**Plots and Graphs**

To plot the graph of a function, you need to take the following steps −

• Define x, by specifying the range of values for the variable x, for which the function is to be plotted

• Define the function, y = f(x)

• Call the plot command, as plot(x, y)

Following example would demonstrate the concept. Let us plot the simple function y = x for the range of values for x from 0 to 100, with an increment of 5.

```
clear all
close all
clc
x = [0:5:100];
y = x;
plot(x, y)
```
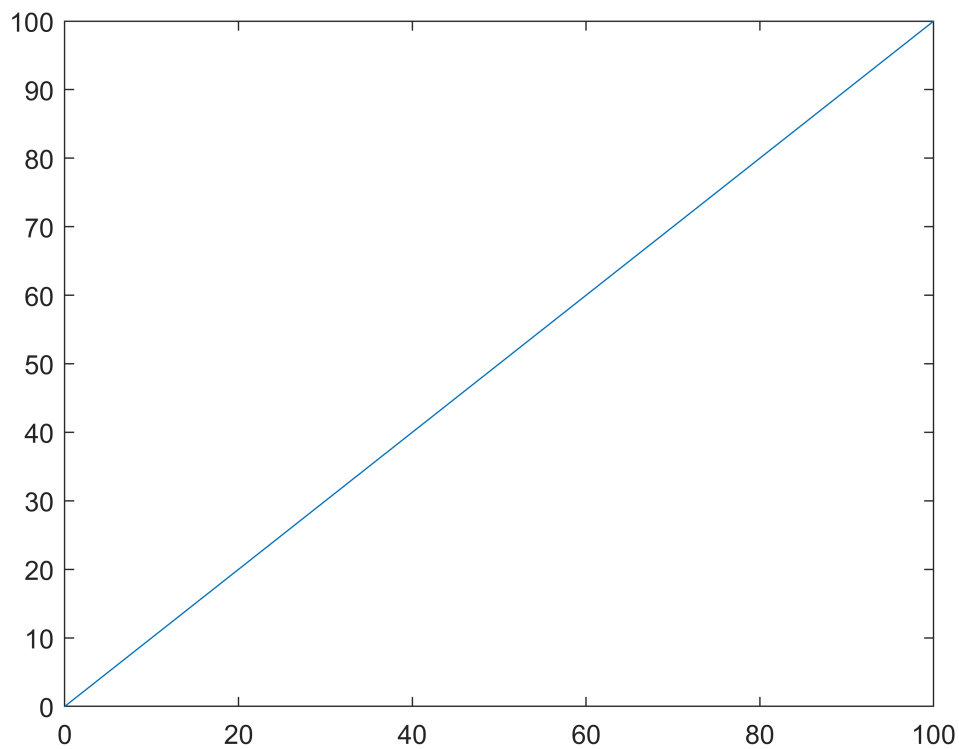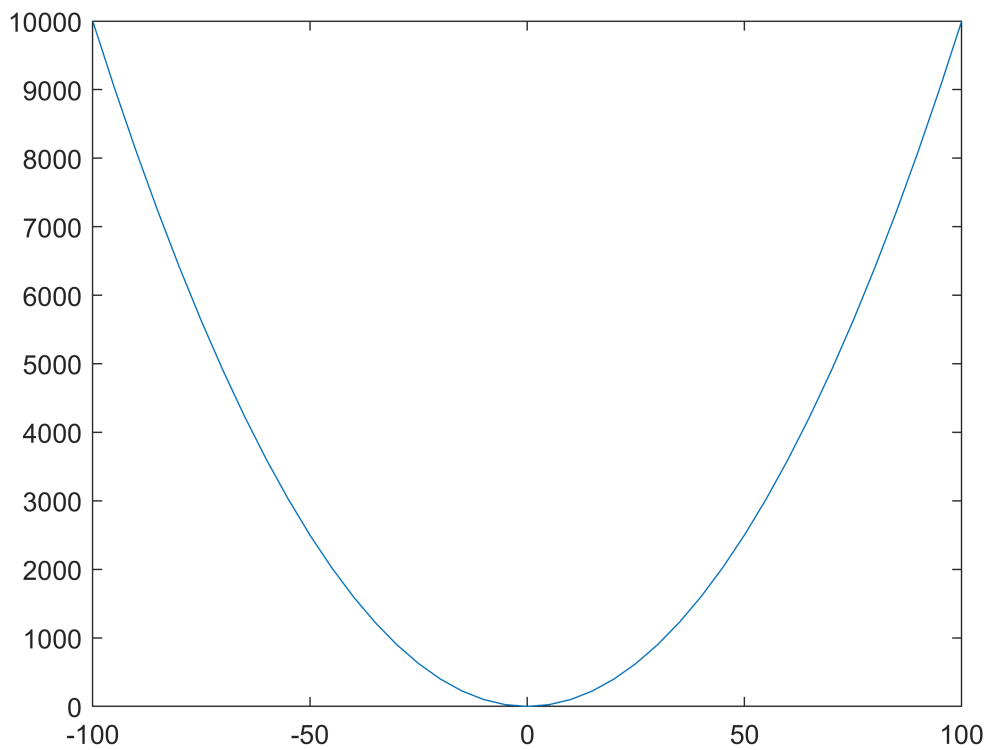


```
figure
x1=0:5:100;
y1=x1;
stem(x1,y1)
```
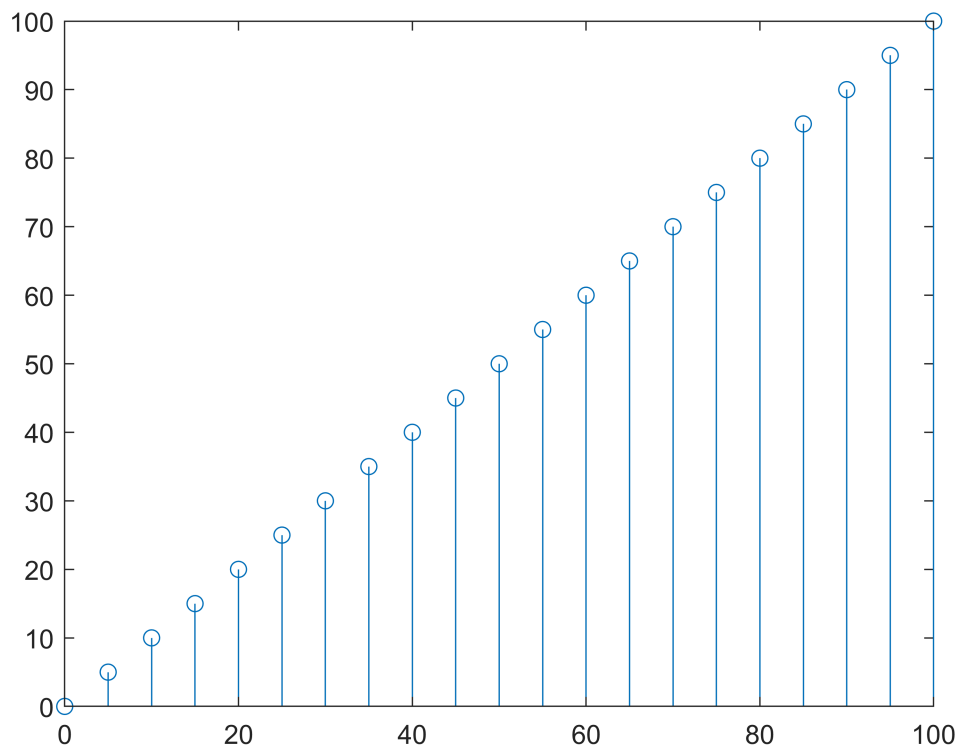
Example:

```
x = [-100:5:100];
y = x.^2;
figure
plot(x, y)
```

Adding Title, Labels, Grid Lines and Scaling on the Graph

MATLAB allows you to add title, labels along the x-axis and y-axis, grid lines and also to adjust the axes to spruce up the graph.

• The xlabel and ylabel commands generate labels along x-axis and y-axis.

• The title command allows you to put a title on the graph.

• The grid on command allows you to put the grid lines on the graph.

• The axis equal command allows generating the plot with the same scale factors and the spaces on both axes.

• The axis square command generates a square plot.

Example

```
x = [0:0.01:10];
y = sin(x);
plot(x, y)
xlabel('x')
ylabel('Sin(x)')
title('Sin(x) Graph')
grid on
axis equal
```
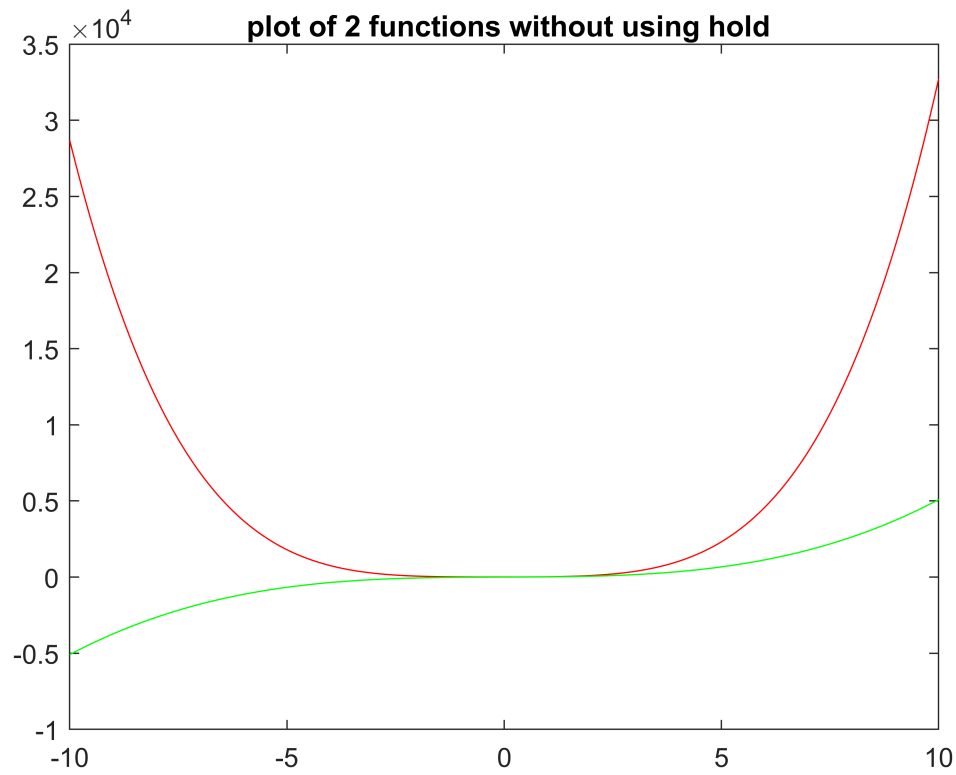
Sin(x) Graph
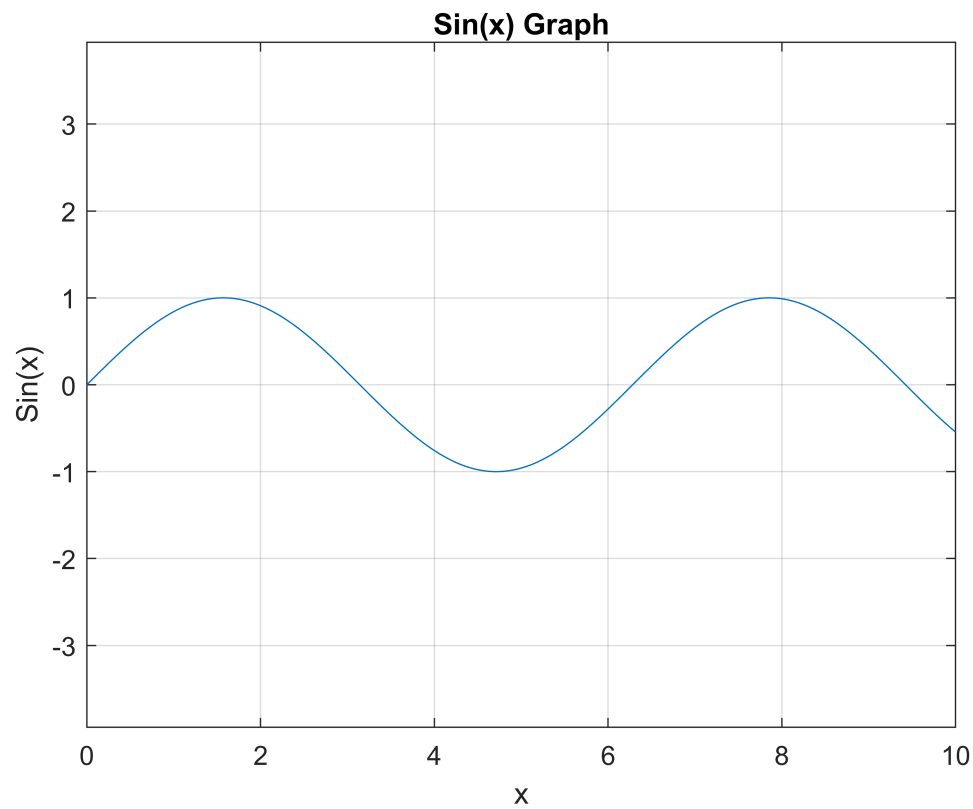
Example

Let us draw the graph of two polynomials

• f(x) = 3x^4 + 2x^3+ 7x2 + 2x + 9 and

• g(x) = 5x3 + 9x + 2

```
x = [-10 : 0.01: 10];
y = 3*x.^4 + 2 * x.^3 + 7 * x.^2 + 2 * x + 9;
g = 5 * x.^3 + 9 * x + 2;
figure
plot(x, y, 'r', x, g, 'g') % or
title(' plot of 2 functions without using hold')
```
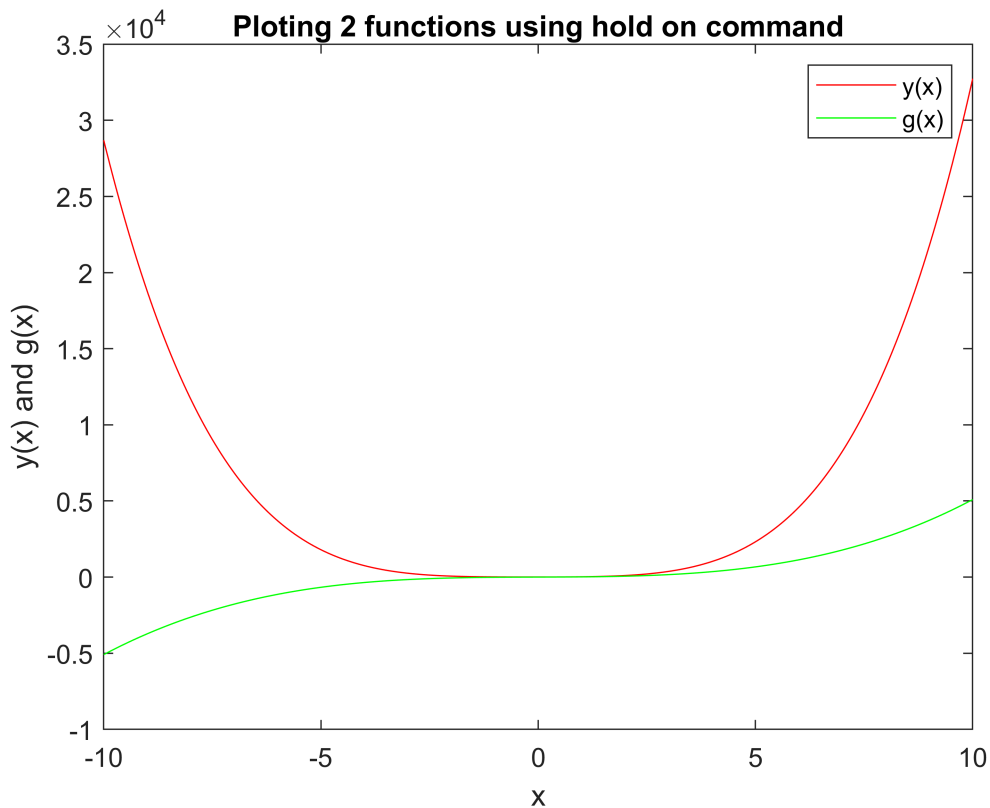
plot of 2 functions without using hold

```
figure

y = 3*x.^4 + 2 * x.^3 + 7 * x.^2 + 2 * x + 9;
plot (x,y,'r')
hold on
g = 5 * x.^3 + 9 * x + 2;
plot(x, g, 'g')
 title('Ploting 2 functions using hold on command')
 xlabel('x')
 ylabel('y(x) and g(x)')
 hold off
 legend('y(x)','g(x)')
```

Example

```
x=linspace(0,2*pi,100);          % Generate vector x
y1=x;
y2=sin(x);   % Calculate y1
y3=cos(x);
y4=x-(x.^3)/6+(x.^5)/120;        % Calculate y3
figure
plot(x,y1,'b+')                          % Plot (x,y1) with solid line
hold on                    % Invoke hold for overlay plots
plot(x,y2,'r--')                         % Plot (x,y1) with solid line
hold on      % Plot (x,y2) with dashed line
plot(x,y3,'m*')                          % Plot (x,y1) with solid line
hold on
plot(x,y4,'ko')              % Plot (x,y3) as pts. marked by 'o'
axis([0 5 -1 5])                         % Zoom-in with new axis limits
hold off                      % Clear hold command
axis([0 5 -1 5])
xlabel('t')                              % Put x-label
ylabel('y=f(x)')       % Put y-label
title('Fun with plots')
% grid

legend('y1=x','y2=sin(x)','y3=cos(x)','y4=poly')
```
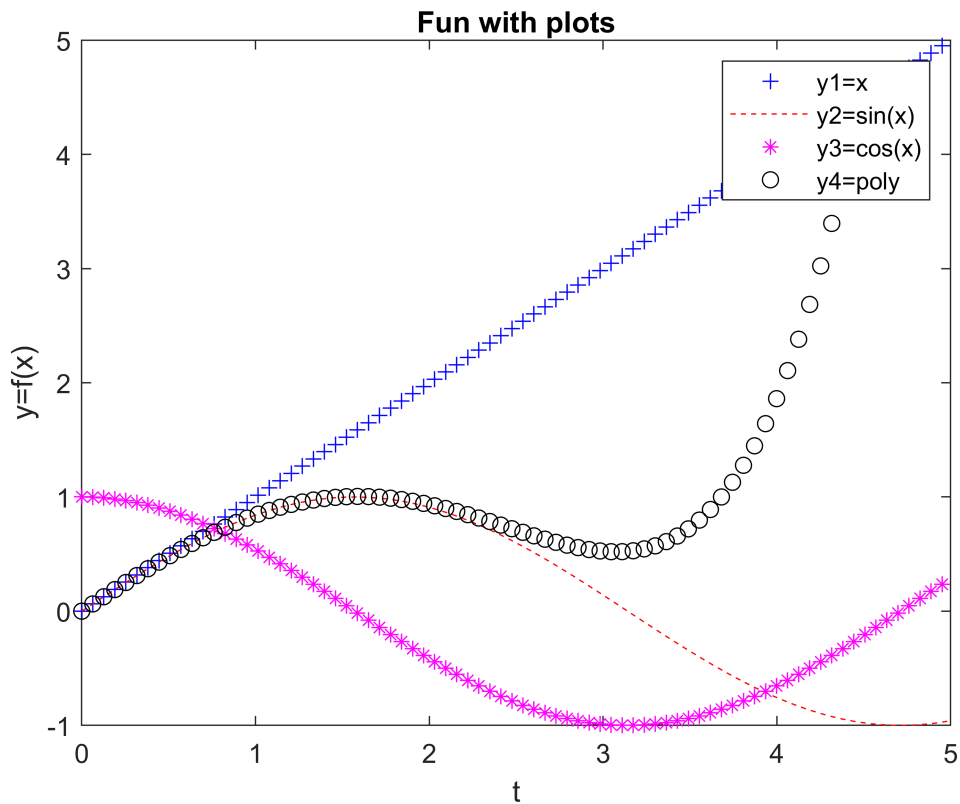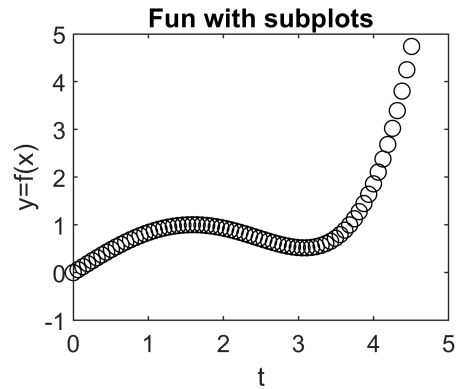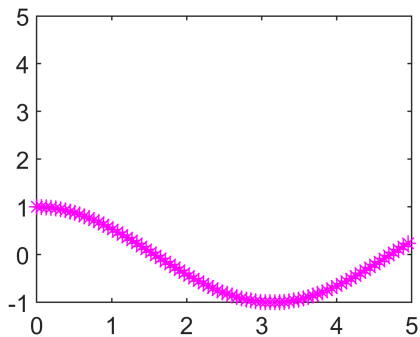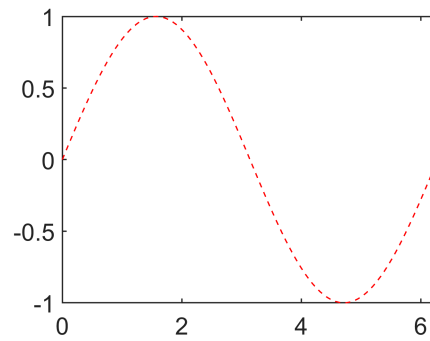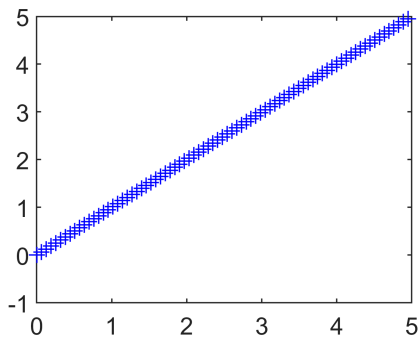
Fun with plots

```
figure
subplot(2,2,1)
plot(x,y1,'b+')
axis([0 5 -1 5])
subplot(2,2,2)
plot(x,y2,'r--')
subplot(2,2,3)
plot(x,y3,'m*')
axis([0 5 -1 5])
subplot(2,2,4)
axis([0 5 -1 5])
plot(x,y4,'ko')
axis([0 5 -1 5])
xlabel('t')                         % Put x-label
ylabel('y=f(x)')        % Put y-label
title('Fun with subplots')
```

Generating Sub-Plots

When you create an array of plots in the same figure, each of these plots is called a subplot. The subplot command is used for creating subplots.

Syntax for the command is subplot(m, n, p), where, m and n are the number of rows and columns of the plot array and p specifies where to put a particular plot.

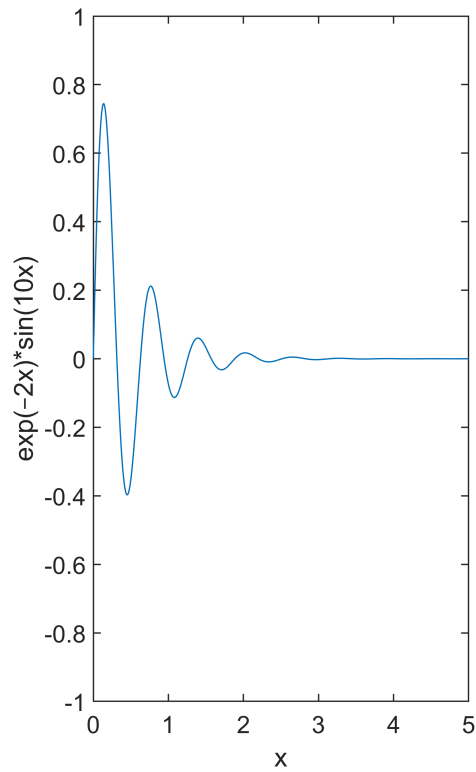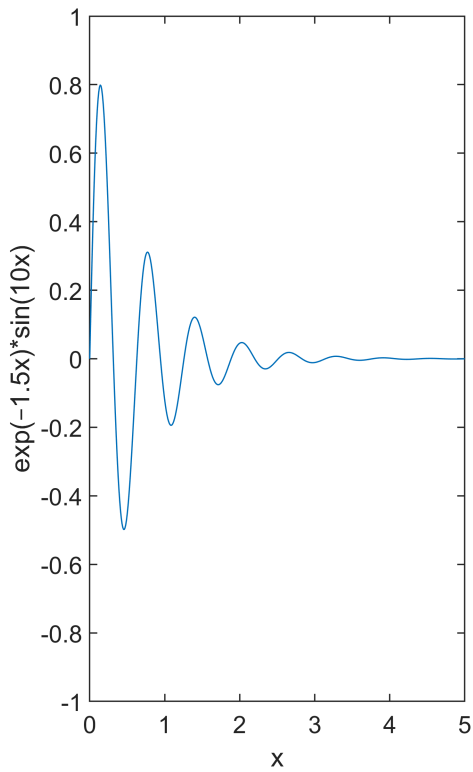Each plot created with the subplot command can have its own characteristics.

```
x = [0:0.01:5];
y = exp(-1.5*x).*sin(10*x);
subplot(1,2,1)
plot(x,y), xlabel('x'),ylabel('exp(-1.5x)*sin(10x)'),axis([0 5 -1 1])
```
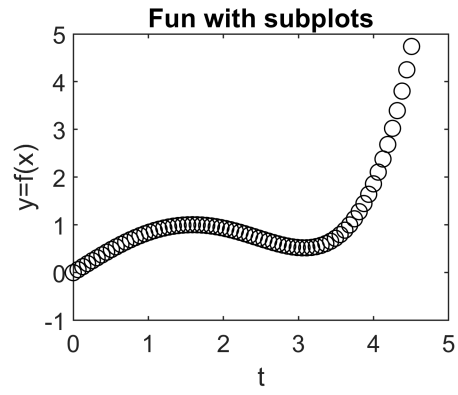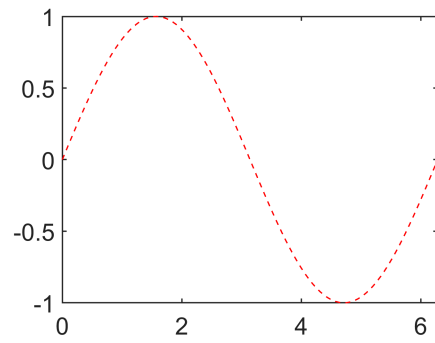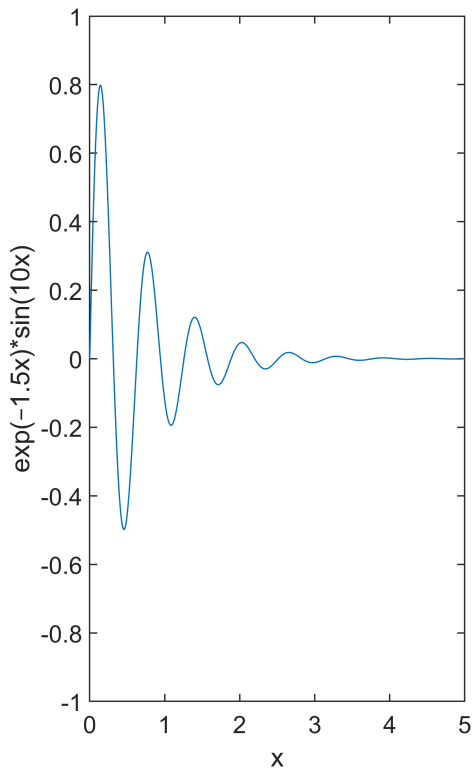
```
y = exp(-2*x).*sin(10*x);
subplot(1,2,2)
plot(x,y),xlabel('x'),ylabel('exp(-2x)*sin(10x)'),axis([0 5 -1 1])
```

Drawing Bar Charts

The bar command draws a two-dimensional bar chart. Let us take up an example to demonstrate the idea.

Example

Let us have an imaginary classroom with 10 students. We know the percent of marks obtained by these students are 75, 58, 90, 87, 50, 85, 92, 75, 60 and 95. We will draw the bar chart for this data.

```
clear all
figure
x = [1:10];
y = [75, 58, 90, 87, 50, 85, 92, 75, 60, 95];
bar(x,y), xlabel('Student'),ylabel('Score'),
title('First Sem:')
```

First Sem:
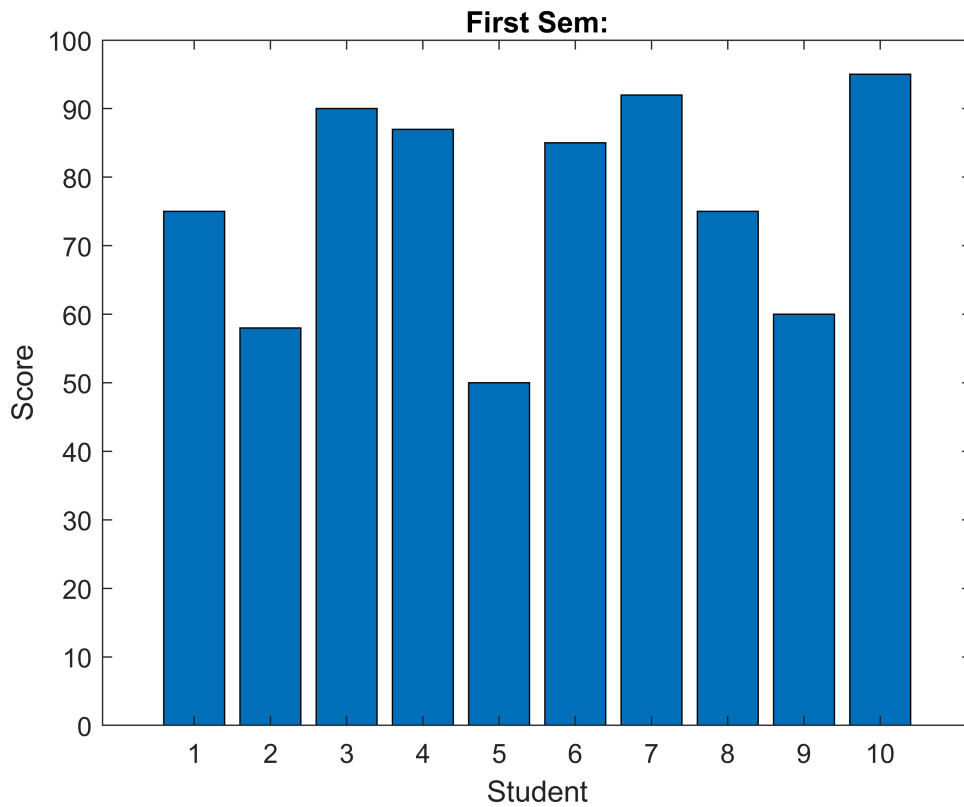
Animation Example

```matlab
% figure
% g = 9.81;
% theta0=45 * pi/ 180;
% v0=5;
% t(1)=0;
% x=0;
% y=0;
% plot(x,y,'o', 'MarkerFaceColor','b','Markersize', 8)
% axis([0 3 0 0.8])
% M(1)=getframe;
% dt=1/128;
% for j=2:200 %j=2 %while j<1000
% t(j)=t(j-1)+dt;
% x=v0 * cos(theta0) * t(j);
% y=v0 * sin(theta0) * t(j) - 0.5 * g * t(j)^2;
%
% plot(x ,y ,'o' ,'MarkerFaceColor','b','Markersize', 8)
% axis([0 3 0 0.8])
% M(1)=getframe;
% if y <= 0, break, end
% %j=j+1;
% end
% pause
% movie(M,1)
```

```
% Struct contents reference from a non-struct array object.
% Error in alternateGetframe
% Error in getframe (line 111)
% x = alternateGetframe(parentFig, offsetRect, includeDecorations);
% Error in Projectile_Movie_2 (line 23)
% M(1)=getframe;
```