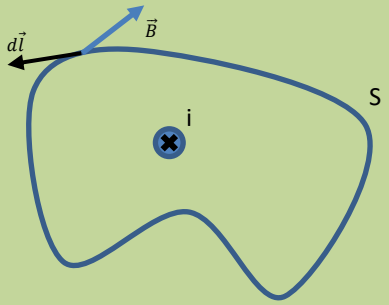
CONCEPT: AMPERE'S LAW WITH CALCULUS

- ANY magnetic field, $\vec{B}$, must satisfy the following equation:

$$\oint_S \vec{B} \cdot d\vec{l} = \_\_\_\_\_$$

- Known as Ampere's Law



- Like for Gauss' law, the magnetic field depends ONLY on the current enclosed by an "Amperian loop".

EXAMPLE: Using Ampere's law, find the magnetic field due to an infinitely long, current-carrying wire.

EXAMPLE: MAGNETIC FIELD DUE TO A SOLENOID

What is the magnetic field along the axis of a solenoid?

PRACTICE: MAGNETIC FIELD DUE TO SOLID, CYLINDRICAL CURRENT-CARRYING CONDUCTOR

A solid, cylindrical conductor carries a uniform current density, $\boldsymbol{J}$. If the radius of the cylindrical conductor is $\boldsymbol{R}$, what is the magnetic field at a distance $\boldsymbol{r}$ from the center of the conductor when $\boldsymbol{r} < \boldsymbol{R}$? What about when $\boldsymbol{r} > \boldsymbol{R}$?