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Homework 6 - Numerical Analysis

Interpolation

We selected the function f(x) = e^x - 1, then we calculated the value for the given points.

Table 1: Points used with the interpolation method.

x	f(x)
-2.5	-0.9179150013761012
-1	-0.6321205588285577
0.5	0.6487212707001282
1.2	2.3201169227365472

With these points and their values we run the interpolation methods Vandermonde, Newton and Lagrange. For each method we obtained the following results:

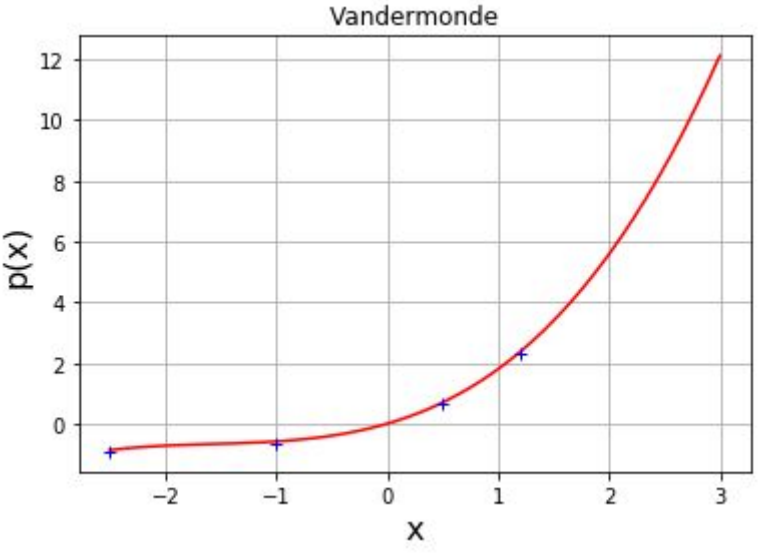

Fig 1: Approximation with Vandermonde method.

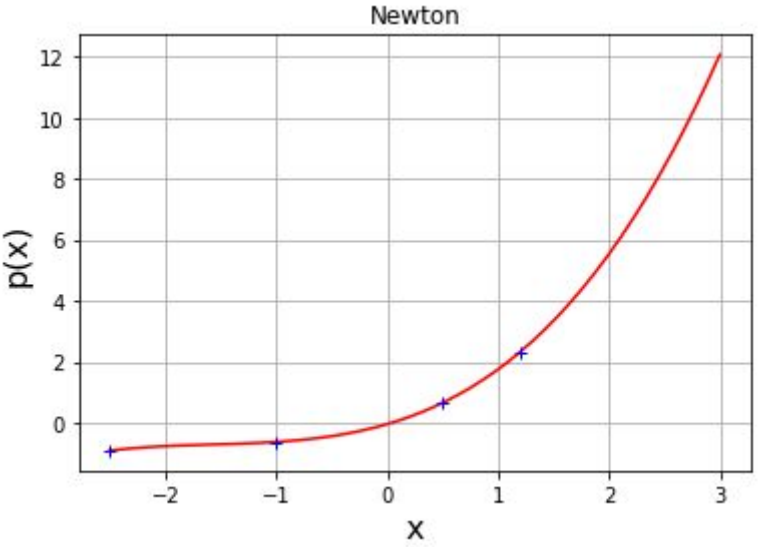

Fig 2: Approximation with Newton method.

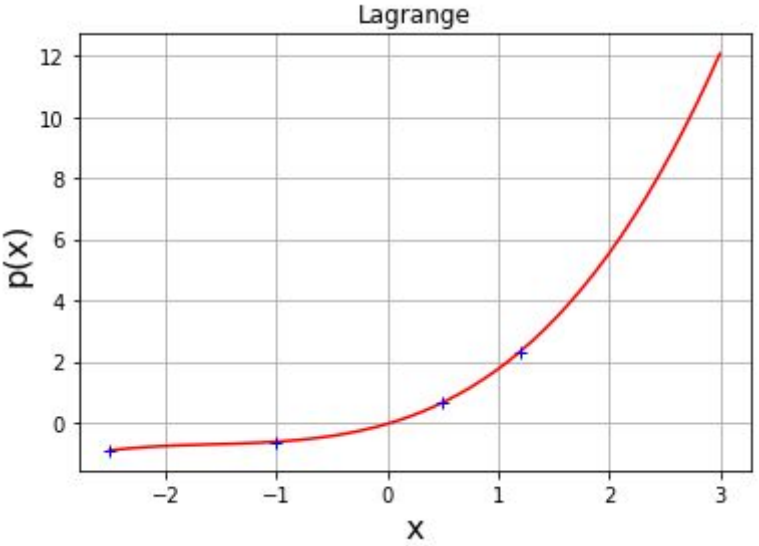

Fig 2: Approximation with Lagrange method.

Root finding methods

For this section we used the vandermonde polynomial which had the following coefficients:
0.12866657 X ^3 + 0.60712136X ^2 + 1.0609553 X - 0.04962004

We used the incremental search method starting from **-3** and with a step of **0.001**. The interval found was **[-2.1938700855983484e-13 , 0.000999999999780613]**.

Using the previous interval we run the methods bisection, regula falsi, newton and secant. For each method we obtained the following results using a tolerance of **1e-7** and an iteration limit of **10000**:

Result	Bisection	Regula falsi	Newton	Secant
Iterations	14	2	5	6
Error	0.0000000648	0.0000000000	0.0000000000	0.0000000005
x	0.0000000610	0.0000000000	0.0000000000	0.0000000000

The approximate polynomial obtained using the Vandermonde method was good enough to obtain a very close value to the real root of the original function.

X0 for newton: -0.1
x0 and x1 for secant: -0.12, -0.1