



# PROGRAMMING WITH MATLAB

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# OVERVIEW

WEEK 1

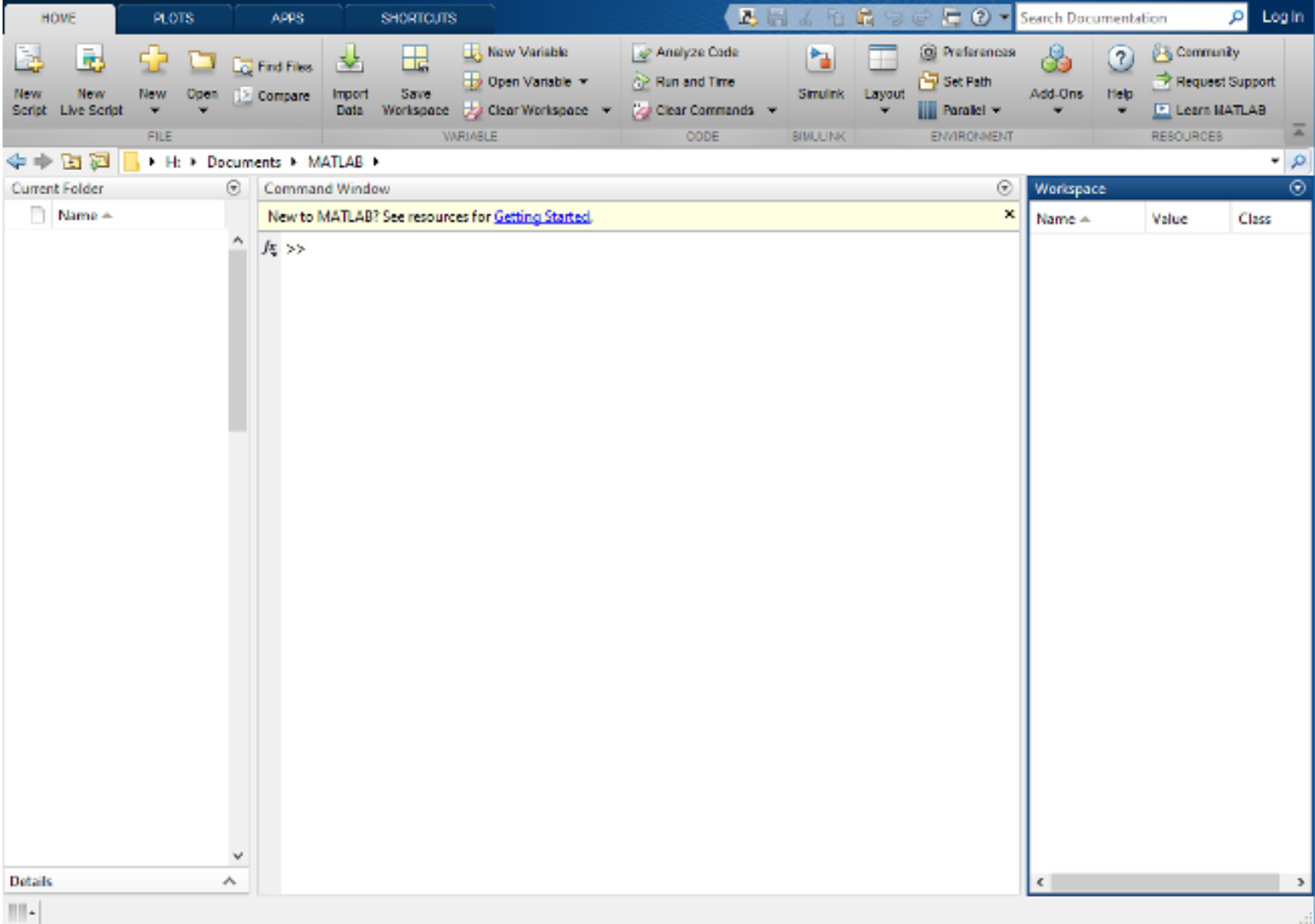


# What is MATLAB<sup>®</sup>?

A powerful software tool:

- Scientific and engineering computations
- Signal processing
- Data analysis and visualization
- Physical system modeling
- Testing of engineering designs

# The Default MATLAB Desktop Layout



# ENTERING COMMANDS AND EXPRESSIONS

- The Command window is where you type MATLAB commands following the prompt: >>
- The Workspace window shows the variables you created in the current session
- MATLAB preserves your previously entered commands and expressions
- Use the up arrow key to scroll back
- Use the down-arrow key to scroll forward
- Press the Enter key to execute the command

# ARITHMETIC OPERATIONS

Operator	Operation	MATLAB expression
+	Addition : $x + y$	$x + y$
-	Subtraction : $x - y$	$x - y$
/	Right division : $x / y = \frac{x}{y}$	$x / y$
\	Left division : $x \backslash y = \frac{y}{x}$	$x \backslash y$
*	Multiplication : $xy$	$x * y$
^	Exponentiation : $x^y$	$x ^ y$

# ORDER OF OPERATIONS

Precedence	Operation
First	Complete all calculations inside parenthesis or brackets using the precedent rules below (starting with the innermost pair)
Second	Exponentiation (left to right)
Third	Multiplication and division with equal precedence (left to right)
Fourth	Addition and subtraction with equal precedence (left to right)

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Some examples:

```
>> 7 + 2*11
```

```
ans =  
    29
```

```
>> (7 + 2)*11
```

```
ans =  
    99
```

```
>> 3*2^4+5
```

```
ans =  
    53
```

```
>> (3*2)^4+5
```

```
ans =  
   1301
```



# WORK SESSION MANAGEMENT

Command	Description
clear	removes all variables from memory
clear variableA variableB	removes the variables variableA and variableB
clc	clears the command window
who	lists variables in memory
;	semicolon, suppresses screen printing
...	ellipsis, continues a line

# BUILT-IN VARIABLES AND CONSTANTS

Variable/constant	Description
pi	the number $\pi$ (3.14159...)
i, j	the complex number ( $\sqrt{-1}$ )
eps	The accuracy of floating point precision
Inf	infinity
NaN	not a number (an undefined numerical result)
ans	variable containing the most recent answer

# COMMENTS

- The comment symbol (%)
- MATLAB ignores everything to the right of this symbol:

```
>> % Here is a comment
```

```
>> x = 10^-1 % and one more comment
```

```
x =
```

```
0.1000
```

# VARIABLES

- Create your own variables:

```
>> radius = 2.5 % variable, radius is created, the value 2.5 is stored in the variable
```

```
radius =
```

```
2.5000
```

```
>> area = pi * radius^2
```

```
area =
```

```
19.6350
```

# STRINGS (TEXT VARIABLES)

```
>> day = 'Friday'
```

```
day =
```

```
Friday
```

- To enter a string put single quotes around it

To display variables

- Type the name of the variable at the command prompt:

```
>> area
```

```
area =
```

```
19.6350
```

or

- Use `disp` function:

```
>> disp('The value of day is:'); disp(day)
```

```
The value of day is:
```

```
Friday
```

# NAMING RULES FOR VARIABLES

- Variable names must begin with a letter
- Names can include any combinations of letters, numbers, and underscores
- Avoid the following names: `i`, `j`, `pi`, and all built-in MATLAB<sup>®</sup> function names such as `length`, `size`, `plot`, `sin`, `log`, ...
- MATLAB<sup>®</sup> is case sensitive. The variable name `X` is different than the variable name `x`
- Do not give a script file the same name as a variable

# SOME MATLAB<sup>®</sup> MATH FUNCTIONS

Function	MATLAB syntax
cosine : $(\cos x)$	$\cos(x)$ , $x$ in radians or $\cosd(x)$ , $x$ in degrees
sine : $(\sin x)$	$\sin(x)$ , or $\sind(x)$
tangent : $(\tan x)$	$\tan(x)$ , or $\tand(x)$
arc cosine : $(\cos^{-1}x)$	$\text{acos}(x)$ , or $\text{acosd}(x)$
arc tangent : $(\tan^{-1}x)$	$\text{atan}(x)$ , or $\text{atand}(x)$
exponential : $(e^x)$	$\text{exp}(x)$
square root : $(\sqrt{x})$	$\text{sqrt}(x)$
natural log : $\ln x$ , (base $e$ )	$\text{log}(x)$
logarithm : $\log_{10}x$ (base 10)	$\text{log10}(x)$

# COMPLEX NUMBER OPERATIONS

- A complex number,  $a = 3 + 5i$  is entered as follows (an asterisk is not needed between  $i$  and  $5$ ):

```
>> a = 3 + 5i
```

```
a =
```

```
3.0000 + 5.0000i
```

- But, an asterisk is needed with a variable ( $b = 7i*a$ ):

```
>> b = 7i*a
```

```
b =
```

```
-35.0000 +21.0000i
```

- Try this:

```
>> 5/3i % 5/(3i)
```

```
ans =
```

```
0.0000 - 1.6667i
```

- and:

```
>> 5/3*i % (5/3)i
```

```
ans =
```

```
0.0000 + 1.6667i
```



# MATLAB HELP FUNCTIONS

- The **help** command provides information about a function. (**help *functionname***)
- Type **help sqrt** at the command window
- Displays in the Command window a description of the function **sqrt**.
- This only works if you know the name of the function
- **lookfor *subject***: Looks for the string *subject* of the help text of all m-files found on matlabpath and displays that text
- **doc *functionname***: Opens the Help Browser to the reference page for the specified function *functionname*