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9. Tutorial on the lecture „Introduction to Numerical Mathematics“

Problem 36:
Find the interpolating polynomial of smallest possible degree through the points $(0, 4)$, $(1, 7)$, $(3, 31)$ and $(2, 14)$. Use Lagrangian base-polynomials.

Add afterwards the point $(x_3, f_3) = (4, 3)$ to your interpolation polynomial!

Problem 37:
Calculate the Newton interpolation polynomial for

x_k	0	1	3
f_k	3	1	1

Add afterwards the point $(x_3, f_3) = (4, 5)$ and find the modified interpolating polynomial!

Problem 38:

(a) Rostock averaged 6.5° C degrees in March, 11.1° C in April, 20.1° C in June, and 22.0° C in July. Approximate the temperature for May.

(b) A prismatic body of length $L = 3$, width and height are equal to 1, is made of a composite material with smoothly changing density $\rho = \rho(x)$, $x \in [0, L]$. From measurements we know that $\rho(0) = 3$, $\rho(1) = \rho(3) = 1$.

Calculate the total mass of the body, using polynomial interpolation of ρ!

(Units dropped, all quantities made dimensionless.)

Problem 39:
Estimate the error of the interpolation from Problem 34 for $x \in [2, 6]$. Assume that the true f has the form

$$f : [0,\ 12] \to \mathbb{R}, \quad f(x) = \alpha + \beta \sin\left(\frac{x}{6}\pi + \gamma\right)$$

and choose $\beta = 8$ as rough approximation.

The tasks are intended both for processing in the seminars and for independent practice. Especially the 90 minutes of an exercise are sometimes not sufficient to discuss and work on all tasks.