

Mathematical Results

Task 3

$$\nabla f = [2x_1 + 2x_2, 2x_1 - 3]$$

$$\text{Richtungsableitung} : (2x_1 - 3) \sin(\phi) + (2x_1 + 2x_2) \cos(\phi)$$

Task 5

(a)

$$f' = [x_2 \cos(x_1) \cos(x_3) \quad \sin(x_1) \cos(x_3) \quad -x_2 \sin(x_1) \sin(x_3)]$$

$$g' = \left[\frac{3x_3 \cos(-x_1+2x_2+x_3)}{\sin^2(-x_1+2x_2+x_3)} \quad -\frac{6x_3 \cos(-x_1+2x_2+x_3)}{\sin^2(-x_1+2x_2+x_3)} \quad \frac{3(-x_3 \cos(-x_1+2x_2+x_3) + \sin(-x_1+2x_2+x_3))}{\sin^2(-x_1+2x_2+x_3)} \right]$$

(b)

$$f' = \begin{bmatrix} \cos(x_1) & -\frac{2x_2}{1-x_2^2} & 0 \\ 0 & -2x_2 e^{-x_2^2} & 0 \\ x_3 \sinh(x_1 x_3) & 0 & x_1 \sinh(x_1 x_3) \end{bmatrix}$$

$$g' = \begin{bmatrix} 3x_1^2 & 4x_2 & \cos(x_3) \\ x_2^2 x_3^3 & 2x_1 x_2 x_3^3 & 3x_1 x_2^2 x_3^2 \\ -\sin(x_1) \sin(x_2) & \cos(x_1) \cos(x_2) & 0 \end{bmatrix}$$

$$h' = \begin{bmatrix} 9x_1^2 e^{3x_1^3+2x_2^2} & 4x_2 e^{3x_1^3+2x_2^2} \\ 0 & -2x_2 \left(\tan^2(e^{-x_2^2}) + 1 \right) e^{-x_2^2} \\ x_2^2 \cosh(x_1 x_2^2) & 2x_1 x_2 \cosh(x_1 x_2^2) \end{bmatrix}$$