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MAT 331

Project 1

14 February 2020

%The implementation of functions f and g, runs a loop to calculate the

%desired values.

function Question1()

%prints the functions f and g for the

%x value in the loop

xVals = [];

fVals = [];

gVals = [];

%populate the function vectors at each x value

for i=1:20

xVals(i) = 5 ^ -i;

fVals(i) = f(xVals(i));

gVals(i) = g(xVals(i));

end

%create the table with the transposes of each row vector

t = table(xVals',fVals',gVals','VariableNames',["x","f", "g"])

function val = f(x)

val = sqrt(x^2 + 4) - 2;

function val = g(x)

val = (x ^ 2) / (sqrt(x^2 + 4) + 2);

>> Question1()

t =

20×3 table

x f g

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0.2 0.0099751 0.0099751

0.04 0.00039996 0.00039996

0.008 1.6e-05 1.6e-05

0.0016 6.4e-07 6.4e-07

0.00032 2.56e-08 2.56e-08

6.4e-05 1.024e-09 1.024e-09

1.28e-05 4.096e-11 4.096e-11

2.56e-06 1.6382e-12 1.6384e-12

5.12e-07 6.5281e-14 6.5536e-14

1.024e-07 2.6645e-15 2.6214e-15

2.048e-08 0 1.0486e-16

4.096e-09 0 4.1943e-18

8.192e-10 0 1.6777e-19

1.6384e-10 0 6.7109e-21

3.2768e-11 0 2.6844e-22

6.5536e-12 0 1.0737e-23

1.3107e-12 0 4.295e-25

2.6214e-13 0 1.718e-26

5.2429e-14 0 6.8719e-28

1.0486e-14 0 2.7488e-29

Function f is more accurate since both functions should converge to 0 as x approaches 0.

%implements functions f, g and h

function Question2(a, b, n)

%create the step size for 101 points

stepSize = (b - a) / (n-1);

xVals = a : stepSize : b;

%initialize the function vectors

fVals = [];

gVals = [];

hVals = [];

%evaluate the functions on xVals

for i=1:length(xVals)

x = xVals(i);

fVals(i) = f(x);

gVals(i) = g(x);

hVals(i) = h(x);

end

%plot the functions

figure(1);

plot(xVals,fVals,'black',xVals,gVals,'blue',xVals,hVals,'red')

%create a table

t = table(xVals',fVals',gVals',hVals','VariableNames',["x","f","g","h"])

function val = f(x)

%creating a coefficient vector

coeffs = [1 -10 45 -120 210 -252 210 -120 45 -10 1];

val = 0;

%looping back direction to preserve order

for i=11:-1:1

val = val + (x ^ (i-1)) \* coeffs(i);

end

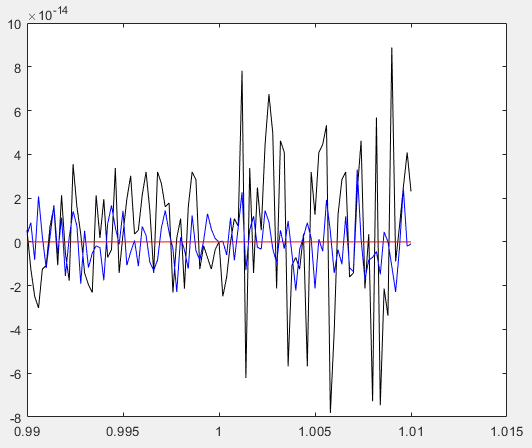
function val = g(x)

val = 1 + x \* (-10 + x \* (45 + x \* (-120 + x \* (210 + x \* (-252 + x \* (210 + x \* (-120 + x \* (45 + x \* (-10 + x)))))))));

function val = h(x)

val = (x-1)^10;

Interval 1 (0.99, 1.01) :



>> Question2(0.99,1.01,101)

t =

101×4 table

x f g h

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0.99 5.32907051820075e-15 3.21964677141295e-15 1.00000000000001e-20

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1.0084 -7.46069872548105e-14 -1.48769885299771e-14 1.74901228765973e-21

1.0086 -2.1316282072803e-14 4.55191440096314e-15 2.21301578888016e-21

1.0088 -3.37507799486048e-14 0 2.78500976009376e-21

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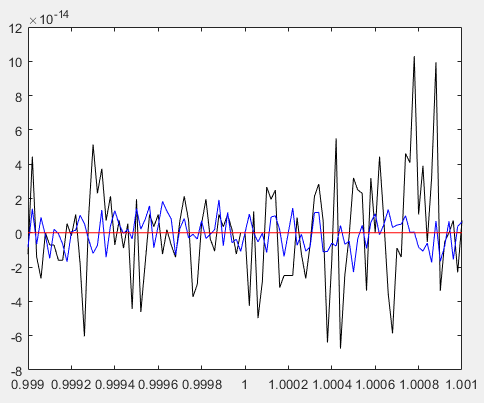
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1.0098 4.08562073062058e-14 -1.99840144432528e-15 8.17072806887573e-21

1.01 2.30926389122033e-14 -8.88178419700125e-16 1.00000000000001e-20

Interval 2 (0.999,1.001) :



>> Question2(0.999,1.001,101)

t =

101×4 table

x f g h

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0.99912 -7.105427357601e-15 2.1094237467878e-15 2.78500976009377e-31

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0.99916 -1.59872115546023e-14 -6.66133814775094e-15 1.74901228766112e-31

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