Computer Programming in C++ and MATLAB

Contents
Programming in C++

Programming in MATLAB

Programming in C++

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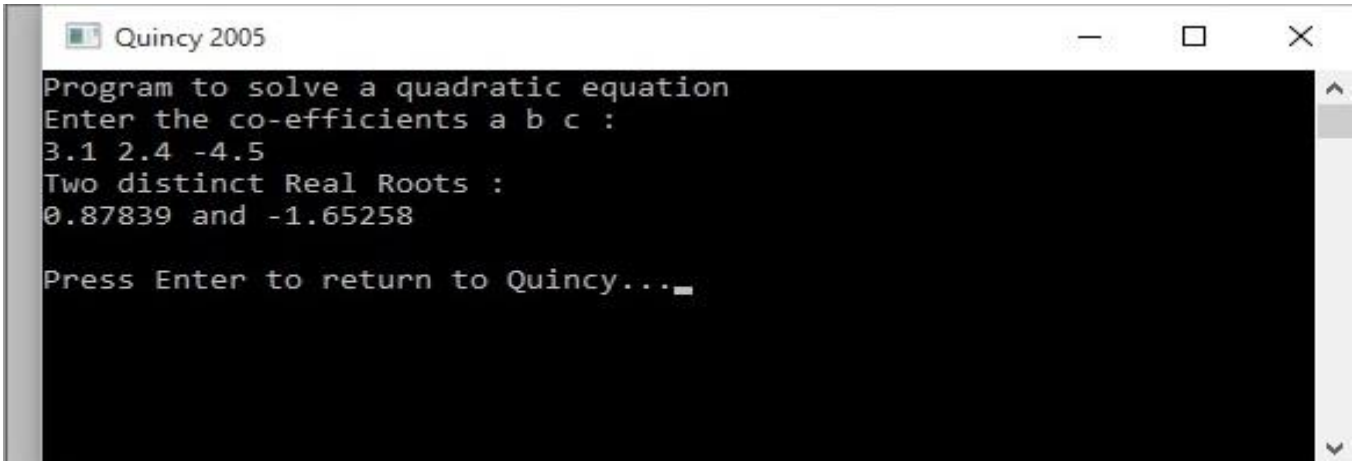
Program to solve a quadratic equation

Problem 1. *Write a program in C++ to solve the quadratic equation* $(2.1+k)x^2+2.4x-4.5=0$ *correct to three decimal places, where k* = 1 *. Run your program and write the output.*

//Program to solve a quadratic equation

```
#include<iostream>
#include<cmath>
using namespace std;
int main()
float a,b,c,P,Q,D;
{

cout<<"Program to solve a quadratic equation :";

cout<<"Enter the co-efficients a b c :";
cin>>a>>b>>c;

D=b*b - 4*a*c;
P=-(b/(2*a));
Q=sqrt(fabs(D))/(2*a);

if(0<D)
{
cout<<"Two distinct Real Roots : "<<endl;
cout<<(P+Q)<<" and "<<(P-Q)<<endl; }

else if(D==0)
{
cout<<"Two Equal Real Roots : "<<endl;
cout<<P<<endl;
}
else
{
cout<<"Two distinct Imaginary Roots : "<<endl;
cout<<"("<<P<<" + i"<<Q<<")"<<" and "<<"("<<P<<" - i"<<Q<<")"<<endl;

return 0;
}
```

Out Put:

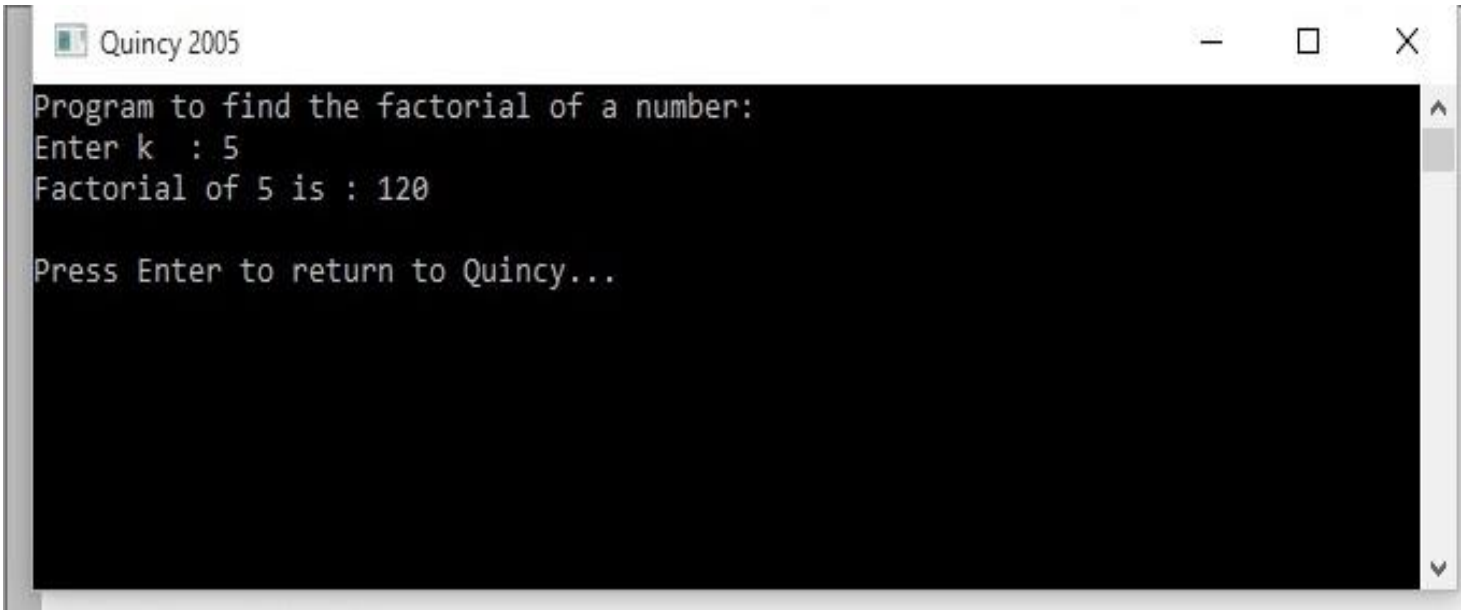

Quincy 2005
Program to solve a quadratic equation
Enter the co-efficients a b c :
3.1 2.4 -4.5
Two distinct Real Roots :
0.87839 and -1.65258
Press Enter to return to Quincy...

Program to find the factorial of a given non-negative integer

Problem 2. *Write a program in C++ to find the factorial of a given non-negative integer. Run your program and write the output.*

```
// Program to find the factorial of a number:
     #include<iostream>
     using namespace std;
     int factorial(int n);
     int main()
     {
     int k;
     cout<<”Program to find the factorial of a number: “<<endl;
     cout<<"Enter k : ";
     cin>>k;

     cout<<"Factorial of "<<k<<" is : "<<factorial(k)<<endl;

     return 0;
     }

     int factorial(int n)
     {
     int t=1;

     if(0<n)
     {
     for(int i=1;i<n+1;i++)

          {
     t=i*t;
     }
     }

     return t;
     }
```

Out Put:

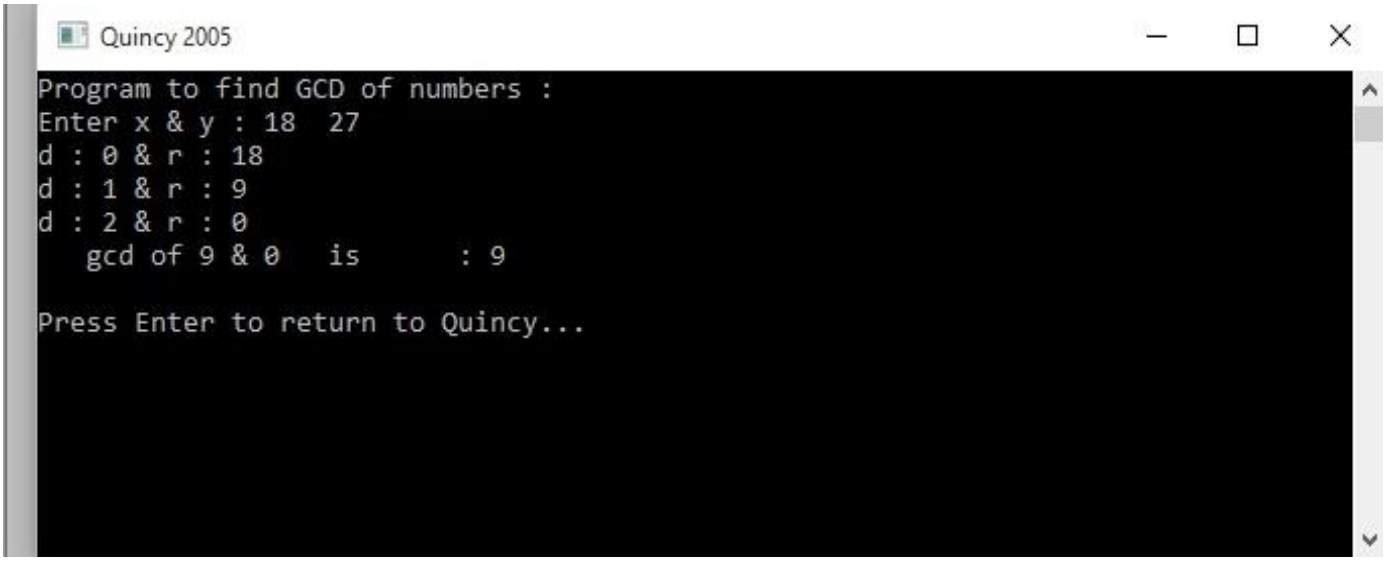

Quincy 2005
Program to find the factorial of a number:
Enter k : 5
Factorial of 5 is : 120
Press Enter to return to Quincy...

Program to find the GCD of two given positive integers

Problem 3. *Write a program in C++ to find the GCD of two given positive integers. Run your program and write the output.*

```
//Program to find GCD :
    #include<iostream>
    #include<cmath>
    using namespace std;
    int main()
    {
    int x,y,d,r,temp;

    cout<<"Enter x & y : ";
    cin>>x>>y;
    do
    {
        r=x%y;
        d=(x-r)/y;
        cout<<"d : "<<d<<" & r : "<<r<<endl;
        temp=y;
        y=r;
        x=temp;
    }
    while(r!=0);
    cout<<"gcd of "<<x<<" & "<<y<<"is  : "<<temp<<endl;

    return 0;
    }
```

Out Put:

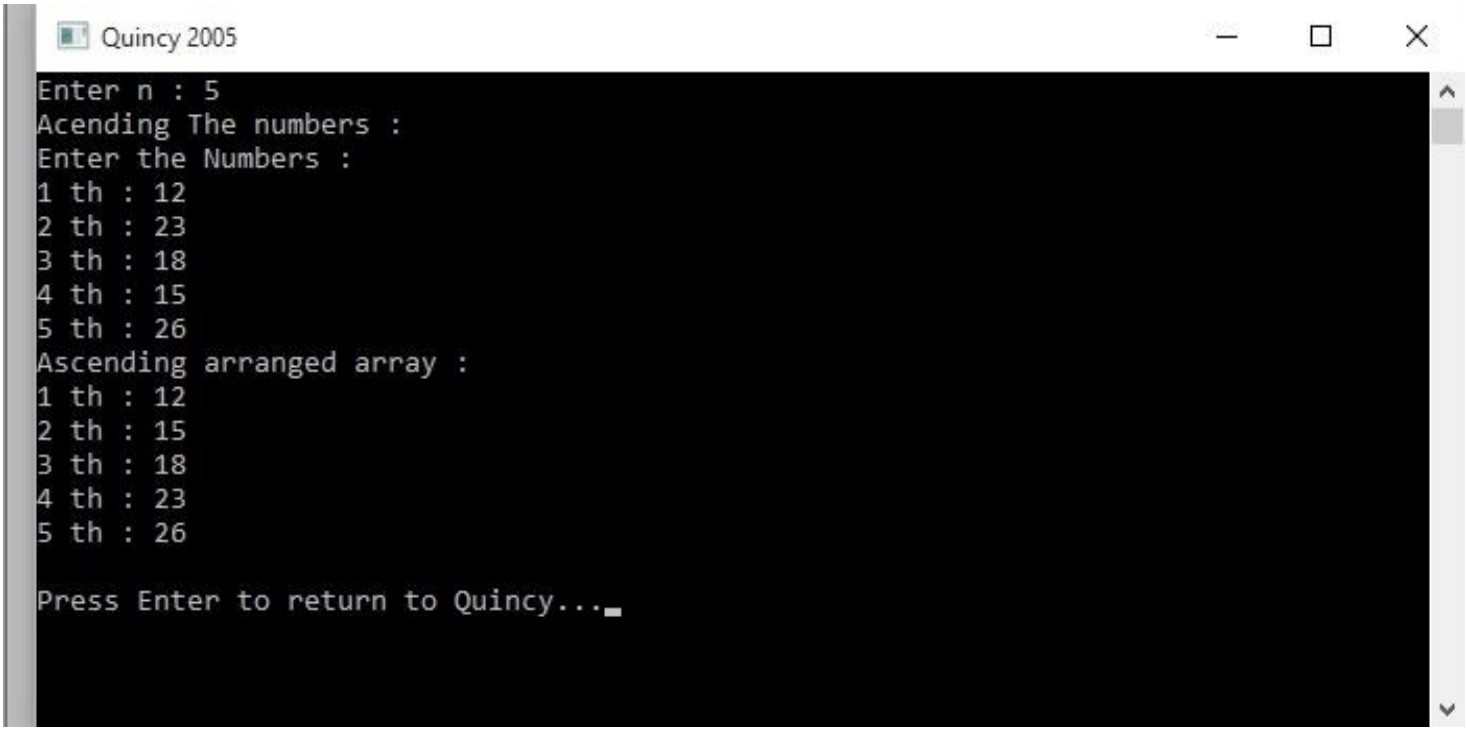

Quincy 2005
Program to find GCD of numbers :
Enter x & y : 18 27
d : 0 & r : 18
d : 1 & r : 9
d : 2 & r : 0
gcd of 9 & 0 is : 9
Press Enter to return to Quincy...

Program to arrange a list of numbers in ascending order

Problem 4. *Write a program in C++ to arrange a list of numbers in ascending order. Run your program and write the output.*

```
//Acending The numbers :
#include<iostream>
using namespace std;
int main()
    {
    int n;
    float x[100],c;
    cout<<"Enter n : ";
    cin>>n;
    cout<<”Acending the Numbers :”<<endl;
    cout<<"Enter the Numbers : "<<endl;
    for(int i=0;i<n;i++)
    {
            cout<<(i+1)<<" th : ";
            cin>>x[i];
            }
            for(int i=0;i<n;i++)
            {
                for(int j=i+1;j<n;j++)
                {
                    if(x[j]<x[i])
                    {
                        c=x[i];
                        x[i]=x[j];
                        x[j]=c;
                    }
                }
            }
            cout<<"Ascending arranged array : "<<endl;
            for(int i=0;i<n;i++)
            {
                cout<<(i+1)<<" th : "<<x[i]<<endl;
            }

        return 0;
        }
```

Out Put:


Quincy 2005
Enter n : 5
Acending The numbers :
Enter the Numbers :
1 th : 12
2 th : 23
3 th : 18
4 th : 15
5 th : 26
Ascending arranged array :
1 th : 12
2 th : 15
3 th : 18
4 th : 23
5 th : 26
Press Enter to return to Quincy...

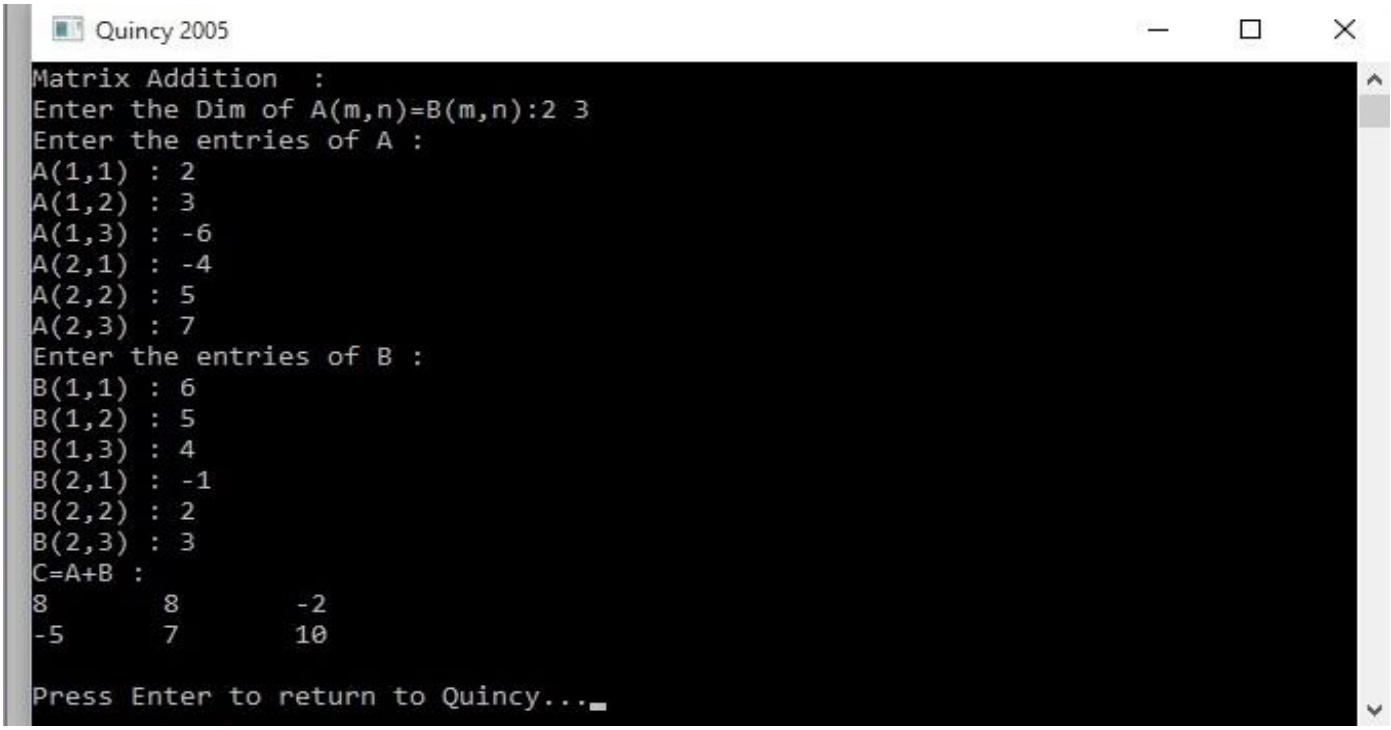
Program for matrix addition

Problem 5. *Write a program in C++ to add two matrices. Run your program and write the output.*

```
//Program for matrix addition
#include<iostream>
using namespace std;
int main()
{
int m,n;
float A[100][100],B[100][100],C[100][100];
cout<<”Matrix Addition  :”<<endl;
cout<<"Enter the Dim of A(m,n)=B(m,n):";
cin>>m>>n;
cout<<"Enter the entries of A : "<<endl; for(int
i=1;i<m+1;i++)
{
for(int j=1;j<n+1;j++)
{
cout<<"A("<<i<<","<<j<<") : ";
cin>>A[i][j];
                }
            }
cout<<"Enter the entries of B :"<<endl;
for(int i=1;i<m+1;i++)
            {
                for(int j=1;j<n+1;j++)
                {
                    cout<<"B("<<i<<","<<j<<") : ";
                    cin>>B[i][j];
                }
            }
            cout<<"C=A+B : "<<endl;
            for(int i=1;i<m+1;i++)
            {
                for(int j=1;j<n+1;j++)
                {
                    C[i][j]=A[i][j]+B[i][j];
                    cout<<C[i][j]<<"    ";
                }
                    cout<<endl;
            }
```

```
return 0;
}
```

Out Put:



Program for matrix multiplication

Problem 6. *Write a program in C++ to find the product of two matrices. Run your program and write the output.*

```
//Program For Matrix Multiplication:
#include<iostream>
using namespace std;
int main()
{
int m,n,p;
    float A[100][100],B[100][100],C[100][100];
        cout<<”Matrix Multiplication:”<<endl;
        cout<<"Enter the Dim of A(m,n) : ";
        cin>>m>>n;

            cout<<"Enter the entries of A :
            "<<endl; for(int i=1;i<m+1;i++) {

                for(int j=1;j<n+1;j++)
                {
                    cout<<"A("<<i<<","<<j<<") : ";
                    cin>>A[i][j];
                }
            }
            cout<<"Enter the dim of B("<<n<<",p)
            :"; cin>>p;
            for(int i=1;i<n+1;i++)
            {
                for(int j=1;j<p+1;j++)
                {
                    cout<<"B("<<i<<","<<j<<") : ";
                    cin>>B[i][j];
                }
            }
            cout<<"C=AB : "<<endl;
            for(int i=1;i<m+1;i++)
            {
                for(int j=1;j<p+1;j++)
                {
```

```
C[i][j]=0;
for(int k=1;k<n+1;k++)
{
 C[i][j]=C[i][j] + A[i][k]*B[k][j];
                  }
  cout<<C[i][j]<<"                    ";
              }
              cout<<endl;
         }

         return 0;
         }
```

Out Put:

Interpolation
Computing a difference table

Problem 7. *Write a program in C++ to construct the forward difference table for the following data*

x	*f*(*x*)
7.05	*k.73168*
7.10	*k.72827*
7.15	*k.72484*
7.20	*k.72138*
7.25	*k.71791*

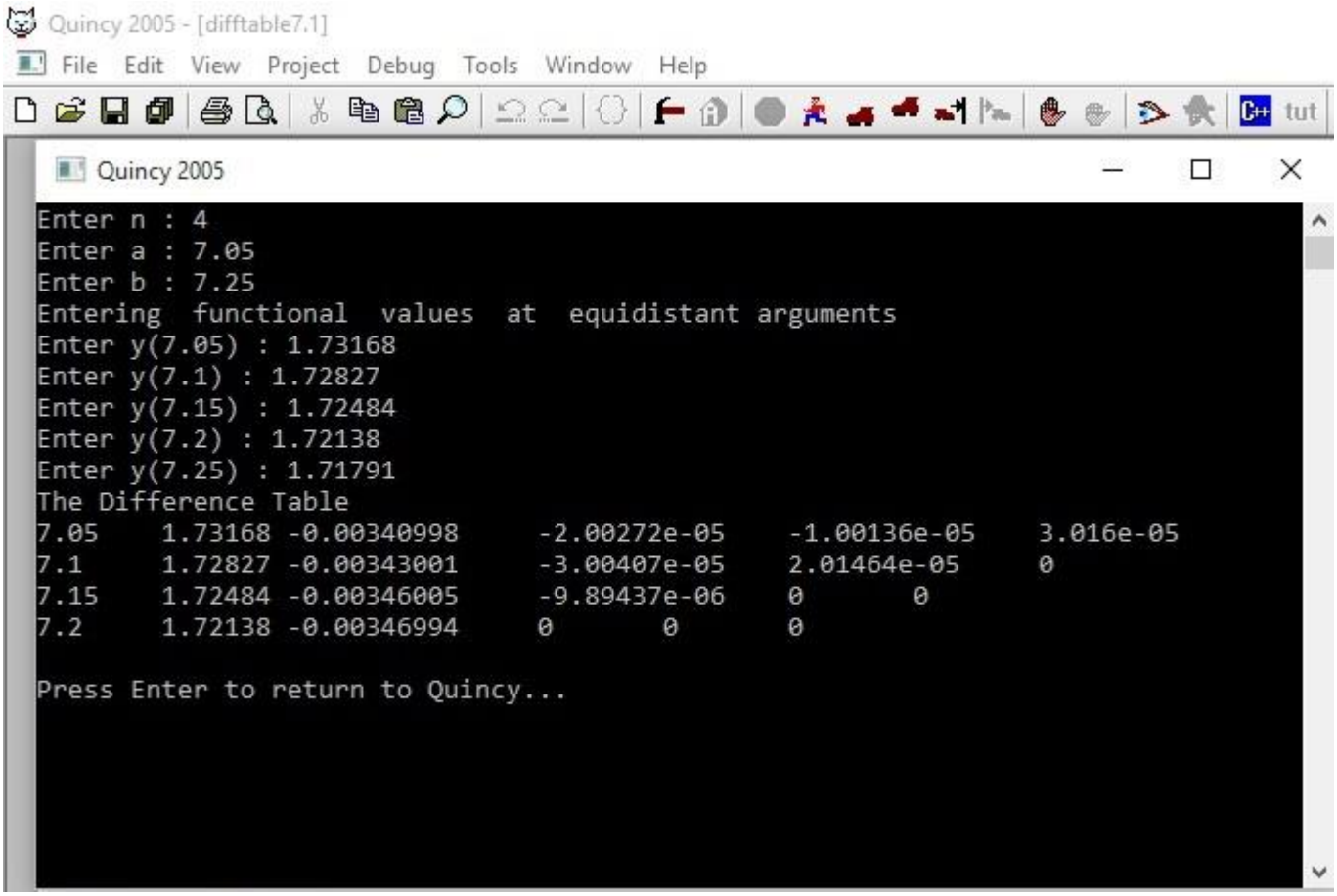
where k= 1 *. Run your program and write the output.so,*

x	*f*(*x*)
7.05	*1.73168*
7.10	*1.72827*
7.15	*1.72484*
7.20	*1.72138*
7.25	*1.71791*

```
//Computing a difference table
#include<iostream>
using namespace std;
int main()
{
int n;
float d[100][100],h,a,b;
//d[i][j]= Ai[yj],c[i] is coefficient array//
cout<<"Enter n : ";
cin>>n;
cout<<”Compute Difference table”<<endl;
cout<<"Enter a : ";
cin>>a;

cout<<"Enter b : ";
cin>>b;
```

```
h=fabs(b-a)/n;

cout<<"Entering functional values at equidistant
arguments"<<endl;
for(int i=0;i<n+1;i++)
{
    cout<<"Enter y("<<(a+i*h)<<") : ";
    cin>>d[0][i];
}

//Difference Table//
for(int i=1;i<n+1;i++)
{
for(int j=0;j<n;j++)
{
    if(n+1==i+j)
    d[i][j]=0;
    else
    d[i][j]=d[i-1][j+1]-d[i-1][j];
}
}
cout<<"The Difference Table"<<endl;

            for(int j=0;j<n;j++)
{
cout<<(a+j*h)<<"    ";
for(int i=0;i<n+1;i++)
{
cout<<d[i][j]<<"    ";
}
cout<<endl;
}
return 0;
}
```

Out Put:


Quincy 2005 - [difftable7.1]
File Edit View Project Debug Tools Window Help
tut
Quincy 2005
Enter n : 4
Enter a : 7.05
Enter b : 7.25
Entering functional values at equidistant arguments
Enter y(7.05) : 1.73168
Enter y(7.1) : 1.72827
Enter y(7.15) : 1.72484
Enter y(7.2) : 1.72138
Enter y(7.25) : 1.71791
The Difference Table
7.05 1.73168 -0.00340998 -2.00272e-05 -1.00136e-05 3.016e-05
7.1 1.72827 -0.00343001 -3.00407e-05 2.01464e-05 0
7.15 1.72484 -0.00346005 -9.89437e-06 0 0
7.2 1.72138 -0.00346994 0 0 0
Press Enter to return to Quincy...

Interpolation
Newton's forward interpolation formula

Problem 8. *Write a program in C++ to compute the value of f(2.16) by Newton's forward interpolation formula:*

x	*f*(*x*)
2.15	*k.9288*
2.20	*k.9275*
2.25	*k.9261*
2.30	*k.9244*
2.35	*k.9224*
2.40	*k.9202*

where k= 1 *. Run your program and write the output. so,*

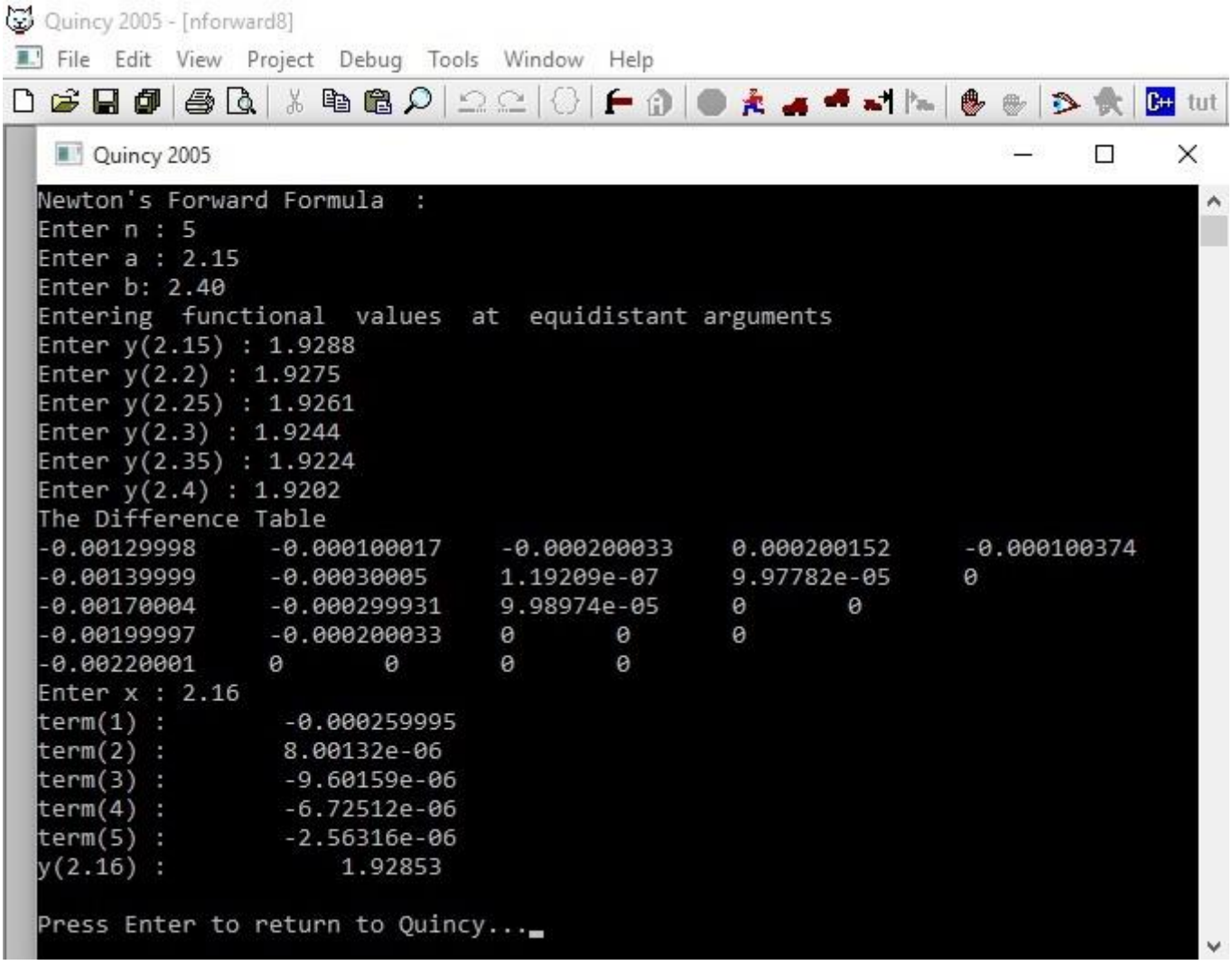
x	*f*(*x*)
2.15	*1.9288*
2.20	*1.9275*
2.25	*1.9261*
2.30	*1.9244*
2.35	*1.9224*
2.40	*1.9202*

```
//Newton's forward interpolation formula
#include<iostream>
using namespace std;
int main()
{
int n;
float   d[100][100],h,a,b,x,u,sum,term;
//d[i][j]= Ai[yj],c[i] is coefficient array//
cout<<"Enter n : ";
cin>>n;
cout<<"Newton's forward interpolation :"<<endl;
```

```
cout<<"Enter a : ";
cin>>a;
cout<<"Enter b: ";
cin>>b;

        h=fabs(b-a)/n;

cout<<"Entering functional values at equidistant
arguments"<<endl;
for(int i=0;i<n+1;i++)
{
    cout<<"Enter y("<<(a+i*h)<<") : ";
    cin>>d[0][i];
}

//Difference Table//
for(int i=1;i<n+1;i++)
{
for(int j=0;j<n;j++)
{
    if(n+1==i+j)
    d[i][j]=0;
    else
    d[i][j]=d[i-1][j+1]-d[i-1][j];
}
}
cout<<"The Difference Table"<<endl;
for(int j=0;j<n;j++) {
    for(int i=1;i<n+1;i++)
    {
        cout<<d[i][j]<<"    ";
    }
cout<<endl;
}
cout<<"Enter x : ";
cin>>x;
u=(x-a)/h;
sum=d[0][0];
for(int i=1;i<n+1;i++)
{
    term=d[i][0];
    for(int j=0;j<i;j++)
    {
        term=term*(u-j)/(j+1);
    }
    cout<<"term("<<i<<") : "<<term<<endl;
```

```
sum=sum + term;
          }
          cout<<"y("<<x<<") : "<<sum<<endl;
          return 0;
          }
```

Out Put:



Interpolation
Newton's backward interpolation formula

Problem 9. *Write a program in C++ to compute the value of* $f(7.68)$ *by Newton's backward interpolation formula:*

x	$f(x)$
7.45	*k.53566*
7.50	*k.52909*
7.55	*k.52258*
7.60	*k.51613*
7.65	*k.50973*
7.70	*k.50338*

where k= 1 *. Run your program and write the output. So,*

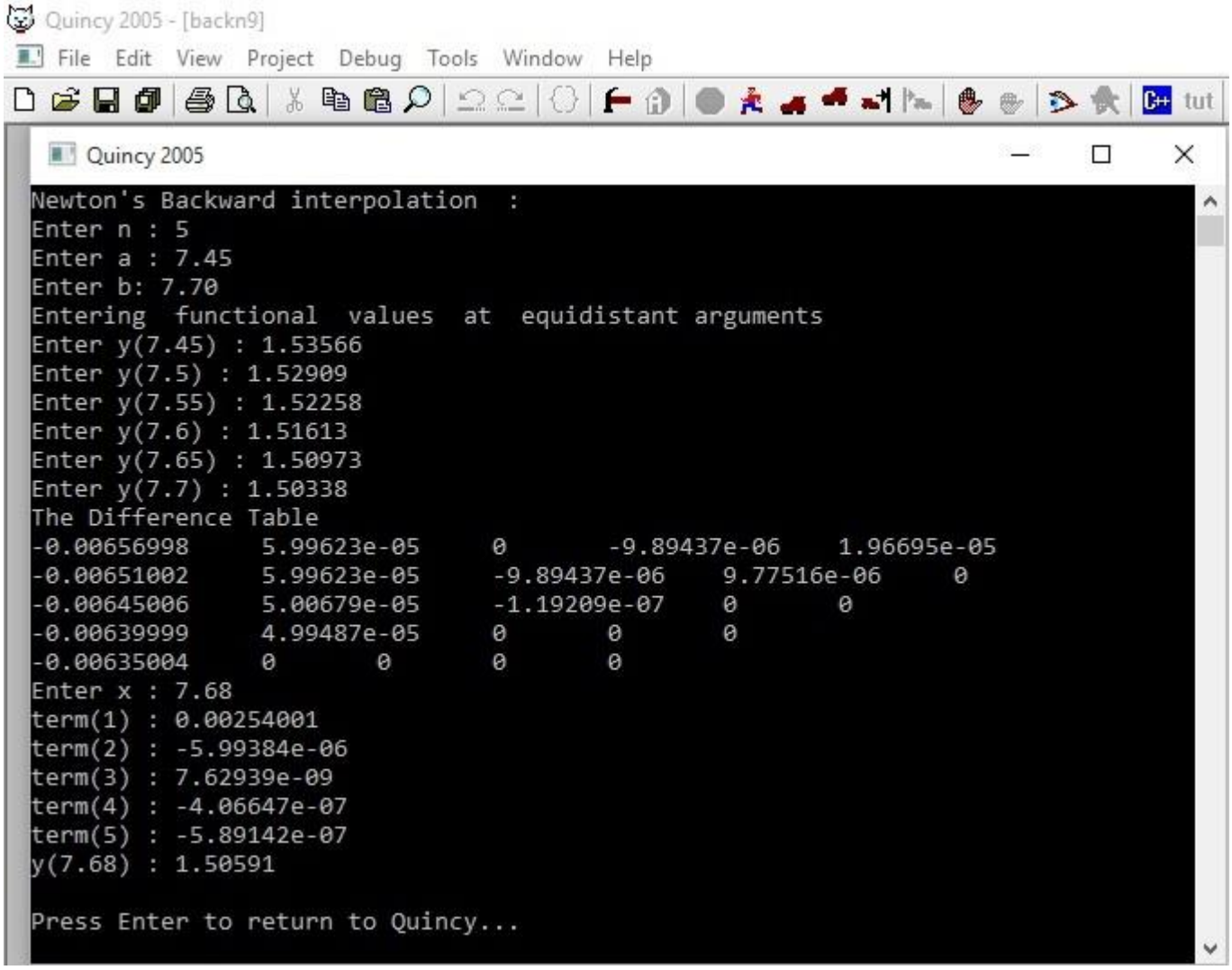
x	$f(x)$
7.45	*1.53566*
7.50	*1.52909*
7.55	*1.52258*
7.60	*1.51613*
7.65	*1.50973*
7.70	*1.50338*

```
//Newton’s Backward Interpolation formula
#include<iostream>
using namespace std;
int main()
{
int n;
float  d[100][100],h,a,b,x,u,sum,term;
//d[i][j]= Ai[yj],c[i] is coefficient array//
Cout<<”Newton’s Backward interpolation  :”<<endl;
cout<<"Enter n : ";
cin>>n;

cout<<"Enter a : ";
cin>>a;
cout<<"Enter b: ";
```

```
cin>>b;

h=fabs(b-a)/n;

cout<<"Entering functional values at equidistant
arguments"<<endl;
for(int i=0;i<n+1;i++)
{
    cout<<"Enter y("<<(a+i*h)<<") : ";
    cin>>d[0][i];
}

//Difference Table//
for(int i=1;i<n+1;i++)
{
for(int j=0;j<n;j++)
{
    if(n+1==i+j)
    d[i][j]=0;
    else
    d[i][j]=d[i-1][j+1]-d[i-1][j];
}
}
cout<<"The Difference Table"<<endl;
for(int j=0;j<n;j++) {
for(int i=1;i<n+1;i++)
{
cout<<d[i][j]<<"    ";
}
cout<<endl;
}
cout<<"Enter x : ";
cin>>x;

u=(x-b)/h;

sum=d[0][n];
for(int i=1;i<n+1;i++)
    {
    term=d[i][n-i];
    for(int j=0;j<i;j++)
    {
    term=term*(u+j)/(j+1);
    }
    cout<<"term("<<i<<") : "<<term<<endl;
    sum=sum + term;
    }
```

```
cout<<"y("<<x<<") : "<<sum<<endl;
return 0;
}
```

Out Put:



Interpolation
Lagrange's interpolation formula

Problem 10. *Write a program in C++ to compute the value of y for x=8.25 by Lagrange's interpolation formula:*

x	*8.0*	*8.1*	*8.3*	*8.5*	*8.6*
y	*k.2364*	*k.2326*	*k.2261*	*k.2210*	*k.2188*

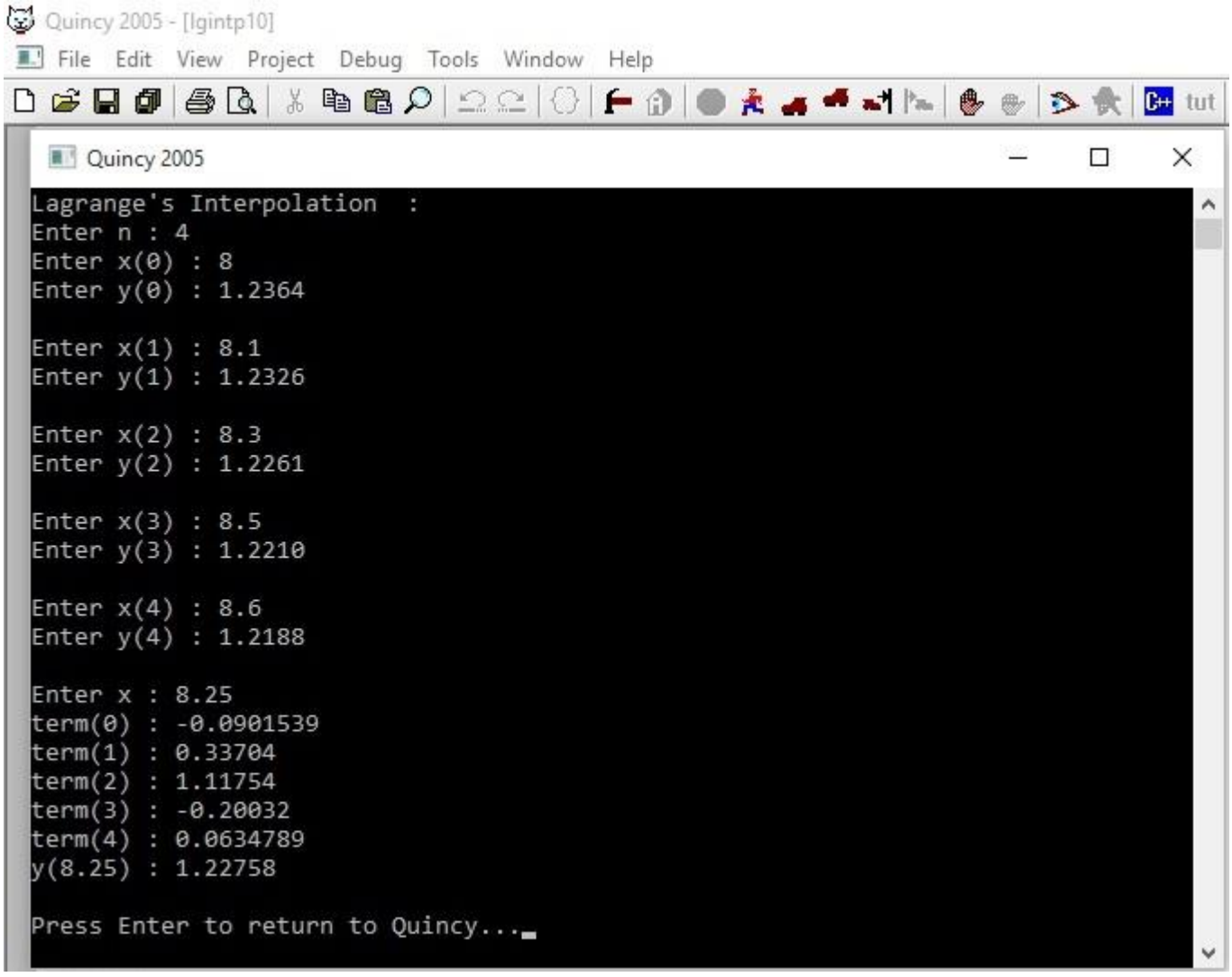
where k = 1 *. Run your program and write the output. so,*

x	*8.0*	*8.1*	*8.3*	*8.5*	*8.6*
y	*1.2364*	*1.2326*	*1.2261*	*1.2210*	*1.2188*

```
//Lagrange’s Interpolation formula
#include<iostream>
using namespace std;
int main()
{
int n;
float x[100],y[100],sum,term,p;
cout<<”Lagrange’s interpolation :”<<endl;
cout<<"Enter n : ";
cin>>n;

for(int i=0;i<n+1;i++)
{
cout<<"Enter x("<<i<<") : ";
cin>>x[i];

cout<<"Enter y("<<i<<") : ";
cin>>y[i];

cout<<endl;
}

cout<<"Enter x : ";
```

```
            cin>>p;

    sum=0;
            for(int i=0;i<n+1;i++)
            {
                term=y[i];
                for(int j=0;j<n+1;j++)
                {
                if(j!=i)
                term=term*(p-x[j])/(x[i]-x[j]);
                }
          cout<<"term("<<i<<") : "<<term<<endl;
          sum=sum+term;
          }
          cout<<"y("<<p<<") : "<<sum<<endl;
          return 0;
              }
```

Out Put:



Numerical integration by trapezoidal rule

Problem 16. *Write a program in C++ to compute the value of the following integral correct to four significant figures by Trapezoidal rule taking 13 ordinates:*

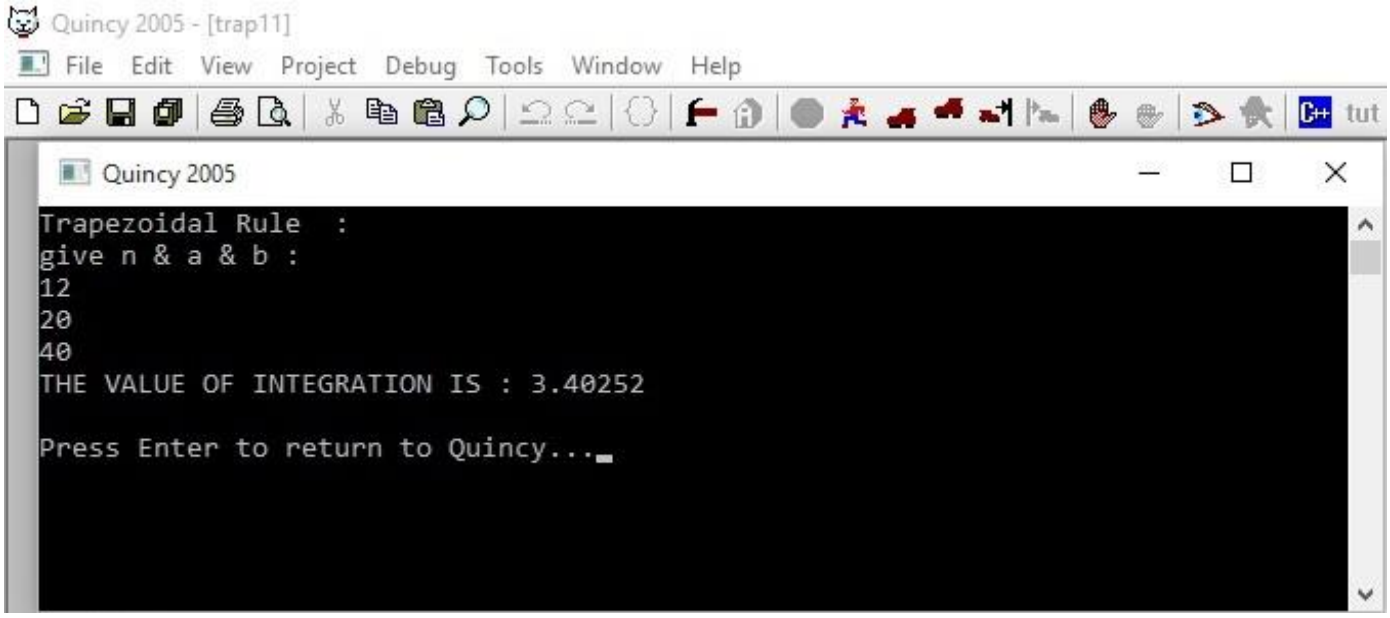
$$\int_{20^\circ}^{40^\circ} \frac{\cos 2x}{1+(k+1)\sin x}\,dx$$

where $k = 1$ *. Run your program and write the output.*

```
//Integration by Trapezoidal-rule
#include<iostream>
#include<cmath>
using namespace std;
float f(float x);
int main()
{
int n,i=1;
float a,b,x,y,h,s=0,s3,sum;
cout<<”Trapezoidal Rule  :”<<endl;
cout<<"give n & a & b : "<<endl;
cin>>n>>a>>b;
h=fabs(b-a)/n;
do
{
    x=a+i*h;
    s=s+f(x);
    i++;

}
while(i<n);
s3= f(a)+f(b);
sum=(s3 + 2*s)*(h/3);
cout<<"THE VALUE OF INTEGRATION IS : "<<fabs(sum)<<endl;
return 0;
}
float f(float x)
```

```
{
float pi=2*acos(0.0);
x=x*pi/180;
return cos(2*x)/(1+2*sin(x));
}
```

Out Put:



Numerical integration by Simpson's one-third rule

Problem 12. *Write a program in C++ to compute the value of the following integral correct to four significant figures by Simpson's one-third rule taking 13 ordinates:*

$$\int_{1.1}^{4.4} \frac{\ln(2.2+ k+ 3.3x)}{3.3+ 2.2x^2} dx$$

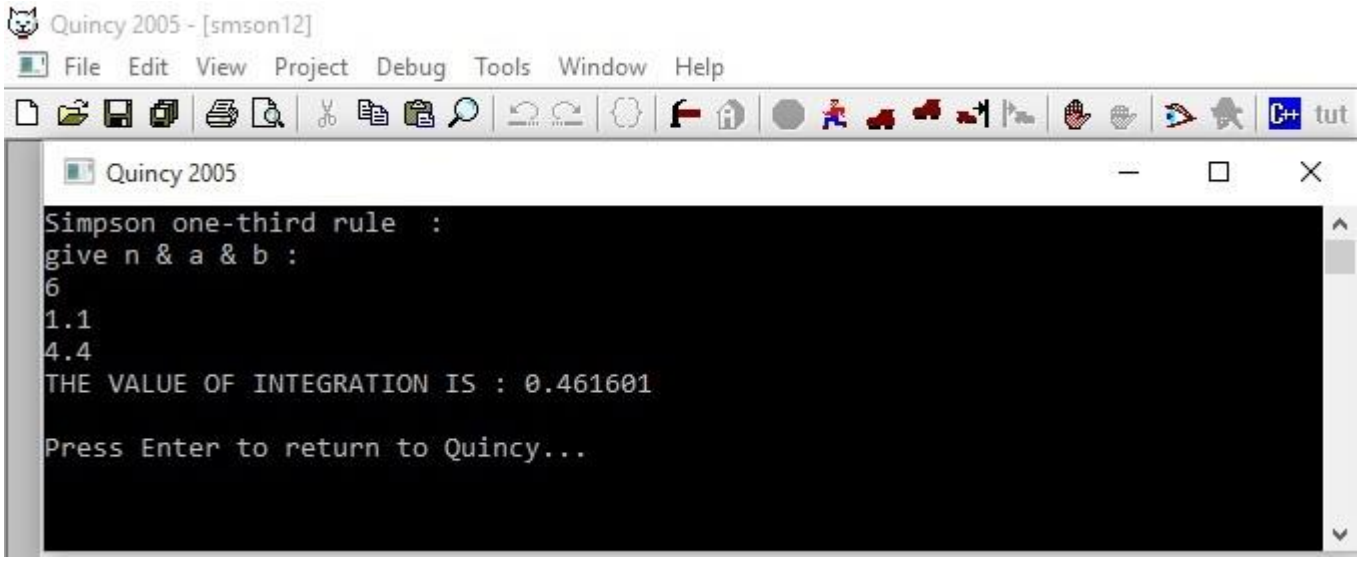
where $k = 1$ *. Run your program and write the output.*

//Integration by Simpos's Method

```
#include<iostream>
#include<cmath>
using namespace std;
float f(float x);
int main()
{
int n,i=1,j=2;
float a,b,x,y,h,s1=0,s2=0,s3,sum;
cout<<"give n & a & b : "<<endl;
cin>>n>>a>>b;
h=fabs(b-a)/(2*n);
do
{
    x=a+i*h;
    y=a+j*h;
s1=s1+f(x);
s2=s2+f(y);
i=i+2;
j=j+2;
}
while(i<=2*n -1 && j<=2*n -2);
s3= f(a)+f(b);
sum=(s3 + 4*s1 + 2*s2)*(h/3);
cout<<"THE VALUE OF INTEGRATION IS : "<<fabs(sum)<<endl;
return 0;
}
```

```
float f(float x)
{
     return (log(3.2 + 3.3*x))/(3.3 + 2.2*x*x);
     }
```

Out Put:



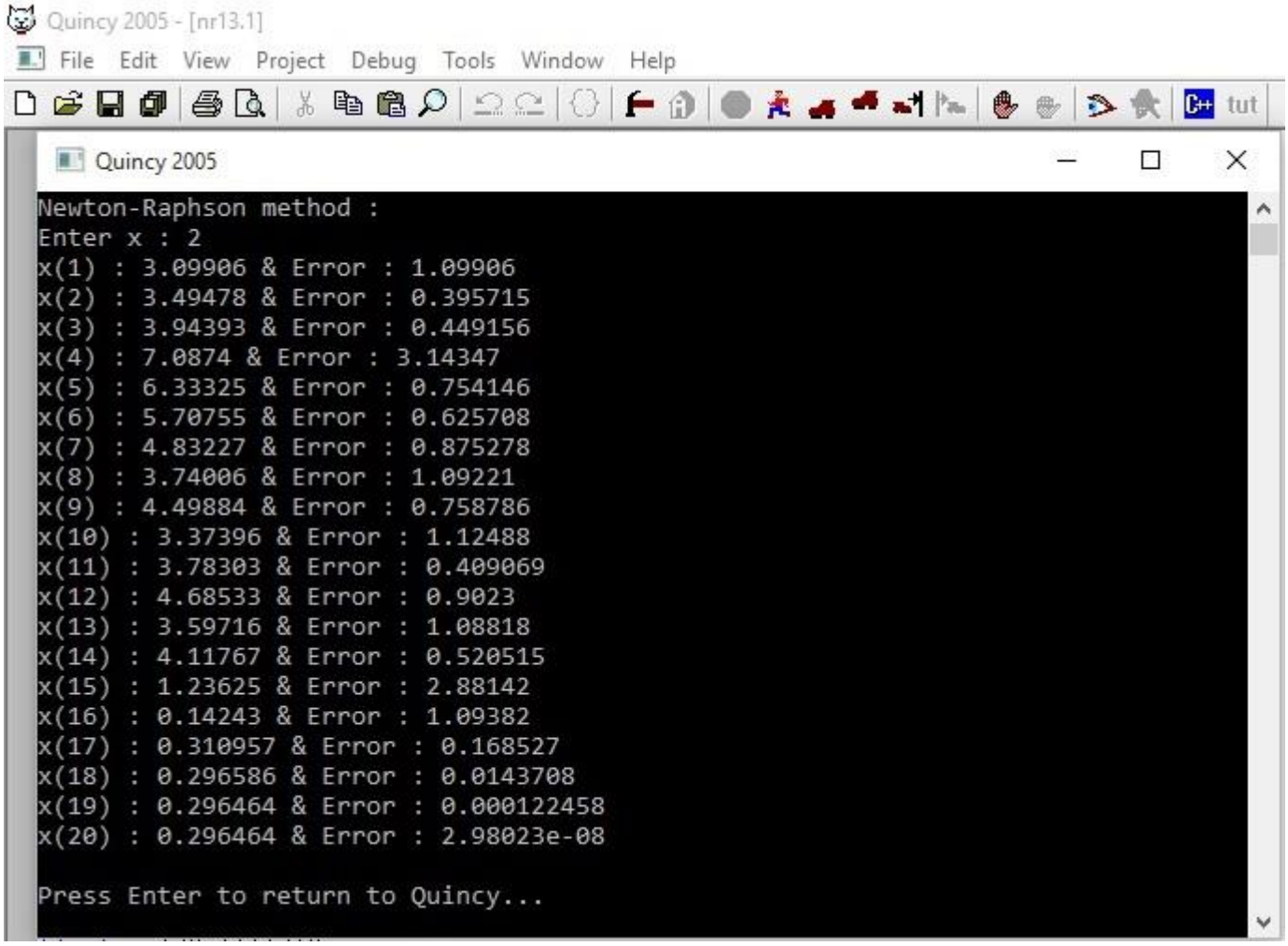
Numerical solution of an equation by Newton-Raphson method

Problem 13. *Write a program in C++ for finding the smallest positive root of the equation* $e^{a\sin x}+\log_a(1+x)-2.2=0$ *correct to five decimal places by Newton-Raphson method, where* $a=\frac{20.1+k}{10}$ *and* $k=1$ *. Run your program and write the output. So,a=2.11;*

```
//Newton-Raphson method
#include<iostream>
#include<cmath>
using namespace std;
float f(float x);
float df(float x);
int main()
{
int n=1;
float h,x,c;
cout<<”Newton-Raphson method :”<<endl;
cout<<"Enter x : ";
cin>>x;

do
{
     c=x;
     h=-f(x)/df(x);
     x=x+h;
     cout<<"x("<<n<<") : "<<x<<" & Error : "<<fabs(x-
c)<<endl;
     n++;
}
while(0.00001<fabs(x-c));

return 0;
}

float f(float x)
```

```
        {

float a=(20.1+1)/10;
        return (exp(a*sin(x)) + (log(1+x)/log(a))-2.2);
        }
```

Out Put:



Numerical solution of a system of linear equations by Gauss' elimination method

Problem 14. *Write a program in C++ for finding solution of the following system of linear equations correct to four decimal places by using Gauss' elimination method:*

$$AX=B,$$

where $A=\begin{pmatrix} 1.162+k & 0.684 & 0.822 & 0.382 \\ 0.785 & 1.192+k & 1.396 & 0.492 \\ 0.735 & 1.602 & 1.108+k & 0.456 \\ 0.443 & 0.573 & 0.338 & 0.899+k \end{pmatrix}$,

$B=[-4.825 \quad 7.106 \quad 7.235 \quad -5.215]^T$, $X=[x_1 \quad x_2 \quad x_3 \quad x_4]^T$ *and* $k=1$.

Run your program and write the output.

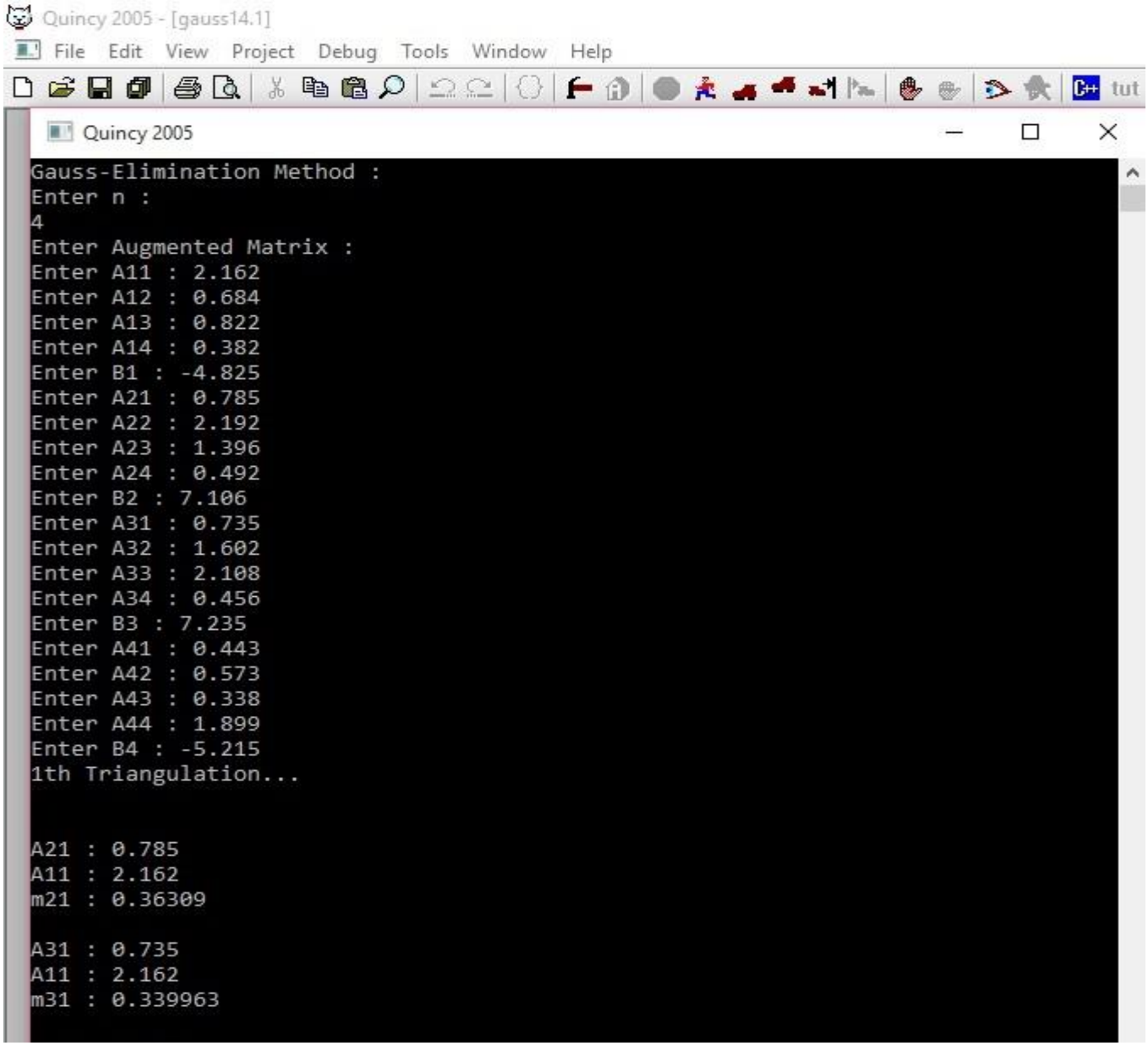
//Gauss-Elimination Method

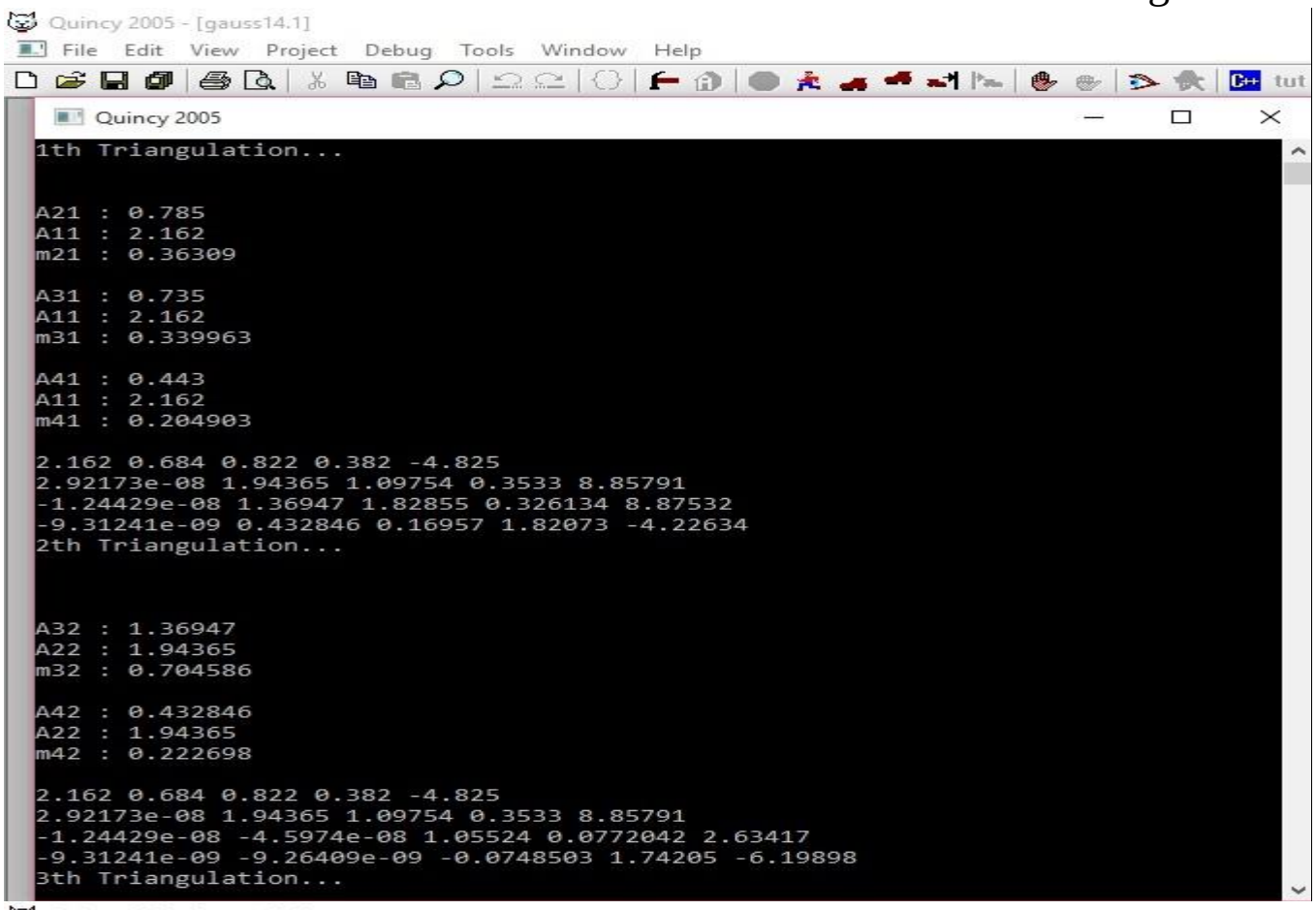
```
#include<iostream>
using namespace std;
int main()
{
int n;
float Ab[100][100],m[100][100],x[100];

cout<<"Enter n : "<<endl;
cin>>n;

cout<<"Enter Augmented Matrix :
"<<endl; for(int i=1;i<n+1;i++) {

for(int j=1;j<n+1;j++)
{
cout<<"Enter A"<<i<<j<<" : ";
cin>>Ab[i][j];
}
cout<<"Enter B"<<i<<" : ";
cin>>Ab[i][n+1];
}
```

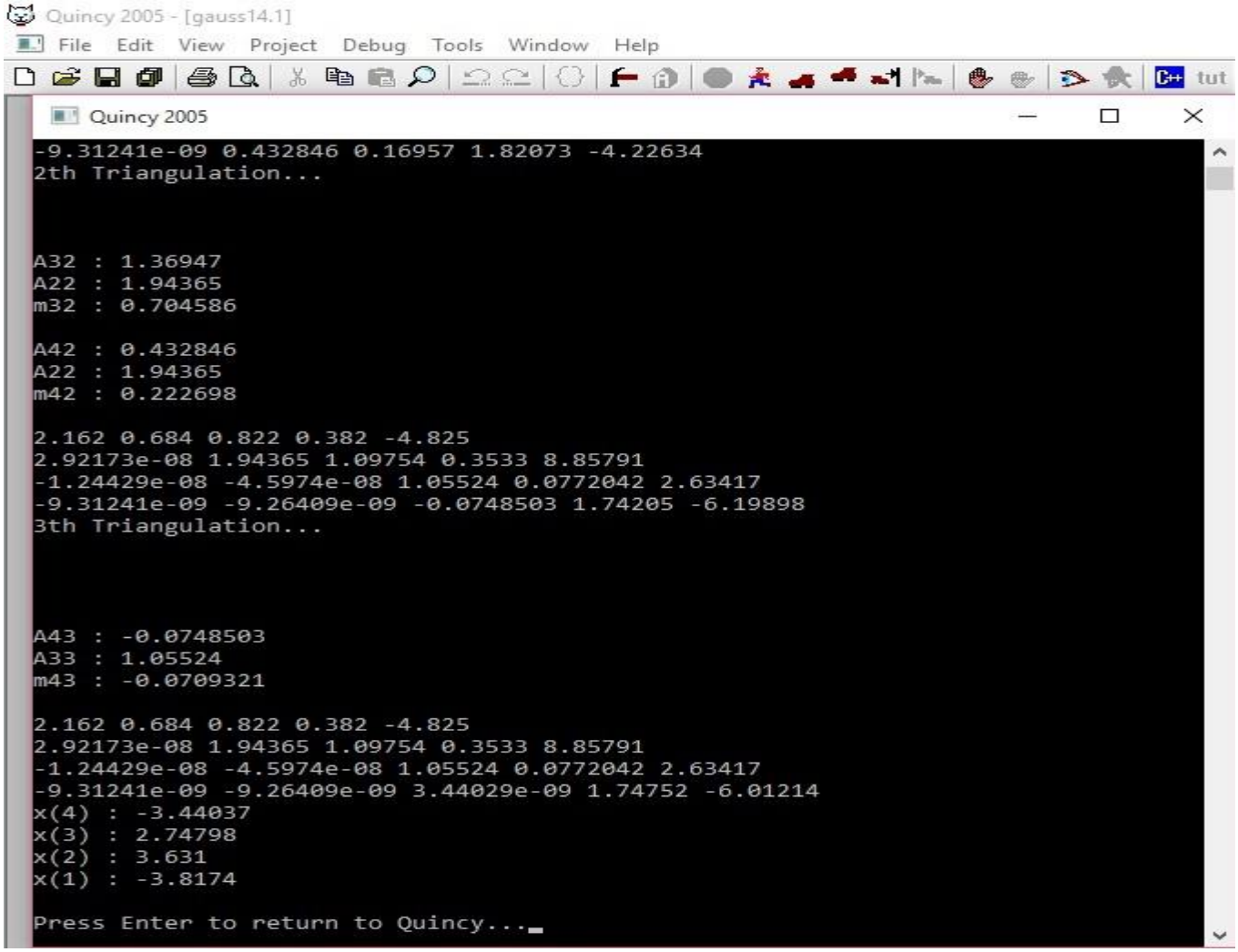
```
//Triangulation...
for(int k=2;k<n+1;k++)
{
cout<<(k-1)<<"th Triangulation..."<<endl<<endl;

for(int i=1;i<n+1;i++)
{

if(k<=i)
{
m[i][k-1]=Ab[i][k-1]/Ab[k-1][k-1];
cout<<"A"<<i<<(k-1)<<" : "<<Ab[i][k-1]<<endl;
cout<<"A"<<(k-1)<<(k-1)<<" : "<<Ab[k-1][k-
1]<<endl;
cout<<"m"<<i<<(k-1)<<" : "<<m[i][k-
1]<<endl; }

for(int j=1;j<n+2;j++)
{

if(k<=i && k<=j+1)
{
        Ab[i][j]=Ab[i][j]-m[i][k-1]*Ab[k-1][j];
}

}
cout<<endl;
}

for(int i=1;i<n+1;i++)
{
for(int j=1;j<n+2;j++)
{
cout<<Ab[i][j]<<" ";
}
cout<<endl;
}
//k loop
}
//Triangulation Complete//

for(int i=n;0<i;i--)
{

x[i]=Ab[i][n+1];
```

```
if(i<n)

{
for(int j=i+1;j<n+1;j++)
{
x[i]=x[i]-Ab[i][j]*x[j];
}
}

x[i]=x[i]/Ab[i][i]; cout<<"x("<<i<<")
: "<<x[i]<<endl; }

return 0;
}
```

Out Put:




Quincy 2005 - [gauss14.1]
File Edit View Project Debug Tools Window Help
Quincy 2005
1th Triangulation...
A21 : 0.785
A11 : 2.162
m21 : 0.36309
A31 : 0.735
A11 : 2.162
m31 : 0.339963
A41 : 0.443
A11 : 2.162
m41 : 0.204903
2.162 0.684 0.822 0.382 -4.825
2.92173e-08 1.94365 1.09754 0.3533 8.85791
-1.24429e-08 1.36947 1.82855 0.326134 8.87532
-9.31241e-09 0.432846 0.16957 1.82073 -4.22634
2th Triangulation...
A32 : 1.36947
A22 : 1.94365
m32 : 0.704586
A42 : 0.432846
A22 : 1.94365
m42 : 0.222698
2.162 0.684 0.822 0.382 -4.825
2.92173e-08 1.94365 1.09754 0.3533 8.85791
-1.24429e-08 -4.5974e-08 1.05524 0.0772042 2.63417
-9.31241e-09 -9.26409e-09 -0.0748503 1.74205 -6.19898
3th Triangulation...


Quincy 2005 - [gauss14.1]
File Edit View Project Debug Tools Window Help
Quincy 2005
-9.31241e-09 0.432846 0.16957 1.82073 -4.22634
2th Triangulation...
A32 : 1.36947
A22 : 1.94365
m32 : 0.704586
A42 : 0.432846
A22 : 1.94365
m42 : 0.222698
2.162 0.684 0.822 0.382 -4.825
2.92173e-08 1.94365 1.09754 0.3533 8.85791
-1.24429e-08 -4.5974e-08 1.05524 0.0772042 2.63417
-9.31241e-09 -9.26409e-09 -0.0748503 1.74205 -6.19898
3th Triangulation...
A43 : -0.0748503
A33 : 1.05524
m43 : -0.0709321
2.162 0.684 0.822 0.382 -4.825
2.92173e-08 1.94365 1.09754 0.3533 8.85791
-1.24429e-08 -4.5974e-08 1.05524 0.0772042 2.63417
-9.31241e-09 -9.26409e-09 3.44029e-09 1.74752 -6.01214
x(4) : -3.44037
x(3) : 2.74798
x(2) : 3.631
x(1) : -3.8174
Press Enter to return to Quincy...

Numerical solution of an ordinary differential equation by fourth order Runge-Kutta method

Problem 15. *Given the differential equation*

$$\frac{dy}{dx}=\frac{xy+1}{11y^2+k+2}, \quad y(0)=2,$$

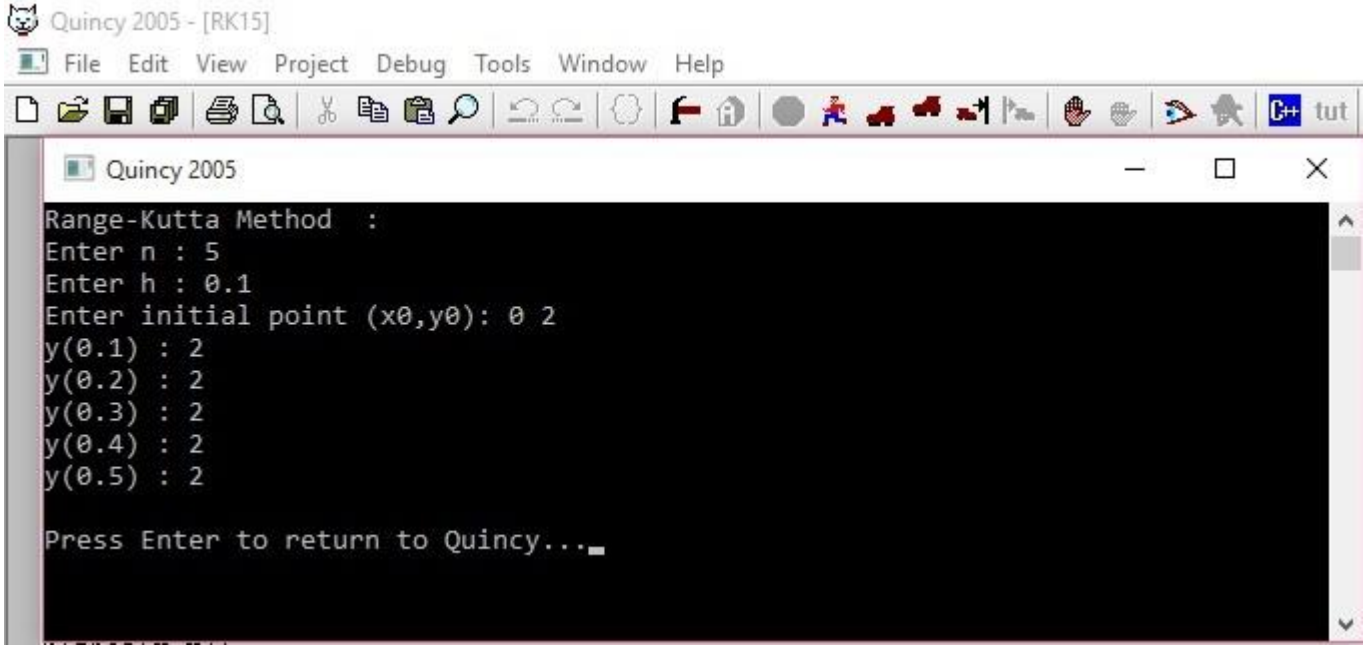
write a program in C++ to tabulate its solution in [*0, 0.4*] *with step length 0.1 correct to five decimal places by the fourth order Runge-Kutta method, where k* $=1$ *. Run your program and write the output.*

//Solve ODE by Range_Kutta Method

```
#include<iostream>
using namespace std;
float f(float x,float y);
int main()
{
int n;
float h,x,y,k1,k2,k3,k4,k0;
cout<<"Enter n : "; cin>>n;


cout<<"Enter h : ";
cin>>h;

cout<<"Enter initial point (x0,y0): ";
cin>>x>>y;

for(int i=0;i<n;i++)
{
k1=h*f(x,y);
k2=h*f(x+0.5*h,y+0.5*k1);
k3=h*f(x+0.5*h,y+0.5*k2);
k4=h*f(x+h,y+k3);

k0=(k1+2*k2+2*k3+k4)/6;

x=x+h;
y=y+k0;
```

```
cout<<"y("<<x<<") : "<<y<<endl; }


return 0;
}

float f(float x,float y)
{
float p;

p=(1+x*y)/(11*y*y +3);

return p;
}
```

Out Put:



Statistical data analysis
Sample characteristics

Problem 16. *The number of telephone calls received daily in a certain house in Kolkata was recorded for 92 days from 1st May to 31st July 1962, and the following data were obtained.*

No. of calls	*Frequency*
3	*2*
4	*5*
5	*10*
6	*8*
7	*12*
8	*12+k*
9	*15-k*
10	*11*
11	*7*
12	*4*
13	*4*
14	*2*
Total	*92*

Write a program in C++ to compute the (i) mean, (ii) median, (iii) mode, (iv) variance, (v) standard deviation, (vi) coefficient of skewness, (vii) coefficient of kurtosis of the sample, where k = 1 *. Run your program and write the output.*

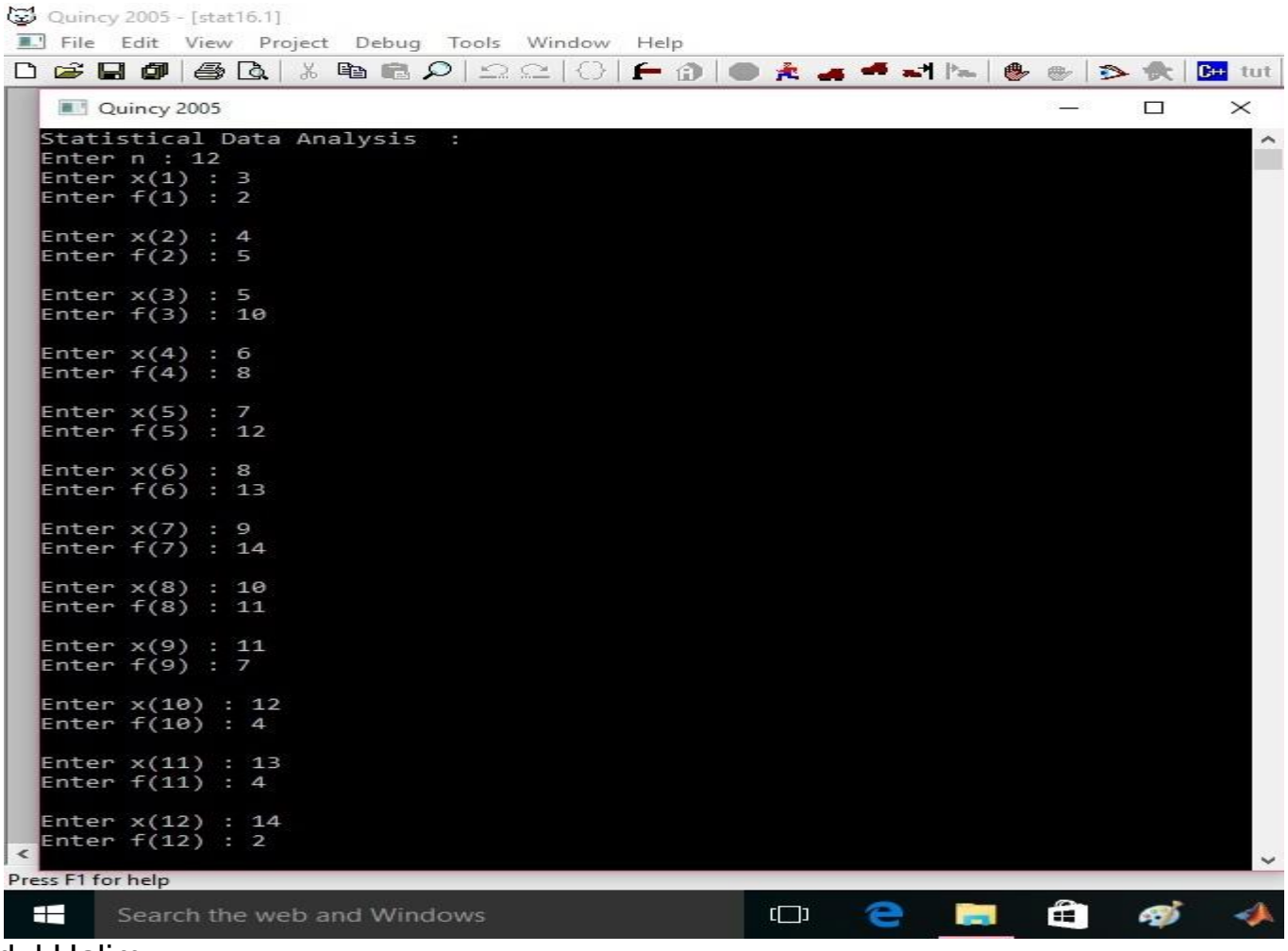
```
#include<iostream>
#include<cmath>
using namespace std;
int main()
{
```

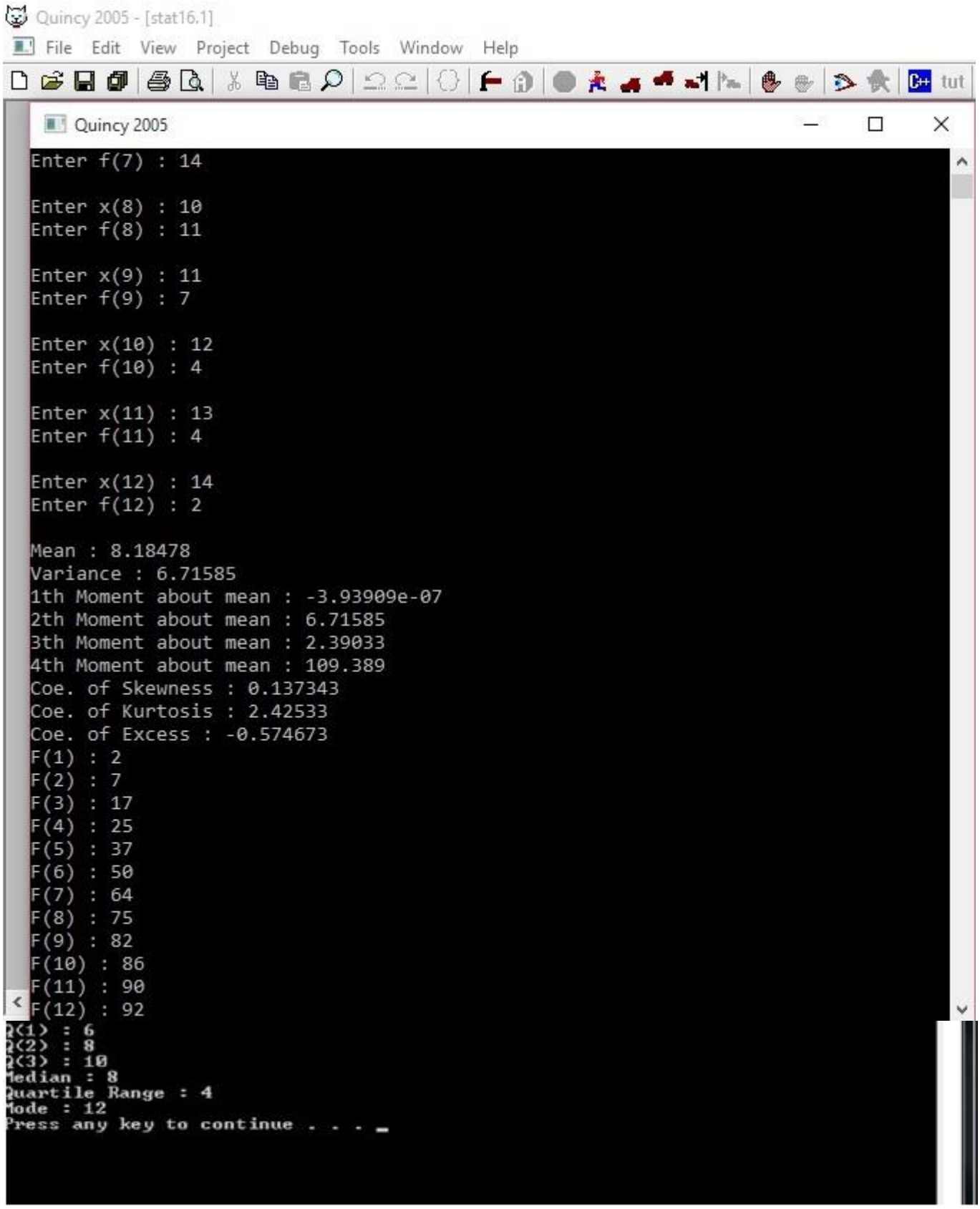
```
        int n,l;
float d,N,x[100],f[100],F[100],mean,median,Q[3],Sx,mx[4],max;

        cout<<"Enter n : ";
        cin>>n;

        //Taking Data Input
        for(int i=1;i<n+1;i++)
        {
            cout<<"Enter x("<<i<<") : ";
            cin>>x[i];

            cout<<"Enter f("<<i<<") : ";
            cin>>f[i];

            cout<<endl;
        }



        //Total freq
        N=0;
        for(int i=1;i<n+1;i++)
        {
            N=N+f[i];
        }
        //Mean
        mean=0;
        for(int i=1;i<n+1;i++)
        {
            mean=mean+f[i]*x[i];
        }
        mean=mean/N;
        cout<<"Mean : "<<mean<<endl;
    //Variance
    Sx=0;
    for(int i=1;i<n+1;i++)
    {
        Sx=Sx+f[i]*(x[i]-mean)*(x[i]-mean);
    }
    Sx=Sx/N;
    cout<<"Variance : "<<Sx<<endl;
    Sx=sqrt(Sx);


    //Moments about Mean//
```

```
for(int j=1;j<=4;j++)
{
     mx[j]=0;
     for(int i=1;i<n+1;i++)
     {
          mx[j]=mx[j]+f[i]*pow((x[i]-mean),j);
     }
     mx[j]=mx[j]/N;
     cout<<j<<"th Moment about mean : "<<mx[j]<<endl;
}

//Coe of Skewness
cout<<"Coe. of Skewness : "<<(mx[3]/pow(Sx,3))<<endl;
//Coe of Kurtosis
cout<<"Coe. of Kurtosis : "<<(mx[4]/pow(Sx,4))<<endl;
//Coe of Excess
cout<<"Coe. of Excess : "<<((mx[4]/pow(Sx,4))-3)<<endl;


//Comulative frequency
F[1]=f[1];
cout<<"F(1) : "<<F[1]<<endl;
for(int i=2;i<n+1;i++)
{
     F[i]=F[i-1]+f[i]; cout<<"F("<<i<<") :
     "<<F[i]<<endl;
}
//Quartiles
for(int r=1;r<4;r++)
{
     d=r*(N+1)/4;
     for(int i=1;i<n;i++)
     {
          if(F[i]<= d && d<=F[i+1])
          {
          Q[r]=x[i+1];
               }
          }
          cout<<"Q("<<r<<") : "<<Q[r]<<endl;
     }

     //Median
     cout<<"Median : "<<Q[2]<<endl;
     //Quartile Range
     cout<<"Quartile Range : "<<(Q[3]-Q[1])<<endl;
     //Mode: Corresponding to the Max freq
```

```
max=f[1];
for(int i=1;i<n;i++)
{
if(f[i]<=f[i+1])
max=f[i+1];
else
max=f[i];
}

for(int i=1;i<n;i++)
{
     if(f[i]==max)
     {
          l=i;
          break;
     }
}
cout<<"Mode : "<<x[l]<<endl;

return 0;
}
```

Out Put:




Quincy 2005 - [stat16.1]
File Edit View Project Debug Tools Window Help
tut
Quincy 2005
Enter f(7) : 14
Enter x(8) : 10
Enter f(8) : 11
Enter x(9) : 11
Enter f(9) : 7
Enter x(10) : 12
Enter f(10) : 4
Enter x(11) : 13
Enter f(11) : 4
Enter x(12) : 14
Enter f(12) : 2
Mean : 8.18478
Variance : 6.71585
1th Moment about mean : -3.93909e-07
2th Moment about mean : 6.71585
3th Moment about mean : 2.39033
4th Moment about mean : 109.389
Coe. of Skewness : 0.137343
Coe. of Kurtosis : 2.42533
Coe. of Excess : -0.574673
F(1) : 2
F(2) : 7
F(3) : 17
F(4) : 25
F(5) : 37
F(6) : 50
F(7) : 64
F(8) : 75
F(9) : 82
F(10) : 86
F(11) : 90
F(12) : 92
Q(1) : 6
Q(2) : 8
Q(3) : 10
Median : 8
Quartile Range : 4
Mode : 12
Press any key to continue . . .

Bivariate sample
Correlation coefficient and regression lines

Problem 17. *The marks (%) obtained in Numerical Analysis Theoretical and Practical at the M.Sc. examination by 10 candidates are given by the following table:*

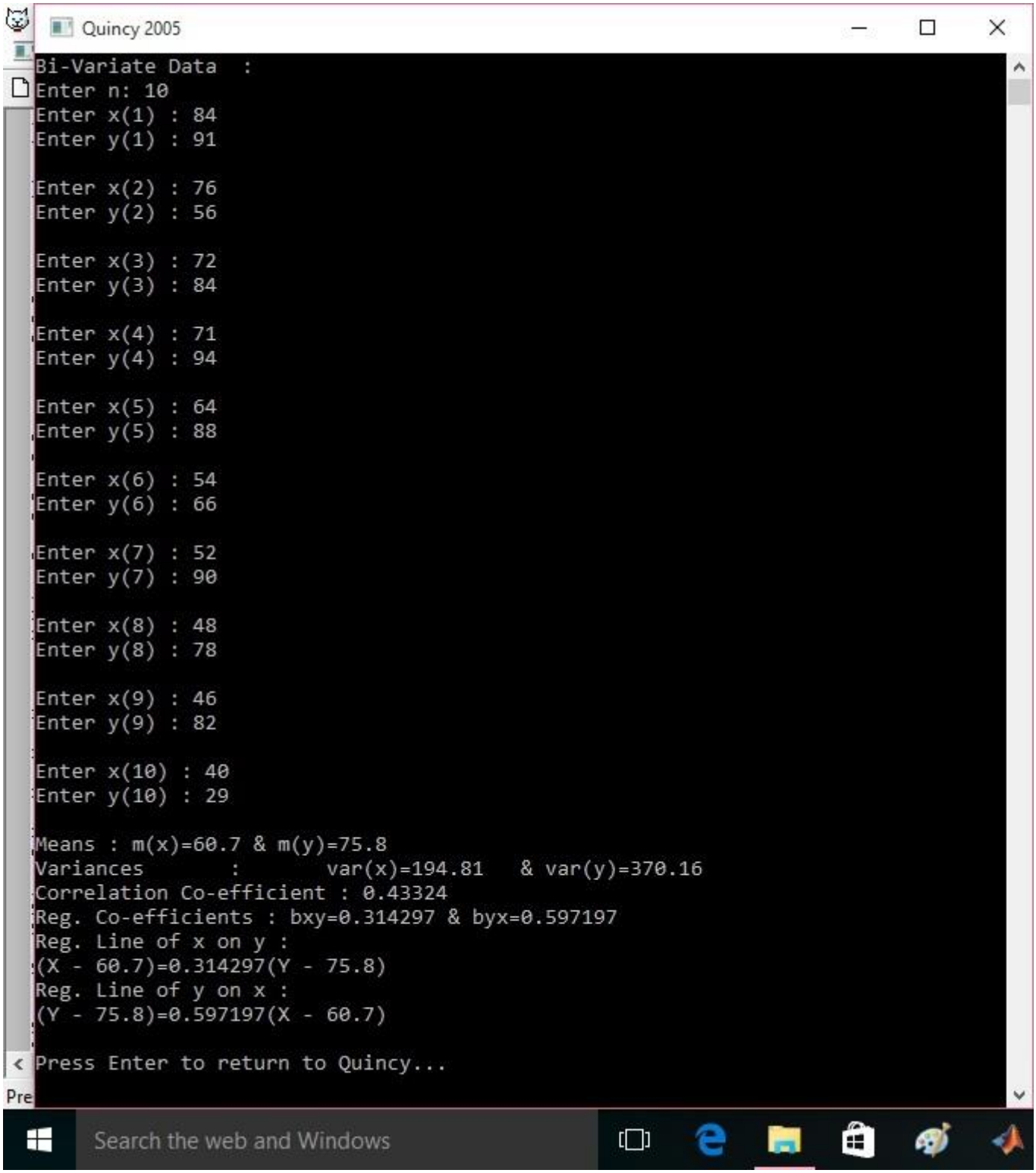
Theoretical Marks (*x*)	*84*	*76*	*72*	*70+k*	*64*	*54*	*52*	*48*	*46*	*40*
Practical Marks (*y*)	*92-k*	*56*	*84*	*94*	*88*	*66*	*90*	*78*	*82*	*30-k*

Write a program in C++ to compute the correlation coefficient (between the theoretical and practical marks) and the lines of regression, where k = 1 . Run your program and write the output.

```
#include<iostream>
#include<cmath>
using namespace std;
int main()
{
int n;
float x[100],y[100],mx,my,mxy,Sx,Sy,Sxy,rxy,bxy,byx;

cout<<"Enter n: ";
cin>>n;

for(int i=1;i<n+1;i++)
{
     cout<<"Enter x("<<i<<") : ";
     cin>>x[i];

     cout<<"Enter y("<<i<<") : ";
     cin>>y[i];

     cout<<endl;
}
//Mean
mx=0;
my=0;
```

```
     for(int i=1;i<n+1;i++)
     {
          mx=mx+x[i];
     my=my+y[i];
}
mx=mx/n;
my=my/n;
cout<<"Means : m(x)="<<mx<<" & m(y)="<<my<<endl;

//Variances
Sx=0;
Sy=0;
Sxy=0;
for(int i=1;i<n+1;i++)
{
     Sx=Sx+(x[i]-mx)*(x[i]-mx);
     Sy=Sy+(y[i]-my)*(y[i]-my);
     Sxy=Sxy+(x[i]-mx)*(y[i]-my);
}
Sx=Sx/n;
Sy=Sy/n;
Sxy=Sxy/n;
cout<<"Variances       :       var(x)="<<Sx<<"       &
var(y)="<<Sy<<endl;
Sx=sqrt(Sx);
Sy=sqrt(Sy);
//Correlation Co-efficient
rxy=Sxy/(Sx*Sy);
cout<<"Correlation Co-efficient : "<<rxy<<endl;
//Regression Lines
bxy=rxy*Sx/Sy;
byx=rxy*Sy/Sx;
cout<<"Reg. Co-efficients : bxy="<<bxy<<" &
byx="<<byx<<endl;

cout<<"Reg. Line of x on y : "<<endl; cout<<"(X -
"<<mx<<")="<<bxy<<"(Y - "<<my<<")"<<endl;

cout<<"Reg. Line of y on x : "<<endl; cout<<"(Y -
"<<my<<")="<<byx<<"(X - "<<mx<<")"<<endl;

return 0;
}
```

Out Put:


Quincy 2005
Bi-Variate Data :
Enter n: 10
Enter x(1) : 84
Enter y(1) : 91
Enter x(2) : 76
Enter y(2) : 56
Enter x(3) : 72
Enter y(3) : 84
Enter x(4) : 71
Enter y(4) : 94
Enter x(5) : 64
Enter y(5) : 88
Enter x(6) : 54
Enter y(6) : 66
Enter x(7) : 52
Enter y(7) : 90
Enter x(8) : 48
Enter y(8) : 78
Enter x(9) : 46
Enter y(9) : 82
Enter x(10) : 40
Enter y(10) : 29
Means : m(x)=60.7 & m(y)=75.8
Variances : var(x)=194.81 & var(y)=370.16
Correlation Co-efficient : 0.43324
Reg. Co-efficients : bxy=0.314297 & byx=0.597197
Reg. Line of x on y :
(X - 60.7)=0.314297(Y - 75.8)
Reg. Line of y on x :
(Y - 75.8)=0.597197(X - 60.7)
Press Enter to return to Quincy...
Search the web and Windows

Programming in MATLAB

Abdul Halim

Matrices and matrix operations

Problem 1. *Let*

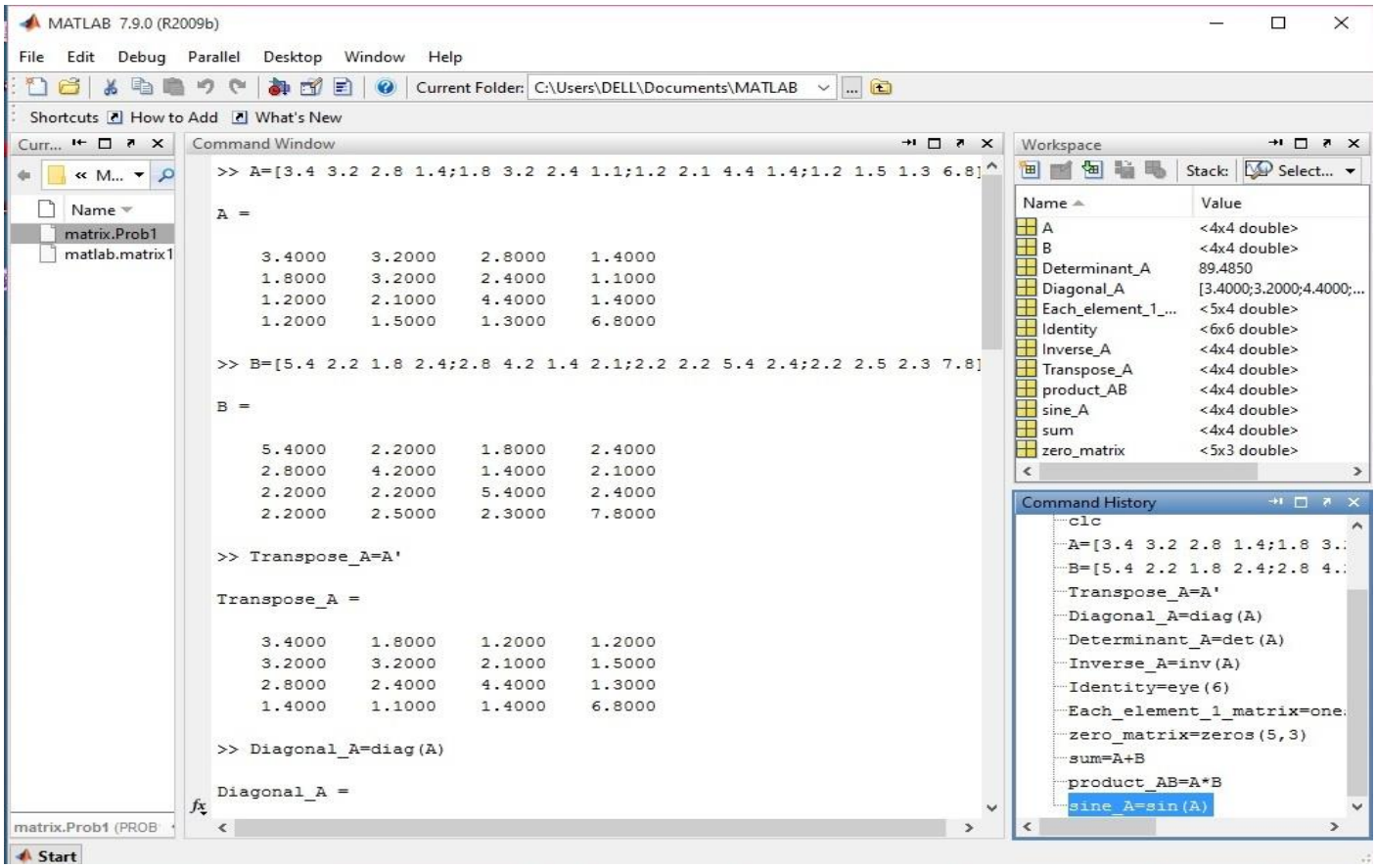
$$A=\begin{pmatrix} 2.4+k & 3.2 & 2.8 & 1.4 \\ 1.8 & 2.2+k & 2.4 & 1.1 \\ 1.2 & 2.1 & 3.4+k & 1.4 \\ 1.2 & 1.5 & 1.3 & 5.8+k \end{pmatrix},$$

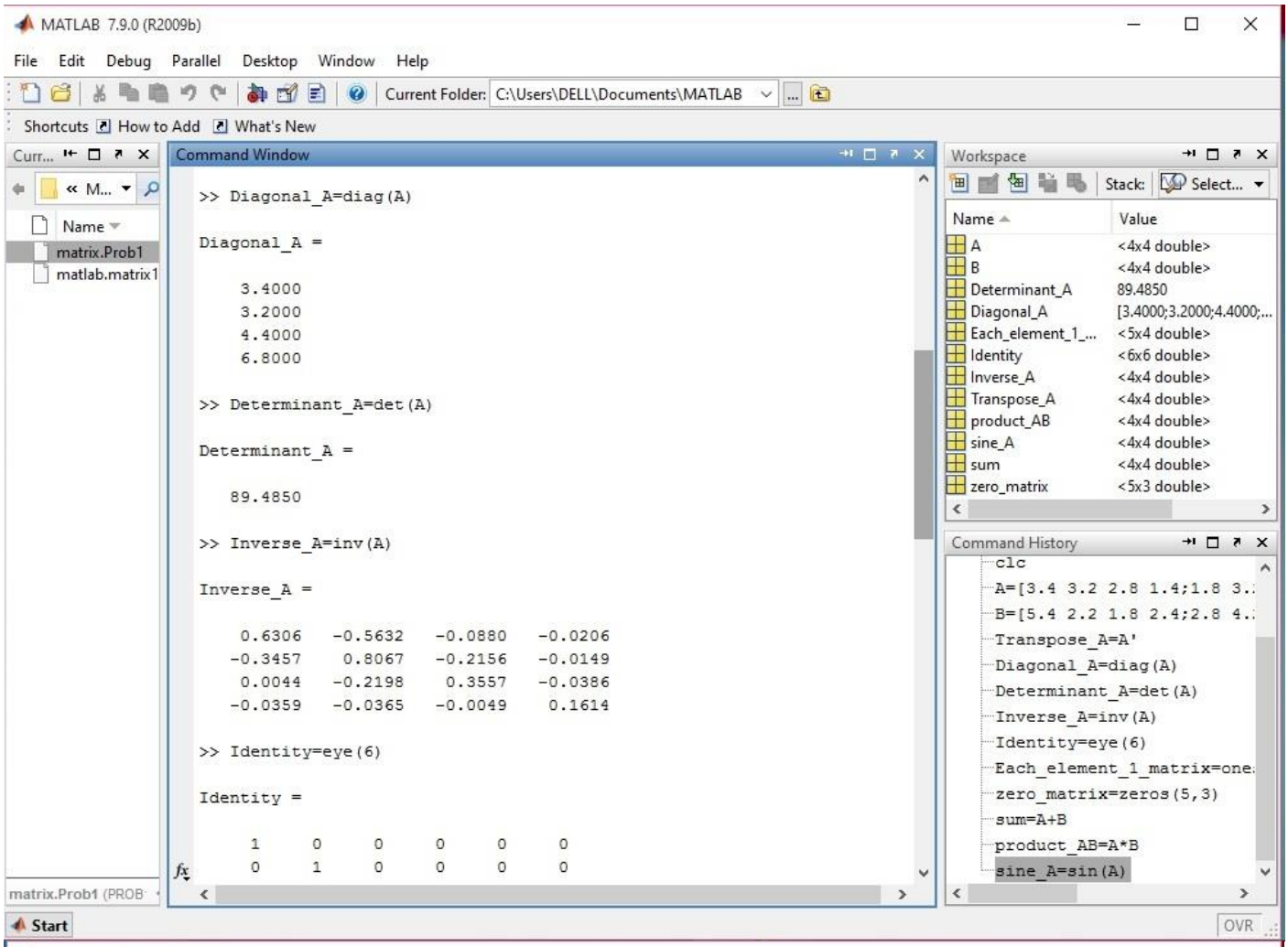
$$B=\begin{pmatrix} 4.4+k & 2.2 & 1.8 & 2.4 \\ 2.8 & 3.2+k & 1.4 & 2.1 \\ 2.2 & 2.2 & 4.4+k & 2.4 \\ 2.2 & 2.5 & 2.3 & 6.8+k \end{pmatrix},$$

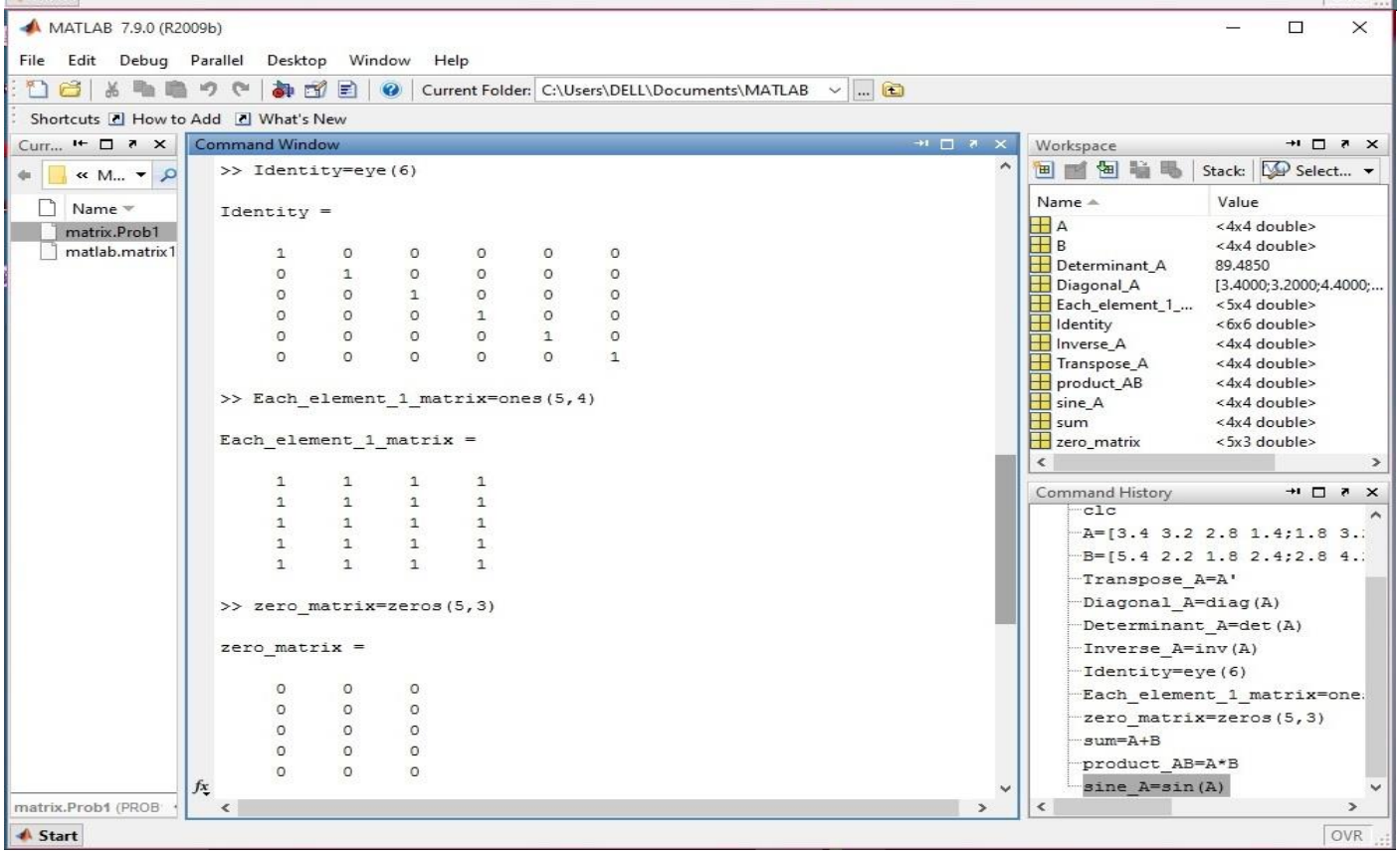
where $k = 1$. *Use MATLAB to answer the following questions.*

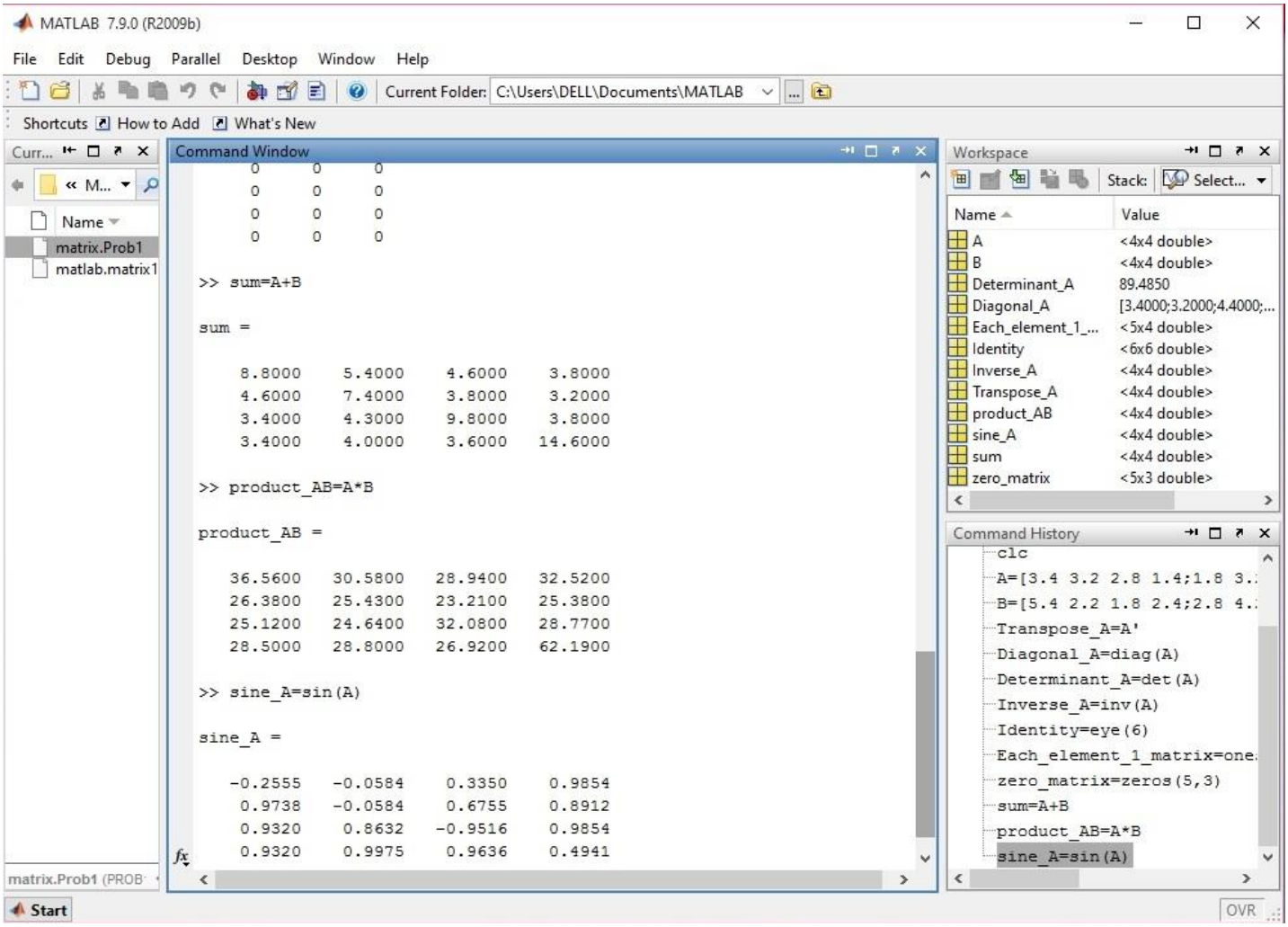
(a) Find the transpose of the matrix A.
(b) Show the diagonal elements of A.
(c) Determine whether A is singular or not.
(d) Find the inverse of the matrix A, if it exists.
(e) Write an identity matrix of order 6.
(f) Write a 5x4 matrix each of whose element is 1.
(g) Write a zero matrix of order 5x3.
(h) Find the matrices A+B and AB.
(i) Find the matrix each of whose element is the sine of the corresponding elements of A.

OUTPUT COMMAND:

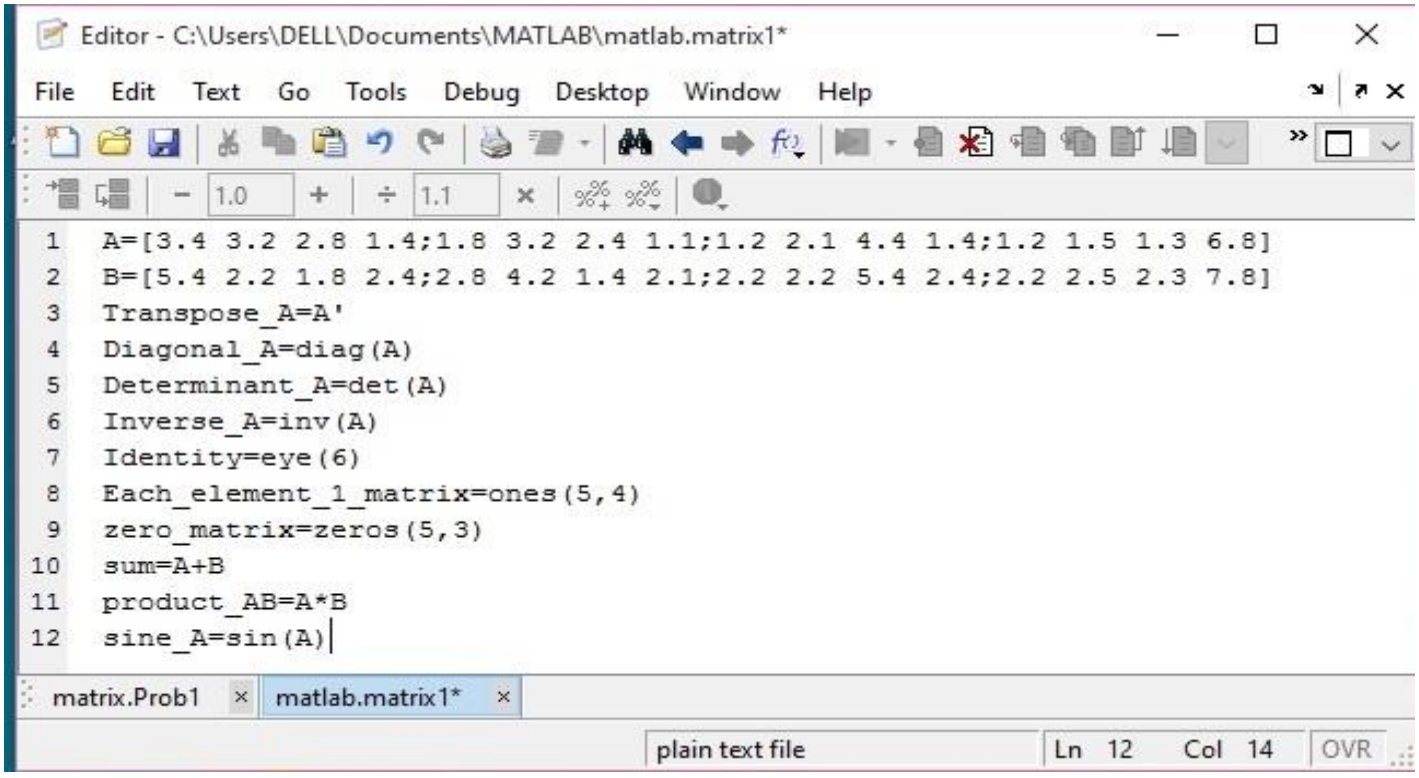



MATLAB 7.9.0 (R2009b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\DELL\Documents\MATLAB
Shortcuts How to Add What's New
Command Window
>> Diagonal_A=diag(A)
Diagonal_A =
3.4000
3.2000
4.4000
6.8000
>> Determinant_A=det(A)
Determinant_A =
89.4850
>> Inverse_A=inv(A)
Inverse_A =
0.6306 -0.5632 -0.0880 -0.0206
-0.3457 0.8067 -0.2156 -0.0149
0.0044 -0.2198 0.3557 -0.0386
-0.0359 -0.0365 -0.0049 0.1614
>> Identity=eye(6)
Identity =
1 0 0 0 0 0
0 1 0 0 0 0
Workspace
Name Value
A <4x4 double>
B <4x4 double>
Determinant_A 89.4850
Diagonal_A [3.4000;3.2000;4.4000;...
Each_element_1_... <5x4 double>
Identity <6x6 double>
Inverse_A <4x4 double>
Transpose_A <4x4 double>
product_AB <4x4 double>
sine_A <4x4 double>
sum <4x4 double>
zero_matrix <5x3 double>
Command History
clc
A=[3.4 3.2 2.8 1.4;1.8 3.
B=[5.4 2.2 1.8 2.4;2.8 4.
Transpose_A=A'
Diagonal_A=diag(A)
Determinant_A=det(A)
Inverse_A=inv(A)
Identity=eye(6)
Each_element_1_matrix=one
zero_matrix=zeros(5,3)
sum=A+B
product_AB=A*B
sine_A=sin(A)
matrix.Prob1
matlab.matrix1
Start
OVR


MATLAB 7.9.0 (R2009b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\DELL\Documents\MATLAB
Shortcuts How to Add What's New
Command Window
>> Identity=eye(6)
Identity =
1 0 0 0 0 0
0 1 0 0 0 0
0 0 1 0 0 0
0 0 0 1 0 0
0 0 0 0 1 0
0 0 0 0 0 1
>> Each_element_1_matrix=ones(5,4)
Each_element_1_matrix =
1 1 1 1
1 1 1 1
1 1 1 1
1 1 1 1
1 1 1 1
>> zero_matrix=zeros(5,3)
zero_matrix =
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
Workspace
Name Value
A <4x4 double>
B <4x4 double>
Determinant_A 89.4850
Diagonal_A [3.4000;3.2000;4.4000;...
Each_element_1_... <5x4 double>
Identity <6x6 double>
Inverse_A <4x4 double>
Transpose_A <4x4 double>
product_AB <4x4 double>
sine_A <4x4 double>
sum <4x4 double>
zero_matrix <5x3 double>
Command History
clc
A=[3.4 3.2 2.8 1.4;1.8 3.
B=[5.4 2.2 1.8 2.4;2.8 4.
Transpose_A=A'
Diagonal_A=diag(A)
Determinant_A=det(A)
Inverse_A=inv(A)
Identity=eye(6)
Each_element_1_matrix=one
zero_matrix=zeros(5,3)
sum=A+B
product_AB=A*B
sine_A=sin(A)
matrix.Prob1
matlab.matrix1
Start
OVR


MATLAB 7.9.0 (R2009b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\DELL\Documents\MATLAB
Shortcuts How to Add What's New
Command Window
>> sum=A+B
sum =
8.8000 5.4000 4.6000 3.8000
4.6000 7.4000 3.8000 3.2000
3.4000 4.3000 9.8000 3.8000
3.4000 4.0000 3.6000 14.6000
>> product_AB=A*B
product_AB =
36.5600 30.5800 28.9400 32.5200
26.3800 25.4300 23.2100 25.3800
25.1200 24.6400 32.0800 28.7700
28.5000 28.8000 26.9200 62.1900
>> sine_A=sin(A)
sine_A =
-0.2555 -0.0584 0.3350 0.9854
0.9738 -0.0584 0.6755 0.8912
0.9320 0.8632 -0.9516 0.9854
0.9320 0.9975 0.9636 0.4941
Workspace
Name Value
A <4x4 double>
B <4x4 double>
Determinant_A 89.4850
Diagonal_A [3.4000;3.2000;4.4000;...
Each_element_1_... <5x4 double>
Identity <6x6 double>
Inverse_A <4x4 double>
Transpose_A <4x4 double>
product_AB <4x4 double>
sine_A <4x4 double>
sum <4x4 double>
zero_matrix <5x3 double>
Command History
clc
A=[3.4 3.2 2.8 1.4;1.8 3.
B=[5.4 2.2 1.8 2.4;2.8 4.
Transpose_A=A'
Diagonal_A=diag(A)
Determinant_A=det(A)
Inverse_A=inv(A)
Identity=eye(6)
Each_element_1_matrix=one
zero_matrix=zeros(5,3)
sum=A+B
product_AB=A*B
sine_A=sin(A)
matrix.Prob1 (PROB
Start
OVR

.m FILES :


Editor - C:\Users\DELL\Documents\MATLAB\matlab.matrix1*
File Edit Text Go Tools Debug Desktop Window Help
1 A=[3.4 3.2 2.8 1.4;1.8 3.2 2.4 1.1;1.2 2.1 4.4 1.4;1.2 1.5 1.3 6.8]
2 B=[5.4 2.2 1.8 2.4;2.8 4.2 1.4 2.1;2.2 2.2 5.4 2.4;2.2 2.5 2.3 7.8]
3 Transpose_A=A'
4 Diagonal_A=diag(A)
5 Determinant_A=det(A)
6 Inverse_A=inv(A)
7 Identity=eye(6)
8 Each_element_1_matrix=ones(5,4)
9 zero_matrix=zeros(5,3)
10 sum=A+B
11 product_AB=A*B
12 sine_A=sin(A)
matrix.Prob1
matlab.matrix1*
plain text file
Ln 12 Col 14
OVR

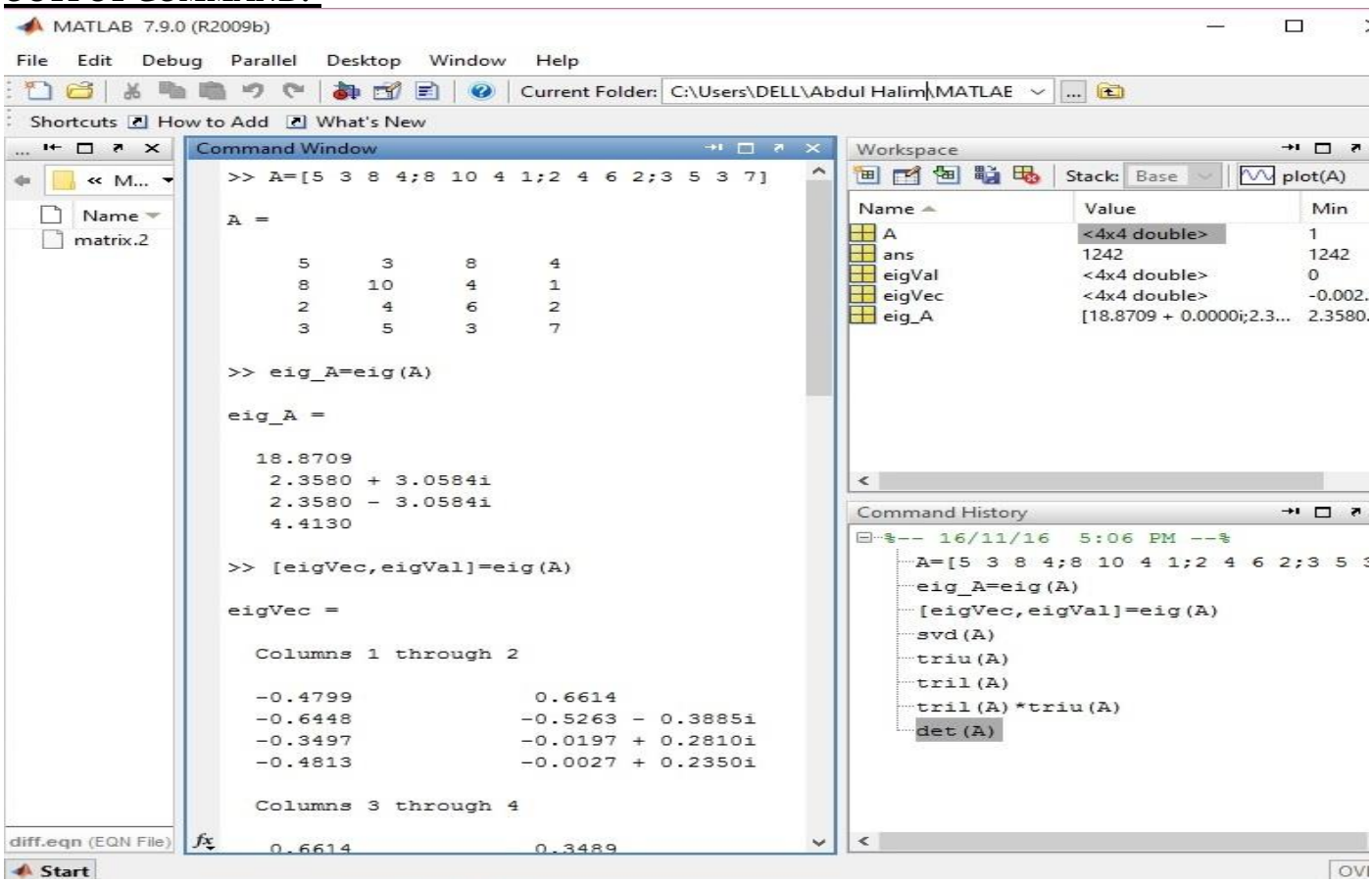
Eigenvalues, eigenvectors and decompositions of matrices

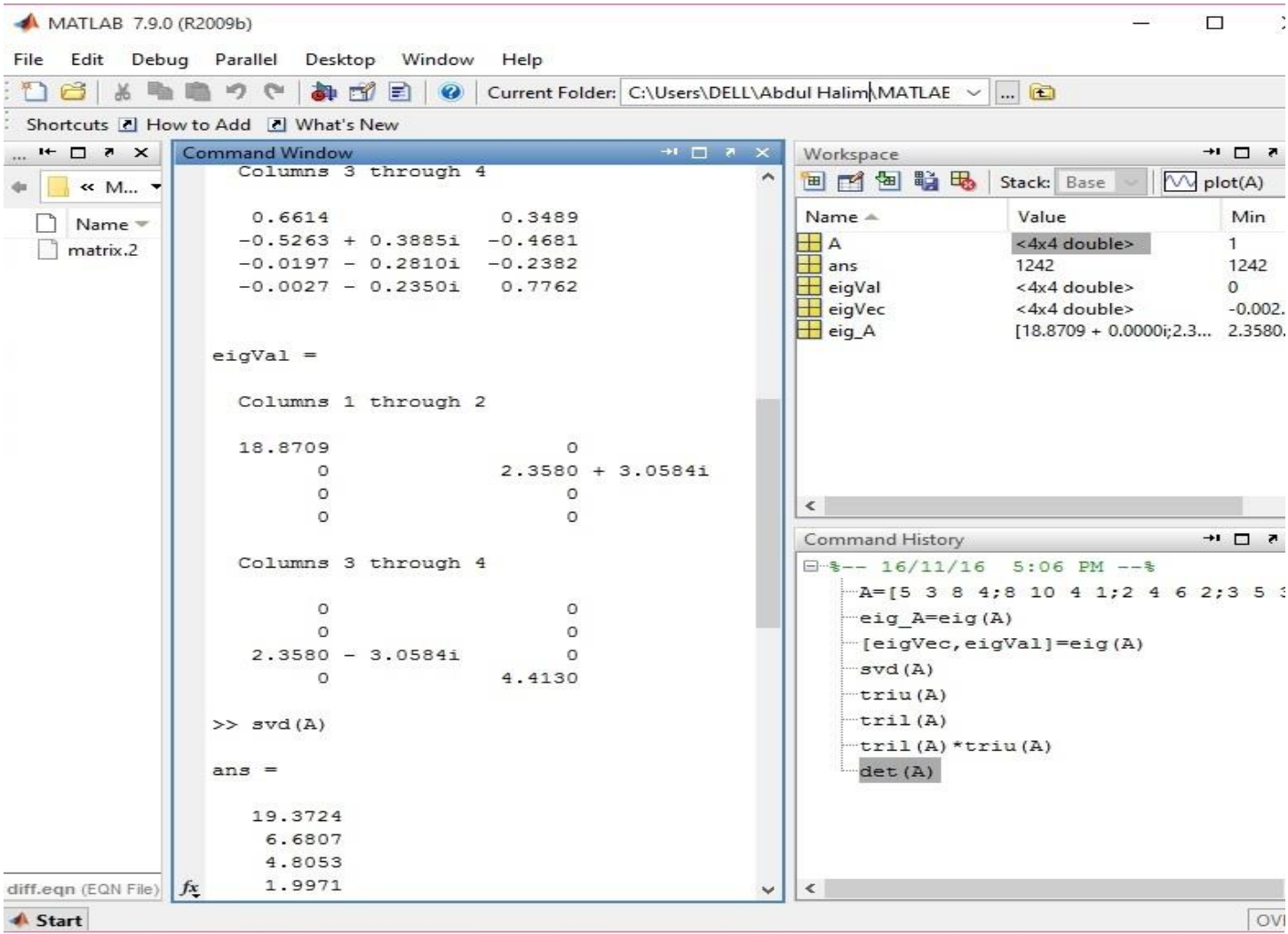
Problem 2. *Let*

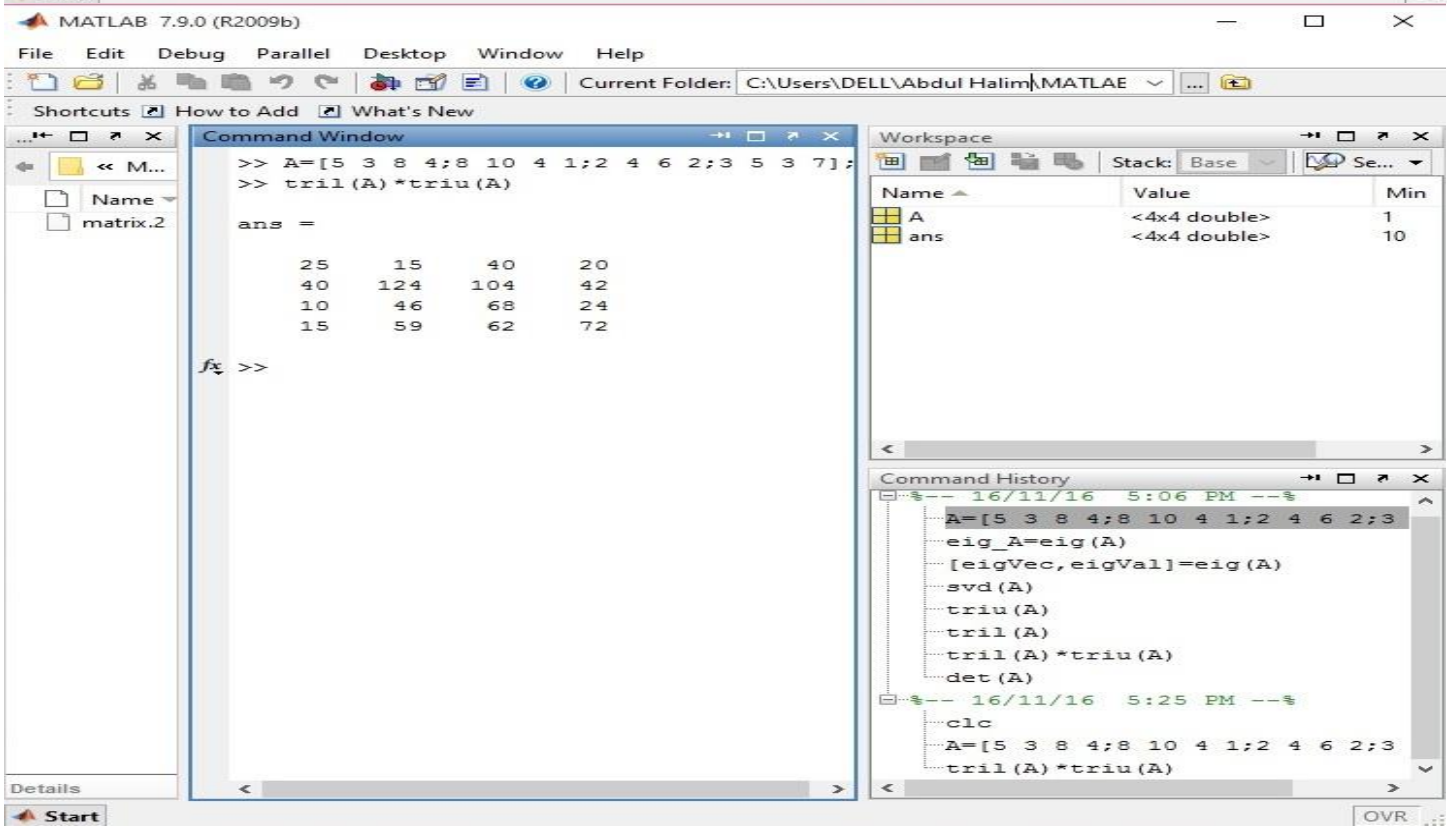
$$A=\begin{pmatrix} 4+k & 3 & 8 & 4 \\ 8 & 2+k & 4 & 1 \\ 2 & 4 & 5+k & 2 \\ 3 & 5 & 3 & 6+k \end{pmatrix},$$

where $k = 1$. *Use MATLAB to answer the following questions.*
(a) Find the eigenvalues and the corresponding eigenvectors of the matrix A.
(b) Find a lower triangular matrix L and an upper triangular matrix U such that LU = A.
(c) Show the singular value decomposition of A.

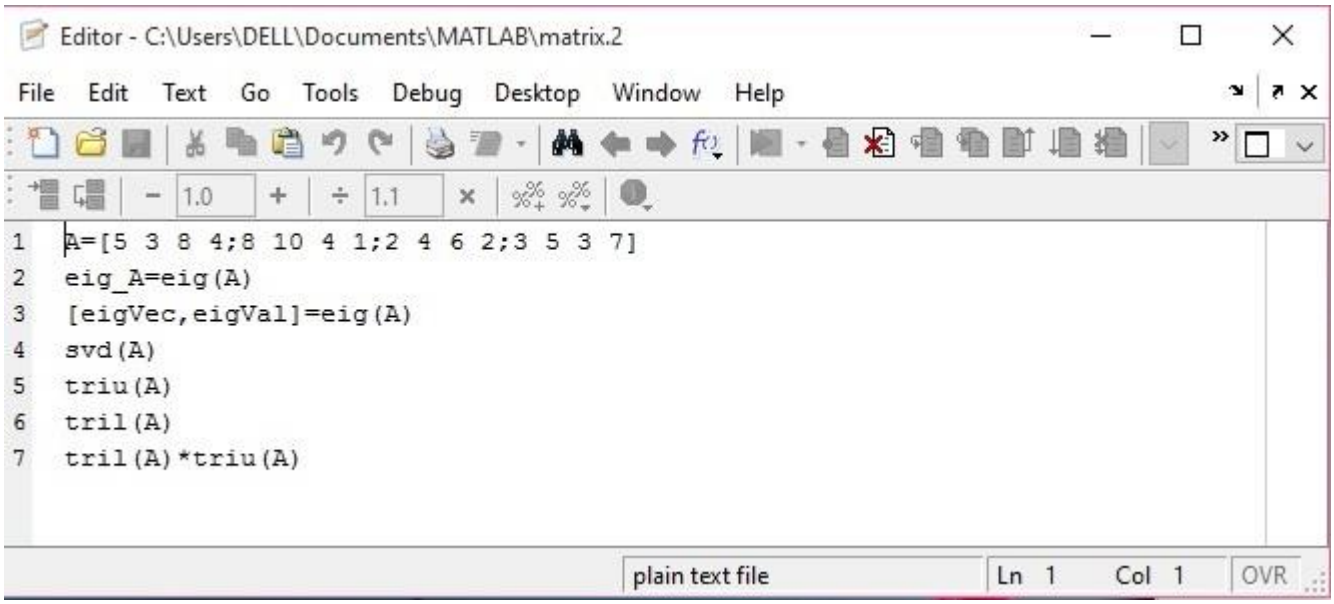
OUTPUT COMMAND:




MATLAB 7.9.0 (R2009b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\DELL\Abdul Halim\MATLAE
Shortcuts How to Add What's New
Command Window
Columns 3 through 4
0.6614 0.3489
-0.5263 + 0.3885i -0.4681
-0.0197 - 0.2810i -0.2382
-0.0027 - 0.2350i 0.7762
eigVal =
Columns 1 through 2
18.8709 0
0 2.3580 + 3.0584i
0 0
0 0
Columns 3 through 4
0 0
0 0
2.3580 - 3.0584i 0
0 4.4130
>> svd(A)
ans =
19.3724
6.6807
4.8053
1.9971
Workspace
Stack: Base plot(A)
Name Value Min
A <4x4 double> 1
ans 1242 1242
eigVal <4x4 double> 0
eigVec <4x4 double> -0.002.
eig_A [18.8709 + 0.0000i;2.3... 2.3580.
Command History
%-- 16/11/16 5:06 PM --%
A=[5 3 8 4;8 10 4 1;2 4 6 2;3 5 3
eig_A=eig(A)
[eigVec,eigVal]=eig(A)
svd(A)
triu(A)
tril(A)
tril(A)*triu(A)
det(A)
diff.eqn (EQN File)
Start


MATLAB 7.9.0 (R2009b)
File Edit Debug Parallel Desktop Window Help
Current Folder: C:\Users\DELL\Abdul Halim\MATLAE
Shortcuts How to Add What's New
Command Window
>> A=[5 3 8 4;8 10 4 1;2 4 6 2;3 5 3 7];
>> tril(A)*triu(A)
ans =
25 15 40 20
40 124 104 42
10 46 68 24
15 59 62 72
>>
Workspace
Stack: Base
Name Value Min
A <4x4 double> 1
ans <4x4 double> 10
Command History
%-- 16/11/16 5:06 PM --%
A=[5 3 8 4;8 10 4 1;2 4 6 2;3
eig_A=eig(A)
[eigVec,eigVal]=eig(A)
svd(A)
triu(A)
tril(A)
tril(A)*triu(A)
det(A)
%-- 16/11/16 5:25 PM --%
clc
A=[5 3 8 4;8 10 4 1;2 4 6 2;3
tril(A)*triu(A)
Details
Start
OVR

.m FILES:


Editor - C:\Users\DELL\Documents\MATLAB\matrix.2
File Edit Text Go Tools Debug Desktop Window Help
1.0
1.1
1 A=[5 3 8 4;8 10 4 1;2 4 6 2;3 5 3 7]
2 eig_A=eig(A)
3 [eigVec,eigVal]=eig(A)
4 svd(A)
5 triu(A)
6 tril(A)
7 tril(A)*triu(A)
plain text file
Ln 1 Col 1
OVR

Solution of a system of equations

Problem 3. (a) *Let*

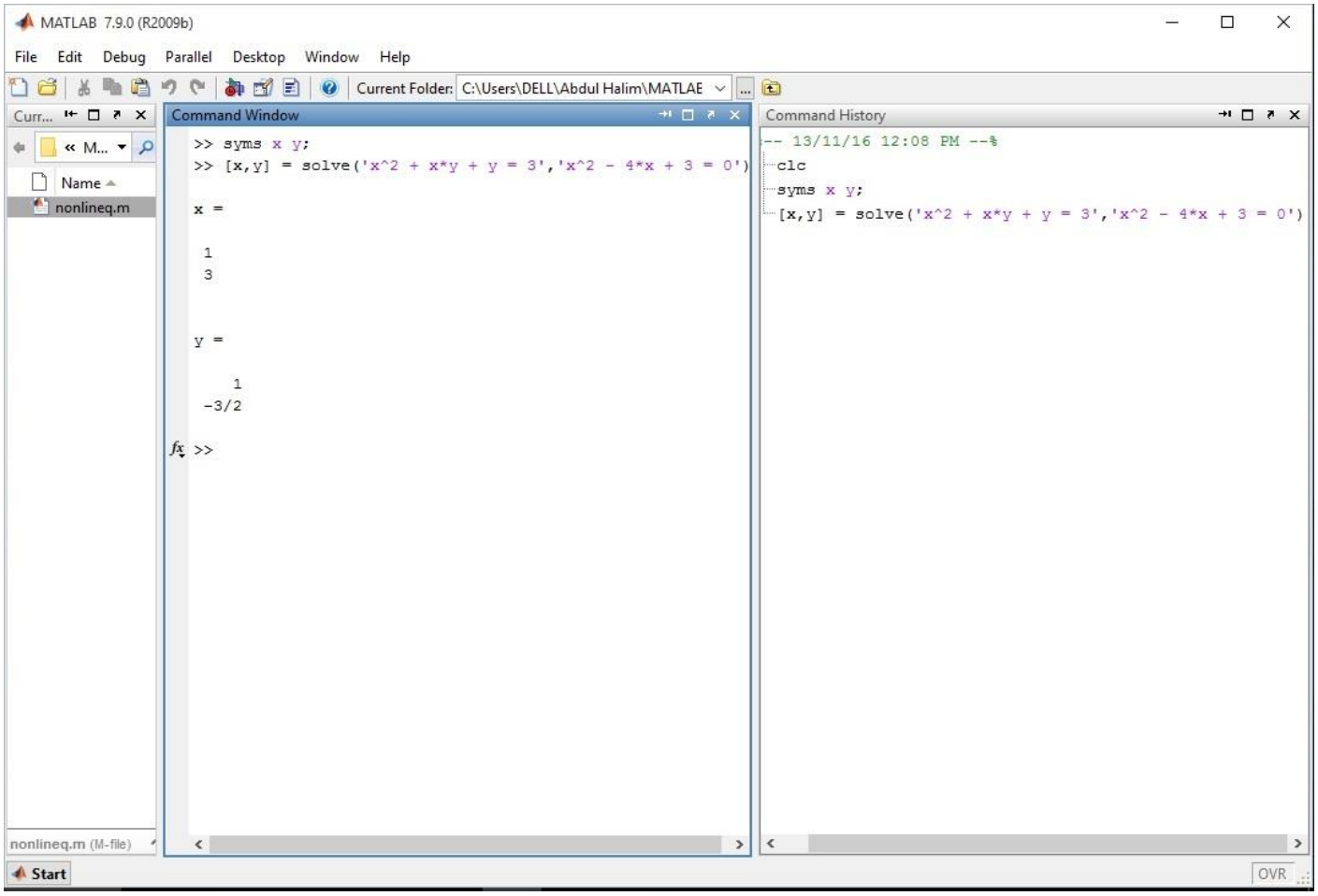
$$A=\begin{pmatrix} 8+k & 3 & 8 & 4 \\ 8 & 7+k & 4 & 1 \\ 2 & 4 & 8+k & 2 \\ 3 & 5 & 3 & 6+k \end{pmatrix},$$

and $B=\begin{pmatrix} 2.3 & 3.4 & 4.8 & 5.6 \end{pmatrix}^T$,

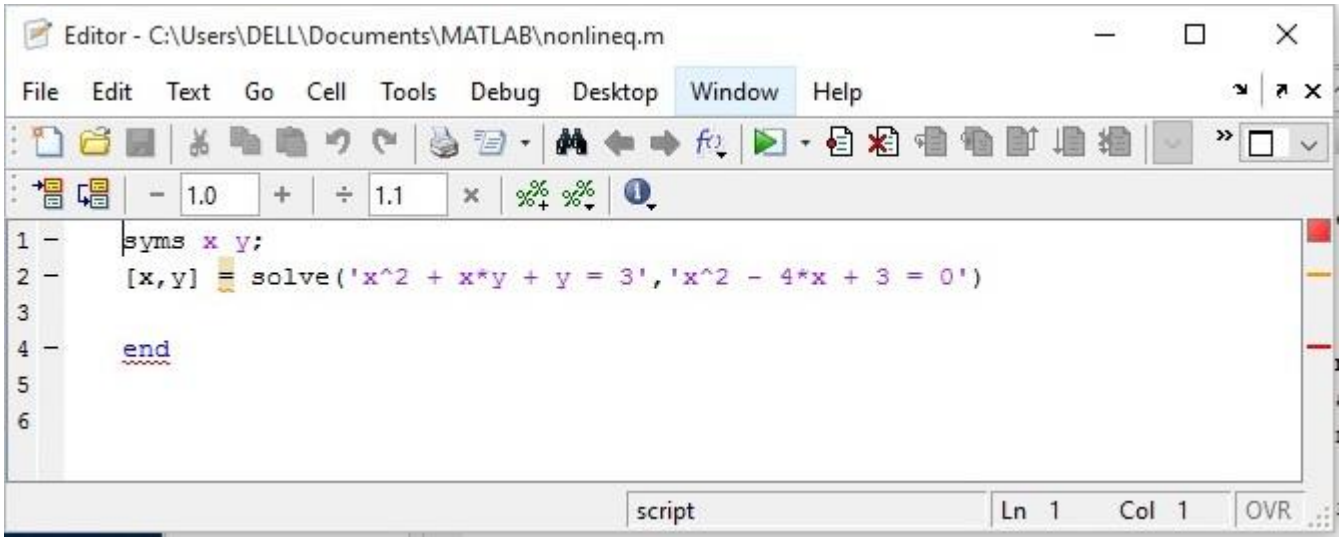
where $k =$ 11 (suitable choice). *Use MATLAB to solve the system AX=B by matrix inversion method and Gauss' elimination method.*

(b) *Solve the equations:* $x^2+xy+y=3, \quad x^2-4x+3=0.$

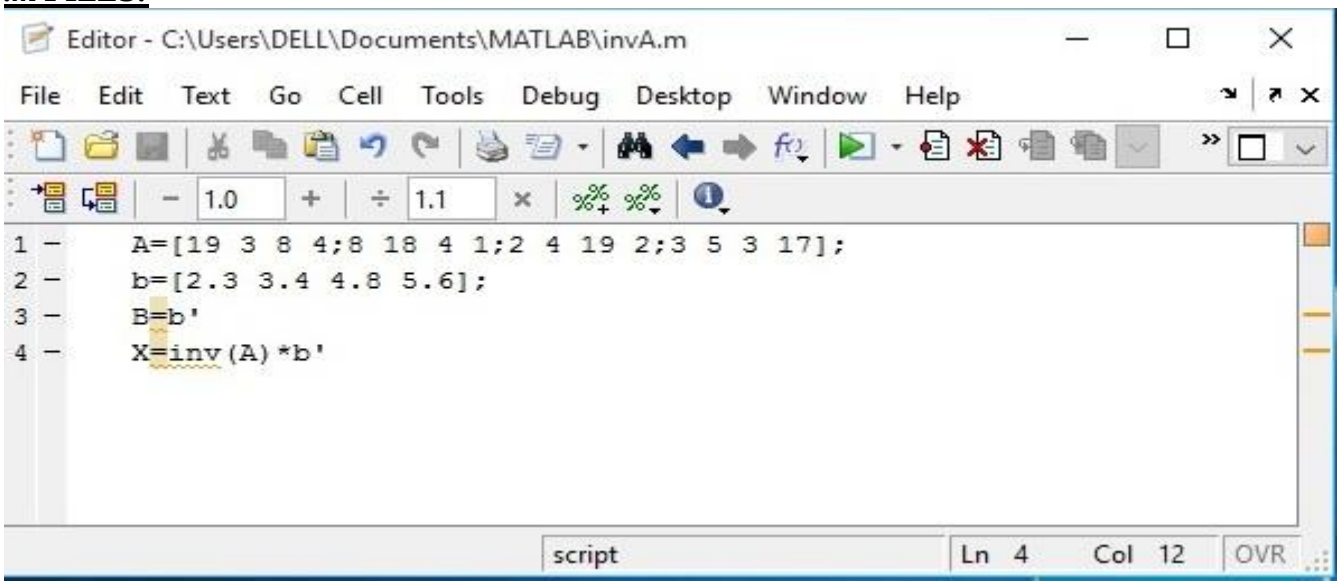
OUTPUT COMMAND:



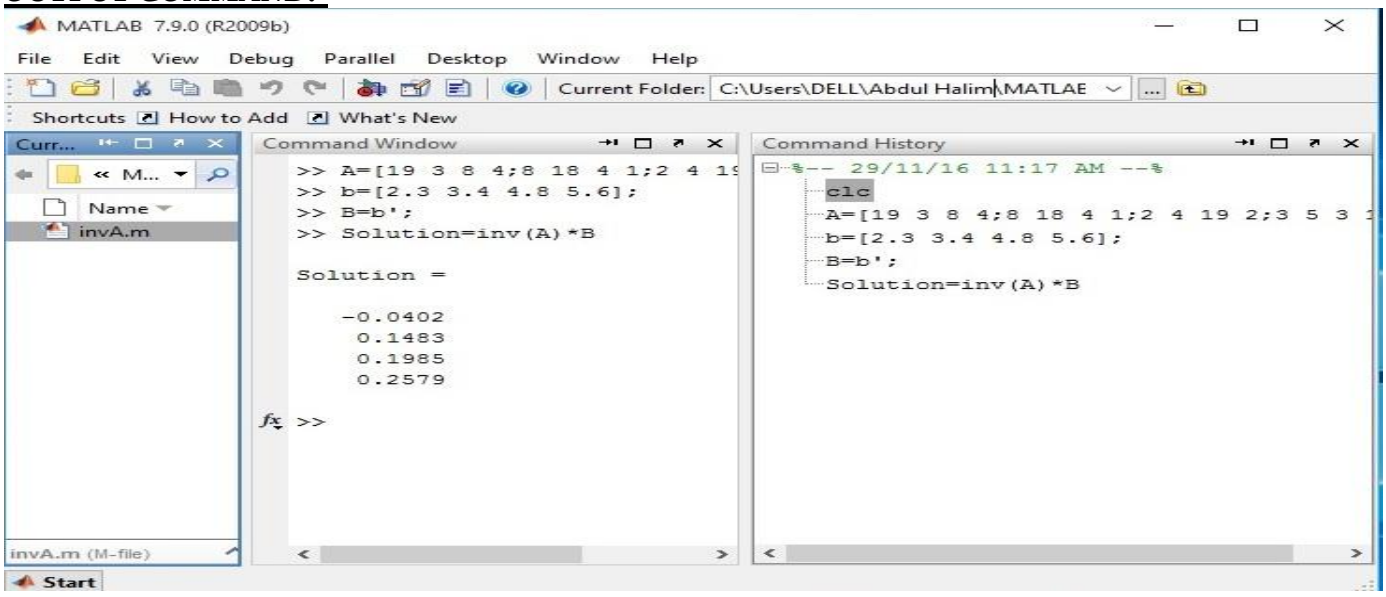
.m FILES:



.m FILES:



OUTPUT COMMAND:



.m FILES:

Editor - C:\Users\DELL\Documents\MATLAB\gauss-elimination.m

File Edit Text Go Cell Tools Debug Desktop Window Help

```
a=[19 3 8 4 2.3;8 18 4 1 3.4;2 4 19 2 4.8;3 5 3 17 5.6]
%Gauss elimination method [m,n)=size(a);
[m,n]=size(a);
for j=1:m-1
    for z=2:m
        if a(j,j)==0
            t=a(j,:);a(j,:)=a(z,:);
            a(z,:)=t;
        end
    end
      for i=j+1:m
          a(i,:)=a(i,:)-a(j,:)*(a(i,j)/a(j,j));
      end
end
          x=zeros(1,m);
          for s=m:-1:1
              c=0;
              for k=2:m
                c=c+a(s,k)*x(k);
              end
                x(s)=(a(s,n)-c)/a(s,s);
          end
                disp('Gauss elimination method:');
                a
                x'
```

script Ln 25 Col 18 OVR

OUTPUT COMMAND:

MATLAB 7.9.0 (R2009b)

File Edit Debug Parallel Desktop Window Help

Current Folder: C:\Users\DELL\Abdul Halim\MATLAE

Shortcuts How to Add What's New

Current F... « M... Name gauss-elimination.m

Command Window

```
end
>> disp('Gauss elimination method:');
Gauss elimination method:
>> a

a =

  Columns 1 through 4

   19.0000    3.0000    8.0000    4.0000
         0   16.7368    0.6316   -0.6842
         0         0   18.0189    1.7296
         0         0         0   16.4031

  Column 5

    2.3000
    2.4316
    4.0226
    4.2296

>> x'

ans =

   -0.0402
    0.1483
    0.1985
    0.2579

>>
```

Command History

```
%-- 14/11/16  9:45 AM --%
clc
a=[19 3 8 4 2.3;8 18 4 1 3.4;2 4 19 2 4.8;3 5 3 17 5.6]
%Gauss elimination method [m,n)=size(a);
[m,n]=size(a);
for j=1:m-1
for z=2:m
if a(j,j)==0
t=a(j,:);a(j,:)=a(z,:);
a(z,:)=t;
end
end
for i=j+1:m
a(i,:)=a(i,:)-a(j,:)*(a(i,j)/a(j,j));
end
end
x=zeros(1,m);
for s=m:-1:1
c=0;
for k=2:m
c=c+a(s,k)*x(k);
end
x(s)=(a(s,n)-c)/a(s,s);
end
disp('Gauss elimination method:');
a
x'
```

gauss-elimination.m

Start OVR

Search the web and Windows

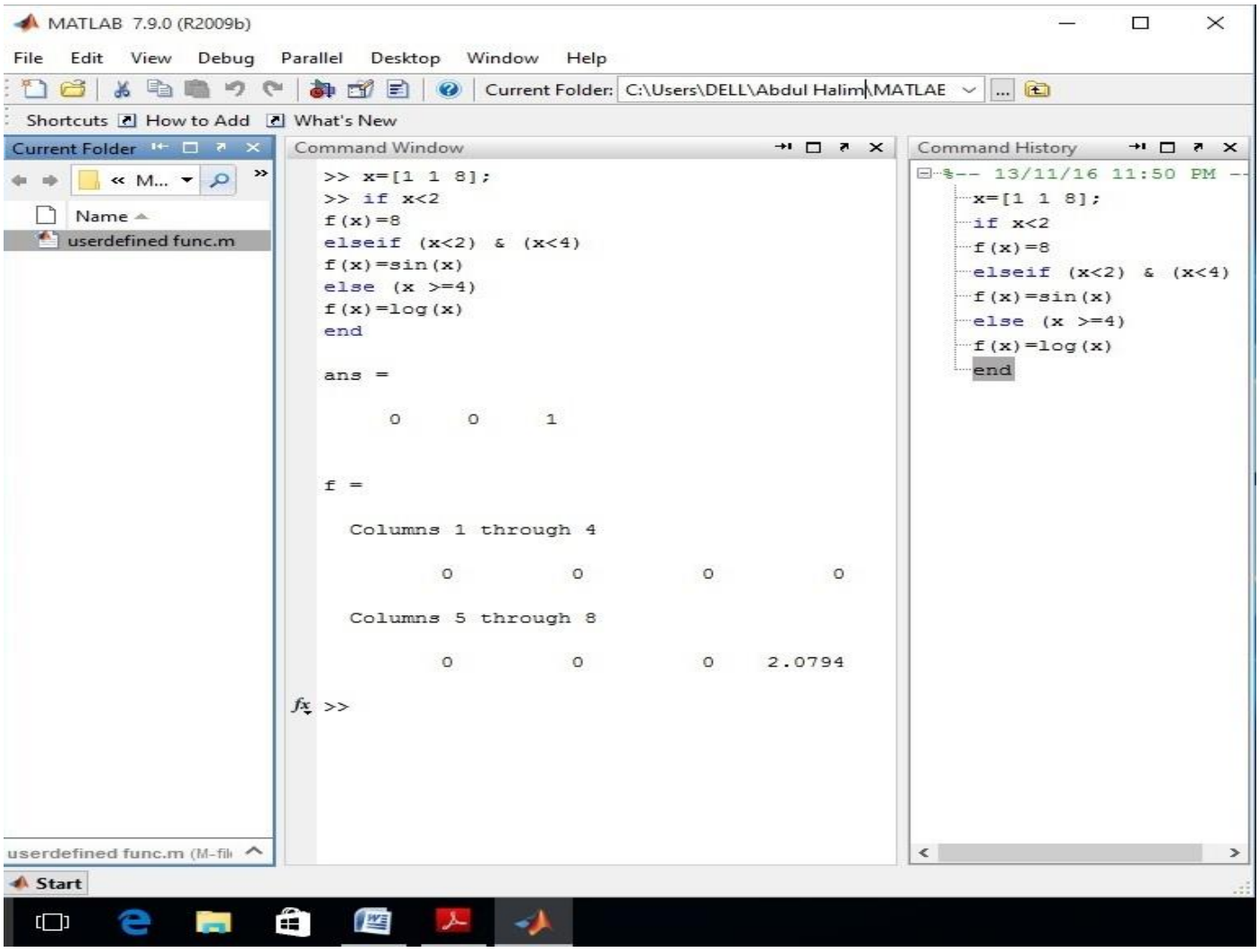
Conditional structure, User-defined functions, and Loop structure

Problem 4. (a) *Use* if-elseif-else *statement to compute the the values of the following real valued function for x=1(1)8:*

$$f(x)=\begin{Bmatrix} 8, & x<2 \\ \sin x, & 2<x<4 \\ \log x, & x\geq 4 \end{Bmatrix}$$

(b) *Find the first 14 Fibonacci numbers by using (i)* for *loop and (ii)* while *loop.*

OUTPUT COMMAND:



.m FILES:

Editor - C:\Users\DELL\Documents\MATLAB\userdefined func.m

File Edit Text Go Cell Tools Debug Desktop Window Help

```
1 -    x=[1 1 8];
2 -    if x<2
3 -      elseif (x<2) & (x<4)
4 -          f(x)=sin(x)
5 -        else (x >=4)
6 -            f(x)=log(x)
7 -            end
```

script Ln 7 Col 13 OVR

(i) For loop

MATLAB 7.9.0 (R2009b)

File Edit Debug Parallel Desktop Window Help

Current Folder: C:\Users\DELL\Abdul Halim\MATLAE

Shortcuts How to Add What's New

Current Fol... « M... Name fibonacci-for-loop.m

Command Window

```
>> N=input('Pick a number\n');
Pick a number
14
>> fib=zeros(1,N);
>> fib(1)=1;
>> fib(2)=1;
>> k=3;
>> for k=3:1:14
fib(k)=fib(k-2)+fib(k-1);
k=k+1;
end
>> fprintf('\n');

>> fprintf('The fibonacci sequence to %d  terms is\n',N);
The fibonacci sequence to 14  terms is
>> fprintf('%g  ',fib)
1  1  2  3  5  8  13  21  34  55  89  144  233  377  >>
```

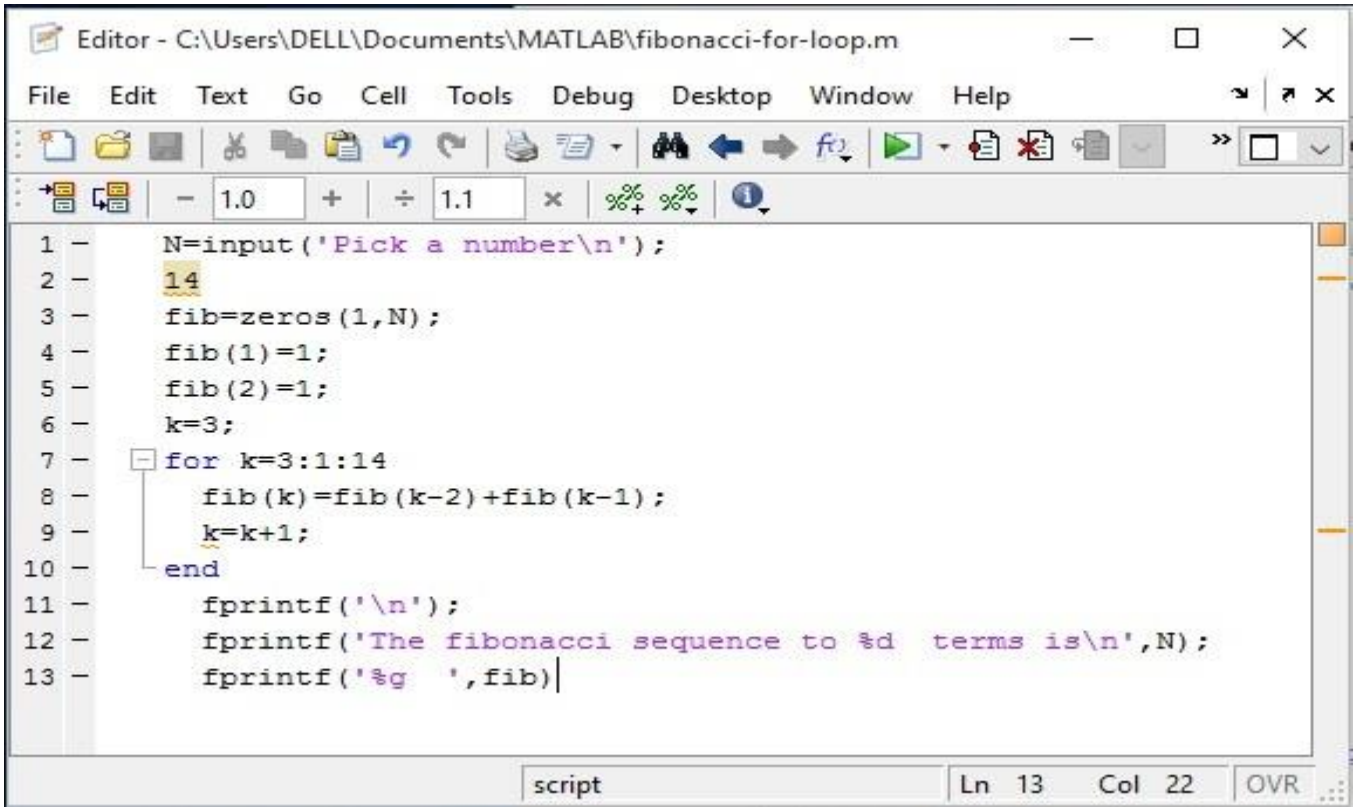
Command History

```
 14/11/16  8:17 AM --%
N=input('Pick a number\n');
14
fib=zeros(1,N);
fib(1)=1;
fib(2)=1;
k=3;
for k=3:1:14
fib(k)=fib(k-2)+fib(k-1);
k=k+1;
end
fprintf('\n');
fprintf('The fibonacci sequence to %d  terms is\n',N);
fprintf('%g  ',fib)
```

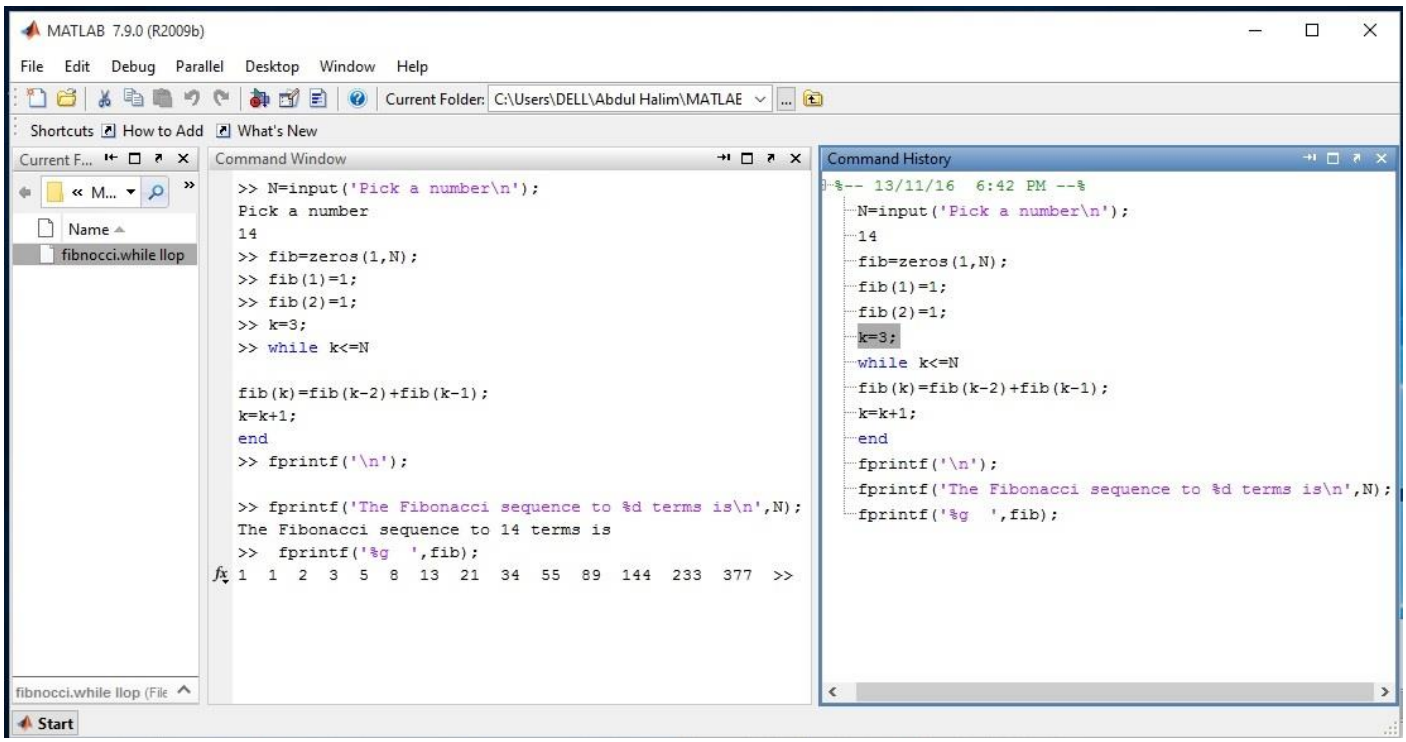
fibonacci-for-loop.m (M-

Start

.m FILES:



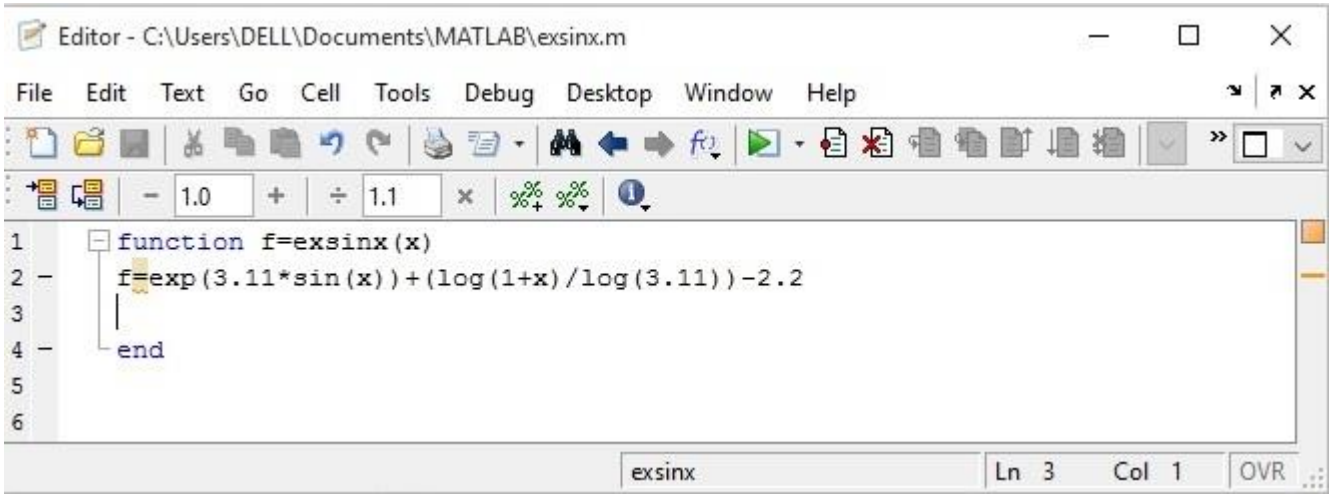
(ii) For While loop



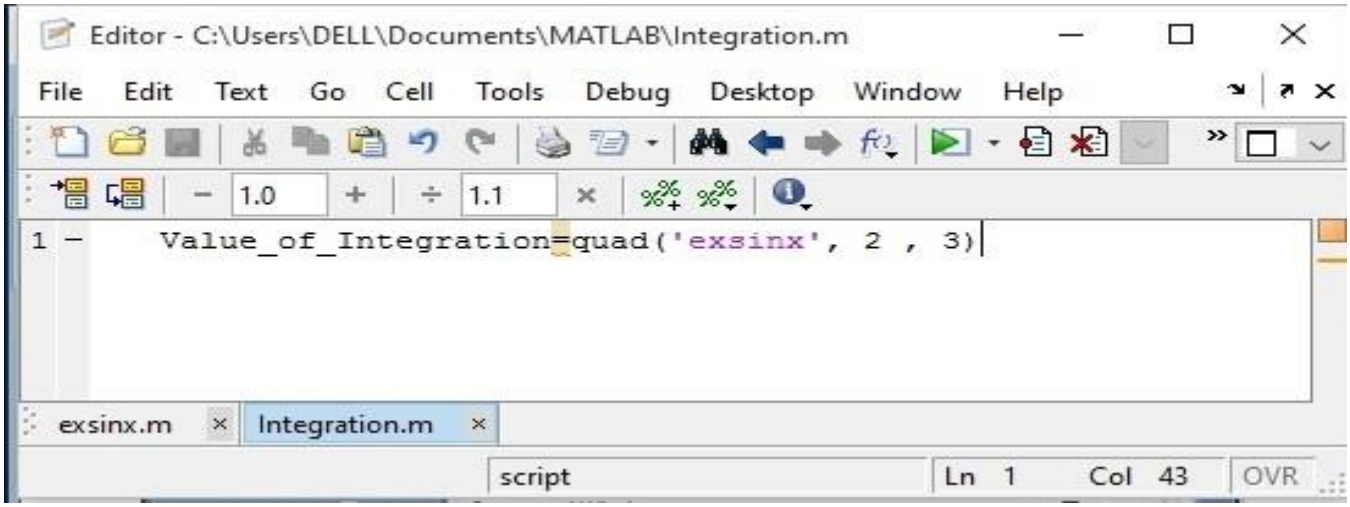
Numerical integration

Problem 5. *Use MATLAB to find* $\int_2^3 e^{-x^2}\sin x\,dx.$

.m FILES (FUNCTION):



.m FILES:

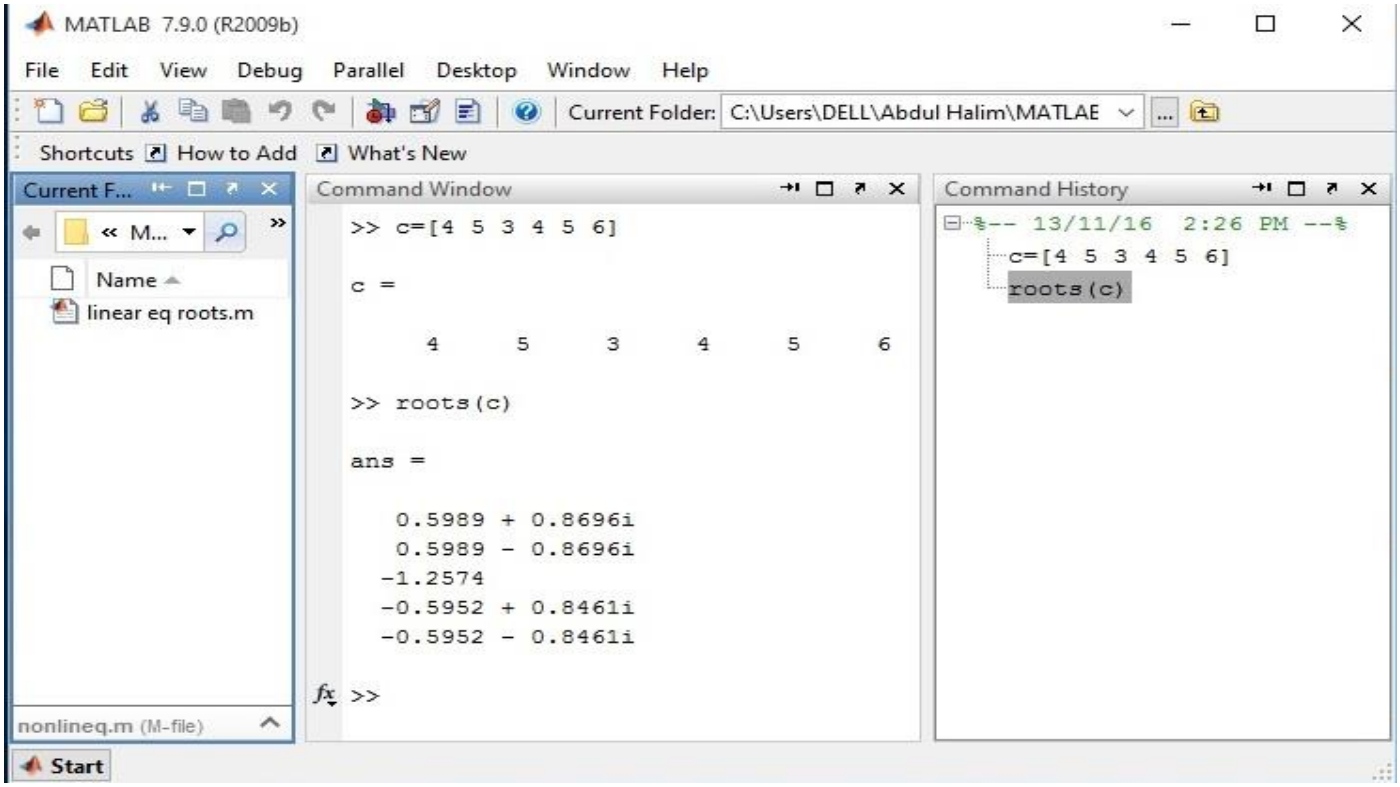


Solution of a polynomial and transcendental equations

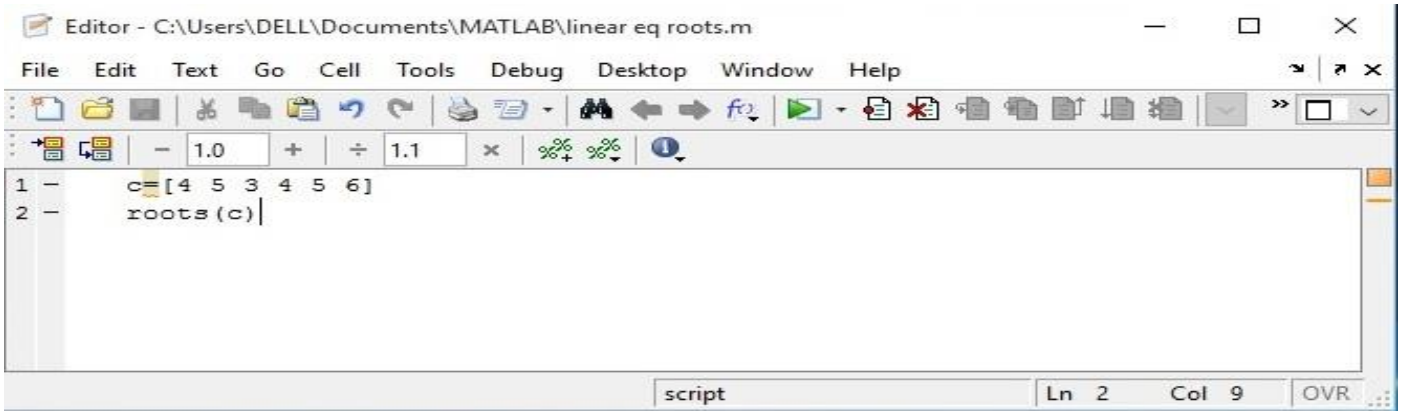
Problem 6. (a) *Use MATLAB to find the roots of* $4x^6+5x^5+3x^4+4x^2+5x+6=0.$

(b) *Use MATLAB to find a root of the equation* $e^{a\sin x}+\log_a(1+x)-2.2=0,$ *where* $a=\frac{20.1+k}{10}$ *and k = 1 .so,a=2.11*

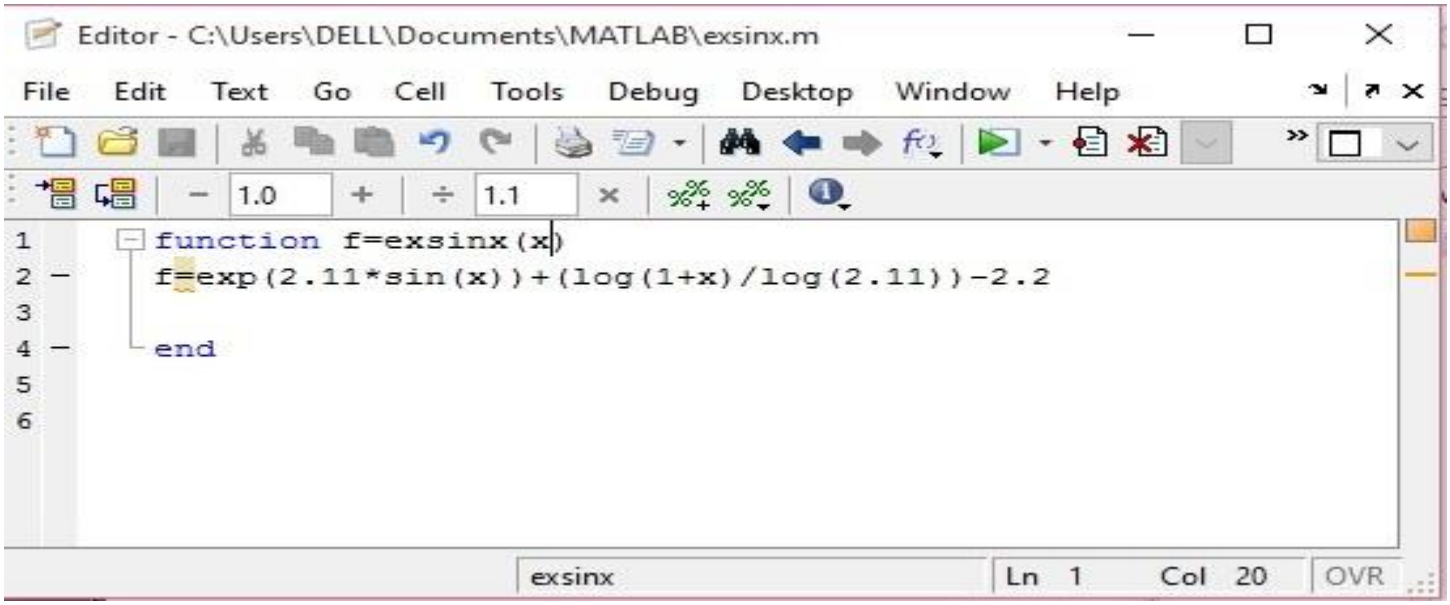
OUTPUT COMMAND:



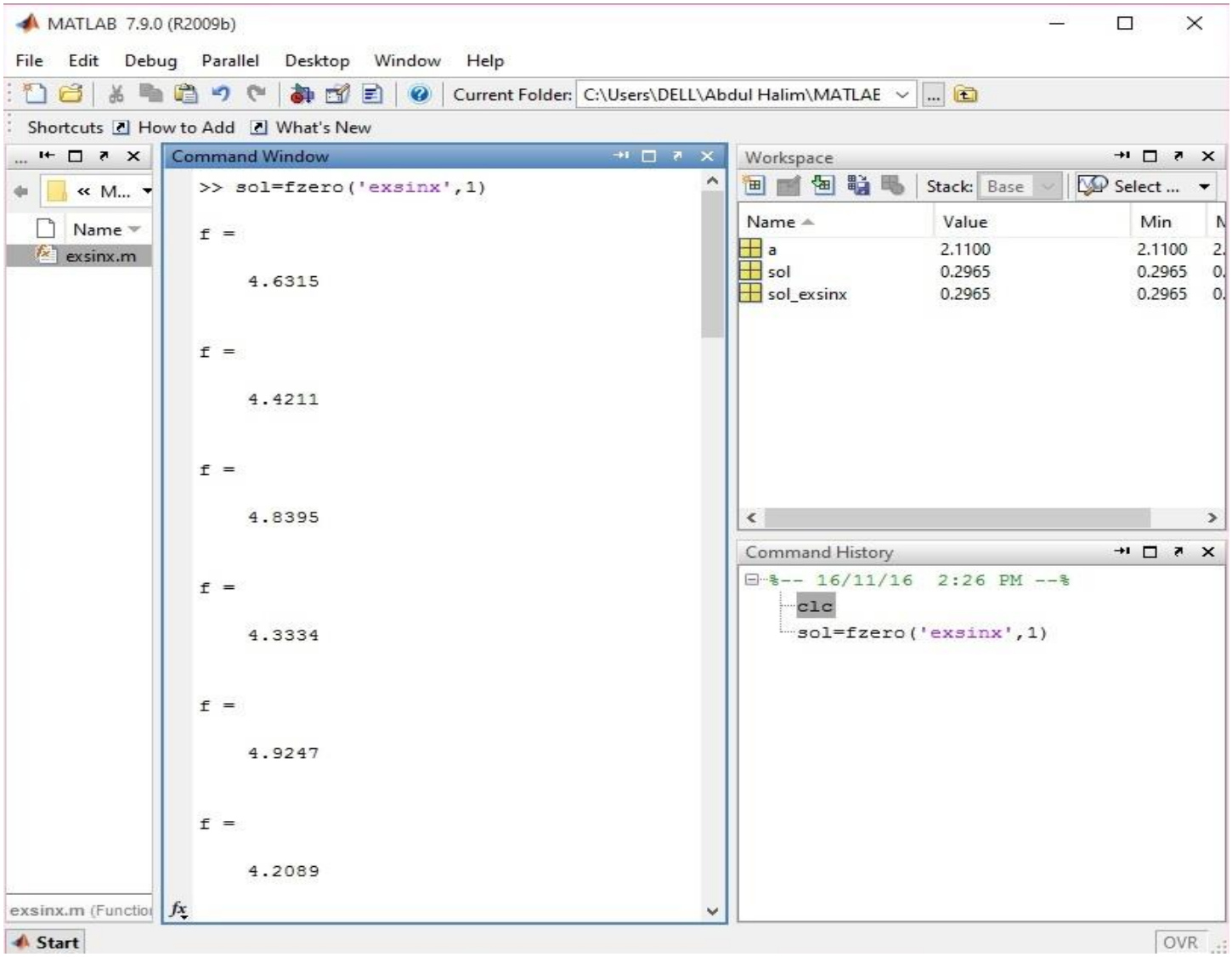
.m FILES:



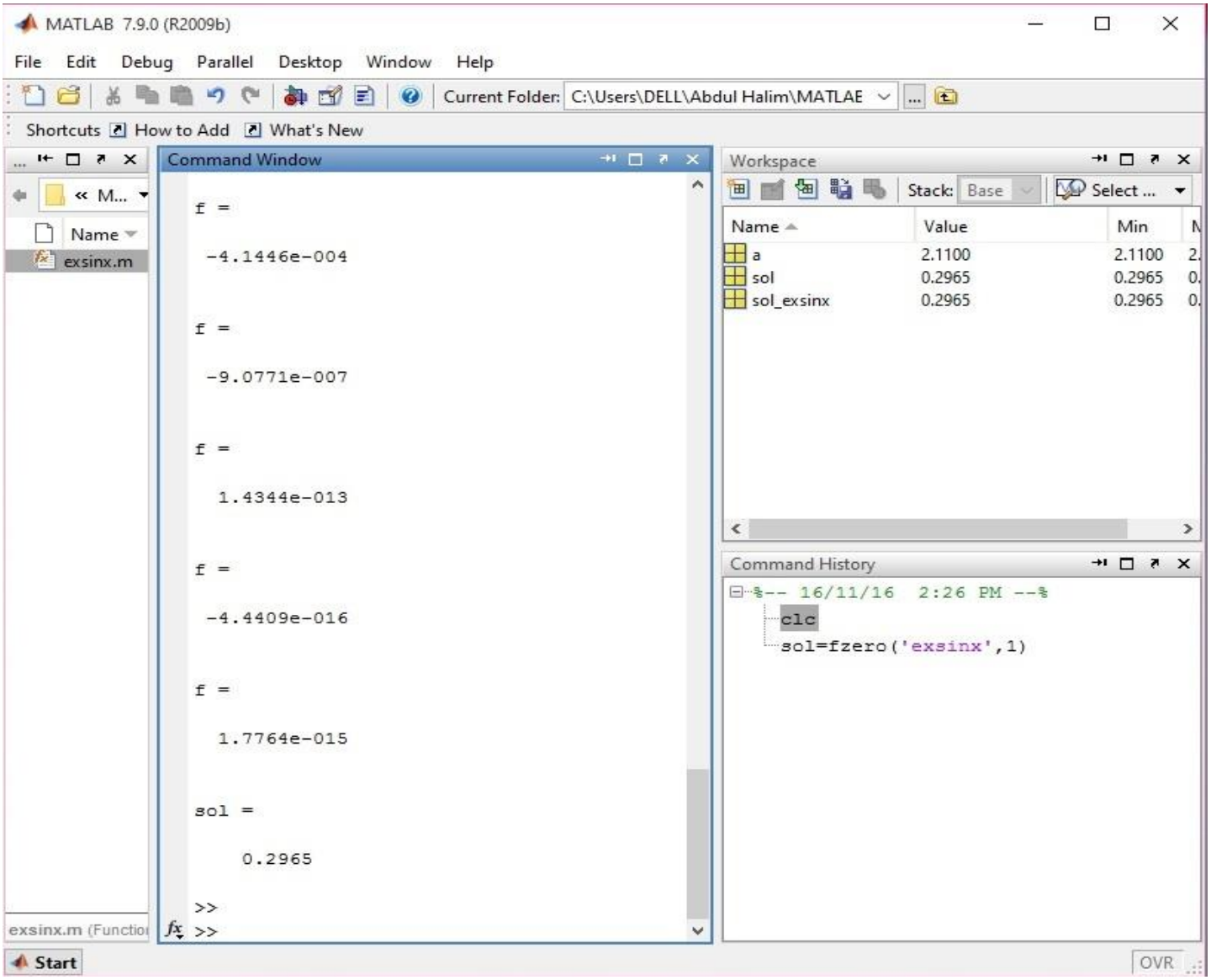
.m FILES (FUNCTION) :



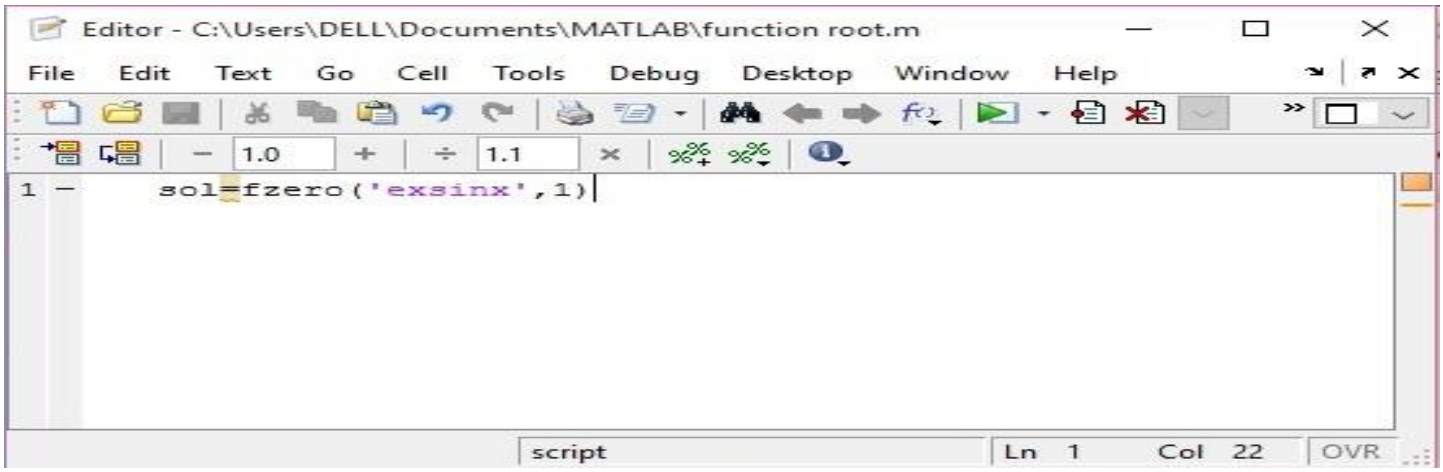
OUTPUT COMMAND:



OUTPUT COMMAND:



.m FILES:



2D and 3D graphics

Problem 7. (a) *Use MATLAB to draw the graph of* $y=\sin x$ *for* $x\in[0,4\pi]$.

(b) *Use MATLAB to draw the graphs of* $y=\sin x$ *and* $y=x^2\sin x$ *in the same figure for* $x\in[0,4\pi]$.

(c) *Plot x, y and z, where* $x=t$, $x=t^{2,}$ $x=\sin(e^t)$ *for* $t\in[-5,5]$.

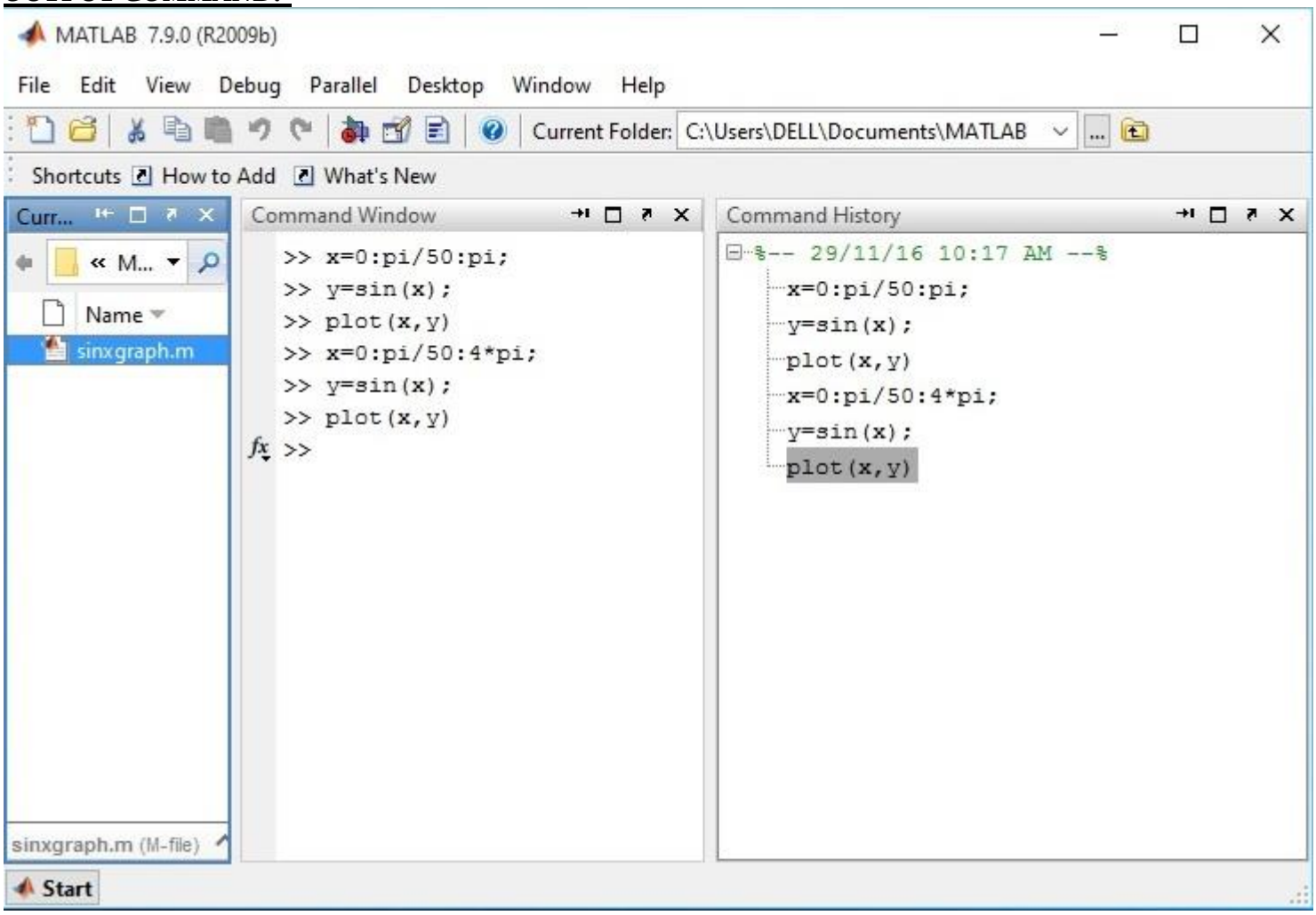
(d) *Draw the surface* $z=\cos x\cos y$ $(x,y\in[-55])$ *using both* surf *and* surfc.

(e) *Draw the bifurcation diagram for the logistic map by running the following:*

```
x=0.5;
for a=2.5:0.0001:4
        y=a*x*(1-x);
        plot(a,y)
        hold on
        x=y;
 end
   hold off
```

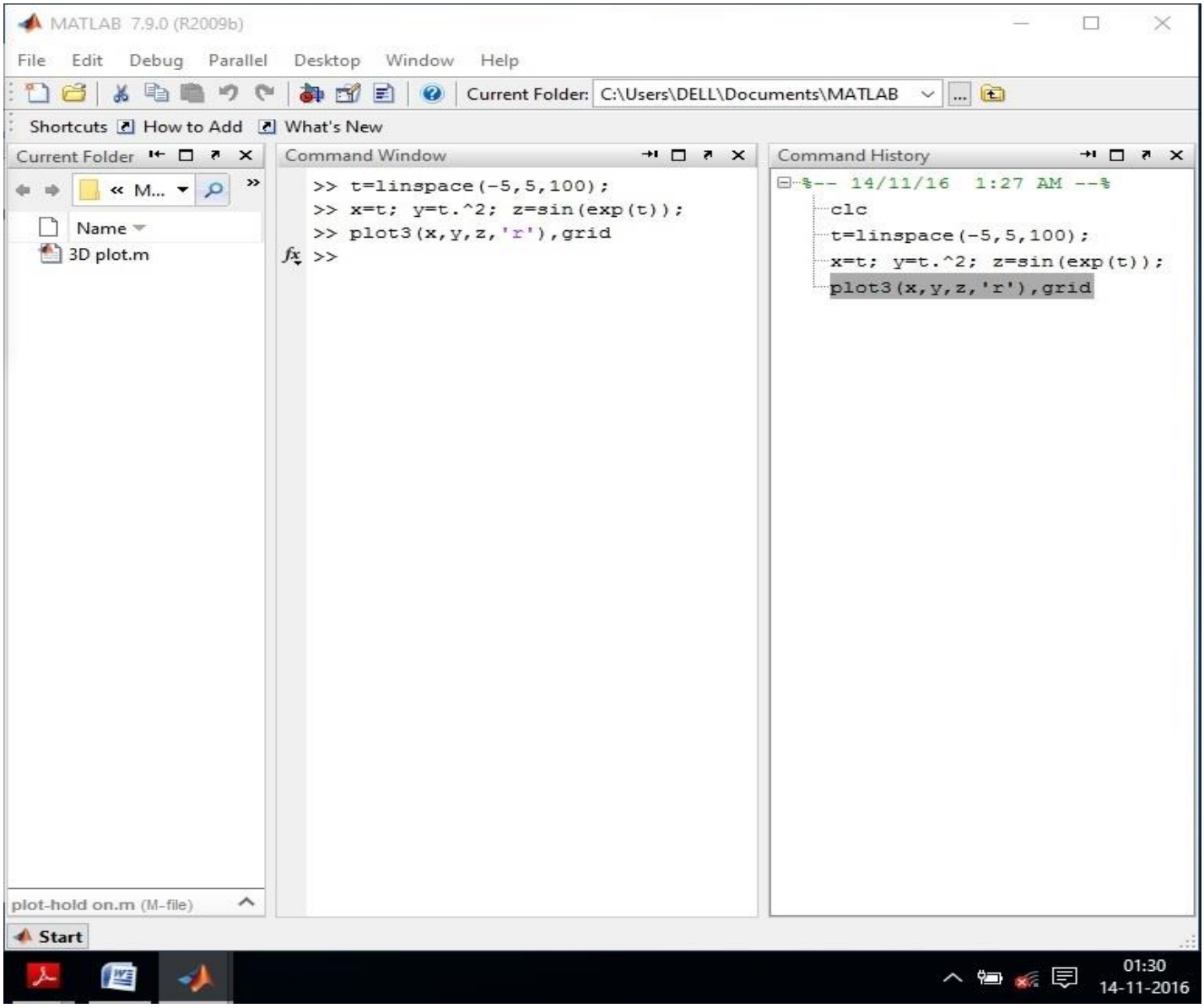
Use while loop to draw the same figure.

OUTPUT COMMAND:

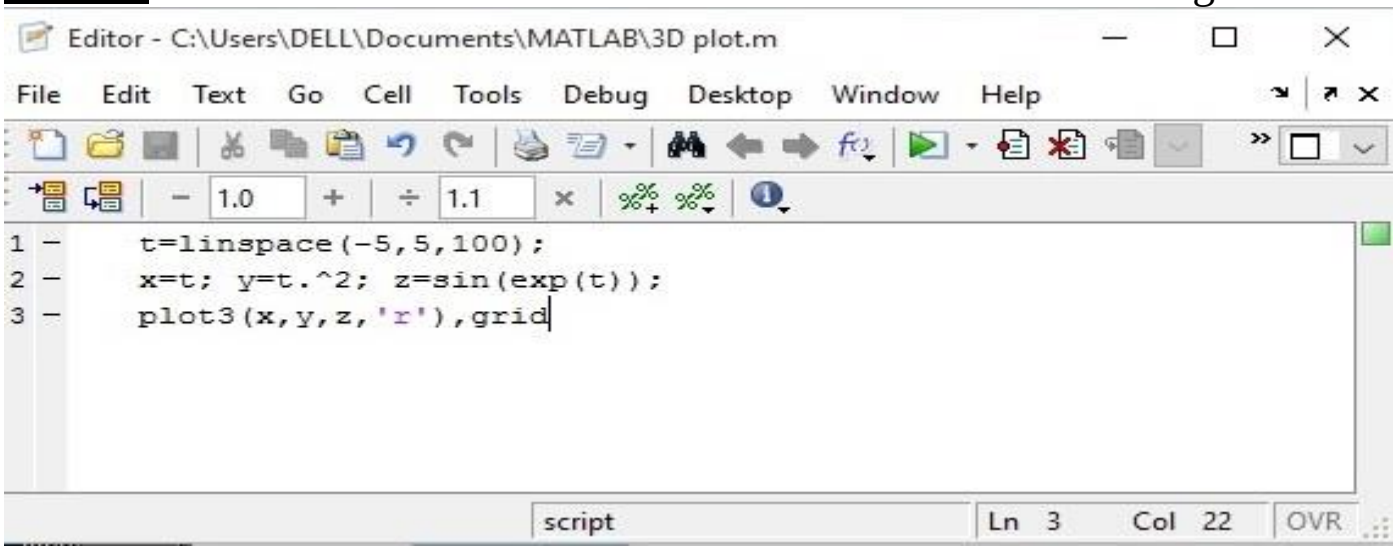


.m FILES:

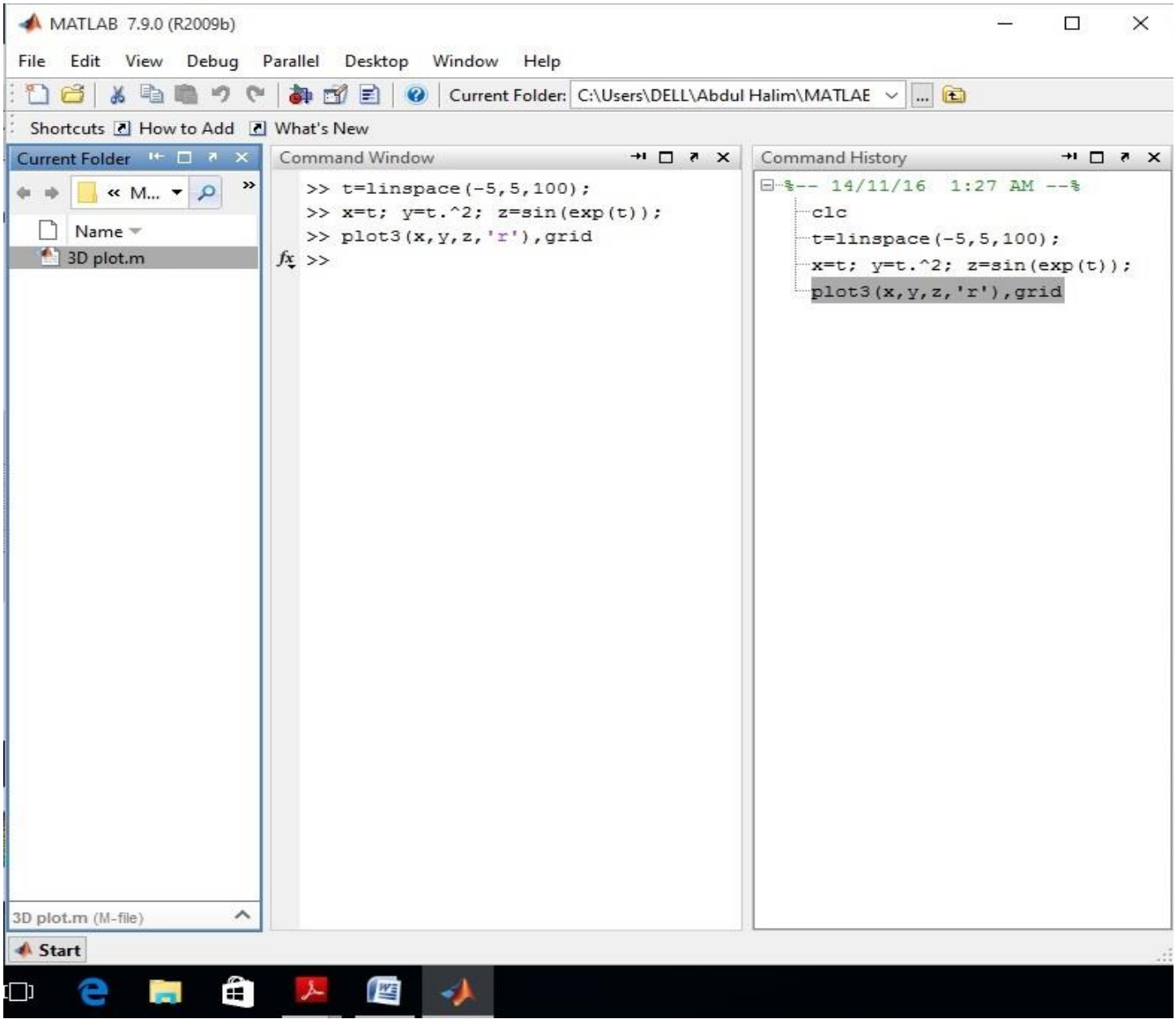
OUTPUT COMMAND:



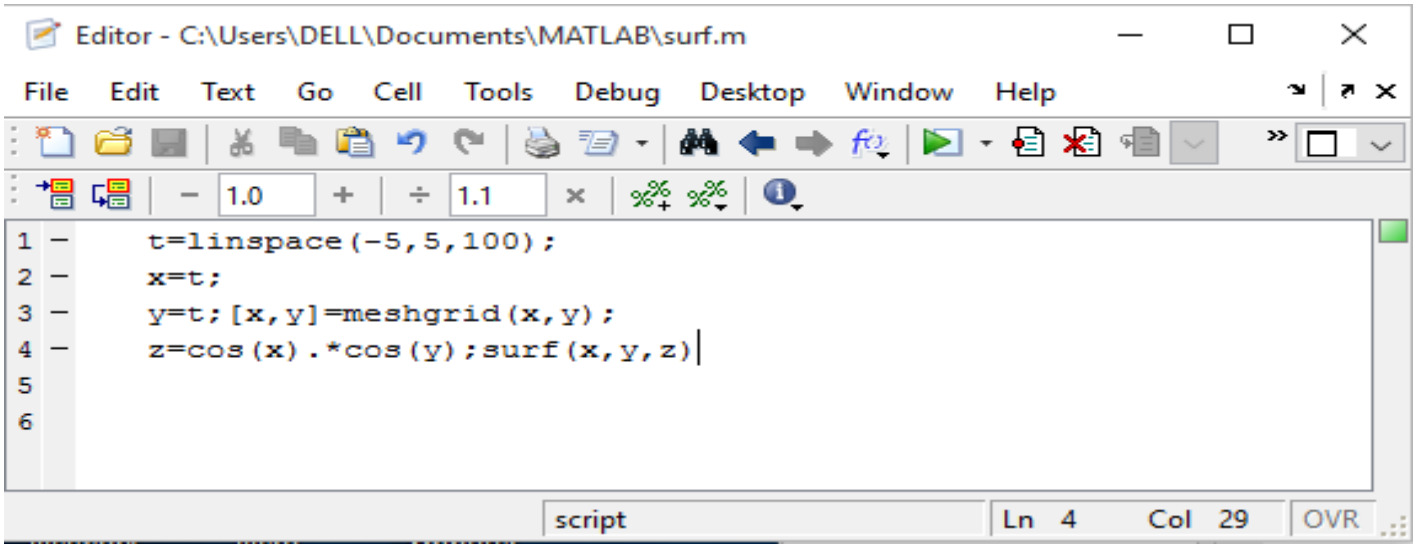
.m FILES:



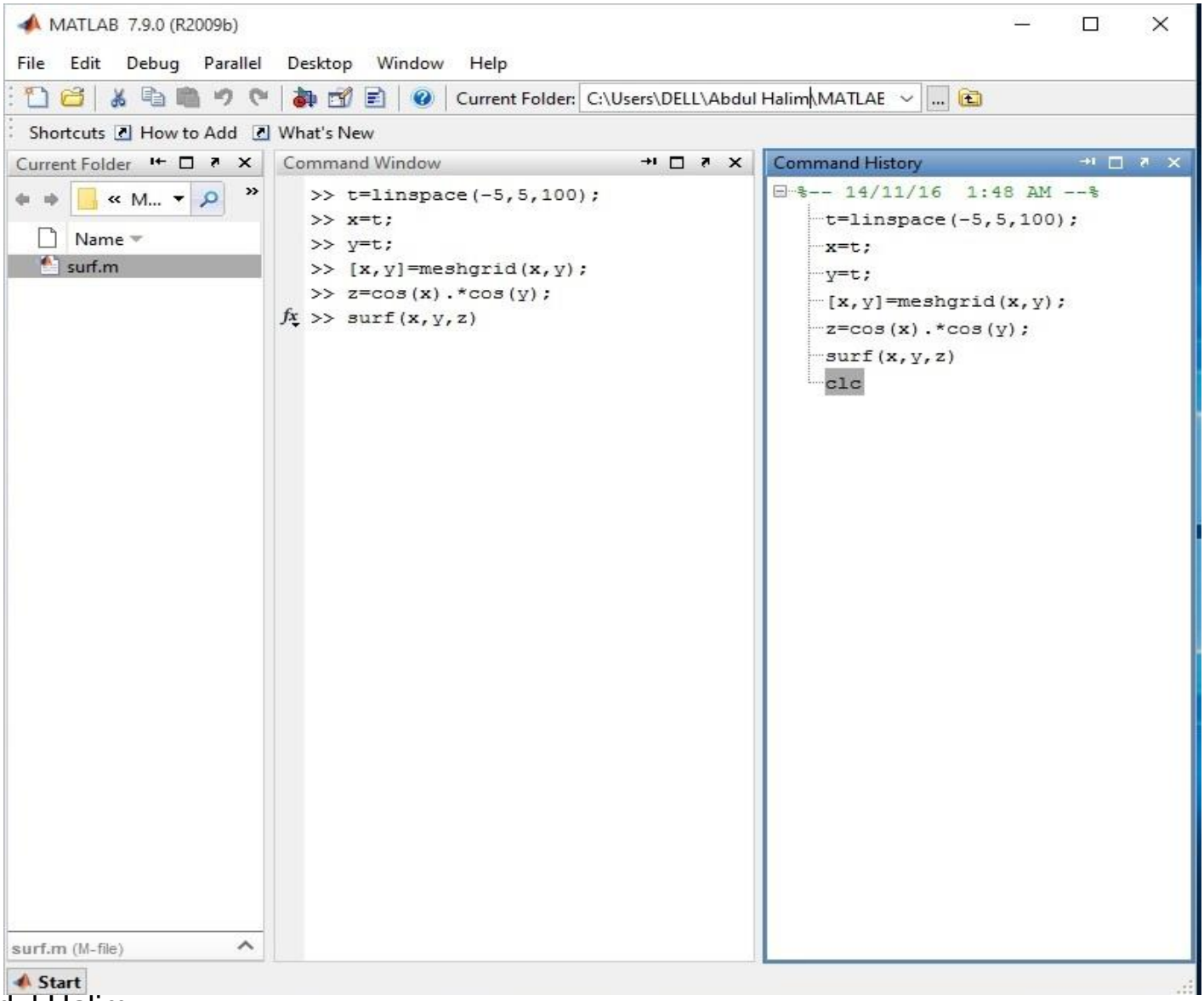
OUTPUT COMMAND:



.m FILES:



RESULTS COMMAND :



.m FILES:

Editor - C:\Users\DELL\Documents\MATLAB\bifru1.m

File Edit Text Go Cell Tools Debug Desktop Window Help

```
1  x=0.5;
2  a=2.5;
3  while(a<4)
4      y=a.*x.*(1-x);
5      plot(a,y)
6      hold on
7      x=y;
8      a=a+0.0001;
9  end
10     hold off
```

script Ln 10 Col 12 OVR

OUTPUT COMMAND:

MATLAB 7.9.0 (R2009b)

File Edit View Debug Parallel Desktop Window Help

Current Folder: C:\Users\DELL\Abdul Halim\MATLAE

Shortcuts How to Add What's New

Command Window

```
>> x=0.5;
>> a=2.5;
>> while(a<4)
y=a.*x.*(1-x);
plot(a,y)
hold on
x=y;
a=a+0.0001;
end
hold off
>>
```

Workspace

Stack: Base Select ...

Name	Value	Min
a	4.0000	4.0000
x	0.9942	0.9942
y	0.9942	0.9942

Command History

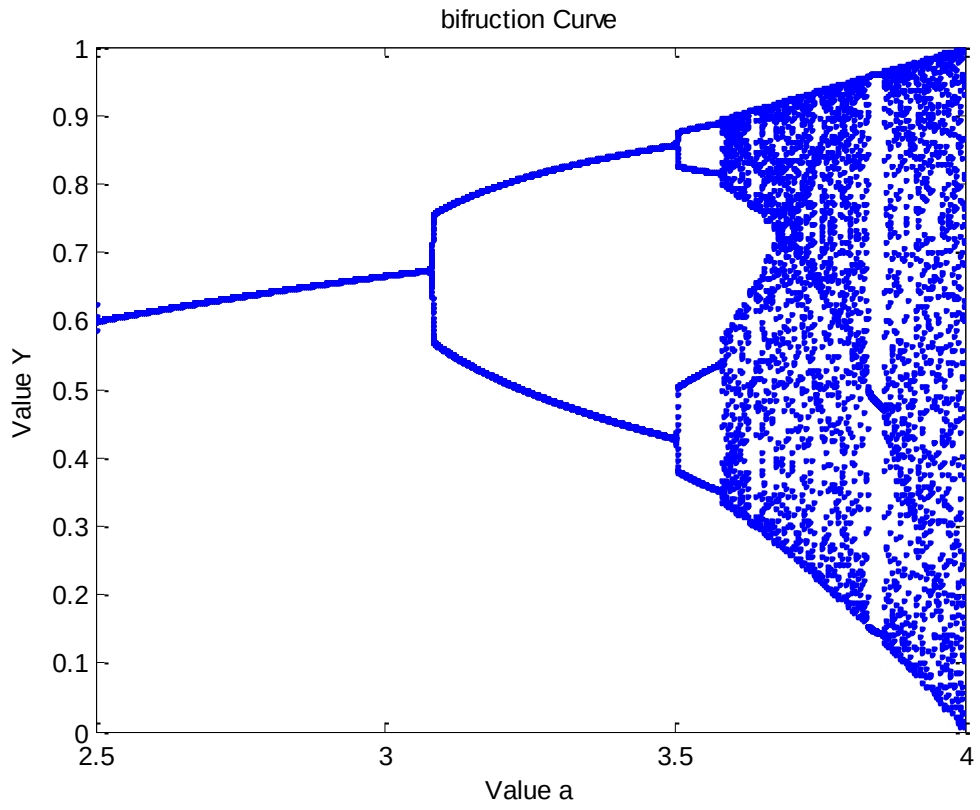
```
%-- 16/11/16 12:25 PM --%
clc
%-- 16/11/16 12:47 PM --%
x=0.5;
a=2.5;
while(a<4)
y=a.*x.*(1-x);
plot(a,y)
hold on
x=y;
a=a+0.0001;
end
hold off
```

Name
bifru1.m
bifru.fig

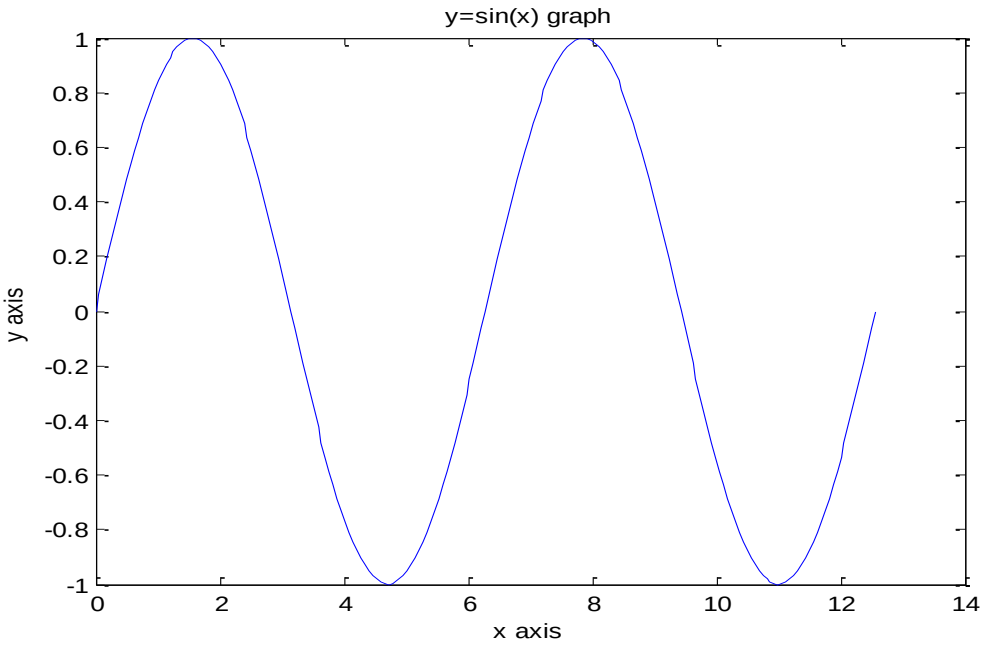
bifru1.m (M-file)

Start

OUTPUT PICTURE:



OUTPUT PICTURE:



Solutions of differential equations

Problem 8. (a) *Use MATLAB to solve the following ODE:*

$$\frac{dx}{dt} = t + x^2, \qquad x(0) = 0, \text{ for } t \in [0,1].$$ *Plot t versus x.*

(b) *Consider the following system of differential equations:*

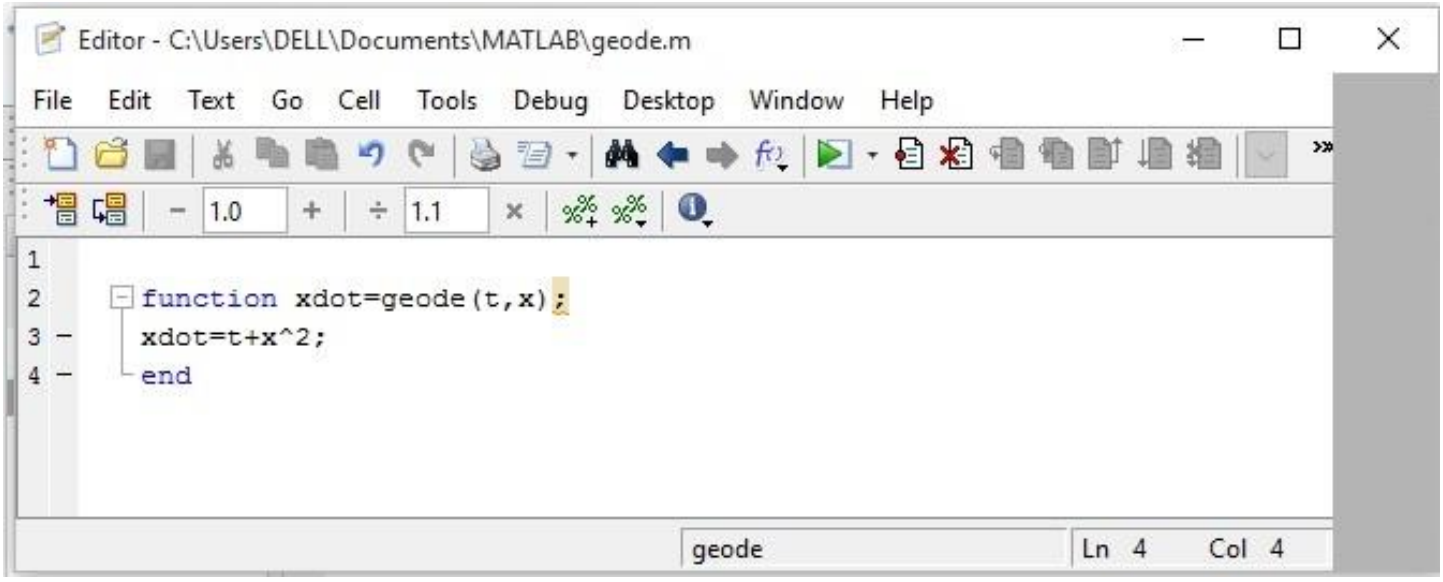
$$\frac{dx}{dt} = x(1-x) - \frac{2xy}{0.5+x},, \qquad x(0) = 0.5,$$

$$\frac{dy}{dt} = \frac{cxy}{0.5+x} - y, \qquad y(0) = 0.5.$$

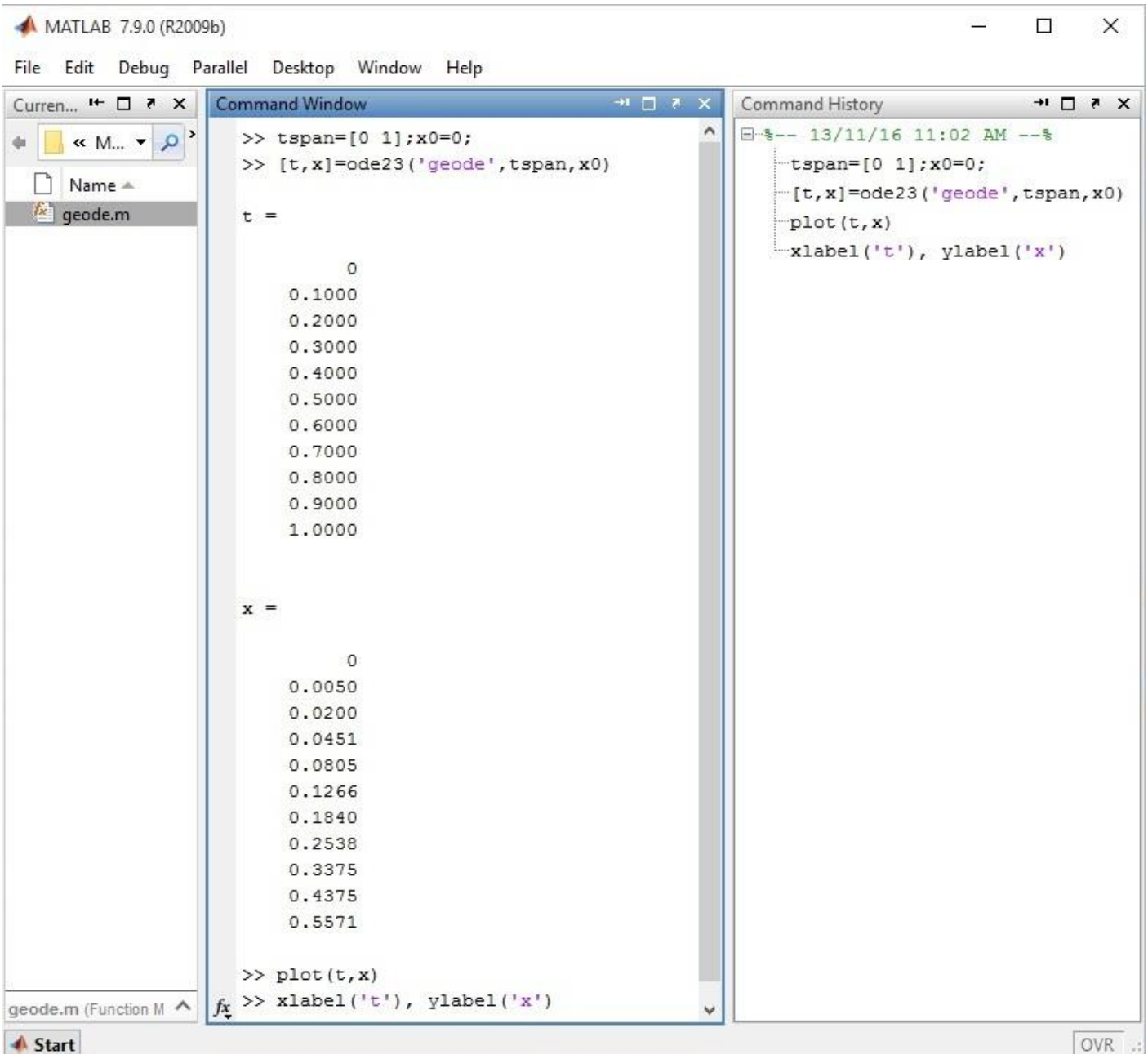
(i) Take c = 2. Use MATLAB to solve the above system for t = 0 to t = 500, and plot the solution (x versus y). Also plot t versus x and t versus y in a single figure (Use red colour to indicate x and blue to indicate y).

(ii) Take c = 4. Use MATLAB to solve the above system for t = 0 to t = 500, and plot the solution (x versus y). Also plot t versus x and t versus y in a single figure (Use red colour to indicate x and blue to indicate y).

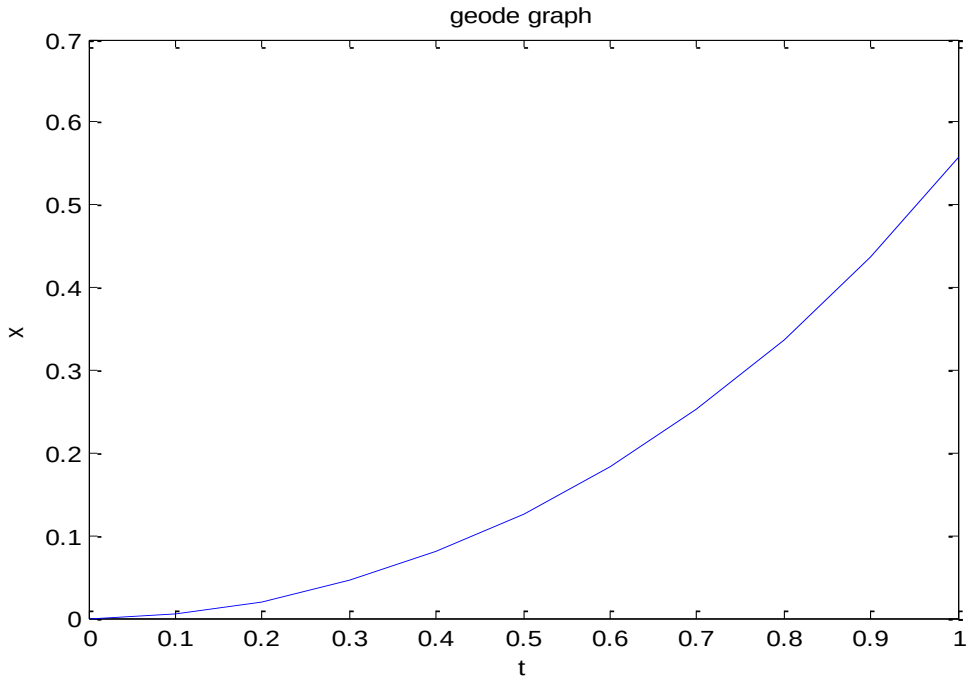
.m FILES (FUNCTION):



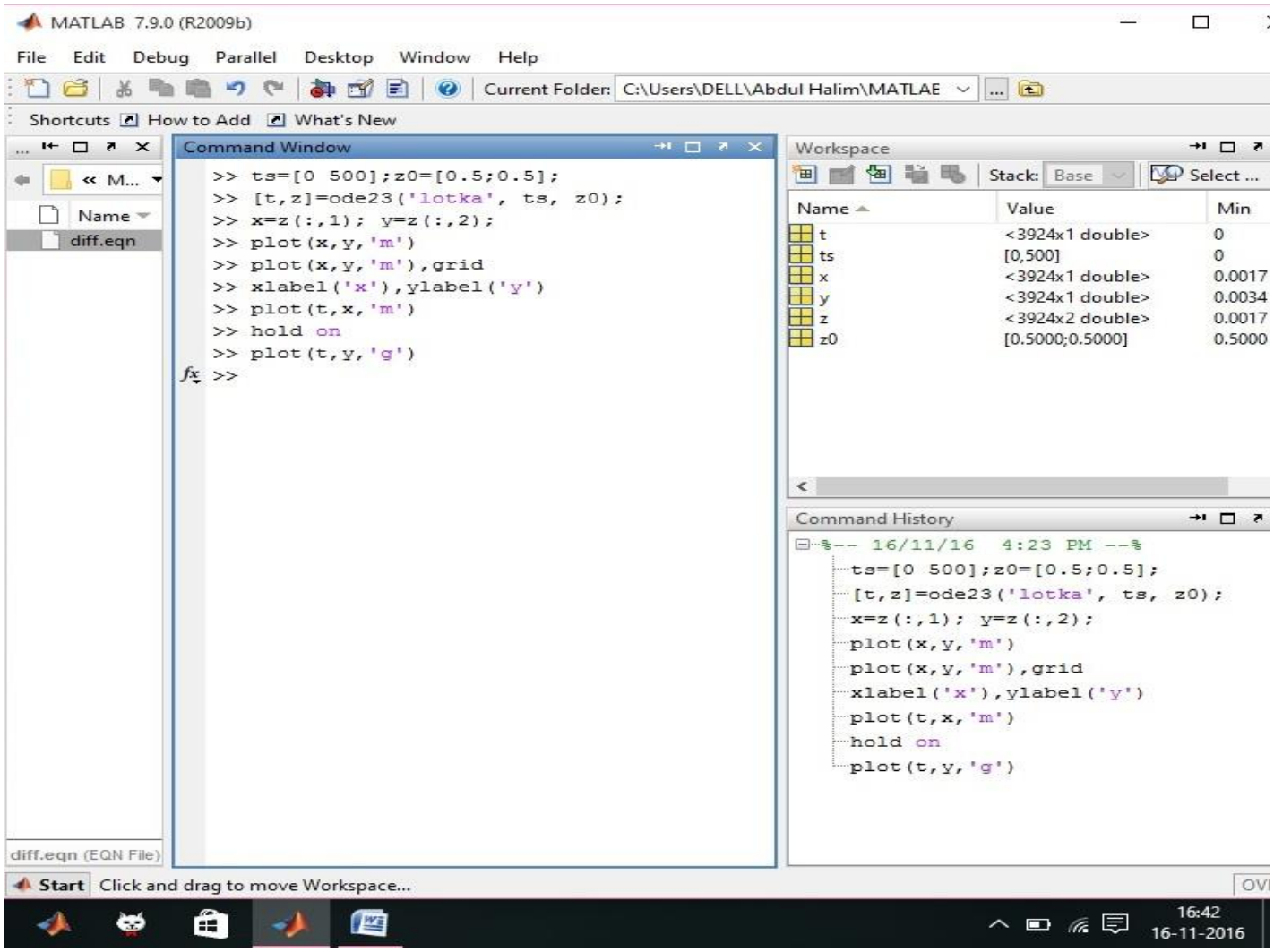
OUTPUT COMMAND:



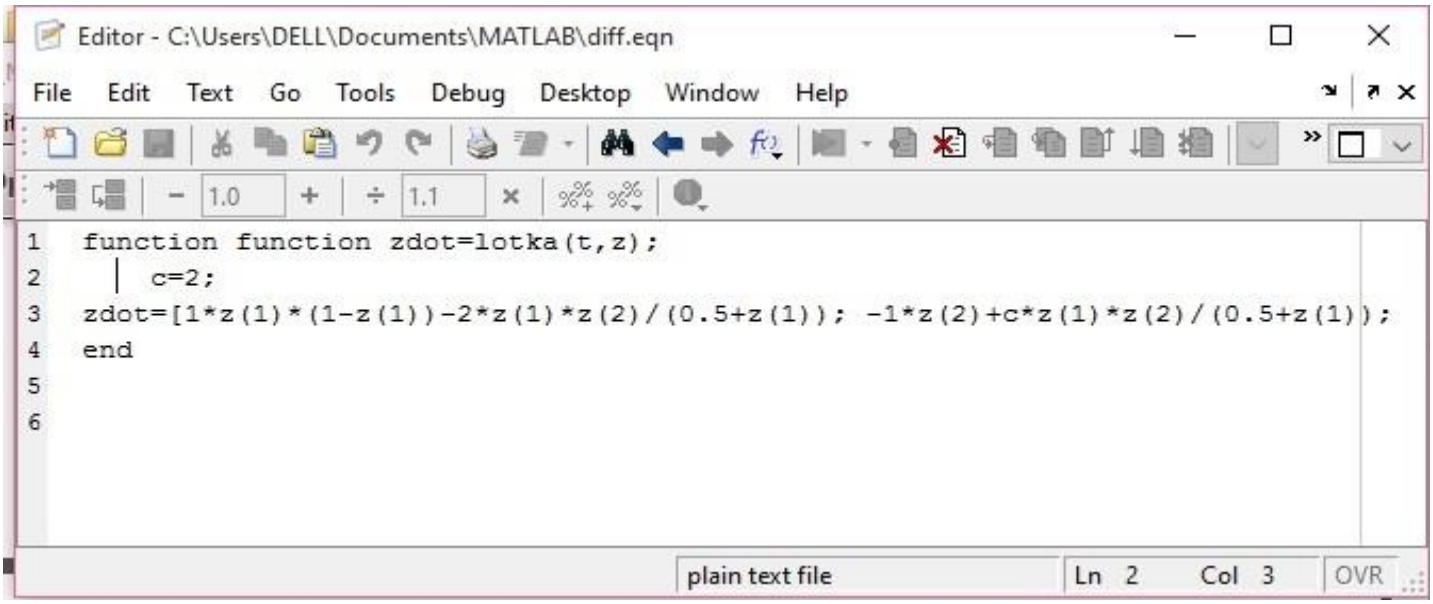
OUTPUT GRAPH:



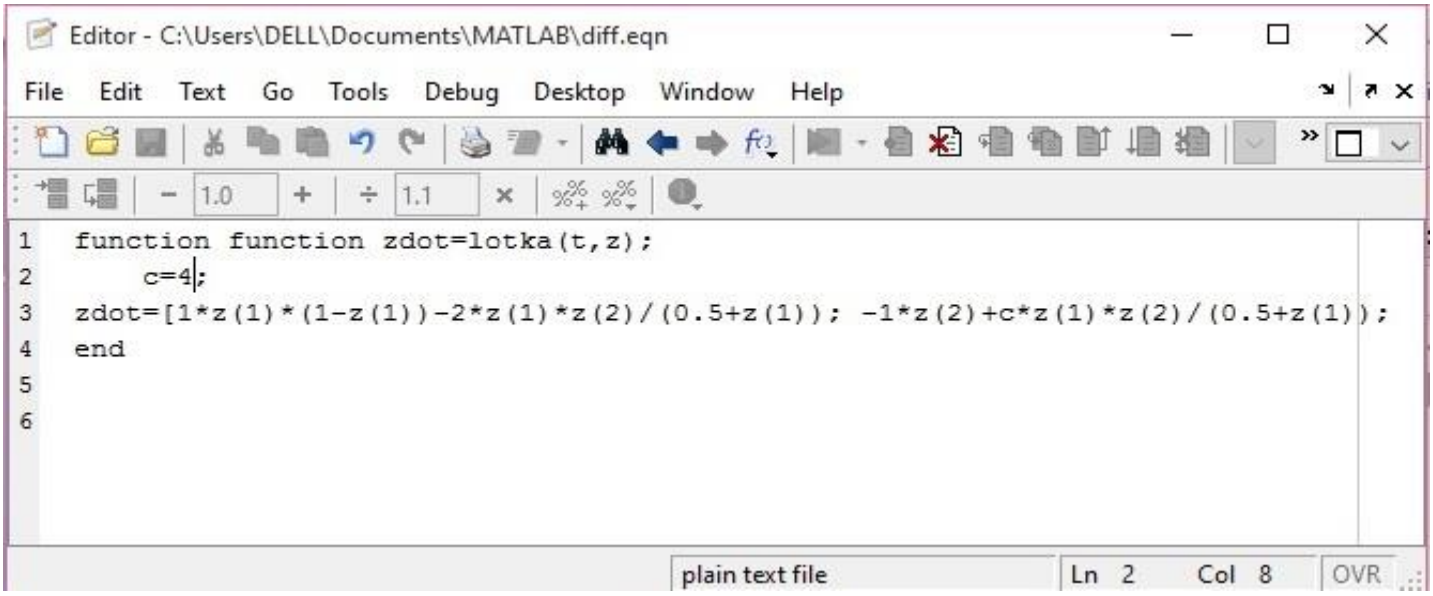
OUTPUT COMMAND:



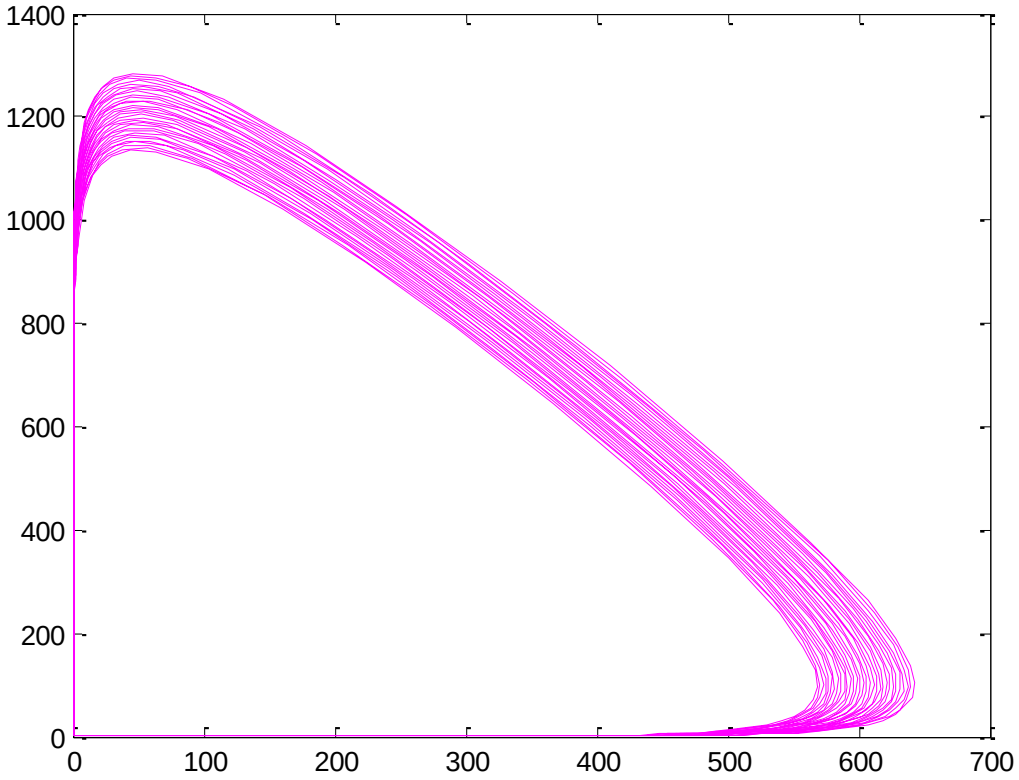
.m FILES(FUNCTION):

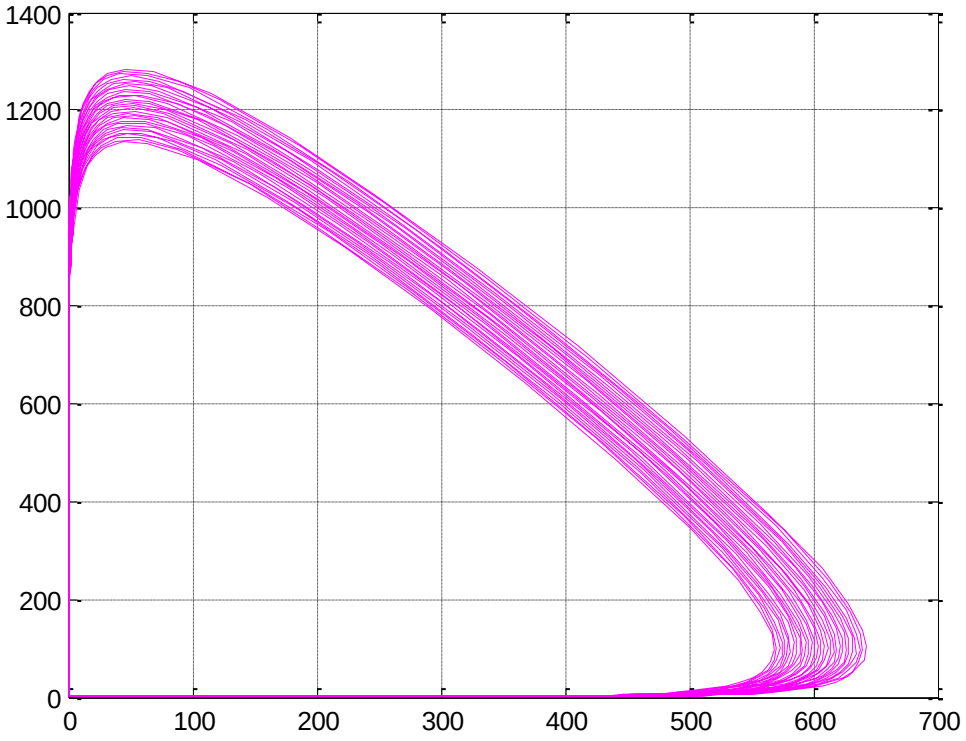


.m FILES(FUNCTION):

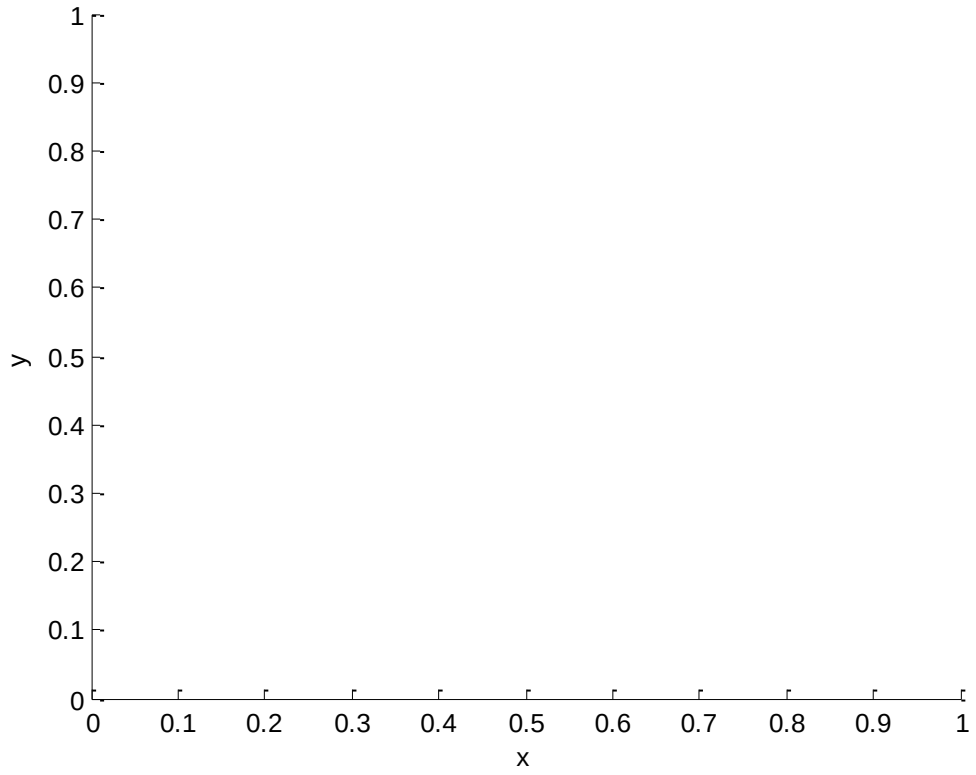


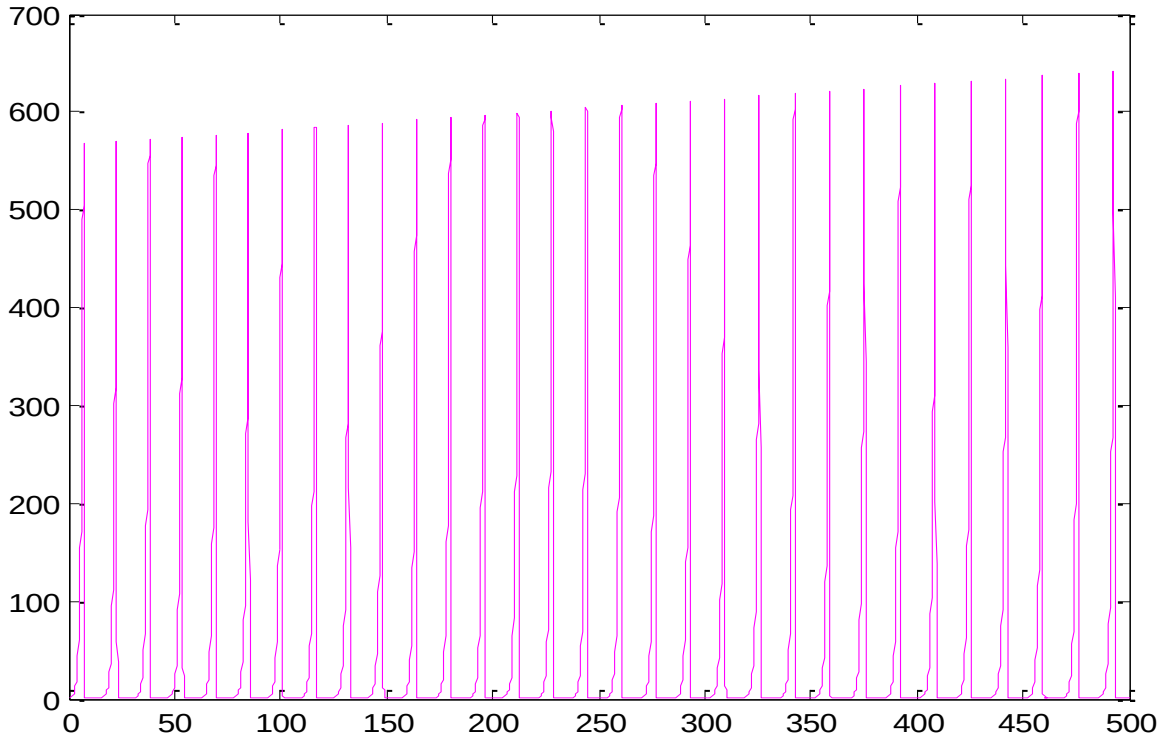
OUTPUT GRAPH:





OUTPUT GRAPH:





Handling complex numbers

Problem 9. *Let z=2+3i. Use MATLAB to answer the following questions.*

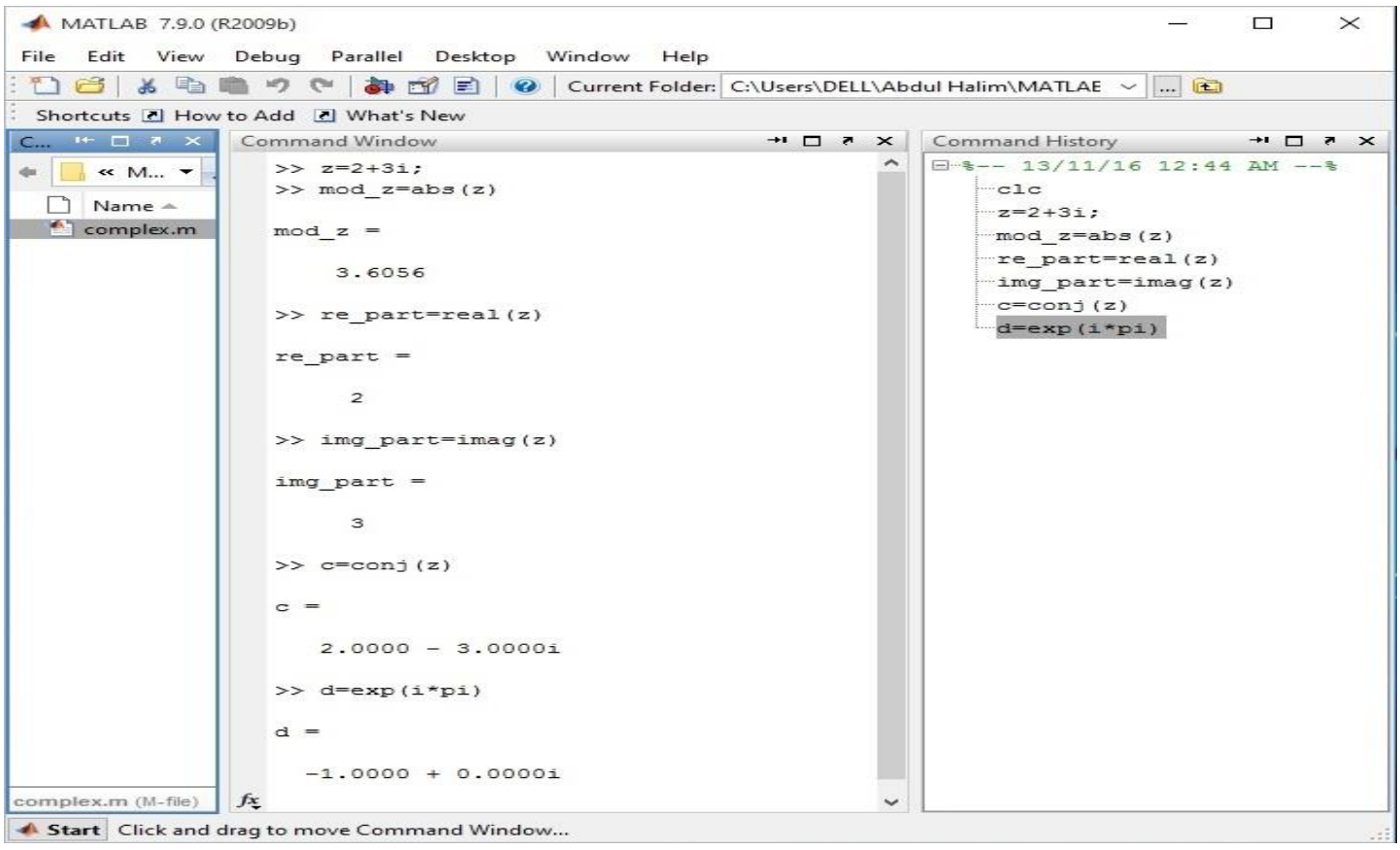
(a) *Find |z|.*

(b) *Find the real and imaginary parts of z.*

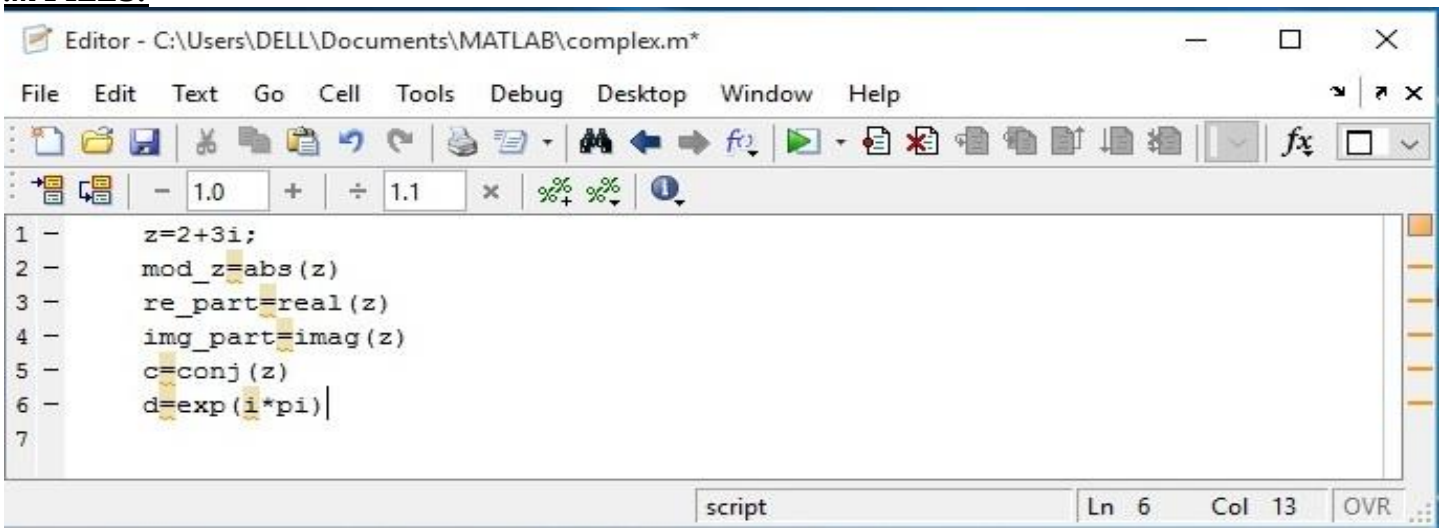
(c) *Find the conjugate of z.*

(d) *Compute the value of* $e^{i\pi}$.

OUTPUT COMMAND:



.m FILES:



Statistical data analysis

Problem 10. *Consider the following data:*

5, 10, 15, 20, 25, 30, 40, 50.

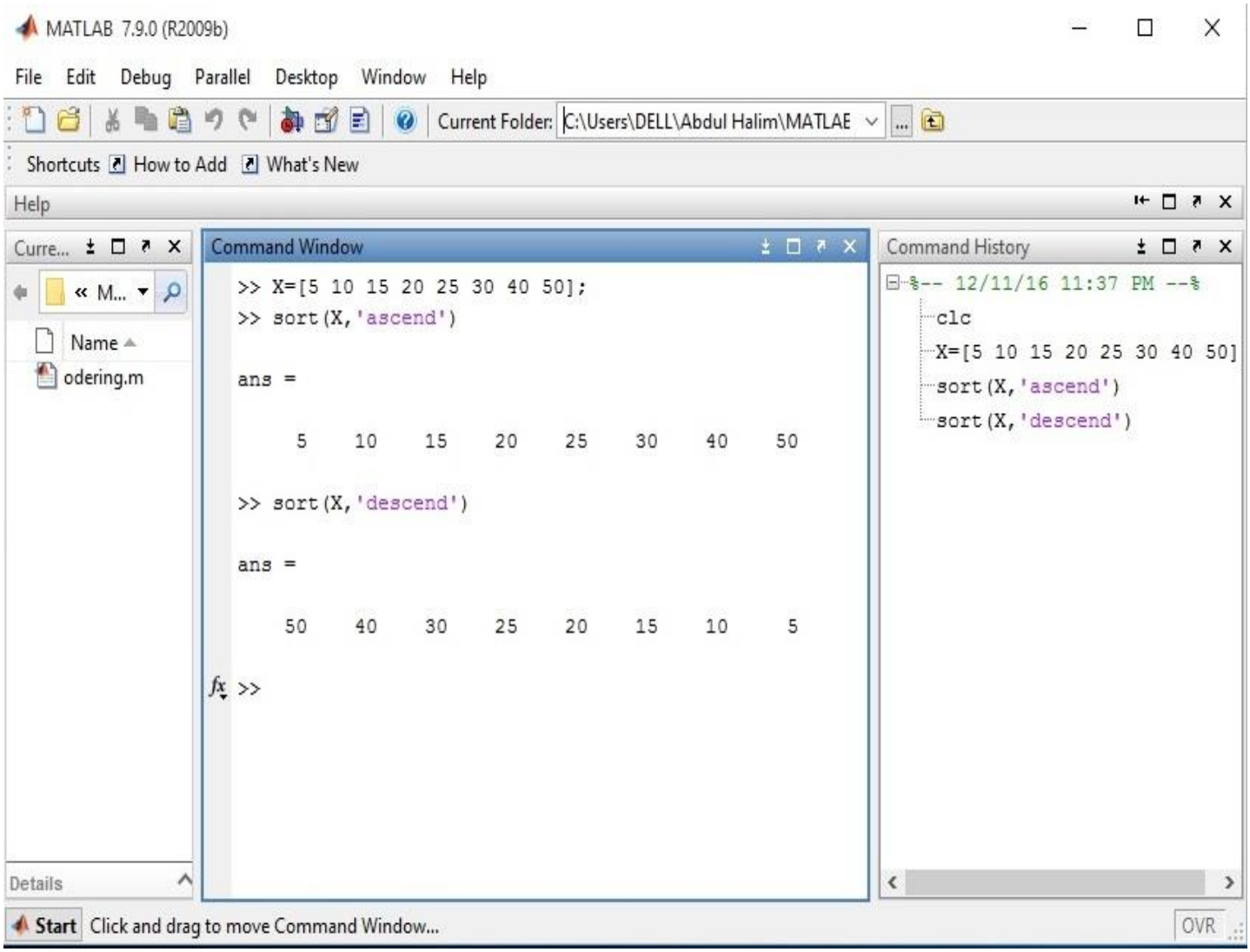
Use MATLAB to answer the following questions.

(a) Sort the numbers in ascending and descending order.

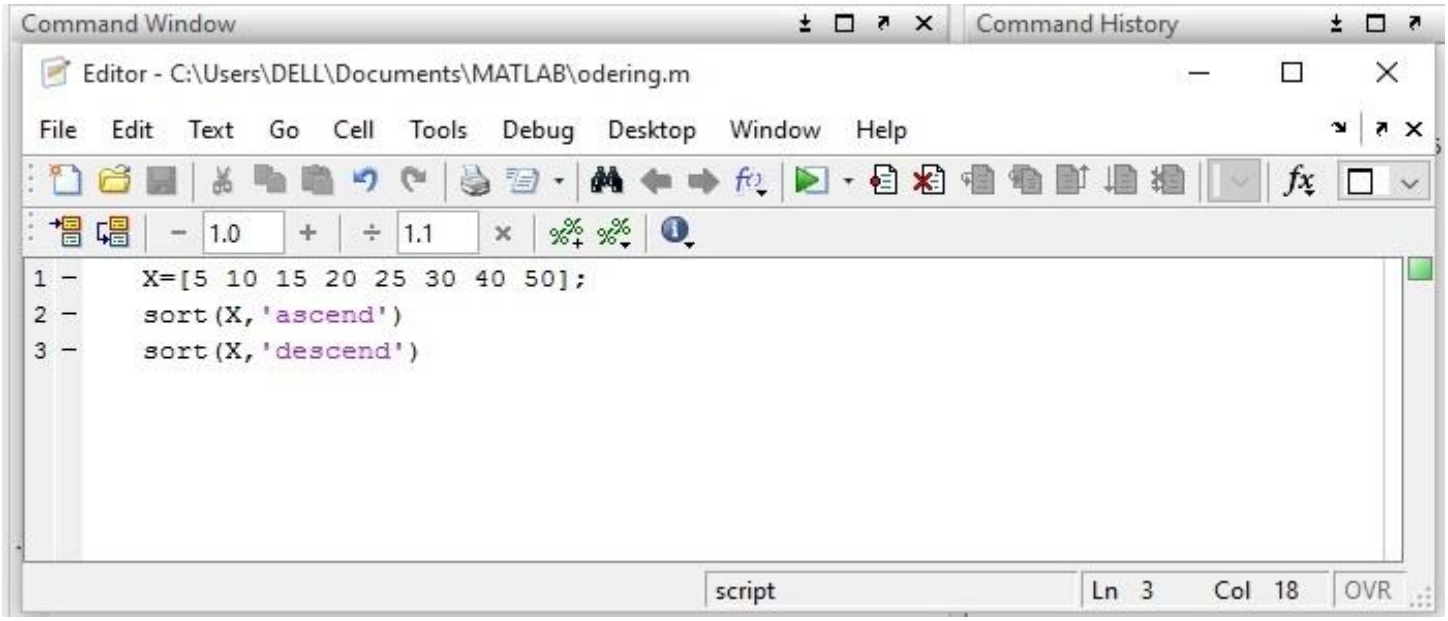
(b) Find (i) minimum and maximum value, (ii) mean, (iii) median, (iv) standard deviation of the data.

(c) Draw a histogram, a bar diagram (both horizontal and vertical), and a pie chart of the data.

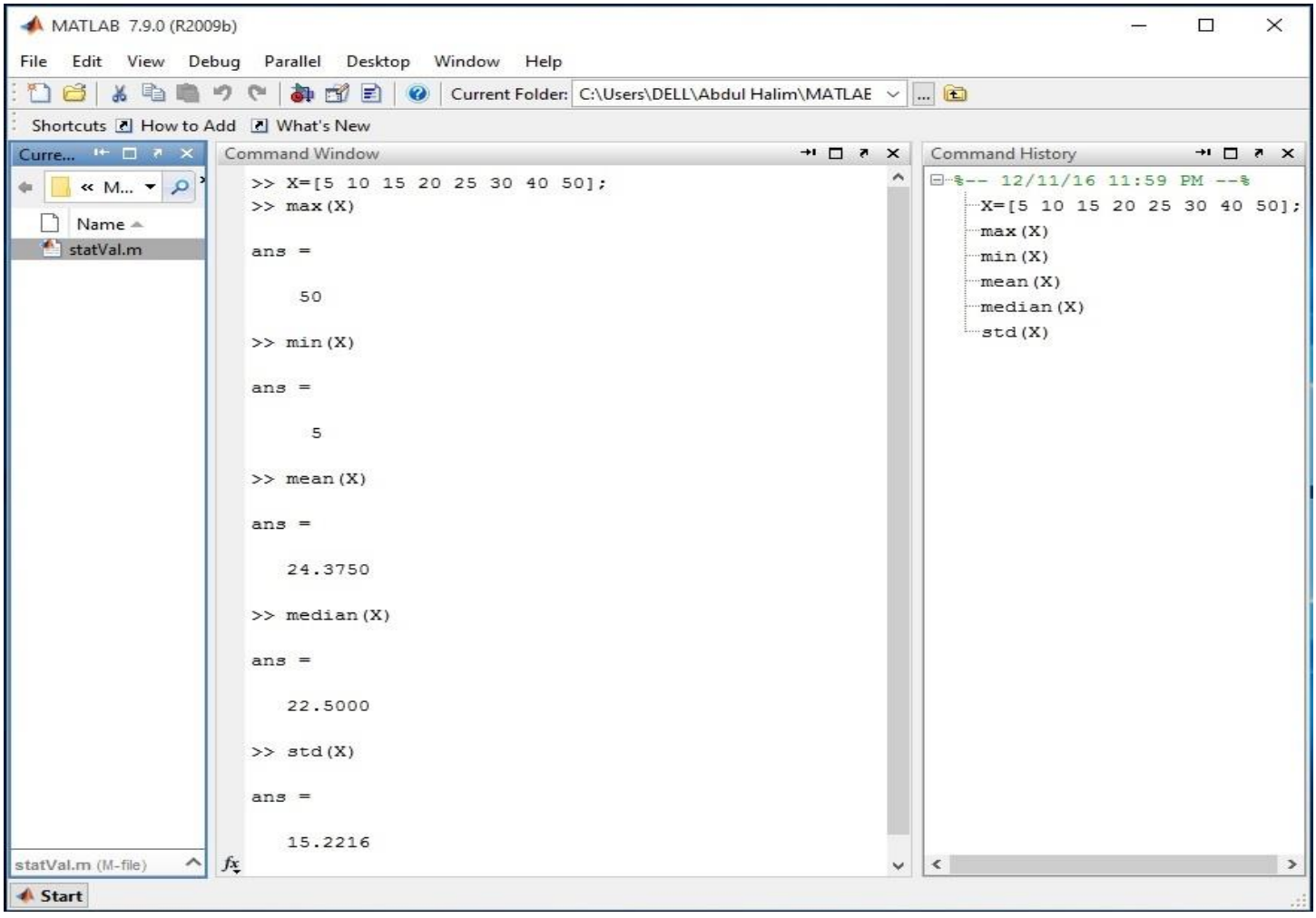
OUTPUT COMMAND:



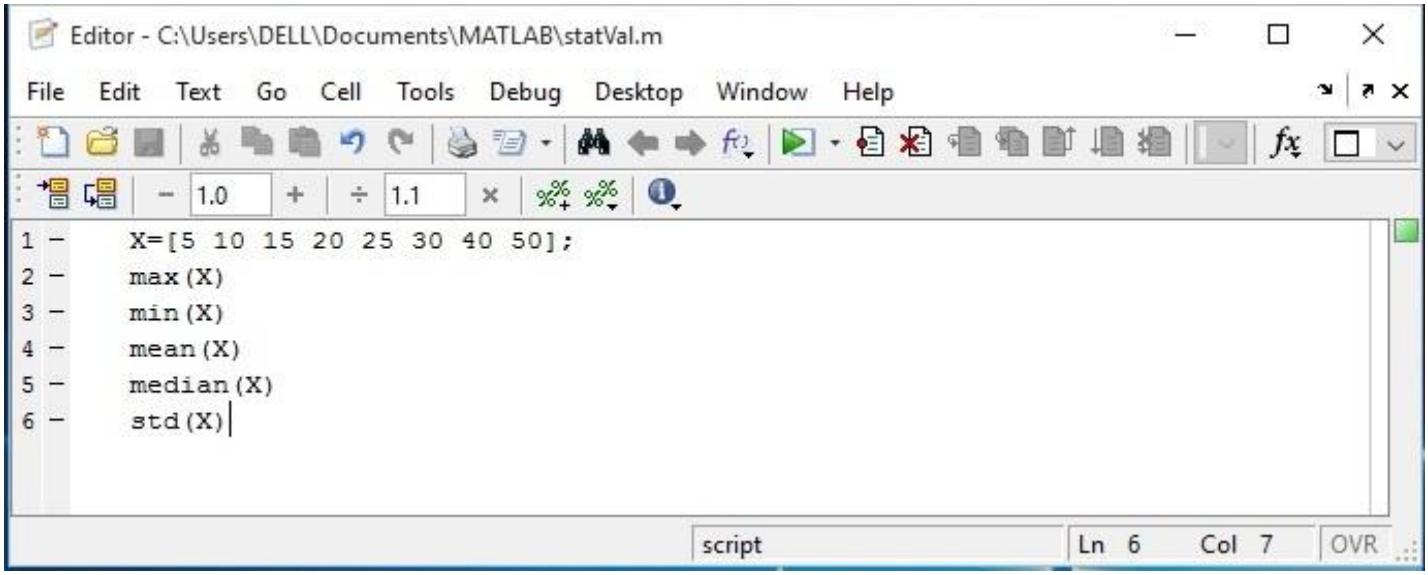
.m FILES:



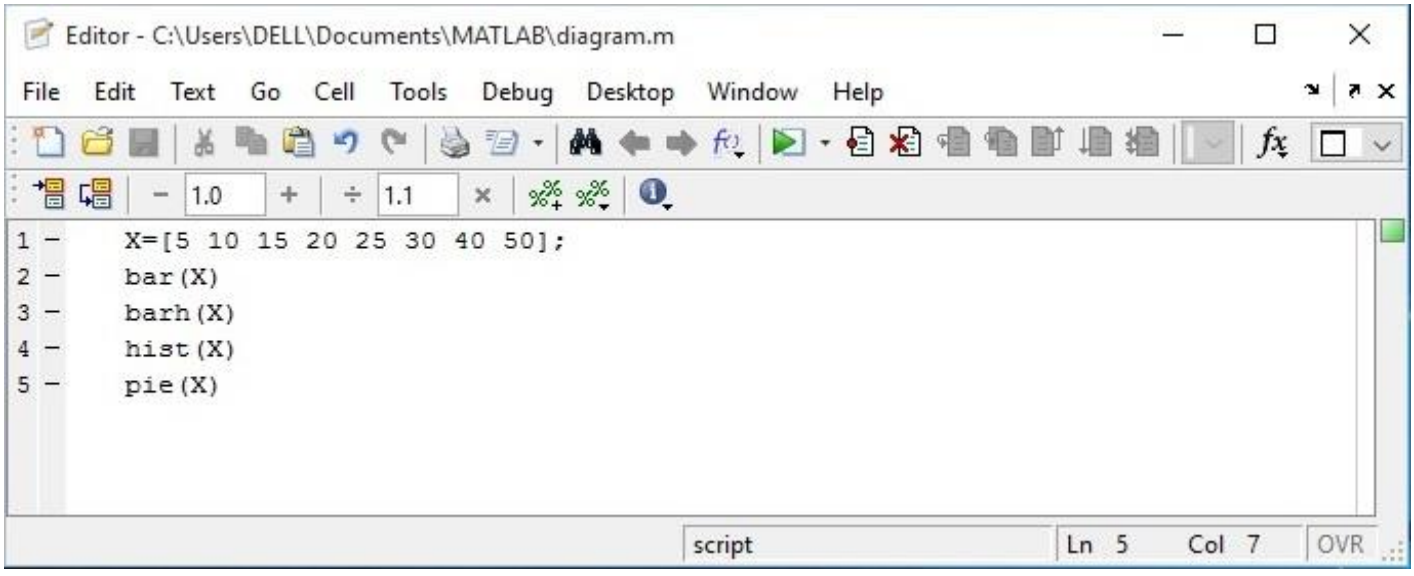
OUTPUT COMMAND:



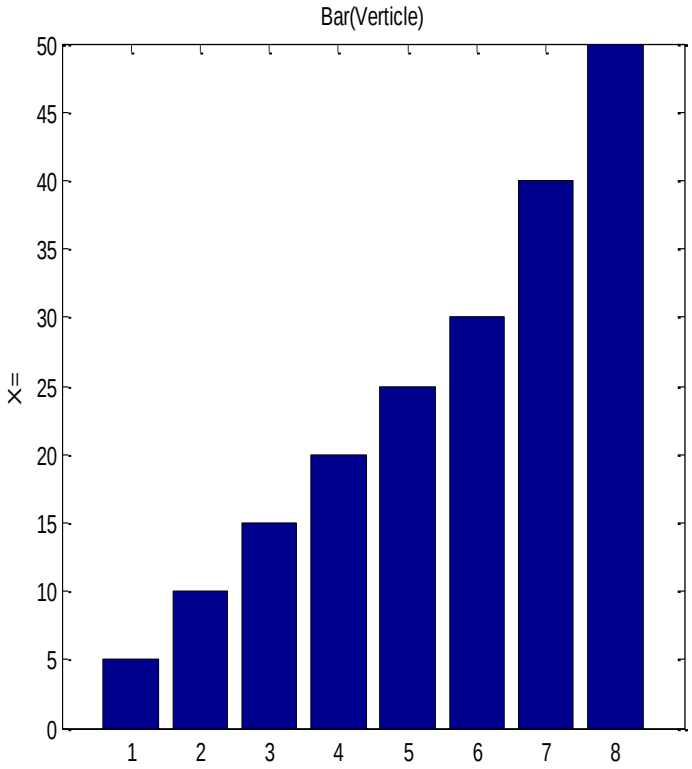
.m FILES:

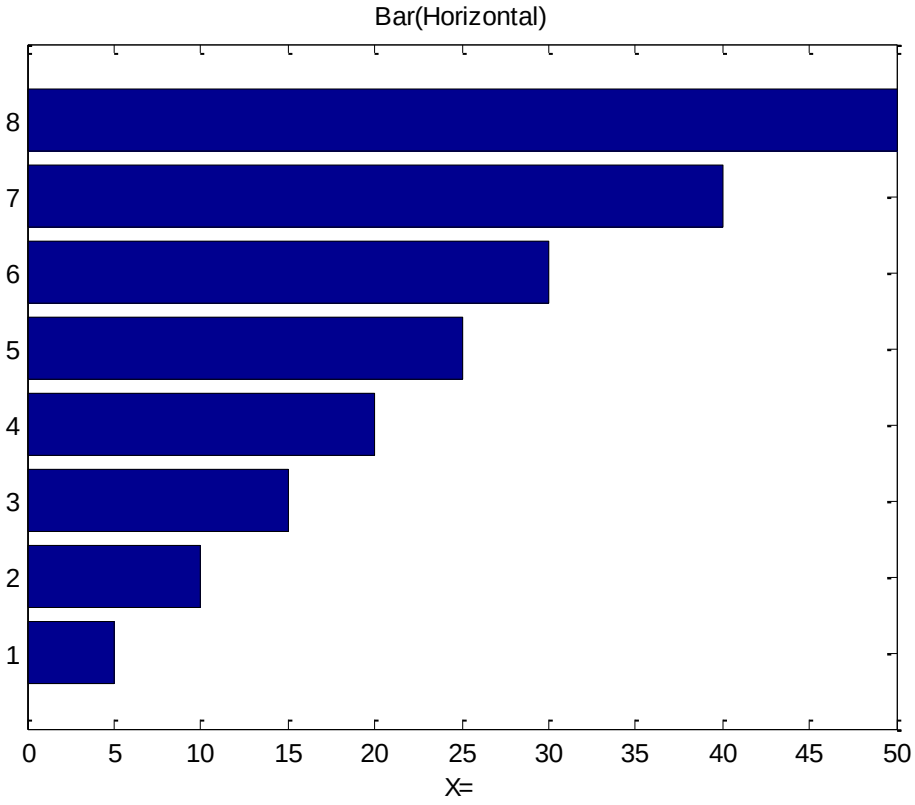


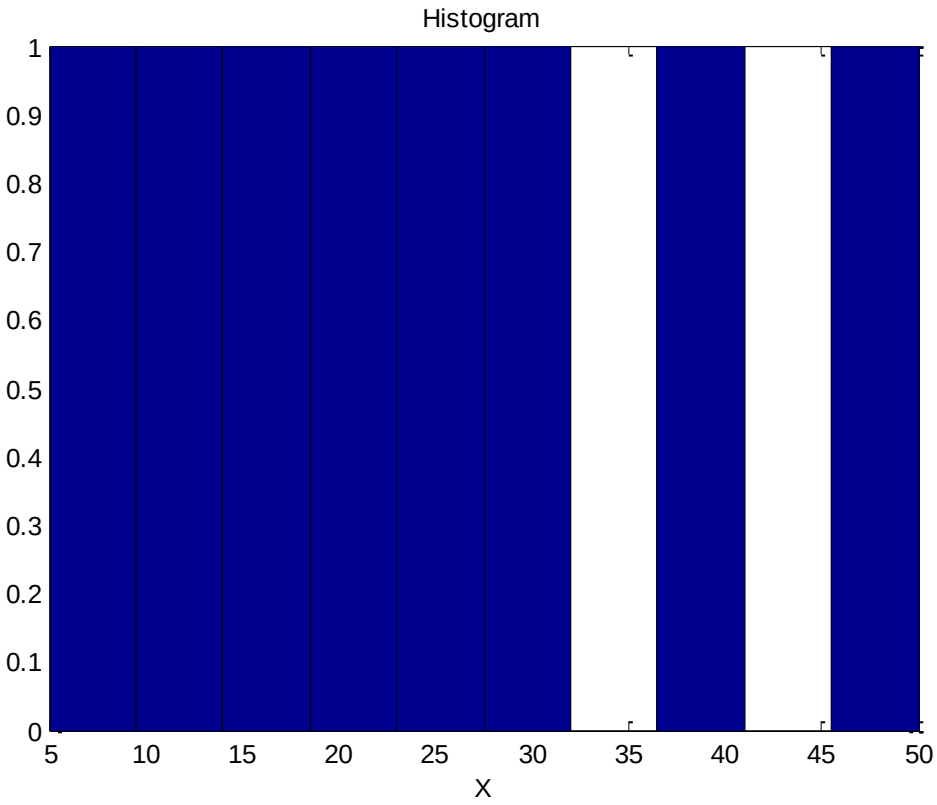
OUTPUT COMMAND:

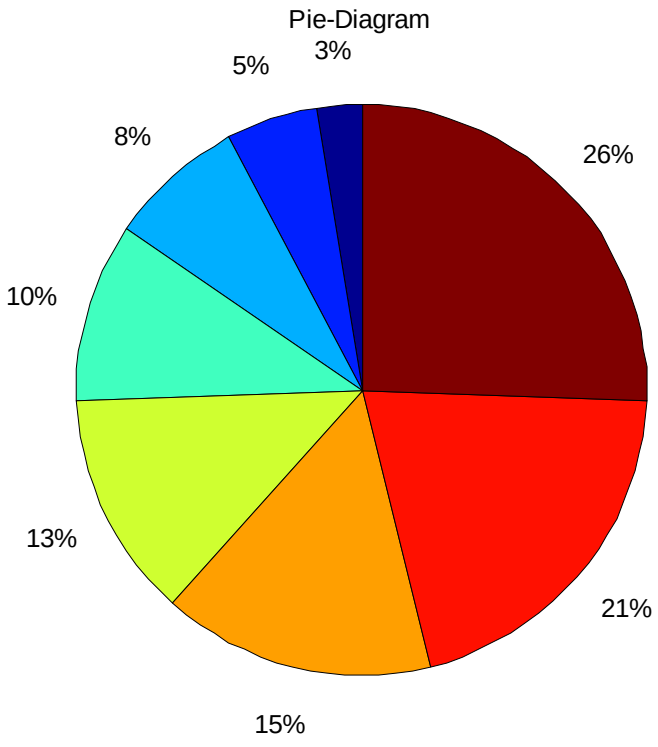


OUTPUT GRAPH:






Histogram
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5
10
15
20
25
30
35
40
45
50
X


Pie-Diagram
3%
5%
8%
26%
10%
13%
21%
15%

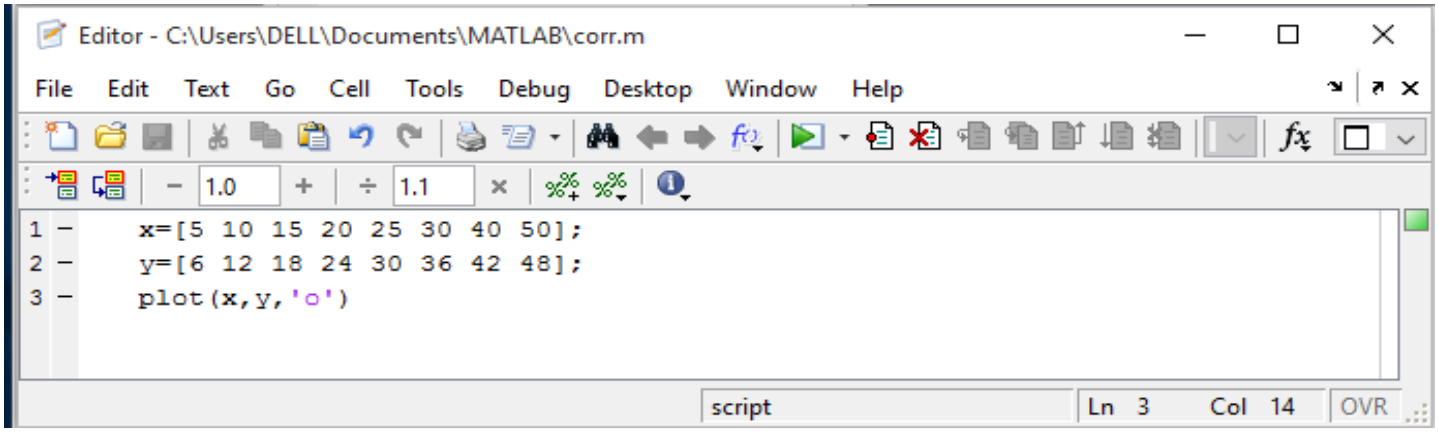
Correlation and curve fitting

Problem 11. *Consider the following bivariate data:*
Use MATLAB to answer the following questions.

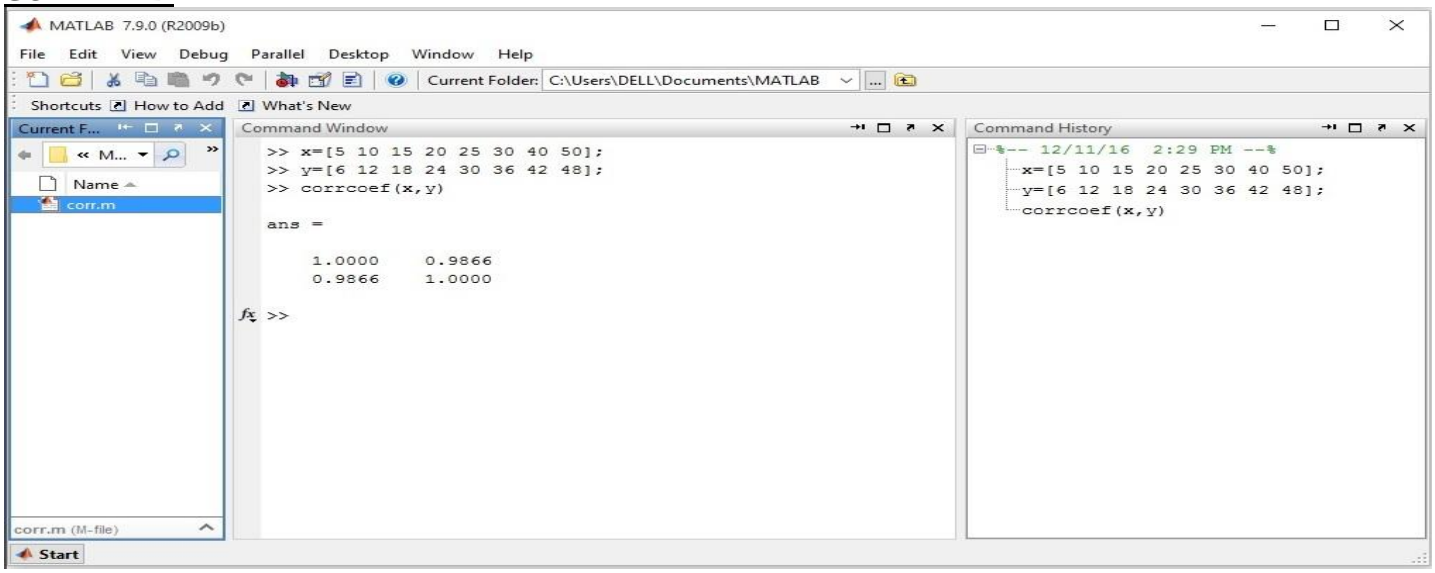
x	y
05	06
10	12
15	18
20	24
25	30
30	36
40	42
50	*48*

(a) Find the correlation coefficient.
(b) Draw a scatter diagram.
(c) Fit polynomials of degree 2,3,4 to the data.

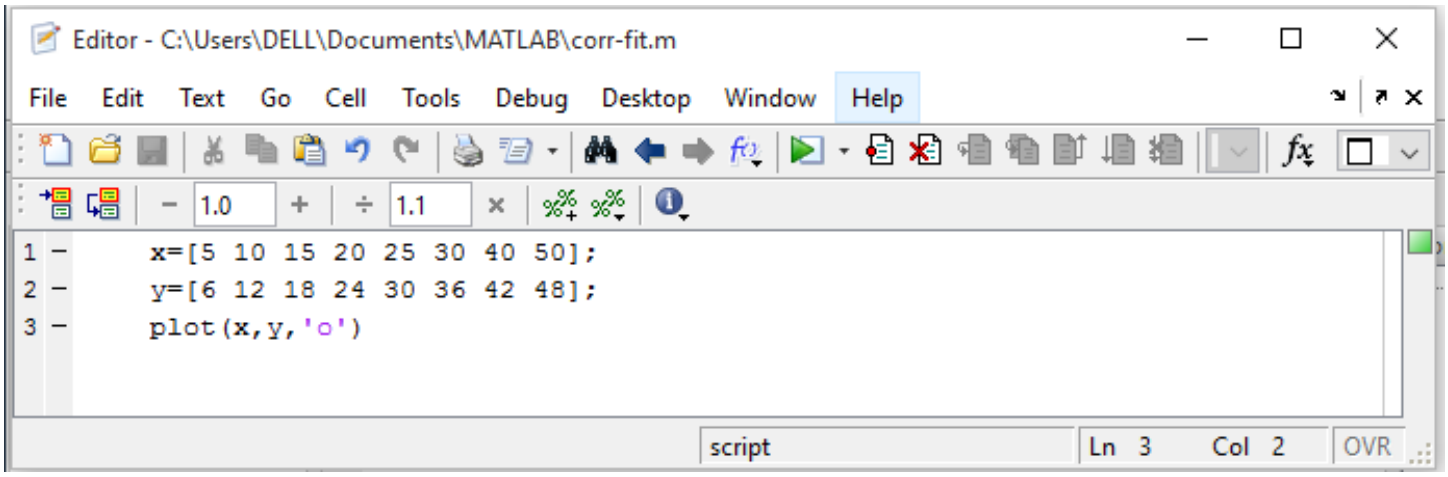
.m FILES:



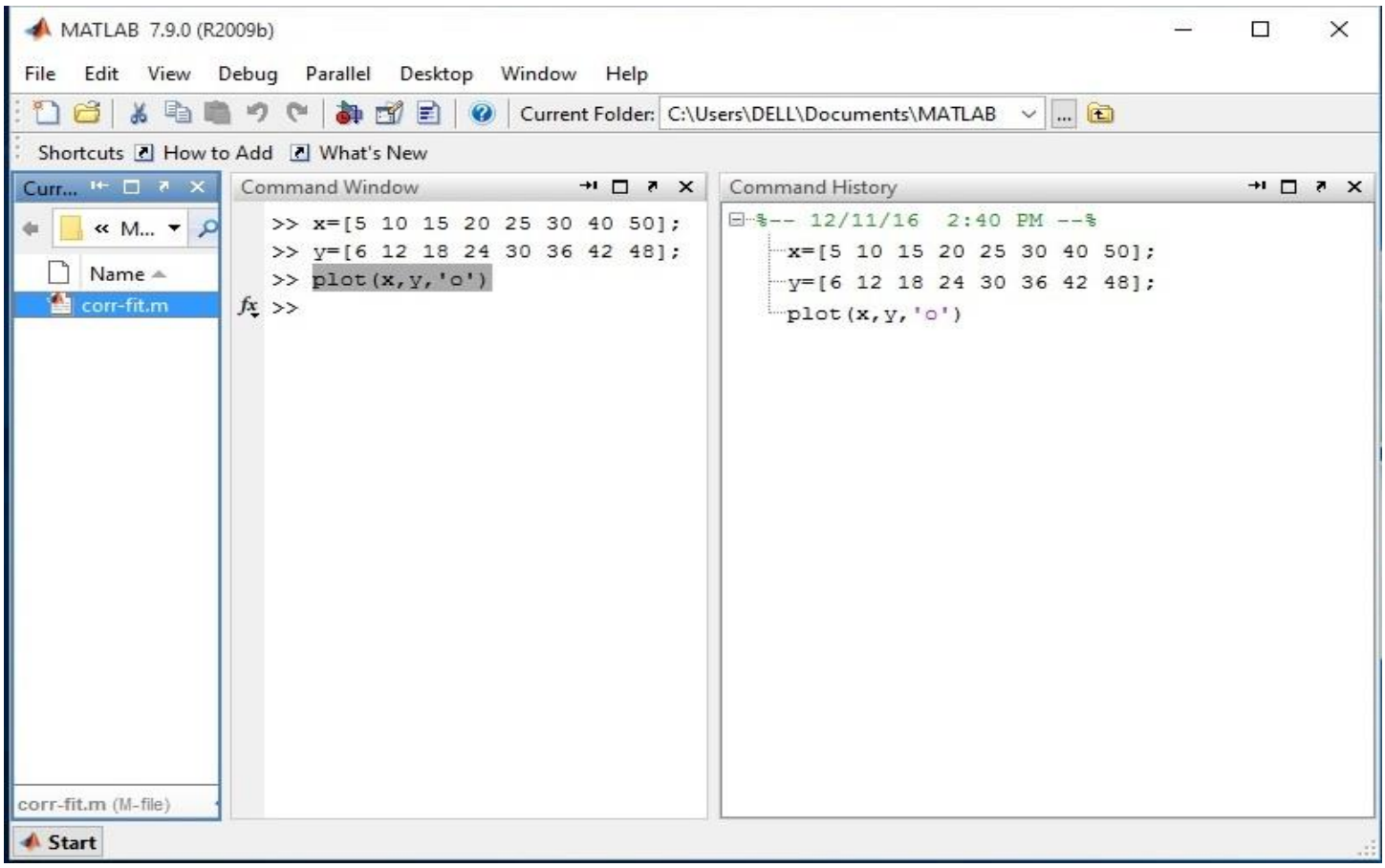
OUTPUT
COMMAND



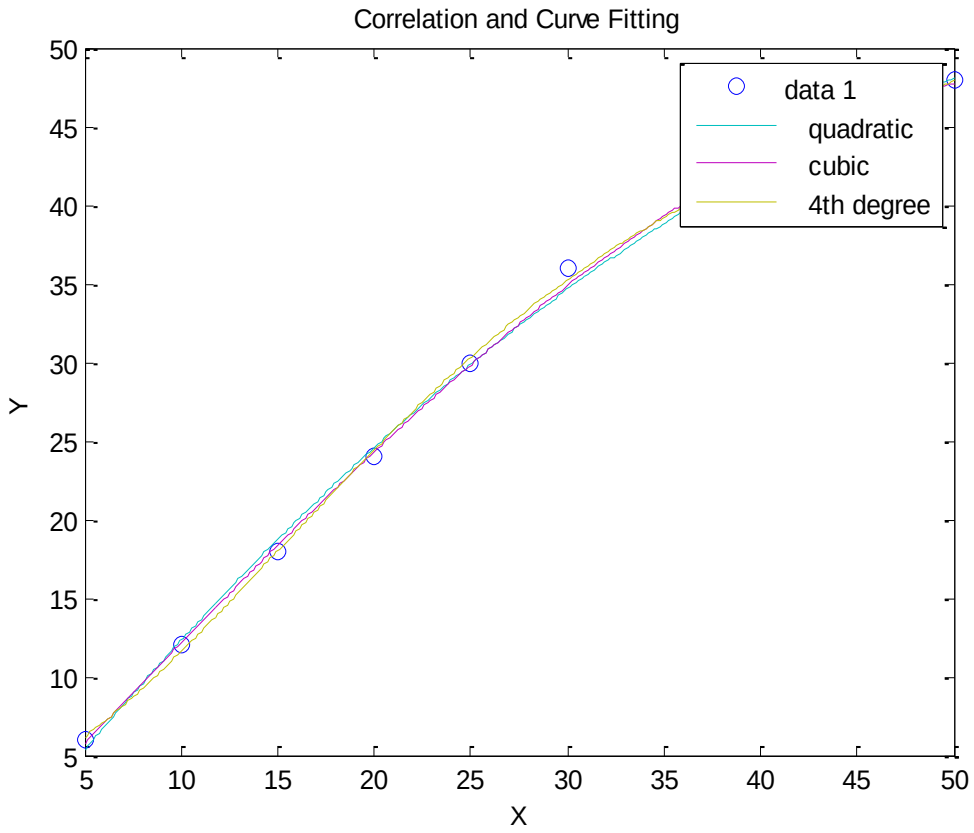
.m FILES:



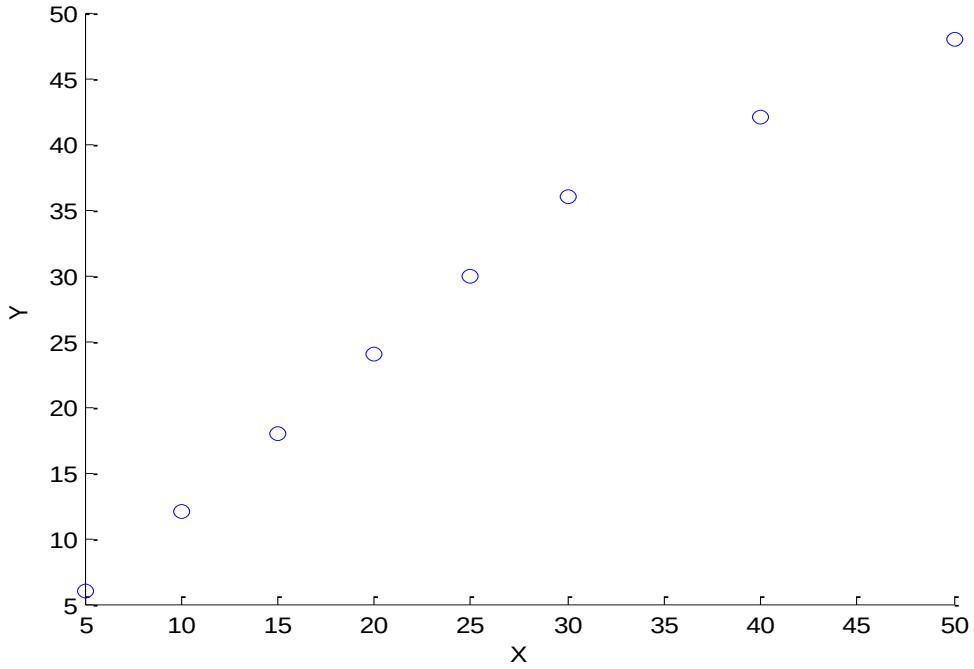
OUTPUT COMMAND:



OUTPUT COMMAND:



scatter diagram



Solution of linear programming problems

Problem 12. *Use MATLAB to solve the following L.P.P:*

(a) Maximize $z = 4x_1 + 3x_2$

subject to $3x_1 + x_2 \le 15,$

$3x_1 + 4x_2 \le 24,$

$x_1, x_2 \ge 0.$

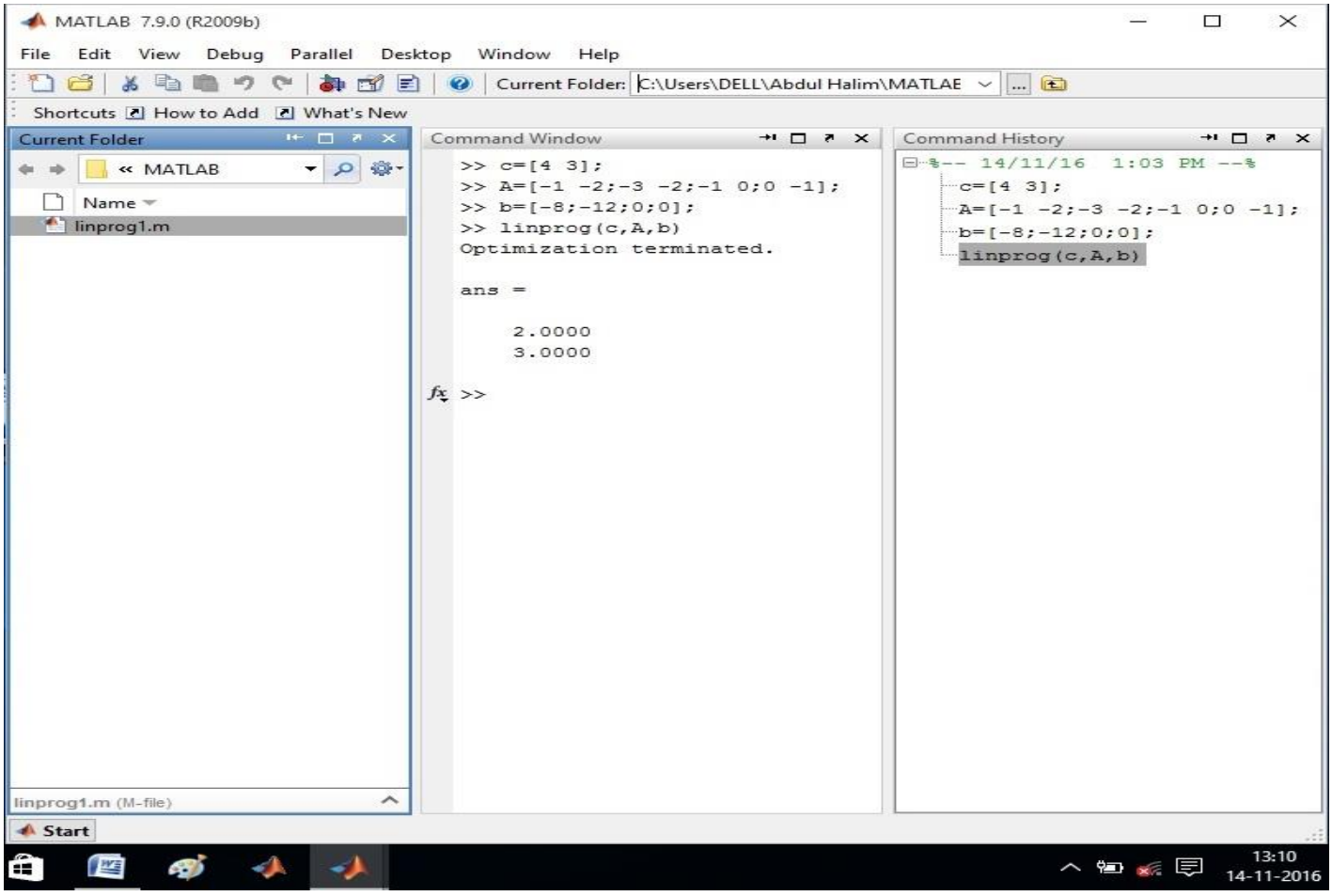
(b) Minimize $z = 4x_1 + 3x_2$

subject to $x_1 + 2x_2 \ge 8,$

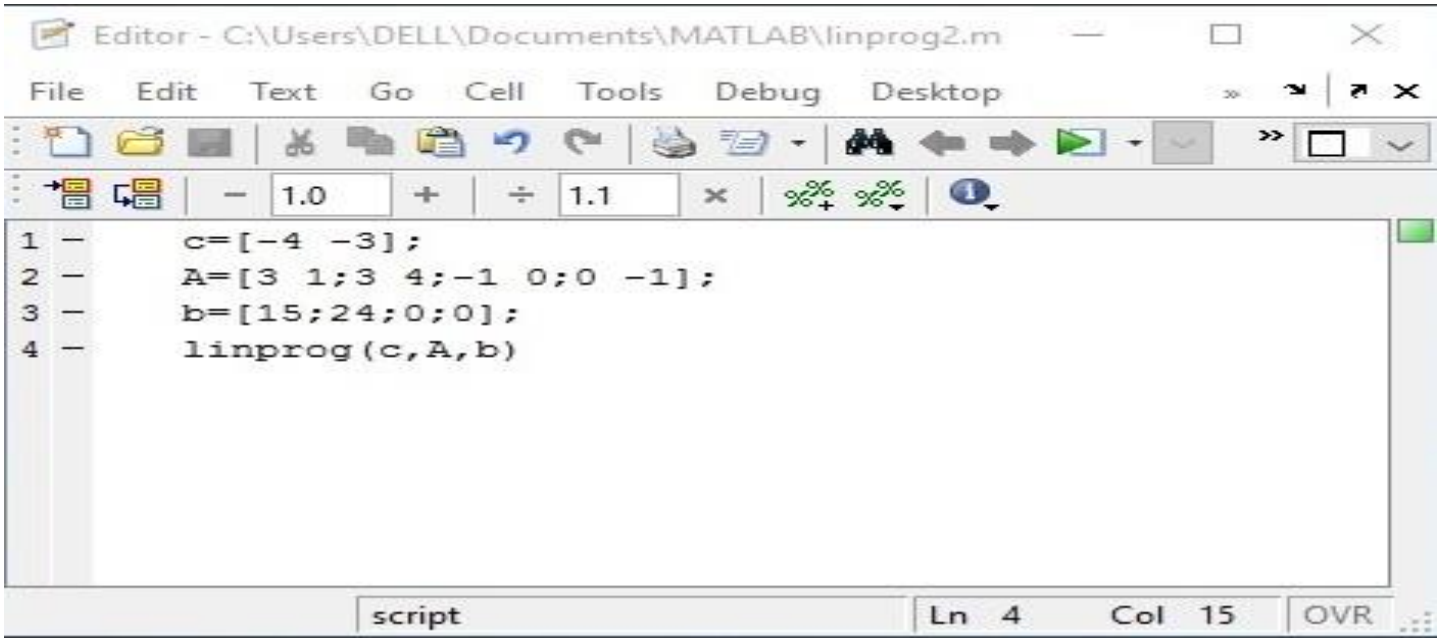
$3x_1 + 2x_2 \le 12,$

$x_1, x_2 \ge 0.$

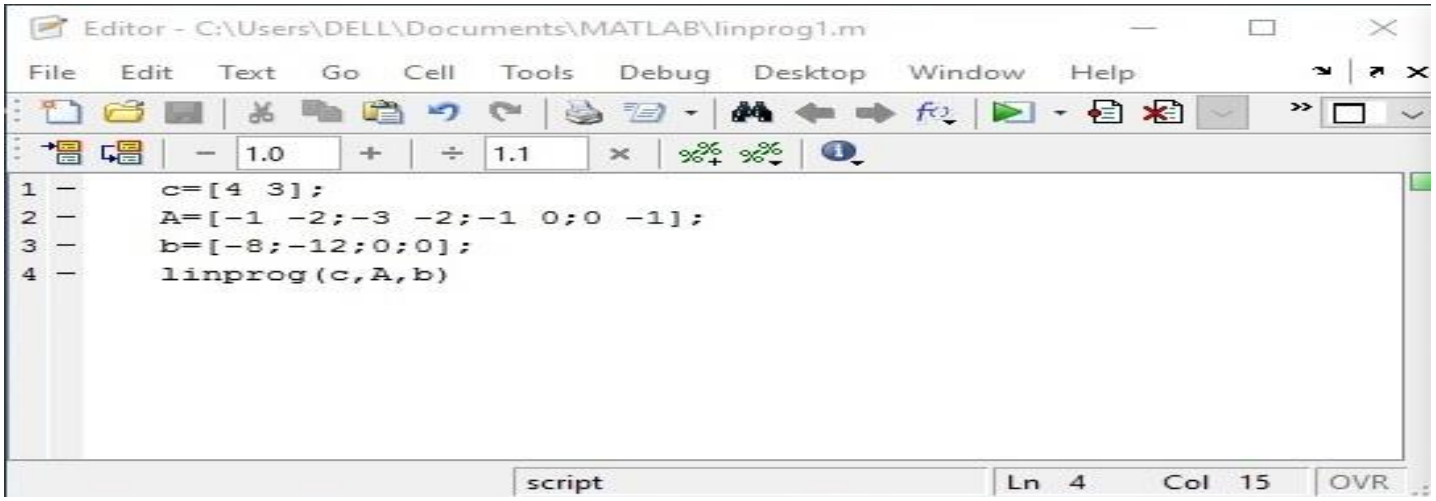
OUTPUT COMMAND:



.m FILES:



.m FILES:



OUTPUT COMMAND: