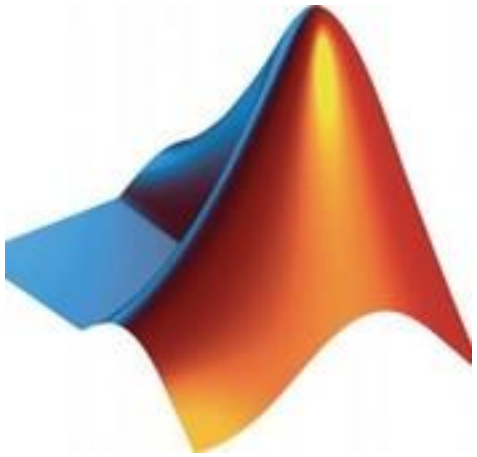
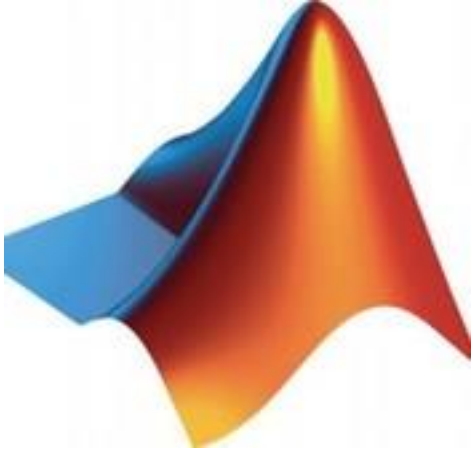

Introduction to MATLAB

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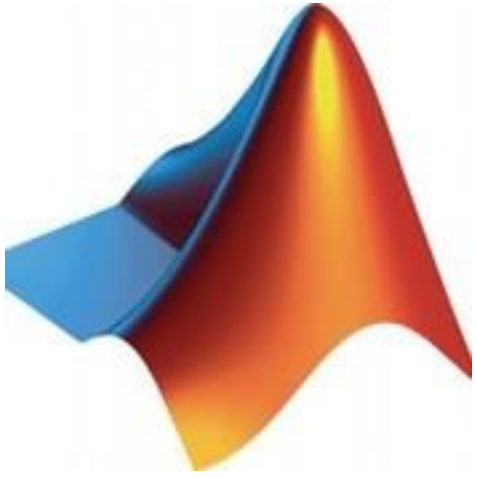
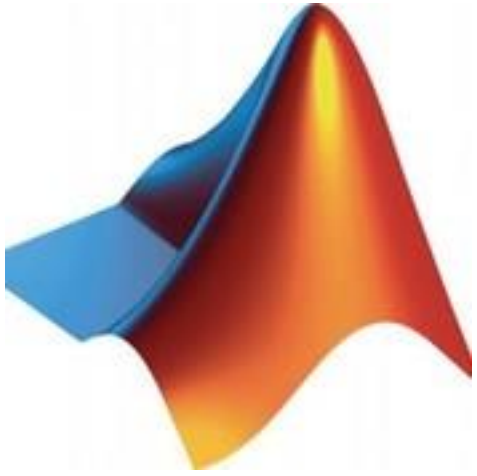

Content

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- **MATLAB Basics**
- **Plots 2D and 3D**
- **Functions**
- **Symbolic Expressions and Equations**

Getting Started with MATLAB

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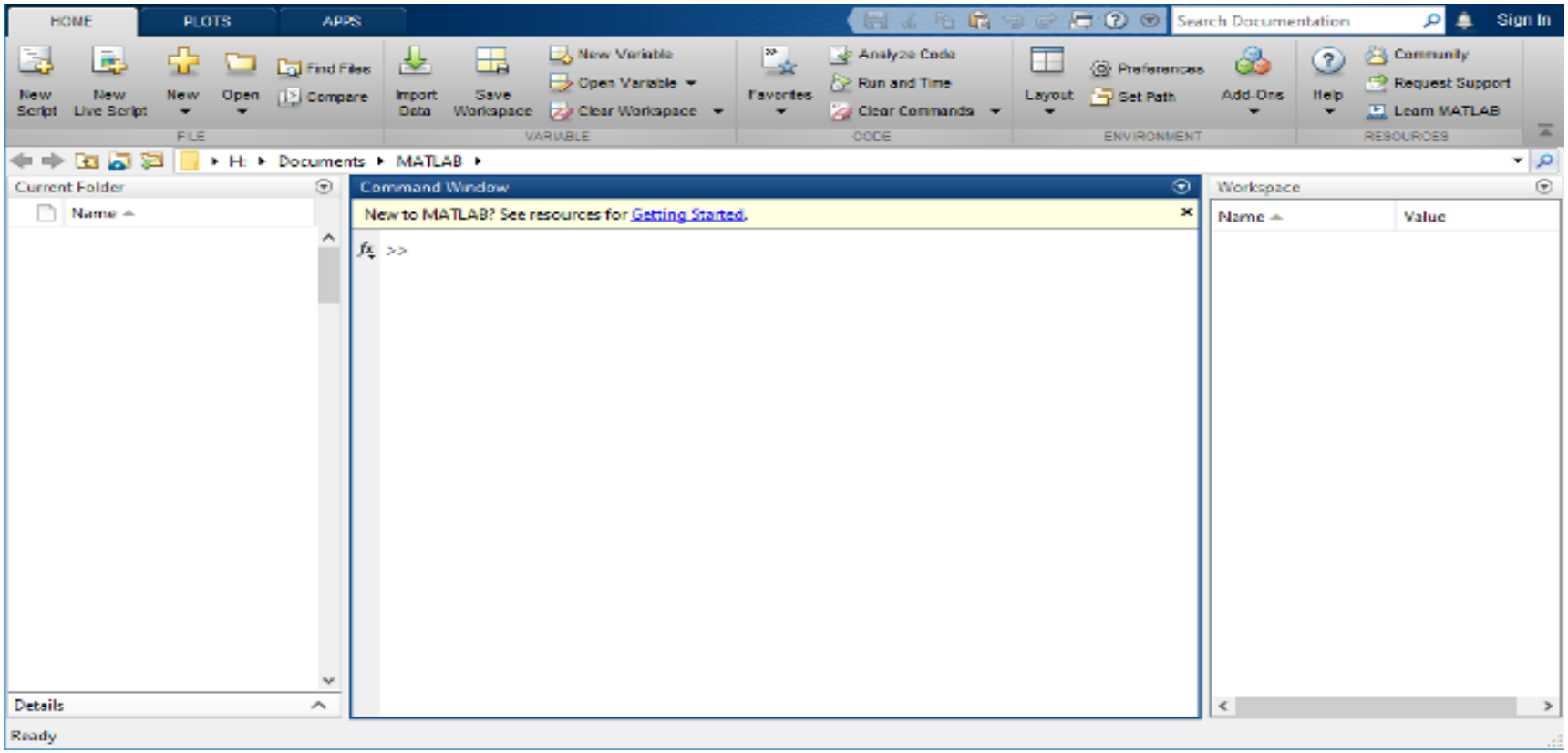
Default layout



The desktop includes these panels:

Current Folder — Access your files.

Command Window — Enter commands at the command line

Workspace — Explore data that you create or import from files

Plots 2D

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Syntax

plot(X,Y): creates a 2-D line plot of the data in Y versus the corresponding values in X.

Plot graphs of the following functions

A) $y = x^2 - 3x + 2$

B) $y = \frac{2x + 3}{1 - 2x}$

C) $y = \frac{x^2 - 1}{x^4 + 1}$

Code to plot a graph

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```
clear all;
close all;
figure(1);
hold on;
% Define values for x
x=-5:0.1:5;
% Define values of function
y=(1-x.^2)./(2+x);
% Plot the graph in red
plot(x,y,'r')
axis([-5 5 -25 30]);
% Plot coordinate axes in black
plot([-5 5],[0 0],'k');
plot([0 0],[-25 30],'k');
%plot the vertical asymptote in green
plot([-2 -2],[-25 30],'g');
title('Graph of function');
xlabel('horizontal axis');
ylabel('y');
```

Code to Plot Multiple Lines

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1- Create a line plot of the sine and cosine values of X

```
clear all;
x=-6.3:0.1:6.3;
y1 = sin(x);
y2 = cos(x);
L=plot(x,y1,'--',x,y2)
L(1).LineWidth = 2;  % Change the line width of the first line to 2
```

2- Create multiple lines of X and Y with and without using hold on routine

```
clear all;
subplot(2,1,1);
x=rand(10, 1); % create 10 random values
plot(x, 'b*-');
hold on
% Add a red line.
y=rand(10, 1);
plot(y, 'r*-’);
subplot(2,1,2);
plot(rand(10, 1), 'y*-');
% Plot red line.  and the Yellow line would disappear because the hold is off
plot(rand(10, 1), 'r*-');
```

Upper and Lower Subplots Example

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Subplot Syntax

subplot(m,n,p): divides the current figure into an m-by-n grid and creates axes in the position specified by p.

% Upper and Lower Subplots Example

```
clear all;
subplot(2,1,1);
x = linspace(0,10);
%OR
%x=0:0.1:10;
y1 = sin(x);
plot(x,y1)
subplot(2,1,2);
y2 = sin(5*x);
plot(x,y2)
```

Modify the same code to create a figure divided into four subplots

Plot 3D surface

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A) $z = 2x^2 - 4y^2$

B) $z = x^2 - y^2 + 10\sin(5xy)$

C) $x^2+4y^2+2z^2=4$

Code to plot 3D surface

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Create a surf plot of the function, z= $x^2 - y^2$

```
close all;

clear all;

[x,y]=meshgrid([-10:.5:10],[-12:.5:10]);% area for plot

z=x.^2-y.^2; % function

surf(x,y,z); %3D surface
```

Create a mesh plot of the **sin** function, z=sin(r)/r

```
clear all;
[X,Y] = meshgrid(-8:.5:8);
% R = sqrt(X.^2 + Y.^2) + eps;
R = sqrt(X.^2 + Y.^2);
Z = sin(R)./R;
C = del2(Z); %Specify a color matrix for a mesh plot.
mesh(X,Y,Z,C)
```

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Plot animated graphs of the following functions under parameter variation

A) $y = 3x^2 + 6x + a, \qquad -2 < a < 2$

B) $y = 0.5x^2 + bx - 2, \qquad 0.5 < b < 2$

Code to Plot animated

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```
clear all
close all
del=.2;                          % step for parameter change
x=-5:.1:5;                       %range for x
N=50;                            % number of frames

for i=1:N                        % loop
  a=-2+del*(i-1);                %parameter value, starts from -2 and goes till -2+del*49
  plot(x,2*x.^2-2*x+a);
  axis([-2 3 -3 12]);
  clip1(i)=getframe;             % getcurrent frame to MOVIE called clip1
end
                                 %end of code

% to play clip1 three times execute the following command
movie(clip1,3)                    % play 3 times
```

Functions

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Syntax

function [y1,...,yN] = myfun (x1,...,xM)

function [y1,...,yN] = myfun(x1,...,xM) declares a function named myfun that accepts inputs x1,...,xM and returns outputs y1,...,yN

% swap two values without using a third variable

```
function  [Res]  = Swap( x,y )
    x=x+y;
    y=x-y;
    x=x-y;
disp('X after Swap is ')
disp(x)
disp('Y after Swap is ')
disp(y)
Res='Well Done';
end
```

Modify the aforementioned code using a third variable

Symbolic Expressions and Equations

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Symbolic & expression

```
clc, clear
x=sym('x');
x1=x+x+x;
disp (x1)
```
Output: 3*x

```
clc, clear
syms x k a
x1=x+x+x;
a=sym('k');
disp(a+a+k+k+x1)
```
Output: 4*k + 3*x

```
%Create symbolic solution of the quadratic equation.
clc, clear
syms x b a c
x1=-b+sqrt(b^2-4*a*c);
x2=-b-sqrt(b^2-4*a*c);
disp (x)
```

Equations

S = solve(eqn,var) : solves the equation eqn for the variable var.

```
clc, clear
syms a b c x
eqn = a*x + b*x + c == 0;
solx = solve(eqn,x)
```
Output:
solx : -c/(a + b)
Sola: -(c + b*x)/x

USE solve command to find solution of the following equation:

$$ax^2 + 6x + c = 0$$