

Aufgabe 1)

$$Df(x) = \begin{pmatrix} \frac{df_1}{dx_1}(x) & \frac{df_1}{dx_2}(x) \\ \frac{df_2}{dx_1}(x) & \frac{df_2}{dx_2}(x) \end{pmatrix} = \begin{pmatrix} -18 & -4x_2 \\ -4x_2 & -4x_1 + 12x_2^2 \end{pmatrix}$$

$$-4x_2(x_1 - x_2^2) = -4x_2x_1 + 4x_2^3$$

$$\frac{df_2}{dx_1}(x) = -4x_2$$

$$\frac{df_2}{dx_2}(x) = -4x_1 + 12x_2^2$$

$$Df(x^{(0)}) \cdot \delta^{(0)} = -f(x^{(0)})$$

$$f(x^{(0)}) = \begin{pmatrix} -1.42 \\ -1.044 \end{pmatrix}$$

$$\|f(x^{(0)})\|_2 = \underline{\underline{1.76}}$$

$$\begin{pmatrix} -18 & -3.6 \\ 3.6 & 5.32 \end{pmatrix} \cdot \delta^{(0)} = \begin{pmatrix} 1.42 \\ 1.044 \end{pmatrix}$$

$$\delta^{(0)} = \begin{pmatrix} -0.10 \\ 0.12 \end{pmatrix}$$

$$\|x^{(1)} - x^{(0)}\|_2 = \|\delta^{(0)}\|_2 = \underline{\underline{0.16}}$$

$$x^{(1)} = x^{(0)} + \delta^{(0)} = \begin{pmatrix} 0.99 \\ 1.02 \end{pmatrix}$$

$$Df(x^{(1)}) \cdot \delta^{(1)} = -f(x^{(1)})$$

$$f(x^{(1)}) = \begin{pmatrix} -0.03 \\ 0.23 \end{pmatrix}$$

$$\|f(x^{(1)})\|_2 = \underline{\underline{0.23}}$$

$$\begin{pmatrix} -18 & -4.10 \\ -4.10 & 8.64 \end{pmatrix} \cdot \delta^{(1)} = \begin{pmatrix} 0.03 \\ -0.23 \end{pmatrix}$$

$$\delta^{(1)} = \begin{pmatrix} 0.004 \\ -0.02 \end{pmatrix}$$

$$\|\delta^{(1)}\|_2 = \underline{\underline{0.02}}$$

$$x^{(2)} = x^{(1)} + \delta^{(1)} = \underline{\underline{\begin{pmatrix} 0.99 \\ 1.00 \end{pmatrix}}}$$