Ampère's law is the magnetic field equivalent to Gauss' law:

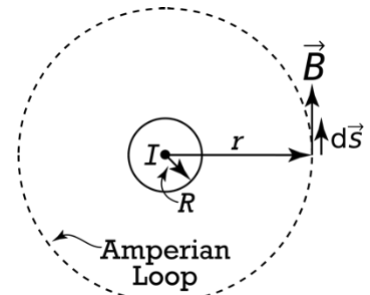$$\Phi_E = \oint \vec{E} \cdot d\vec{A} = \frac{q_{in}}{\varepsilon_0}$$

- Gauss' law:
  - Closed surface integral and charge inside a Gaussian surface.

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{in}$$

- Ampère's law:
  - Closed loop integral and current inside an Amperian loop.

Example: Determine the magnitude of the magnetic field outside an infinitely long, straight, wire with radius R and current I.

Start by drawing an Amperian loop in the shape of a circuit of radius $r \geq R$ which is concentric with the wire. And let's use Ampère's law.

$$\Rightarrow \oint B ds \cos\theta = \oint B ds \cos 0° = B \oint ds = B(2\pi r) = \mu_0 I_{in}$$

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