

# MATLAB for Beginners

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## MATLAB Graphics

- [Download PDF](#)
- To access the updated lecture notes, please click on the following link:  
<https://yasirbhutta.github.io/matlab/docs/graphics.html>

### 2D Plots

#### Printing Labels

The `xlabel()` and `ylabel()` functions are used to label the x and y axes in a figure in MATLAB. The labels should describe the data that is being plotted on each axis.

The `title()` function is used to add a title to a figure in MATLAB. The title should provide a brief description of the plot.

Example 3: Label the axes and add a title

```
x = linspace(0, 10, 100);  
y = sin(x);  
  
plot(x, y);  
xlabel('X-axis');  
ylabel('Y-axis');  
title('Sine Wave');
```

#### Grid and Axes Box

The `grid()` function is used to add grid lines to a figure in MATLAB. Grid lines can help to make it easier to interpret the data in a plot.

#### Entering Text in a Plot

#### Axis Control

The `axis()` function is used to set the limits of the axes in a figure in MATLAB. The axes are the horizontal and vertical lines that extend across the figure window.

#### Axis Aspect Ration

#### Multiple Plots

#### Using plot Command

The `plot()` function is used to create a line plot in MATLAB. A line plot is a graphical representation of a set of data points connected by a line.

### Using hold Command

The `hold` function is used to prevent MATLAB from overwriting existing plots when creating new ones. By default, MATLAB overwrites existing plots when creating new ones. However, if you use the `hold` function before creating a new plot, MATLAB will add the new plot to the existing plot instead of overwriting it.

Example 2: Plotting multiple lines on the same graph

```
x = linspace(0, 10, 100);
y1 = sin(x);
y2 = cos(x);

plot(x, y1, 'b');
hold on;
plot(x, y2, 'r');
hold off;
```

This will plot two lines on the same graph, one blue and one red. The `hold on` and `hold off` functions are used to prevent the second line from overwriting the first line.

### Using line Command

#### Style Options

#### Example

```
x = 1:1:10;

y1 = sqrt(x.^2+1);
y2 = 2 * x + 20;
y3 = 3 * x + 3;

plot(x,y1,'r*');
line(x,y2);
line(x,y3);
```

#### Example: Plotting Two Functions on the Same Graph in MATLAB

```
x = 1:1:10;

y1 = sqrt(x.^2+1);
y2 = 2 * x + 20;
```

```
plot(x, y1, 'r', x, y2, 'bo');  
axis([0 12 0 45]);
```

## LEGEND

The `legend()` function is used to create a legend for a figure in MATLAB. A legend is a key that explains which line or curve corresponds to which data set.

### Example

```
% Real world data example  
% Global average temperature data from NASA  
% https://data.giss.nasa.gov/gistemp/graphs/  
  
% Load the data  
data = load('global_average_temperature.csv');  
  
% Extract the years and temperatures  
years = data(:, 1);  
temperatures = data(:, 2);  
  
% Create a line plot of the data  
figure;  
plot(years, temperatures);  
  
% Add a legend  
legend('Global average temperature');  
  
% Set the axis labels and title  
xlabel('Year');  
ylabel('Temperature (°C)');  
title('Global Average Temperature from 1880 to 2022');
```

## SUBPLOTS

### Specialized 2D plots

#### Logarithmic Plot Functions

##### polar

##### area

##### bar

### Example 3: Plotting a bar graph

```
x = categorical({'A', 'B', 'C'});  
y = [10, 20, 30];  
  
bar(x, y);
```

**Categorical Array:** categorical is a data type to store data with values from a finite set of discrete categories. For example, the syntax `C = categorical({'R','G','B','B','G','B'})` creates a categorical array with six elements that belong to the categories R, G, or B.<sup>[1]</sup>

Download dataset [Population by Country](#) from [Datasets](#).

### Example

```
% Specify the name of the CSV file  
filename = 'data1.csv';  
  
% Read the data from the CSV file into a table variable  
data = readtable(filename);  
  
% Convert the Country column to a categorical variable  
x = categorical(data.Country);  
  
% Generate a bar plot of the population data  
bar(x,data.Population);  
  
% Add a title and axis labels to the plot  
title('Population by Country');  
xlabel('Country');  
ylabel('Population');
```

### See also:

- [bar - MathWorks Help Center](#)

### barh

### See also:

### histogram

Example 4: Plotting a histogram

```
x = randn(1000, 1);  
histogram(x);
```

**See also:**

- [histogram - MathWorks Help Center](#)
- [Replace Discouraged Instances of hist and histc](#)

**rose****pie**

Example 5: Plotting a pie chart

```
X = [10 20 30];  
  
pie(X);
```

This will plot a pie chart with three slices, one for each value in the vector X. The size of each slice represents the proportion of that value to the total.

**stairs****stem****compass****3D Plots****plot3****bar3****bar3h****pie3****See also:**

- [pie3 - MathWorks Help Center](#)

**stem3****meshgrid****mesh****surf****contour and contour3**

True/False (Mark T for True and F for False)

- The MATLAB plot function plots data points as connected line segments. **True**
- The MATLAB bar function plots the relationship between two variables. **False**
- The xlabel() and ylabel() functions are used to label the X-axis and Y-axis of the current plot, respectively. **True**.
- The clf() function clears the current plot. **True**
- The xlabel, ylabel, and title functions in MATLAB are used to add labels to a plot. **True**
- You can customize the appearance of a plot in MATLAB by specifying various properties like line color, line style, and marker type. **True**

## Multiple Choice (Select the best answer)

Which of the following functions is used to create a plot of a line?

1. ☒ plot()
2. ☐ stem()
3. ☐ bar()
4. ☐ pie()

Which of the following functions is used to create a plot of a bar graph?

1. ☐ plot()
2. ☐ stem()
3. ☒ bar()
4. ☐ pie()

Which of the following functions is used to create a plot of a pie chart?

1. ☐ plot()
2. ☐ stem()
3. ☐ bar()
4. ☒ pie()

Which of the following is NOT a valid MATLAB graphics command?

1. ☐ plot()
2. ☐ subplot()
3. ☒ log1pp()
4. ☐ title()

What is the purpose of the title() function?

1. ☐ To label the axes of a plot
2. ☐ To create a new figure window
3. ☒ To add a title to a plot
4. ☐ To change the color of a plot

How can you create a subplot in MATLAB?

1. ☒ Use the subplot() function.
2. ☐ Use the figure() function.
3. ☐ Use the plot() function.

4. ☐ Use the title() function.

What is the difference between a bar plot and a histogram?

1. ☒ A bar plot is used to compare categorical data, while a histogram is used to visualize continuous data.
2. ☐ A bar plot is used to represent frequencies, while a histogram is used to represent probabilities.
3. ☐ A bar plot is used to show the distribution of data, while a histogram is used to compare means.
4. ☐ A bar histogram is used to show the relationship between two variables, while a plot is used to show the distribution of a single variable.

Which of the following is NOT a valid MATLAB graphics function?

1. ☐ plot()
2. ☐ bar()
3. ☐ pie()
4. ☒ histogram()
5. ☐ stem()

Which of the following is the correct syntax for plotting a line graph of the function  $y = x^2$ ?

1. ☐ plot(x, y=x^2)
2. ☒ plot(x, x.^2)
3. ☐ plot(y, x^2)
4. ☐ plot(x^2, y)
5. ☐ plot(y^2, x)

What is the purpose of the legend() function?

1. ☐ To label the x-axis of a graph
2. ☐ To label the y-axis of a graph
3. ☐ To add a title to a graph
4. ☒ To add a legend to a graph
5. ☐ To change the color of a line on a graph

What is the purpose of the xlabel() and ylabel() functions?

1. ☒ To label the x-axis of a graph
2. ☒ To label the y-axis of a graph
3. ☐ To add a title to a graph
4. ☐ To add a legend to a graph
5. ☐ To change the color of a line on a graph

Which of the following commands would you use to change the title of the current figure to 'My Figure'?

1. ☒ title('My Figure')
2. ☐ sets(gcf, 'Title', 'My Figure')
3. ☐ title(figure, 'My Figure')
4. ☐ sets(figure, 'Title', 'My Figure')

What is the command to create a 2-D line plot of x and y vectors in MATLAB?

1. ☒ plot(x,y)
2. ☐ line(x,y)
3. ☐ graph(x,y)
4. ☐ draw(x,y)

What is the command to create a pie chart of a vector x in MATLAB?

1. ☐ pie(x)
2. ☐ pie3(x)
3. ☐ piechart(x)
4. ☒ pie(x) and pie3(x)

Which MATLAB function is used to label the axes of a figure?

1. ☐ title()
2. ☐ legend()
3. ☒ xlabel()
4. ☒ ylabel()

What is the command to show the box outline around the axes in MATLAB?

1. ☐ box off
2. ☐ box show
3. ☒ box on
4. ☐ box hide

What is the command to show the grid in a MATLAB figure?

1. ☐ box on
2. ☒ grid on
3. ☐ grid off
4. ☐ box show
5. ☐ box hide

Which MATLAB function is used to add text to a plot?

1. ☒ text()
2. ☐ label()
3. ☐ title()
4. ☐ legend()

How can you change the font color of the text in a plot?

1. ☒ Use the color property of the text() function.
2. ☐ Use the Color property of the current axes.
3. ☐ Use the Color property of the figure window.
4. ☐ Use the Color property of the current figure.

**Code snippet:**



```
x = 1:10;  
y = 1:10;  
plot(x, y);  
text(6, 5, 'string', 'color', 'red');
```

How can you position text relative to a specific data point in a plot?

- ☒ Use the x and y coordinates of the data point.
- ☐ Use the DataPoints property of the text() function.
- ☐ Use the handle property of the data point object.
- ☐ Use the Position property of the text object.

What is the primary purpose of the `hold` function in MATLAB plotting?

- ☐ To clear the current plot window
- ☐ To temporarily pause the execution of a plot command
- ☒ To prevent subsequent plot commands from overwriting existing plots
- ☐ To adjust the scaling of the plot axes

Which of the following statements correctly describes the behavior of the `hold` function when used in conjunction with the plot function?

- ☐ The hold function must be called before the plot function for it to have any effect.
- ☐ The hold function must be called after the plot function for it to have any effect.
- ☒ The hold function remains active until it is explicitly turned off using the hold off command.
- ☐ The hold function only affects the current plot window and has no effect on subsequent plot windows.

Which of the following scenarios would require the use of the `hold` function?

- ☐ Plotting two different line graphs of separate data sets on the same axes
- ☐ Plotting multiple curves representing different functions in the same plot window
- ☐ Creating a scatter plot of data points along with a trend line
- ☒ All of the above

What are the two basic arguments required for the `plot()` function?

- ☒ x-coordinates and y-coordinates
- ☐ x-axis label and y-axis label
- ☐ figure window and axes labels
- ☐ title and legend

What is the default line style used by the `plot()` function?

- ☒ Solid line (-)
- ☐ Dashed line (--)
- ☐ Dotted line (⋯)
- ☐ Dot-dash line (-.)

What is the default line color used by the `plot()` function?

- ☐ Blue
- ☐ Red
- ☐ Green
- ☒ Black

Which line style is represented by the string `'-.'`?

- ☐ Solid line
- ☐ Dashed line
- ☐ Dotted line
- ☐ [x] Dash-dotted line

What is the purpose of using different line styles in a plot?

- ☐ To make the plot more visually appealing
- ☐ To distinguish between different data sets in a plot
- ☐ To increase the readability of the plot
- ☒ All of the above

How would you set the line style of a plot to be dashed?

- ☒ `plot(x, y, '--')`
- ☐ `line(x, y, '--')`
- ☐ `get(plot(x, y), 'LineStyle', '--')`
- ☐ `style(plot(x, y), '--')`

How would you create a plot with two lines, one solid and one dashed?

- ☐ `plot(x1, y1, '-', x2, y2, '--')`
- ☐ `line(x1, y1, '-', x2, y2, '--')`
- ☐ `figure(plot(x1, y1), 'LineStyle', '-'), plot(x2, y2), 'LineStyle', '--')`
- ☐ `style(plot(x1, y1), '-'), plot(x2, y2), 'LineStyle', '--')`

What is the default marker style for a line plot in MATLAB?

- ☒ No marker
- ☐ Circle (o)
- ☐ Plus sign (+)
- ☐ Asterisk (\*)

## Exercises

## Review Questions

- What is the syntax for adding text to a plot using the `text()` function?
- What is the purpose of the `plot()` function in MATLAB?
- What is the purpose of the `grid()` function in MATLAB?
- What is the purpose of the `axis()` function in MATLAB?
- What is the purpose of the `xlabel()` and `ylabel()` functions in MATLAB?

- What is the purpose of the `title()` function in MATLAB?
- What is the purpose of the `legend()` function in MATLAB?
- What are some of the different line styles that can be used in MATLAB?
- What are some of the different marker styles that can be used in MATLAB?
- What is the difference between the hold on and hold off functions in MATLAB?
- How do you use the line function in MATLAB?

**Answer:**

The line function is used to create a line plot in MATLAB. The syntax for the line function is as follows:

```
line(x, y)
```

where x is a vector of x-coordinates and y is a vector of y-coordinates.

- How do you plot a line in MATLAB using `plot` function?

**Answer:**

To plot a line in MATLAB, you can use the `plot()` function. The `plot()` function takes two vectors as arguments: the x-values and the y-values. For example, the following command will plot a line with x-values from 1 to 10 and y-values from 1 to 10:

```
x = 1:10;  
y = 1:10;  
plot(x, y);
```

- How do you change the color of a line in MATLAB?

**Answer:**

To change the color of a line in MATLAB, you can use the Color property. For example, the following command will change the color of the line to red:

```
x = 1:10;  
y = 1:10;  
plot(x, y, 'Color', 'red');
```

- How do you add a `title` to a figure in MATLAB?

**Answer:**

To add a title to a figure in MATLAB, you can use the `title()` function. For example, the following command will add the title "My Line Plot" to the figure:

```
x = 1:10;  
y = 1:10;  
plot(x, y);  
title('My Line Plot');
```

- How do you add labels to the axes in a figure in MATLAB?

**Answer:**

To add labels to the axes in a figure in MATLAB, you can use the `xlabel()` and `ylabel()` functions. For example, the following commands will add the labels "X-Axis" and "Y-Axis" to the x-axis and y-axis, respectively:

```
x = 1:10;  
y = 1:10;  
plot(x, y);  
xlabel('X-Axis');  
ylabel('Y-Axis');
```

- How do you add a grid to a figure in MATLAB

**Answer:**

To add a grid to a figure in MATLAB, you can use the `grid()` function. For example, the following command will add a grid to the figure:

```
x = 1:10;  
y = 1:10;  
plot(x, y);  
grid on;
```

- What is the difference between a 2D and 3D plot in MATLAB?

**Answer:**

A 2D plot is used to visualize data that has two dimensions, such as height and weight. A 3D plot is used to visualize data that has three dimensions, such as height, weight, and depth.

- What does the hold function do in MATLAB?

## References

- [^1:] [Categorical Arrays - MathWorks Help Center](#)
- [MATLAB Graphics](#)
- [MATLAB: Plotting - tutorialspoint](#)

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