$$d\overline{B} = \frac{\mu_0 I}{4\pi} \frac{\overline{dl} \times \overline{r}}{r^3}$$

$$\overline{r} = -\left(r_0 + \frac{a}{2\pi}\varphi\right)\overline{e_r} = \begin{bmatrix} -r_0 - \frac{a}{2\pi}\varphi \\ 0 \\ 0 \end{bmatrix}_{r,\varphi,z}$$

$$\overline{dl} = \frac{a}{2\pi} d\varphi\, \overline{e_\varphi} = d\varphi \begin{bmatrix} 0 \\ \frac{a}{2\pi} \\ 0 \end{bmatrix}_{r,\varphi,z}$$

$$\overline{dl} \times \overline{r} = \left(r_0 \frac{a}{2\pi} + \frac{a^2}{4\pi^2}\varphi\right) d\overline{z}\, d\varphi$$

dla danych z zadania

$$B = 0{,}0099\ mT$$

$$B = \frac{\mu_0 I}{4\pi} \int_0^{2\pi N} \frac{\frac{a}{2\pi}\cancel{\left(r_0 + \frac{a}{2\pi}\varphi\right)}}{\left(r_0 + \frac{a}{2\pi}\varphi\right)^{\cancel{3}\,2}} d\varphi =$$

$$= \left\{ \begin{array}{l} u = r_0 + \frac{a}{2\pi}\varphi \\ du = \frac{a}{2\pi} d\varphi \end{array} \right\} = \frac{\mu_0 I}{4\pi} \int_{r_0}^{r_0 + aN} \frac{1}{u^2} du =$$

$$= \frac{\mu_0 I}{4\pi} \left[-\frac{1}{u}\right]_{r_0}^{r_0 + aN} = \frac{\mu_0 I}{4\pi}\left(\frac{1}{r_0} - \frac{1}{r_0 + aN}\right)$$