**Assignment-2**

Course: SC-374

Computational and Numerical Methods

Instructor: Prof. Arnab Kumar

Made by:

Yatin Patel – 201601454

Rutvik Kothari – 201601417

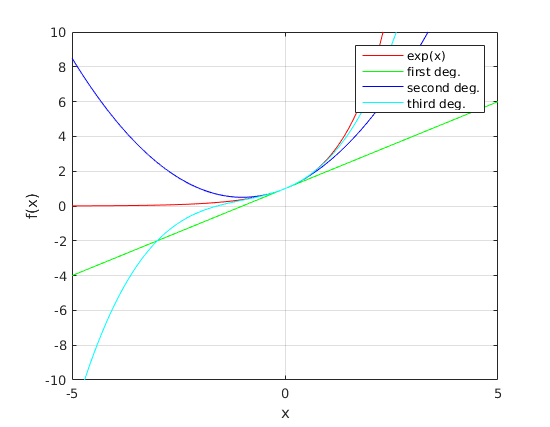
# **Problem: 1**

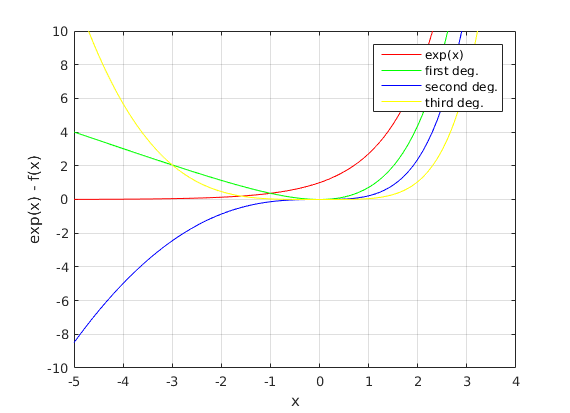
♦ **Statement:**

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



♦ **Graphs:**





♦ **Observations :**

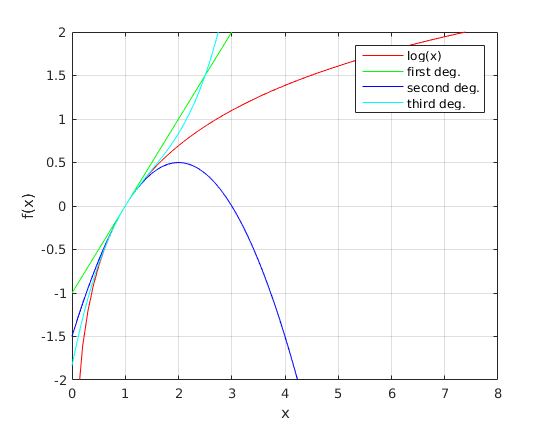
We have plotted the graph for first, second and third degree of function .

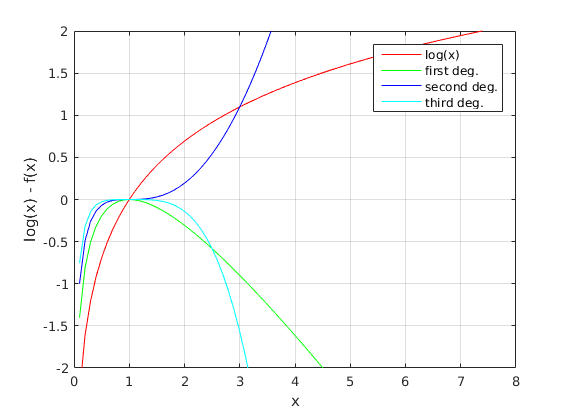
Where , , . We can say that as the degree of polynomial increases the function comes nearer and nearer to . If we compare the second-degree polynomial with first degree polynomial, we can see that second-degree polynomial is more nearer to y as compared to first degree polynomial. And if we compare third degree polynomial with second degree polynomial, we can see that third-degree polynomial is more nearer to y as compared to second degree polynomial. In the second-degree polynomial, the highest degree term is even, so for the graph of second degree polynomial is above the function and first degree and third-degree polynomials are below the function . for increases very rapidly as compared to first, second and third-degree polynomials, because it contains much higher degree terms as compared to first, second and third-degree terms.

As we go away from , the difference of the function increases. Where difference of first degree polynomial increasing rate is more than second degree polynomial. And difference of second degree polynomial increasing rate is more than third degree polynomial.



♦ **Graphs :**





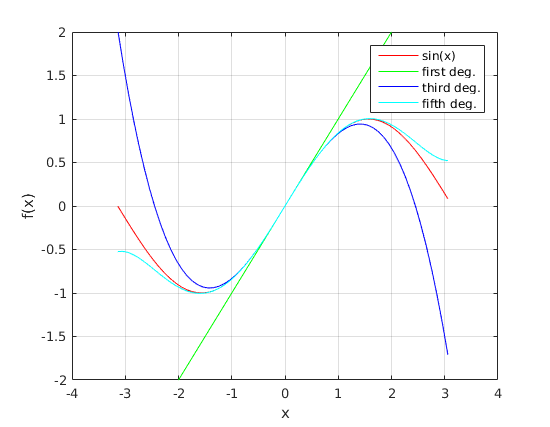
♦ **Observations:**

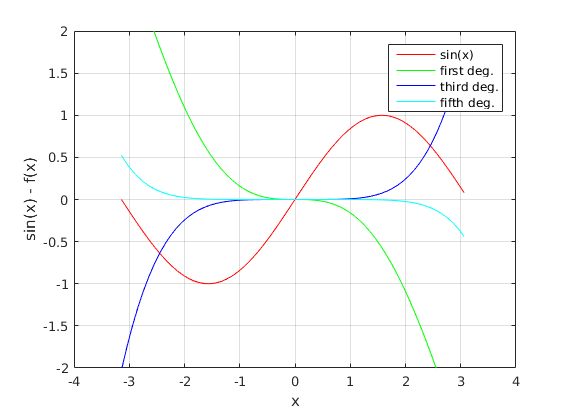
We have plotted the graph for first, second and third-degree polynomials of function . Where , , . We can see that third-degree polynomial is the closest to function y as compared to first and second-degree polynomials.

When , the value of the function will increase for odd degree polynomials and will decrease for even degree polynomials. This can be seen in the third figure when the second-degree curve is below and the first and third-degree curves are above . The difference between and the given degrees of polynomials can be seen in the figure. The discussion stated above justifies it.



♦ **Graphs:**





♦ **Observations:**

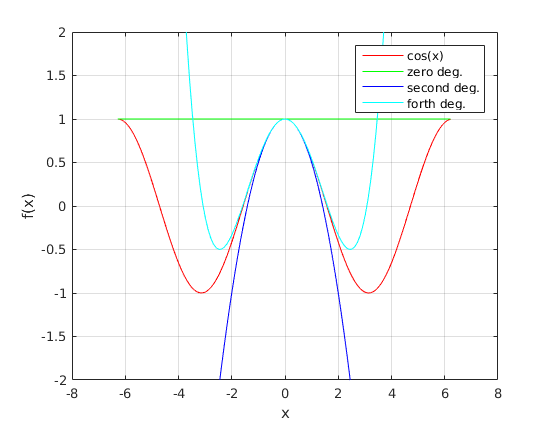
We have plotted the graph for first, second and third-degree polynomials of function . Where , , . We can see that fifth-degree polynomial is the closest to function y as compared to first and third-degree polynomials.

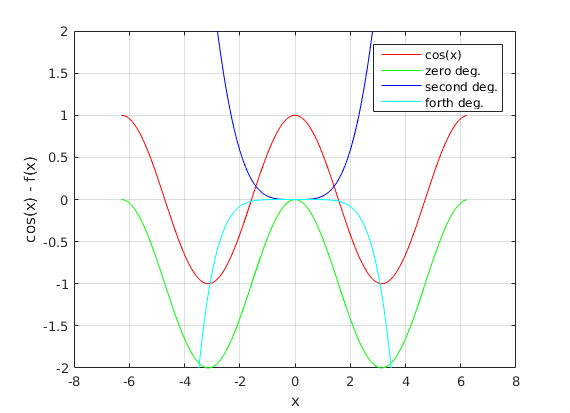
If we compare the third-degree polynomial with first degree polynomial, we can see that third-degree polynomial is more nearer to y as compared to first degree polynomial. And if we compare fifth degree polynomial with third degree polynomial, we can see that fifth-degree polynomial is more nearer to y as compared to third degree polynomial.

For the even degrees, we can say that they lie above for the negative And the odd ones are below but in the case of the increases values of in the positive side, the odd degree polynomials lie above, and the even ones are found Below .

1. **y = cos(x)**

♦ **Graphs:**





♦ **Observations:**

We have plotted the graph for first, second and third-degree polynomials of function . Where , , . We can see that fourth-degree polynomial is the closest to function y as compared to zeroth and second-degree polynomials.

If we compare the second-degree polynomial with zeroth degree polynomial, we can see that second-degree polynomial is more nearer to y as compared to zeroth degree polynomial. And if we compare forth degree polynomial with second degree polynomial, we can see that forth-degree polynomial is more nearer to y as compared to second degree polynomial.

We also observe that the zeroth order approximation and the second order approximation lie above the equation y = cos(x) while the forth order equation lies below the given equation.