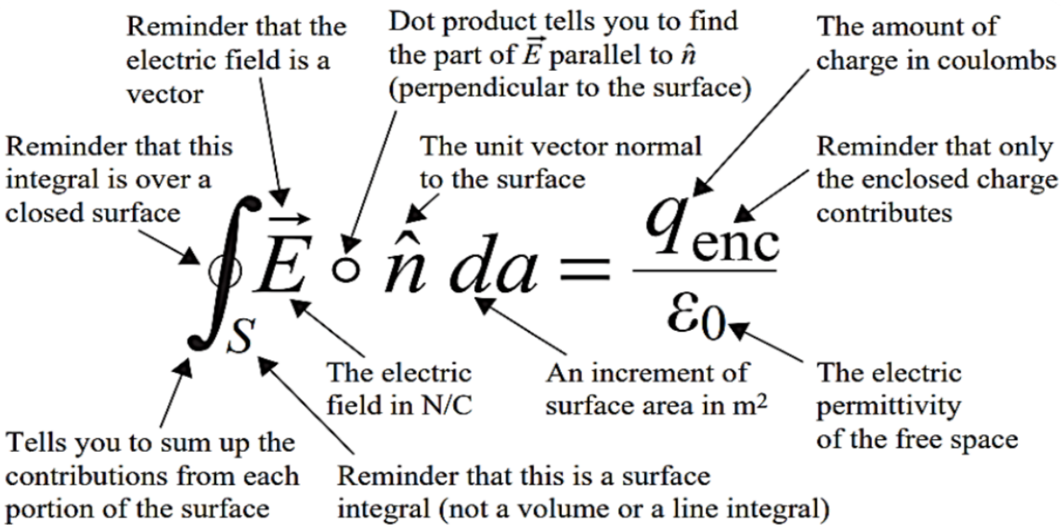
Maxwell's Equations Symbols

Dr. Abdullah Idrees

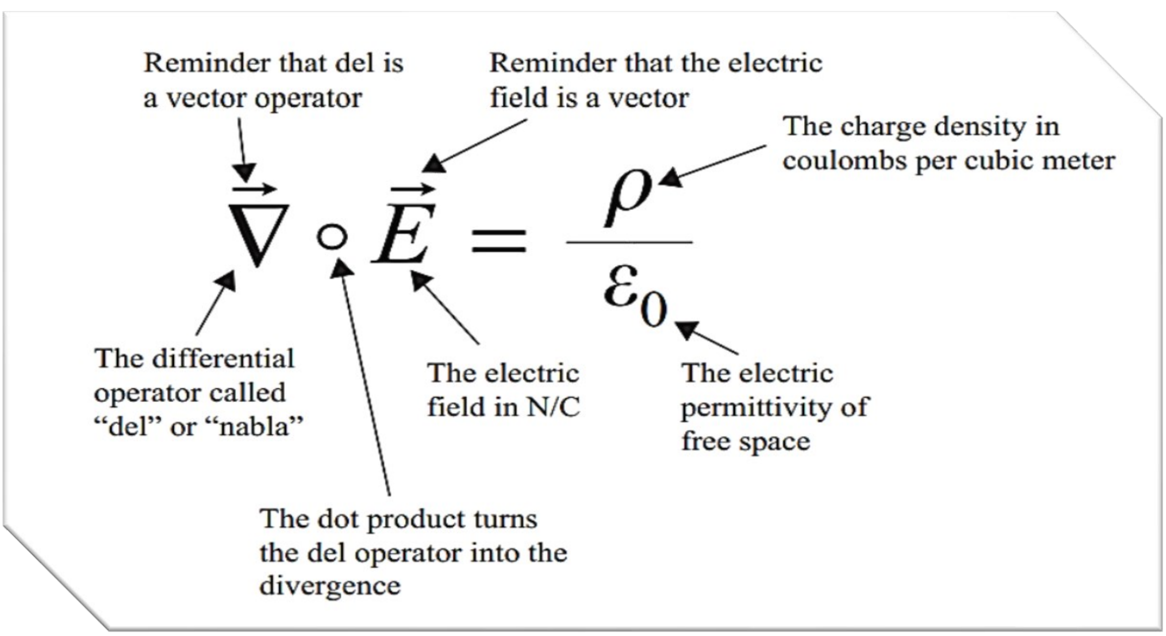
The integral form of Gauss's law

Electric charge produces an electric field, and the flux of that field passing through any closed surface is proportional to the total charge contained within that surface.



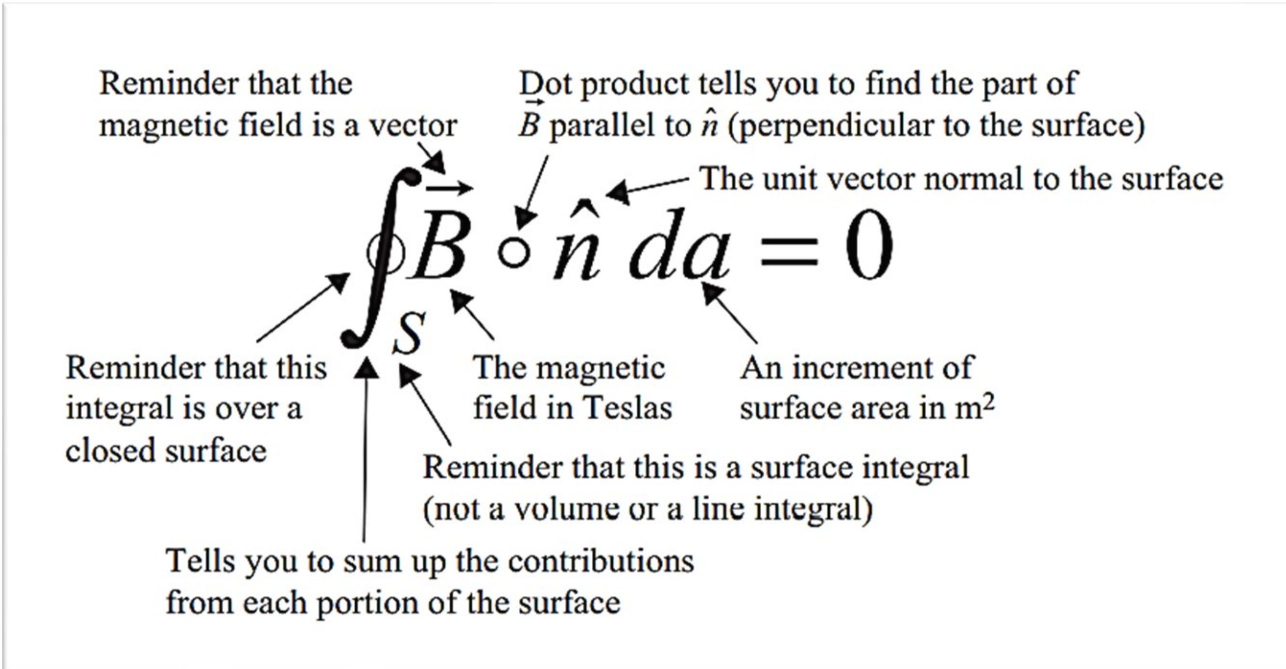
The differential form of Gauss's law

The electric field produced by electric charge diverges from positive charge and converges upon negative charge.



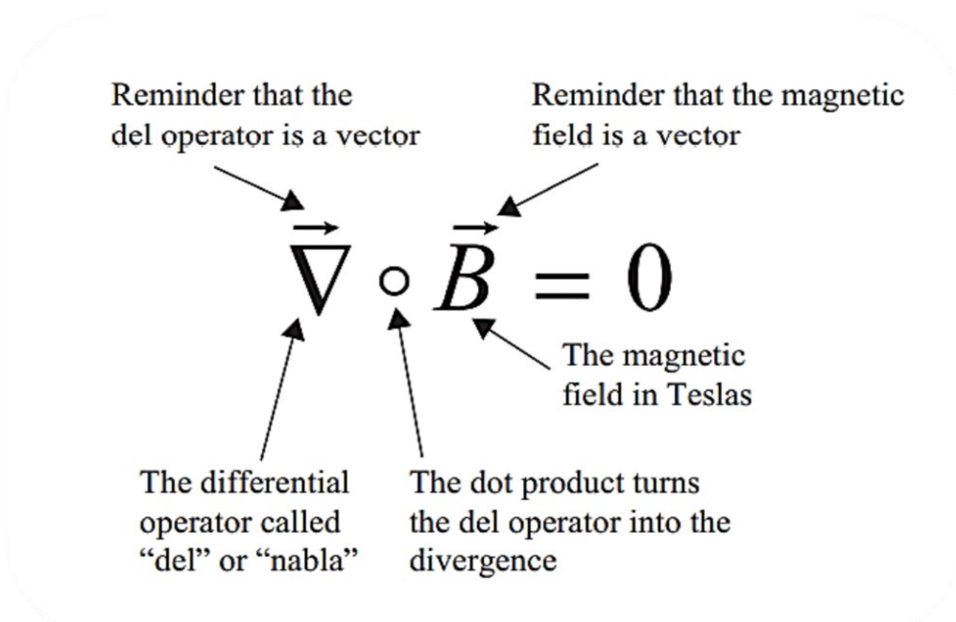
Gauss's law for magnetic fields

The total magnetic flux passing through any closed surface is zero.



The differential form of Gauss's law

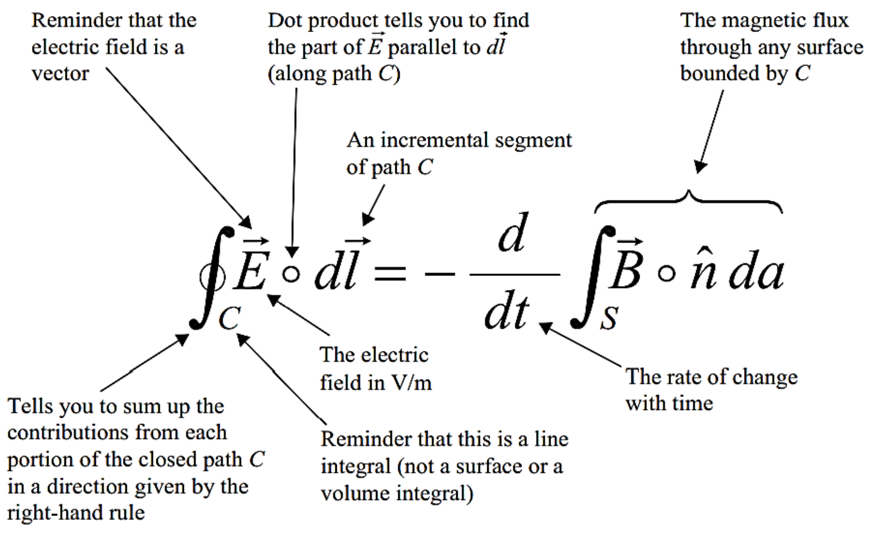
The divergence of the magnetic field at any point is zero.



Faraday's law

Standard form of Faraday's law:

Changing magnetic flux through a surface induces an emf in any boundary path of that surface, and a changing magnetic field induces a circulating electric field.



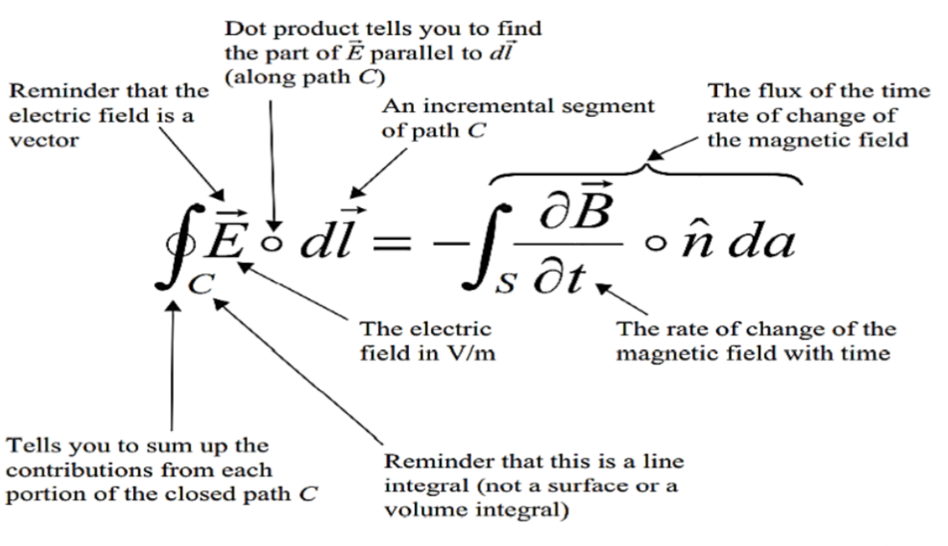
$$\oint_C \vec{E} \circ d\vec{l} = -\frac{d}{dt}\int_S \vec{B} \circ \hat{n}\, da$$

Faraday's law

Changing magnetic flux through a surface induces an emf in any boundary path of that surface, and a changing magnetic field induces a circulating electric field.

Alternative form of Faraday's law

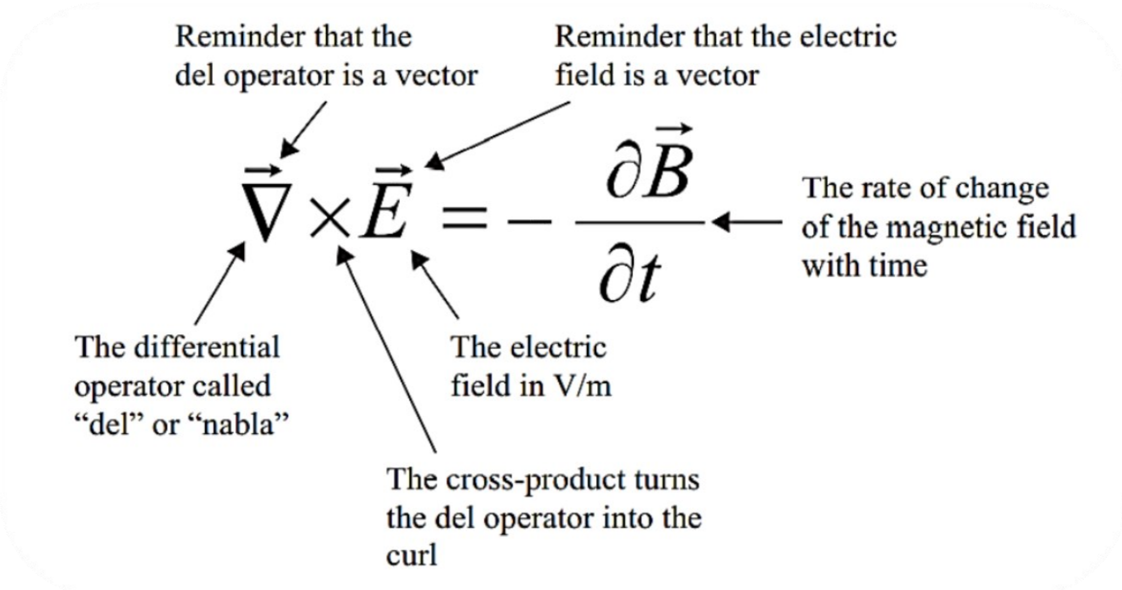
This version of Faraday's law; the time derivative operates only on the magnetic field rather than on the magnetic flux



$$\oint_C \vec{E} \circ d\vec{l} = -\int_S \frac{\partial \vec{B}}{\partial t} \circ \hat{n}\, da$$

The differential form of Faraday's law

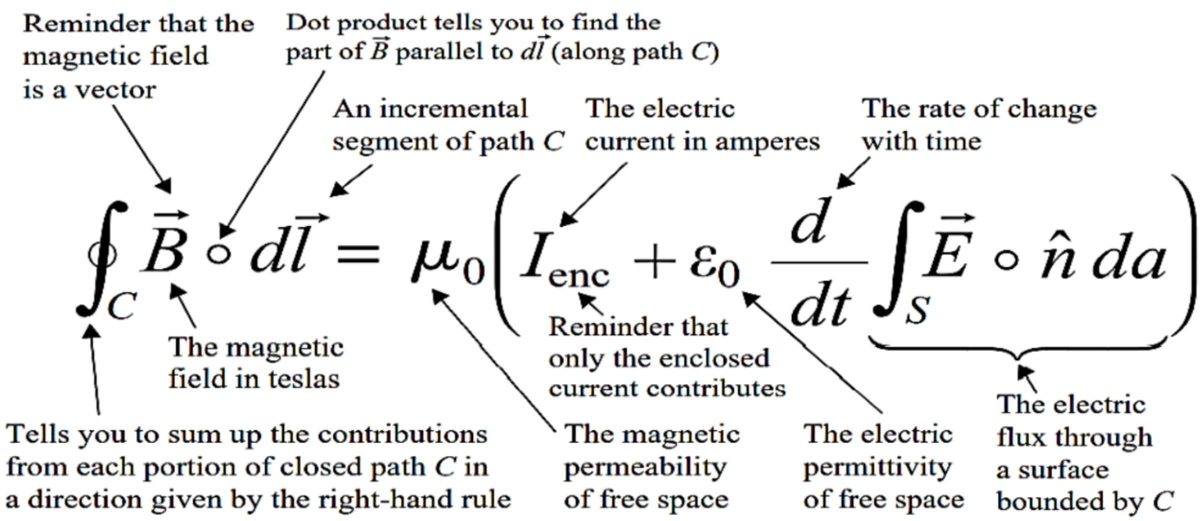
A circulating electric field is produced by a magnetic field that changes with time



The integral form of the Ampere–Maxwell law

An electric current or a changing electric flux through a surface produces a circulating magnetic field around any path that bounds that surface.

$$\oint_C \vec{B} \circ d\vec{l} = \mu_0 \left(I_{\text{enc}} + \varepsilon_0 \frac{d}{dt} \int_S \vec{E} \circ \hat{n}\, da \right)$$



The differential form of the Ampere–Maxwell law

A circulating magnetic field is produced by an electric current and by an electric field that changes with time

$$\vec{\nabla} \times \vec{B} = \mu_0 \left(\vec{J} + \varepsilon_0 \frac{\partial \vec{E}}{\partial t} \right)$$