

# MATLAB

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# Matlab (Matrix laboratory) - It is a fourth generation high-level programming language and interactive environment for numerical computation, visualization and programming.

- Matlab is developed by MATHWORKS.
- Matlab file has the extension .m.

\* Matlab power of computational mathematics:-

Following are some commonly used mathematical calculations where matlab is used:-

- a) Dealing with matrices and array.
- b) 2-D & 3-D plotting and graphics.
- c) Linear and non-linear functions and algebra.
- d) Algebraic equation
- e) statistics
- f) Data Analysis
- g) Numerical calculations
- h) Integration
- i) Image and Video processing
- j) computational finance
- k) Computational Biology

\* Matlab environment :-

- a) current folder - This panel allow us to access the project folder and files.



b) Command Window - This is the main area where command can be entered at command line. It is indicated by the command prompt (>>).

c) Workspace - Show all the variables created and / or imported files.

d) Command history - This panel shows commands that are entered at command line.

| * Operator | Purpose              |
|------------|----------------------|
| .*         | Array Multiplication |
| .^         | Array exponentiation |
| \          | left division        |
| /          | right division       |
| .\         | Array left division  |
| ./         | Array right division |
| %          | Single line comment  |

### \* Special Variable and Constants in matlab

| Name | Meaning                    |
|------|----------------------------|
| ans  | Most recent answer         |
| eps  | Accuracy of floating point |
| i, j | The imaginary unit         |
| Inf  | Infinity                   |
| NaN  | not a number               |
| pi   | The number (3.14)          |

## \* Naming Variables in Matlab :-

Variables name consist of a letter followed by any number of letters, digits or underscore.

Q) Note :- Matlab is case sensitive.

## \* Some important command used in matlab :-

a) Save command - Saving all the variables in the workspace.

b) Who command - display all the variables name you have used.

c) clear command - delete all the specified variable from memory.

example:

clear x % It will delete x .

clear % It will delete all the variables % on current workspace .

Q) WAP in matlab to display a text message "hello matlab".

```
fprintf ("hello matlab");
```

Q. WAP in matlab to use sqrt() function ?

$$x = \text{sqrt}(16)$$

$$x = 4$$



Q.) WAP in matlab to plot a graphics for random number b/w 1 to 100 ?

```
z = rand(1, 100)
plot(z)
```

Q.) WAP in matlab to add two no ?

```
a = input('Enter 1st no');
b = input('Enter 2nd no');
c = a + b;
fprintf('sum = %d\n', c);
```

Output:-

Enter 1st no > 1

Enter 2nd no > 2

sum = 3

### \* Control structure in matlab :-

1. if... else
2. Nested if... else
3. if... else if ladder

Q.) WAP in matlab to find the greater between two no ?

```
a = input('Enter 1st no');
b = input('Enter 2nd no');
if a > b
    disp('a is greater')
else
    disp('b is greater')
end
```

output :-

Enter 1st no &gt; 1

Enter 2nd no &gt; 2

b is greater

Q.) WAP in matlab to find the greatest between three no using nested if...else?

```
a = input('Enter 1st no');
b = input('Enter 2nd no');
c = input('Enter 3rd no');
if a>b && a>c
    disp ('A is greatest');
else
    if b>c
        disp ('B is greatest');
    else
        disp ('c is greatest');
    end
end
```

output :-

Enter 1st no &gt; 1

Enter 2nd no &gt; 2

Enter 3rd no &gt; 3

c is greatest



Q.) WAP in matlab to find the greatest between three no using the if...else if ladder ?

```
a = input('Enter 1st no');
b = input('Enter 2nd no');
c = input('Enter 3rd no');
if a>b && a>c
    disp('A is greatest');
elseif b>c
    disp('B is greatest');
else
    disp('C is greatest');
end
```

Output:-

```
Enter 1st no>12
Enter 2nd no>2
Enter 3rd no>123
C is greatest
```

Q.) WAP in matlab to check a no is odd or even ?

```
a = input('Enter no');
z = mod(a, 2);
if z == 0
    disp('even');
else
    disp('odd');
end
```



output:-

Enter no>3

odd

Enter no>4

even

### \* Looping statement in matlab :-

a) while loop

b) for loop

Q) WAP in matlab to generate the table of a given no ? using while loop.

```
a = input ('Enter no');
```

```
i = 1
```

```
while i <= 10
```

```
fprintf ('%d\n', i*a);
```

```
i = i + 1;
```

```
end
```

output:-

Enter no>5

i = 1

5

i = 2

10



i

i = 10

50

i = 11



Q.) Example of for loop ?

```
for i = 1 : 10
    disp(i)
end
```

Output :-

```
1
2
3
:
:
10
```

Q.) WAP in matlab to find the factorial of a given number using for loop ?

```
n = input('Enter no');
f = 1
for i = 1:n
    f = f * i;
end
disp(f);
```

Output :-

Enter no > 5

```
f = 1
f = 1
f = 2
f = 6
f = 24
f = 120
```

120



## # Function in matlab :-

A function is a group of ~~words~~ statements that together perform a task.

- In Matlab, functions are defined in separate file. The name of the file and of the function should be same.
- Functions operate on variables within their own workspace, which is also called the local work space.
- Functions can access more than one input arguments and then return one output argument.

Syntax :

function [Output] = function\_name (in1, in2, ..., inN)

- where 'function' is a keyword.

\* Types of function :-

a) System defined functions - mod(), rand(), plot(), input(), fprintf(), disp() etc.

b) User defined functions - These functions are created by user as per need.



\* Advantage of function :-

a) Reusability of existing code.

b) Modular programming style.

\* Example of creating a user define function :-

# add1.m

```
function f = add1(a,b)
f = a+b
end
```

use.m

```
x = input('Enter 1st no')
y = input('Enter 2nd no')
add1(x,y) % calling the user defined func
```

# WAP in matlab to check a number is even or odd using user defined function.

oe.m

```
function ans1 = oe(n)
```

```
x = mod(n,2)
```

```
if x == 1
```

```
ans1 = "ODD NUMBER"
```

```
else
```

```
ans1 = "EVEN NUMBER"
```

```
end
```



## use.m

`x = input ('Enter no')`

`oe(x) % calling the user define function`

## # Array in Matlab :-

All variables of all data types in MATLAB are multidimensional arrays.

A vector is one-dimensional array and a matrix is a two-dimensional array.

## \* Special Arrays in MATLAB :-

a) `zeros()` - function creates an array of all zeros.

example:

`octave:1> zeros(4)`

`ans =`

`0 0 0 0`

`0 0 0 0`

`0 0 0 0`

`0 0 0 0`

b) `ones()` - function creates an array of all ones.

example:

`ones(2, 2)`

`ans =`

`1 1`

`1 1`



c) `eye()` - function creates an identity matrix.

example:

`eye(3, 3)`

ans =

1 0 0

0 1 0

0 0 1

d) `rand()` - function creates an array of uniformly distributed random numbers.

example:

`rand(3, 2)`

ans =

0.4851 0.8610

0.2891 0.5970

0.1864 0.8861

## # Multidimensional Arrays :-

An array having more than two dimension is called a multidimensional array.

In MATLAB, a multidimensional array is an extension of the normal two-dimensional matrix.

Generally to generate a multidimensional array, we first create a two-dimensional array and extend it.



example: Let's create a two-dimensional array.

$a = [1, 2, 3; 4, 5, 6; 7, 8, 9]$

$a =$

|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

we can also use the cat () function to build multidimensional arrays. It concatenates a list of arrays along a specified direction.

Syntax for cat () -

$B = \text{cat}(\text{dim}, A_1, A_2, \dots)$

where  $A_1, A_2, \dots, A_n$  are the matrix.

### \* Array Functions :-

MATLAB provides the following functions to sort, rotate, permute, reshape or shift array contents.

| Function | Purpose                           |
|----------|-----------------------------------|
| length   | Length of vector or largest array |
| ndims    | Number of array dimensions        |
| numel    | Number of array elements          |



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## Array dimensions

iscolumn

Determines whether input is column vector

isempty

Determines whether <sup>array</sup> <sub>input</sub> is array empty

ismatrix

Determines whether input is matrix

isrow

Determines whether input is row vector

sort

Sorts array elements in ascending or descending order

### # Sorting arrays :-

Sort 1-D Array -

> a = [3, 4, 12, 4, 78, 2, 45, 6]

a =

3 4 12 4 78 2 45 6

> sort(a)

ans =

2 3 4 4 6 12 45 78



## sort 2-D Array

$m = [1, 2, 3]$

>  $m = [12, 3, 1; 23, 5, 1; 8, 7, 2]$

$m =$

|    |   |   |
|----|---|---|
| 12 | 3 | 1 |
| 23 | 5 | 1 |
| 8  | 7 | 2 |

>  $\text{sort}(m, 1)$

$\text{ans} =$

|    |   |   |
|----|---|---|
| 8  | 3 | 1 |
| 12 | 5 | 1 |
| 23 | 7 | 2 |

>  $\text{sort}(m, 2)$

$\text{ans} =$

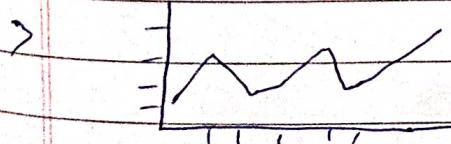
|   |   |    |
|---|---|----|
| 1 | 3 | 12 |
| 1 | 5 | 23 |
| 2 | 7 | 8  |

Q) WAP in matlab to draw a graph to display the no of students in IT dept from year 2015 to 2021 using the array and plot function?

$\text{year} = [2015, 2016, 2017, 2018, 2019, 2020, 2021]$

$\text{IT} = [78, 90, 67, 100, 120, 78, 144]$

$\text{plot}(\text{year}, \text{IT})$





## # File handling in Matlab :-

### \* File -

- File is a collection of interrelated data and information.
- Using file we can store our data permanently in computer secondary storage like hard disk.
- Using file we can work on large volume of data.

### \* File Mode -

- a) write mode - ~~W~~ Writing in a file from the start of the file.
- b) read mode - Reading a file from the start of the file.
- c) append - also a write mode but writing operation from the end of the file.



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Q.) WAP in matlab to perform some writing operation in a text file?

```
f = fopen ('file.txt', 'w');
fprintf (f, 'File handling in matlab :- \n');
fclose (f);
```

Q.) WAP in matlab to perform some append operation in a text file?

```
f = fopen ('file.txt', 'a');
fprintf (f, 'File is a collection of interrelated
data and information \n');
fclose (f);
```

Q.) WAP in matlab to read a text file char by char?

```
f = fopen ('k1.txt', 'r');
data = textscan (f, "%c");
disp (data);
fclose (f);
```

Q.) WAP in matlab to read a text file word by word?

```
f = fopen ('k1.txt', 'r');
data = textscan (f, "%s");
disp (data);
fclose (f);
```



Q.) WAP in matlab to read a text file line by line?

~~fopen~~

```
f = fopen('k1.txt', 'r');
data = textscan(f, '%s', 'delimiter', '\n');
disp(data);
fclose(f);
```

\* reads data from an open text file into a cell of array.

→ Assignment on file handling :-

Q.) WAP in matlab to copy a file content to another file?

Q.) WAP in matlab to merge two file contents in a 3<sup>rd</sup> file?

Q.) WAP in matlab to store a student record (name roll dob and course) in a text file?

Q.) WAP in matlab to count the word "hello" in a text file?