Getting Started with Python

Now that you have the latest version of Python installed, you can begin to get programming. These are your first steps in the wider world of Python and we're here to help you write your first piece of code, save it and run it in the Python IDLE Shell.

We cover variables, numbers and expressions, user input, conditions and loops and the types of errors you will undoubtedly come across in your time with Python. Let's start and see how to get coding.

Starting Python for the First Time

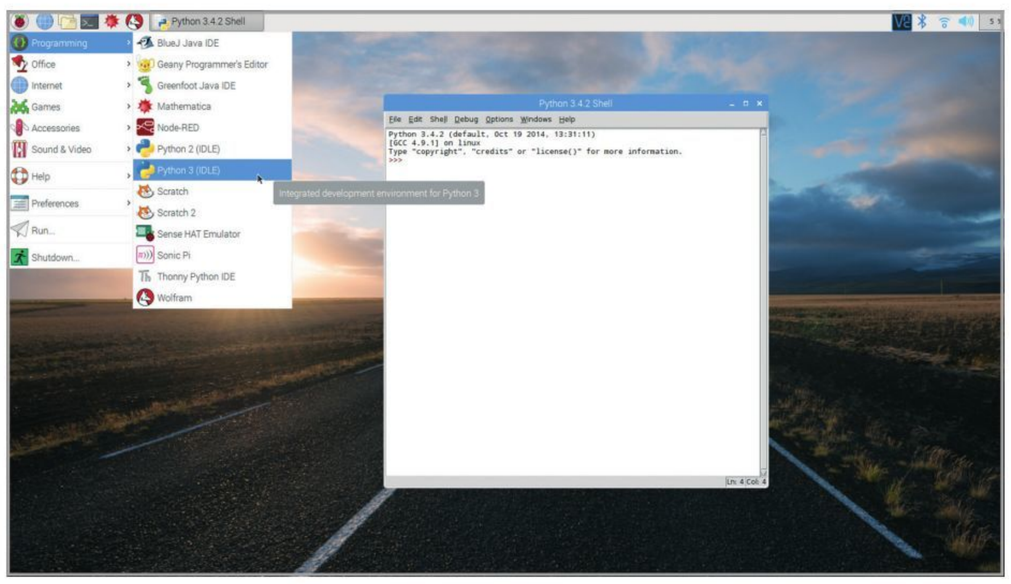
If you're using the new Raspberry Pi together with its latest release of Raspbian, then you will need to manually install the Python IDLE. This is due to the Pi team removing the core Python IDLE in favour of their own coding text editor.

STARTING PYTHON

For those using the Pi 4 and new Raspbian, drop into a Terminal and enter: sudo apt-get install idle3. Older versions of Raspbian already have the official Python IDLE pre-installed.

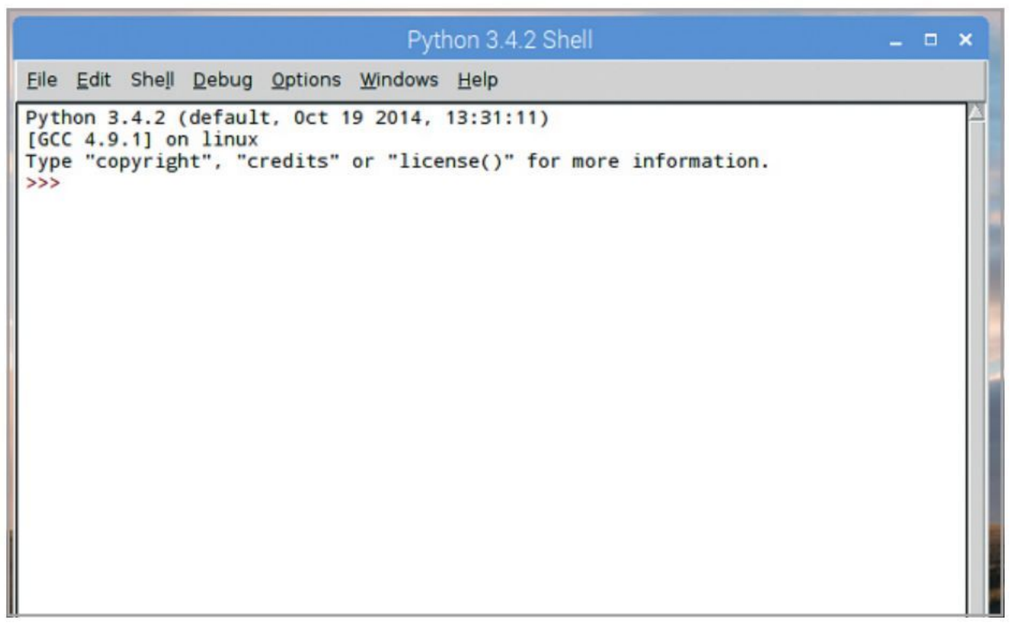
STEP 1

With the Raspbian desktop loaded, click on the Menu button followed by Programming > Python 3 (IDLE). This will open the Python 3 Shell. Windows and Mac users can find the Python 3 IDLE Shell from within the Windows Start button menu and via Finder.



STEP 2

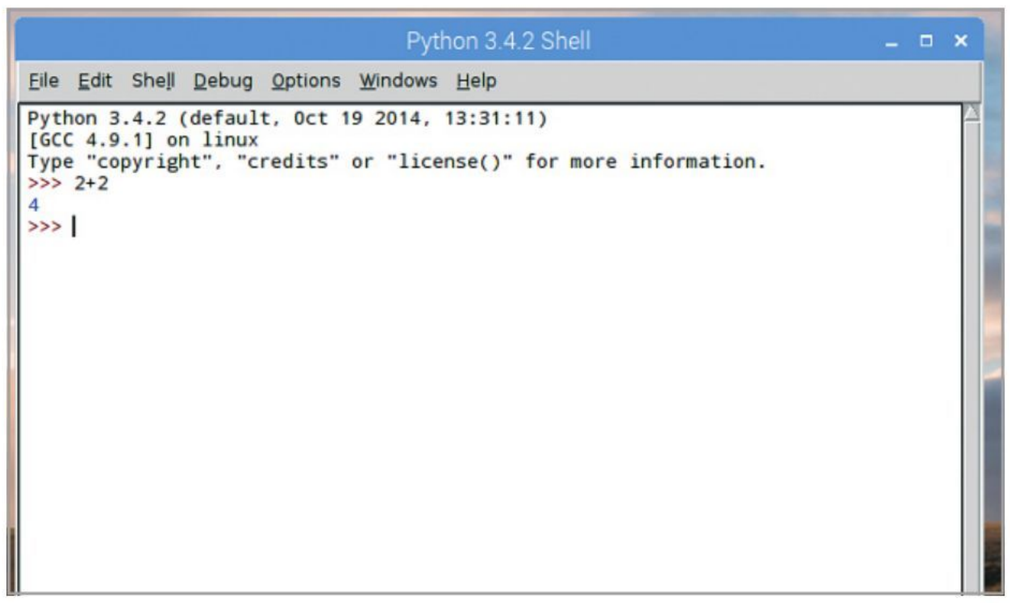
The Shell is where you can enter code and see the responses and output of code you've programmed into Python. This is a kind of sandbox, where you're able to try out some simple code and processes.



STEP 3

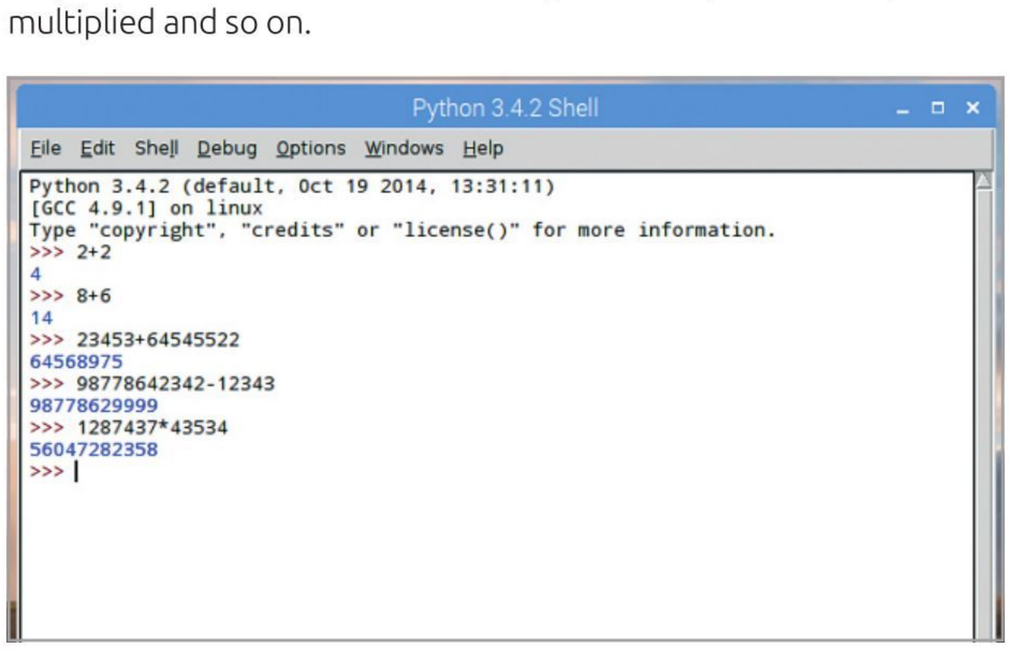
For example, in the Shell enter: 2+2

After pressing Enter, the next line will display the answer: 4. Basically, Python has taken the 'code' and produced the relevant output.



STEP 4

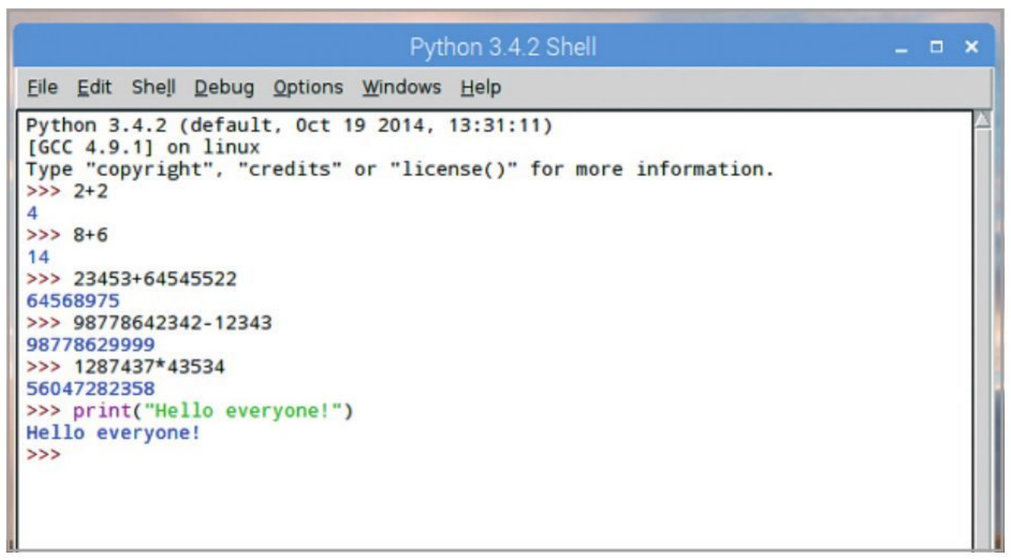
The Python Shell acts very much like a calculator, since code is basically a series of mathematical interactions with the system. Integers, which are the infinite sequence of whole numbers can easily be added, subtracted, multiplied and so on.



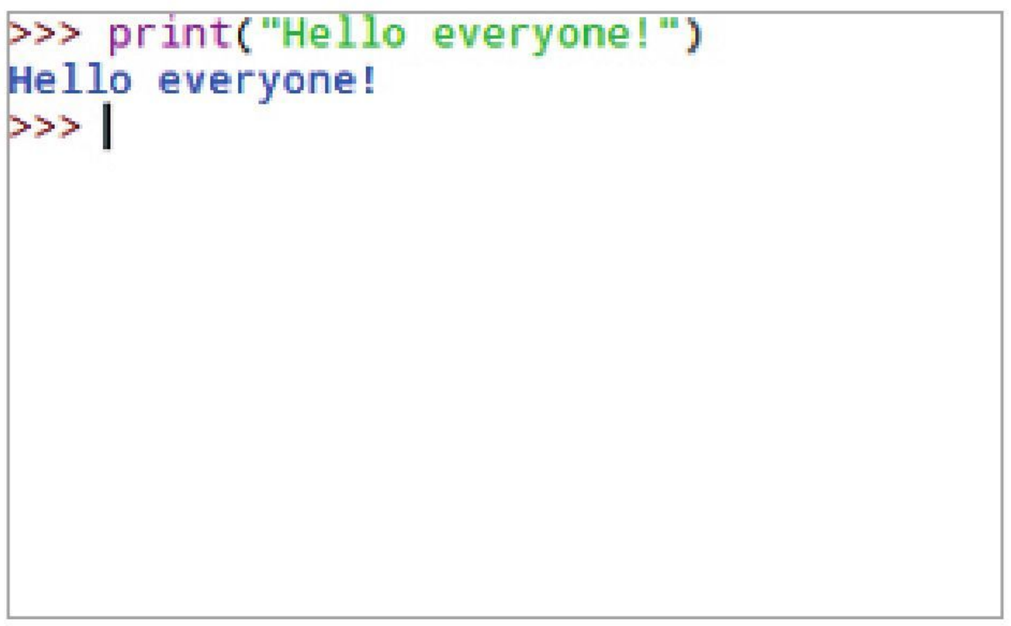
STEP 5 While that's very interesting, it's not particularly exciting. Instead, try this:

```
print("Hello everyone!")
```

As per the code we entered in Sublime in the Installing a Text Editor section of this book.



STEP 6 This is a little more like it, since you've just produced your first bit of code. The Print command is fairly self-explanatory, it prints things. Python 3 requires the brackets as well as quote marks in order to output content to the screen, in this case the Hello everyone! bit.



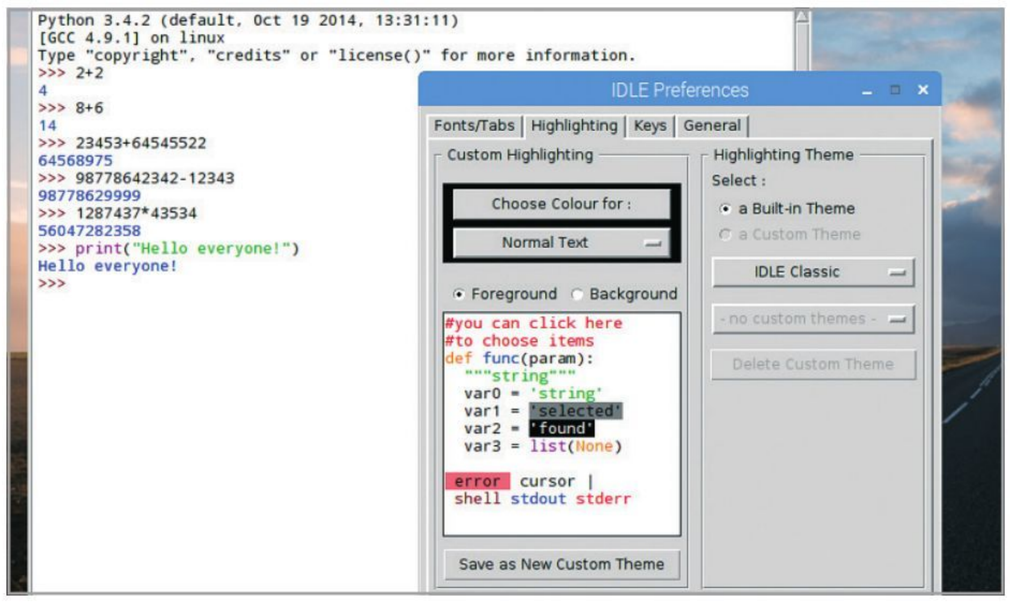
STEP 7 You may have noticed the colour coding within the Python IDLE. The colours represent different elements of Python code. They are:

Black – Data and Variables
Green – Strings
Purple – Functions
Orange – Commands
Blue – User Functions
Dark Red – Comments
Light Red – Error Messages

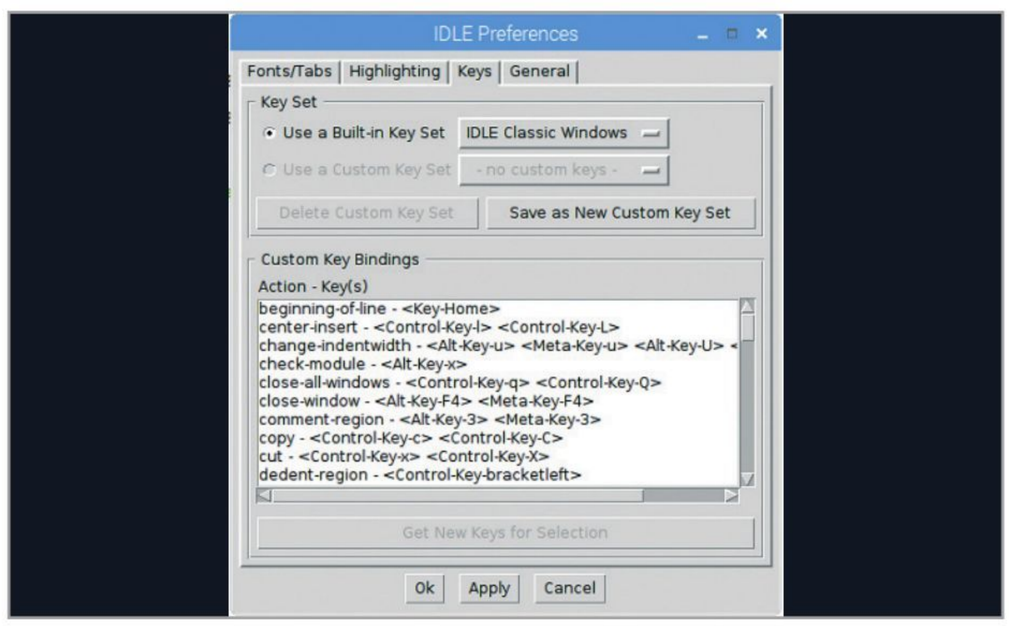
IDLE Colour Coding

Colour	Use for	Examples
Black	Data & variables	`23.6 area`
Green	Strings	`"Hello World"`
Purple	Functions	`len() print()`
Orange	Commands	`if for else`
Blue	User functions	`get_area()`
Dark red	Comments	`#Remember VAT`
Light red	Error messages	`SyntaxError:`

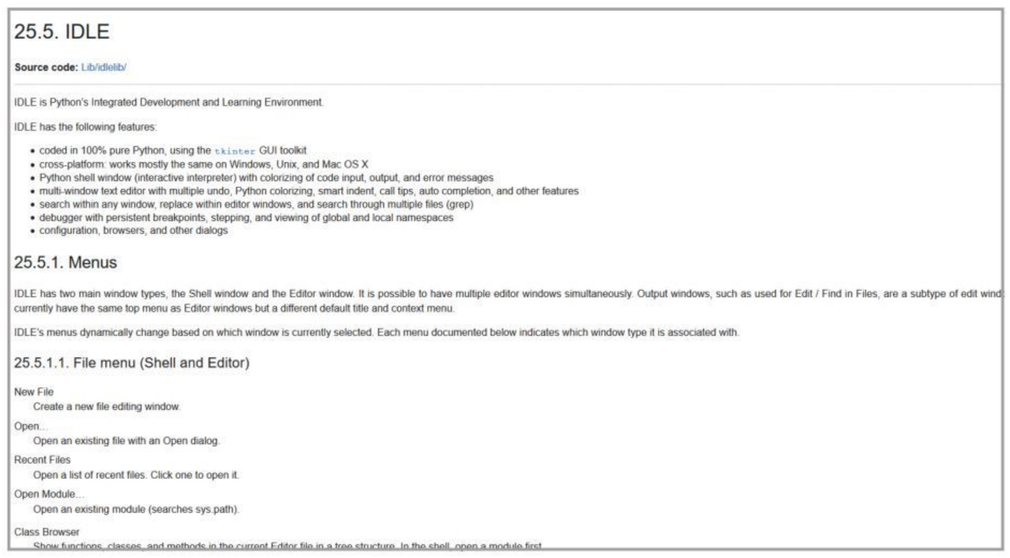
STEP 8 The Python IDLE is a configurable environment. If you don't like the way the colours are represented, then you can always change them via Options > Configure IDLE and clicking on the Highlighting tab. However, we don't recommend that as you won't be seeing the same as our screenshots.



STEP 9 Just like most programs available, regardless of the operating system, there are numerous shortcut keys available. We don't have room for them all here but within the Options > Configure IDLE and under the Keys tab, you can see a list of the current bindings.



STEP 10 The Python IDLE is a power interface, and one that's actually been written in Python using one of the available GUI toolkits. If you want to know the many ins and outs for the Shell, we recommend you take a few moments to view www.docs.python.org/3/library/idle.html, which details many of the IDLE's features.



25.5. IDLE

Source code: Lib/idlelib/

IDLE is Python's Integrated Development and Learning Environment.

IDLE has the following features:

- coded in 100% pure Python, using the `tkinter` GUI toolkit
- cross-platform: works mostly the same on Windows, Unix, and Mac OS X
- Python shell window (interactive interpreter) with colorizing of code input, output, and error messages
- multi-window text editor with multiple undo, Python colorizing, smart indent, call tips, auto completion, and other features
- search within any window, replace within editor windows, and search through multiple files (grep)
- debugger with persistent breakpoints, stepping, and viewing of global and local namespaces
- configuration, browsers, and other dialogs

25.5.1. Menus

IDLE has two main window types, the Shell window and the Editor window. It is possible to have multiple editor windows simultaneously. Output windows, such as used for Edit / Find in Files, are a subtype of edit wind
currently have the same top menu as Editor windows but a different default title and context menu.

IDLE's menus dynamically change based on which window is currently selected. Each menu documented below indicates which window type it is associated with.

25.5.1.1. File menu (Shell and Editor)

New File
Create a new file editing window.

Open...
Open an existing file with an Open dialog.

Recent Files
Open a list of recent files. Click one to open it.

Open Module...
Open an existing module (searches sys.path).

Class Browser
Show functions, classes, and methods in the current Editor file in a tree structure. In the shell, open a module first.

Your First Code

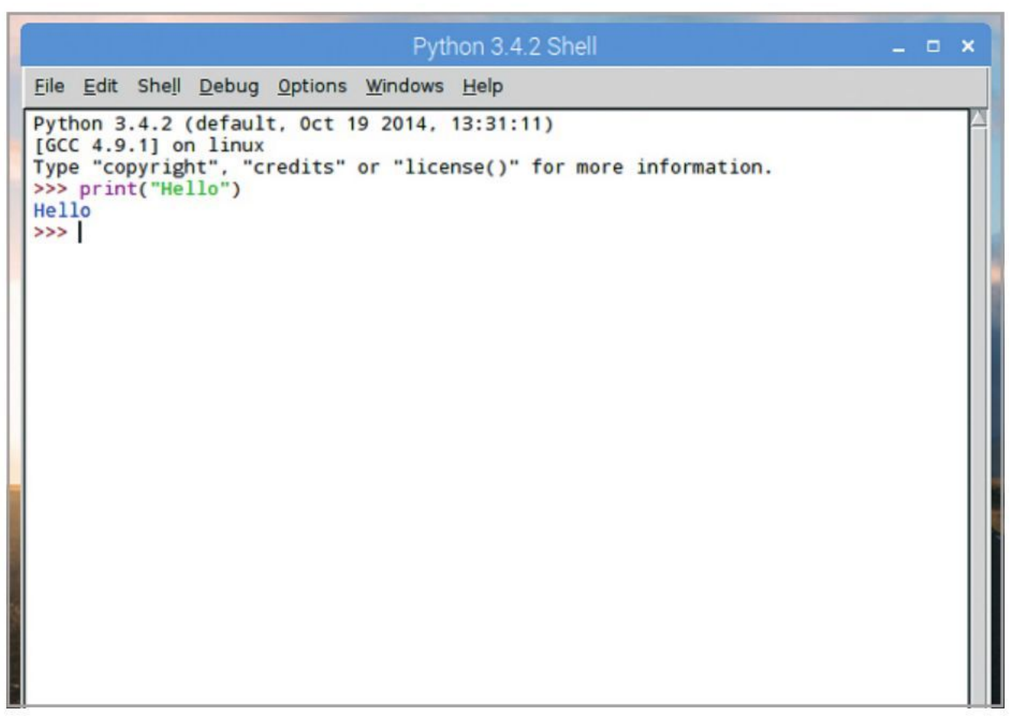
Essentially, you've already written your first piece of code with the 'print("Hello everyone!")' function from the previous tutorial. However, let's expand that and look at entering your code and playing around with some other Python examples.

PLAYING WITH PYTHON

With most languages, computer or human, it's all about remembering and applying the right words to the right situation. You're not born knowing these words, so you need to learn them.

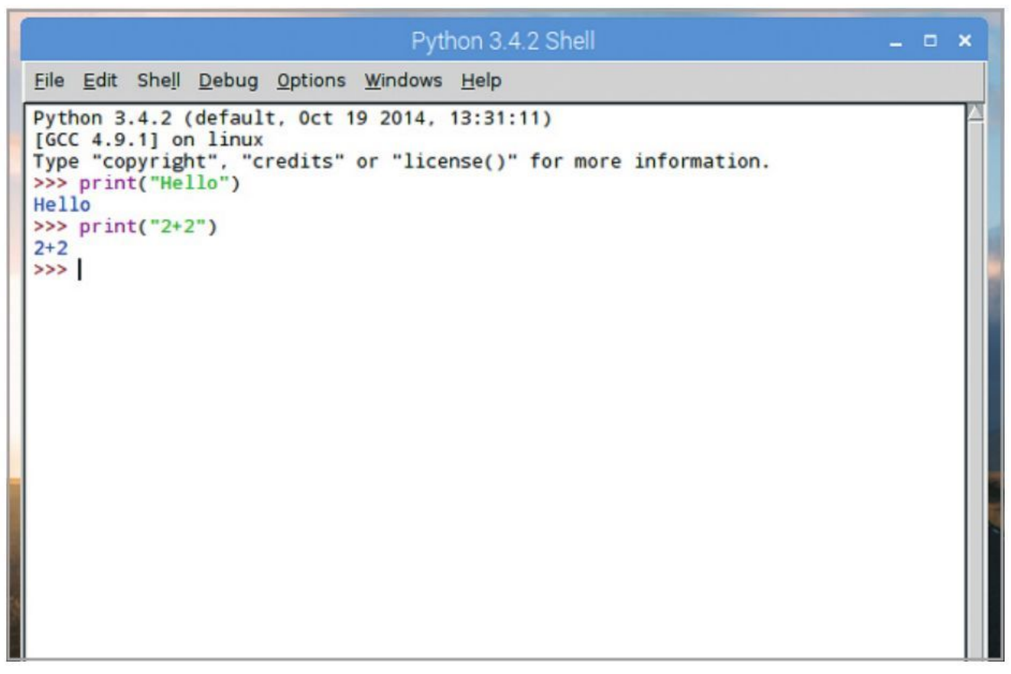
STEP 1 If you've closed Python 3 IDLE, reopen it in whichever operating system version you prefer. In the Shell, enter the familiar following:

```
print("Hello")
```



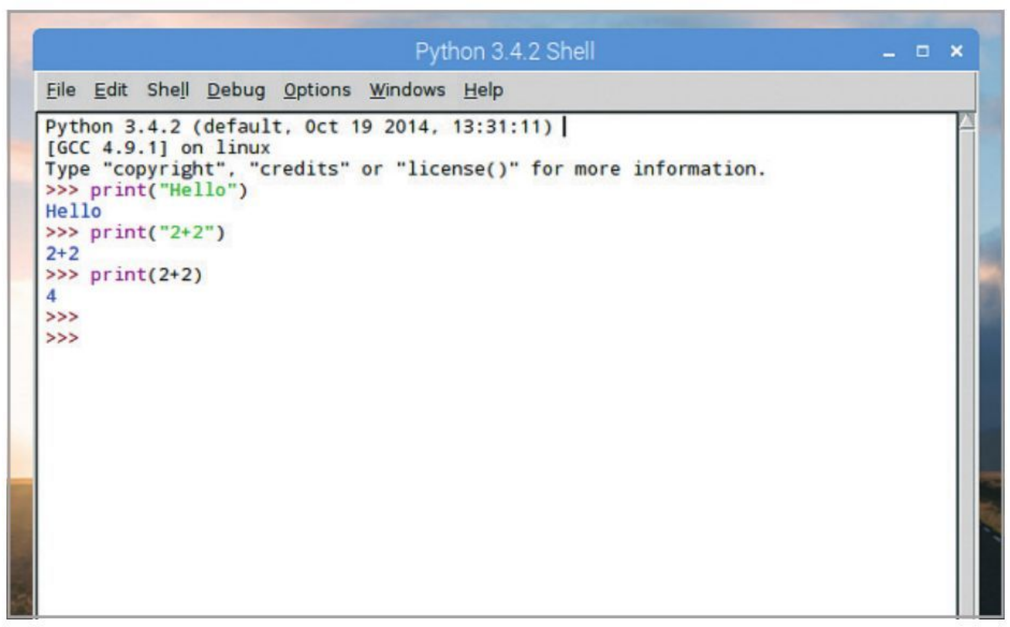
STEP 2 Just as predicted, the word Hello appears in the Shell as blue text, indicating output from a string. It's fairly straightforward and doesn't require too much explanation. Now try:

```
print("2+2")
```



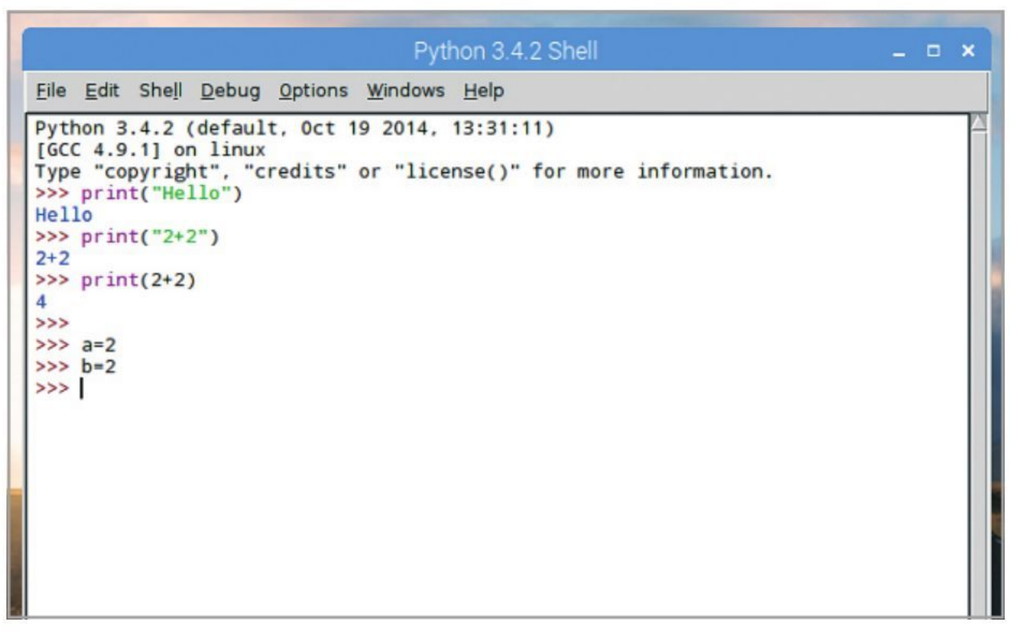
STEP 3 You can see that instead of the number 4, the output is the 2+2 you asked to be printed to the screen. The quotation marks are defining what's being outputted to the IDLE Shell; to print the total of 2+2 you need to remove the quotes:

```
print(2+2)
```



STEP 4 You can continue as such, printing 2+2, 464+2343 and so on to the Shell. An easier way is to use a variable, which is something we will cover in more depth later. For now, enter:

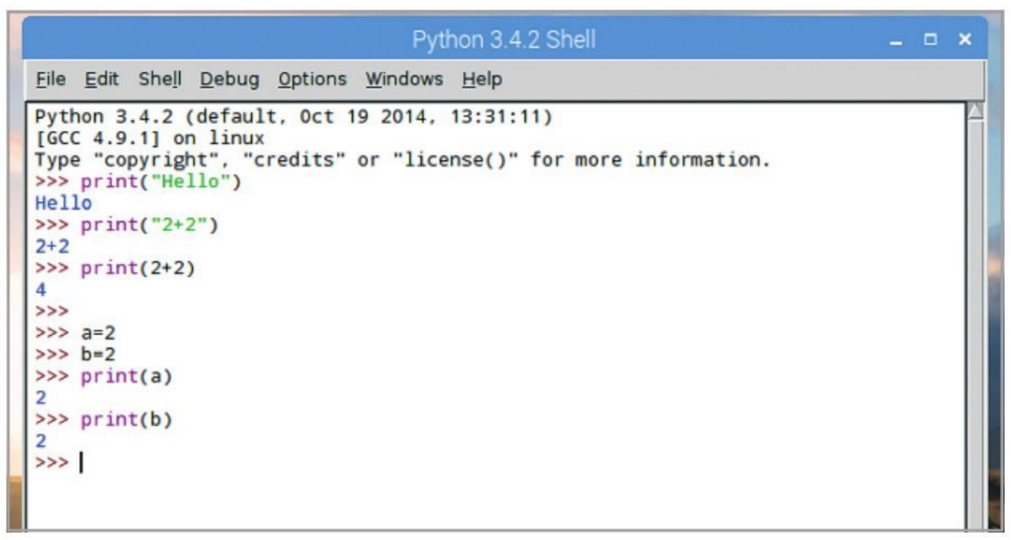
```
a=2
b=2
```



STEP 5

What you have done here is assign the letters a and b two values: 2 and 2. These are now variables, which can be called upon by Python to output, add, subtract, divide and so on for as long as their numbers stay the same. Try this:

```
print(a)
print(b)
```

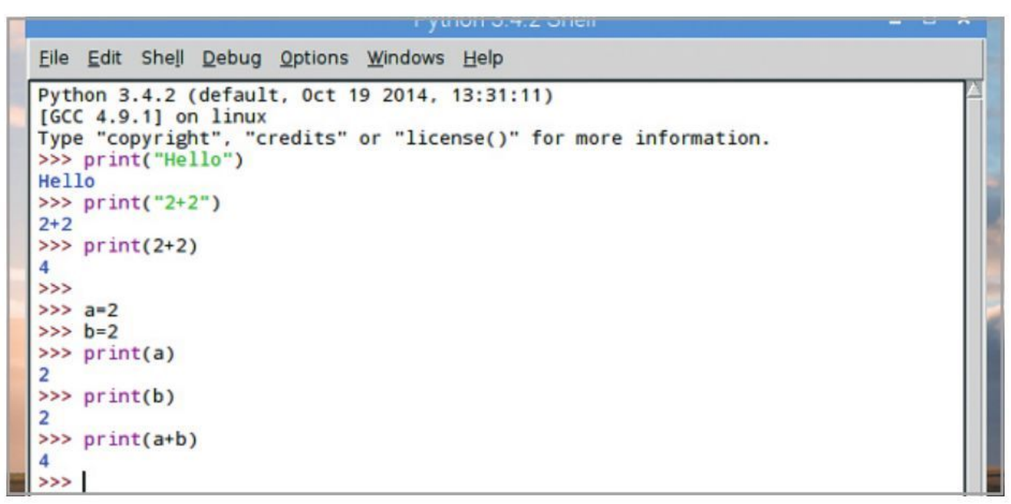


STEP 6

The output of the last step displays the current values of both a and b individually, as you've asked them to be printed separately. If you want to add them up, you can use the following:

```
print(a+b)
```

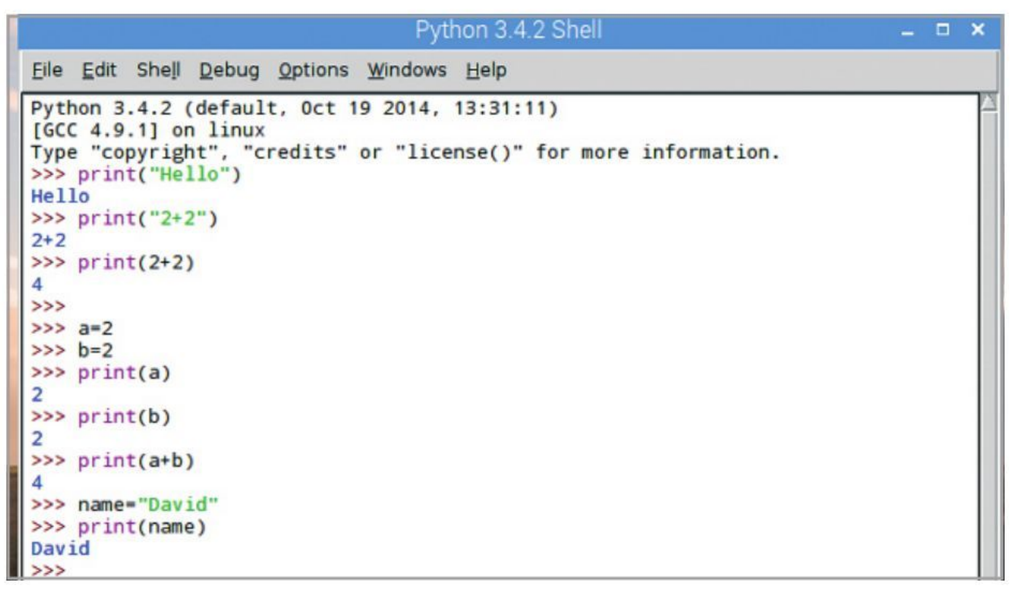
This code simply takes the values of a and b, adds them together and outputs the result.



STEP 7

You can play around with different kinds of variables and the Print function. For example, you could assign variables for someone's name:

```
name="David"
print(name)
```

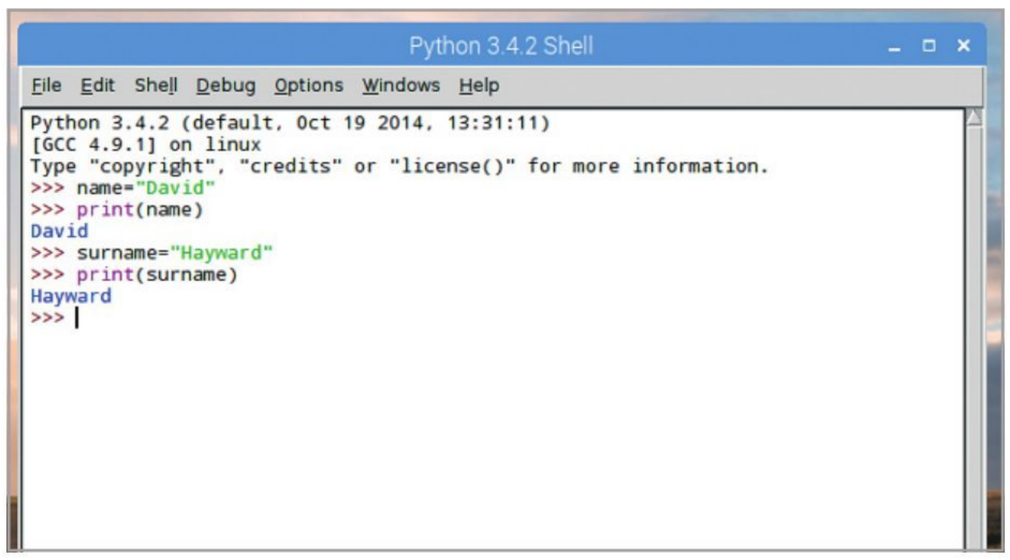


STEP 8

Now let's add a surname:

```
surname="Hayward"
print(surname)
```

You now have two variables containing a first name and a surname and you can print them independently.

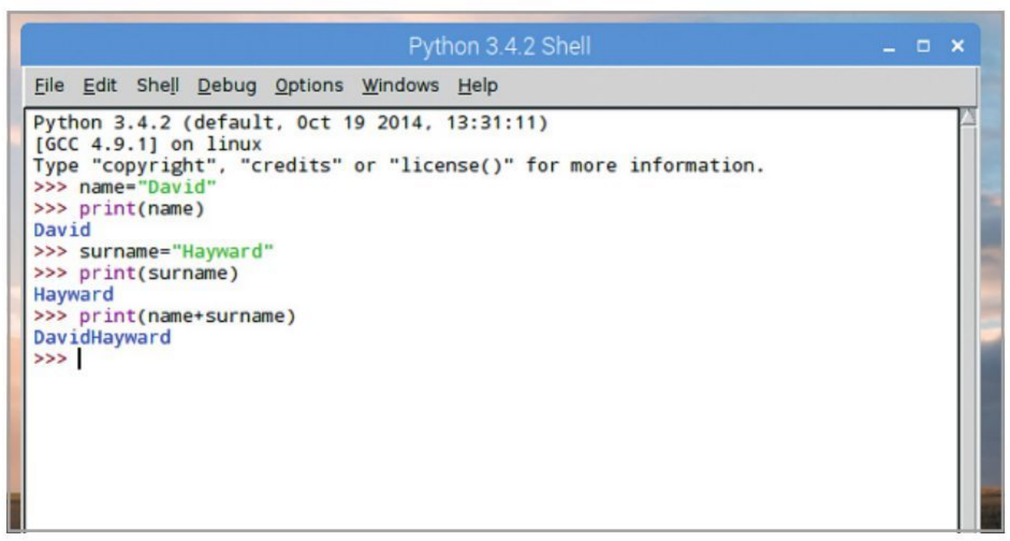


STEP 9

If we were to apply the same routine as before, using the + symbol, the name wouldn't appear correctly in the output in the Shell. Try it:

```
print(name+surname)
```

You need a space between the two, defining them as two separate values and not something you mathematically play around with.



STEP 10

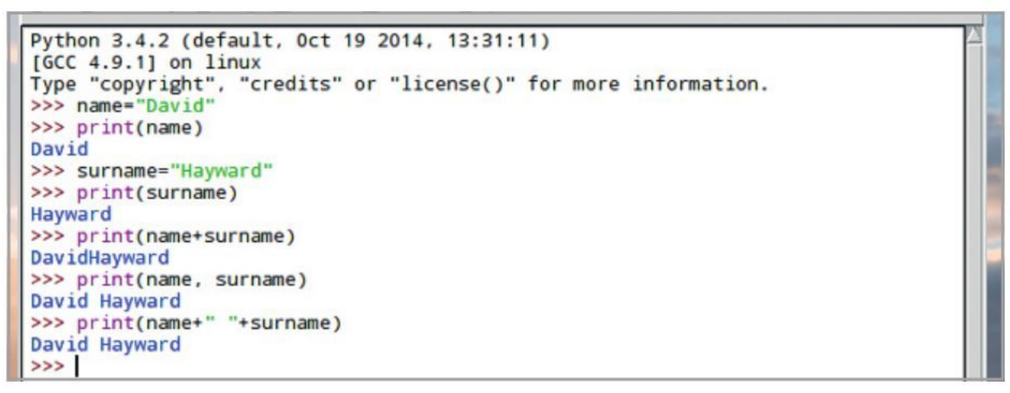
In Python 3 you can separate the two variables with a space using a comma:

```
print(name, surname)
```

Alternatively, you can add the space ourselves:

```
print(name+" "+surname)
```

The use of the comma is much neater, as you can see. Congratulations, you've just taken your first steps into the wide world of Python.



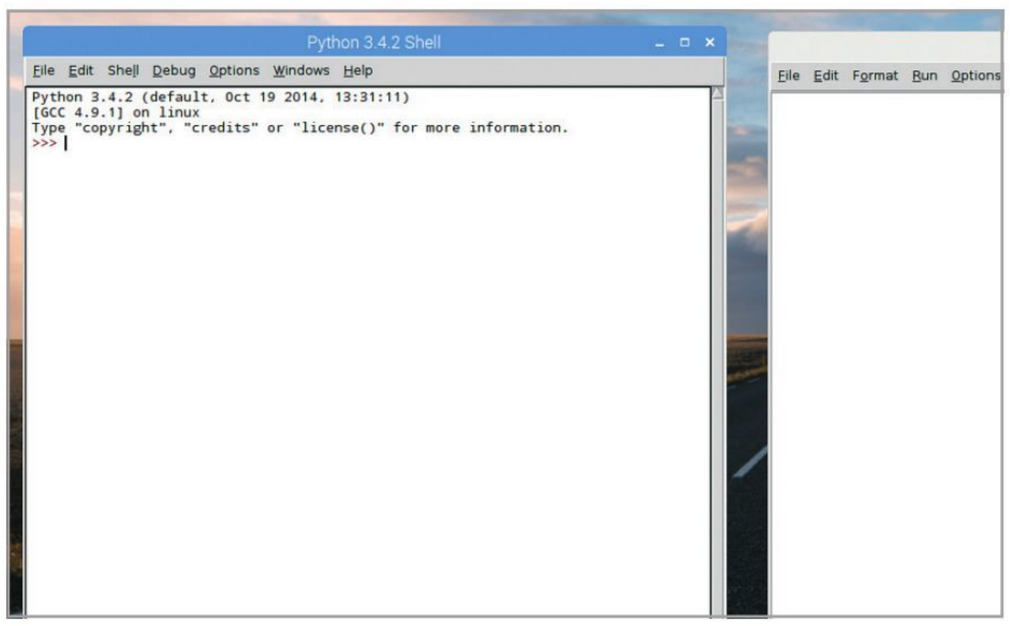
Saving and Executing Your Code

While working in the IDLE Shell is perfectly fine for small code snippets, it's not designed for entering longer program listings. In this section you're going to be introduced to the IDLE Editor, where you will be working from now on.

EDITING CODE

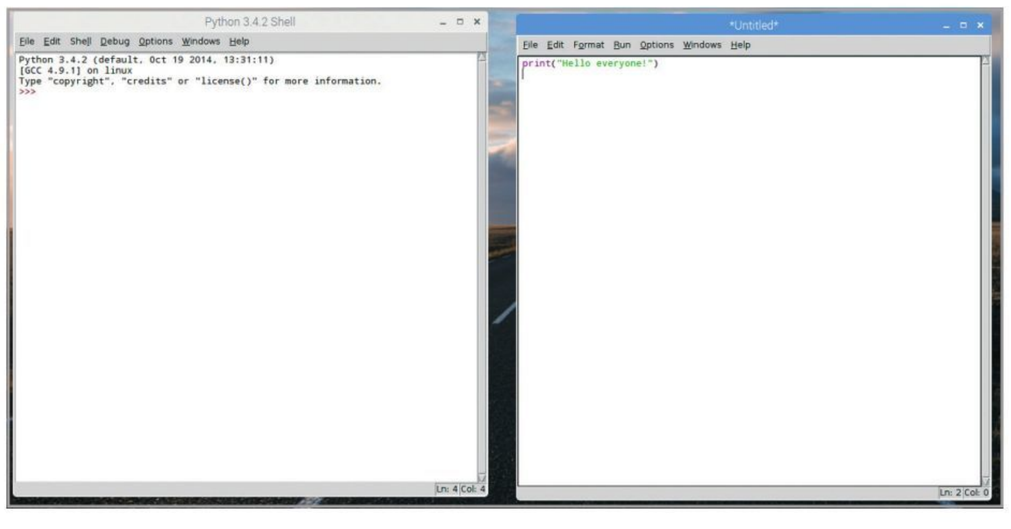
You will eventually reach a point where you have to move on from inputting single lines of code into the Shell. Instead, the IDLE Editor will allow you to save and execute your Python code.

STEP 1 First, open the Python IDLE Shell and when it's up, click on File > New File. This will open a new window with Untitled as its name. This is the Python IDLE Editor and within it you can enter the code needed to create your future programs.

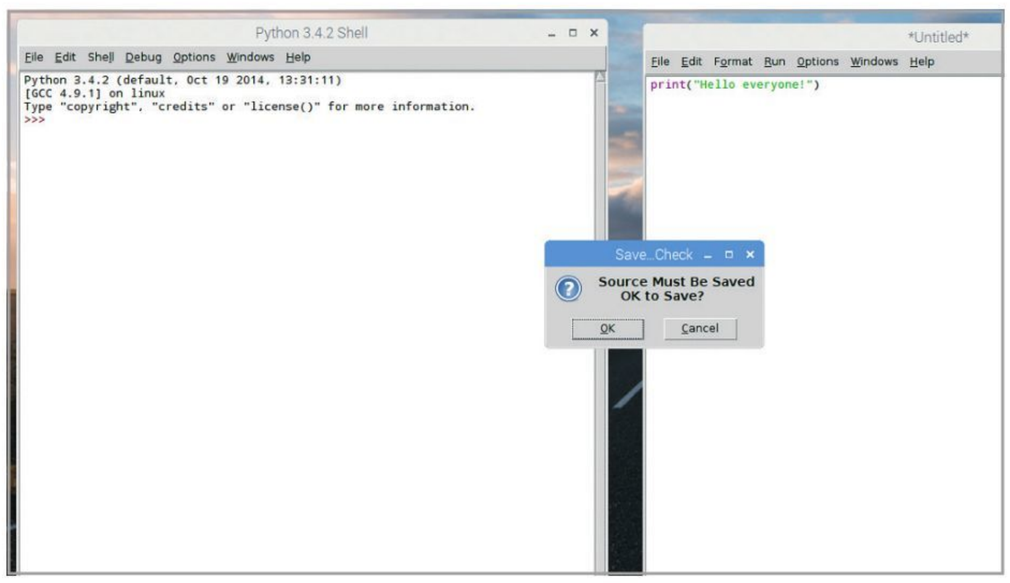


STEP 2 The IDLE Editor is, for all intents and purposes, a simple text editor with Python features, colour coding and so on; much in the same vein as Sublime. You enter code as you would within the Shell, so taking an example from the previous tutorial, enter:

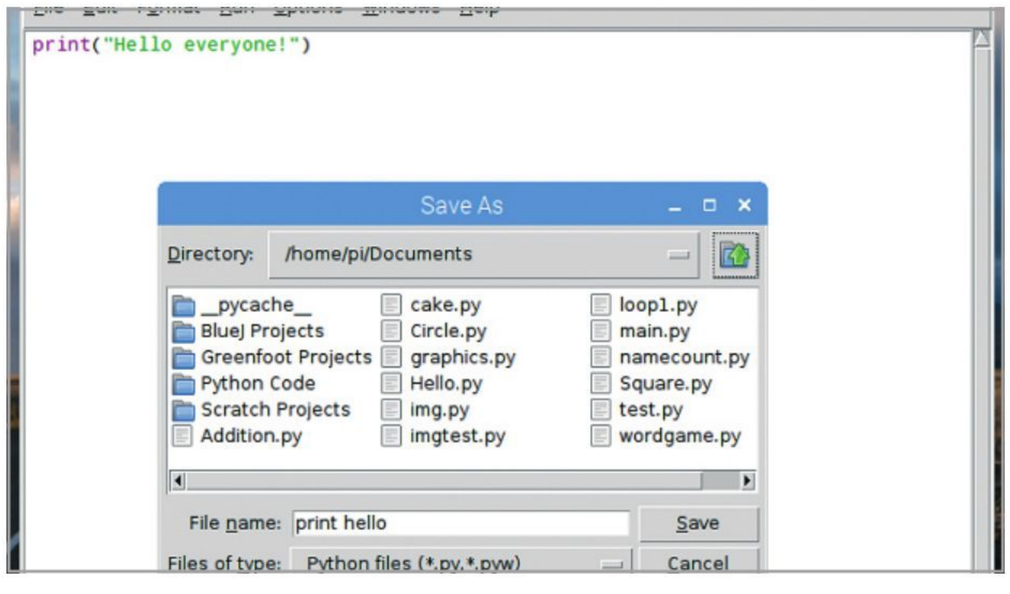
```
print("Hello everyone!")
```



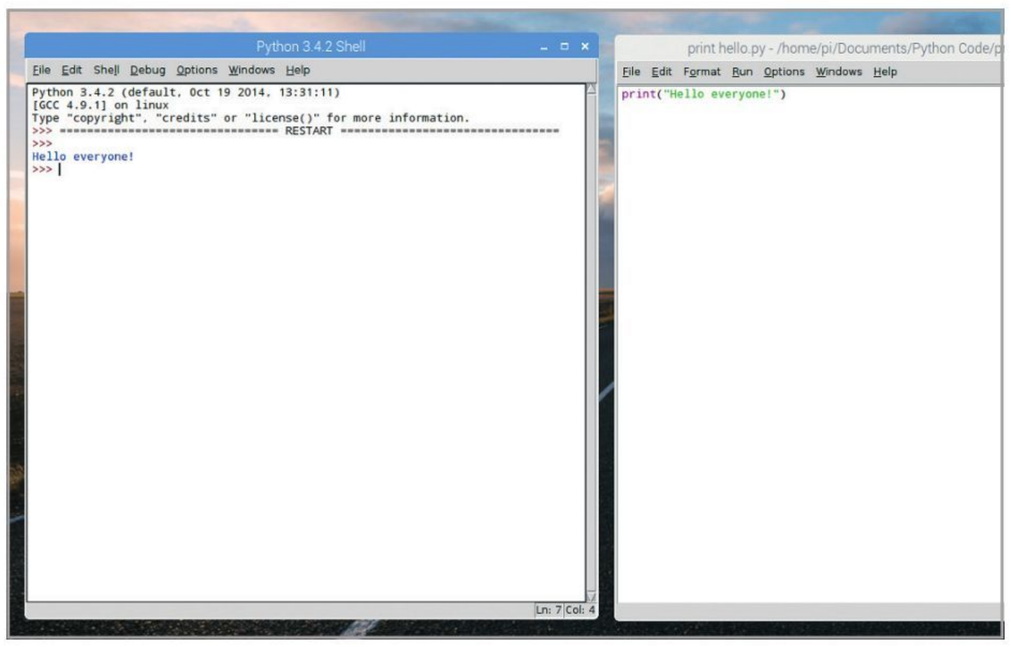
STEP 3 You can see that the same colour coding is in place in the IDLE Editor as it is in the Shell, enabling you to better understand what's going on with your code. However, to execute the code you need to first save it. Press F5 and you get a Save…Check box open.



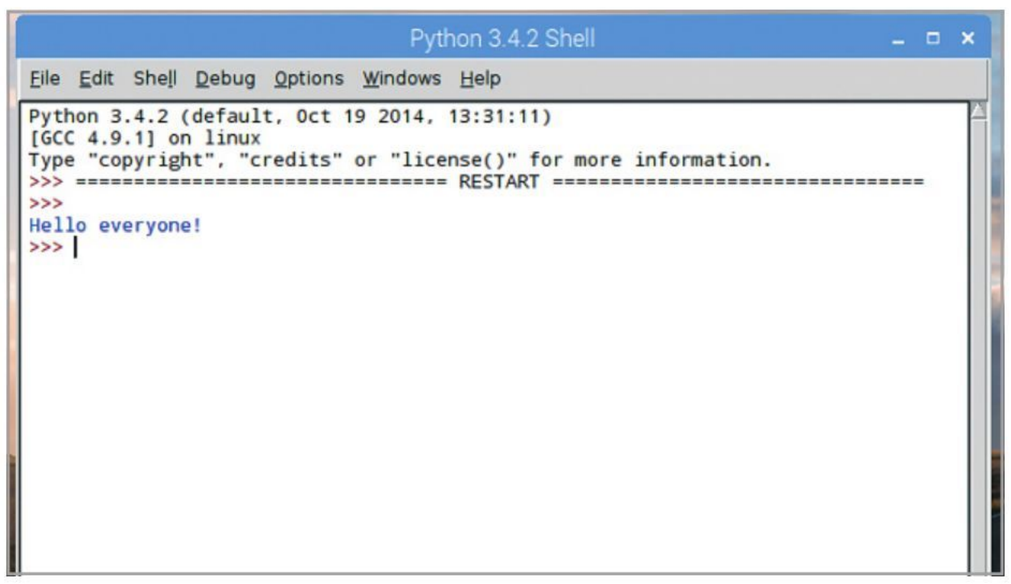
STEP 4 Click on the OK button in the Save box and select a destination where you'll save all your Python code. The destination can be a dedicated folder called Python or you can just dump it wherever you like. Remember to keep a tidy drive though, to help you out in the future.



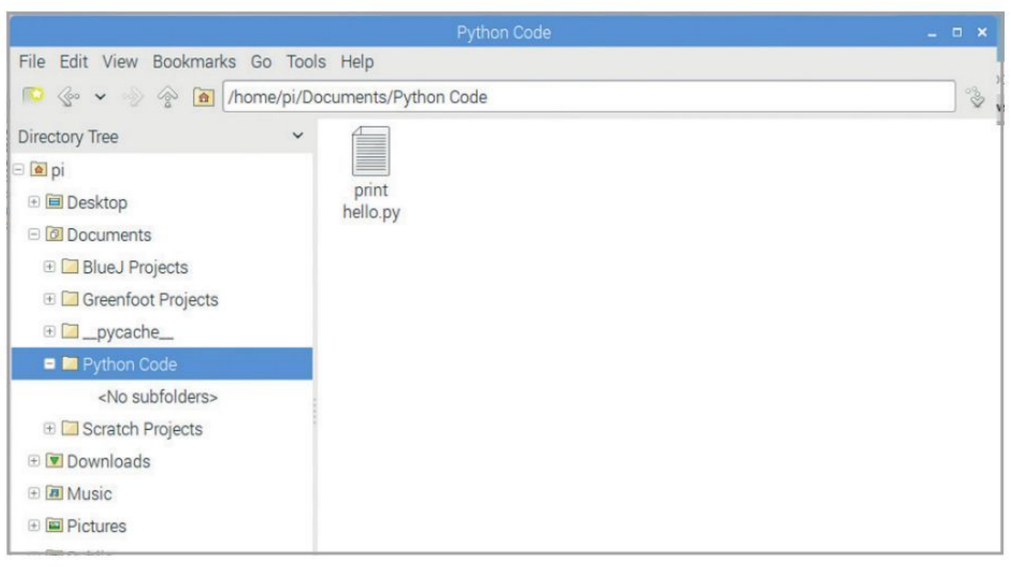
STEP 5 Enter a name for your code, 'print hello' for example, and click on the Save button. Once the Python code is saved it's executed and the output will be detailed in the IDLE Shell. In this case, the words 'Hello everyone!'.



STEP 6 This is how the vast majority of your Python code will be conducted. Enter it into the Editor, hit F5, save the code and look at the output in the Shell. Sometimes things will differ, depending on whether you've requested a separate window, but essentially that's the process. It's the process we will use throughout this book, unless otherwise stated.



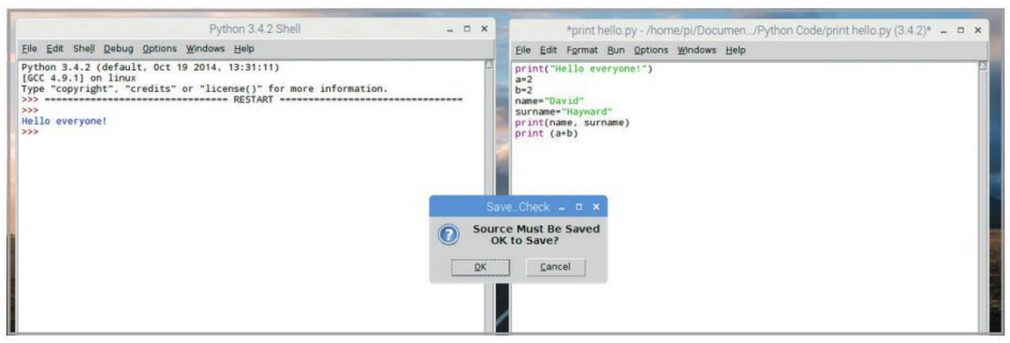
STEP 7 If you open the file location of the saved Python code, you can see that it ends in a .py extension. This is the default Python file name. Any code you create will be whatever.py and any code downloaded from the many internet Python resource sites will be .py. Just ensure that the code is written for Python 3.



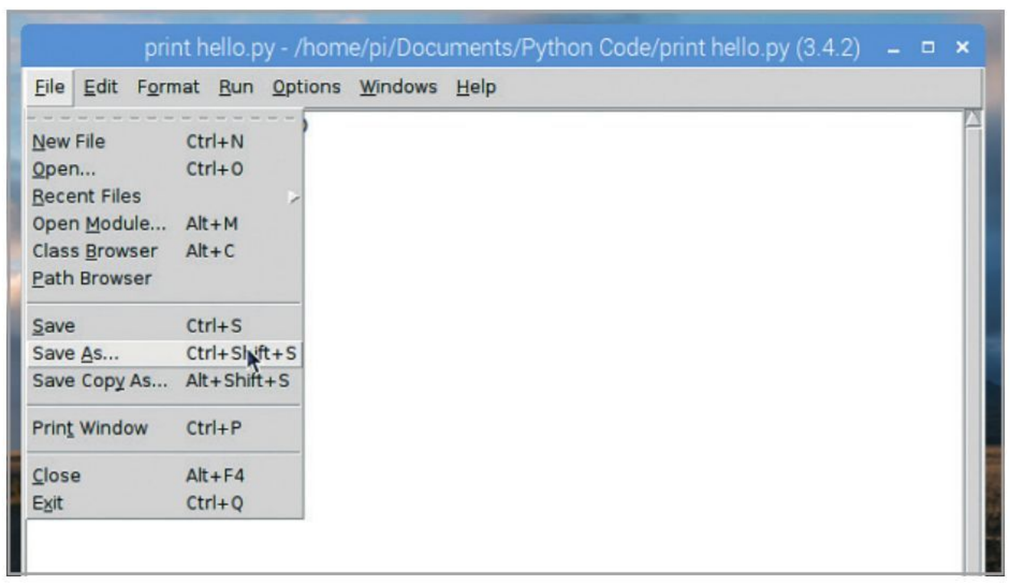
STEP 8 Let's extend the code and enter a few examples from the previous tutorial:

```
a=2
b=2
name="David"
surname="Hayward"
print(name, surname)
print (a+b)
```

If you press F5 now you'll be asked to save the file, again, as it's been modified from before.



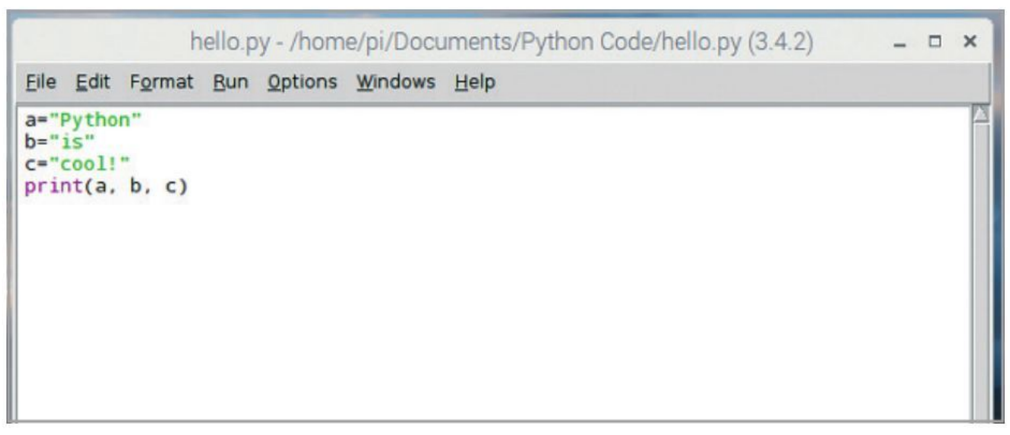
STEP 9 If you click the OK button, the file will be overwritten with the new code entries, and executed, with the output in the Shell. It's not a problem with just these few lines but if you were to edit a larger file, overwriting can become an issue. Instead, use File > Save As from within the Editor to create a backup.



STEP 10 Now create a new file. Close the Editor, and open a new instance (File > New File from the Shell). Enter the following and save it as hello.py:

```
a="Python"
b="is"
c="cool!"
print(a, b, c)
```

You will use this code in the next tutorial.



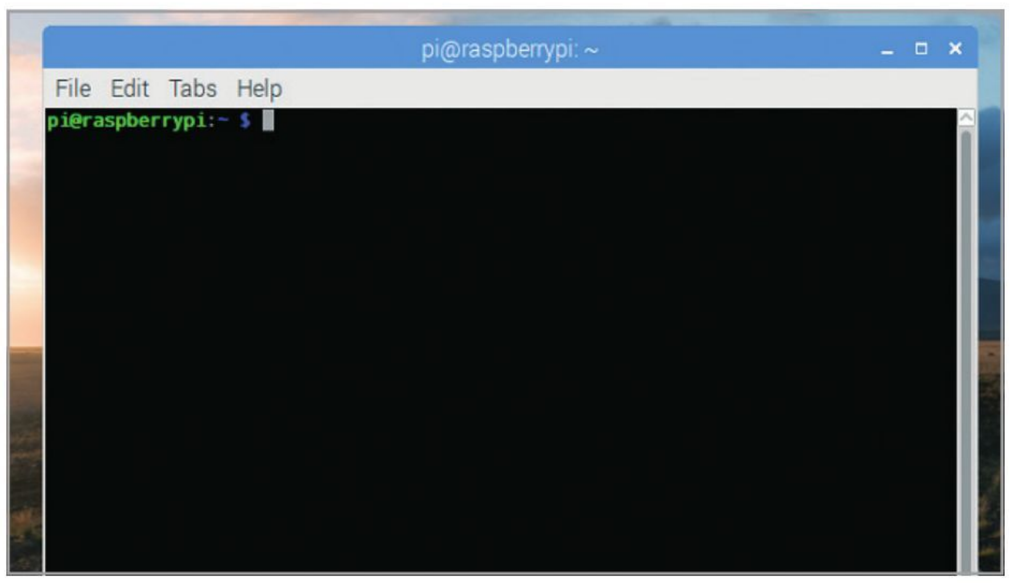
Executing Code from the Command Line

Although we're working from the GUI IDLE throughout this book, it's worth taking a look at Python's command line handling. We already know there's a command line version of Python but it's also used to execute code.

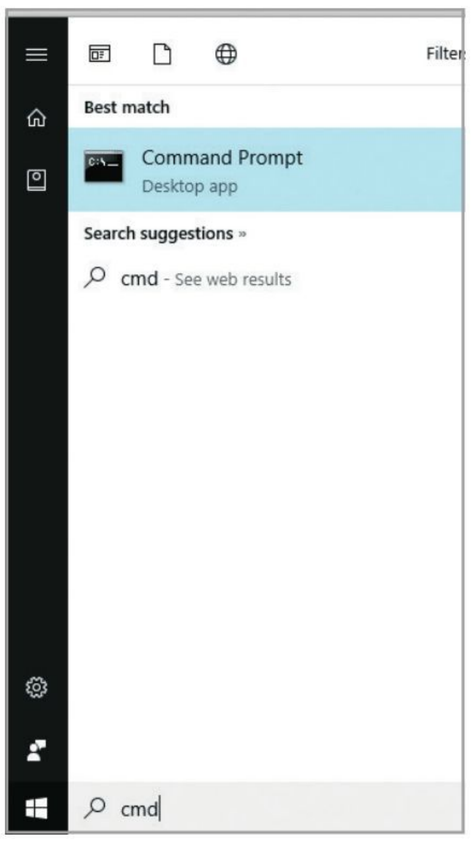
COMMAND THE CODE

Using the code we created in the previous tutorial, the one we named hello.py, let's see how you can run code that was made in the GUI at the command line level.

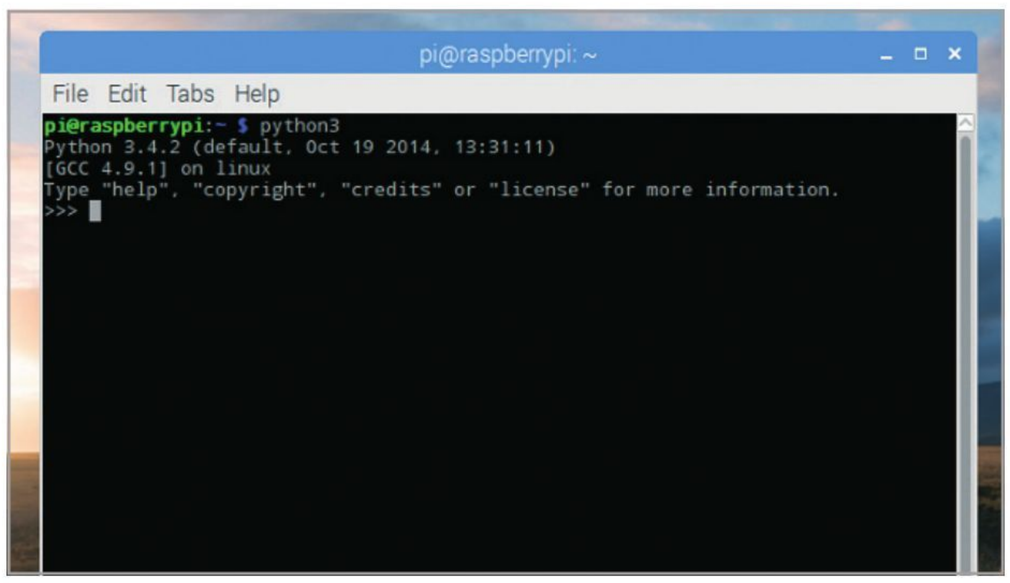
STEP 1 Python, in Linux, comes with two possible ways of executing code via the command line. One of the ways is with Python 2, whilst the other uses the Python 3 libraries and so on. First though, drop into the command line or Terminal on your operating system.



STEP 2 Just as before, we're using a Raspberry Pi: Windows users will need to click the Start button and search for CMD, then click the Command Line returned search; and macOS users can get access to their command line by clicking Go > Utilities > Terminal.



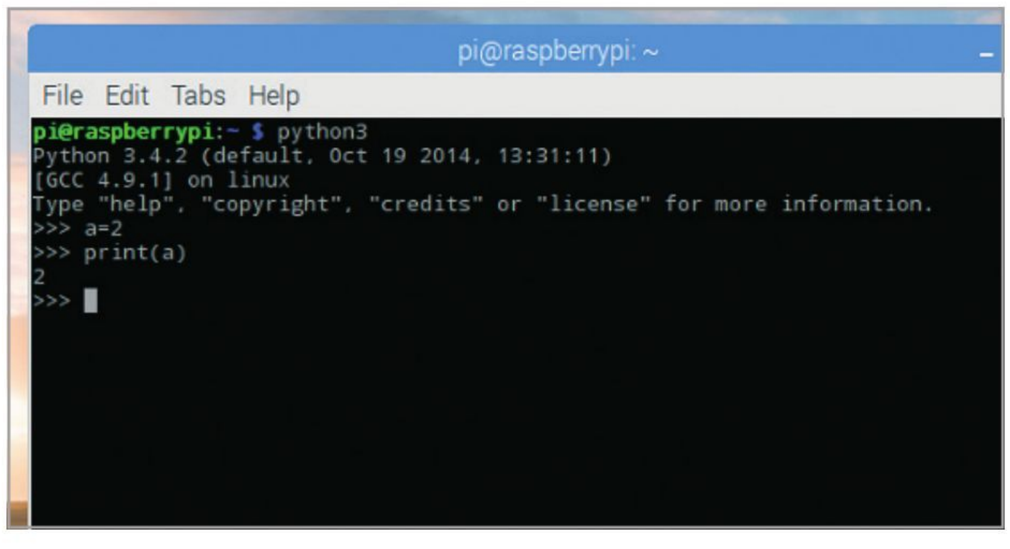
STEP 3 Now you're at the command line we can start Python. For Python 3 you need to enter the command **python3** and press Enter. This will put you into the command line version of the Shell, with the familiar three right-facing arrows as the cursor (>>>).



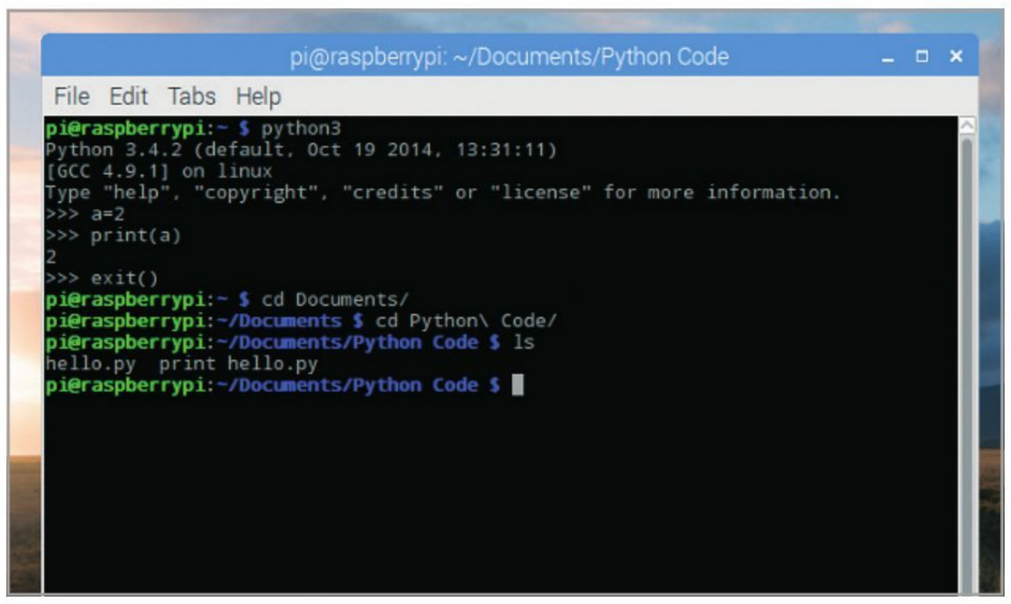
STEP 4 From here you're able to enter the code you've looked at previously, such as:

```
a=2
print(a)
```

You can see that it works exactly the same.



STEP 5 Now enter: **exit()** to leave the command line Python session and return you back to the command prompt. Enter the folder where you saved the code from the previous tutorial and list the available files within; hopefully you should see the hello.py file.

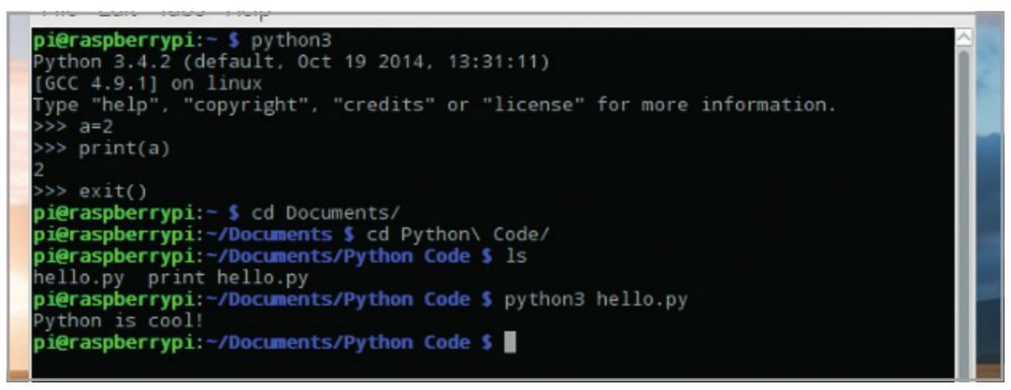


STEP 6 From within the same folder as the code you're going to run, enter the following into the command line:

```
python3 hello.py
```

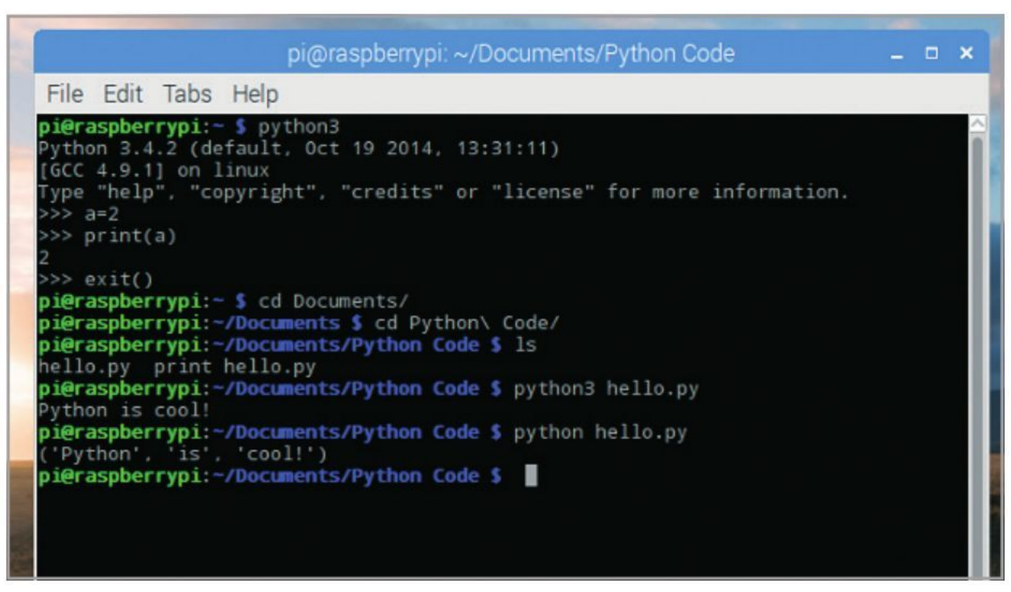
This will execute the code we created, which to remind you is:

```
a=”Python”
b=”is”
c=”cool!”
print(a, b, c)
```

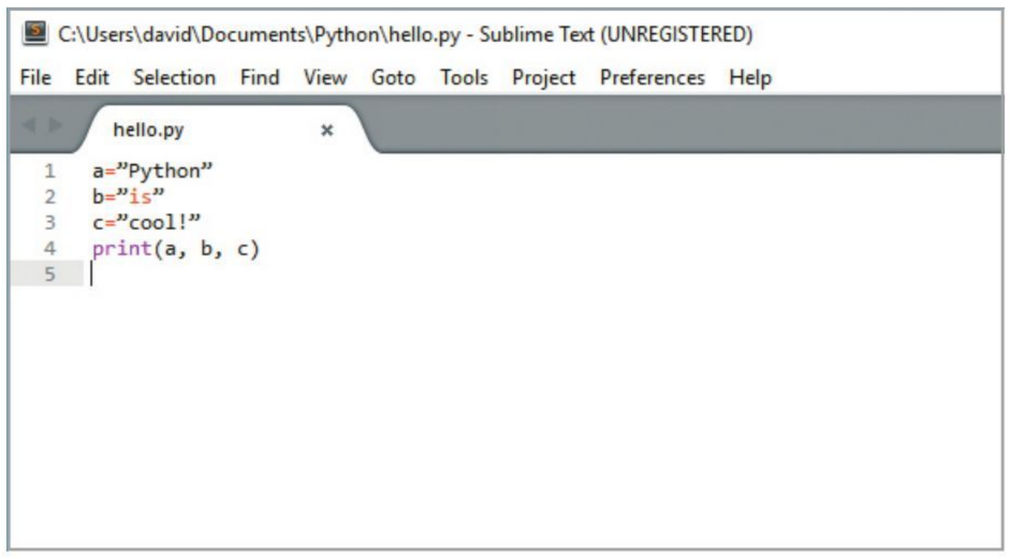


STEP 7 Naturally, since this is Python 3 code, using the syntax and layout that's unique to Python 3, it only works when you use the python3 command. If you like, try the same with Python 2 by entering:

```
python hello.py
```

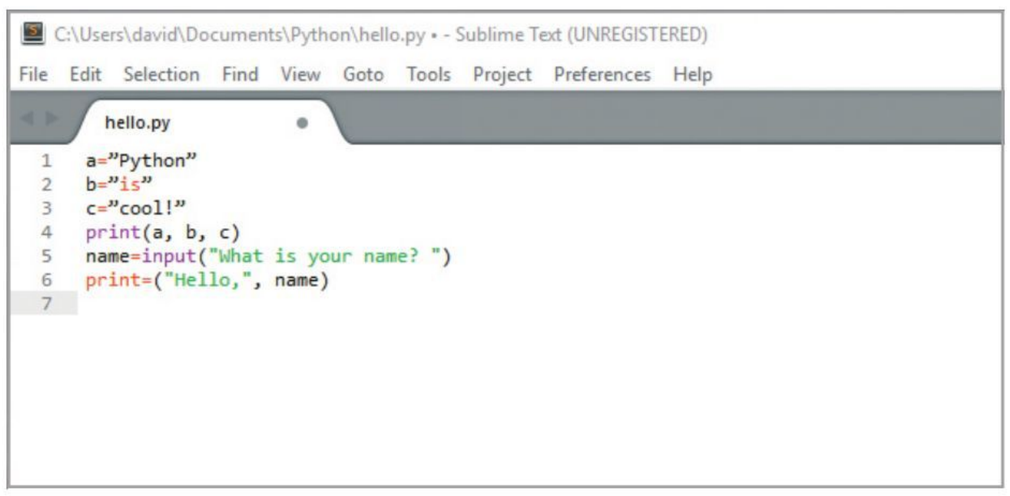


STEP 8 The result of running Python 3 code from the Python 2 command line is quite obvious. Whilst it doesn't error out in any way, due to the differences between the way Python 3 handles the Print command over Python 2, the result isn't as we expected. Using Sublime for the moment, open the hello.py file.



STEP 9 Since Sublime Text isn't available for the Raspberry Pi, you're going to temporarily leave the Pi for the moment and use Sublime as an example that you don't necessarily need to use the Python IDLE. With the hello.py file open, alter it to include the following:

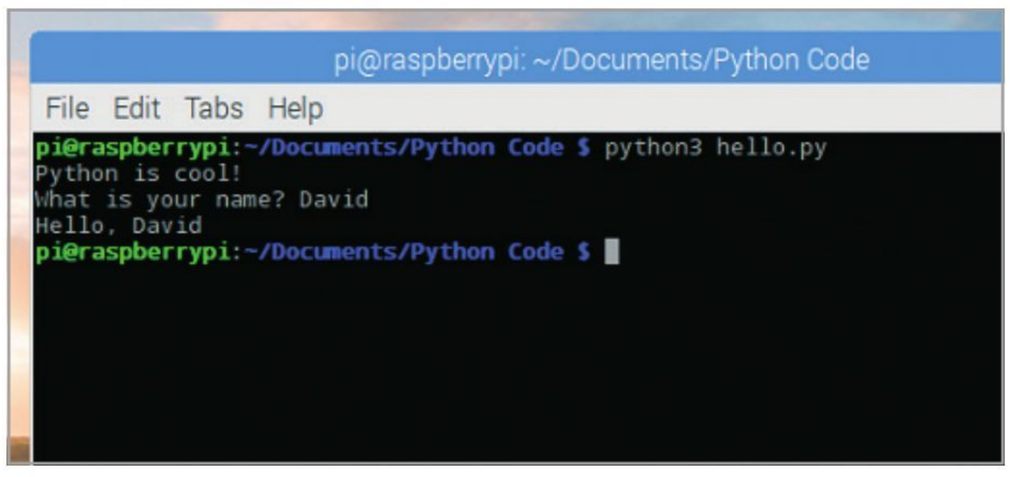
```
name=input(“What is your name? “)
print(“Hello,”, name)
```



STEP 10 Save the hello.py file and drop back to the command line. Now execute the newly saved code with:

```
python3 hello.py
```

The result will be the original Python is cool! statement, together with the added input command asking you for your name, and displaying it in the command window.



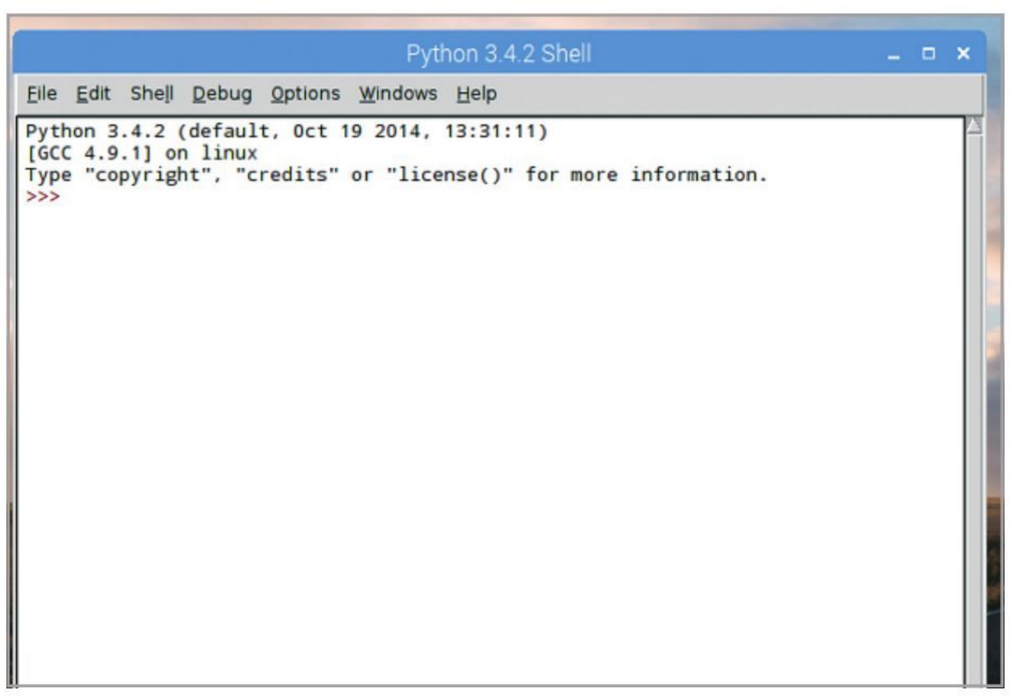
Numbers and Expressions

We've seen some basic mathematical expressions with Python, simple addition and the like. Let's expand on that now and see just how powerful Python is as a calculator. You can work within the IDLE Shell or in the Editor, whichever you like.

IT'S ALL MATHS, MAN

You can get some really impressive results with the mathematical powers of Python; as with most, if not all, programming languages, maths is the driving force behind the code.

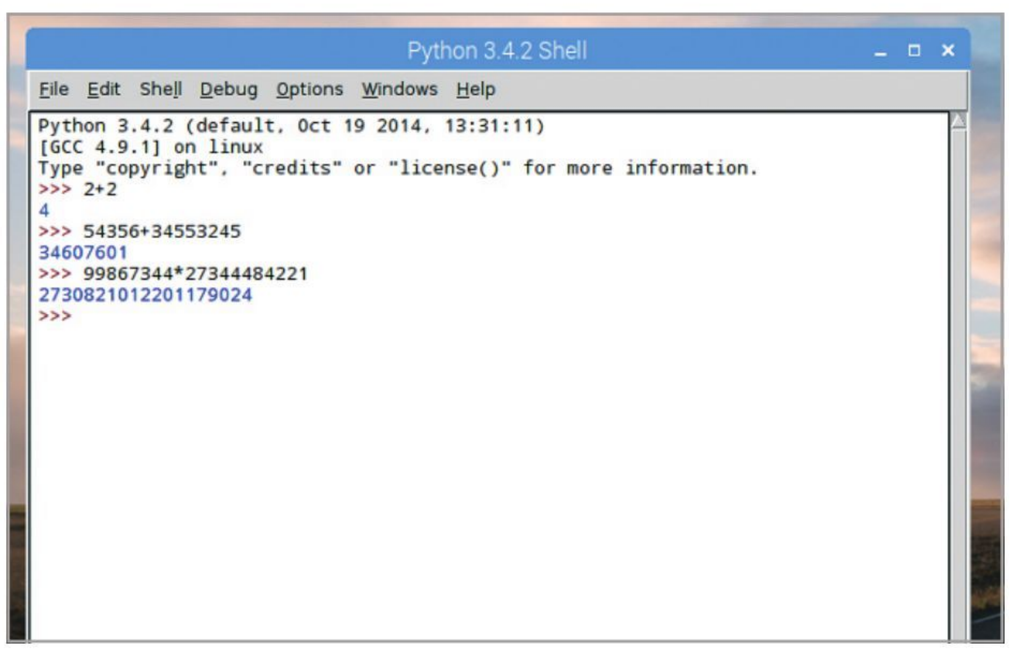
STEP 1 Open up the GUI version of Python 3, as mentioned you can use either the Shell or the Editor. For the time being, you're going to use the Shell just to warm our Maths muscle, which we believe is a small gland located at the back of the brain (or not).



STEP 2 In the Shell enter the following:

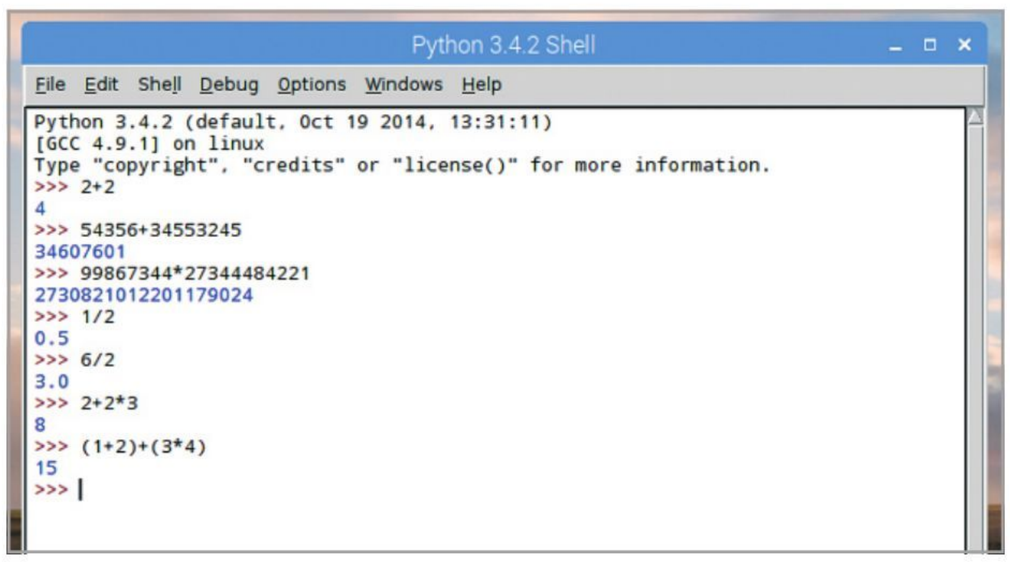
```
2+2
54356+34553245
99867344*27344484221
```

You can see that Python can handle some quite large numbers.



STEP 3 You can use all the usual Mathematical operations: divide, multiply, brackets and so on. Practise with a few, for example:

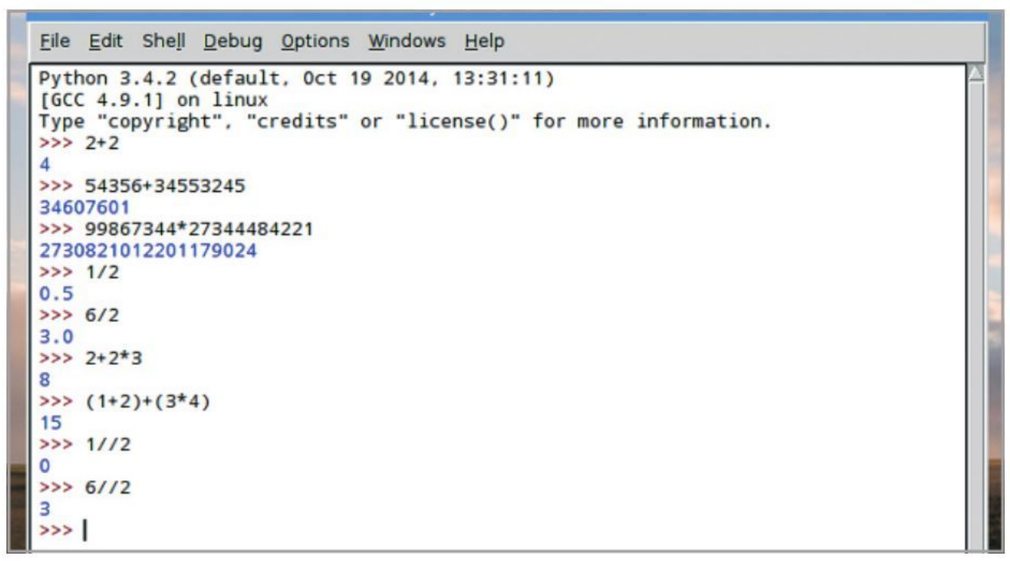
```
1/2
6/2
2+2*3
(1+2)+(3*4)
```



STEP 4 You've no doubt noticed, division produces a decimal number. In Python these are called floats, or floating point arithmetic. However, if you need an integer as opposed to a decimal answer, then you can use a double slash:

```
1//2
6//2
```

And so on.



STEP 5

You can also use an operation to see the remainder left over from division. For example:

```
10/3
```

Will display 3.333333333, which is of course 3.3-recurring. If you now enter:

```
10%3
```

This will display 1, which is the remainder left over from dividing 10 into 3.

STEP 6

Next up we have the power operator, or exponentiation if you want to be technical. To work out the power of something you can use a double multiplication symbol or double-star on the keyboard:

```
2**3
10**10
```

Essentially, it's 2x2x2 but we're sure you already know the basics behind Maths operators. This is how you would work it out in Python.

STEP 7

Numbers and expressions don't stop there. Python has numerous built-in functions to work out sets of numbers, absolute values, complex numbers and a host of mathematical expressions and Pythagorean tongue-twisters. For example, to convert a number to binary, use:

```
bin(3)
```

STEP 8

This will be displayed as '0b11', converting the integer into binary and adding the prefix 0b to the front. If you want to remove the 0b prefix, then you can use:

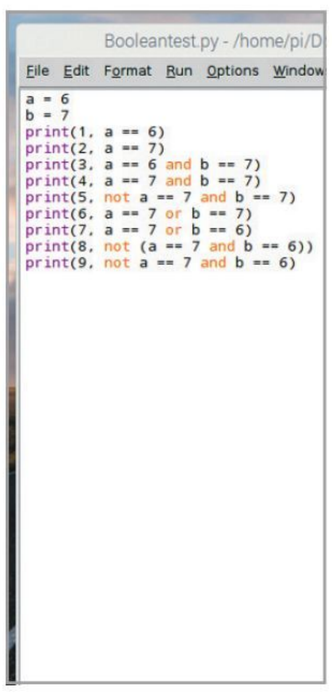
```
format(3, 'b')
```

The Format command converts a value, the number 3, to a formatted representation as controlled by the format specification, the 'b' part.

STEP 9

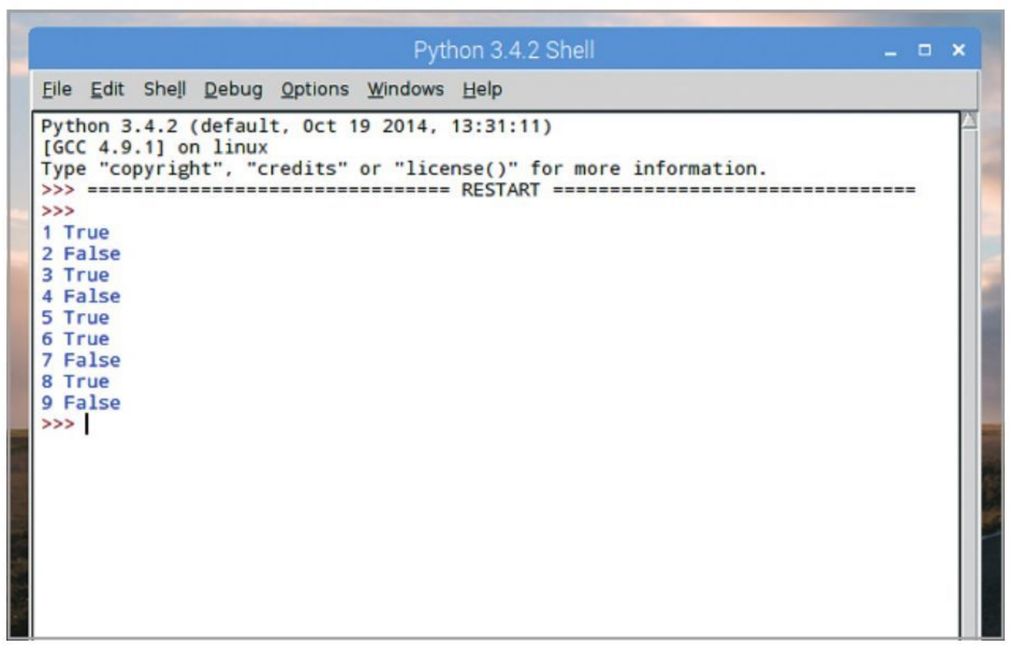
A Boolean Expression is a logical statement that will either be true or false. We can use these to compare data and test to see if it's equal to, less than or greater than. Try this in a New File:

```
a = 6
b = 7
print(1, a == 6)
print(2, a == 7)
print(3, a == 6 and b == 7)
print(4, a == 7 and b == 7)
print(5, not a == 7 and b == 7)
print(6, a == 7 or b == 7)
print(7, a == 7 or b == 6)
print(8, not (a == 7 and b == 6))
print(9, not a == 7 and b == 6)
```



STEP 10

Execute the code from Step 9, and you can see a series of True or False statements, depending on the result of the two defining values: 6 and 7. It's an extension of what you've looked at, and an important part of programming.



Using Comments

When writing your code, the flow, what each variable does, how the overall program will operate and so on is all inside your head. Another programmer could follow the code line by line but over time, it can become difficult to read.

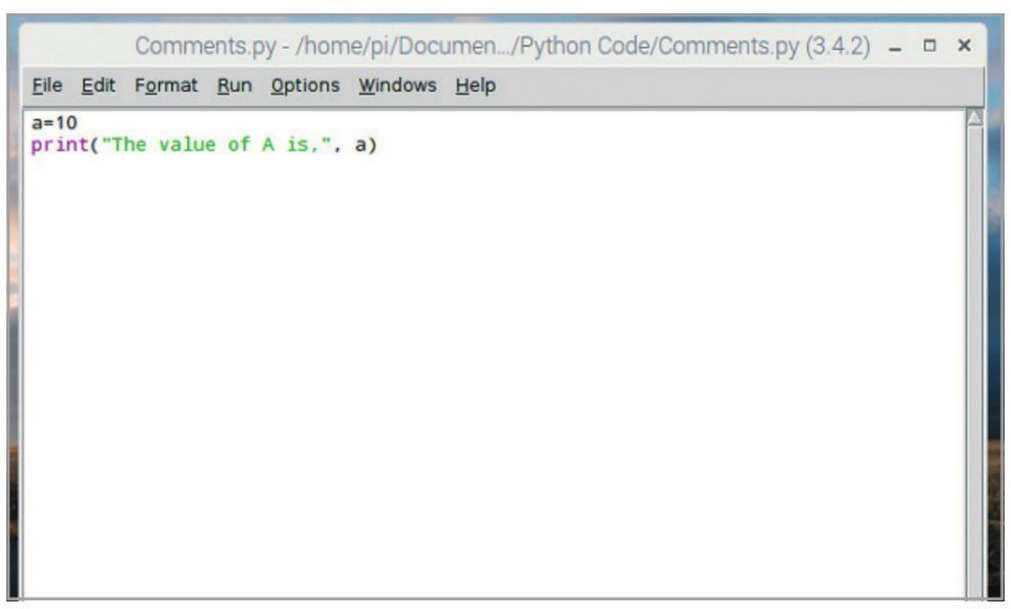
#COMMENTS!

Programmers use a method of keeping their code readable by commenting on certain sections. If a variable is used, the programmer comments on what it's supposed to do, for example. It's just good practise.

STEP 1 Start by creating a new instance of the IDLE Editor (File > New File) and create a simple variable and print command:

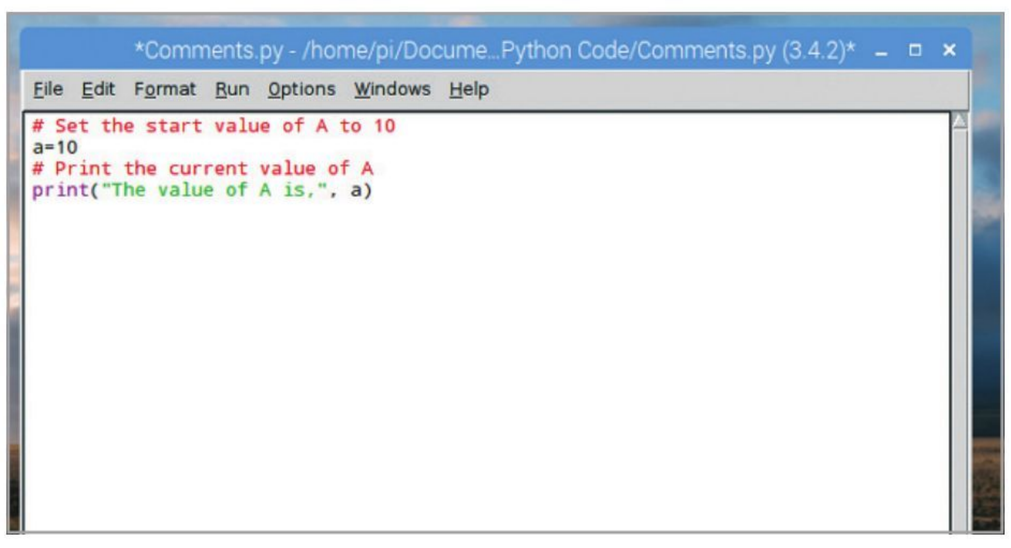
```
a=10
print("The value of A is,", a)
```

Save the file and execute the code.

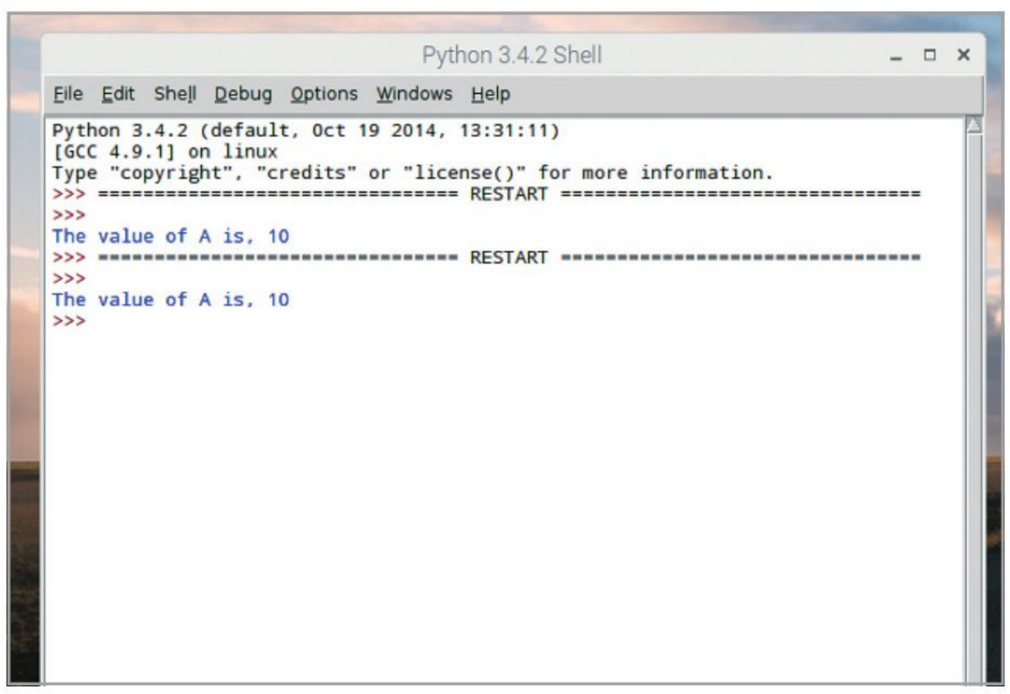


STEP 2 Running the code will return the line: The value of A is, 10 into the IDLE Shell window, which is what we expected. Now, add some of the types of comments you'd normally see within code:

```
# Set the start value of A to 10
a=10
# Print the current value of A
print("The value of A is,", a)
```

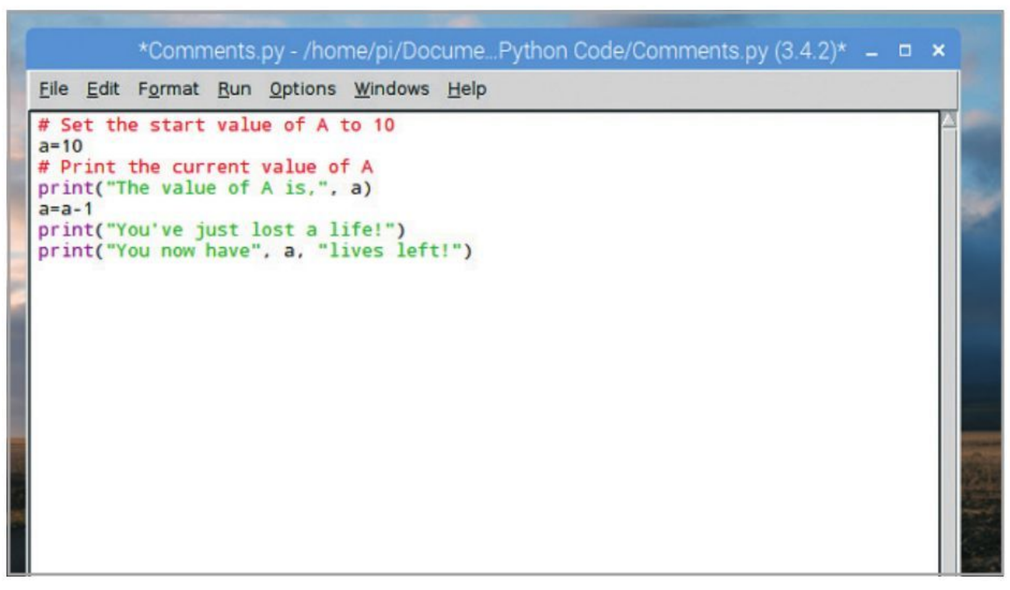


STEP 3 Resave the code and execute it. You can see that the output in the IDLE Shell is still the same as before, despite the extra lines being added. Simply put, the hash symbol (#) denotes a line of text the programmer can insert to inform them, and others, of what's going on without the user being aware.



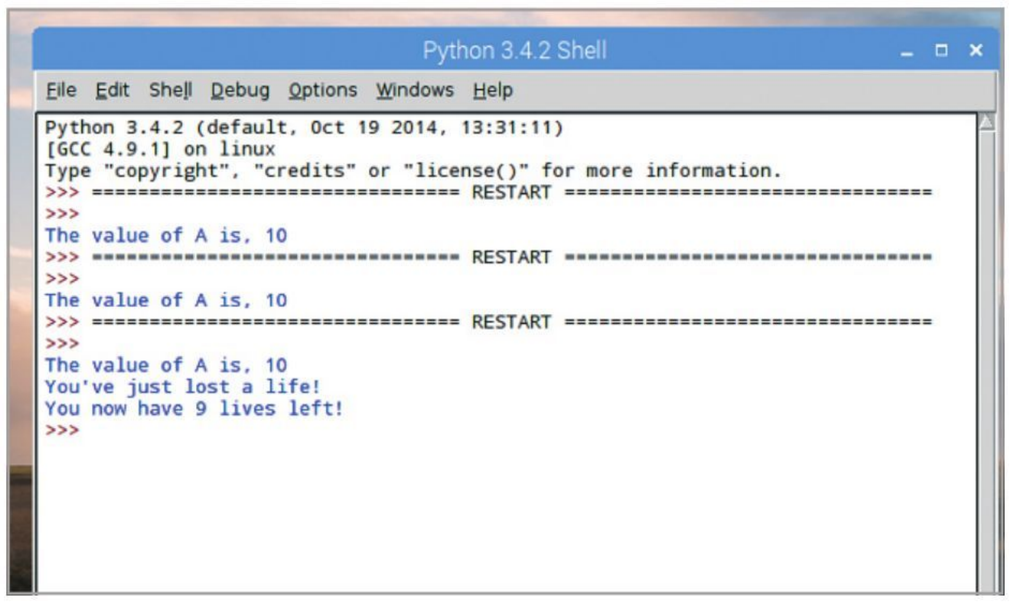
STEP 4 Let's assume that the variable A that we've created is the number of lives in a game. Every time the player dies, the value is decreased by 1. The programmer could insert a routine along the lines of:

```
a=a-1
print("You've just lost a life!")
print("You now have", a, "lives left!")
```



STEP 5

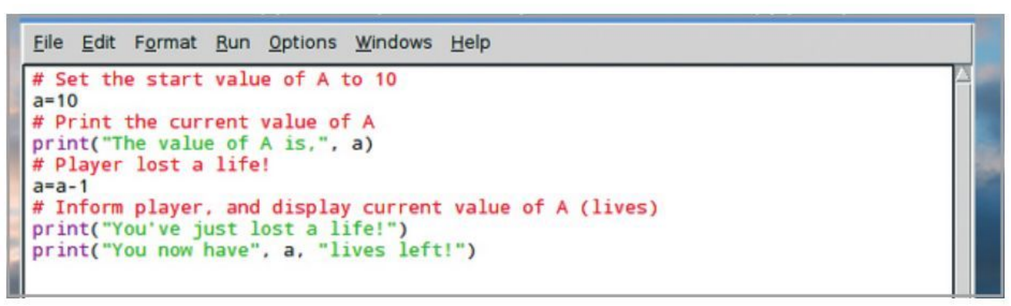
Whilst we know that the variable A is lives, and that the player has just lost one, a casual viewer or someone checking the code may not know. Imagine for a moment that the code is twenty thousand lines long, instead of just our seven. You can see how handy comments are.



STEP 6

Essentially, the new code together with comments could look like:

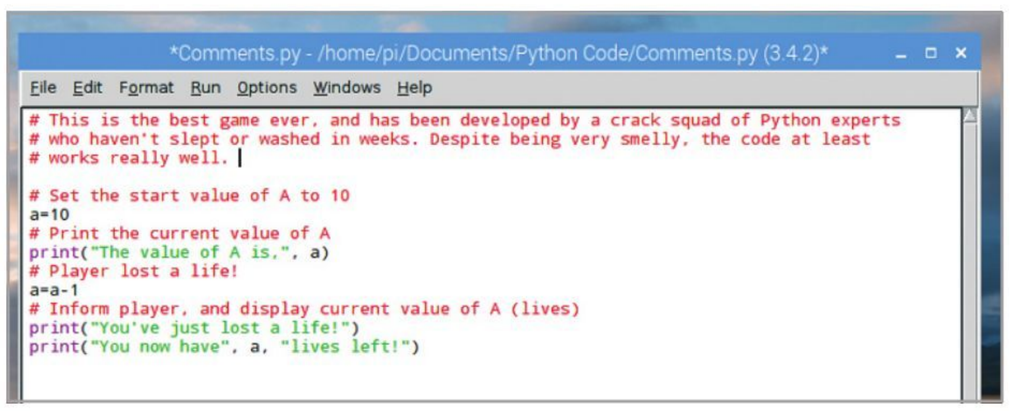
```
# Set the start value of A to 10
a=10
# Print the current value of A
print(“The value of A is,”, a)
# Player lost a life!
a=a-1
# Inform player, and display current value
of A (lives)
print(“You’ve just lost a life!”)
print(“You now have”, a, “lives left!”)
```



STEP 7

You can use comments in different ways. For example, Block Comments are a large section of text that details what’s going on in the code, such as telling the code reader what variables you’re planning on using:

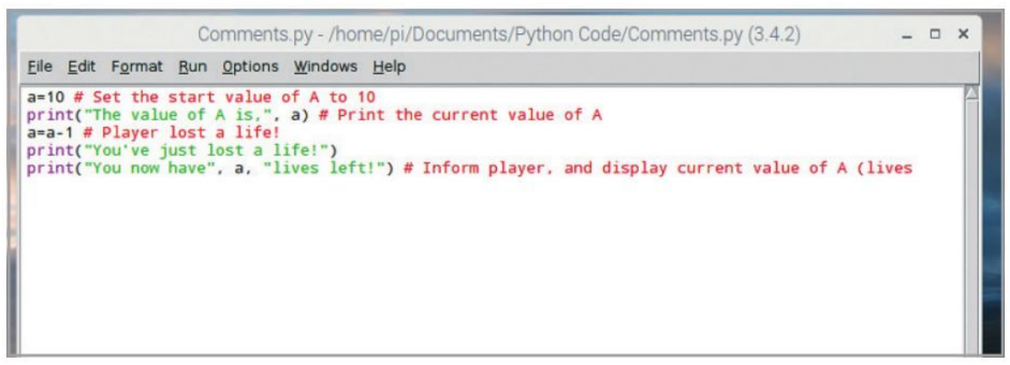
```
# This is the best game ever, and has been
developed by a crack squad of Python experts
# who haven’t slept or washed in weeks. Despite
being very smelly, the code at least
# works really well.
```



STEP 8

Inline comments are comments that follow a section of code. Take our examples from above, instead of inserting the code on a separate line, we could use:

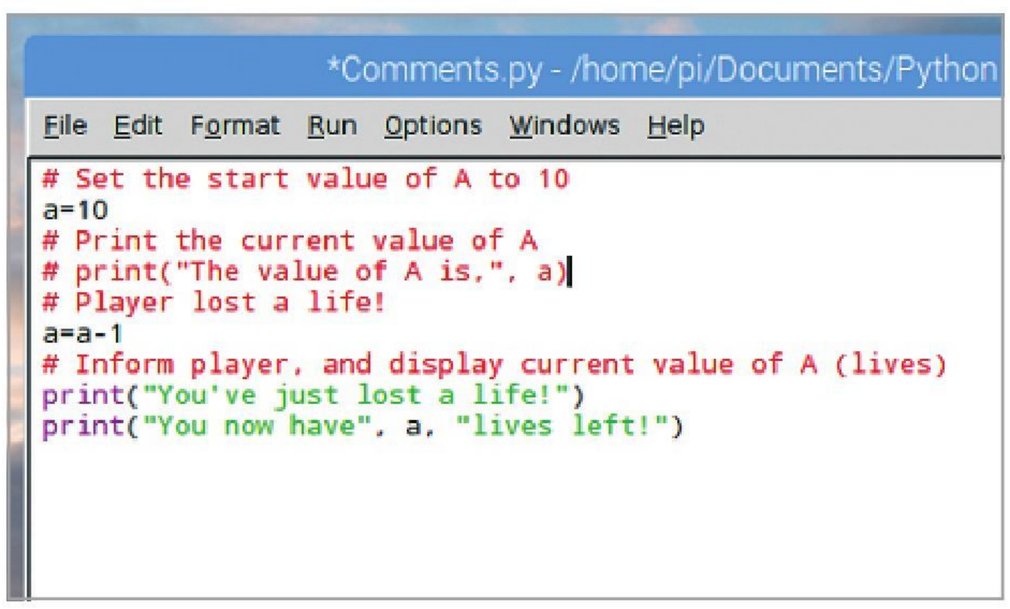
```
a=10 # Set the start value of A to 10
print(“The value of A is,”, a) # Print the current
value of A
a=a-1 # Player lost a life!
print(“You’ve just lost a life!”)
print(“You now have”, a, “lives left!”) # Inform
player, and display current value of A (lives)
```



STEP 9

The comment, the hash symbol, can also be used to comment out sections of code you don’t want to be executed in your program. For instance, if you wanted to remove the first print statement, you would use:

```
# print(“The value of A is,”, a)
```



STEP 10

You also use three single quotes to comment out a Block Comment or multi-line section of comments. Place them before and after the areas you want to comment for them to work:

```
’’’
This is the best game ever, and has been developed
by a crack squad of Python experts who haven’t
slept or washed in weeks. Despite being very
smelly, the code at least works really well.
’’’
```