E.M.I.

Magnetic flux:- $\phi = \vec{B} \cdot \vec{A} = BA\cos\theta$.

If coil have N-turn $\phi_T = NBA\cos\theta$.

Faraday's Law:- (I) When flux changes in a coil, then Emf produce in coil, this Emf is called induced Emf. & due to induced Emf also produce current, current is known as induced current.

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

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

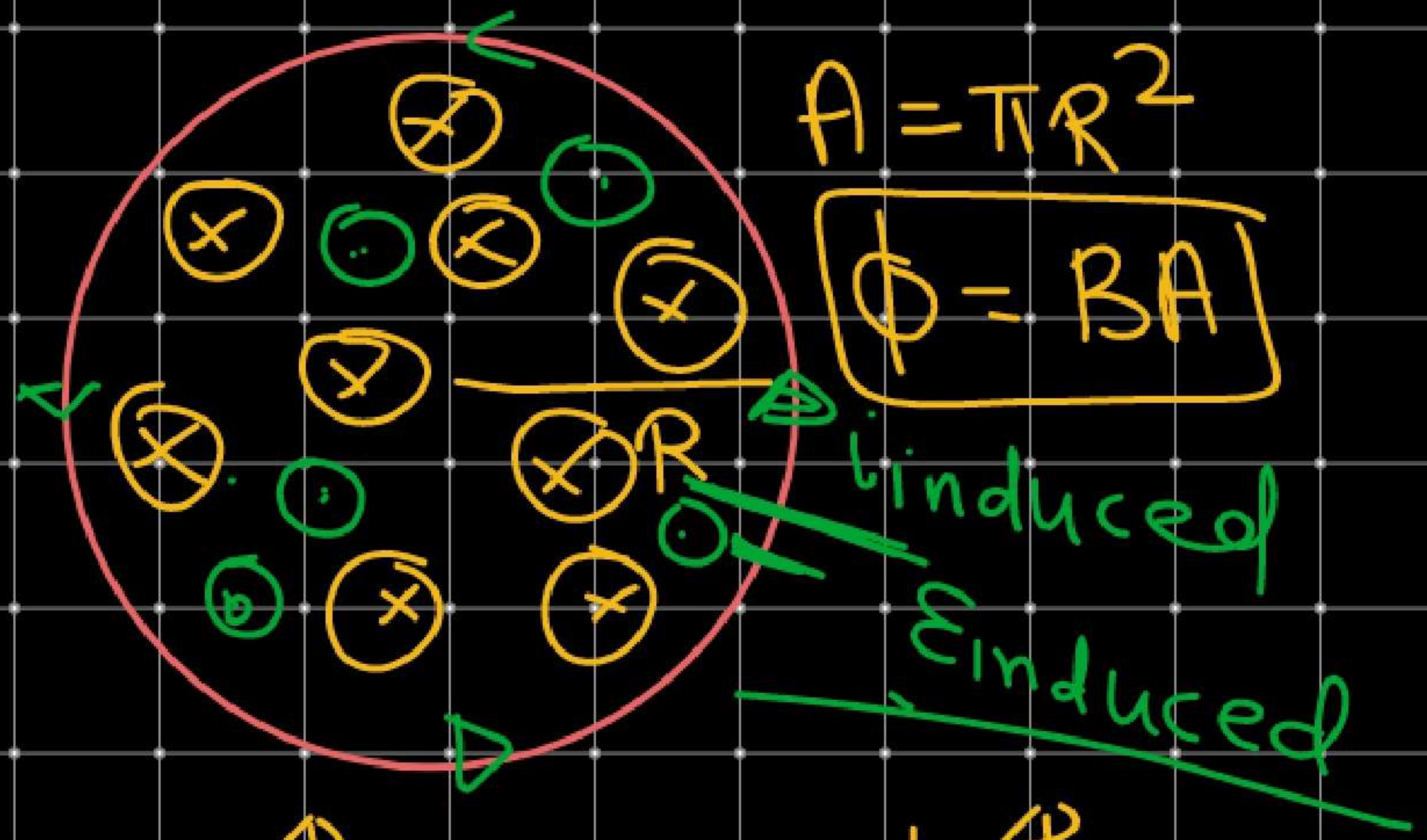
Lenz Law :- ⇒ based on Conservation of Energy

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

↳

dirⁿ of Induced Emf / induced Current In such a way It oppo change of flux.

⇒



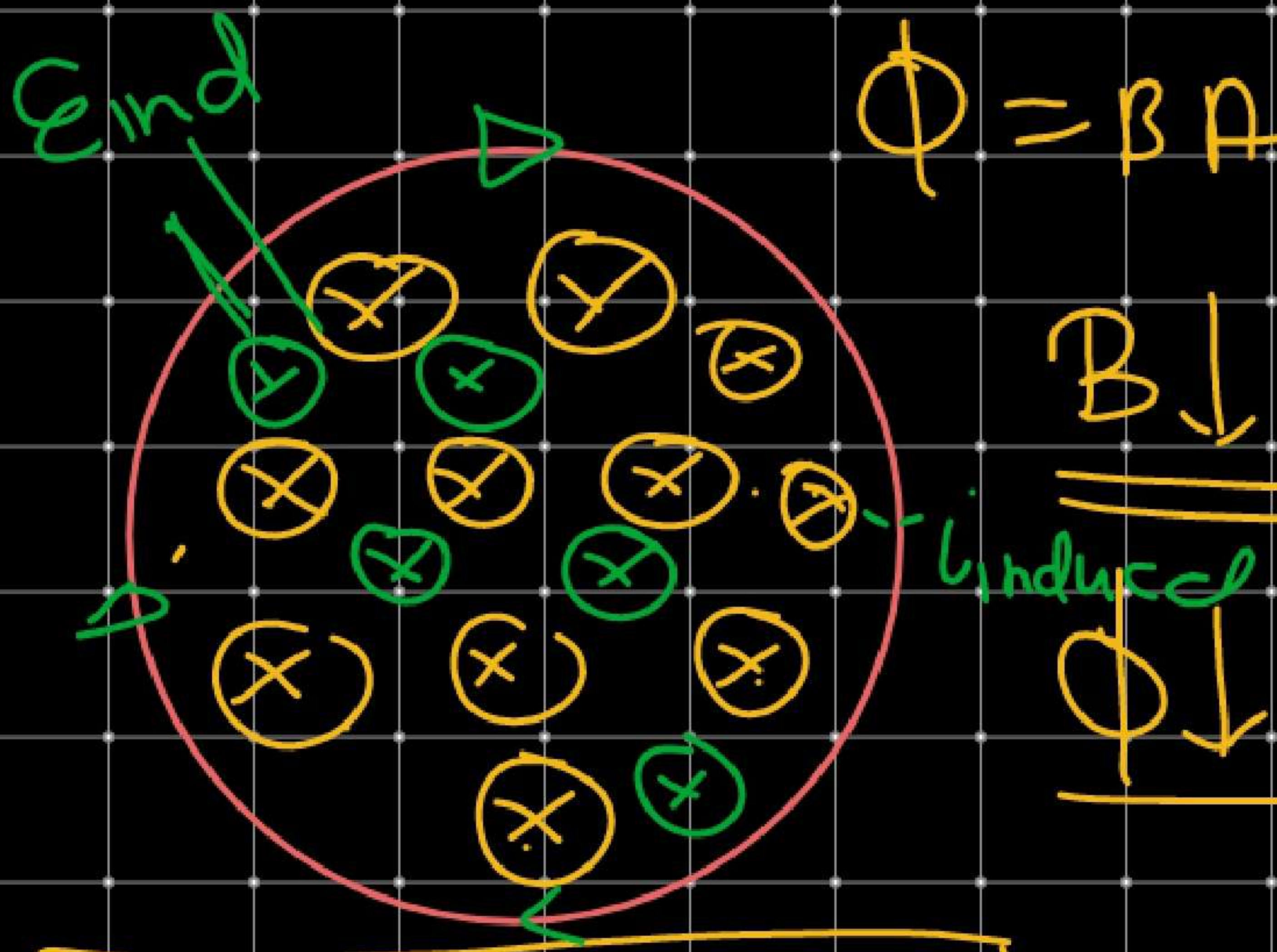
$A = \pi R^2$

$\phi = BA$

① $B \uparrow$ seg $\Rightarrow \phi \uparrow$ seg

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

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

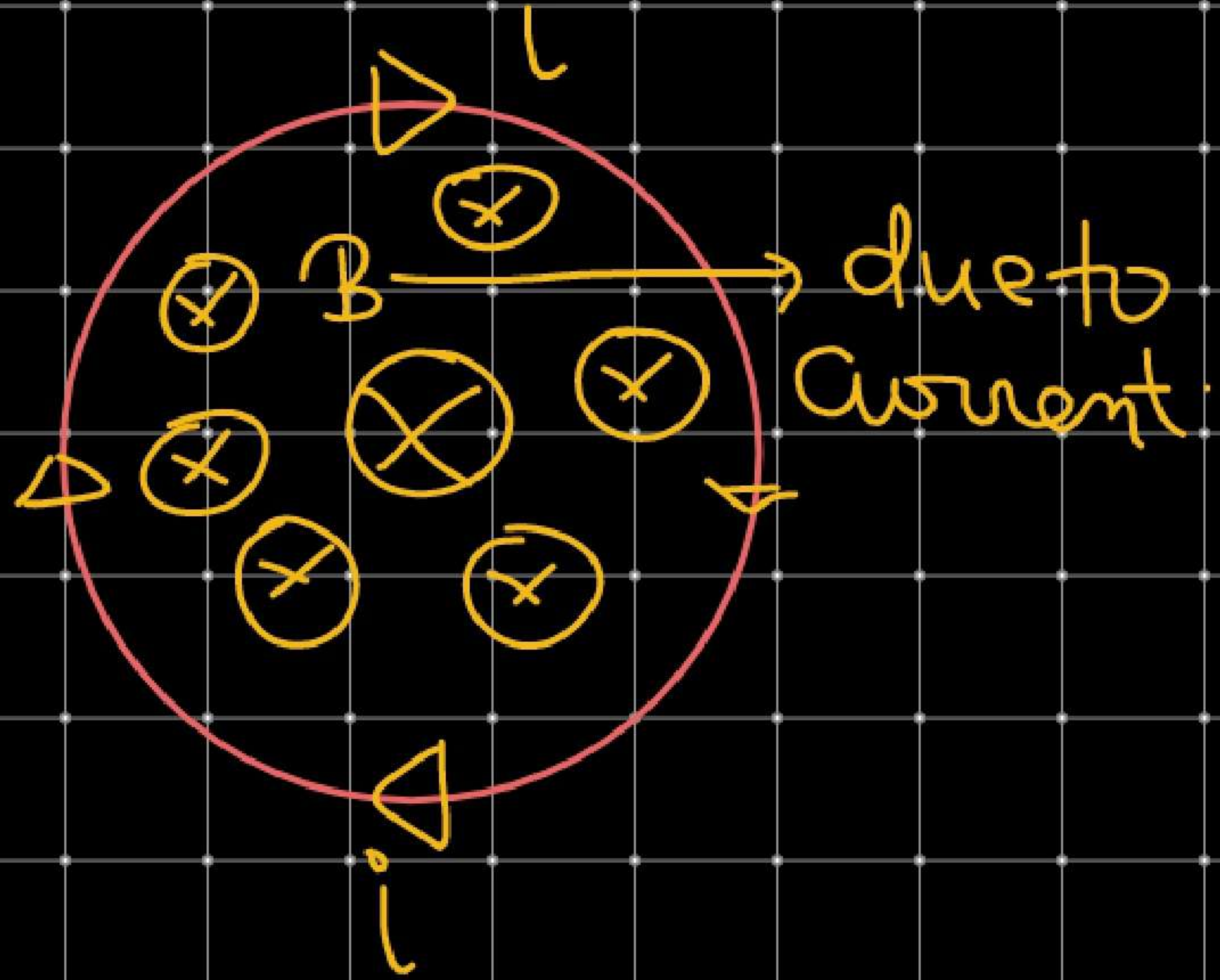


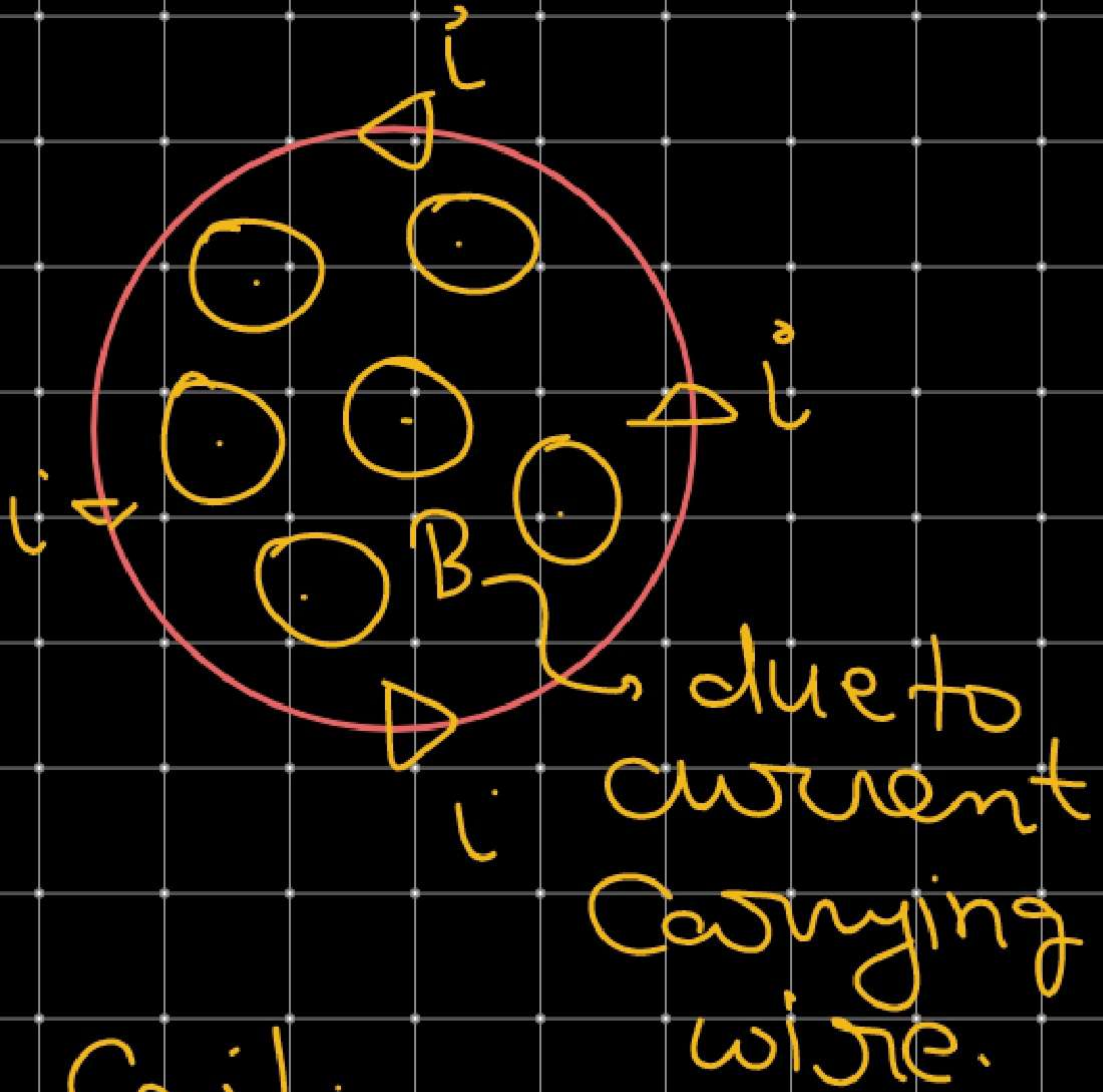
$\phi = BA\cos\theta$

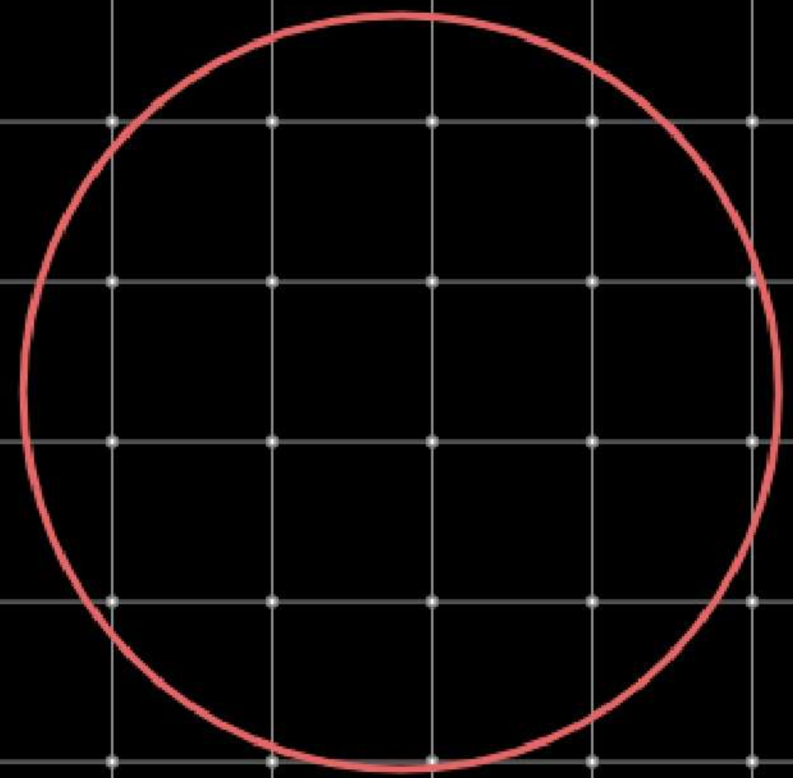
$B \downarrow$ seg

$\phi \downarrow$ seg

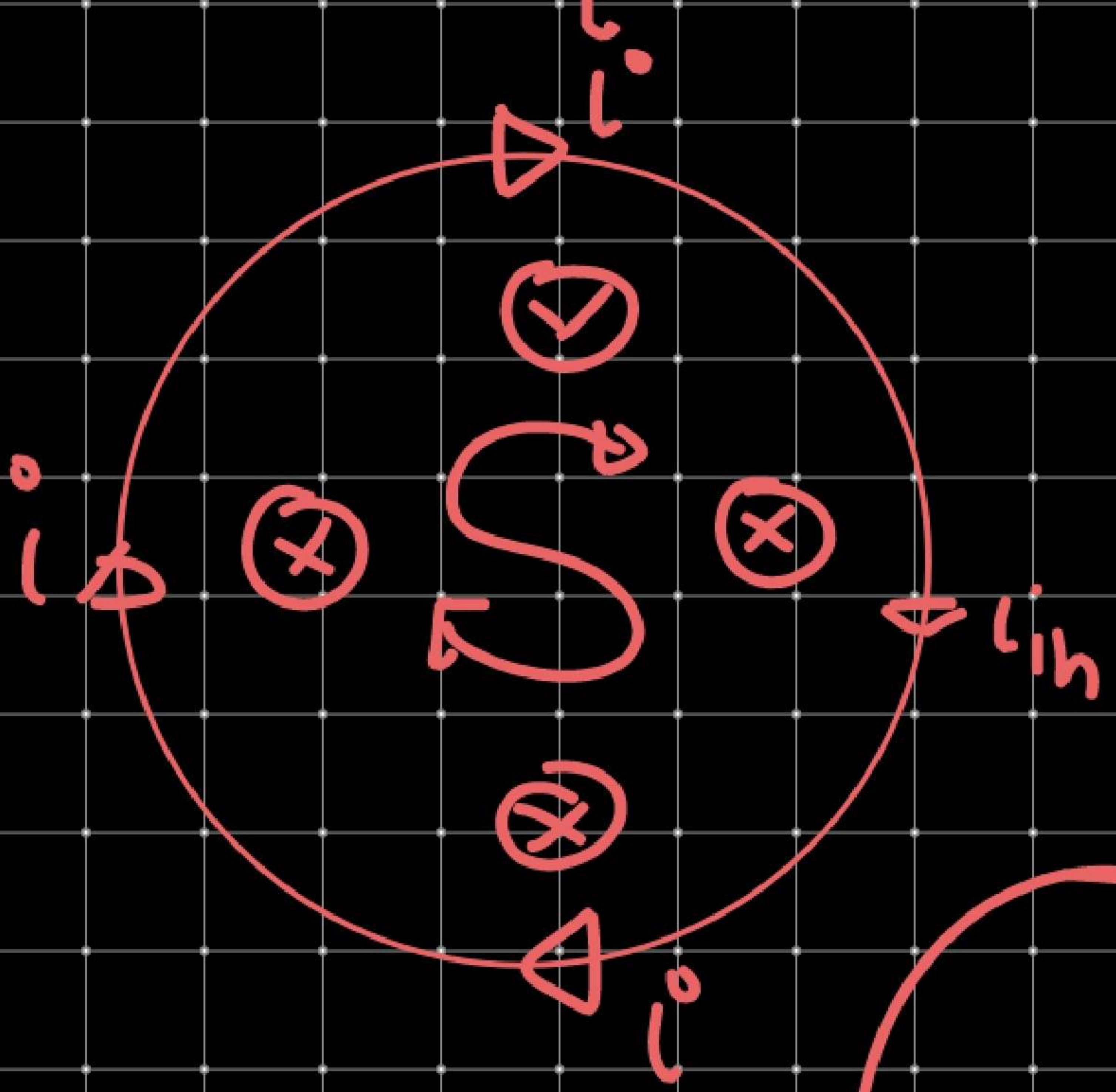
$\varepsilon_{ind} = \left| \frac{d\phi}{dt} \right|$

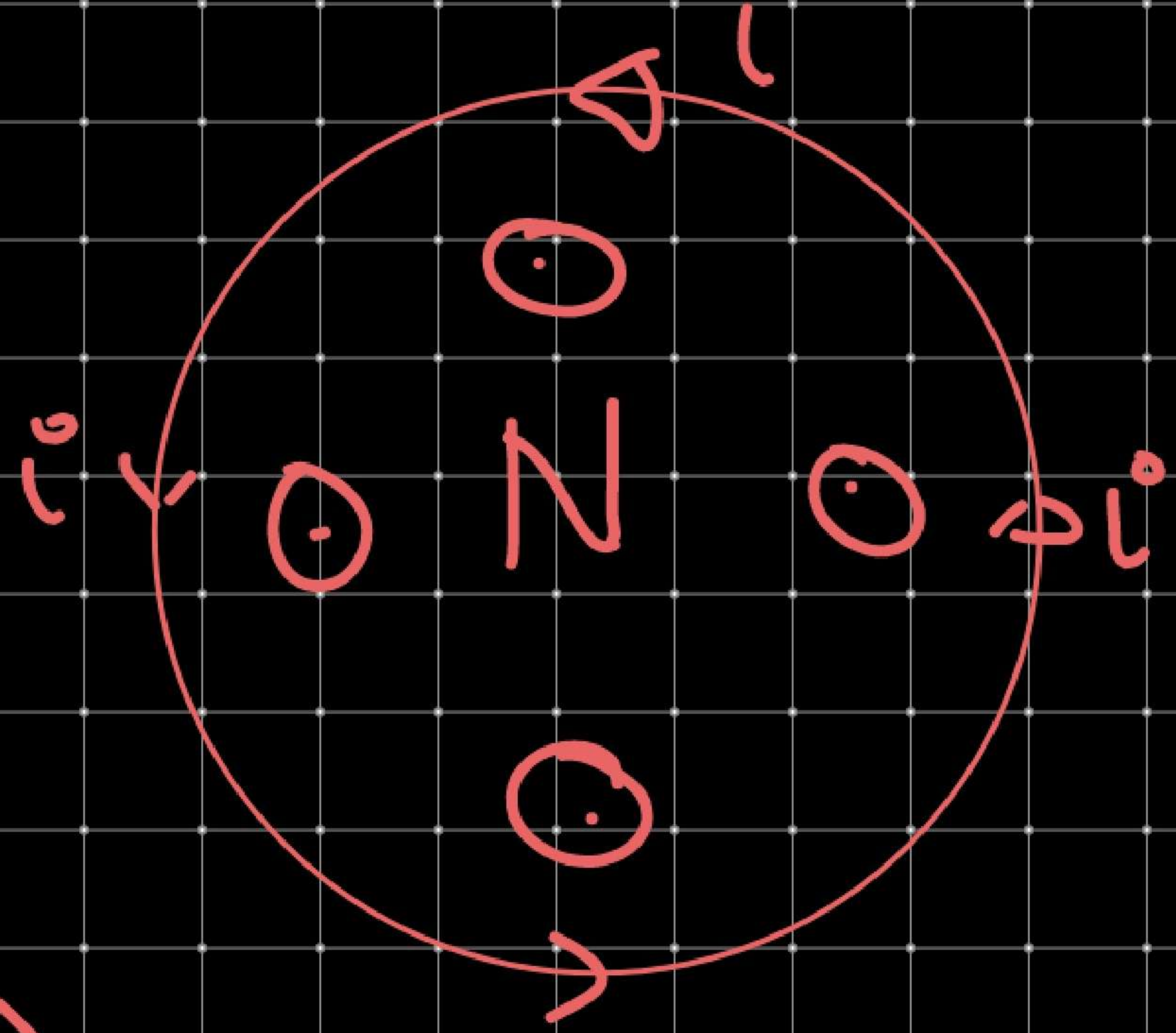


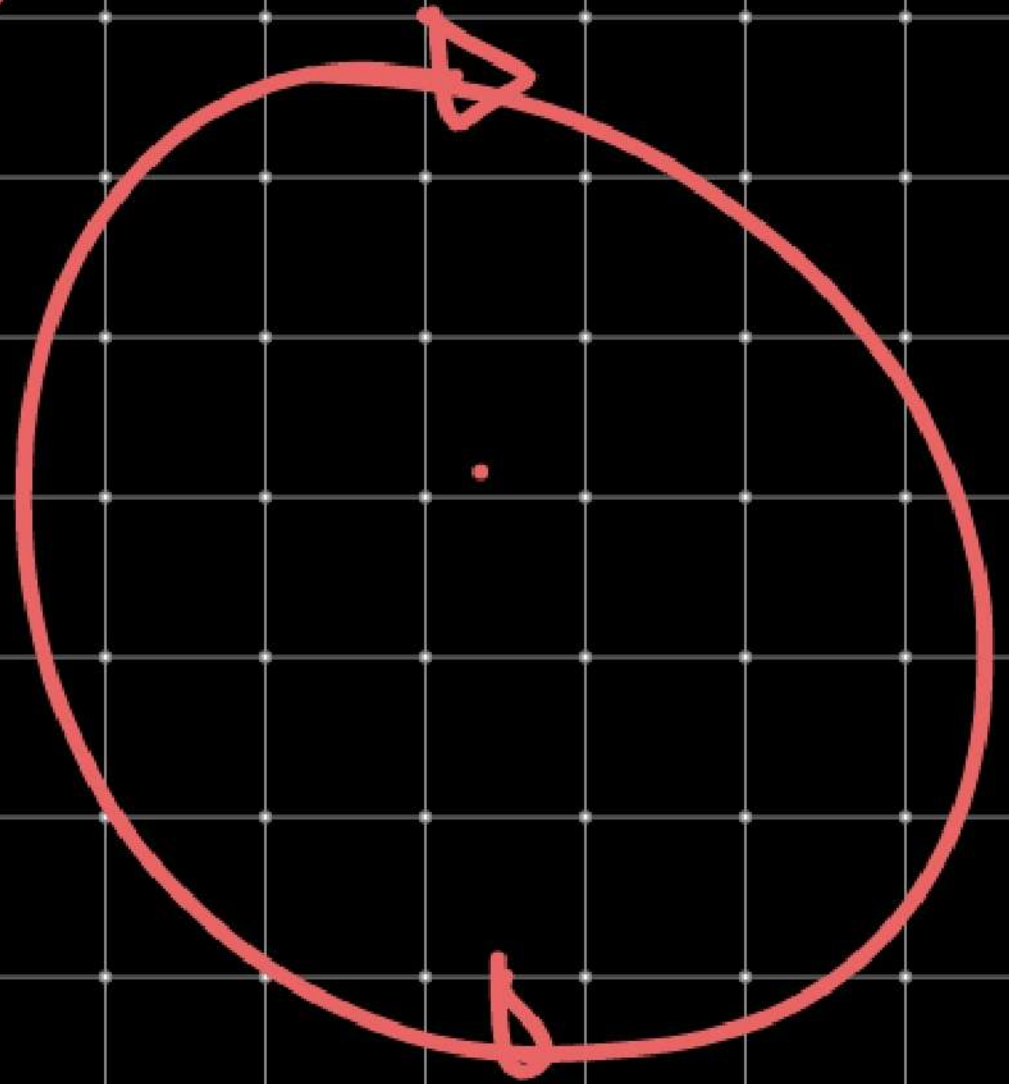


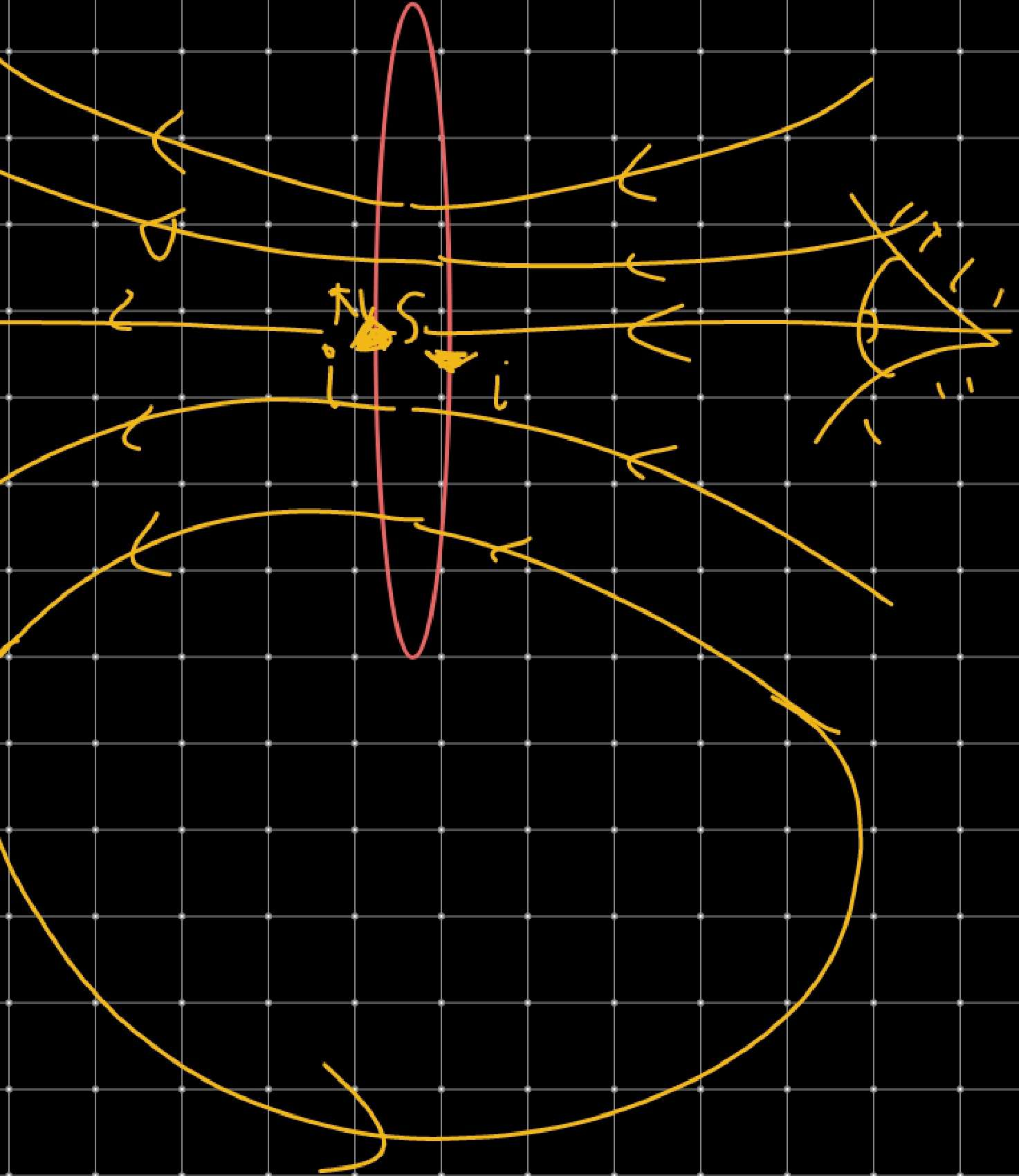


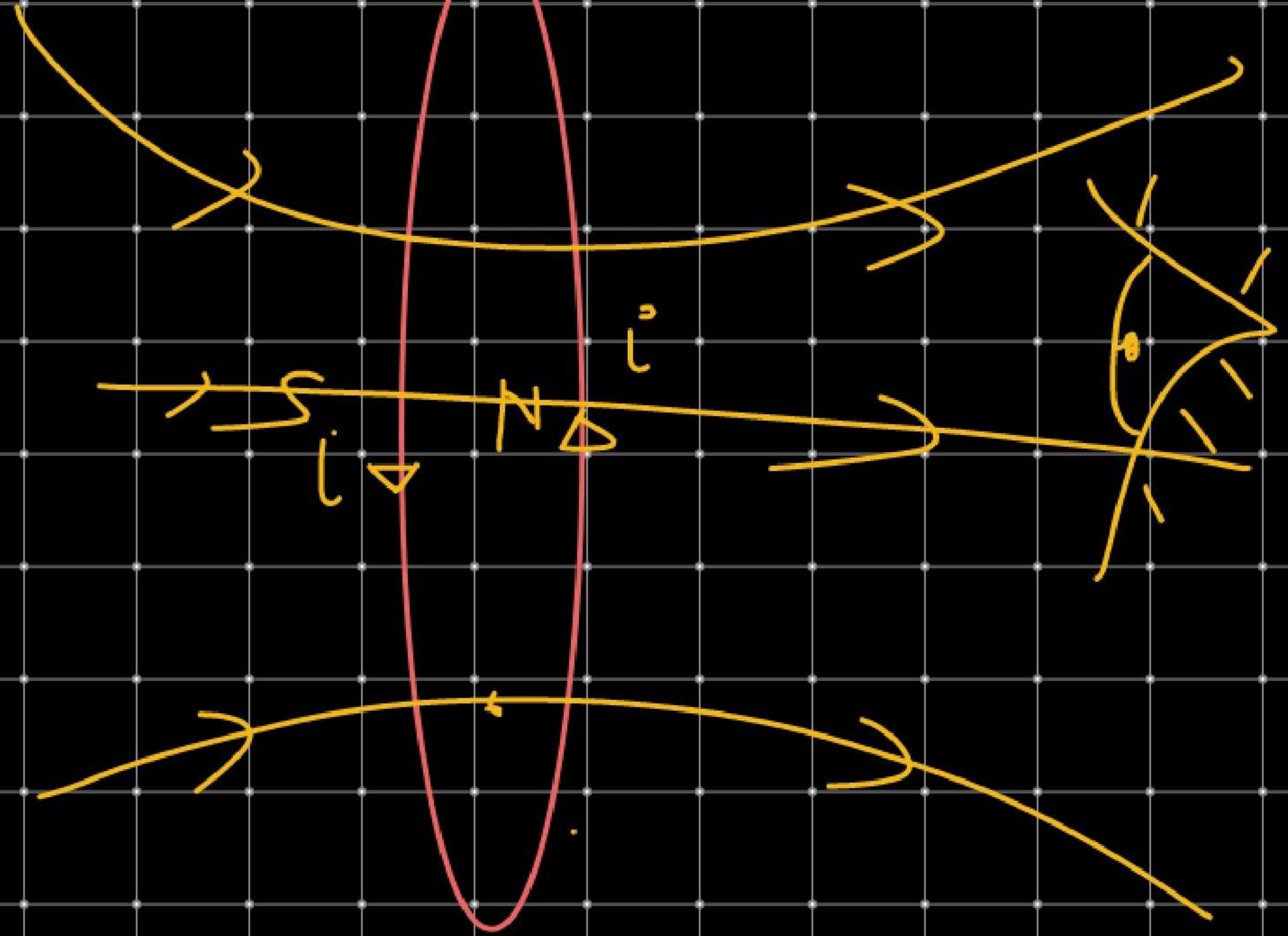
⇒ Inside the Coil


S
i


N
i




N
S
i
i


S
N
i
i

& resistance of coil is 2Ω

$A = 2\,m^2$

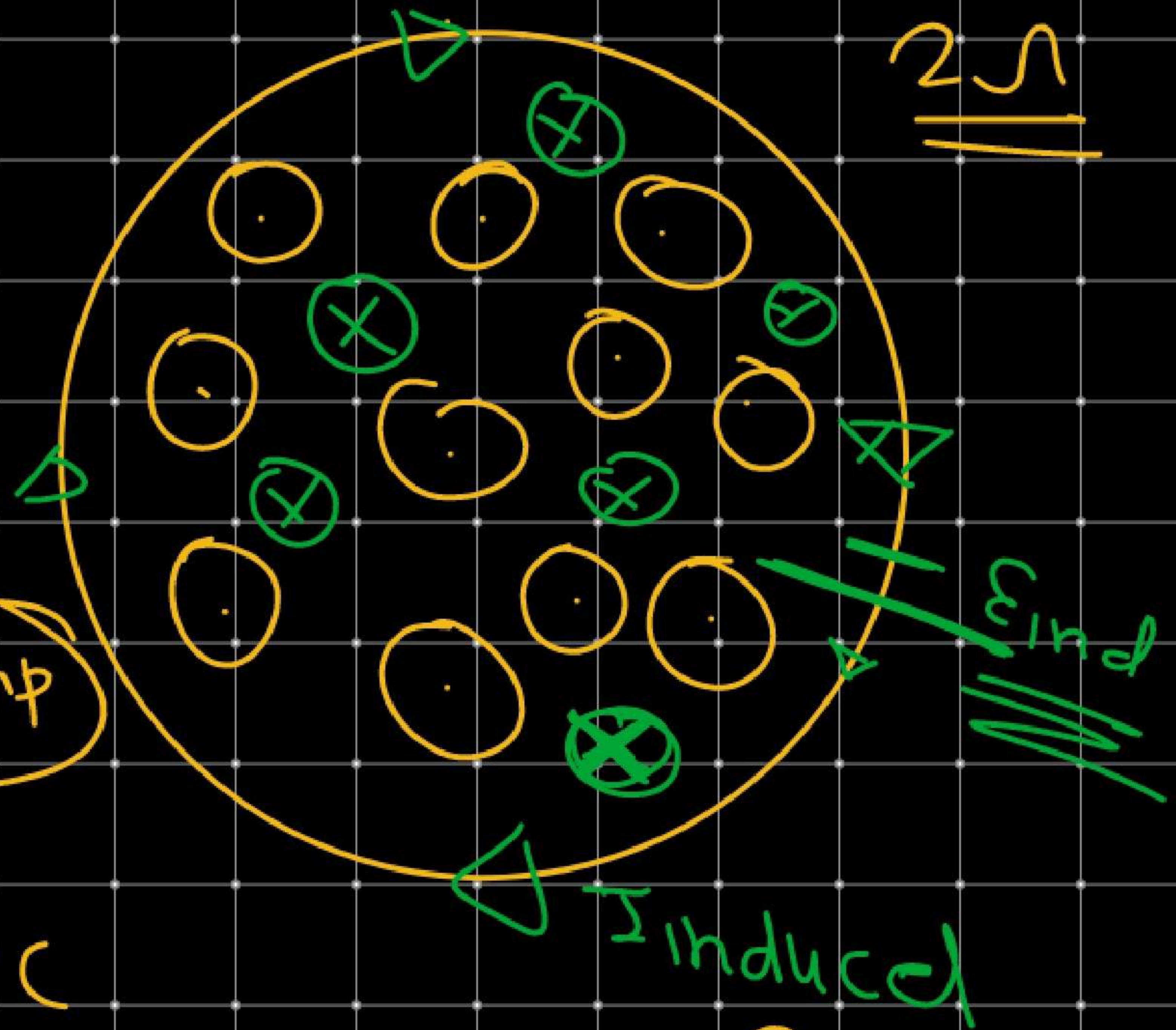
$B = 4T \odot \quad t = 0$

$\phi_i = BA\cos 0$

$\phi_i = 4 \times 2 = 8\,T\text{-}m^2 = Wb$

$t = 2\,sec \qquad B = 8T \odot$

$\phi_f = BA\cos 0 = 8 \times 2 = 16\,T\text{-}m^2 = Wb$



$\Delta t = 2\,sec$

$\Delta\phi = (16 - 8) = 8\,T\text{-}m^2 = 8\,Wb$

$\varepsilon_{ind} = \left|\frac{\Delta\phi}{\Delta t}\right| = \frac{8}{2} = 4\,\frac{T\text{-}m^2}{sec} = Volt$

$\varepsilon_{ind} = 4\,Volt$

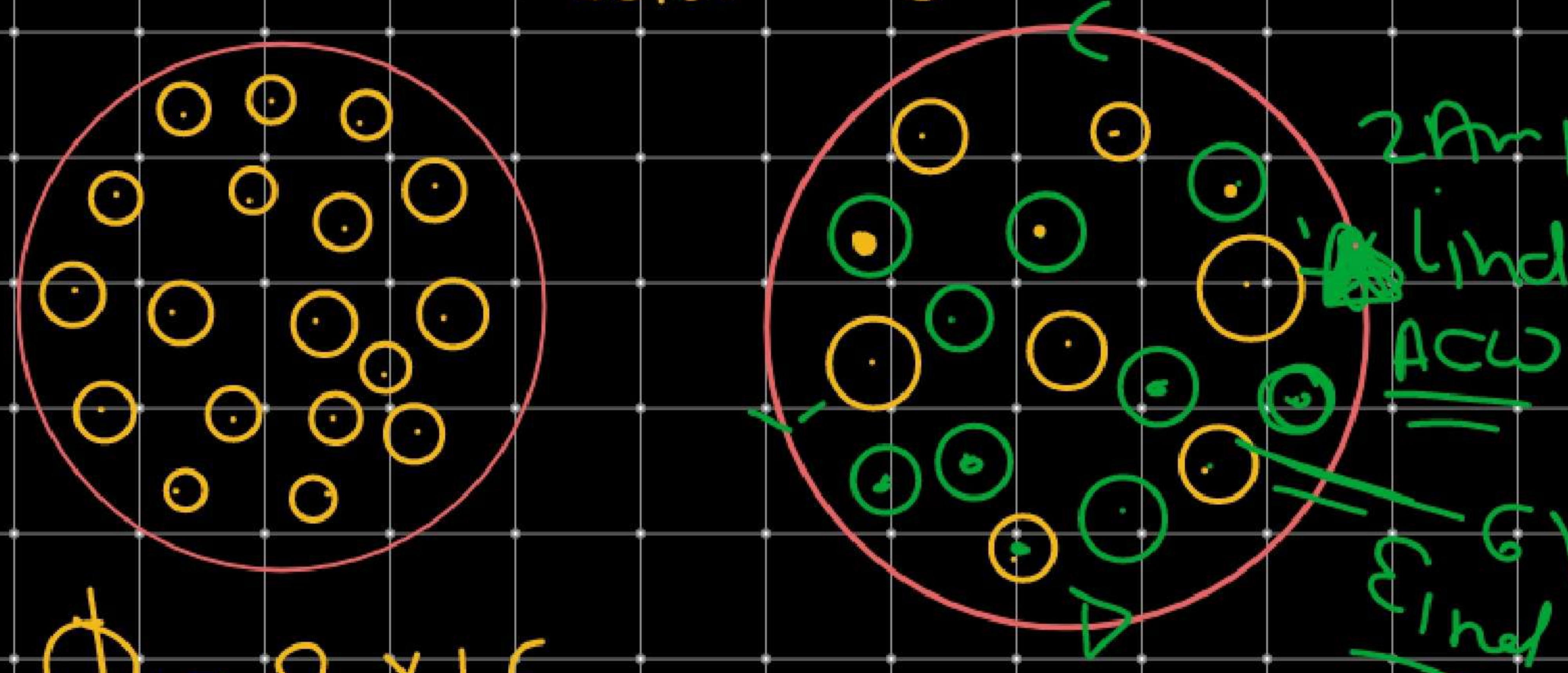
$i_{ind} = \frac{\varepsilon_{ind}}{R}$

$i_{ind} = \frac{4}{2} = 2\,Amp$

Q) Area of coil ⇒ $2m^2$.

$R_{coil} = 3\Omega$

Initial magnetic field 16T & magnetic field dec after 4 sec magnetic field become 4T find induced Emf & dirn of induced current if dirn of magnetic field is outward



$\phi_i = 2 \times 16$
$= 32\ Wb$

$\phi_f = 4 \times 2 = 8\ Wb$ Ans) 2A (ACW)

$t = 4$ sec

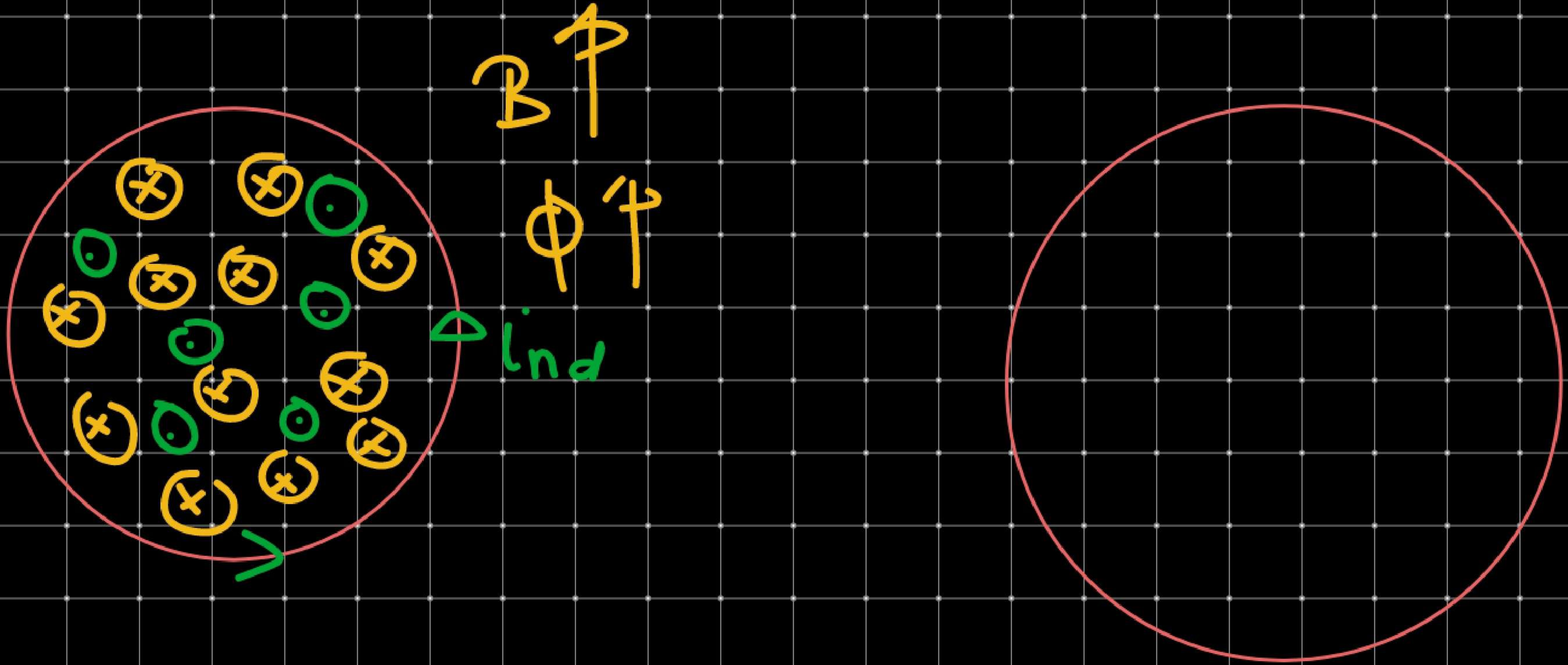
$\varepsilon_{ind} = \left|\frac{\Delta\phi}{\Delta t}\right|$

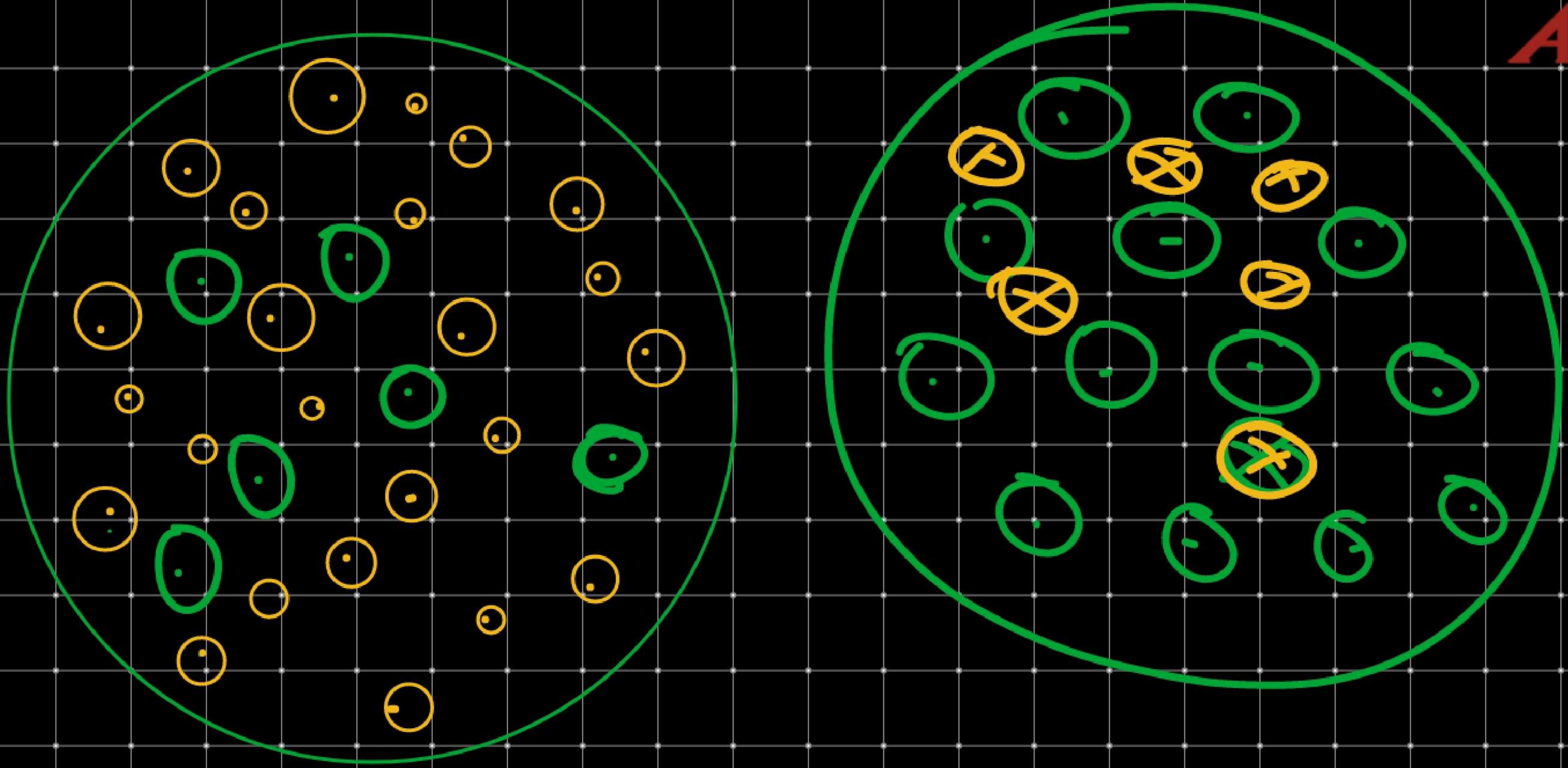
$= \left|\frac{24}{4}\right| = 6\ Volt$

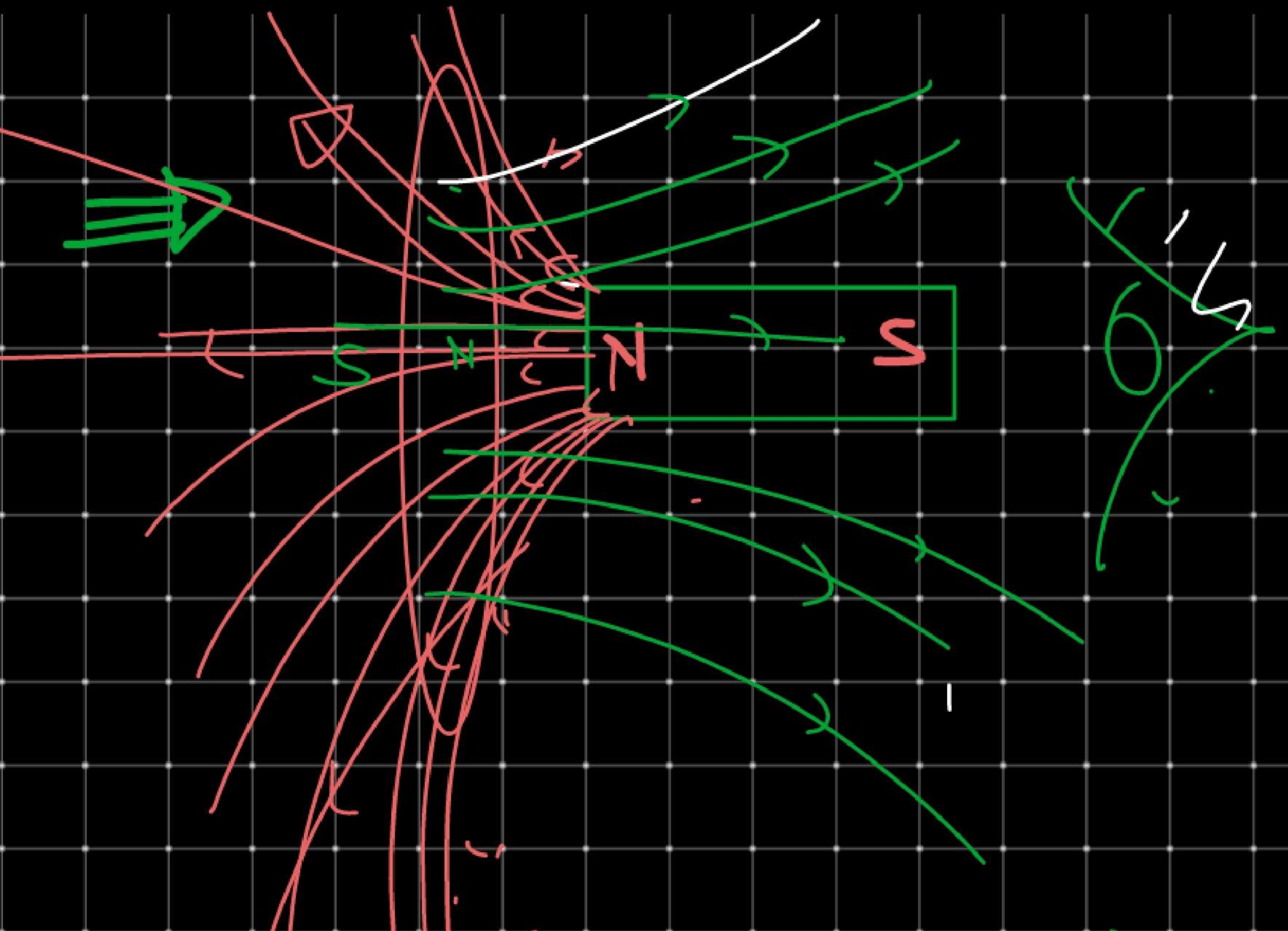
$i_{ind} = \frac{6}{3} = 2\ Amp$

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

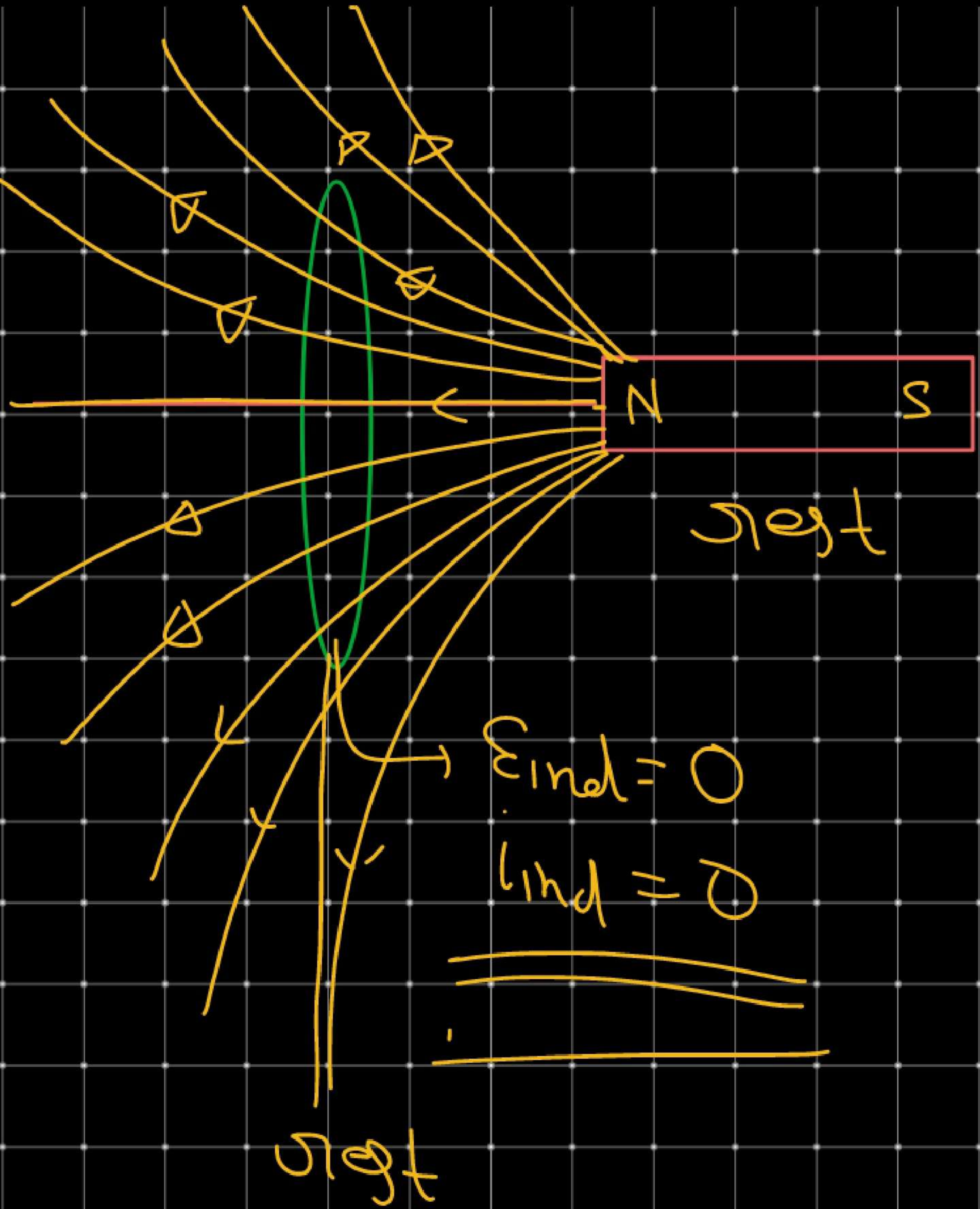
$i_{ind} = \frac{\varepsilon_{ind}}{R} = \frac{1}{R}\left(-\frac{d\phi}{dt}\right)$

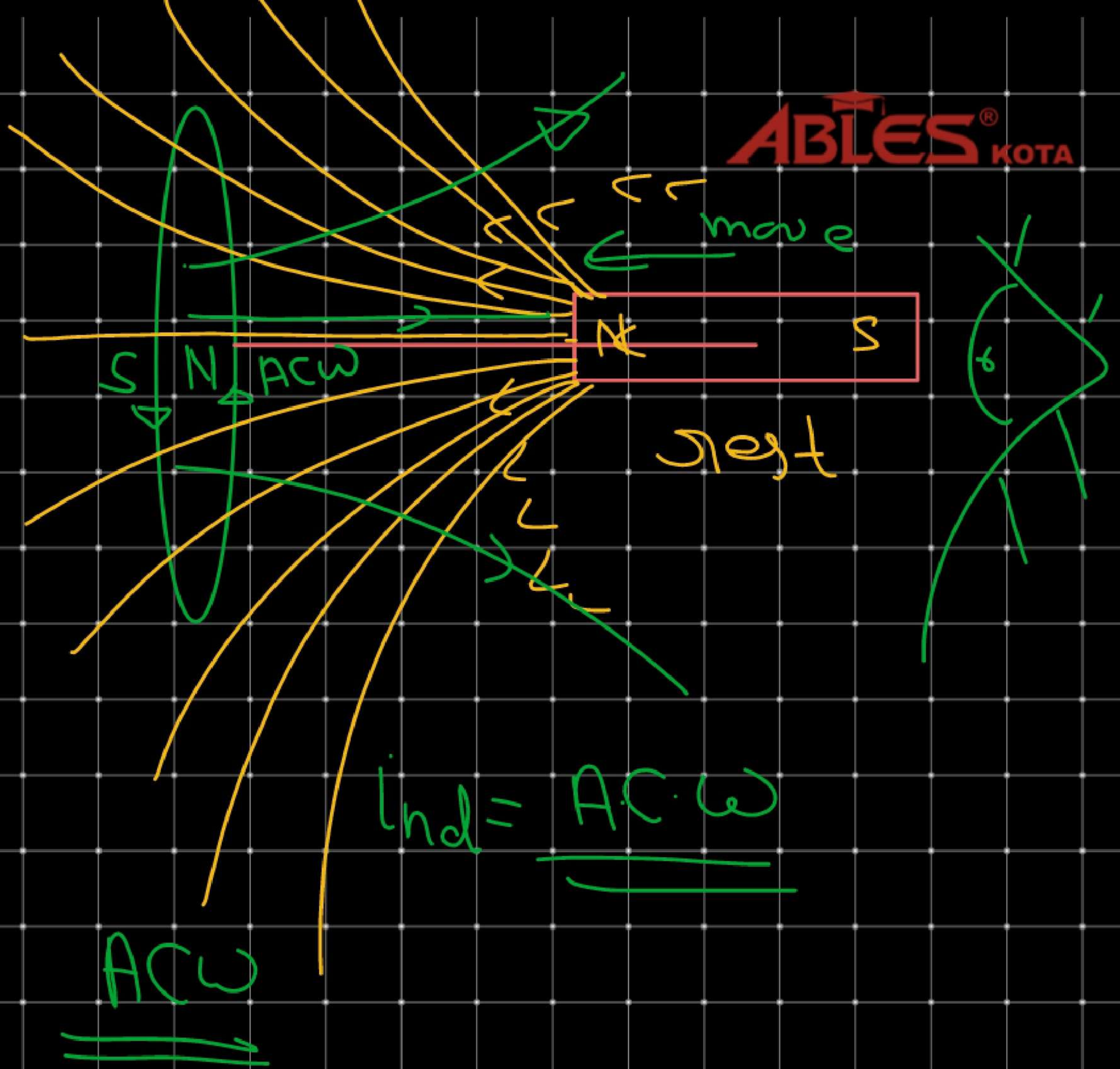

B ↑
φ ↑
ind

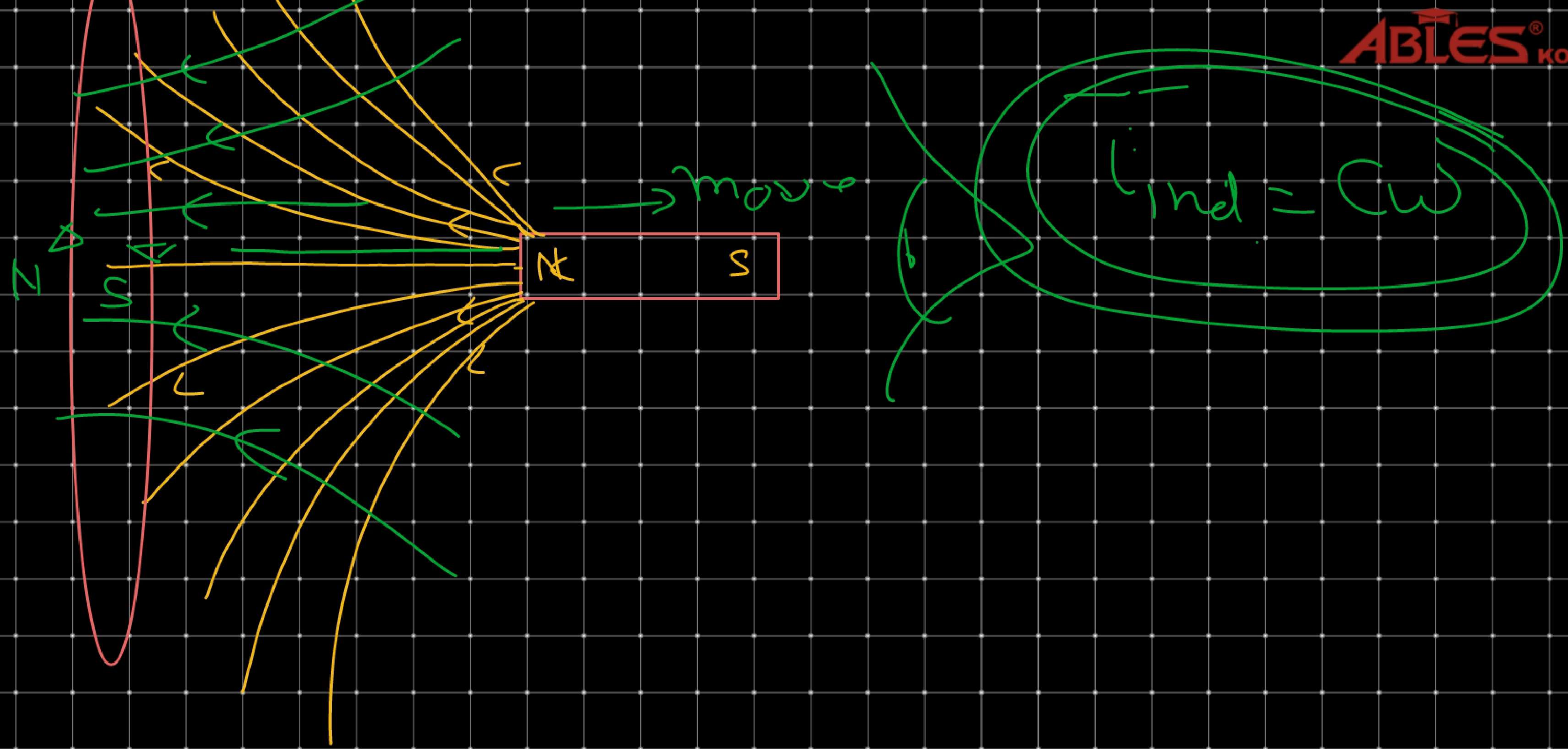


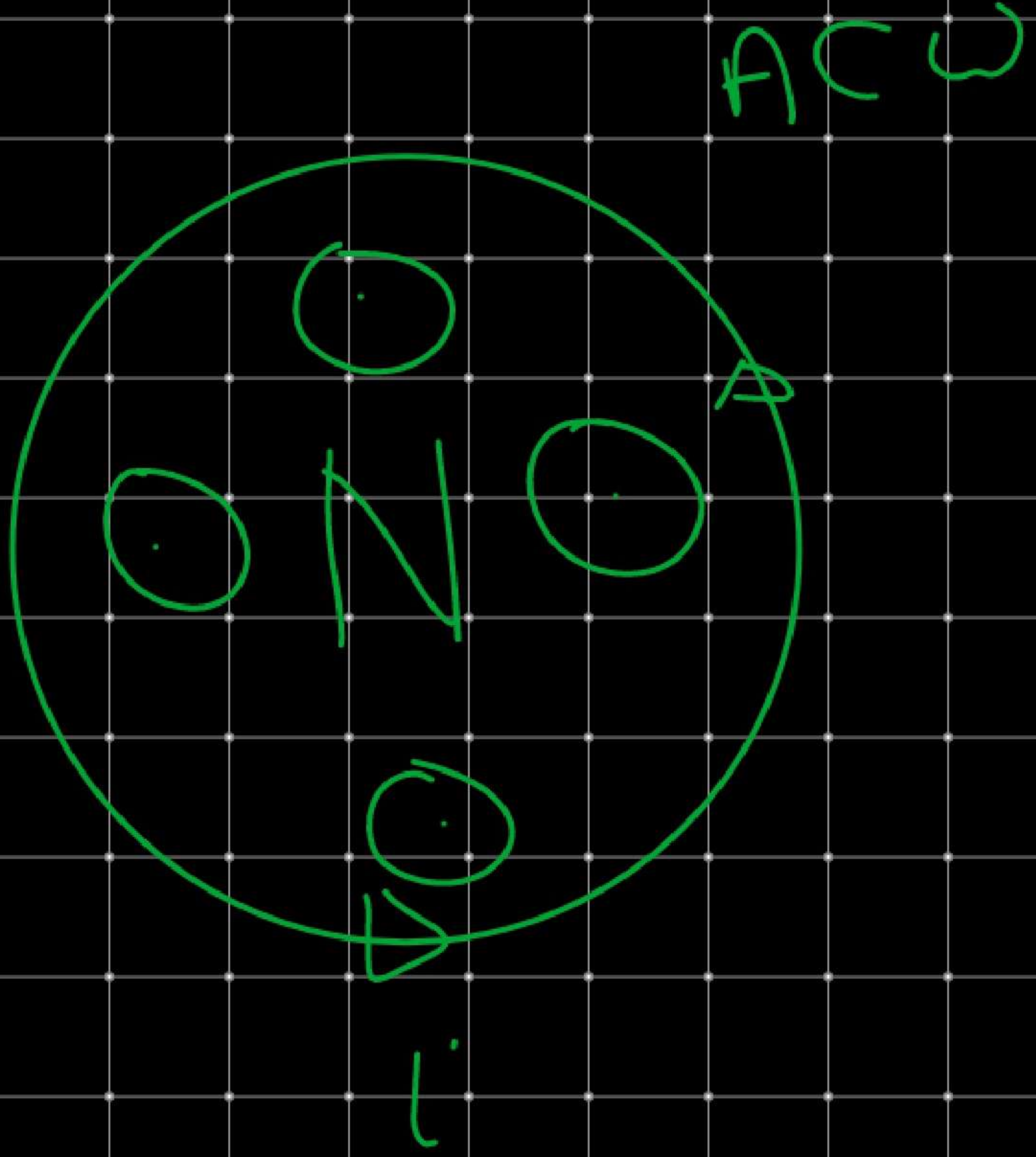


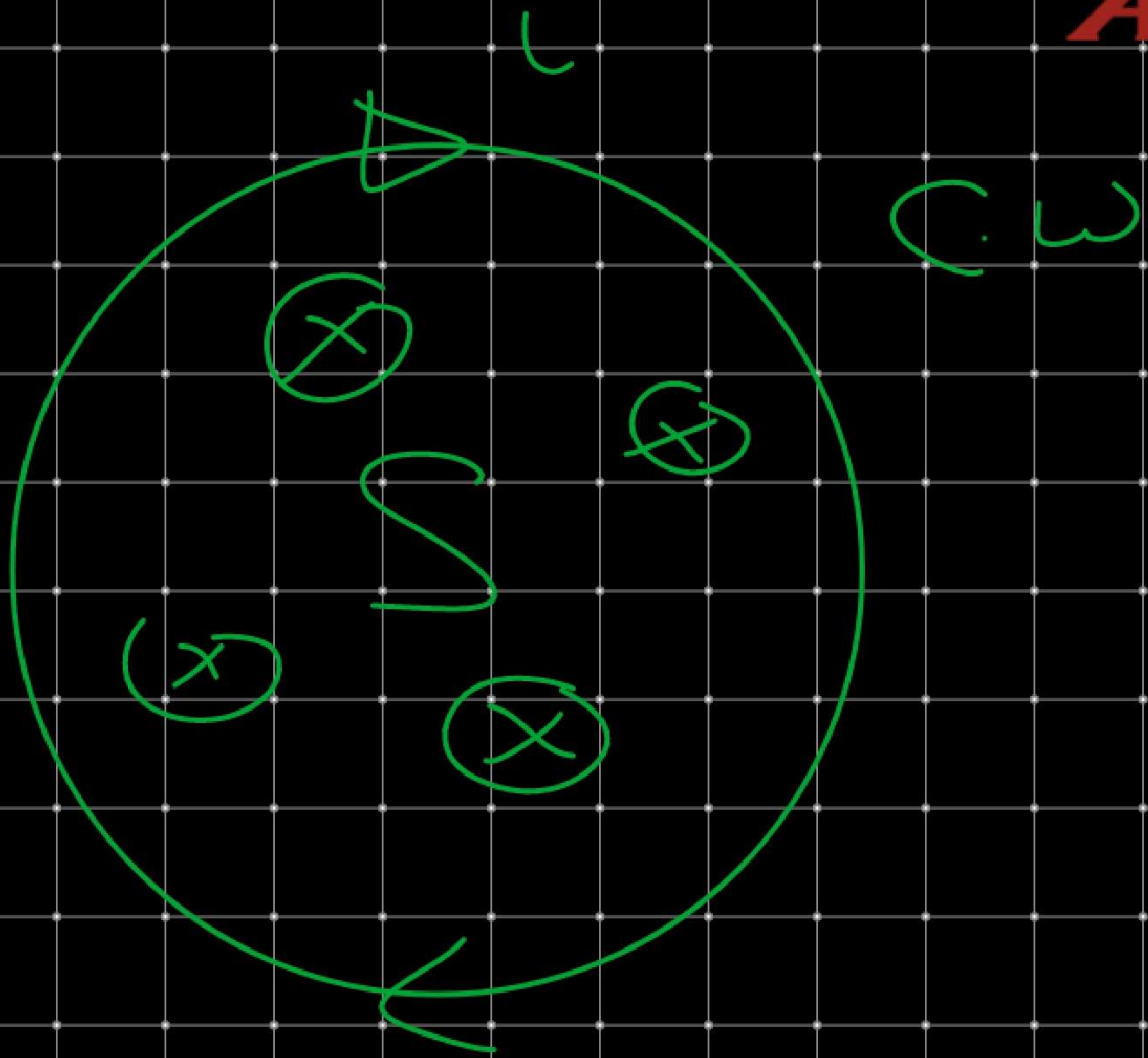
$$\varepsilon_{ind} = \left| \frac{d\phi}{dt} \right|$$


N
S
rest
rest
Eind = 0
iind = 0


move
N
S
rest
S
N
ACW
iind = A.C.W
ACW


N
S
N
S
move
$i_{ind} = CW$


ACW
N
i


i
CW
S

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

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