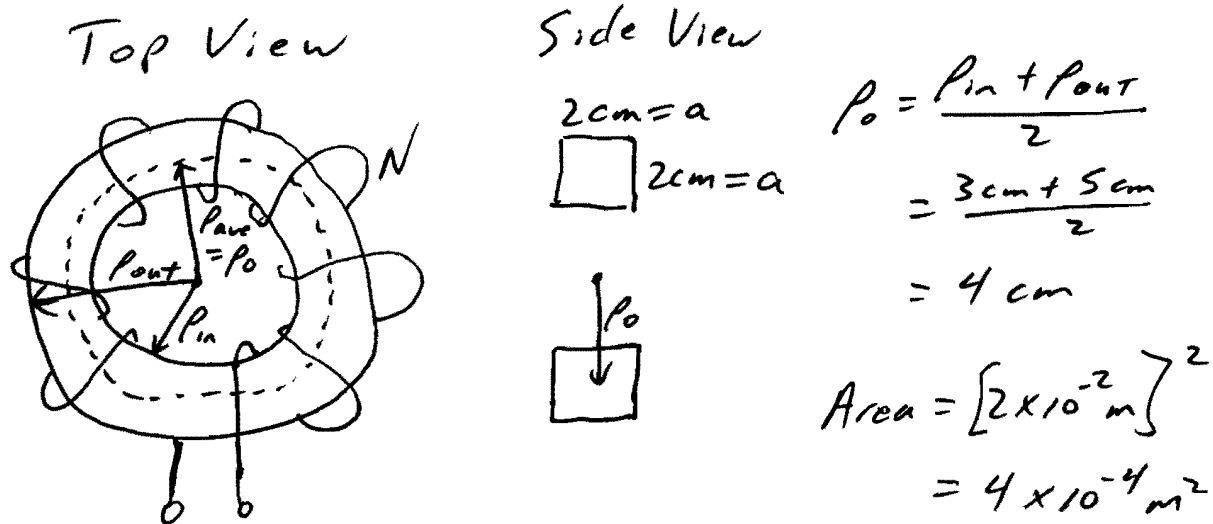


8.42 An air-filled toroid of square cross section has inner radius 3 cm, outer radius 5 cm, and height 2 cm. How many turns are required to produce an inductance of $45 \mu\text{H}$?

- Round to closest integer.



use result of problem 8.41 that

$$L = \frac{\mu_0 N^2 a}{2\pi} \ln \left[\frac{2\rho_o + a}{2\rho_o - a} \right]$$

$$\hookrightarrow N^2 = \frac{2\pi L}{\mu_0 a \ln \left[\frac{2\rho_o + a}{2\rho_o - a} \right]} = \frac{2\pi (45 \times 10^{-6})}{4\pi \times 10^{-7} (2 \times 10^{-2}) \ln \left[\frac{8 \times 10^{-2} + 2 \times 10^{-2}}{8 \times 10^{-2} - 2 \times 10^{-2}} \right]}$$

$$= \frac{11250}{\ln(10/6)} = 22023.17088$$

$$N = \sqrt{22023.17}$$

$$\underline{\underline{N = 148.402 \text{ turns} \approx 148 \text{ turns}}}$$