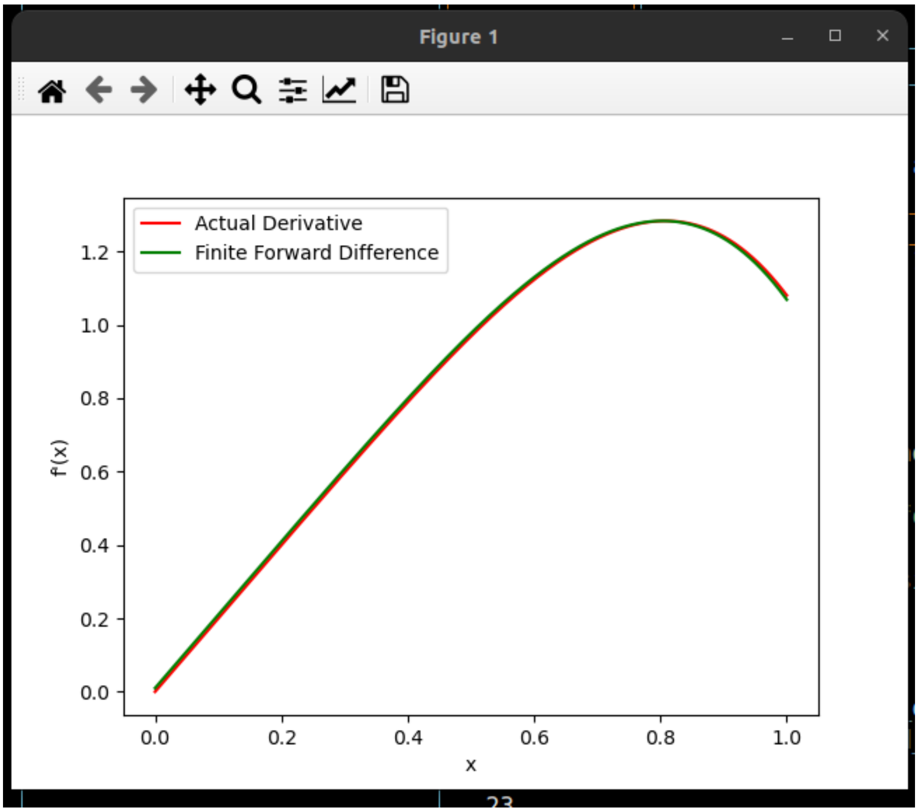
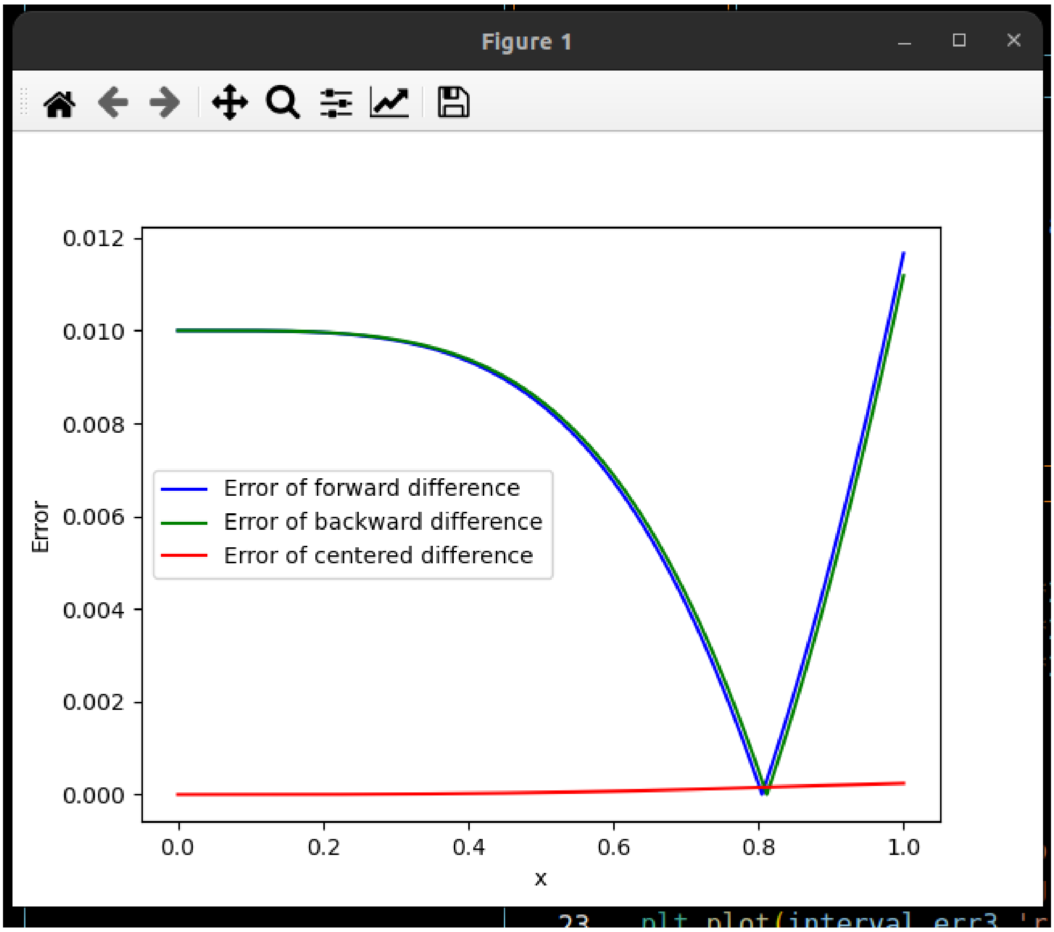
112001041
Sidharth chadha

Week 4 lab report

1)
In this we have to plot derivative one actual and one using forward finite difference of thecuntion f(x) = sin(x^2)
We used the f(x)=2xcos(x^2) for actual differentiation

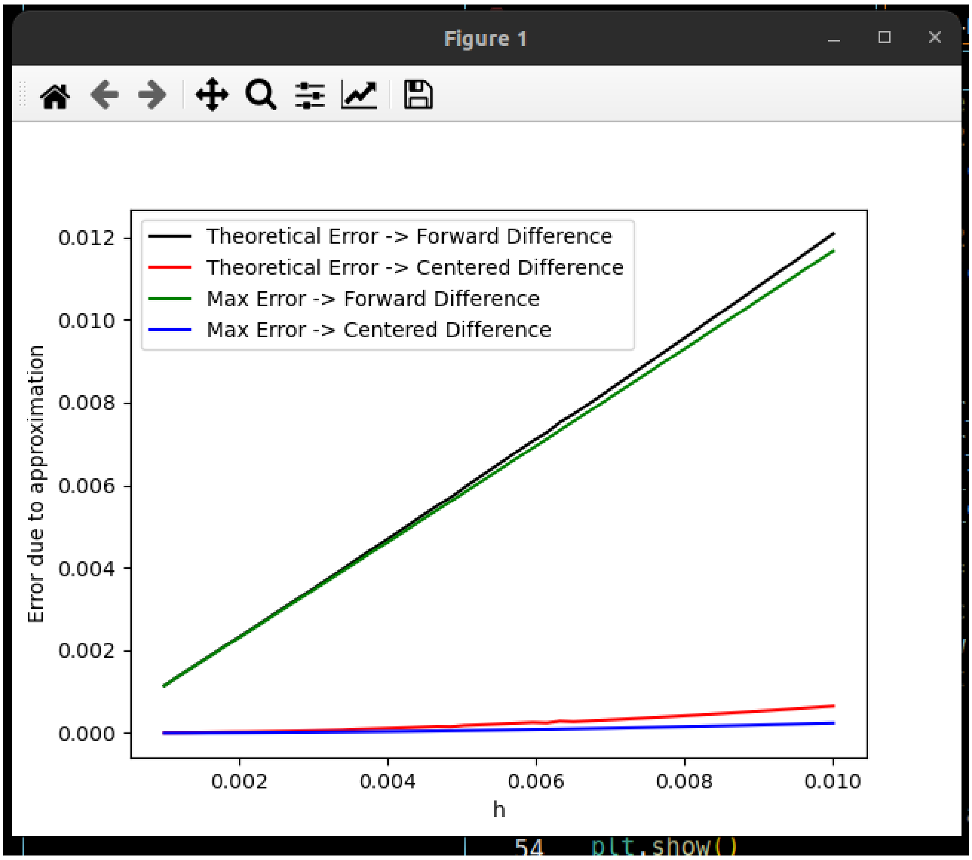


2)
In this question we have to plot errors due to methods such as forward, backward and centred difference with the actual derivative of the function sin(x^2).

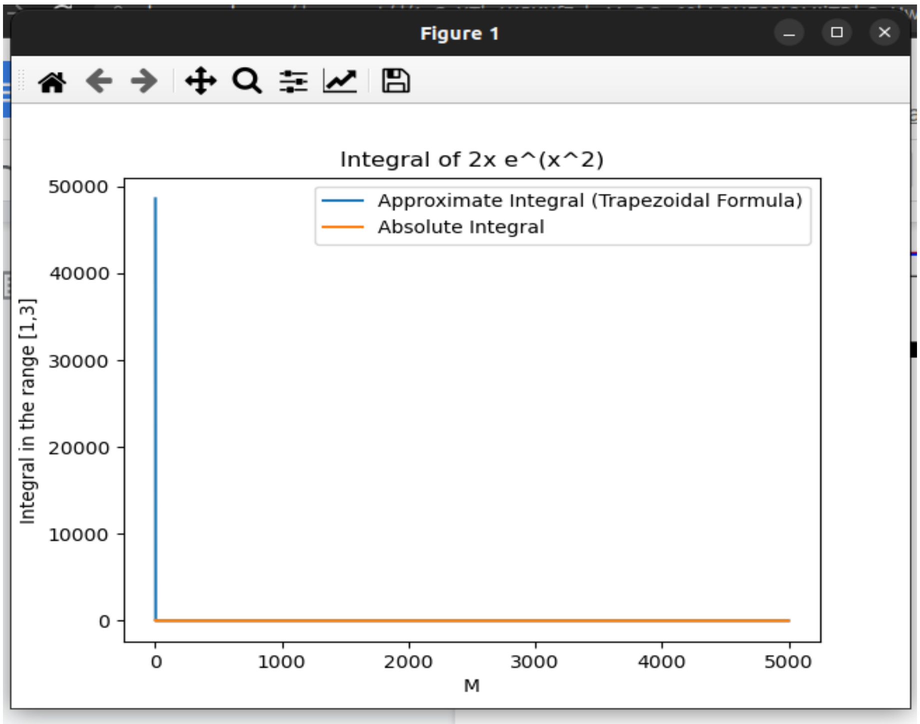


3)

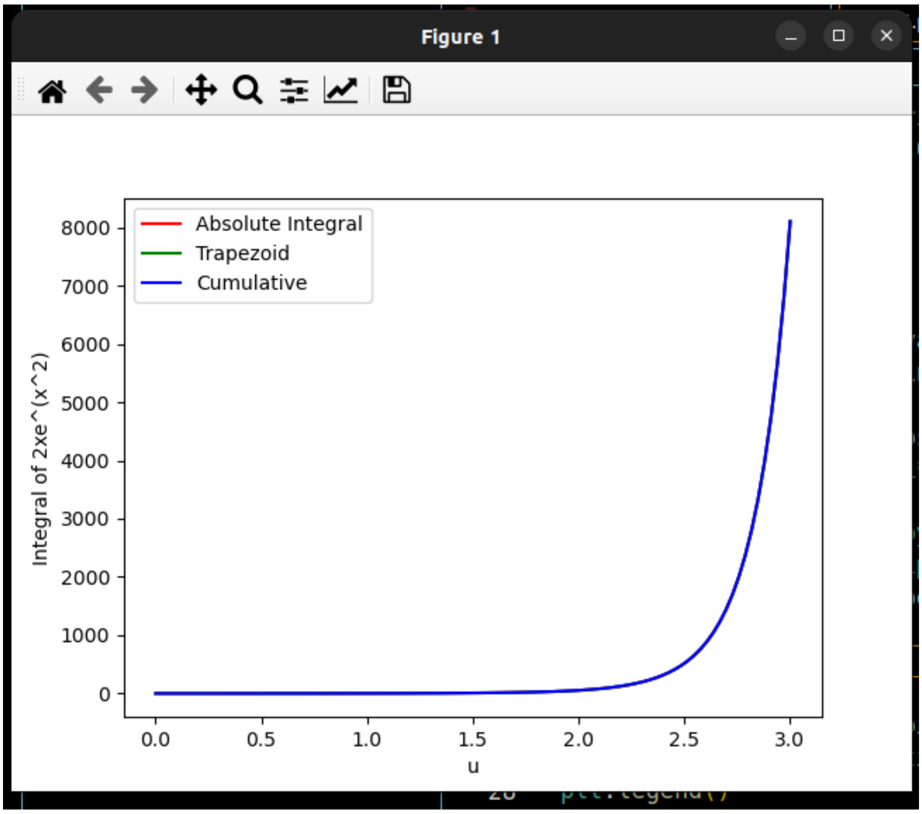
In this to visualise the mamaximum error due to forward and backward difference as a function of h we took 50 points in the range [0.001.0.01] as h and for every point found the maximum error due to approximation in the range [0,1] of the function sin(x^2)



q4)
Using trapezoids over M intervals in the range [1,3], we compute approximate area under a curve, and compare with actual area under the curve.



q5)
We use the scipy.integrate module of Python to calculate the integral with trapezoid and cumulative method and compared it with the absolute integral value.



q6)
We added two methods in our polynomial class in lab3

Def derivative(Self):
This function calculates the derivative of a polynomial object by taking coefficients of the polynomial, multiplying them by corresponding powers

Def area(self,a,b):
This function calculates the area under curve of a polynomial object between two values. It calculates the integral then uses these coeff to calculate the area and updates the attribute self.integral_area with the area calculated

```python
        x=0
        while x < len(Integral_coeff):
            val_a=val_a+Integral_coeff[x]*itr
            itr=itr*a
            x=x+1
        self.integral_area=abs(val_b-val_a)

        return ( "Area :" +str(self.integral_area) )


p = Polynomial([1, 2, 3])
pd = p.derivative()
print(pd)

p = Polynomial([1, 2, 3])
print(p.area(1,2))
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL COMMENTS

```
(base) sid@sid-HP-Spectre-x360-Convertible-13-aw0xxx:~/Documents/cma/week4$ python3 q6.py
2 6
Area :11.0
(base) sid@sid-HP-Spectre-x360-Convertible-13-aw0xxx:~/Documents/cma/week4$
```

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7)

We calculated the area of e^x * sin(x) over [0,0.5] using taylor series expansion of sin(x) and e^x till some degree each so that the error is reduced under the range 10^-6.
We then multiplied both the polynomials with the predefined method done in lab3 and for the new polynomial we calculated the area using the trapezoid method of ques6 and our error was compared with the exact integral value and it was of the order 10^-14.

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL COMMENTS

```
(base) sid@sid-HP-Spectre-x360-Convertible-13-aw0xxx:~/Documents/cma/week4$ python3 q7.py
Area :0.17177502331471262
Error in approximation is:  1.021405182655144e-14
(base) sid@sid-HP-Spectre-x360-Convertible-13-aw0xxx:~/Documents/cma/week4$
```

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