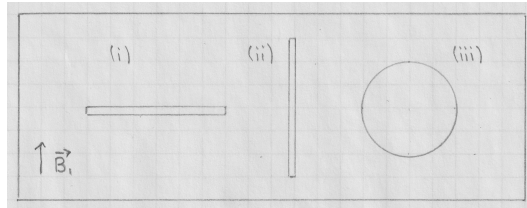## [lex70] Magnetized material with cavities of different shapes

Consider a magnetic material characterized by a uniform magnetic susceptibility. It has three cavities in the shape of (i) a disk, (ii) a needle, and (iii) a sphere as shown in cross section. The vector relations,

$$\mathbf{B}_1 = \mu_0(\mathbf{H}_1 + \mathbf{M}_1), \quad \mathbf{B}_0 = \mu_0 \mathbf{H}_0,$$

hold inside the magnetic material and inside the cavities, respectively. Find $\Delta \mathbf{B} \doteq \mathbf{B}_0 - \mathbf{B}_1$ in units $\mu_0 \mathbf{M}_1$ and $\Delta \mathbf{H} \doteq \mathbf{H}_0 - \mathbf{H}_1$ in units $\mathbf{M}_1$ for all three cases.
Hint: Use boundary conditions for cases (i) and (ii). Use a result of [lex68] for case (iii).

Solution: