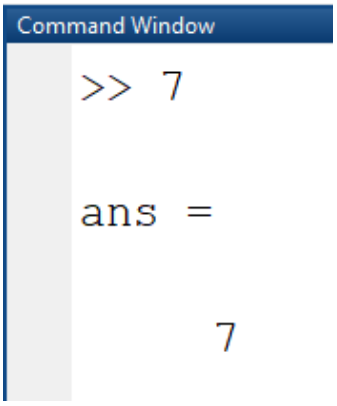
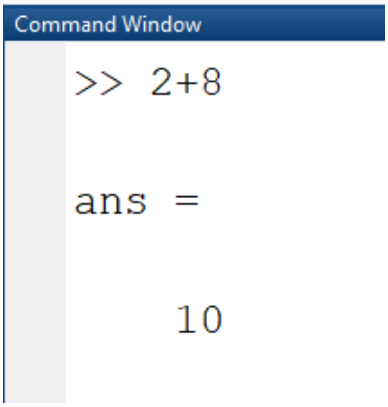
MATLAB

MATLAB is a tool for mathematical calculator, first it can be used as scientific calculator next it allows you to plot or visualize data in many different ways.

You can start MATLAB, double clicking on MATLAB icon that should be on the desktop of your computer

The string (**>>**) is the MATLAB prompt appears when the command windows is active commands in MATLAB are excited by pressing enter or return to out put will be by displayed or screen immediately

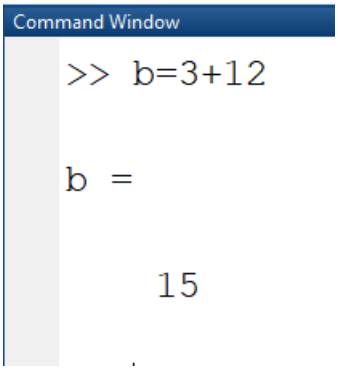




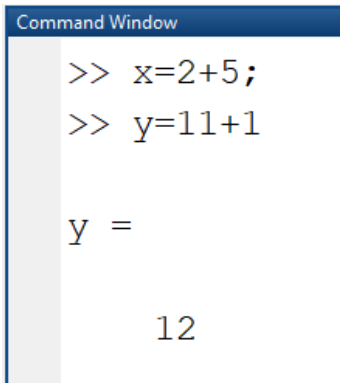
The **exist** matlab the commend exist or quite

NOTE: the **spaces** are not important in matlab

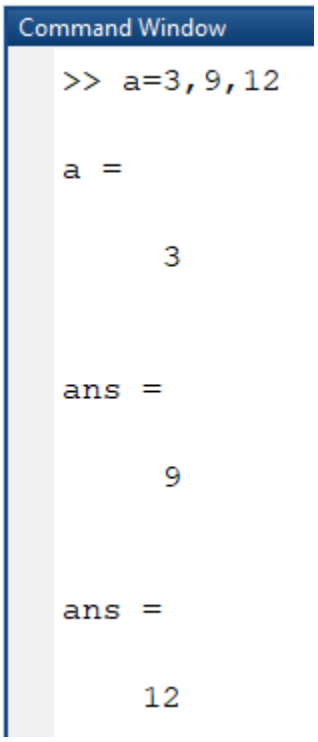
You can also define your own **variable**



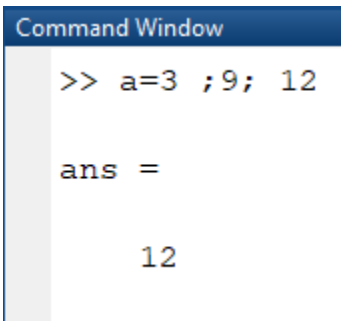
When the comment is following by **semi colom (;)** then the output is suppressant



It is possible to excute more than one variable at same time by use **comm** as (,)



or by use semcolom (;)



Operation in Matlab

Operation	Symbol	Example
Addition	+	5 + 3
Subtraction	–	5 – 3
Multiplication	*	5 * 3
Right division	/	5 / 3
Left division	\	5 \ 3 = 3 / 5
Exponentiation	^	5 ^ 3 (means $5^3 = 125$)

Matlab as Calculater

There are three kinds of numbers used in matlab integer , real and complex. In addition (**inf**) for postive infinity by dividing a non-zero number by zero and **NoN** which is not a number

For example:-

```
>> 100/0

ans =

   Inf
```

```
>> 0/0

ans =

   NaN
```

```
>> inf/0

ans =

   Inf
```

```
>> inf/inf

ans =

   NaN
```

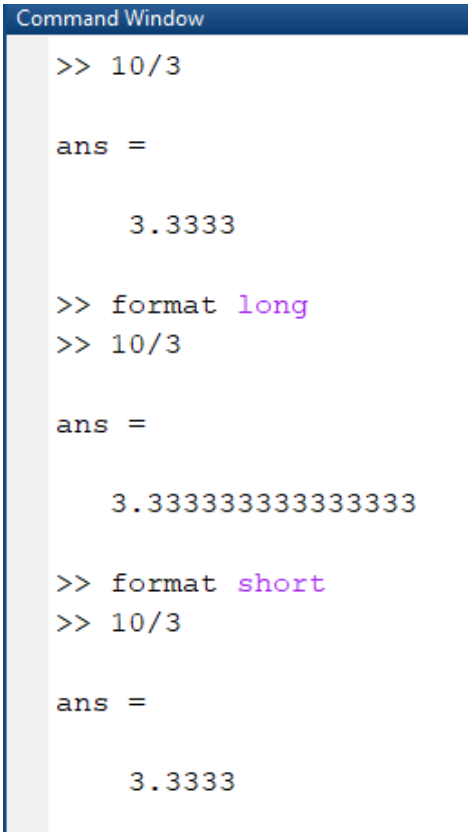
If we input v and w as follow then

```
Command Window
>> v=[1 2 3];
>> w=[2 0 6];
>> v./w

ans =

    0.5000       Inf    0.5000
```

Matlab disply only 5 digite and use the command **format long** to increase this number to 15 digite while use the command is **format short** reduced to 5 digite.



All lext after a **present sgin %** in thr end of the line is the trented as a Note.

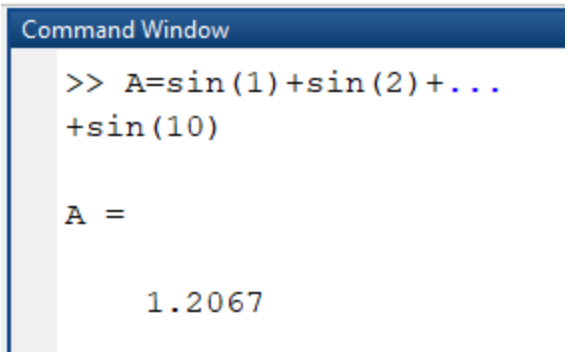
```
>> z=71 % z varaible.
```

To enter the statement that too long to typed in one line use three point **(…)**

```
>> 1+2+...
+5

ans =

     8
```



Complex Number

Matlab working with complex number is easy:

```
Command Window
>> 3+i*4

ans =

   3.0000 + 4.0000i

>> c1=3+i*5;
>> c2=2+i*4;
>> c=c1+c2

c =

   5.0000 + 9.0000i
```

Or

```
Command Window
>> complex(3,4) %    3+i4

ans =

    3.0000 + 4.0000i
```

also

```
Command Window
>> c=5+sin(5*pi/3)*i;
>> cr=real(c)

cr =

     5

>> ci=imag(c)

ci =

   -0.8660
```

```
Command Window
>> c=5+6*i;
>> angle(c)

ans =

    0.8761
```

Lin function in matlab write as **log**

Example :- write the following equation in matlab

$$A = \sqrt{5} + |7| + \sin^{-1} 6 + lin2 + \exp(9)$$

Solution:-

```
Command Window
>> A=sqrt(5)+abs(7)+asin(6)*log(2)+exp(9)

A =

   8.1134e+03 - 1.7175e+00i
```

Exercise 1:-

Define the variables a, b, c, and d as:

$a = 12$, $b = 5.6$, $c = \frac{3a}{b^2}$, and $d = \frac{(a-b)^c}{c}$, then evaluate:

(a) $\frac{a}{b} + \frac{d-c}{d+c} - (d-b)^2$

(b) $e^{\frac{d-c}{a-2b}} + \ln\left(\left|c-d+\frac{b}{a}\right|\right)$

Exercise 2:-

Define the variable t as $t = 3.2$, then evaluate:

(a) $56t - 9.81\frac{t^2}{2}$

(b) $14e^{-0.1t}\sin(2\pi t)$

Variable

Variable in matlab are named objects that are assigned using the equal sign (=)

```
Command Window
>> z=3+4*i;
>> w=5+7*i;
>> z*w

ans =

 -13.0000 +41.0000i

>> z/w

ans =

   0.5811 - 0.0135i

>> z-w

ans =

  -2.0000 - 3.0000i

>> z+w

ans =

   8.0000 +11.0000i
```

Mathematics with Vectors and Matrix

The basis elements of matlab is matrix or (an array) special case

1) a x matrix , a scaler or a single number

Ex :- $a = 5$

2) a matrix existing only of one row or one column

Ex:- $v = [1\ 5\ 2]$

Note v' is **transpose** of vector v

For example

```
>> z'

ans =

   3.0000 - 4.0000i

>> v=[1 2 3];
>> v'

ans =

     1
     2
     3
```

Vector :- **Row vector** are lists of numbers separated either by **comma** (,) or by **space**

They are examples of single array first elements has index 1 the number of entires known as the long of vectors. The entires must be enclosed in [ ].

Example 1:-

Command Window

```
>> v=[6 7 9]

v =

     6     7     9

>> length(v)

ans =

     3
```

Example 2:-

```
Command Window
>> v=[6 7 9]

v =

     6     7     9

>> vv=v+2

vv =

     8     9    11
```

Example 3:-

```
Command Window
>> v=[-1 2 7];
>> w=[2 3 4];
>> z=w+v

z =

     1     5    11

>> t=[2*v,-w]

t =

    -2     4    14    -2    -3    -4

>> v(3)

ans =

     7

>> v(3)+w(2)

ans =

    10
```

Colon Nation and Extraction

(Part of a Vector)

Example 1:-

```
Command Window
>> 2:5

ans =

     2     3     4     5

>> -2:3

ans =

    -2    -1     0     1     2     3

>> 0.2:0.5:2.4

ans =

    0.2000    0.7000    1.2000    1.7000    2.2000

>> -3:3:10

ans =

    -3     0     3     6     9
```

Example 2:-

```
Command Window
>> V=[1:2:7,12:3:18,25]

V =

     1     3     5     7    12    15    18    25

>> v(3)

ans =

     7

>> V(3:6)

ans =

     5     7    12    15
```

Colomn Vectors and Transposing

To create column vectors, you should sperate entries by new lines or by semicolon.

Example 1 :-

Command Window

```
>> z=[2
5
6];
>> z

z =

     2
     5
     6

>> u=[-1;3;5]

u =

    -1
     3
     5
```

Command Window

```
>> v=[ 4 6 8 ];
>> u

u =

    -1
     3
     5

>> u+v'

ans =

     3
     9
    13

>> z=[2+3*i 6-7*i]

z =

   2.0000 + 3.0000i   6.0000 - 7.0000i
```

```
>> z'

ans =

   2.0000 - 3.0000i
   6.0000 + 7.0000i
```

Example 2:-

Command Window

```
>> v=[1 5 12];
>> u=[9 21 16];
>> v*u
Error using  *
Inner matrix dimensions must agree.

>> v'*u

ans =

     9    21    16
    45   105    80
   108   252   192

>> v*u'

ans =

   306
```

The command “who”

Give a list of all variables that used

Command Window

```
>> who

Your variables are:

ans  u    v    z
```

The command “whos”

Gives a list of all variables that are used with more information

```
>> whos
  Name        Size                Bytes  Class     Attributes

  ans         1x1                     8  double
  u           1x3                    24  double
  v           1x3                    24  double
  z           1x2                    32  double    complex
```

The command “clc”

Used for rase the command window with out deleting the variable and other commands that used

The command “clear”

Used to delete the variables that are used

```
Command Window
  >> clear
  >> calendar
                        Aug 2020
       S      M     Tu      W     Th      F      S
       0      0      0      0      0      0      1
       2      3      4      5      6      7      8
       9     10     11     12     13     14     15
      16     17     18     19     20     21     22
      23     24     25     26     27     28     29
      30     31      0      0      0      0      0

  >> calendar(2012,2)
                        Feb 2012
       S      M     Tu      W     Th      F      S
       0      0      0      1      2      3      4
       5      6      7      8      9     10     11
      12     13     14     15     16     17     18
      19     20     21     22     23     24     25
      26     27     28     29      0      0      0
       0      0      0      0      0      0      0

  >> date

  ans =

      '28-Aug-2020'
```

Converting of Numbers

Example 1:-

```
Command Window
>> dec2bin(10)

ans =

    '1010'

>> bin2dec('1010')

ans =

    10
```

Example 2:-

```
>> dec2bin(25)

ans =

    '11001'

>> bin2dec('11001')

ans =

    25
```

The Colon Operation

To generate a vector of equally spaced elements, provides the colon operation

```
Command Window
>> v=1:5

v =

     1     2     3     4     5

>> 0:pi/2:2*pi

ans =

         0    1.5708    3.1416    4.7124    6.2832
```

Linspace: to gererate a vector of equally space point between two end points.

$X = linspace(a, b, n)$ gererate a vector x of n equally space point between a & b

Example 1:-

```
Command Window
>> x=linspace(1,10,7)

x =

    1.0000    2.5000    4.0000    5.5000    7.0000    8.5000   10.0000

>> x=linspace(2,10,5)

x =

     2     4     6     8    10

>> x=linspace(0,1,10)

x =

         0    0.1111    0.2222    0.3333    0.4444    0.5556    0.6667    0.7778    0.8889    1.0000
```

You can now tabulate easily values of a function for gives list of arguments

Example 2:-

```
Command Window
>> x=1:0.5:4

x =

    1.0000    1.5000    2.0000    2.5000    3.0000    3.5000    4.0000

>>
>> y=sqrt(x).*cos(x)

y =

    0.5403    0.0866   -0.5885   -1.2667   -1.7147   -1.7520   -1.3073

>> x=2:2:10;
>> y=6:10;
>> w=x./y

w =

    0.3333    0.5714    0.7500    0.8889    1.0000

>> z=-1:3

z =

    -1     0     1     2     3
```

```
>> x./z

ans =

   -2.0000       Inf    6.0000    4.0000    3.3333

>> z./z

ans =

     1   NaN     1     1     1

>> 2./x

ans =

    1.0000    0.5000    0.3333    0.2500    0.2000
```

Example 3:-

Command Window

```
>> x=2:2:20

x =

     2     4     6     8    10    12    14    16    18    20

>> x([2 3 4])% position of 2 & 3 & 4 is disply in command window

ans =

     4     6     8
```