

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')
```

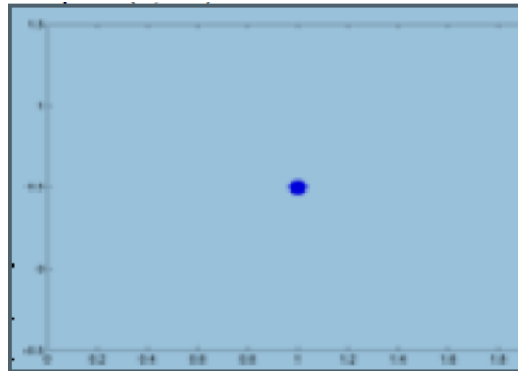
```
//the function plot () creates a graphics window, called a Figure window, and named by
```

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

Example : Complex number

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

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

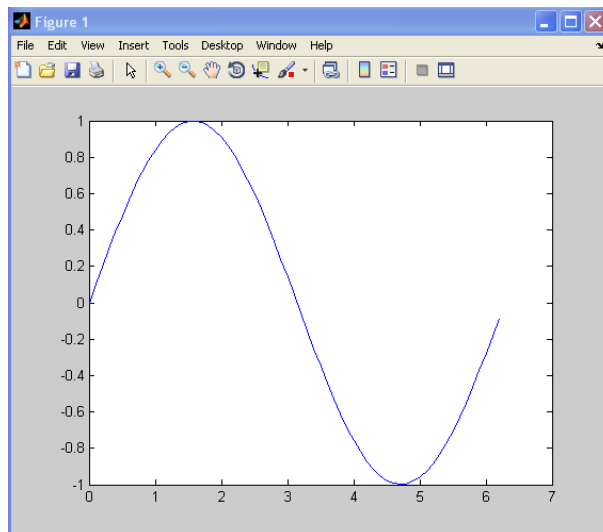


To plot Sin wave:

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

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

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



Sin wave

Task: Plot Cos wave in Matlab.

a) **Commands for axes:**

command	description
axis ([xmin xmax ymin ymax])	Define minimum and maximum values of the axes
axis square	Produce a square plot
axis equal	equal scaling factors for both axes
axis normal	turn off axis square, equal
axis (auto)	return the axis to defaults

b) **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

c) **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

d) **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.

e) **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');
```

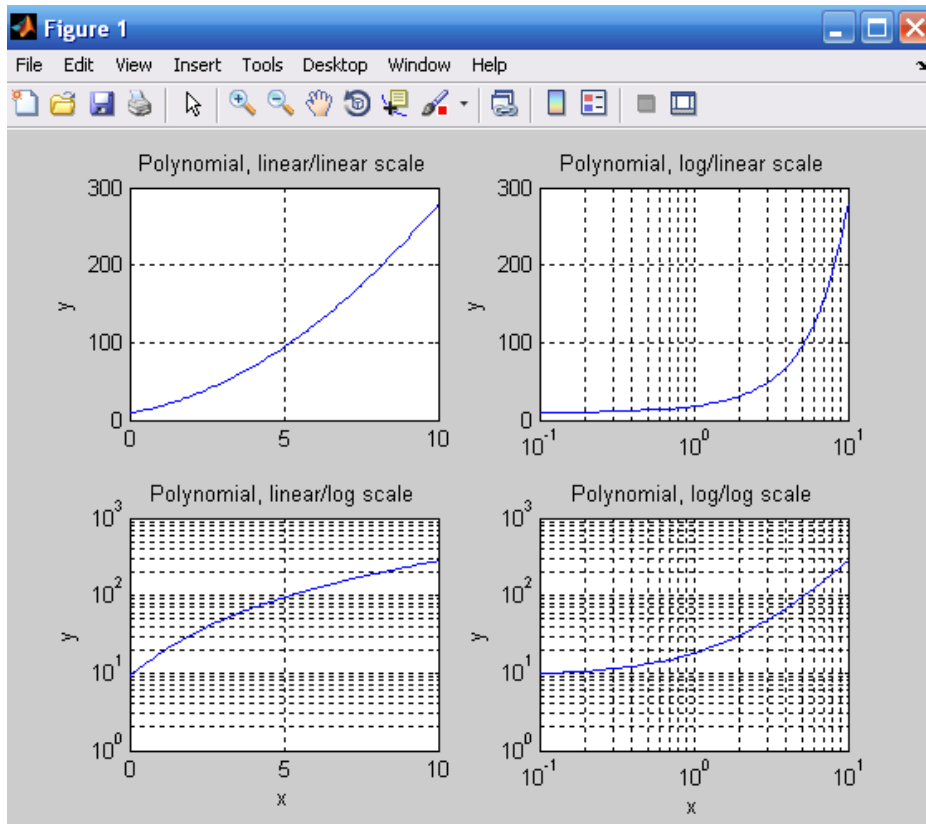
```
xlabel('x'), ylabel ('y'), grid;
```

```
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

f) **Grids and Labels:**

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

`text(x,y,'text')` Adds text in quotes to location (x,y) on the current axes, where (x,y) is in units from the current plot.

g) Additional commands for plotting

Color of the point or curve

Symbol	Color
Y	Yellow
M	Magenta
C	Cyan
R	Red
G	Green
B	Blue
W	White
K	Black

Marker of the data

Symbol	Marker
.	●
o	○
x	×
+	+
*	*
s	□
d	◇
v	▽
^	△
h	☆

Plot line styles

Symbol	Line Style
—	Solid line
:	Dotted line
-.	Dash-dot line
--	Dashed line

Example 1:

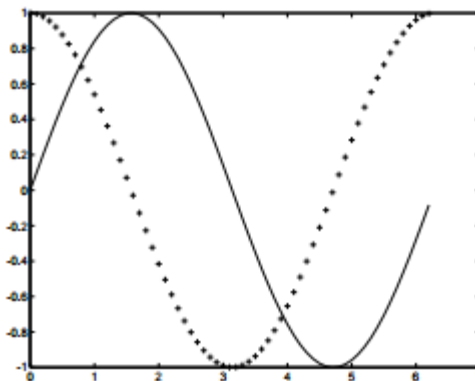
Plot $y_1 = \sin(x)$ and $y_2 = \cos(x)$ with x in $[0; 2\pi]$ on the same graph. Use a solid line for $\sin(x)$ and the symbol $+$ for $\cos(x)$. The first step is to define a set of values for x at which the functions will be defined.

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

```
y1 = sin(x);
```

```
y2 = cos(x);
```

```
plot(x, y1, '-', x, y2, '+')
```



Graph of Example 1

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) What does GUI tools stand for in Matlab?

- c) What do the following commands mean:

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

Lab Tasks

Task 1

- a) Plot sin wave taking time interval from 0 to 2π and plot the same wave with an increment of 0.2. Explain the difference between the two waves.
- b) Plot any four signals using subplot command.s

Task 2

- a) Display the output of Cos and Sin wave in one graph window and label them as well.

Take $t=1:0.001:10$.

Task 3:

- a) For the following, use the signal described as:

$t=0:0.2:2*\pi$

Now perform the following operation on the signal t:

- Put two plots on the same graph, i.e. $\sin(t)$ and $\sin(2t)$
 - Turn on the grid for the signal
 - Title and labeling should be done.
- b) Using single “plot” instruction, plot the following , Differentiate between all the three signals by using ‘.’ , ‘+’ and ‘-’
 - $y1=\sin(x)$;
 - $y2=\sin(2x)$;
 - $y3=\sin(4x)$;

(x is the time period)