Homework 5 - Maxwell's equations

Q5.1. Write Maxwell's equations in integral form and explain their meaning.

A5.1.

$$\int_{\partial S_3} \underline{\underline{F}} = 0 \quad , \quad \int_{\partial S_3} \underline{\underline{G}} = \int_{S_3} \underline{\underline{J}} = Q \tag{A5.1.1}$$

$$\begin{aligned} \int_{\partial S_3} \underline{\underline{B}} &= 0 \quad , & \int_{\partial S_3} \underline{\underline{D}} &= \int_{S_3} \underline{\underline{\rho}} = Q \\ \int_{\partial S_2} \underline{E} + \int_{S_2} \frac{\partial}{\partial t} \underline{\underline{B}} &= 0 \quad , & \int_{\partial S_2} \underline{H} - \int_{S_2} \frac{\partial}{\partial t} \underline{\underline{D}} &= \int_{S_2} \underline{\underline{j}} = I \end{aligned} \tag{A5.1.2}$$

Q5.2. A current flows steadily in a straight line from A to B. Draw a diagram showing the behaviour of the various electromagnetic quantities.

A5.2.

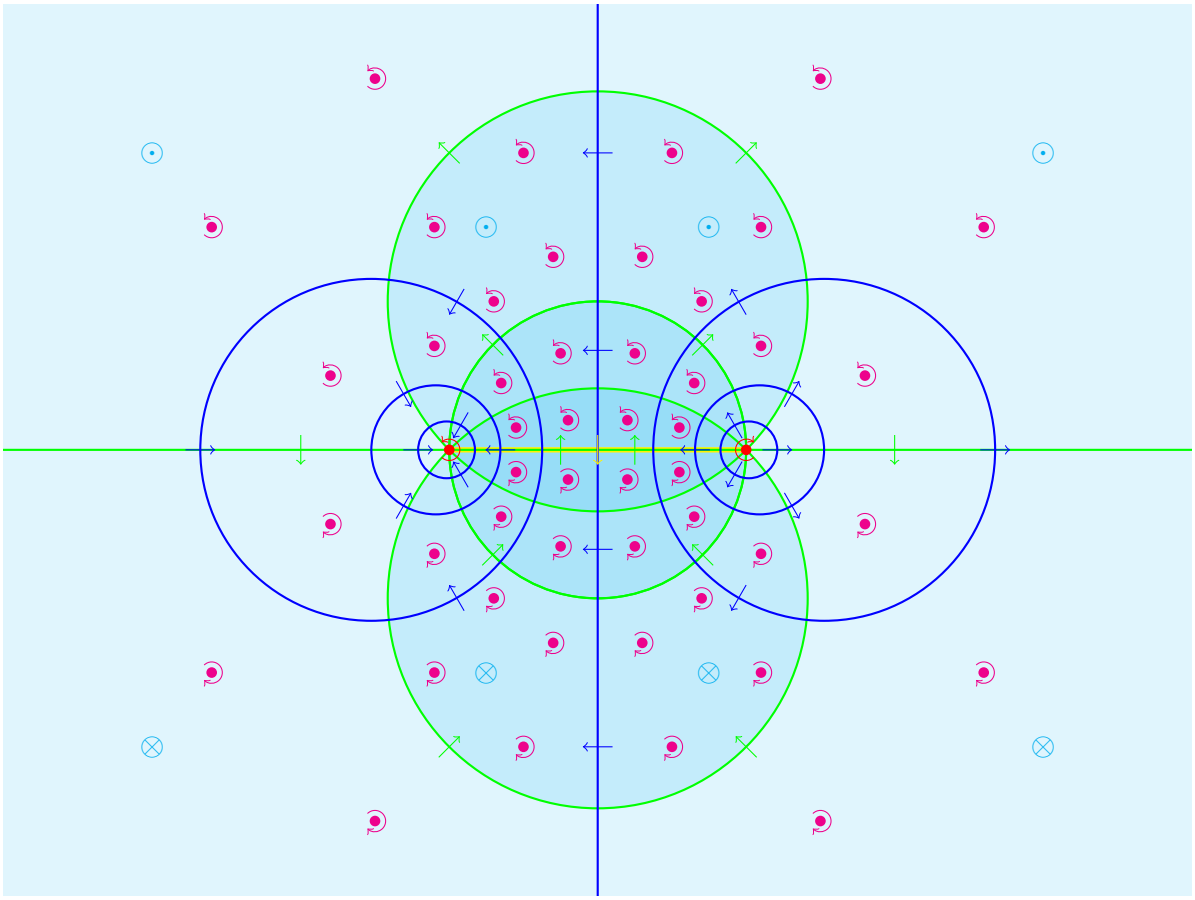

Figure A5.2.1: $\underline{\nabla} \wedge \underline{\dot{D}} = \underline{\underline{\dot{\rho}}} = -\underline{\nabla} \wedge \underline{j}$, $\underline{\nabla} \wedge \underline{H} = \underline{j} + \underline{\dot{D}}$, $\underline{E} = *\underline{\dot{D}}$, $\underline{\underline{B}} = *\underline{H}$.