Exercise 8: Adjustment Calculation - part III

- Non-linear adjustment problem -

Group:	Surname, First name:	Matriculation number:	Signature*:

* With my signature I declare that I was involved in the elaboration of this homework.

Submission until: **12.01.2025**

Objective

This exercise deals with the adjustment of non-linear observation equations. The objective function of the non-linear adjustment problem from task 1 is depicted in Figure 1. The minimum of this function is the solution of the linearized problem.

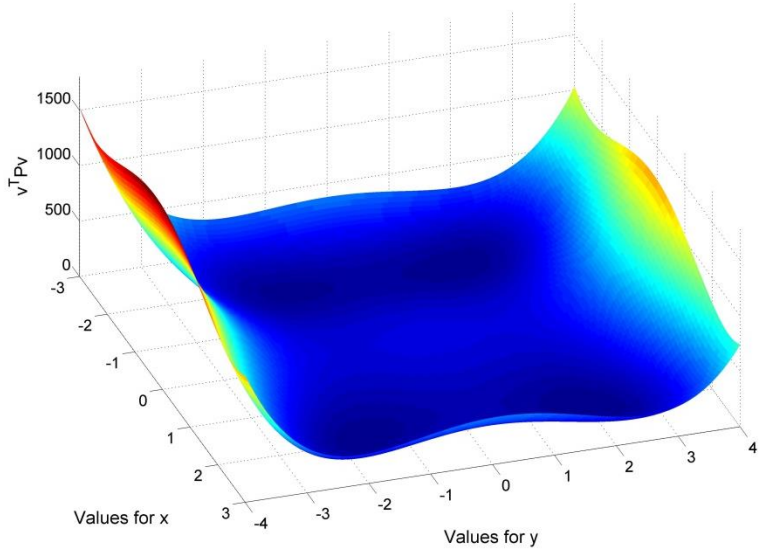

Figure 1: Objective function of the equation system of task 1

Task 1:

Solve the following over-determined, non-linear equation system via least-squares adjustment applying matrix notation (example from the lecture).

$$-4.0 = x + y - 2y^2$$
$$8.0 = x^2 + y^2$$
$$7.7 = 3x^2 - y^2$$

- The values -4.0, 8.0 and 7.7 are equally weighted, uncorrelated measurements.
- The parameters x and y are unknowns.
- Solve the normal equation system and determine the estimated parameters.

Task 2 (Homework):

The side length a and the mass m of a cube of copper were measured. The density $\rho = 8.93\ \mathrm{g/cm^3}$ of copper is error free and the temperature effect can be neglected.

- Calculate the adjusted volume V of the cube via least-squares adjustment.
    - Setup the functional model.
    - Which parameters are observations, error-free or unknown parameters?
    - Why it is a non-linear adjustment problem? Please give a short explanation.

Table 1: Measurements

	L_i	σ_{L_i}
a	11.60 mm	0.05 mm
m	15.15 g	0.05 g