5.27)

$$B = \frac{\pm \mu_0 K}{2} \hat{y} \qquad \bar{A} = A(z)\hat{x}$$

$$\frac{\partial A}{\partial z} = \pm \frac{\mu_0 K}{2}$$

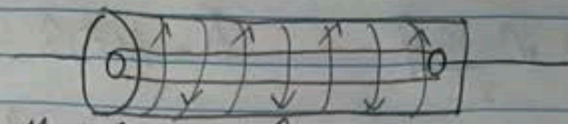
$$\boxed{\bar{A} = -\frac{\mu_0 K z}{2} \hat{x}}$$

Ex 5.12)

$$A = \frac{\mu_0}{4\pi} \int \frac{J(r')}{\eta} \, d\tau'$$

$$\oint A \cdot dl = \int B \cdot dA$$

5.16)



i) $B = \mu_0 I(n_2 - n_1)\hat{z}$

ii) $B = \mu_0 I n_2 \hat{z}$

iii) $\boxed{B = 0}$

5.19) $$I = \int_S J \cdot da$$

5.21) $$\nabla \times B = \mu_0 J$$

$$\nabla \cdot (\nabla \times B) = \mu_0 (\nabla \times J)$$
$$= -\mu_0 \frac{\partial \rho}{\partial t}$$

· Requires ρ to be constant, meaning currents are fixed.

5.23) a finite segment I (z_1, z_2)

$$A = \frac{\mu_0 I}{4\pi} \int dI' = \frac{\mu_0 I}{4\pi} \hat{z} \int_{z_1}^{z_2}$$

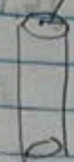
$$A = \frac{\mu_0 I}{4\pi} \ln\left(\frac{z_2 + \sqrt{z_2^2 + s^2}}{z_1 + \sqrt{z_1^2 + s^2}}\right)\hat{z}$$

$$B = \nabla \times A = -\frac{\partial A}{\partial s}\hat{\phi}$$

Homework (5. 4,7, 11, 12, 14, 19, 21, 23, 27)

$r = a$

5.11) n turns/ length



I

$\bar{I} = I n dz$

$$B = \frac{\mu_0 n I}{2} \int \frac{a^2}{(a^2+z^2)^{3/2}} dz$$

$$z = a \cot(\theta)$$

$$B = -\frac{\mu_0 n I}{2} \int_{\theta_1}^{\theta_2} \sin\theta \, d\theta$$

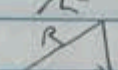
$$= \frac{\mu_0 n I}{2} \left(\cos\theta_2 - \cos\theta_1 \right)$$

lim as $\theta \to \pi$ & $\theta \to 0$ $\quad B = \frac{\mu_0 n I}{2} \left(1 - (-1) \right)$

$$\boxed{B = \mu_0 n I}$$

$\frac{1}{2} + \frac{1}{4}$

5.12) $B(r) = \frac{\mu_0}{4\pi} \frac{qv \times B}{r^2}$ $\qquad \sigma = \frac{Q}{(4\pi R^2)}$



$\to R\sin\theta$

$z = R\cos\theta$

$dI = KR\,d\theta$

$K = \sigma v$

$v = \omega R \sin\theta$

$$dB = \frac{\mu_0}{2R} \sin^2\theta \, dI \;\to\; dI = \frac{Q\omega}{4\pi} \sin\theta \, d\theta$$

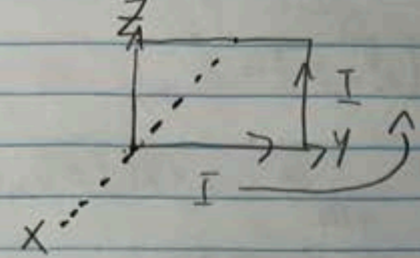
$$\int dB = \int \frac{\mu_0}{2R} \sin^2\theta \frac{Q\omega}{4\pi} \sin\theta \, d\theta$$

$$= \int \frac{\mu_0 Q \omega}{8\pi R} d\theta$$

$$\boxed{B = \frac{\mu_0 Q \omega}{6\pi R}}$$

Homework (5. 4, 7, 11, 12, 16, 19 21, 23, 27) ex. 5.12

5.4) $B = Kz\,\hat{x}$ □ loop side (a) YZ plane (0,0)



$I \circlearrowleft$

$L = \frac{a^2}{z}\hat{y}$

$F = I(L \times B)$

$F_{Net} = I K a^2 \hat{z}$

$F = I\left(\frac{a^2}{z}\hat{y} \times Kz\hat{x}\right)$

$\boxed{I a^2 K \hat{z}}$

5.7) Show $\int J\,d\tau = \frac{dp}{dt}$ $J = -\frac{\partial \rho}{\partial t}$

$\nabla \cdot (xJ) = x(\nabla \cdot J) + J \cdot (\nabla x)$

$= -x\frac{\partial \rho}{\partial t} + J_x$

$\int_V \nabla (xJ)\,d\tau$

$= \int_V\left(-x\frac{\partial \rho}{\partial t} + J_x\right)d\tau = \oint_S xJ\,dA = 0$

$\int_V x\frac{\partial \rho}{\partial t}\,d\tau = \int_V J_x\,d\tau$

$\int_V y\frac{\partial \rho}{\partial t}\,d\tau = \int_V J_y\,d\tau$

$\int_V z\frac{\partial \rho}{\partial t}\,d\tau = \int_V J_z\,d\tau$

$$\boxed{\int_V J\,d\tau = \frac{d}{dt}\int_V \rho\,d\tau = \frac{dp}{dt}}$$