

Introduction to Matlab

305171 Computer Programming
Jiraporn Pooksook
Naresuan University

What is Matlab?

- [MATLAB](#)[®] is a programming platform designed specifically for engineers and scientists. The heart of MATLAB is the MATLAB language.
- MATLAB is an interpreter. As part of its internal optimizations, sometimes it compiles portions of the code using its own internal facilities (not using an external compiler).
- Ref: <https://www.mathworks.com>

Try with Matlab Command

Command Window

New to MATLAB? See resources for [Getting Started](#).

Trial License -- for use to evaluate programs for possible

```
>> 3+4
```

```
ans =
```

```
7
```

```
>> 2^3
```

```
ans =
```

```
8
```

```
>> sin(pi / 2)
```

```
ans =
```

```
1
```

Try with Matlab Command

```
>> x = 3
```

```
x =
```

```
3
```

```
>> y = 4
```

```
y =
```

```
4
```

```
>> x + y
```

```
ans =
```

```
7
```

Matlab Command vs. C codes

```
Command Window
New to MATLAB? See resources for Ge

Trial License -- fo:

>> 3+4

ans =

     7

>> 2^3

ans =

     8

>> sin(pi /2)

ans =

     1
```

```
8
9  #include <stdio.h>
10 #include <math.h>
11
12 #define PI 3.14159265
13 int main()
14 {
15     printf("%d \n", 3 + 4);
16     printf("%f \n", pow(2,3));
17     printf("%f \n", sin(PI/2));
18
19     return 0;
20 }
21
```

```
7
8.000000
1.000000
```

Matlab Command vs. C codes

```
>> x = 3
```

```
x =
```

```
3
```

```
>> y = 4
```

```
y =
```

```
4
```

```
>> x + y
```

```
ans =
```

```
7
```

```
9  #include <stdio.h>
10 #include <math.h>
11
12 #define PI 3.14159265
13 int main()
14 {
15     int x,y;
16     x=3;
17     y=4;
18     printf("%d \n", x+y);
19
20     return 0;
21 }
22
```



```
7
```

Matlab Variables

```
>> x = 3
```

```
x =
```

```
3
```

```
>> y = 4
```

```
y =
```

```
4
```

```
>> x + y
```

```
ans =
```

```
7
```

```
>> ans + 3
```

```
ans =
```

```
10
```

Define variable's name and assign its value.

use the name 'ans' to calculate .

Create M-Files

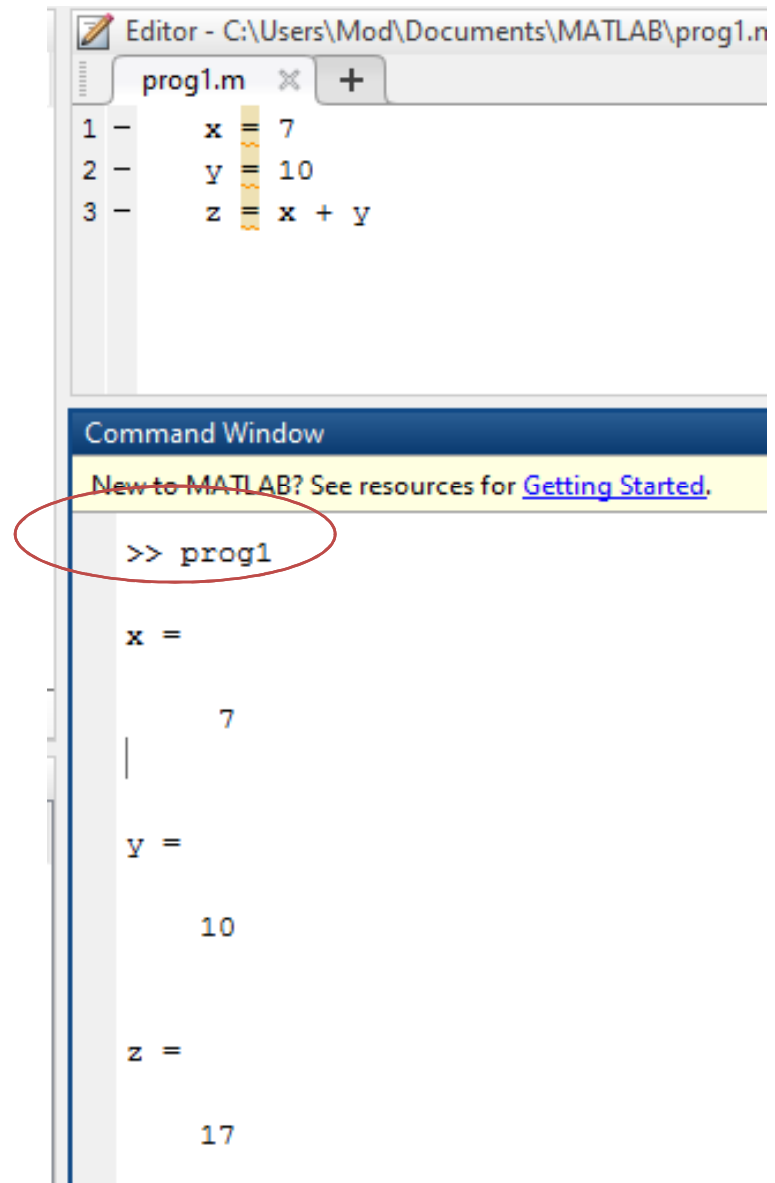
The image shows the MATLAB R2018a interface. The 'HOME' tab is active, and the 'New Script' button is circled in red. The Command Window displays the following MATLAB code:

```
>> x = 3
x =
    3
>> y = 4
y =
    4
>> x + y
ans =
    7
>> ans + 3
ans =
    10
>> edit test.m
>> edit prog1.m
```

A dialog box titled 'MATLAB Editor' is open, asking: 'File C:\Users\Mod\Documents\MATLAB\prog1.m does not exist. Do you want to create it?'. The 'Yes' button is highlighted with a red circle. The 'Do not show this prompt again.' checkbox is unchecked.

Name	Value
ans	10
x	3
y	4

Run M-files



The image shows a MATLAB interface with two windows. The top window is the Editor, showing a file named 'prog1.m' with the following code:

```
1 - x = 7
2 - y = 10
3 - z = x + y
```

The bottom window is the Command Window, which displays the command '>> prog1' circled in red. Below the command, the output of the script is shown:

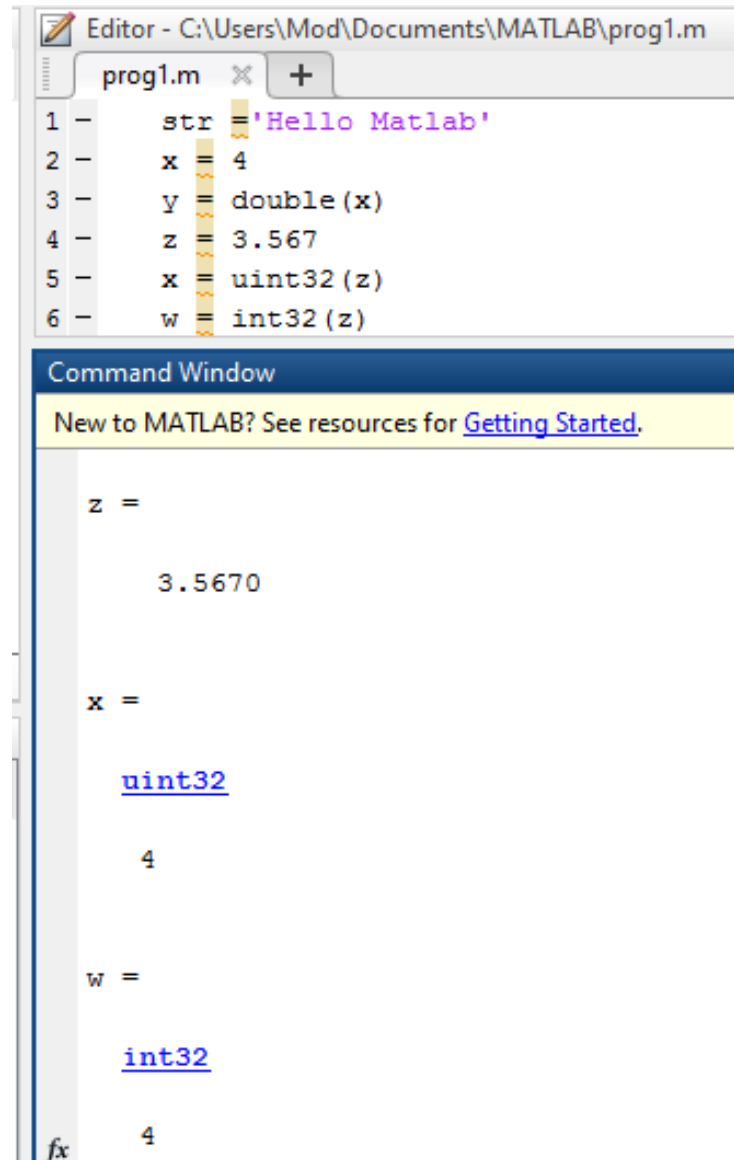
```
x =
    7
y =
   10
z =
   17
```

The Command Window also features a yellow banner at the top that reads: "New to MATLAB? See resources for [Getting Started.](#)"

Matlab Data Type

Type	Details
int8	8-bit signed integer
uint8	8-bit unsigned integer
int16	16-bit signed integer
uint16	16-bit unsigned integer
int32	32-bit signed integer
uint32	32-bit unsigned integer
int64	64-bit signed integer
uint64	64-bit unsigned integer
single	single precision numerical data
double	double precision numerical data
logical	0 or 1
char	character data (strings are stored as vector of characters)

Matlab Data Type



The screenshot shows the MATLAB Editor window with a script named 'prog1.m' containing the following code:

```
1 - str = 'Hello Matlab'  
2 - x = 4  
3 - y = double(x)  
4 - z = 3.567  
5 - x = uint32(z)  
6 - w = int32(z)
```

Below the editor is the Command Window, which displays the output of the script:

```
z =  
  
    3.5670  
  
x =  
  
    uint32  
  
    4  
  
w =  
  
    int32  
  
    4
```

The Command Window also features a yellow banner at the top that reads: "New to MATLAB? See resources for [Getting Started](#)."

Display Output : fprintf

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m x +
1 - prompt = 'enter a number ';
2 - x = input(prompt)
3 - if x < 0
4 -     fprintf('%d is negative\n',x );
5 - else
6 -     fprintf('%d is positive\n',x );
7 - end
8
```

Use fprintf to directly display the text without creating a variable

```
Command Window
New to MATLAB? See resources for Getting Started.
>> prog1
enter a number 45

x =

    45

45 is positive
```

Display Output

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m x +
1 - prompt = 'enter a number ';
2 - x = input(prompt)
3 - if x < 0
4 -     output = sprintf('%d is negative\n',x );
5 - else
6 -     output = sprintf('%d is positive\n',x );
7 - end
8 -
9 - disp(output)
```

Use sprintf to create text,
and then display it
with disp

```
Command Window
New to MATLAB? See resources for Getting Started.
-2 is positive
>> prog1
enter a number -2

x =

    -2

-2 is negative
```

If-Else

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m x +
1 - prompt = 'enter a number ';
2 - x = input(prompt)
3 - if x < 0
4 -     fprintf('%d is negative\n',x );
5 - else
6 -     fprintf('%d is positive\n',x );
7 - end
8
```

```
Command Window
New to MATLAB? See resources for Getting Start

>> prog1
enter a number 45

x =

    45

45 is positive
```

If-Elseif

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m x +
1 - prompt = 'enter a number ';
2 - x = input(prompt)
3 - if x < 0 && x > -10
4 -     output = sprintf('%d is in between -1 and -10',x );
5 - elseif x >=0 && x < 10
6 -     output = sprintf('%d is in between 1 and 10',x );
7 - else
8 -     output = sprintf('%d is 0',x );
9 - end
10
11 - disp(output)
```

```
Command Window
New to MATLAB? See resources for Getting Started.
>> prog1
enter a number 2

x =

    2

2 is in between 1 and 10
```

Nested-If

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m x +
1 - prompt = 'enter a number ';
2 - x = input(prompt)
3 - if x < 0
4 -     if x > -10
5 -         output = sprintf('%d is in between -1 and -10',x );
6 -     end
7 - elseif x >=0 && x < 10
8 -     output = sprintf('%d is in between 1 and 10',x );
9 - else
10 -     output = sprintf('%d is 0',x );
11 - end
12
13 - disp(output)
```

```
Command Window
New to MATLAB? See resources for Getting Started.
>> prog1
enter a number 3

x =

     3

3 is in between 1 and 10
```


Loop: while

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m
1 -     prompt = 'Enter a number '
2 -     n = input(prompt)
3 -     i = 1
4 -     while( i < n )
5 -         fprintf('%d\n', i);
6 -         i = i + 1;
7 -     end
```

```
Command Window
New to MATLAB? See resources for Getting Started

Enter a number 3

n =

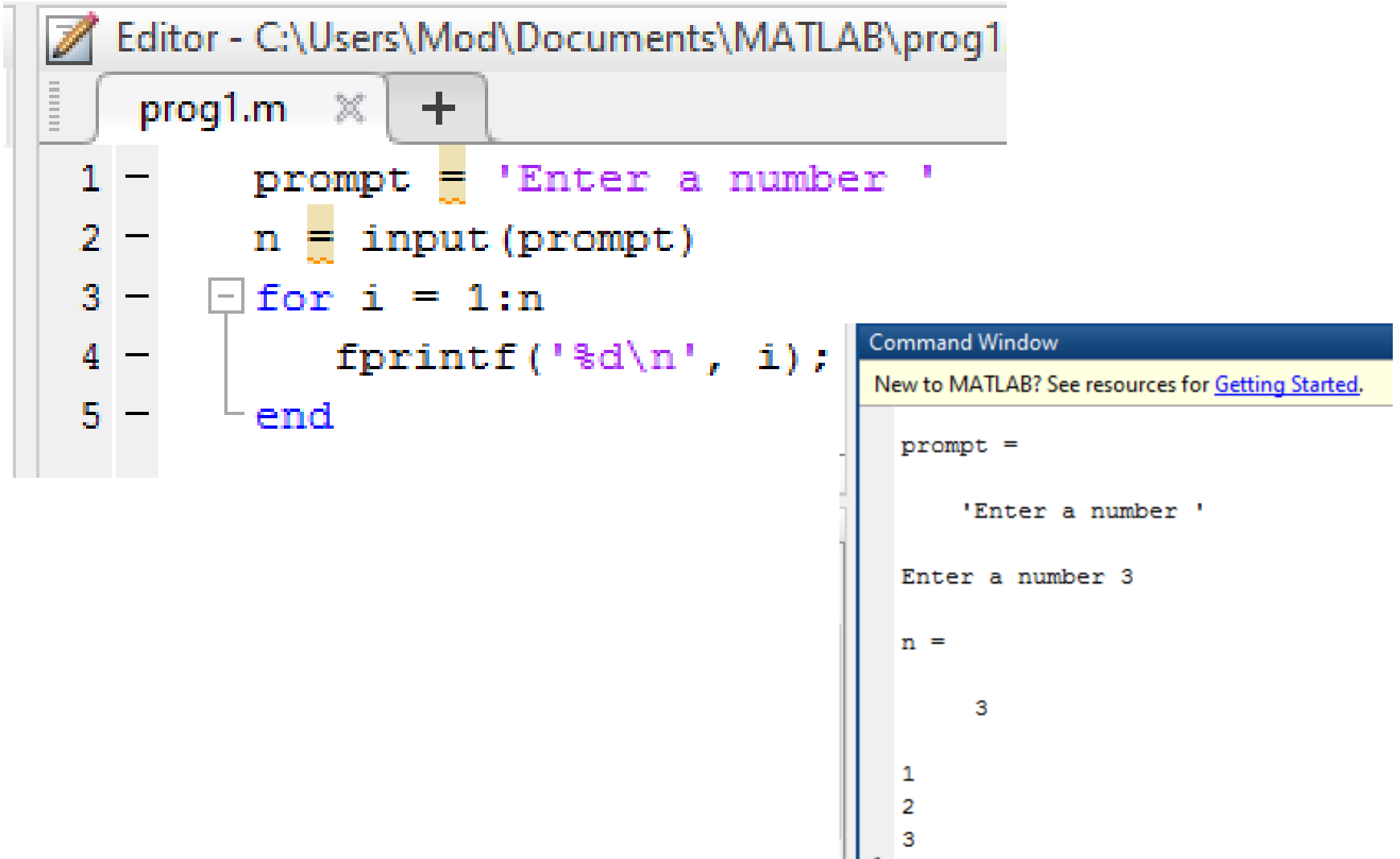
     3

i =

     1

1
2
```

Loop : for



The image shows a MATLAB Editor window with a script named 'prog1.m' and a Command Window. The script defines a prompt, takes user input, and uses a for loop to print numbers from 1 to the input value. The Command Window shows the execution of the script, including the prompt, the user input '3', and the output '1', '2', and '3'.

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1
prog1.m x +
1 - prompt = 'Enter a number '
2 - n = input(prompt)
3 - for i = 1:n
4 -     fprintf('%d\n', i);
5 - end

Command Window
New to MATLAB? See resources for Getting Started.

prompt =

    'Enter a number '

Enter a number 3

n =

    3

1
2
3
```

Nested Loop

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.n
prog1.m
1 - prompt = 'Enter a number '
2 - n = input(prompt)
3 - for i = 1:n
4 -     for j=1:i
5 -         fprintf('*');
6 -     end
7 -     fprintf('\n');
8 - end
```

```
Command Window
New to MATLAB? See resources fo
Enter a number 4
n =
    4
*
**
***
****
```

Matrix

- Matrix in Matlab is an arrays.

```
>> a = [ 1 2 3 4 5; 2 3 4 5 6; 3 4 5 6 7; 4 5 6 7 8]
```

```
a =
```

```
     1     2     3     4     5
     2     3     4     5     6
     3     4     5     6     7
     4     5     6     7     8
```

Matrix

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
a =
```

```
    1    2    3    4    5
    2    3    4    5    6
    3    4    5    6    7
    4    5    6    7    8
```

```
>> a(2,3)
```

```
ans =
```

```
    4
```

Refer an element in the matrix

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
a =
```

```
    1    2    3    4    5
    2    3    4    5    6
    3    4    5    6    7
    4    5    6    7    8
```

```
>> v = a(:,4)
```

```
v =
```

```
    4
    5
    6
    7
```

Create a vector by referring to a column in the matrix

Matrix

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
a =  
  
     1     2     3     4     5  
     2     3     4     5     6  
     3     4     5     6     7  
     4     5     6     7     8
```

```
>> a(:, 2:3)
```

```
ans =  
  
     2     3  
     3     4  
     4     5  
     5     6
```

Refer two columns
in the matrix

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
>> a  
  
a =  
  
     1     2     3     4     5  
     2     3     4     5     6  
     3     4     5     6     7  
     4     5     6     7     8
```

```
>> sa = a(2:3, 2:4)
```

```
sa =  
  
     3     4     5  
     4     5     6
```

Create a
sub-matrix

Matrix Operation

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
a =  
  
     1     2     3     4     5  
     2     3     4     5     6  
     3     4     5     6     7  
     4     5     6     7     8
```

```
>> a(4, :) = []
```

```
a =  
  
     1     2     3     4     5  
     2     3     4     5     6  
     3     4     5     6     7
```

Delete the 4th
row of the
matrix

```
>> a = [ 1 2 3; 2 3 4; 1 2 5]  
det(a)
```

```
a =
```

```
     1     2     3  
     2     3     4  
     1     2     5
```

```
ans =
```

```
    -2
```

Matrix operation :
determinant

Matrix Operation

```
Command Window
New to MATLAB? See resources for Getting Started.

>> a = [ 1 2 3; 2 3 4; 1 2 5]
inv(a)

a =

     1     2     3
     2     3     4
     1     2     5

ans =

    -3.5000    2.0000    0.5000
     3.0000   -1.0000   -1.0000
    -0.5000         0    0.5000
```

Matrix operation : inverse

```
Command Window
New to MATLAB? See resources for Getting Started.

>> a = [ 10 12 23 ; 14 8 6; 27 8 9]
b = a'

a =

    10    12    23
    14     8     6
    27     8     9

b =

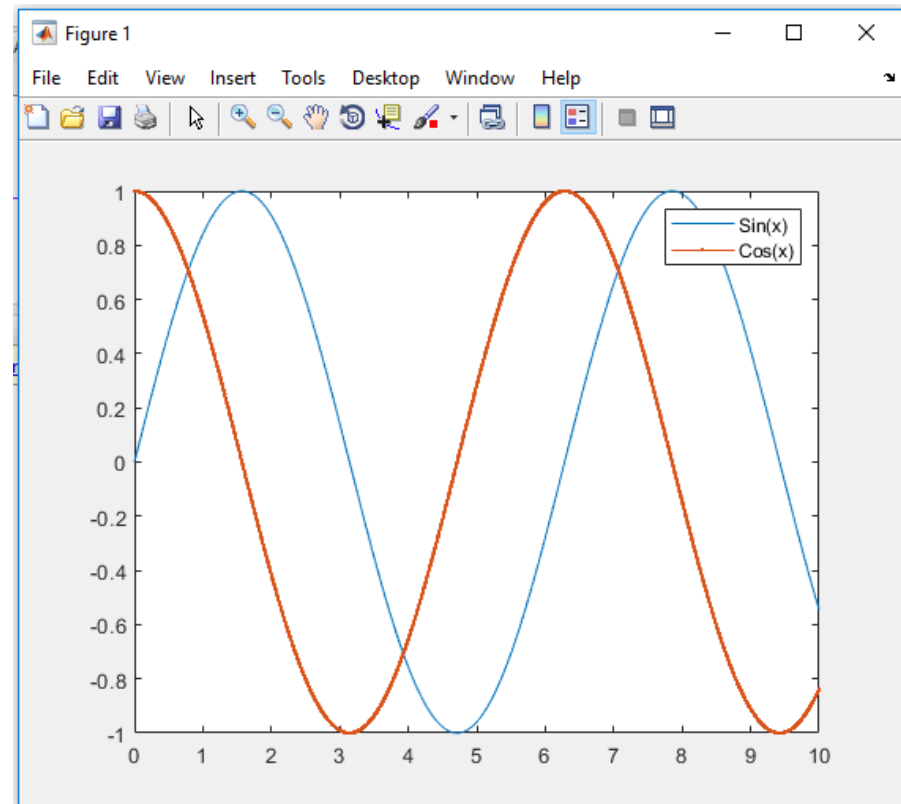
    10    14    27
    12     8     8
    23     6     9
```

Matrix Operation: transpose

Plot

```
Editor - C:\Users\Mod\Documents\MATLAB\prog1.m  
prog1.m x +  
1 - x = [0 : 0.01: 10];  
2 - y = sin(x);  
3 - g = cos(x);  
4 - plot(x, y, x, g, '-'), legend('Sin(x)', 'Cos(x)')
```

Range of value starting from 0 to 10 with an increment of 0.01



Calculus and Polynomials

$$P(x) = x^4 + 7x^3 - 5x + 9$$

```
>> p = [1 7 0 -5 9];  
polyval(p,4)
```

```
ans =
```

```
693
```

Create
symbolic
variable

```
>> syms x  
>> limit((x - 3)/(x-1),1)
```

```
ans =
```

```
NaN
```

$f(x) = (x-3)/(x-1)$
as x tends to 1.