

# **MATLAB TUTORIAL FOR BEGINNERS**

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**Automation & Robotics Research Institute  
(ARRI)**

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The purpose of this workshop is to get you started and to have fun with MATLAB!

Let's talk a little and decide on what we will be covering today.

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- WHY MATLAB?
- WHAT MATLAB IS NOT.
- SETTING THE TOOL:
- MATRIX OPERATIONS:
- XY PLOTS IN MATLAB
- IMPORTING DATA:
- SIMULINK:

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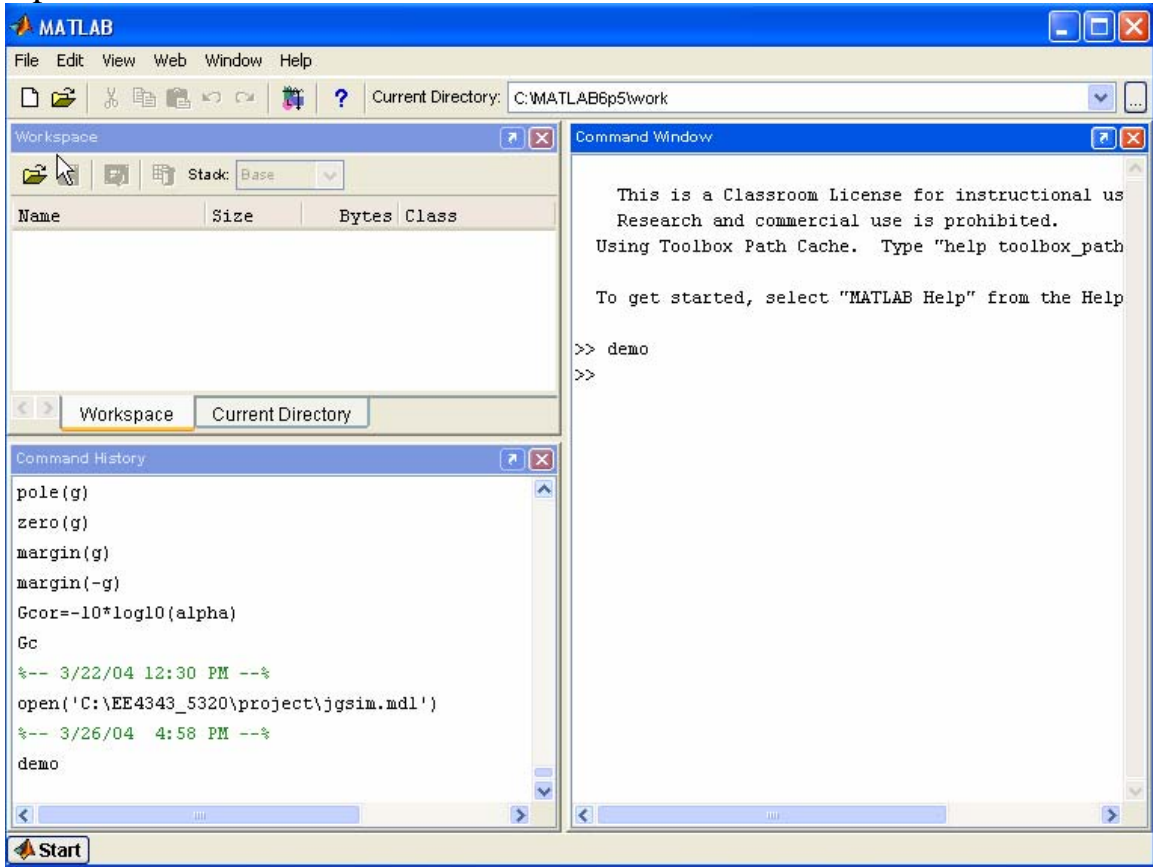
- WHY MATLAB?
  - MATLAB is relatively easy to learn
  - MATLAB code is optimized to be relatively quick when performing matrix operations
  - MATLAB may behave like a calculator or as a programming language
  - MATLAB is interpreted, errors are easier to fix.
  - WHAT MATLAB IS NOT.
- Limitations of MATLAB
- MATLAB is NOT a general purpose programming language.
  - MATLAB is an interpreted language (making it for the most part slower than a compiled language such as C++)
  - MATLAB is designed for scientific computation and is not suitable for some things (such as parsing text).

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SETTING THE TOOL :  
Open MATLAB:

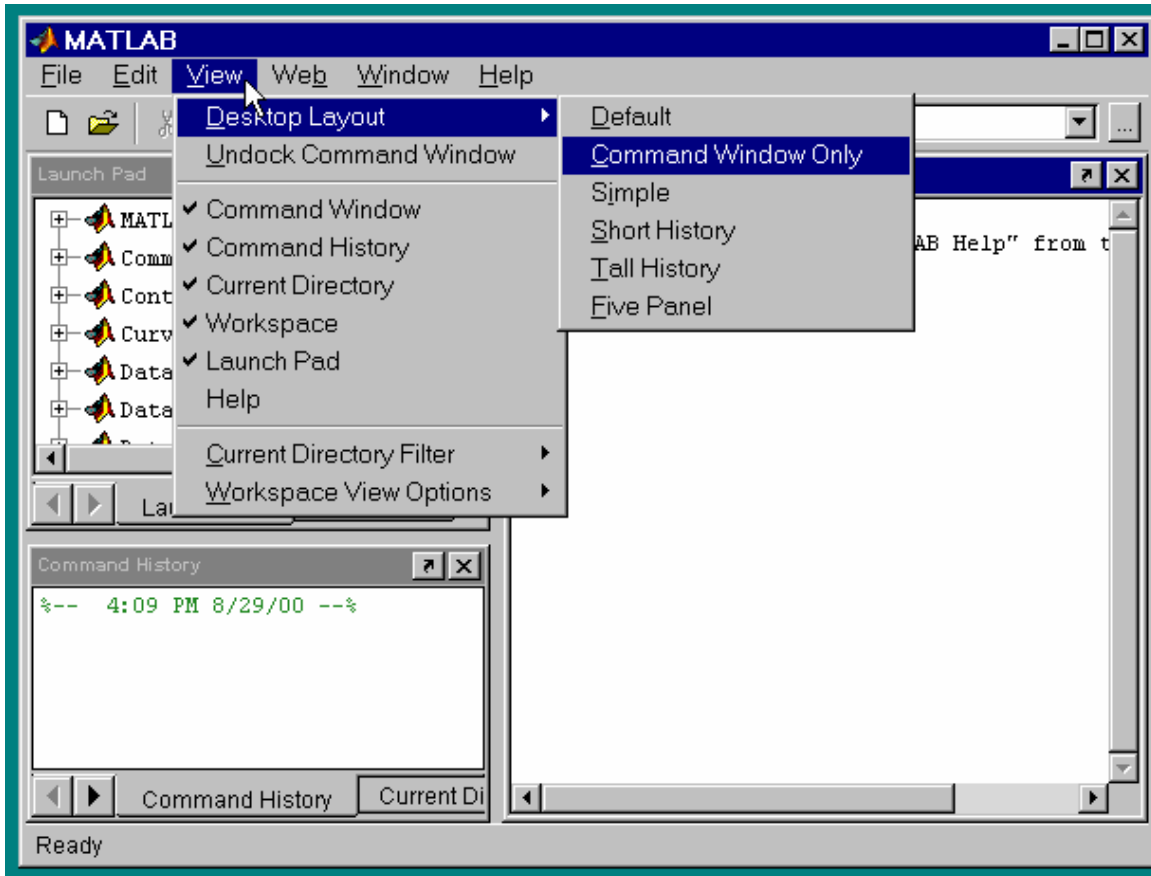


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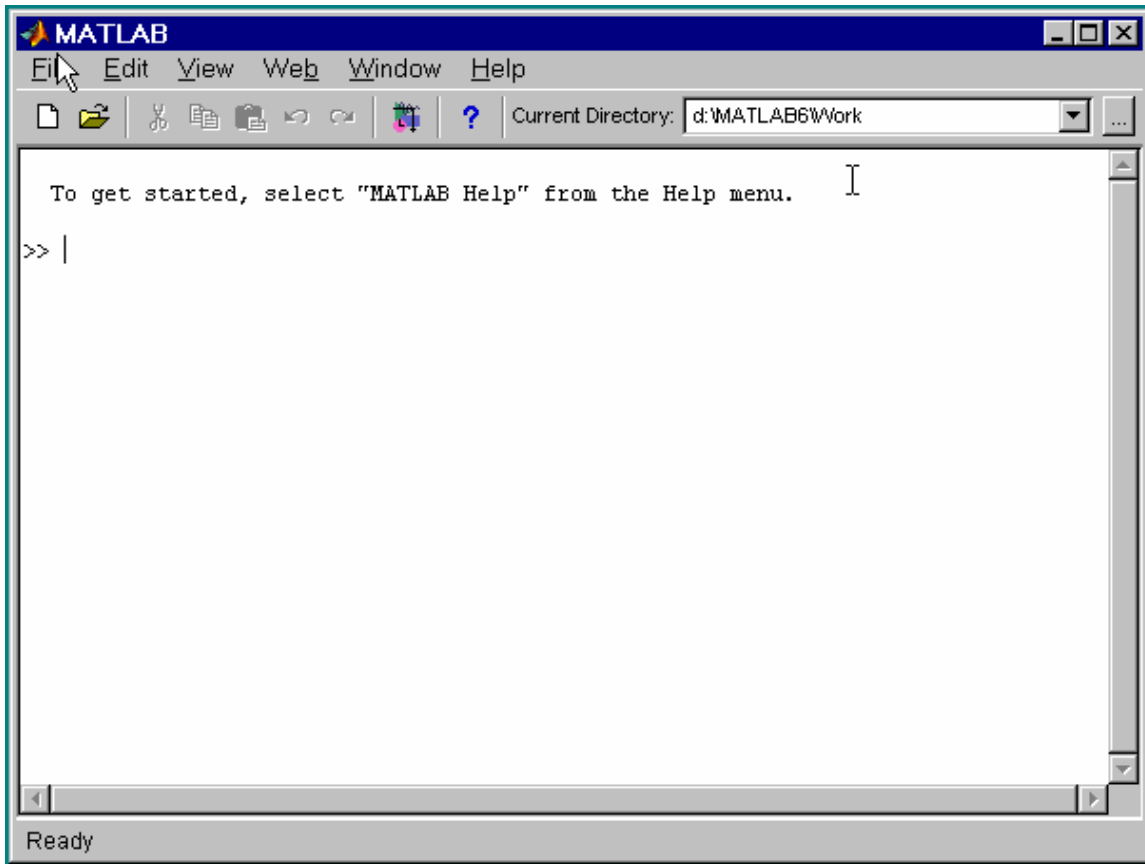


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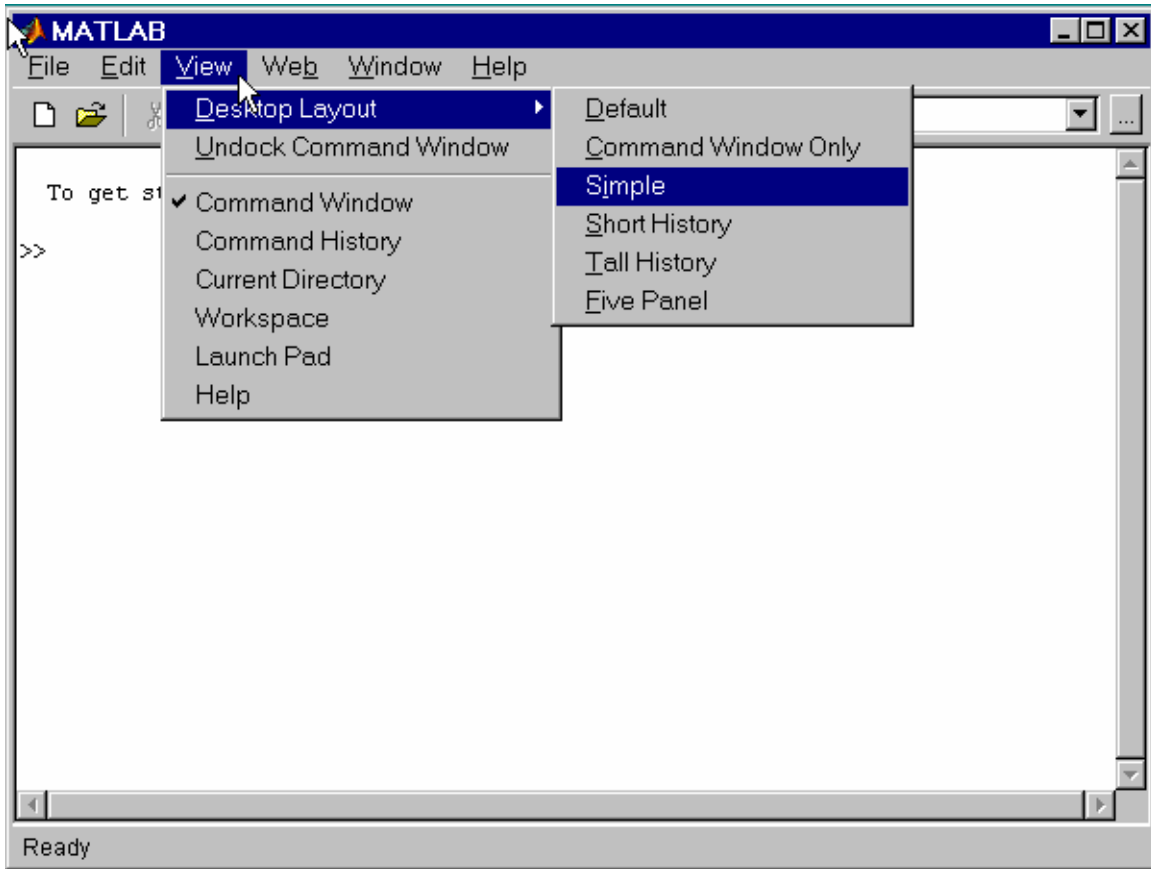


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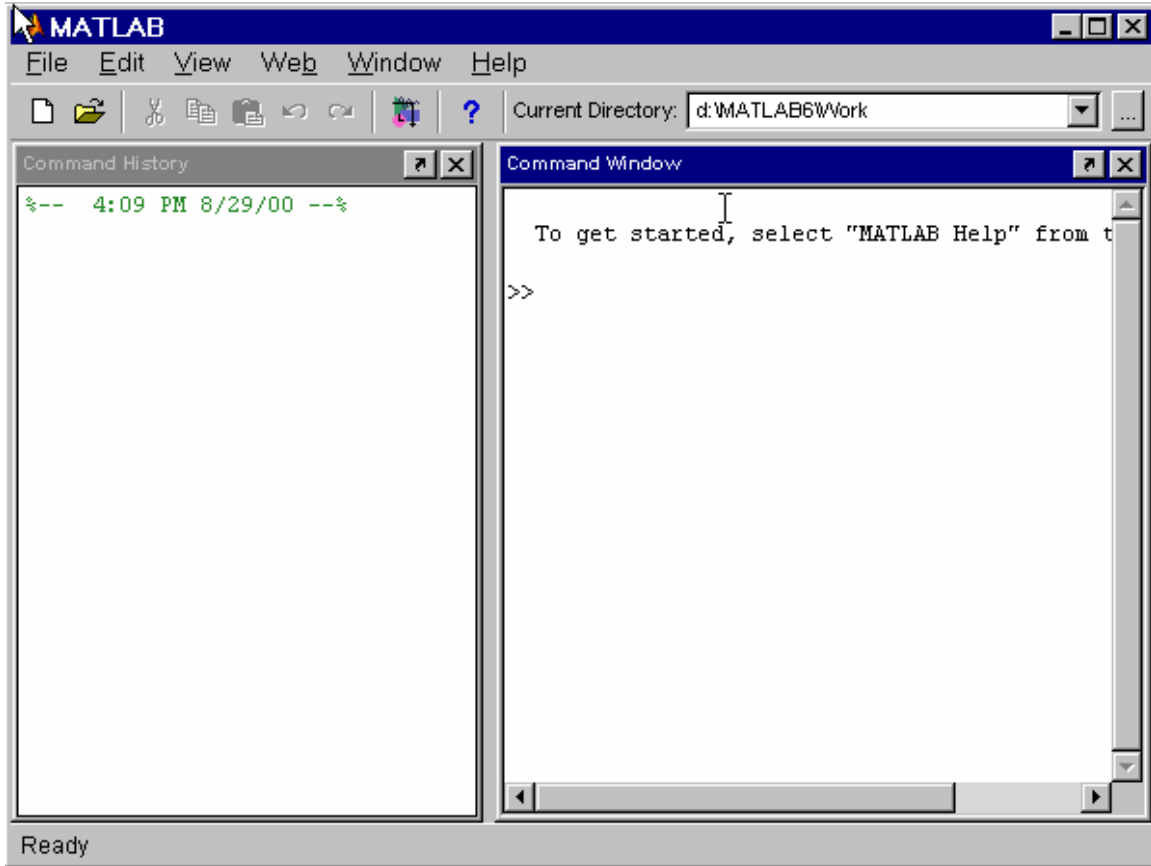


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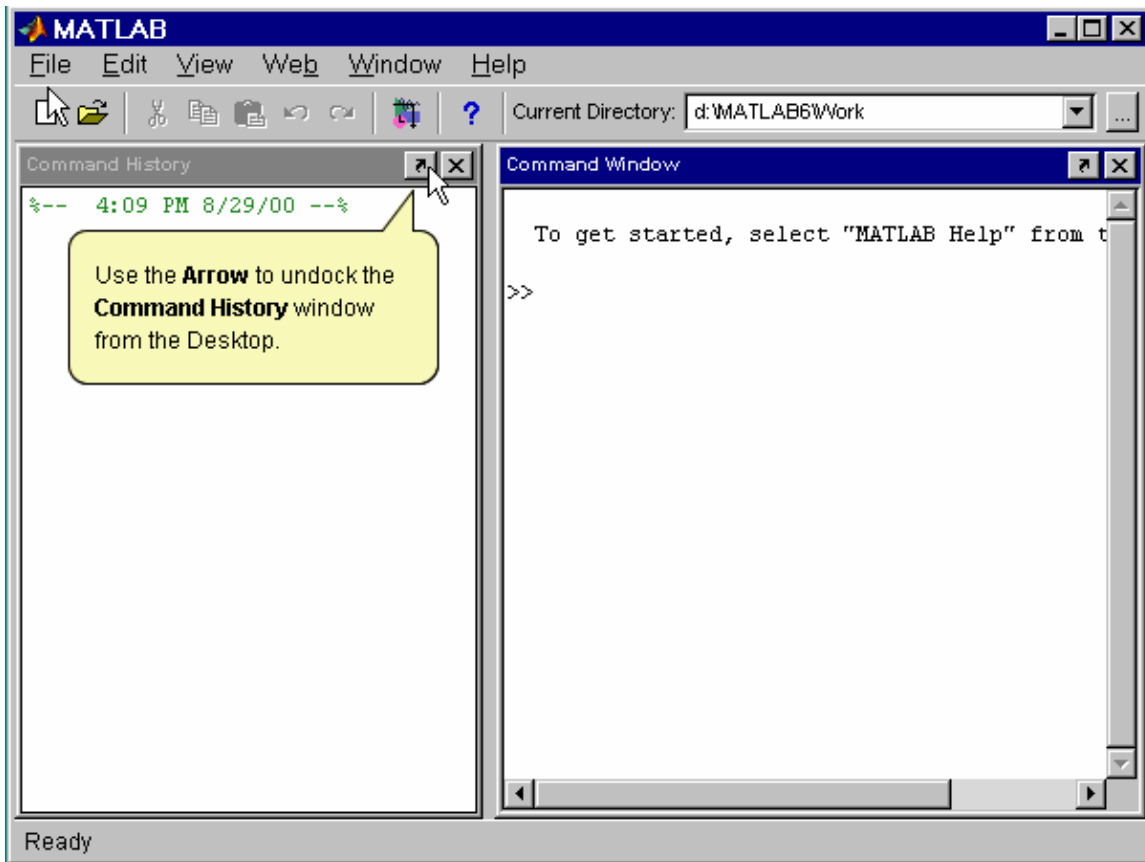


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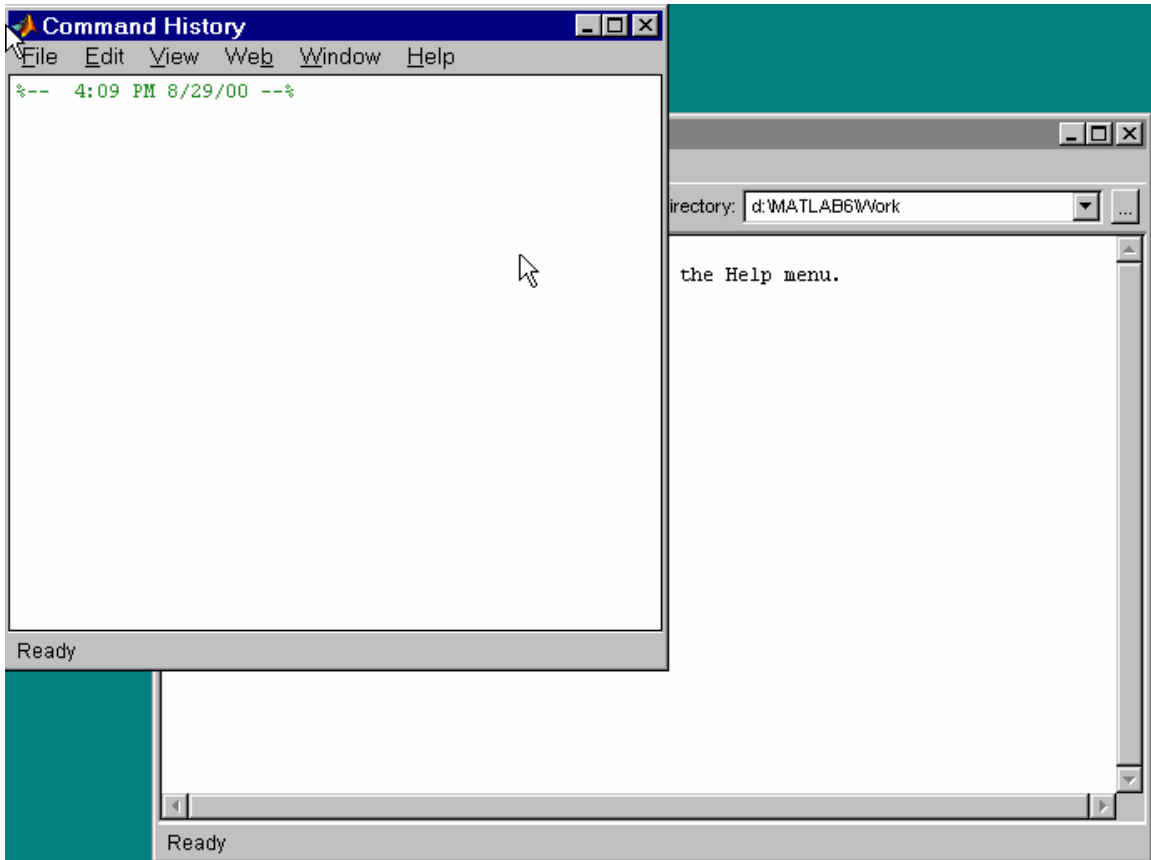


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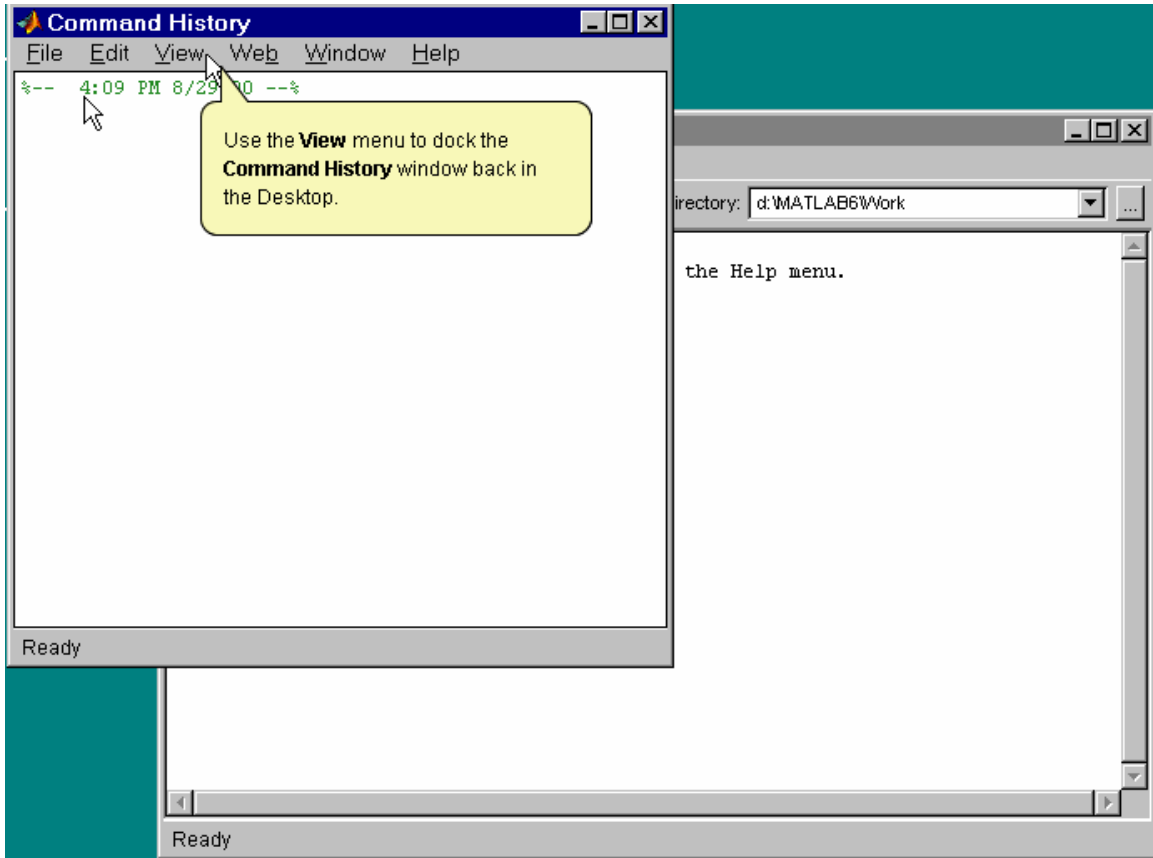


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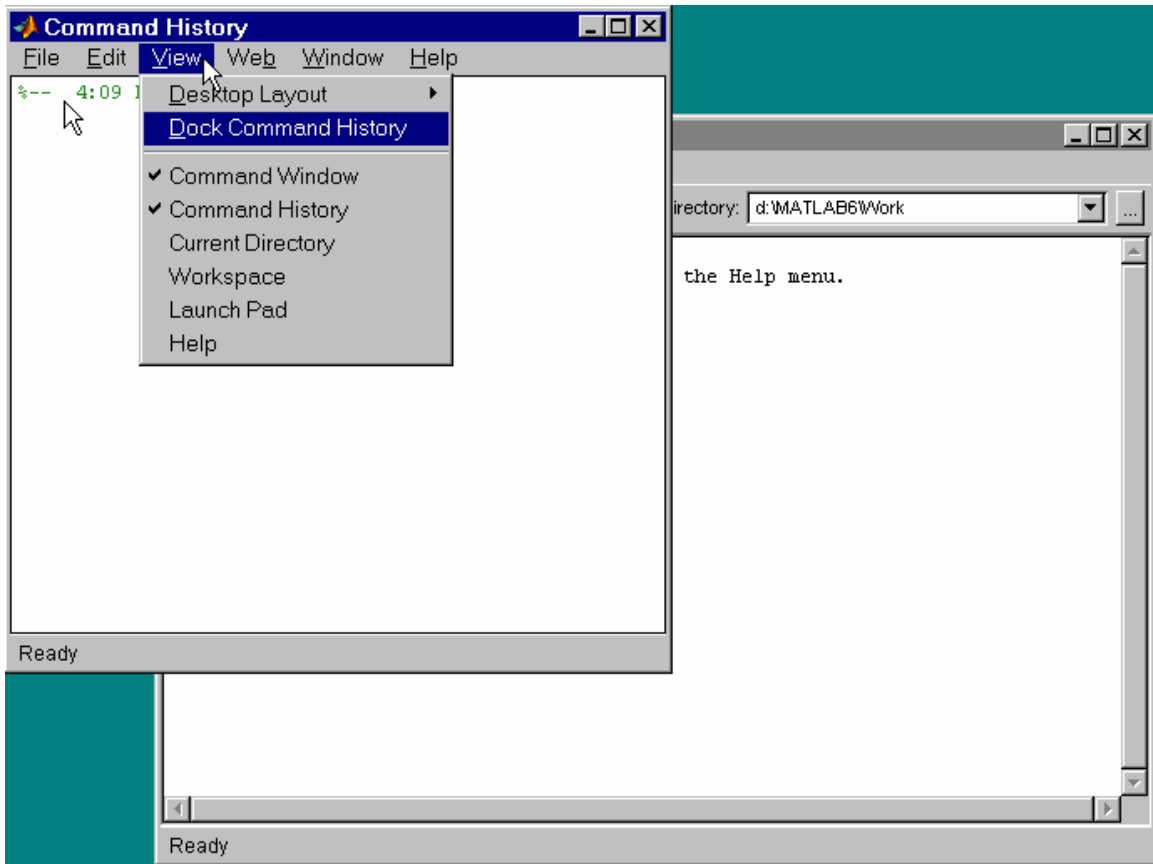


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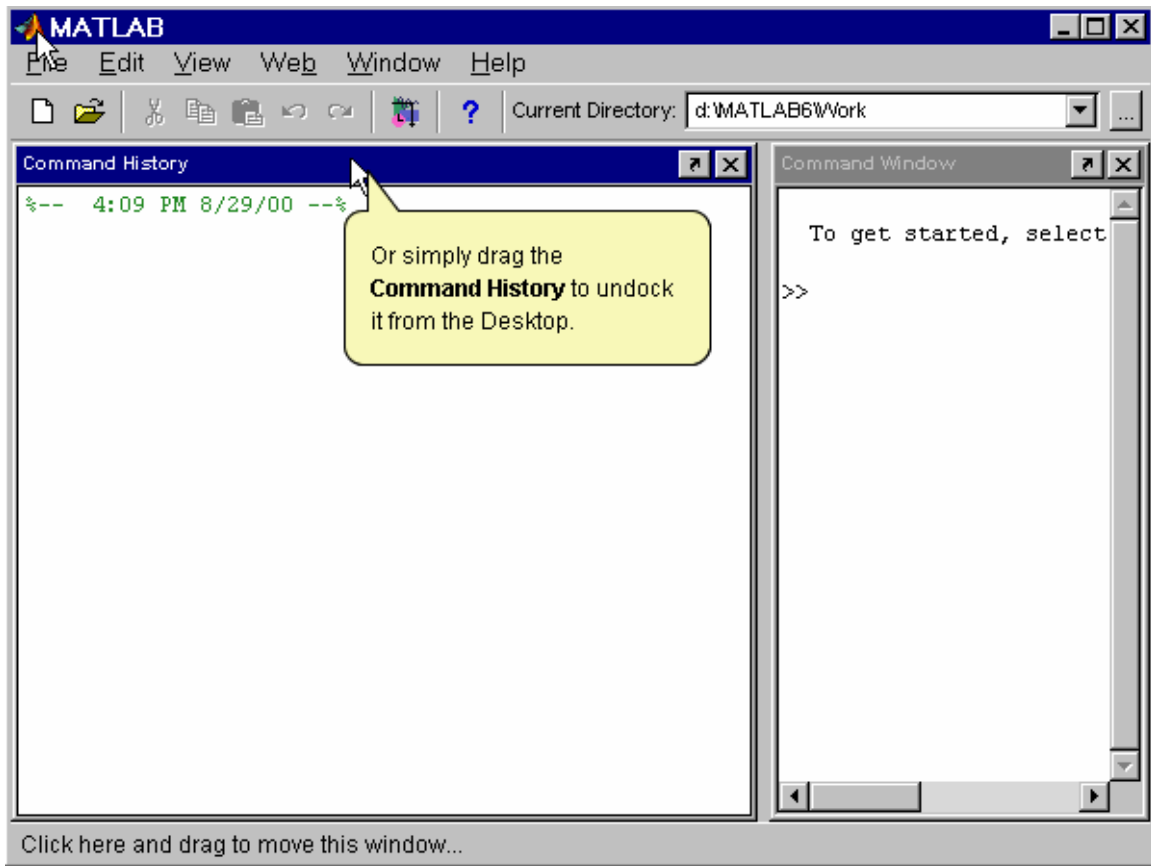


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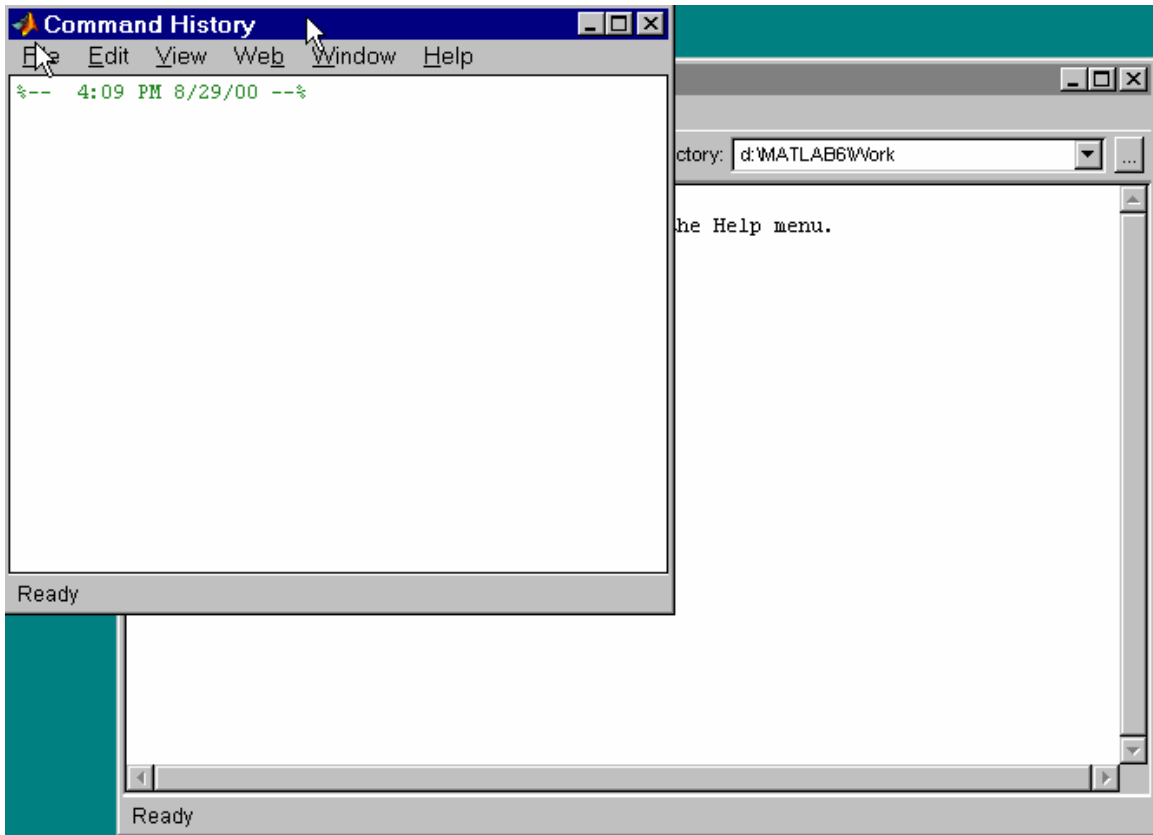


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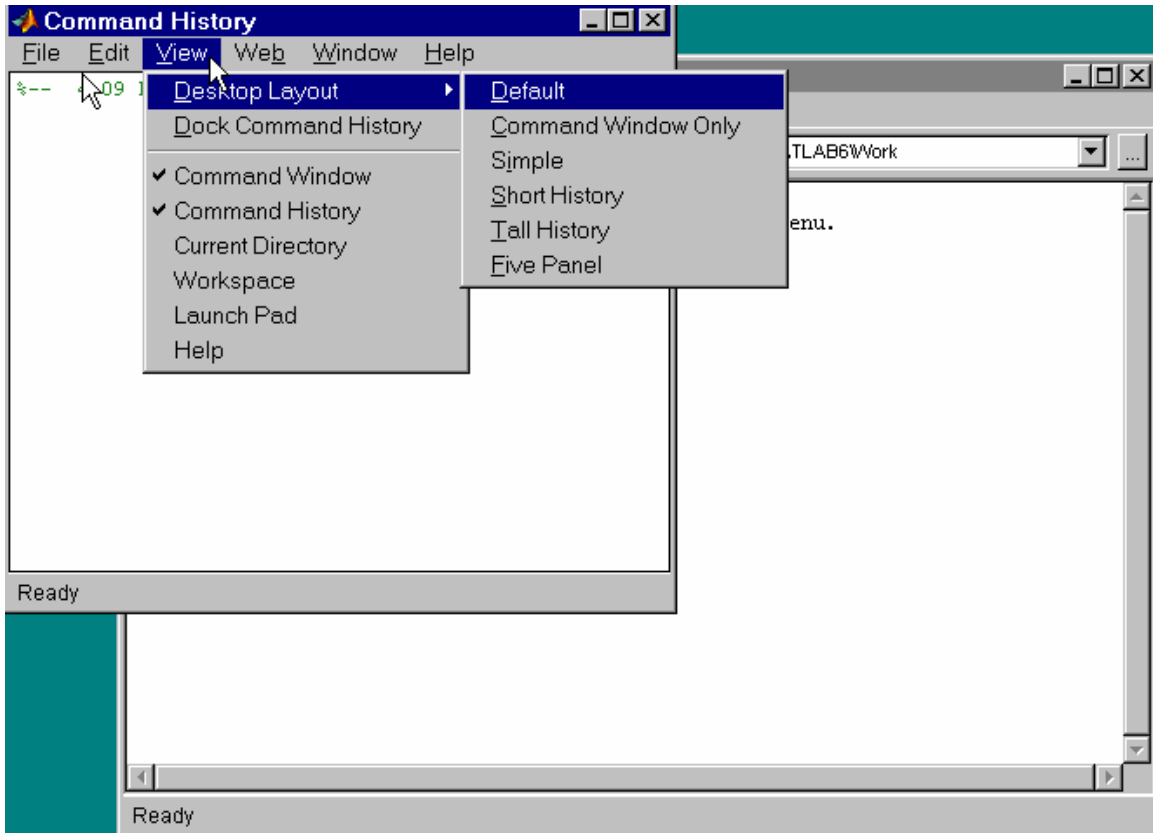


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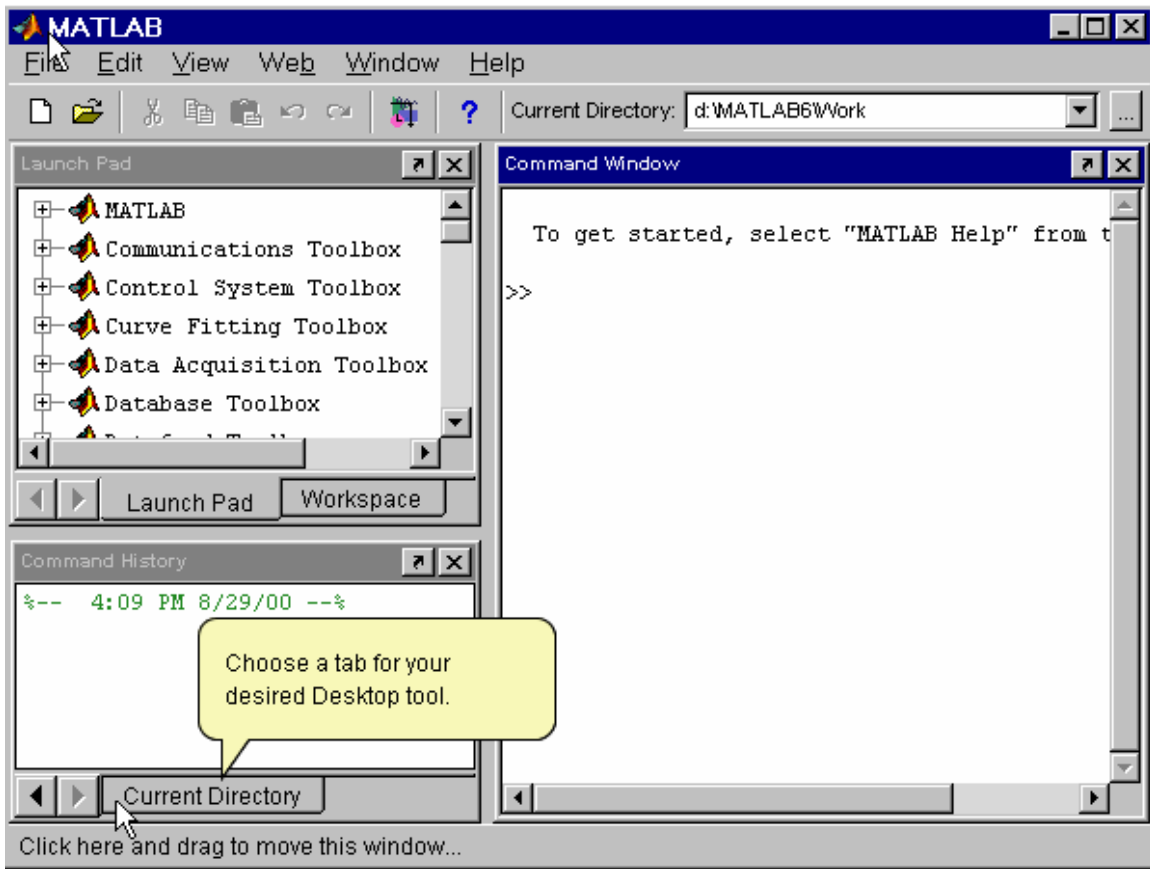


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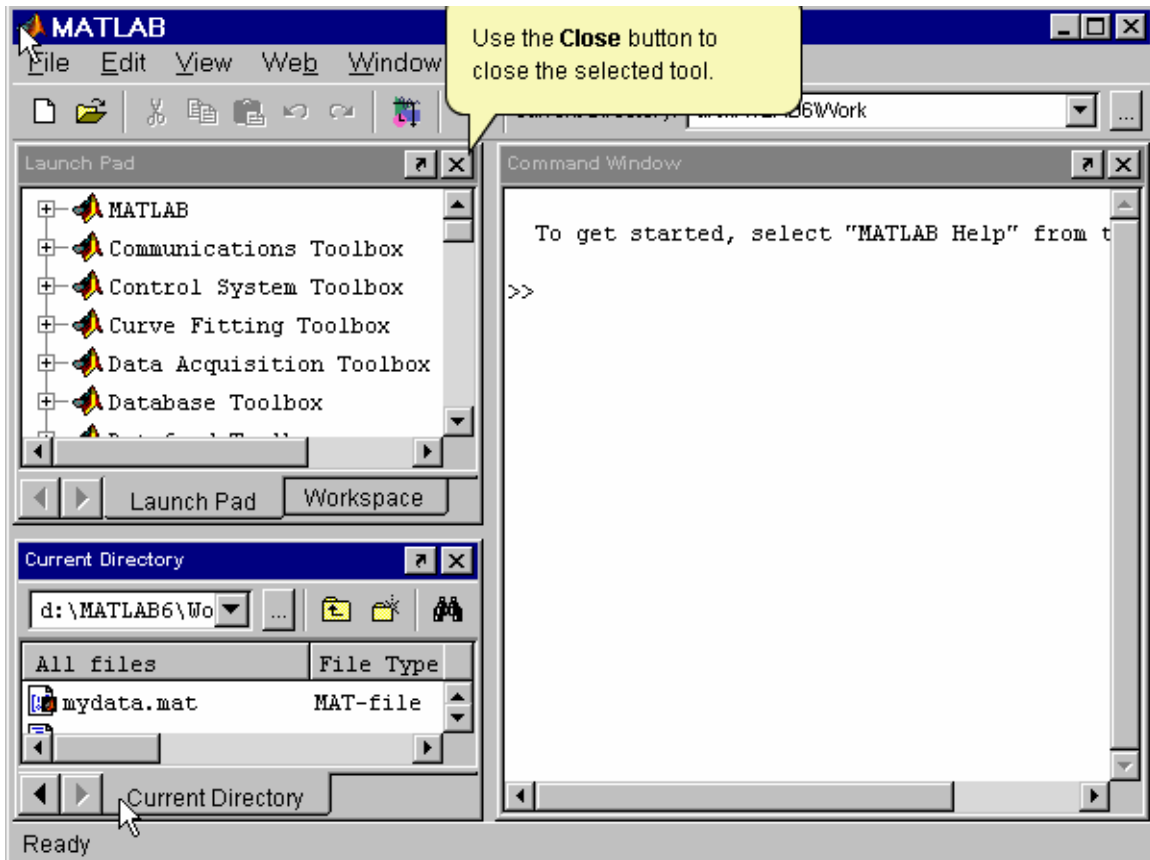


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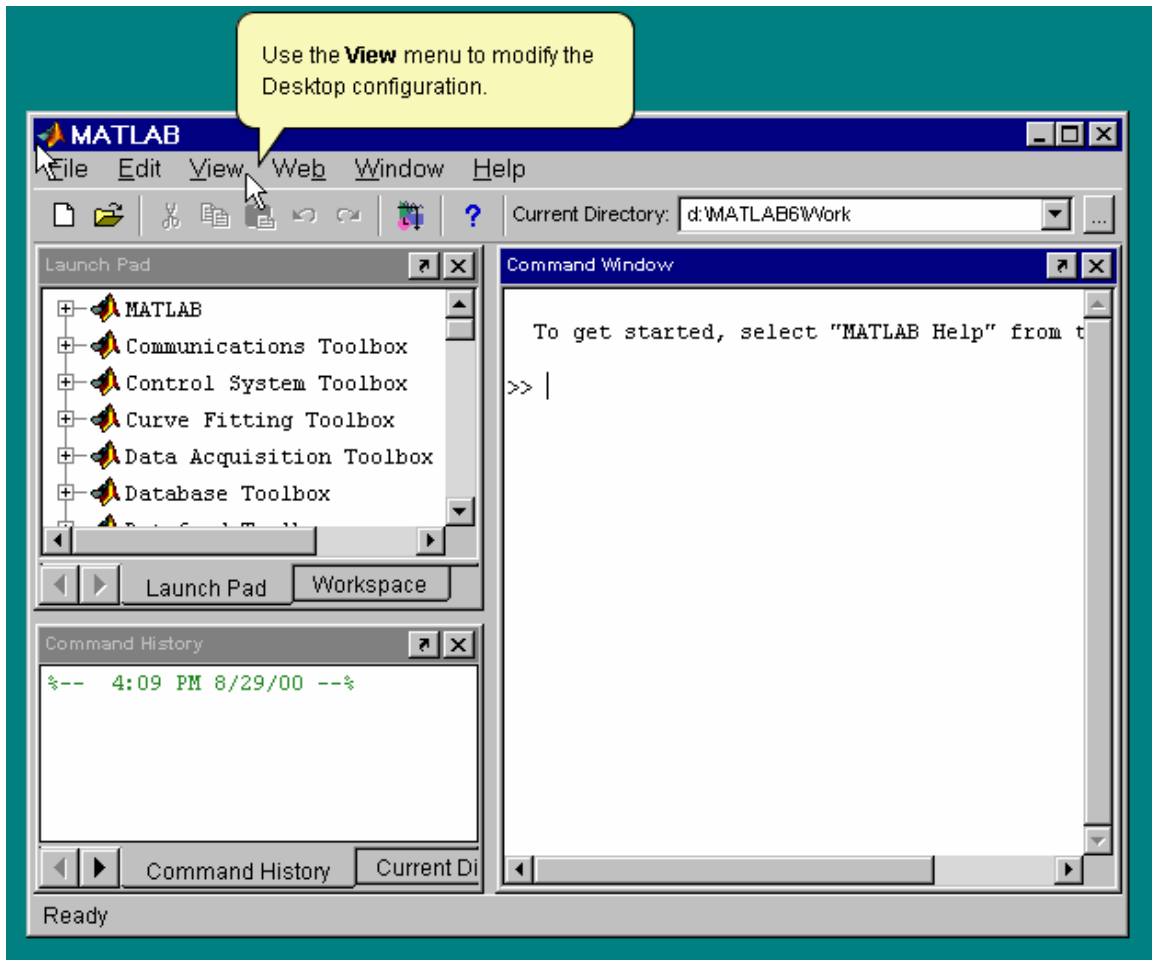


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**MATLAB IS A MATRIX CALCULATOR !**  
**MATrix + LABoratory = MATLAB**

**MATRICES**

What is a matrix?

A matrix is an arrangement of rows and columns,

Like this

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

One can see that this has 3 rows and 3 columns i.e. it is a 3 by 3 matrix.

**FOR MATLAB EVERYTHING IS A MATRIX,**

Question: Is scalar number “5” a matrix for MATLAB?

Answer: Yes number “5” is a 1 by 1 matrix.

Creating a matrix is as easy as making a vector, using semicolons (;) to separate the rows of a matrix.

If we type

A= [1 2 3; 4 5 6; 7 8 9] ;

Matlab will receive a matrix A in workspace.

If we do A+Enter MATLAB will give what is stored in “A”.

One area in which MATLAB excels is matrix computation.

We can easily find the transpose of the matrix 'A'.

B = A'

Now let's multiply these two matrices together.

Note again that MATLAB doesn't require you to deal with matrices as a collection of numbers. MATLAB knows when you are dealing with matrices and adjusts your calculations accordingly.

C = A \* B

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Let's find the inverse of a matrix ...

$$X = \text{inv}(A)$$

and then illustrate the fact that a matrix times its inverse is the identity matrix.

$$I = \text{inv}(A) * A$$

MATLAB has functions for nearly every type of common matrix calculation.

### Some Basic Matrix Operations

First, let's create a simple vector with 9 elements called 'a'.

$$a = [1 \ 2 \ 3 \ 4 \ 6 \ 4 \ 3 \ 4 \ 5]$$

Now let's add 2 to each element of our vector, 'a', and store the result in a new vector.

Notice how MATLAB requires no special handling of vector or matrix math.

$$b = a + 2$$

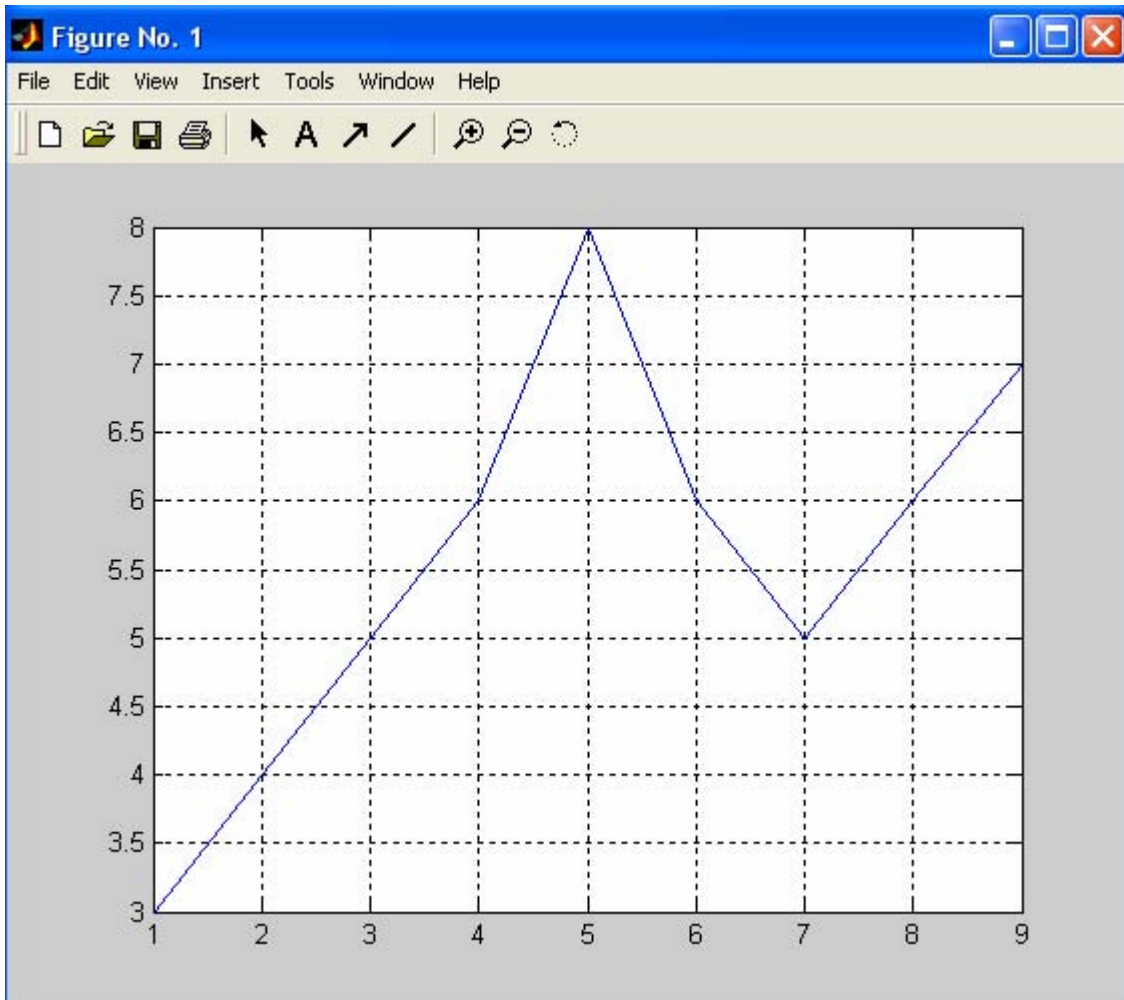
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Creating graphs in MATLAB is as easy as one command. Let's plot the result of our vector addition with grid lines.

```
plot(b)  
grid on
```



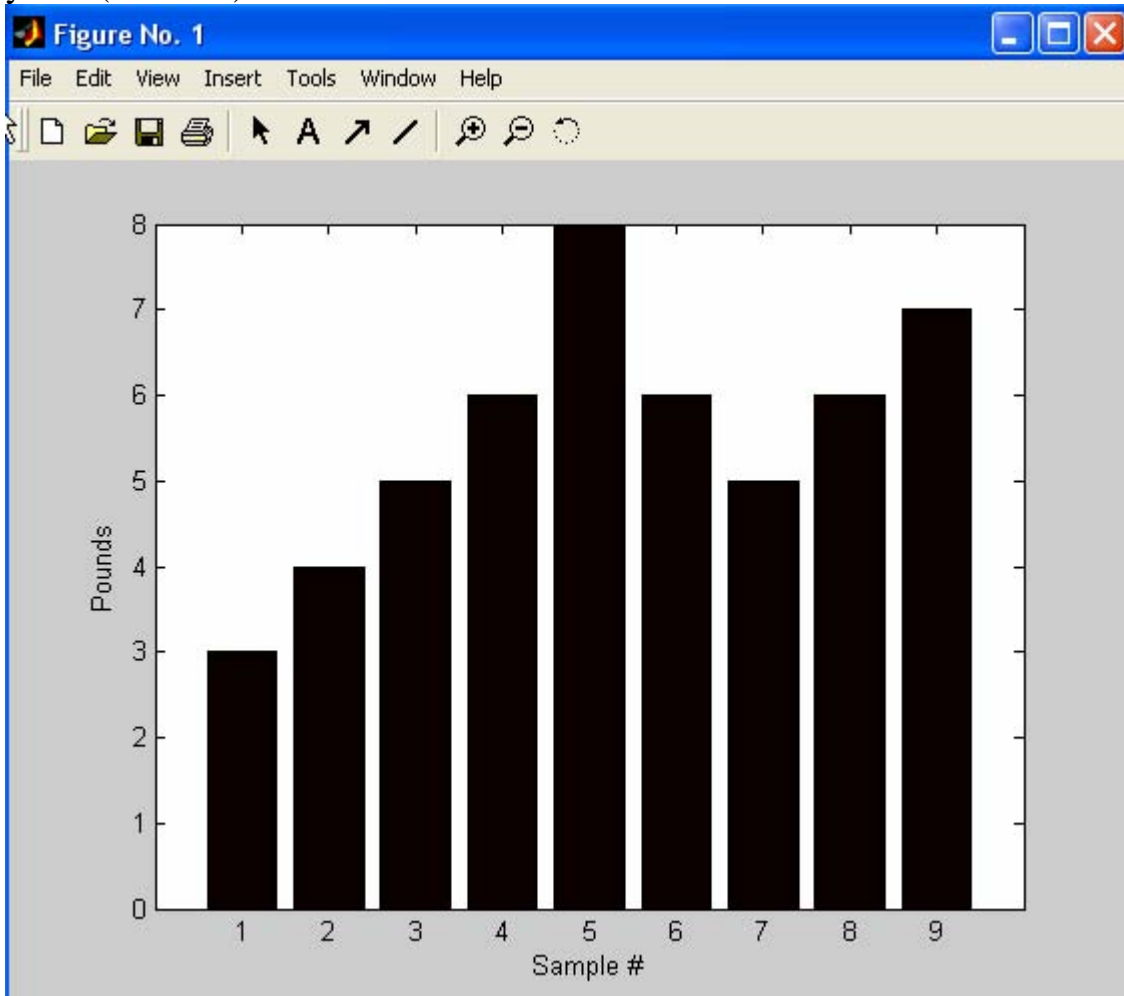
MATLAB can make other graph types as well, with axis labels.

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```
bar(b)  
xlabel('Sample #')  
ylabel('Pounds')
```



MATLAB can use symbols in plots as well. Here is an example using \*'s to mark the points. MATLAB offers a variety of other symbols and line types.

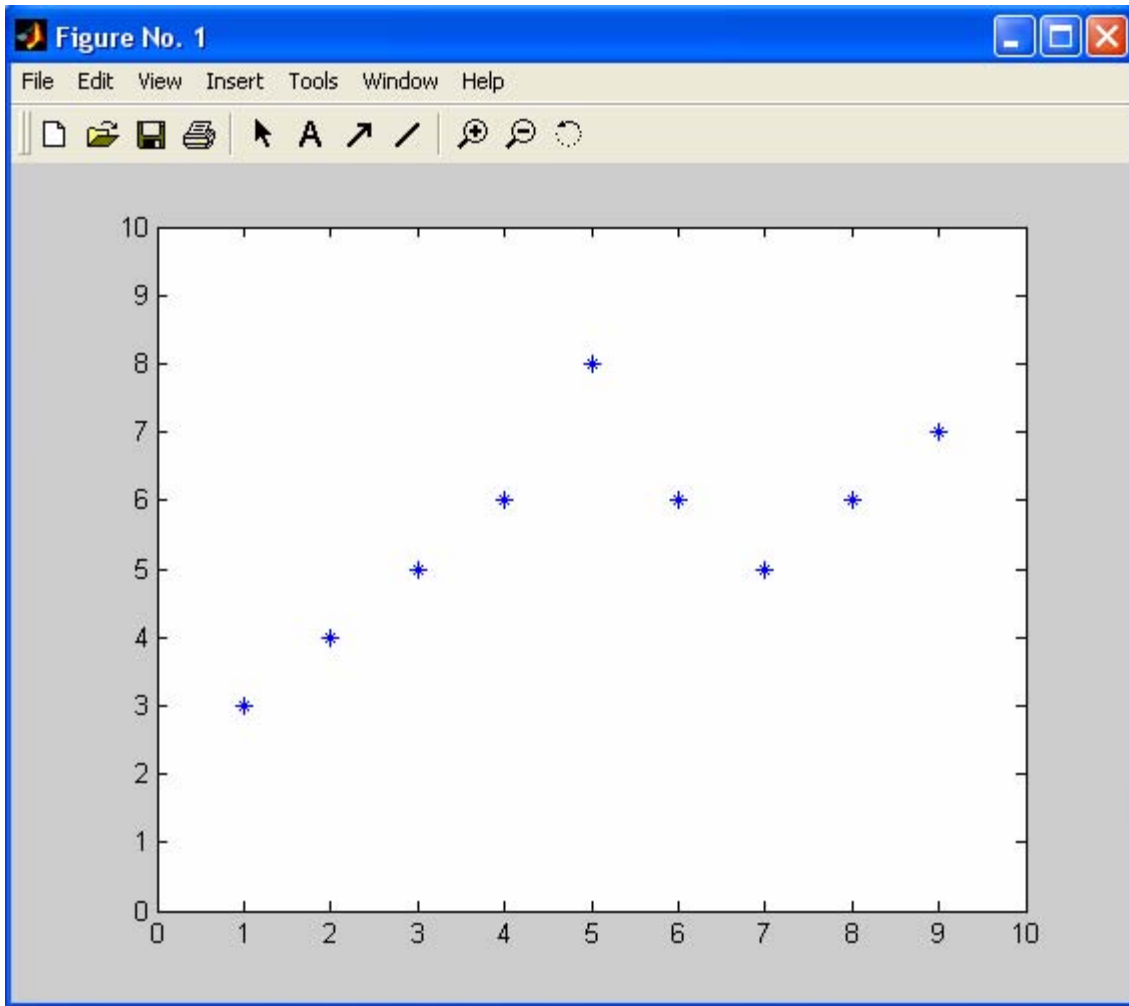
```
plot(b,'*')  
axis([0 10 0 10])
```

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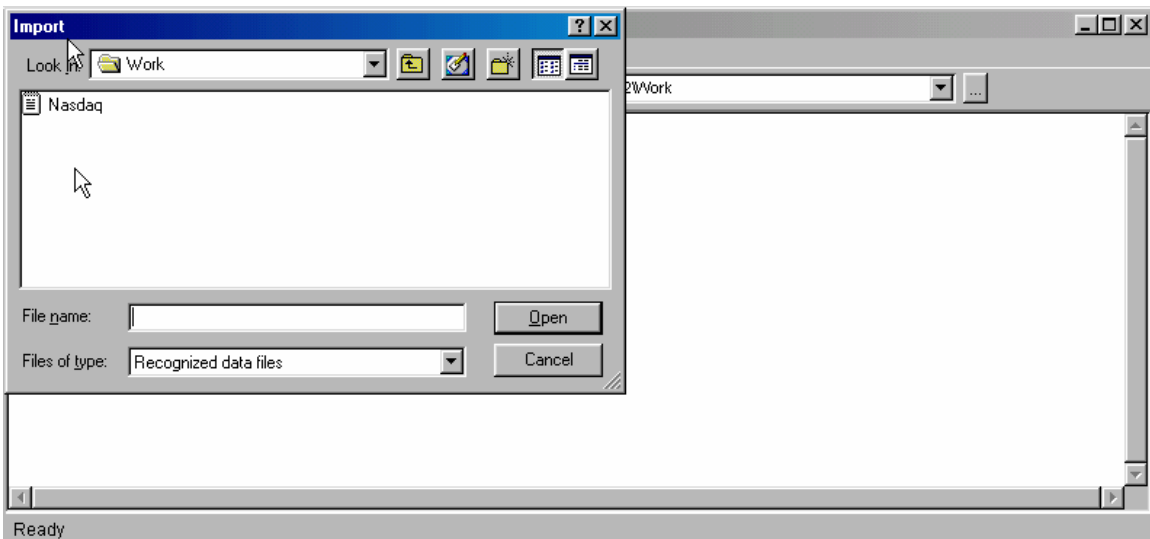
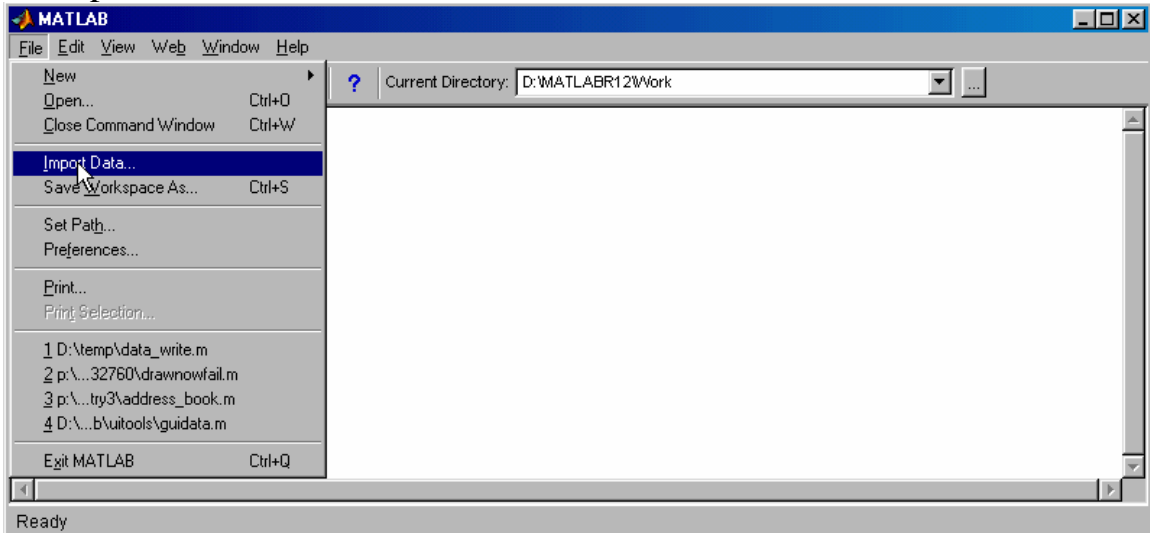


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## Importing Data:

### How to import data into MATLAB?

1. Select Import data from the file menu and then select the file to import.



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What column separator does your data use?

Column separator

Comma  Space  Semicolon  Tab  Other  Text header lines:

Preview of D:/MATLABR12/Work/Nasdaq.txt

Date	O	H	L	C
728321	407.19	410.11	406.59	409.93
728322	409.93	412.65	409.73	412.52
728325	412.52	415.42	412.26	413.99
728326	413.99	413.99	408.96	410.22
728327	410.22	412.44	408.68	411.78
728328	411.78	411.78	407.19	410.05
728329	410.05	410.08	397.48	400.19
728332	397.48	400.19	402.24	405.11
728333	399.62	402.24	404.91	408.28
728334	401.46	404.61	407.33	408.74
728335	403.91	405.95	405.35	407.39
728336	401.31	402.77		
728339	401.83	405.56	401.83	405.11
728340	405.11	409.17	404.91	408.28
728341	408.28	411.29	407.33	408.74
728342	408.74	412.43	405.35	407.39

Preview truncated to 10x10

	1	2	3	
1	728321	407.1900	410.1100	4
2	728322	409.9300	412.6500	4
3	728325	412.5200	415.4200	4
4	728326	413.9900	413.9900	4
5	728327	410.2200	412.4400	4
6	728328	411.7800	411.7800	4
7	728329	410.0500	410.0800	3
8	728332	397.4800	400.1900	3
9	728333	399.6200	402.2400	3

The preview pane shows the format of the data within the file.

Cancel < Back Next > Finish

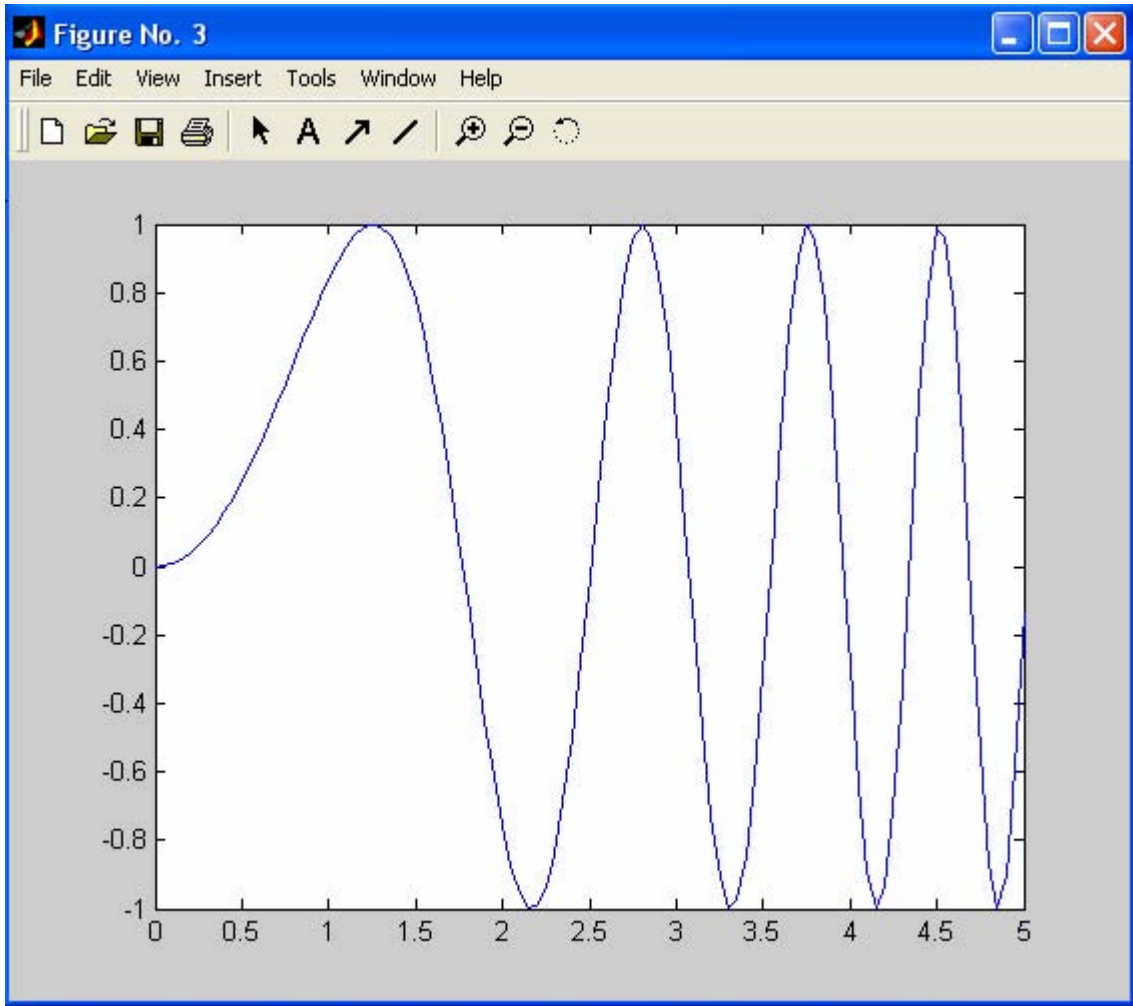
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## XY Plots in MATLAB

```
% Line plot of a chirp  
x=0:0.05:5;  
y=sin(x.^2);  
plot(x,y);
```

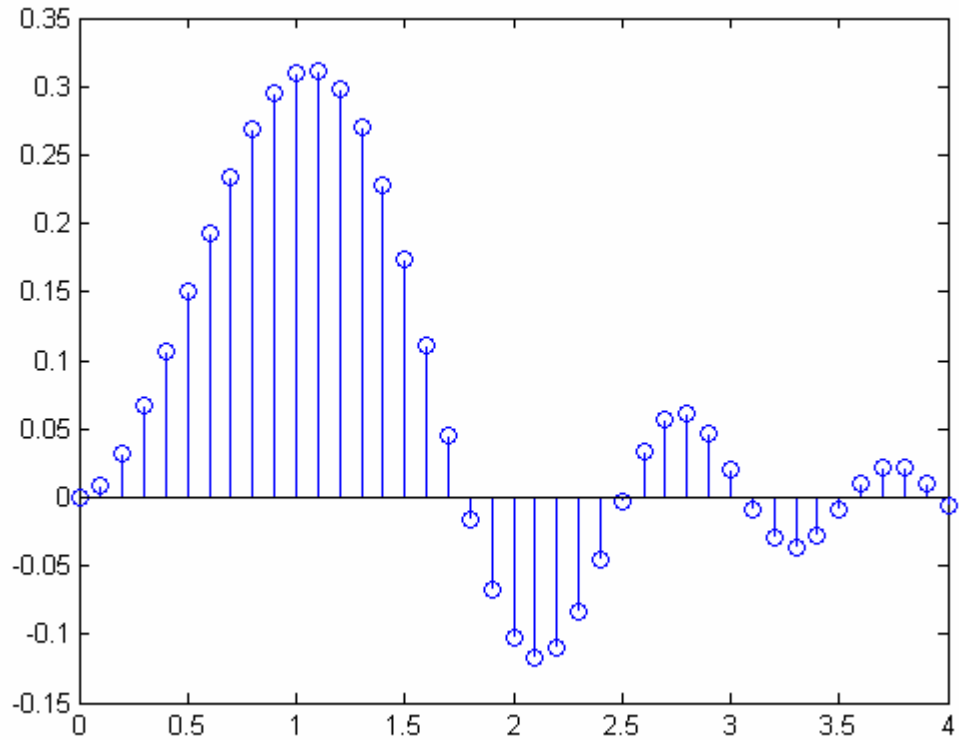


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```
% Stem plot  
x = 0:0.1:4;  
y = sin(x.^2).*exp(-x);  
stem(x,y)
```



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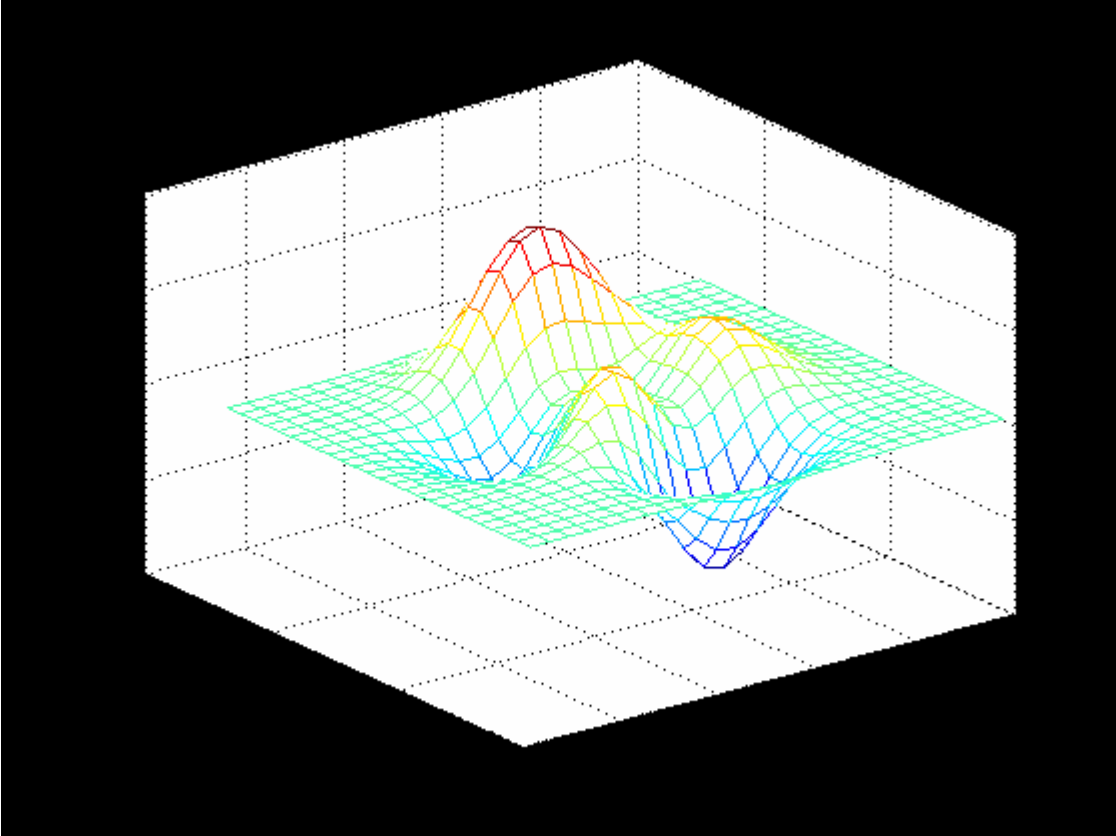
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### 3 D Plots

```
figure;% Mesh Plot of Peaks
```

```
z=peaks(25);
```

```
mesh(z);
```

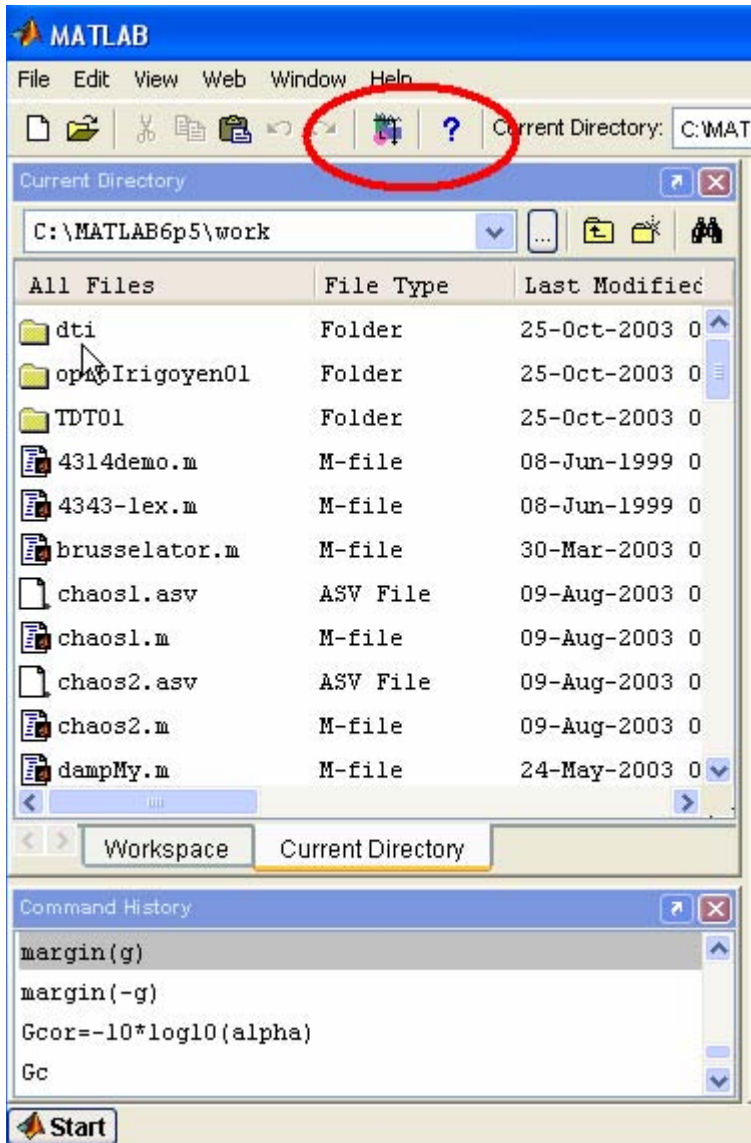


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Simulink  
type simulink  
>>simulink  
or click on this simulink block

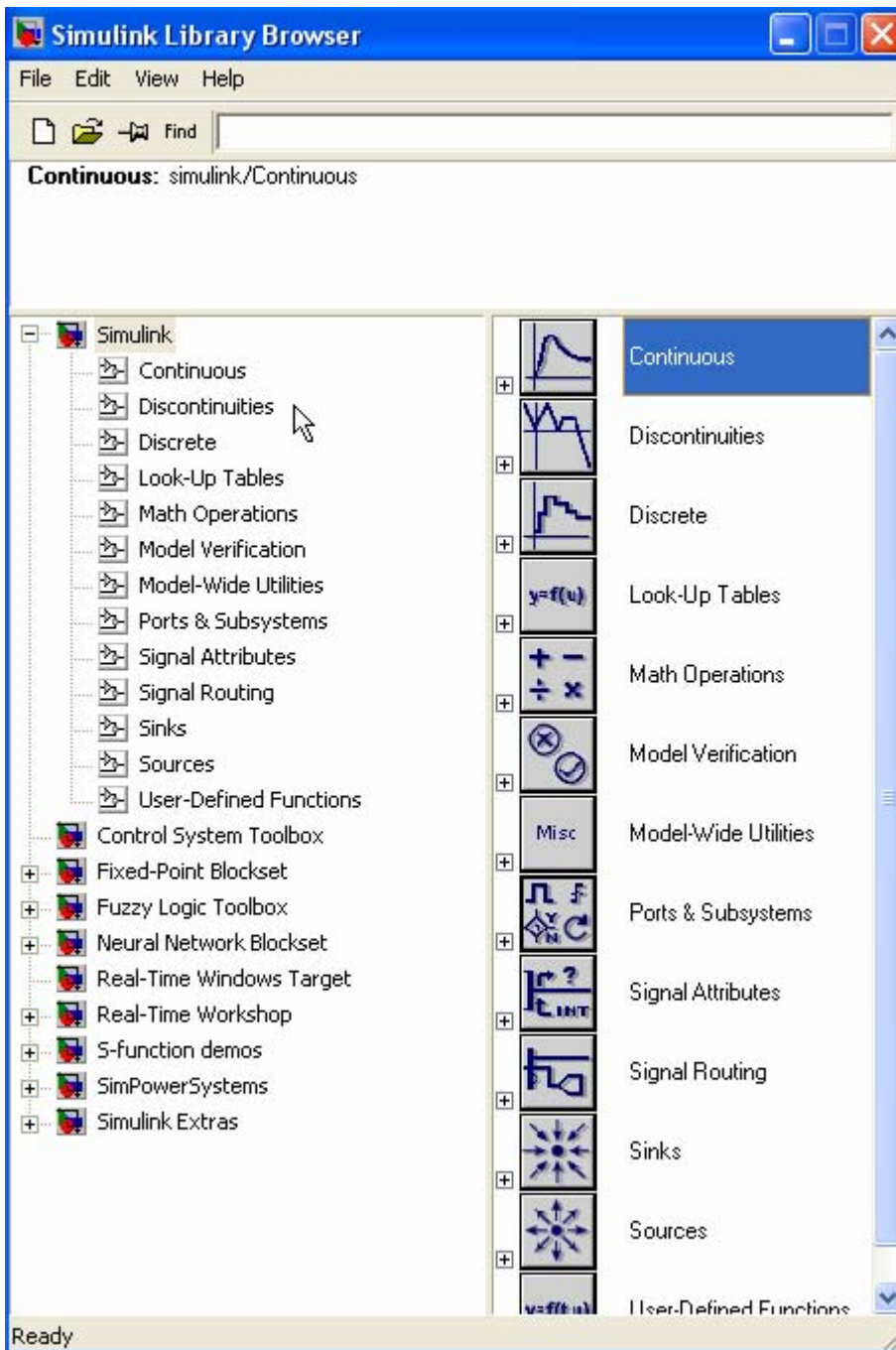


Simulink Library Browser will open up

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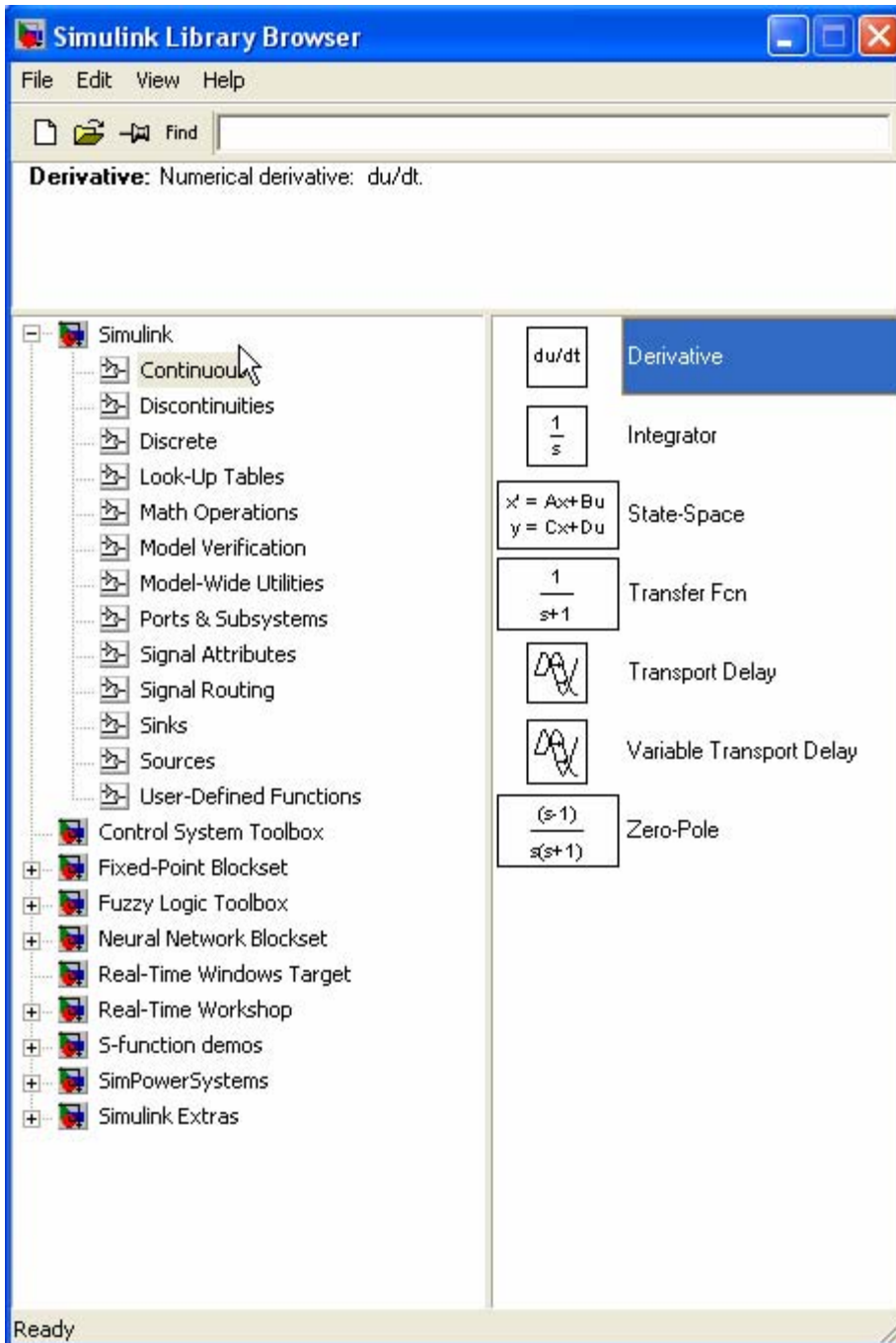
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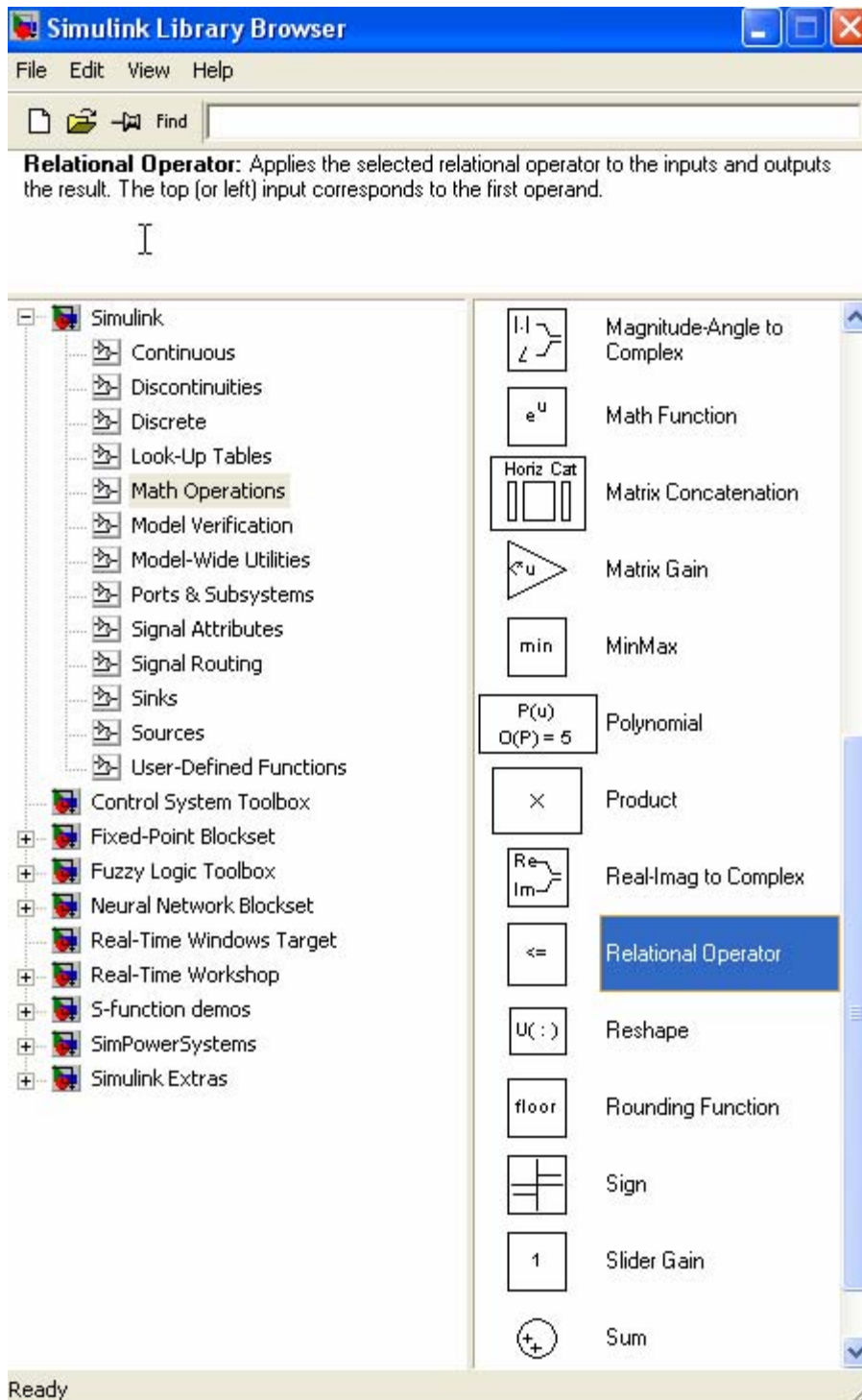
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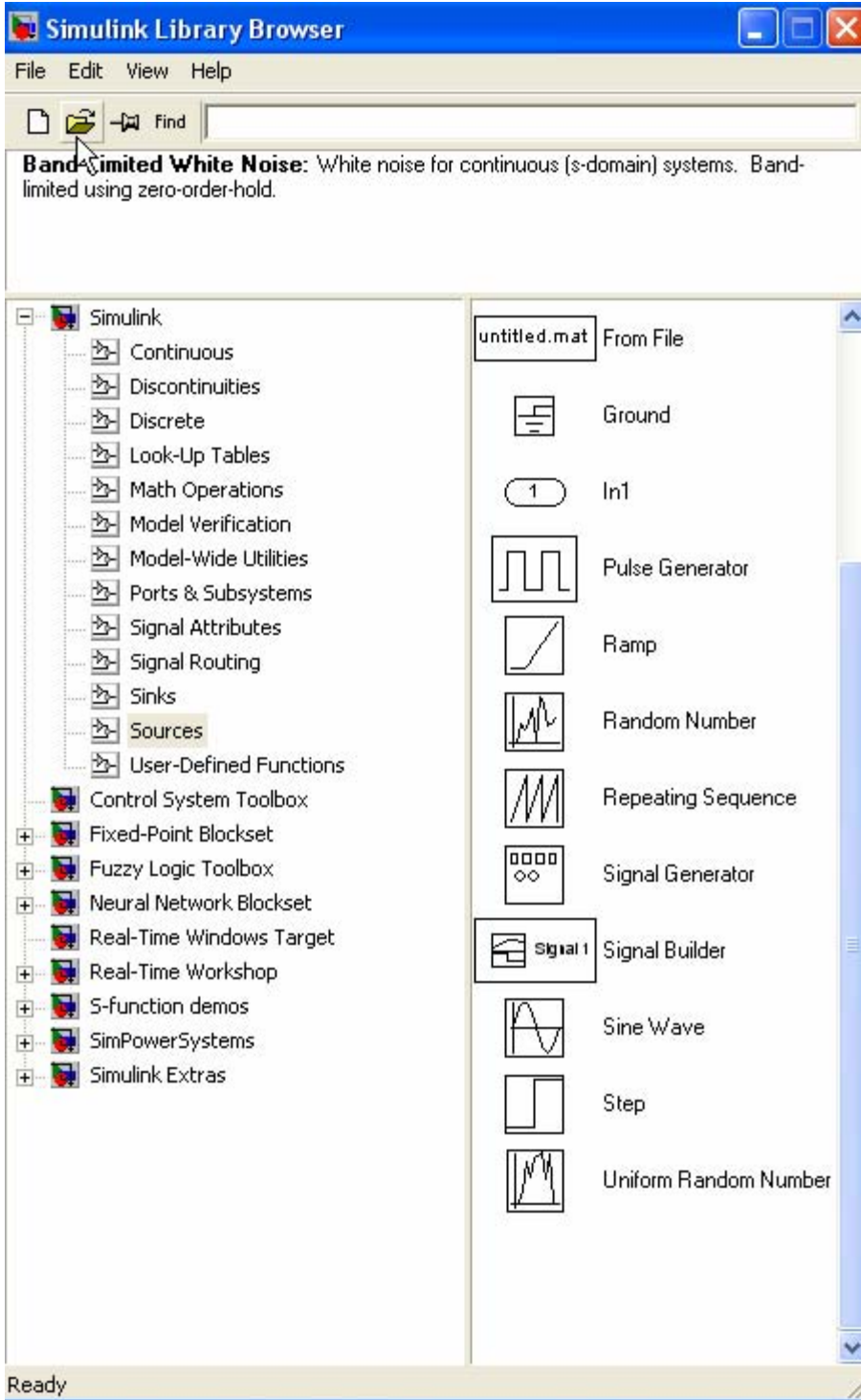
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Sources

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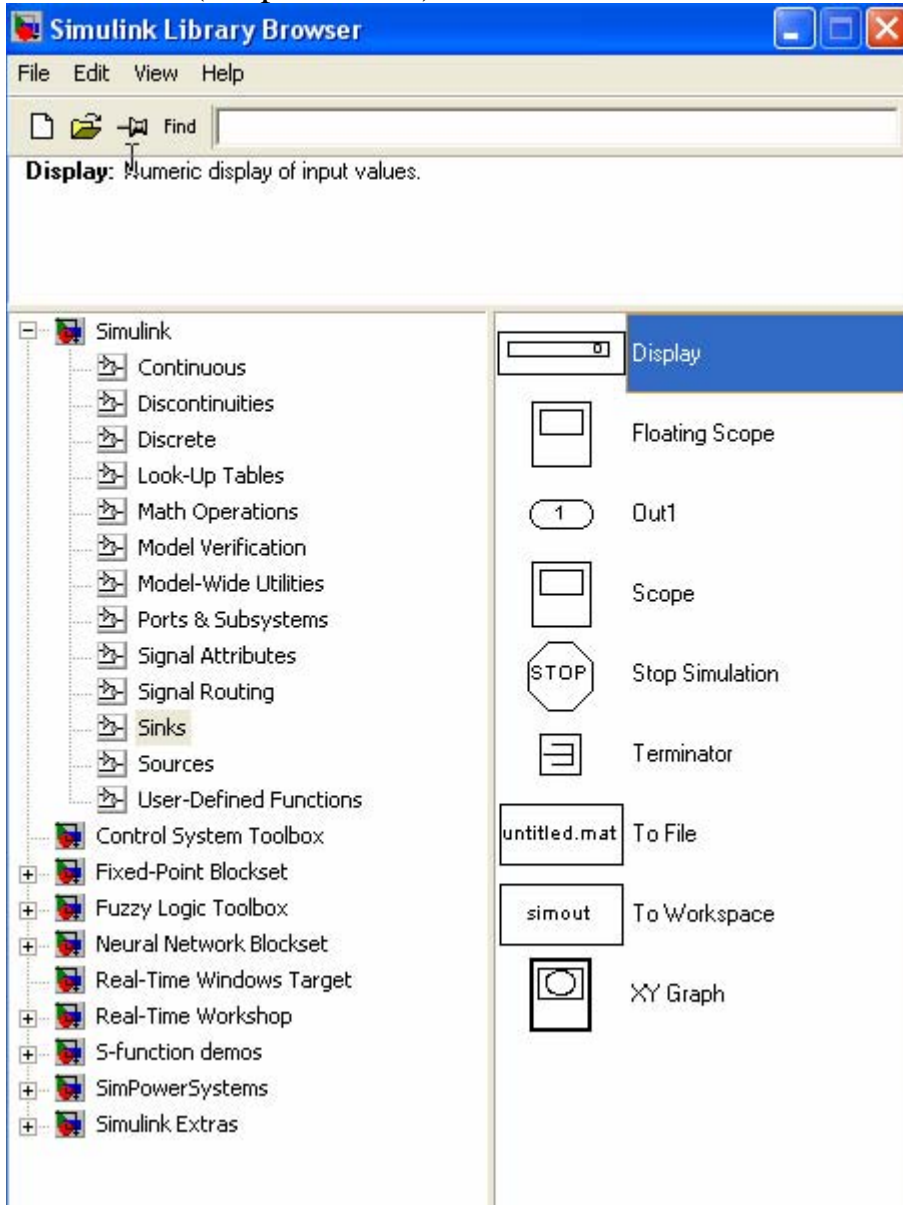


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## Some Sinks (Output Blocks)



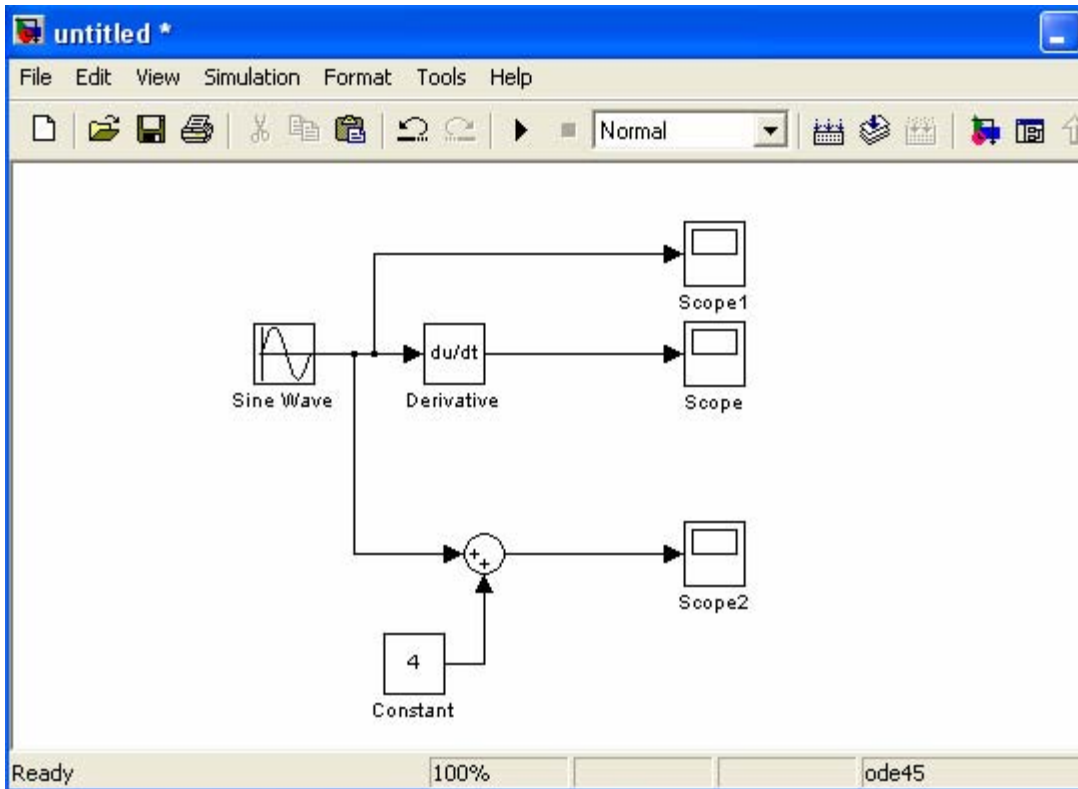
One Simple simulink Model

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HOW TO EXPLORE IT MORE.

- This tutorial uses standard MATLAB help and demos.
- Simply type help and try instructions.
- MATLAB Central file Exchange.
- MATLAB downloads are at [www.mathworks.com](http://www.mathworks.com).

<http://arri.uta.edu/acs/jyotirmay/gadewadikar.htm>

Email : [jyotir@arri.uta.edu](mailto:jyotir@arri.uta.edu)

THANK YOU AND HAVE A GOOD TIME !

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