COMPUTATIONAL MATHEMATICS LABORATORY

LAB MANUAL

Year	:	2017 - 2018
Course Code	:	AHS102
Regulations	:	R16
Class	:	B.Tech I Semester
Branch	:	CSE / IT / ECE / EEE

Prepared By
Mr. G. Nagendra Kumar, Assistant Professor

FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

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Program Outcomes	
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutionsin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineeringcommunity and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

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Program Specific Outcomes - Aeronautical Engineering	
PSO1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products
PSO2	**Problem solving skills**: imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles
PSO3	**Practical implementation and testing skills**: Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies.
PSO4	**Successful career and entrepreneurship**: To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats
Program Specific Outcomes - Computer Science And Engineering	
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.
PSO2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.
Program Specific Outcomes - Information Technology	
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.
PSO2	**Software Engineering practices:** The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success.
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.
Program Specific Outcomes - Electronics And Communication Engineering	
PSO1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.
PSO2	**Problem-solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.
PSO3	**Successful Career and Entrepreneurship:**An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur

Program Specific Outcomes - Electrical And Electronics Engineering	
PSO1	**Professional Skills:**Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based team work.
PSO2	**Problem-Solving Skills:** Can explore the scientific theories, ideas, methodologies and the new cutting edge technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally.
PSO3	**Successful Career and Entrepreneurship:** The understanding of technologies like PLC, PMC, process controllers, transducers and HMI one can analyze, design electrical and electronics principles to install, test , maintain power system and applications.
Program Specific Outcomes - Mechanical Engineering	
PSO1	To produce engineering professional capable of analyzing and synthesizing mechanical systems including allied engineering streams.
PSO2	An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.
PSO3	To build the nation, by imparting technological inputs and managerial skills to become technocrats.
Program Specific Outcomes - Civil Engineering	
PSO1	**Engineering Knowledge:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.
PSO2	**Broadness and Diversity:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.
PSO3	**Self-Learning and Service:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.

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Certificate

This is to certify that it is a bonafied record of practical work done by Sri/Kum. _____ bearing the Roll No. _____ of _____ class _____ branch in the _____ laboratory during the academic year _____ under our supervision.

Head of the Department **Lecturer In-Charge**

External Examiner **Internal Examiner**

ATTAINMENT OF PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

Expt. No.	Program Outcomes Attained	Program Specific Outcomes Attained			
		CSE	ECE	EEE	IT
I	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
II	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
III	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
IV	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
V	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
VI	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
VII	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
VIII	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
IX	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
X	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
XI	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2
XII	PO1, PO2, PO3, PO4, PO5, PO9, PO12	PSO1, PSO2	PSO2	PSO3	PSO1, PSO2

COMPUTATIONAL MATHEMATICS LABORATORY SYLLABUS

Recommended Systems/Software Requirements:

Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100MB free disk space. MATLAB compiler.

LIST OF EXPERIMENTS

Week-1	**BASIC FEATURES**

a. To Know the history and features of MATLAB
b. To Know the local environment of MATLAB

Week-2	**ALGEBRA**

a. Find the roots of the equations $6x^5 - 41x^4 + 97x^3 - 97x^2 + 41x - 6$
b. Find the values of x,y,z of the equations x+y+z=3,x+2y+3z=4,x+4y+9z=6
c. For $f(x)=8x^8 - 7x^7 + 12x^6 - 5x^5 + 8x^4 + 13x^3 - 12x + 9$ compute f(2),roots of f(x) and plotfor $0 \le x \le 20$

Week-3	**CALCULUS**

a. Verification of basic properties of limits for the functions f(x) = (3x + 5)/(x - 3) and $g(x) = x^2 + 1$as x endsto 4.
b. Find the derivative of (x+2)(x^2+3)
c. Calculate the area enclosed between the x-axis, and the curve $y=x^3 - 2x + 5$ and the ordinates x = 1 and x = 2.

Week-4	**MATRICES**

a. Find the addition, subtraction and multiplication of matrix

$$A=\begin{bmatrix} 1 & 2 & -9 \\ 2 & -1 & 2 \\ 3 & -4 & 3 \end{bmatrix}, B=\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

b. Find the transpose of matrix $A=\begin{bmatrix} 1 & 2 & -9 \\ 2 & -1 & 2 \\ 3 & -4 & 3 \end{bmatrix}$

c. Find the inverse of matrix $A=\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 2 \\ 1 & 2 & 5 \end{bmatrix}$

Week-5	**SYSTEM OF LINEAR EQUATIONS**

a. Find the rank of matrix $A=\begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 10 & 11 \\ 13 & 14 & 15 \end{bmatrix}$

b. Find the row echelon form $A=\begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 10 & 11 \\ 13 & 14 & 15 \end{bmatrix}$

c. Find the LU decomposition of the matrix $\begin{bmatrix} 2 & -3 & -1 \\ 1/2 & 1 & -1 \\ 0 & 1 & -1 \end{bmatrix}$

Week-6	LINEAR TRANSFORMATION
a. Find the characteristics equation of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{bmatrix}$ b. Find the Eigen values of the matrix $\begin{bmatrix} 1 & 8 & -10 \\ -4 & 2 & 4 \\ -5 & 2 & 8 \end{bmatrix}$ c. Find the Eigen vector of the matrix $\begin{bmatrix} 3 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$	
Week-7	**DIFFERENTIATION AND INTEGRATION**
a. Solve $(D^2 + 5D + 6)y = e^x$ b. Solve $\int_0^5 \int_0^{x^2} x(x^2 + y^2)dxdy$ c. Solve $\int_0^3 \int_0^{3-x} \int_0^{3-x-y} xyzdxdydz$	
Week-8	**INTERPOLATION AND CURVE FITTING**
a. Find the lagrange's polynomial for the following data (0,2),(1,3),(2,12),(5,147) b. Fit a straight line for the following data (0,12),(5,15),(10,17),(15,22),(20,24),(25,30) c. Fit a polynomial curve for the following data (0,1),(1,1.8),(2,1.3),(3,2.5),(4,6.3)	
Week-9	**ROOT FINDING**
write a program to find the root of the equation by using x^3-5x+3 a. Bisection Method b. Regula Falsi c. Newton Raphson Method	
Week-10	**NUMERICAL DIFFERENTION AND INTEGRATION**
a. Evaluate $\int_0^{1.2} e^x$ by using trapezoidal and Simpson's method b. Evaluate y^1=x+y, y(0)=1 of size h=0.2 by using Euler's and Runge-Kutta method	
Week-11	**3D PLOTTING**
a. Evaluate $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ Where region is bounded by $y = x^2, y = \sqrt{x}$ and plot the diagram. b. Plot the surface for $f = (2 - \cos \pi x)e^y$ c. Plot the surface for 2+cost	
Week-12	**VECTOR CALCULUS**
a. Find grad f where f=x^3+y^3+3xyz at (1,1,1) b. If $\overline{f} = xy^2 i + 2x^2 yzj - 3yz^2 k$ find div $\overline{f}$ at the point (1,-1,1) c. If $\overline{f} = xy^2 i + 2x^2 yzj - 3yz^2 k$ find curl $\overline{f}$ at the point (1,-1,1)	

EXPERIMENT-I

1.1 OBJECTIVES

a. To Know the history and features of MATLAB
b. To Know the local environment of MATLAB

1.1.1 CONTENT

Introduction

MATLAB is a high-level language and interactive environment for numericalcomputation, visualization, and programming. Using MATLAB, you can analyse data, develop algorithms, and create models and applications. The language, tools, and built-inmath functions enable you to explore multiple approaches and reach a solution fasterthan with spread sheets or traditional programming languages, such as C/C++ or Java. You can use MATLAB for a range of applications, including signal processing andcommunications, image and video processing, control systems, test and measurement, computational finance, and computational biology. More than a million engineers andscientists in industry and academia use MATLAB, the language of technical computing.

History

- Developed primarily by Cleve Moler in the 1970'sDerived from FORTRAN subroutines LINPACK and EISPACK, linear and eigenvaluesystems.
- Developed primarily as an interactive system to access LINPACK and EISPACK.
- Gained its popularity through word of mouth, because it was not socially distributed.
- Rewritten in C in the 1980's with more functionality, which include plotting routines.
- The Math Works Inc. was created (1984) to market and continue development of MATLAB.

Strengths

- MATLAB may behave as a calculator or as a programming language
- MATLAB combine nicely calculation and graphic plotting.
- MATLAB is relatively easy to learn
- MATLAB is interpreted (not compiled), errors are easy to fix
- MATLAB is optimized to be relatively fast when performing matrix operations
- MATLAB does have some object-oriented elements

Weaknesses

- MATLAB is not a general purpose programming language such as C, C++, or FORTRAN
- MATLAB is designed for scientific computing, and is not well suitable for other applications
- MATLAB is an interpreted language, slower than a compiled language such as C++
- MATLAB commands are specific for MATLAB usage. Most of them do not have a direct equivalent with other programming language commands

Competition

One of MATLAB's competitors is Mathematica the symbolic computation program.MATLAB is more convenient for numerical analysis and linear algebra. It is frequentlyused in engineering community. Mathematica has superior symbolic manipulation, making it popular among physicists. There are other competitors: Scilab, GNU Octave, and Rlab

Key Features

- It is a high-level language for numerical computation, visualization and application development.
- It also provides an interactive environment for iterative exploration, design and problem solving.
- It provides vast library of mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration and solving ordinary differential equations.
- It provides built-in graphics for visualizing data and tools for creating custom plots.
- MATLAB's programming interface gives development tools for improving code quality, maintainability, and maximizing performance.
- It provides tools for building applications with custom graphical interfaces.
- It provides functions for integrating MATLAB based algorithms with external applications and languages such as C, Java, .NET and Microsoft Excel.

MATLAB's Power of Computational Mathematics

MATLAB is used in every facet of computational mathematics. Following are some commonly used mathematical calculations where it is used most commonly:

- Dealing with Matrices and Arrays
- 2-D and 3-D Plotting and graphics
- Linear Algebra
- Algebraic Equations
- Non-linear Functions
- Statistics
- Data Analysis
- Calculus and Differential Equations
- Numerical Calculations
- Integration
- Transforms
- Curve Fitting
- Various other special functions

Uses of MATLAB

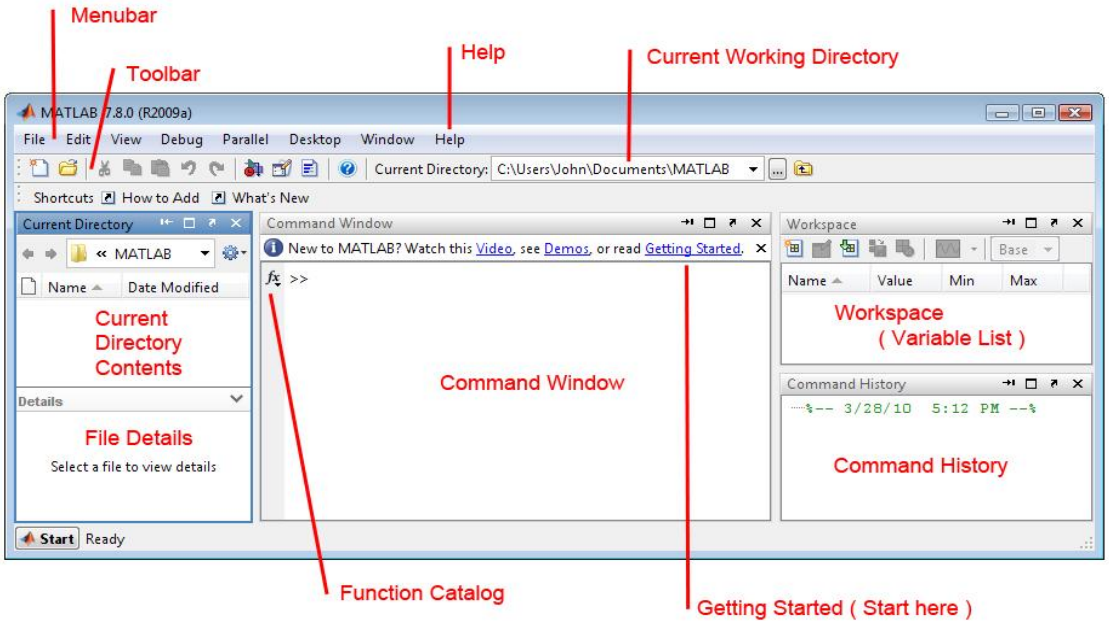
MATLAB is widely used as a computational tool in science and engineering encompassing the fields of physics, chemistry, math and all engineering streams. It is used in a range of applications including:

- Signal processing and Communications
- Image and video Processing
- Control systems
- Test and measurement
- Computational finance
- Computational biology

Understanding the MATLAB Environment

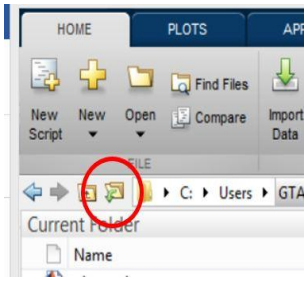
MATLAB development IDE can be launched from the icon created on the desktop. The main working window in MATLAB is called the desktop. When MATLAB is started, the desktop appears in its default layout:

The MATLAB Work Environment

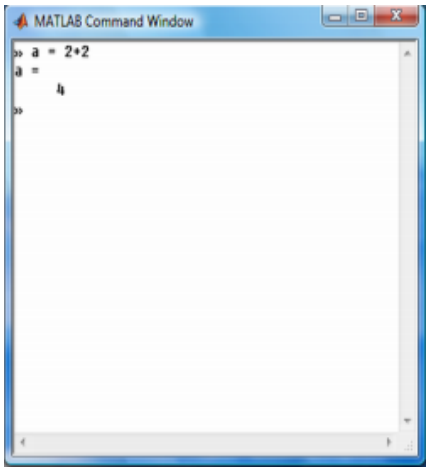


The desktop includes these panels:

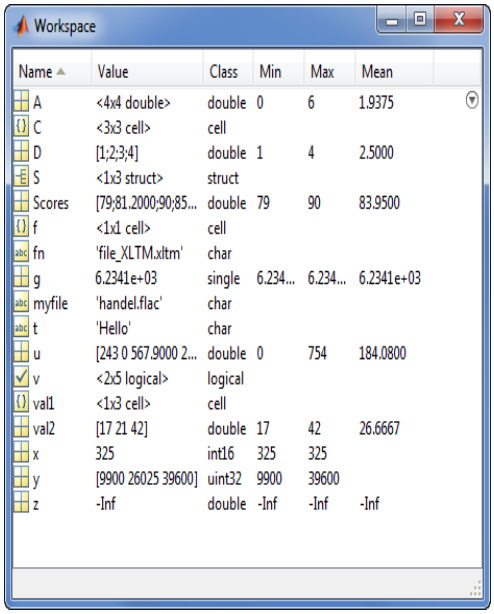
Current Folder - This panel allows you to access the project folders and files.



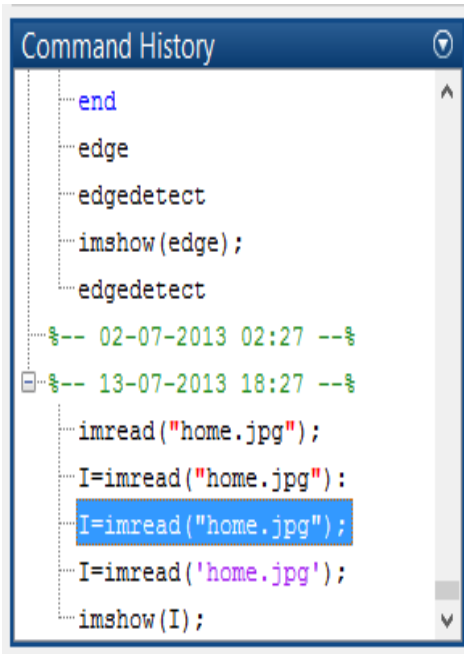
Command Window - This is the main area where commands can be entered at the command line. It is indicated by the command prompt (>>).

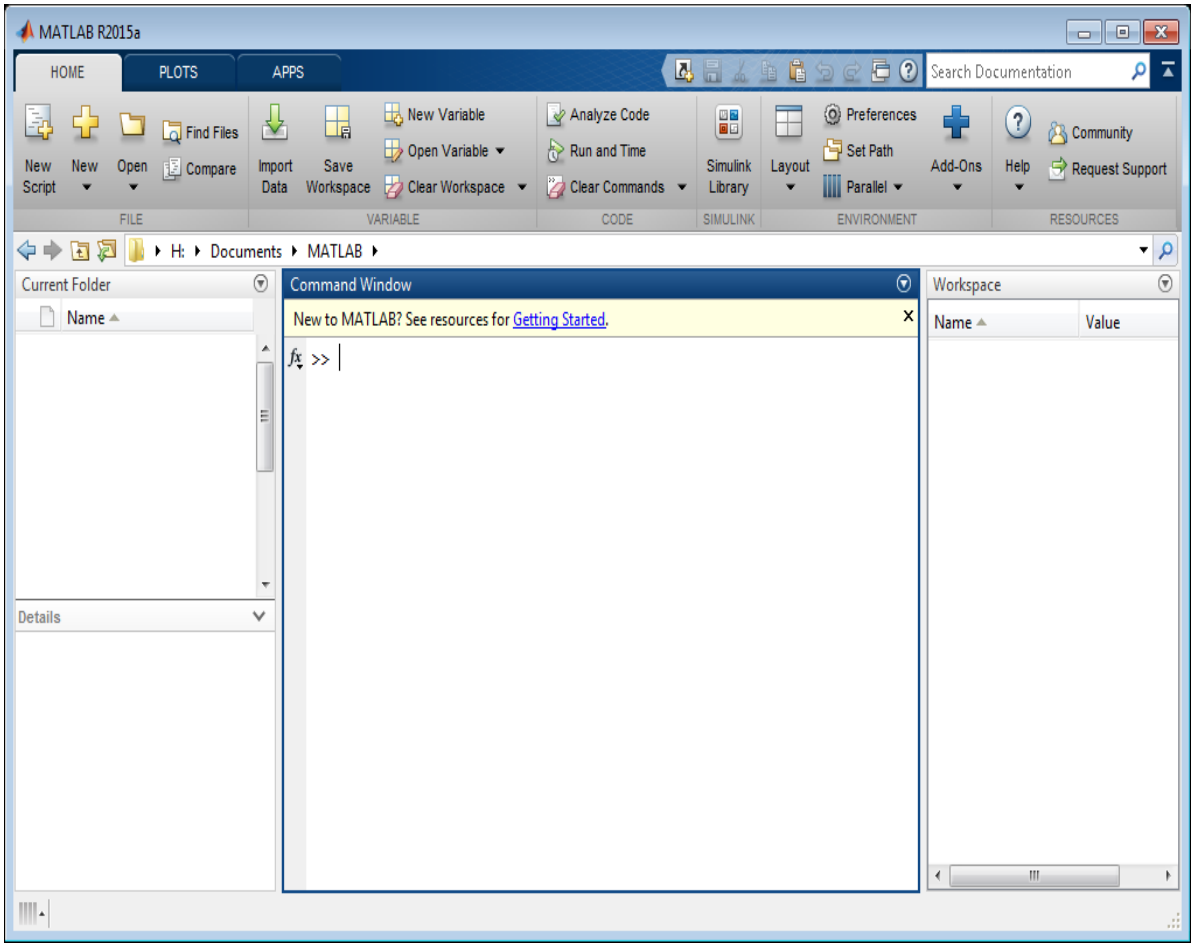


Workspace - The workspace shows all the variables created and/or imported from files.



Command History - This panel shows or rerun commands that are entered at the command line.





You are now faced with the MATLAB desktop on your computer, which contains the prompt (>>) in the Command Window. Usually, there are 2 types of prompt:

>>For full version
EDU> for educational version

Note:

1. To simplify the notation, we will use this prompt, >>, as a standard prompt sign, though our MATLAB version is for educational purpose.
2. MATLAB adds variable to the workspace and displays the result in the Command Window.

Managing workspace and file commands

Command	Description
cd	Change current directory
clc	Clear the Command Window
clear (all)	Removes all variables from the workspace
clear x	Remove x from the workspace
copy file	Copy file or directory
delete	Delete files

dir	Display directory listing
exist	Check if variables or functions are defined
help	Display help for MATLAB functions
look for	Search for specified word in all help entries
mkdir	Make new directory
move file	Move file or directory
pwd	Identify current directory
rmdir	Remove directory
type	Display contents of file
what	List MATLAB files in current directory
which	Locate functions and files
who	Display variables currently in the workspace
whos	Display information on variables in the workspace

Commonly used Operators and Special Characters

MATLAB supports the following commonly used operators and special characters:

Operator	Purpose
+	Plus; addition operator.
-	Minus; subtraction operator.
*	Scalar and matrix multiplication operator.
.*	Array multiplication operator.
^	Scalar and matrix exponentiation operator.
.^	Array exponentiation operator.
\	Left-division operator.
/	Right-division operator.
.\	Array left-division operator.
./	Array right-division operator.
:	Colon; generates regularly spaced elements and represents an entire row or column.
( )	Parentheses; encloses function arguments and array indices; overrides precedence.
[ ]	Brackets; enclosures array elements.
.	Decimal point.
…	Ellipsis; line-continuation operator
,	Comma; separates statements and elements in a row
;	Semicolon; separates columns and suppresses display.
%	Percent sign; designates a comment and specifies formatting.

_	Quote sign and transpose operator.
._	Non-conjugated transpose operator.
=	Assignment operator.

Note:

If you end a statement with a semicolon, MATLAB performs the computation, butsuppresses the display of output in the Command Window.

Special Variables and Constants

MATLAB supports the following special variables and constants:

Name	Meaning
ans	Most recent answer.
eps	Accuracy of floating-point precision.
i,j	The imaginary unit √-1.
Inf	Infinity.
NaN	Undefined numerical result (not a number).
pi	The number π

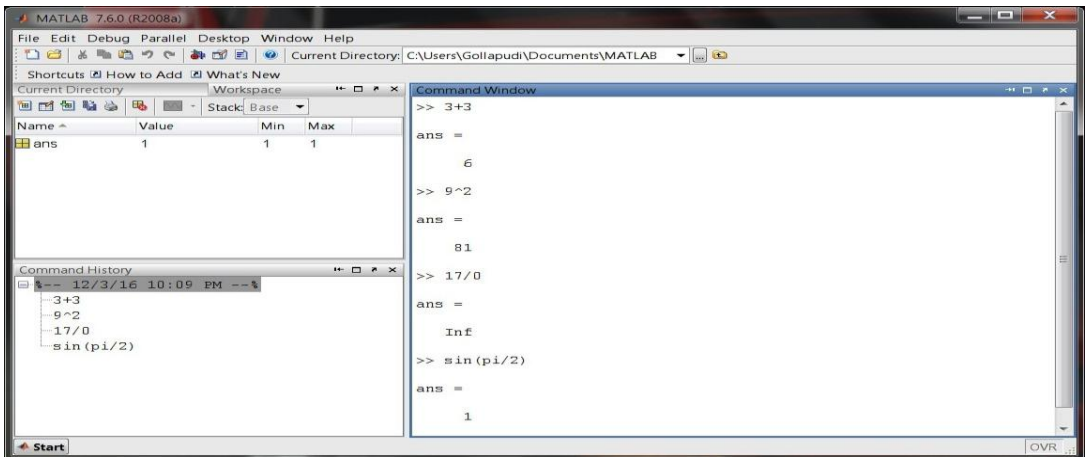
Naming Variables

Variable names consist of a letter followed by any number of letters, digits or underscore.
MATLAB is **case-sensitive**.
Variable names can be of any length; however, MATLAB uses only first N characters, where N is given by the function **namelengthmax**.

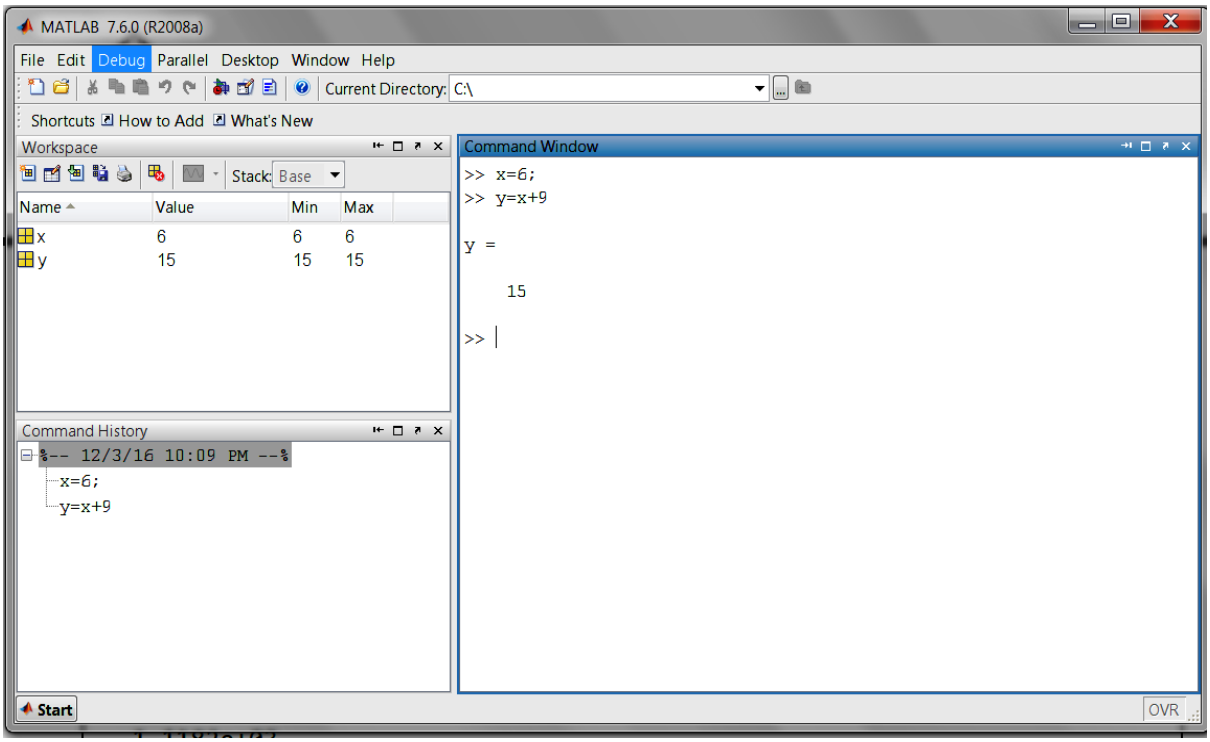
Saving Your Work

The **save** command is used for saving all the variables in the workspace, as a file with .mat extension, in the current directory.
For example, save myfile
You can reload the file anytime later using the **load** command.
load myfile

Example 1:

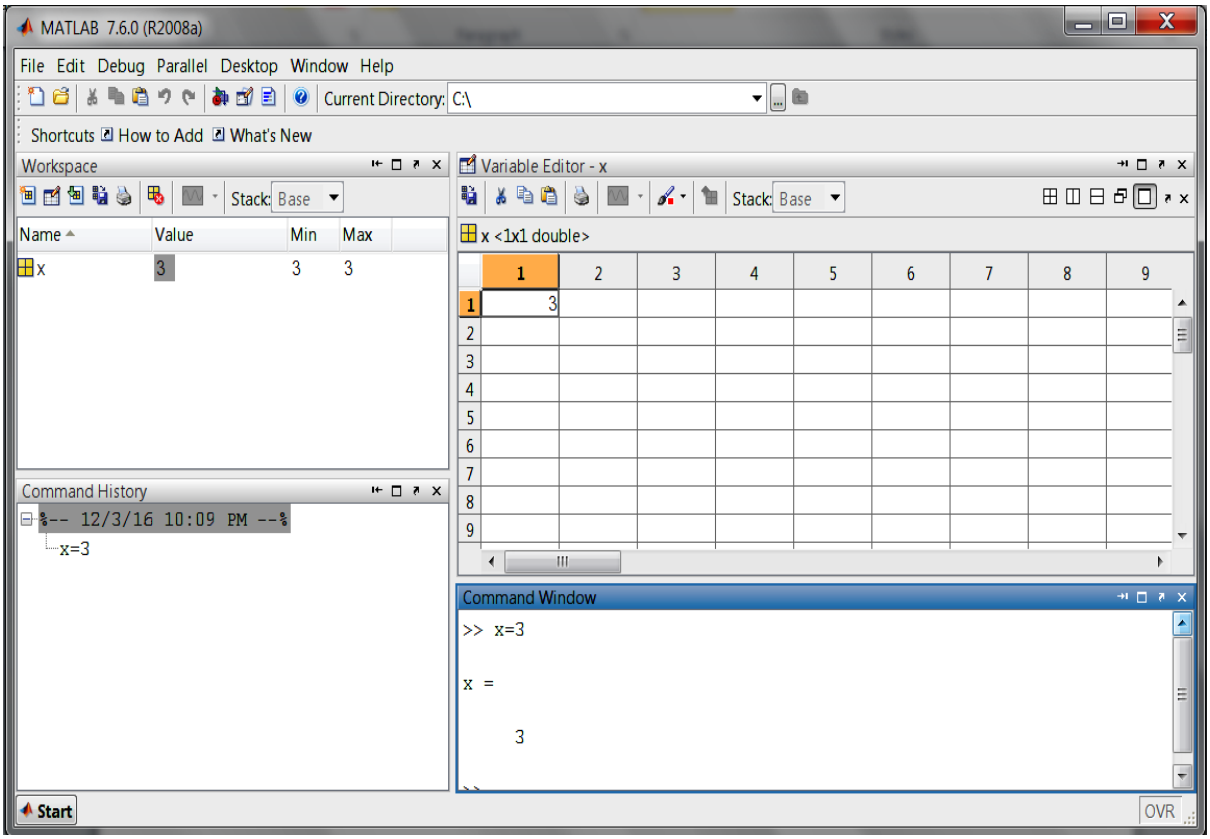


Example 2:



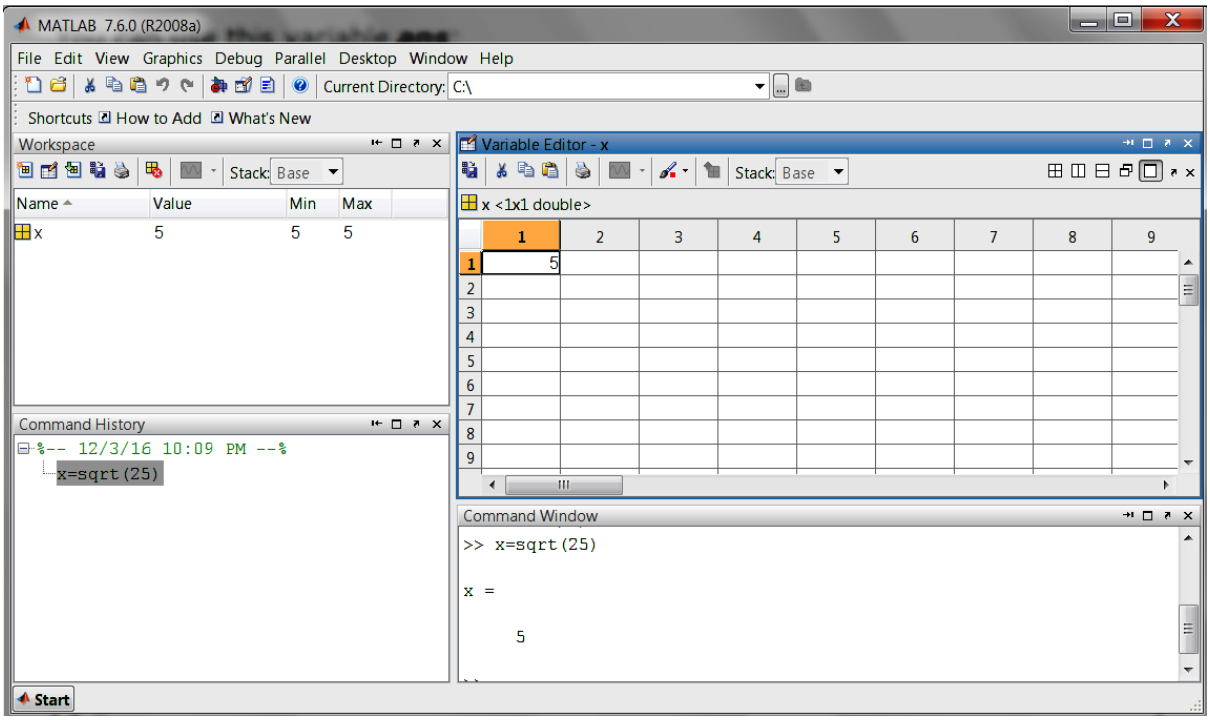
In MATLAB environment, every variable is an array or matrix.

Example 3:



In the above example it creates a 1-by-1 matrix named ‘x’and stores the value 3 in its element.

Example 4:



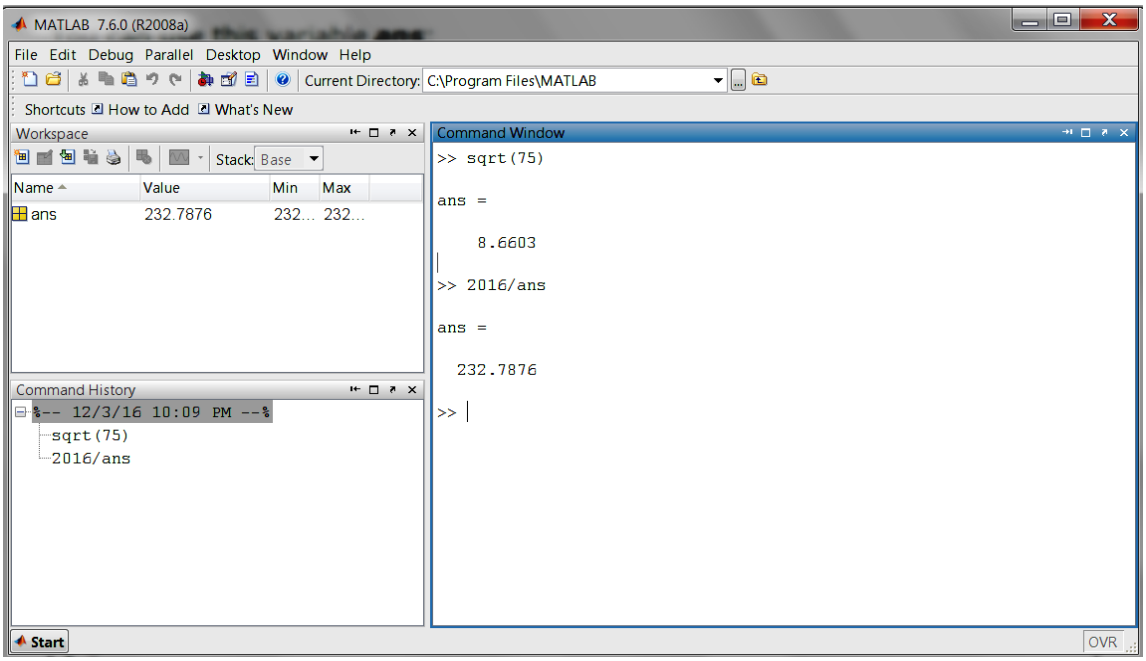
In this example x is to find the square root of 25 it creates a 1-by-1 matrix named 'x'and stores the value 5 in its element

.

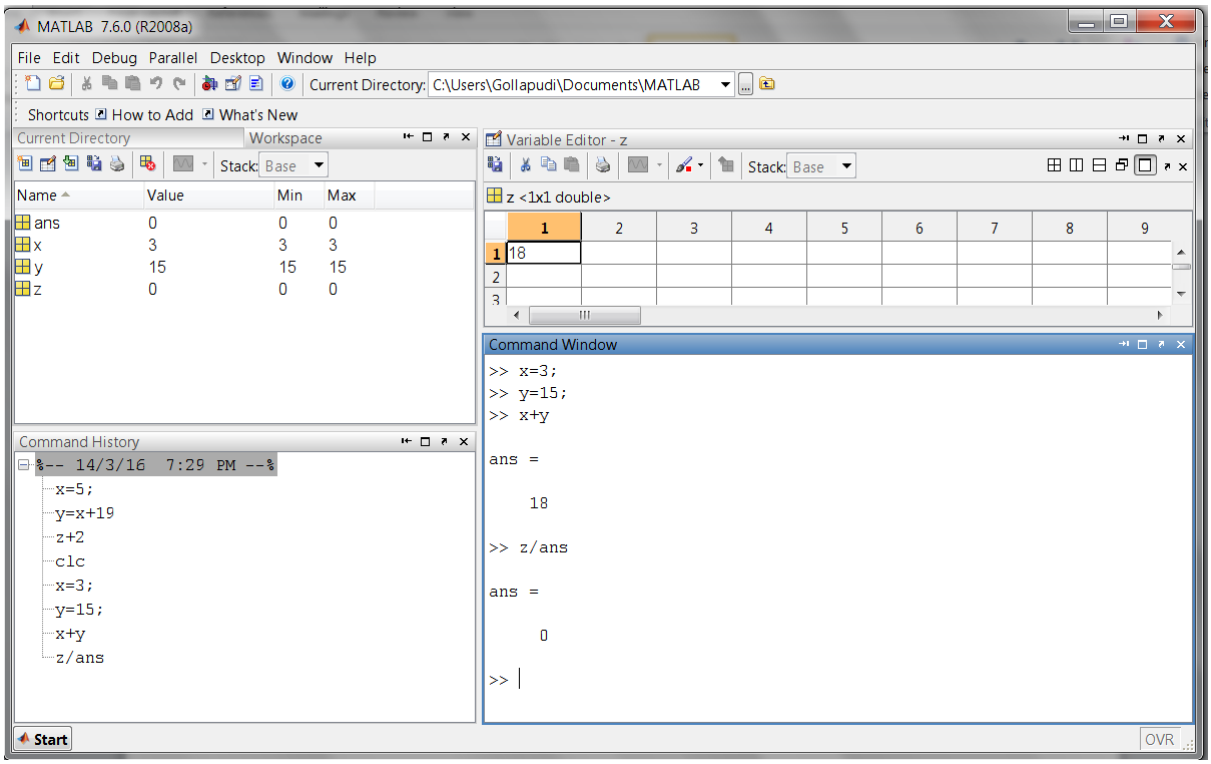
Note:

- Once a variable is entered into the system, you can refer to it later.
- Variables must have values before they are used.
- When you do not specify an output variable, MATLAB uses the variable ans, short for *answer*, to store the results of your calculation.

Example 6:



Example 7:



In the above example we have multiple assignments

EXPERIMENT-2

2.1 OBJECTIVES

a. Find the roots of the equations $6x^5 -41x^4 +97x^3 -97x^2 +41x-6$
b. Find the values of x,y,z of the equations x+y+z=3,x+2y+3z=4,x+4y+9z=6
c. For $f(x)=8x^8 -7x^7 +12x^6 -5x^5 +8x^4 +13x^3 -12x+9$ compute f(2),roots of f(x) and plotfor $0 \le x \le 20$

2.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

2.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

2.4 PROGRAM

Roots of the equations $6x^5 -41x^4 +97x^3 -97x^2 +41x-6$

```
v = [6, -41, 97, -97, 41,-6]; % writing the coefficients
s = roots(v);
disp('The first root is: '), disp(s(1));
disp('The second root is: '), disp(s(2));
disp('The third root is: '), disp(s(3));
disp('The fourth root is: '), disp(s(4));
disp('The fifth root is: '), disp(s(5));
```

Values of x,y,z of the equations x+y+z=3,x+2y+3z=4,x+4y+9z=6

```
A=[1,1,1;1,2,3;1,4,9];
b=[3;4;6];
A\b
```

f(2),roots and plot of f(x)

```
p=[8 -7 12 -5 8 13 0 -12 9];
polyval(p,2)
roots(p)
x=0:0.1:20;
y=polyval(p,x);
plot(x,y)
```

2.5 OUTPUT

Roots of the equations $6x^5 -41x^4 +97x^3 -97x^2 +41x-6$

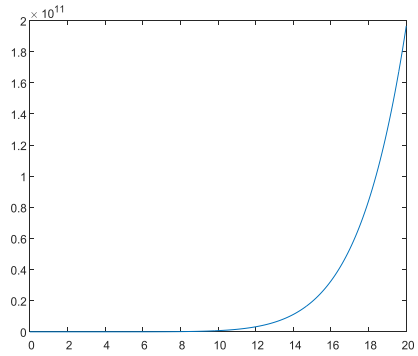
```
The first root is: 3.0000
The second root is:2.0000
The third root is: 1.0000
The fourth root is:0.5000
The fifth root is: 0.3333
```

Values of x,y,z of the equations x+y+z=3,x+2y+3z=4,x+4y+9z=6

```
ans =
    2
    1
    0
```

f(2),roots and plot of f(x)

```
ans = 1977
ans =  -0.2079 + 1.3091i
       -0.2079 - 1.3091i
       -0.8053 + 0.4306i
       -0.8053 - 0.4306i
        0.8878 + 0.9318i
        0.8878 - 0.9318i
        0.5629 + 0.3828i
         0.5629 - 0.3828i
```



2.6 EXERCISES

a) Find the roots of the equation $x^5-3x^4+6x^2-5x+1=0$

b) Find the roots of the equation $x^4-x-10=0$

c) Find the roots of the equation $x^3-4x-9=0$

d) Find the roots of the equation $x^3-5x+1=0$

e) Find the values of x,y,z of the equations x+3z=10, 2x+y=4, 5y-4z=-2

f) Find the values of x,y,z of the equations 10x-y+2z=4, x+10y-z=3, 2x+3y+20z=7

g) Find the values of x,y,z of the equations 2x+y+z=10, 3x+2y+3z=18, x+4y+9z=16

h) Find the values of x,y,z,w of the equations 2x+y+z-2w=-10, 4x+2z+w=8, 3x+2y+2z=7, and x+3y+2z-w= -5

i) Draw the graph of $y = x^2$ for $-10 \le x \le 10$ and compute f(3)

j) Draw the graph of $y = x^3-5x+1$ for $-5 \le x \le 5$ and find f(10)

k) Draw the graph of y = sinx for $0 \le x \le 30$

l) Draw the graph of $y=x^3+\cos x+10$ for $-4 \le x \le 4$

EXPERIMENT-3

3.1 OBJECTIVES

a. Verification of basic properties of limits for the functions f(x) = (3x + 5)/(x - 3) and g(x) = x^2 + 1as x endsto 4.
b. Find the derivative of (x+2)(x^2+3)
c. Find the area of the region bounded by the curve $y=x^3$ -2x+5 and the ordinates x = 1 and x = 2.

3.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

3.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

3.4 PROGRAM

Properties of limits

```
f = (3*x + 5)/(x-3);
g = x^2 + 1;
flim = limit(f, 4)
glim = limit (g, 4)
Add = limit(f + g, 4)
Sub = limit(f - g, 4)
Mult = limit(f*g, 4)
Div = limit (f/g, 4)
```

Derivative

```
syms x
 f=(x+2)*(x^2+3)
diff(f)
diff(ans)
diff(ans)
diff(ans)
```

Integration

```
syms x
 f = x^3 - 2*x +5;
 a = int(f, 1, 2)
display('Area: '), disp(double(a));
```

3.5 OUTPUT

Properties of limits

l1 =17
l2 = 17
lAdd = 34
lSub = 0
lMult = 289
lDiv = 1

Derivative

f = (x+2)*(x^2+3)
ans = x^2+3+2*(x+2)*x
ans = 6*x+4
ans = 6
ans = 0

Integration

a =23/4
Area:5.7500

3.6 EXERCISES

a) Verify basic properties of limits for the functions $f(x) =(x^3-8x^2+45)/(2x^2-3x-9)$ and $g(x)=(x^3-27)/(x-3)$ as x tends to three.

b) Verification of basic properties of limits for the functions $f(x) = x^2 + 2$ and $g(x) = (3x + 5)/(x - 3)$ as x tends to four.

c) Verify basic properties of limits for the functions $f(x)=\sin 3x/x \cos x$ and $g(x)=(\tan 2x-x)/(3x-\sin x)$ as x tends to zero.

d) Verify basic properties of limits for the functions $f(x)=\log x/(x-1)$ and $g(x)=\sin(x-1)/(x^2-1)$ as x tends to one

e) Verify basic properties of limits for the functions $f(x)=2\log(1+x)/x$ and $g(x)=(x^3-6x-9)/(x^4-81)$as x tends to zero.

f) Find the derivatives of $f(x)=x^6-6x^5+5x^2+2$

g) Find the derivatives of $f(x)=\sin x+\log x$

h) Find the derivatives of $f(x)=x^2\log x+\sin x$

i) Find the derivatives of $f(x)= (x^2+6x+3)/(x+5)$

j) Find the area of the region bounded by the curve $y= x^2-3x+2$ and the ordinates x = 0 and x = 3.

k) Find the area of the region bounded by the curve $y= x^4-x-10$ and the ordinates x = 1and x = 3
.

l) Find the area of the region bounded by the curve $y= x^3-4x-9$ and the ordinates x = 0 and x = 2.

m) Find the area of the region bounded by the curve $y= x^3-5x+1$and the ordinates x = 1 and x = 2.

EXPERIMENT-4

4.1 OBJECTIVES

a. Find the addition, subtraction and multiplication of matrix

$$A=\begin{bmatrix}1 & 2 & -9\\ 2 & -1 & 2\\ 3 & -4 & 3\end{bmatrix},\ B=\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\end{bmatrix}$$

b. Find the transpose of matrix $A=\begin{bmatrix}1 & 2 & -9\\ 2 & -1 & 2\\ 3 & -4 & 3\end{bmatrix}$

c. Find the inverse of matrix $A=\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 2\\ 1 & 2 & 5\end{bmatrix}$

4.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

4.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

4.4 PROGRAM

Addition, Subtraction and Multiplication of matrix

```
a=[1 2 -9 ; 2 -1 2; 3 -4 3];
b=[1 2 3; 4 5 6; 7 8 9];
disp('The matrix a= ');a
disp('The matrix b= ');b
% to find sum of a and b
c=a+b;
disp('The sum of a and b is ');c
% to find difference of a and b
d=a-b;
disp('The difference of a and b is ');d
%to find multiplication of a and b
e=a*b;
disp('The product of a and b is ');e
% to find element-by-element multiplication
```

Transpose of matrix

```
A=[1,2,-9;2,-1,2;3,-4,3]
B = A.'
```

Inverse of matrix

```
a = [ 1 2 3; 2 3 4; 1 2 5]
inv (a)
```

4.5 OUTPUT

Addition, Subtraction and Multiplication of matrix

```
The matrix a=
a =
    1    2   -9
    2   -1    2
    3   -4    3

The matrix b=
b =
    1    2    3
    4    5    6
    7    8    9

The sum of a and b is
c =
    2    4   -6
    6    4    8
   10    4   12

The difference of a and b is
d =
    0    0  -12
   -2   -6   -4
   -4  -12   -6

The product of a and b is
e =
  -54  -60  -66
   12   15   18
    8   10   12
```

Transpose of matrix

```
A =
    1    2   -9
    2   -1    2
    3   -4    3

B =
    1    2    3
    2   -1   -4
   -9    2    3
```

Inverse of matrix

```
a =
    1    2    3
    2    3    4
    1    2    5

ans =
   -3.5000    2.0000    0.5000
    3.0000   -1.0000   -1.0000
   -0.5000         0    0.5000
```

4.6 EXERCISES

a) Find the addition, subtraction and multiplication of matrices $A=\begin{bmatrix}1 & 4\\ 2 & 9\end{bmatrix}$, $B=\begin{bmatrix}9 & -4\\ -2 & 1\end{bmatrix}$

b) Find the addition, subtraction and multiplication of matrices $A=\begin{bmatrix}1 & -3 & 2\\ 2 & 1 & -3\\ 4 & -1 & 3\end{bmatrix}$, $B=\begin{bmatrix}2 & -2 & -4\\ 1 & 3 & 4\\ 1 & -2 & -3\end{bmatrix}$

c) Find the addition, subtraction and multiplication of matrices $A=\begin{bmatrix}2 & 3 & 1\\ 0 & -1 & 5\\ 1 & 2 & 3\end{bmatrix}$, $B=\begin{bmatrix}1 & 2 & -6\\ 0 & -1 & 3\\ -2 & 0 & 1\end{bmatrix}$

d) Find the addition, subtraction and multiplication of matrices $A=\begin{bmatrix}1 & 4 & 1\\ 2 & 7 & 1\\ 3 & 10 & 0\end{bmatrix}$, $B=\begin{bmatrix}2 & 3 & 0\\ 5 & -7 & 1\\ -6 & 8 & 1\end{bmatrix}$

e) Find the transpose of a matrix $A=\begin{bmatrix}1 & -2 & 3\\ -1 & 0 & 2\end{bmatrix}$

f) Find the transpose of a matrix $A=\begin{bmatrix}4 & 0 & 5\\ 1 & 2 & 0\\ 0 & 3 & 1\end{bmatrix}$

g) Find the transpose of a matrix $A=\begin{bmatrix}-3 & -2\\ 1 & -5\\ 4 & 3\end{bmatrix}$

h) Find the transpose of a matrix $A=\begin{bmatrix}4 & -3\\ -1 & 1\end{bmatrix}$

i) Find the inverse of a matrix $A=\begin{bmatrix}1 & 2 & 2\\ 2 & 3 & 0\\ 0 & 1 & 2\end{bmatrix}$

j) Find the inverse of a matrix $A=\begin{bmatrix}1 & -2 & -3\\ 0 & 2 & 0\\ 0 & 0 & 3\end{bmatrix}$

k) Find the inverse of a matrix $A=\begin{bmatrix}0 & 1 & 2 & 2\\ 1 & 1 & 2 & 3\\ 2 & 2 & 2 & 3\\ 2 & 3 & 3 & 3\end{bmatrix}$

l) Find the inverse of a matrix $A=\begin{bmatrix}-1 & -3 & 3 & -1\\ 1 & 1 & -1 & 0\\ 2 & -5 & 2 & -3\\ -1 & 1 & 0 & 1\end{bmatrix}$

EXPERIMENT-5

5.1 OBJECTIVES

a. Find the rank of matrix $A=\begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 10 & 11 \\ 13 & 14 & 15 \end{bmatrix}$

b. Find the row echelon form $A=\begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 10 & 11 \\ 13 & 14 & 15 \end{bmatrix}$

c. Find the LU decomposition of the matrix $\begin{bmatrix} 2 & -3 & -1 \\ 1/2 & 1 & -1 \\ 0 & 1 & -1 \end{bmatrix}$

5.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

5.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

5.4 PROGRAM

Rank of matrix

```
A= [1, 2, 3; 5, 6, 7;9, 10, 11;13, 14, 15]
rank (A)
```

Row echelon form

```
A = [1, 2, 3;5, 6, 7;9, 10, 11;13, 14, 15]
R = rref(A)
```

LU decomposition

```
A = [2 -3 -1; 1/2 1 -1; 0 1 -1]
[L, U] = lu(A)
```

5.5 OUTPUT

Rank of matrix

A =

```
    1     2     3
    5     6     7
    9    10    11
   13    14    15
```

ans = 2

Row echelon form

A =

```
    1     2     3
    5     6     7
    9    10    11
   13    14    15
```

R =

```
    1     0    -1
    0     1     2
    0     0     0
    0     0     0
```

LU decomposition

L =

```
   1.0000         0         0
   0.2500    1.0000         0
        0    0.5714    1.0000
```

U =

```
   2.0000   -3.0000   -1.0000
        0    1.7500   -0.7500
        0         0   -0.5714
```

5.6 EXERCISES

a) Find the rank of a matrix $A=\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & -4 \\ 2 & 3 & 5 & -5 \\ 3 & -4 & -5 & 8 \end{bmatrix}$

b) Find the rank of a matrix $A=\begin{bmatrix} 1 & 4 & 3 & -2 & 1 \\ -2 & -3 & -1 & 4 & 3 \\ -1 & 6 & 7 & 2 & 9 \\ -3 & 3 & 6 & 6 & 12 \end{bmatrix}$

c) Find the rank of a matrix $A=\begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 3 & 4 \\ 3 & 7 & 5 & 6 \end{bmatrix}$

d) Find the rank of a matrix $A=\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$

e) Find the row echelon form of $A=\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$

f) Find the row echelon form of $A=\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$

g) Find the row echelon form of $A=\begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & -8 \end{bmatrix}$

h) Find the row echelon form of $A=\begin{bmatrix} 2 & -4 & 3 & -1 & 0 \\ 1 & -2 & -1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$

i) Find the LU decomposition of the matrix $A=\begin{bmatrix} -3 & 12 & -6 \\ 1 & -2 & 2 \\ 0 & 1 & 1 \end{bmatrix}$

j) Find the LU decomposition of the matrix $A=\begin{bmatrix} 1 & 3 & 8 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$

k) Find the LU decomposition of the matrix $A=\begin{bmatrix} 2 & 1 & -1 \\ 1 & -2 & -2 \\ -1 & 2 & -3 \end{bmatrix}$

l) Find the LU decomposition of the matrix $A=\begin{bmatrix} 3 & 1 & -3 \\ 1 & -2 & -5 \\ 1 & 1 & 1 \end{bmatrix}$

EXPERIMENT-6

6.1 OBJECTIVES

a. Find the characteristics equation of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{bmatrix}$

b. Find the Eigen values of the matrix $\begin{bmatrix} 1 & 8 & -10 \\ -4 & 2 & 4 \\ -5 & 2 & 8 \end{bmatrix}$

c. Find the Eigen vector of the matrix $\begin{bmatrix} 3 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$

6.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

6.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

6.4 PROGRAM

Characteristics equation

```
A = [1 2 3; 4 5 6; 7 8 0]
p = poly(A)
```

Eigen values

```
A = [1 8 -10; -4 2 4; -5 2 8]
e = eig(A)
```

Eigen vector

```
A=[3,1,1;1,0,2;1,2,0];
[eigenvector, eigenvalue] = eig(A)
```

6.5 OUTPUT

Characteristics equation

```
A =
    1    2    3
    4    5    6
    7    8    0
p =1.0000   -6.0000  -72.0000  -27.0000
```

Eigen values

A =

```
    1     8   -10
   -4     2     4
   -5     2     8
```

e =

```
  11.6219
  -0.3110 + 2.6704i
  -0.3110 - 2.6704i
```

Eigen vector

eigenvector =

```
   -0.0000    0.5774   -0.8165
    0.7071   -0.5774   -0.4082
   -0.7071   -0.5774   -0.4082
```

eigenvalue =

```
   -2.0000         0         0
         0    1.0000         0
         0         0    4.0000
```

6.6 EXERCISES

a) Find the characteristics equation, Eigen value and Eigen vectors of the matrix $\begin{bmatrix} 5 & -2 & 0 \\ -2 & 6 & 2 \\ 0 & 2 & 7 \end{bmatrix}$

b) Find the characteristics equation, Eigen value and Eigen vectors of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

c) Find the characteristics equation, Eigen value and Eigen vectors of the matrix

$$\begin{bmatrix} i & 0 & 0 \\ 0 & 0 & i \\ 0 & i & 0 \end{bmatrix}$$

d) Find the characteristics equation, Eigen value and Eigen vectors of the matrix $\begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$

EXPERIMENT-7

7.1 OBJECTIVES

a. solve $(D^2 + 5D + 6)y = e^x$

b. solve $\int_0^5 \int_0^{x^2} x(x^2 + y^2)dxdy$

c. solve $\int_0^3 \int_0^{3-x} \int_0^{3-x-y} xyzdxdydz$

7.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

7.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

7.4 PROGRAM

Higher order differential

```
dsolve('D2y+5*Dy+6*y=exp(x)','x')
```

Double Integration

```
syms x y
firstint=int(x*(x^2+y^2),y,0,x^2)
answer=int(firstint,x,0,5)
```

Triple Integration

```
syms x y z
firstans=int(int(int(x*y*z,z,0,3-x-y),y,0,3-x),x,0,3)
```

7.5 OUTPUT

Higher order differential

```
ans =exp(-2*x)*C2+exp(-3*x)*C1+1/12*exp(x)
```

Double Integration

```
firstint = 1/3*x^7+x^5
answer = 453125/24
```

Triple Integration

```
firstans = 81/80
```

7.6 EXERCISES

a. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^{2x}$

b. Solve $(D^3+2D^2-D-2)y=1-4x^3$

c. Solve $(D^4-1)y=e^x \cos x$

d. Solve $\frac{d^2y}{dx^2} + y = \sin 2x$

e. Solve $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2)dydx$

f. Solve $\int_0^1 \int_0^{x^2} e^{y/x}dydx$

g. Solve $\int_0^2 \int_0^3 xydydx$

h. Solve $\int_0^1 \int_x^{\sqrt{x}} x^2y^2(x + y)dydx$

i. Solve $\int_0^1 \int_1^2 \int_2^3 xyzdxdydz$

j. Solve $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} e^x dxdydz$

k. Solve $\int_0^1 \int_y^1 \int_0^{1-x} xdzdydx$

l. Solve $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyzdxdydz$

EXPERIMENT-8

8.1 OBJECTIVES

a. Find the lagrange's polynomial for the following data (0,2),(1,3),(2,12),(5,147)
b. Fit a straight line for the following data (0,12),(5,15),(10,17),(15,22),(20,24),(25,30)
c. Fit a polynomial curve for the following data (0,1),(1,1.8),(2,1.3),(3,2.5),(4,6.3)

8.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

8.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

8.4 PROGRAM

Lagrange's polynomial

```
x=[0 1 2 5];
y=[2 3 12 147];
disp([x;y])
v=vander(x)
c=v\y'
```

Straight Line

```
x=[0 5 10 15 20 25];
y=[12 15 17 22 24 30];
disp([x;y])
p=polyfit(x,y,1);
disp(p);
```

Polynomial curve

```
x=[0 1 2 3 4];
y=[1 1.8 1.3 2.5 6.3];
disp([x;y])
p=polyfit(x,y,2);
disp(p);
```

8.5 OUTPUT

Lagrange's polynomial

```
    0     1     2     5
    2     3    12   147

v =0     0     0     1
    1     1     1     1
    8     4     2     1
  125    25     5     1
```

c =1.0000
1.0000
-1.0000
2.0000

Straight Line

0 5 10 15 20 25
12 15 17 22 24 30

0.6971 11.2857

Polynomial curve

0 1.0000 2.0000 3.0000 4.0000
1.0000 1.8000 1.3000 2.5000 6.3000

0.5500 -1.0700 1.4200

8.6 EXERCISES

a) Find the Lagrange's polynomial for the data (0,12) (3,6) (4,8)
b) Find the Lagrange's polynomial for the data (-1,-8) (0,3) (2,1) (3,12)
c) Find the Lagrange's polynomial for the data (1,1) (3,27) (4,64)
d) Find the Lagrange's polynomial for the data (1,1) (2,2) (3,9) (4,28)
e) Fit a straight line for the data (4,1) (3,2) (2,3) (1,4)
f) Fit a straight line for the data (0,1) (1,1.8) (2,3.3) (3,4.5) (4,6.3)
g) Fit a straight line for the data (1,2) (2,5) (3,4) (4,9) (5,10)
h) Fit a straight line for the data (0,-1) (2,5) (5,12) (7,20)
i) Fit a Second degree polynomial curve for the data (0,1) (1,6) (2,17)
j) Fit a Second degree polynomial curve for the data (0,1) (1,0) (2,3) (3,10) (4,21)
k) Fit a Second degree polynomial curve for the data (-1,-2) (0,1) (1,2) (2,4)
l) Fit a Second degree polynomial curve for the data (1,10) (2,12) (3,8) (4,10) (5,14)

EXPERIMENT-9

9.1 OBJECTIVES

write a program to find the root of the equation by using x^3-5x+3

a. Bisection Method
b. Regula Falsi
c. Newton Raphson Method

9.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

9.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

9.4 PROGRAM

Bisection Method

```
 f=@(x) x^3-5*x+3;
display('Equation is x^3-5*x+3= 0')
i=1;
while(i)
    xl=input('Enter lower value:');
    xu=input('Enter upper value: ');
    e=input('Enter accuracy: ');
   if f(xl)*f(xu)<0
      i=0;
   else
      warning('Enter proper range');
   end
end
if f(xl)<0
   xn=xl;
   xp=xu;
else
   xn=xu;
   xp=xl;
end
while (abs(xn-xp)>e)
   xm=(xn+xp)/2;
   if f(xm)<0
      xn=xm;
   else
      xp=xm;
   end
end
Root=xm
```

Regula Falsi

```
 f=@(x) x^3-5*x+3;
display('Equation is x^3-5*x+3= 0')
i=1;
while(i)
   xl=input('Enter lower value:');
   xu=input('Enter upper value: ');
   e=input('Enter accuracy: ');
   if f(xl)*f(xu)<0
      i=0;
   else
      warning('Enter proper range');
   end
end
if f(xl)<0
   xn=xl;
   xp=xu;
else
   xn=xu;
   xp=xl;
end
xm=xl;
while (abs(f(xm))>e)
  xm=(xn*f(xp)-xp*f(xn))/(f(xp)-f(xn));
   if f(xm)<0
      xn=xm;
   else
      xp=xm;
   end
end
Root=xm
```

Newton Raphson Method

```
 syms x
f= x^3-5*x+3;
fdash=diff(f);
disp('The equation is: '),disp(f);
disp('The derivative of equation is: '),disp(fdash);
y=inline(f);
dy=inline(fdash);
x0=input('Enter approximate root: ');
e=input('Enter the accuracy: ');
while abs(feval(y,x0))>e
h=-feval(y,x0)/feval(dy,x0);
x0=x0+h;
end
root=x0
```

9.5 OUTPUT

Bisection Method

```
Equation is x^3-5*x+3= 0
Enter lower value:1
Enter upper value: 2
Enter accuracy: 0.0001
Root =1.8343
```

Regula Falsi

Equation is x^3-5*x+3= 0
Enter lower value:1
Enter upper value: 2
Enter accuracy: 0.0001
Root =1.8342

Newton Raphson Method

The equation is: x^3-5*x+3
The derivative of equation is: 3*x^2-5
Enter approximate root: 1.5
Enter the accuracy: 0.0001
root =1.8343

9.6 EXERCISES

Find the root of the equation following equation by using Bisection Method, Regula Falsi and Newton Raphson Methods

a) $x^3-x-1=0$

b) $4\sin x=e^x$

c) $2x-\cos x=3$

EXPERIMENT-10

10.1 OBJECTIVES

a. Evaluate $\int_0^{1.2} e^x$ by using trapezoidal and Simpson's method

b. Evaluate y^1=x+y, y(0)=1 of size h=0.2 by using Euler's and Runge-Kutta method

10.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

10.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

10.4 PROGRAM

Trapezoidal Method:

```
x=0:0.2:1.2;
y=exp(x);
trapz(x,y)
```

Simpson's Method:

```
quad('exp(x)',0,1.2)
```

Euler's and Runge-Kutta method

```
f=@(x,y) (x+y);
[x,y]=ode23(f,[0:0.2:1],1)
[x,y]=ode45(f,[0:0.2:1],1)
```

10.5 OUTPUT

Trapezoidal Method:

```
ans =2.3278
```

Simpson's Method:

```
ans =2.3201
```

Euler's method

```
x =   0
    0.2000
    0.4000
    0.6000
    0.8000
    1.0000

y =1.0000
    1.2428
```

1.5836
2.0442
2.6510
3.4364

Runge-Kutta method

x = 0
0.2000
0.4000
0.6000
0.8000
1.0000

y =1.0000
1.2428
1.5836
2.0442
2.6511
3.4366

10.6 EXERCISES

a) Evaluate $\int_4^{5.2} \log x\,dx$ using trapezoidal method

b) Evaluate $\int_0^1 (1+x^2)\,dx$ using trapezoidal method

c) Evaluate $\int_2^5 e^{\sin x}\,dx$ using trapezoidal method

d) Evaluate $\int_0^4 e^x\,dx$ using trapezoidal method

e) Evaluate $\int_0^{1.2} \sin x\,dx$ by using trapezoidal method

f) Evaluate $\frac{dy}{dx}=3x^2+1$, y(1)=2 of size h=0.5 using Euler's method

g) Evaluate $\frac{dy}{dx}=x+y+xy$, y(0)=1 of size h=0.025 using Euler's method

h) Evaluate $\frac{dy}{dx}=x^2+y^2$, y(0)=0 of size h=0.1 using Euler's method

i) Evaluate $\frac{dy}{dx}=2e^x-3y$, y(0)=0 of size h=0.25 using Euler's method

EXPERIMENT-11

11.1 OBJECTIVES

a. Evaluate $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ Where region is bounded by $y = x^2, y = \sqrt{x}$ and plot the diagram.

b. Plot the surface for $f = (2 - \cos \pi x)e^y$

c. Plot the surface for 2+cost

11.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

11.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

11.4 PROGRAM

Line Integral

```
clear all
clc
syms x y
f=[3*x.^2-8*y.^2 4*y-6*x*y];
disp('Along the curve y=x.^2')
a=subs(f,y,x.^2);
b=diff(x.^2,x);
c=b*a(2);
d=int(a(1),x,0,1);
e=int(c,x,0,1);
u=d+e
disp('Along the curve y=sqrt(x)')
p=subs(f,y,sqrt(x));
q=diff(sqrt(x),x);
r=q*p(2);
s=int(p(1),x,1,0);
t=int(r,x,1,0);
v=s+t
I=u+v
x=-2:0.5:2;
y2=sqrt(x);
y1=x.^2;
plot(x,y1,'r', x,y2,'g');
grid on
```

Surface

```
x=-1:.1:1;y=0:.1:1.5;
[X,Y]=meshgrid(x,y);
```

```
F=(2-cos(pi*X)).*exp(Y);
surf(X,Y,F);
xlabel('x');
ylabel('y');
```

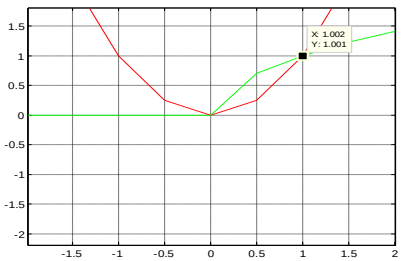
Volume

```
t = 0:pi/10:2*pi;
figure
[X,Y,Z] = cylinder(2+cos(t));
surf(X,Y,Z)
axis square
```

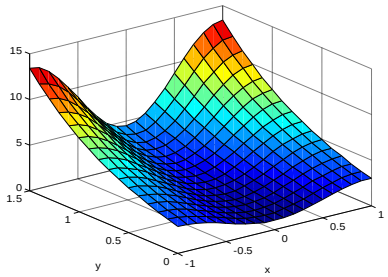
11.5 OUTPUT

Line Integral

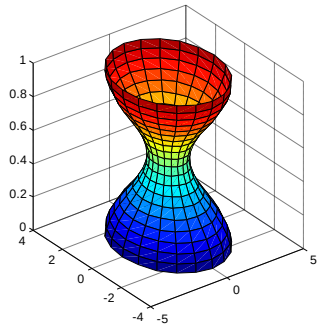
Along the curve y=x.^2
u =-1
Along the curve y=sqrt(x)
v =5/2
I =3/2



Surface



Volume



11.6 EXERCISES

a. Evaluate $\int_C (x^2 - y^2)dx + 2xydy$ where the region is bounded by y= x^2 and y= $\sqrt{x}$ and also plot 2D diagram

b. Plot 3D surface for f=x^2+y^2

c. Plot 3D surface for f=cosx+siny

d. Plot 3D surface for f=y^2+5cosπx

e. Plot 3D Volume for f=t^2+2t+1

f. Plot 3D Volume for f=sint+cost

EXPERIMENT-12

12.1 OBJECTIVES

a. Find grad f where $f=x^3+y^3+3xyz$ at (1,1,1)
b. If $\overline{f} = xy^2 i + 2x^2 yzj - 3yz^2 k$ find div $\overline{f}$ at the point (1,-1,1)
c. If $\overline{f} = xy^2 i + 2x^2 yzj - 3yz^2 k$ find curl $\overline{f}$ at the point (1,-1,1)

12.2 SOFTWARE REQUIRED

1. MATLAB R2013a.
2. Windows 7/XP SP2.

12.3 PROCEDURE

1. Open MATLAB
2. Open new M-file
3. Type the program
4. Save in current directory
5. Compile and Run the program
6. For the output see command window\ Figure window

12.4 PROGRAM

Gradient

```
syms x y z
f=x.^3+y.^3+3*x*y*z;
p = diff(f,x)
q = diff(f,y)
r = diff(f,z)
w=[p q r]
subs(w,{x,y,z},{1,1,1})
```

Divergent

```
syms x y z
f=[x*y.^2 2*x.^2*y*z -3*y*z.^2];
p = diff(f(1),x)
q = diff(f(2),y)
r = diff(f(3),z)
w = p + q + r
subs(w,{x,y,z},{1,-1,1})
```

Curl

```
syms x y z
f=[x*y.^2 2*x.^2*y*z -3*y*z.^2];
p=diff(f(3),y)-diff(f(2),z)
q=diff(f(3),x)-diff(f(1),z)
r=diff(f(2),x)-diff(f(1),y)
w=[p q r]
subs(w,{x,y,z},{1,-1,1})
```

12.5 OUTPUT

Gradient

```
p =3*x^2+3*y*z
q =3*y^2+3*x*z
r =3*x*y
w =[ 3*x^2+3*y*z, 3*y^2+3*x*z,       3*x*y]
ans = 6     6     3
```

Divergent

```
p =y^2
q =2*x^2*z
r =-6*y*z
w =y^2+2*x^2*z-6*y*z
ans = 9
```

Curl

```
p =-3*z^2-2*x^2*y
q =0
r =4*x*y*z-2*x*y
w = [ -3*z^2-2*x^2*y,            0,  4*x*y*z-2*x*y]
ans = -1     0    -2
```

12.6 EXERCISES

a. Find gradf where f= xy^2+yz^2at (2,-1,1)
b. Find gradf where f=xy+yz+zx at (1,2,3)
c. Find gradf where f=xyz^2+xz at (1,1,1)
d. Find gradf where f= $x^2yz+4xz^3$at (1,-2,-1)
e. Find gradf where f=$3xy^2$+y-z at (0,1,1)
f. Find divf where f=$(x^2+yz)i+(y^2-zx)j+(z^2+xy)k$ at (1,-2,3)
g. Find divf where f=$(x^3-yz)i-2x^2yj+yzk$at (3,-2,1)
h. Find divf where f=4xzi-y^2j+yzk at (2,-1,1)
i. Find divf where f=$(x^2-xy^3)i+(y^2-2xy)j+(z^2-xyz)k$ at (1,1,1)
j. Find divf where f=$xy^2i+2x^2yzj-3yz^2k$ at (1,-1,1)
k. Find curlf where f=$(x^2+yz)i+(y^2-zx)j+(z^2+xy)k$ at (1,-2,3)
l. Find curlf where f=$(x^3-yz)i-2x^2yj+yzk$at (3,-2,1)
m. Find curlf where f=4xzi-y^2j+yzk at (2,-1,1)
n. Find curlf where f=$(x^2-xy^3)i+(y^2-2xy)j+(z^2-xyz)k$ at (1,1,1)
o. Find curlf where f=$xy^2i+2x^2yzj-3yz^2k$ at (1,-1,1)