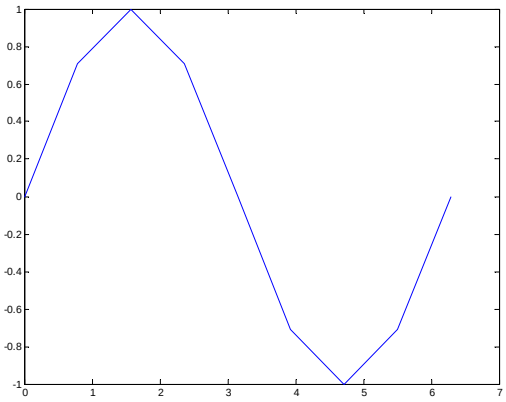
PLOTTING

As an example we can plot sine and cosine waves. We can use the variable definitions from the previous tutorial.

```
>>x=linspace(0,2*pi,9) ;
>>y=sin(x) ;
>>z=cos(x) ;
```

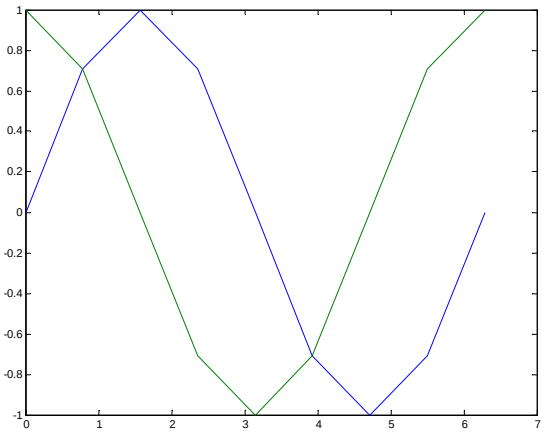
Now we can plot the sine function with the plot command. The plot will show up in a separate window. The plot can be exported by going to file, export, and choose a ".emf" file. Other file types will work as well depending to on which program you are exporting the file.

```
>> plot(x,y)
```



You can make a plot of more than one set of data with the plot command too.

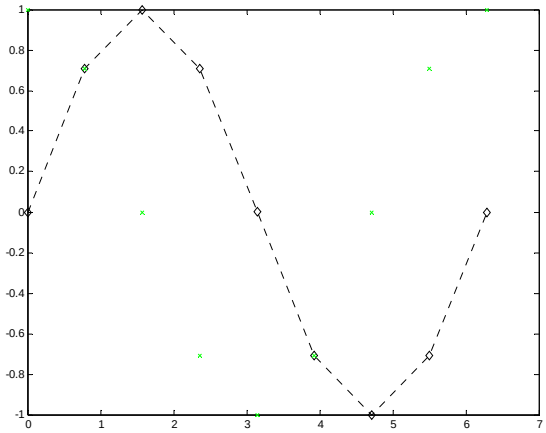
```
>> plot(x,y,x,z)
```



The properties of the lines can be changes as well. A table at the end of the tutorial is included as a key. We will change the sine wave to a dotted (:), black (k) line with

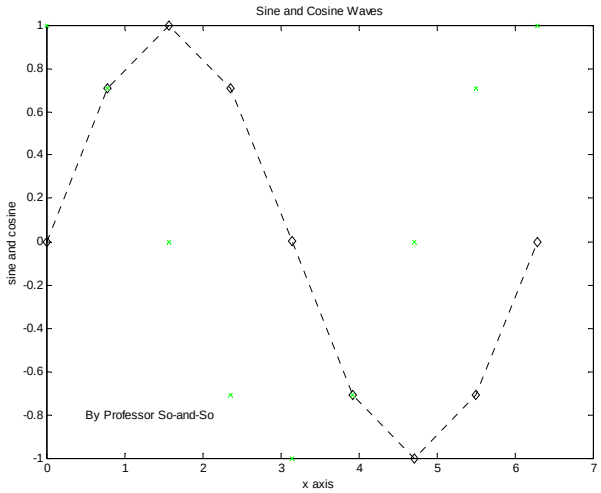
diamonds for data points (d) and the cosine wave to data points which are green (g) crosses (x).

```
>> plot(x,y,'kd:',x,z,'gx')
```



The final steps for our plot will require titles and labels. A title can be added with the "title('Name of Title')" command, where "Name of Title" is the title you give. Axis labels can be added using the xlabel and ylabel commands. Other text can be added to the plot using the text command "text(a,b,'name')" where a and b are the coordinates of where the text will start and name is the text that you will put on the plot.

```
>> Title('Sine and Cosine Waves')
>> xlabel('x axis')
>> ylabel('sine and cosine')
>> text(.5,-.8,'By Professor So-and-So')
```



To create a smoother curve for the two functions, use more x values to plug into the sine and cosine functions.

MatLab Symbol Definitions for Plotting

Symbol replaces an "x" in the plot function: plot(x-variable,y-variable,'xxx')

Symbol	Color
b	blue
g	green
r	red
c	cyan
m	magenta
y	yellow
k	black
w	white

Symbol	Marker
.	point
o	circle
x	cross
+	plus sign
*	asterisk
s	square
d	diamond
v	triangle (up)
^	triangle (down)
<	triangle (left)
>	triangle (right)
p	pentagram
h	hexagram

Symbol	Linestyle
-	solid line
:	dotted line
-.	dash-dot line
--	dashed line

EXAMPLE: Data has been collected that should fit on a line of $y = x^2$. Plot the data set below along with $y = x^2$ to see how well the data fit on the line. The data should be plotted as points and the $y = x^2$ fit should be plotted as a continuous line without data points.

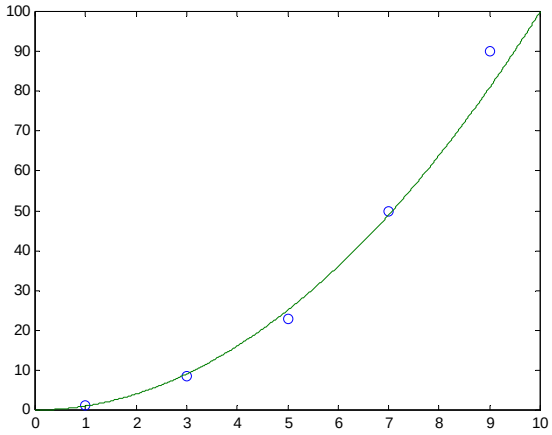
THE DATA

x	1	3	5	7	9
y	1.2	8.5	23	50	90

The data will be given x and y as variable names. The x^2 line will be given xx and yy as variable names. Starting from scratch the following commands can be used:

```
>>x=[1 3 5 7 9];
>>y=[1.2 8.5 23 50 90];
```

```
>>xx=linspace(0,10,1000);
>>yy=xx.^2;
plot(x,y,'o',xx,yy,'-')
```



Things to Notice:

1) The start and end values of xx are arbitrary. There were chosen because they bracket the data set.
2) In the declaration of xx, 1000 points were used in the linspace command to make a smooth line. Notice how the line is smoother than the sine curve above that only used 9 points.
3) In the declaration of yy, the ".^" notation was used because simply squaring a vector will not work; the inner dimensions will not agree.
4) Without a semicolon after the declaration for xx, 1000 elements would print in the workspace.

DO IT YOURSELF

A graduate student in Professor Leclerc's lab has calibrated a thermal mass flow controller that controls the amount of air in his reactor that converts natural gas to hydrogen. The manufacturer says that if you set the voltage to some value in millivolts and multiply it by 20 then add 10 you will know the mass flow rate of air in cubic centimeters per minute. The graduate student found the data below. Plot the data as points along with a continuous line that represents the fact that the flow rate is the 20 times the voltage setting plus 10.

THE DATA

Setting (mV)	15	25	35	45	55
Flow(cc/min)	300	520	720	880	1100

You will notice that in the example and in the "Do It Yourself" problem, the data points do not fall exactly on the line. In a future tutorial, we will find a way to determine how well the data fits the line.