$\frac{\partial}{\partial t}\underline{\boldsymbol{B}} = -\nabla \times \underline{\boldsymbol{E}}$

$\frac{\partial}{\partial t}\underline{\boldsymbol{D}} = \nabla \times \underline{\boldsymbol{H}}$

GhK
TET

$\frac{\partial}{\partial t}\underline{\boldsymbol{p}} = \nabla \cdot \underline{\underline{\boldsymbol{T}}}$

$\frac{\partial}{\partial t}\underline{\underline{\boldsymbol{S}}} = \mathrm{sym}\{\nabla \underline{\boldsymbol{v}}\}$

Exercises for Electromagnetic Field Theory I
(EFT I)
SS 2002

University of Kassel
Department of EE/CS
Electromagnetic Theory

Sheet 5

Exercise 10 (Method of Images)
Given is a distribution of point charges. A charge of $-Q$ is placed at the point $P_1(a, -b, c)$, a charge of Q at point $P_2(d, e, -f)$, with $a = b = D$, $d = e = 2D$ and $c = 3f = D$.
The yz plane is perfecty electrically conducting and $\Phi(x = 0, y, z) = 0$.

a) Make a sketch of the problem.

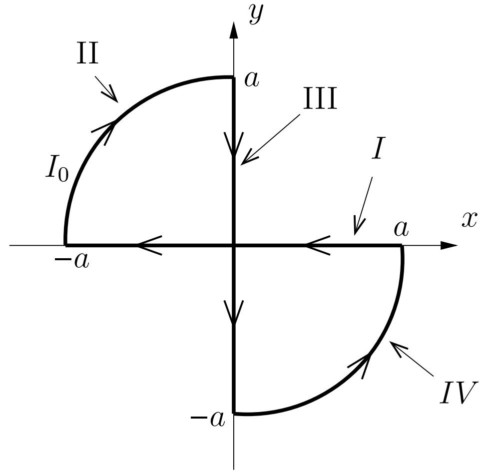
b) Determine the electric potential $\Phi(\underline{\mathbf{R}})$ using the method of images and specify the validity space for your solution.

c) Determine the electric flux density $\underline{\mathbf{D}}(\underline{\mathbf{R}})$

d) Specify the electric surface charge density $\eta(\underline{\mathbf{R}})$ on the yz-plane.

Exercise 11 (Law of Biot-Savart)

Given is a wire loop (see figure) with $N = 5$ windings consisting of four parts: I, II, III and IV. The wire loop is placed in the xy plane and a constant current I_0 is flowing through the loop. The crossing wires in the origin are not connected.
The terminal wires are to be neglected and are not shown in the figure.



Determine the magnetic field strength on the z-axis using the law of Biot-Savart.
Hint:

$$\int \frac{1}{(\alpha^2 + x^2)^{\frac{3}{2}}} dx = \frac{x}{\alpha^2 \sqrt{\alpha^2 + x^2}}$$