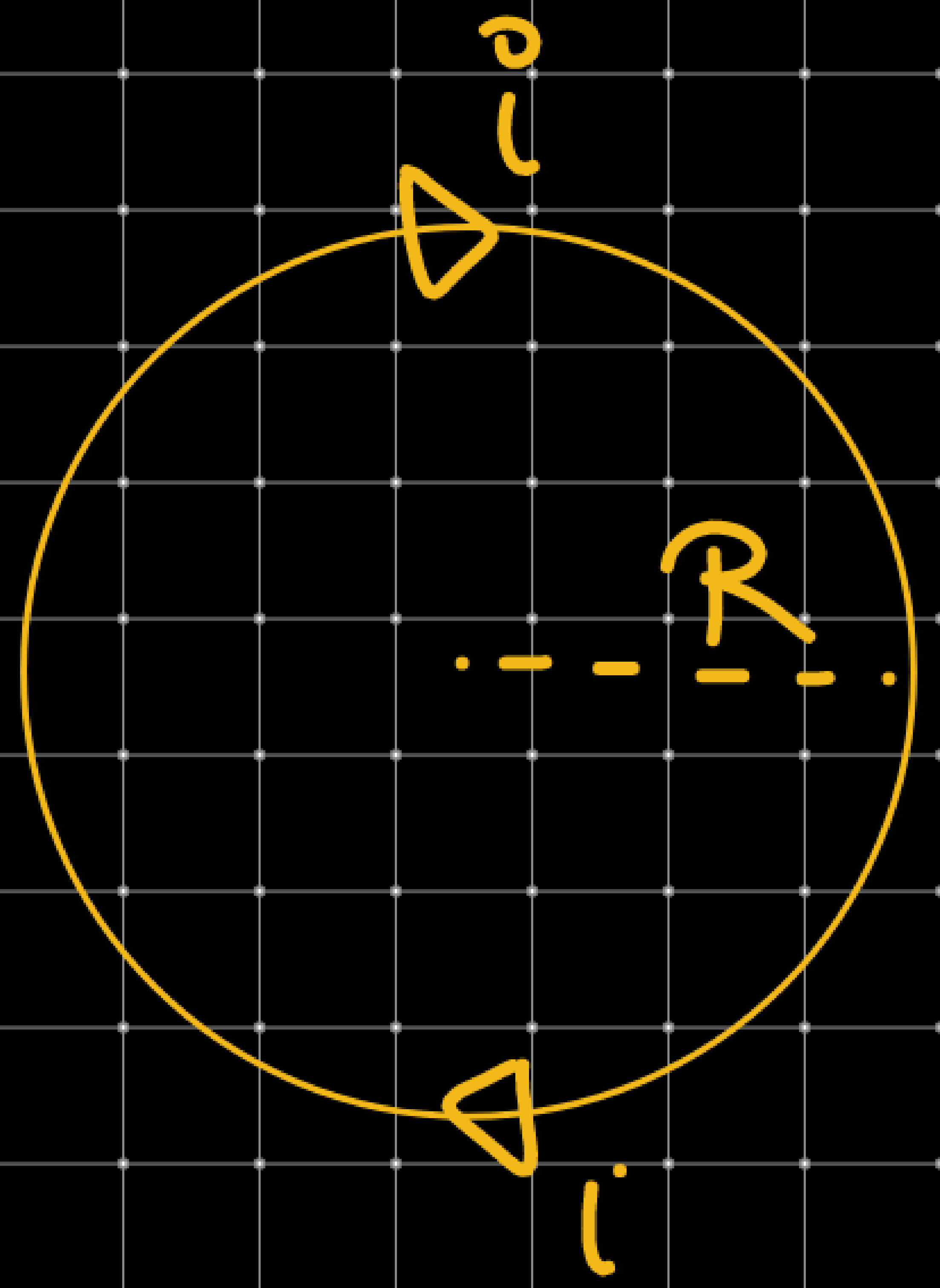
$$i_{ind} \propto \frac{1}{t}$$

$$\boxed{|q_{flow}| = \left|\frac{d\phi}{R}\right|}$$

$$q_{flow} \propto t^0$$

JEE(m)

NEET



(i) $B_{centre} = ?$

(ii) $B_{centre} \times A$

H.W

(iii) $\frac{B \times A}{i} = ?$