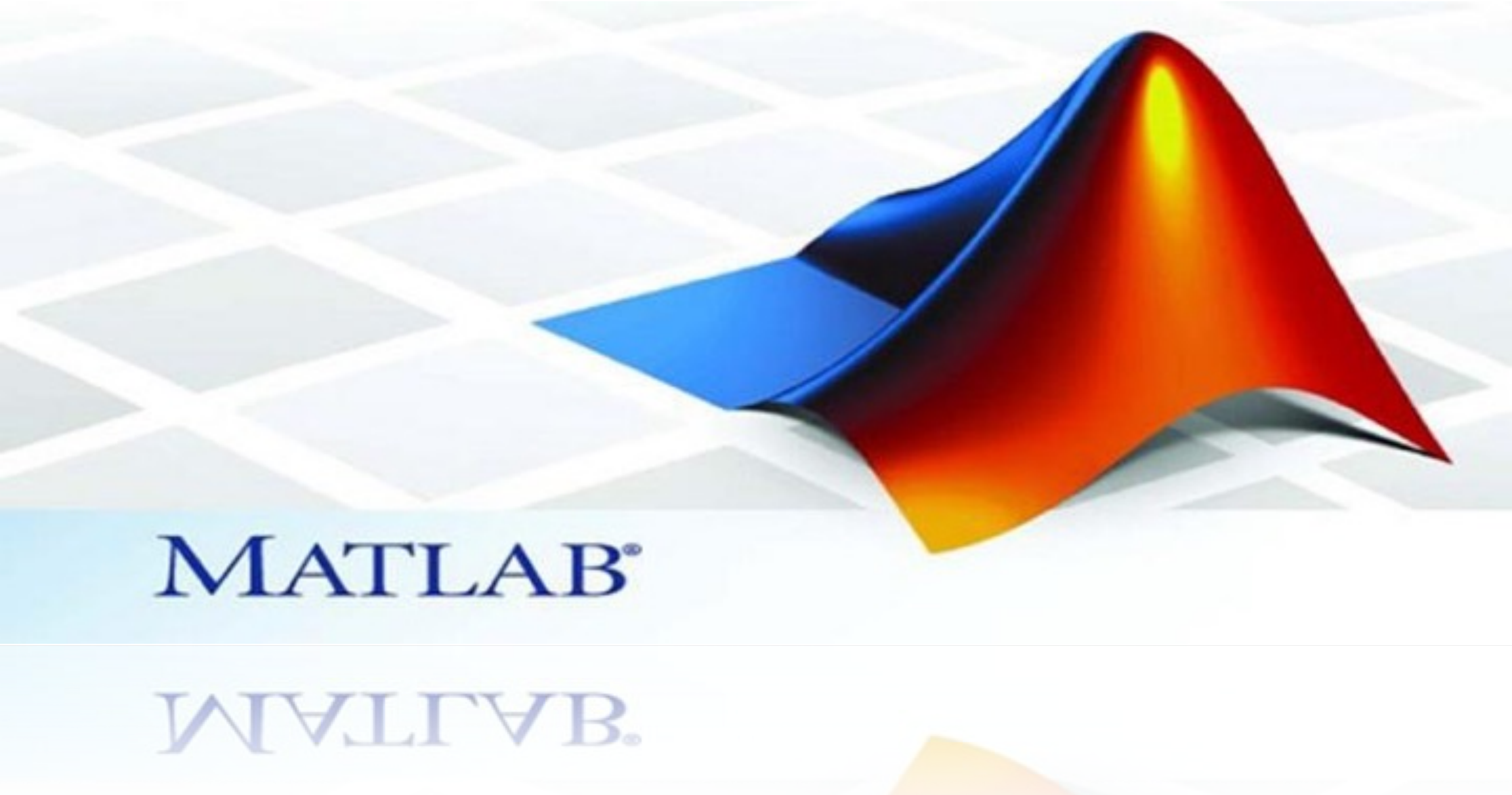
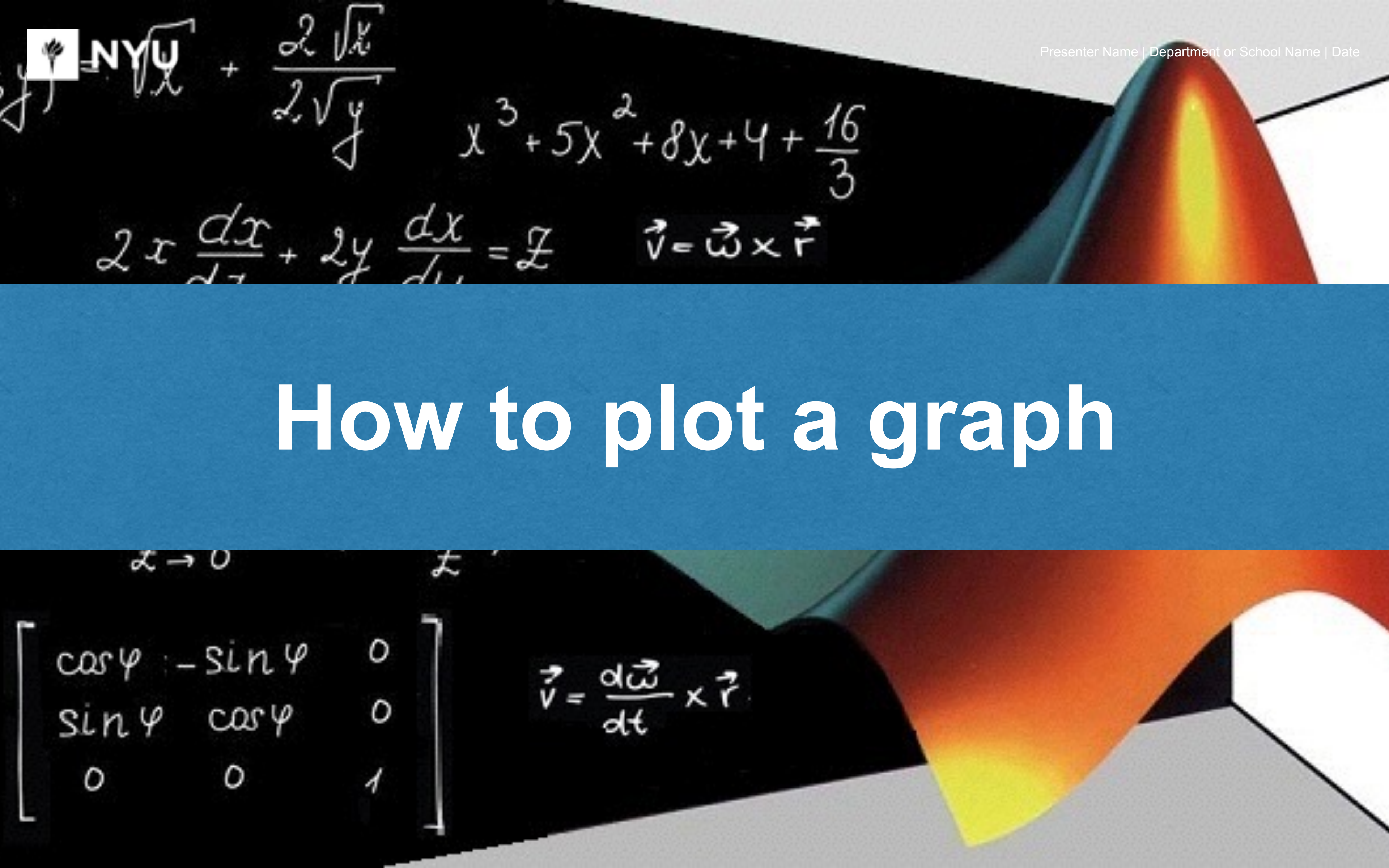
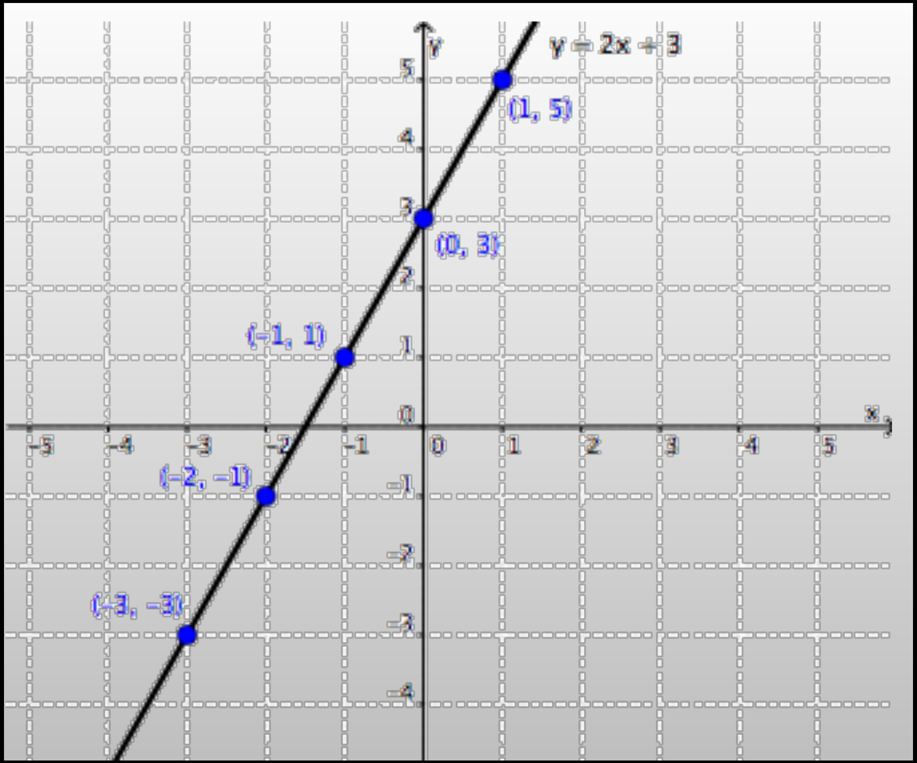

MATLAB®

Presenter Name | Department or School Name | Date


$x^3+5x^2+8x+4+\frac{16}{3}$
$\vec{v}=\vec{\omega}\times\vec{r}$
$\begin{bmatrix} \cos\varphi & -\sin\varphi & 0 \\ \sin\varphi & \cos\varphi & 0 \\ 0 & 0 & 1 \end{bmatrix}$
$\vec{v}=\frac{d\vec{\omega}}{dt}\times\vec{r}$

How to plot a graph

Remember how you would plot a graph (say y = 2x-3) in Algebra class?



By plugging in arbitrary x values and computing y values, what you are doing is basically creating 2 vectors (x and y)

```
x = [-3,   -2,   -1,    0,    1]
y = [-3,   -1,    1,    3,    5]
```

And these 2 vectors are paired up with each index and create a coordinate.

This is how MATLAB plot a 2D graph.

plot command

- First you need 2 vectors to plot with (your x and y)

Syntax:

plot(______,______)

Your X vector

Your Y vector

Markers

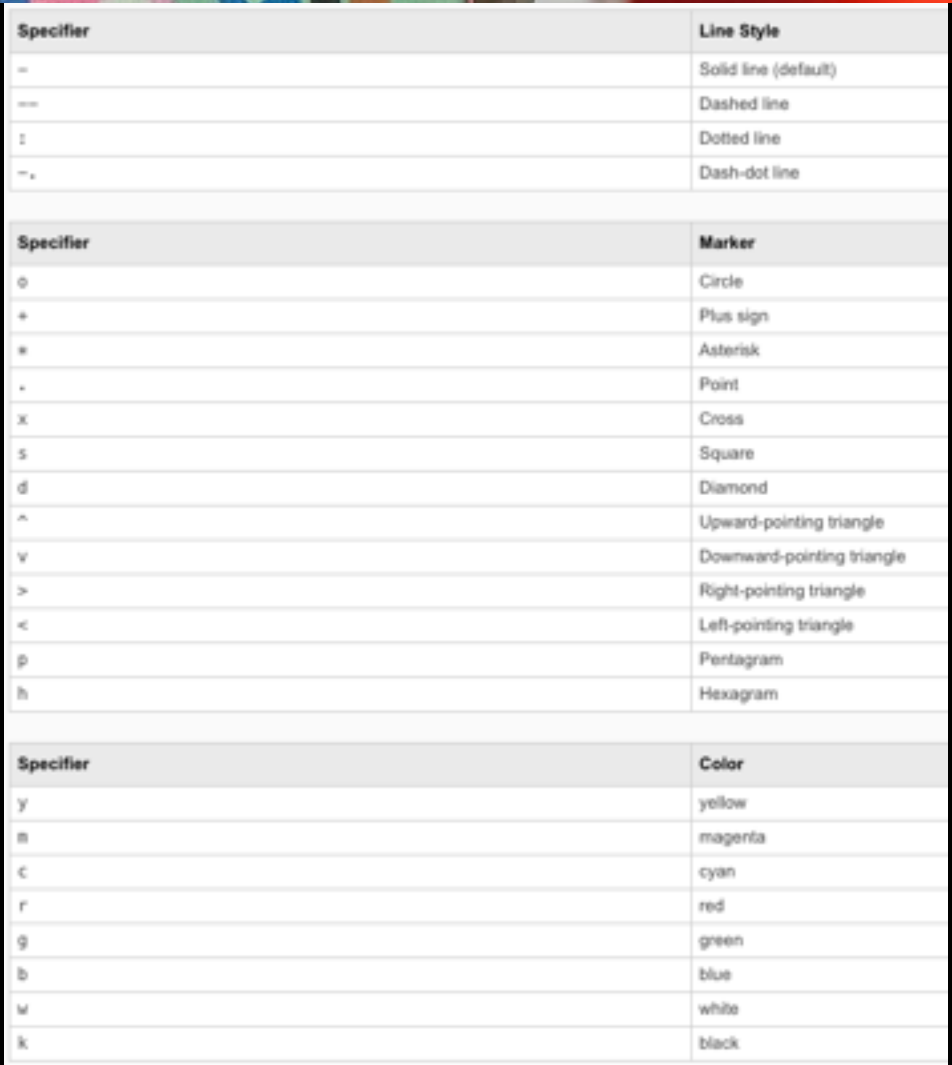
- MATLAB, by default, connects each data points (coordinates) with a line
- We will often use markers to visualize the data points
- Markers can be assigned as an option after x & y vectors

Syntax: plot(____ , ____ , '____')

Your X vector

Your Y vector

Options (Markers, Line CLR)



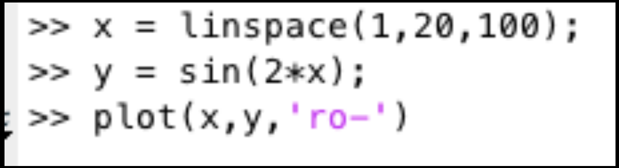
Specifier	Line Style
-	Solid line (default)
--	Dashed line
:	Dotted line
-.	Dash-dot line

Specifier	Marker
o	Circle
+	Plus sign
*	Asterisk
.	Point
x	Cross
s	Square
d	Diamond
^	Upward-pointing triangle
v	Downward-pointing triangle
>	Right-pointing triangle
<	Left-pointing triangle
p	Pentagram
h	Hexagram

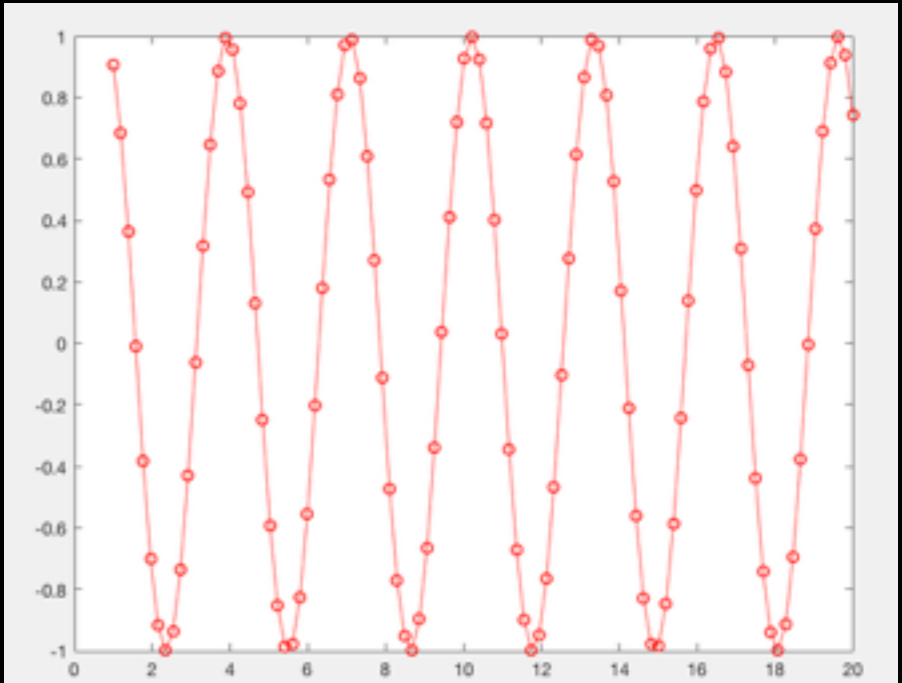
Specifier	Color
y	yellow
m	magenta
c	cyan
r	red
g	green
b	blue
w	white
k	black

Example:

$$y = \sin(2*x)$$



```
>> x = linspace(1,20,100);
>> y = sin(2*x);
>> plot(x,y,'ro-')
```



Quick Exercise

Plot

$$y = x^2 + 3x - 4$$

- At least 100 data points
- x range from 1 to 20
- Use Yellow color with cross marker

Two (or more) plots in one grid

There are 2 ways of doing it.

If you have relatively small number of graphs to plot,
go with **FIRST option**

If you have many graphs to plot,
go with **SECOND option**

1st Option (Small number of graphs in one grid)

Keep list the pairs of two vectors after the first one.

$$\text{plot(}\underbrace{\_\_\_,\_\_\_}_{\text{1st pair}}\;,\;\underbrace{\_\_\_,\_\_\_}_{\text{2nd pair}}\;,\;\underbrace{\_\_\_,\_\_\_}_{\text{3rd pair}}\;\text{....)}$$

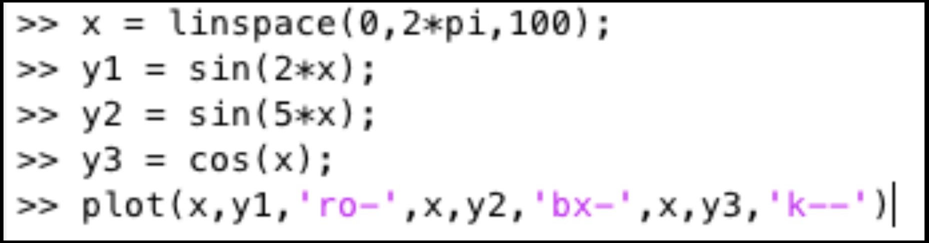
You must provide 2 vectors (1 pair) for each plot!
Each plot can have its own options (marker, color..)

Example:

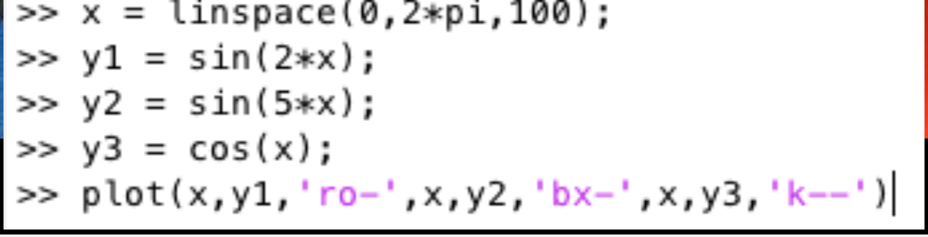
y1 = sin(2*x)

y2 = sin(5*x)

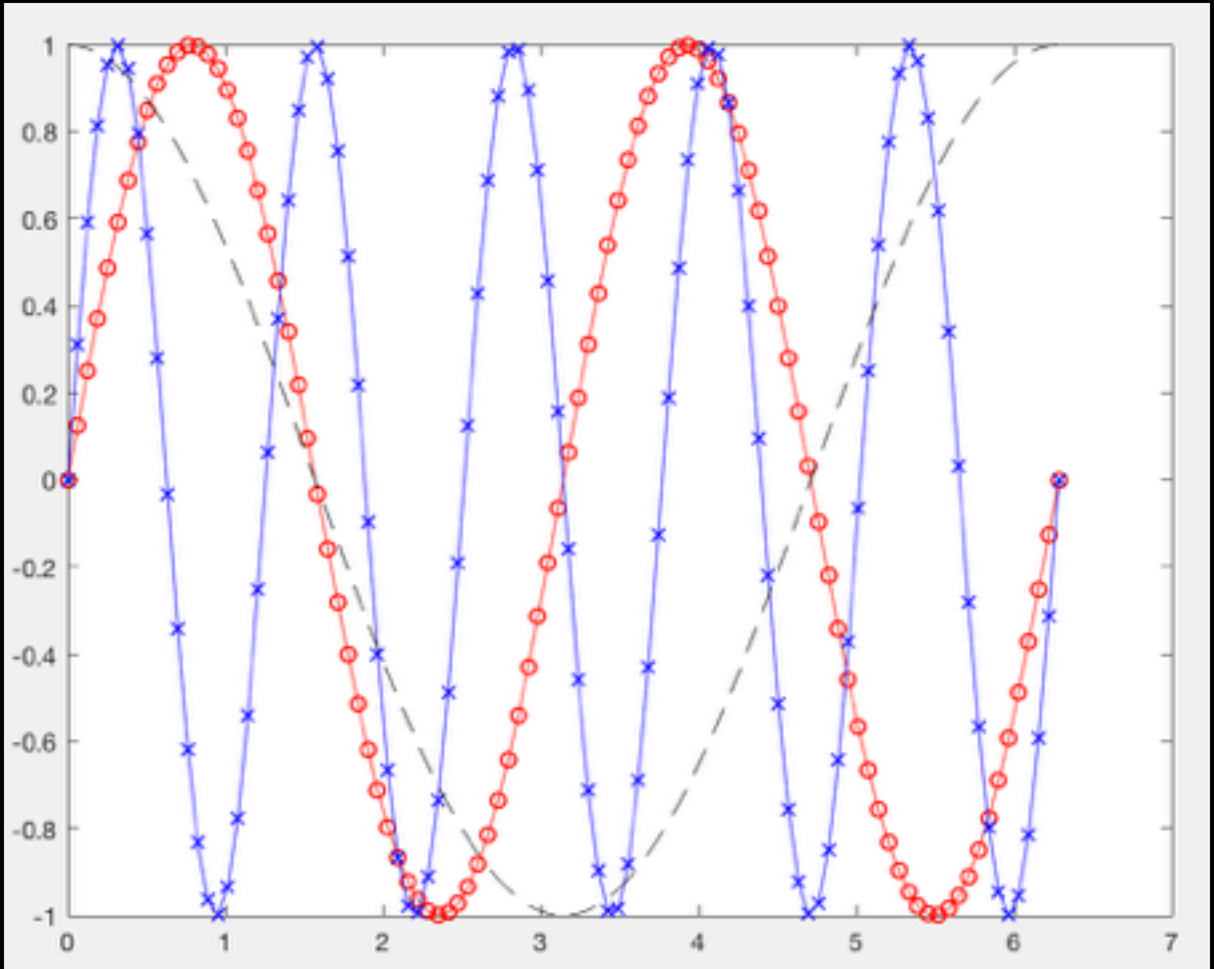
y3 = cos(x)



```
>> x = linspace(0,2*pi,100);
>> y1 = sin(2*x);
>> y2 = sin(5*x);
>> y3 = cos(x);
>> plot(x,y1,'ro-',x,y2,'bx-',x,y3,'k--')
```



```
>> x = linspace(0,2*pi,100);
>> y1 = sin(2*x);
>> y2 = sin(5*x);
>> y3 = cos(x);
>> plot(x,y1,'ro-',x,y2,'bx-',x,y3,'k--')
```



2nd Option (Large number of graphs in one grid)

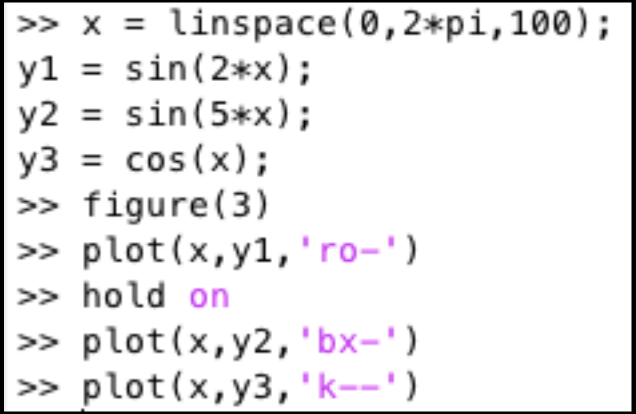
`figure(1);` ← Brings up a new window named figure 1 (or any number you like, or you can even omit it)

`plot(x,y1);` ← Plots the first graph

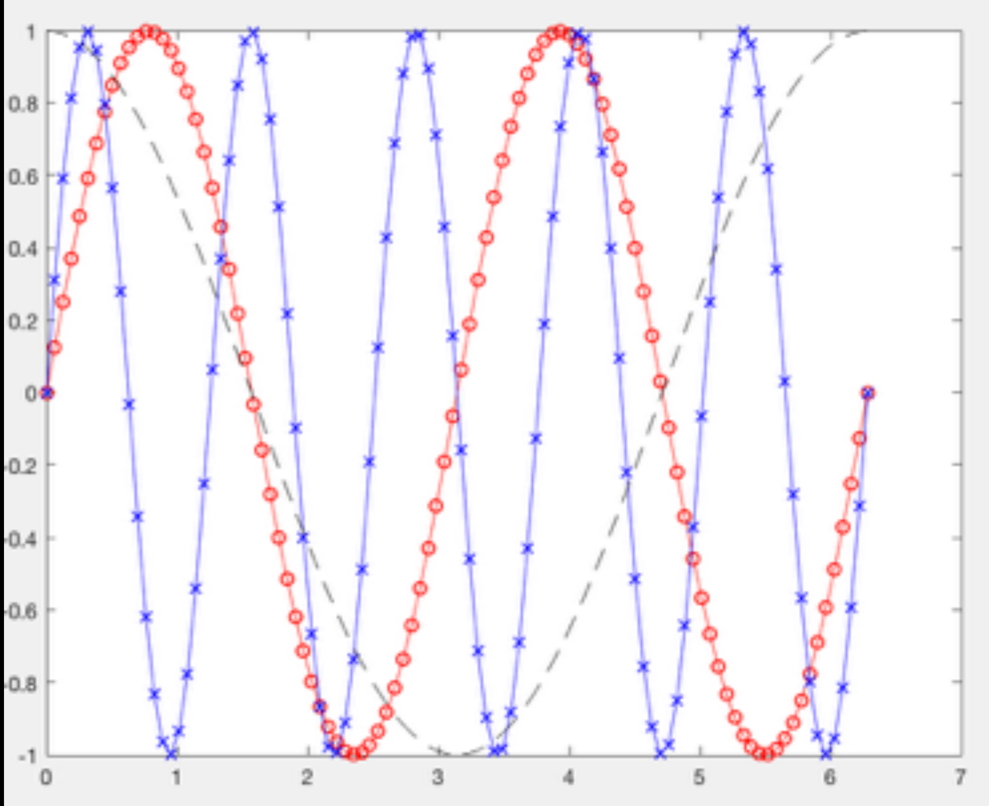
`hold on;` ← MATLAB holds on to the graph with the current window

`plot(x,y2);`
`plot(x,y3);` ← Additional graphs on top of the 1st graph

….



```
>> x = linspace(0,2*pi,100);
y1 = sin(2*x);
y2 = sin(5*x);
y3 = cos(x);
>> figure(3)
>> plot(x,y1,'ro-')
>> hold on
>> plot(x,y2,'bx-')
>> plot(x,y3,'k--')
```



Good practice: make sure type ‘hold off’ when you are done with plotting

Labels, Legends, Title, and Range

Adding,

- **Labels:** xlabel(‘yourXlabel’)
  ylabel(‘yourYlabel’)

- **Legends:** legend(‘1stPltLeg’, ‘2ndPltLeg’,…)

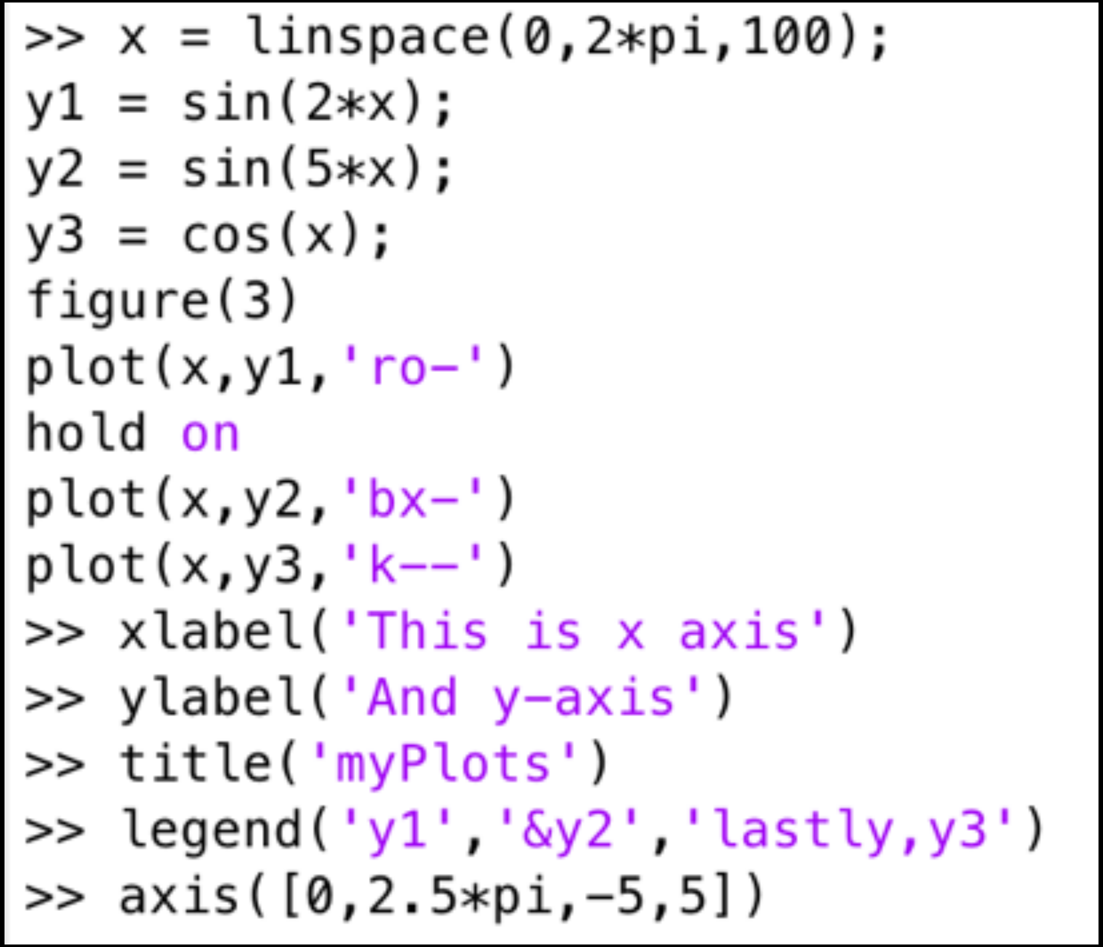
- **Title:** title(‘myPlotTItle’)

Adjusting the x (horizontal) & y (vertical) range

Syntax:

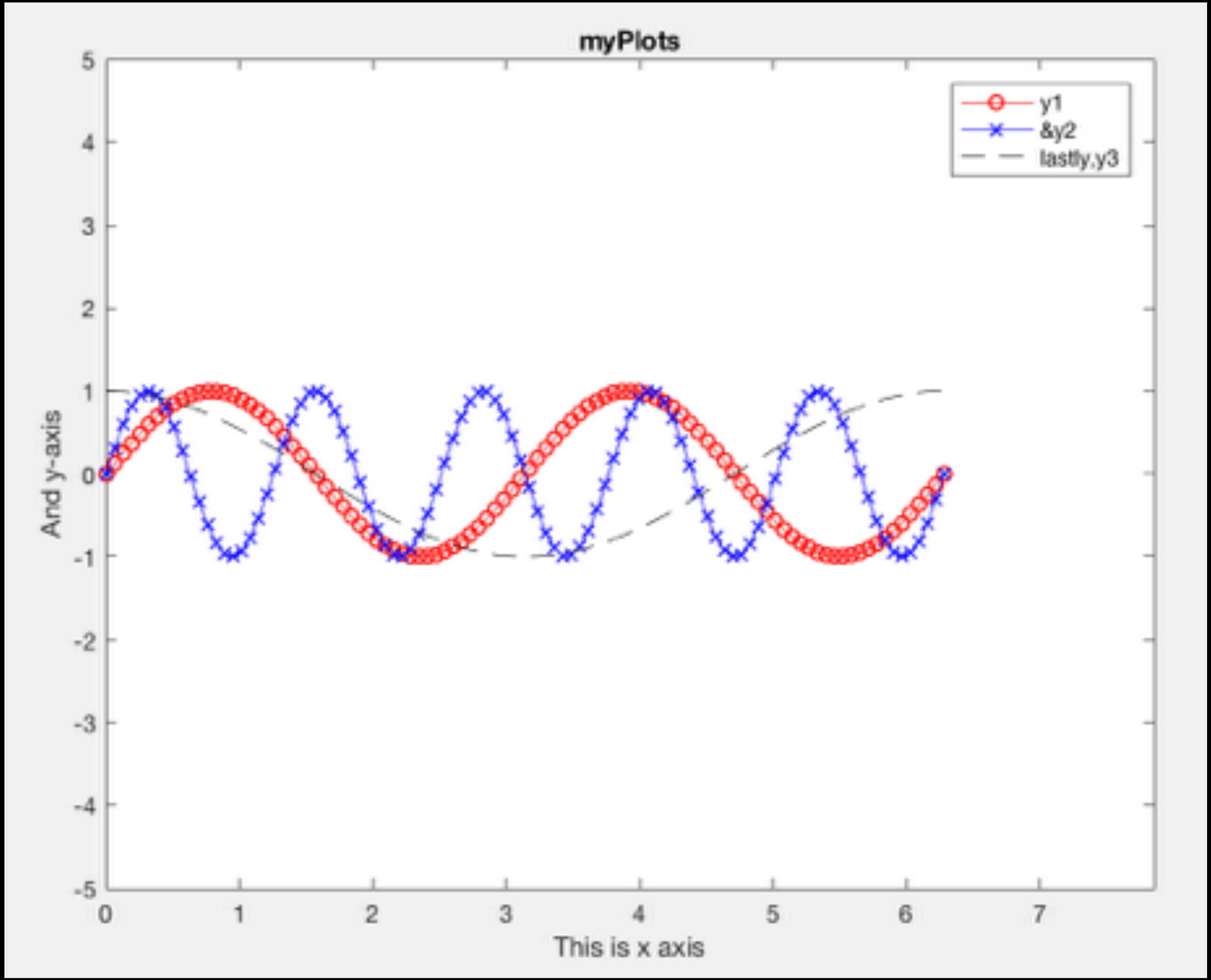
```
axis([xmin, xmax, ymin, ymax])
```

Example:



```
>> x = linspace(0,2*pi,100);
y1 = sin(2*x);
y2 = sin(5*x);
y3 = cos(x);
figure(3)
plot(x,y1,'ro-')
hold on
plot(x,y2,'bx-')
plot(x,y3,'k--')
>> xlabel('This is x axis')
>> ylabel('And y-axis')
>> title('myPlots')
>> legend('y1','&y2','lastly,y3')
>> axis([0,2.5*pi,-5,5])
```

Example:

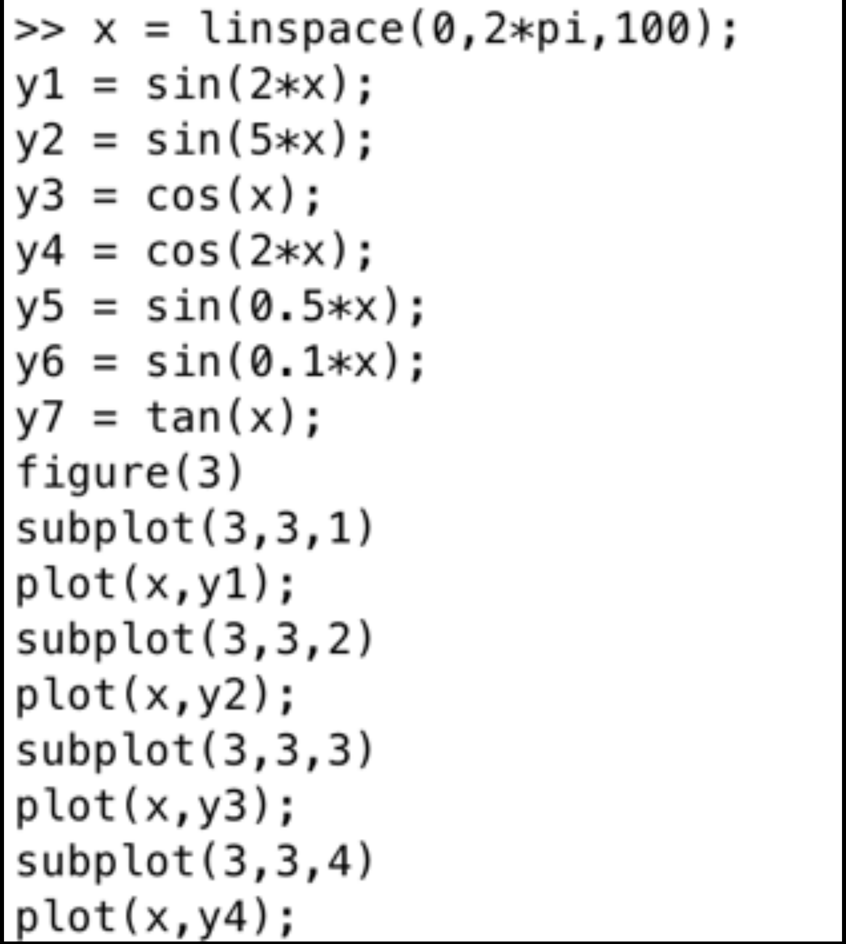

myPlots
y1
&y2
lastly,y3
And y-axis
This is x axis
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
1
2
3
4
5
6
7

Subplot

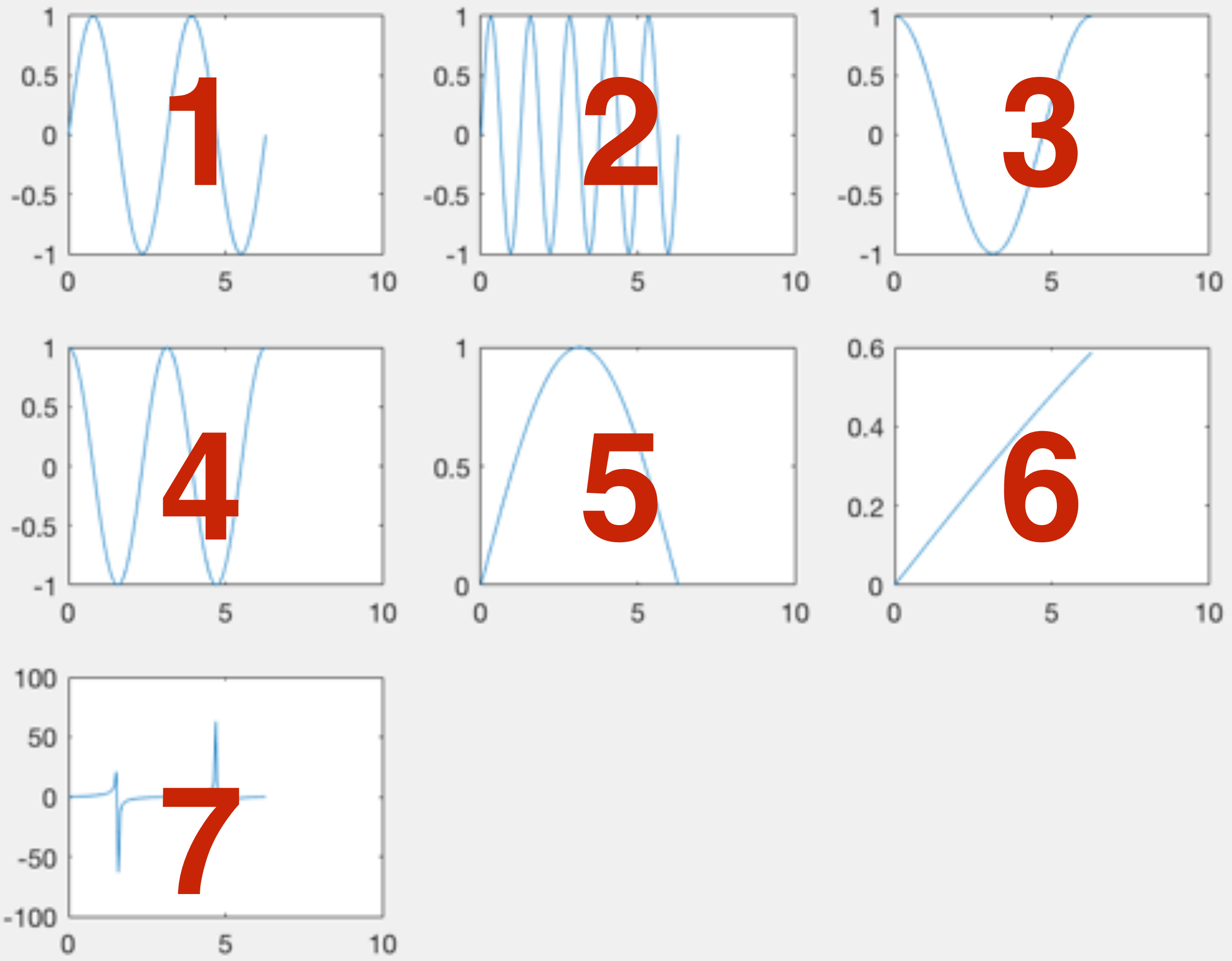
- Brings up a window containing n x m sub-plots (mini-plots)
- User can specify how many plots they want

Syntax: subplot(______,______,______)

n Rows m Col Subplot index



```
>> x = linspace(0,2*pi,100);
y1 = sin(2*x);
y2 = sin(5*x);
y3 = cos(x);
y4 = cos(2*x);
y5 = sin(0.5*x);
y6 = sin(0.1*x);
y7 = tan(x);
figure(3)
subplot(3,3,1)
plot(x,y1);
subplot(3,3,2)
plot(x,y2);
subplot(3,3,3)
plot(x,y3);
subplot(3,3,4)
plot(x,y4);
```


1
0.5
0
-0.5
-1
0
5
10
1
2
3
4
0.6
0.4
0.2
5
6
100
50
-50
-100
7

Class Exercise

Plot sin(x) with different frequency from 0 to 2π
(i.e. sin(2*x), sin(5*x), sin(0.5*x) etc..)

Plot all graphs in one window, and make sure you give distinct markers to distinguish one from other

When generating the vector x, first try 10 points, then increase it to 20, 50, then 100.