Assignment-1

Course: SC-374

Computational and Numerical Methods

Instructor: Prof. Arnab Kumar

Made by:

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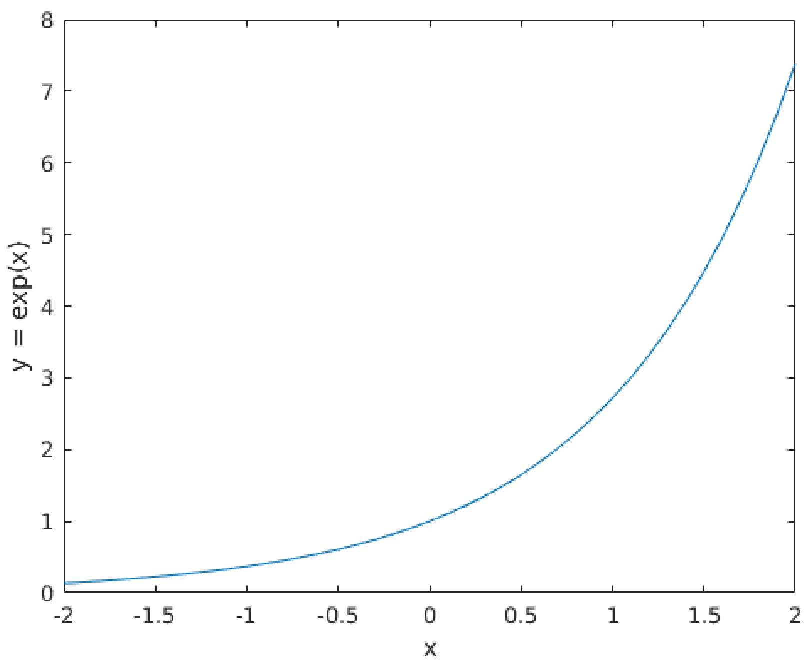
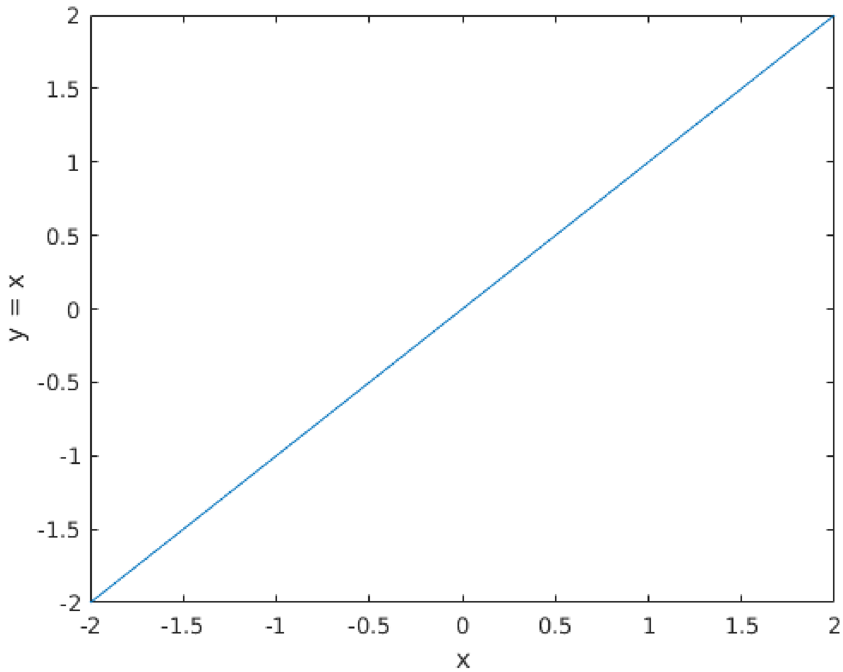
Problem: 1

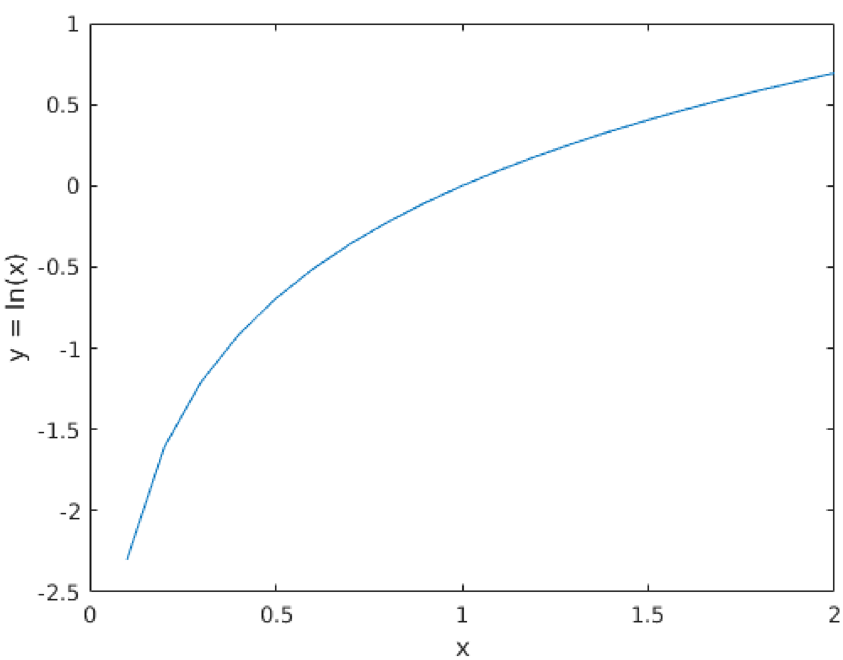
♦ **Statement:**

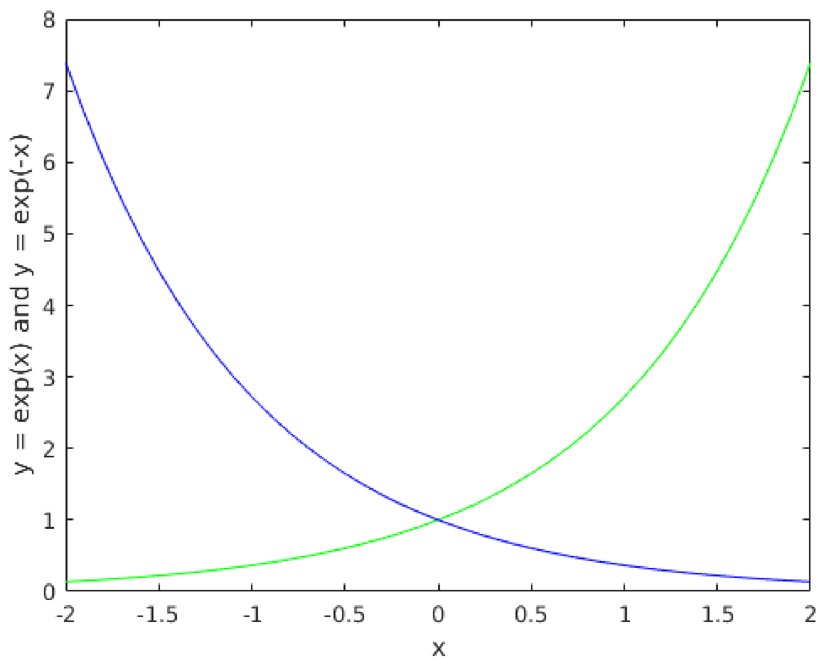
With the help of a single code, plot the following functions (a) y=exp(x) , (b) y=x , (c) y=ln(x). use suitable ranges of x for each of the functions and judge their properties on various scale of x. Extending this exercise , plot exp(x) and exp(-x) on the same graph and compare them.

♦ **Graphs:**




y = x
x
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2


y = ln(x)
x
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0
0.5
1
1.5
2



♦ **Observations:**

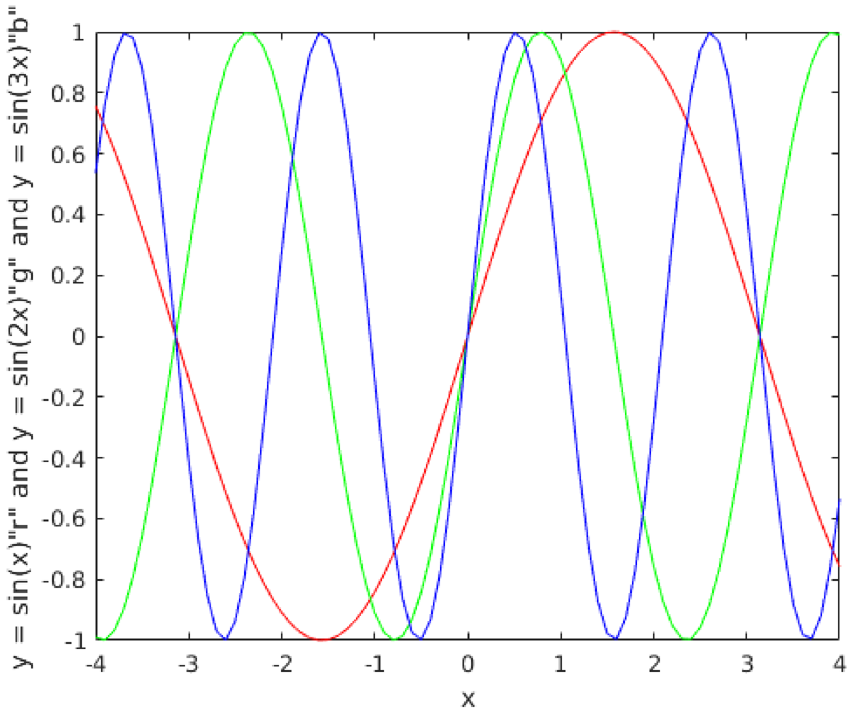
<u>Problem: 2</u>

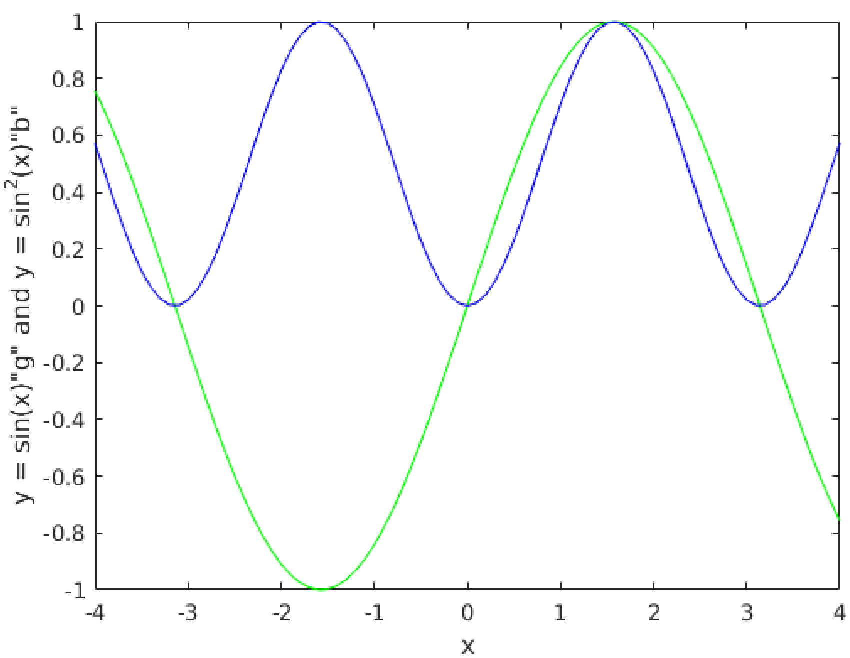
♦ **Statement:**

For a fixed parameter a plot the function y=sin(kx) for a few suitably chosen values of k. What is the role of k in determining the profile of the function? Thereafter for k=1 plot sin(x) and sin^2(x) on the same graph within

–pi < x < pi. Compare both.

♦ **Graphs:**





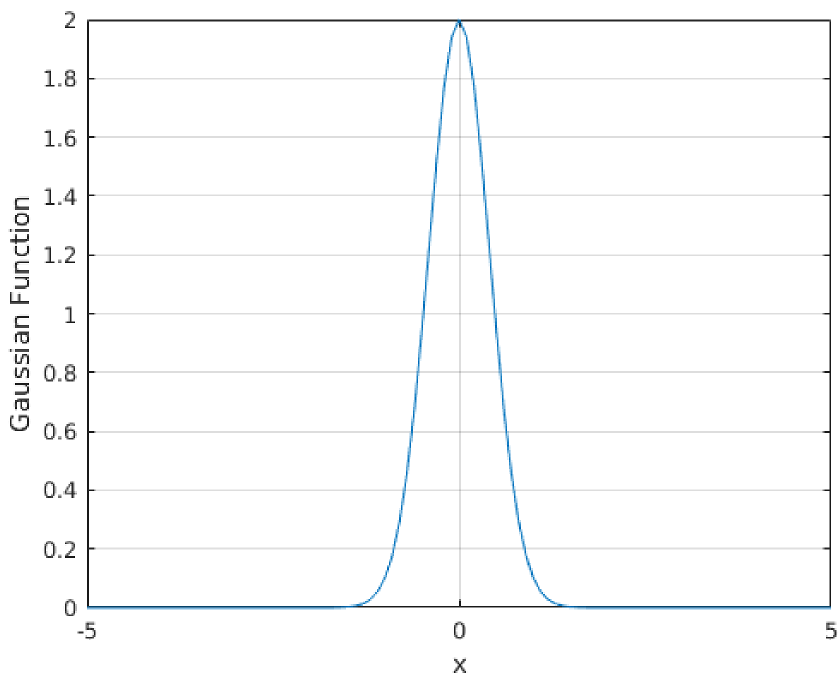
♦ Observations:

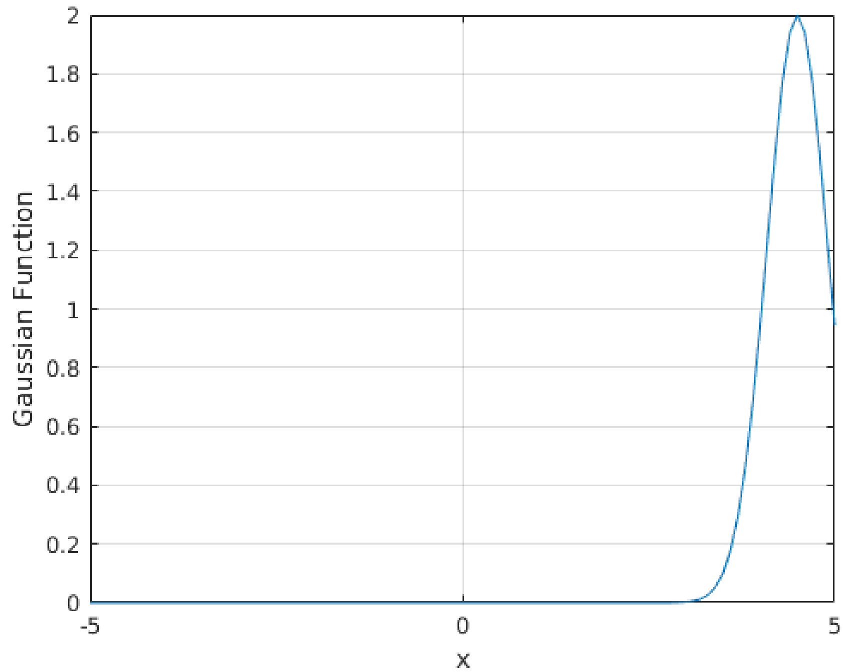
Problem: 3

♦ Statement:

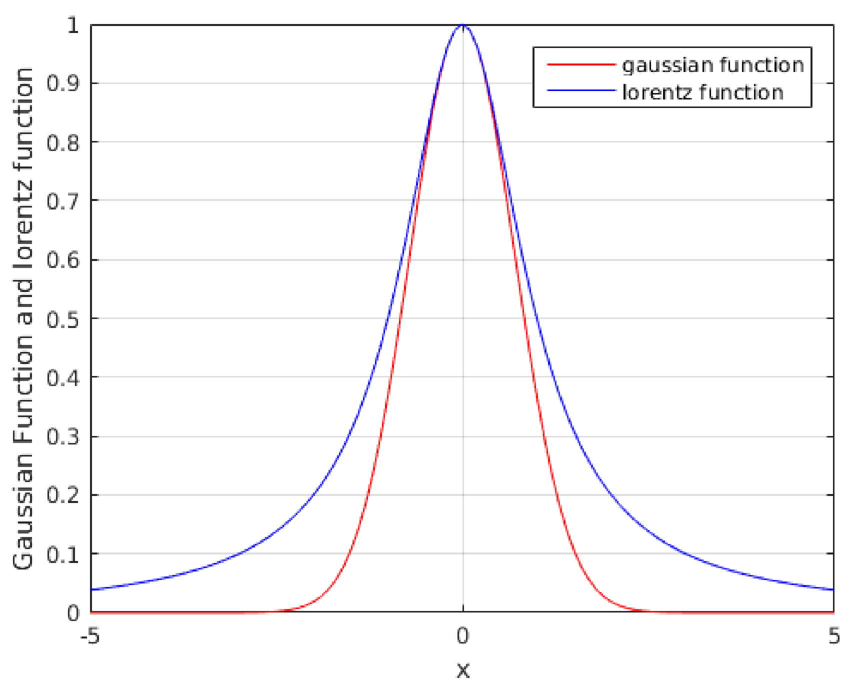
Plot the Gaussian function y= , for a few suitably chosen values of the parameters y0,a and μ. Examine the shifting profile oof the function with changes in the parameters.Then for y0=a=1 and μ=0.Consider the first order expansion of the Gaussian function to obtain the Lorentz function.Plot both of them together and compare their behaviour. For every value of x take the difference between the two functions and plot it against x over 0 < x <10.

♦ Graphs

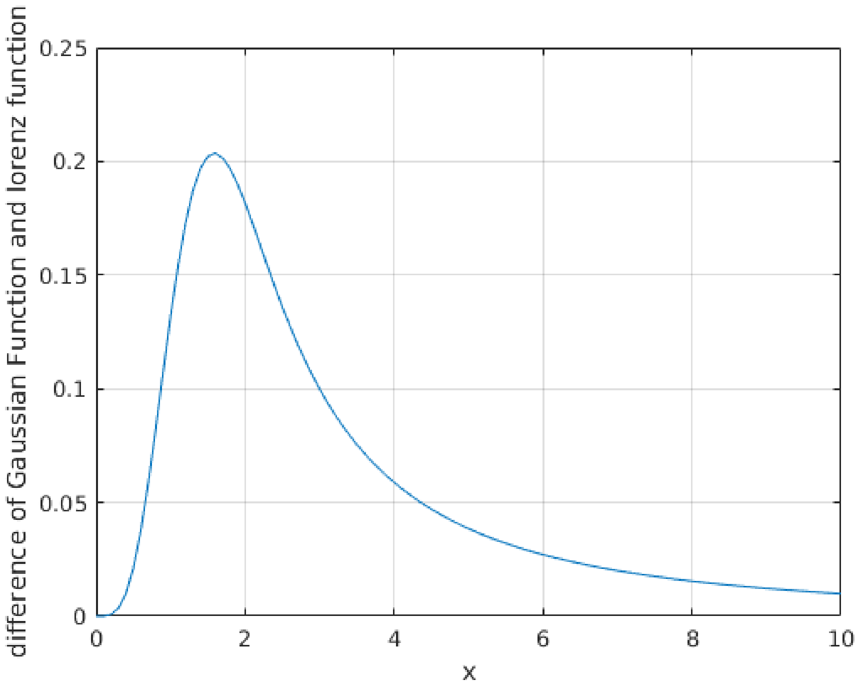




Gaussian Function
x
-5
0
5
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2



gaussian function
lorentz function
Gaussian Function and lorentz function
x
-5
0
5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



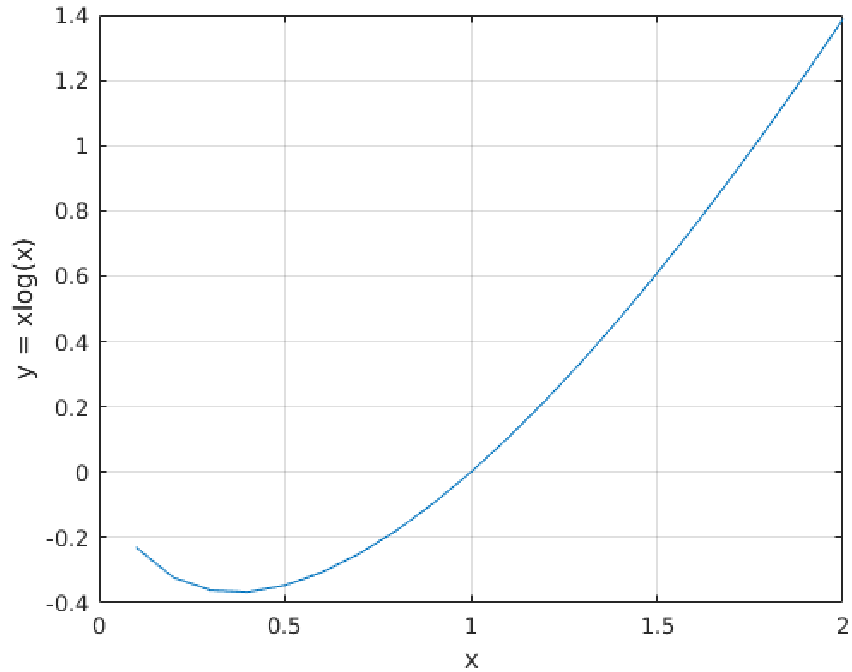
♦ **Observations:**

Problem: 4

♦ **Statement:**

Plot y=xlog(x) and carefully examine it for 0 < x < 2 .Provide an analytical justification for what you observe .Also note the growth of the function for very large x.

♦ **Graphs:**



♦ **Observations:**

Problem: 5

♦ **Statement:**

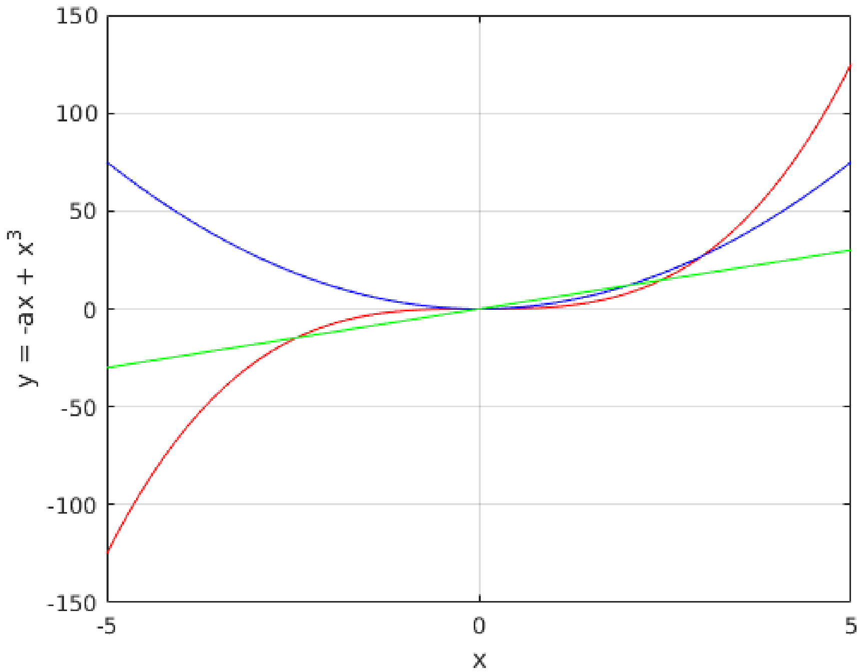
Plot y(x) , y'(x) , y''(x) for the following polynomial functions ,

(a) y= -ax + x^3

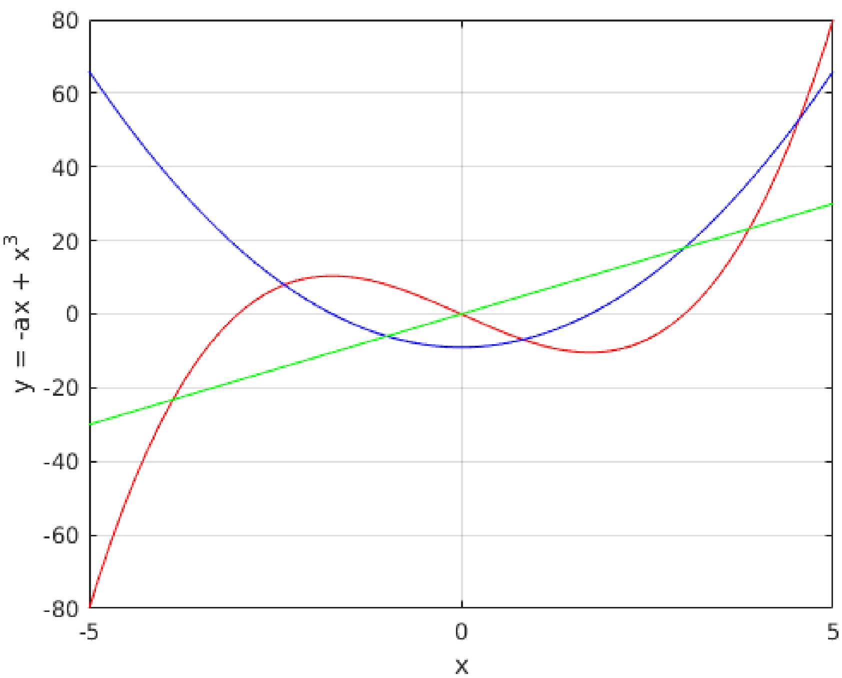
(b)y=-ax^2 + x^4

Change a continuously over a suitable range of values(a>=0) to observe the shift in the function profiles and their two derivatives .Carefully , check all conditions for a=0.

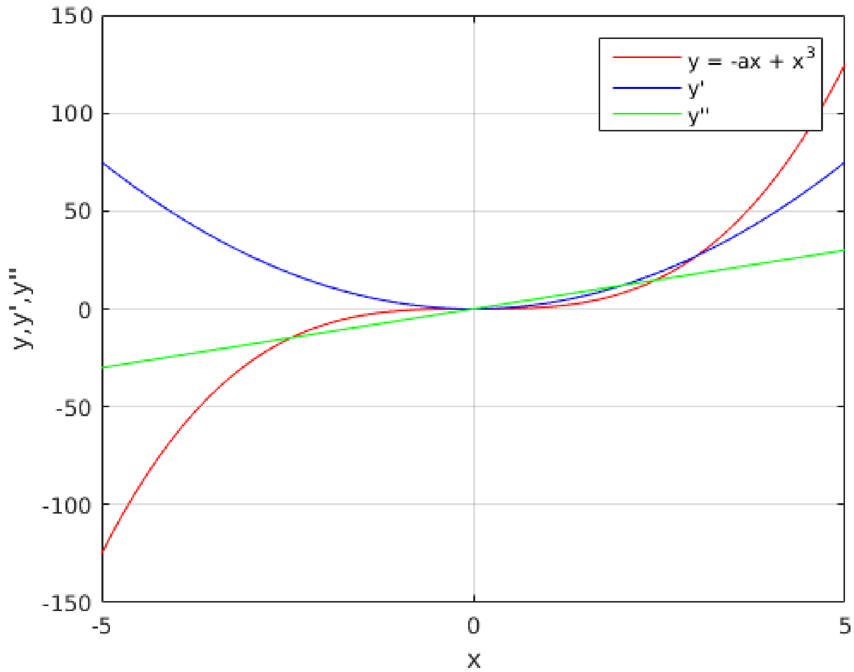
♦ **Graphs:**

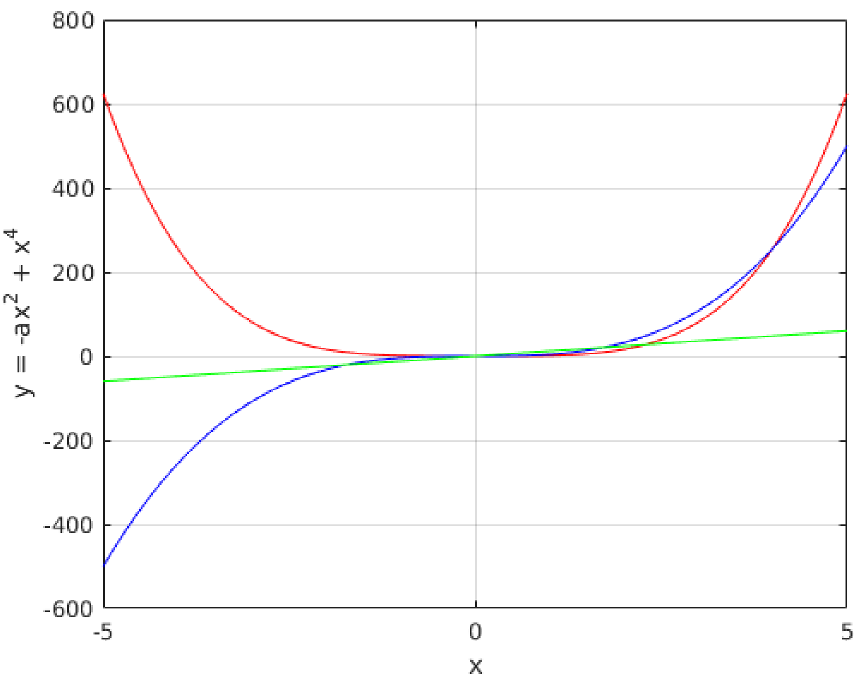


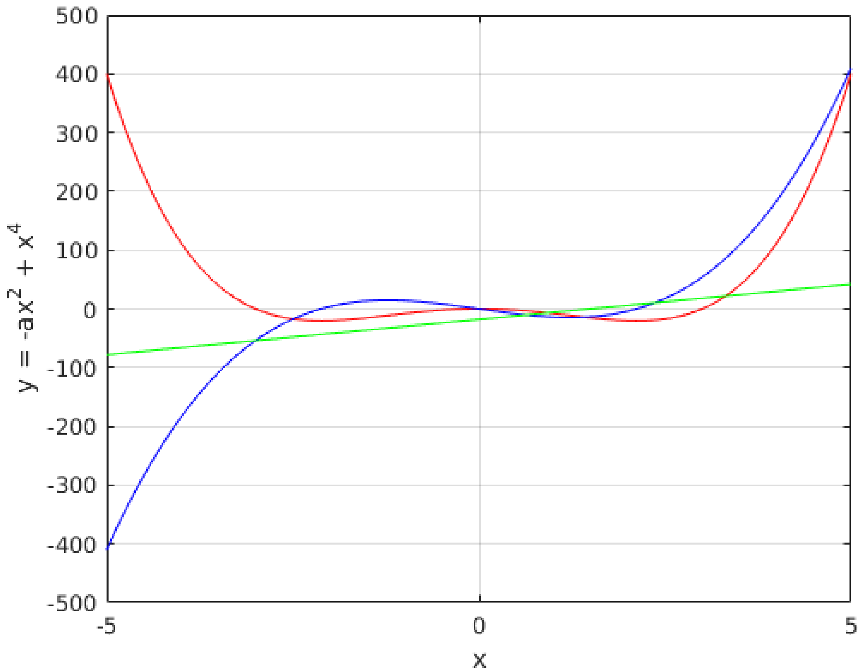
150
100
50
0
-50
-100
-150
-5
0
5
x
y = -ax + x^3

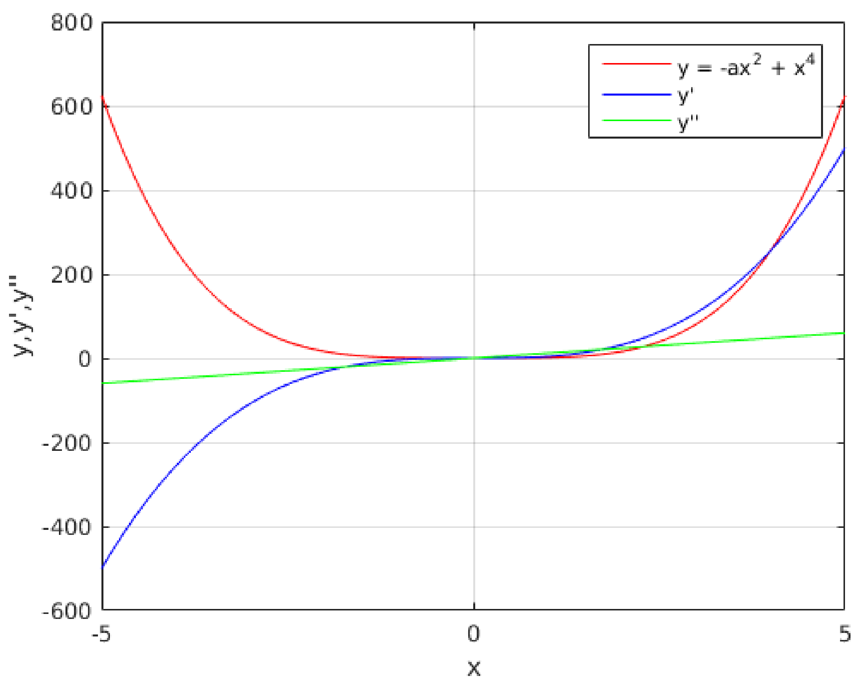


80
60
40
20
0
-20
-40
-60
-80
-5
0
5
x
y = -ax + x^3


y = -ax + x^3
y'
y''
150
100
50
0
-50
-100
-150
y,y',y''
-5
0
5
x


800
600
400
200
0
-200
-400
-600
y = -ax^2 + x^4
-5
0
5
x





♦ **Observations:**

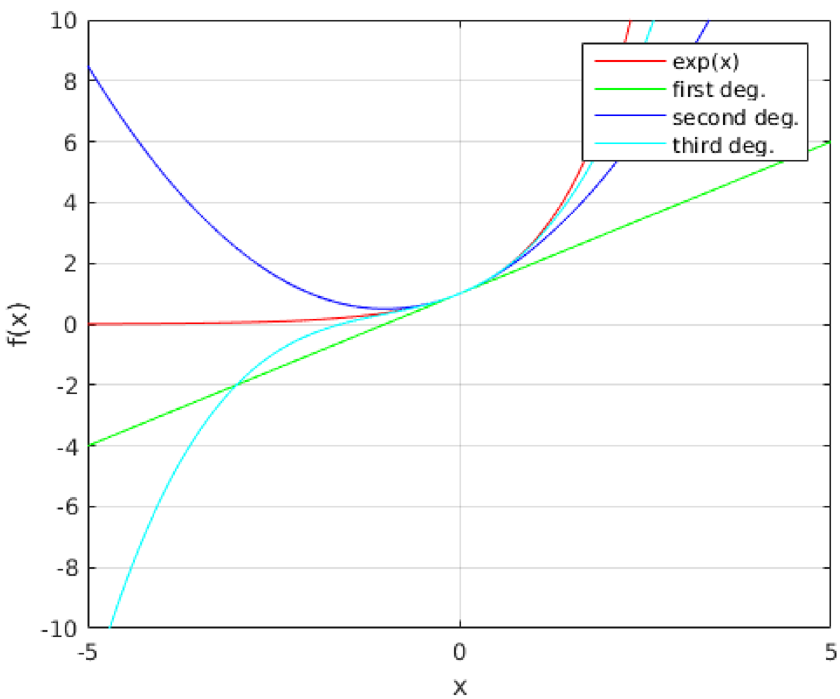
Problem: 1(set - 2)

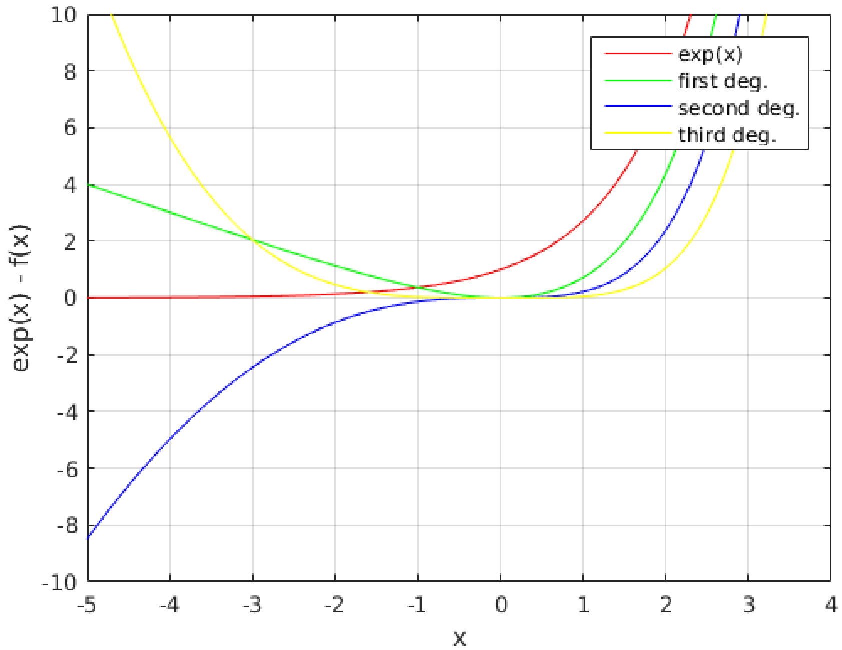
- **Statement:**

Consider the following functions y=f(x) , produce the first , the second and third-degree Taylor polynomials for each of the foregoing functions, using a=1 as the point of approximation for logx and a=0 for the rest. In a suitably chosen neighbourhood of a , follow how the accuracy of a Taylor polynomial improves with the increasing degree. For this you will have to estimate the difference between f(x) and its Taylor polynomials in a code . Present your results graphically for each function along with its Taylor polynomials of all three degrees.

(A) y = exp(x)

- **Graphs:**

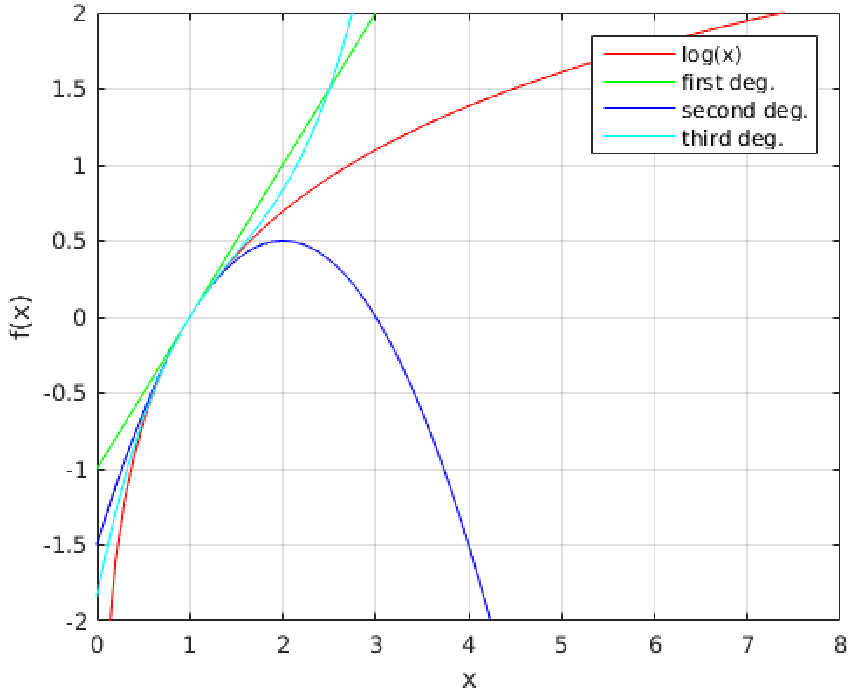


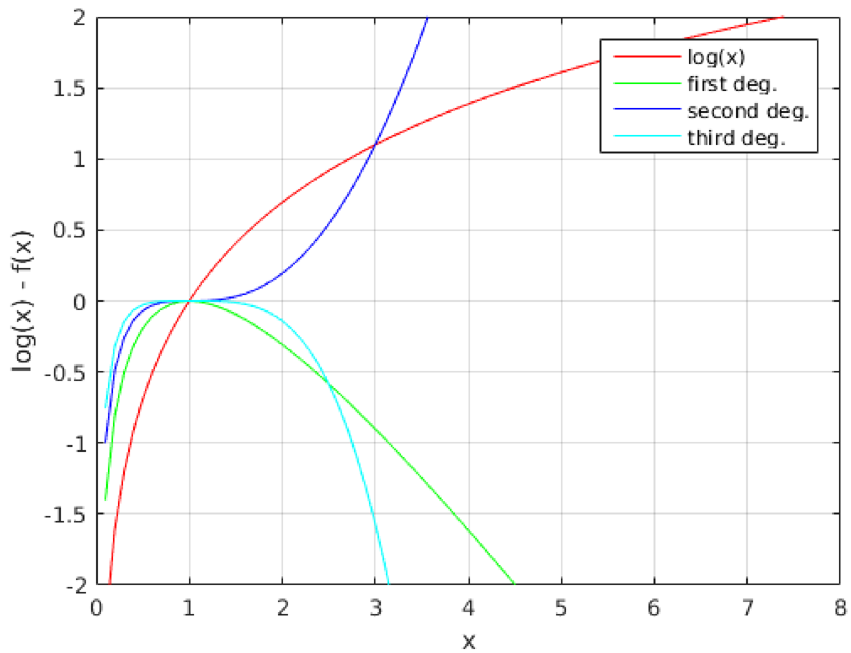


♦ **Observations:**

(A) y = ln(x)

♦ **Graphs:**

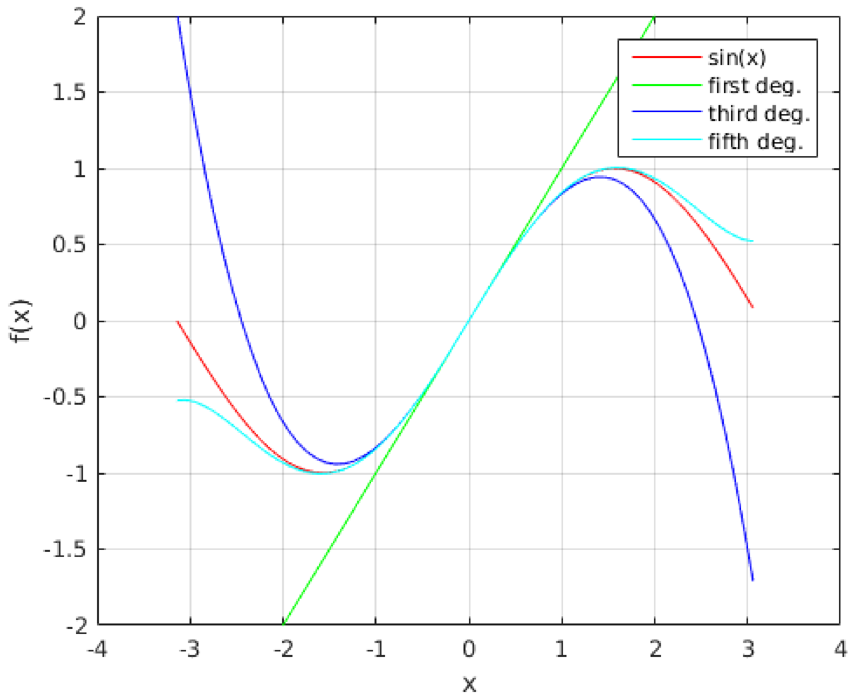


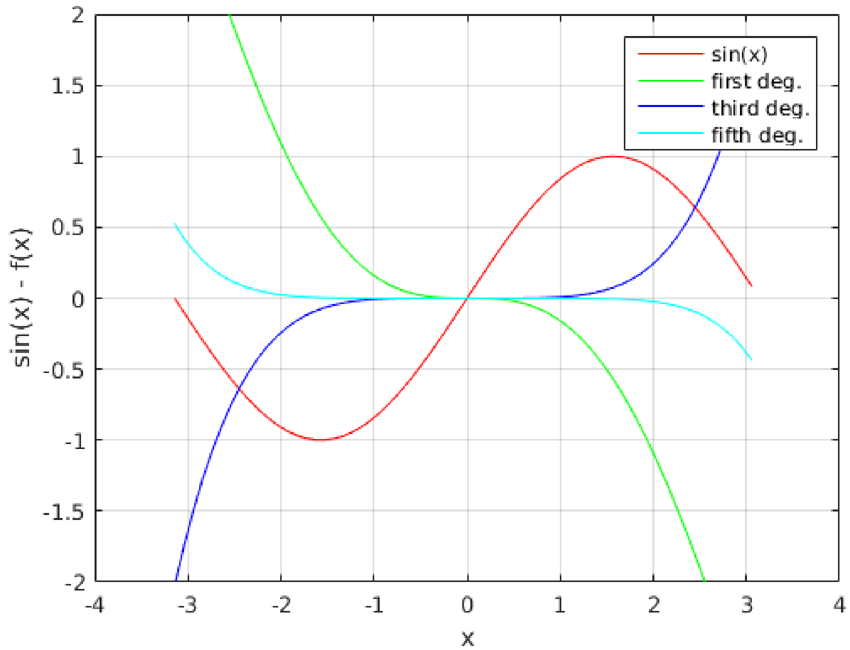


♦ **Observations:**

(A) y = sin(x)

- **Graphs:**

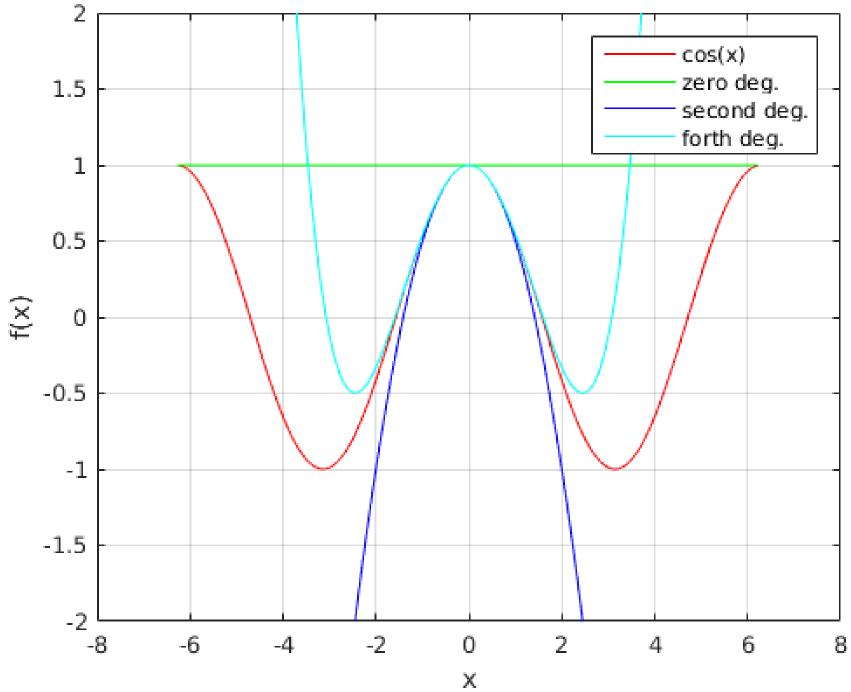


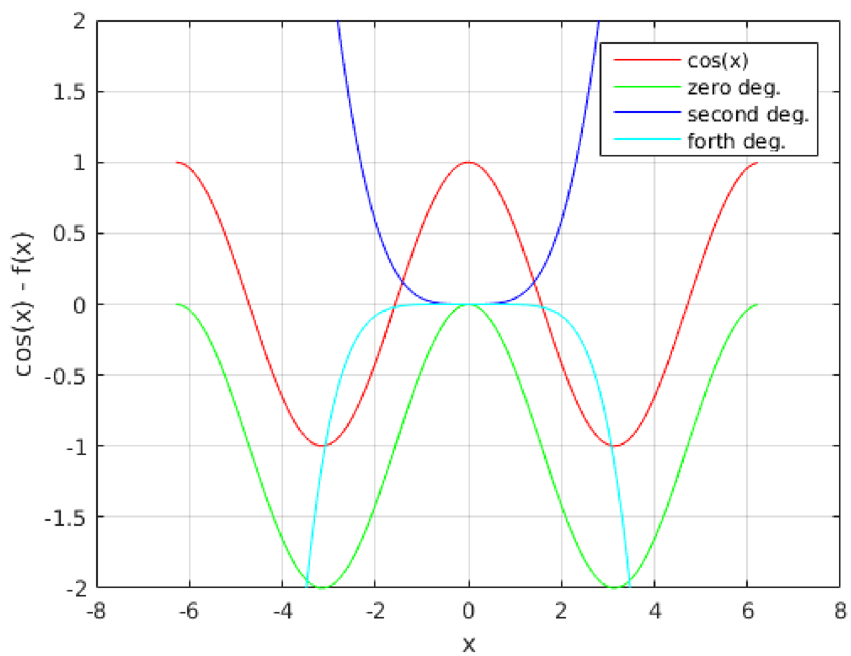


♦ **Observations:**

(A) y = cos(x)

♦ **Graphs:**





♦ **Observations:**