Numbers in Python

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Quick Overview

- We all have experience with numbers. It doesn’t matter if you’re a middle schooler or a phD in mathematics!
- Since numbers are a common ground with humanity, we’re start learning python by re-discovering the wonderful world of numbers.
- In this lesson we’ll learn about numbers in python. We’ll learn how to store them (variables), how to view them (print), how to manipulate them using operators, some funky python operators, and how to enhance the standard math functionality with the math module. We’ll then wrap together everything we learned by doing some *microprogramming sessions*.

FYI: Code in these Slides are on GitHub

Download and play with it, it's a good way to learn coding: https://github.com/purcellconsult/Master-Python-3-Course-/blob/master/1_numbers_in_python.py

What’s a variable?

Anything that changes. Weather, day of week, money in da bank, and your mood. :-) :(

Creating variables in python

```
a = 5

b = 10

c = a

d = a**2

e = d + 10
```

Viewing variables in python

```
print(a)                    # 5
print(b)                    # 10
print(c)                    # 5
print(d)                    # 25
print(e)                    # 35
# prints text
print('Hello World')       # Hello World
print(5, 'birds')               # 5, birds
print()                     # prints empty space
```

Using python as a calculator

```
>>> print(10 + 10)
20
>>> print(20 - 5)
15
>>> print(9 * 9)
81
>>> print(5 / 2)
2.5
>>> # floor functionality
... print(5 // 2)
2
>>> print(10 % 3)
1
>>> print(5 ** 3)
125
>>> # the parentheses changes order of execution
... print(10 - 3 / (5 % 3))
8.5
```

Some Tricky Operators

%: This is known as modulus. It does typical division and then returns the remainder.

**: This is equivalent to exponentiation. So, x ** y equals x^y.

//: This is the floor operator. So, 5 // 2 is equal to 2. Do division as usual and round DOWN to nearest integer.

int and float

These are the two main numbers in python. You do have complex numbers but they are not as common.

Which numbers are int and float?

```
>>> a1 = 5
>>> print(type(a))
<class 'float'>
>>> # euler's number
... b1 = 2.71828182845904523536028747135 27
>>> print(type(b1))
<class 'float'>
>>>
>>>
>>> # 7.718281828459045
... c1 = a1 + b1
>>> print(c1)
7.718281828459045
>>> # 7.Truncates the mantissa
... print(int(c1))
7
```

How to read in text in python

There’s a built in function, or code that’s already been written by expert programmers to help ramp up our coding productivity. That function is: input()

Reading in text with input() example

```
your_message = input('What\'s your message? ')

print('The message is: ', your_message)
```

Reading in numbers

- To do this you need to use two built in functions. Pass the input() function to the int() function:

Reading in numbers example in python

```
your_int = int(input('Enter any number '))

print('Your number is: ', your_int)
```

Importing modules

- A module is a python file that contains code that we can reuse in our programs.
- There’s a suite of modules available for us that we can make use of!
- Use the import statement to import modules in python.

import statement

```
import math

import os

from sys import gettrace          # imports select elements from the module

from email import *               # imports everything in that module
```

Example of the math module

```
import math

from math import degrees

print(math.sin(90))

print(math.cos(180))

print(math.tan(45))

print(degrees(math.pi/2))

print(math.pi)

print(math.factorial(4))

print(math.gcd(75, 1000))

print(math.isclose(10, 10.000000000000000000000000000001 ))
```

Microprogramming session

Let’s built some small python programs to tie in everything that we learned thus far.

Change calculator

Let’s say that you go into a grocery store and buy three items: milk, loaf of bread, and ham. Write a program that prompts the user for money and then returns the appropiate change. Enter in only $10, $20, or $50 bills...

Change Calculator Python Code

```
milk = 2.90

loaf_of_bread = 1.89

pack_of_ham = 4.99

grocery_cost = milk + loaf_of_bread + pack_of_ham

change = int(input('Enter the amount of change you have in $10, $20, or '

                   '$50 portions. '))



your_change = ??????????????

print(round(your_change, 2))
```

Correct Code

```
change - grocery_cost
```

Area of a triangle

Write a program that asks the user for the base and height, and then calculates the area of a triangle.

Area of Triangle Python Code

```
# area of a triangle is 1/2 * b * h
base = float(input('Enter base of a triangle '))
height = float(input('Enter height of triangle '))
area = ??????????????????????????????
print('Area of a triangle with base', base, 'and height ', height, 'is',
area)
```

Missing Piece

```
area = 1/2 * base * height
```

Calculate Quadratic Equation

Has two roots:

x = -b + sqrt(b^2 - 4ac) / 2a

x = -b - sqrt(b^2 - 4ac) / 2a

write a program that accepts a, b, and c, then computes the two roots.

Work this one out

Make sure to code up your own solution first before looking at the answer. The solution is in the GitHub file:
https://github.com/purcellconsult/Master-Python-3-Course-/blob/master/1_numbers_in_python.py

Coding Project

Let’s write a more interesting program. Let’s simulate some of the functionality of a scientific calculator. Should handle: addition, subtraction, multiplication, division, modulus, square root, exponential, basic trigonometry: sin(), cos(), tan(), (gives answer in both radians and degrees), and logarithm.

Coding Hint

```
'''
addition operation
'''
a1 = float(input('Addition. Enter first number '))
a2 = float(input('Enter second number '))
a3 = a1 + a2
print(a1, '+', a2, '=', a3)
```