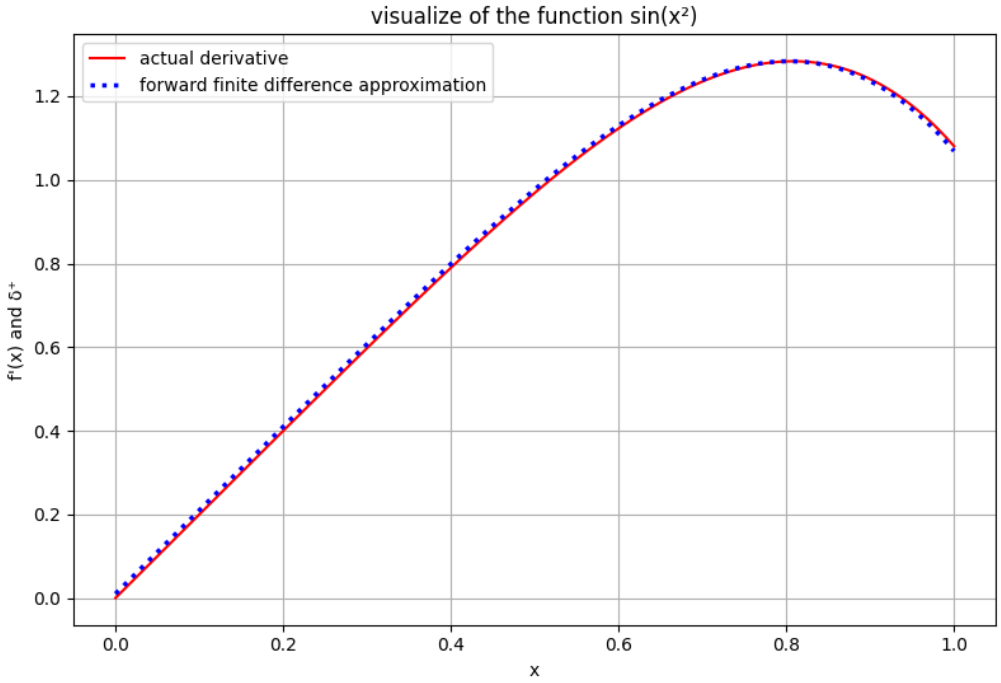
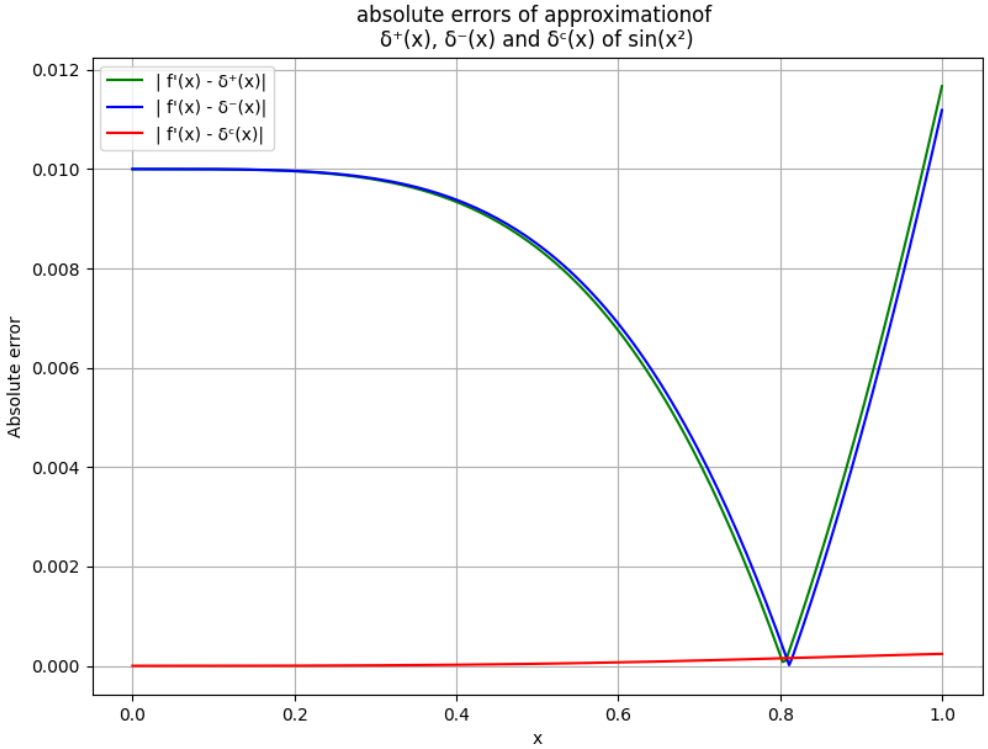
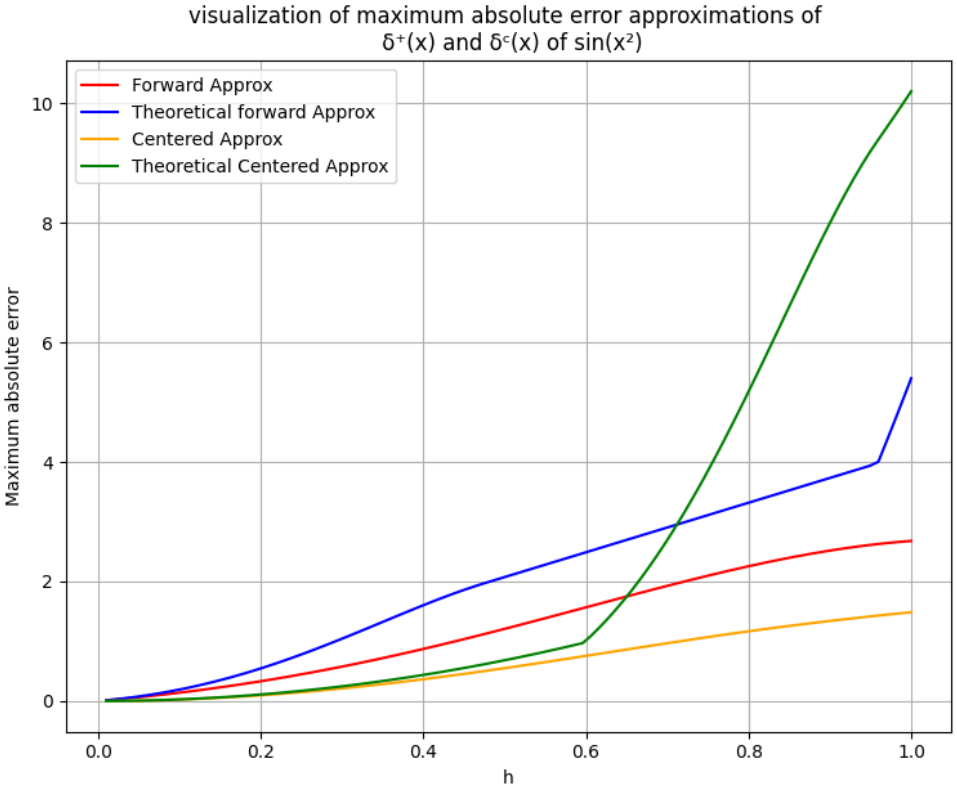
Q1)


visualize of the function sin(x²)
actual derivative
forward finite difference approximation
f'(x) and δ⁺
x
0.0
0.2
0.4
0.6
0.8
1.0
1.2

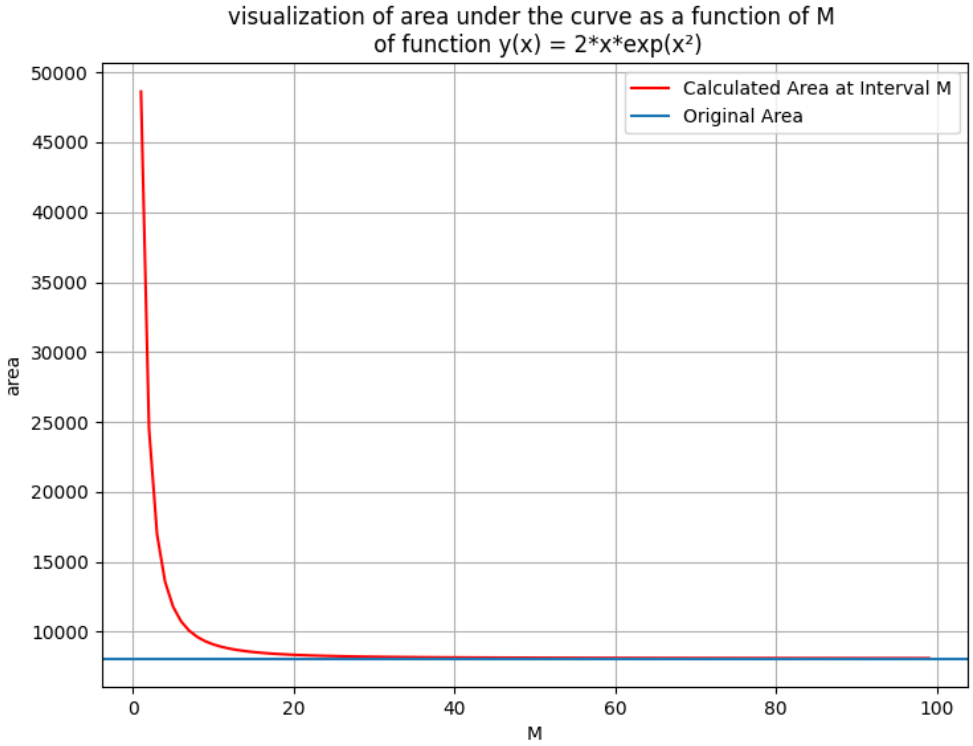
Q2)


absolute errors of approximationof
δ⁺(x), δ⁻(x) and δᶜ(x) of sin(x²)
| f'(x) - δ⁺(x)|
| f'(x) - δ⁻(x)|
| f'(x) - δᶜ(x)|
Absolute error
x
0.000
0.002
0.004
0.006
0.008
0.010
0.012

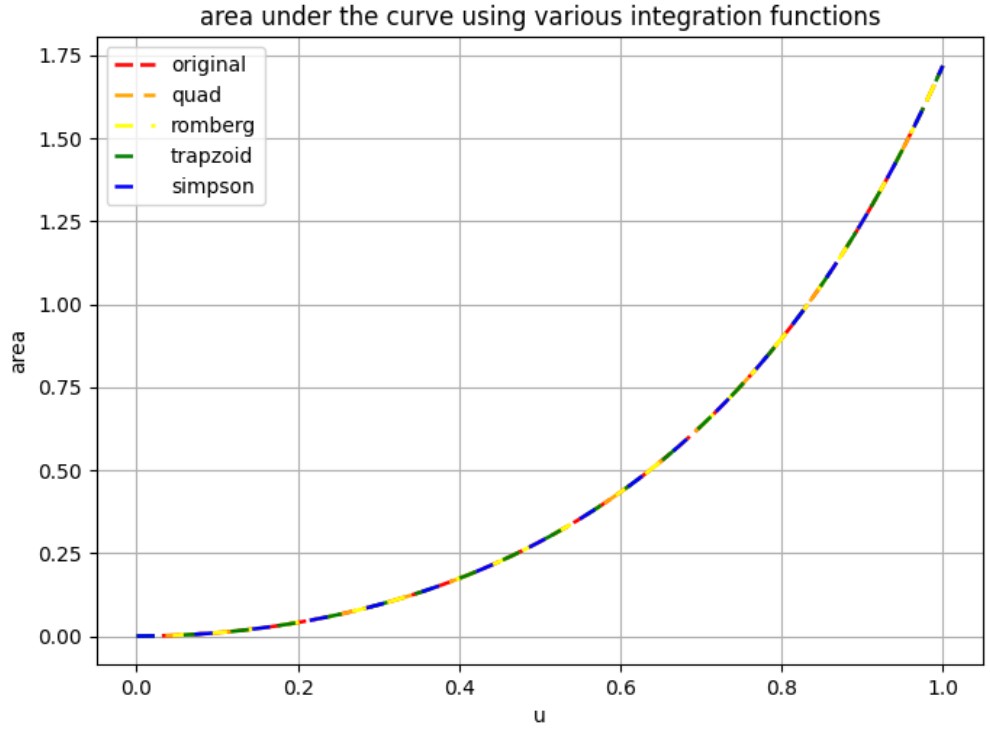
Q3)


visualization of maximum absolute error approximations of
δ⁺(x) and δᶜ(x) of sin(x²)
Forward Approx
Theoretical forward Approx
Centered Approx
Theoretical Centered Approx
Maximum absolute error
h
0
2
4
6
8
10
0.0
0.2
0.4
0.6
0.8
1.0

Q4)


visualization of area under the curve as a function of M
of function y(x) = 2*x*exp(x²)
Calculated Area at Interval M
Original Area
area
M
10000
15000
20000
25000
30000
35000
40000
45000
50000
0
20
40
60
80
100

Q5)



Q6)

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

```
Coefficients of the polynomial are:
2 6
```

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

```
Area in the interval [1, 2] is: 11.0
```

Q7)

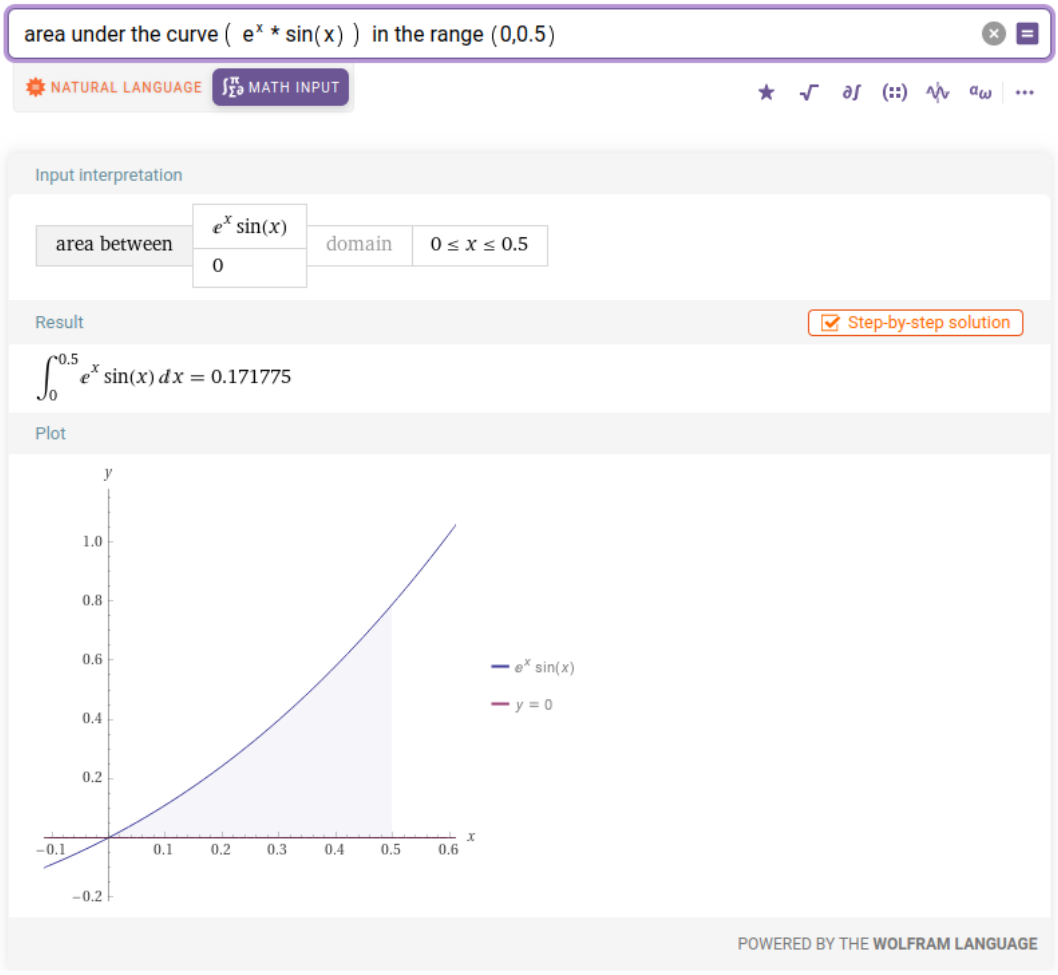
```
Calculated Area :  0.17177502333917638
Error ( Actual - Calculated ) :  -2.3339176369319148e-08
```

Used fit matrix method of the polynomial class to create the polynomial form of the given function by generating `(x,f(x))` points and calculated area of the same in given range `[0,0.5]` using method area of polynomial class

Error within a guaranteed error of 10^{-8}

Actual area used is **`0.171775`**

Calculated using https://www.wolframalpha.com/



Link of the above page