Program_06_2

Requirements

Given the following equation, create **taylorExp** function.

$$1+\frac{x^1}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\frac{x^4}{4!}+\frac{x^5}{5!}+\cdots=1+x+\frac{x^2}{2}+\frac{x^3}{6}+\frac{x^4}{24}+\frac{x^5}{120}+\cdots=\sum_{n=0}^{\infty}\frac{x^n}{n!}$$

Use the following code to help with defining your function. **NOTE: you will need to create the function in an M file, do not create it here.**

---------- Copy code for starting function ----------

```
function [taylorExp] = TaylorExp(x) % function definition line
% H1: Computes e^x using a Taylor Series for x >= 0
% Help Text:
% Input argument:
% x = a vector of exponents, all values of x >= 0
% Output Argument:
% Texp = a vector of e^x values computed using a Taylor Series
```

---------- End copy code for starting function ----------

The function shall:

- Compute e^x given the value(s) passed in using a Taylor Series
- Be capable of accepting a vector of x values, compute e^x for each value in the vector
- Assume a tolerance of 1e-6. That is, compute the Taylor terms until the value of the current term is less than the tolerance.

After creating your function, create a script named **Program_06_2.** In the script, create a vector of x values. Then, using your `taylorExp()` function and the MATLAB `exp()` function, generate the example output as efficiently as possible.

Tips:

- Start by creating a function that only works with a scalar value, then modify it to work with a vector
- Think of key words that indicate what sort of conditional statements you'll need
- The program should likely be 15 or less lines of actual code, if you're exceeding this you may be overthinking the problem.

Program

In the code block below, create your program, editing the existing text as necessary.

Note: If you are using Octave then you will need to create a separate script file, save that separate file as the name **Program_06_02**. It will not conflict with this file of the same name since the extension will be different.

```
% Filename: Program_06_2
% Author:   Geoff Berl
% Assisted by: No one

% Program Description:
% The purpose of this program is to test function TaylorExp(x) and compare
% it with the built-in function exp(x).

% Clear the command window and all variables and close figure windows
clc        % clc clears the contents of the command window
clear      % clear, clears all defined variables from the Matlab workspace
close all  % close all figure windows

% Output of the title and author to the command window.
fprintf('Output for Program_05_2 written by Geoff Berl.\n\n')

% Print the table heading
fprintf('   x      TaylorExp(x)        Exp(x)    Exp(x) - TaylorExp(x)\n')

% create the vector of x values
x = 0: 0.5: 20;

% create vectors of each function and the difference
taylor = taylorExp(x);
BuiltIn = exp(x);
diff = BuiltIn - taylor;

% Create a table of the vectors
table = [x;taylor; BuiltIn; diff];

% Print the values, table will be printed column by column
fprintf('%5.1f     %11.5e     %11.5e    %13.5e\n',table)
```

Example Output

Your program output should match the following when run from the Command Window. Be sure to run your program from the Command Window as the output format will differ from what you see in the live script.

Output for Program_05_2 written by Geoff Berl.

x	TaylorExp(x)	Exp(x)	Exp(x) - TaylorExp(x)
0.0	1.00000e+00	1.00000e+00	0.00000e+00
0.5	1.64872e+00	1.64872e+00	5.66417e-09
1.0	2.71828e+00	2.71828e+00	2.73127e-08
1.5	4.48169e+00	4.48169e+00	3.49720e-08
2.0	7.38906e+00	7.38906e+00	2.86047e-08
2.5	1.21825e+01	1.21825e+01	1.30260e-07
3.0	2.00855e+01	2.00855e+01	7.17365e-08
3.5	3.31155e+01	3.31155e+01	2.16198e-07
4.0	5.45981e+01	5.45982e+01	1.04995e-07
4.5	9.00171e+01	9.00171e+01	5.01973e-08
5.0	1.48413e+02	1.48413e+02	1.19807e-07
5.5	2.44692e+02	2.44692e+02	2.63349e-07
6.0	4.03429e+02	4.03429e+02	1.19335e-07
6.5	6.65142e+02	6.65142e+02	2.43495e-07
7.0	1.09663e+03	1.09663e+03	1.09477e-07
7.5	1.80804e+03	1.80804e+03	2.12167e-07
8.0	2.98096e+03	2.98096e+03	9.52055e-08
8.5	4.91477e+03	4.91477e+03	1.77706e-07
9.0	8.10308e+03	8.10308e+03	3.22062e-07
9.5	1.33597e+04	1.33597e+04	1.44799e-07
10.0	2.20265e+04	2.20265e+04	2.56397e-07
10.5	3.63155e+04	3.63155e+04	1.15651e-07
11.0	5.98741e+04	5.98741e+04	2.01064e-07
11.5	9.87158e+04	9.87158e+04	3.43178e-07
12.0	1.62755e+05	1.62755e+05	1.55909e-07
12.5	2.68337e+05	2.68337e+05	2.62866e-07
13.0	4.42413e+05	4.42413e+05	1.19908e-07
13.5	7.29416e+05	7.29416e+05	1.99885e-07
14.0	1.20260e+06	1.20260e+06	3.28757e-07
14.5	1.98276e+06	1.98276e+06	1.50874e-07
15.0	3.26902e+06	3.26902e+06	2.47266e-07
15.5	5.38970e+06	5.38970e+06	3.99537e-07
16.0	8.88611e+06	8.88611e+06	1.84402e-07
16.5	1.46507e+07	1.46507e+07	3.03611e-07
17.0	2.41550e+07	2.41550e+07	1.34110e-07
17.5	3.98248e+07	3.98248e+07	2.23517e-07
18.0	6.56600e+07	6.56600e+07	3.50177e-07
18.5	1.08255e+08	1.08255e+08	2.23517e-07
19.0	1.78482e+08	1.78482e+08	2.98023e-07
19.5	2.94268e+08	2.94268e+08	3.57628e-07
20.0	4.85165e+08	4.85165e+08	2.98023e-07