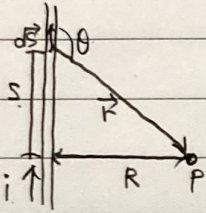


3. (a) Biot-Savart 법칙 이용



$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{id\vec{s} \times \vec{r}}{r^3} \quad (\text{Biot-Savart Law})$$

$$|d\vec{B}| = dB = \frac{\mu_0}{4\pi} \frac{id s \sin\theta}{r^2}$$

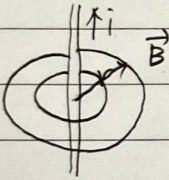
$$B = 2 \int_0^\pi dB = \frac{\mu_0 i}{2\pi} \int_0^\pi \frac{\sin\theta}{r^2} ds$$

$$r = \sqrt{s^2 + R^2}$$

$$\sin\theta = \sin(\pi - \theta) = \frac{R}{r} = \frac{R}{\sqrt{s^2 + R^2}}$$

$$B = \frac{\mu_0 i}{2\pi} \int_0^\infty \frac{R}{(s^2 + R^2)^{3/2}} ds = \frac{\mu_0 i}{2\pi} \left[\frac{s}{(s^2 + R^2)^{1/2}} \right]_0^\infty \Rightarrow B = \frac{\mu_0 i}{2\pi R}$$

(b) Ampere 법칙 이용



$$\oint \vec{B} \cdot d\vec{s} = \mu_0 i_{enc} \quad (\text{Ampere's Law})$$

$$2\pi r \cdot B(r) = \mu_0 i$$

$$\Rightarrow B(r) = \frac{\mu_0 i}{2\pi r}$$