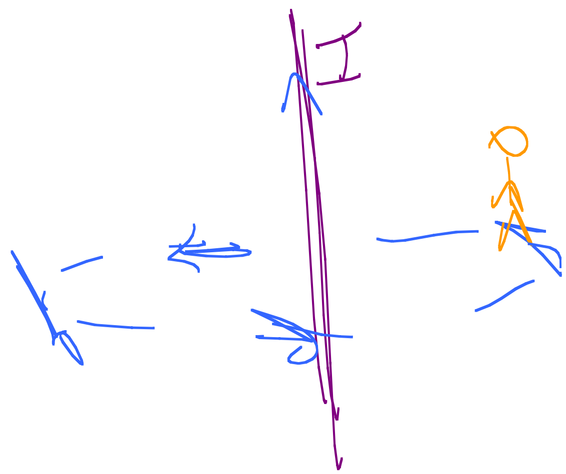
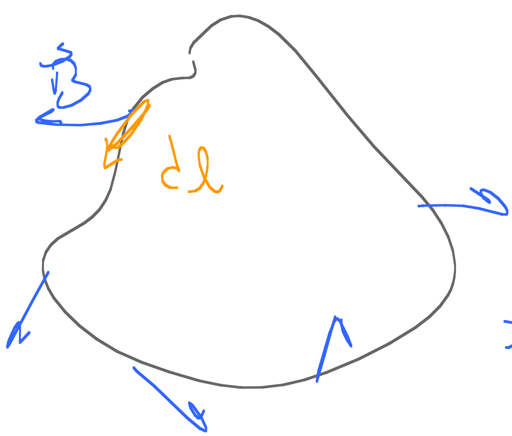
Phys 2120 - 4 10/12/12

Note Title 10/12/2012

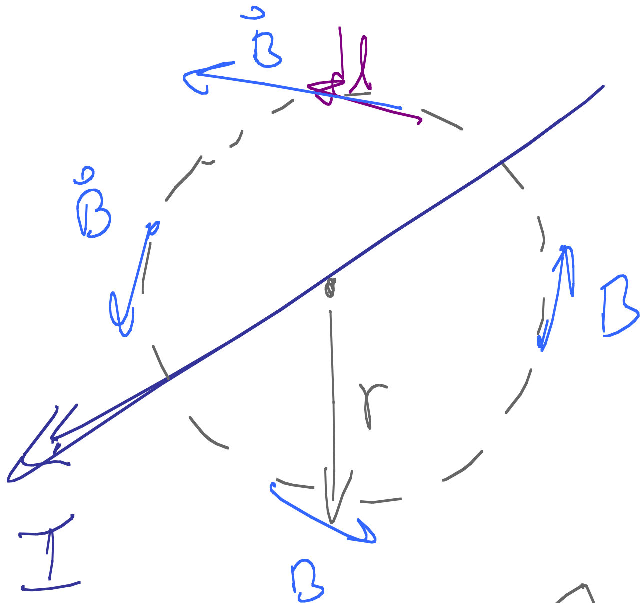
# Magnetism




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




$\vec{B} \cdot d\vec{\ell} \longrightarrow \oint \vec{B} \cdot d\vec{\ell}$ line integral of $\vec{B}$ field

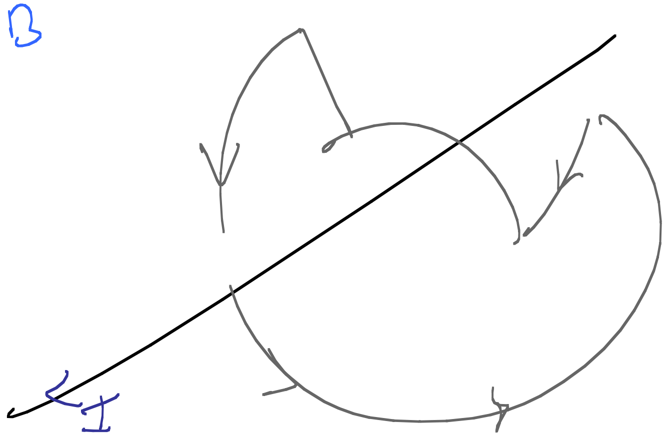


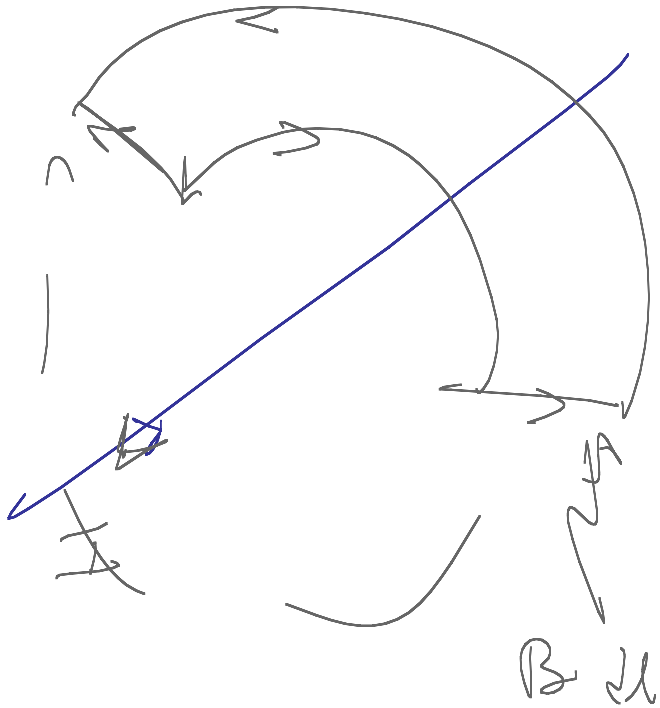

$\oint \vec{B} \cdot \vec{dl}$ easy

$$= \frac{\mu_0 I}{\cancel{2\pi r}} \cancel{2\pi r} = \mu_0 I$$

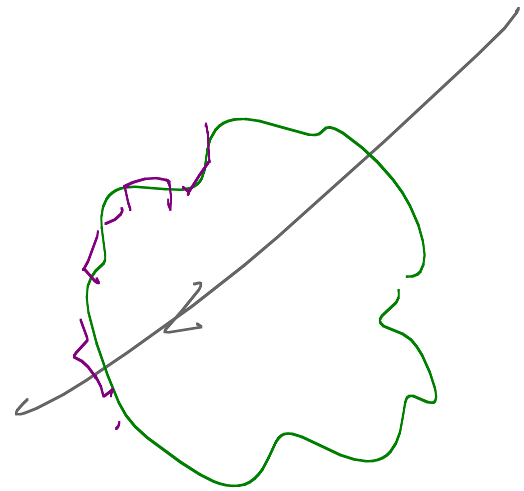
$$\int \vec{B} \cdot dl = \mu_0 I$$

Try:



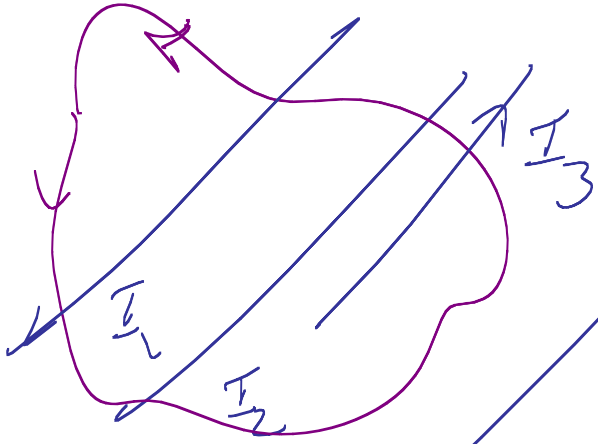



$$\oint \vec{B}\cdot d\vec{l} = 0$$



Wire.

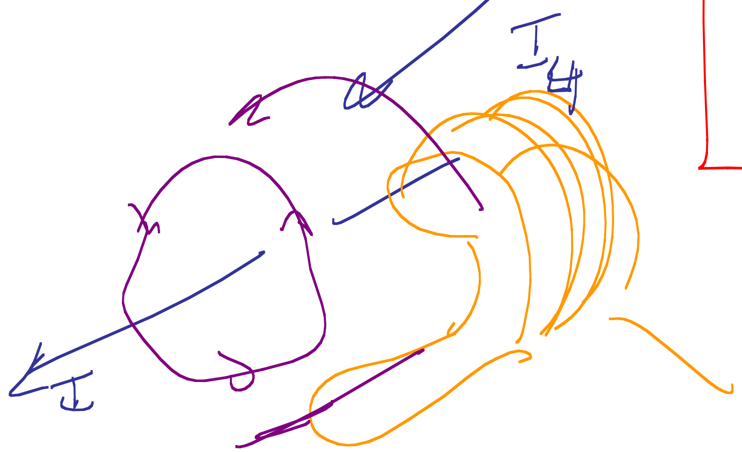
$$\oint \vec{B}\cdot d\vec{l} = \mu_0 I_{encl.}$$



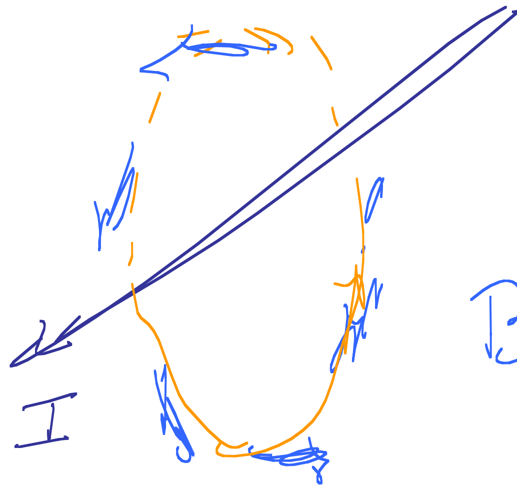

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{encl_{Total}}$$

$$= \mu_0 (I_1 + I_2 - I_3)$$

$$\boxed{\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enc}}$$



Ampère's Law

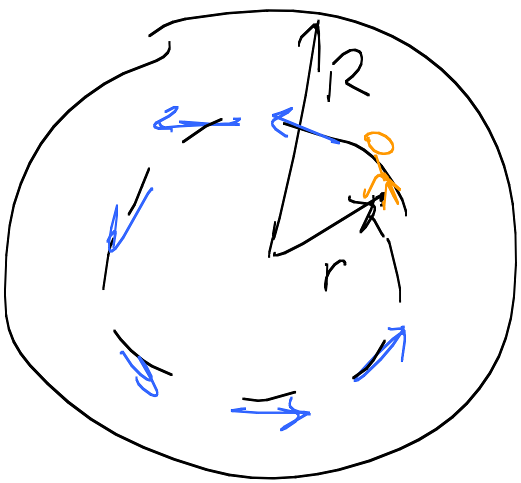


$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I$$

$$B \cdot 2\pi r = \mu_0 I$$

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

# Magnetic Inside Fat Wire




$r < R$

$$\oint \vec{B}\cdot d\vec{l}$$

$$= B(2\pi r)$$

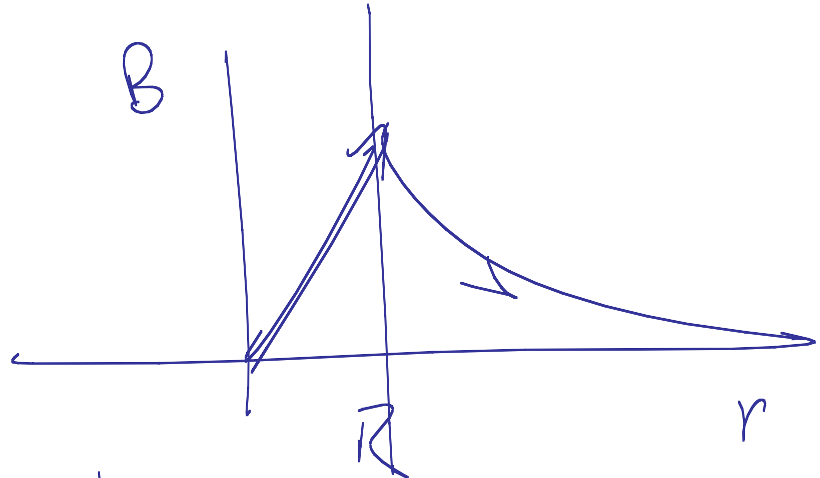
$$= \mu_0 I_{enc} = \mu_0 \underbrace{\pi r^2 \left(\frac{I}{\pi R^2}\right)}_{J} = \frac{\mu_0 r^2 I}{R^2}$$


$I$

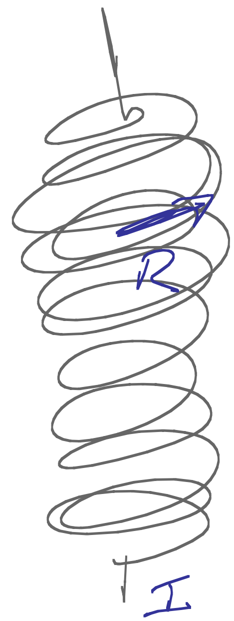
$A = \pi R^2$

$$J = \frac{I}{A} \cdot \frac{I}{\pi R^2}$$

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




## Solenoid

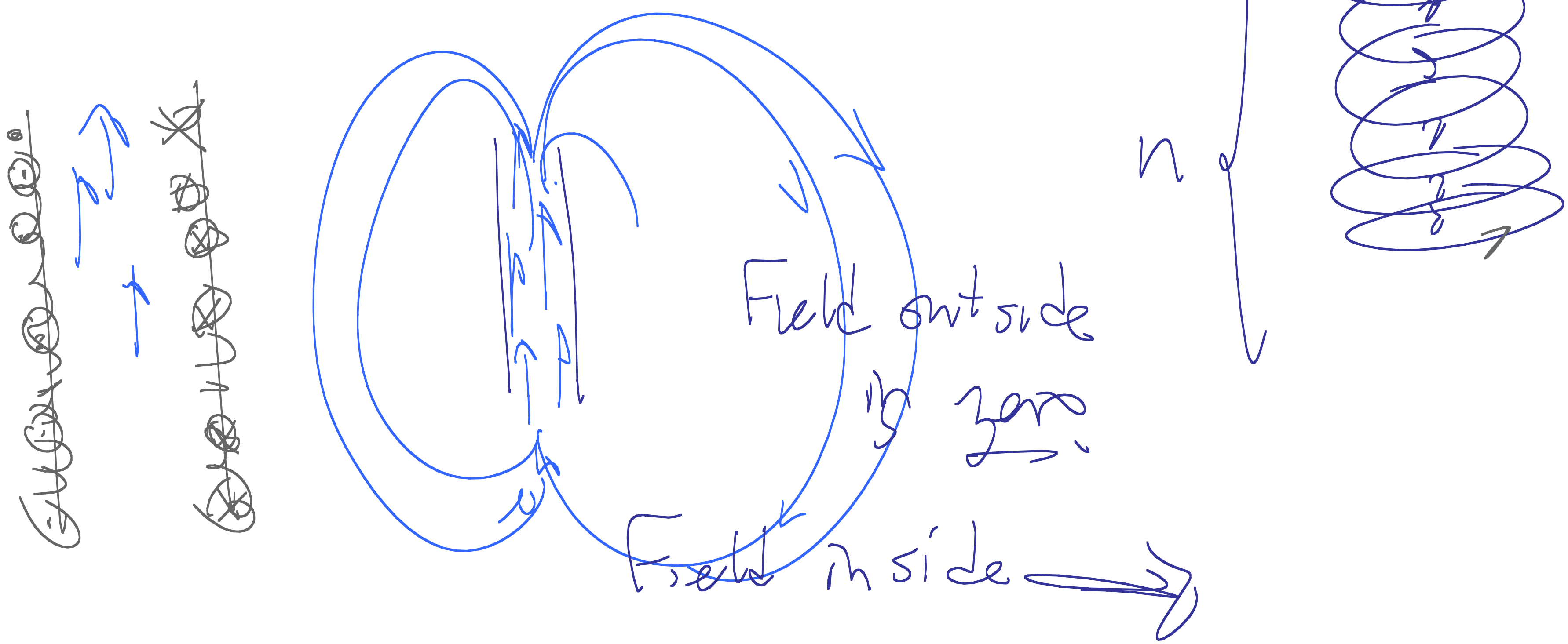


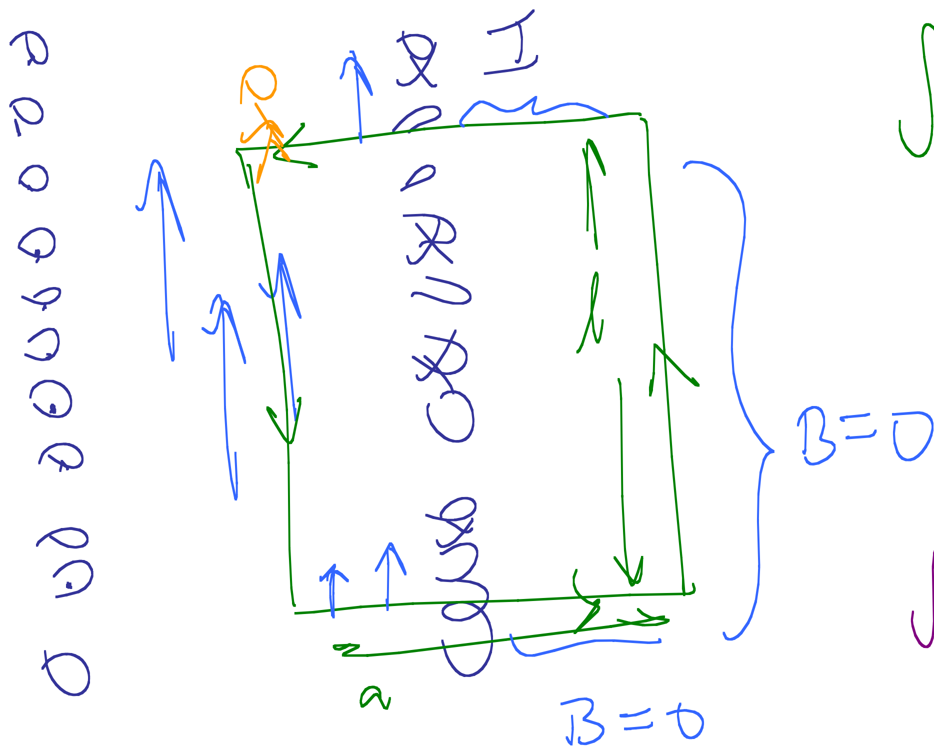

Length >> radius

Infinite!

$$n = \frac{\# \text{ turns}}{\text{length}} \quad \left(\frac{1}{m}\right)$$

We want B inside B field outside.






$$\int \vec{B}\cdot\vec{dl} = \mu_0 I_{encl}$$

B field uniform on inside.

$$\int \vec{B}\cdot\vec{dl} = -Bl = \mu_0 I_{encl}$$

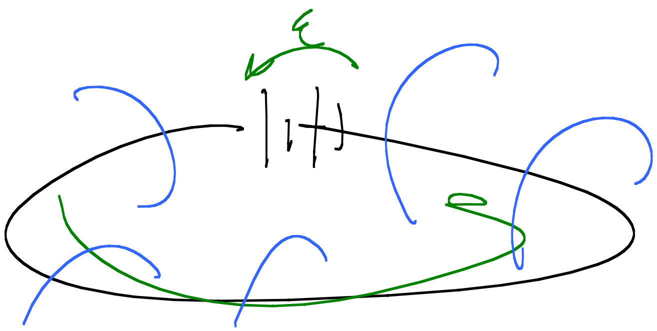
Into board

$$= -\mu_0 n l I$$

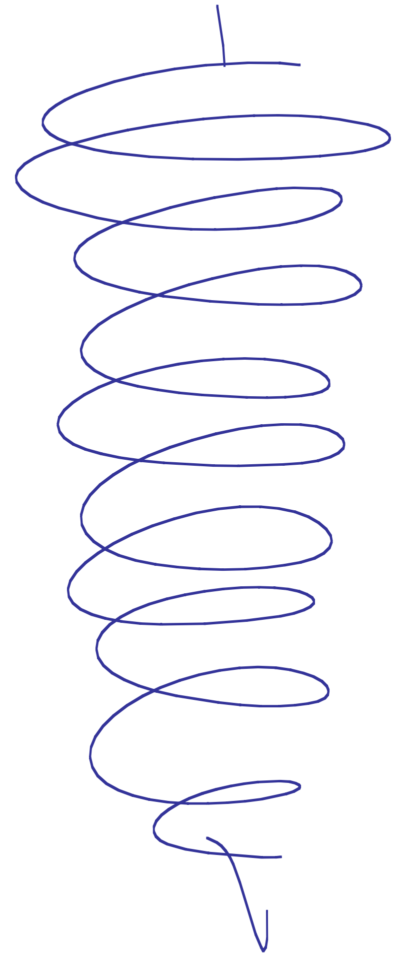
Equates $B = \mu_0 n I$

## Chap 27 EM Induction

Are $\vec{E}$ & $\vec{B}$ related?




Yes in an obscured

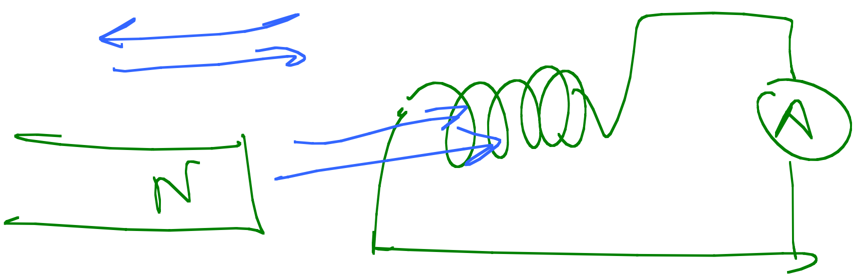


## Several expts

0) hold magnet in front

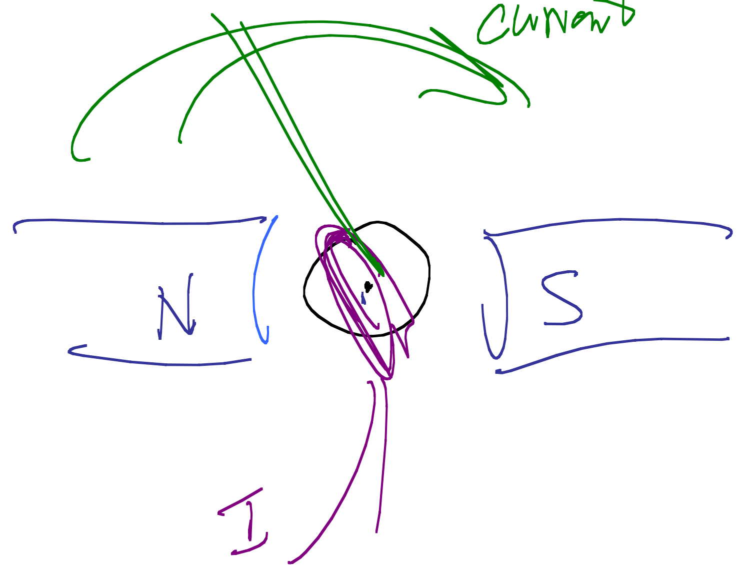

nothing happens.

1)

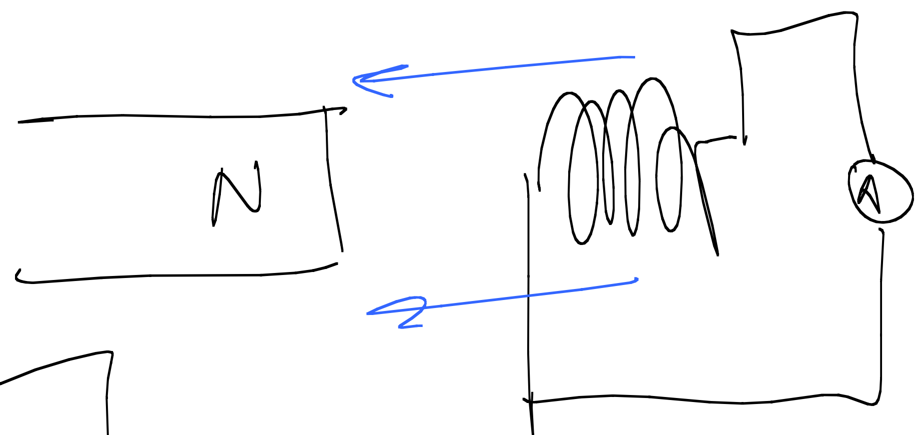



When magnet is in motion, current

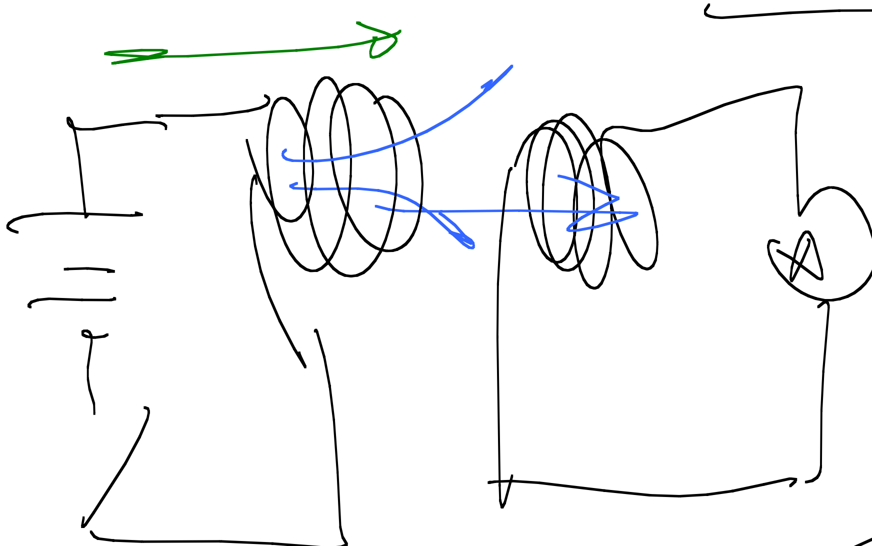
## Galvanometer



2) Get current if coil is motion.



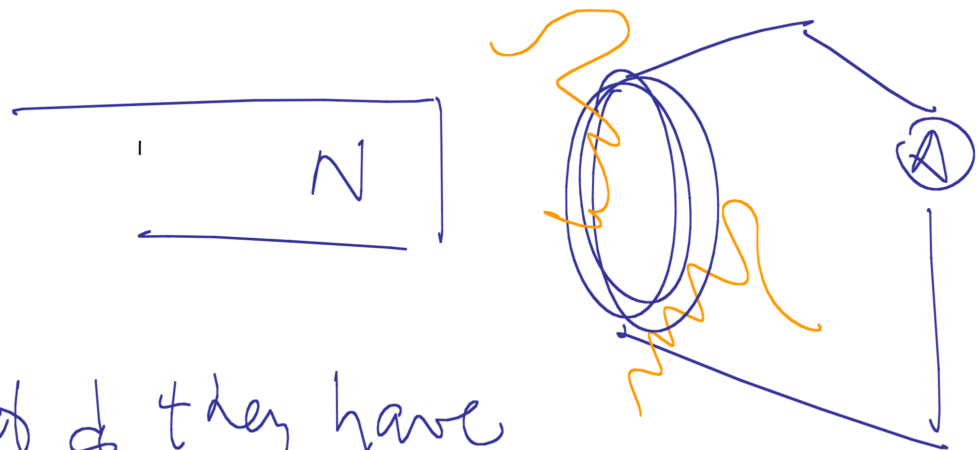

3)




Throw switch, get current in second

EM Induction.

Induced current




Change shape $\Rightarrow$ Get current.

What do they have in common.

Changing $\vec{B}$ field around $2^{nd}$ coil $\Rightarrow$ Induced current.

$$\Phi_B = \int_S \vec{B}\cdot d\vec{A}$$