$\boxed{4}$

$B = \nabla \times A$

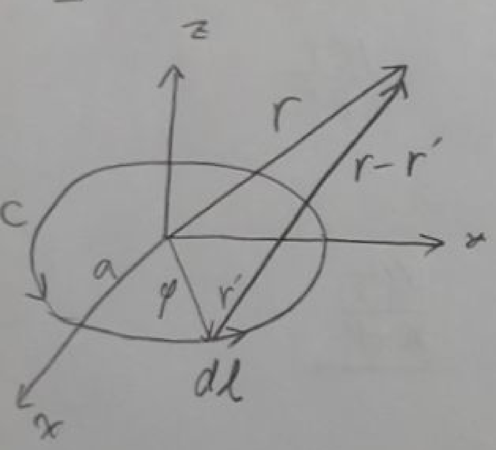
$$B_x = \frac{\partial A_z}{\partial y} - \frac{\partial A_y}{\partial z} = \underline{\frac{\mu_0 m}{4\pi} \cdot \frac{3zx}{r^5}}$$

$$B_y = \frac{\partial A_x}{\partial z} - \frac{\partial A_z}{\partial x} = \underline{\frac{\mu_0 m}{4\pi} \frac{3yz}{r^5}}$$

$$B_z = \frac{\partial A_y}{\partial x} - \frac{\partial A_x}{\partial y} = \frac{\mu_0 m}{4\pi}\left(\frac{1}{r^3} - \frac{3x^2}{r^5} + \frac{1}{r^3} - \frac{3y^2}{r^5}\right)$$

$$= \underline{\frac{\mu_0 m}{4\pi} \frac{3z^2 - r^2}{r^5}}$$

$\boxed{5}$



$$r' = (a\cos\varphi, a\sin\varphi, 0)$$

$$dl = (-a\sin\varphi\, d\varphi, a\cos\varphi\, d\varphi, 0)$$

$$A(r) = \frac{\mu_0 I}{4\pi} \int_C \frac{dl}{|r - r'|}$$

$(r \gg a)$

$$\frac{1}{|r - r'|} = \left((x - a\cos\varphi)^2 + (y - a\sin\varphi)^2 + z^2\right)^{-\frac{1}{2}}$$

$$\fallingdotseq \frac{1}{r}\left(1 + \frac{a(x\cos\varphi + y\sin\varphi)}{r^2}\right)$$

よって

$$A_x = \frac{\mu_0 I}{4\pi} \int_0^{2\pi} \frac{1}{r}\left(1 + \frac{a(x\cos\varphi + y\sin\varphi)}{r^2}\right) \times (-a\sin\varphi)\, d\varphi$$

$$= \underline{-\frac{\mu_0 I}{4\pi} \frac{\pi a^2 y}{r^3}}$$

$$A_y = \frac{\mu_0 I}{4\pi} \int_0^{2\pi} \frac{1}{r}\left(1 + \frac{a(x\cos\varphi + y\sin\varphi)}{r^2}\right) \times a\cos\varphi\, d\varphi$$

$$= \frac{\mu_0 I}{4\pi} \frac{\pi a^2 x}{r^3}$$

$A_z = 0$

$m = \pi a^2 I$ とすると

$$\underline{A(x, y, z) = \frac{\mu_0 m}{4\pi r^3} (-y, x, 0)}$$