Physics 454 Applied Electromagnetism

Maxwell's Equations:

$$\vec{\nabla} \cdot \vec{D} = \rho$$
$$\vec{\nabla} \cdot \vec{B} = 0$$
$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$
$$\vec{\nabla} \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$$

Products of derivatives:

$$\vec{\nabla} \times (\vec{\nabla} f) = 0 \qquad \text{The curl of a gradient is zero.}$$

$$\vec{\nabla} \cdot (\vec{\nabla} \times \vec{F}) = 0 \qquad \text{The divergence of a curl is zero.}$$

$$\vec{\nabla} \times (\vec{\nabla} \times \vec{F}) = \vec{\nabla}(\vec{\nabla} \cdot \vec{F}) - \nabla^2 F$$

Lorentz Transforms: Any four-vector transforms as

$$x'^{\mu} = \Lambda^{\mu}_{\nu} x^{\nu}$$

where

$$\Lambda^{\mu}_{\nu} = \begin{vmatrix} \gamma & -\beta\gamma & 0 & 0 \\ -\beta\gamma & \gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}.$$

Remember that, as with ordinary vectors, all four terms in a four-vector have the same physical units.