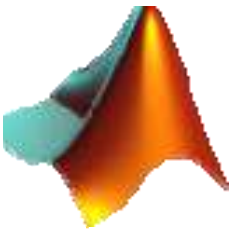
Lab $N^o 2$
Graph and M-File



Learning Objective

The objectives of this unit are to introduce some of basic concepts related to:

1) Matrices (cont.)
2) Interaction with the user: reading the values entered by the user and displaying results.
3) Graphical representation of mathematical functions and display of 2D curves and 3D.
4) Saving workspace variables and programming in Script mode.

Exercise 1:

1. Create the following matrices with 3 methods:

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{bmatrix} \text{ et } \begin{bmatrix} 0 & 4 & 4 & 4 \\ 4 & 0 & 4 & 4 \\ 4 & 4 & 0 & 4 \\ 4 & 4 & 4 & 0 \end{bmatrix}$$

2. Let A be a 2 × 3 matrix containing the coordinates of 3 points on the plane.
   Use only 1 command to obtain a matrix where the points are ordered in increasing order of abscissa.

$$A= \begin{bmatrix} 5 & 7 & 4 \\ 5 & 6 & 5 \end{bmatrix}$$

3. Find the roots of the following polynomial and linear equation systems

$$f(x) = 3x^6 + 15x^5 - 10x^3 + 4x$$

4. Using matrix writing, solve the linear system

$$\begin{cases} 2x + 3y + 4z &= 3 \\ x - y - z &= 0 \\ -x + 4y + z &= 5 \end{cases}$$

Exercise 2: Figure Plotting in 2D and 3D

Task 1: Execute the following instructions in the command window:

```
>> x = 0 : pi/90 : pi ;
>> y = sin(x);
>> plot(x,y) % to display the curve
>> grid % to display a grid
>> xlabel('x, radians') % to name the abscissa
>> ylabel('sin(x)')
```

Task 2: Represent the following curves:

1- y= $e^{(0.2*x)}$ for x between interval -5 and 5 with a step= 0.1.
2- x=m(w -sin w) and y=m(1-cos w), with m is value fixed (m=5 for example) and w between interval 0 and 5m with step = 0.1
3- Draw, in red color, the function y= x sin($\frac{1}{x}$) for x between interval -5 and 5 with a step= 0.1.
4- Plot the functions y=x and y=-x in dotted lines and in blue (see the following figure).
5- Write their equation on the graph next to the curves.

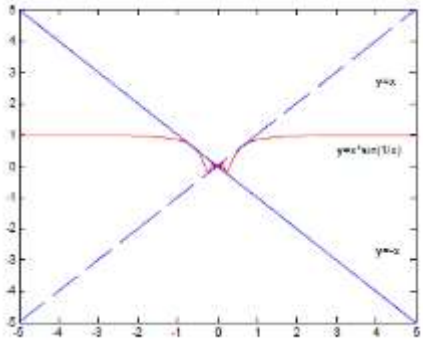
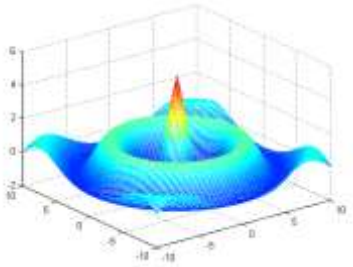


Figure to obtain.

Task 3: Represent the following curves:

1- First get help for the following functions: mesh, surf and plot3.
2- Plot the 3D curve of the following function using plot3, mesh, surf.

Z=$\frac{15\cos(r)}{r+4}$ avec r=$\sqrt{x^2+y^2}$ and x, y are between interval -12 and 12 with step = 0.1



3D figure

Exercise 3: Files (.mat) and Scripts (.m)

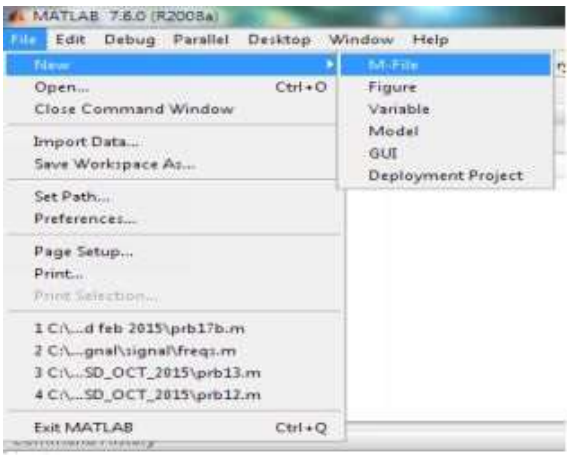
File (.mat): Files ".mat" obtained by "File->Save Workspace As" or "Ctrl+S" can be read again with "Open" or "Ctrl+O". These files contain the variables stored in the workspace.

Task 1: Save in the file "Part1.mat" all the variables created during the exercise1. Then enter the "Clear" command then reload the contents of the "exercise1" file in the workspace.

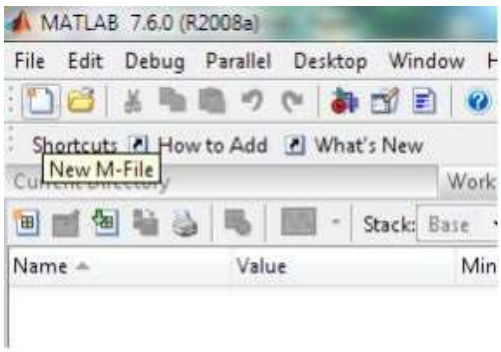
Scripts (.m): Files used in MATLAB programming are called as **script**. Scripts are the simplest kind of M-file. They are useful for automating blocks of MATLAB commands, such as **computations you have to perform repeatedly** from the command line.

Scripts can operate on existing data in the workspace, or they can create new data on which to operate. Although scripts do not return output arguments, any variables that they create remain in the workspace, so you can use them in further computations

Using GUI ->file
->new
->M-file



For this function, MATLAB has provided a quick access button on the main screen.



Using command window enter following command
>>edit
Or
>>edit filename.m
The editor window looks like following:

Task2 : Create the following script with the name “sum.m”. Then save the script and call it in the interpreter by typing the file name “sum” without the extension. Make sure that the “sum.m” file is saved in the folder " current folder "

```
clear
clc
% finding sum of two numbers
disp('Calcul de la somme de a+b')  % disp is used to display text on the screen,
A=input('enter the first number= ');% input asks the user to enter a value of a on the keyboard
B=input('enter the second number= ');  % input asks the user to enter a value of a on the keyboard
sum2=A+B;
dis(sum2)    % display of sum2
```

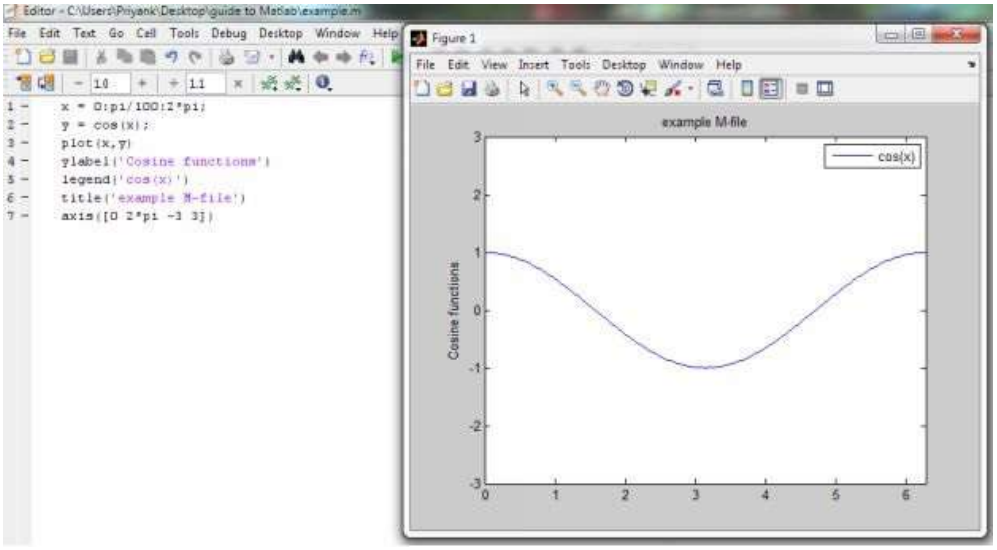
Task3: Let us create a file which will plot a **sine wave**. You may just copy and paste the program as it is as we are to study many functions and commands.

```
x = 0:pi/100:2*pi;
y = cos(x);
plot(x,y)
ylabel('Cosine functions')
legend('cos(x)')
title('example M-file')
axis([0 2*pi -3 3])
```

Once you have copied this program in editor press “ctrl+s” or go to file and click on save. Save your file in desired location. A new window to save will pop up.

Once you have saved it, you are ready to run it. To run file click on the button as shown in the image below:

MATLAB will take some time to give the output depending on your system configuration and you will be able to see the following output.



Remark: M files can be of two types: they can be simple scripts or functions. For now we have discussed only the script ones but once we get hold of MATALB and script we will find it very easy to generate a function file.