In[1]:=
```
ClearAll["Global`*"]
(*Define metric*)
η = {{-1, 0, 0, 0}, {0, 1, 0, 0}, {0, 0, 1, 0}, {0, 0, 0, 1}};
(*Define electromagnetic tensor w/ upper indices*)
F = {{0, E1, E2, E3}, {0, 0, B3, 0}, {0, 0, 0, B1}, {0, B2, 0, 0}}; F = F - Transpose[F];(*Antisymmetric*)
FLowered = Transpose[η].F.η;

(*-------------------- Check Ampère' law --------------------*)
J = {{ρ}, {J1}, {J2}, {J3}}; (*Define electric current*)
Off[General::ivar](*Turn off some warnings*);
LHSfunction[β_] := Sum[D[F[[α + 1, β + 1]], α], {α, 0, 3}] + J[[β + 1]];
Print[FullSimplify[MatrixForm[{{LHSfunction[1]}, {LHSfunction[2]}, {LHSfunction[3]}}], " = 0"];
```

$$\begin{pmatrix} (\,J1 + \partial_1 0 + \partial_3 B2 + \partial_2 (-B3) + \partial_0 E1\,) \\ (\,J2 + \partial_2 0 + \partial_3 (-B1) + \partial_1 B3 + \partial_0 E2\,) \\ (\,J3 + \partial_3 0 + \partial_2 B1 + \partial_1 (-B2) + \partial_0 E3\,) \end{pmatrix} = \begin{matrix} 0 \\ 0 \\ 0 \end{matrix}$$

```
(*-------------------- Check Gauß' law for magnetism--------------------*)
LHSfunction[α_, β_, γ_] := D[FLowered[[β + 1, γ + 1]], α] + D[FLowered[[α + 1, β + 1]], γ] +
    D[FLowered[[γ + 1, α + 1]], β](*For evaluating the LHS of (2)*)
 (*What kind of fucking programming language indexes from 1??*);

Print[LHSfunction[1, 2, 3], " = 0"];
```

$$\partial_1 B1 + \partial_2 B2 + \partial_3 B3 = 0$$

```
(*-------------------- Check Faraday-s law --------------------*)
Print[MatrixForm[{{LHSfunction[0, 2, 3]}, {LHSfunction[0, 1, 3]}, {LHSfunction[0, 1, 2]}}], " = 0"];
```

$$\begin{pmatrix} \partial_0 B1 + \partial_3 (-E2) + \partial_2 E3 \\ \partial_0 (-B2) + \partial_3 (-E1) + \partial_1 E3 \\ \partial_0 B3 + \partial_2 (-E1) + \partial_1 E2 \end{pmatrix} = \begin{matrix} 0 \\ 0 \\ 0 \end{matrix}$$