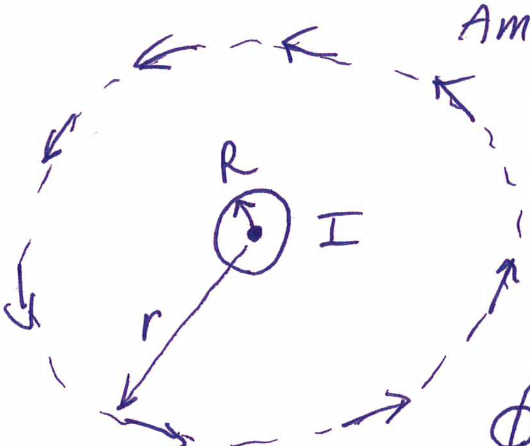
Ampère Law : Infinite Wire



$\vec{B} \parallel \vec{dl}$

$$\oint \vec{dl} \cdot \vec{B} = 2\pi r B = \mu_0 I_{enc.}$$

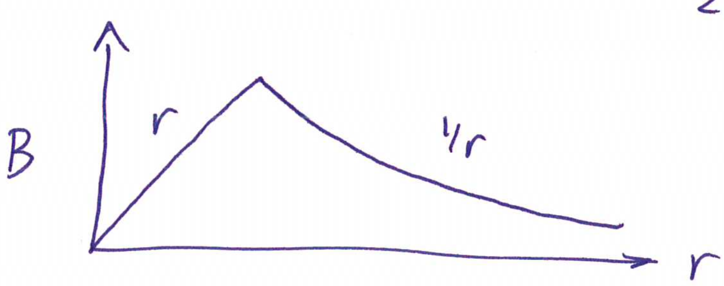
$$B = \frac{\mu_0 I_{enc}}{2\pi r} \qquad r > R$$

$$j = \text{current density} = \frac{I}{\pi R^2}$$

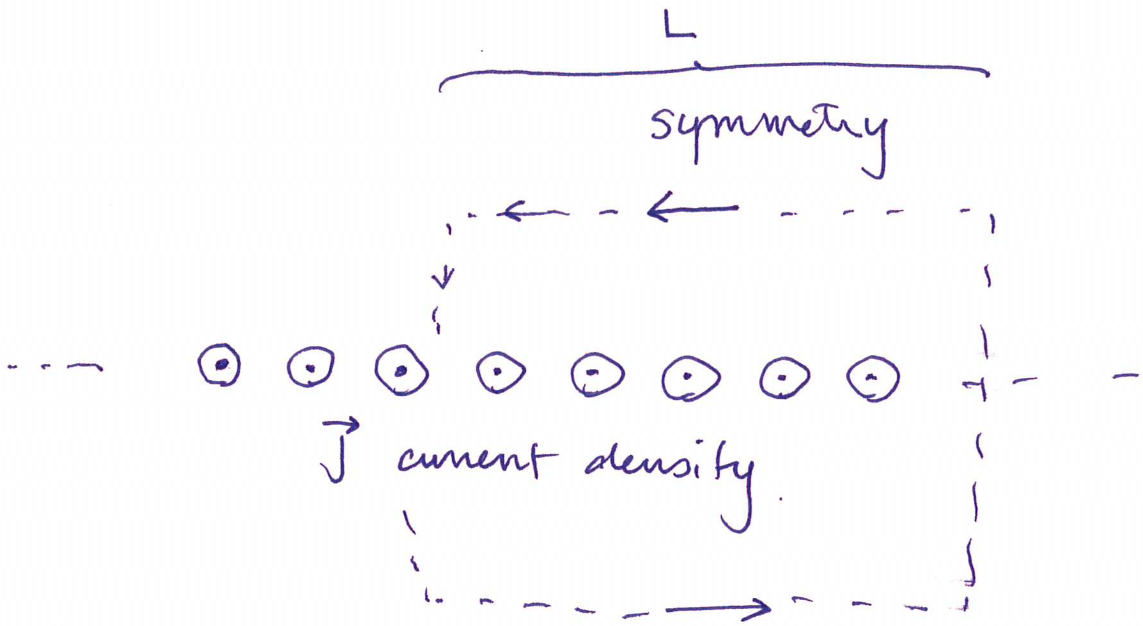
$r < R$

$$2\pi r B(r) = \mu_0 \frac{I}{\cancel{\pi} R^2} \cancel{\pi} r^2$$

$$B(r) = \frac{\mu_0 I_0}{2\pi r} \begin{cases} \frac{r^2}{R^2}, & r < R \\ 1, & r > R \end{cases}$$



Ampère Law: infinite plane



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

symmetry.

$$B\, 2L = \mu_0 L\, n\, I$$

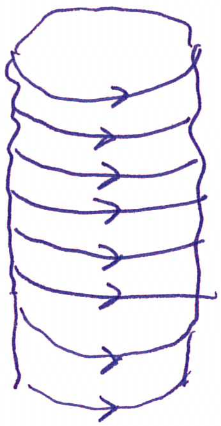
wire density.

$$B = \frac{\mu_0 n I}{2}$$

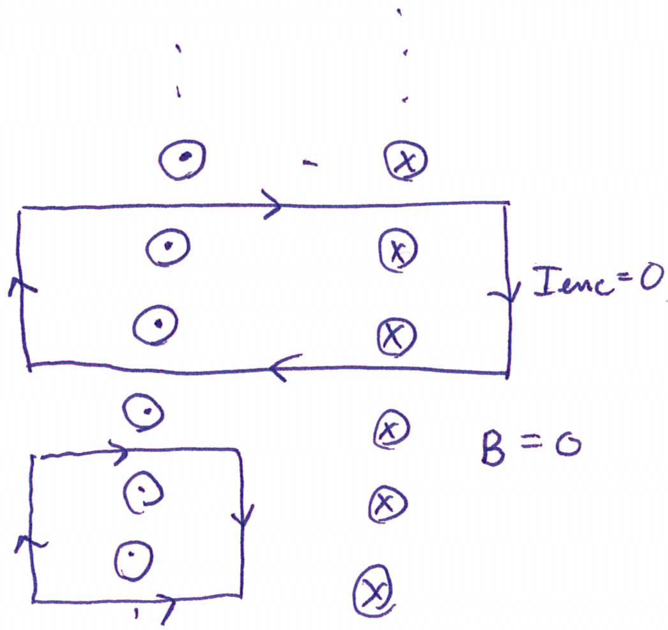
analogous to:

$$\left(E = \frac{\sigma}{2\varepsilon_0} \right)$$

Ampère Law "Solenoid" ∞



n = wire density.



$$\boxed{B = \mu_0 I n}$$

no $\frac{1}{2}$

analogus to

$E_\perp$ from a conductor:

$$E_\perp = \frac{\sigma}{\varepsilon_0} \quad \text{vs} \quad E = \frac{\sigma}{2\varepsilon_0}$$

plane of charge