Introduction to Matlab

305171 Computer Programming

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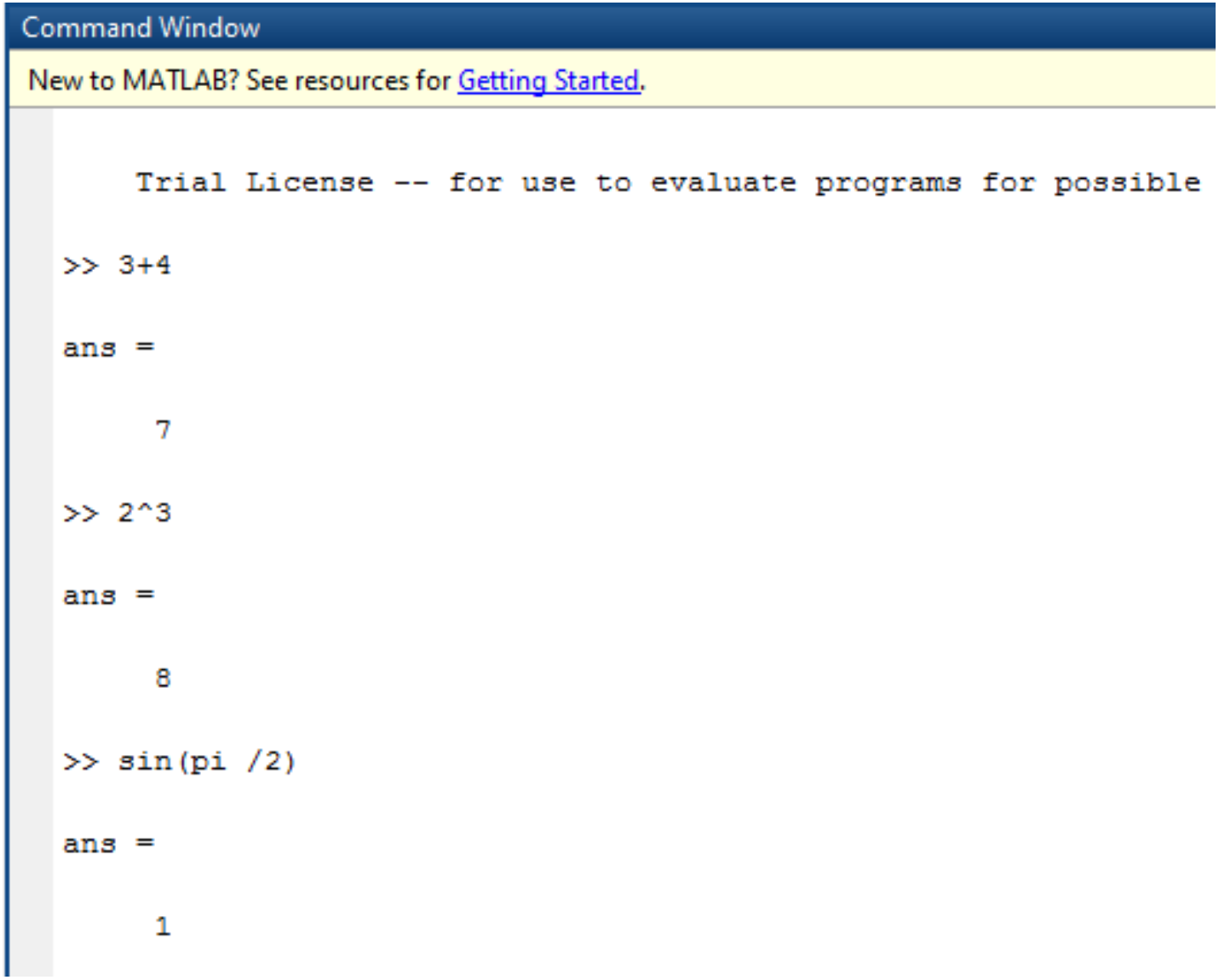
What is Matlab?

- 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

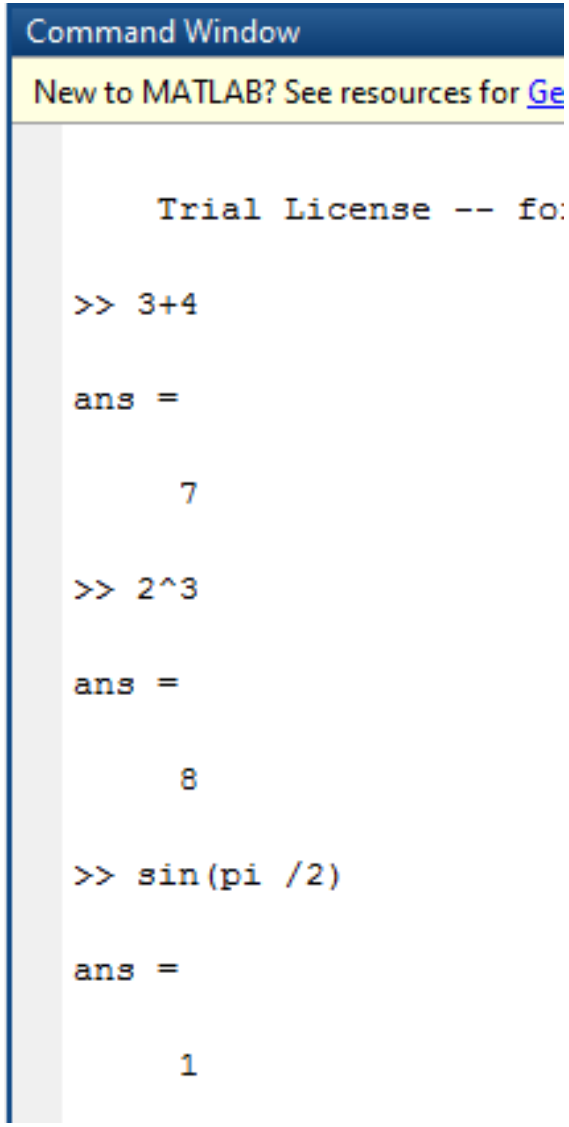
Try with Matlab Command



Try with Matlab Command

```
>> x = 3

x =

     3

>> y = 4

y =

     4

>> x + y

ans =

     7
```

Matlab Command vs. C codes




```c
#include <stdio.h>
#include <math.h>

#define PI 3.14159265
int main()
{
    printf("%d \n", 3 + 4);
    printf("%f \n", pow(2,3));
    printf("%f \n", sin(PI/2));

    return 0;
}
```

```
7
8.000000
1.000000
```

Matlab Command vs. C codes

```
>> x = 3

x =

     3

>> y = 4

y =

     4

>> x + y

ans =

     7
```

```c
#include <stdio.h>
#include <math.h>

#define PI 3.14159265
int main()
{
    int x,y;
    x=3;
    y=4;
    printf("%d \n", x+y);

    return 0;
}
```

```
7
```

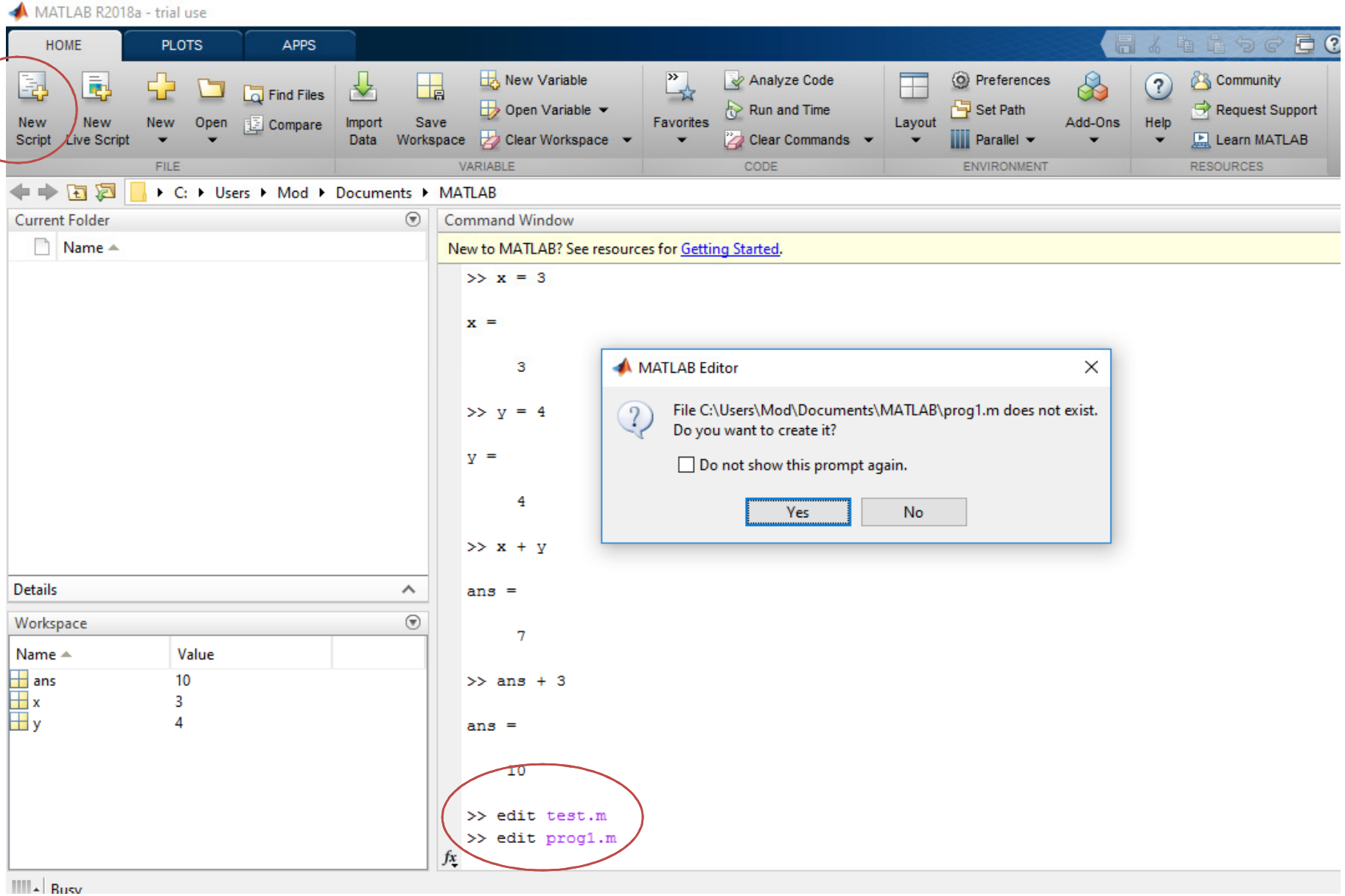
Matlab Variables

```
>> x = 3

x =

     3

>> y = 4

y =

     4

>> x + y

ans =

     7

>> ans + 3

ans =

    10
```

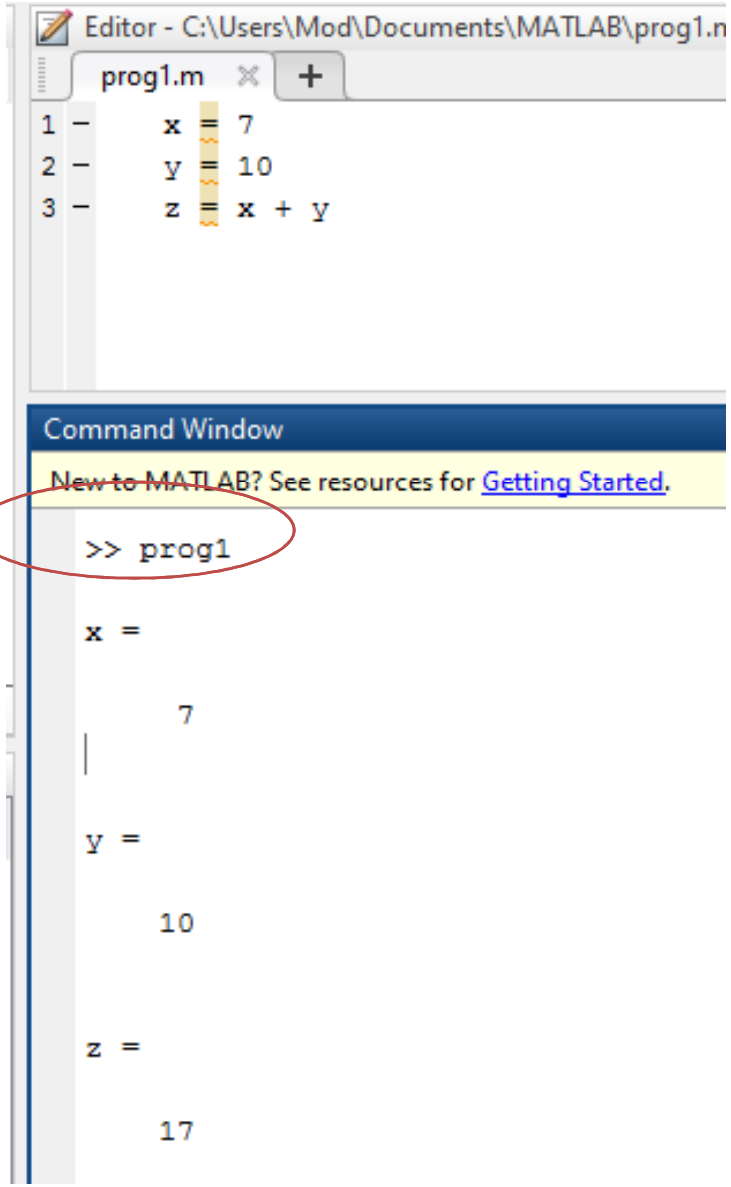
Define variable's name and assign its value.

use the name 'ans' to calculate .

Create M- Files



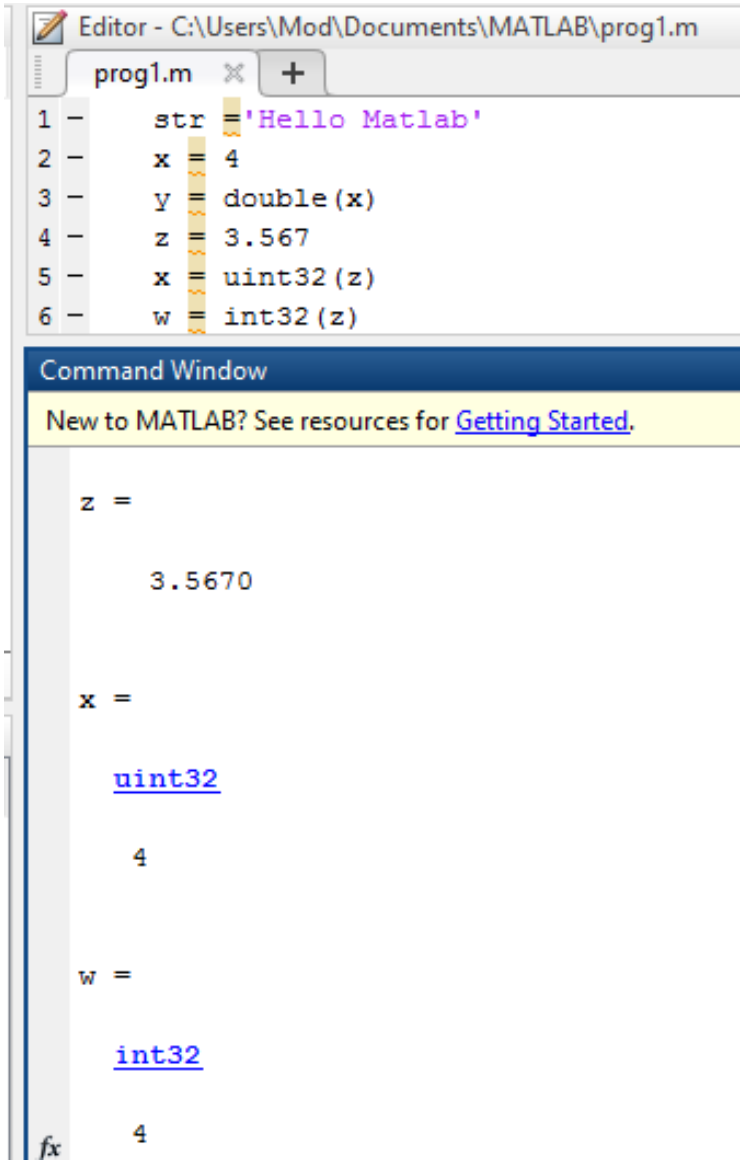
Run M-files


Editor - C:\Users\Mod\Documents\MATLAB\prog1.m
prog1.m
1 - x = 7
2 - y = 10
3 - z = x + y
Command Window
New to MATLAB? See resources for Getting Started.
>> prog1
x =
7
y =
10
z =
17

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



Display Output : fprintf

Editor - C:\Users\Mod\Documents\MATLAB\prog1.m

prog1.m

```
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
```

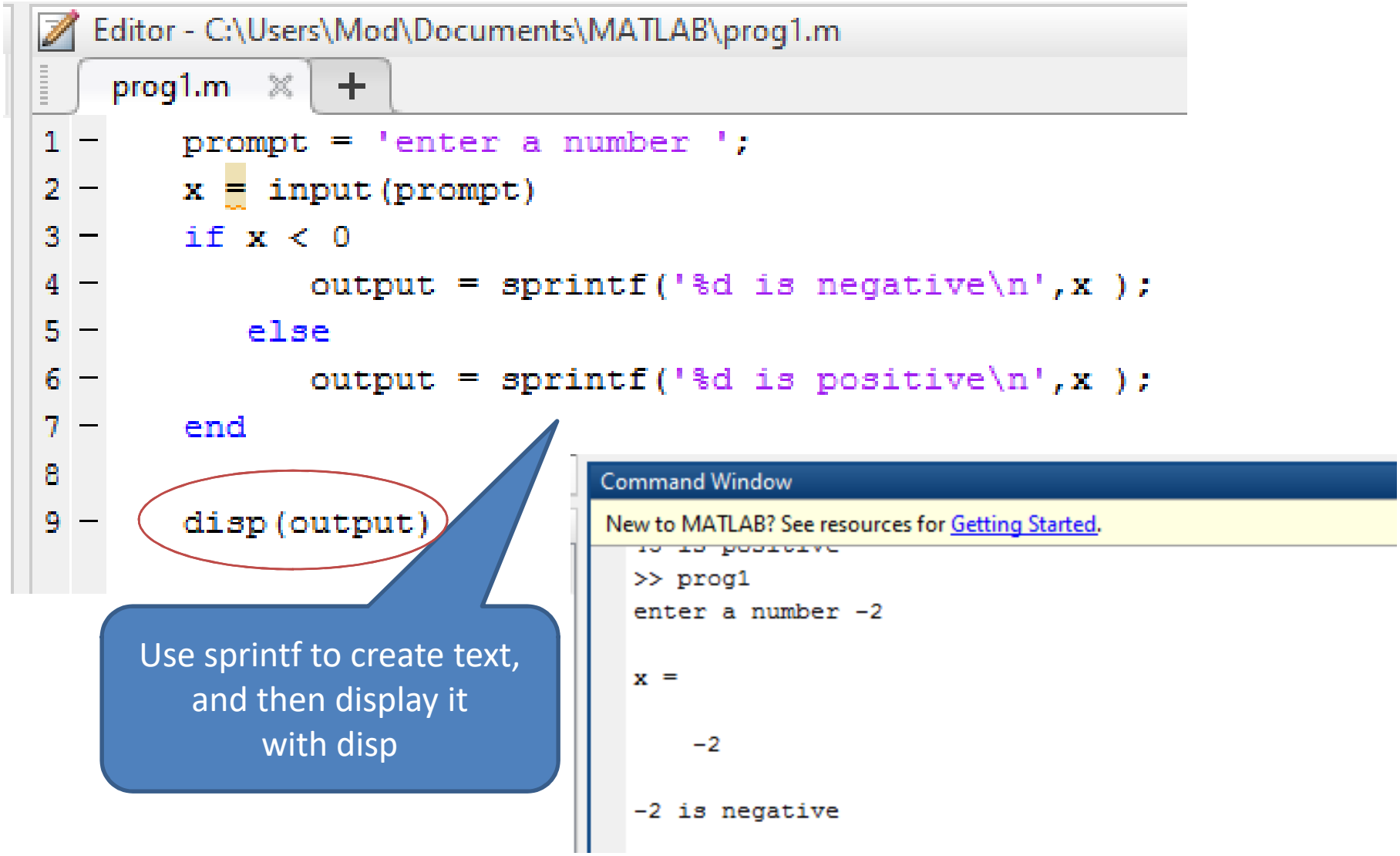
Use fprintf to directly display the text without creating a variable

Command Window

New to MATLAB? See resources for Getting Started.

```
>> prog1
enter a number 45

x =

    45

45 is positive
```

Display Output



If-Else

Editor - C:\Users\Mod\Documents\MATLAB\prog1.m

prog1.m

```
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

```
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

```
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 Ge

```
Enter a number 3

n =

     3


i =

     1

1
2
```

Loop : for

Editor - C:\Users\Mod\Documents\MATLAB\prog1

prog1.m

```
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.m

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

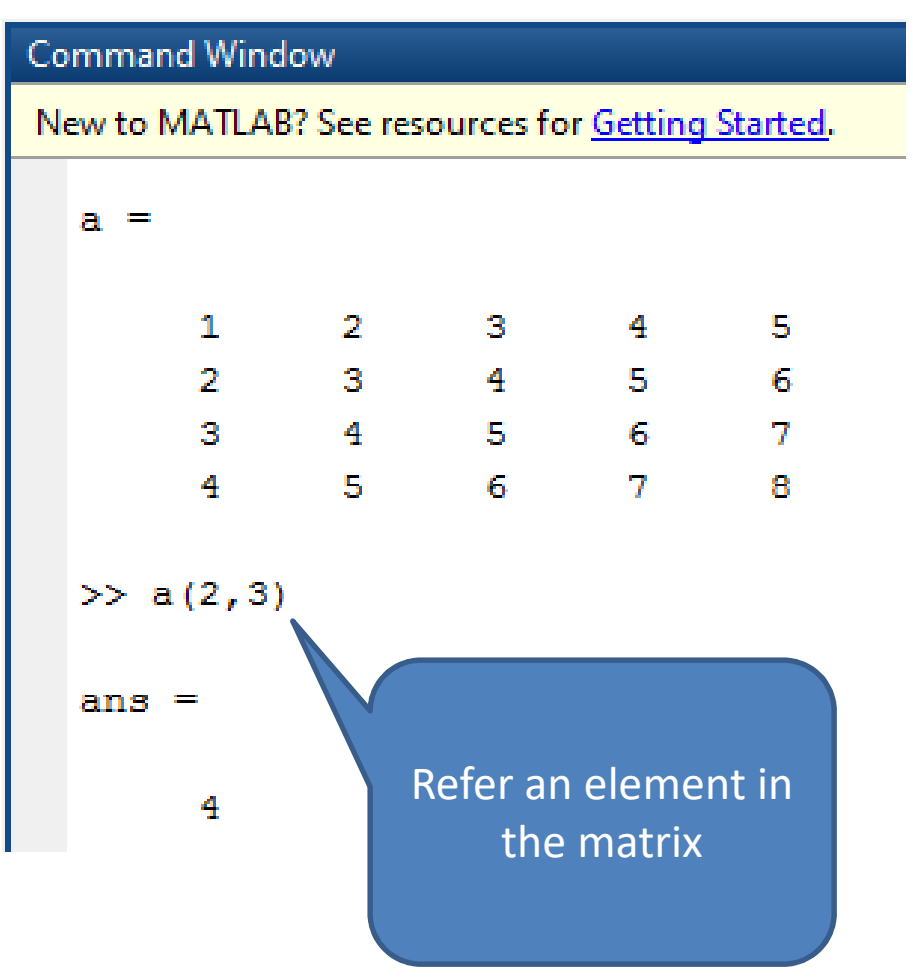
```
Enter a number 4

n =

     4


*
**
***
****
```

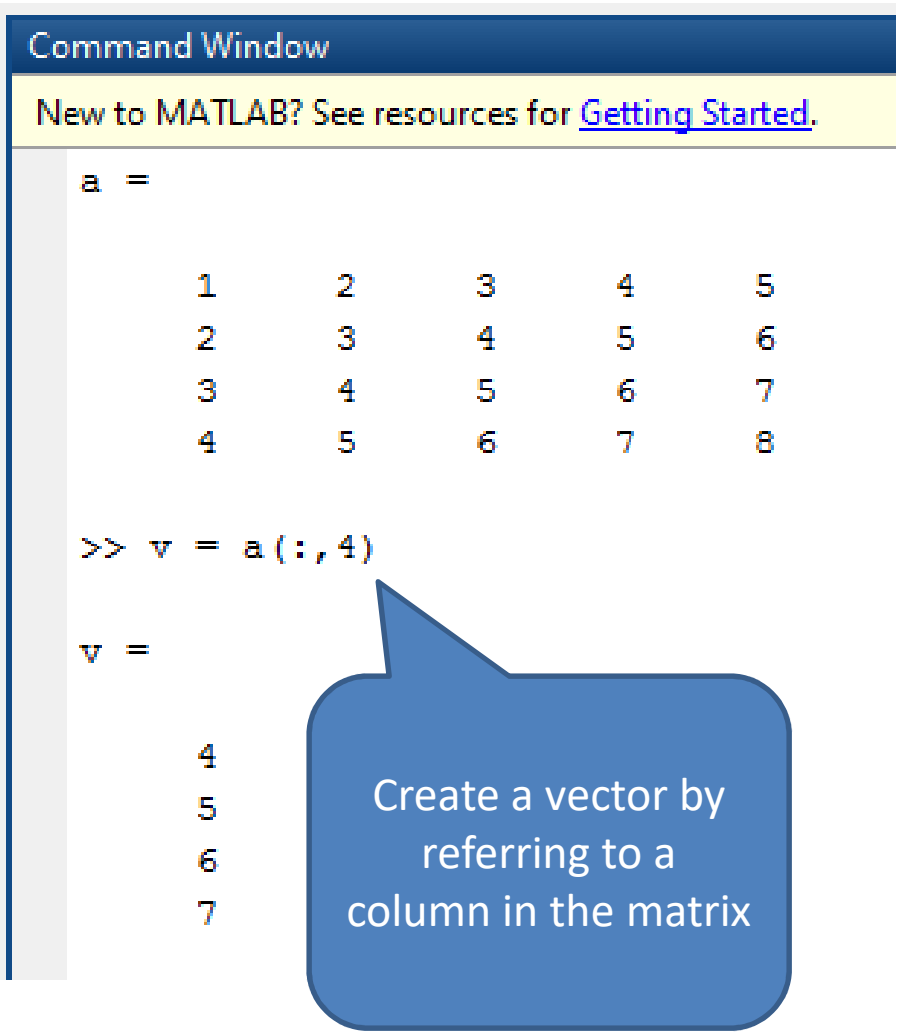
Matrix

- Matrix in Matlab is an arrays.

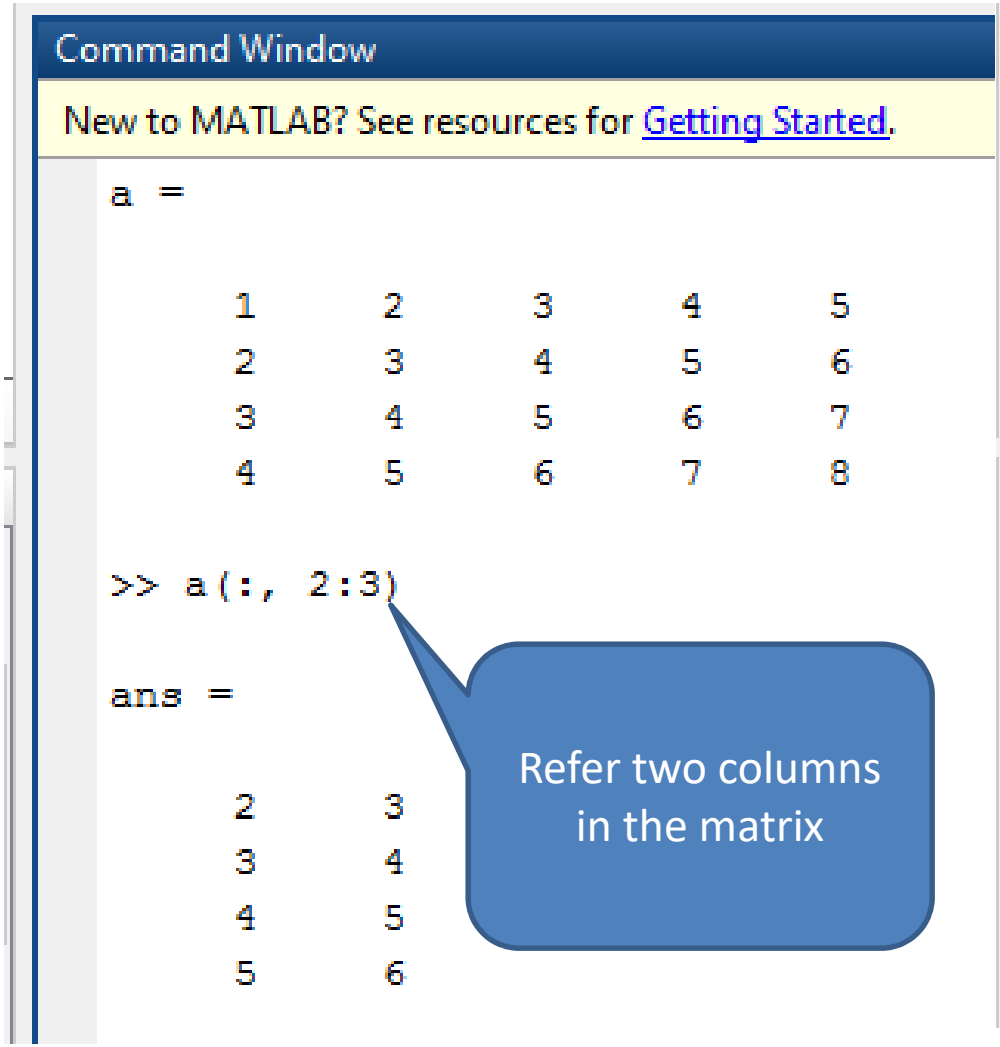
```
>> a = [ 1 2 3 4 5; 2 3 4 5 6; 3 4 5 6 7; 4 5 6 7 8]

a =

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

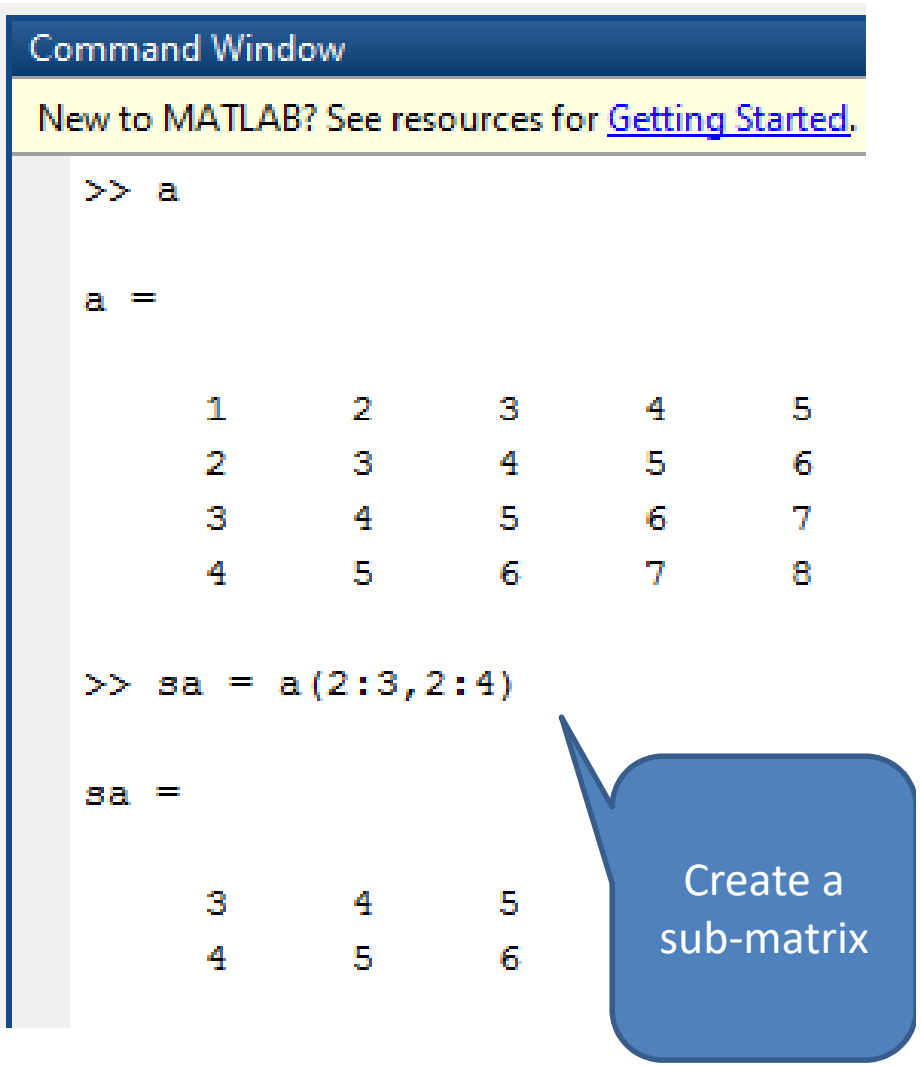
Matrix


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

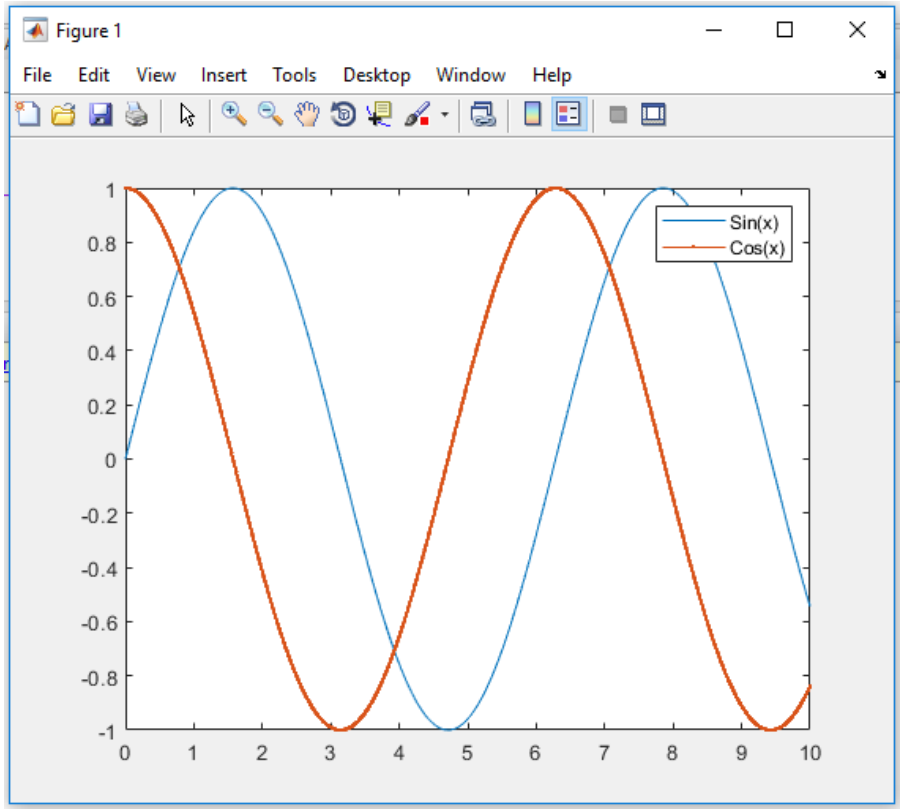
Plot

Editor - C:\Users\Mod\Documents\MATLAB\prog1.m

prog1.m

```
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

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

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

ans =

NaN
```