

# CSE 1570

## Interacting with MATLAB

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## Outline

- Starting MATLAB
- MATLAB Windows
- Using the Command Window
  - Some useful commands
- Using MATLAB as a calculator
  - Arithmetic operations with scalars
  - Order of precedence
  - Elementary math built-in functions

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## Outline

- Defining scalar variables
  - The assignment operator
  - Rules for variable names
  - Predefined variables
  - Useful commands for managing variables
- Script files

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## Starting MATLAB

On a campus machine, launch MATLAB through the “start” menu (clicking on the “start” button on the bottom left corner of the screen):

Start → All Programs → MATLAB → R2010a → MATLAB R2010a

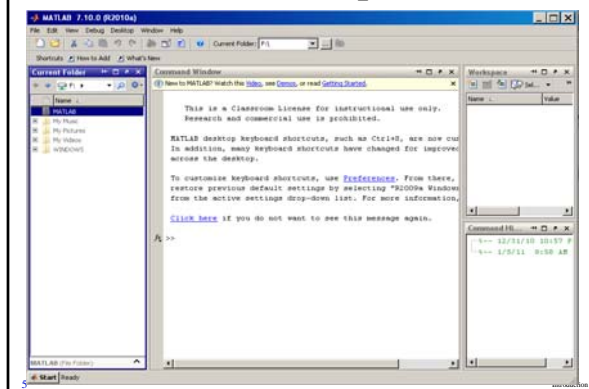
At home, launch MATLAB through WebFAS:

- Log into WebFAS at <http://webfas.yorku.ca> with your FAS account
- Click on “matlabr2010a”

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Introduction

## MATLAB Desktop Window



## MATLAB Windows

Desktop window contains four smaller windows

- Command window
  - Most important window
  - for issuing commands and displaying the results
- Current Folder window (called “Current Directory” in previous versions)
  - Lists the files and sub-folders contained in the current folder
  - The current folder is usually your personal desktop folder (My Documents)
  - You can change the current folder (will learn later)

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## MATLAB Windows (Cont'd)

- **Workspace window**
  - Lists the variables currently active
- **Command History window**
  - Lists the commands that you have entered in the Command window.

You can close and re-open any window

- Click on **x** at the top right corner of the window
- Open by selecting the window name from the **Desktop** menu

Get back to default layout of the Desktop:

- **Desktop → Desktop Layout → Default**

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## MATLAB Windows (Cont'd)

Three other important windows:

- **Editor window** (will study later)
  - For writing and editing MATLAB programs and functions.
  - Can be opened from the **File** menu
- **Figure window**
  - Opens automatically when graphics commands are executed
  - Contains graphs created by these commands
- **Help window**
  - Provides help information
  - Can be opened from the **Help** menu or by typing the **doc** command in the Command window

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## Using the Command Window

You can type MATLAB command after **>>** prompt

Practice the following commands

- **date** ---- show the current date
- **calendar** ---- show a month's calendar (default: current month)
- **pwd** ---- show the current folder name
- **ls** ---- list the content of current folder
- up arrow (↑) ---- brings back the last command
- **clc** ---- clear command window
- **help** (also try **help command/function\_name**)
- **doc** (also try **doc command/function\_name**)

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## Using MATLAB as a Calculator

Type a math expression in the command line and press the **Enter** key

Practice the following:

- **3+6/3**
- **(3+6)/3**
- **2+7/2+5**
- **(2+7)/(2+5)**

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## Using MATLAB as a Calculator

Arithmetic operators:

Operation	Symbol	Example
Addition	+	5+3
Subtraction	-	5-3
Multiplication	*	5*3
Division	/	5/3
Exponentiation	^	5^3 (means 5 <sup>3</sup> =125)

Practice the following:

- **6\*8-6/2**
- **5^3-25**

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## Using MATLAB as a Calculator

Order of Precedence:

Precedence	Math Operations
First	Parentheses. For nested parentheses, the innermost are executed first.
Second	Exponentiation (^)
Third	Multiplication (*), division (/) (equal precedence)
Fourth	Addition (+), subtraction (-) (equal precedence)

Practice the following:

- **6\*(8-6)/(2\*3)** vs **6\*(8-6)/2\*3**
- **5\*(5-4+1)/((2+3)\*2)**

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### Using MATLAB as a Calculator

Express the following using MATLAB:

$$\left(\frac{18}{3}\right)^2 - 10$$

Expression:

`(18/3)^2-10`

Result:

`ans =`

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### Using MATLAB as a Calculator

Express the following using MATLAB:

$$\left(\frac{18-4}{3}\right)^2 - 10$$

Expression:

`((18-4)/3)^2-10`

Result:

`ans =`

11.7778

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### Using MATLAB as a Calculator

Express the following using MATLAB:

$$\left(\frac{7}{3}\right)^2 \times 4^3 \times 12 - \frac{6^7}{9^3 - 652}$$

Expression:

`(7/3)^2*4^3*12-6^7/(9^3-652)`

Result:

`ans =`

545.8009

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### Elementary Math Built-in Functions

Expressions in MATLAB can include *functions*

A **function** has a *name* and one or more *arguments* in parentheses as input. It performs a task and returns a value. For example,

*function name*  
↑  
`sqrt(x)`  
↓  
*argument*

Function `sqrt(x)` takes the square root of `x`

Try:

• `sqrt(64)`

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### Elementary Math Built-in Functions

Some elementary math functions

Function	Description	Example
<code>sqrt(x)</code>	Square root of <code>x</code>	<code>sqrt(81)</code>
<code>nthroot(x,n)</code>	<code>n</code> th root of <code>x</code>	<code>nthroot(27,3)</code>
<code>abs(x)</code>	Absolute value of <code>x</code>	<code>abs(-28)</code>
<code>exp(x)</code>	Exponential ( $e^x$ )	<code>exp(5)</code>
<code>log(x)</code>	Natural logarithm (Base $e$ logarithm) of <code>x</code>	<code>log(1000)</code>
<code>log10(x)</code>	Base 10 logarithm of <code>x</code>	<code>log10(1000)</code>
<code>factorial(x)</code>	The factorial of <code>x</code>	<code>factorial(5)</code>
<code>rem(x,y)</code>	The remainder after <code>x</code> is divided by <code>y</code>	<code>rem(13,5)</code>

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### Exercise

Express the following using MATLAB:

$$28.5 \times 3^3 - \sqrt{1500}$$

Expression:

`28.5*3^3-sqrt(1500)`

Result:

`ans =`

730.7702

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## Exercise

Express the following using MATLAB:

$$e^4 - \frac{\ln 200}{1.5}$$

Expression:

```
exp(4)-log(200)/1.5
```

Result:

```
ans =
```

```
51.0659
```

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## Defining Scalar Variables

### A variable

- is a name (made of a letter or several letters and digits) of a piece of memory space used to store a value. The value can be changed from time to time.
- can be assigned a numerical value by

Variable\_name = a numerical value or a computable expression

where “=” is called *assignment operator*

- can be used in math expressions, in functions and any MATLAB statements and commands.

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## Examples of Variables

Type the following in the command line:

```
x=5
```

which assigns value 5 to variable **x**.

Output from MATLAB:

```
x=
```

```
5
```

Can use **x** in expressions:

```
y=x^2+x+3
```

which first calculates **5^2+5+3** and assigns the result to variable **y**.

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## Examples of Variables

What does the following do?

```
x=5
```

```
x=x+2
```

The second line first takes the current value of **x**, adds 2 to it and assigns the result back to **x**.

Output: (>> is the prompt; what's after it is the command you input)

```
>> x=5
```

```
x =
```

```
5
```

```
>> x=x+2
```

```
x =
```

```
7
```

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## Suppressing the Output

You can use “;” at the end of a command to suppress the output of the command:

```
x=5;
```

which will prevent the output from being displayed.

Thus,

```
x=5;
```

```
y=x^2+x+3
```

will only output **y** value:

```
y=
```

```
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```

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## Exercise

Define variables **x** and **y** as **x=5.3** and **y=7.8**, then calculate:

$$\frac{xy}{(x-y)^2}$$

Expression and result:

```
>> x=5.3; y=7.8;
```

```
>> x*y/(x-y)^2
```

```
ans =
```

```
6.6144
```

← can put more than one assignment in one line. A comma or semicolon can be used as a separator. Semicolon suppresses the output, while comma does not. Try it.

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## Rules About Variable Names

- Must begin with a letter
- Can contain letters, digits and the underscore character. For example,  
`A1, xy3, First_name, firstName, c23D`
- Cannot contain special characters (\$, %, &, @ .....)
- MATLAB is case sensitive, meaning
  - A and a are names of different variables.
- No space is allowed between characters
  - Use underscore where a space is desired.
- Avoid using the names of build-in functions (e.g., `sqrt`, `exp`, `log`, `sin`, `cos`,...)
- Avoid using keywords reserved by MATLAB (`for`, `if`, `else`, `while`,...)

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## Predefined Variables in MATLAB

**ans** – hold the value of the last expression if it was not assigned to another variable.

**pi** – the number  $\pi$  (3.1416)

**eps** – a very small number. Equal to  $2^{-52}$ .

**inf** – a very big number. Used for infinity.

**NaN** – stand for Not-a-Number. Used when MATLAB cannot determine a valid value, such as  $0/0$ .

**i** and **j** – defined as  $\sqrt{-1}$

*If you assign a value to a pre-defined variable, the pre-defined value is overwritten.*

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## Useful Commands for Managing Variables

**who** – Display a list of the variables currently in the memory.

**whos** – Display a list of the variables currently in the memory and their size and other related information.

**clear** – Removes all variables from the memory.

**clear x, y, z** – Removes only variables **x**, **y**, and **z** from the memory.

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## Exiting MATLAB

You can exit MATLAB in one of the following ways:

- Type one of the following commands in the Command window:
  - **exit**
  - **quit**
- Choose “Exit MATLAB” from the **File** menu
- Click **x** at the top right corner of the MATLAB Desktop window.

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## Home Exercise

Assign 6 to variable **n** and calculate the factorial of **n**.

Assign 281 to **N** and 5 to **a**. Then calculate  $\log_a N$

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## Next Class

Creating script files

Creating vectors and matrices

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