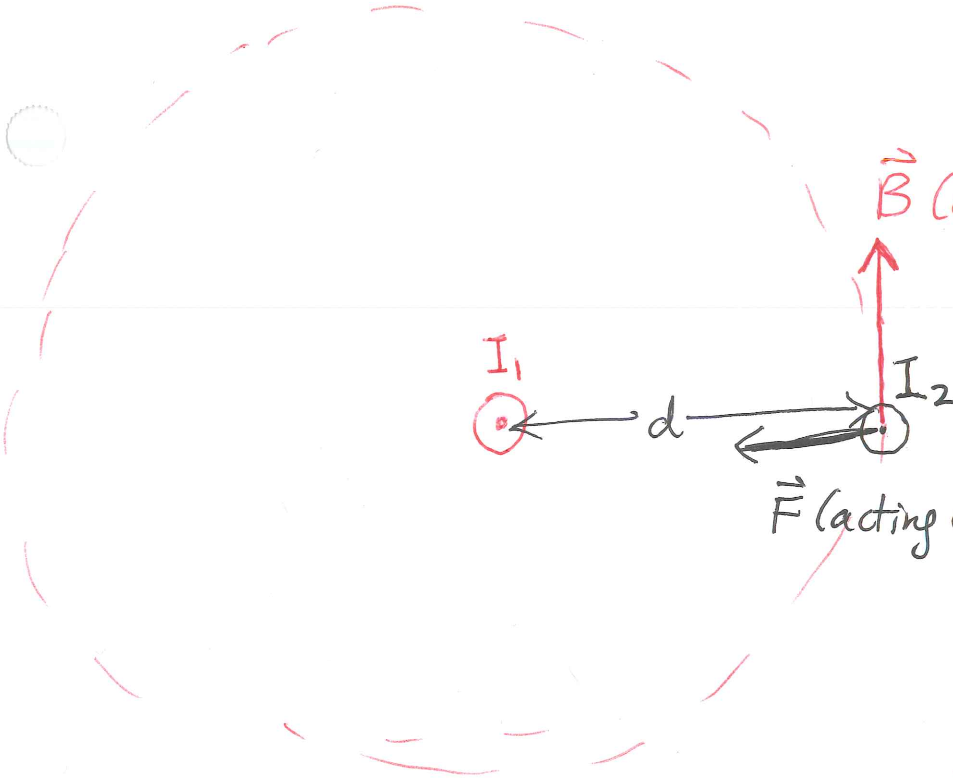
$\vec{B}$ (due to I_1) $= \dfrac{\mu_0 I_1}{2\pi d}$.



$\vec{F}$ (acting on I_2 due to $\vec{B}$)

$$= I_2 L B$$

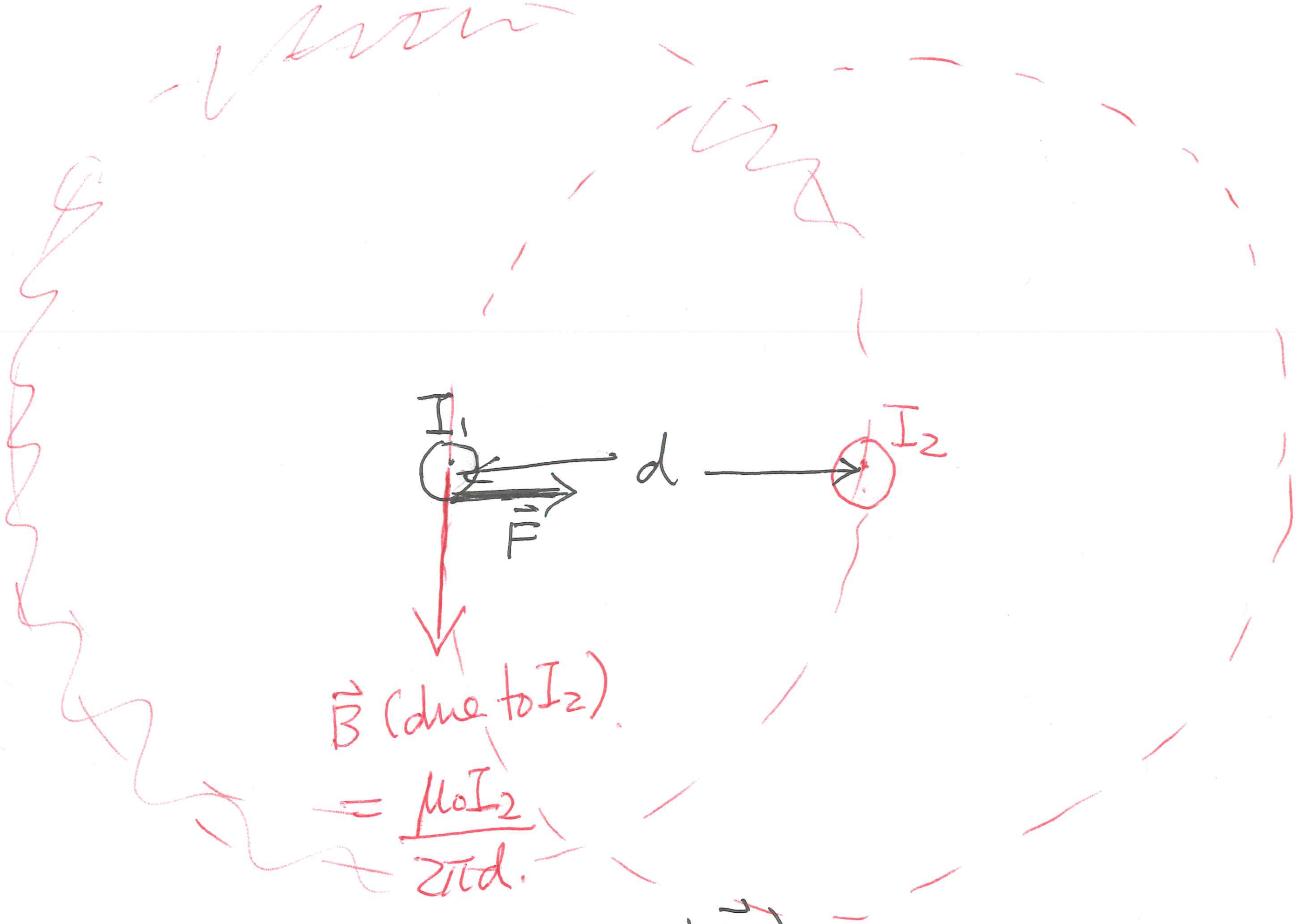
Length of I_2.

$$= I_2 L \left(\frac{\mu_0 I_1}{2\pi d}\right).$$

$$= L \frac{\mu_0 I_1 I_2}{2\pi d}.$$

Force is attractive

$$\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi d}$$



$\vec{F}$ (acting on I_1 due to $\vec{B}$).

$= I_1 L B$

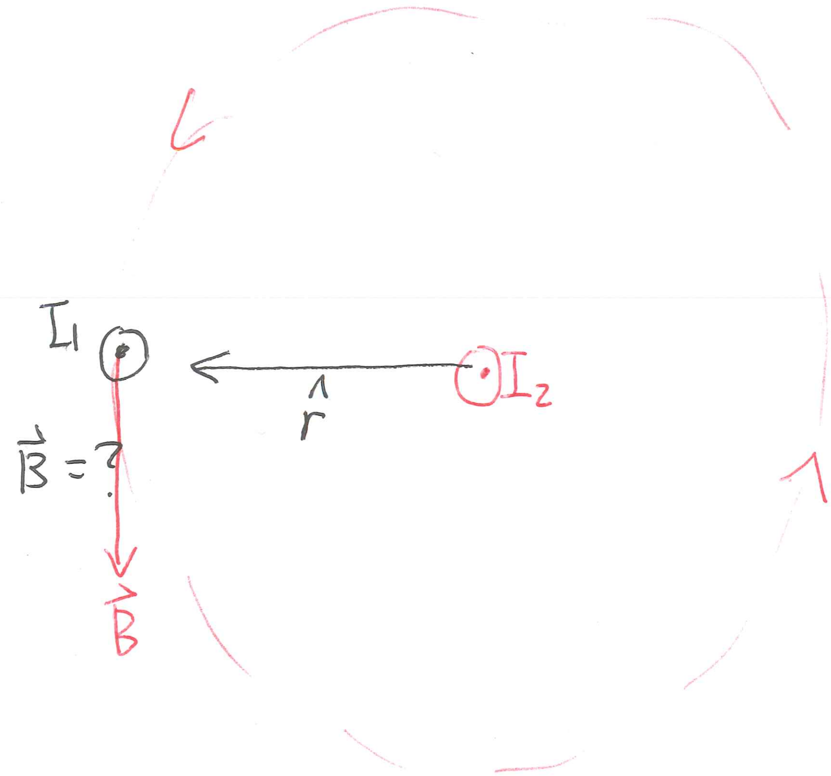
Length of I_1

$= I_1 L \left(\frac{\mu_0 I_2}{2\pi d}\right)$.

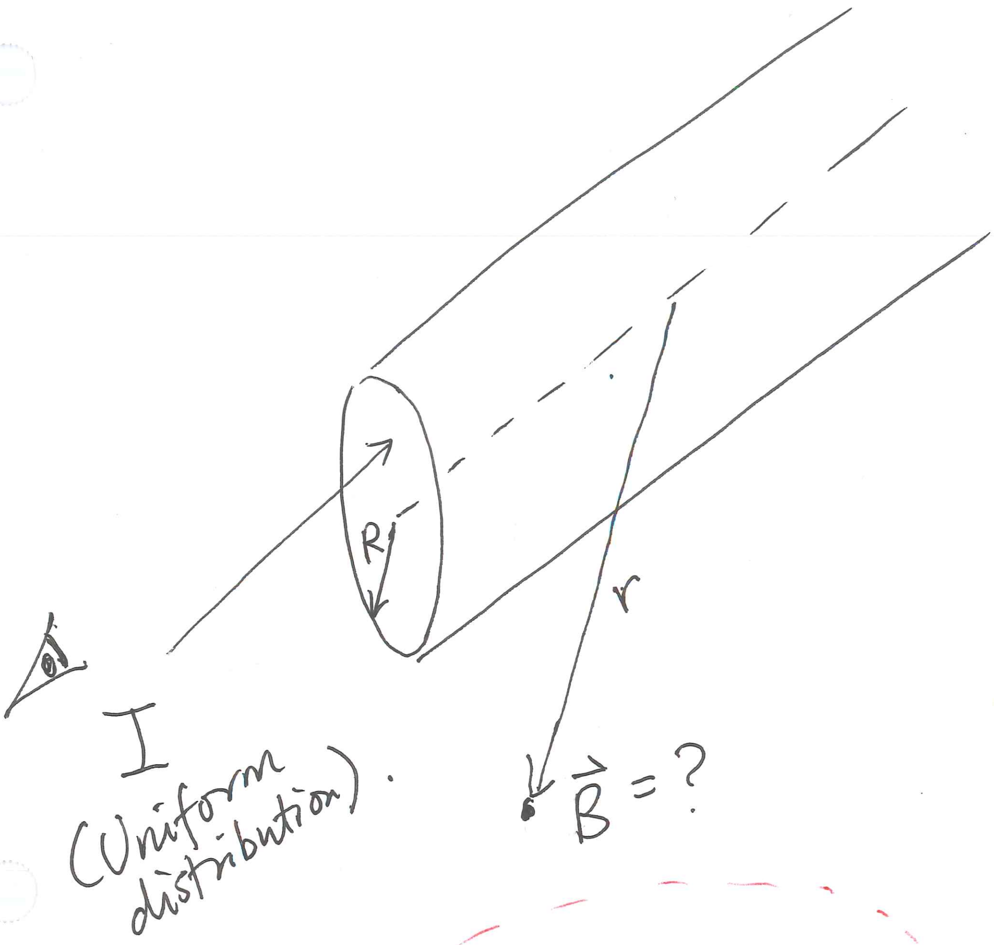
$= L \left(\frac{\mu_0 I_1 I_2}{2\pi d}\right)$.

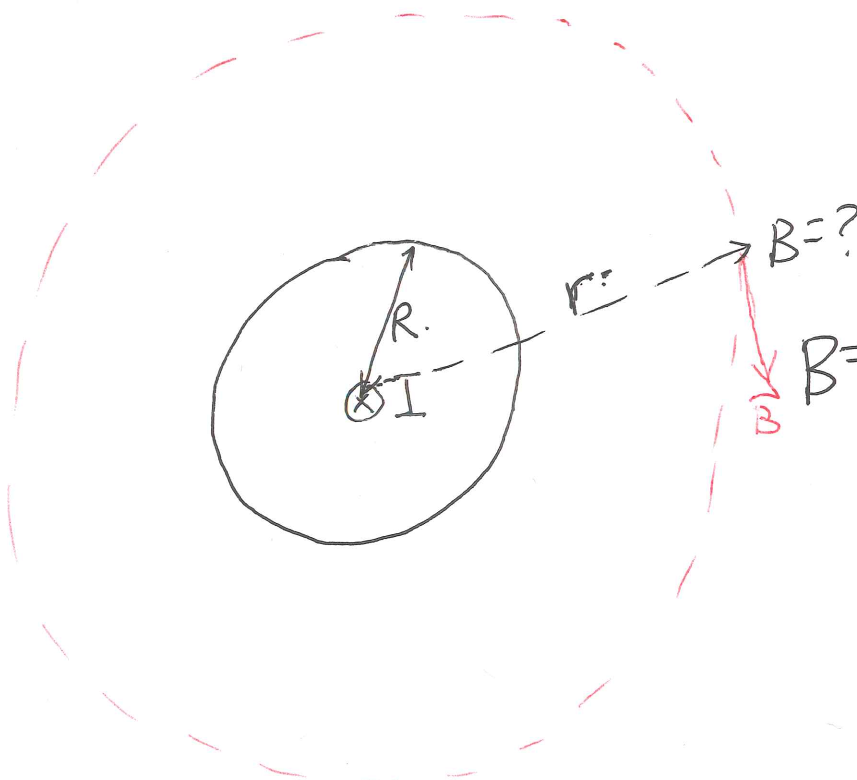
$$\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi d}.$$

$$\cancel{\frac{F}{L} = \frac{\mu_0 I_1^2 I_2}{2\pi d}}$$

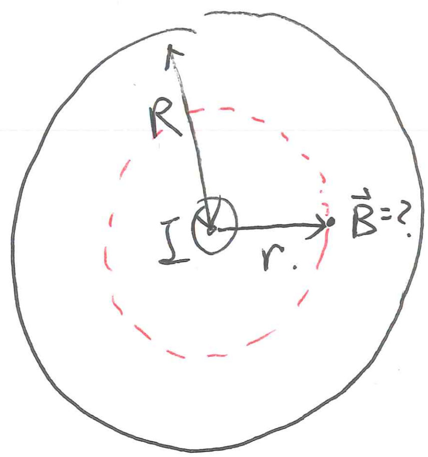


I_1
I_2
$\hat{r}$
$\vec{B} = ?$
$\vec{B}$





$$B = \frac{\mu_0 I}{2\pi r}.$$



$$B = \frac{\mu_0 I_{en}}{2\pi r}$$!

$$I_{en} = I\frac{r^2}{R^2}$$

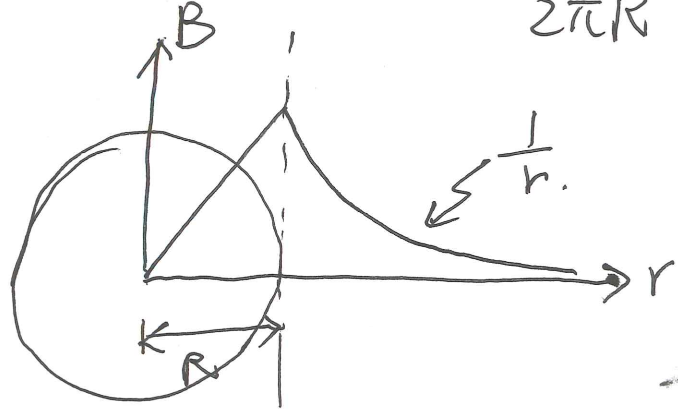
$$J = \frac{I}{\pi R^2}$$

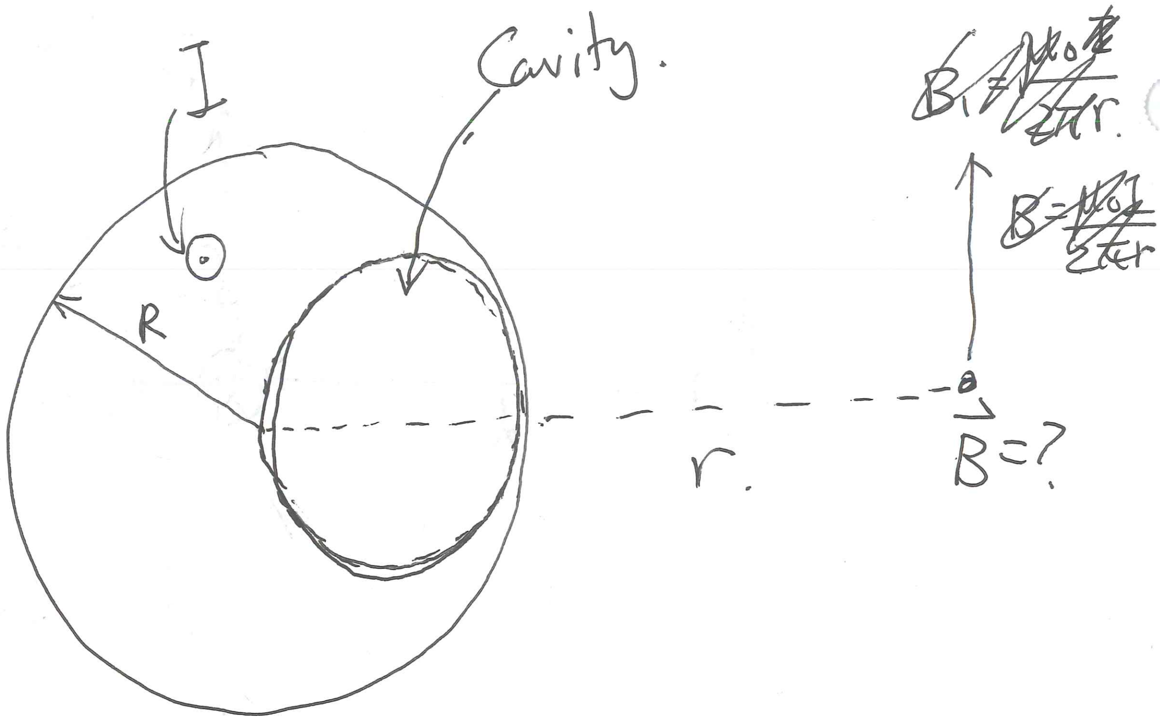
Current density

$$I_{en} = \frac{I}{\pi R^2}\cdot \pi r^2$$

$$= I\frac{r^2}{R^2}$$

$$B = \frac{\mu_0}{2\pi r}\cdot I \cdot \frac{r^2}{R^2} = \frac{\mu_0 I}{2\pi R^2} r$$





$$\vec{B}_{Total} = \frac{\mu_0 \cdot (J \cdot \pi R^2)}{2\pi r}.$$

$$\vec{B}_{cavity} = \frac{\mu_0 \left(J \cdot \pi \cdot \left(\frac{R}{2}\right)^2\right)}{2\pi \left(\cancel{\quad}\right) \left(r - \frac{R}{2}\right)}$$

$$\vec{B}_{net} = \cancel{\frac{\mu_0 J}{2\pi}} \frac{\mu_0 J}{2}\left[\frac{R^2}{r} - \frac{\frac{R^2}{4}}{\left(r - \frac{R}{2}\right)}\right].$$

$$= \frac{\mu_0 J}{2} R^2 \left[\frac{1}{r} - \frac{1}{2(2r - R)}\right].$$