Slide Set 1
Introduction to MATLAB

Maria Ptashkina Damian Romero

Barcelona Graduate School of Economics

September 2020

Outline

Introduction

Administrative

Sessions

- 5 sessions of 2 hours each
- Introduction to main concepts and practice exercises

Emails

- Maria Ptashkina: `maria.ptashkina@barcelonagse.eu`
- Damian Romero: `damian.romero@barcelonagse.eu`

Introduction

What is MATLAB?

- Interactive computational environment originally designed to solve linear algebra equations or systems of equations using matrices

What can we do with it?

- Import/export data; plots
- Matrix operations
- Numerical optimization

Some examples of applications

- Macroeconomics: solve static and dynamic equilibrium models
- Econometrics: estimation and simulation

Contents

Goals of this course

1. Get familiar with the basic computational tools available in MATLAB and main graphics tools
2. Get the basics of logic programming: loops, if-else clauses
3. Import/export data and perform data analysis
4. Build your own functions

Before We Start

Fundamentals of Programming

For our purpose, we can talk about two basic "programming paridigmes" (simply, styles of programming)

- Procedural programming: writing a list of instructions to tell the computer what to do step by step
- Functional programming: writing a mathematical function, i.e. a function that takes arguments and returns a value

Silly example (not in any language):

Functional

```
num = 1
def function_to_add_one(num):
    num += 1
    return num


function_to_add_one(num)
function_to_add_one(num)
function_to_add_one(num)
function_to_add_one(num)
function_to_add_one(num)

#Final Output: 2
```

Procedural

```
num = 1
def procedure_to_add_one():
    global num
    num += 1
    return num


procedure_to_add_one()
procedure_to_add_one()
procedure_to_add_one()
procedure_to_add_one()
procedure_to_add_one()

#Final Output: 6
```

Most of the things you will be doing in MATLAB are procedural

Other Languages

In Economics, many general-purpose languages are used, with the most common being:

- MATLAB
- R
- Julia
- Python

Which one to use?

- There is no definite answer: depending on the project, any of the four could be the best choice
- Generally, MATLAB and Julia are best for numerical problems and simulations, while R and Python are great at data handling
- If curious, read this comparison of the four languages

You already know Stata...

- ...but Stata is not a language, but a statistical software, so the programming logic in this course might be different

Some Language-Agnostic Tips for Coding

Programming is more than writing code: structuring, testing, documenting and collaborating on code are central!

Main principles:

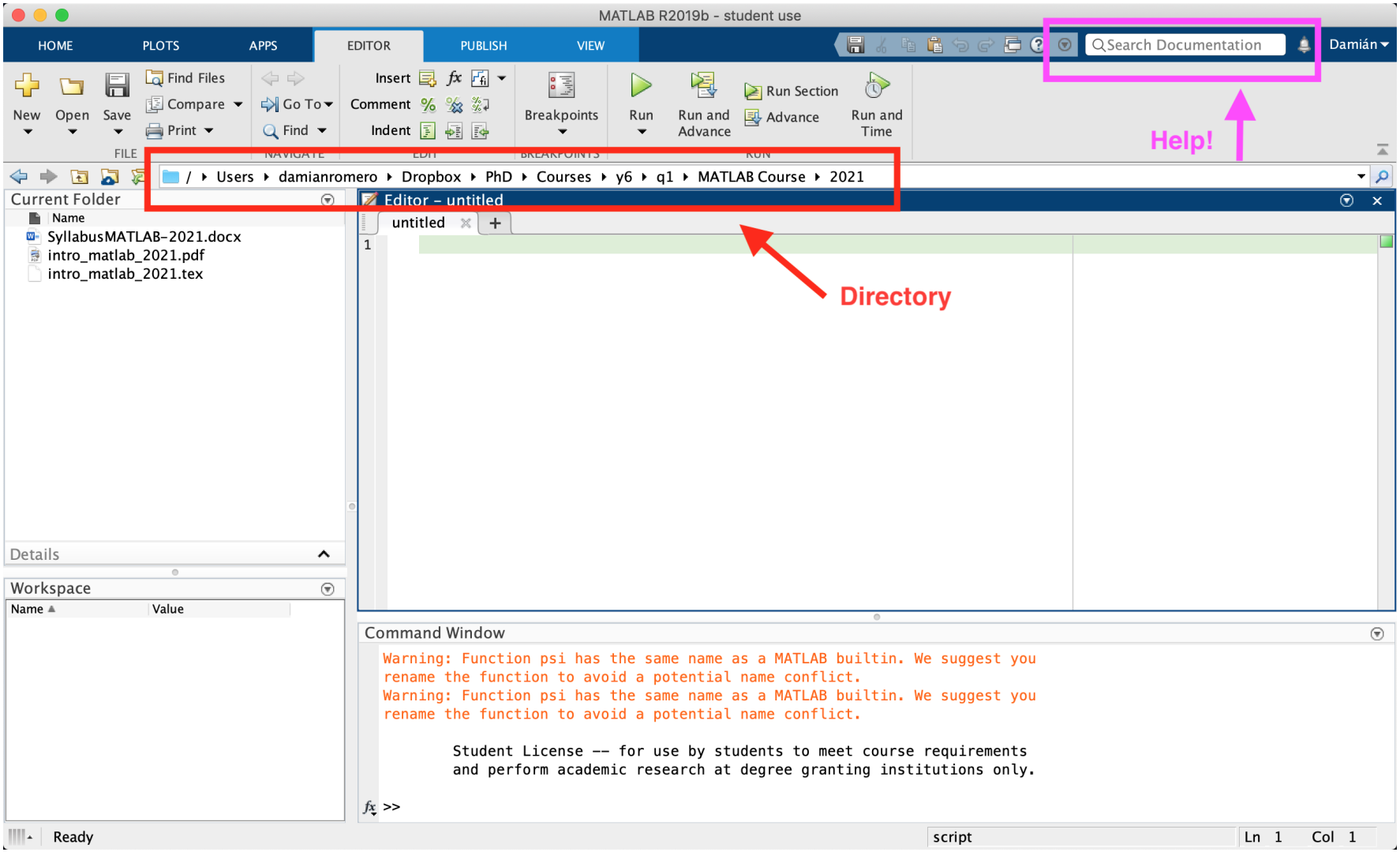
- Make your code as easy as possible
- Automate and abstract to make your code reproducible (for your future self)

Active learning: to learn programming (in any language) you need to work on actual problems yourself!

This guide for Social Science research might be handy at some point in time

Outline

MATLAB interface

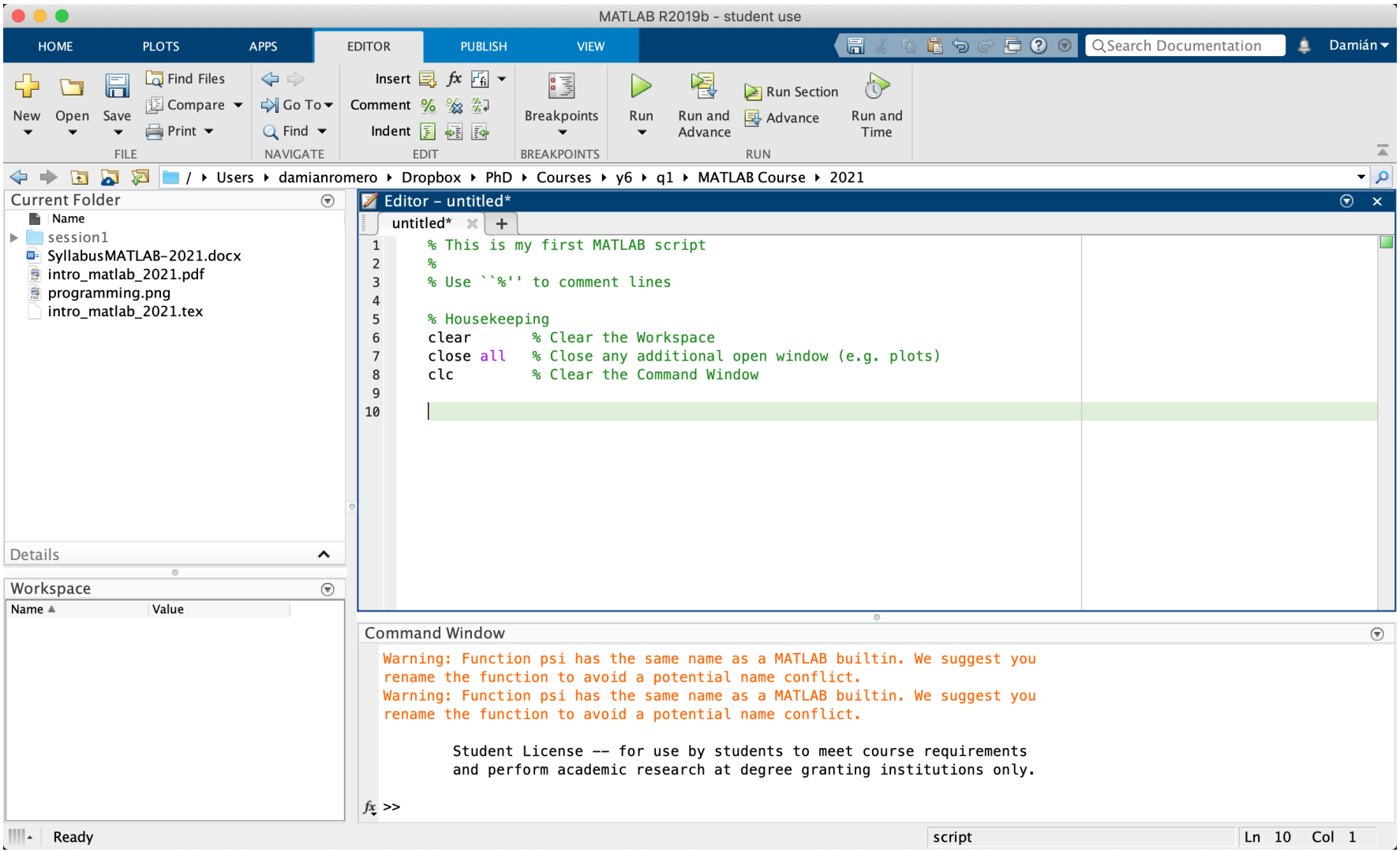


MATLAB interface

- **Command window:** the window where to execute the commands and get basic help
- **Workspace:** contains the "objects" (e.g. variables, whole datasets etc. you are currently working with)
- **Editor:** is the environment in which you can generate Script files. A Script a file with extension ".m" in which you can save sequence of commands for future use (we will cover this extensively later on)
- **Current Folder:** The folder you are working on and on which MATLAB looks for user-created functions, MATLAB datasets, other files (e.g. Excel, txt etc..)
- **Directory:** The path of the current folder
- **Help:** provides support and documentation on different MATLAB functions

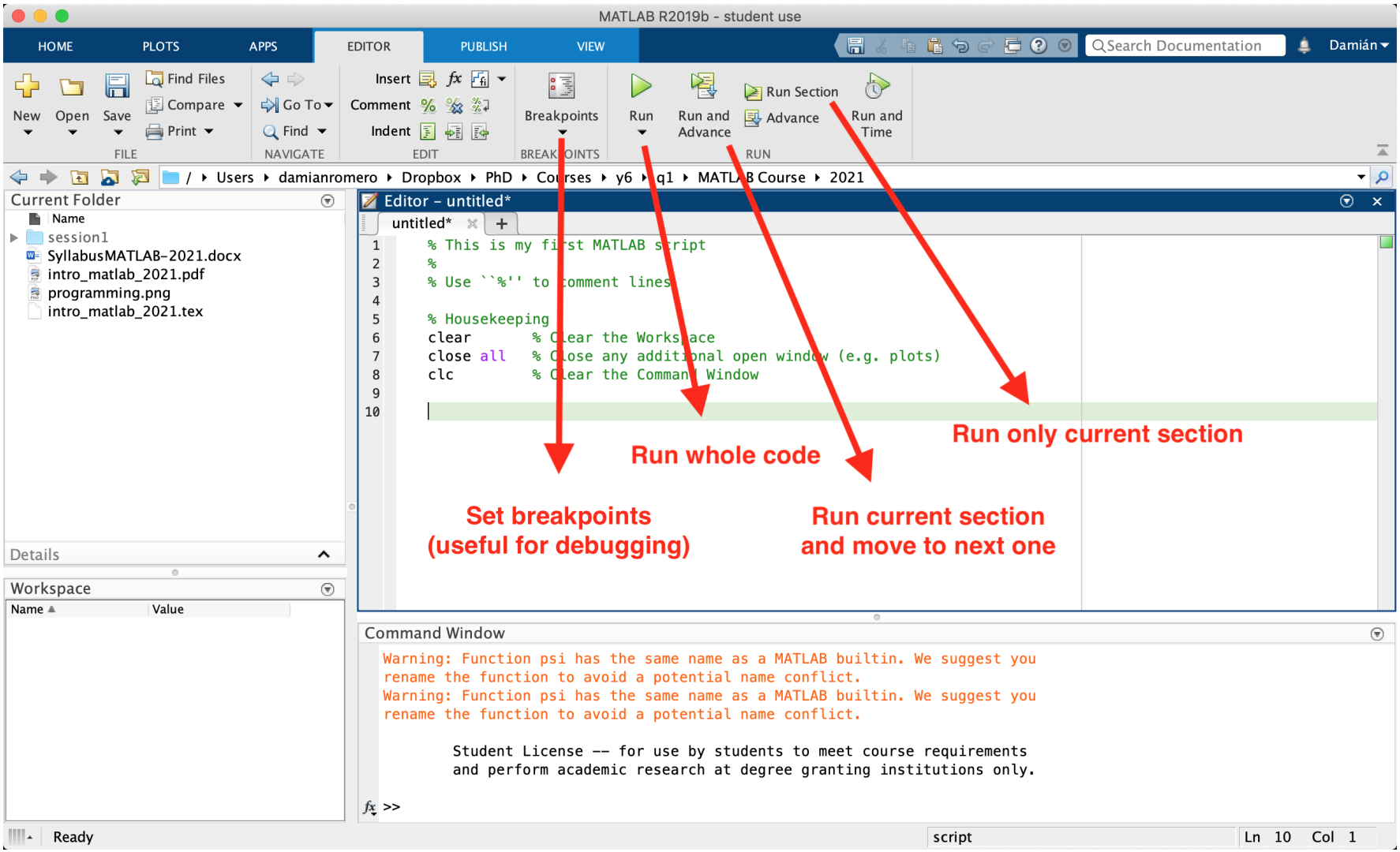
MATLAB interface

Editor



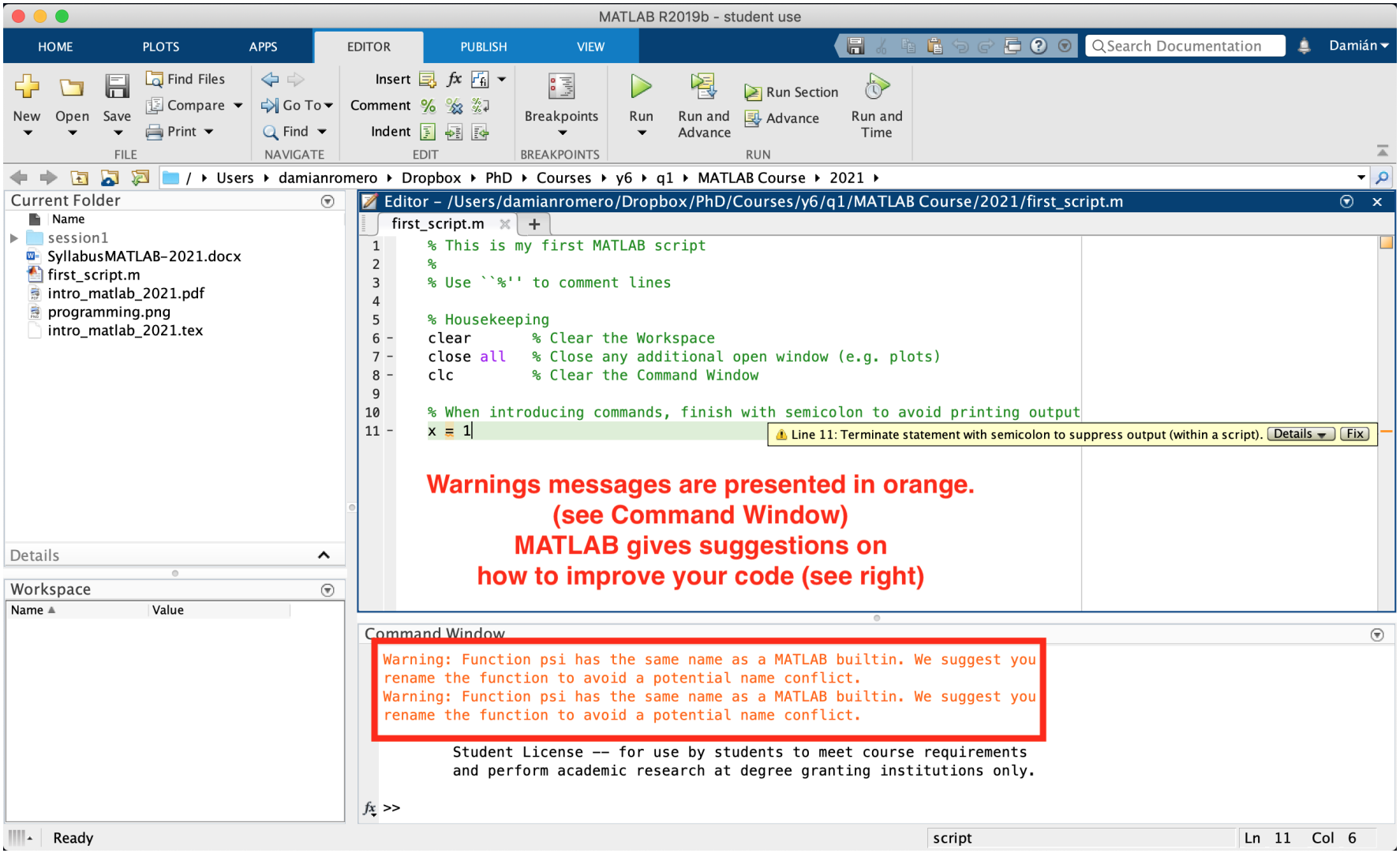
MATLAB interface

Editor



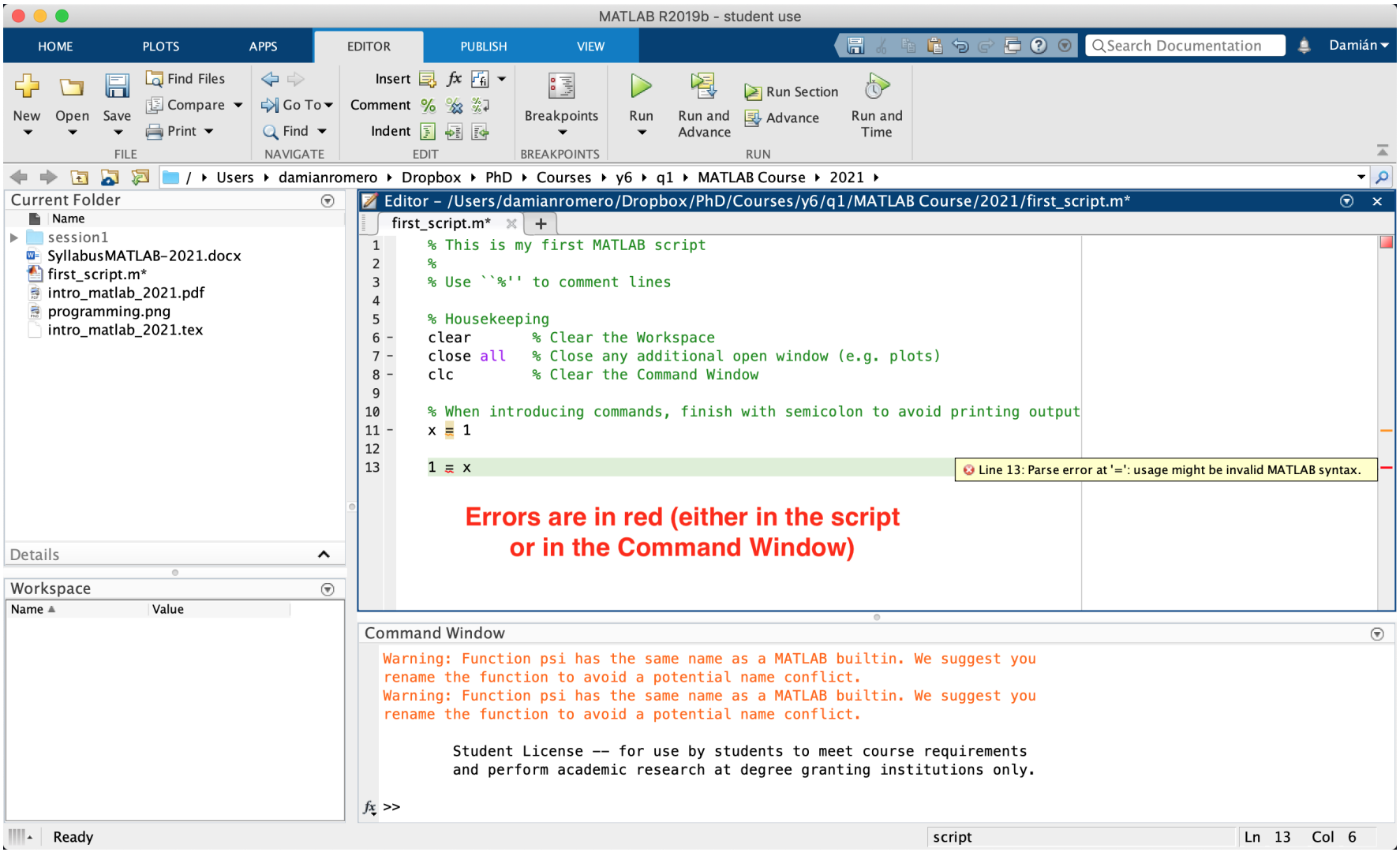
MATLAB interface

Editor



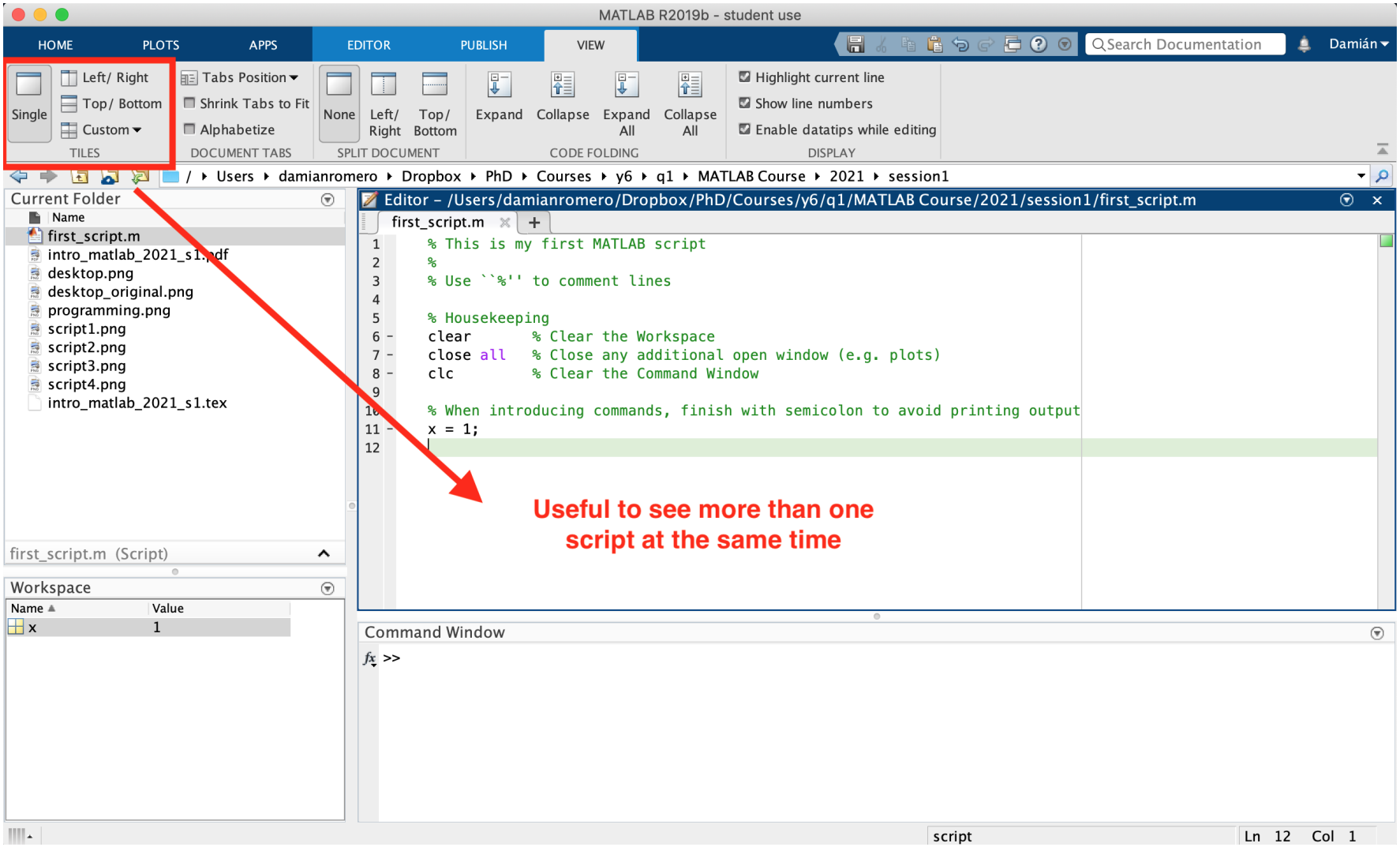
MATLAB interface

Editor



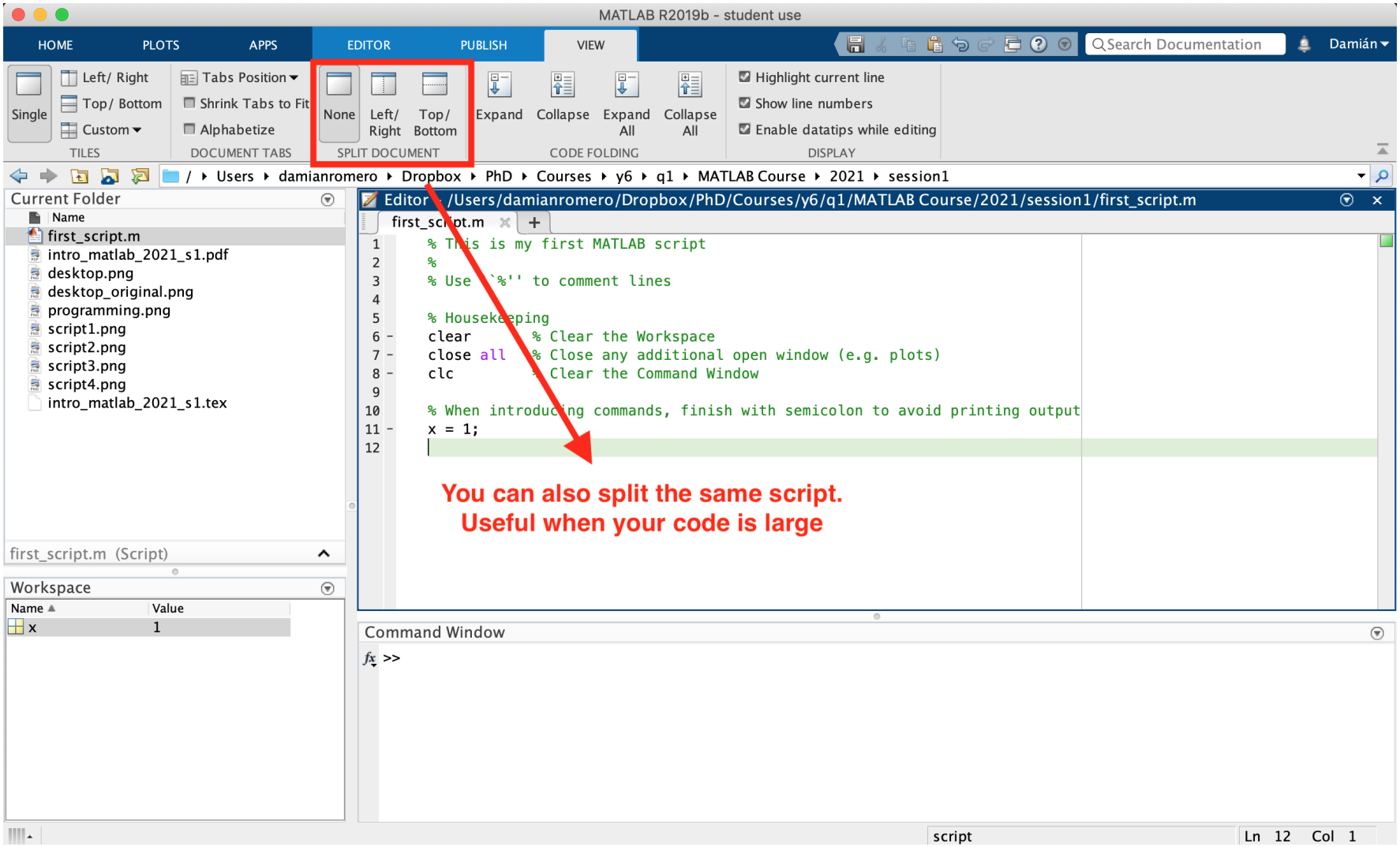
MATLAB interface

View



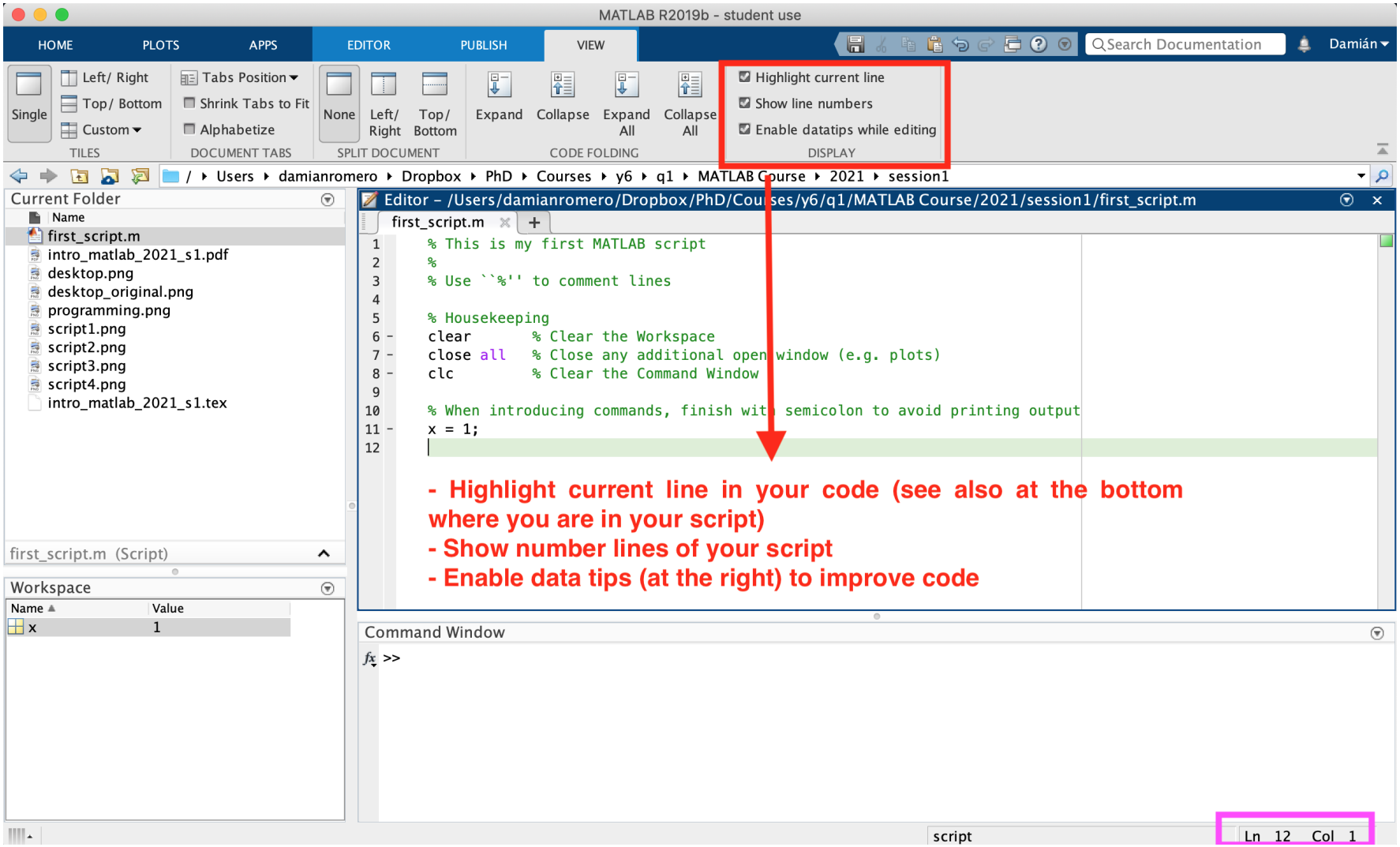
MATLAB interface

View



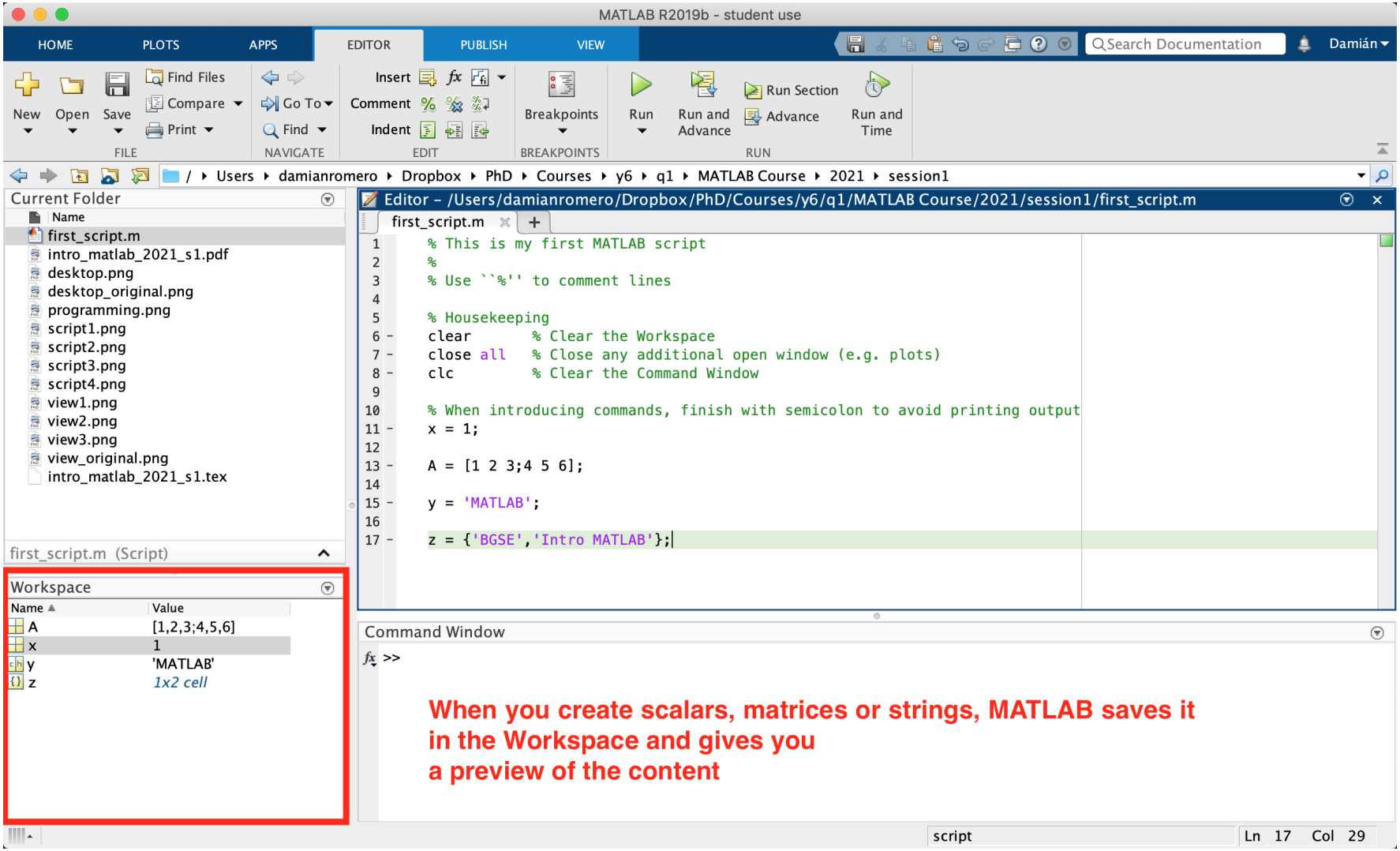
MATLAB interface

View



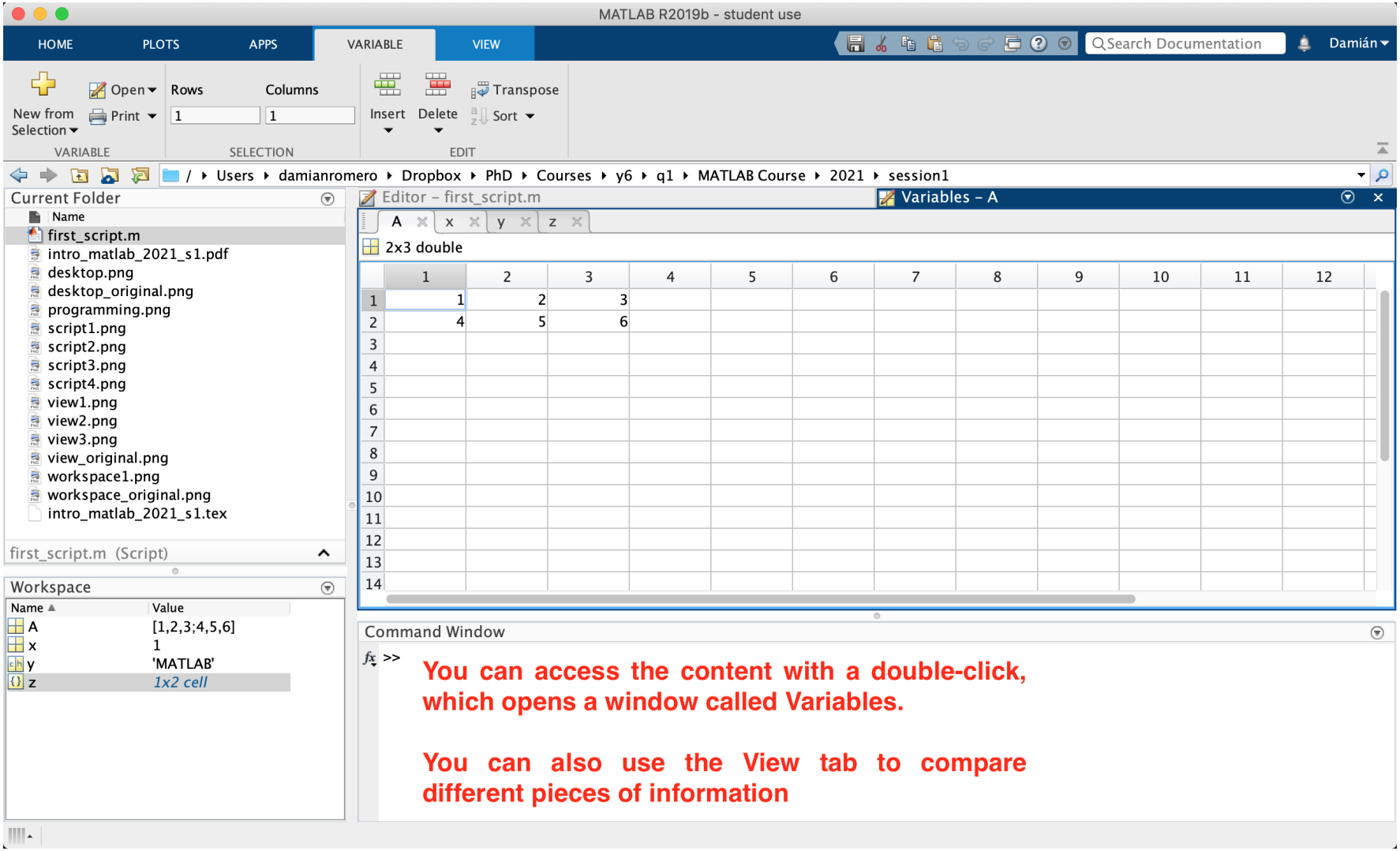
MATLAB interface

Workspace and Variables



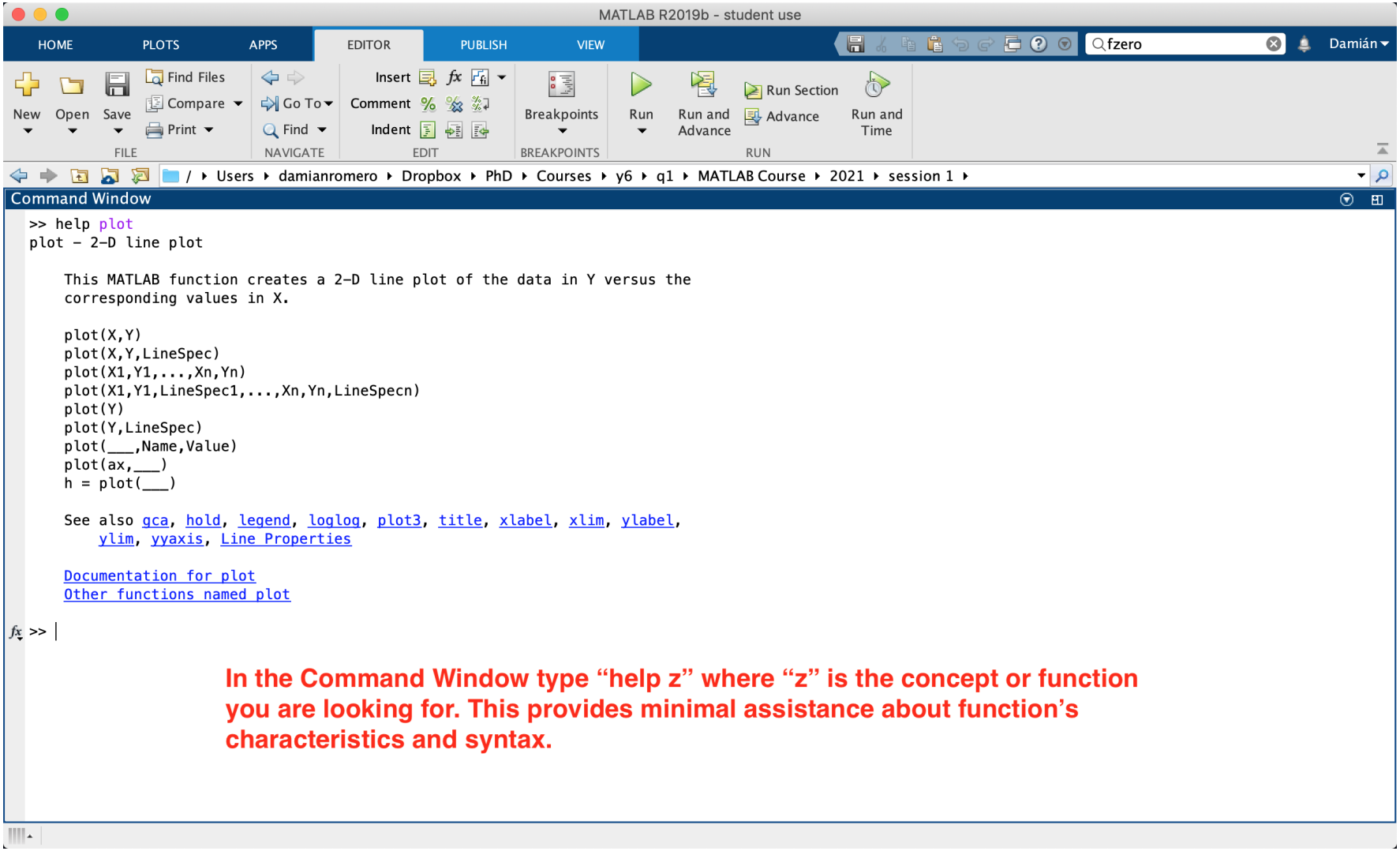
MATLAB interface

Workspace and Variables



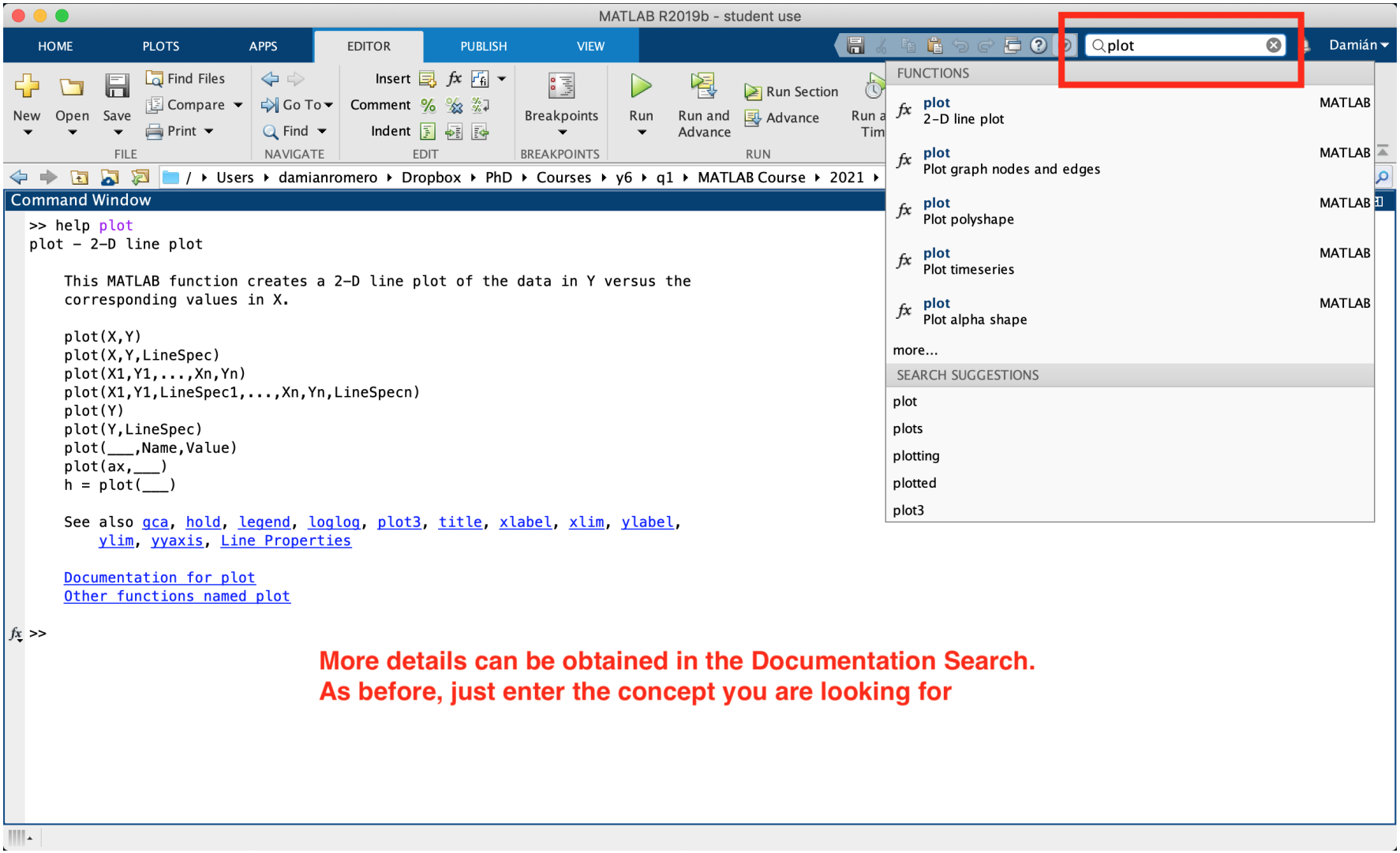
MATLAB interface

Getting help



MATLAB interface

Getting help



MATLAB interface

Getting help

Help

plot

Documentation All Examples Functions

Search R2019b Documentation

« Documentation Home

« MATLAB
« Graphics
« 2-D and 3-D Plots
« Line Plots

plot

ON THIS PAGE
Syntax
Description
Examples
Input Arguments
Output Arguments
Tips
Extended Capabilities
See Also

Trial Software Product Updates

plot

R2019b

2-D line plot

collapse all in page

Syntax

```
plot(X,Y)
plot(X,Y,LineSpec)
plot(X1,Y1,...,Xn,Yn)
plot(X1,Y1,LineSpec1,...,Xn,Yn,LineSpecn)
```

```
plot(Y)
plot(Y,LineSpec)
```

```
plot( __ ,Name,Value)
plot(ax, __ )
```

```
h = plot( __ )
```

Description

`plot(X,Y)` creates a 2-D line plot of the data in Y versus the corresponding values in X. example

- If X and Y are both vectors, then they must have equal length. The `plot` function plots Y versus X.
- If X and Y are both matrices, then they must have equal size. The `plot` function plots columns of Y versus columns of X.
- If one of X or Y is a vector and the other is a matrix, then the matrix must have dimensions such that one of its dimensions equals the vector length. If the number of matrix rows equals the vector length, then the `plot` function plots each matrix column versus the vector. If the number of matrix columns equals the vector length, then the function plots each matrix row versus the vector. If the matrix is square, then the function plots each column versus the vector.
- If one of X or Y is a scalar and the other is either a scalar or a vector, then the `plot` function plots discrete points. However, to see the points you must specify a marker symbol, for example, `plot(X,Y,'o')`.

`plot(X,Y,LineSpec)` sets the line style, marker symbol, and color.

`plot(X1,Y1,...,Xn,Yn)` plots multiple X, Y pairs using the same axes for all lines. example

`plot(X1,Y1,LineSpec1,...,Xn,Yn,LineSpecn)` sets the line style, marker type, and color for each line. You can mix X, Y, `LineSpec` triplets with X, Y pairs. For example, `plot(X1,Y1,X2,Y2,LineSpec2,X3,Y3)`. example

`plot(Y)` creates a 2-D line plot of the data in Y versus the index of each value. example

- If Y is a vector, then the *x*-axis scale ranges from 1 to `length(Y)`.
- If Y is a matrix, then the `plot` function plots the columns of Y versus their row number. The *x*-axis scale ranges from 1 to the number of rows in Y.
- If Y is complex, then the `plot` function plots the imaginary part of Y versus the real part of Y, such that `plot(Y)` is equivalent to `plot(real(Y),imag(Y))`.

`plot(Y,LineSpec)` sets the line style, marker symbol, and color.

`plot( __ ,Name,Value)` specifies line properties using one or more `Name,Value` pair arguments. For a list of properties, see Line Properties. Use this option with any of the input argument combinations in the previous syntaxes. Name-value pair settings apply to all the lines plotted. example

`plot(ax, __ )` creates the line in the axes specified by `ax` instead of in the current axes (`gca`). The option `ax` can precede any of the input argument combinations in the previous syntaxes. example

https://www.mathworks.com/help/releases/R2019b/matlab/ref/plot.html?lang=en