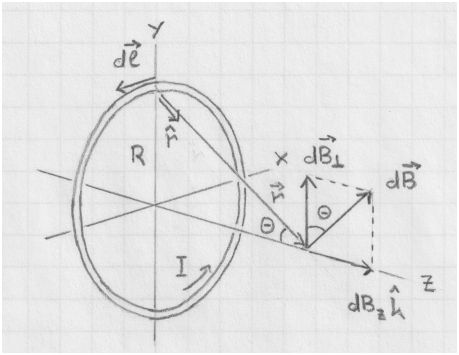
[lex59] Magnetic field of a circular current I

A thin circular wire of radius R is placed in the xy-plane centered at the z-axis and carries a steady current I in the direction shown.
(a) Use the Biot-Savart law and symmetry considerations to show that the electric field at point on the z-axis is

$$\mathbf{B} = \frac{\mu_0 I}{2} \frac{R^2}{(z^2 + R^2)^{3/2}} \hat{\mathbf{k}}.$$

(b) Simplify the expression for the case $z = 0$, represents the field at the center of the circle.
(c) Simplify the expression by expansion for the case $z \gg R$, representing the field generated by a magnetic dipole $\mathbf{m} = I\pi R^2 \hat{\mathbf{k}}$.



Solution: