

MATH 4650/CS 4656 - Numerical Analysis I

Worksheet Chapter 4

The following are in-class exercises for chapter 4.

Our dataset is:

$$\mathbf{D}_4 = \begin{array}{l} x : \quad 4 \quad -2 \quad -1 \quad 0 \\ y = f(x) : 1 \quad 7 \quad -16 \quad -51 \end{array}$$

1. Compute the Lagrange interpolation polynomial for \mathbf{D}_4 .
2. Compute the Newton interpolation polynomial for \mathbf{D}_4 .
3. Show that the two polynomials that you obtained in 1, 2 are the same.
4. Compute the Newton interpolation polynomial for \mathbf{D}_4 by computing the associated divided difference table and using it to find the interpolation polynomial.

Given $f(x) = x^2 + 2x + 1$, $f'(1) = 4$. We will compute this in several ways below.

5. Compute $f'(1) = \frac{f(1+h)-f(1)}{h}$ for $h = 10^{-n}$ for $n = 1, 5, 10$
6. Compute the truncation error for $h_0 = 0.1$ and $h = 10^{-n}$.
7. Compute $f'(1) = \frac{f(1+h)-f(1-h)}{2h}$ for $h = 10^{-n}$ for $n = 1, 5, 10$
8. Compute the truncation error for $h_0 = 0.1$ and $h = 10^{-n}$.
9. Now compute $f'(1)$ using automatic differentiation.