Mechi Multiple Campus

(Tribhuvan University)
Bhadrapur, Jhapa

Lab Report of Mathematics-I (CAMT-104)

Faculty of Humanities & Social Sciences
Tribhuvan University
Kritipur, Nepal

Submitted By

Name: Santosh Bhandari

Roll no: 58 (1^{st} Semester)

Submitted To

Mechi Multiple Campus

Department of Bachelor in Computer

Bhadrapur, Jhapa, Nepal

Submission Date:

Internal Examiner: External Examiner:

ACKNOWLEDGEMENT

This project is specially designed to develop enhance the knowledge of student in Mathematica and MATLAB software. The assigned project is for the partial fulfillment of BCA (Bachelor in Computer Application) first semester student.

I would like to express my sincere gratitude to my subject teacher **“Mr. Kumar Subedi”** and the whole faculty of Humanities and Social Sciences who gave me this opportunity to fulfill this report. He gave me moral support and guided in different matters regarding the topics. He had been very kind and patient while suggesting me the outlines. I thank him for his overall support.

I am also thankful to everyone who all supported me, for that I have completed my report effectively and moreover on time. They gave me many helpful comments which helped me a lot in preparing it.

<u>CERTIFICATE FROM THE SUPERVISOR</u>

This is to certify that the Lab Report entitled **"MATHEMATICA & MATLAB"** is an academic work done by "Santosh Bhandari" submitted in the partial fulfillment of the requirements for the degree of Bachelor of Computer Application at Faculty of Humanities and Social Sciences, Tribhuvan University under my guidance & supervision. To the best of my knowledge, the worked performed by him in the Lab Report is his own creation.

Signature of the Supervisor:

Name:

Designation:

Date:

DECLERATION

I hereby declare that the project entitled **“Mathematica & Matlab”** is a general concept of mathematical software, original work done by Santosh Bhandari, and this project work is submitted in the requirements for the award of the degree of Bachelor First Semester. The results enrolled in the report have not been submitted to any other university or institute for the award of degree of BCA.

Santosh Bhandari
BCA First Semester

TABLE OF CONTENTS

MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non-interactive language such as C or Fortran.

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of-the-art in software for matrix computation.

MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to *learn* and *apply* specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

MATLAB

- First Open Command Window of MATLAB.
- Enter the matrix by assigning the variable.
- Perform any operation using arithmetic operators.

1. ADDITION & ASSIGNING SCALARS

For Example

Type

>> x=100

It will display

x=

100

```
Command Window
>> 70+69

ans =

   139

>> 64+8

ans =

    72

>> x=69

x =

    69

>> y=52

y =

    52

fx >>
```

2. ASSIGNING MATRICS

2.1 Addition & Subtraction

For Example:

>> A = [2 8 6; 7 6 4; 9 3 4]

A =

$$\begin{matrix} 2 & 8 & 6 \\ 7 & 6 & 4 \\ 9 & 3 & 4 \end{matrix}$$

>> B = [7 9 4; 6 0 2; 3 7 9]

B =

$$\begin{matrix} 7 & 9 & 4 \\ 6 & 0 & 2 \\ 3 & 7 & 9 \end{matrix}$$

```
Command Window
>> A=[2 8 6; 7 6 4; 9 3 4]

A =

     2     8     6
     7     6     4
     9     3     4

>> B=[7 9 4; 6 0 2;3 7 9]

B =

     7     9     4
     6     0     2
     3     7     9

>> A+B

ans =

     9    17    10
    13     6     6
    12    10    13

>> A-B

ans =

    -5    -1     2
     1     6     2
     6    -4    -5
```

2.2 Multiplication

For Example:

```
>>A= [9  4  6; 3  7  2]

                    A =

                          9    4   6

                          3    7   2

>>B= [7  6; 3  8; 6  1]

                    B =

                         7    6

                         3    8

                         6    1
```

```
Command Window
>> A=[9 4 6; 3 7 2]

A =

     9     4     6
     3     7     2

>> B=[7 6; 3 8; 6 1]

B =

     7     6
     3     8
     6     1

>> A*B

ans =

   111    92
    54    76

>> B*A

ans =

    81    70    54
    51    68    34
    57    31    38

fx >> 
```

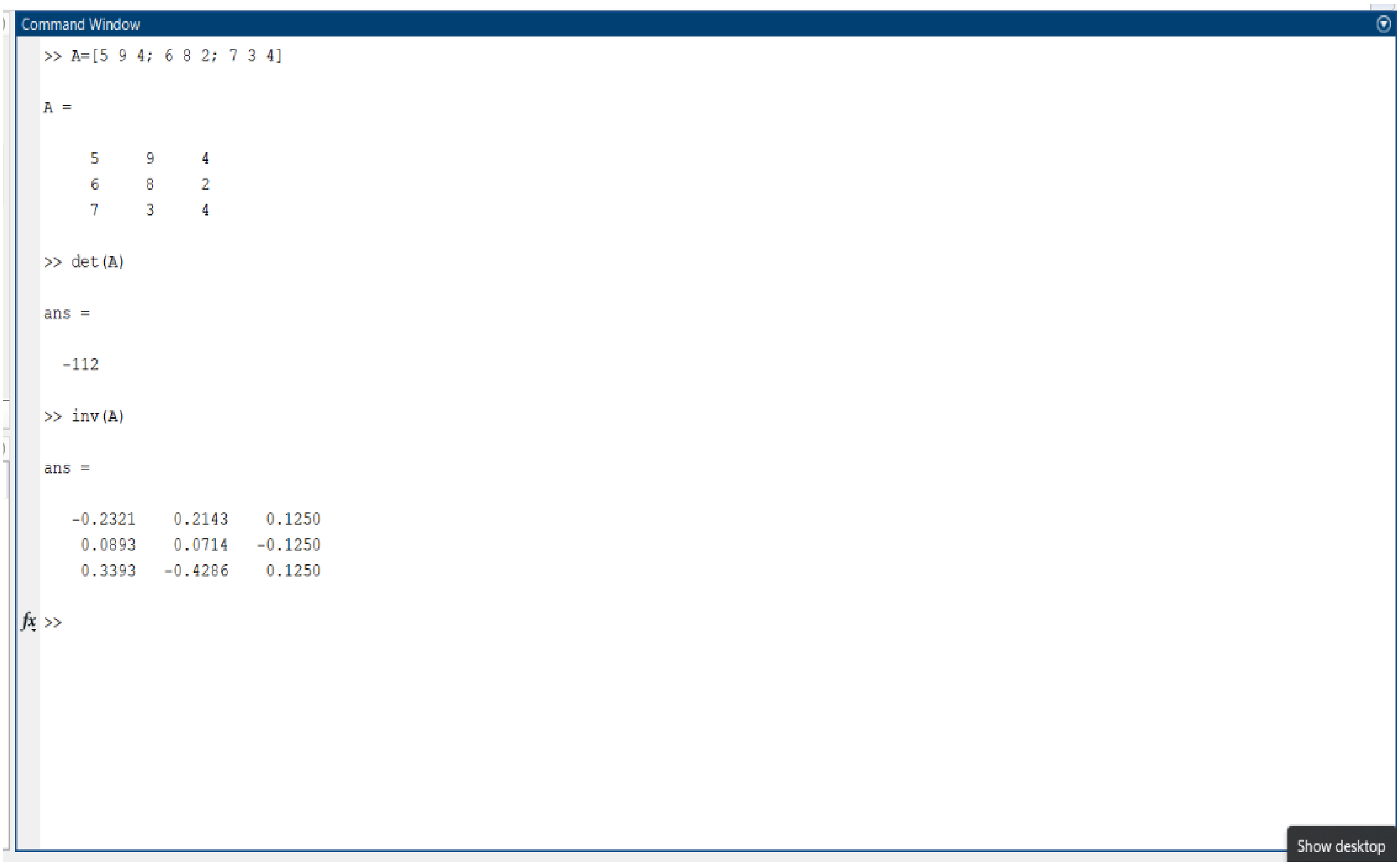
Some of the Matrices Functions

Commands	Description
eye	Identity matrix
rand	Randomly Generated Matrix
size	Size of Matrix
det	Determinant of a Square Matrix
inv	Inverse of a Matrix
rank	Rank of Matrix

Command Window

```
>> rand(5,6)

ans =

    0.8147    0.0975    0.1576    0.1419    0.6557    0.7577
    0.9058    0.2785    0.9706    0.4218    0.0357    0.7431
    0.1270    0.5469    0.9572    0.9157    0.8491    0.3922
    0.9134    0.9575    0.4854    0.7922    0.9340    0.6555
    0.6324    0.9649    0.8003    0.9595    0.6787    0.1712

>> eye(7,8)

ans =

     1     0     0     0     0     0     0     0
     0     1     0     0     0     0     0     0
     0     0     1     0     0     0     0     0
     0     0     0     1     0     0     0     0
     0     0     0     0     1     0     0     0
     0     0     0     0     0     1     0     0
     0     0     0     0     0     0     1     0

>>
```

```
>>A = [5  9  4;  6  8  2; 7  3  4]
                A =
                      5   9   4
                      6   8   2
                      7   3   4
```



```
>>A = [5  9  4;  6  8  2; 7  3  4]
A =
    5   9   4
    6   8   2
    7   3   4
```

Vector in Space

1. Elements separated by comma or space give row vector.

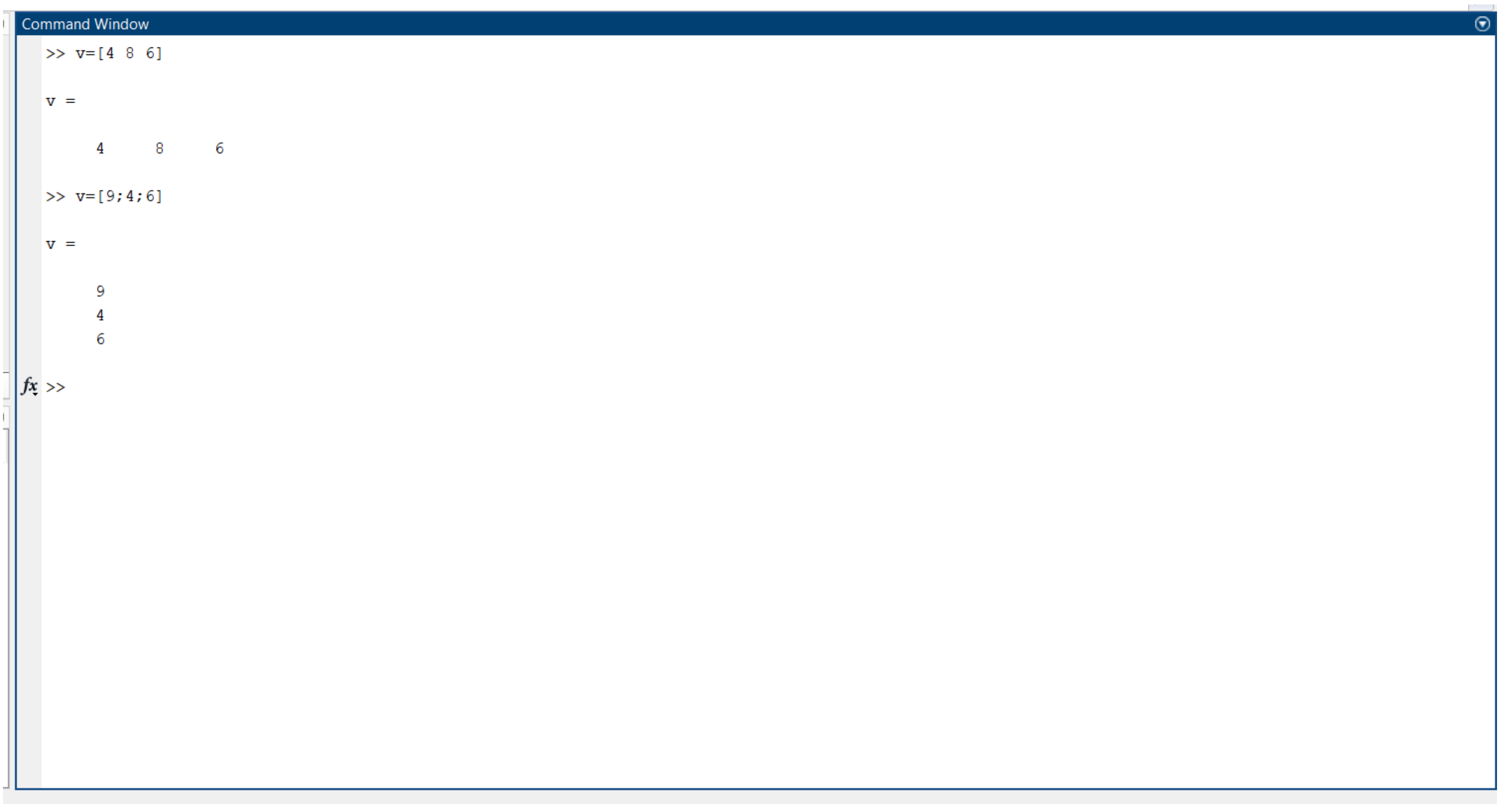
For Example:

```
>> v = [4  8  6]
        V =
            4   8   6
```

2. Elements separated by semi- colon give column vector.

For Example:

```
>> v = [9; 4; 6]
         V =
             9
             4
             6
```



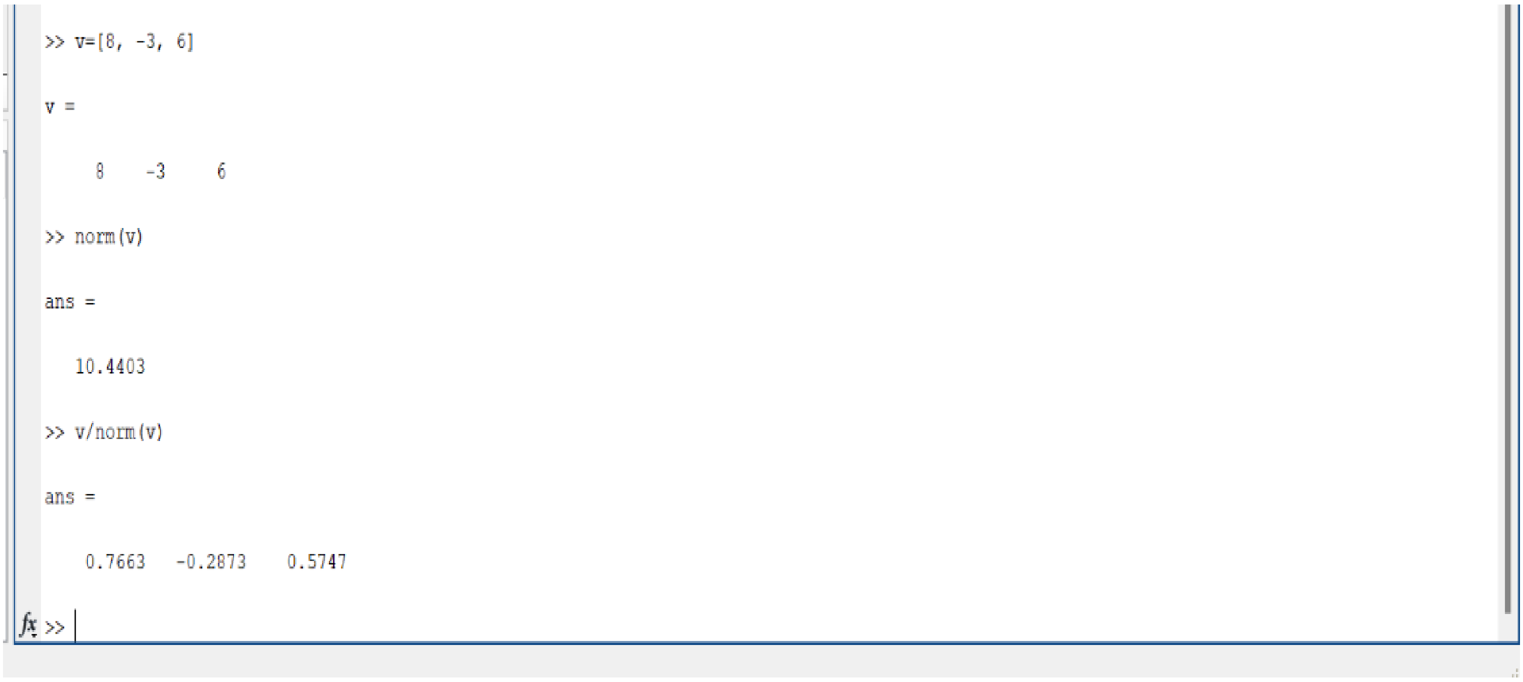
3. Length of the vector V and Unit Vector

For Example:

>>v = [8, -3, 6]

v =

8 -3 6



```
>> v=[8, -3, 6]

v =

     8    -3     6

>> norm(v)

ans =

   10.4403

>> v/norm(v)

ans =

    0.7663   -0.2873    0.5747

>>
```

Some Vector Functions

Commands	Description
dot (a, b)	Dot product of a and b
cross (a, b)	Cross product of a and b
dot (a, cross (b, c))	Scalar triple product of a, b and c
cross (a, cross (b, c))	Vector product of a, b and c

Dot and Cross Product of a and b

For Example:

>> a = [9 4 5]

a =

9   4   5

>> b = [3 -2 7]

b =

3   -2   7

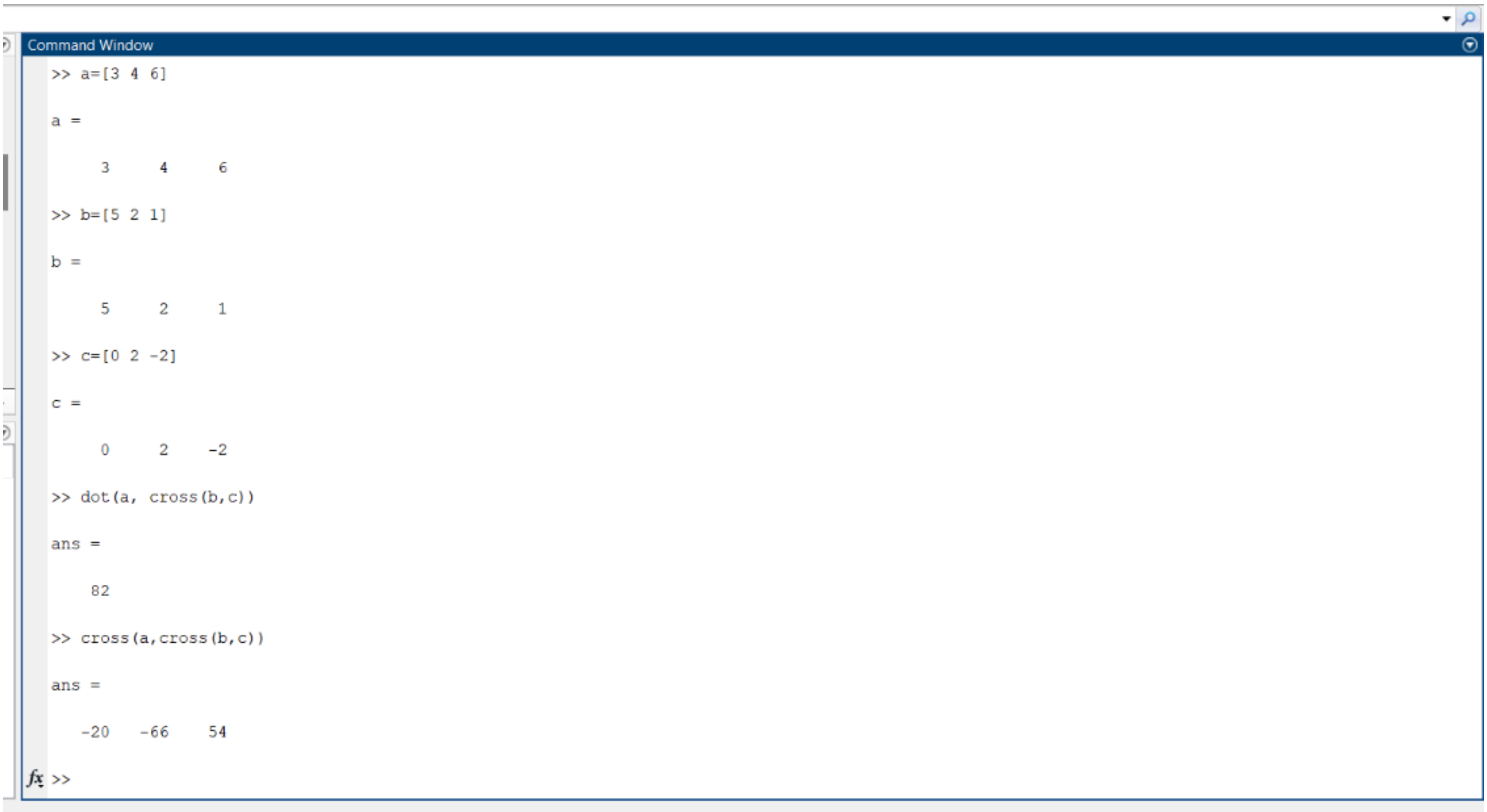
Command Window

```
>> a=[9 4 5]

a =

     9     4     5

>> b=[3 -2 7]

b =

     3    -2     7

>> dot(a,b)

ans =

    54

>> cross(a,b)

ans =

    38   -48   -30

fx >> 
```

Dot and Cross Product of a, b and c

For Example:

```
>> a = [3  4  6]
            a =
                 3     4     6
>> b = [5  2  1]
            b =
                 5     2     1
>> c = [0  2  -2]
            c =
                 0     2    -2
```



```
Command Window
>> a=[3 4 6]

a =

     3     4     6

>> b=[5 2 1]

b =

     5     2     1

>> c=[0 2 -2]

c =

     0     2    -2

>> dot(a, cross(b,c))

ans =

    82

>> cross(a,cross(b,c))

ans =

   -20   -66    54

fx >>
```

MATHEMATICA

Mathematica is a mathematical software package that can be used by any member of the Engineering Department. This seminar will show you what Mathematica can do, and will let you assess how useful it could be to you. Mathematica is a huge package with far more features than can be covered in a single afternoon. However, the seminar will show you the basics of enter problems and obtaining and displaying results. It will also show you how to explore the package for yourself and find the things that you are interested in. The majority of the seminar is devoted to giving you real hands on experience of using Mathematica. The main driving philosophy behind Mathematica is to produce a mathematical software package that is as close as possible to doing mathematics with a pen and paper. This shows itself in two ways. The appearance resembles normal mathematical text much closer than a program using a conventional programming language. You can easily use mathematical symbols like integral signs and Greek characters can be used in variable names. You can include explanatory text, with titles and subsections that make a Mathematica note book look more like a document than a program. However, the most important feature of Mathematica is that it can perform algebraic mathematics in addition to numerical mathematics. Computers mostly do numerical calculations. So for example, the expression y = x 2 takes the number x and squares it and puts the value into y. Using computational algebra the result y is a symbolic expression that can then be manipulated algebraically, differentiated and integrated using the same rules you use to manipulate equations.

Arithmetic Operations in Mathematica

Symbols	Operations
+	Add
-	Minus
Space or *	Multiply
/	Divide
^	Power

Some Mathematical Functions

Sqrt[x]	$\sqrt{X}$
Exp[x]	e^x
Log[x]	$\log_e x$
Log[a, x]	$\log_a x$
Sin[x], Cos[x], Tan[x]	$\sin x, \cos x, \tan x$
Abs[x]	$\lvert x \rvert, Abssolute\ Value$
Mod[m, n]	M Modulo n
Pi	π
E	e

Some Examples:

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help

```
In[1]:= 8 + 10

Out[1]= 18

In[2]:= 2^8

Out[2]= 256

In[4]:= 2^42 // N

Out[4]= 4.39805 × 10^12

In[5]:= Sqrt[225]

Out[5]= 15

In[6]:= Sqrt[6]

Out[6]= √6

In[7]:= Sqrt[6] // N

Out[7]= 2.44949

In[11]:= Sin[Pi / 4]

Out[11]= 1/√2

In[13]:= Log[3, 81]

Out[13]= 4
```

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help

```
In[13]:= Log[3, 81]

Out[13]= 4

In[14]:= 2 x + 3 /. x → 2

Out[14]= 7

In[15]:= Expand[(1 + x)^2]
```

Out[15]= $1 + 2x + x^2$

```
In[16]:= Factor[%]
```

Out[16]= $(1 + x)^2$

```
In[18]:= Factor[x^31 + y^31]
```

Out[18]= $(x + y)\,(x^{30} - x^{29} y + x^{28} y^2 - x^{27} y^3 + x^{26} y^4 - x^{25} y^5 + x^{24} y^6 - x^{23} y^7 + x^{22} y^8 - x^{21} y^9 + x^{20} y^{10} - x^{19} y^{11} + x^{18} y^{12} - x^{17} y^{13} + x^{16} y^{14} - x^{15} y^{15} + x^{14} y^{16} - x^{13} y^{17} + x^{12} y^{18} - x^{11} y^{19} + x^{10} y^{20} - x^9 y^{21} + x^8 y^{22} - x^7 y^{23} + x^6 y^{24} - x^5 y^{25} + x^4 y^{26} - x^3 y^{27} + x^2 y^{28} - x y^{29} + y^{30})$

```
In[19]:= 5 > 8

Out[19]= False

In[20]:= 5 < 8

Out[20]= True

In[24]:= Solve[y^2 - 5 y + 4 == 0, y]

Out[24]= {{y → 1}, {y → 4}}
```

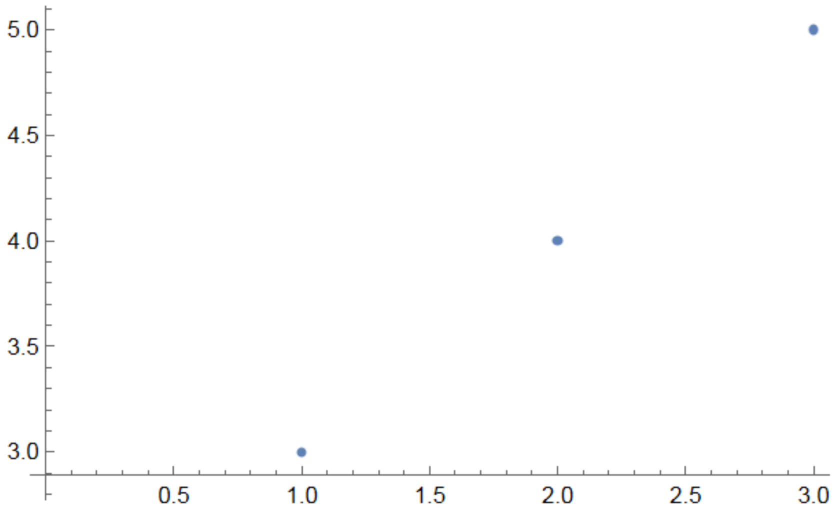
Plotting List of Data

Some Example:

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help

```
In[25]:= y = Table[y + 2, {y, 3}]

Out[25]= {3, 4, 5}

In[27]:= ListPlot[y]
```

Out[27]=

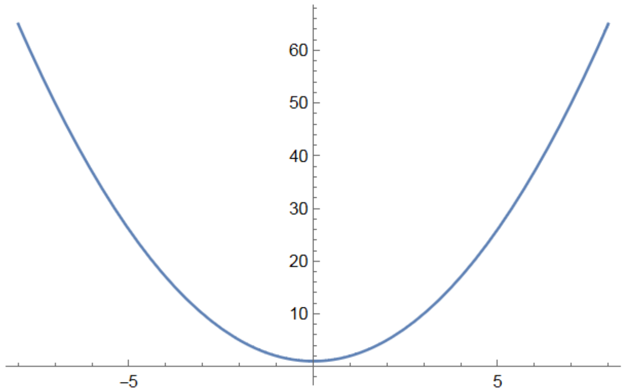


Applying Functions

Some Examples

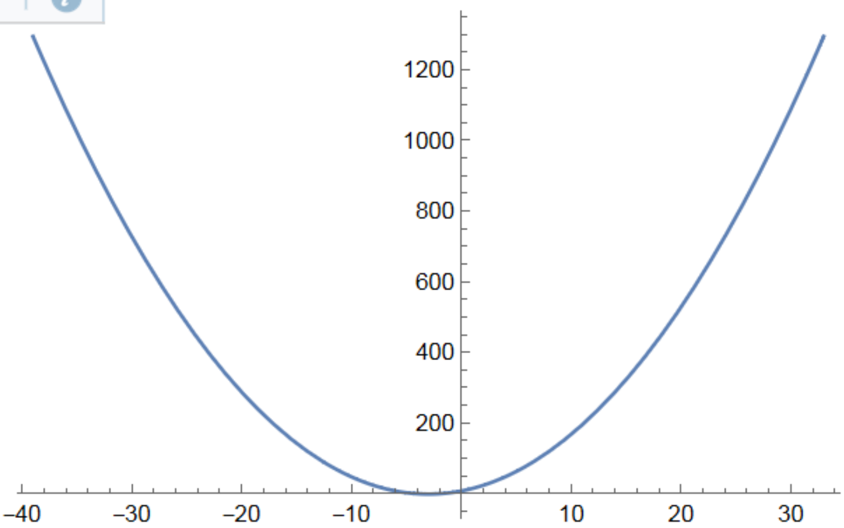
```
In[2]:= f[x_] := x + 3
        g[x_] := x^2 - 2

In[4]:= f[g[x]]
Out[4]= 1 + x^2

In[5]:= Plot[1 + x^2, {x, -8, 8}]
```

Out[5]=




```
In[6]:= g[f[x]]
Out[6]= -2 + (3 + x)^2

In[7]:= Plot[-2 + (3 + x)^2, {x, -39., 33.}]
```

Out[7]=

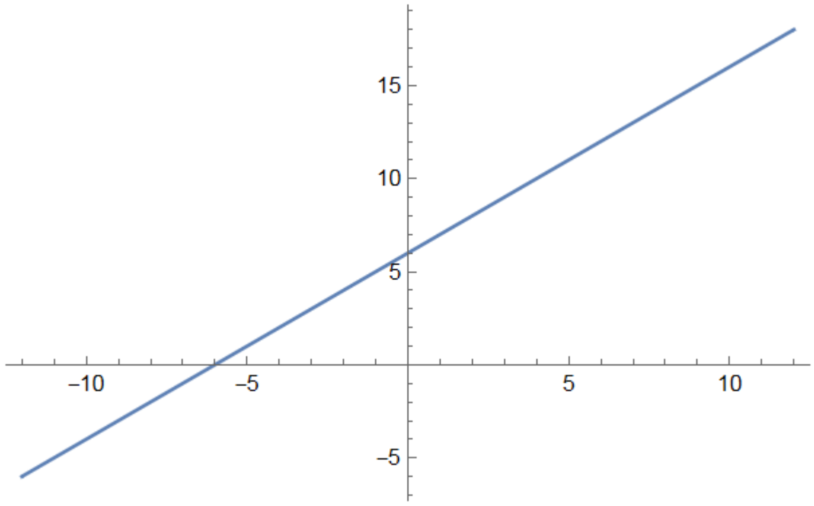


In[8]:= `f[f[x]]`

Out[8]= $6+x$

In[9]:= `Plot[6 + x, {x, -12, 12}]`

Out[9]=



In[10]:= `g[g[x]]`

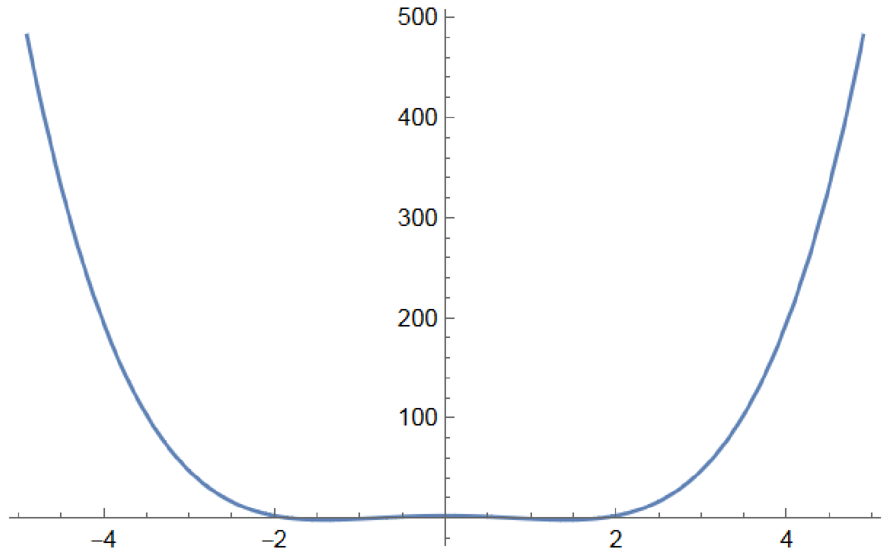
Out[10]= $-2+\left(-2+x^2\right)^2$

In[11]:= `Simplify[-2 + (-2 + x^2)^2]`

Out[11]= $2-4x^2+x^4$

In[12]:= `Plot[2 - 4 x^2 + x^4, {x, -4.89898, 4.89898}]`

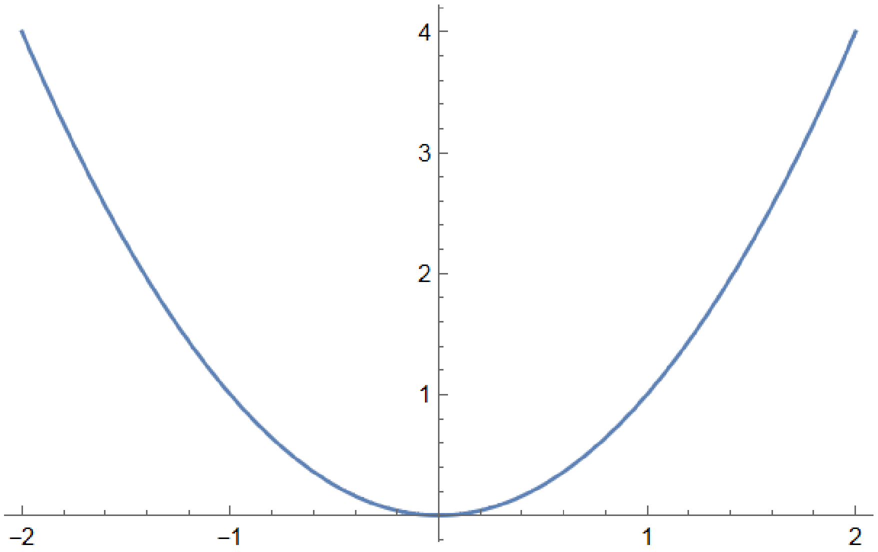
Out[12]=



Graph of x^2 and x^3

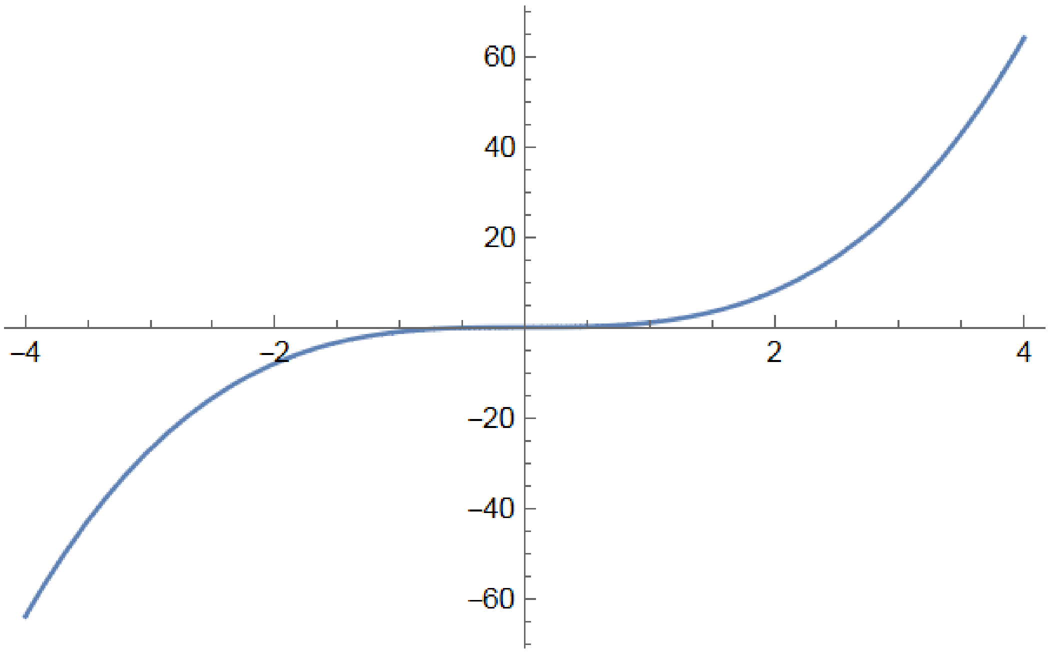
```
In[13]:= Plot[x^2, {x, -2, 2}]
```

Out[13]=




```
In[14]:= Plot[x^3, {x, -4, 4}]
```

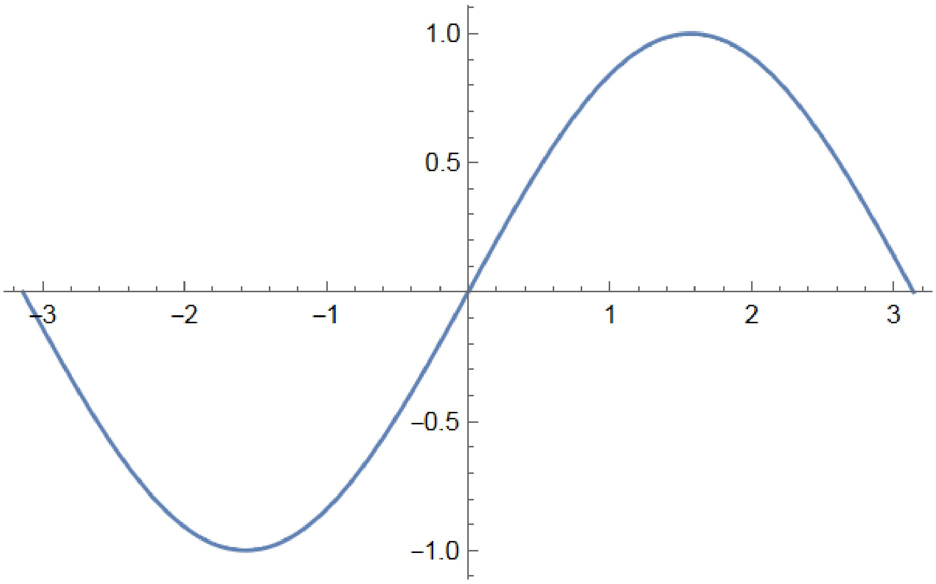
Out[14]=



Graph of Some Trigonometric Functions

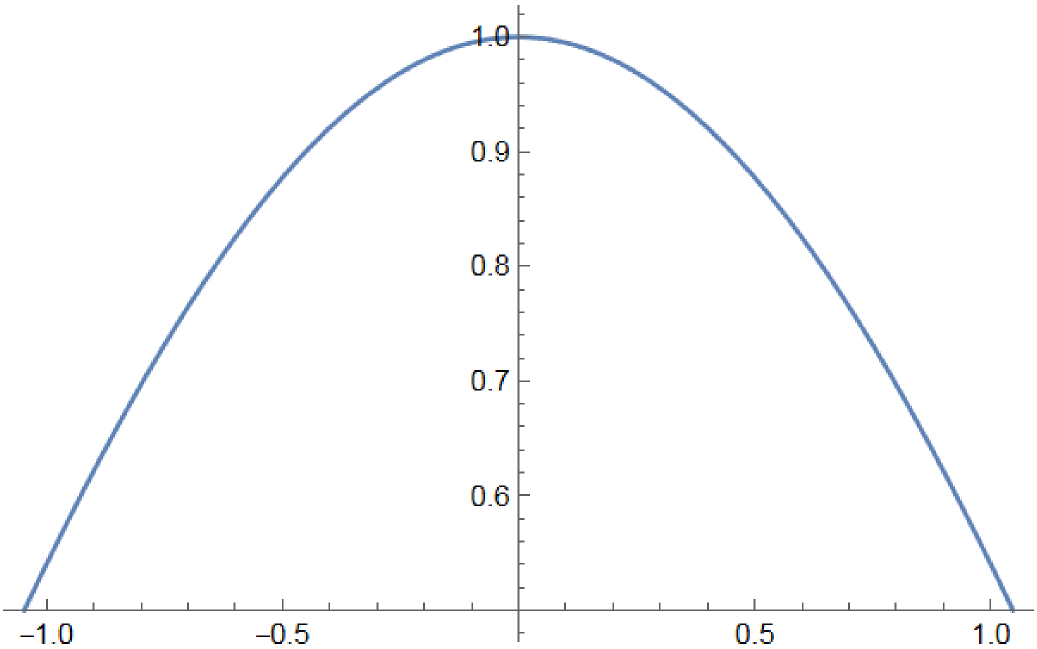
In[15]:= `Plot[Sin[x], {x, -Pi, Pi}]`

Out[15]=



In[16]:= `Plot[Cos[x], {x, -Pi / 3, Pi / 3}]`

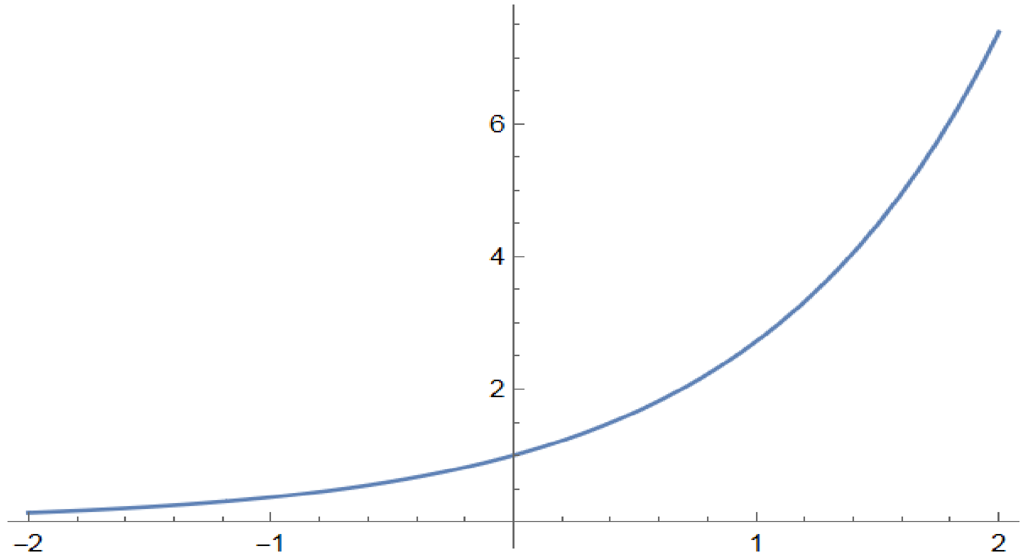
Out[16]=



Graph of Exponential Function

In[17]:= `Plot[Exp[x], {x, -2, 2}]`

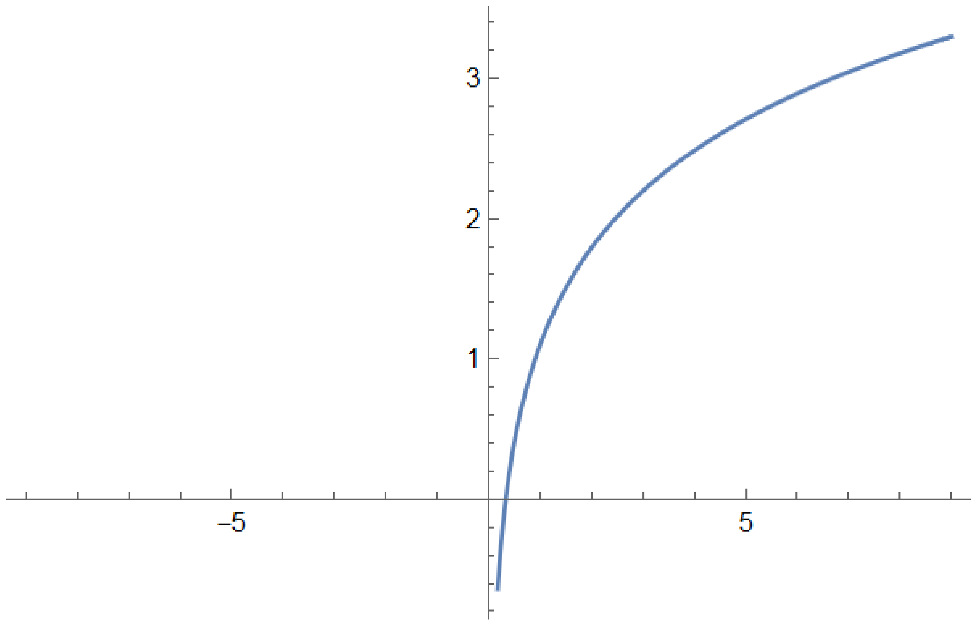
Out[17]=



Graph of Logarithmic Function

In[18]:= `Plot[Log[3 x], {x, -9, 9}]`

Out[18]=



CIRCLE

To draw circle using Mathematica Software:

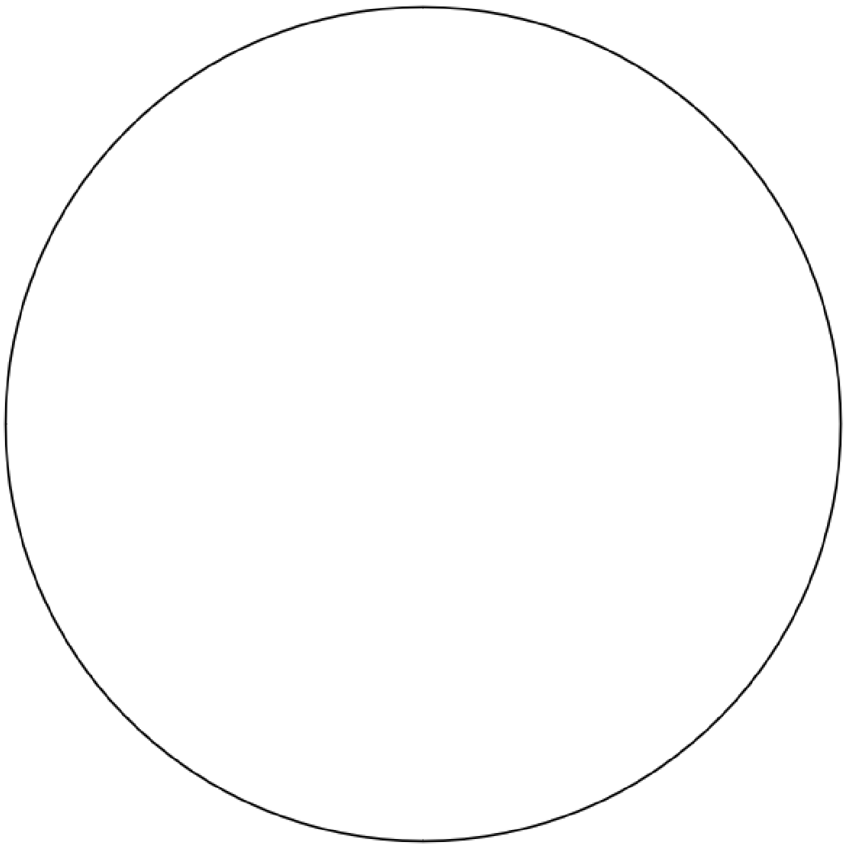
- Open Wolfram Mathematica
- Enter the following Command
- Graphics [{Circle [{h, k}, r] }]

Where (h, k) is the Centre and r is radius.

For Example

```
In[20]:= Graphics[{Circle[{0, 0}, 3]}]
```

Out[20]=



Parabola

To draw parabola using Mathematica Software:

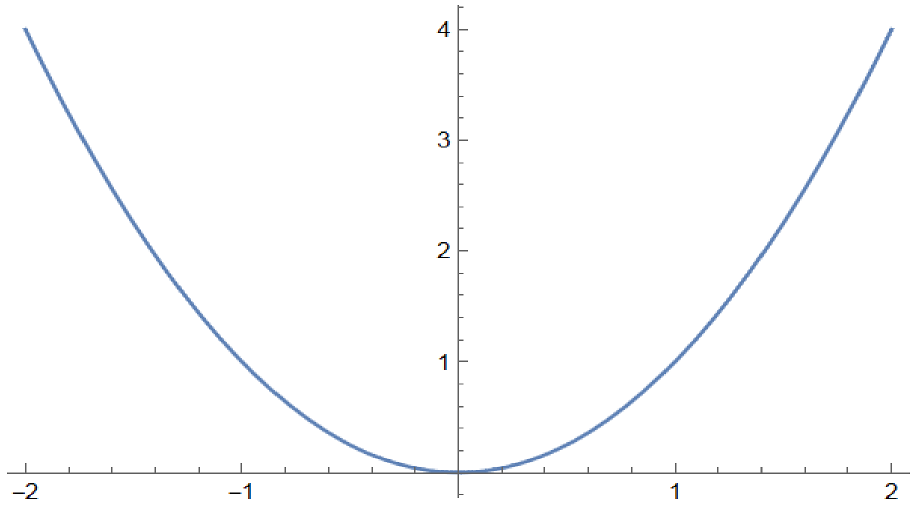
• Open Wolfram Mathematica

• Enter the following Command

In(24):-Plot [x^2, {x, -2, 2}]

```
In[24]:= Plot[x^2, {x, -2, 2}]
```

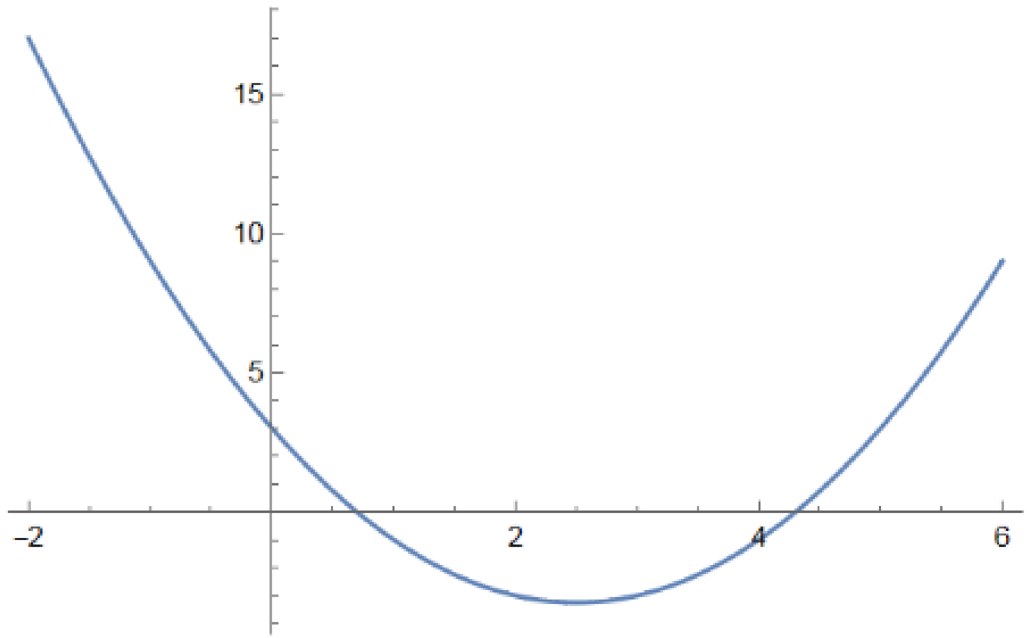
Out[24]=



Graph of y=x^2-4x+3

```
In[30]:= Plot[Evaluate[x^2 - 5 x + 3], {x, -2, 6}]
```

Out[30]=



Ellipses

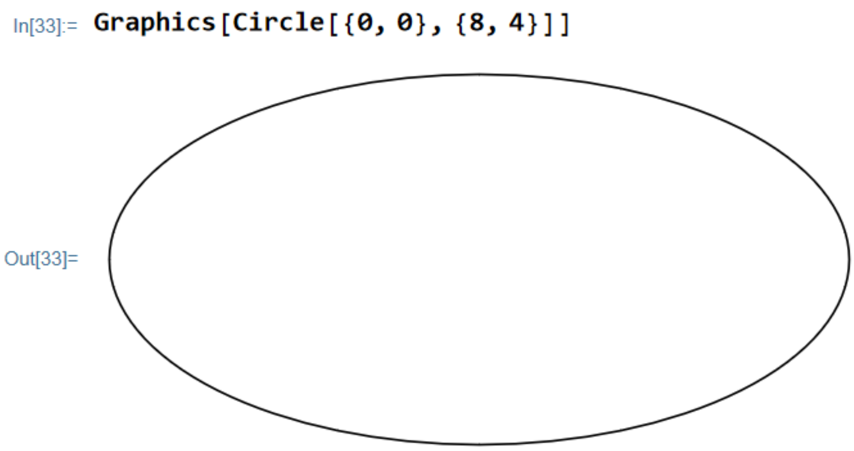
To draw parabola using Mathematica Software:

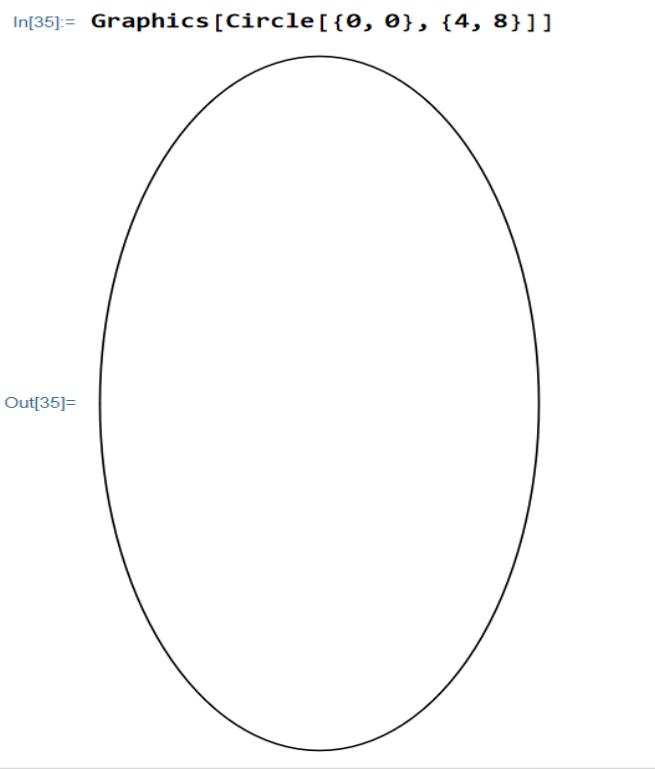
• Open Wolfram Mathematica

• Enter the following Command

Graphics[Circle [{0, 0}, {a, b}]]

For Example





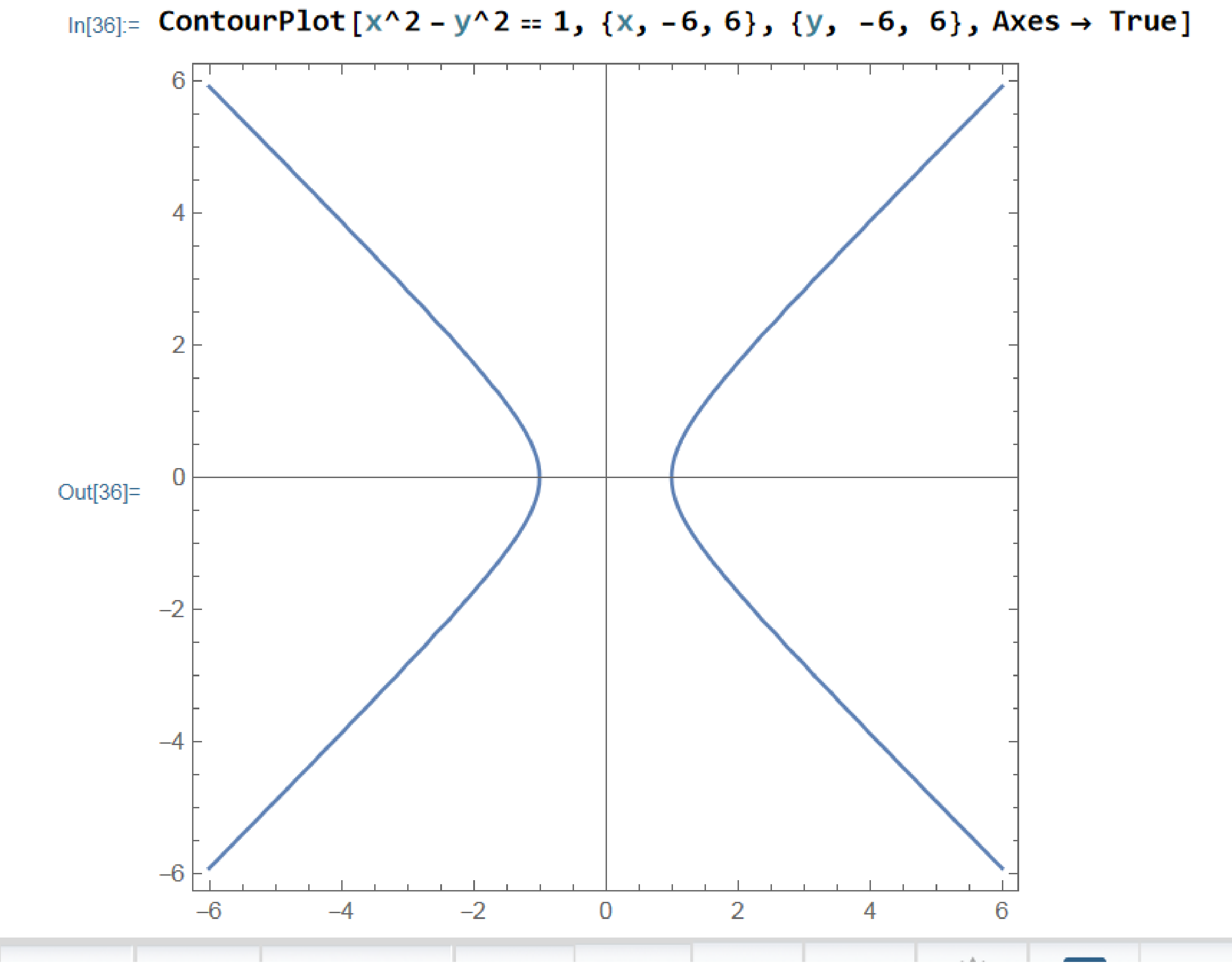
Hyperbola

To draw parabola using Mathematica Software:

• Open Wolfram Mathematica

• Enter the following Command

In(36):= ContourPlot[x^2-y^2==1, {x, -6, 6}, {y, -6, 6}, Axes→True]



In[39]:= ContourPlot[y^2 - x^2 == 1, {x, -6, 6}, {y, -6, 6}, Axes → True]

Out[39]=