

17. Using the result of problem 12 and Eq. 30-12, we wish to show that

$$\frac{2\sqrt{2}\mu_0 i}{\pi a} > \frac{\mu_0 i}{2R} \quad , \quad \text{or} \quad \frac{4\sqrt{2}}{\pi a} > \frac{1}{R} \quad ,$$

but to do this we must relate the parameters  $a$  and  $R$ . If both wires have the same length  $L$  then the geometrical relationships  $4a = L$  and  $2\pi R = L$  provide the necessary connection:

$$4a = 2\pi R \quad \Longrightarrow \quad a = \frac{\pi R}{2} \quad .$$

Thus, our proof consists of the observation that

$$\frac{4\sqrt{2}}{\pi a} = \frac{8\sqrt{2}}{\pi^2 R} > \frac{1}{R} \quad ,$$

as one can check numerically (that  $8\sqrt{2}/\pi^2 > 1$ ).