Differentialoperatoren

- Kartesische Orthonormalbasis

$$\{\underline{e}_1, \underline{e}_2, \underline{e}_3\} \quad \text{mit} \quad \underline{e}_a \underline{e}_b = \delta_{ab}$$

- Gradient

$$\operatorname{grad} f = \partial_{\underline{r}} f = \underline{e}_1 \partial_{x^1} f + \underline{e}_2 \partial_{x^2} f + \underline{e}_3 \partial_{x^3} f$$

- Divergenz

$$\operatorname{div} \underline{A} = \partial_{\underline{r}} \cdot \underline{A} = \partial_{x^1} A^1 + \partial_{x^2} A^2 + \partial_{x^3} A^3$$

- Rotation

$$\begin{aligned} \operatorname{rot} \underline{A} = \partial_{\underline{r}} \times \underline{A} = \; & \left(\partial_{x^2} A^3 - \partial_{x^3} A^2\right) \underline{e}_1 + \\ & \left(\partial_{x^3} A^1 - \partial_{x^1} A^3\right) \underline{e}_2 + \\ & \left(\partial_{x^1} A^2 - \partial_{x^2} A^1\right) \underline{e}_3 \end{aligned}$$

- Einsteinsche Summenkonvention

$$\begin{aligned} \operatorname{grad} f &= \underline{e}_a \partial_{x^a} f \\ \operatorname{div} \underline{A} &= \partial_{x^a} A^a \\ \operatorname{rot} \underline{A} &= \varepsilon_{abc} \underline{e}_a \partial_{x^b} A^c \end{aligned}$$