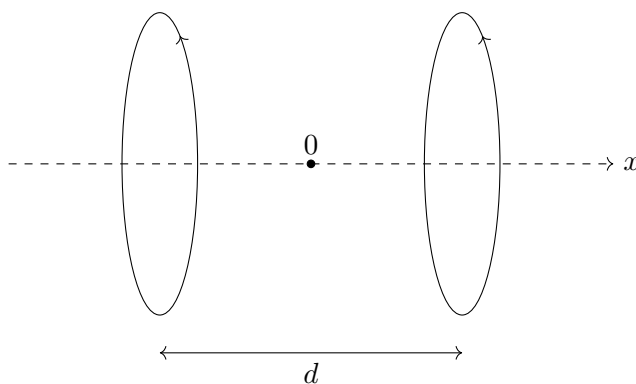


Physics 158 Magnetism Problem Bank

Problem 1

Created by Tyler Wilson 2023

Two current carrying loops, each with current I and radius R , are placed a distance d apart from each other, centered at the points $(-\frac{d}{2}, 0, 0)$ and $(\frac{d}{2}, 0, 0)$



- a) Compute the magnitude of the magnetic field at the origin $(0, 0, 0)$ due to this configuration.
- b) Compute the magnitude of the magnetic field for all points on the x -axis, $|\vec{B}(x)|$.
- c) Determine the optimal distance d between the two loops such that the magnetic field along the x -axis is as uniform as possible.

Hint: This can be done by choosing d to make as many derivatives of $|\vec{B}(x)|$ equal to zero as possible.

Solution:

- a) We can start by writing the Biot-Savart law for the magnetic field due to a current carrying loop.

$$B = \frac{\mu_0 I}{4\pi} \int_0^{2\pi} \frac{d\vec{l} \times \hat{r}}{r^2}$$