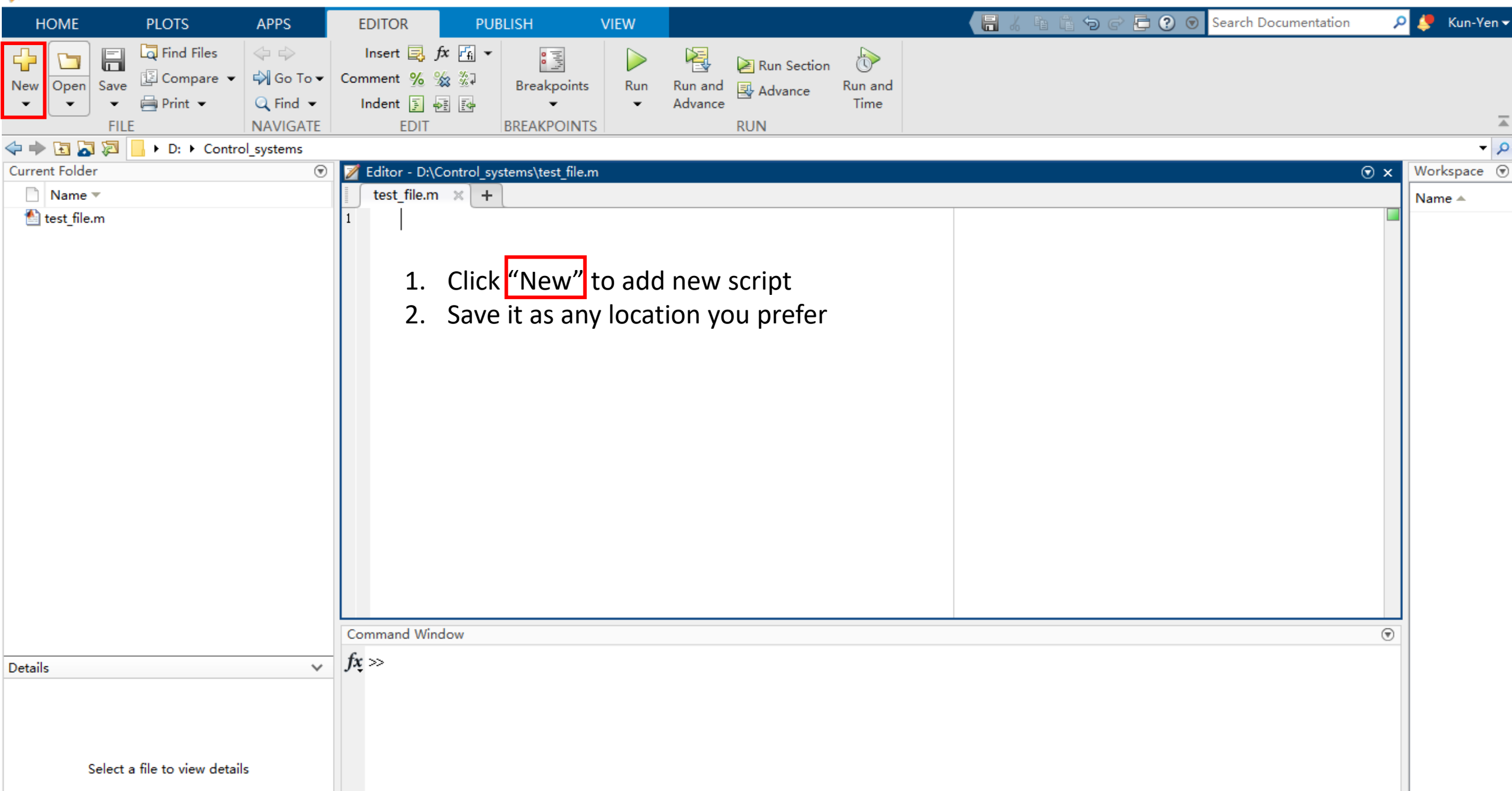




MATLAB Tutorial





The image shows the MATLAB R2019b interface. The top ribbon has tabs for HOME, PLOTS, APPS, EDITOR, PUBLISH, and VIEW. The HOME tab is active, and the 'New' button (represented by a plus sign icon) is highlighted with a red box. Below the ribbon, the 'Current Folder' pane on the left shows the directory 'D:\Control_systems' containing a file named 'test_file.m'. The 'Editor' pane in the center shows the file 'test_file.m' open, with a red box highlighting the word 'New' in the instructions. The 'Command Window' at the bottom shows the MATLAB prompt 'fx >>'. The 'Workspace' pane on the right is empty.

HOME PLOTS APPS EDITOR PUBLISH VIEW

Search Documentation

New Open Save Find Files Compare Print Go To Find

FILE NAVIGATE

Insert Comment Indent Breakpoints Run Run and Advance Run Section Advance Run and Time

EDITOR EDIT BREAKPOINTS RUN

Current Folder

Name

test_file.m

Editor - D:\Control_systems\test_file.m

test_file.m

1

1. Click "New" to add new script

2. Save it as any location you prefer

Command Window

fx >>

Workspace

Name

Select a file to view details

Basic Operator

+	Plus; addition operator.
-	Minus; subtraction operator.
*	Scalar and matrix multiplication operator.
.*	Array multiplication operator.
^	Scalar and matrix exponentiation operator.
.^	Array exponentiation operator.
	Left-division operator.
/	Right-division operator.
.	Array left-division operator.
./	Array right-division operator.
:	Colon; generates regularly spaced elements and represents an entire row or column.

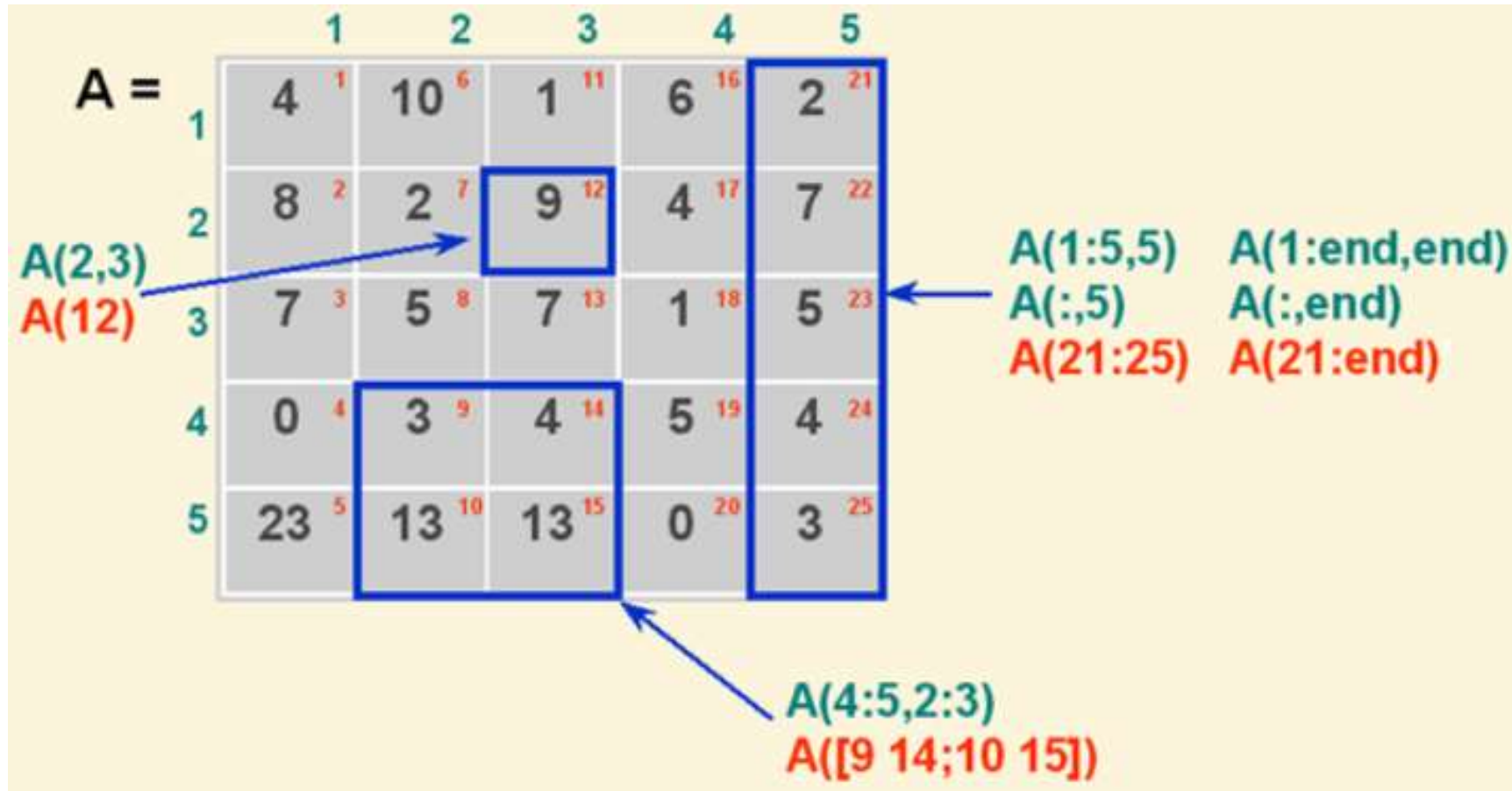
Exponential and Logarithmic Functions

exp (x)	Exponential; e^x .
log (x)	Natural logarithm; $\ln(x)$.
log10 (x)	Common (base 10) logarithm; $\log(x)=\log_{10}(x)$.
sqrt (x)	Square root; \sqrt{x} .

Symbolic Linear Algebra Functions

det	Returns the determinant of a matrix.
eig	Returns the eigenvalues (characteristic roots) of a matrix.
inv	Returns the inverse of a matrix.
poly	Returns the characteristic polynomial of a matrix.

Matrix Representation



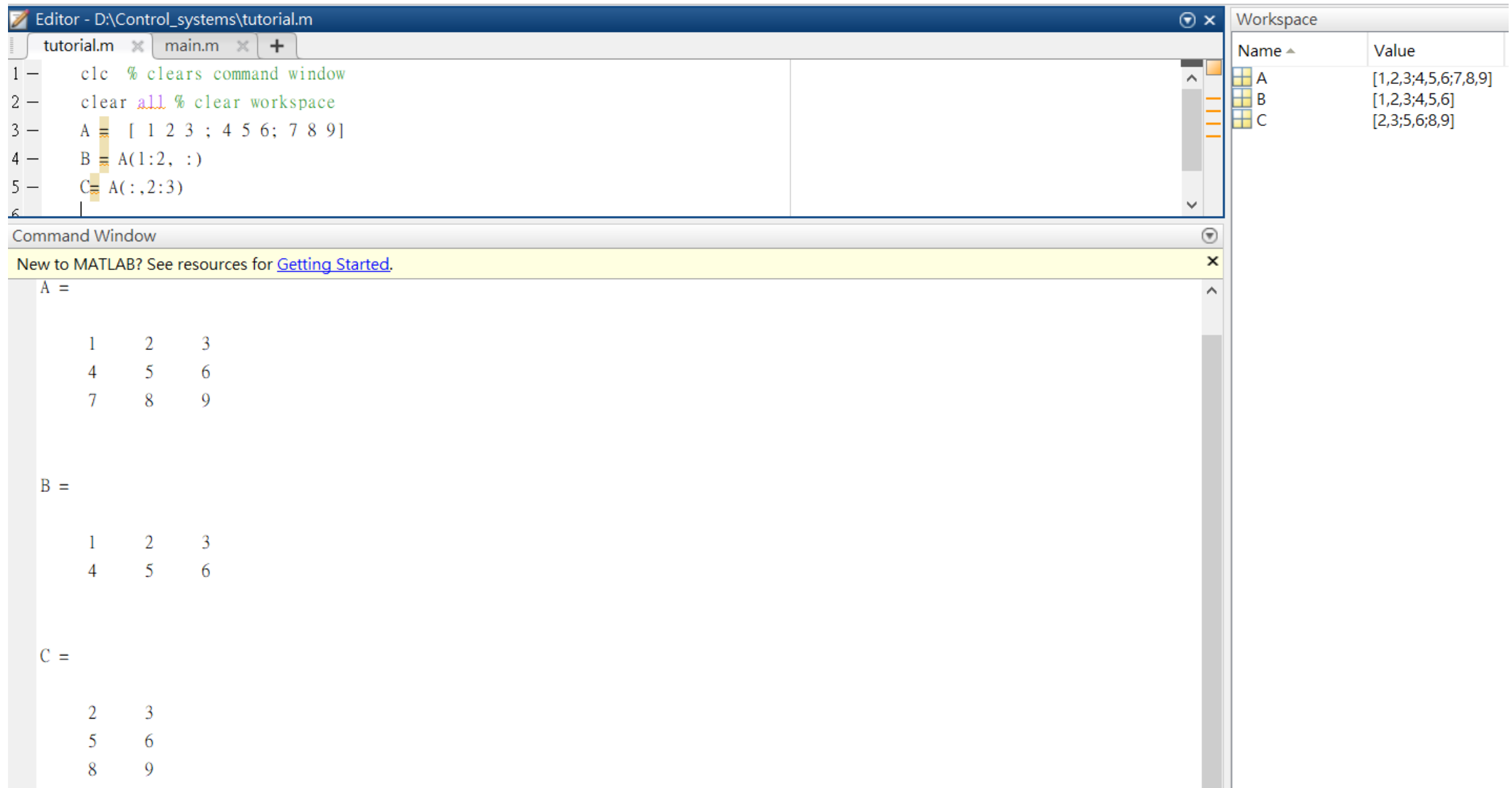
Noticed

$A(\text{##}, \text{##})$

Column
(run vertical)

Row
(run horizontal)

Exercise 1 – Create Matrix



The image shows the MATLAB environment with the Editor, Command Window, and Workspace panels.

Editor - D:\Control_systems\tutorial.m

```
1 clc % clears command window
2 clear all % clear workspace
3 A = [ 1 2 3 ; 4 5 6; 7 8 9]
4 B = A(1:2, :)
5 C = A(:, 2:3)
```

Command Window

New to MATLAB? See resources for [Getting Started](#).

A =

```
1     2     3
4     5     6
7     8     9
```

B =

```
1     2     3
4     5     6
```

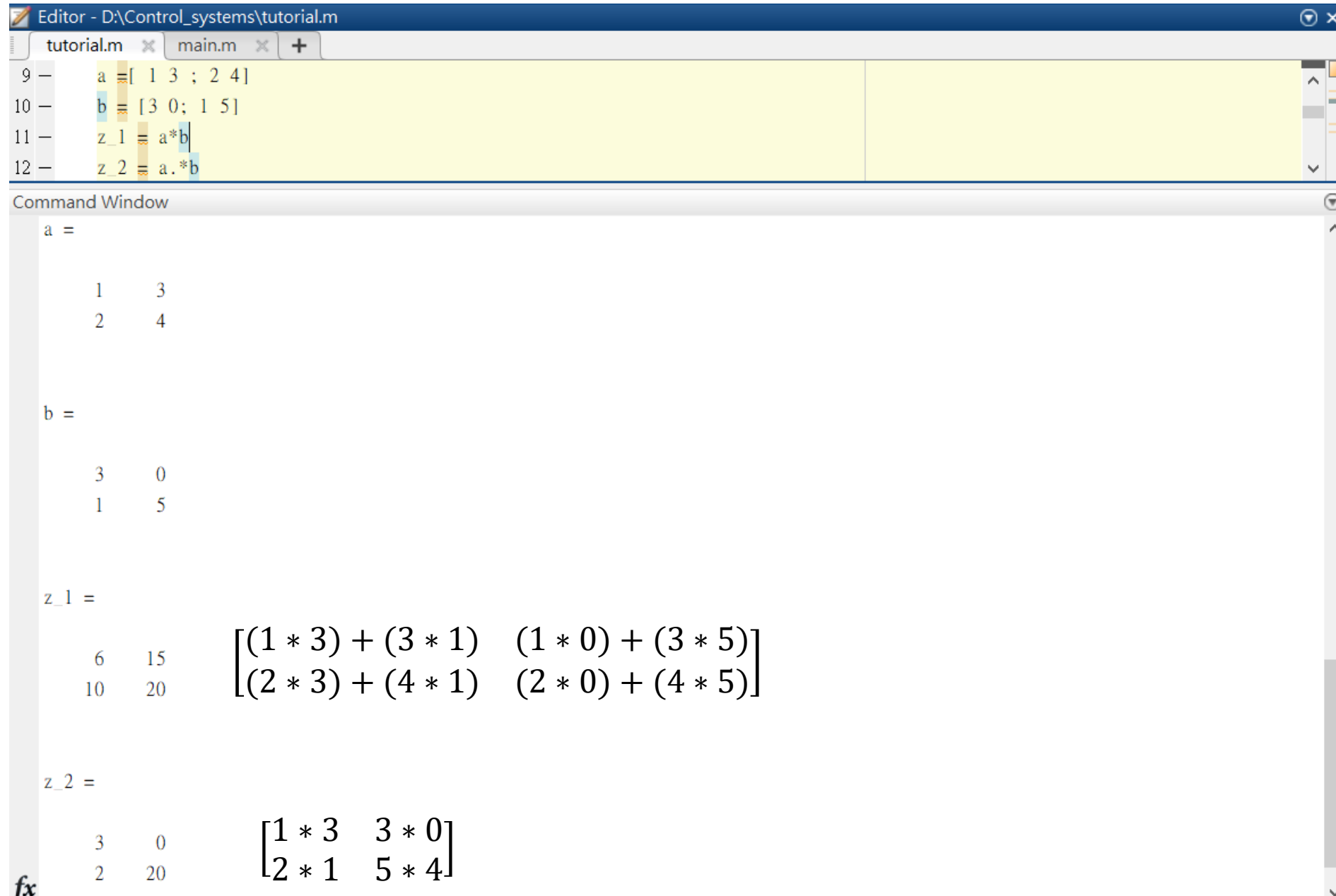
C =

```
2     3
5     6
8     9
```

Workspace

Name	Value
A	[1,2,3;4,5,6;7,8,9]
B	[1,2,3;4,5,6]
C	[2,3;5,6;8,9]

Exercise 2 – Matrix Multiplication



The image shows a MATLAB Editor window with a script named `tutorial.m` and a Command Window below it. The script defines two matrices `a` and `b`, and calculates their product `z_1` and element-wise product `z_2`.

```
9 a = [ 1 3 ; 2 4]
10 b = [ 3 0; 1 5]
11 z_1 = a*b
12 z_2 = a.*b
```

The Command Window displays the results of these operations:

`a =`

$$\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

`b =`

$$\begin{bmatrix} 3 & 0 \\ 1 & 5 \end{bmatrix}$$

`z_1 =`

$$\begin{bmatrix} 6 & 15 \\ 10 & 20 \end{bmatrix} \quad \begin{bmatrix} (1 * 3) + (3 * 1) & (1 * 0) + (3 * 5) \\ (2 * 3) + (4 * 1) & (2 * 0) + (4 * 5) \end{bmatrix}$$

`z_2 =`

$$\begin{bmatrix} 3 & 0 \\ 2 & 20 \end{bmatrix} \quad \begin{bmatrix} 1 * 3 & 3 * 0 \\ 2 * 1 & 5 * 4 \end{bmatrix}$$

Exercise 3 – Solve Linear Equations

```
18 %A*X = B
19 y_1 = [2 4 ; 1 4] %y_1 = 2*x_1 + 4*x_2 = 16;    y_1 = 2x_1 + 4x_2 = 16
20 y_2 = [16; 14] %y_2 = 1*x_1 + 4*x_2 = 14;    y_2 = 1x_1 + 4x_2 = 14
21 x_value = y_1 \ y_2 %You can also do inv(y_1)*y_2
22
23
```

Command Window

y_1 =

2 4
1 4

$$y_1 = \begin{bmatrix} 2 & 4 \\ 1 & 4 \end{bmatrix}$$

y_2 =

16
14

$$y_2 = \begin{bmatrix} 16 \\ 14 \end{bmatrix}$$

x_value =

2
3

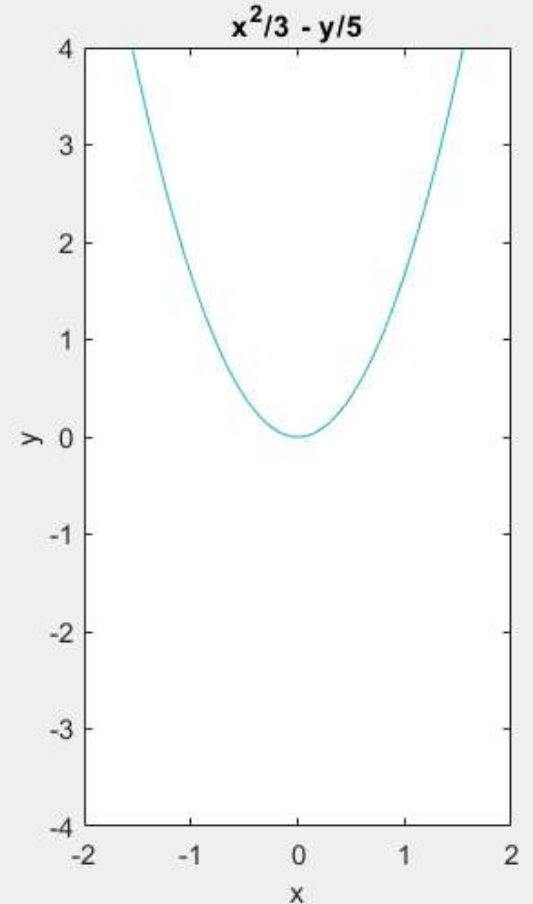
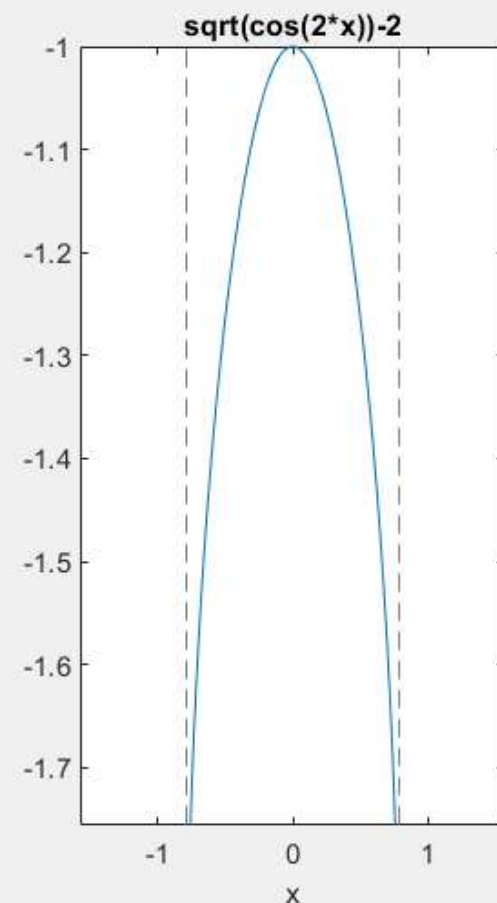
$$x_value = \begin{bmatrix} 2 \\ 3 \end{bmatrix} \Rightarrow x_1 = 2, x_2 = 3$$

Exercise 4 – Plot equations

```
%%  
%plot equations  
subplot(1,2,1) % column:1 /row:2 /figure location: 1  
fplot(@(x) sqrt(cos(2*x))-2,[-pi/2, pi/2]) %ezplot(fun2,[xmin,xymax])  
title('sqrt(cos(2*x))-2');  
xlabel('x');  
  
subplot(1,2,2) % column:1 /row:2 /figure location: 2  
syms x y  
ezplot((x.^2/3) - (y./5), [-2, 2, -4, 4]) %ezplot(fun,[xmin,xmax,ymin,ymax])
```

nd Window

File Edit View Insert Tools Desktop Window Help



Eq1: $y = \sqrt{\cos(2x)} - 2, x \in [-\frac{\pi}{2}, \frac{\pi}{2}]$

Eq2: $f(x,y) = \frac{x^2}{3} - \frac{y}{5}, (-2 \leq x \leq 2, -4 \leq y \leq 4)$

Reference

- <https://www.tutorialspoint.com/matlab/index.htm>