

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/

MATLAB Window

Current Folder: C:\Users\Mike\Documents\MATLAB\Courses

Command Window

New to MATLAB? Watch this [Video](#), see [Demos](#), or read [Getting Started](#).

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)

x =

    1.0000
   -1.0000
    2.0000

fx >>
```

Workspace

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

Command History

```
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
%-- 1/3/2015 11:54 AM --
A=[-1 1 2; 3 -1 1; -1 3 4];
b=[2 6 4]';
x=linsolve(A,b)
```

Start

11:54 AM 1/3/2015

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)

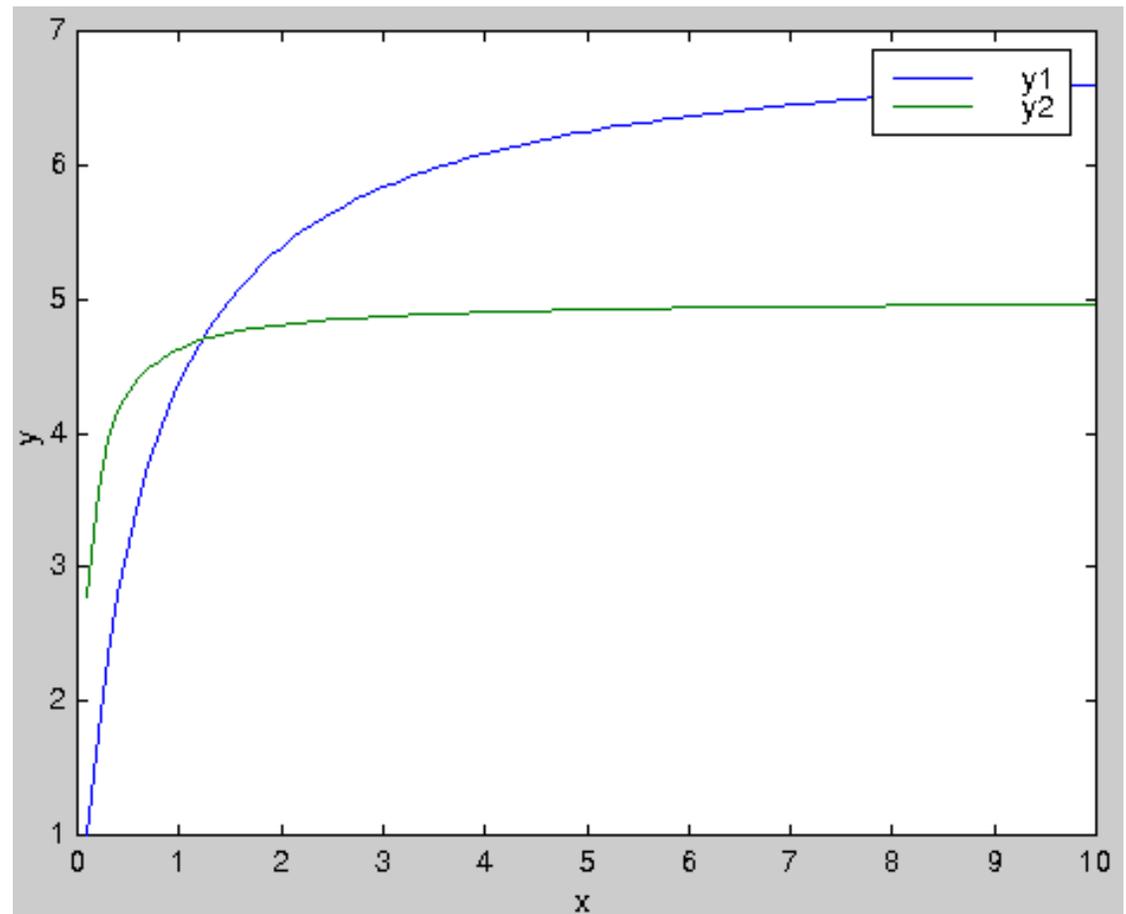
- Formatting axes
 - **xlim([x y])** – sets the x-axis limits to x and y
 - **ylim([x y])** – sets the y-axis limits to x and y

- 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

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

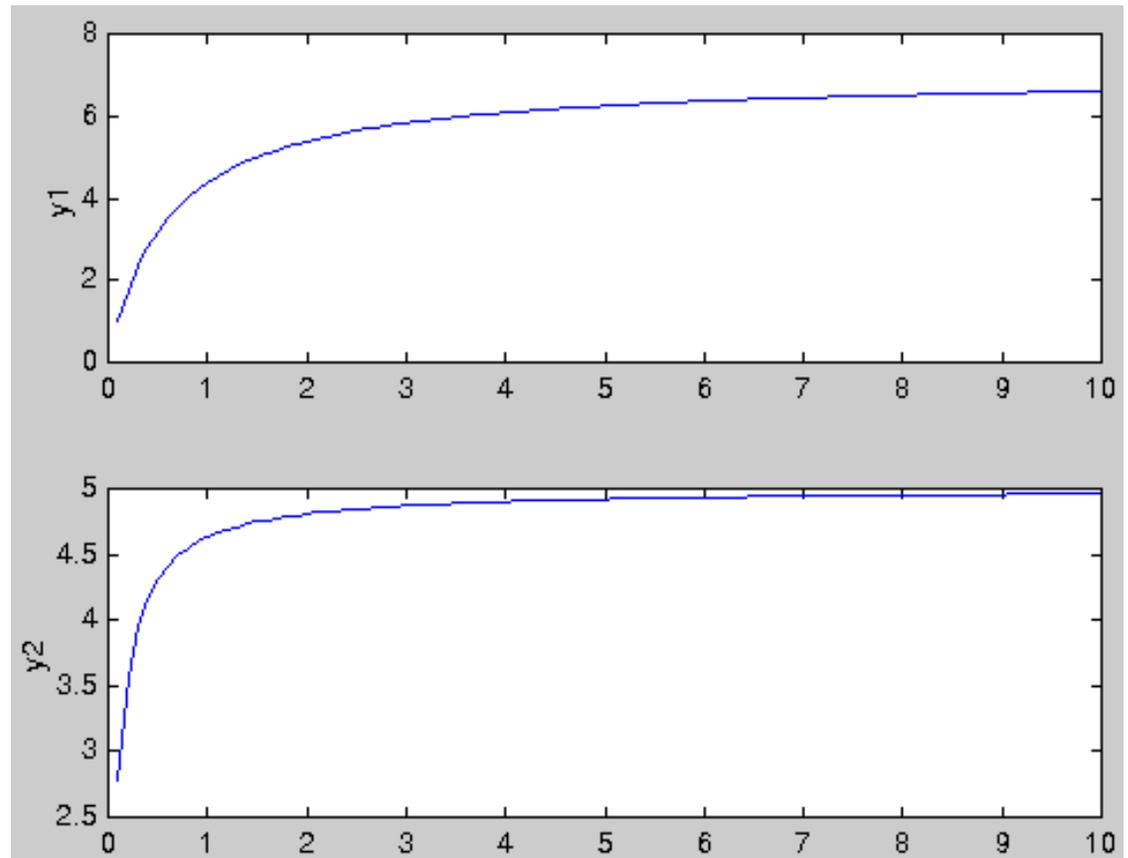
- » `x = [0.1:0.1:10];`
- » `y1 = 7*x./(0.6 + x);`
- » `y2 = 5*x ./ (0.08+x);`
- » `plot(x,y1,x,y2)`
- » `xlabel('x')`
- » `ylabel('y')`
- » `legend('y1','y2')`



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:

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

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