

Homework Problem Set #9

(Due date: 2011/05/18)

This problem set covers materials of Lesson 11. The full score is 35 points.

- 1) (20 points) P.6-12 (a-c) of the textbook (p298).
- 2) In [Example 11-2](#) of the lecture notes, we applied the Ampere's circuital law [[eq. \(11.5\)](#)] to arrive at the magnetic flux density \vec{B} created by an infinitely long hollow solenoid oriented along the z -axis, with n turns per unit length, and carrying a steady current I :

$$\vec{B} = \vec{a}_z \mu_0 n I \quad (1)$$

Here we show that [eq. \(1\)](#) can also be derived by the Biot-Savart law [[eq. \(11.13\)](#)].

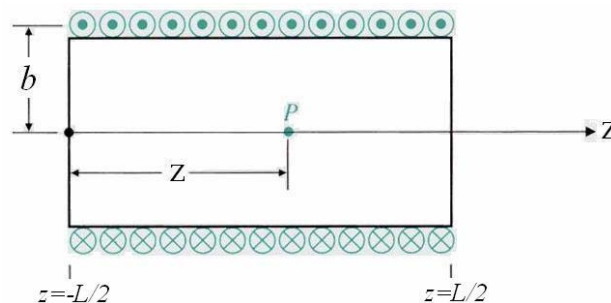


Fig. 1.

- 2a) (10 points) Consider a solenoid of radius b , length L , carrying a current I in its N turns of closely wound coil ($n = N/L$, [Fig. 1](#)). Use the result of [Example 11-4](#) of the lecture notes to evaluate the magnetic flux density \vec{B} at a point $P(0,0,z)$ on the axis.
- 2b) (5 points) What are the magnetic flux densities \vec{B} at the center ($z = 0$), and the ends ($z = \pm L/2$), respectively? How are they simplified when $L \rightarrow \infty$?