

# MATLAB: Introduction

---

1. MATLAB and basic plotting
2. In-class exercise

---

# **MATLAB: Introduction**

MATLAB and Basic Plotting

# Overview

---

- MATLAB

- » A high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran.

- MATLAB toolboxes

- » Add additional functionality
  - » Statistics toolbox – provides engineers, scientists, researchers, financial analysts, and statisticians with a comprehensive set of tools to assess and understand their data.

- From [www.mathworks.com/](http://www.mathworks.com/)

# MATLAB Window

The image displays the MATLAB 7.11.0 (R2010b) desktop environment. The main window is the Command Window, which contains the following text:

MATLAB desktop keyboard shortcuts, such as Ctrl+S, are now customizable. In addition, many keyboard shortcuts have changed for improved consistency across the desktop.

To customize keyboard shortcuts, use [Preferences](#). From there, you can also restore previous default settings by following the steps outlined in [Help](#).

[Click here](#) if you do not want to see this message again.

```
>> A=[-1 1 2; 3 -1 1; -1 3 4];  
>> b=[2 6 4]';  
>> x=linsolve(A,b)
```

The output of the commands is displayed below the prompt:

```
x =  
  
    1.0000  
   -1.0000  
    2.0000
```

The Workspace window on the right shows the variables defined in the Command Window:

Name	Value	Memory
A	[-1,1,2;3,-1,1;-1,3,4]	-1
b	[2;6;4]	2
x	[1.0000;-1.0000;2.0000]	-1.0

The Command History window at the bottom right shows the commands entered in the Command Window:

```
A=[-1 1 2; 3 -1 1; -1 3 4];  
b=[2 6 4]';  
x=inv(A)*b;  
x=A\b;  
x=linsolve(A,b)  
clear
```

The MATLAB desktop also includes a File Explorer on the left showing the current folder (C:\Users\Mike\Documents\MATLAB\Courses) and a Start button at the bottom left. The Windows taskbar at the bottom shows the Start button and various application icons.

# MATLAB Workspace

---

- Variables are stored in the workspace
  - » **who** – list current variables
  - » **whos** – detailed list of variables
  - » **clear** – removes all variables from the workspace
  - » **clear x** – removes variables x from the workspace
- Matlab files must be in either the working directory or in a directory listed in the search path
  - » **pwd** – displays the current working directory
  - » **what** – lists Matlab specific files in the working directory
  - » **cd** – change current working directory
  - » **path** – displays the current search path
  - » **addpath** – adds specified folders to the search path
  - » **close** – close current window
  - » **close all** – close all open windows except the main window

# MATLAB Help

---

- Within Matlab

- » Type **help** at the Matlab prompt or **help** followed by a function name for help on a specific function

- Online

- » Online documentation for Matlab at the MathWorks website

- <http://www.mathworks.com/access/helpdesk/help/techdoc/matlab.html>

- » There are also numerous tutorials online that are easily found with a web search

# Plotting Commands

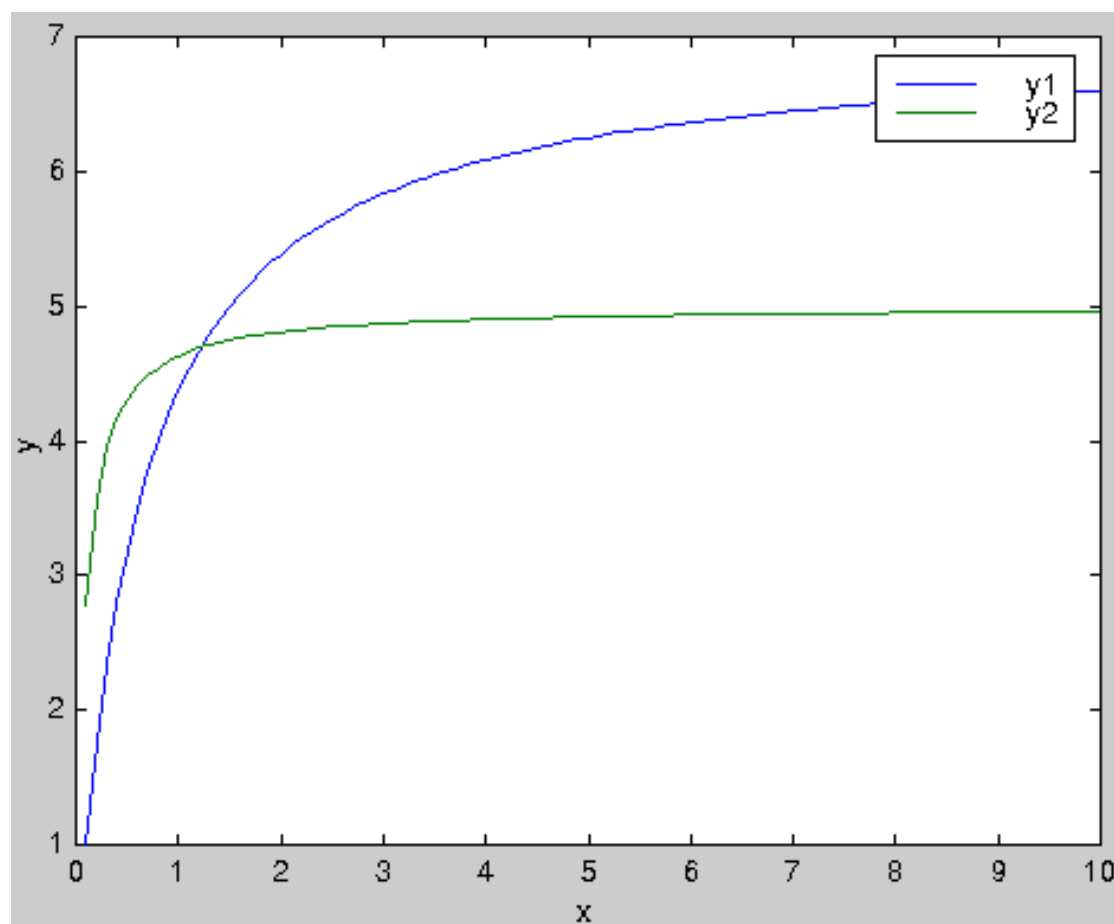
---

- Basic plots and graphs
  - **plot(X,Y)** – plot vectors or matrices
  - **hold** – hold current graph (for multiple plots on same graph)
  - **subplot(m,n,p)** – create axes in tiled positions (for multiple graphs in same figure)
  - **figure** – creates a new figure window (so a new plot does not replace a previous plot)
- Formatting axes
  - **xlim([x y])** – sets the x-axis limits to x and y
  - **ylim([x y])** – sets the y-axis limits to x and y
- Annotating plots
  - **title('Figure Title')**
  - **xlabel('Label for x-axis')**
  - **ylabel('Label for y-axis')**
  - **legend('Name of line 1','Name of line 2')**

# Plotting Two Functions on One Graph

$$y_1 = \frac{7x}{0.6 + x} \quad y_2 = \frac{5x}{0.08 + x}$$

```
» x = [0.1:0.1:10];  
» y1 = 7*x./(0.6 + x);  
» y2 = 5*x ./ (0.08+x);  
» plot(x,y1,x,y2)  
» xlabel('x')  
» ylabel('y')  
» legend('y1','y2')
```

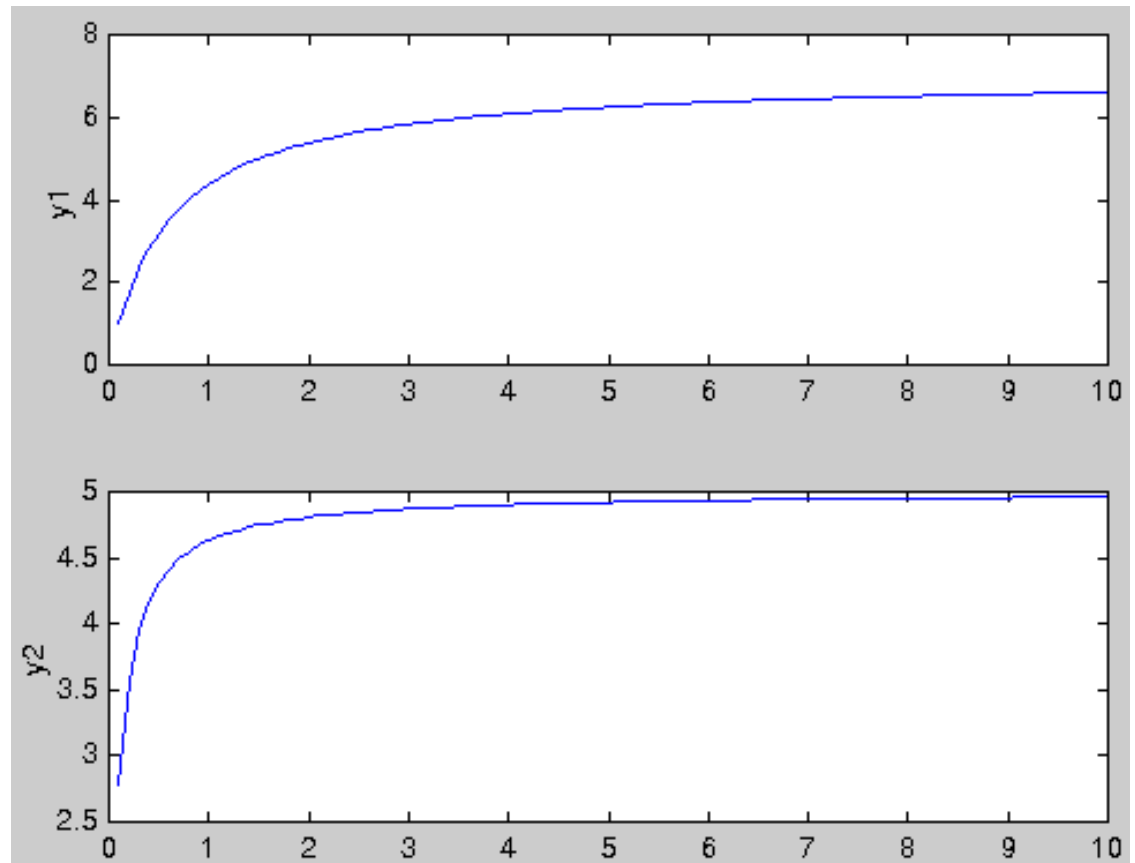




# Plotting Two Functions on Separate Graphs

$$y_1 = \frac{7x}{0.6 + x} \quad y_2 = \frac{5x}{0.08 + x}$$

```
» figure
» subplot(2,1,1)
» plot(x,y1)
» ylabel('y1')
» subplot(2,1,2)
» plot(x,y2)
» ylabel('y2')
```



---

# **MATLAB: Introduction**

In-class Exercise

# The Logistic Equation

---

- The logistic equation is used to model nutrient limited growth of cell populations:

$$\frac{dN}{dt} = \frac{rN(K - N)}{K} \quad N(0) = N_0 \quad \xrightarrow{x \equiv N/K} \quad \frac{dx}{dt} = rx(1 - x) \quad x(0) = x_0$$

- The solution of the logistic equation is:

$$x(t) = \frac{1}{1 + \left( \frac{1}{x_0} - 1 \right) e^{-rt}} \quad \gg x = 1./ (1 + (1/x_0 - 1) * \exp(-r*t));$$

- Plot the solution  $x(t)$  for  $0 < t < 10$ ,  $x_0 = 0.1$  and  $r = 0.5$