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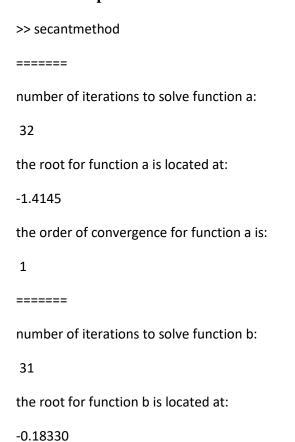
Math 131-05D

Homework #4 2a secant

2. a)
$$f(x) = cos(x + sqrt(2)) + x * (\frac{x}{2} + sqrt(2))$$
 interval [-2,1]
b) $f(x) = exp(6 * x) + 3 * ((log(2))^2) * exp(2 * x) - log(8) * exp(4 * x) - (log(2))^3$
Interval [-1, 0]

The code uses secant method $[x_{n+1} = x_n - \frac{f(x_n)(x_n - x_{n-1})}{f(x_n) - f(x_{n-1})}]$ to find roots of a function up to a tolerance of 10^{-5} within 100 iterations and graph the logarithmic error. For function (a) the code found the root to be at -1.4145 with 32 iterations with an order of convergence of 1. For function (b) the root was found to be -0.18330 this was found with 31 iterations with an order of convergence of 1.0245.

Matlab Output:



the order of convergence for function b is:

1.0245

Matlab code used for this problem:

%======================================
%Name: Yeash Patel
%Class: Math131-Numerical Analysis-05D-SP17
%Title: HW4
%
%problem 2 secantmethod method for a and b
%
%problem 3
% newtons is quadratic and requires the deriviative of the
% function also takes less iterations.
%
% Secant does not require the derivative of the function and
% therfore less function evaluations.
%
%======================================
close all
clc
clear all
a=@(x)cos(x+sqrt(2))+x*(x/2+sqrt(2));
$b = @(z) \exp(6*z) + 3*((\log(2))^2)* \exp(2*z) - \log(8)* \exp(4*z) - (\log(2))^3$
N=100;

```
TOL=10^-5;
i=1;
t=1;
x=-2;
x1=-1.5;
err=[];
errb=[];
z=-1
z1=-0.999
while(i<=N)
  xn(i)=x1-(a(x1)*(x1-x))/(a(x1)-a(x))
  err(i)=abs(xn(i)-x1)
 if(err(i) \le TOL | err(i) = 0)
   disp(i)
   disp(x)
   break;
 end
 x=x1
 x1=xn(i)
 j++
```

```
while(t<=N)
  zn(t)=z1-(b(z1)*(z1-z))/(b(z1)-b(z))
  errb(t)=abs(zn(t)-z1)
 if(errb(t) \le TOL | errb(t) = 0)
   disp(t)
   disp(z)
   break;
 end
 z=z1
 z1=zn(t)
 t++
end
u=length(err)-1
n=length(errb)
aa=log(err(2:u))./log(err(1:u-1))
ab=log(errb(2:n))./log(errb(1:n-1))
disp('=====')
disp('number of iterations to solve function a:')
disp(i)
disp('the root for function a is located at:')
```

```
disp(x)
disp('the order of convergence for function a is:')
disp(aa(u-1))
disp('======')
disp('number of iterations to solve function b:')
disp(t)
disp('the root for function b is located at:')
disp(z)
disp('the order of convergence for function b is:')
disp(ab(n-1))
subplot(1,2,1)
loglog(errb(2:u),err(1:u-1),'*-')
axis on
title("secant method error for a")
xlabel('number of iteration')
ylabel('log(error)')
subplot(1,2,2)
loglog(errb(2:n),errb(1:n-1),'*-')
axis on
title("secant method error for b")
xlabel('number of iteration')
ylabel('log(error)')
```