

TFY4240

Problem set 5 Autumn 2015

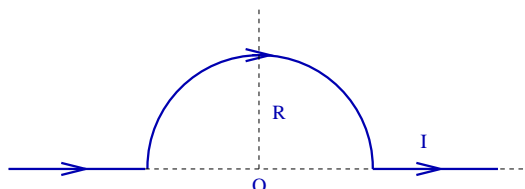
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fysikk**Problem 1.**

Consider an infinitesimal static magnetic dipole of magnetic dipole moment \mathbf{m} . In a coordinate system centered at the dipole, the vector potential associated with the dipole can in the Coulomb gauge be written

$$\mathbf{A}(\mathbf{r}) = \frac{\mu_0}{4\pi} \frac{\mathbf{m} \times \hat{\mathbf{r}}}{r^2}. \quad (1)$$

- Use expression (1) to obtain an expression for the magnetic field $\mathbf{B}(\mathbf{r})$. Express your answer in *coordinate-free form*.
- Compare your answer from the previous subproblem with the expression for the electric field from a static electric dipole.

Problem 2.

An infinitely long wire carries a (time-independent) current I . The wire is bent so as to have a semi-circular detour, of radius R , around the origin O (see figure).

- Derive an expression for the magnetic field \mathbf{B} at the origin O of the coordinate system.
- Determine the numeric value of this magnetic field given the current $I = 1$ A and radius $R = 1$ cm.

Problem 3.

Examples 6.1 and 6.3 from Griffiths.