Experiment-9

AIM : Plots of the exponential functions and comparison with the plots of their Taylor series expansion till first 10 terms

CODE :

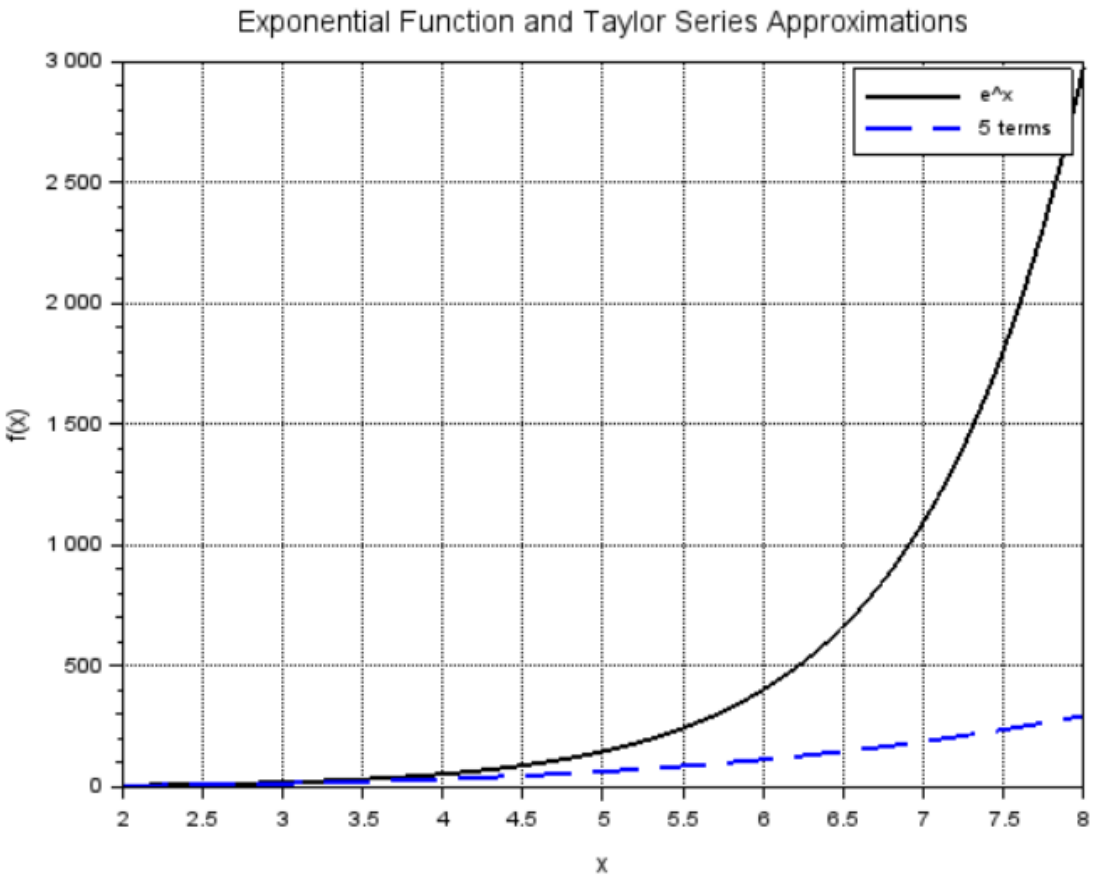
```
clc;clf;clear;

disp("Prattayaya amrit")

disp("13601")

disp(" Plots of the exponential functions and comparison with the
plots of their Taylor series expansion till first 10 terms")

// Define the function to calculate the series expansion

function sum=ex(x, t)

    sum = 0;

    for i = 0:(t-1) // Scilab index starts at 1, adjust for factorial

        sum = sum + (x^i) / factorial(i);

    end

endfunction


// Get user inputs

disp("Enter the range of x for plotting:");

x_min = input("Minimum x: ");

x_max = input("Maximum x: ");

n_points = input("Number of points for plotting (suggest 100): ");

disp("Enter the number of terms for Taylor series approximations:");

terms_2 = input("Number of terms for first approximation (e.g., 2):
");

terms_3 = input("Number of terms for second approximation (e.g., 3):
");

terms_8 = input("Number of terms for third approximation (e.g., 8):
");

disp("Enter specific x points for the table (comma-separated):");

x_points = input("e.g., [1, 2, 3, 4, 5]: ");
```

```
// Generate x values for plotting
x = linspace(x_min, x_max, n_points);

// Compute the actual exponential and approximations using loops
fx = exp(x); // True exponential values
fx_2_terms = zeros(x); // Placeholder for first approximation
fx_3_terms = zeros(x); // Placeholder for second approximation
fx_8_terms = zeros(x); // Placeholder for third approximation

for i = 1:length(x)
    fx_2_terms(i) = ex(x(i), terms_2);
    fx_3_terms(i) = ex(x(i), terms_3);
    fx_8_terms(i) = ex(x(i), terms_8);
end

// Plotting
clf(); // Clear the current figure
plot(x, fx, '-k', 'LineWidth', 2); // Plot actual exponential in black

plot(x, fx_8_terms, '--b', 'LineWidth', 2); // Plot third
approximation in blue

// Add legends and labels
legend(['e^x', sprintf('%d terms', terms_2), sprintf('%d terms',
terms_3), sprintf('%d terms', terms_8)], "location", "northwest");
xlabel('x');
ylabel('f(x)');
title('Exponential Function and Taylor Series Approximations');
xgrid(); // Enable gridlines

// Compute values for the specific x points
```

```
fx_points = exp(x_points);                  // True exponential values
fx_2_points = zeros(x_points); // Placeholder for first approximation
fx_3_points = zeros(x_points); // Placeholder for second approximation
fx_8_points = zeros(x_points); // Placeholder for third approximation


for i = 1:length(x_points)
    fx_2_points(i) = ex(x_points(i), terms_2);
    fx_3_points(i) = ex(x_points(i), terms_3);
    fx_8_points(i) = ex(x_points(i), terms_8);
end


// Display table
disp("Index | X | f(X)       | f(X) upto terms specified");
disp("-------------------------------------------------------------------
------");
for i = 1:length(x_points)
    mprintf("%5d | %10.4f | %10.4f | %16.4f | %16.4f | %16.4f\n", i,
x_points(i), fx_points(i), fx_2_points(i), fx_3_points(i),
fx_8_points(i));
end
```

OUTPUT :

```
  "Prattayaya amrit"
  "13601"
  " Plots of the exponential functions and comparison with the plots of their Taylor series expansion till first 10 terms"
  "Enter the range of x for plotting:"
Minimum x: 2

Maximum x: 8

Number of points for plotting (suggest 100): 120

  "Enter the number of terms for Taylor series approximations:"
Number of terms for first approximation (e.g., 2): 5

Number of terms for second approximation (e.g., 3): 5

Number of terms for third approximation (e.g., 8): 5

  "Enter specific x points for the table (comma-separated):"
e.g., [1, 2, 3, 4, 5]: [3,6,9,12,15,18,21,24,27]

  "Index | X | f(X)        | f(X) upto terms specified"
  "-------------------------------------------------------------------------"
    1 |     3.0000 |    20.0855 |          16.3750 |          16.3750 |          16.3750
    2 |     6.0000 |   403.4288 |         115.0000 |         115.0000 |         115.0000
    3 |     9.0000 |  8103.0839 |         445.3750 |         445.3750 |         445.3750
    4 |    12.0000 | 162754.7914 |        1237.0000 |        1237.0000 |        1237.0000
    5 |    15.0000 | 3269017.3725 |        2800.3750 |        2800.3750 |        2800.3750
    6 |    18.0000 | 65659969.1373 |        5527.0000 |        5527.0000 |        5527.0000
    7 |    21.0000 | 1318815734.4832 |        9889.3750 |        9889.3750 |        9889.3750
    8 |    24.0000 | 26489122129.8435 |       16441.0000 |       16441.0000 |       16441.0000
    9 |    27.0000 | 532048240601.7986 |       25816.3750 |       25816.3750 |       25816.3750

-->
```


Exponential Function and Taylor Series Approximations
3 000
2 500
2 000
1 500
1 000
500
0
f(x)
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
X
e^x
5 terms