Ampere's law and the derivation of magnetic field due to current carrying wire

Objective

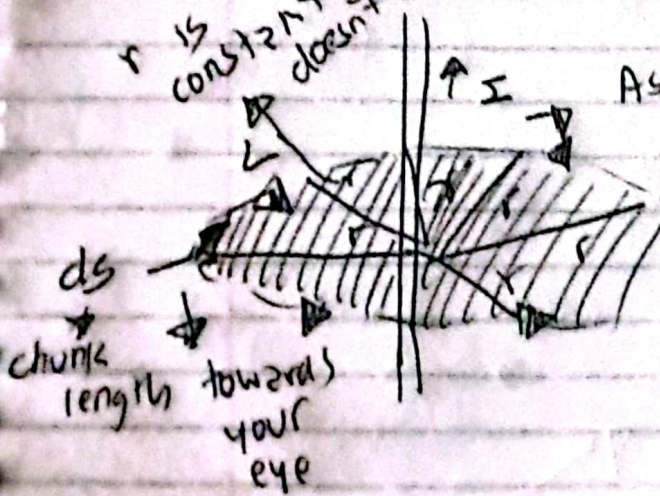
Use ampere's law and symmetry arguements & Right hand rule to relate $\vec{B}$ field to current for planer or cylindrical symmetries

Ampere's law

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I$$ ← current puncturing that loop

closed form

example



As current goes up, it punctures the surface loop

$\cos(0) = 1$

$\oint B \cdot ds$ $B \parallel s$, $\oint B \cdot ds = \oint B\, ds$

$= B \oint ds = B \cdot 2\pi r$

Ampere law to bion sevart law

$$\oint B \cdot ds = \mu_0 I$$

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

$$B \int ds = \mu_0 I$$

$$B [2\pi r] = \mu_0 I$$