

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
- This course is for you, so please provide anonymous feedback using the google form
- Practice makes progress!
- Group work highly encouraged
- If you run into problems, Google and Stack Overflow will likely have solutions

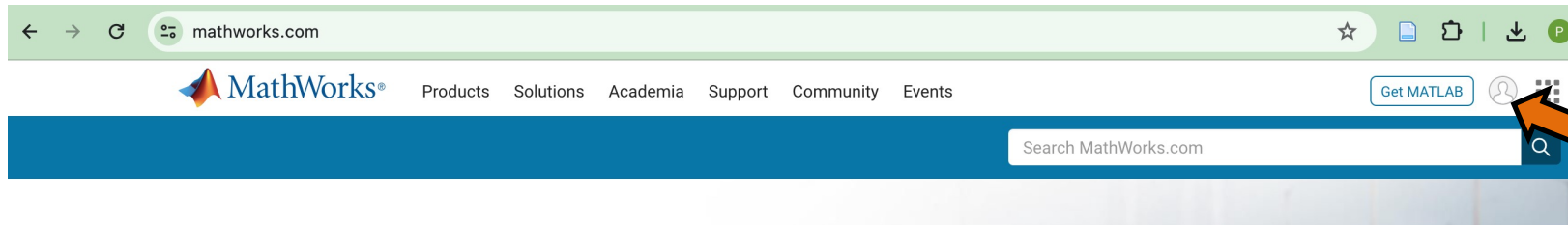
Some other excellent resources to learn MATLAB

Please check these excellent resources:

- [Github repo by Mai Nguyen](#)
- [MIT Open courseware](#)

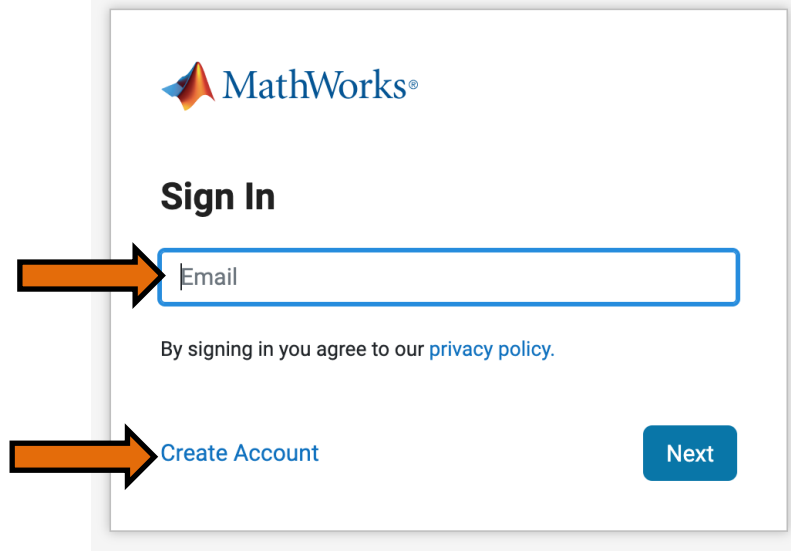
Setting Up MATLAB

1) Go to www.mathworks.com

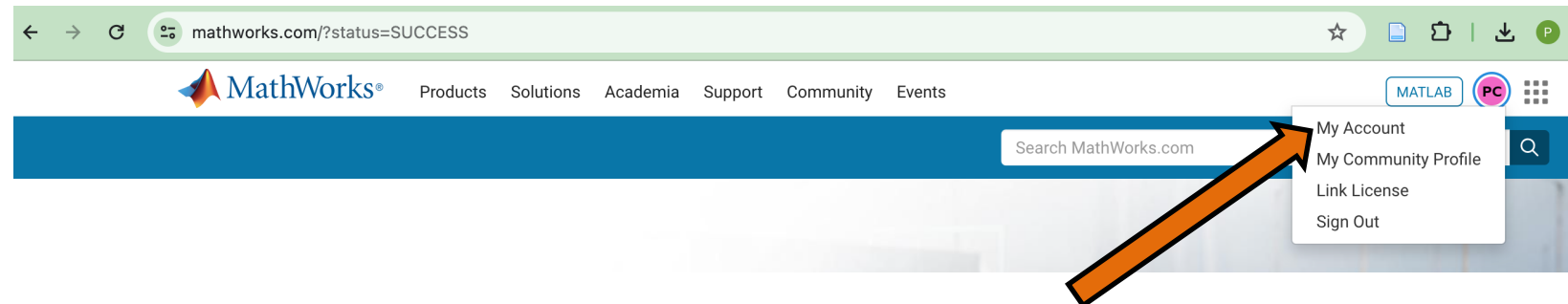


2) Click account icon

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



4) Navigate to My Account



Setting Up MATLAB

MathWorks Account

[My Account](#) | [Profile ▾](#) | [Security Settings ▾](#) | [Quotes](#)



Polina Cherepanova

MATLAB

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Click to access MATLAB Online (bookmark this page!)



Click to access MATLAB Drive and upload files from github repo

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 Polina ▾




New




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Save




Compare To




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Find




Bookmark




Refactor




Code Issues




Debugger




Run Section




Section Break




Run and Advance




Run to End



Run



Step



Stop

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/ > MATLAB Drive

Files

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%% 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 be useful 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 change?

%% 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')

Workspace

Name	Value	Size	Class
------	-------	------	-------

Command Window

>>

Zoom: 100% UTF-8 LF script Ln 1 Col 26

Working directory

Files in the working directory

script

Workspace variables

Command window

week_1_lecture_1.m

Command Window

```
>> num1=10

num1 =

    10

>> num2=20;
>>
```

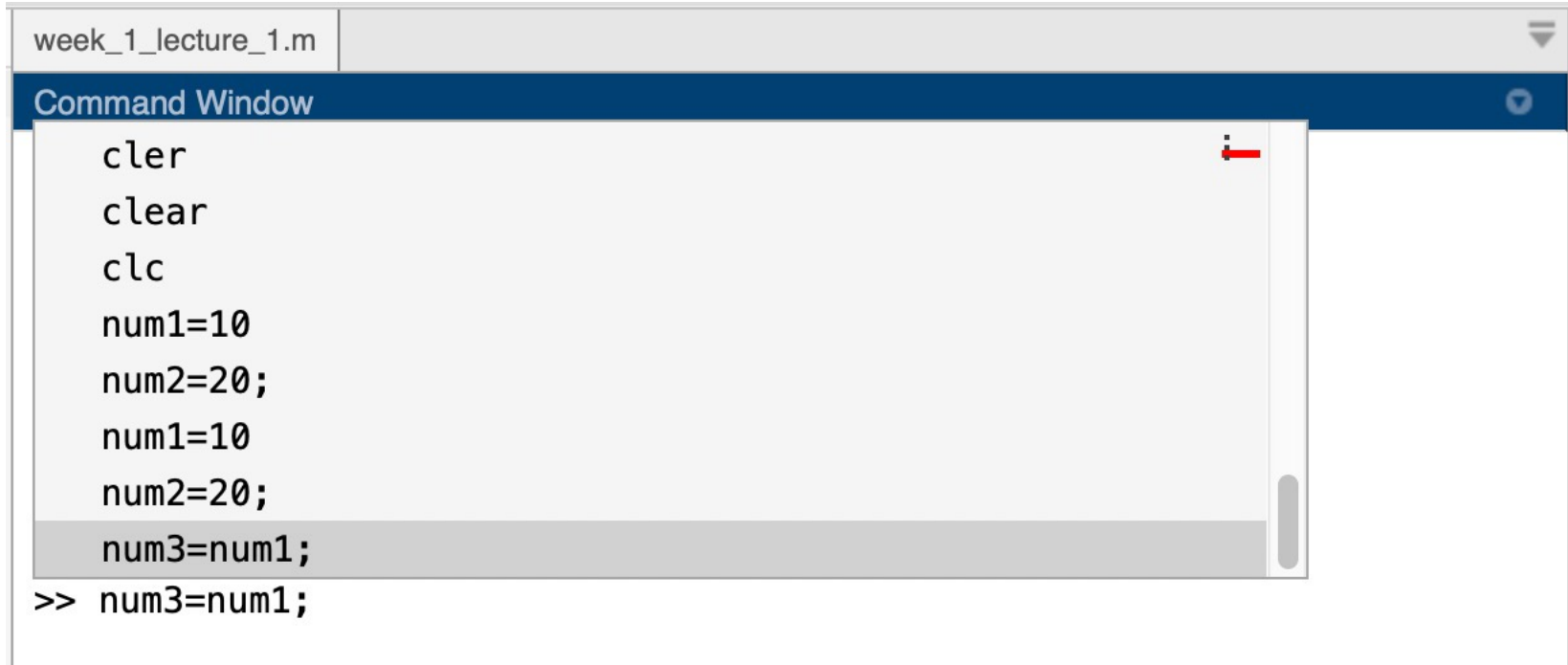
Workspace

Name	Value	Size	Class
num1	10	1×1	double
num2	20	1×1	double

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



The image shows a screenshot of the MATLAB Command Window. The window title is 'week_1_lecture_1.m'. The Command Window has a dark blue header with the text 'Command Window'. Below the header, a list of previous commands is shown: 'cler', 'clear', 'clc', 'num1=10', 'num2=20;', 'num1=10', 'num2=20;', and 'num3=num1;'. The command 'num3=num1;' is highlighted with a grey background. Below the list, the prompt '>>' is followed by the command 'num3=num1;'.

```
week_1_lecture_1.m  
Command Window  
cler  
clear  
clc  
num1=10  
num2=20;  
num1=10  
num2=20;  
num3=num1;  
>> num3=num1;
```

- 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

MATLAB In-built function



Input to the function passed inside the brackets



```
>> disp('Hello world, this is a MATLAB command')
```

```
Hello world, this is a MATLAB command
```



Output of the function

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.

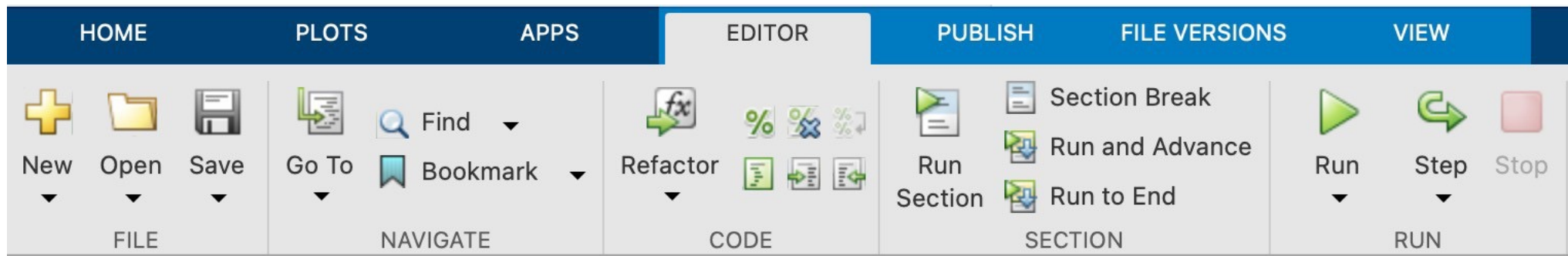
See also [formattedDisplayText](#), [sprintf](#), [num2str](#), [format](#), [details](#).

[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

- $a=5;$
- $a+2$

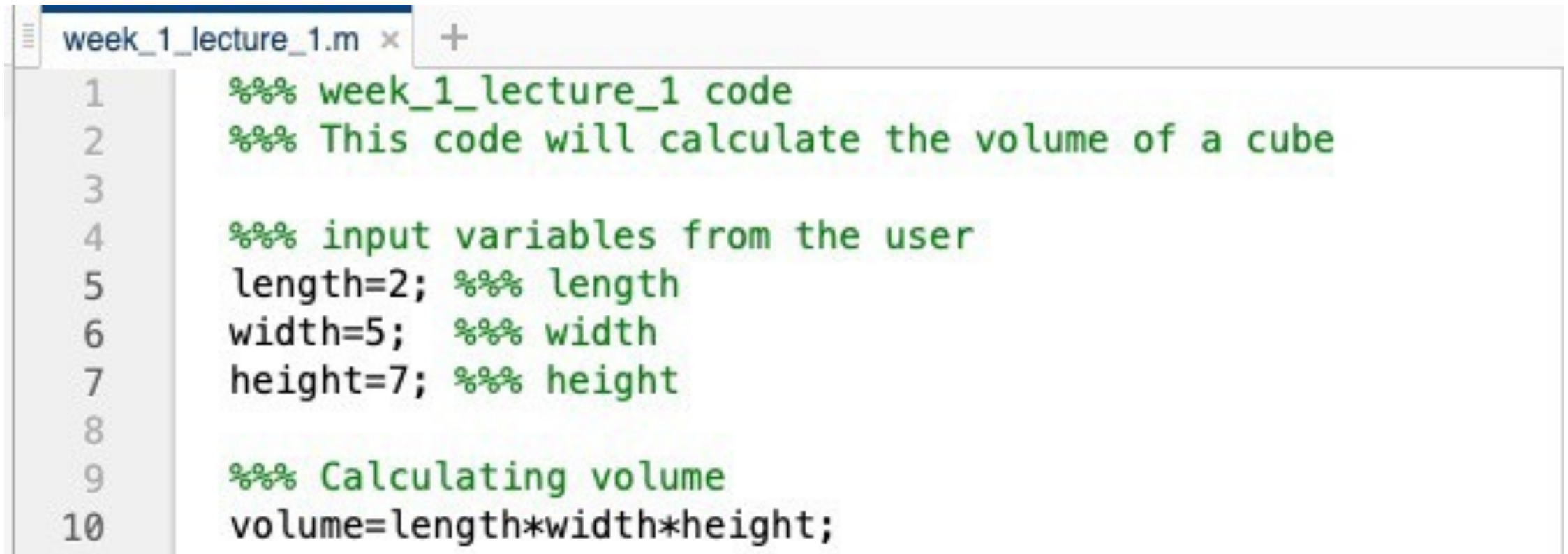
```
Command Window
>> a = 5
a =
    5
>> a+2
ans =
    7
```

- 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.

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.