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MEC 232

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Q1. Write and execute a MATLAB program to solve the following function by Bisection Method

$f(c) = 9.8 * 68.1/c\,[1 - e^{(-0.146813c)}] - 40$. Search your answer between c values 12 to 16. Assume minimum error to be considered as 0.001.

Solution

```
clear all;
clc;
a = input('value of a= ');
b = input('value of b = ');
tol = 0.001;
count = 0;
f = @(c) (c\(9.8* 68.1) * (1-exp(-0.146813 * c)) -40);
while f(a) * f(b) > 0
   b = input('value of b = ');
   a = input('value of a = ');
end
while abs(b-a) > tol
   c = (a+b)/2;
   if f(a) * f(c) < 0
      b = c;
   else
      a = c;
   end
```

```
    count = count+1;
end
fprintf('total iterations: %d\n', count)
fprintf('The root is %.1.1of\n The value of f(%.f) is %f\n', c, c, f(c))
```

Q2. Write a MATLAB code to calculate the roots of the equation $f(x) = e^{-x} - x$ by newton raphson method, employing an initial guess value $x_0 = 1$. Assume minimum error to be 0.001.

Solution

```
clear all;
clc;
tol = 0.001;
error = 1;
count = 0;
f = @(x)( exp(-x) - x);
df = @(x)(-exp(-x) - 1);
x = input('Initial approximation = ');
while error > tol
    x1 = x - (f(x)/df(x));
    error = abs(x1 - x);
    x = x1;
    count = count+1;
end
fprintf('Total iterations: %d\n', count)
fprintf('The root is = %d\n', x)
fprintf('The value of function at root = %f\n', f(x))
```

Q3. Compare the results and number of iterations obtained from newton raphson and secant method for the equation $f(x) = e^{-x} - x$, employing an initial guess

③

value of $x_0 = 0$. Assume minimum error to be 0.001

Solution

```
clear all;
clc;
disp('Secant method')
count = 0;
f = @(x) (exp(-x) - x);
x(1) = input ('1st guess: ');
x(2) = input ('2nd guess: ');
for n = 3:50
  x(n) = (x(n-2) * f(x(n-1)) - x(n-1) * f(x(n-2))) / (f(x(n-1)) - f(x(n-2)));
  if abs (x(n) - x(n-1)) < 0.001 && f(x(n)) < 0.001
    root = x(n);
    break
  end
  count = count + 1;
end
fprintf('Total iterations: %d \n', count)
fprintf('The root is %f \n', x(n))
fprintf('The value of function at root = %f \n', f(x(n)))

fprintf('\n')

clear all;
disp('Newton Raphson method')
tol = 0.001;
error = 0;
f = @(x) (exp(-x) - x);
df = @(x) (-exp(-x) - 1);
x = input ('Initial approximation = ');
```

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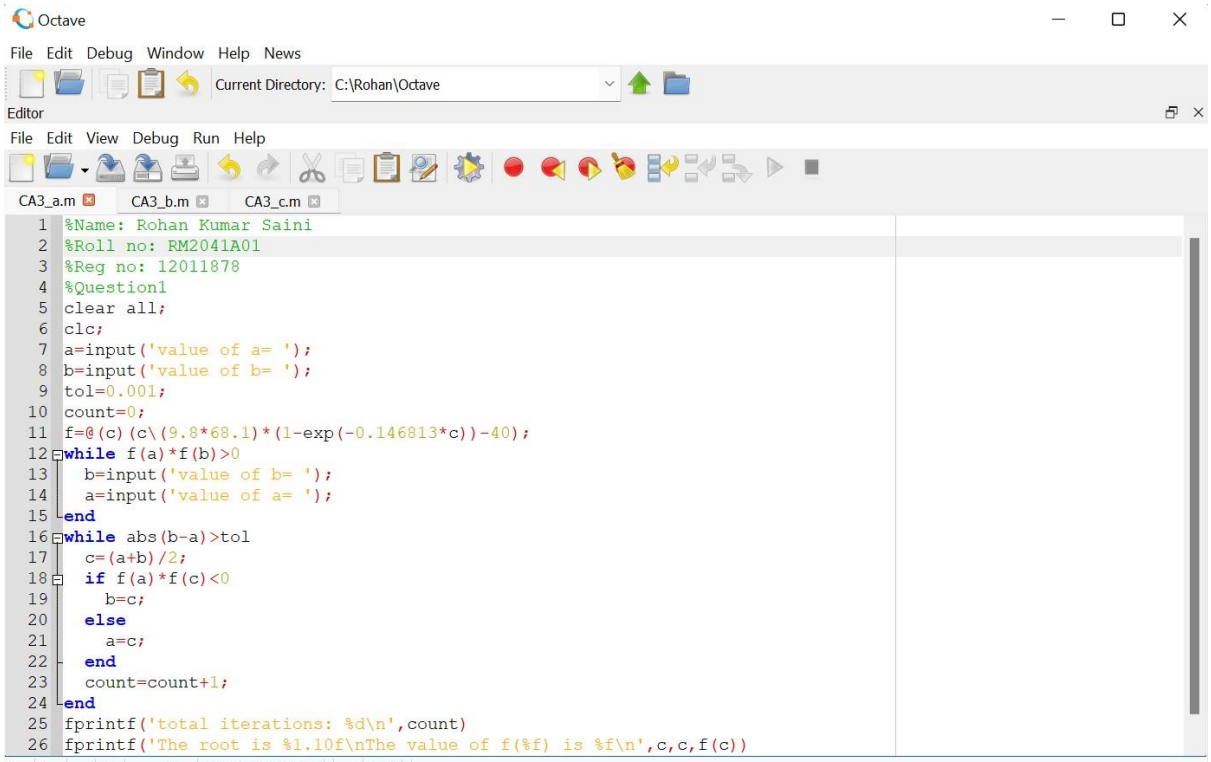
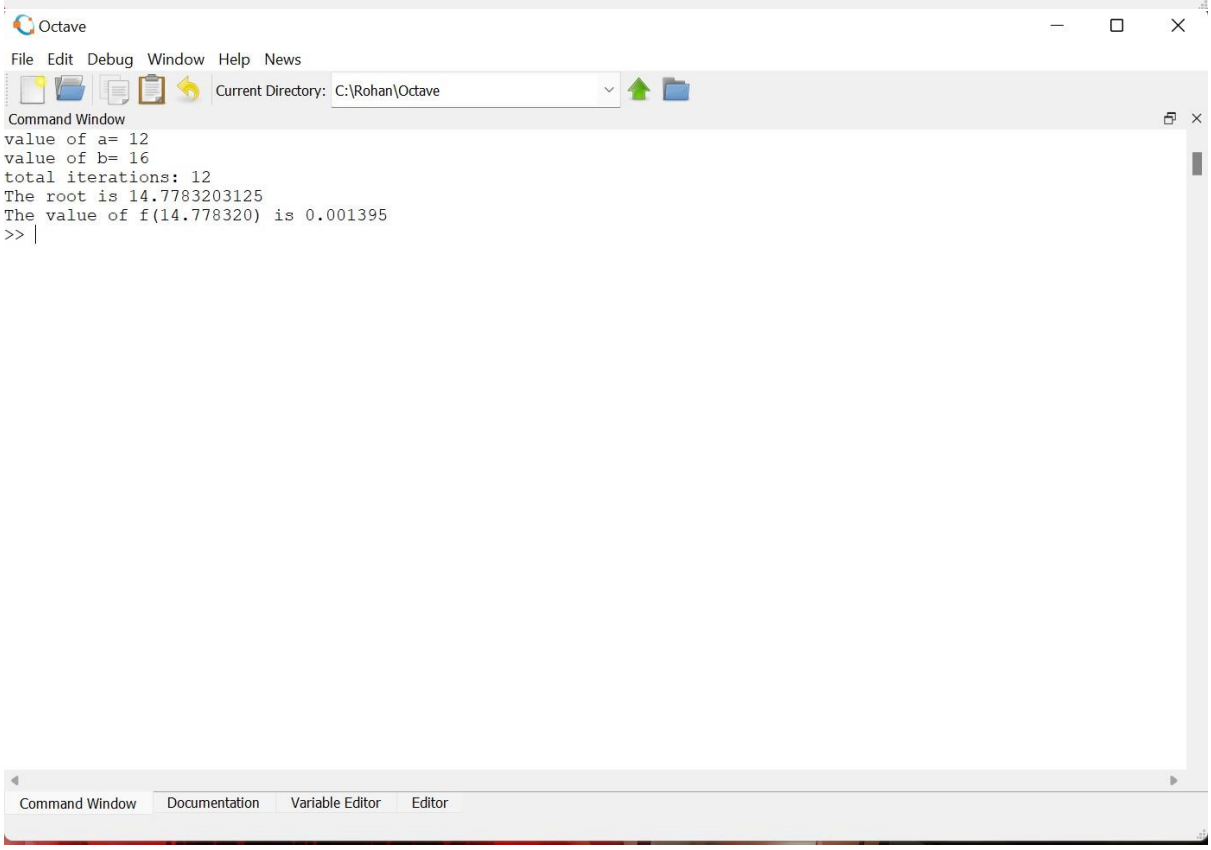
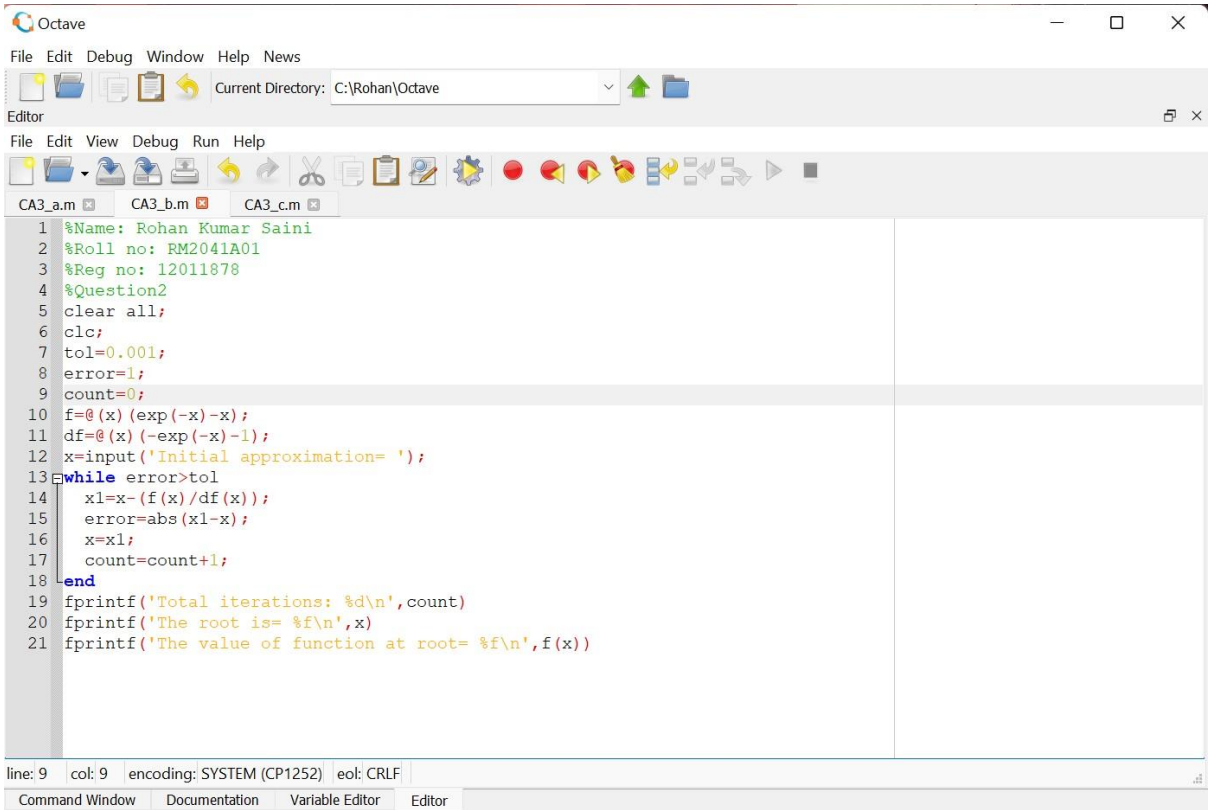
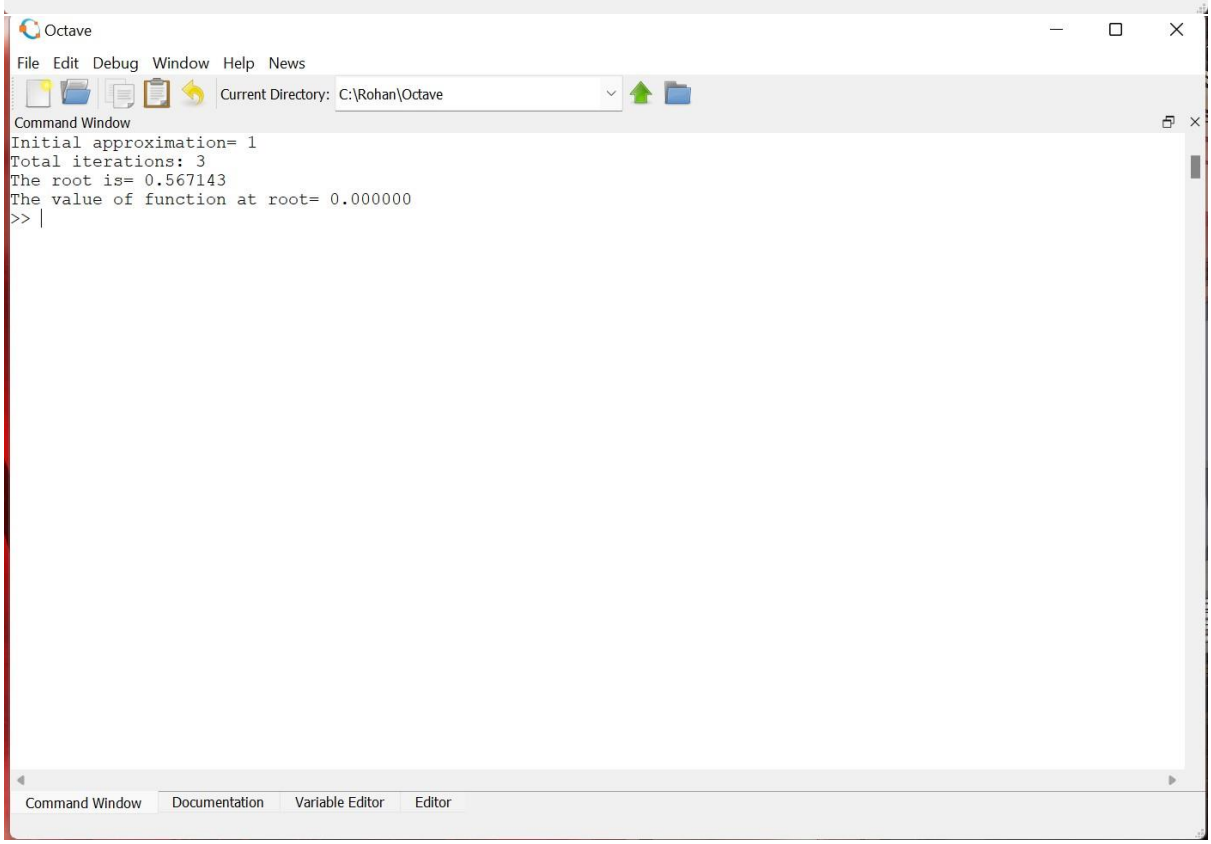
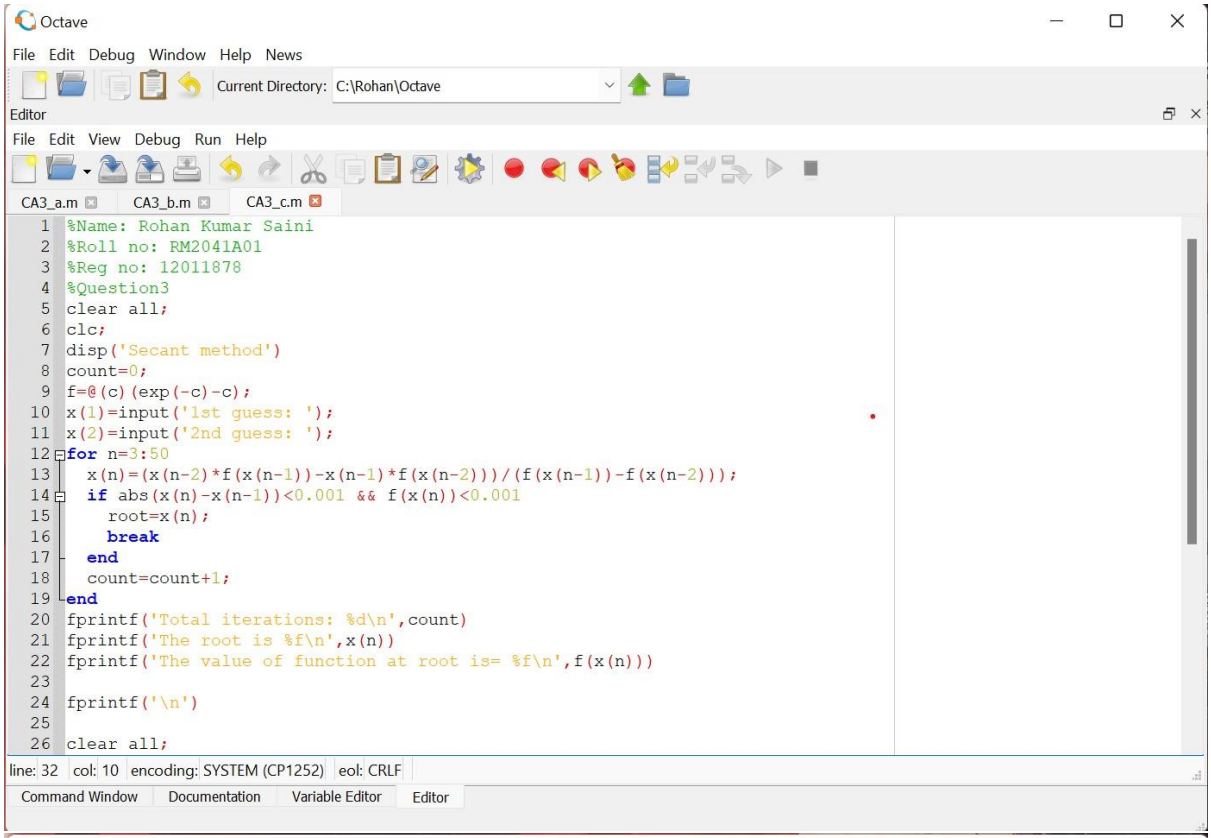
```
while error > tol
    x1 = x - (f(x)/df(x));
    error = abs(x1 - x);
    x = x1;
    count = count + 1;
end
fprintf('Total Iterations: %d \n', count)
fprintf('The root is = %f \n', x)
fprintf('The value of function at root = %f \n', f(x))
```

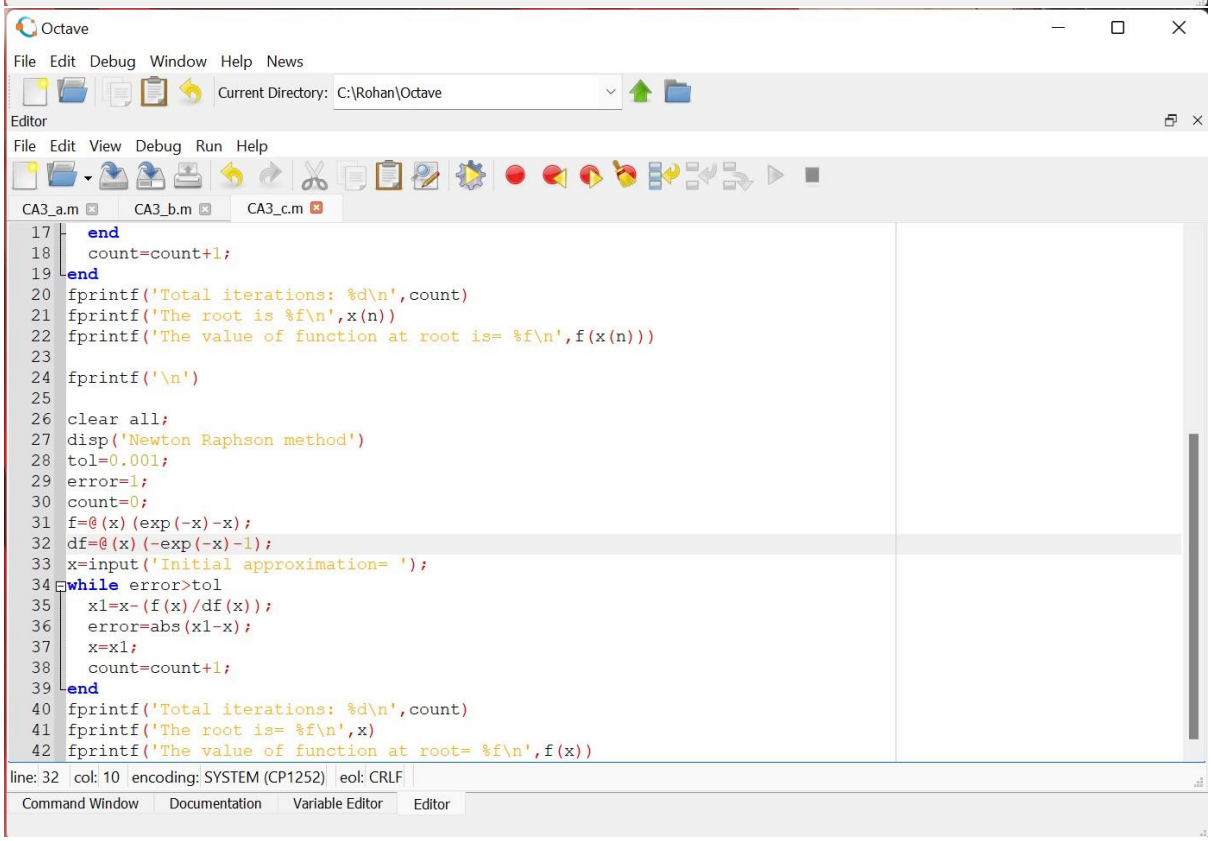

Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Editor
File Edit View Debug Run Help
CA3_a.m
CA3_b.m
CA3_c.m
%Name: Rohan Kumar Saini
%Roll no: RM2041A01
%Reg no: 12011878
%Question1
clear all;
clc;
a=input('value of a= ');
b=input('value of b= ');
tol=0.001;
count=0;
f=@(c)(c\(9.8*68.1)*(1-exp(-0.146813*c))-40);
while f(a)*f(b)>0
b=input('value of b= ');
a=input('value of a= ');
end
while abs(b-a)>tol
c=(a+b)/2;
if f(a)*f(c)<0
b=c;
else
a=c;
end
count=count+1;
end
fprintf('total iterations: %d\n',count)
fprintf('The root is %1.10f\nThe value of f(%f) is %f\n',c,c,f(c))
line: 2 col: 18 encoding: SYSTEM (CP1252) eol: CRLF
Command Window Documentation Variable Editor Editor

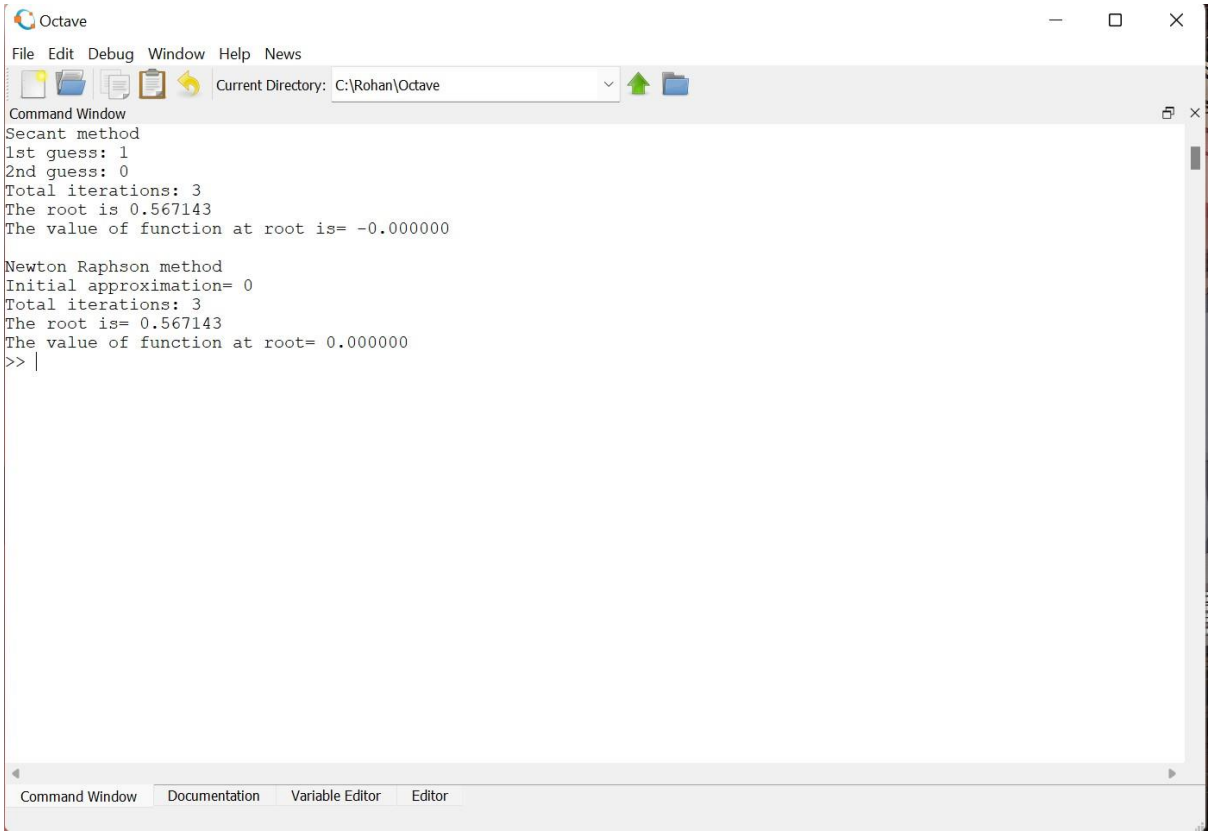

Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Command Window
value of a= 12
value of b= 16
total iterations: 12
The root is 14.7783203125
The value of f(14.778320) is 0.001395
>>
Command Window Documentation Variable Editor Editor


Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Editor
File Edit View Debug Run Help
CA3_a.m
CA3_b.m
CA3_c.m
%Name: Rohan Kumar Saini
%Roll no: RM2041A01
%Reg no: 12011878
%Question2
clear all;
clc;
tol=0.001;
error=1;
count=0;
f=@(x)(exp(-x)-x);
df=@(x)(-exp(-x)-1);
x=input('Initial approximation= ');
while error>tol
x1=x-(f(x)/df(x));
error=abs(x1-x);
x=x1;
count=count+1;
end
fprintf('Total iterations: %d\n',count)
fprintf('The root is= %f\n',x)
fprintf('The value of function at root= %f\n',f(x))
line: 9 col: 9 encoding: SYSTEM (CP1252) eol: CRLF
Command Window Documentation Variable Editor Editor


Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Command Window
Initial approximation= 1
Total iterations: 3
The root is= 0.567143
The value of function at root= 0.000000
>>
Command Window Documentation Variable Editor Editor


Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Editor
File Edit View Debug Run Help
CA3_a.m CA3_b.m CA3_c.m
%Name: Rohan Kumar Saini
%Roll no: RM2041A01
%Reg no: 12011878
%Question3
clear all;
clc;
disp('Secant method')
count=0;
f=@(c)(exp(-c)-c);
x(1)=input('1st guess: ');
x(2)=input('2nd guess: ');
for n=3:50
x(n)=(x(n-2)*f(x(n-1))-x(n-1)*f(x(n-2)))/(f(x(n-1))-f(x(n-2)));
if abs(x(n)-x(n-1))<0.001 && f(x(n))<0.001
root=x(n);
break
end
count=count+1;
end
fprintf('Total iterations: %d\n',count)
fprintf('The root is %f\n',x(n))
fprintf('The value of function at root is= %f\n',f(x(n)))
fprintf('\n')
clear all;
line: 32 col: 10 encoding: SYSTEM (CP1252) eol: CRLF
Command Window Documentation Variable Editor Editor


Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Editor
File Edit View Debug Run Help
CA3_a.m CA3_b.m CA3_c.m
end
count=count+1;
end
fprintf('Total iterations: %d\n',count)
fprintf('The root is %f\n',x(n))
fprintf('The value of function at root is= %f\n',f(x(n)))
fprintf('\n')
clear all;
disp('Newton Raphson method')
tol=0.001;
error=1;
count=0;
f=@(x)(exp(-x)-x);
df=@(x)(-exp(-x)-1);
x=input('Initial approximation= ');
while error>tol
x1=x-(f(x)/df(x));
error=abs(x1-x);
x=x1;
count=count+1;
end
fprintf('Total iterations: %d\n',count)
fprintf('The root is= %f\n',x)
fprintf('The value of function at root= %f\n',f(x))
line: 32 col: 10 encoding: SYSTEM (CP1252) eol: CRLF
Command Window Documentation Variable Editor Editor


Octave
File Edit Debug Window Help News
Current Directory: C:\Rohan\Octave
Command Window
Secant method
1st guess: 1
2nd guess: 0
Total iterations: 3
The root is 0.567143
The value of function at root is= -0.000000
Newton Raphson method
Initial approximation= 0
Total iterations: 3
The root is= 0.567143
The value of function at root= 0.000000
>>
Command Window
Documentation
Variable Editor
Editor