

Plotting in Matlab

CHEN 1703

see the [wiki page](#) for more information on plotting

Creating 2-D (x,y) Plots

- plot (x)** - plot vector **x**.
- plot (x , y , ' abc ')** - plots vector **x** versus vector **y**.
 - if **y** is a matrix, then this generates several lines - one for each column in **y**.
 - a** - color of the line & symbol
 - b** - style of the symbols (markers)
 - c** - style of the line
 - See Table 5.2-1 in your text.

Color		Symbol		Line Style	
b	blue	.	point	-	solid
g	green	o	circle	:	dotted
r	red	x	x-mark	-.	dot-dash
c	cyan	+	plus	--	dashed
m	magenta	*	star		no line
y	yellow	s	square		
k	black	^	triangle (up)		
w	white	v	triangle (down)		
	Default	<	triangle (left)		
		>	triangle (right)		
		p	pentagon		
		h	hexagon		
			no symbol		

Examples:

```
plot(x,y1,'r-')
plot(x,y2,'b.:')
plot(x,y3,'ks-.')
```

Multiple Lines on a Plot

hold on - allows you to “stack” lines on a plot.

```
figure;           % create a new plotting window.
hold on;          % add multiple plot commands to this figure
plot(x1,y1);
plot(x2,y2,'gs--');
fmt = 'bo: ';
plot(x3,y3,fmt);
hold off;         % next plot command overwrites the figure
```

Plot several lines with different styles, all in the same command and on the same plot.

```
plot(x1,y1,s1, x2,y2,s2, x3,y3,s3);
```

NOTE: you may eliminate formatting strings here as well...

Labeling Plots

- Labeling is a MUST for ALL plots!
 - Include units where applicable.
- `xlabel('label text');`
 - Adds a label to the x axis
- `ylabel('label text');`
 - Adds a label to the y axis
- `legend('1', '2', '3');`
 - Add any text to legends, including greek symbols.
- Annotating plots:
 - `text(xpos, ypos, label);`
 - adds text `label` to position `(xpos,ypos)`.
- Use the figure editor to control many aspects of a plot after it is created (like in Excel)

Greek symbols in plots

Text	Symbol
<code>\Lambda</code>	Λ
<code>\Xi</code>	Ξ
<code>\Pi</code>	Π
<code>\Sigma</code>	Σ
<code>\Psi</code>	Ψ
<code>\Omega</code>	Ω
<code>\alpha</code>	α
<code>\beta</code>	β
<code>\gamma</code>	γ
<code>\delta</code>	δ
<code>\epsilon</code>	ϵ
<code>\eta</code>	η
<code>\theta</code>	θ

Text	Symbol
<code>\kappa</code>	κ
<code>\lambda</code>	λ
<code>\mu</code>	μ
<code>\nu</code>	ν
<code>\xi</code>	ξ
<code>\pi</code>	π
<code>\rho</code>	ρ
<code>\sigma</code>	σ
<code>\tau</code>	τ
<code>\chi</code>	χ
<code>\psi</code>	ψ
<code>\omega</code>	ω
<code>\Upsilon</code>	Υ
<code>\phi</code>	ϕ

Example - Ideal Gas Law

$$pV = nRT$$

V is the volume occupied by n moles of an ideal gas at temperature T and pressure p .

$$p\bar{V} = RT$$

\bar{V} is the volume occupied by a single mole of an ideal gas at temperature T and pressure p . (molar volume)

- Plot \bar{V} as a function of T at various pressures.
 - What do we expect?
- Plot \bar{V} as a function of p at various temperatures.
 - What do we expect?

$$R = 8.20574587 \times 10^{-5} \frac{\text{m}^3 \text{ atm}}{\text{mol K}}$$

- T in Kelvin,
- p in atmospheres,
- molar volume in m^3 .

Log-scale Plots

plot (x , y)

- linear in x and y

semilogx (x , y)

- log scale in x, linear in y

semilogy (x , y)

- log scale in y, linear in x

loglog (x , y)

- log scale on x and y.

Some Plotting Tips:

- Always label your plots!
 - Include axis labels and units.
 - Include legends
- Use symbols when you have data to plot (unless their use would make the plot unreadable)
- Do NOT use symbols when plotting an analytic function.

Example:

- How many times can you fold a piece of paper in half?
- Plot number of sheets as a function of number of folds...

$$n_s = 2^{n_f}$$

Other useful Plotting commands

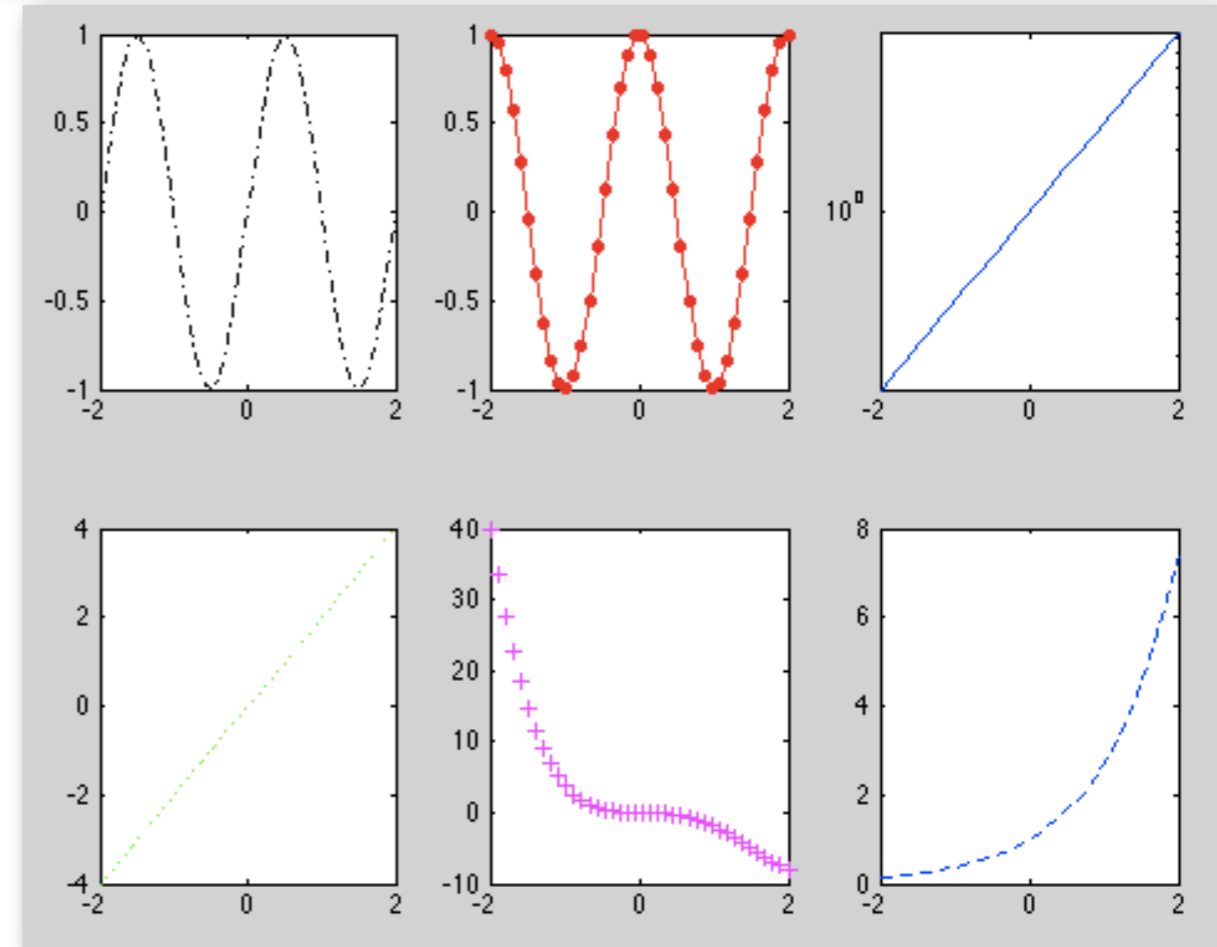
- **grid** command - put x-y grid lines on the plot
 - grid on - turn grid on.
 - grid off - turn grid off.
- **axis** - control range on axes.
 - axis([xmin,xmax,ymin,ymax]);
 - ▶ sets x and y limits on the axes.
 - axis auto, axis tight, axis square, axis equal
 - axis manual
 - ▶ use with “hold on” to keep the axis limits from the first plot.
- **plotyy**(x1 , y1 , x2 , y2) - plot with a secondary y-axis.
 - y1 on primary (left) axis, y2 on secondary (right) axis.
 - See MATLAB help for more details.
- Figures may be edited graphically after they are created.
 - Do as much in the script as you can easily do to save time tweaking plots manually.

Subdividing a Figure



subplot(m, n, p);

- creates a plotting window with **m** rows and **n** columns. The current plot is placed at position **p**. **p** is counted along rows...
- **plot(x, y, style);**
- You can also add labels, legends, etc. to each subplot.



```
clear; close all; clc;
```

```
x=linspace(-2,2,40);
```

```
subplot(2,3,1); plot(x,sin(pi*x), 'k-.');
```

```
subplot(2,3,2); plot(x,sin(pi*x), 'k:', x,cos(pi*x), 'r.-');
```

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

```
subplot(2,3,4); plot(x,2*x, 'go');
```

```
subplot(2,3,5); plot(x,x.^4-3*x.^3, 'm+');
```

```
subplot(2,3,6); plot(x,exp(x), 'b--');
```


Other MATLAB Plots

- bar graphs, pie charts, histograms
- surface plots
- contour plots

For more information:

```
help graph2d  
help graph3d
```