

Ampère's Law: Magnetic Field Outside a Wire



Consider a long, straight wire of radius R with current I .

Apply Ampère's law, $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I_C$, to the circular loop of radius $r > R$.

- The symmetry dictates that the magnetic field \vec{B} is directed tangentially with magnitude B depending on R only.
- Current inside loop: $I_C = I$.
- Ampère's law applied: $B(2\pi r) = \mu_0 I$.
- Magnetic field at radius $r > R$: $B = \frac{\mu_0 I}{2\pi r}$.

