

Lab # 3

To plot graphs and multiple graphs for functions, use of grid, labels and titles in MATLAB

Objective:

Introduction:

- The MATLAB environment offers a variety of data plotting functions plus a set of GUI tools to create, and modify graphic displays. The GUI tools afford most of the control over graphic properties and options that typed commands such as `annotate`, `get`, and `set` provide.
- A figure is a MATLAB window that contains graphic displays (usually data plots) and UI components. You create figures explicitly with the `figure` function, and implicitly whenever you plot graphics and no figure is active.
- By default, figure windows are resizable and include pull-down menus and toolbars.
- A plot is any graphic display you can create within a figure window. Plots can display tabular data, geometric objects, surface and image objects, and annotations such as titles, legends, and color bars.
- Figures can contain any number of plots. Each plot is created within a 2-D or a 3-D data space called axes. You can explicitly create axes with the `axes` or `subplot` functions.
- A graph is a plot of data within a 2-D or 3-D axes. Most plots made with MATLAB functions and GUIs are therefore graphs. Some types of graphs can display more than one variable at a time, others cannot.

For more information on 2-D plotting, type `help graph2d`

To Plot a point:

```
>>plot ( variablename, 'symbol')
```

```
//the function plot () creates a graphics window, called a Figure window, and named by
```

```
//default"Figure No. 1"
```

Following syntaxes can be used for creating a matrix and swapping its elements as required.

```
A = 1:100;  
B = rand (2,2);  
A(2,[1:2]);  
A(2,[1,2]);  
A(1:2,1);  
A(1:2,2:2);  
A = [a(1,1),a(2,2)];  
h = 0:100;  
n = [h(2:11),h(22:31)]
```

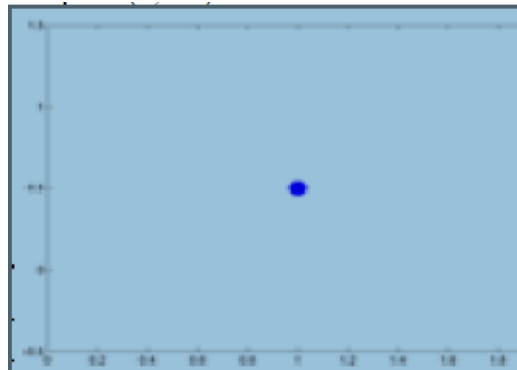
Following syntaxes are used for creating n-points between two limits.

```
A = [0:2:100];  
A = linspace(0,100,50);
```

Example : Complex number

```
>> z = 1 + 0.5j;
```

```
>>plot (z, '.')
```

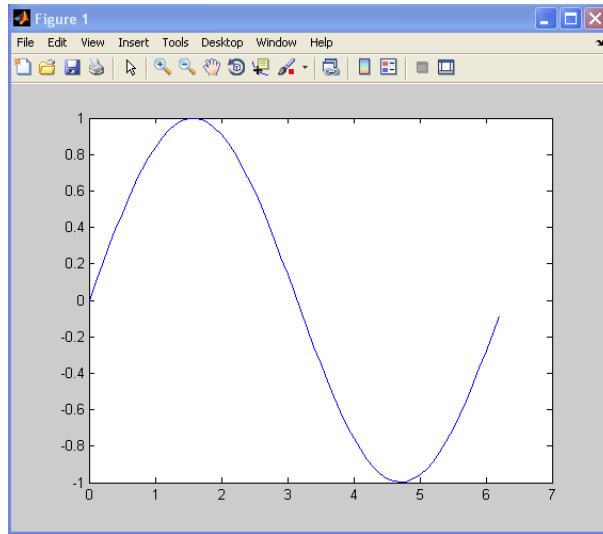


To plot Sin wave:

```
>>t=0:0.1:2*pi;
```

```
>>a=sin(t);
```

```
>>plot(t,a)
```



Sin wave

Cos wave can also be plotted the same way.

a) **Plotting Curves:**

- **plot (x,y)** generates a linear plot of the values of x (horizontal axis) and y (vertical axis).
- **semilogx (x,y)** generate a plot of the values of x and y using a logarithmic scale for x and a linear scale for y
- **semilogy (x,y)** generate a plot of the values of x and y using a linear scale for x and a logarithmic scale for y.
- **loglog(x,y)** generate a plot of the values of x and y using logarithmic scales for both x and y

b) **Multiple Curves:**

- **plot (x, y, w, z)** – multiple curves can be plotted on the same graph by using multiple arguments in a plot command. The variables x, y, w, and z are vectors. Two curves will be plotted: y vs. x, and z vs. w.
- **legend ('string1', 'string2',...)** – used to distinguish between plots on the same graph

c) Multiple Figures:

- figure (n) – used in creation of multiple plot windows.place this command before the plot() command, and the corresponding figure will be labeled as “Figure n”
- close – closes the figure n window.
- close all – closes all the figure windows.

d) Subplots:

- subplot (m, n, p) – m by n grid of windows, with p specifying the current plot as the pth window

Example: (polynomial function)

Plot the polynomial using linear/linear scale, log/linear scale, linear/log scale, & log/log scale:

% Generate the polynomial:

```
x = linspace (0, 10);
```

```
y = 2*x.^2 + 7*x + 9;
```

% plotting the polynomial:

```
figure (1);
```

```
subplot (2,2,1), plot (x,y);
```

```
title ('Polynomial, linear/linear scale');
```

```
ylabel ('y'), grid;
```

```
subplot (2,2,2), semilogx (x,y);
```

```
title ('Polynomial, log/linear scale');
```

```
ylabel ('y'), grid;
```

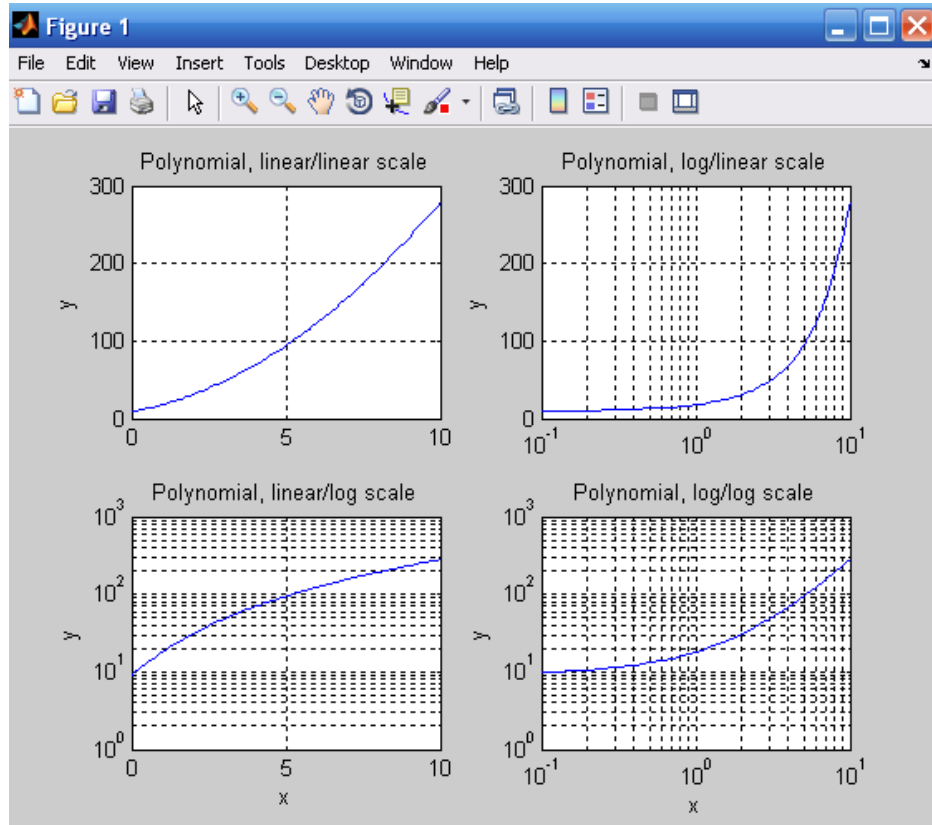
```
subplot (2,2,3), semilogy (x,y);
```

```
title ('Polynomial, linear/log scale');
```

```
xlabel('x'), ylabel ('y'), grid;
```

```
subplot (2,2,4), loglog (x,y);  
title ('Polynomial, log/log scale');  
xlabel('x'), ylabel ('y'), grid;
```

MatlabOuput:



While adding new curves to the existing graph, use the hold command to add lines/points to an existing plot.

- hold on** – retain existing axes, add new curves to current axes. Axes are rescaled when necessary.

- hold off** – release the current figure window for new plots

e) Grids and Labels:

Command	Description
grid on	Adds dashed grids lines at the tick marks
grid off	removes grid lines (default)
title ('text')	labels top of plot with text in quotes
xlabel ('text')	labels horizontal (x) axis with text is quotes
ylabel ('text')	labels vertical (y) axis with text is quotes

f) Additional commands for plotting

Color of the point or curve		Marker of the data		Plot line styles	
Symbol	Color	Symbol	Marker	Symbol	Line Style
Y	Yellow	.	●	—	Solid line
M	Magenta	o	○	:	Dotted line
C	Cyan	x	×	-.	Dash-dot line
R	Red	+	+	--	Dashed line
G	Green	*	*		
B	Blue	s	□		
W	White	d	◇		
K	Black	v	▽		
		^	△		
		h	☆		

Saving Your Work:

All the commands, variables created in the Matlab can be saved using following procedure.

File -> Save Workspace As -> Choose Directory->Filename.mat -> Click on Save

In Command Window:

>> save filename.mat % save all the variables in filename.mat file in Current Directory

>>savefilename.mat s% saves only variable s in filename.mat file.

>>diaryfilename.mat %will save all commands and variables in filename file

>>diary off will close the file and save it as text file containing all the commands

Loading file

We can load file by double click on the saved file or in command window type

>> load filename.mat % all variables will be loaded as saved in previous session.

Post Lab Questions

- a) **Which command is used to plot of the values of x and y using a linear scale for x and a logarithmic scale for y.**

- b) **How subplot(m,n,p) breaks the figure window?**

- c) **What do the following commands mean:**

hold on	
grid on	
label('text')	
x=linspace(0,10)	

Lab Tasks

Task 1

Generate a matrix of random numbers from -10 to 10 in 100 rows and 3 columns. Also extract the elements of 2 row and 1:2 column simultaneously.

Task 2

Plot a SIN and a COS wave of 4Hz keeping $t=0:0.001:1$;

Now perform the following operation on the signal

- Put two plots on the same graph
- Turn on the grid for the signal
- Title and labeling should be done.

Task 3

Using single “plot” instruction, plot the following , Differentiate between all the three signals by using ‘.’ , ‘+’ and ‘-’

- $y1=\sin(2*\pi*x)$;
- $y2=\sin(2*\pi*2*x)$;
- $y3=\cos(2*\pi*6*x)$;

(x is the time period)