Assignment-6

Course: SC-374

Computational and Numerical Methods

Instructor: Prof. Arnab Kumar

Made by:

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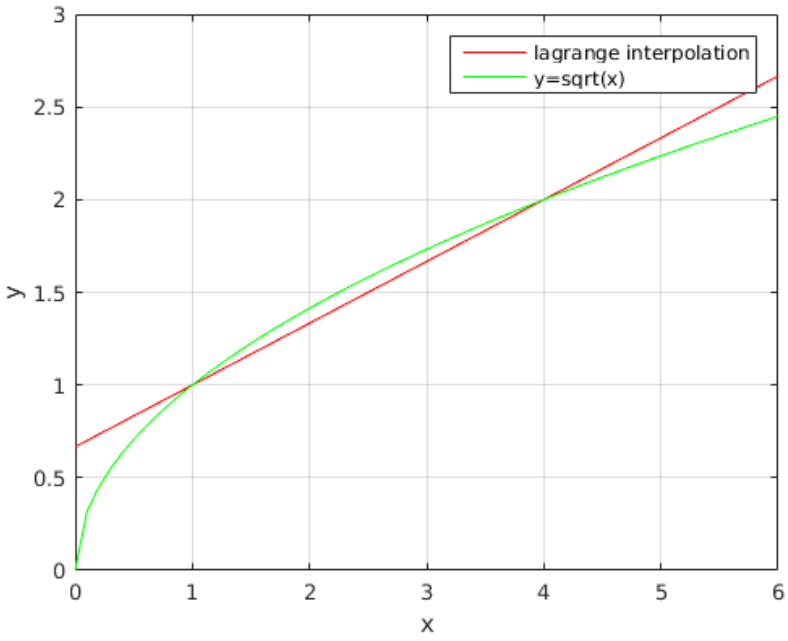
Problem: 1

♦ **Statement:**

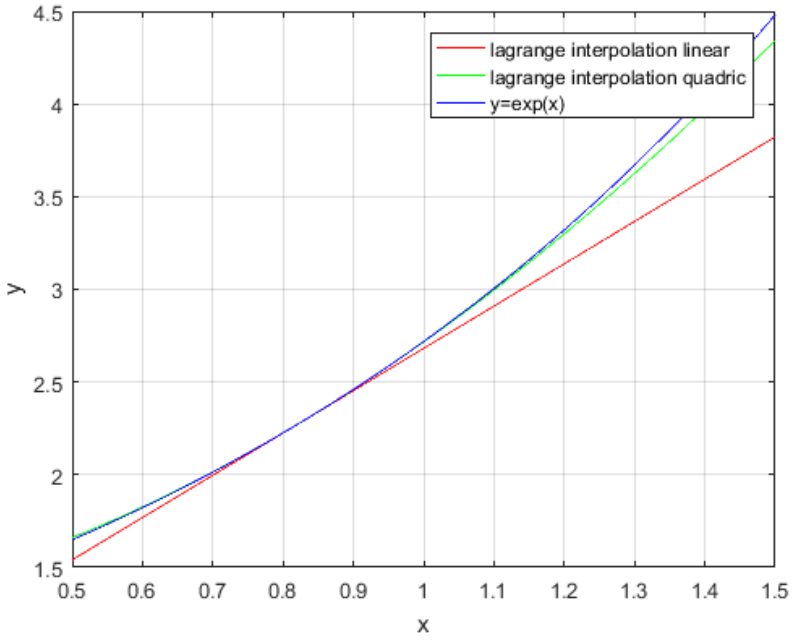
Carry out the Lagrange linear interpolation between (1, 1) and (4, 2). Plot your interpolation function together with $y = x^{\frac{1}{2}}$ for comparison.



Problem: 2

♦ **Statement:**

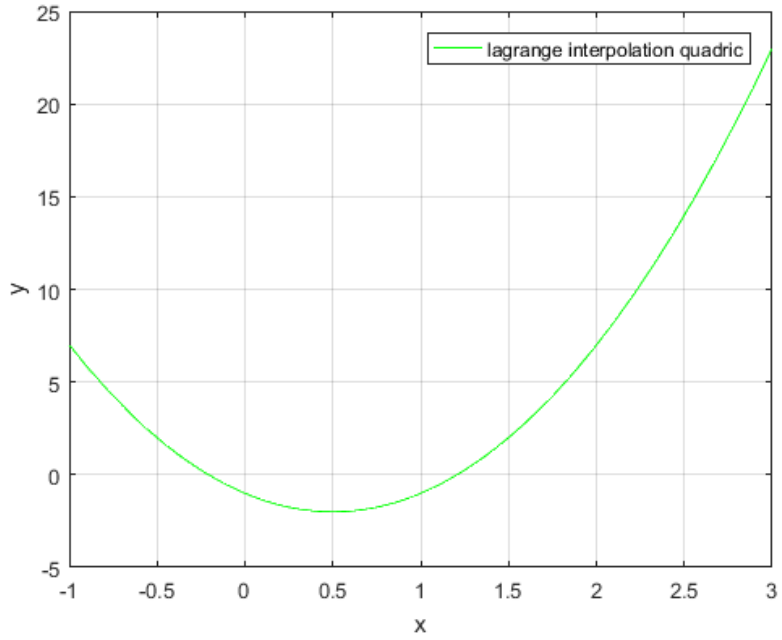
Carry out a Lagrange linear interpolation for (0.82, 2.270500) and (0.83, 2.293319). Extend your study with a Lagrange quadratic polynomial using (0.84, 2.316367). Compare your polynomials with the function $y = e^x$, plotting all of them on same graph.

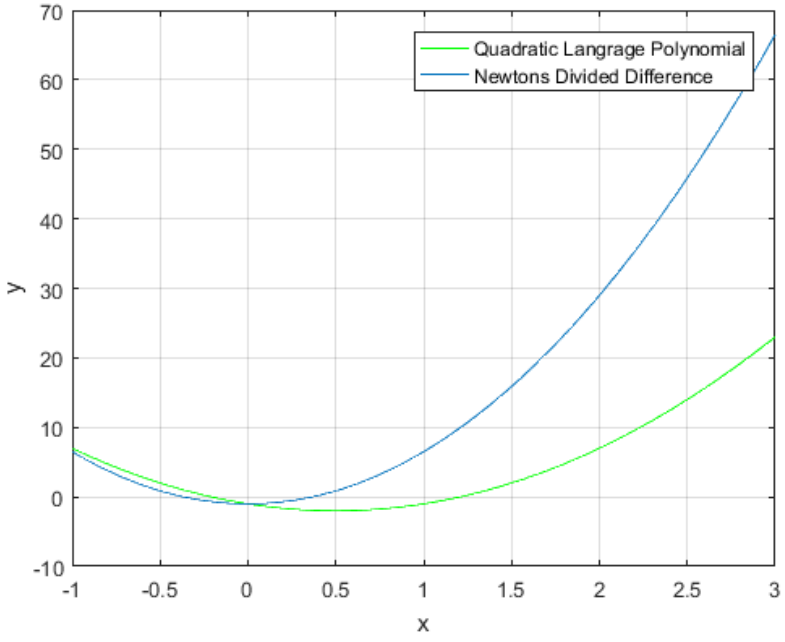


Problem: 3

♦ **Statement:**

Construct a quadratic Lagrange polynomial using the points (0, −1), (1, −1) and (2, 7). Plot your result. Extend this entire exercise with Newton's divided-difference quadratic polynomial and compare the two methods.


lagrange interpolation quadric
25
20
15
10
5
0
-5
y
-1
-0.5
0
0.5
1
1.5
2
2.5
3
x

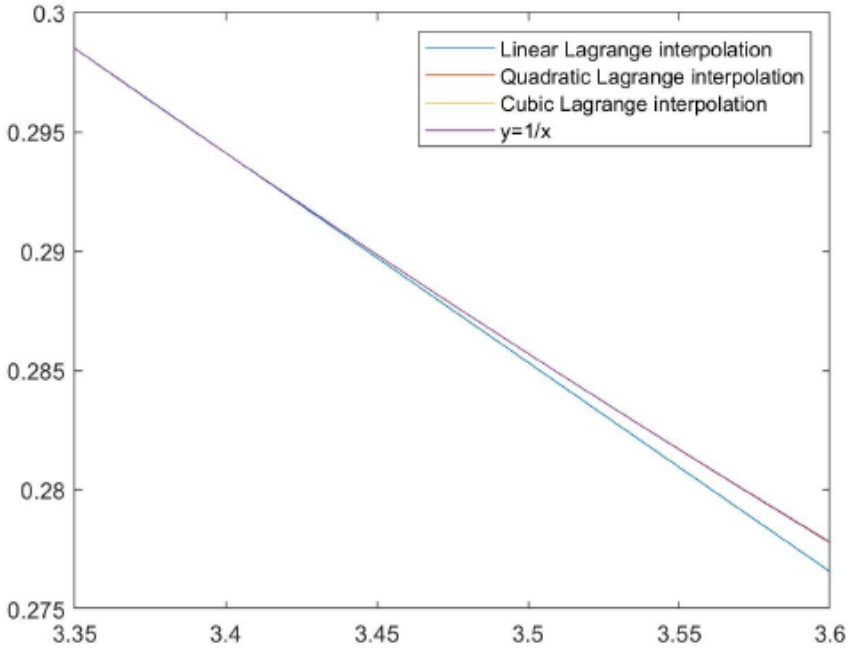

Quadratic Langrage Polynomial
Newtons Divided Difference
70
60
50
40
30
20
10
0
-10
y
-1
-0.5
0
0.5
1
1.5
2
2.5
3
x

Problem: 4

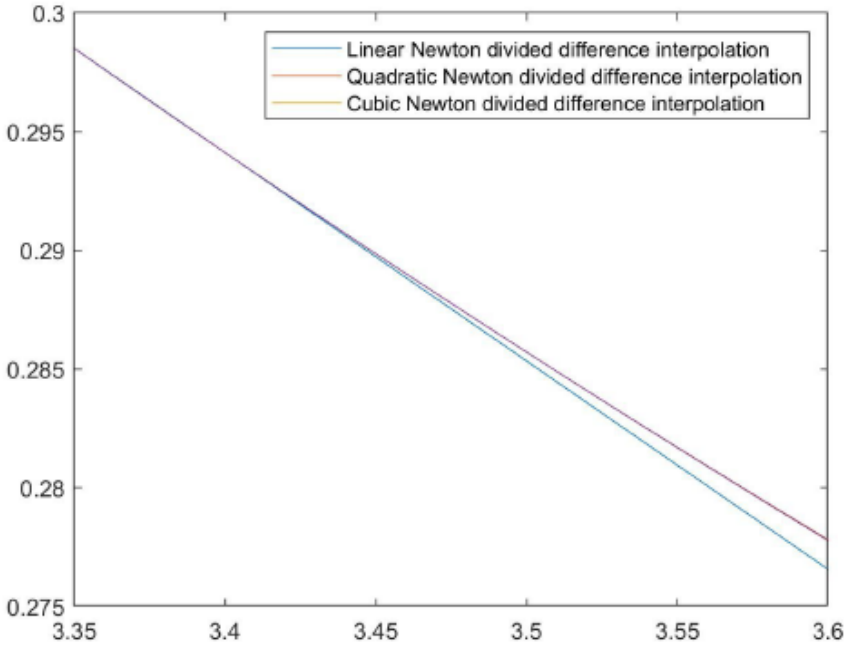
♦ **Statement:**

With the data in provided in table

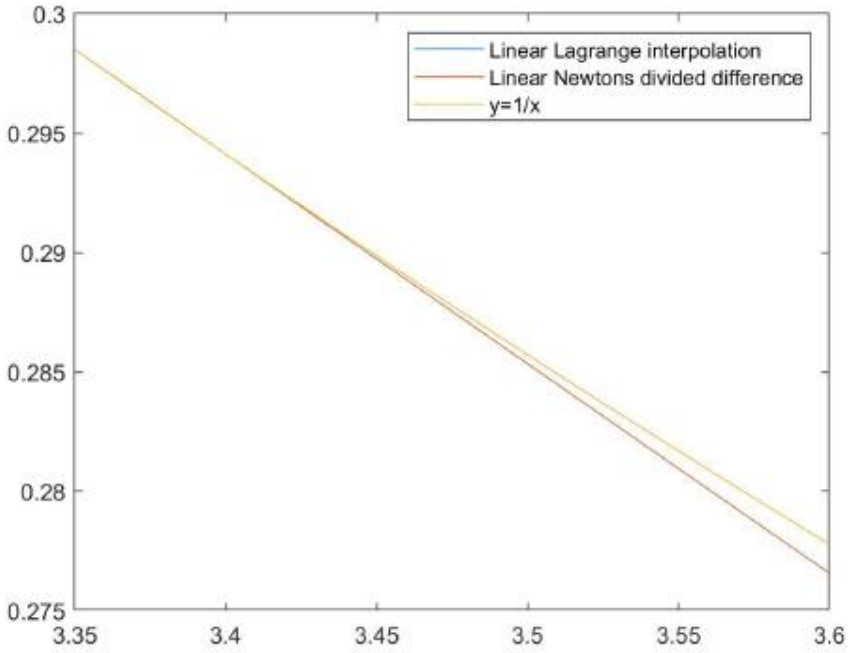
A.) Produce Lagrange polynomials of the linear, quadratic and cubic orders With increasing values of x.

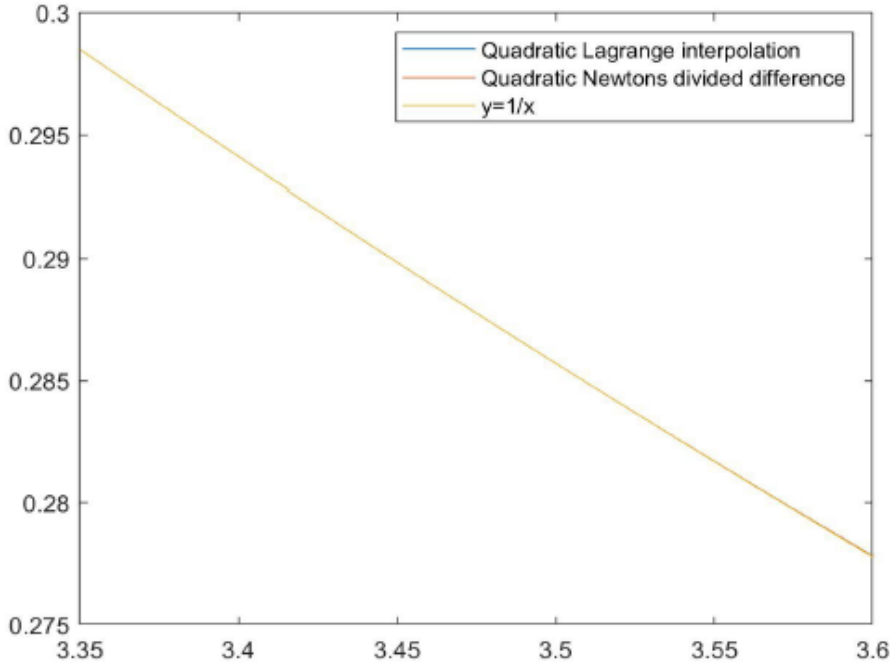


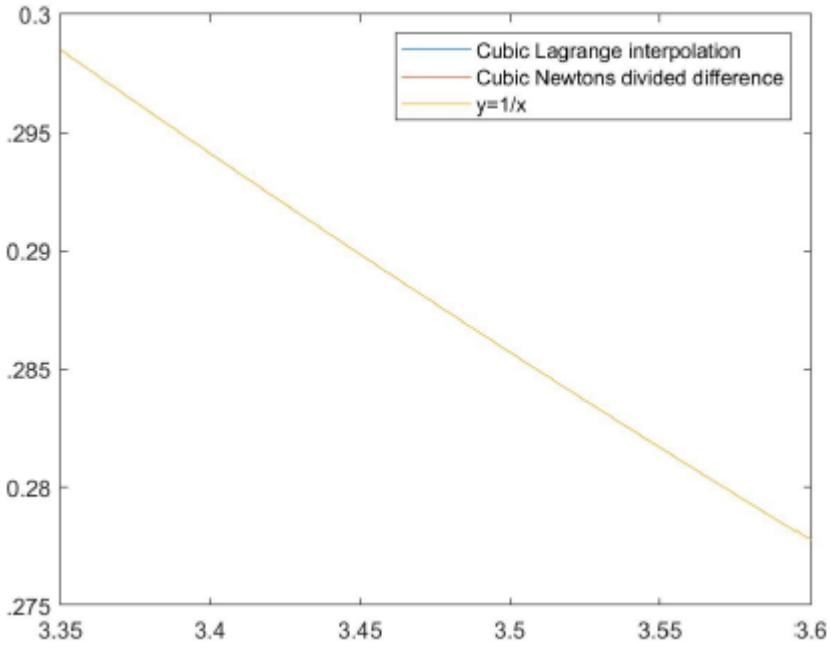
B.) Produce Newton's divided-difference polynomials of the linear, quadratic and cubic orders with increase value of x .



C.) Plot the result of both methods on the same graph and compare them with the function $y = \frac{1}{x}$. Also comment on respective computational advantage of the two methods.


Linear Lagrange interpolation
Linear Newtons divided difference
y=1/x
0.3
0.295
0.29
0.285
0.28
0.275
3.35
3.4
3.45
3.5
3.55
3.6


Quadratic Lagrange interpolation
Quadratic Newtons divided difference
y=1/x
0.3
0.295
0.29
0.285
0.28
0.275
3.35
3.4
3.45
3.5
3.55
3.6

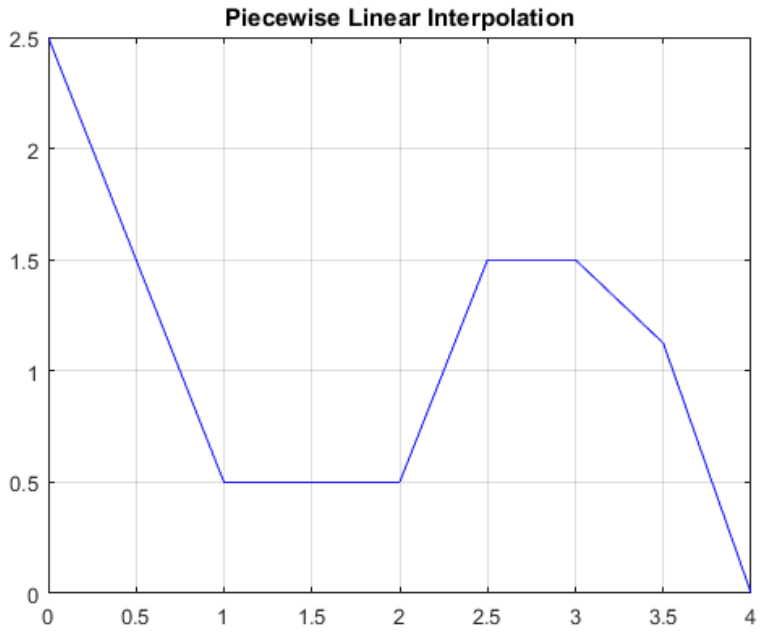


Problem: 5

♦ **Statement:**

With the data in provided in table

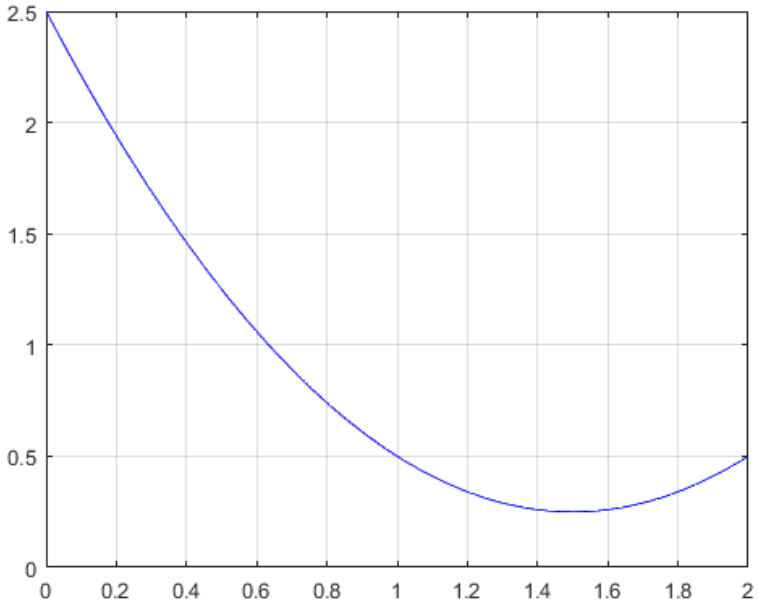
A.) Interpolate successive points by straight line segments. This is known as piecewise linear interpolation .



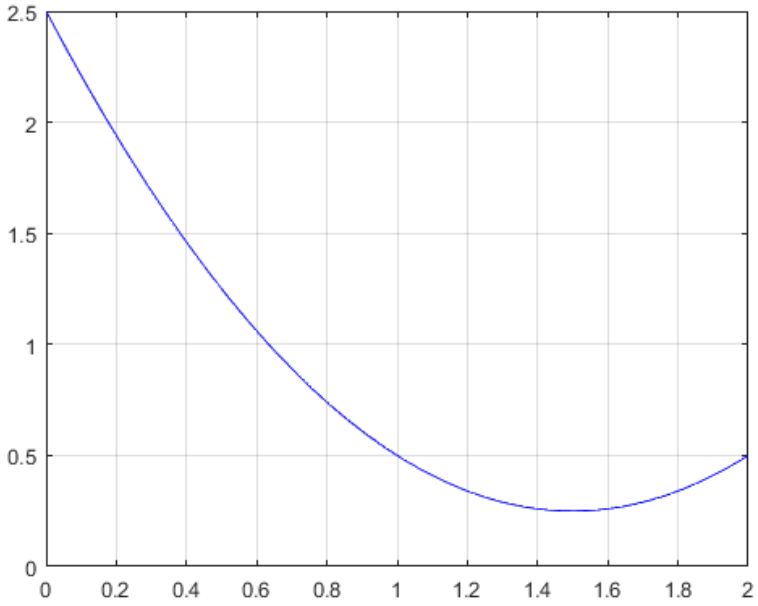
B.) On each of the three following subintervals of x [0 2] , [2 3] and [3 4] interpolate using both lagrange's quadratic polynomial and Newton's divided-difference interpolation polynomial .

- For x[0 2] :-

  Lagrange Quadratic Interpolation

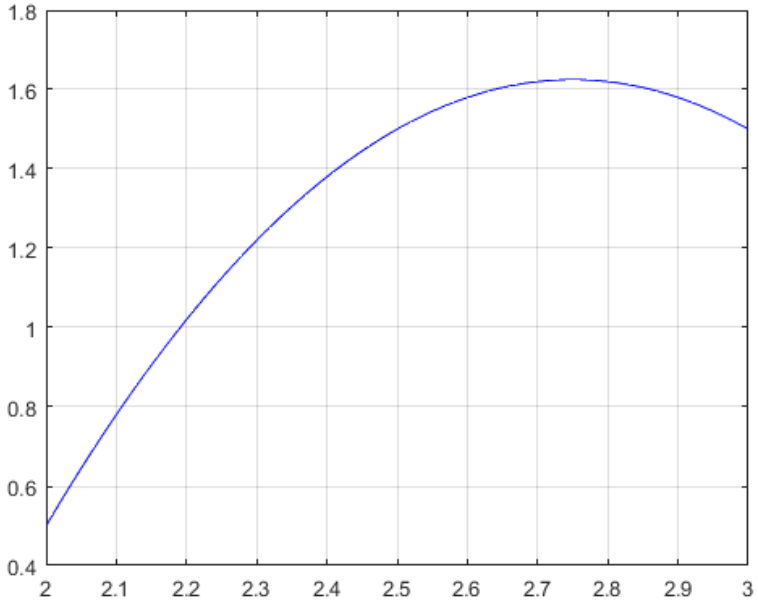


Newton’s divided-difference interpolation

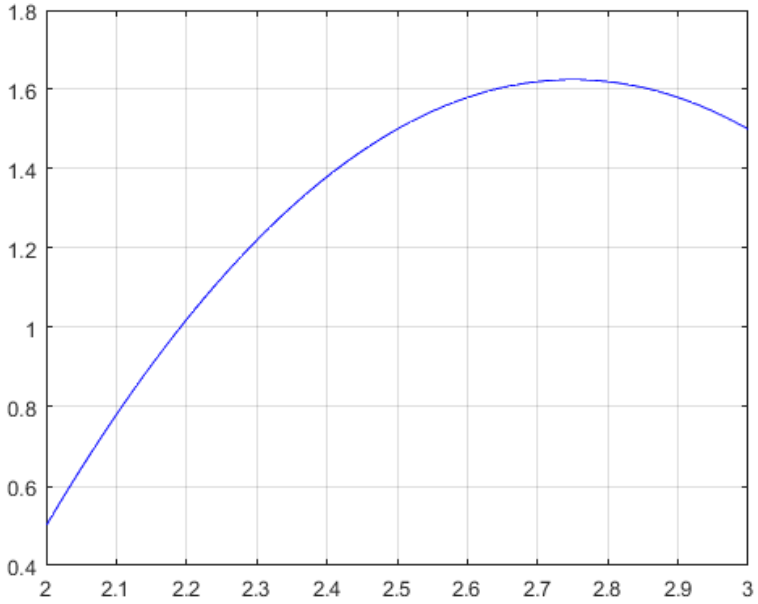


- For x[2 3] :-

Lagrange Quadratic Interpolation

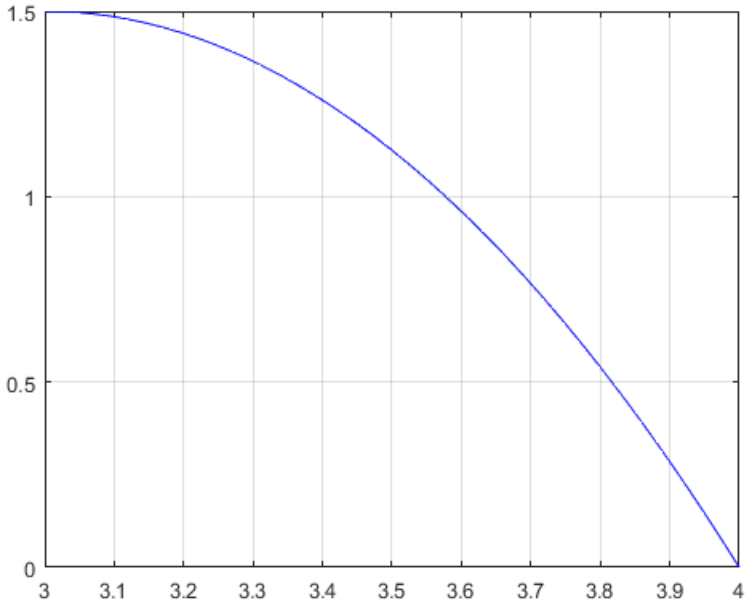


Newton’s divided-difference interpolation

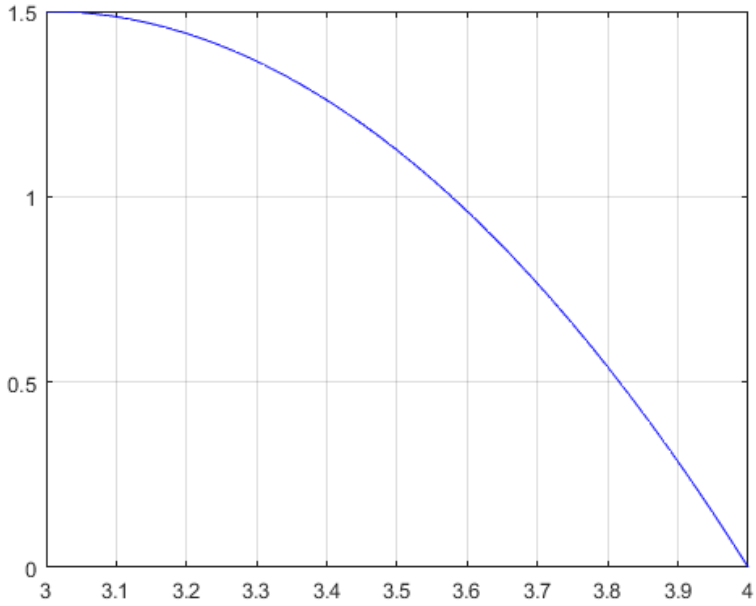


- For x[3 4] :-

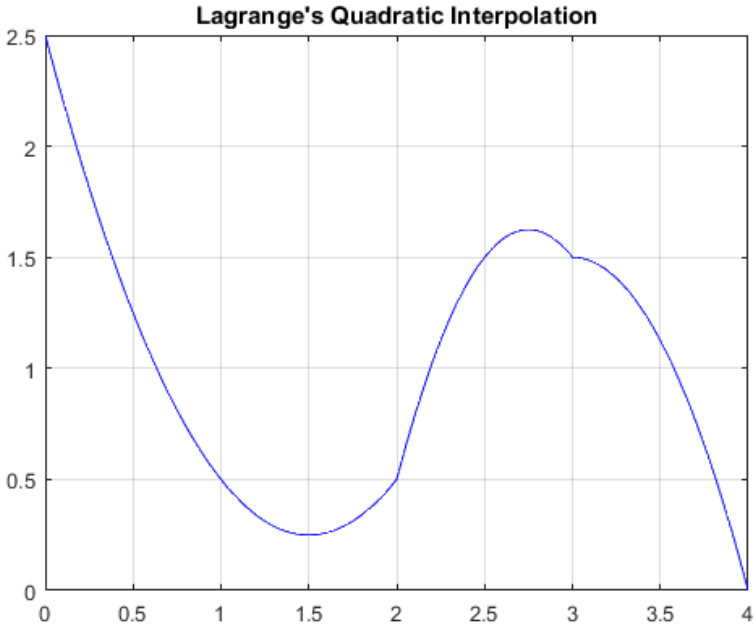
  Lagrange Quadratic Interpolation

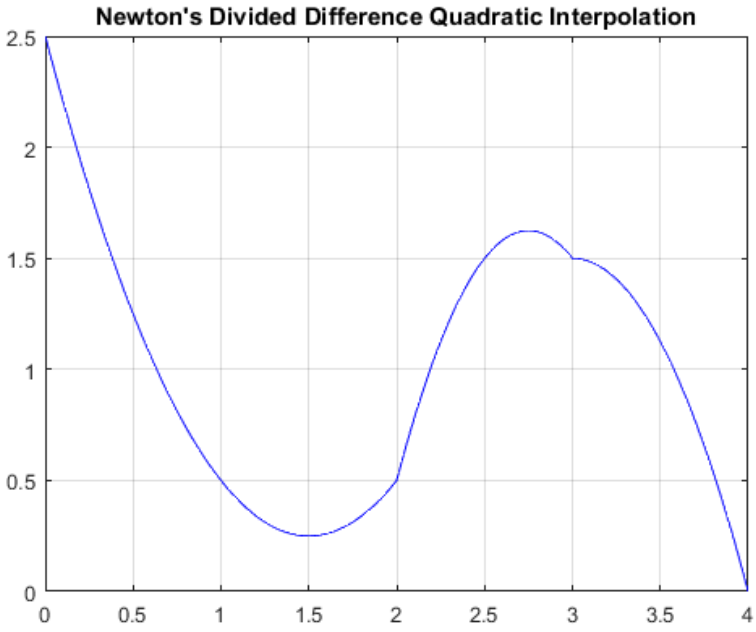


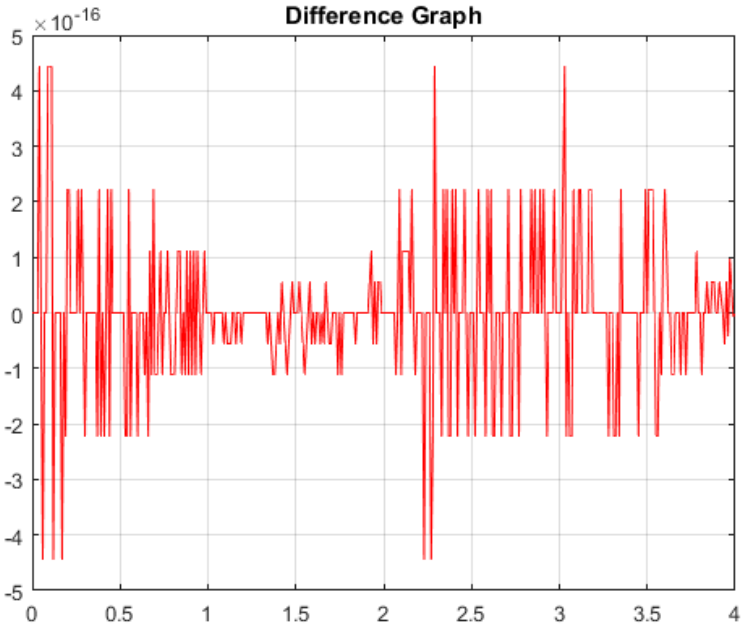
  Newton’s divided-difference interpolation



C.) Plot the results of both methods Covering all the three subintervals on the same graph and compare them




Newton's Divided Difference Quadratic Interpolation
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
3.5
4


Difference Graph
×10^-16
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
0.5
1
1.5
2
2.5
3
3.5
4