

# Introduction to Engineering MATLAB – 1 Introduction to MATLAB

- Agenda
- Introduction
  - Arithmetic Operations
  - MATLAB Windows
  - Command Window
  - Defining Variables

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MATLAB is a software for numerical computations, graphing, and programming.

The name **MATLAB** stands for **MAT**rix **LAB**oratory. Its basic data element is an array (explained later).

**With MATLAB you can:**

- ❖ Use it as a calculator.
- ❖ Use built-in functions (sin, cos, max, min, etc.).
- ❖ Define variables and use them in calculations.
- ❖ Plot graphs.
- ❖ Write and run computer programs.
- ❖ Do symbolic calculations.

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**Help Window** (The Help Window can be opened from the Help menu of any of the previous windows)



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## ARITHMETIC OPERATIONS

Symbol	Operation	MATLAB Form
+	addition: a+b	a+b
-	subtraction: a-b	a-b
*	multiplication ab	a*b
/	right division: $a/b = \frac{a}{b}$	a/b (divides a by b)
\	left division: $a/b = \frac{b}{a}$	a\b (divides b by a)
^	exponentiation: ab	a^b

**NOTE:** For scalars the arithmetic operations are the usual ones. For vectors and matrices the arithmetic operations can either follow matrix algebra rules, or can be performed on element-by-element basis (discussed in the next lecture).

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## ORDER OF PRECEDENCE

(The order in which operations are executed by the computer)

Higher-precedence operations are executed before lower-precedence operations.

If two operations have the same precedence, then the expression is executed from left to right.

PRECEDENCE	OPERATION
First	Parentheses, starting with the innermost pair.
Second	Exponentiation.
Third	Multiplication and division (equal precedence).
Fourth	Addition and subtraction (equal precedence).

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## DISPLAY FORMATS

The format command controls how output numbers appear on the screen. Input numbers can be written in any format.

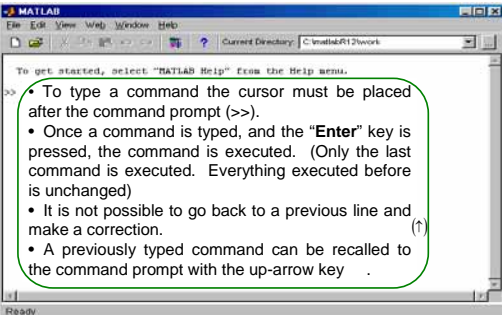
format short (default)	13.6745	four decimal digits.
format long	17.27484029463547	sixteen digits.
format short e	6.3792e+03	five digits (4 decimals) plus exponent.
format long e	6.379243784781294e-04	sixteen digits (15 decimals) plus exponent.
Format bank	126.73	two decimal digits.

MATLAB has several other formats in which numbers can be displayed.

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## WORKING IN THE COMMAND WINDOW

- The command window opens when MATLAB is started.
- Type `clc` to clear the command window.
  - Type `%` before comments (non-command text).



## USING MATLAB AS A CALCULATOR

Using numbers:

```
>> 7+8/2
ans =
    11
```

Type and press Enter → 8/2 is executed first  
Computer response →

```
>> (7+8)/2
ans =
    7.5000
```

Type and press Enter → 7+8 is executed first  
Computer response →

```
>> 4+5/3+2
ans =
    7.6667
```

Type and press Enter → 5/3 is executed first  
Computer response →

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```
5^3/2
ans =
    62.5000>>
```

Type and press Enter → 5^3 is executed first,  
Computer response → /2 is executed next.

```
>> 27^(1/3)+32^0.2
ans =
    5
```

Type and press Enter → 1/3 is executed first,  
Computer response → ^ is executed next,  
+ is executed last.

```
>> 27^1/3+32^0.2
ans =
    11
```

Type and press Enter → 27^1 and 32^0.2 is  
Computer response → /3 is executed next,  
+ is executed last.

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## MATLAB BUILT-IN MATH FUNCTIONS

In addition to arithmetic operations, MATLAB can be used to calculate elementary math functions. The most common ones are:

- `sin(x)` x in radians
- `cos(x)` x in radians
- `tan(x)` x in radians
- `cot(x)` x in radians
- The inverse is: `asin(x)`, `acos(x)`, etc.
- `exp(x)` exponential
- `log(x)` natural logarithm
- `log10(x)` base 10 logarithm
- `sqrt(x)` square root
- `abs(x)` absolute value

Examples:

```
>> sin(0.78539)
ans =
    0.7071
```

```
>> sqrt(169)
ans =
    13
```

```
>> log10(10000)
ans =
    4
```

MATLAB has hundreds of built-in functions (this will be discussed in future lectures).

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## Assignment #1

- Experiment with MATLAB
- Do the problems below in the command window. Start each problem in a new (clear) window.
- The first two lines in each problem should be:
  - `% First Last, CID`
  - `% MATLAB 1, Problem Number Page Number`
- Submit the printout of the command window.
  - 1. Calculate:  $\frac{3^7 \log(76)}{7^3 + 546} + \sqrt[3]{910}$
  - 2. Calculate:  $\frac{4 \sqrt[4]{250} + 23}{e^{(45-3^7)}}$

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