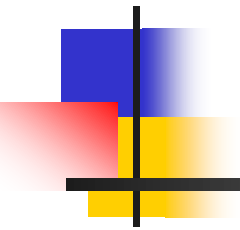
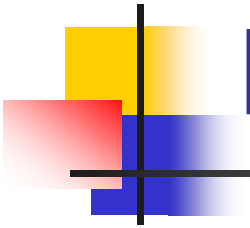


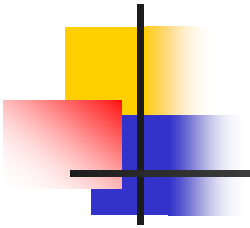
MATLAB

Lecture 1
MATLAB Environment

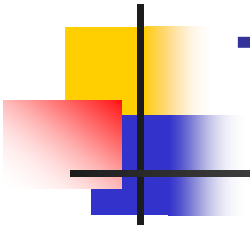


MATLAB

- Full name is **MAT**rix **LAB**oratory
- Excels in numerical calculations especially in matrix calculations and graphics
- Excellent Programming
- MATLAB executes program faster than similar program written in a high-level language



- Symbolic calculations
  - Symbolic algebra
  - Solve equation
  - Differentiation and Integration
- Can not work with units like MathCAD
  - You need to convert the units of all the variables to same system of unit



Three Windows:

- Command Window (the default)
  - Perform calculations the way a scientific calculator does
- Graphics Window (opens when you plot)
- Edit Window (opens when you type "edit" in the Command Window or by choosing ***File/New/m-file*** from menu)

Three Utilities:

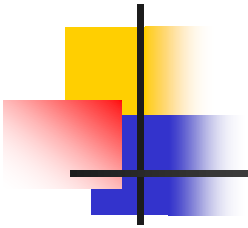
- **Workspace window**

  (allows you to view all of the variables in your workspace, i.e. keeps track of all variables)
- **Command History Window**

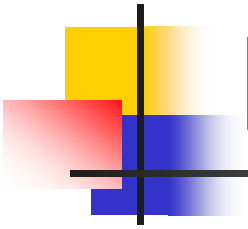
  (lists the commands that have been entered in previously)
- **Current Directory Window**

  (lets you see files and subdirectories)

MATLAB's Five Step Problem Solving Methodology

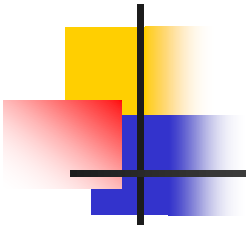


1. State the problem clearly.
2. Describe the input and output information.
3. Work the problem by hand for a simple set of data.
4. Develop a MATLAB solution.
5. Test the solution with a variety of data.



MATLAB Basics

- To repeat a command that you have entered in the Command Window use up and down arrow keys

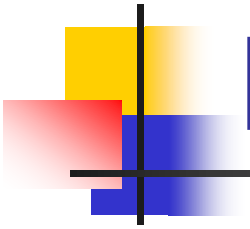


MATLAB Basics:

Start your program with these commands…

- clc (clears the Command Window but not the Command History Window)
- clf (clears the Graph Window)

NOTE: Typing "clear" permanently clears ALL the variables! BIG difference!!!



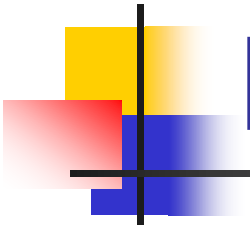
MATLAB Basics:

- To enter comments in order to help in reading MATLAB statements,

  type % first,then your comments…

Note: If done correctly,

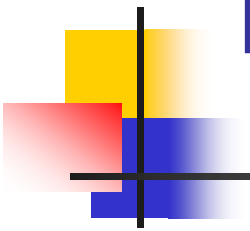
your comments will change color!



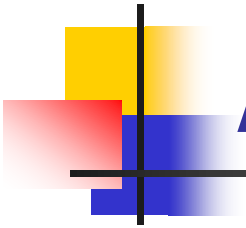
MATLAB Basics:

- Lets assign a value to a variable
  - x = 3
- then MATLAB will print the value of x on the screen unless we suppress the printing by typing a semicolon (;) at end of each of statement…
  - x = 3; MATLAB will not print the value

MATLAB Variables

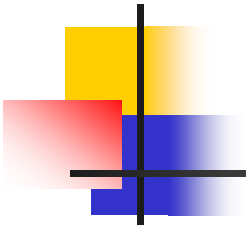


- Names must start with a letter
- Names are case sensitive
- Names can contain letters, digits and underscore (_)
- Names can not be any of MATLAB's keywords
- Avoid to use name of a build-in function
- Names can contain up to 63 characters



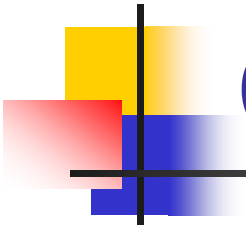
Arithmetic Operations

- Addition: a + b
- Subtraction: a – b
- Multiplication: a * b
- Division: a / b
- Exponentiation: a ^ b
- Order of operations is same as algebra
- MATLAB does not read white space. It will be easier to read a long expression if you add spaces between numbers and operators



MATLAB Basics:

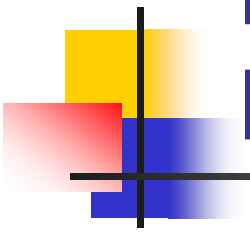
- In MATLAB you represent data by using a MATRIX.
- The data in a Matrix are written in brackets:
  - C = [-1 0 0;3 0 1]
  - Use space or , between the elements in a row
  - Use ; to separate two rows
  - C = [-1 0 0;
    3 0 1] helpful to keep track of each row



Colon Operator

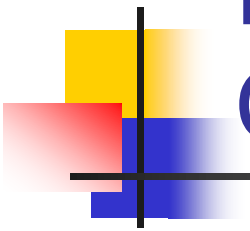
- Use to define a range (like .. in MathCAD)
- A = 1:5
  - Means A = 1, 2, 3, 4, 5
  - By default the increment is 1
- A = 1:2:5
  - The middle number is the increment
  - So, A = 1, 3, 5

Four Ways to Write a Matrix in MATLAB



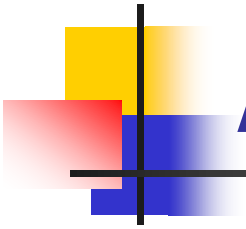
- Explicitly list: C=[3, 4;2, 5]
- Import data from a file…
- Implement the Colon Operator D=[2:5] (returns a row matrix)
- Simply prompt the user to enter data from the keyboard…(Use the Input function)

Make the USER Do the Work of Creating a Matrix



- For this example, let M be your matrix variable…
- Type the following:

  M=input('Enter values for M in brackets:');
- Note: The user can see what is within the quotes ''



Array operations

- If you want element-by-element operation for an array use .
  - A.*B element-by-element multiplication
  - A./B element-by-element division
  - A.^3 exponentiation of individual elements
  - But for addition and subtraction use A+B
  - To multiply or divide each elements of array A by a constant number use 2.5*A

Format the results

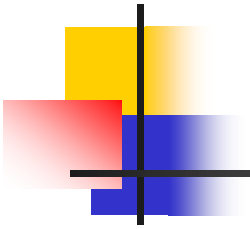
- format long: 14 decimal places
- format short: 4 decimal places (default)
- format short e: 4 exponential places
- format long e: 14 exponential places
- format compact: compact form
- format +: shows + or – sign without the number

Write your results in a Table

- Use commands as follows

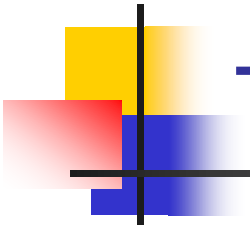
```
time = 0:2:20 ;
distance = 0.5 * 9.81 * time .^ 2 ;
%create a table of time and distance
table = [time', distance']
```

- time is a row vector, time' is a column vector
- Transpose operator is '



Saving your works

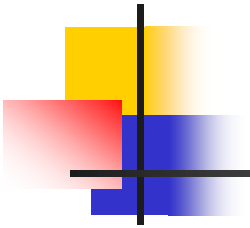
- You can save the variables used in Command Window in a .mat file
  - save filename
  - MATLAB will save it as filename.mat (binary file)
  - Or choose *File/Save Workspace As* from menu
- To restore the data from filename.mat
  - load filename
- If you want to save only a few variables
  - save filename A B



The Command Window

- Execute typed in commands and see the results immediately.
- Execute or run M-Files and see the results. (type the M-File name without .m extension)
- Save ONLY variables or data.
- Cannot save comments

The M-FILE (another way to save your work)



- Enter Commands just like Command Window.
- Save comments, equations and variables
- Create programs and save.
- Run your M-File. (click on "*Debug/Run*")
  - Can also run from Command Window
- NOTE: You CANNOT see the results of your program here…
- The results will be written in the Command Window

Some useful Commands

- exit, quit : terminates MATLAB
- help : help utility
- pi : π
- who : lists variable in memory
- ans : default variable name for results
- what : gives the current directory
- clc : clears the command window