Magnetic Field of Circular Current

- Law of Biot and Savart: $dB = \dfrac{\mu_0}{4\pi}\dfrac{Id\ell}{z^2+R^2}$
- $dB_z = dB\sin\theta = dB\dfrac{R}{\sqrt{z^2+R^2}}$

  $\Rightarrow\ dB_z = \dfrac{\mu_0 I}{4\pi}\dfrac{Rd\ell}{(z^2+R^2)^{3/2}}$
- $B_z = \dfrac{\mu_0 I}{4\pi}\dfrac{R}{(z^2+R^2)^{3/2}}\displaystyle\int_0^{2\pi R} d\ell$

  $\Rightarrow\ B_z = \dfrac{\mu_0 I}{2}\dfrac{R^2}{(z^2+R^2)^{3/2}}$
- Field at center of ring $(z=0)$: $B_z = \dfrac{\mu_0 I}{2R}$
- Magnetic moment: $\mu = I\pi R^2$
- Field at large distance $(z \gg R)$: $B_z \simeq \dfrac{\mu_0}{2\pi}\dfrac{\mu}{z^3}$