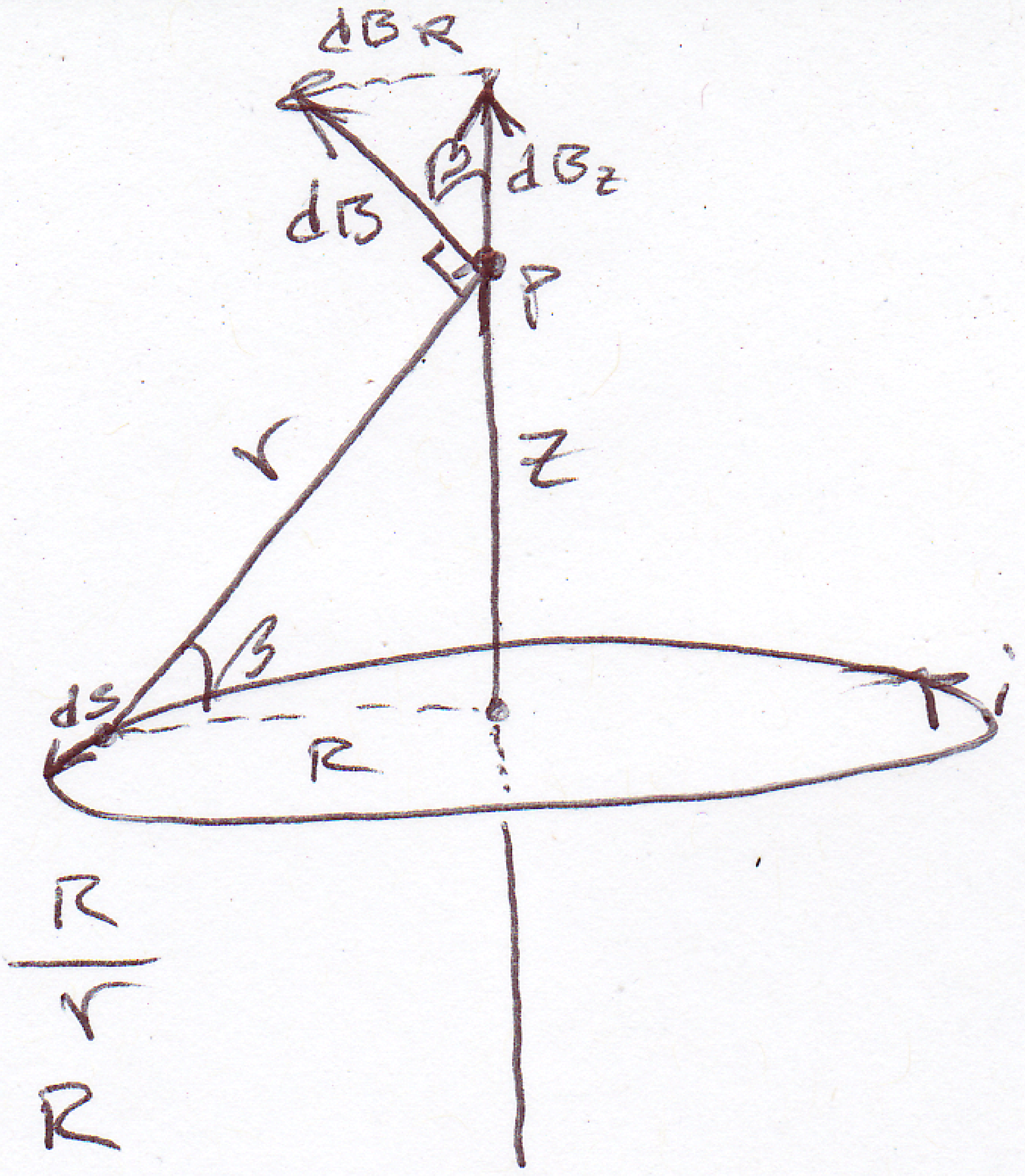


$$dB = \frac{\mu_0}{4\pi} i \frac{d\vec{s}\times\hat{r}}{r^2}$$

$$d\vec{s}\times\hat{r} = ds\,\hat{r}\sin\theta,\ \theta = \pi/2$$

$$= ds(1)\sin\left(\frac{\pi}{2}\right) = ds$$

$$\cos\beta = \frac{R}{r} = \frac{R}{\sqrt{z^2+R^2}}$$

$$r^2 = R^2 + z^2$$

dB sin β cancel out!

$$dB_z = dB\cos\beta = \frac{\mu_0 i\, ds}{4\pi(R^2+z^2)}\cos\beta$$

$$\int_{B} dB_z = \int_0^{2\pi R} \frac{\mu_0 i R\, ds}{4\pi(R^2+z^2)^{3/2}}$$

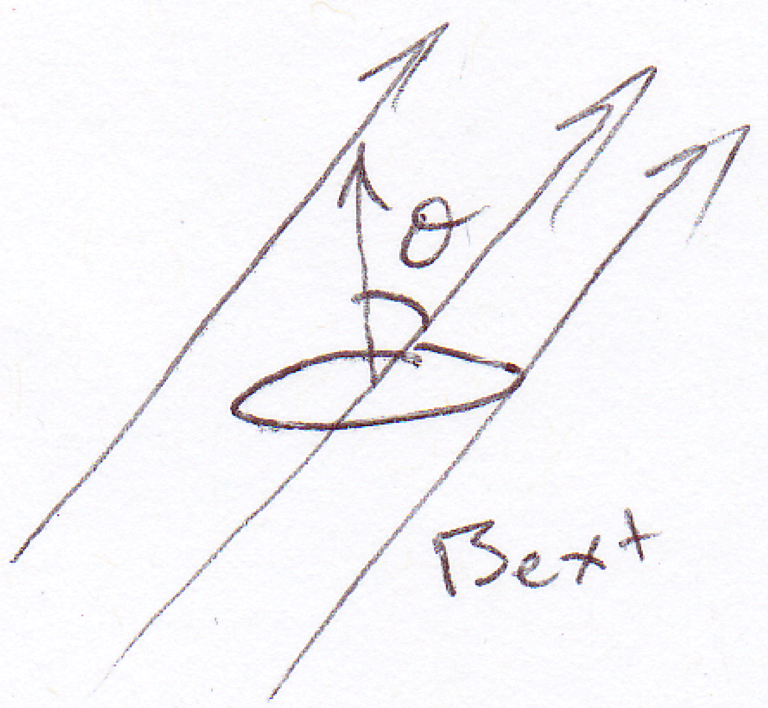
$$B_z = \frac{\mu_0 i R(2\pi R)}{4\pi(R^2+z^2)^{3/2}} = \frac{\mu_0 i R^2}{2(R^2+z^2)^{3/2}}$$

if R = ___ B = ___ z = ___

$\vec{\mu} = iNA$, $A = \pi R^2$

$N = 1$

$$i = \frac{2B_z(R^2+z^2)^{3/2}}{\mu_0 R^2}$$



$\tau = \vec{\mu}\times\vec{B}_{ext}$

$= \mu B_{ext}\sin\theta$, give τ_{max} find B_{ext}

$$B_{ext} = \frac{\tau}{\mu\sin\theta}$$