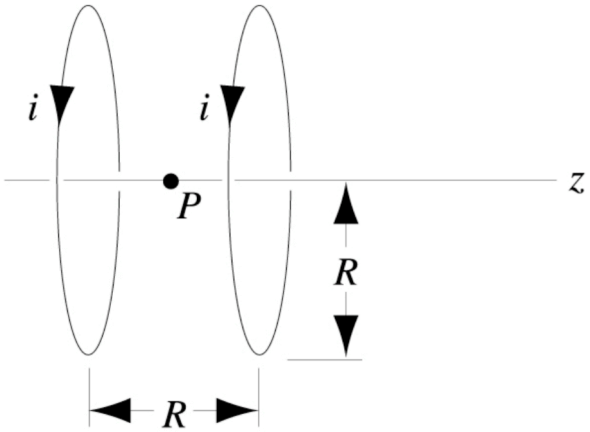
A circular loop has radius *R*, carries current *i*, and lies in the *xy*-plane.

a) Show that the magnetic field at a distance *z* along the axis of the loop is $B = \dfrac{\mu_0 i R^2}{2\left(z^2 + R^2\right)^{3/2}}\hat{\mathbf{k}}$.

b) What is the magnetic field if instead you have *N* loops?

Two circular coaxial coils are separated by distance *R*, one at *z* = 0 and the other at *z* = *R*. This arrangement is called a Helmholtz coil. The coils carry equal currents *i* in the same direction and each has *N* turns.



c) Determine the magnetic field at *P* midway between the coils.

d) Derive an expression for the magnetic field at a distance *z* along the axis of the coils.

e) Graph the magnetic field as a function of the distance *z* along the axis of the coils.