
6.094

Introduction to Programming in MATLAB

**Lecture 1: Variables, Scripts,
and Operations**

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Course Layout

- Lectures

- 1: Variables, Scripts and Operations
- 2: Visualization and Programming
- 3: Solving Equations, Fitting
- 4: Images, Animations, Advanced Methods
- 5: Optional: Symbolic Math, Simulink

Course Layout

- Problem Sets / Office Hours
 - One per day, should take about 3 hours to do
 - Submit doc or pdf (include code, figures)
 - No set office hours but available by email
- Requirements for passing
 - Attend all lectures
 - Complete all problem sets (-, \checkmark , +)
- Prerequisites
 - Basic familiarity with programming
 - Basic linear algebra, differential equations, and probability

Outline

(1) Getting Started

(2) Scripts

(3) Making Variables

(4) Manipulating Variables

(5) Basic Plotting

Getting Started

- To get MATLAB Student Version for yourself
 - » <https://msca.mit.edu/cgi-bin/matlab>
 - Use VPN client to enable off-campus access
 - Note: MIT certificates are required
- Open up MATLAB for Windows
 - Through the START Menu
- On Athena
 - » `add matlab`
 - » `matlab &`

Current Directory: C:\MATLAB6p5\work

Current directory

Workspace

| Name | Size | Bytes | Class |
|---------|------|-------|--------------|
| a | 1x1 | 8 | double array |
| ans | 1x1 | 8 | double array |
| b | 2x3 | 48 | double array |
| textVar | 1x6 | 12 | char array |

Workspace

Command Window

```
>> a=10;
>> b=[1 3 5; 3 3 2];
>> textVar='matlab'

textVar =

matlab

>> 1+3

ans =

    4

>>
```

Command Window

Command History

```
taylor((x./(14*log10(x)+11.455)),10^(-11.455/14))
syms x
taylor((x./(14*log10(x)+11.455)),10^(-11.455/14))
%-- 6/27/05 11:17 AM --%
load catERBs
w=1./gausswin(54);
plot(w)
%-- 9/21/05 11:53 AM --%
syms('x','d')
syms('a')
int('exp(-x^2/a)',0,d/2)
%-- 12/09/05 1:01 PM --%
clc
a=10;
b=[1 3 5; 3 3 2];
textVar='matlab'
1+3
```

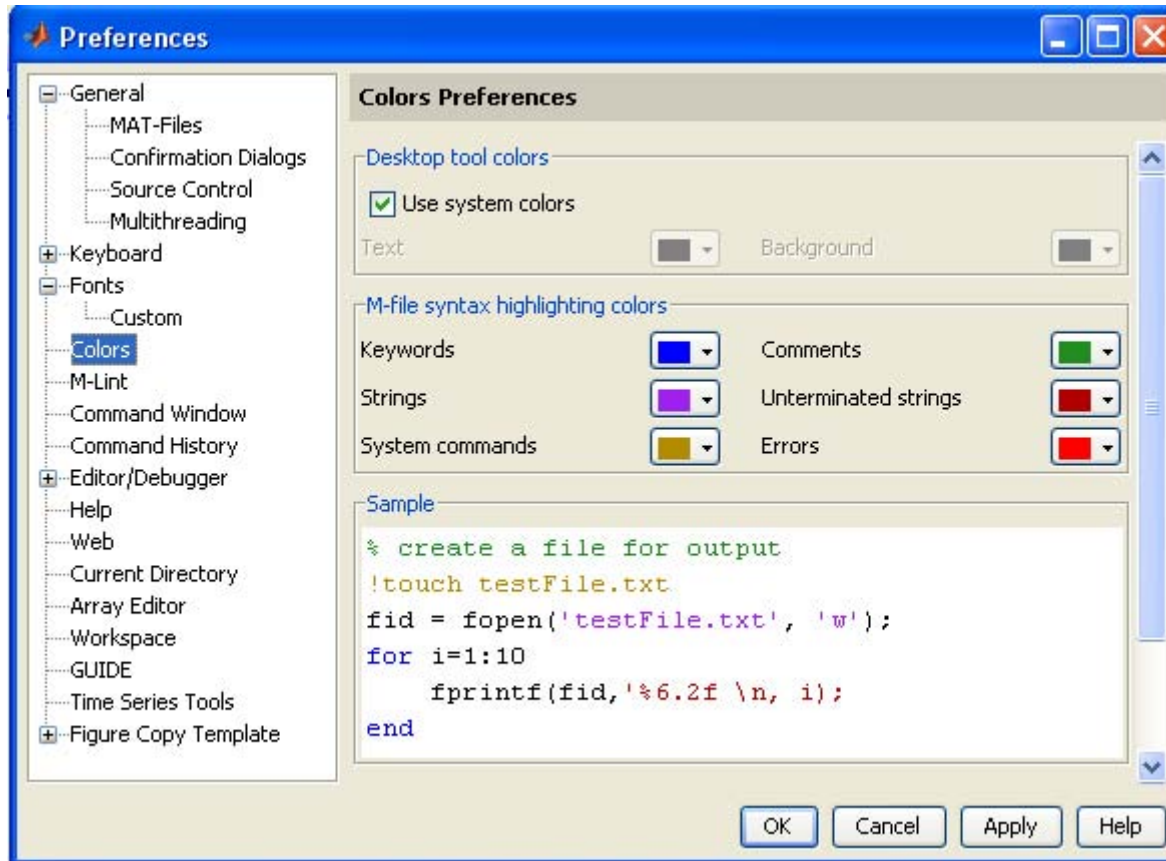
Command History

Making Folders

- Use folders to keep your programs organized
- To make a new folder, click the 'Browse' button next to 'Current Directory'
- Click the 'Make New Folder' button, and change the name of the folder. **Do NOT use spaces** in folder names. In the MATLAB folder, make two new folders: `IAPMATLAB\day1`
- Highlight the folder you just made and click 'OK'
- The current directory is now the folder you just created
- To see programs outside the current directory, they should be in the Path. Use File-> Set Path to add folders to the path

Customization

- File → Preferences
 - Allows you personalize your MATLAB experience



MATLAB Basics

- MATLAB can be thought of as a super-powerful graphing calculator
 - Remember the TI-83 from calculus?
 - With many more buttons (built-in functions)
- In addition it is a programming language
 - MATLAB is an interpreted language, like Java
 - Commands executed line by line

Help / Docs

- `help`
 - **The most** important function for learning MATLAB on your own
- To get info on how to use a function:
 - » `help sin`
 - Help lists related functions at the bottom and links to the doc
- To get a nicer version of help with examples and easy-to-read descriptions:
 - » `doc sin`
- To search for a function by specifying keywords:
 - » `doc` + Search tab

Outline

(1) Getting Started

(2) Scripts

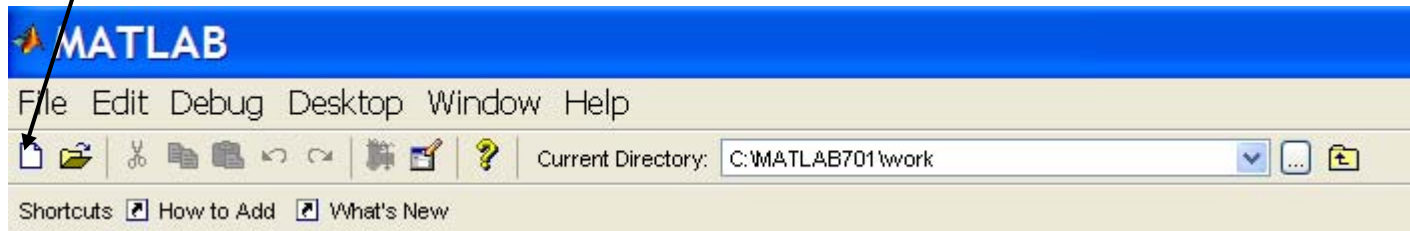
(3) Making Variables

(4) Manipulating Variables

(5) Basic Plotting

Scripts: Overview

- Scripts are
 - collection of commands executed in sequence
 - written in the MATLAB editor
 - saved as MATLAB files (.m extension)
- To create an MATLAB file from command-line
 - » `edit helloWorld.m`
- or click



Scripts: the Editor

Line numbers

MATLAB file path

Debugging tools

* Means that it's not saved

Real-time error check

Help file

Comments

Possible breakpoints

```
1 % coinToss.m
2 % a script that flips a fair coin and displays the output
3
4 - if rand<0.5 % if a random number is less than .5 say heads
5 -     disp('HEADS');
6 - else % if greater than 0.5 say tails
7 -     disp('TAILS');
8 - end
```

script Ln 8 Col 4 OVR

Scripts: Some Notes

- **COMMENT!**

- Anything following a **%** is seen as a comment
- The first contiguous comment becomes the script's help file
- Comment thoroughly to avoid wasting time later

- Note that scripts are somewhat static, since there is no input and no explicit output

- All variables created and modified in a script exist in the workspace even after it has stopped running

Exercise: Scripts

Make a `helloWorld` script

- When run, the script should display the following text:

Hello World!

I am going to learn MATLAB!

- **Hint:** use `disp` to display strings. Strings are written between single quotes, like `'This is a string'`

Exercise: Scripts

Make a `helloWorld` script

- When run, the script should display the following text:

Hello World!

I am going to learn MATLAB!

- **Hint:** use `disp` to display strings. Strings are written between single quotes, like `'This is a string'`
- Open the editor and save a script as `helloWorld.m`. This is an easy script, containing two lines of code:
 - » `% helloWorld.m`
 - » `% my first hello world program in MATLAB`

 - » `disp('Hello World!');`
 - » `disp('I am going to learn MATLAB!');`

Outline

- (1) Getting Started
- (2) Scripts
- (3) Making Variables**
- (4) Manipulating Variables
- (5) Basic Plotting

Variable Types

- MATLAB is a weakly typed language
 - No need to initialize variables!
- MATLAB supports various types, the most often used are
 - » `3.84`
 - 64-bit double (default)
 - » `'a'`
 - 16-bit char
- Most variables you'll deal with will be vectors or matrices of doubles or chars
- Other types are also supported: complex, symbolic, 16-bit and 8 bit integers, etc. You will be exposed to all these types through the homework

Naming variables

- To create a variable, simply assign a value to a name:
 - » `var1=3.14`
 - » `myString='hello world'`
- Variable names
 - first character must be a LETTER
 - after that, any combination of letters, numbers and `_`
 - CASE SENSITIVE! (`var1` is different from `Var1`)
- Built-in variables. Don't use these names!
 - `i` and `j` can be used to indicate complex numbers
 - `pi` has the value 3.1415926...
 - `ans` stores the last unassigned value (like on a calculator)
 - `Inf` and `-Inf` are positive and negative infinity
 - `NaN` represents 'Not a Number'

Scalars

- A variable can be given a value explicitly
 - » `a = 10`
 - shows up in workspace!
- Or as a function of explicit values and existing variables
 - » `c = 1.3*45-2*a`
- To suppress output, end the line with a semicolon
 - » `cooldude = 13/3;`

Arrays

- Like other programming languages, arrays are an important part of MATLAB
- Two types of arrays

(1) matrix of numbers (either double or complex)

(2) cell array of objects (more advanced data structure)

**MATLAB makes vectors easy!
That's its power!**



Row Vectors

- Row vector: comma or space separated values between brackets

```
» row = [1 2 5.4 -6.6]
```

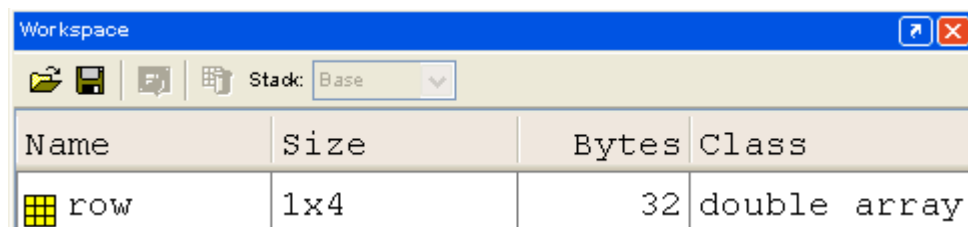
```
» row = [1, 2, 5.4, -6.6];
```

- Command window: `>> row=[1 2 5.4 -6.6]`

```
row =
```

```
1.0000    2.0000    5.4000   -6.6000
```

- Workspace:



| Name | Size | Bytes | Class |
|------|------|-------|--------------|
| row | 1x4 | 32 | double array |

Column Vectors

- Column vector: semicolon separated values between brackets

» `column = [4;2;7;4]`

- Command window: `>> column=[4;2;7;4]`

```
column =
```

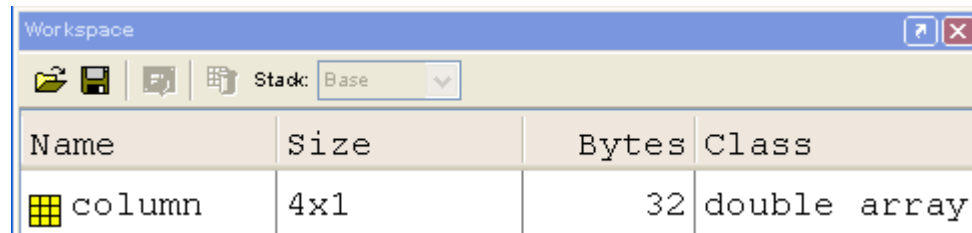
```
4
```


```
2
```

```
7
```

```
4
```

- Workspace:



| Name | Size | Bytes | Class |
|--|------|-------|--------------|
|  column | 4x1 | 32 | double array |

size & length

- You can tell the difference between a row and a column vector by:
 - Looking in the workspace
 - Displaying the variable in the command window
 - Using the size function

```
>> size(row)           >> size(column)

ans =

     1     4           ans =

     4     1
```

- To get a vector's length, use the length function

```
>> length(row)        >> length(column)

ans =

     4           ans =

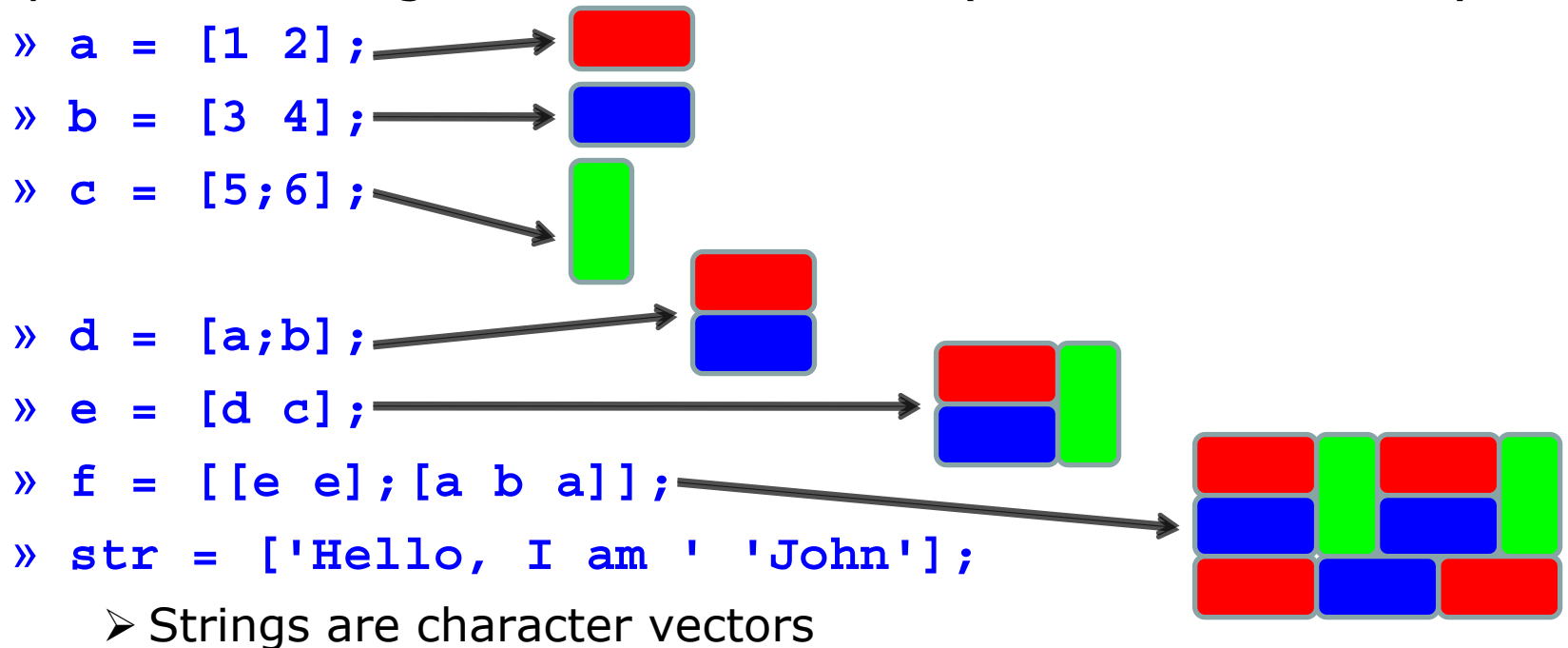
     4
```


Matrices

- Make matrices like vectors

- Element by element
» `a = [1 2; 3 4];` → $a = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

- By concatenating vectors or matrices (dimension matters)



save/clear/load

- Use **save** to save variables to a file
 - » `save myFile a b`
 - saves variables a and b to the file myfile.mat
 - myfile.mat file is saved in the current directory
 - Default working directory is
 - » `\MATLAB`
 - Make sure you're in the desired folder when saving files. Right now, we should be in:
 - » `MATLAB\IAPMATLAB\day1`
- Use **clear** to remove variables from environment
 - » `clear a b`
 - look at workspace, the variables a and b are gone
- Use **load** to load variable bindings into the environment
 - » `load myFile`
 - look at workspace, the variables a and b are back
- Can do the same for entire environment
 - » `save myenv; clear all; load myenv;`

Exercise: Variables

Get and save the current date and time

- Create a variable `start` using the function `clock`
- What is the size of `start`? Is it a row or column?
- What does `start` contain? See `help clock`
- Convert the vector `start` to a string. Use the function `datestr` and name the new variable `startString`
- Save `start` and `startString` into a mat file named `startTime`

Exercise: Variables

Get and save the current date and time

- Create a variable `start` using the function `clock`
- What is the size of `start`? Is it a row or column?
- What does `start` contain? See `help clock`
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- Save `start` and `startString` into a mat file named `startTime`

» `help clock`

» `start=clock;`

» `size(start)`

» `help datestr`

» `startString=datestr(start);`

» `save startTime start startString`

Exercise: Variables

Read in and display the current date and time

- In `helloWorld.m`, read in the variables you just saved using `load`
- Display the following text:
I started learning MATLAB on *start date and time*
- **Hint:** use the `disp` command again, and remember that strings are just vectors of characters so you can join two strings by making a row vector with the two strings as sub-vectors.

Exercise: Variables

Read in and display the current date and time

- In `helloWorld.m`, read in the variables you just saved using `load`
- Display the following text:
I started learning MATLAB on *start date and time*
- **Hint:** use the `disp` command again, and remember that strings are just vectors of characters so you can join two strings by making a row vector with the two strings as sub-vectors.

```
» load startTime
```

```
» disp(['I started learning MATLAB on ' ...  
startString]);
```

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Basic Scalar Operations

- Arithmetic operations (+, -, *, /)
 - » `7/45`
 - » `(1+i)*(2+i)`
 - » `1 / 0`
 - » `0 / 0`
- Exponentiation (^)
 - » `4^2`
 - » `(3+4*j)^2`
- Complicated expressions, use parentheses
 - » `((2+3)*3)^0.1`
- Multiplication is NOT implicit given parentheses
 - » `3(1+0.7)` gives an error
- To clear command window
 - » `clc`

Built-in Functions

- MATLAB has an **enormous** library of built-in functions
- Call using parentheses – passing parameter to function
 - » `sqrt(2)`
 - » `log(2)`, `log10(0.23)`
 - » `cos(1.2)`, `atan(-.8)`
 - » `exp(2+4*i)`
 - » `round(1.4)`, `floor(3.3)`, `ceil(4.23)`
 - » `angle(i)`; `abs(1+i)`;

Exercise: Scalars

You will learn MATLAB at an exponential rate! Add the following to your helloWorld script:

- Your learning time constant is **1.5 days**. Calculate the number of **seconds** in 1.5 days and name this variable **tau**
- This class lasts 5 days. Calculate the number of seconds in 5 days and name this variable **endOfClass**
- This equation describes your knowledge as a function of time t:

$$k = 1 - e^{-t/\tau}$$

- How well will you know MATLAB at **endOfClass**? Name this variable **knowledgeAtEnd**. (use **exp**)
- Using the value of **knowledgeAtEnd**, display the phrase:

At the end of 6.094, I will know X% of MATLAB

- **Hint:** to convert a number to a string, use **num2str**

Exercise: Scalars

```
» secPerDay=60*60*24;
» tau=1.5*secPerDay;
» endOfClass=5*secPerDay
» knowledgeAtEnd=1-exp(-endOfClass/tau);
» disp(['At the end of 6.094, I will know ' ...
num2str(knowledgeAtEnd*100) '% of MATLAB'])
```

Transpose

- The transpose operators turns a column vector into a row vector and vice versa
 - » `a = [1 2 3 4+i]`
 - » `transpose(a)`
 - » `a'`
 - » `a.'`
- The `'` gives the Hermitian-transpose, i.e. transposes and conjugates all complex numbers
- For vectors of real numbers `.'` and `'` give same result

Addition and Subtraction

- Addition and subtraction are element-wise; sizes must match (unless one is a scalar):

$$\begin{array}{r} [12 \quad 3 \quad 32 \quad -11] \\ + [2 \quad 11 \quad -30 \quad 32] \\ \hline = [14 \quad 14 \quad 2 \quad 21] \end{array}$$

$$\begin{bmatrix} 12 \\ 1 \\ -10 \\ 0 \end{bmatrix} - \begin{bmatrix} 3 \\ -1 \\ 13 \\ 33 \end{bmatrix} = \begin{bmatrix} 9 \\ 2 \\ -23 \\ -33 \end{bmatrix}$$

- The following would give an error
 - » `c = row + column`
- Use the transpose to make sizes compatible
 - » `c = row' + column`
 - » `c = row + column'`
- Can sum up or multiply elements of vector
 - » `s=sum(row) ;`
 - » `p=prod(row) ;`

Element-Wise Functions

- All the functions that work on scalars also work on vectors
 - » `t = [1 2 3];`
 - » `f = exp(t);`
 - is the same as
 - » `f = [exp(1) exp(2) exp(3)];`
- If in doubt, check a function's help file to see if it handles vectors elementwise
- Operators (`*` / `^`) have two modes of operation
 - element-wise
 - standard

Operators: element-wise

- To do element-wise operations, use the dot: `.*`, `./`, `.^`. BOTH dimensions must match (unless one is scalar)!
 - » `a=[1 2 3];b=[4;2;1];`
 - » `a.*b`, `a./b`, `a.^b` → all errors
 - » `a.*b'`, `a./b'`, `a.^(b')` → all valid

$$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} .* \begin{bmatrix} 4 \\ 2 \\ 1 \end{bmatrix} = \text{ERROR}$$

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} .* \begin{bmatrix} 4 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 4 \\ 4 \\ 3 \end{bmatrix}$$

$$3 \times 1 .* 3 \times 1 = 3 \times 1$$

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix} .* \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$$

$$3 \times 3 .* 3 \times 3 = 3 \times 3$$

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

Can be any dimension

Operators: standard

- Multiplication can be done in a standard way or element-wise
- Standard multiplication ($*$) is either a dot-product or an outer-product
 - Remember from linear algebra: inner dimensions must MATCH!!
- Standard exponentiation ($^{\wedge}$) can only be done on square matrices or scalars
- Left and right division ($/$ \backslash) is same as multiplying by inverse
 - Our recommendation: just multiply by inverse (more on this later)

$$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} * \begin{bmatrix} 4 \\ 2 \\ 1 \end{bmatrix} = 11$$

$1 \times 3 * 3 \times 1 = 1 \times 1$

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} ^{\wedge} 2 = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} * \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

Must be square to do powers

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix} * \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 3 & 6 & 9 \\ 6 & 12 & 18 \\ 9 & 18 & 27 \end{bmatrix}$$

$3 \times 3 * 3 \times 3 = 3 \times 3$

Exercise: Vector Operations

Calculate how many seconds elapsed since the start of class

- In `helloWorld.m`, make variables called `secPerMin`, `secPerHour`, `secPerDay`, `secPerMonth` (assume 30.5 days per month), and `secPerYear` (12 months in year), which have the number of seconds in each time period.
- Assemble a row vector called `secondConversion` that has elements in this order: `secPerYear`, `secPerMonth`, `secPerDay`, `secPerHour`, `secPerMinute`, `1`.
- Make a `currentTime` vector by using `clock`
- Compute `elapsedTime` by subtracting `currentTime` from `start`
- Compute `t` (the elapsed time in seconds) by taking the dot product of `secondConversion` and `elapsedTime` (transpose one of them to get the dimensions right)

Exercise: Vector Operations

```
» secPerMin=60;
» secPerHour=60*secPerMin;
» secPerDay=24*secPerHour;
» secPerMonth=30.5*secPerDay;
» secPerYear=12*secPerMonth;
» secondConversion=[secPerYear secPerMonth ...
    secPerDay secPerHour secPerMin 1];
» currentTime=clock;
» elapsedTime=currentTime-start;
» t=secondConversion*elapsedTime';
```

Exercise: Vector Operations

Display the current state of your knowledge

- Calculate `currentKnowledge` using the same relationship as before, and the `t` we just calculated:

$$k = 1 - e^{-t/\tau}$$

- Display the following text:

At this time, I know X% of MATLAB

Exercise: Vector Operations

Display the current state of your knowledge

- Calculate `currentKnowledge` using the same relationship as before, and the `t` we just calculated:

$$k = 1 - e^{-t/\tau}$$

- Display the following text:

At this time, I know X% of MATLAB

```
» currentKnowledge=1-exp(-t/tau);  
» disp(['At this time, I know ' ...  
    num2str(currentKnowledge*100) '% of MATLAB']);
```

Automatic Initialization

- Initialize a vector of **ones**, **zeros**, or **random** numbers
 - » `o=ones(1,10)`
 - row vector with 10 elements, all 1
 - » `z=zeros(23,1)`
 - column vector with 23 elements, all 0
 - » `r=rand(1,45)`
 - row vector with 45 elements (uniform [0,1])
 - » `n=nan(1,69)`
 - row vector of NaNs (useful for representing uninitialized variables)

The general function call is:

```
var=zeros(M,N);
```

Number of rows

Number of columns

Automatic Initialization

- To initialize a linear vector of values use **linspace**
 - » `a=linspace(0,10,5)`
 - starts at 0, ends at 10 (inclusive), 5 values
- Can also use colon operator (`:`)
 - » `b=0:2:10`
 - starts at 0, increments by 2, and ends at or before 10
 - increment can be decimal or negative
 - » `c=1:5`
 - if increment isn't specified, default is 1
- To initialize logarithmically spaced values use **logspace**
 - similar to **linspace**, but see **help**

Exercise: Vector Functions

Calculate your learning trajectory

- In `helloWorld.m`, make a linear time vector `tVec` that has 10,000 samples between 0 and `endOfClass`
- Calculate the value of your knowledge (call it `knowledgeVec`) at each of these time points using the same equation as before:

$$k = 1 - e^{-t/\tau}$$

Exercise: Vector Functions

Calculate your learning trajectory

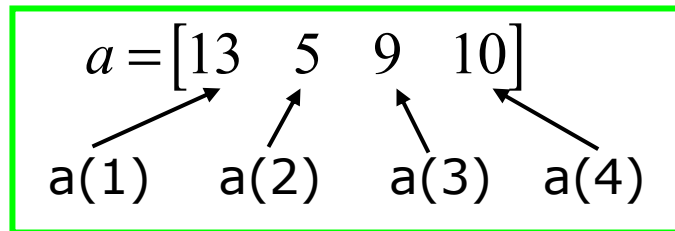
- In `helloWorld.m`, make a linear time vector `tVec` that has 10,000 samples between 0 and `endOfClass`
- Calculate the value of your knowledge (call it `knowledgeVec`) at each of these time points using the same equation as before:

$$k = 1 - e^{-t/\tau}$$

```
» tVec = linspace(0, endOfClass, 10000);  
» knowledgeVec = 1 - exp(-tVec/tau);
```


Vector Indexing

- MATLAB indexing starts with **1**, not **0**
 - We will not respond to any emails where this is the problem.
- $a(n)$ returns the n^{th} element



- The index argument can be a vector. In this case, each element is looked up individually, and returned as a vector of the same size as the index vector.
 - » $x = [12 \ 13 \ 5 \ 8];$
 - » $a = x(2:3);$ —————→ $a = [13 \ 5];$
 - » $b = x(1:end-1);$ —————→ $b = [12 \ 13 \ 5];$

Matrix Indexing

- Matrices can be indexed in two ways
 - using **subscripts** (row and column)
 - using linear **indices** (as if matrix is a vector)
- Matrix indexing: **subscripts** or **linear indices**

$$\begin{array}{l} b(1,1) \longrightarrow \begin{bmatrix} 14 & 33 \\ 9 & 8 \end{bmatrix} \longleftarrow b(1,2) \\ b(2,1) \longrightarrow \quad \quad \quad \longleftarrow b(2,2) \end{array}$$

$$\begin{array}{l} b(1) \longrightarrow \begin{bmatrix} 14 & 33 \\ 9 & 8 \end{bmatrix} \longleftarrow b(3) \\ b(2) \longrightarrow \quad \quad \quad \longleftarrow b(4) \end{array}$$

- Picking submatrices
 - » `A = rand(5)` % shorthand for 5x5 matrix
 - » `A(1:3,1:2)` % specify contiguous submatrix
 - » `A([1 5 3], [1 4])` % specify rows and columns

Advanced Indexing 1

- To select rows or columns of a matrix, use the `:`

$$c = \begin{bmatrix} 12 & 5 \\ -2 & 13 \end{bmatrix}$$

» `d=c(1, :)` ;  `d=[12 5]` ;

» `e=c(:, 2)` ;  `e=[5;13]` ;

» `c(2, :)= [3 6]` ; `%replaces second row of c`

Advanced Indexing 2

- MATLAB contains functions to help you find desired values within a vector or matrix
 - » `vec = [5 3 1 9 7]`
- To get the minimum value and its index:
 - » `[minVal,minInd] = min(vec);`
 - `max` works the same way
- To find any the indices of specific values or ranges
 - » `ind = find(vec == 9);`
 - » `ind = find(vec > 2 & vec < 6);`
 - **find** expressions can be very complex, more on this later
- To convert between subscripts and indices, use **ind2sub**, and **sub2ind**. Look up **help** to see how to use them.

Exercise: Indexing

When will you know 50% of MATLAB?

- First, find the index where `knowledgeVec` is closest to 0.5. Mathematically, what you want is the index where the value of $|knowledgeVec - 0.5|$ is at a minimum (use `abs` and `min`).
- Next, use that index to look up the corresponding time in `tVec` and name this time `halfTime`.
- Finally, display the string: I will know half of MATLAB after X days
Convert `halfTime` to days by using `secPerDay`

Exercise: Indexing

When will you know 50% of MATLAB?

- First, find the index where `knowledgeVec` is closest to 0.5. Mathematically, what you want is the index where the value of $|knowledgeVec - 0.5|$ is at a minimum (use `abs` and `min`).
- Next, use that index to look up the corresponding time in `tVec` and name this time `halfTime`.
- Finally, display the string: I will know half of MATLAB after X days
Convert `halfTime` to days by using `secPerDay`

```
» [val, ind] = min(abs(knowledgeVec - 0.5));  
» halfTime = tVec(ind);  
» disp(['I will know half of MATLAB after ' ...  
num2str(halfTime/secPerDay) ' days']);
```

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Did everyone sign in?

Plotting

- Example
 - » `x=linspace(0,4*pi,10);`
 - » `y=sin(x);`
- Plot values against their index
 - » `plot(y);`
- Usually we want to plot y versus x
 - » `plot(x,y);`

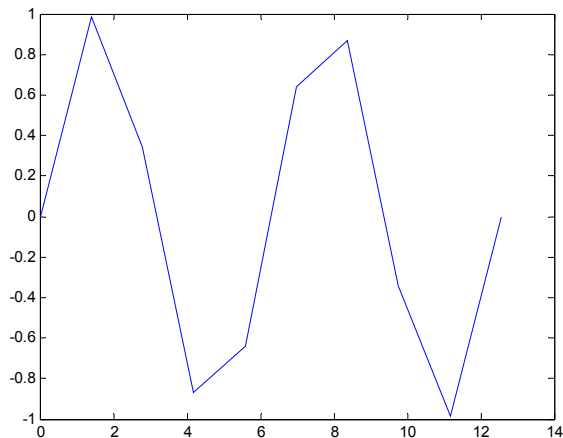
**MATLAB makes visualizing data
fun and easy!**



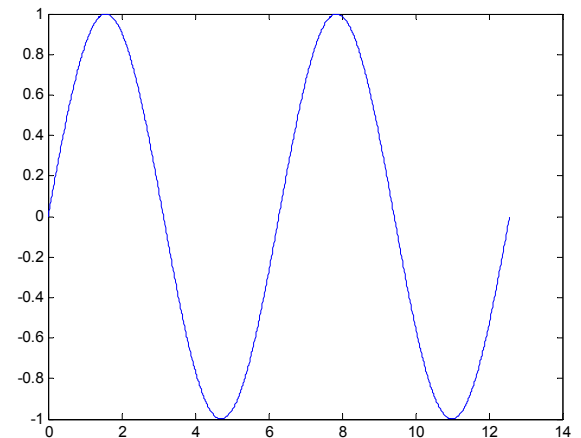
What does plot do?

- **plot** generates dots at each (x,y) pair and then connects the dots with a line
- To make plot of a function look smoother, evaluate at more points
 - » `x=linspace(0,4*pi,1000);`
 - » `plot(x,sin(x));`
- x and y vectors must be same size or else you'll get an error
 - » `plot([1 2], [1 2 3])`
 - error!!

10 x values:



1000 x values:



Exercise: Plotting

Plot the learning trajectory

- In `helloWorld.m`, open a new figure (use `figure`)
- Plot the knowledge trajectory using `tVec` and `knowledgeVec`. When plotting, convert `tVec` to days by using `secPerDay`
- Zoom in on the plot to verify that `halfTime` was calculated correctly

Exercise: Plotting

Plot the learning trajectory

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- Zoom in on the plot to verify that `halfTime` was calculated correctly

» `figure`

» `plot(tVec/secPerDay, knowledgeVec);`

End of Lecture 1

- (1) Getting Started
- (2) Scripts
- (3) Making Variables
- (4) Manipulating Variables
- (5) Basic Plotting

Hope that wasn't too much!!



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6.094 Introduction to MATLAB®

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