What is MATLAB

- MATLAB stand for Matrix Laboratory
- MATLAB is one of a number of commercially available, sophisticated mathematical computation tools
- MATLAB excels at
  - Numerical calculations, especially matrices
  - Graphics
  - Modeling, development, and verification of systems
  - Engineering problem solving
- Not a general purpose language like C++ or Java
- Other tools like
  - Maple
  - Mathematica
  - MathCad
  - Matrixx

History of MATLAB

- Initially developed by Cleve Moler, a professor of Univ. of New Mexico, for class uses, now chief scientist
- Commercialized by Jack Little, a graduate of MIT and Stanford, now president of Mathworks (mathworks.com)
- Quickly spread in various industry fields
  - Control
  - Signal processing
  - System integration
- Adopted by most engineering schools all over the world
- Originally developed in FORTRAN, letter written in C
  - Similarity in syntax
  - Easy interface to C

Try These …

- Type in MATLAB command window
  - `3*4+5`
  - `sin(pi/4)`
  - `format long`

    `ans`
  - `% MATLAB Script`

    `x = pi/100:pi/100:10*pi`

    `y = sin(x)./x;`

    `plot(x,y)`

    `grid`

Try These …

- Type in MATLAB command window
  - ```
    H = zeros(5);
    for k=1:5
      for m=1:5
        H(k,m) = 1/(k+m-1);
      end
    end
    H
    ```
  - ```
    x = -1:0.05:1;
    y = x;
    [xi, yi] = meshgrid(x,y);
    zi = yi.^2 - xi.^2;
    mesh(xi, yi, zi)
    ```

MATLAB Basic Features

- Command window
- Command history
  - Saves all commands typed in the past
- Current directory
  - Work directory and reference point
- Workspace
  - Saves all variables created or imported in the past
  - Can add/edit variables
  - Try this: `openvar`
  - Try this: import a .jpg
  - Try this: `image(...)`
  - Try this: `clear, clear all, clear ans, clc`
- MATLAB Help

Variables

- No need to declare for type or size
- Variable name starts with a letter, followed by letters, digits, underscores.
- Case sensitive
- Can be scalar (single number) or matrix (multiple numbers)
- Avoid keyword
  - Try this: `iskeyword`
- Avoid using too long names
  - Try this: `namelengthmax`

Numbers

- Special constants

Representation	Definition
`pi`	3.141592653589793
`i or j`	Imaginary unit, $\sqrt{-1}$
`Inf`	Infinity
`NaN`	Not-a-number

- Any numbers

  Try these:

3	-99	0.0001
9.6397238	1.60210e-20	6.02252e23
1i	-3.14159j	3e5i

Operators

Operator	Description
+	Addition
-	Subtraction
*	Multiplication
/	Division
^	Power
( )	Group

Functions and Expressions

- MATLAB has built-in functions
  - Implement various operations automatically
  - Can be used by user directly
  - Try: `help elfun, help specfun, help elmat`
- MATLAB expressions consist of variables, numbers, operators and function calls
- Try these:
  - `rho = (1+sqrt(5))/2`
  - `a = abs(-3+4i)`
  - `B = sin(pi/2)`
  - `c = sind(45)`
  - `Xtream = log(10)`
  - `d = log10(100)`

Matrix

- A matrix is a rectangular array of numbers
  - 1-by-1 matrix – scalars
  - Matrix with only one row or column – vector (1 dimensional array)
  - Matrix with multiple row or column – 2 dimensional array
  - Multiple matrix may be created at the same time
- MATLAB works with entire matrices
  - Other programming languages work with numbers one at a time
- Try these:
  - `arr = [1 2 3; 4 5 6; 7 8 9]`
  - `s = size(arr)` `total_number = prod(size(arr))`
  - `bigger_arr = [arr; arr+10]`
  - `Z = zeros(3, 3)` `id = ones(3, 2, 2)`
  - `mat1 = id(:, :, 1)` `mat2 = mat1(1:2, 1)`
  - `vect1 = [1:14]` `vect2 = [0:0.1:1]`