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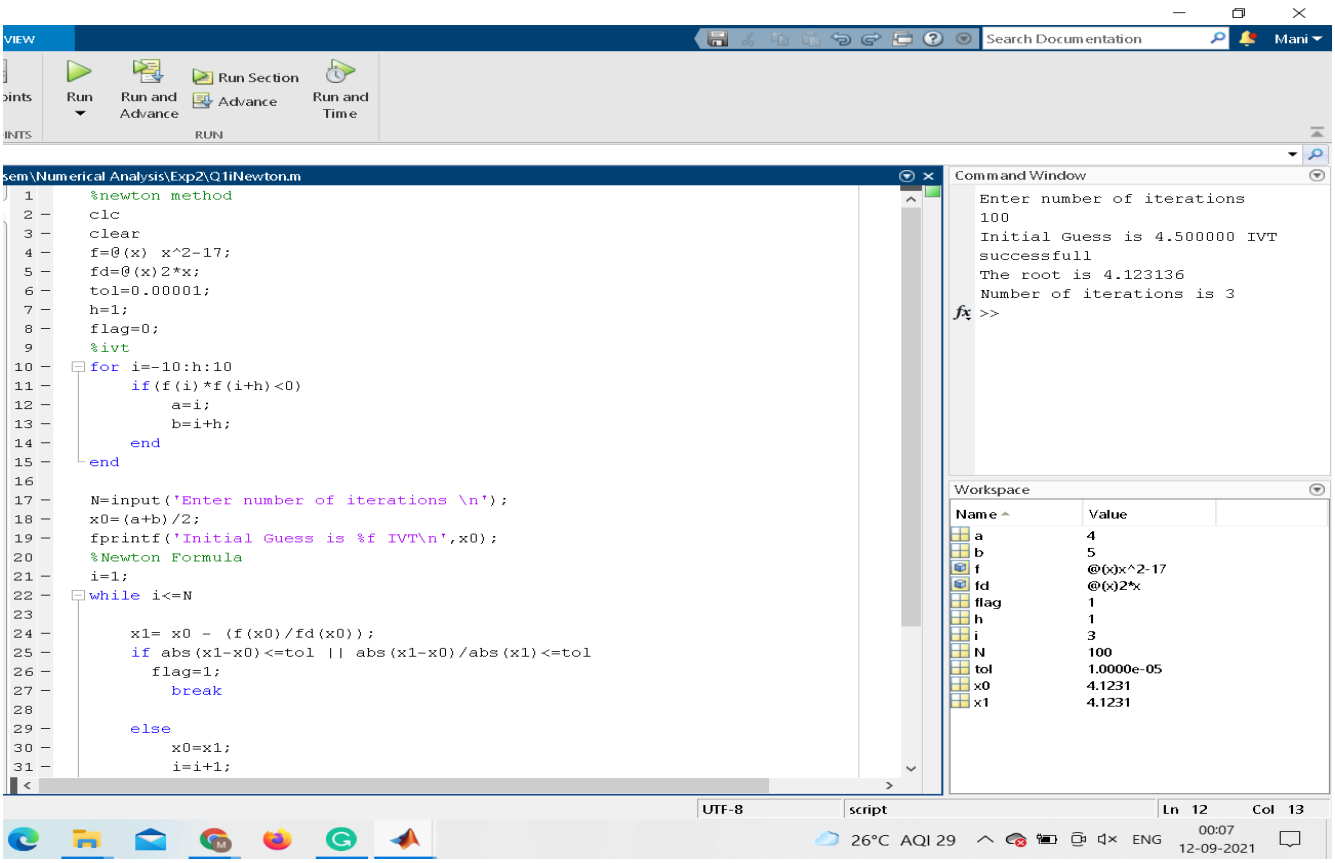
EXPERIMENT-2

Q1

3. Students are required to write both the program and implement it on the following examples. Take tolerance value $\epsilon = 0.00001$
   (i) Compute $\sqrt{17}$.
   (ii) The root of $exp(-x)(x^2 + 5x + 2) + 1 = 0$. Take initial guess –1.0.
   (iii) Find a non-zero solution of $x = 2\sin x$. (Apply IVT to find an initial guess)

Ans1(i) by Newton Method

SUCCESSFUL:



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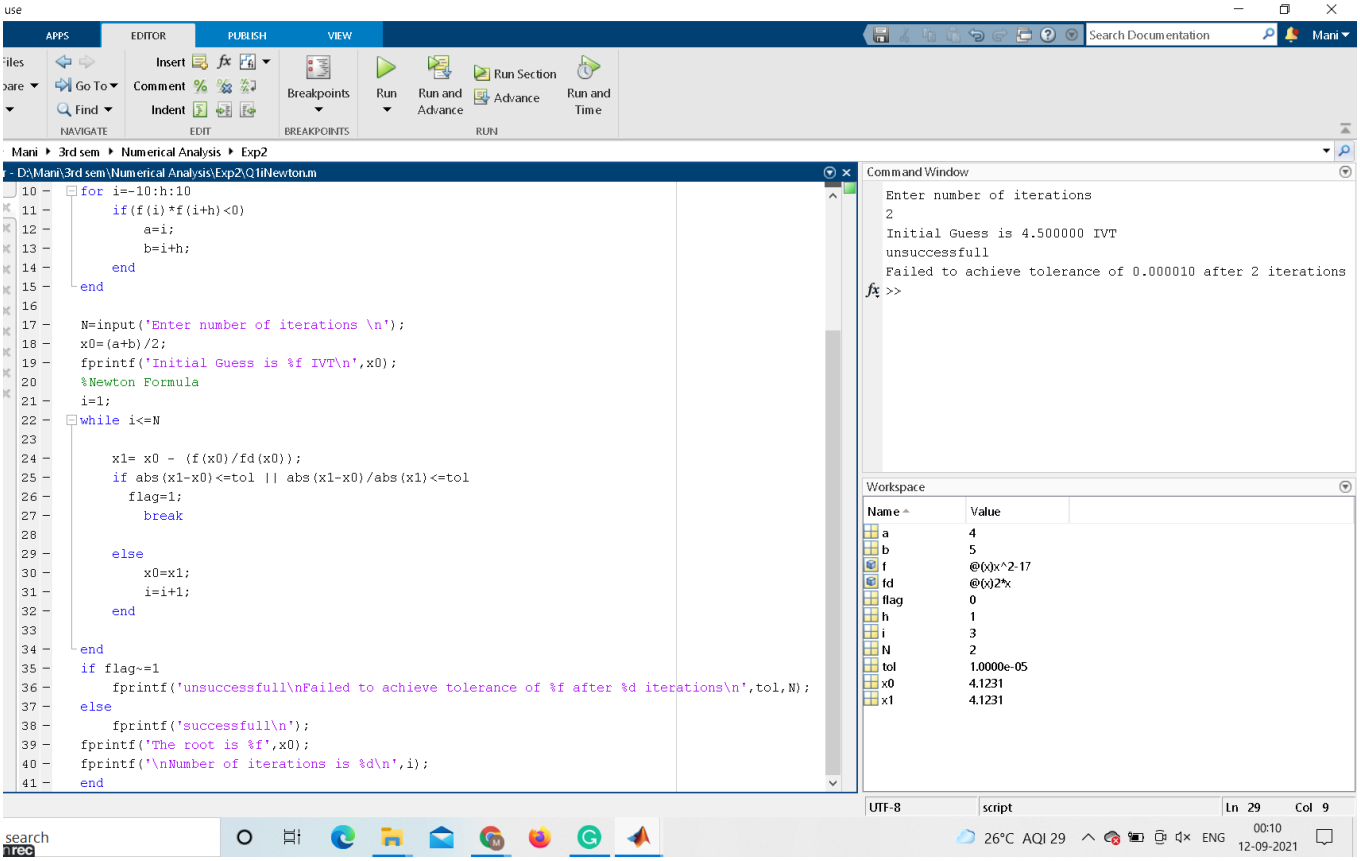
UNSUCCESSFUL:



CODE:

```
%newton method

clc

clear

f=@(x) x^2-17;

fd=@(x)2*x;

tol=0.00001;

h=1;

flag=0;

%ivt

for i=-10:h:10

    if(f(i)*f(i+h)<0)
```

```
      a=i;
      b=i+h;
   end
end

N=input('Enter number of iterations \n');
x0=(a+b)/2;
fprintf('Initial Guess is %f IVT\n',x0);
%Newton Formula
i=1;
while i<=N

   x1= x0 - (f(x0)/fd(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
    flag=1;
      break

   else
      x0=x1;
      i=i+1;
   end

end
if flag~=1
   fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
   fprintf('successfull\n');
```

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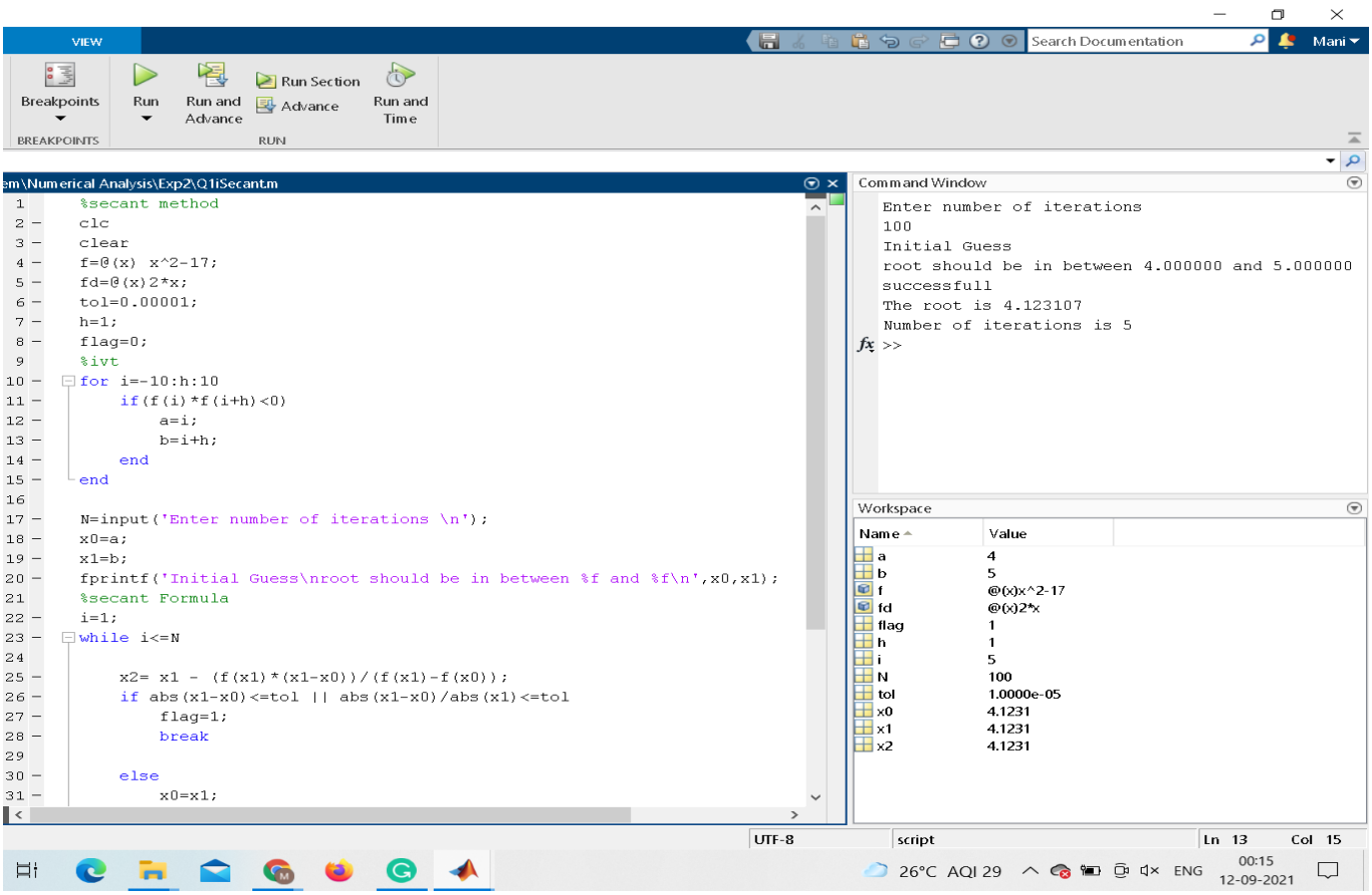
```
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

Ans1(i) by Secant Method

SUCCESSFUL:



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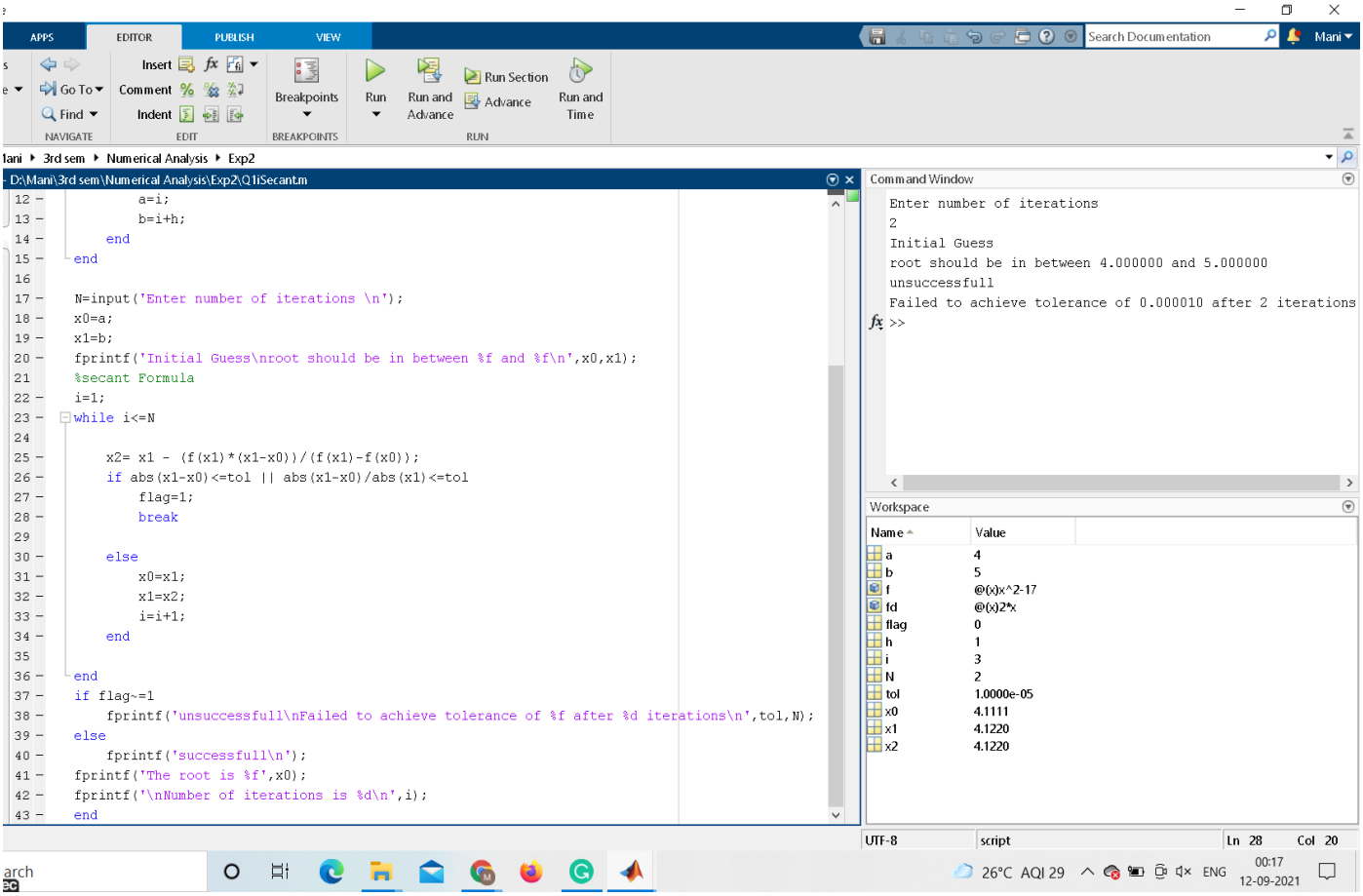
UNSUCCESSFUL:



CODE:

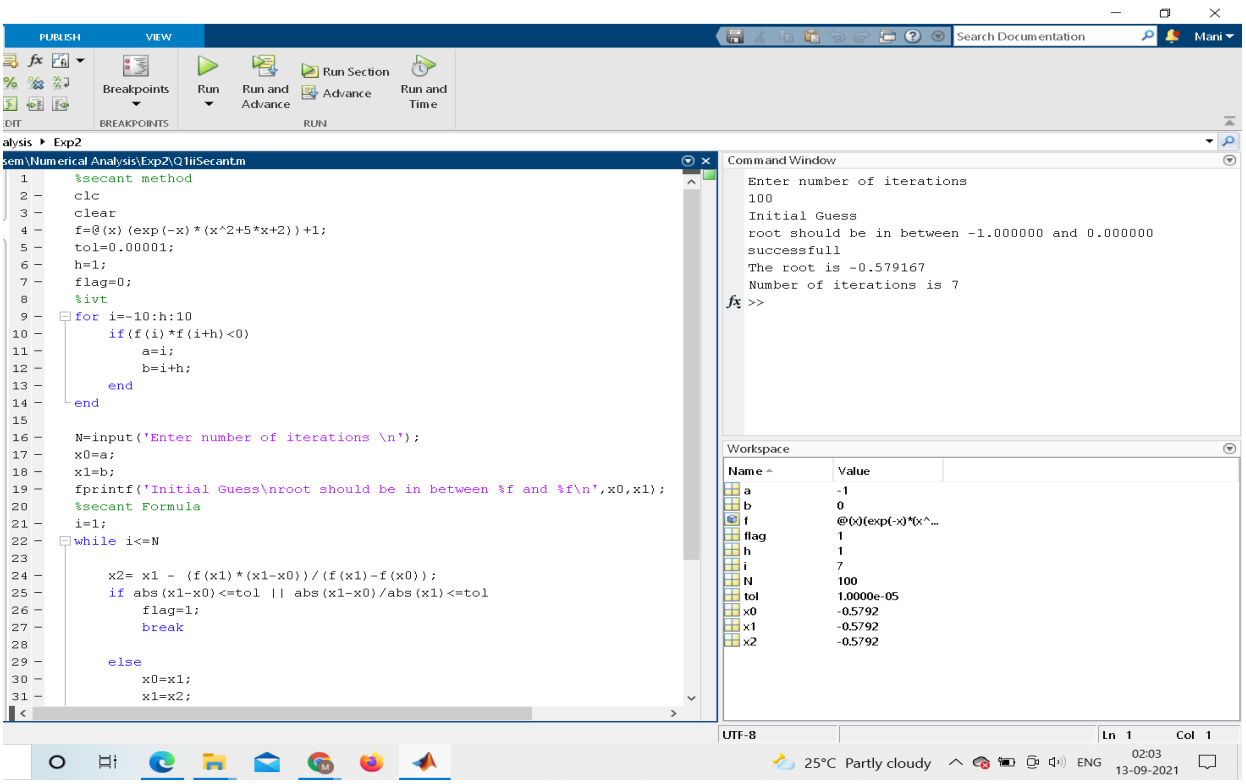
```
%secant method

clc

clear

f=@(x) x^2-17;

fd=@(x)2*x;

tol=0.00001;

h=1;

flag=0;

%ivt

for i=-10:h:10
```

```
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
   end
end

N=input('Enter number of iterations \n');
x0=a;
x1=b;
fprintf('Initial Guess\nroot should be in between %f and %f\n',x0,x1);
%secant Formula
i=1;
while i<=N

   x2= x1 - (f(x1)*(x1-x0))/(f(x1)-f(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
      flag=1;
      break

   else
      x0=x1;
      x1=x2;
      i=i+1;
   end

end
if flag~=1
```

```
    fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
    fprintf('successfull\n');
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

Ans1(ii) by Secant Method

SUCCESSFUL:



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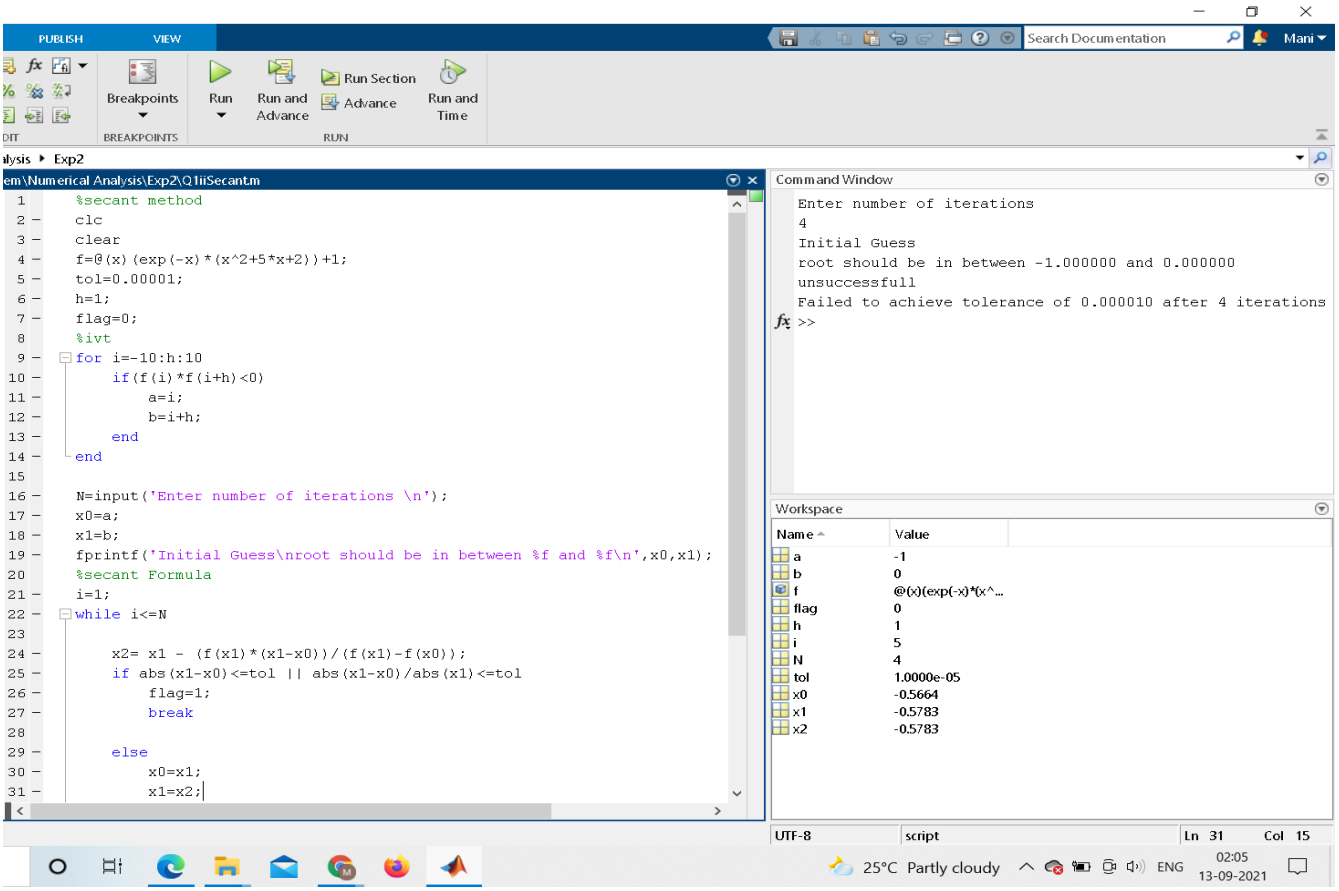
UNSUCCESSFUL:



CODE:

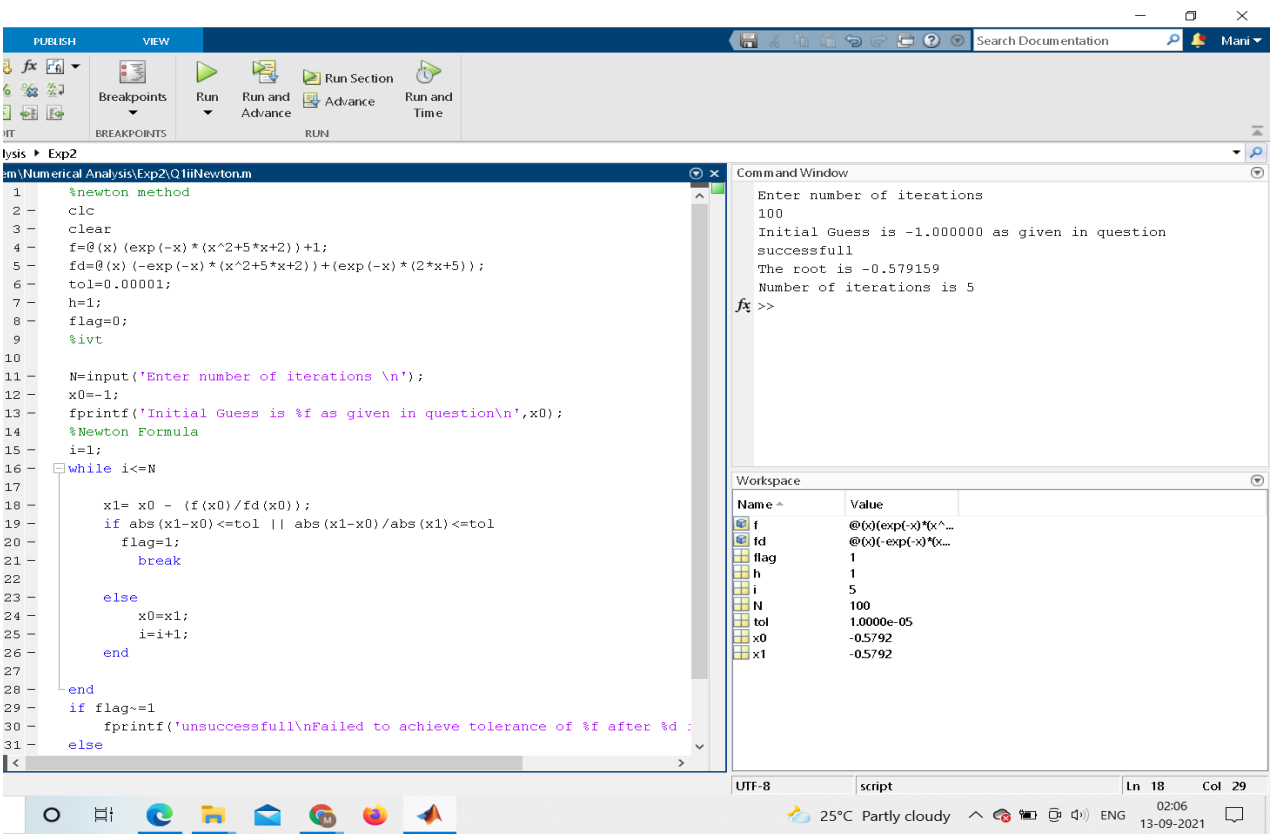
```
%secant method

clc

clear

f=@(x)(exp(-x)*(x^2+5*x+2))+1;

tol=0.00001;

h=1;

flag=0;

%ivt

for i=-10:h:10

    if(f(i)*f(i+h)<0)
```

```
        a=i;
        b=i+h;
    end
end

N=input('Enter number of iterations \n');
x0=a;
x1=b;
fprintf('Initial Guess\nroot should be in between %f and %f\n',x0,x1);
%secant Formula
i=1;
while i<=N

    x2= x1 - (f(x1)*(x1-x0))/(f(x1)-f(x0));
    if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
        flag=1;
        break

    else
        x0=x1;
        x1=x2;
        i=i+1;
    end

end
if flag~=1
    fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
```

```
else
   fprintf('successfull\n');
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

Ans1(ii) by Newton Method

SUCCESSFUL:



UNSUCCESSFUL:

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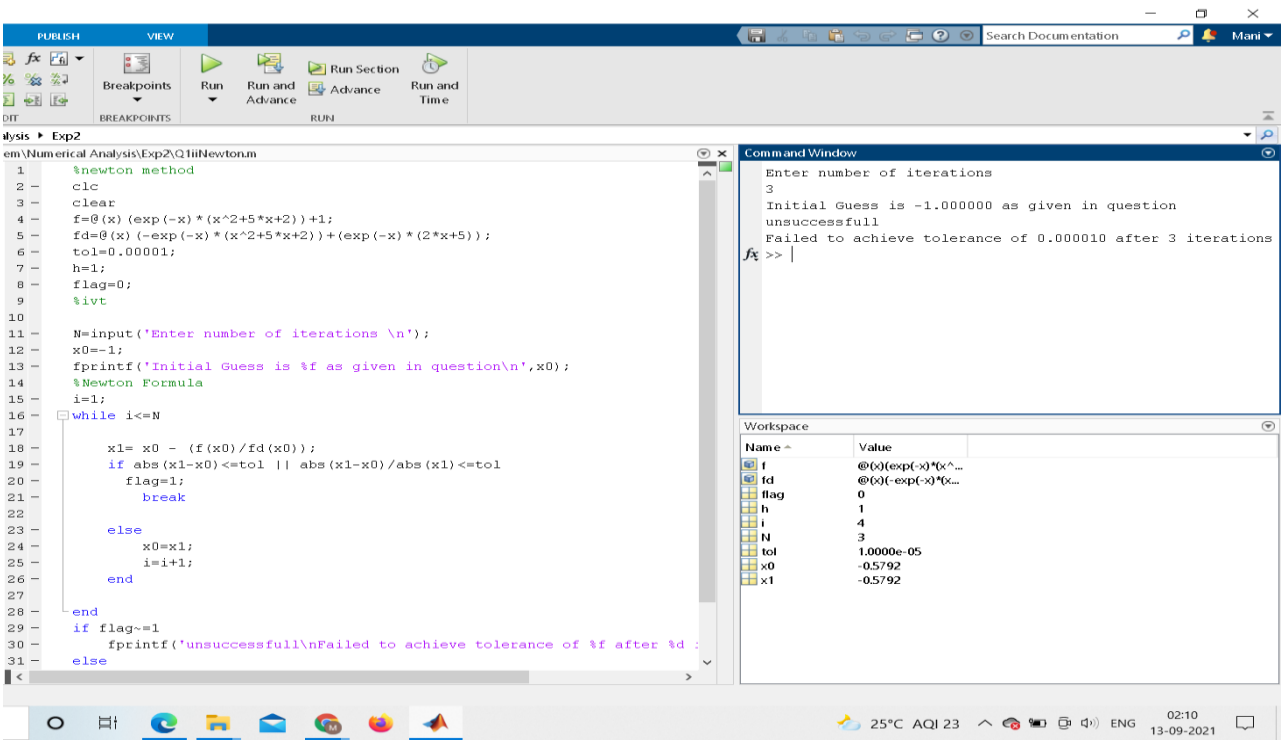

CODE:

```
%newton method
clc
clear
f=@(x)(exp(-x)*(x^2+5*x+2))+1;
fd=@(x)(-exp(-x)*(x^2+5*x+2))+(exp(-x)*(2*x+5));
tol=0.00001;
h=1;
flag=0;
%ivt

N=input('Enter number of iterations \n');
x0=-1;
fprintf('Initial Guess is %f as given in question\n',x0);
%Newton Formula
```

```
i=1;
while i<=N

   x1= x0 - (f(x0)/fd(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
    flag=1;
      break

   else
      x0=x1;
      i=i+1;
   end

end
if flag~=1
   fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
   fprintf('successfull\n');
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

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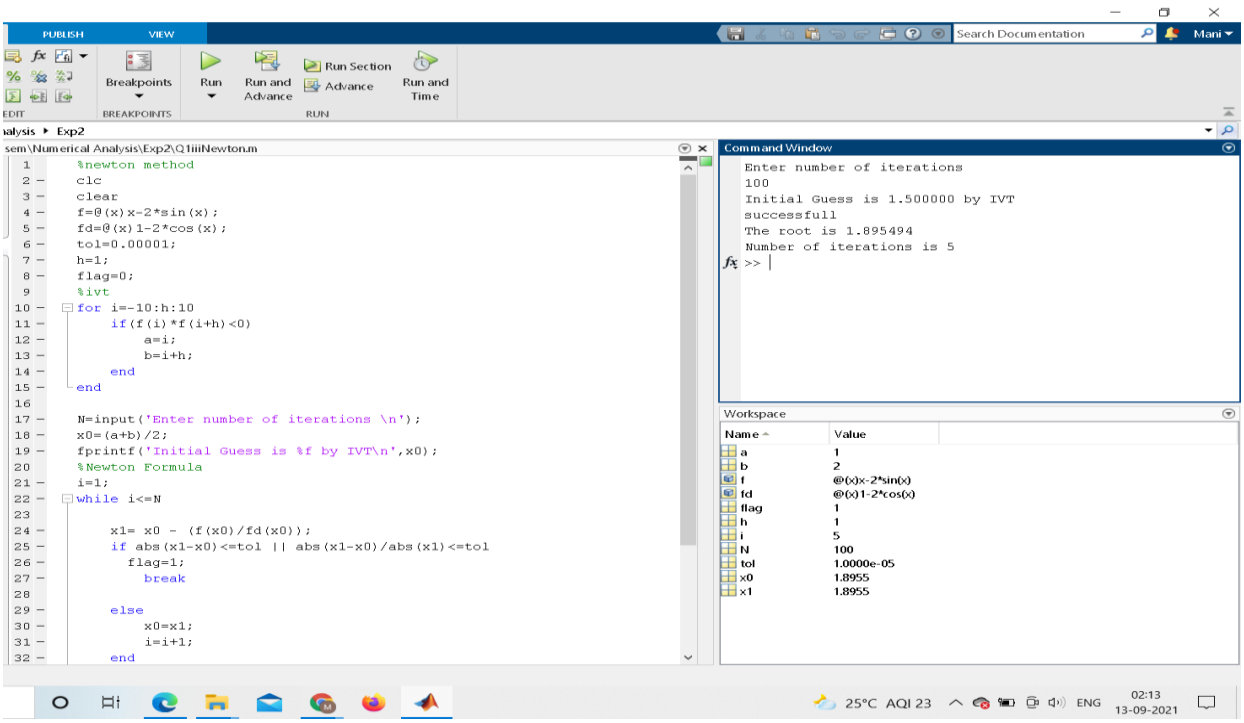
Ans1(iii) by Newton Method

SUCCESSFUL:



UNSUCCESSFUL:

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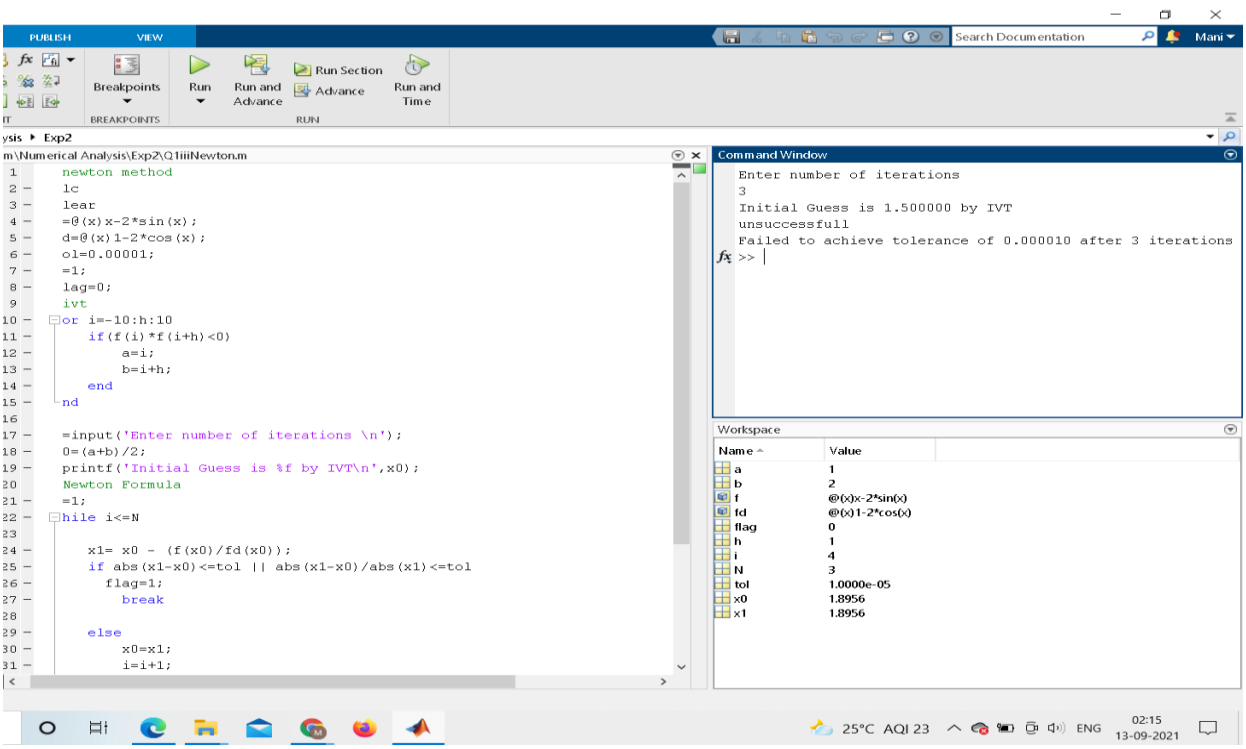

CODE:

```
%newton method
clc
clear
f=@(x)x-2*sin(x);
fd=@(x)1-2*cos(x);
tol=0.00001;
h=1;
flag=0;
%ivt
for i=-10:h:10
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
   end
```

```
end

N=input('Enter number of iterations \n');
x0=(a+b)/2;
fprintf('Initial Guess is %f by IVT\n',x0);
%Newton Formula
i=1;
while i<=N

   x1= x0 - (f(x0)/fd(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
     flag=1;
       break

   else
      x0=x1;
      i=i+1;
   end

end
if flag~=1
   fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
   fprintf('successfull\n');
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

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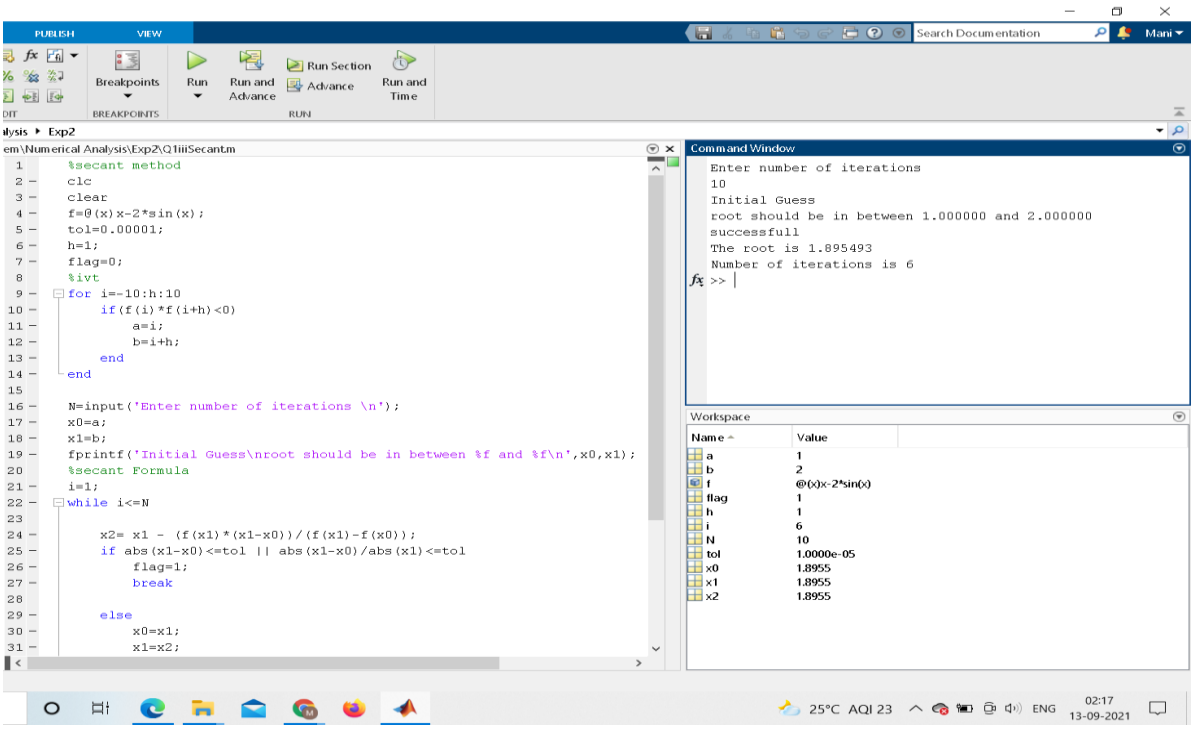
Ans1(iii) by Secant Method

SUCCESSFUL:



UNSUCCESSFUL:

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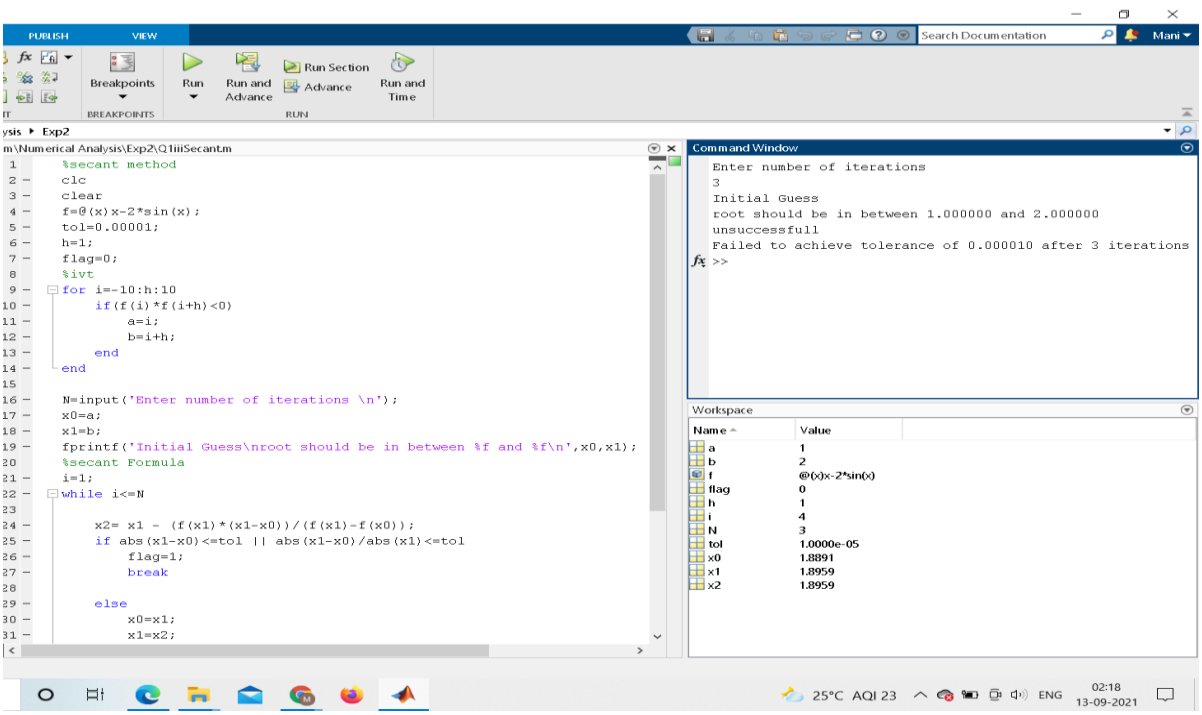


CODE:

```
%secant method
clc
clear
f=@(x)x-2*sin(x);
tol=0.00001;
h=1;
flag=0;
%ivt
for i=-10:h:10
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
   end
```

```
end

N=input('Enter number of iterations \n');
x0=a;
x1=b;
fprintf('Initial Guess\nroot should be in between %f and %f\n',x0,x1);
%secant Formula
i=1;
while i<=N

   x2= x1 - (f(x1)*(x1-x0))/(f(x1)-f(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
      flag=1;
      break

   else
      x0=x1;
      x1=x2;
      i=i+1;
   end

end
if flag~=1
   fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
   fprintf('successfull\n');
fprintf('The root is %f',x0);
```

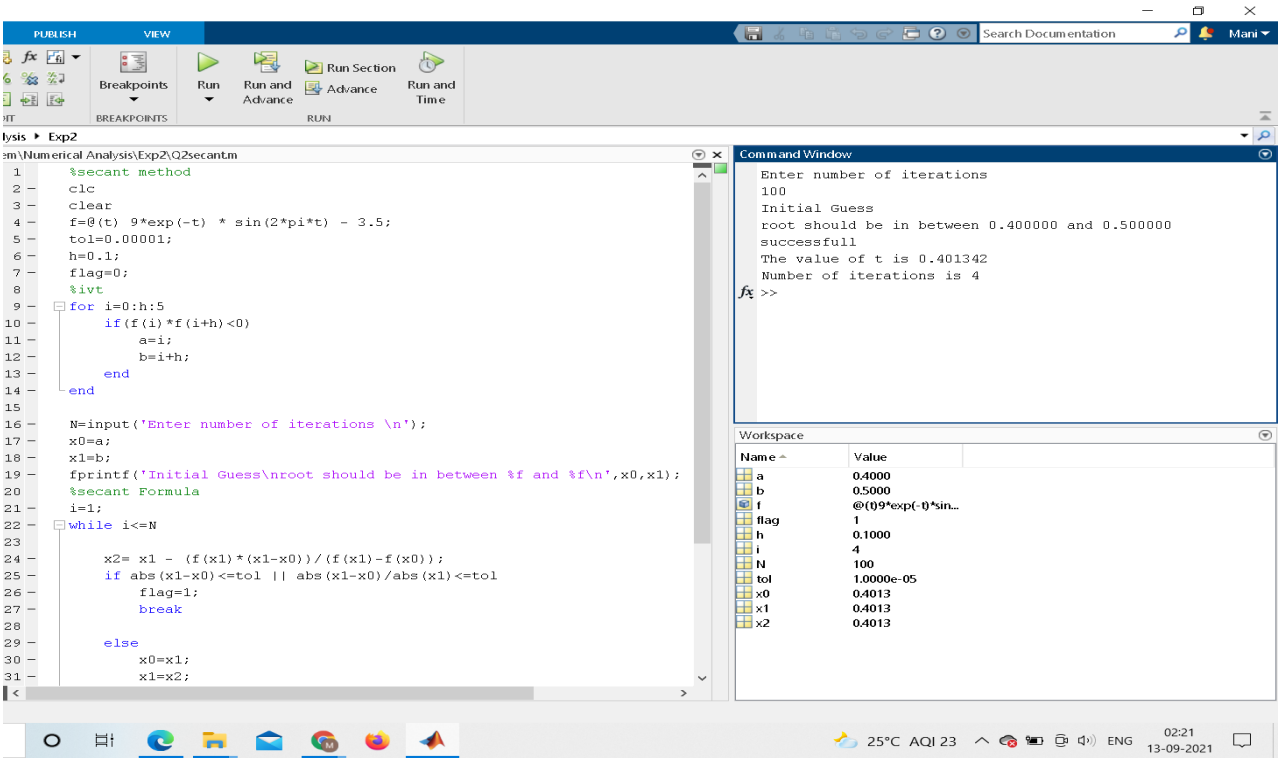
fprintf('\nNumber of iterations is %d\n',i);

end

Q2

4. An oscillating current in an electric circuit is described by $i = 9e^{-t}\sin(2\pi t)$, where t is in seconds. Determine the lowest value of t such that $i = 3.5$.

Ans2 by Secant Method



CODE:

%secant method

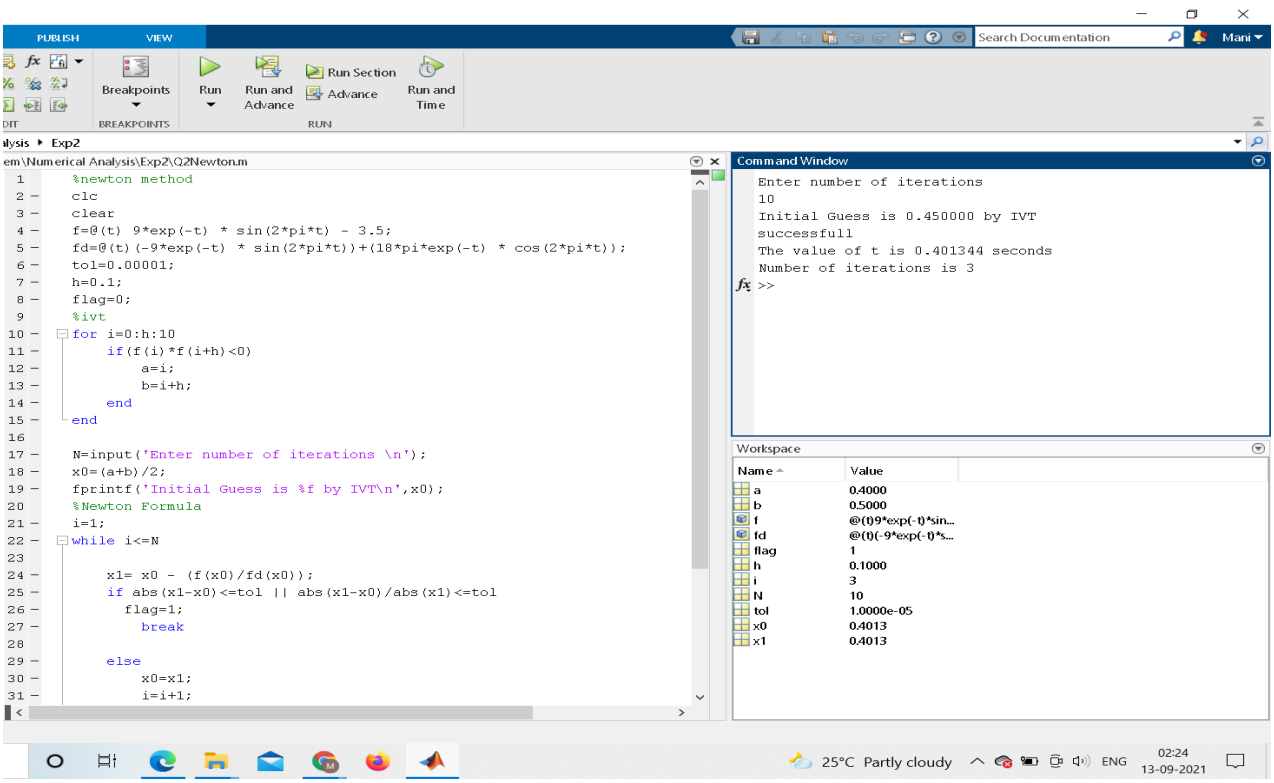
clc

clear

```
f=@(t) 9*exp(-t) * sin(2*pi*t) - 3.5;
tol=0.00001;
h=0.1;
flag=0;
%ivt
for i=0:h:5
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
   end
end

N=input('Enter number of iterations \n');
x0=a;
x1=b;
fprintf('Initial Guess\nroot should be in between %f and %f\n',x0,x1);
%secant Formula
i=1;
while i<=N

   x2= x1 - (f(x1)*(x1-x0))/(f(x1)-f(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
      flag=1;
      break

   else
      x0=x1;
```

```
    x1=x2;
    i=i+1;
  end

end
if flag~=1
  fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
  fprintf('successfull\n');
fprintf('The value of t is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

Ans2 by Newton Method



CODE:

```
%newton method
clc
clear
f=@(t) 9*exp(-t) * sin(2*pi*t) - 3.5;
fd=@(t)(-9*exp(-t) * sin(2*pi*t))+(18*pi*exp(-t) * cos(2*pi*t));
tol=0.00001;
h=0.1;
flag=0;
%ivt
for i=0:h:10
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
   end
end

N=input('Enter number of iterations \n');
x0=(a+b)/2;
fprintf('Initial Guess is %f by IVT\n',x0);
%Newton Formula
i=1;
while i<=N

   x1= x0 - (f(x0)/fd(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
     flag=1;
```

```
        break

    else
        x0=x1;
        i=i+1;
    end

end
if flag~=1
    fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
    fprintf('successfull\n');
fprintf('The value of t is %f seconds',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

EXTRA QUES GIVEN: exp(x)=cos(x)

Ans by Newton Method

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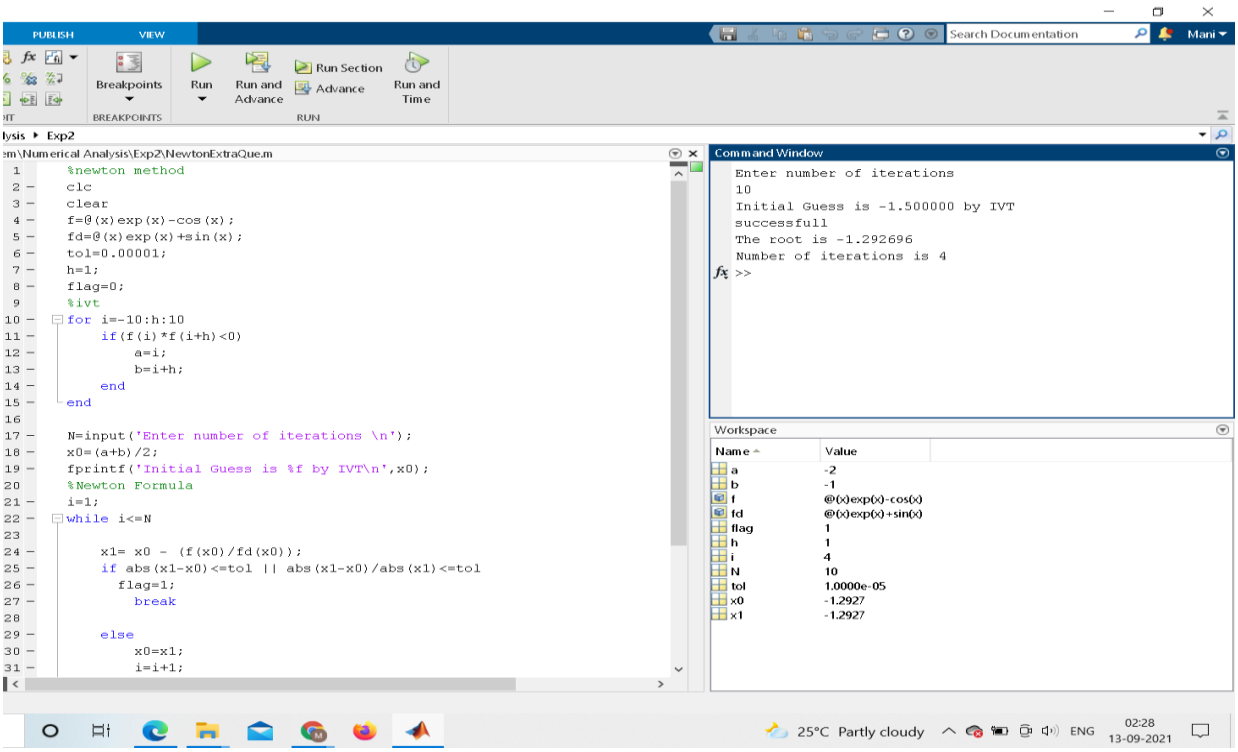

CODE:

```
%newton method
clc
clear
f=@(x)exp(x)-cos(x);
fd=@(x)exp(x)+sin(x);
tol=0.00001;
h=1;
flag=0;
%ivt
for i=-10:h:10
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
   end
```

```
end

N=input('Enter number of iterations \n');
x0=(a+b)/2;
fprintf('Initial Guess is %f by IVT\n',x0);
%Newton Formula
i=1;
while i<=N

   x1= x0 - (f(x0)/fd(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
     flag=1;
       break

   else
      x0=x1;
      i=i+1;
   end

end
if flag~=1
   fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations\n',tol,N);
else
   fprintf('successfull\n');
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```

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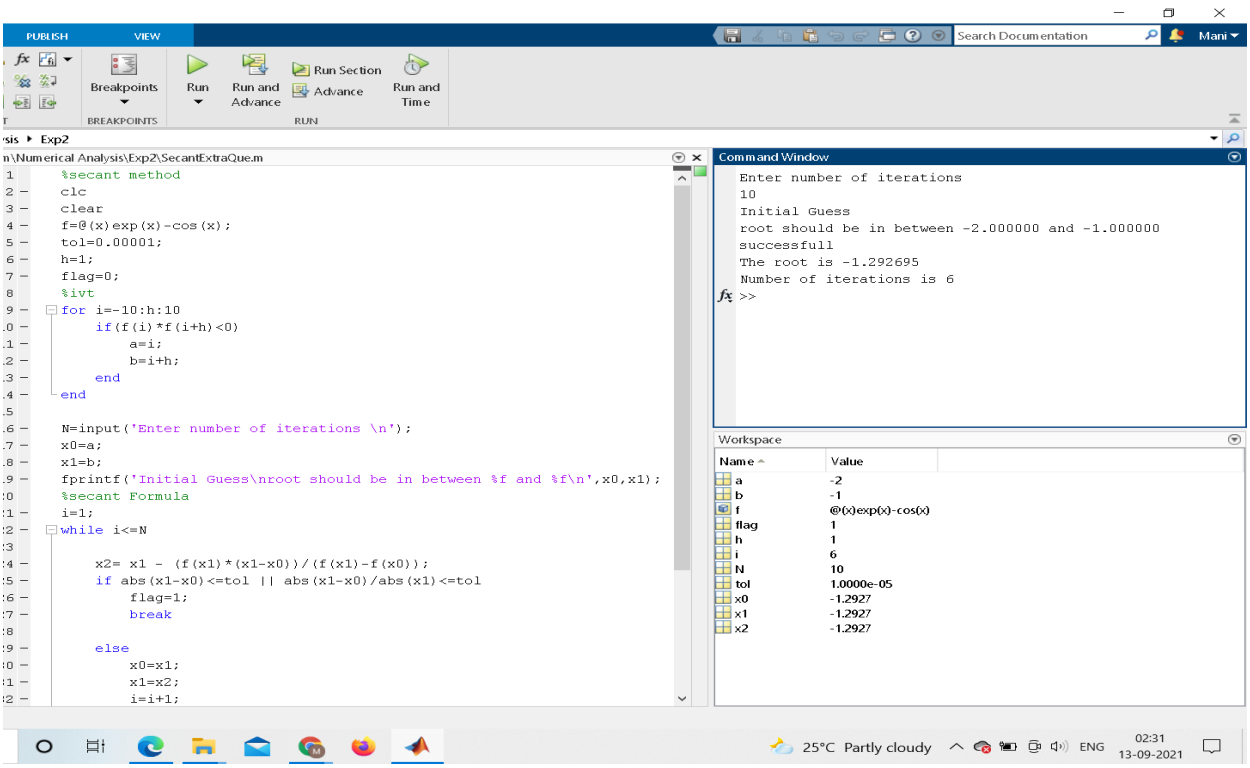
Ans by Secant Method



CODE:

```
%secant method
clc
clear
f=@(x)exp(x)-cos(x);
tol=0.00001;
h=1;
flag=0;
%ivt
for i=-10:h:10
   if(f(i)*f(i+h)<0)
      a=i;
      b=i+h;
```

```
   end
end

N=input('Enter number of iterations \n');
x0=a;
x1=b;
fprintf('Initial Guess\nroot should be in between %f and %f\n',x0,x1);
%secant Formula
i=1;
while i<=N

   x2= x1 - (f(x1)*(x1-x0))/(f(x1)-f(x0));
   if abs(x1-x0)<=tol || abs(x1-x0)/abs(x1)<=tol
      flag=1;
      break

   else
      x0=x1;
      x1=x2;
      i=i+1;
   end

end
if flag~=1
   fprintf('unsuccessfull\nFailed to achieve tolerance of %f after %d iterations',tol,N);
else
   fprintf('successfull\n');
```

```
fprintf('The root is %f',x0);
fprintf('\nNumber of iterations is %d\n',i);
end
```