Leonardo Carrico
CSCI/MATH 240

Lab 3

Exercise 1

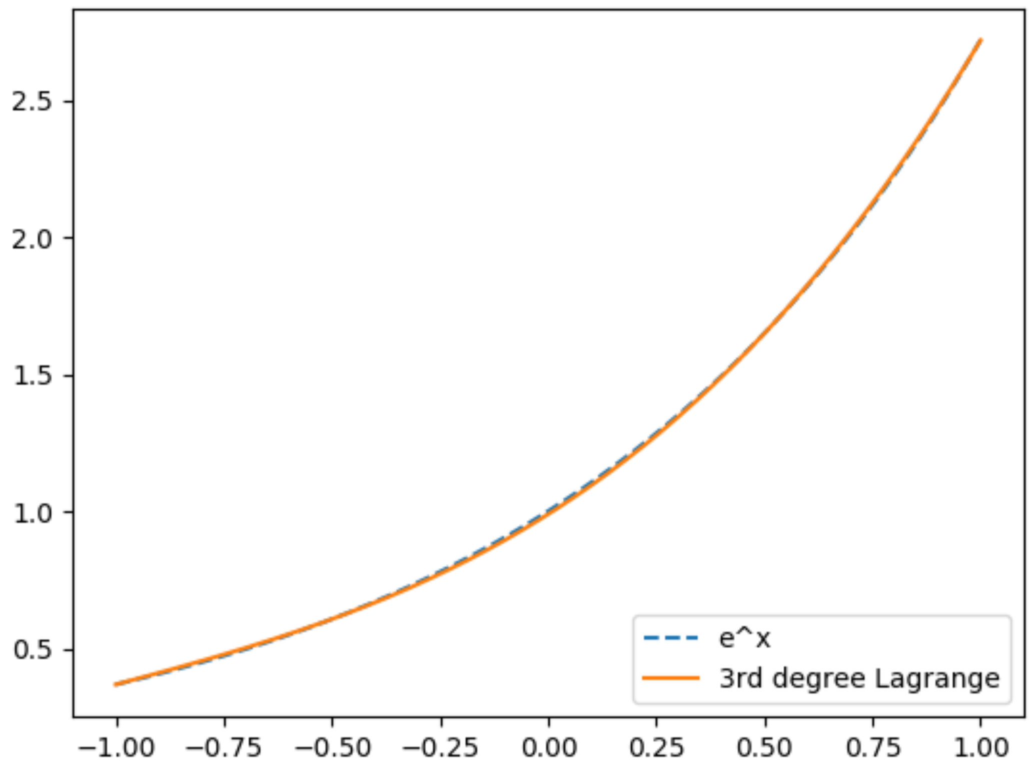
1. The divided differences function was done recursively and is stored inside the lib.py python file.
2. The function I picked was x^4 with the X values as [1, 2, 3] and Y values as [1, 16, 81]. The 2nd derivative of x^4 is 12x^2. When inputting the value x value of 2 into the 2nd derivative, you would get a y value of 48. The divided differences formula gave me the value of 50, which was somewhat of a approximation to 48.

Exercise 2

1. For approximating the 3rd derivative of cos(2x) + e^x + x at 0, I used the X as [-.25, -.1, .1, .25]. This got me the approximation of 1.0036.
2. For approximating the 2nd derivative of ln(x) + x at 1 with 0.1, 1, and 2, I got the value of -1.9635. The error value was .9635 since the actual value is -1.
3. This problem is approximating a value of the same derivative of the same function as the previous problem, but with the change of X values. With X as [.5, 1. 1.5], we actually get a much closer approximation of -1.1507. The reason for this is that the x values from this problem were actually closer to the x value of the approximation.

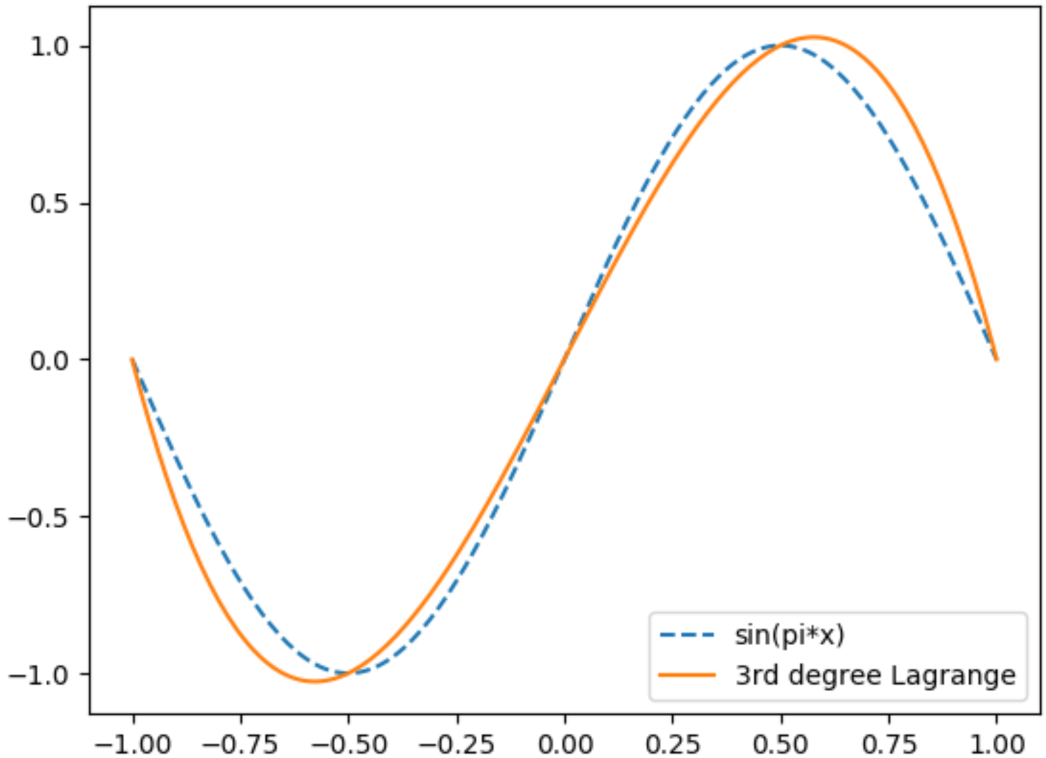
Exercise 3

1.



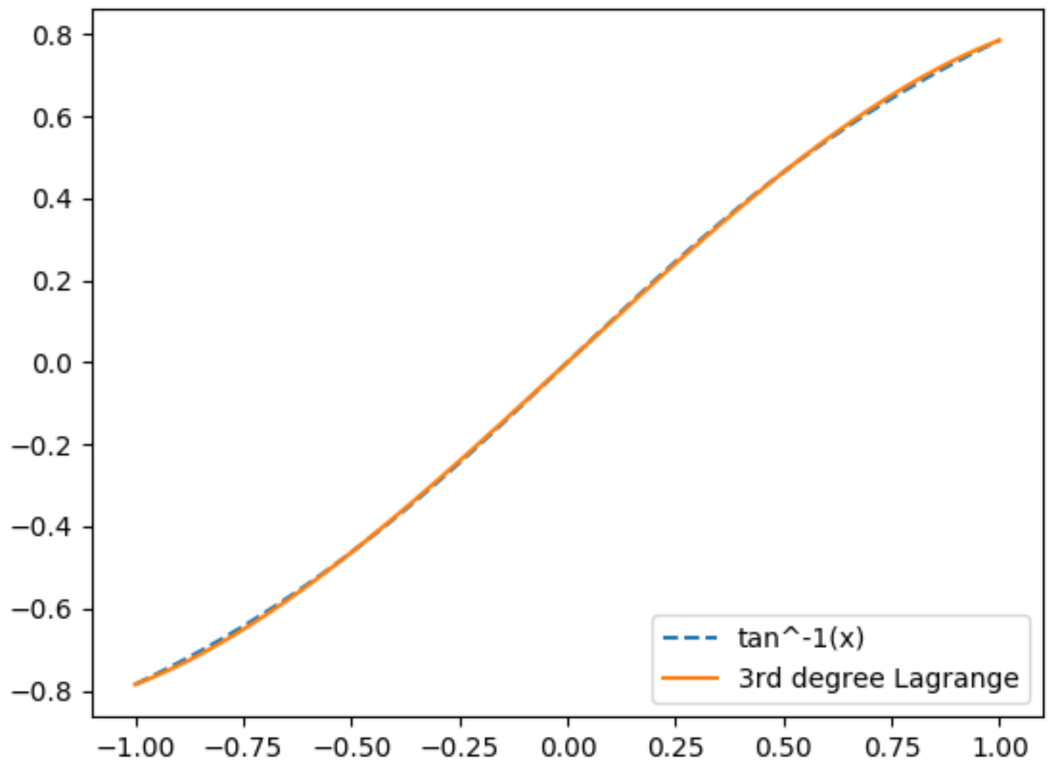
2.5
2.0
1.5
1.0
0.5
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00
e^x
3rd degree Lagrange

2.

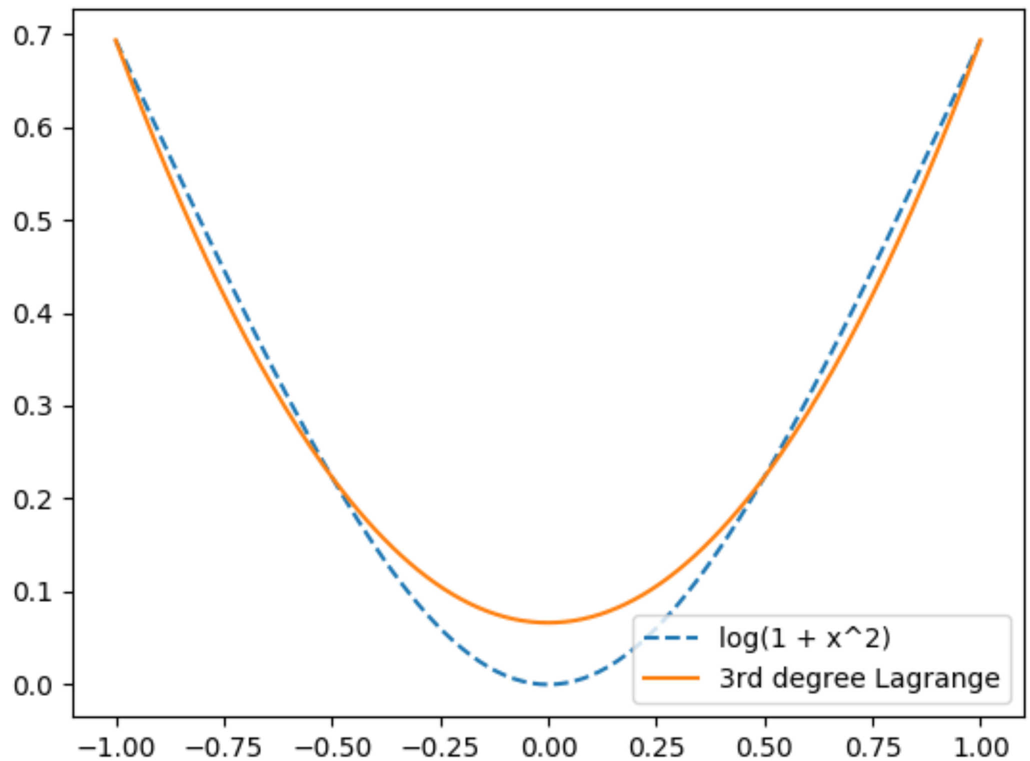


1.0
0.5
0.0
−0.5
−1.0
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00
sin(pi*x)
3rd degree Lagrange

3.


0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00
tan^-1(x)
3rd degree Lagrange

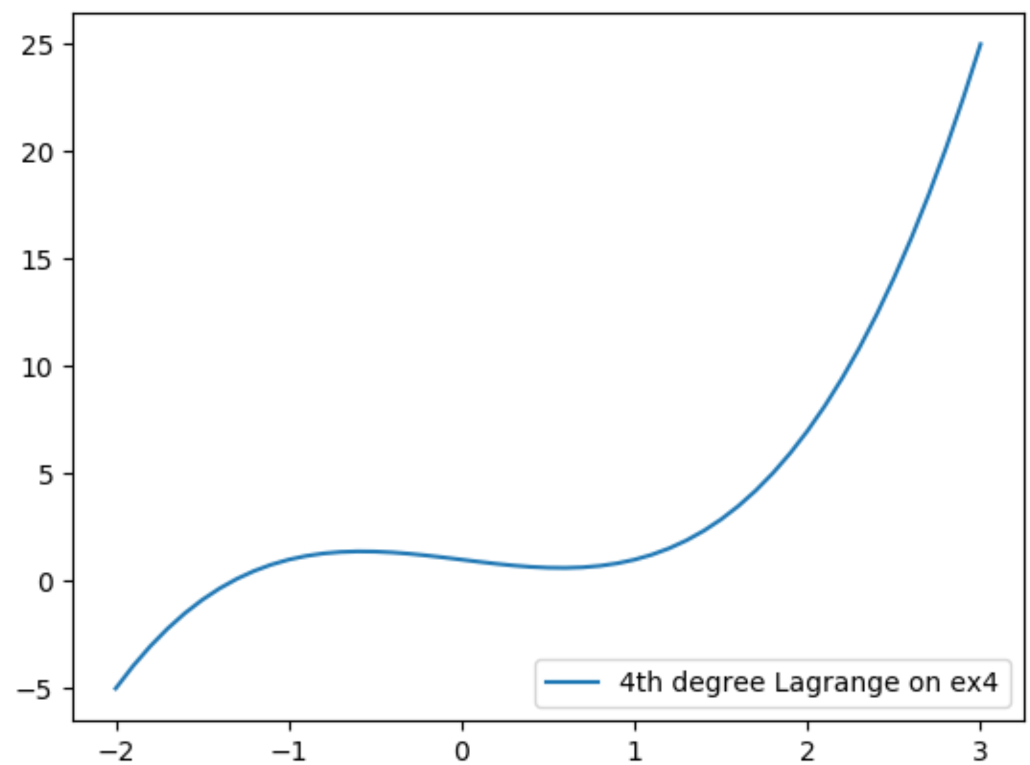
4.


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00
log(1 + x^2)
3rd degree Lagrange

Exercise 4

1. The degree of this polynomial would be 5th degree, since the total amount of given points are 6.

The polynomial is: x*(x - 3)*(x - 2)*(x - 1)*(x + 1)/24 + x*(x - 3)*(x - 2)*(x - 1)*(x + 2)/24 + x*(x - 3)*(x - 2)*(x + 1)*(x + 2)/12 - 7*x*(x - 3)*(x - 1)*(x + 1)*(x + 2)/24 + 5*x*(x - 2)*(x - 1)*(x + 1)*(x + 2)/24 - (x - 3)*(x - 2)*(x - 1)*(x + 1)*(x + 2)/12



Exercise 5

1. Using Lagrange, we get an approximation of 61.0156. I would say this is not a really good estimate. The reason for this is that looking at the change between the y values, the jump between the end of weights of 1330 and 1233 are only 9, yet the approximation claims the jump would be much greater. We could most likely fix this if the approximation was between some of our given points or if we had more points that surround our approximation.