Introduction to MATLAB

Summer Internship Program Coding Course
2024

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Course overview

- Tuesdays and Thursdays, 2-3 pm
- PNI A02 (except June 25 & 27 in A30)
- Office hours by appointment (email us!)
- Weekly assignments assigned each Thursday, due the following Thursday before class
- Course github: https://github.com/polcher/pni-summer-intro-matlab-2024

Course overview (subject to change)

- June 6: Introduction, variables
- June 11 and 13: Arrays and matrices
- June 18 and 20: Functions and operators
- June 25 and 27: Loops and plotting intro
- July 2: Plotting and transition to advanced MATLAB

Course overview

- We want to encourage a welcoming and safe space for everyone to ask questions
- Practice makes progress!
- Group work highly encouraged
- If you run into problems, Google and Stack Overflow will likely have solutions

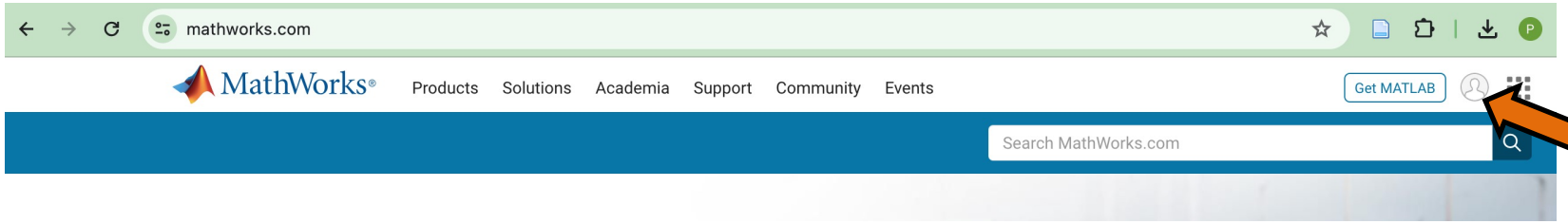
Some other excellent resources to learn MATLAB

Please check these excellent resources:

- Github repo by Mai Nguyen
- MIT Open courseware

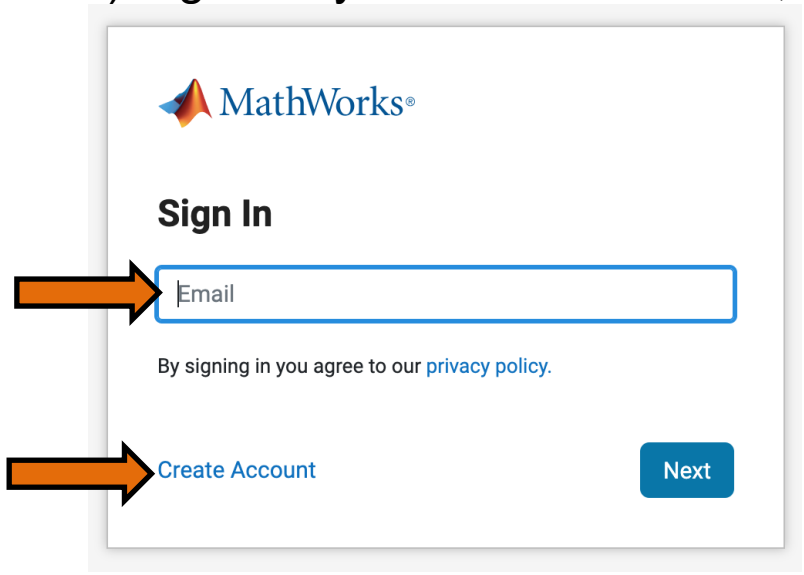
Setting Up MATLAB

1) Go to www.mathworks.com

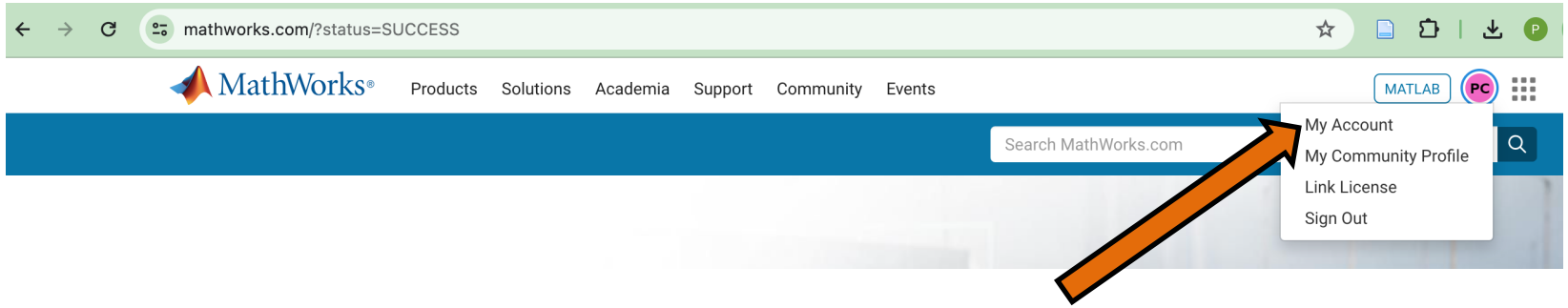


2) Click account icon

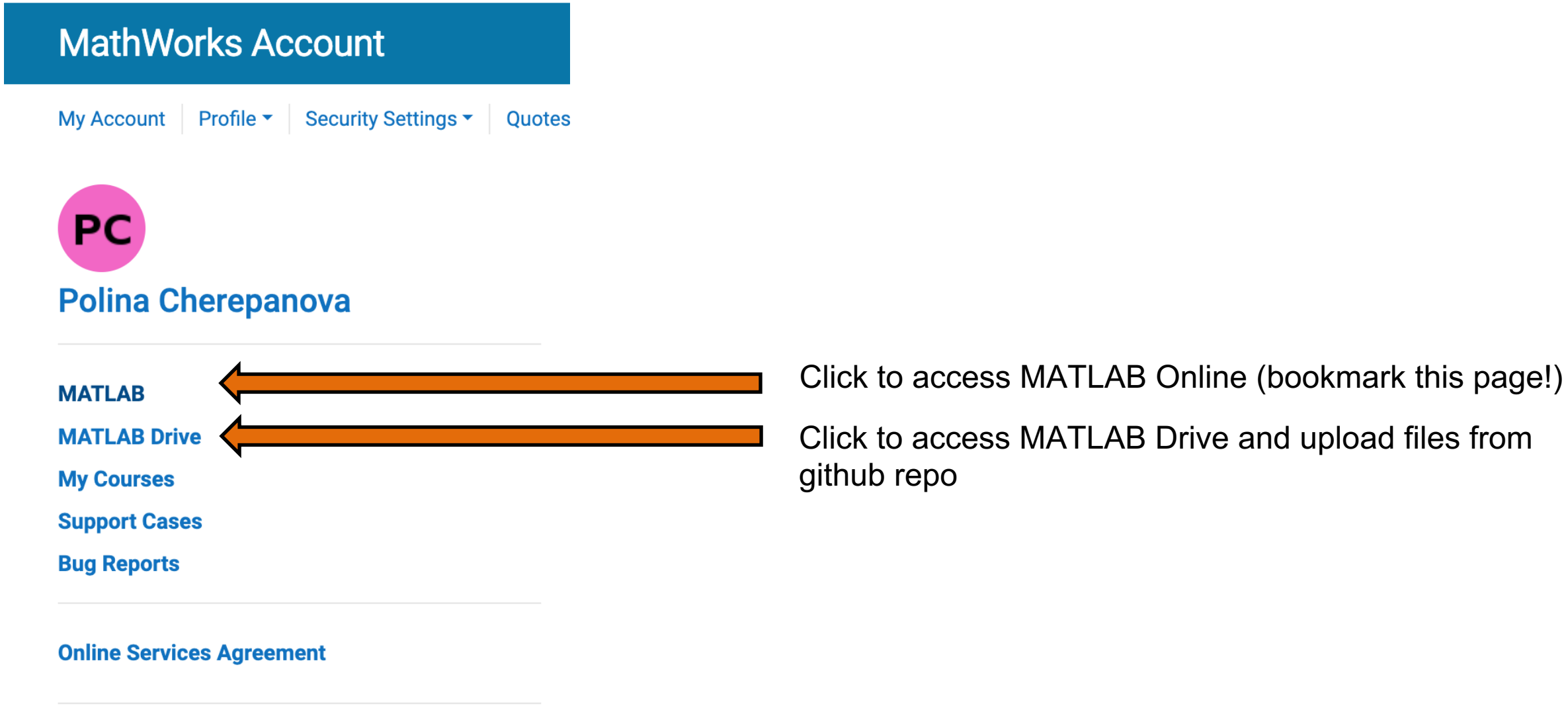
3) Sign in if you have an account, or create new account w/ Princeton credentials



4) Navigate to My Account

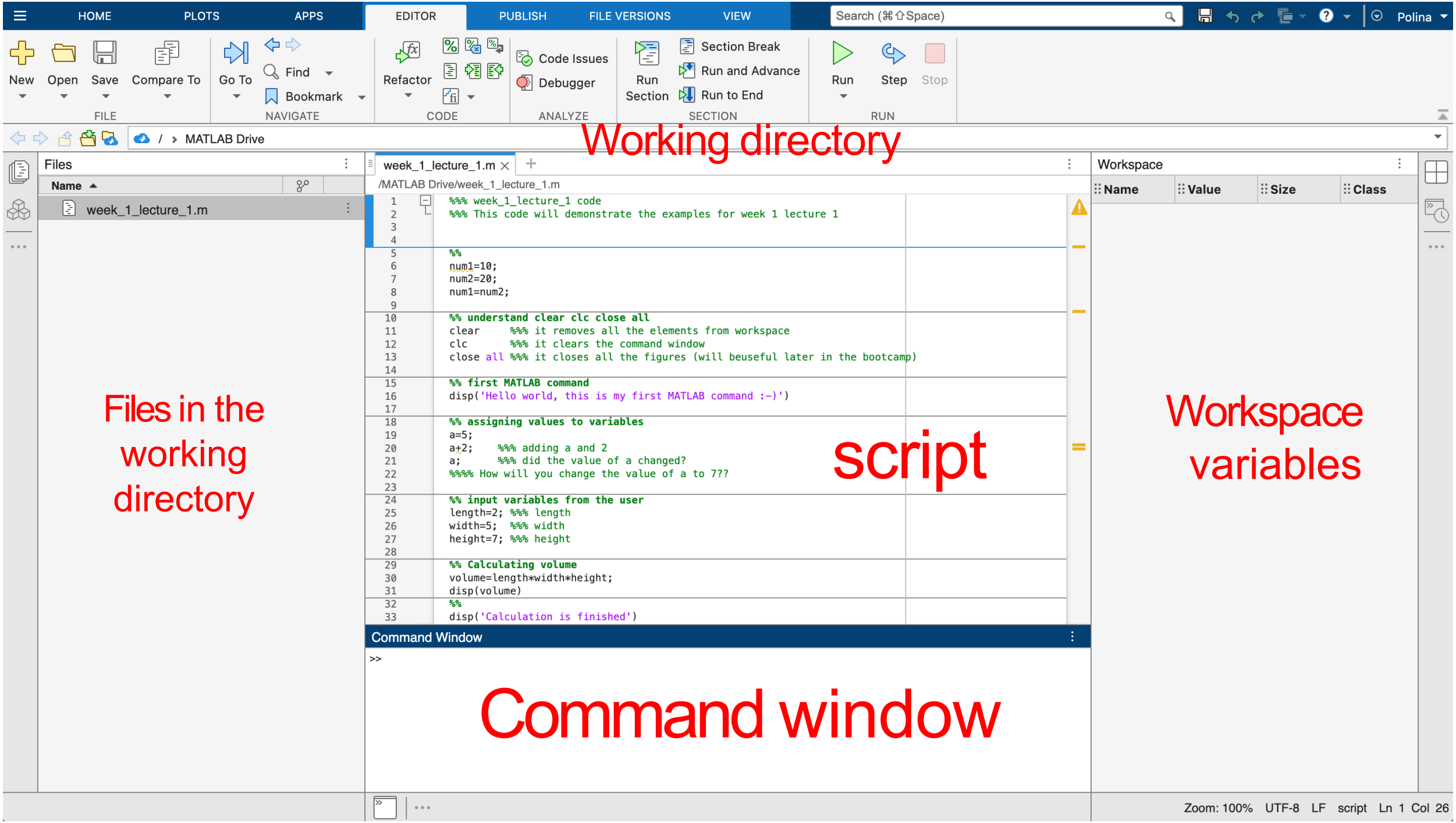


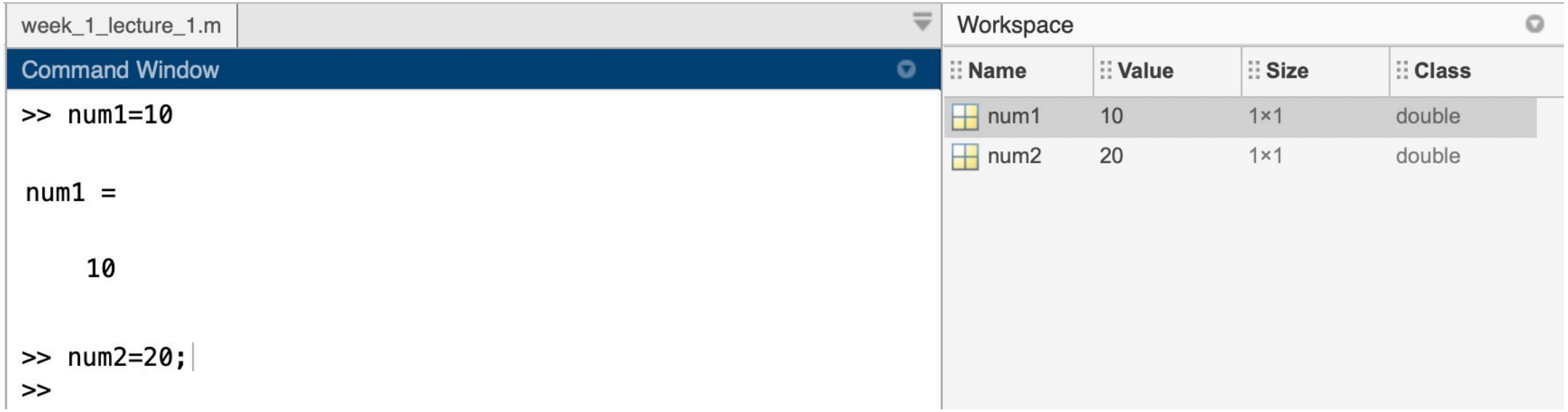
Setting Up MATLAB



Click to access MATLAB Online (bookmark this page!)

Click to access MATLAB Drive and upload files from github repo

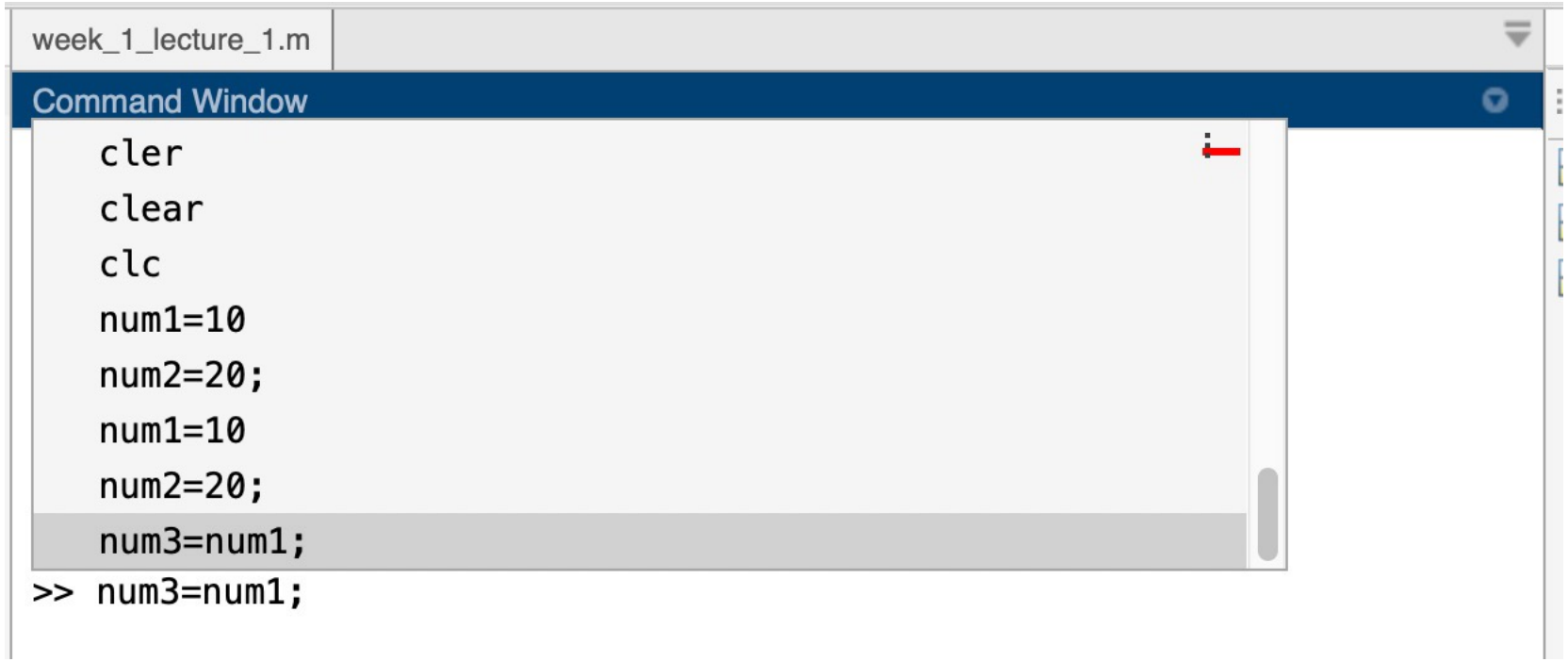

HOME
PLOTS
APPS
EDITOR
PUBLISH
FILE VERSIONS
VIEW
Search (⌘⇧Space)
Polina
New
Open
Save
Compare To
FILE
Go To
Find
Bookmark
NAVIGATE
Refactor
CODE
Code Issues
Debugger
ANALYZE
Run Section
Section Break
Run and Advance
Run to End
SECTION
Run
Step
Stop
RUN
/ › MATLAB Drive
Working directory
Files
Name
week_1_lecture_1.m
Files in the working directory
week_1_lecture_1.m
/MATLAB Drive/week_1_lecture_1.m
%%% week_1_lecture_1 code
%%% This code will demonstrate the examples for week 1 lecture 1
%%
num1=10;
num2=20;
num1=num2;
%% understand clear clc close all
clear %%% it removes all the elements from workspace
clc %%% it clears the command window
close all %%% it closes all the figures (will beuseful later in the bootcamp)
%% first MATLAB command
disp('Hello world, this is my first MATLAB command :-)')
%% assigning values to variables
a=5;
a+2; %%% adding a and 2
a; %%% did the value of a changed?
%%%% How will you change the value of a to 7??
%% input variables from the user
length=2; %%% length
width=5; %%% width
height=7; %%% height
%% Calculating volume
volume=length*width*height;
disp(volume)
%%
disp('Calculation is finished')
script
Command Window
>>
Command window
Workspace
Name
Value
Size
Class
Workspace variables
Zoom: 100%
UTF-8
LF
script
Ln 1 Col 26



This is how you define a variable:

1) Here we created a new variable num1 and assigned it a value of 10
2) Note that the information always transfer from right to left! (try num1=num2; and see what is the new value of num1)
3) Observe that once you assign values to the variables they appear in the workspace
4) Can you tell the effect of using semicolon (;) at the end of command line?

Helpful tips for MATLAB



1) You can press the up arrow and select any of the previous commands.

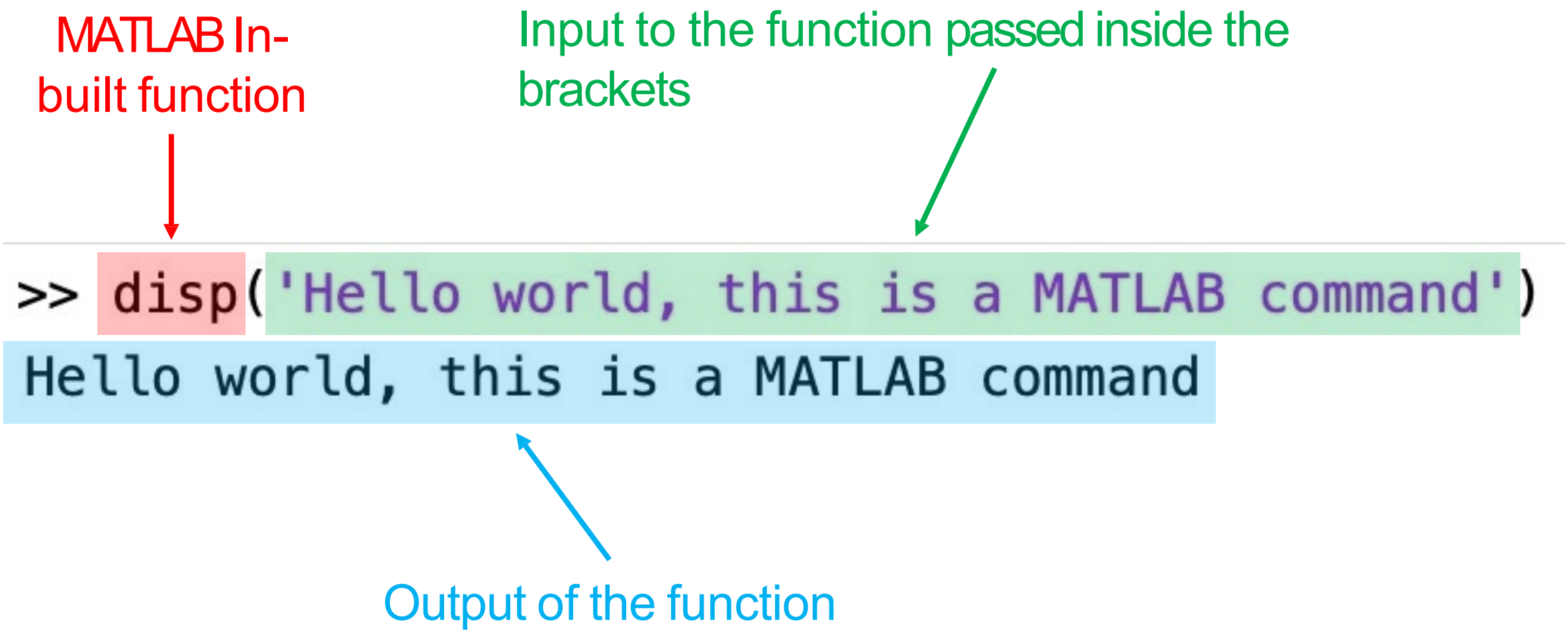
2) You can autocomplete the name of a variable by pressing on tab key

clear, clc, close all

- clear removes all the elements from workspace
- clc clears the text in the command window
- close all closes all the figures (will be useful later)

- I usually include all these commands at the beginning of each matlab script

First MATLAB command



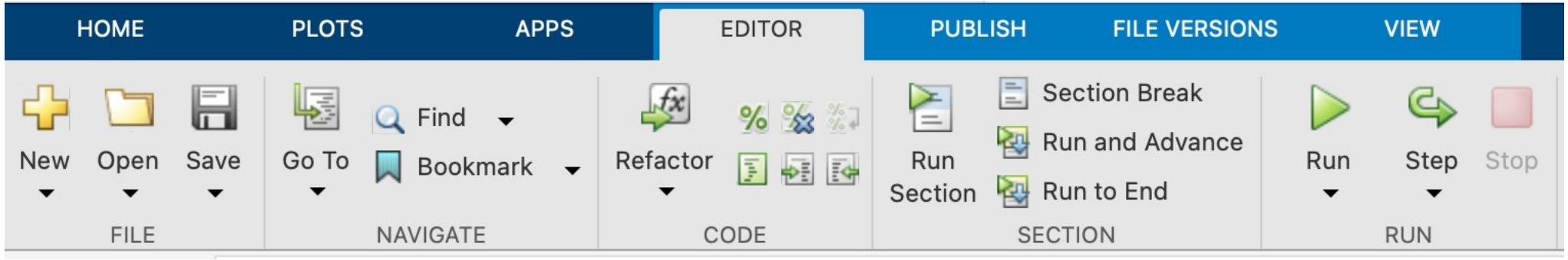
Help function in MATLAB

Command Window

```
>> help disp
 disp Display array.

    disp(X) displays array X without printing the array name or

    additional description information such as the size and class
name.

    In all other ways it is the same as leaving the semicolon off an

    expression except that nothing is shown for empty arrays.


    If X is a string or character array, the text is displayed.


    See also formattedDisplayText, sprintf, num2str, format, details.


    Documentation for disp

    Other functions named disp
```

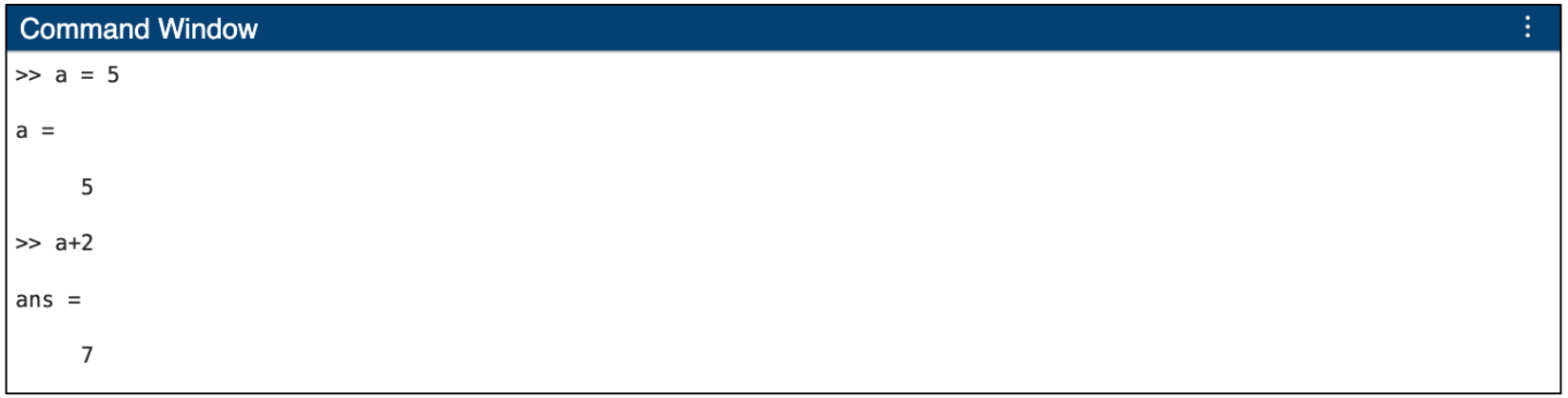
Options for Running your MATLAB script

1. Running from command window
2. Run section
3. Run and advance
4. Run to end
5. Run



Assigning values to variables

- a=5;
- a+2



- What is the new value of a?
- How can you increase the value of variable ‘a’ by 2?

Calculation using variables

- volume= length x width x height
- length=2;
- width=5;
- height=7;
- volume=length*width*height;

- How will you print the value of the variable `volume`?
- How will you print the values of `volume` and `width` together?

Using MATLAB editor

week_1_lecture_1.m

```
1   %%% week_1_lecture_1 code
2   %%% This code will calculate the volume of a cube
3
4   %%% input variables from the user
5   length=2; %%% length
6   width=5;  %%% width
7   height=7; %%% height
8
9   %%% Calculating volume
10  volume=length*width*height;
```

1) Any line of code which begins with % is considered as comment and is not executed by MATLAB.
2) Using %% will divide the code into sections (very helpful)
3) Adding comments at the very top of the code will be displayed when you use help filename.m

Predefined values and variables in MATLAB

Expression	Description
`pi`	The number π up to 15 significant digits.
`i, j`	The complex number $\sqrt{-1}$.
`inf`	Represents the mathematical Infinity concept, for example, a result of division by zero.
`NaN`	Stands for Not-A-Number. Represents the result of a meaningless mathematical function, like $0/0$.
`clock`	Contains the current date and time in the form of a 6-element row vector: year,month,day,hour,minute,second.
`date`	Contains a string representing today's date.
`eps`	Stands for **epsilon**. It represents the smallest number that can be represented by your MATLAB software.
`ans`	A special variable that MATLAB uses to store the result of MATLAB's command line.

https://www.cdslab.org/matlab/notes/values-variables-types/variables/index.html

Keywords in MATLAB

- MATLAB has pre-defined keywords such as while, for, if, parfor, global etc.
- You cannot use these keywords as a variable e.g. you cannot use while=1;
- To see the complete list of keywords, enter iskeyword in the command window.
- Also, try not to use MATLAB functions as variable names. For e.g. avoid using mean=4, sin=20, etc.

Time taken by MATLAB to execute a code

```
22    %%
23    tic
24    exp(500)
25    toc
26
```

Command Window

```
>> tic
exp(500)
toc

ans =

  1.4036e+217

Elapsed time is 0.034693 seconds.
>>
```

MATLAB tells the time to execute a command between tic and toc

Infinity and NaN (Not a number)

- Inf: Inf is the outcome of division by 0 (e.g. 1/0) or overflow when the result is too large (e.g. exp(1000))

- NaN: MATLAB uses NaN to represent the numbers which are not real or complex. e.g. 0/0, Inf/Inf

- Usually in experiments/data analysis, the missing data points are represented by NaN.

https://www.mathworks.com/help/matlab/matlab_prog/infinity-and-nan.html