1. Find the force between a square loop of side $s$ and an infinite wire at distance $s$ (fig. 1), each carrying current $I$. Evaluate for 1 A and 1 cm.

![FIG. 1](image1)

2. A copper wire oriented East-West carries current density $J$ sufficient to levitate the wire in the earth’s magnetic field, which is $0.5 \times 10^{-4}$ T directed North, and gravitational field $g = 9.8$ m/s$^{-2}$ downward. Find $J$. Is it reasonable? Does $J$ point East or West?

3. Find $B$ at distance $z$ on the axis of a square loop of side $s$, lying in the $xy$ plane, carrying current $I$ (Fig. 2). Evaluate at $z = 0$ for $I = 1$ A and $s = 1$ cm.

![FIG. 2](image2)
4. Find $B$ at the center of the semicircle in Fig. 3. Evaluate for $I = 1$ A and $r = 1$ cm.

![FIG. 3](image)

5. Find $B$ at the center of the semicircle in Fig. 4. Evaluate for $I = 1$ A and $r = 1$ cm.

![FIG. 4](image)

6. A charge of $-2$ nC moves East with speed $2000$ m/s, in a magnetic field of $5 \times 10^{-5}$ T directed Northward. Find the force.

7. Find $B$ inside and outside of an infinite cylinder of radius $R$ and current density $J(r) = K/r$, where $K$ is a constant (Fig. 5); then reexpress in terms of current $I$

![FIG. 5](image)

8. Find the $B$ field between parallel planes (Fig. 6), separated by $s$, carrying opposite surface current densities of $K$. Evaluate for $K = 1000$ A/m.
9. Superposition: An infinite cylinder of uniform (axial) current density $\mathbf{J}$ and radius $R$ contains a cylindrical cavity of radius $R/2$ (Fig. 7). Find the $\mathbf{B}$ field at point $p$ on the surface.

10. Find $\mathbf{B}$ inside the cavity of Fig. 7