

# Maxwells equations

- [curl of a curl more clearly explained](#)
- [Div , Grad , Curl : Vector Calculus](#)
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## Symbols

$\nabla$  = Del , Nabla or upside down Delta - The Grad operator will turn scalar into a vector field.

$\nabla \cdot$  = Div or divergence defined as Dot Product - returns a scalar field.

$\nabla$  = Del , Nabla or upside down Delta. - grad operator will turn scalar into a vector field

x,y, and z or zed are vectors returns matrix of partial derivatives

$\begin{bmatrix} \partial f / \partial x \\ \partial f / \partial y \\ \partial f / \partial z \end{bmatrix}$

$f(x,y,z) = \begin{bmatrix} \partial f / \partial x \\ \partial f / \partial y \\ \partial f / \partial z \end{bmatrix}$

$\begin{bmatrix} \partial f / \partial x \\ \partial f / \partial y \\ \partial f / \partial z \end{bmatrix}$

The rule for taking the curl of a curl in mathematics is that the curl of the curl of a vector field is essentially equivalent to applying the Laplacian operator to each component of the vector field, with a slight adjustment to account for the vector nature of the operation; mathematically, it can be written as:  $\text{curl}(\text{curl}(\mathbf{F})) = \nabla(\nabla \cdot \mathbf{F}) - \nabla^2 \mathbf{F}$  where  $\nabla$  is the gradient operator,  $\nabla \cdot$  is the divergence operator, and  $\nabla^2$  is the Laplacian operator

Vector components:

When calculating the curl of a curl, you need to apply the Laplacian to each component of the vector field separately.

Interpretation:

The curl of a curl essentially measures the "rotation of the rotation" within a vector field.

Schrodinger equation:

$\Psi$  is the wavefunction, a function of time and position. The purpose of the Schrodinger equation is to describe the wavefunction and how it evolves over time.

$\hbar$  is the reduced Planck constant, a constant with a value of about  $10^{-34}$  Js.

$m$  is the mass of the particle being modelled.

$V$  is a potential acting on that particle.

and all other symbols should be self-explanatory.

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Heaviside Maxwell equations" refers to the modern, simplified form of Maxwell's equations, which were significantly reorganized and presented using vector calculus by Oliver Heaviside, making them more concise and widely used today; essentially, the term describes the set of four equations that represent the fundamental laws of electromagnetism in their most common form, credited to Heaviside's work on simplifying Maxwell's original equations.

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Newton's laws of motion relate an objects motion to the forces acting on it.

1. In the first law, an object will not change its motion unless a force acts on it. Aristotle mechanics -> Galileo Galilei -> Rene Descartes ->
2.  $F = ma$
3. every action there is an equal but opposite reaction.

In the 20th century Newton's laws were replaced by quantum mechanics and relativity as the most fundamental laws of physics. Philosophiæ Naturalis Principia Mathematica established classical mechanics

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