**Reading assignment**
Popović and Popović, Chapter 10
Connor and Salon VI-1 - VI-13

**Software**
div_curl_example.m

**Problem 1 - Magnetic field properties**
Run div_curl_example.m. Which of the fields shown are possible magnetic fields? Which are possible electrostatic fields?

**Problem 2 - Symmetry**
Three standard geometries for analytical magnetostatic calculations are shown below.

a. Use the right hand rule (thumb along the current direction, fingers for \( \mathbf{B} \)) and determine the direction of \( \mathbf{B} \) in each case.

b. All 3 geometries can best be analyzed in cylindrical coordinates. For each, determine whether \( \mathbf{B} \) is a function of \( r \), \( \phi \), and/or \( z \).

(Example from electric fields, \( \mathbf{E} \) of cylindrically symmetric charge is only a function of \( r \).)
Problem 3 - Ampere's Law
A long solenoid has a current density of $\mathbf{J} = J_0 \mathbf{a}_\varphi$ for $a < r < b$ and is 0 everywhere else. Ignore end effects.

a. Find the magnetic flux density, $\mathbf{B}$ for $r < a$. Be sure to sketch the line integral paths you use. Assume $\mathbf{B} = 0$ for $r > b$.

b. Check your answer to part a. by evaluating $\nabla \cdot \mathbf{B}$ and $\nabla \times \mathbf{B}$.

c. Find $\mathbf{B}$ for $a < r < b$. Sketch the line integral path you use.

d. Check your answer to part c. by evaluating $\nabla \cdot \mathbf{B}$ and $\nabla \times \mathbf{B}$.

e. Plot $B_z$ vs $r$.

f. Show that $\mathbf{B} \neq 0$ for $r > b$.