

12. The center of a square is a distance $R = a/2$ from the nearest side (each side being of length $L = a$). There are four sides contributing to the field at the center, so the result of problem 11 leads to

$$B_{\text{center}} = 4 \left(\frac{\mu_0 i}{2\pi(a/2)} \right) \left(\frac{a}{\sqrt{a^2 + 4(a/2)^2}} \right) = \frac{2\sqrt{2}\mu_0 i}{\pi a} .$$