

PH2150 Scientific Computing Skills

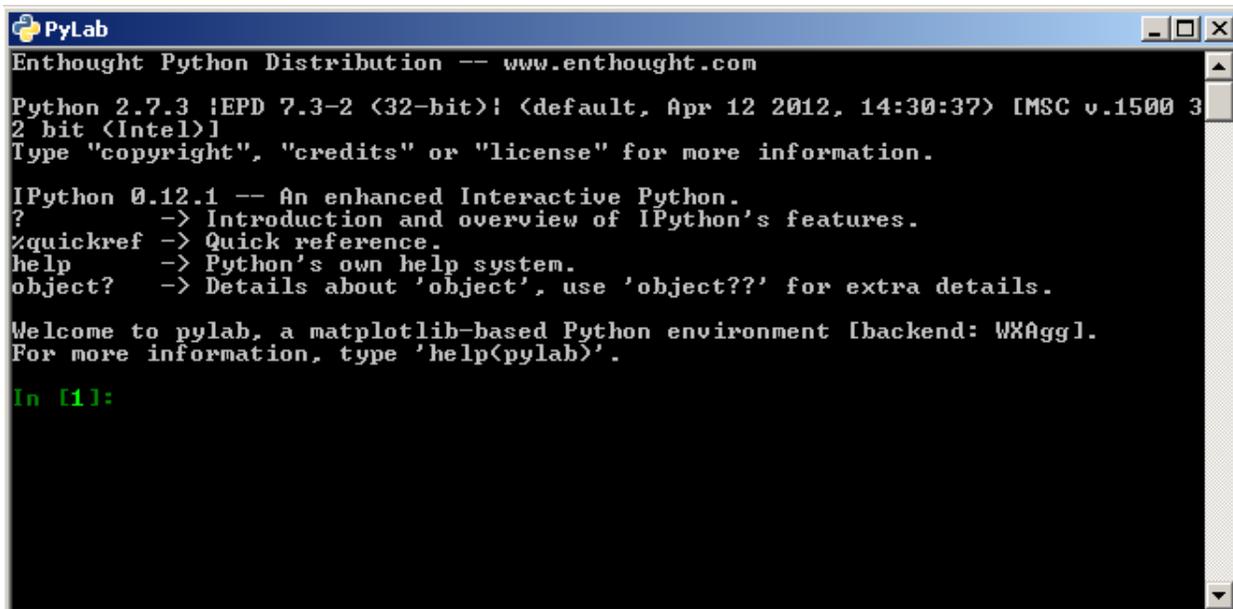
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1 Problem Sheet 1, Exercise 1:

Launch PyLab, from within PyLab create a directory on your *y:* drive, *y://PH2150//Exercises*
Useful commands when navigating the directory structure in PyLab:

- `pwd` = print working directory (tells you where you are, by default will be a local drive)
- `ls` = list directory (lists contents of working directory)
- `cd` *followed by path* = change directory
- `mkdir` *followed by name* = make directory
- `cd "y:"` parentheses are needed within *PyLab* to change to *y*



```
PyLab
Enthought Python Distribution -- www.enthought.com
Python 2.7.3 |EPD 7.3-2 (32-bit)| (default, Apr 12 2012, 14:30:37) [MSC v.1500 3
2 bit (Intel)]
Type "copyright", "credits" or "license" for more information.

IPython 0.12.1 -- An enhanced Interactive Python.
?          -> Introduction and overview of IPython's features.
%quickref  -> Quick reference.
help       -> Python's own help system.
object?    -> Details about 'object', use 'object??' for extra details.

Welcome to pylab, a matplotlib-based Python environment [backend: WXAgg].
For more information, type 'help(pylab)'.

In [1]:
```

Fig. 1: The interpreter PyLab, this is where you can directly type Python code (interactive mode) or run scripts that were coded in the development environment.

2 Problem Sheet 1, Exercise 2:

Within PyLab, type `help(pylab)`, become familiar with the contents of the help file

3 Problem Sheet 1, Exercise 3:

Using Python as a calculator, write a program that:

- 3a) Prints the square root of seventeen
- 3b) Prints the factorial of 18
- 3b) Prints the sine of 33 degrees

Note these functions have not be defined in the notes and you will need to search the online tutorial or interactive help to get the correct answers.

4 Problem Sheet 1, Exercise 4:

A question to practice requesting inputs from users and returning the output after evaluation: The problem is as follows. A ball is dropped from a tower of height h , built on level ground. The ball has initial velocity zero and accelerates downwards under gravity. The challenge is to write a program that asks the user to enter the height in meters of the tower and a time interval t in seconds, then prints on the screen the height of the ball from the ground at time t after it is dropped, ignoring air resistance.

5 Problem Sheet 1, Exercise 5: Defining Functions

A satellite is to be launched into a circular orbit around the Earth so that it orbits the planet once every T seconds.

- a) Show that the altitude h above the Earth's surface that the satellite must have is

$$h = (GMT^2/4\pi^2)^{1/3} - R$$

where $G = 6.67 \times 10^{-11} m^3 kg^{-1} s^{-2}$ is Newton's gravitational constant, $M = 5.97 \times 10^{24} kg$ is the mass of the Earth, and $R = 6371$ km is its radius.

- b) Write a program that asks the user to enter the desired value of T and then calculates and prints out the correct altitude in meters.

c) Use your program to calculate the altitudes of satellites that orbit the Earth once a day (so-called geosynchronous orbit), once every 90 minutes, and once every 45 minutes. What do you conclude from the last of these calculations?

6 Problem Sheet 1, Exercise 6: Using Functions

Using the `write()` method create a file containing the first law of thermodynamic: “In all cases in which work is produced by the agency of heat, a quantity of heat is consumed which is proportional to the work done; and conversely, by the expenditure of an equal quantity of work an equal quantity of heat is produced.” Write a program to read out the sixth word of the string and then print the whole statement.