

# Mathython (=Math+Python)

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<http://github.com/debdut/mathython>

# Preface

Mathython as you guessed means Math + Python. This book guides you through how can you enrich your mathematical creativity with the master tool Python. This book requires neither any previous knowledge of Python nor any experience with programming. But some experience with middle school mathematics and eagerness to explore is expected. The format of this book is almost like story-telling although it covers some serious topics. I earnestly hope that you will enjoy it. If you find any error feel free to contact me or commit your fix at <http://github.com/debdut/mathython> . I will be very happy to receive any comments or ideas about this book.

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# Chapter 1

## Creating Mathython Environment

### 1.1 Introduction

In this chapter we will create the **Mathython** Environment. I have been using GNU/Linux environment while writing this book and will assume that you are also running some GNU/Linux distribution or atleast some Unix-type operating system. I hope that does not deter you from reading this book! **Don't worry! this chapter includes instructions for setting up a GNU/Linux distribution.** Or if you can import my instructions for use in windows, I won't mind. If you are in MacOS, feel happy because you are already in a Unix-type environment but still there will be some little differences.

Choose any GNU/Linux distribution based on Debian/Ubuntu, some of the preferred distributions for beginners are :

- **GNU Trisquel**
- **Elementary OS (Mac-Like)**
- **Xubuntu**
- **Ubuntu**
- **Linux Mint (Windows-Like)**

Out of this, I prefer **Elementary OS**<sup>1</sup> for beginners. Note The instructions in the whole book for all of this distributions is same. So you have two options:

---

<sup>1</sup>I have some special instructions for Elementary OS **here** to make it the nicest workplace. Experiment with it and have some fun!

- Install GNU/Linux distribution in your harddisk.
- Install GNU/Linux distribution in a USB stick.

## 1.2 Starting Python

Open Terminal or console, type `python` followed by `<Enter>` and you will probably see this:

```
Python 2.7.3 (default, Apr 10 2013, 05:46:21)
[GCC 4.6.3] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

Did you see the same thing (without colors)? Yeppy! You are running python. If not, then probably your distribution does not have python installed. Go to [Downloads](#) and save the file. Change to directory of download and do the following to install python :

```
$tar -xvzf Python-2.7.9.tar.xz
$cd Python-2.7.9
$./configure
$make
$./python
$sudo make install
```

Ok, now you must be able to open python by typing `python` in terminal.

## 1.3 Installing Python Packages

## Chapter 2

# Python & Numbers

### 2.1 Basics

Lets get our hands dirty! We start with this **Hello Numbers** example :

```
# This program prints the counting numbers 1, 2, 3, 4 ... 10  
  
print 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
```

Write or copy this code into file **hellonum.py**, save it and run it. You will probably get this :

```
1 2 3 4 5 6 7 8 9 10
```

Ok! lets understand what that program does. The command **print** takes numbers as arguments and prints them to the file **stdout**. This file is the Standard Output file, which in turn is printed on the screen before us. This print command can also print strings as shown in the following example :

```
#This program prints a string and numbers  
  
print "My favorite number is", 7
```



Guess what this outputs,

```
My favorite number is 7
```

### 2.1.1 Numbers and Strings

#### Numbers

Python generally separates numbers in two ways :

- Integers ( $\dots - 2, -1, 0, 1, 2, 3, \dots$ ) or plain integers as type `int`
- Floating point numbers, eg. (1.0, 1.2, 1.3, 0.0, 1.3332) , as type `float` to represent decimals upto a certain precision.

`int` have the capability to handle numbers from  $-2^{31}$  to  $2^{31} - 1$  . For integers larger than that are handled by `long` type. For example, (1000000000000000L, 1L). The letter `L` at the end denotes type. Operations involving `long` type numbers may output in `long` type even if they are in range of `int` type.

Python also has other types such as `Decimal`, `Fraction`, `complex` to handle other types of numbers. We will go through those later in this book.

#### Strings and Characters

On the other hand, python needs to handle characters and other things. Single characters, eg. (a, b, c, A, Z) are handled by `char` type in python.

But to handle sequence to characters, python has String or `str` type, eg. (“Hello Numbers”, ‘My favorite number is 7.0’). Strings are enclosed in either double quotes “” or single quotes ‘’. There are some special character such as :

- ‘ ’ or space character
- `\n` or newline character
- `\t` or tab character

- `\b` or backspace character
- `\v` or vertical tab character

A program to understand special characters : After you copy this program, please make sure that you write the print command line is a single line, otherwise, you get a error. Here it is shown in many lines for convenience. Special strings known as [Verbatim Strings](#) with three quotes, ““ ””, support this feature. These are strings in which escape sequences (such as `\n`) won't be interpreted, line breaks will be preserved and quotation marks don't have to be masked. They are enclosed with triple double quotation marks. Possible indentations after a line break are part of the string as well.

```
#This program shows use of special characters

print "\t\t\t\b3.141592653589793238462643383279\n    502884197169
3993751058209749445923\n    07816406286208998628034825342117067\n
    9821    48086    5132    \n 823    06647    0
9384    \n46    09550    58223    \n17
25359    4081    \n    2848    1117
    \n    4502    8410    \n    2701
    9385    \n    21105    55964    \n
    46229    48954    \n    9303    81964
    \n    4288    10975    \n    66593
    34461    \n    284756    48233    \n
    78678    31652    71\n    2019091    4564
85    66\n    9234603    486104543266480\n    2133936
    0726024914127 \n    3724587    00660631558
\n    817488    152092096    Pi"
```

The ‘ ’ or space character insert single blank in between other characters, while `\t` or tab character insert a tab, and with `\n` newline character we go to new line. The backspace character does not show the previous character.

```

3.141592653589793238462643383279
5028841971693993751058209749445923
07816406286208998628034825342117067
9821    48086    5132
823     06647    09384
46      09550    58223
17      25359    4081
        2848     1117
        4502     8410
        2701     9385
        21105    55964
        46229    48954
        9303     81964
        4288     10975
        66593    34461
        284756   48233
        78678    31652    71
        2019091  456485    66
9234603    486104543266480
2133936    0726024914127
3724587    00660631558
817488     152092096    Pi

```

### 2.1.2 Booleans

You may or may not know that there is a lot math about booleans. In python, we call them `bool` type. It have two values `true` and `false` . For mathematical purposes, we use 1 for `true` and 0 for `false` . We will talk about them later.

## 2.2 Python as calculator

Open python console and follow me :

```
[GCC 4.6.3] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> 2+2
4
>>>
```

After we write each line, we press **<Enter>** , get the result and continue. Some operations in python :

- + or addition operator; it is a binary operator, i.e, takes two inputs and gives single output.
- \* or multiplication operator; it is a binary operator, i.e, takes two inputs and gives single output.
- - or subtraction operator; it is a binary operator, i.e, takes two inputs and gives single output.
- / or division operator; it is a binary operator, i.e, takes two inputs and gives single output.
- \*\* or exponentiation operator; it is a binary operator, i.e, takes two inputs and gives single output. (Simply, power operator, for eg.  $2^2$  or 2 to the power 2)

Note : All this operators work with `int`, `long`, `Fraction`, `float` and `complex`. The + operation is also used for strings to concatenate or merge. Other operators in the list do not work with strings. We will talk about this topic later.

### 2.2.1 Addition

```
Python 2.7.3 (default, Apr 10 2013, 05:46:21)
[GCC 4.6.3] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> 107+24
131
>>> 1073741824+0
1073741824
>>> -2+2
0
>>> 2.333+2.334
4.667
>>> 1073741824+124
1073741948
>>>
```



# Appendix A

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