

Matlab Introduction

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Outline

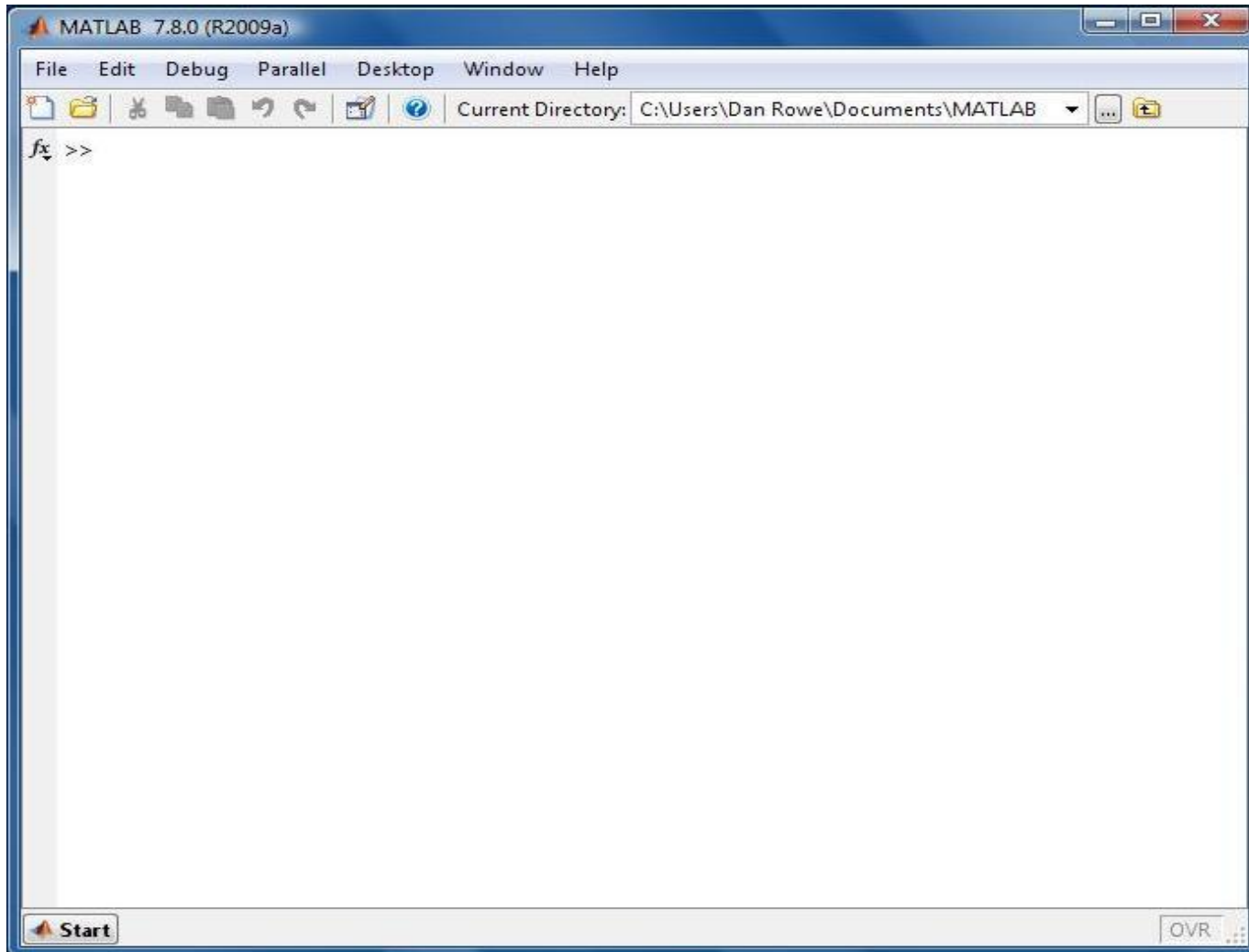
- About Matlab
- Arithmetic and Variables
- Arrays and Indexing
- Programming
- Plotting
- Functions and m-files
- Importing and Exporting
- Images
- Summary

About MATLAB

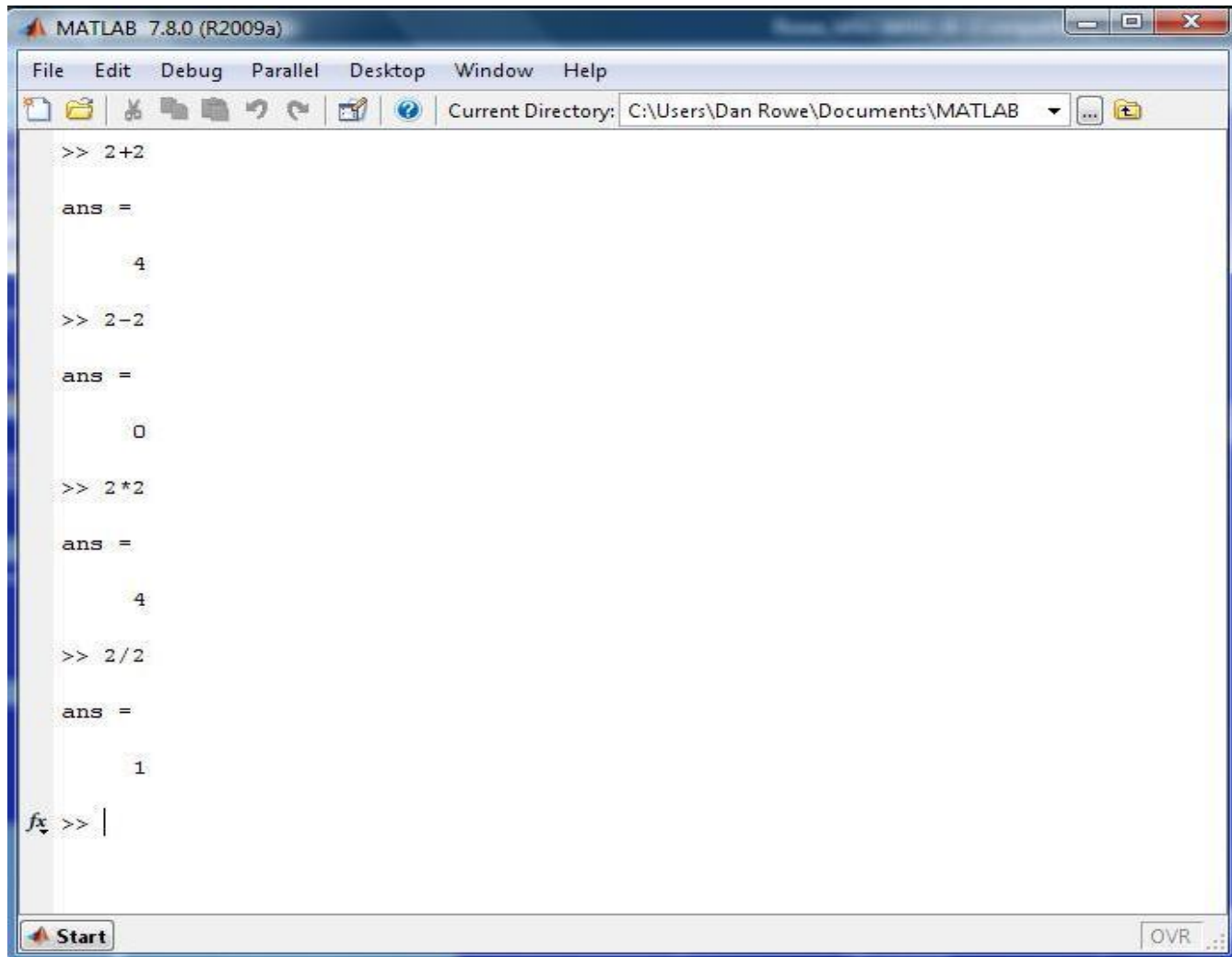
“MATLAB[®] is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran.”

Incredible for piloting and development!

About MATLAB



Arithmetic and Variables

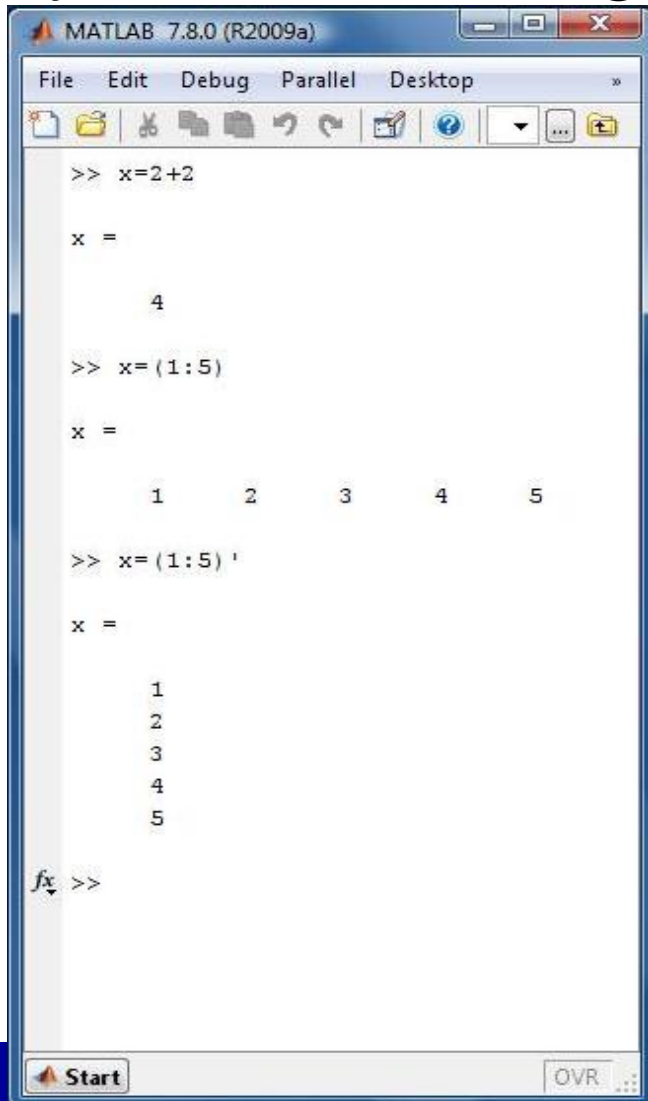


The image shows a screenshot of the MATLAB 7.8.0 (R2009a) command window. The window title is "MATLAB 7.8.0 (R2009a)". The menu bar includes "File", "Edit", "Debug", "Parallel", "Desktop", "Window", and "Help". The toolbar contains icons for file operations and a "Current Directory" dropdown set to "C:\Users\Dan Rowe\Documents\MATLAB". The command window displays the following sequence of operations and results:

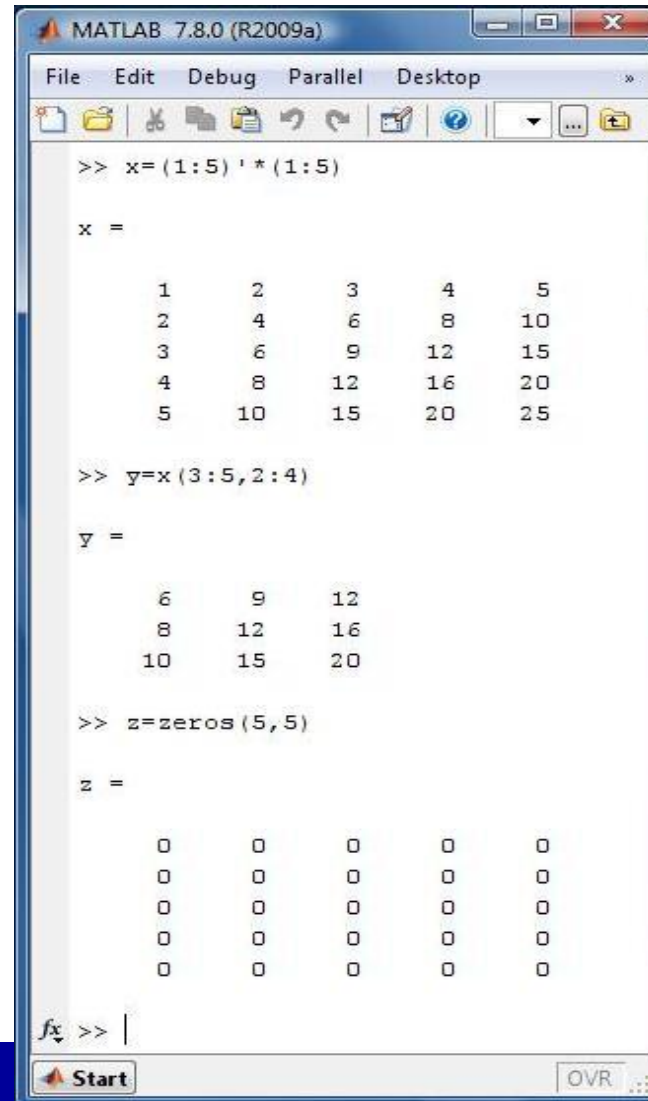
```
>> 2+2  
ans =  
     4  
>> 2-2  
ans =  
     0  
>> 2*2  
ans =  
     4  
>> 2/2  
ans =  
     1  
fx >> |
```

The window also shows a "Start" button in the bottom left corner and an "OVR" indicator in the bottom right corner.

Arrays and Indexing

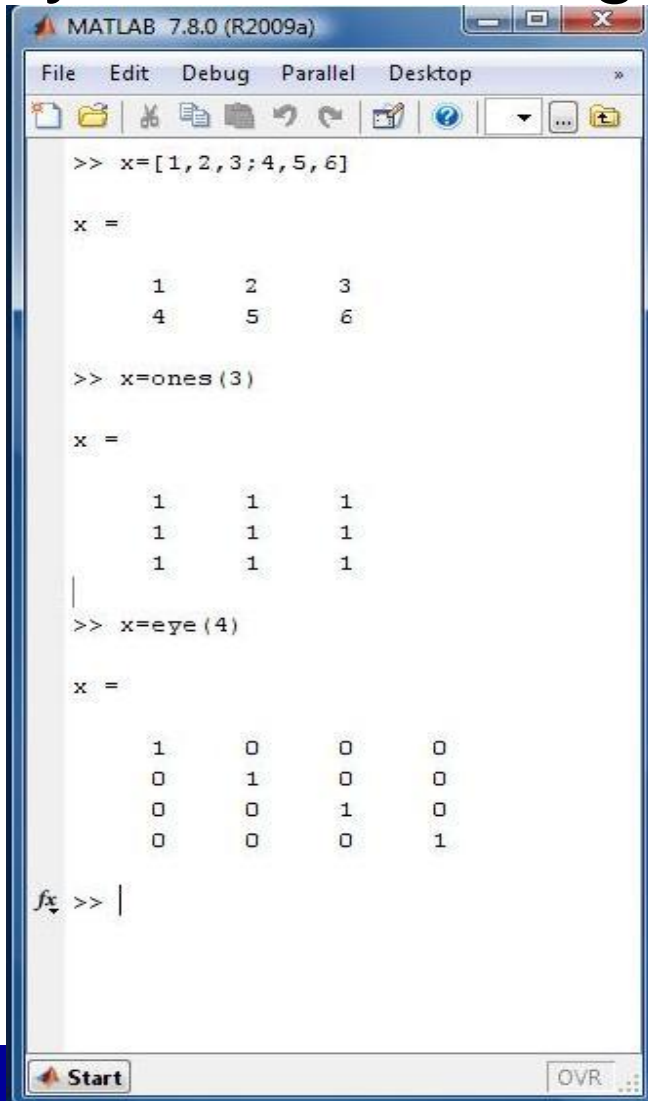


```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop
>> x=2+2
x =
    4
>> x=(1:5)
x =
    1    2    3    4    5
>> x=(1:5) '
x =
    1
    2
    3
    4
    5
fx >>
```

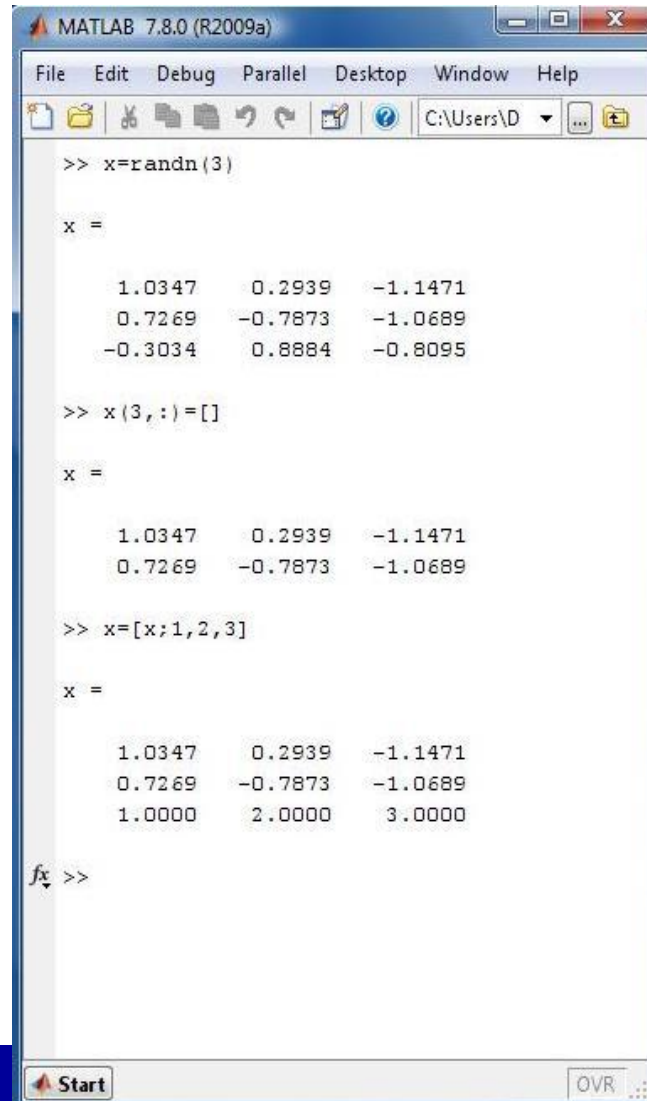


```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop
>> x=(1:5) ' * (1:5)
x =
    1    2    3    4    5
    2    4    6    8   10
    3    6    9   12   15
    4    8   12   16   20
    5   10   15   20   25
>> y=x(3:5,2:4)
y =
    6    9   12
    8   12   16
   10   15   20
>> z=zeros(5,5)
z =
    0    0    0    0    0
    0    0    0    0    0
    0    0    0    0    0
    0    0    0    0    0
    0    0    0    0    0
fx >>
```

Arrays and Indexing



```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop
>> x=[1,2,3;4,5,6]
x =
     1     2     3
     4     5     6
>> x=ones(3)
x =
     1     1     1
     1     1     1
     1     1     1
>> x=eye(4)
x =
     1     0     0     0
     0     1     0     0
     0     0     1     0
     0     0     0     1
fx >> |
```



```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop Window Help
C:\Users\D
>> x=randn(3)
x =
     1.0347     0.2939    -1.1471
     0.7269    -0.7873    -1.0689
    -0.3034     0.8884    -0.8095
>> x(3,:)=[]
x =
     1.0347     0.2939    -1.1471
     0.7269    -0.7873    -1.0689
>> x=[x;1,2,3]
x =
     1.0347     0.2939    -1.1471
     0.7269    -0.7873    -1.0689
     1.0000     2.0000     3.0000
fx >> |
```

Arithmetic and Variables

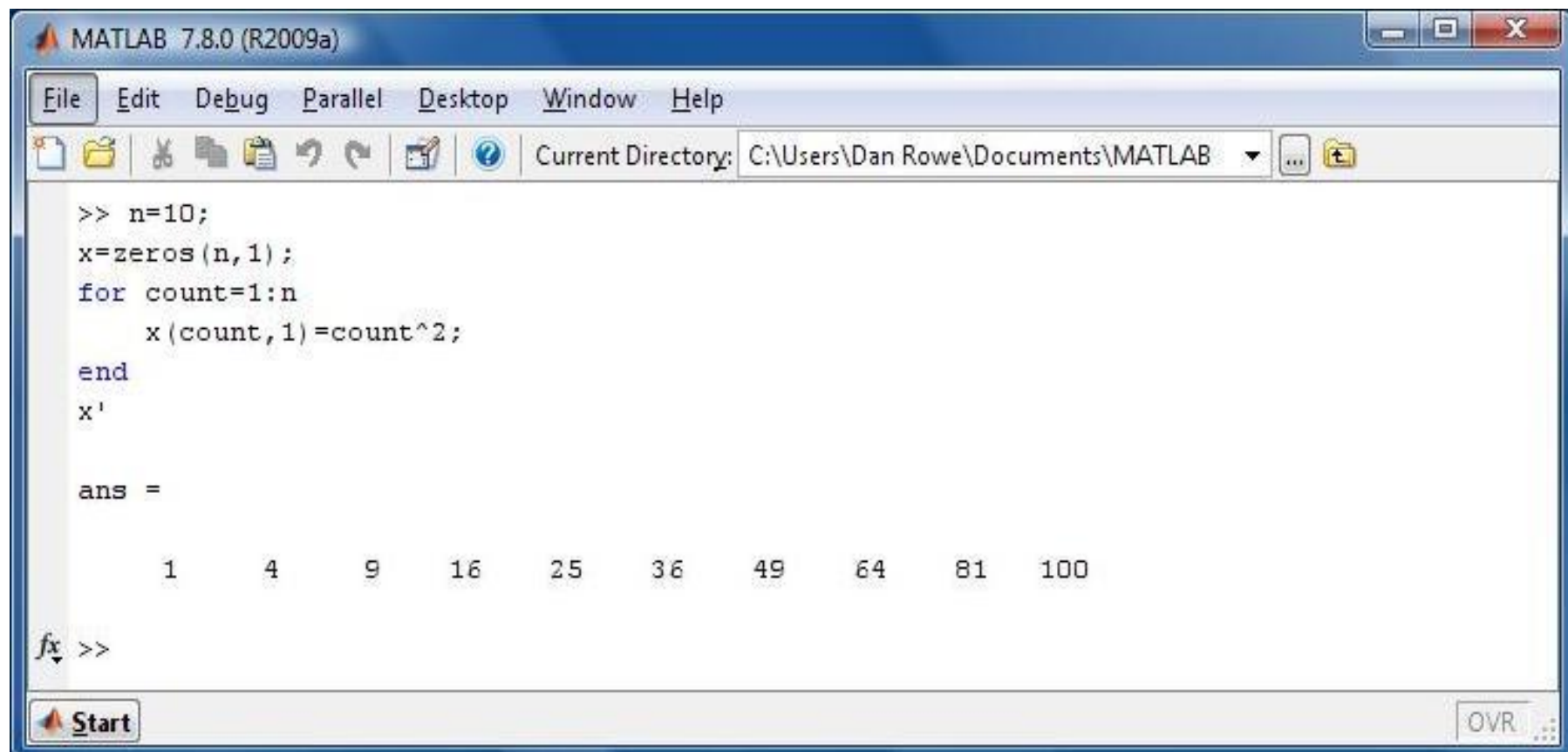
Matrix Operations:

$+$, $-$, $*$, $/$, $\text{sqrt}()$, $\text{sin}()$, $\text{det}()$, $\text{eig}()$, $\text{rank}()$, ...

Element Operations:

$.$, $.*$, $./$, $.^2$, $A.*B$, $A./B$, ...

Programming



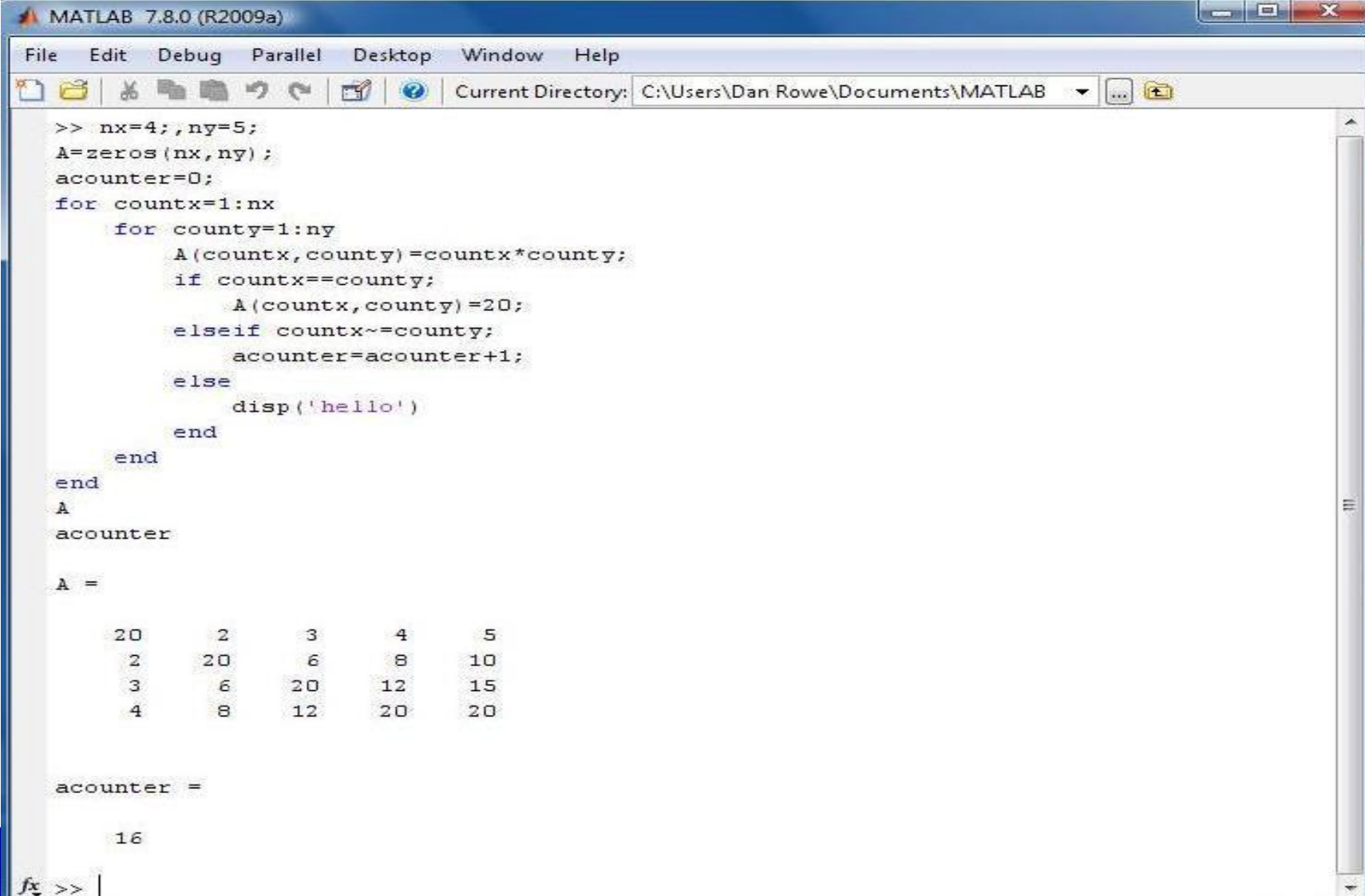
```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop Window Help
Current Directory: C:\Users\Dan Rowe\Documents\MATLAB
>> n=10;
x=zeros(n,1);
for count=1:n
    x(count,1)=count^2;
end
x'

ans =

    1     4     9    16    25    36    49    64    81   100

fx >>
```

Programming



```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop Window Help
Current Directory: C:\Users\Dan Rowe\Documents\MATLAB
>> nx=4; ny=5;
A=zeros(nx,ny);
acounter=0;
for countx=1:nx
    for county=1:ny
        A(countx,county)=countx*county;
        if countx==county;
            A(countx,county)=20;
        elseif countx~=county;
            acounter=acounter+1;
        else
            disp('hello')
        end
    end
end
A
acounter

A =

    20     2     3     4     5
     2    20     6     8    10
     3     6    20    12    15
     4     8    12    20    20

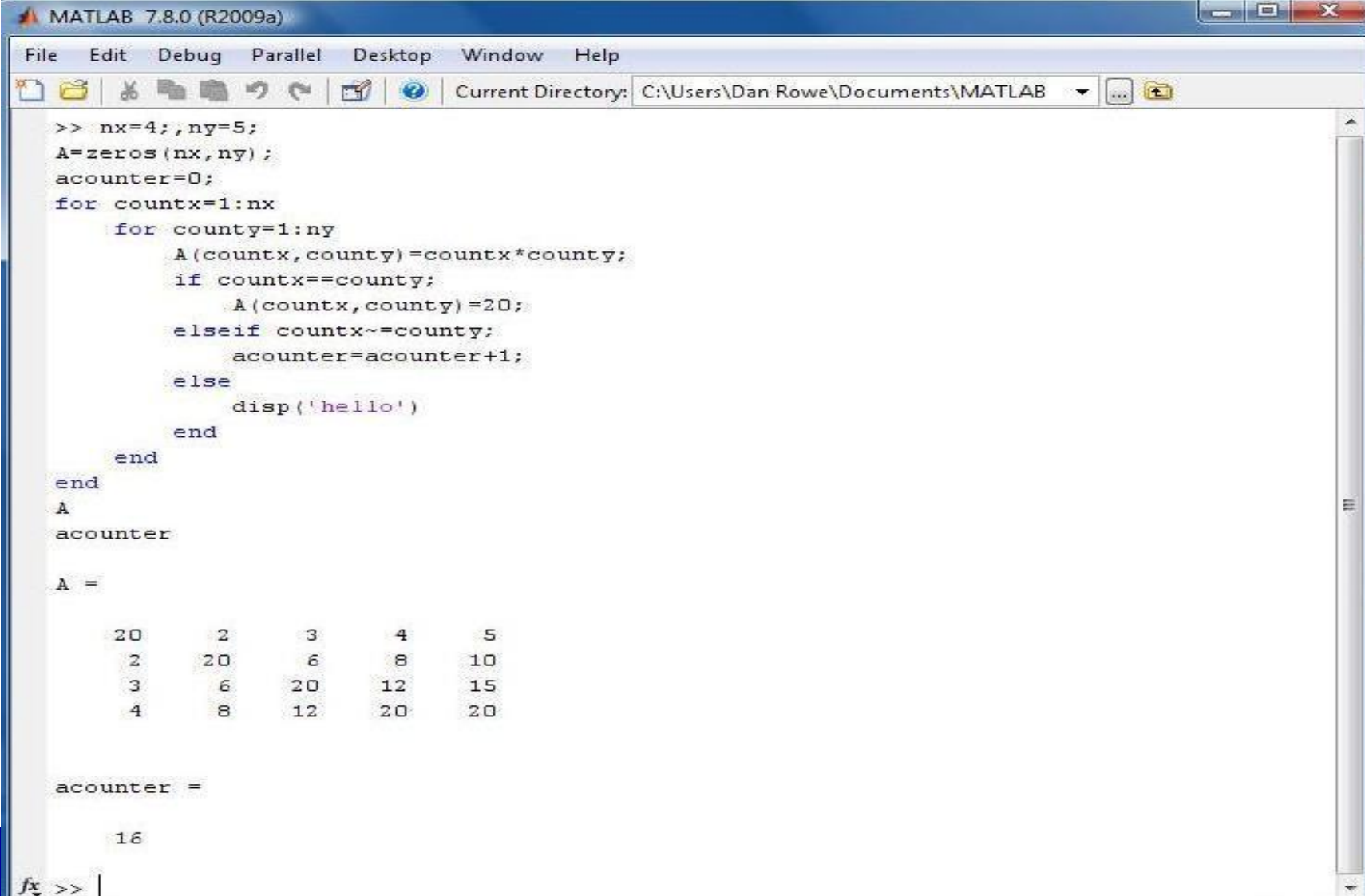
acounter =

    16
```

fx >> |

Start D.B. Rowe OVR

Programming



```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop Window Help
Current Directory: C:\Users\Dan Rowe\Documents\MATLAB
>> nx=4; ny=5;
A=zeros(nx,ny);
acounter=0;
for countx=1:nx
    for county=1:ny
        A(countx,county)=countx*county;
        if countx==county;
            A(countx,county)=20;
        elseif countx~=county;
            acounter=acounter+1;
        else
            disp('hello')
        end
    end
end
A
acounter

A =

    20     2     3     4     5
     2    20     6     8    10
     3     6    20    12    15
     4     8    12    20    20

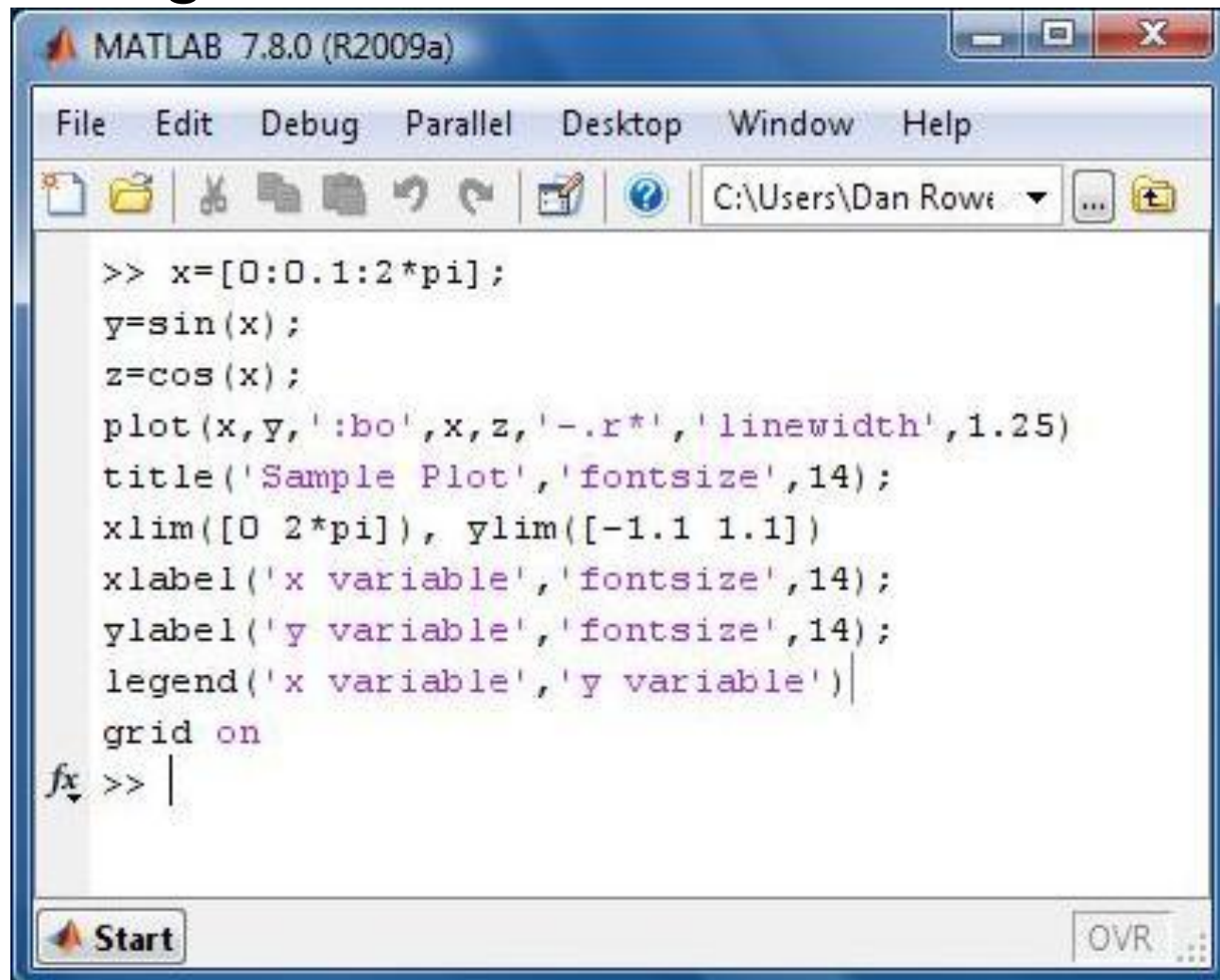
acounter =

    16
```

fx >> |

Start D.B. Rowe OVR

Plotting

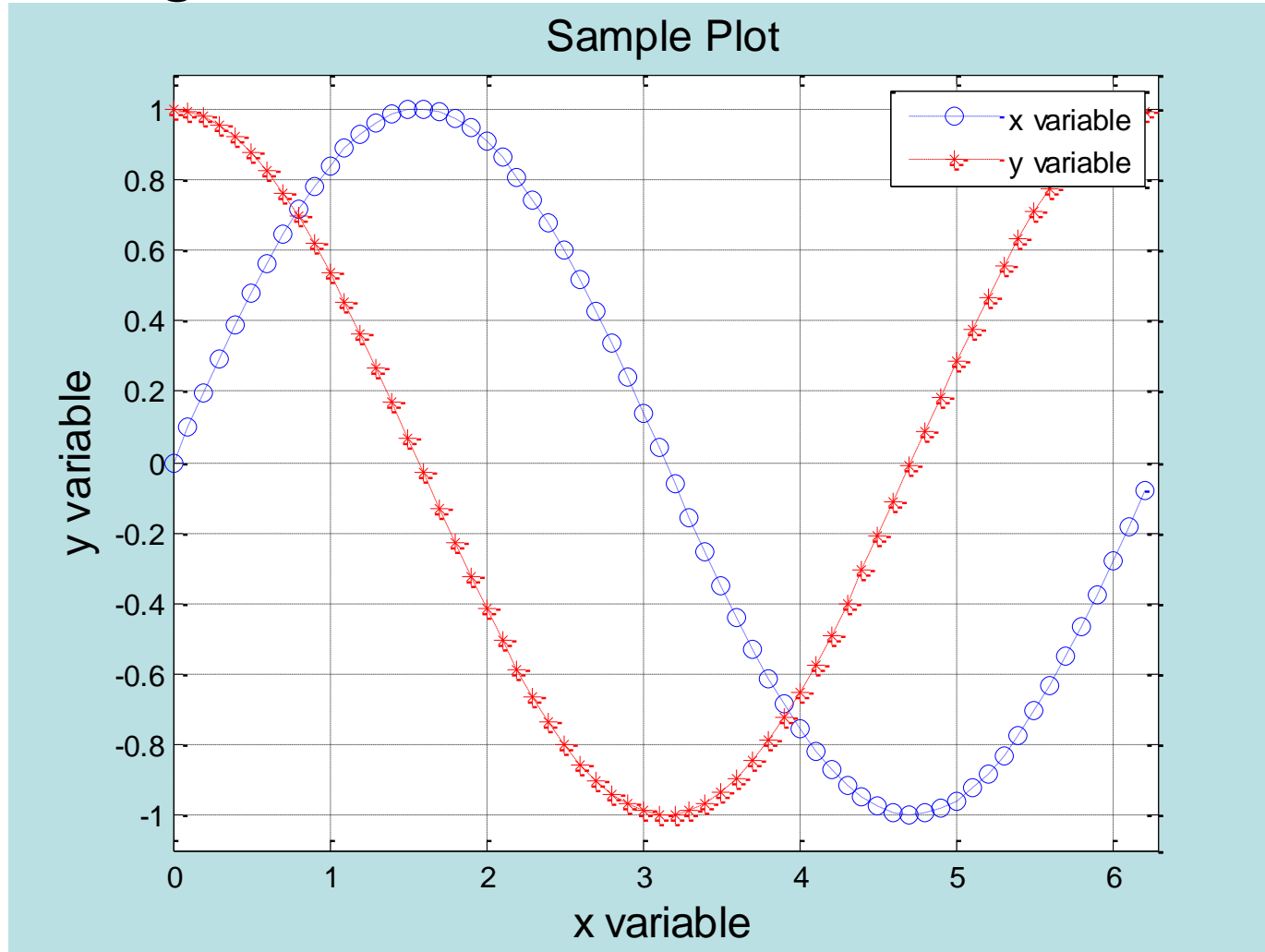


The image shows a screenshot of the MATLAB 7.8.0 (R2009a) software interface. The window title is "MATLAB 7.8.0 (R2009a)". The menu bar includes "File", "Edit", "Debug", "Parallel", "Desktop", "Window", and "Help". The toolbar contains various icons for file operations and editing. The current directory is "C:\Users\Dan Rowe". The command window contains the following MATLAB code:

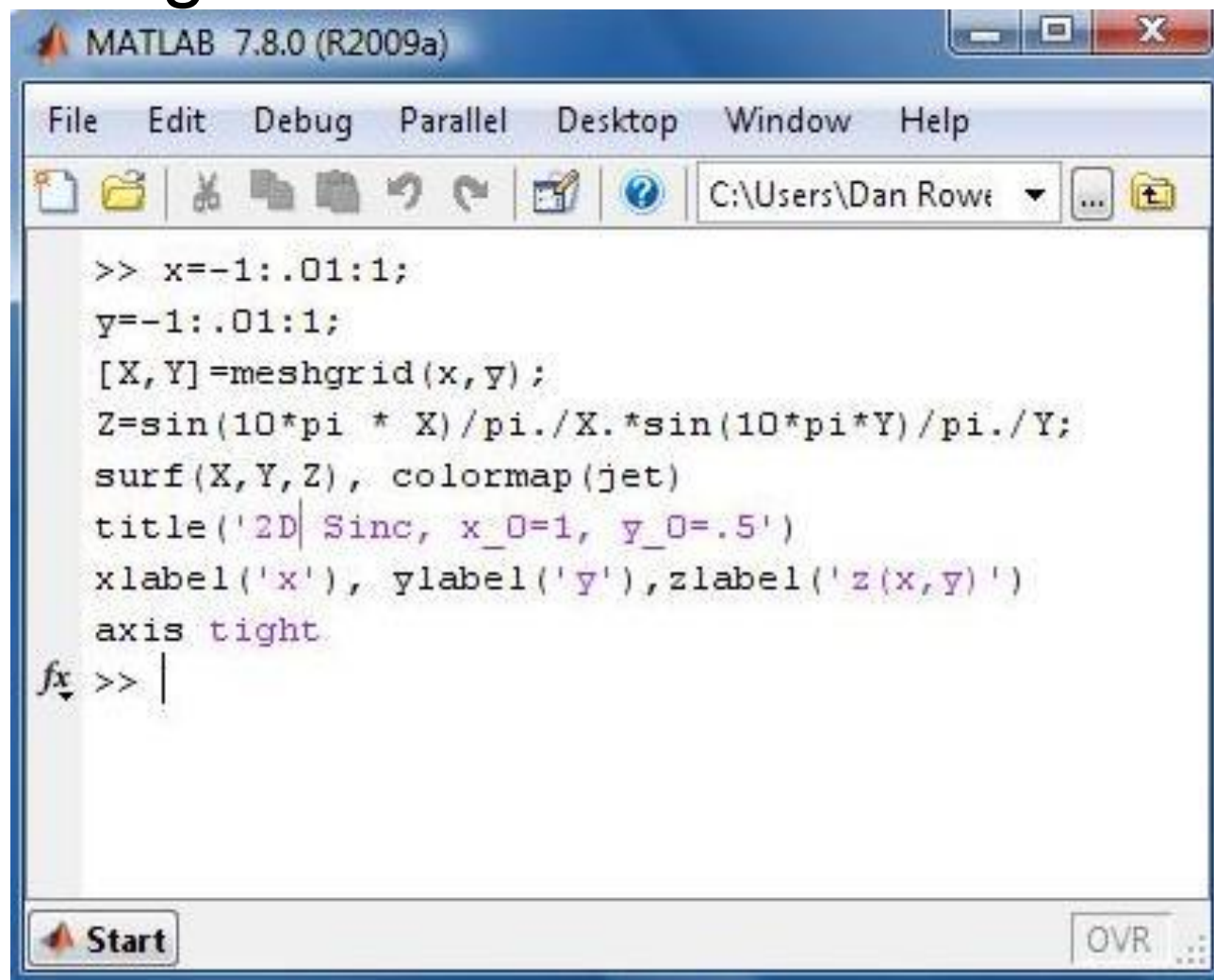
```
>> x=[0:0.1:2*pi];  
y=sin(x);  
z=cos(x);  
plot(x,y,':bo',x,z,'-.r*','linewidth',1.25)  
title('Sample Plot','fontsize',14);  
xlim([0 2*pi]), ylim([-1.1 1.1])  
xlabel('x variable','fontsize',14);  
ylabel('y variable','fontsize',14);  
legend('x variable','y variable')  
grid on  
fx >> |
```

The window also shows a "Start" button in the bottom left and "OVR" in the bottom right.

Plotting - 2D



Plotting - 2D

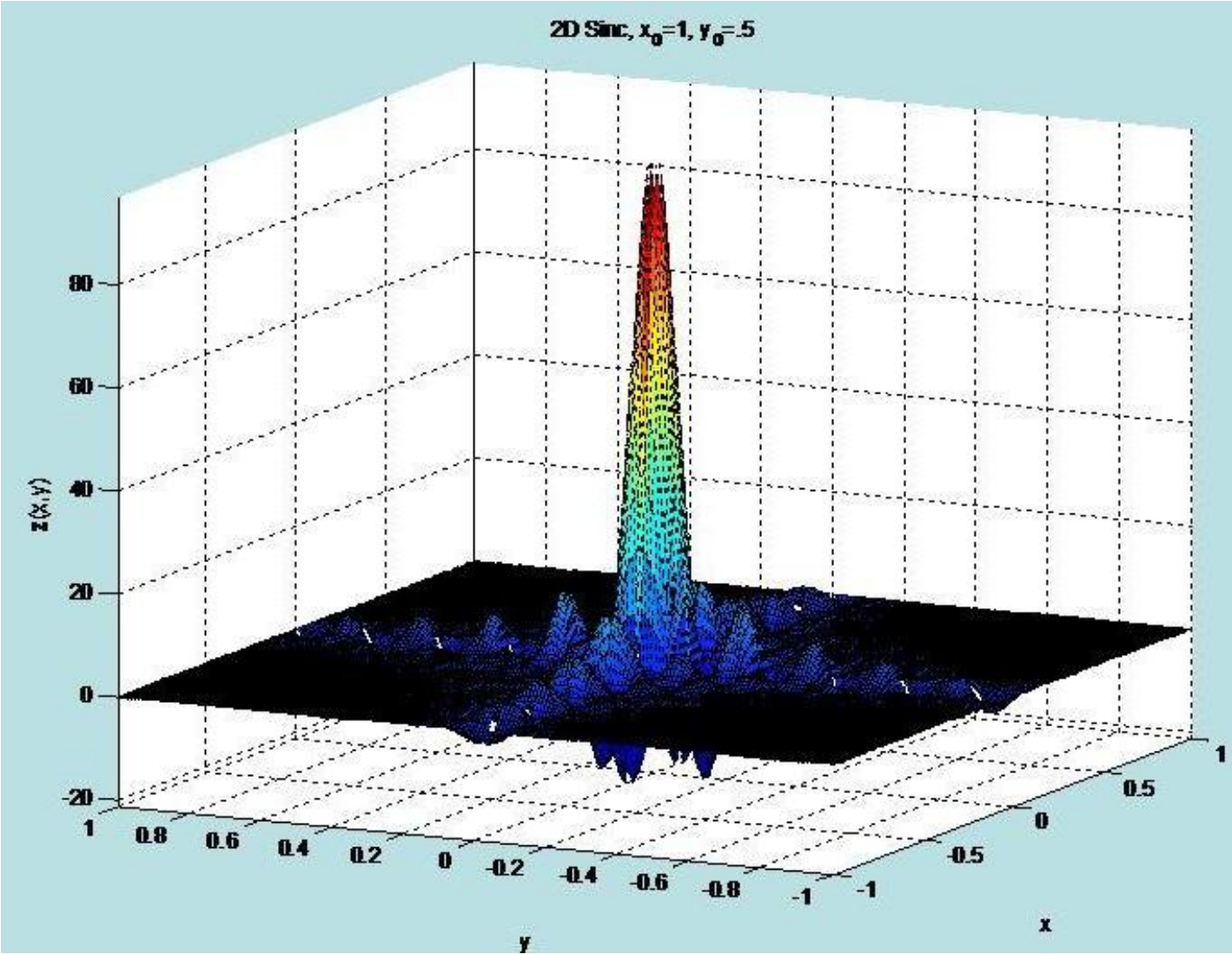


The image shows a MATLAB 7.8.0 (R2009a) window with a command window containing the following code:

```
>> x=-1:.01:1;
y=-1:.01:1;
[X,Y]=meshgrid(x,y);
Z=sin(10*pi * X)/pi./X.*sin(10*pi*Y)/pi./Y;
surf(X,Y,Z), colormap(jet)
title('2D Sinc, x_0=1, y_0=.5')
xlabel('x'), ylabel('y'), zlabel('z(x,y)')
axis tight.
```

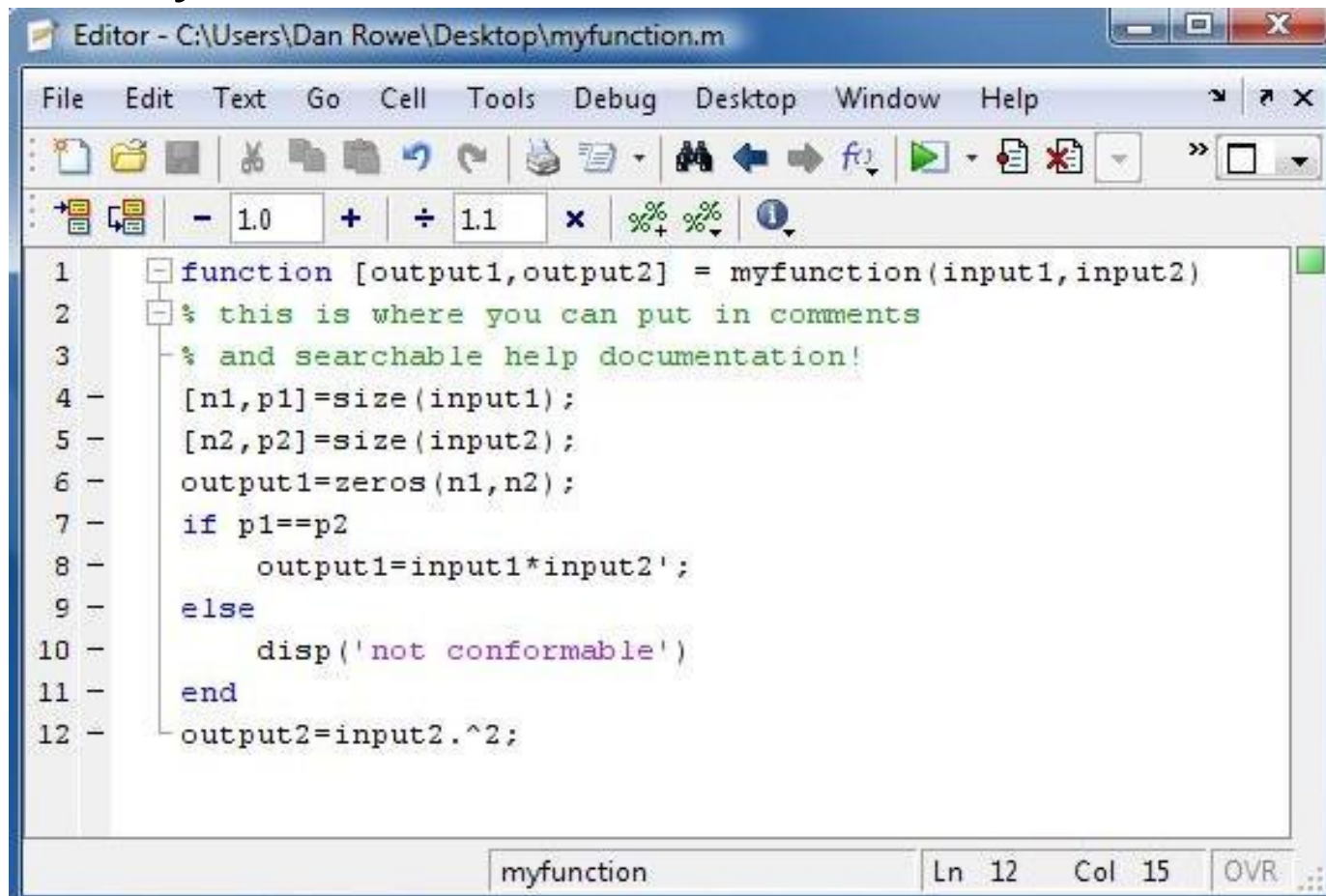
The window also shows a toolbar with various icons, a file path of C:\Users\Dan Rowe, and a Start button at the bottom left.

Plotting - 3D



Functions and m-files

Create your own functions!



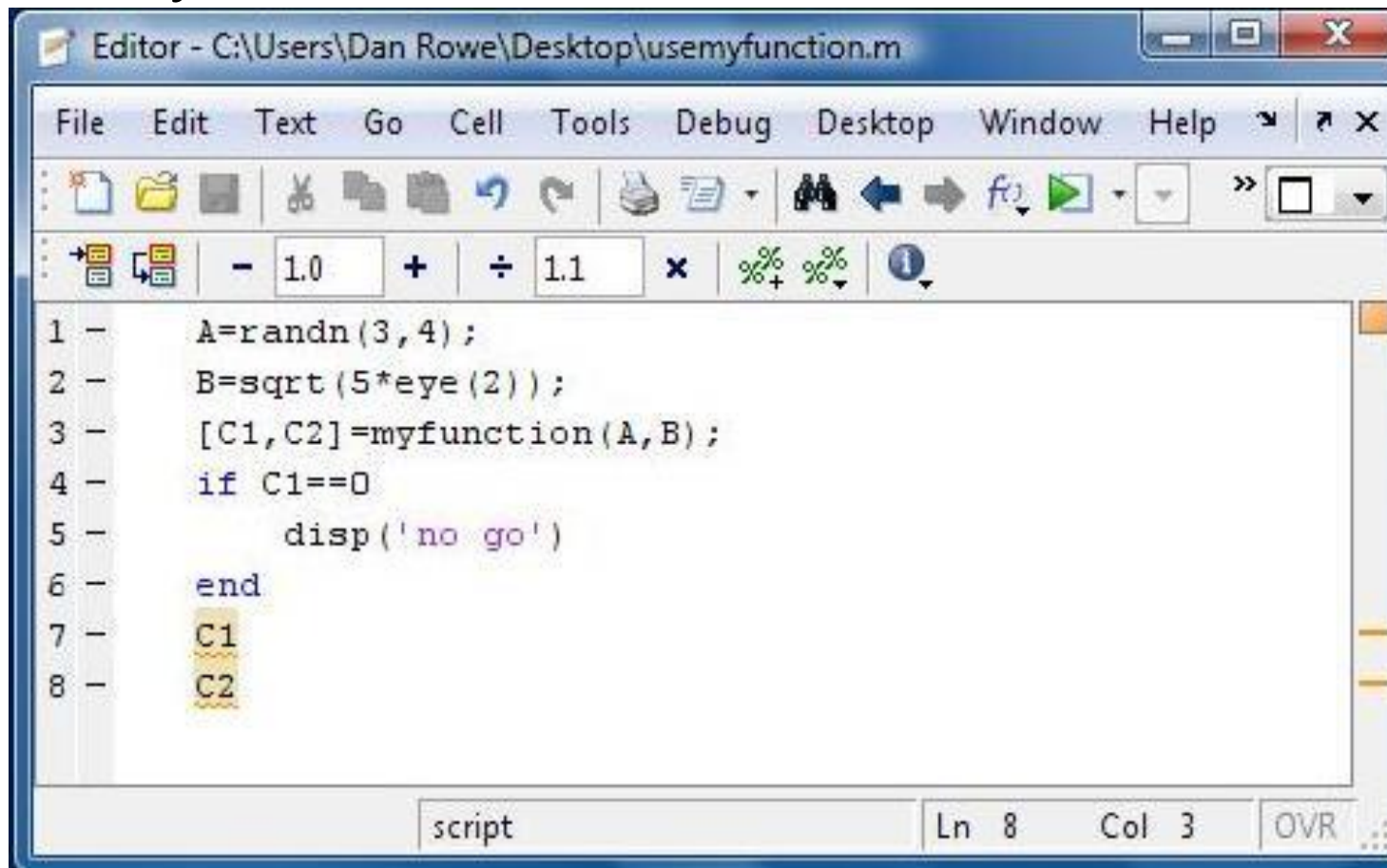
The screenshot shows a MATLAB Editor window titled "Editor - C:\Users\Dan Rowe\Desktop\myfunction.m". The window contains the following code:

```
1 function [output1,output2] = myfunction(input1,input2)
2 % this is where you can put in comments
3 % and searchable help documentation!
4 - [n1,p1]=size(input1);
5 - [n2,p2]=size(input2);
6 - output1=zeros(n1,n2);
7 - if p1==p2
8 -     output1=input1*input2';
9 - else
10 -     disp('not conformable')
11 - end
12 - output2=input2.^2;
```

The status bar at the bottom of the window shows "myfunction", "Ln 12", "Col 15", and "OVR".

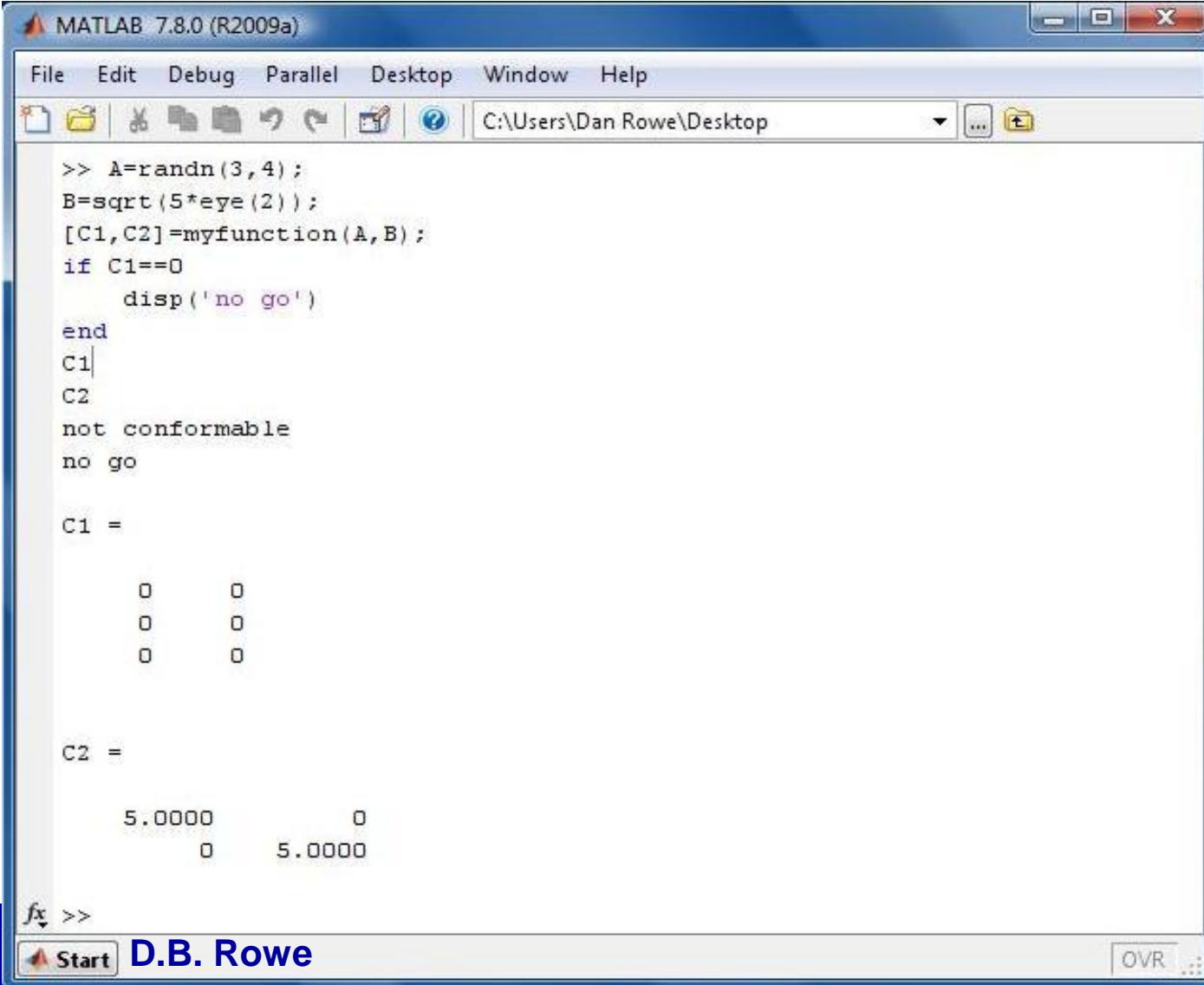
Functions and m-files

Create your own functions!



```
Editor - C:\Users\Dan Rowe\Desktop\usemyfunction.m
File Edit Text Go Cell Tools Debug Desktop Window Help
- 1.0 + ÷ 1.1 x % %
1 - A=randn(3,4);
2 - B=sqrt(5*eye(2));
3 - [C1,C2]=myfunction(A,B);
4 - if C1==0
5 -     disp('no go')
6 - end
7 - C1
8 - C2
script Ln 8 Col 3 OVR
```

Functions and m-files



```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop Window Help
C:\Users\Dan Rowe\Desktop
>> A=randn(3,4);
B=sqrt(5*eye(2));
[C1,C2]=myfunction(A,B);
if C1==0
    disp('no go')
end
C1
C2
not conformable
no go

C1 =

    0    0
    0    0
    0    0

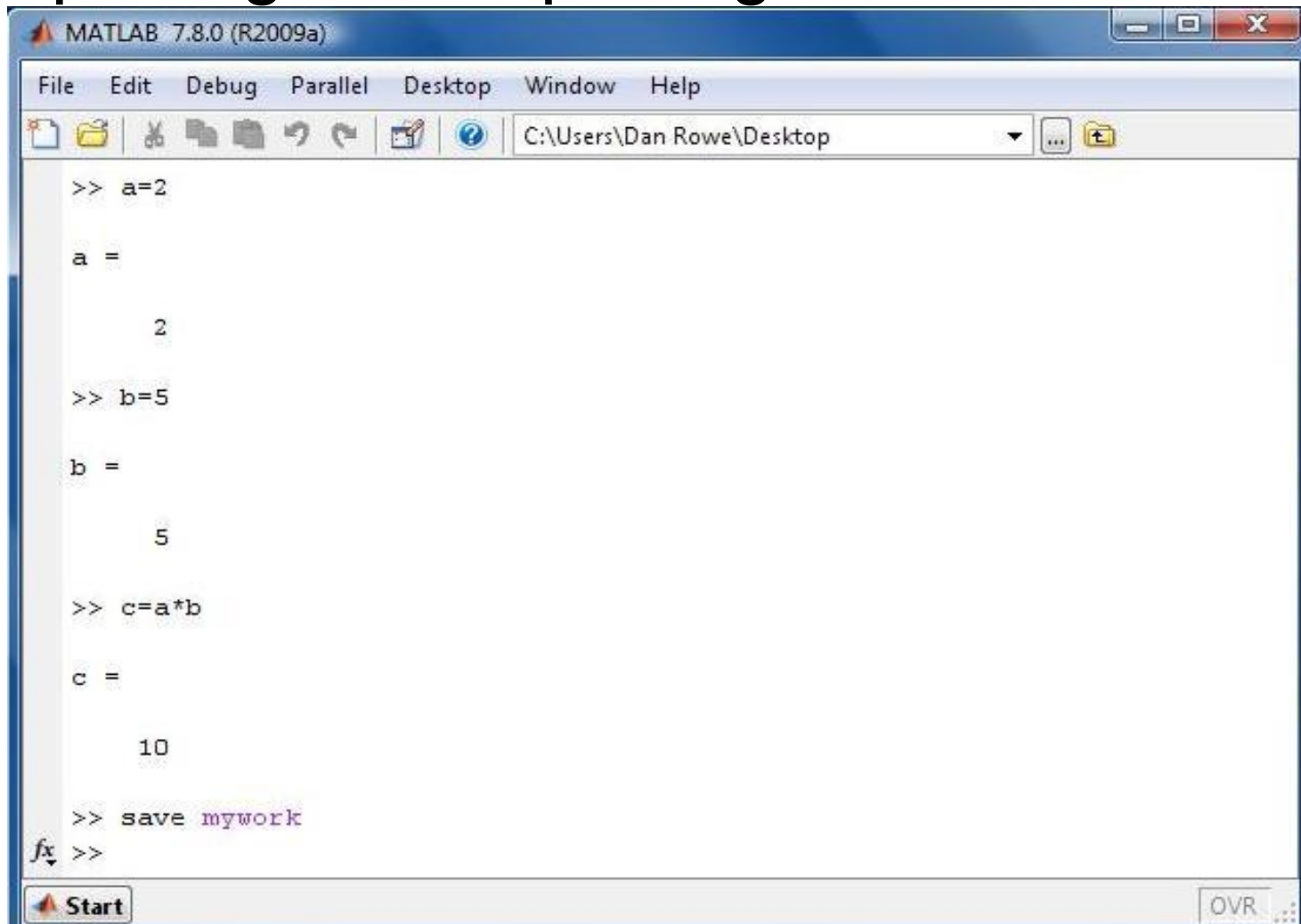
C2 =

    5.0000    0
    0    5.0000

fx >>
```

Start **D.B. Rowe** OVR

Importing and Exporting

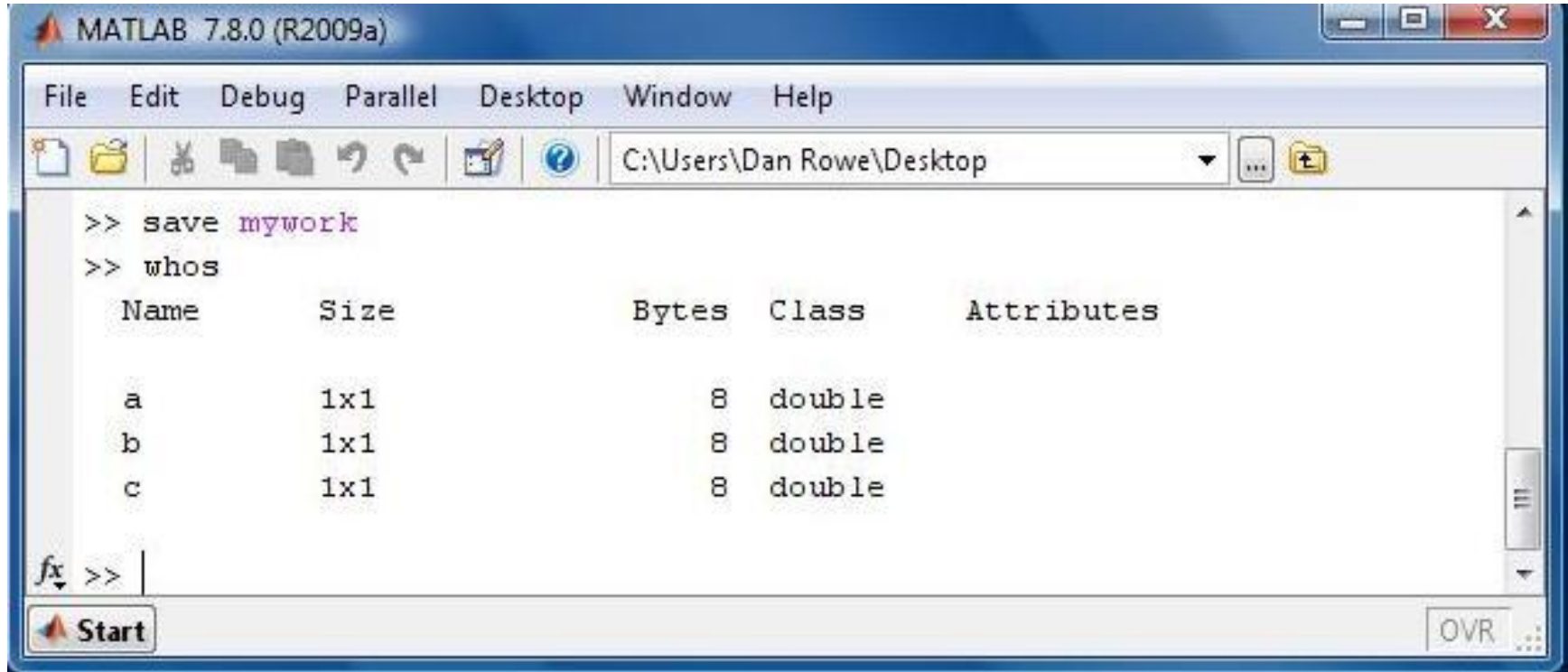


The image shows a screenshot of the MATLAB 7.8.0 (R2009a) command window. The window title is "MATLAB 7.8.0 (R2009a)". The menu bar includes "File", "Edit", "Debug", "Parallel", "Desktop", "Window", and "Help". The toolbar contains icons for file operations and a path field showing "C:\Users\Dan Rowe\Desktop". The command window contains the following text:

```
>> a=2  
  
a =  
  
    2  
  
>> b=5  
  
b =  
  
    5  
  
>> c=a*b  
  
c =  
  
   10  
  
>> save mywork  
fx >>
```

At the bottom left of the window is a "Start" button, and at the bottom right is an "OVR" button.

Importing and Exporting

A screenshot of the MATLAB 7.8.0 (R2009a) Command Window. The window title is "MATLAB 7.8.0 (R2009a)". The menu bar includes "File", "Edit", "Debug", "Parallel", "Desktop", "Window", and "Help". The toolbar contains icons for file operations and help. The current directory is "C:\Users\Dan Rowe\Desktop". The command prompt shows the following commands and output:

```
>> save mywork
>> whos
```

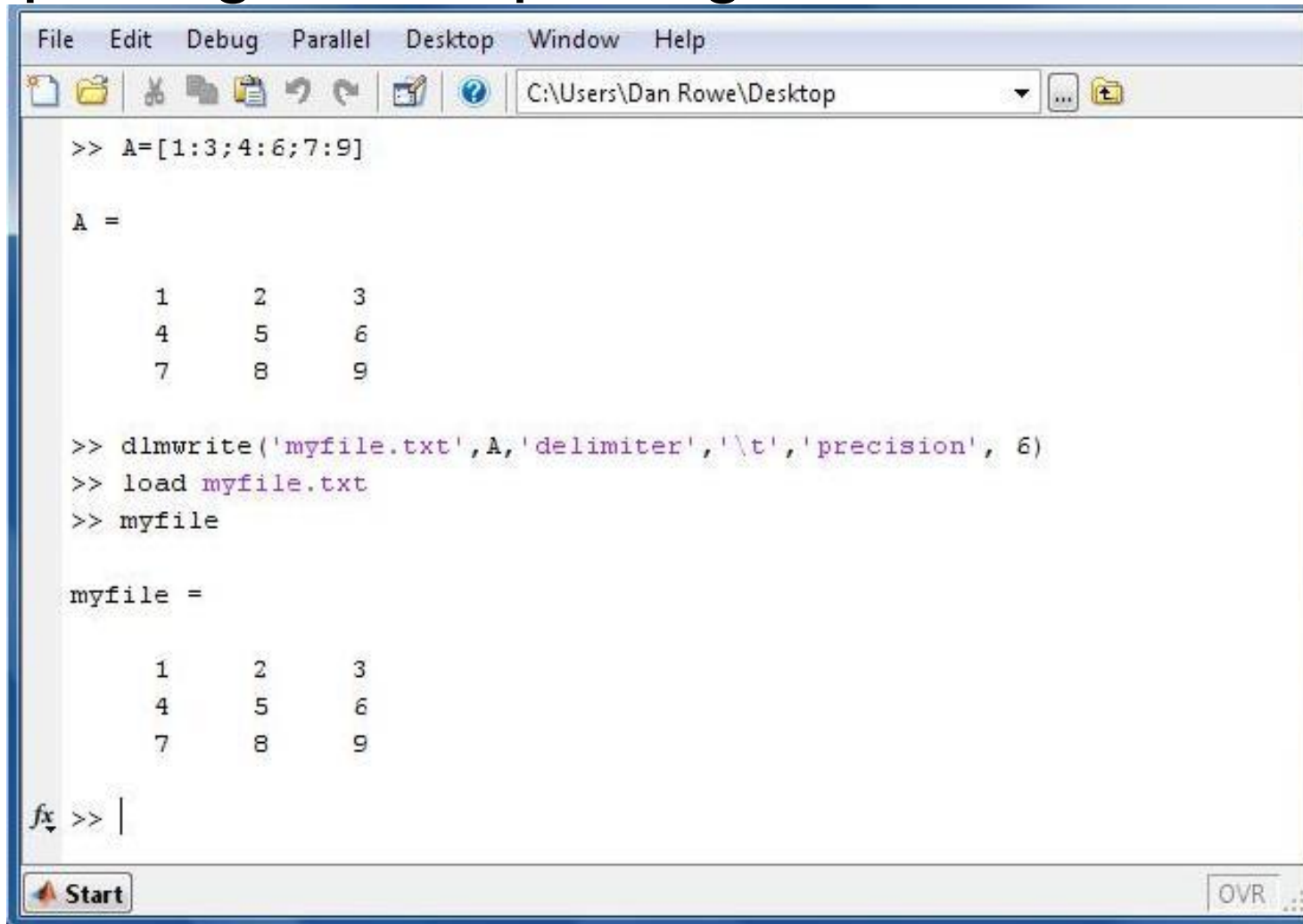
Name	Size	Bytes	Class	Attributes
a	1x1	8	double	
b	1x1	8	double	
c	1x1	8	double	

The Command Window also shows a "Start" button and an "OVR" indicator.

The file type is .mat

To read back in use “load mywork”

Importing and Exporting



```
File Edit Debug Parallel Desktop Window Help
C:\Users\Dan Rowe\Desktop
>> A=[1:3;4:6;7:9]

A =

     1     2     3
     4     5     6
     7     8     9

>> dlmwrite('myfile.txt',A,'delimiter','\t','precision',6)
>> load myfile
>> myfile

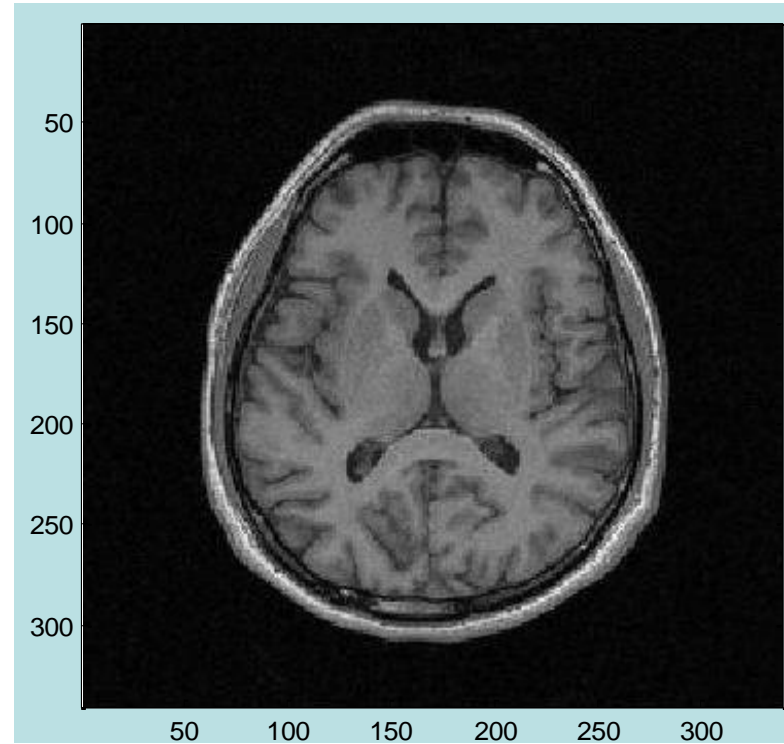
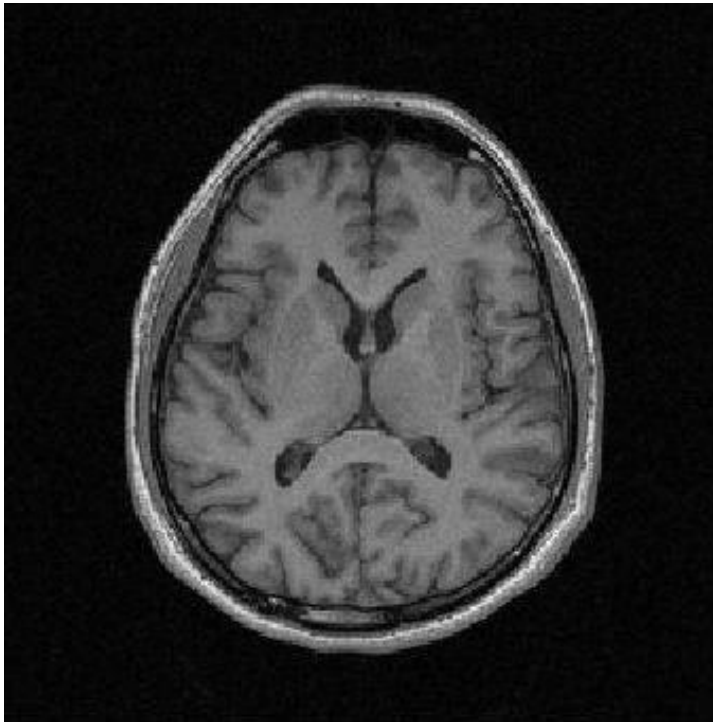
myfile =

     1     2     3
     4     5     6
     7     8     9

fx >> |
```

The image shows a MATLAB Command Window interface. The title bar includes 'File', 'Edit', 'Debug', 'Parallel', 'Desktop', 'Window', and 'Help'. The address bar shows the current directory as 'C:\Users\Dan Rowe\Desktop'. The command prompt shows the following sequence of operations: creating a 3x3 matrix 'A' with values [1:3; 4:6; 7:9], writing it to 'myfile.txt' using 'dlmwrite' with tab delimiters and 6-digit precision, loading the file back with 'load myfile', and displaying the resulting 'myfile' matrix, which is identical to 'A'. The window also shows a 'Start' button at the bottom left and an 'OVR' indicator at the bottom right.

Images



```
MATLAB 7.8.0 (R2009a)
File Edit Debug Parallel Desktop Window Help
C:\Users\Dan Rowe\Desktop
>> brainimage=imread('imageSWI.jpg');
figure(1)
image(brainimage)
axis image
fx >>
```

Start **D.B. Rowe** OVR

Some Additional Toolboxes

- Bioinformatics Toolbox
- Curve Fitting Toolbox
- Financial Toolbox
- Image Processing Toolbox
- Optimization Toolbox
- Signal Processing Toolbox
- Statistics Toolbox
- Wavelet Toolbox

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- Images