

Problema 3

Nr	Soluție	Punctaj
1a)	$B_1 = \frac{1}{2} \frac{2\mu\mu_0 I}{2\pi a} = \frac{1}{2} \frac{\mu\mu_0 I}{\pi a}. \quad (1,5 \text{ p.}) \quad B = 4B_1 = 4 \frac{1}{2} \frac{\mu\mu_0 I}{\pi a} = \frac{2\mu\mu_0 I}{\pi a}. \quad (1,5 \text{ p.})$ $B = \frac{2 \cdot 4\pi \cdot 10^{-7} \cdot 10}{\pi \cdot 0,1} = 8 \cdot 10^{-5} \text{ T}. \quad (0,5 \text{ p.})$	3 p.
1b)	$B = 0$	2 p.
2)	<p> $\vec{B} = \vec{B}_1 + \vec{B}_2 + \vec{B}_3 + \vec{B}_4.$ $\vec{B} = \vec{B}'_1 + \vec{B}''_1 + \vec{B}'_2 + \vec{B}''_2 + \vec{B}'_3 + \vec{B}''_3 + \vec{B}'_4 + \vec{B}''_4. \quad (0,5 \text{ p.})$ Orientăm axa x spre noi și proiectăm ultima expresie pe axa x. $B = B'_1 + B''_1 - B'_2 + B''_2 - B'_3 + B''_3 + B'_4 + B''_4. \quad (0,5 \text{ p.})$ $B'_1 = \frac{4\mu\mu_0 I}{4\pi a} \left(\sin \frac{\pi}{2} - \sin \frac{\pi}{4} \right) = \frac{4\mu\mu_0 I}{4\pi a} \left(1 - \frac{\sqrt{2}}{2} \right),$ $B''_1 = B'_1. \quad (0,5 \text{ p.})$ $B'_2 = B'_1, \quad B''_2 = \frac{4\mu\mu_0 I}{4\pi a} \left(\sin \frac{\pi}{2} + \sin \frac{\pi}{4} \right) = \frac{4\mu\mu_0 I}{4\pi a} \left(1 + \frac{\sqrt{2}}{2} \right). \quad (0,5 \text{ p.})$ $B'_3 = \frac{4\mu\mu_0 I}{4\pi a} \left(\sin \frac{\pi}{2} + \sin \alpha_1 \right), \quad \sin \alpha_1 = \frac{3/4 \cdot a}{\sqrt{(3/4 \cdot a)^2 + (1/2 \cdot a)^2}} = \frac{3}{\sqrt{13}}. \quad (0,5 \text{ p.})$ $B'_3 = \frac{2\mu\mu_0 I}{4\pi a} \left(1 - \frac{3}{\sqrt{13}} \right), \quad B''_3 = \frac{4\mu\mu_0 I}{4\pi \cdot 3a} \left(\sin \frac{\pi}{2} + \sin \alpha_2 \right).$ $\sin \alpha_2 = \frac{1/4 \cdot a}{\sqrt{(3/4 \cdot a)^2 + (1/2 \cdot a)^2}} = \frac{1}{\sqrt{13}}, \quad B''_3 = \frac{4\mu\mu_0 I}{4\pi \cdot 3a} \left(1 + \frac{1}{\sqrt{13}} \right). \quad (0,5 \text{ p.})$ $B'_4 = \frac{4\mu\mu_0 I}{4\pi a} \left(\sin \frac{\pi}{2} + \sin \alpha_1 \right) = B'_3, \quad B''_4 = \frac{4\mu\mu_0 I}{4\pi \cdot 3a} \left(\sin \frac{\pi}{2} - \sin \alpha_2 \right).$ $B''_4 = \frac{4\mu\mu_0 I}{4\pi \cdot 3a} \left(1 - \frac{1}{\sqrt{13}} \right). \quad (0,5 \text{ p.})$ $B = B'_1 + B''_2 + B'_3 + B''_4. \quad (0,5 \text{ p.})$ $B = \frac{4\mu\mu_0 I}{4\pi a} \left(1 - \frac{\sqrt{2}}{2} \right) + \frac{4\mu\mu_0 I}{4\pi a} \left(1 + \frac{\sqrt{2}}{2} \right) + \frac{4\mu\mu_0 I}{4\pi \cdot 3a} \left(1 + \frac{1}{\sqrt{13}} \right) + \frac{4\mu\mu_0 I}{4\pi \cdot 3a} \left(1 - \frac{1}{\sqrt{13}} \right).$ $B = \frac{\mu\mu_0 I}{\pi a} \cdot 2 + \frac{\mu\mu_0 I}{3\pi a} \cdot 2, \quad B = \frac{2\mu\mu_0 I}{\pi a} \left(1 + \frac{1}{3} \right), \quad B = \frac{8\mu\mu_0 I}{3\pi a}. \quad (0,5 \text{ p.})$ $B = \frac{8 \cdot 4\pi \cdot 10^{-7} \cdot 10}{3\pi \cdot 0,1} = ? \cdot 10^{-5} \text{ T}. \quad (0,5 \text{ p.})$ </p>	5 p.
Total		10 p.

