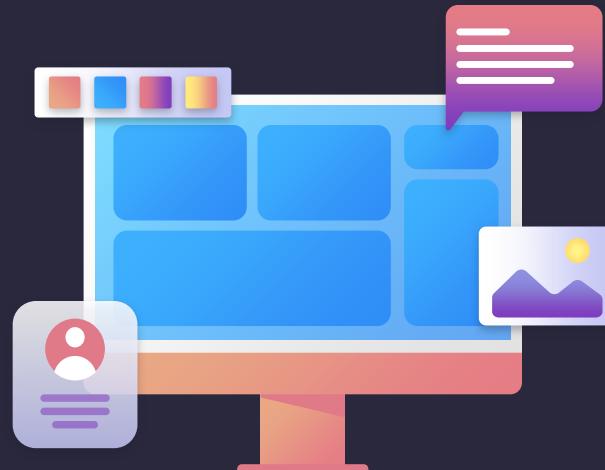


/MY JOURNAL TO PYTHON

4110E231 柯立丹





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PYTHON?

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/01

<WHAT IS PYTHON>



/LEARN PYTHON



- . Python is a popular programming language.
- . Python can be used on a server to create web applications.

Example:

A screenshot of a Python code editor interface. At the top, there are icons for file, edit, and run, followed by a green 'Run >' button. To the right of the run button is the text 'Result Size: 625 x 454' and a green button that says 'Get your own website'. The main area has two sections: a white input field containing the Python code 'print("Hello, World!")' and a black output field below it displaying the result 'Hello, World!'. The entire interface is set against a dark background.

```
print("Hello, World!")
```

Hello, World!

/WHAT PYTHON



- . Python is a popular programming language.
- . Python can be used on a server to create web applications.

Example:

A screenshot of a Python code editor interface. At the top, there are icons for file, edit, and run, followed by a green 'Run >' button. To the right of the run button is the text 'Result Size: 625 x 454' and a green button that says 'Get your own website'. The main area has two sections: a white input field containing the Python code 'print("Hello, World!")' and a black output field below it displaying the result 'Hello, World!'. The entire interface is set against a dark background.

```
print("Hello, World!")
```

```
Hello, World!
```

/WHAT IS PYTHON



Python is a popular programming language. It was created by Guido van Rossum, and released in 1991.

It is used for:

- web development (server-side),
- software development,
- mathematics,
- system scripting.



/WHAT IS PYTHON



What can Python do?

- Python can be used on a server to create web applications.
- Python can be used alongside software to create workflows.
- Python can connect to database systems. It can also read and modify files.
- Python can be used to handle big data and perform complex mathematics.
- Python can be used for rapid prototyping, or for production-ready software development.



/WHY PYTHON?



- Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).
- Python has a simple syntax similar to the English language.
- Python has syntax that allows developers to write programs with fewer lines than some other programming languages.
- Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick.
- Python can be treated in a procedural way, an object-oriented way or a functional way.



/02

<PYTHON SYNTAX>





<Python Indentation>



/PYTHON INDENTATION



Indentation refers to the spaces at the beginning of a code line.

Where in other programming languages the indentation in code is for readability only, the indentation in Python is very important.

Python uses **indentation** to indicate a block of code.

Example

```
if 5 > 2:  
    print("Five is greater than two!")
```

[Try it Yourself »](#)



Indentation

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, search, refresh, and a green 'Run' button. To the right of the run button, it says 'Result Size: 497 x 332' and 'Get your own website'. Below the toolbar, the code is displayed in a white box:

```
if 5 > 2:  
    print("Five is greater than two!")
```

To the right of the code box, the output is shown in a black box:

```
Five is greater than two!
```

/PYTHON INDENTATION



Python uses **indentation** to indicate a block of code.

Example

```
if 5 > 2:  
    print("Five is greater than two!")
```

Try it Yourself »



With Indentation



Run ➔

Result Size: 497 x 332

Get your own website

```
if 5 > 2:  
    print("Five is greater than two!")
```

Five is greater than two!



/PYTHON INDENTATION



Python will give you an error if you skip the indentation:

Example

Syntax Error:

```
if 5 > 2:  
    print("Five is greater than two!")
```

Try it Yourself »



W/O Indentation

The screenshot shows a Python code editor interface. On the left, there's a code editor window with the following code:

```
if 5 > 2:  
    print("Five is greater than two!")
```

On the right, there's a results panel with the following output:

Result Size: 497 x 332 Get your own website

```
File "demo_indentation_test.py", line 2  
    print("Five is greater than two!")  
          ^  
IndentationError: expected an indented block
```

A yellow arrow points from the 'W/O Indentation' text above to the code editor, and another yellow arrow points from the 'RESULT' text to the results panel.

RESULT



/PYTHON INDENTATION



The number of spaces is up to you as a programmer, the most common use is four, but it has to be at least one.

Example

```
if 5 > 2:  
    print("Five is greater than two!")  
if 5 > 2:  
    print("Five is greater than two!")
```



Try It Yourself »



/PYTHON INDENTATION



You have to use the same number of spaces in the same block of code, otherwise Python will give you an error:

Example

Syntax Error:

```
if 5 > 2:  
    print("Five is greater than two!")  
        print("Five is greater than two!")
```

Try it Yourself »





<Python Comments>



/PYTHON COMMENTS



- Comments can be used to explain Python code.
- Comments can be used to make the code more readable.
- Comments can be used to prevent execution when testing code.

Creating a Comment:

Comments starts with a #, and Python will ignore them:

Example

```
#This is a comment  
print("Hello, World!")
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings, followed by a 'Run' button with a green arrow. Below the editor area, the code is displayed:

```
#This is a comment.  
print("Hello, World!")
```

The output window below shows the result of running the code:

```
Hello, World!
```

At the bottom right, there's a button that says "Get your own website".

/PYTHON COMMENTS



A comment does not have to be text that explains the code, it can also be used to prevent Python from executing code:

Example

```
#print("Hello, World!")
print("Cheers, Mate!")
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, file, settings, and run, followed by a green 'Run >' button. To the right, it says 'Result Size: 497 x 332' and 'Get your own website'. Below the editor, the code is displayed:

```
#print("Hello, World!")
print("Cheers, Mate!")
```

The output window shows the result of running the code:

Cheers, Mate!



/PYTHON COMMENTS



Comments can be placed at the end of a line, and Python will ignore the rest of the line:

Example

```
print("Hello, World!") #This is a comment
```

[Try it Yourself »](#)[Run >](#)

Result Size: 497 x 332

[Get your own website](#)

```
print("Hello, World!") #This is a comment.
```

Hello, World!



/PYTHON COMMENTS



Multi Line Comments

Python does not really have a syntax for multi line comments.
To add a multiline comment you could insert a # for each line:

Example

```
#This is a comment  
#written in  
#more than just one line  
print("Hello, World!")
```

[Try it Yourself »](#)[Run >](#)

Result Size: 497 x 332

[Get your own website](#)

```
#This is a comment  
#written in  
#more than just one line  
print("Hello, World!")
```

Hello, World!



/PYTHON COMMENTS



Or, not quite as intended, you can use a multiline string.

Since Python will ignore string literals that are not assigned to a variable, you can add a multiline string (triple quotes) in your code, and place your comment inside it:

Example

```
"""
This is a comment
written in
more than just one line
"""
print("Hello, World!")
```

[Try it Yourself >](#)

The screenshot shows a Python code editor interface. At the top, there are navigation icons: a house (Home), a list (File), a document (Edit), and a circle (Run). Next to the Run icon is a green button labeled "Run >". To the right of the editor area, there are status messages: "Result Size: 567 x 399" and a green button labeled "Get your own website".

The code editor displays the following Python code:

```
"""
This is a comment
written in
more than just one line
"""
print("Hello, World!")
```

To the right of the editor, the output window shows the result of running the code: "Hello, World!"





- □ ×

/PYTHON COMMENTS



Note: As long as the string is not assigned to a variable, Python will read the code, but then ignore it, and you have made a multiline comment.





<Python Variables>



/PYTHON VARIABLES



- Variables are containers for storing data values.

Example

```
x = 5  
y = "John"  
print(x)  
print(y)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are several icons: a house (Home), three horizontal lines (File/Menu), a circular arrow (Run/Stop), and a circle with a dot (Settings). To the right of these is a green 'Run' button with a white arrow. Below the icons is a code editor window containing the following Python code:

```
x = 5  
y = "John"  
print(x)  
print(y)
```

To the right of the code editor is a black terminal window showing the output of the code execution:

```
5  
John
```

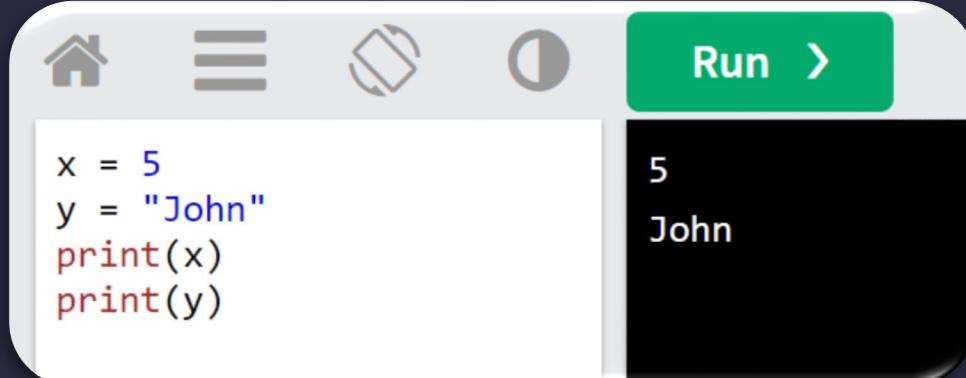


/PYTHON VARIABLES – CREATING VARIABLES

Python has no command for declaring a variable.
A variable is created the moment you first assign a value to it.

Example

```
x = 5  
y = "John"  
print(x)  
print(y)
```

[Try it Yourself »](#)

The image shows a screenshot of a Python code editor. At the top, there are several icons: a house, three horizontal lines, a refresh symbol, and a circle. To the right of these is a green button labeled "Run >". Below the icons is a code block containing the following Python code:

```
x = 5  
y = "John"  
print(x)  
print(y)
```

On the right side of the editor, there is a black panel displaying the output of the code. The output consists of two lines of text: "5" and "John".

/PYTHON VARIABLES



Variables do not need to be declared with any particular *type*, and can even change type after they have been set.

Example

```
x = 4      # x is of type int
x = "Sally" # x is now of type str
print(x)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. On the left, there is a code editor window containing the following Python code:

```
x = 4
x = "Sally"
print(x)
```

On the right, there is a terminal window showing the output of the code: "Sally". Above the code editor, there is a toolbar with icons for home, file, edit, and run, followed by a green "Run >" button. The terminal window has a black background.

/PYTHON VARIABLES



Variables do not need to be declared with any particular *type*, and can even change type after they have been set.

Example

```
x = 4      # x is of type int
x = "Sally" # x is now of type str
print(x)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. On the left, there is a code editor window containing the following Python code:

```
x = 4
x = "Sally"
print(x)
```

On the right, there is a terminal window showing the output of the code: "Sally". Above the code editor, there is a toolbar with icons for file, edit, run, and other functions. A green "Run >" button is visible on the toolbar.

/PYTHON VARIABLES - Get the Type



Get the Type

You can get the data type of a variable with the `type()` function.

Example

```
x = 5  
y = "John"  
print(type(x))  
print(type(y))
```

[Try it Yourself »](#)

The image shows a screenshot of a Python code editor. At the top, there are icons for file, edit, run, and settings. Below the code area, there is a status bar with the text 'Run >'. The code itself is identical to the one in the example box. To the right, the output window displays the results of running the code: '`<class 'int'>`' and '`<class 'str'>`'.

```
x = 5  
y = "John"  
print(type(x))  
print(type(y))
```

```
<class 'int'>  
<class 'str'>
```



/PYTHON VARIABLES



Single or Double Quotes?

String variables can be declared either by using single or double quotes:

Example

```
x = "John"  
# is the same as  
x = 'John'
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, and settings, followed by a green 'Run' button with a right-pointing arrow. The code area contains the following Python script:

```
x = "John"  
print(x)  
#double quotes are the  
same as single quotes:  
x = 'John'  
print(x)
```

To the right of the code area, the output window displays the results of the print statements:

```
John  
John
```

/PYTHON VARIABLES



Case-Sensitive

Variable names are case-sensitive.

Example

This will create two variables:

```
a = 4  
A = "Sally"  
#A will not overwrite a
```

[Try it Yourself »](#)

The image shows a Python code editor interface. At the top, there are icons for home, file, edit, run, and settings. Below the icons, the code is displayed in a white box:

```
a = 4  
A = "Sally"  
  
print(a)  
print(A)
```

To the right of the code editor is a green 'Run' button with a right-pointing arrow. To the right of the run button is a black box containing the output of the code:

4
Sally

/PYTHON VARIABLES



Casting

If you want to specify the data type of a variable, this can be done with casting.





<Python – Variables Names>



/PYTHON VARIABLES - Variable Names



Variable Names

A variable can have a short name (like `x` and `y`) or a more descriptive name (`age`, `carname`, `total_volume`). Rules for Python variables:



/PYTHON VARIABLES - Variable Names



- A variable name must start with a letter or the underscore character
- A variable name cannot start with a number
- A variable name can only contain alpha-numeric characters and underscores (A-z, 0-9, and _)
- Variable names are case-sensitive (age, Age and AGE are three different variables)



/PYTHON VARIABLES - Variable Names



Example

Legal variable names:

```
myvar = "John"  
my_var = "John"  
_my_var = "John"  
myVar = "John"  
MYVAR = "John"  
myvar2 = "John"
```

Try it Yourself »

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, and settings. On the right, a green 'Run' button is visible. The code area contains several variable assignments and their corresponding print statements. The output window on the right displays the value 'John' for each of the six variables.

```
myvar = "John"  
my_var = "John"  
_my_var = "John"  
myVar = "John"  
MYVAR = "John"  
myvar2 = "John"  
  
print(myvar)  
print(my_var)  
print(_my_var)  
print(myVar)  
print(MYVAR)  
print(myvar2)
```

myvar = "John"	John
my_var = "John"	John
_my_var = "John"	John
myVar = "John"	John
MYVAR = "John"	John
myvar2 = "John"	John



/PYTHON VARIABLES - Variable Names



Example

Illegal variable names:

```
2myvar = "John"  
my-var = "John"  
my var = "John"
```

Try it Yourself »

The screenshot shows a Python code editor interface. On the left, there is a code editor window with the following text:

```
2myvar = "John"  
my-var = "John"  
my var = "John"
```

Below the code editor is a green button labeled "Run". To the right of the code editor is a terminal window displaying the output of the run command. The terminal output shows two separate error messages:

```
#This example will produce an error in the result  
  
Traceback (most recent call last):  
  File "/usr/lib/python3.7/py_compile.py", line 143, in compile  
    _optimize=optimize)  
  File "<frozen importlib._bootstrap_external>", line 791, in source_to_code  
  File "<frozen importlib._bootstrap>", line 219, in _call_with_frames_removed  
  File "./prog.py", line 1  
    2myvar = "John"  
          ^  
SyntaxError: invalid syntax  
  
During handling of the above exception, another exception occurred:  
  
Traceback (most recent call last):  
  File "<string>", line 1, in <module>  
  File "/usr/lib/python3.7/py_compile.py", line 147, in compile  
    raise py_exc  
py_compile.PyCompileError:   file "./prog.py", line 1  
    2myvar = "John"  
          ^  
SyntaxError: invalid syntax
```



- Remember that variable names are case-sensitive

/PYTHON VARIABLES - Multi Words Variable Names



- **Variable names with more than one word can be difficult to read.**
- There are several techniques you can use to make them more readable:

Camel Case

Each word, except the first, starts with a capital letter:

```
myVariableName = "John"
```

Pascal Case

Each word starts with a capital letter:

```
MyVariableName = "John"
```

Snake Case

Each word is separated by an underscore character:

```
my_variable_name = "John"
```



/PYTHON VARIABLES - Assign Multiple Values



Many Values to Multiple Variables

Python allows you to assign values to multiple variables in one line:

Example

```
x, y, z = "Orange", "Banana", "Cherry"  
print(x)  
print(y)  
print(z)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, and settings, followed by a green 'Run' button with a right-pointing arrow. Below the code area, the output window displays the words 'Orange', 'Banana', and 'Cherry' each on a new line.

```
x, y, z = "Orange",  
          "Banana", "Cherry"  
  
print(x)  
print(y)  
print(z)
```

Orange
Banana
Cherry



/PYTHON VARIABLES - Assign Multiple Values



Unpack a Collection

If you have a collection of values in a list, tuple etc. Python allows you to extract the values into variables. This is called *unpacking*.

Example

Unpack a list:

```
fruits = ["apple", "banana", "cherry"]
x, y, z = fruits
print(x)
print(y)
print(z)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. On the left, the code is written:

```
fruits = ["apple", "banana", "cherry"]
x, y, z = fruits
print(x)
print(y)
print(z)
```

On the right, there are several icons: a house, a list, a refresh, a circle, and a green 'Run' button with a right arrow. To the right of the run button is the output window, which displays the following text:

```
apple
banana
cherry
```

/PYTHON VARIABLES - Output Variables



In the `print()` function, you output multiple variables, separated by a comma:

Example

```
x = "Python"  
y = "is"  
z = "awesome"  
print(x, y, z)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. On the left, there is a code editor window containing the following Python code:

```
x = "Python"  
y = "is"  
z = "awesome"  
print(x, y, z)
```

To the right of the code editor is a terminal window showing the output of the code: "Python is awesome". Above the terminal window, there is a green "Run" button.



/PYTHON VARIABLES - Output Variables



Notice the space character after "Python " and "is ", without them the result would be "Pythonisawesome".

For numbers, the + character works as a mathematical operator:

Example

```
x = 5  
y = 10  
print(x + y)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, refresh, and run, followed by a green "Run >" button. Below the code input area, the code is displayed:

```
x = 5  
y = 10  
print(x + y)
```

To the right of the code, the output window displays the result:

15



/PYTHON VARIABLES - Output Variables



In the `print()` function, when you try to combine a string and a number with the `+` operator, Python will give you an error:

Example

```
x = 5  
y = "John"  
print(x + y)
```

[Try it Yourself »](#)



Run >

```
x = 5  
y = "John"  
print(x + y)
```

TypeError: unsupported operand type(s) for +: 'int' and 'str'

/PYTHON VARIABLES - Output Variables



The best way to output multiple variables in the `print()` function is to separate them with commas, which even support different data types:

Example

```
x = 5  
y = "John"  
print(x, y)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are several icons: a house (home), three horizontal lines (menu), a clipboard (copy), and a circle with a dot (settings). Below the icons, the code is displayed in a white box:

```
x = 5  
y = "John"  
print(x, y)
```

To the right of the code editor is a green button labeled "Run >". To the right of the run button is a black box containing the output of the code: "5 John".

/PYTHON VARIABLES - Global Variables



Variables that are created outside of a function (as in all of the examples above) are known as global variables.

Global variables can be used by everyone, both inside of functions and outside.

Example

Create a variable outside of a function, and use it inside the function

```
x = "awesome"

def myfunc():
    print("Python is " + x)

myfunc()
```

[Try it Yourself »](#)



```
x = "awesome"

def myfunc():
    print("Python is " + x)

myfunc()
```

Run >

Python is awesome

/PYTHON VARIABLES - Global Variables



If you create a variable with the same name inside a function, this variable will be local, and can only be used inside the function. The global variable with the same name will remain as it was, global and with the original value.

Example

Create a variable inside a function, with the same name as the global variable

```
x = "awesome"

def myfunc():
    x = "fantastic"
    print("Python is " + x)

myfunc()

print("Python is " + x)
```

Try it Yourself »



The screenshot shows a Python code editor interface with the following code:

```
x = "awesome"

def myfunc():
    x = "fantastic"
    print("Python is " + x)

myfunc()

print("Python is " + x)
```

The code defines a global variable `x` with the value "awesome". Inside the `myfunc()` function, a local variable `x` is assigned the value "fantastic". When the function is called, it prints "Python is fantastic". After the function call, the global variable `x` is printed again, showing its original value "awesome".

The editor has a toolbar with icons for home, file, settings, and run, followed by a green "Run" button. The output window on the right displays the results of the code execution.

/PYTHON VARIABLES - Global Variables



The **global** Keyword

Normally, when you create a variable inside a function, that variable is local, and can only be used inside that function.

To create a global variable inside a function, you can use the **global** keyword.



/PYTHON VARIABLES - Global Variables



Example

If you use the `global` keyword, the variable belongs to the global scope:

```
def myfunc():
    global x
    x = "fantastic"

myfunc()

print("Python is " + x)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface with a toolbar at the top featuring icons for home, file, edit, run, and settings. A green button labeled "Run >" is visible. The code area contains the following Python script:

```
def myfunc():
    global x
    x = "fantastic"

myfunc()

print("Python is " + x)
```

The output window on the right displays the result of running the script: "Python is fantastic".

/PYTHON VARIABLES - Global Variables



Also, use the **global** keyword if you want to change a global variable inside a function.

Example

To change the value of a global variable inside a function, refer to the variable by using the **global** keyword:

```
x = "awesome"

def myfunc():
    global x
    x = "fantastic"

myfunc()

print("Python is " + x)
```

[Try it Yourself >](#)



The screenshot shows a Python code editor interface with the following code in the editor pane:

```
x = "awesome"

def myfunc():
    global x
    x = "fantastic"

myfunc()

print("Python is " + x)
```

The output pane displays the result: "Python is fantastic".



<Python Data Types>



/PYTHON DATA TYPES



Built-in Data Types

In programming, data type is an important concept.

Variables can store data of different types, and different types can do different things.



/PYTHON DATA TYPES



Python has the following data types built-in by default, in these categories:

Text Type: `str`

Numeric Types: `int`, `float`, `complex`

Sequence Types: `list`, `tuple`, `range`

Mapping Type: `dict`

Set Types: `set`, `frozenset`

Boolean Type: `bool`

Binary Types: `bytes`, `bytearray`, `memoryview`

None Type: `NoneType`



/PYTHON DATA TYPES - Getting the Data Type

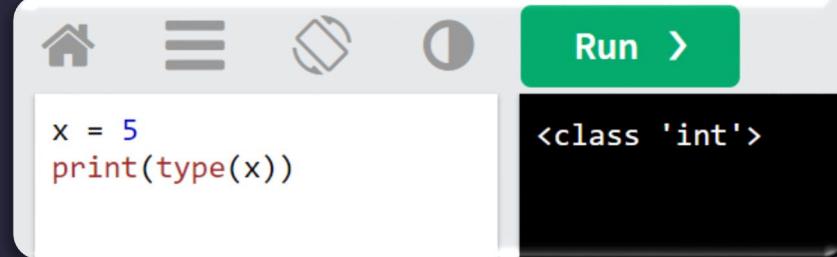
You can get the data type of any object by using the `type()` function:

Example

Print the data type of the variable `x`:

```
x = 5  
print(type(x))
```

[Try it Yourself »](#)



The image shows a screenshot of a Python code editor interface. At the top, there are several icons: a house, three horizontal lines, a clipboard, and a circular progress bar. To the right of these is a green "Run >" button. Below the icons, the code is displayed in a white text area:
`x = 5
print(type(x))`On the right side, the output is shown in a black text area:
`<class 'int'>`

/PYTHON DATA TYPES - Getting the Data Type



Example:	Data Type	Try it
x = "Hello World"	str	Try it »
x = 20	int	Try it »
x = 20.5	float	Try it »
x = 1j	complex	Try it »
x = ["apple", "banana", "cherry"]	list	Try it »
x = ("apple", "banana", "cherry")	tuple	Try it »
x = range(6)	range	Try it »



/PYTHON DATA TYPES - Getting the Data Type

```
x = {"name" : "John", "age" : 36}
```

dict

[Try it »](#)

```
x = {"apple", "banana", "cherry"}
```

set

[Try it »](#)

```
x = frozenset({"apple", "banana", "cherry"})
```

frozenset

[Try it »](#)

```
x = True
```

bool

[Try it »](#)

```
x = b"Hello"
```

bytes

[Try it »](#)

```
x = bytearray(5)
```

bytearray

[Try it »](#)

```
x = memoryview(bytes(5))
```

memoryview

[Try it »](#)

```
x = None
```

NoneType

[Try it »](#)



/PYTHON DATA TYPES - Setting the Specific Data Type



Example	Data Type	Try it
<code>x = str("Hello World")</code>	<code>str</code>	Try it »
<code>x = int(20)</code>	<code>int</code>	Try it »
<code>x = float(20.5)</code>	<code>float</code>	Try it »
<code>x = complex(1j)</code>	<code>complex</code>	Try it »
<code>x = list(("apple", "banana", "cherry"))</code>	<code>list</code>	Try it »
<code>x = tuple(("apple", "banana", "cherry"))</code>	<code>tuple</code>	Try it »

/PYTHON DATA TYPES - Setting the Specific Data Type

```
x = range(6)
```

range

[Try it »](#)

```
x = dict(name="John", age=36)
```

dict

[Try it »](#)

```
x = set(("apple", "banana", "cherry"))
```

set

[Try it »](#)

```
x = frozenset(("apple", "banana", "cherry"))
```

frozenset

[Try it »](#)

```
x = bool(5)
```

bool

[Try it »](#)

```
x = bytes(5)
```

bytes

[Try it »](#)

```
x = bytearray(5)
```

bytearray

[Try it »](#)

```
x = memoryview(bytes(5))
```

memoryview

[Try it »](#)

/03

<PYTHON NUMBERS>



/PYTHON NUMBERS



There are three numeric types in Python:

- . int
- . float
- . Complex

Variables of numeric types are created when you assign a value to them:



/PYTHON NUMBERS



Example

```
x = 1      # int  
y = 2.8    # float  
z = 1j     # complex
```



/PYTHON NUMBERS



To verify the type of any object in Python, use the `type()` function:

Example

```
print(type(x))  
print(type(y))  
print(type(z))
```

Try it Yourself »

The image shows a screenshot of a Python code editor interface. At the top, there are several icons: a house (home), three horizontal lines (menu), a square with a diagonal line (refresh), and a circle with a dot (stop). To the right of these is a green button labeled "Run >". Below the icons is a code editor window containing the following Python code:

```
x = 1  
y = 2.8  
z = 1j  
  
print(type(x))  
print(type(y))  
print(type(z))
```

On the right side of the editor, the output of the code is displayed in a black box:

```
<class 'int'>  
<class 'float'>  
<class 'complex'>
```



<Int/int>



/PYTHON NUMBERS - Int



Int, or **integer**, is a whole number, positive or negative, without decimals, of unlimited length.

Example

Integers:

```
x = 1
y = 35656222554887711
z = -3255522

print(type(x))
print(type(y))
print(type(z))
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, file, edit, and run. A green 'Run' button is visible. The code area contains the following Python code:

```
x = 1
y = 35656222554887711
z = -3255522

print(type(x))
print(type(y))
print(type(z))
```

The output window on the right shows the results of running the code:

```
<class 'int'>
<class 'int'>
<class 'int'>
```



<Float>



/PYTHON NUMBERS - Float



Float, or "floating point number" is a number, positive or negative, containing one or more decimals.

Example

Floats:

```
x = 1.10  
y = 1.0  
z = -35.59
```

```
print(type(x))  
print(type(y))  
print(type(z))
```

[Try it Yourself »](#)

```
x = 1.10  
y = 1.0  
z = -35.59  
  
print(type(x))  
print(type(y))  
print(type(z))
```

Run >

```
<class 'float'>  
<class 'float'>  
<class 'float'>
```



/PYTHON NUMBERS - Float



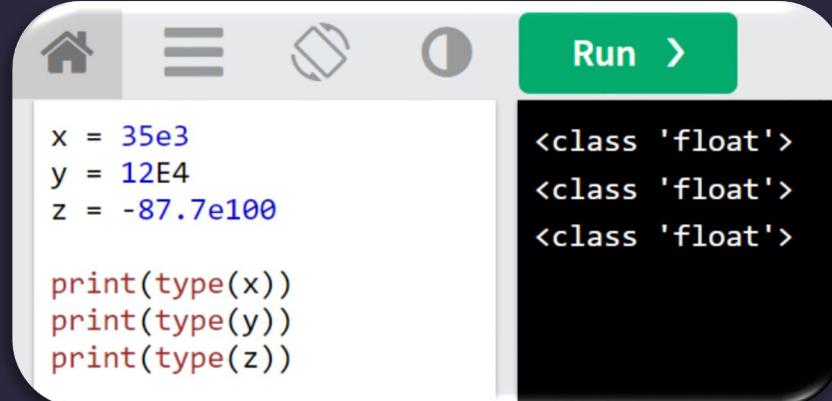
Float can also be scientific numbers with an "e" to indicate the power of 10.

Example

Floats:

```
x = 35e3  
y = 12E4  
z = -87.7e100  
  
print(type(x))  
print(type(y))  
print(type(z))
```

[Try it Yourself »](#)



```
x = 35e3  
y = 12E4  
z = -87.7e100  
  
print(type(x))  
print(type(y))  
print(type(z))
```

<class 'float'>
<class 'float'>
<class 'float'>





<Complex>



/PYTHON NUMBERS - Complex



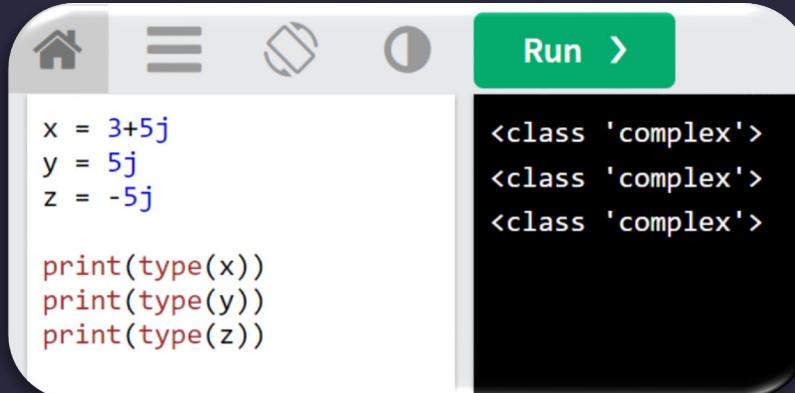
Complex numbers are written with a "j" as the imaginary part:

Example

Complex:

```
x = 3+5j  
y = 5j  
z = -5j  
  
print(type(x))  
print(type(y))  
print(type(z))
```

Try it Yourself »



The screenshot shows a Python code editor interface with the following content:

```
x = 3+5j  
y = 5j  
z = -5j  
  
print(type(x))  
print(type(y))  
print(type(z))
```

The output window displays the results of the print statements:

```
<class 'complex'>  
<class 'complex'>  
<class 'complex'>
```



/PYTHON NUMBERS - Type Conversion



Type Conversion

You can convert from one type to another with the `int()`, `float()`, and `complex()` methods:

```
#convert from int to float:  
x = float(1)  
  
#convert from float to int:  
y = int(2.8)  
  
#convert from int to complex:  
z = complex(1)  
  
print(x)  
print(y)  
print(z)  
  
print(type(x))  
print(type(y))  
print(type(z))
```

```
1.0  
2  
(1+0j)  
<class 'float'>  
<class 'int'>  
<class 'complex'>
```



/PYTHON NUMBERS - Type Conversion



Type Conversion

Note: You cannot convert complex numbers into another number type.



/PYTHON NUMBERS - Random Number



Random Number

Python does not have a **random()** function to make a random number, but Python has a built-in module called random that can be used to make **random** numbers:

Example

Import the random module, and display a random number between 1 and 9:

```
import random  
  
print(random.randrange(1, 10))
```

[Try it Yourself »](#)



```
import random  
  
print(random.randrange(1, 10))
```

5



<PYTHON CASTING>



/PYTHON CASTING - Specify a Variable Type



Specify a Variable Type

There may be times when you want to specify a type on to a variable. This can be done with casting. Python is an object-orientated language, and as such it uses classes to define data types, including its primitive types.

Casting in python is therefore done using constructor functions:

- **int()** - constructs an integer number from an integer literal, a float literal (by removing all decimals), or a string literal (providing the string represents a whole number)
- **float()** - constructs a float number from an integer literal, a float literal or a string literal (providing the string represents a float or an integer)
- **str()** - constructs a string from a wide variety of data types, including strings, integer literals and float literals



/PYTHON CASTING - Specify a Variable Type

EXAMPLE: int

Example

Integers:

```
x = int(1)    # x will be 1
y = int(2.8)  # y will be 2
z = int("3")  # z will be 3
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, and settings. On the right, there is a green "Run >" button. The code area contains the following Python script:

```
x = int(1)
y = int(2.8)
z = int("3")
print(x)
print(y)
print(z)
```

To the right of the code, the output window displays the results of the execution:

```
1
2
3
```

/PYTHON CASTING - Specify a Variable Type



EXAMPLE: float

Example

Floats:

```
x = float(1)      # x will be 1.0
y = float(2.8)    # y will be 2.8
z = float("3")    # z will be 3.0
w = float("4.2")  # w will be 4.2
```

Try it Yourself »

The image shows a screenshot of a Python code editor interface. On the left, there is a code editor window with the following Python code:

```
x = float(1)      # x will be 1.0
y = float(2.8)    # y will be 2.8
z = float("3")    # z will be 3.0
w = float("4.2")  # w will be 4.2
print(x)
print(y)
print(z)
print(w)
```

On the right, there is a terminal window showing the output of the code:

```
1.0
2.8
3.0
4.2
```

The interface includes standard icons for file, edit, and run, along with a green "Run >" button.

/PYTHON CASTING - Specify a Variable Type



EXAMPLE: string

Example

Strings:

```
x = str("s1") # x will be 's1'  
y = str(2)      # y will be '2'  
z = str(3.0)    # z will be '3.0'
```

[Try it Yourself »](#)

The image shows a screenshot of a Python code editor. At the top, there are icons for home, file, edit, and run. A green 'Run' button is visible. The code area contains the following Python code:

```
x = str("s1")  
y = str(2)  
z = str(3.0)  
print(x)  
print(y)  
print(z)
```

The output window on the right displays the results of the print statements:

```
s1  
2  
3.0
```



<PYTHON STRINGS>





<STRINGS>



/PYTHON STRINGS - STRINGS



Strings in python are surrounded by either single quotation marks, or double quotation marks.

'hello' is the same as
"hello".

You can display a string literal with the **print()** function:

Example

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

[Try it Yourself »](#)

The image shows a screenshot of a Python code editor. At the top, there are icons for home, menu, and refresh, followed by a green 'Run >' button. Below the toolbar, the code is displayed in a white box:
`#You can use double or single quotes:`
`print("Hello")`
`print('Hello')`

To the right, the output window shows the results of the execution:
`Hello`
`Hello`

/PYTHON STRINGS - Assign String to a Variable



Assigning a string to a variable is done with the variable name followed by an equal sign and the string:

Example

```
a = "Hello"  
print(a)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are several icons: a house, three horizontal lines, a smartphone, and a circle. To the right of these is a green 'Run' button with a white arrow. Below the icons, the code `a = "Hello"
print(a)` is written in a light gray text area. To the right of the code area is a black output window containing the text `Hello`.

/PYTHON STRINGS - Multiline Strings



You can assign a multiline string to a variable by using three quotes:

Example

```
a = """Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do eiusmod tempor incididunt  
ut labore et dolore magna aliqua."""  
print(a)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green button labeled "Run >" is visible. Below the editor area, the code is displayed in a light gray box:

```
a = """Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do eiusmod tempor incididunt  
ut labore et dolore magna aliqua."""  
print(a)
```

To the right of the code, the output is shown in a black box:

```
 Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do eiusmod tempor incididunt  
ut labore et dolore magna aliqua.
```

/PYTHON STRINGS - Multiline Strings



Or three single quotes:

Example

You can use three double quotes:

```
a = """Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do eiusmod tempor incididunt  
ut labore et dolore magna aliqua."""  
print(a)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings, followed by a green "Run >" button. Below the toolbar, the code is displayed in a white editor area:

```
a = """Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do eiusmod tempor incididunt  
ut labore et dolore magna aliqua."""  
print(a)
```

To the right of the editor, a black terminal window displays the output of the code execution:

```
 Lorem ipsum dolor sit amet,  
consectetur adipiscing elit,  
sed do eiusmod tempor incididunt  
ut labore et dolore magna aliqua.
```



<SLICING STRINGS>



/PYTHON STRINGS - Slicing



You can return a range of characters by using the slice syntax.

Specify the start index and the end index, separated by a colon, to return a part of the string.

Example

Get the characters from position 2 to position 5 (not included):

```
b = "Hello, World!"  
print(b[2:5])
```

[Try it Yourself »](#)



```
b = "Hello, World!"  
print(b[2:5])
```

llo

Note: The first character has index 0.

/PYTHON STRINGS - Slice From the Start



By leaving out the start index, the range will start at the first character:

Example

Get the characters from the start to position 5 (not included):

```
b = "Hello, World!"  
print(b[:5])
```

[Try it Yourself »](#)

```
b = "Hello, World!"  
print(b[:5])
```

Hello



/PYTHON STRINGS - Slice to the End



By leaving out the end index, the range will go to the end:

Example

Get the characters from position 2, and all the way to the end:

```
b = "Hello, World!"  
print(b[2:])
```

[Try it Yourself »](#)

```
b = "Hello, World!"  
print(b[2:])
```

llo, World!



/PYTHON STRINGS - Negative Indexing



Use negative indexes to start the slice from the end of the string:

Example

Get the characters:

From: "o" in "World!" (position -5)

To, but not included: "d" in "World!" (position -2):

```
b = "Hello, World!"  
print(b[-5:-2])
```

[Try it Yourself »](#)



The image shows a screenshot of a Python code editor. At the top, there are icons for home, menu, and run. A green button labeled "Run >" is visible. Below the editor area, the code is displayed in a white box:

```
b = "Hello, World!"  
print(b[-5:-2])
```

The output window to the right shows the result of the execution:

```
orl
```



<MODIFY STRINGS>



/PYTHON STRINGS – MODIFY STRINGS



Python has a set of built-in methods that you can use on strings.

Upper Case

Example

The `upper()` method returns the string in upper case:

```
a = "Hello, World!"  
print(a.upper())
```

[Try it Yourself »](#)

```
a = "Hello, World!"  
print(a.upper())
```

HELLO, WORLD!



/PYTHON STRINGS – MODIFY STRINGS



Remove Whitespace

Whitespace is the space before and/or after the actual text, and very often you want to remove this space.

Example

The `strip()` method removes any whitespace from the beginning or the end:

```
a = " Hello, World! "
print(a.strip()) # returns "Hello, World!"
```

[Try it Yourself »](#)



The screenshot shows a code editor interface with a toolbar at the top featuring icons for home, menu, file, run, and refresh. A green 'Run' button is visible. The code area contains the following Python code:

```
a = " Hello, World! "
print(a.strip())
```

The output window to the right displays the result of the execution:

```
Hello, World!
```

/PYTHON STRINGS – MODIFY STRINGS



Replace String

Example

The `replace()` method replaces a string with another string:

```
a = "Hello, World!"  
print(a.replace("H", "J"))
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, file, edit, run, and settings. A green 'Run' button is visible. Below the editor area, the code is displayed:

```
a = "Hello, World!"  
print(a.replace("H", "J"))
```

To the right of the code, the output is shown in a black box:

Jello, World!



/PYTHON STRINGS – MODIFY STRINGS



Split String

The **split()** method returns a list where the text between the specified separator becomes the list items.

Example

The `split()` method splits the string into substrings if it finds instances of the separator:

```
a = "Hello, World!"  
print(a.split(",")) # returns ['Hello', ' World!']
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, and file operations, followed by a green 'Run' button. Below the code area, the output window displays the result of running the provided code.

```
a = "Hello, World!"  
b = a.split(",")  
print(b)
```

['Hello', ' World!']



/PYTHON STRINGS – “STRINGS METHOD”



Python has a set of built-in methods that you can use on strings.

Note: All string methods returns new values. They do not change the original string.

Method	Description
<code>capitalize()</code>	Converts the first character to upper case
<code>casefold()</code>	Converts string into lower case
<code>center()</code>	Returns a centered string
<code>count()</code>	Returns the number of times a specified value occurs in a string
<code>encode()</code>	Returns an encoded version of the string
<code>endswith()</code>	Returns true if the string ends with the specified value
<code>expandtabs()</code>	Sets the tab size of the string
<code>find()</code>	Searches the string for a specified value and returns the position of where it was found
<code>format()</code>	Formats specified values in a string
<code>format_map()</code>	Formats specified values in a string





/PYTHON STRINGS – “STRINGS METHOD”



Method	Description
<u>capitalize()</u>	Converts the first character to upper case
<u>casefold()</u>	Converts string into lower case
<u>center()</u>	Returns a centered string
<u>count()</u>	Returns the number of times a specified value occurs in a string
<u>encode()</u>	Returns an encoded version of the string
<u>endswith()</u>	Returns true if the string ends with the specified value
<u>expandtabs()</u>	Sets the tab size of the string
<u>find()</u>	Searches the string for a specified value and returns the position of where it was found
<u>format()</u>	Formats specified values in a string
<u>format_map()</u>	Formats specified values in a string





/PYTHON STRINGS – “STRINGS METHOD”



<u>index()</u>	Searches the string for a specified value and returns the position of where it was found
<u>isalnum()</u>	Returns True if all characters in the string are alphanumeric
<u>isalpha()</u>	Returns True if all characters in the string are in the alphabet
<u>isascii()</u>	Returns True if all characters in the string are ascii characters
<u>isdecimal()</u>	Returns True if all characters in the string are decimals
<u>isdigit()</u>	Returns True if all characters in the string are digits
<u>isidentifier()</u>	Returns True if the string is an identifier
<u>islower()</u>	Returns True if all characters in the string are lower case
<u>isnumeric()</u>	Returns True if all characters in the string are numeric
<u>isprintable()</u>	Returns True if all characters in the string are printable
<u>isspace()</u>	Returns True if all characters in the string are whitespaces
<u>istitle()</u>	Returns True if the string follows the rules of a title
<u>isupper()</u>	Returns True if all characters in the string are upper case





/PYTHON STRINGS – “STRINGS METHOD”



<u>join()</u>	Converts the elements of an iterable into a string
<u>ljust()</u>	Returns a left justified version of the string
<u>lower()</u>	Converts a string into lower case
<u>lstrip()</u>	Returns a left trim version of the string
<u>maketrans()</u>	Returns a translation table to be used in translations
<u>partition()</u>	Returns a tuple where the string is parted into three parts
<u>replace()</u>	Returns a string where a specified value is replaced with a specified value
<u>rfind()</u>	Searches the string for a specified value and returns the last position of where it was found
<u>rindex()</u>	Searches the string for a specified value and returns the last position of where it was found
<u>rjust()</u>	Returns a right justified version of the string
<u>rpartition()</u>	Returns a tuple where the string is parted into three parts
<u>rsplit()</u>	Splits the string at the specified separator, and returns a list
<u>rstrip()</u>	Returns a right trim version of the string



/PYTHON STRINGS – MODIFY STRINGS



<u>split()</u>	Splits the string at the specified separator, and returns a list
<u>splitlines()</u>	Splits the string at line breaks and returns a list
<u>startswith()</u>	Returns true if the string starts with the specified value
<u>strip()</u>	Returns a trimmed version of the string
<u>swapcase()</u>	Swaps cases, lower case becomes upper case and vice versa
<u>title()</u>	Converts the first character of each word to upper case
<u>translate()</u>	Returns a translated string
<u>upper()</u>	Converts a string into upper case
<u>zfill()</u>	Fills the string with a specified number of 0 values at the beginning





<String Concatenation>



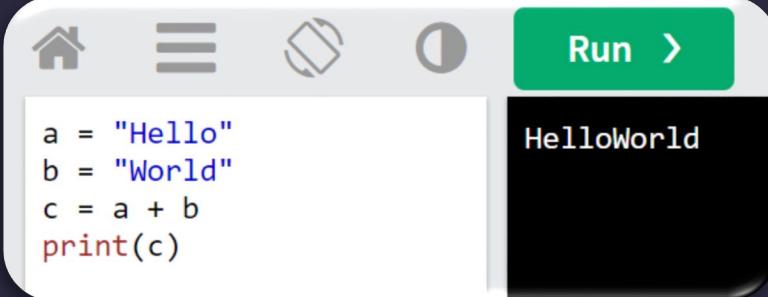
/PYTHON STRINGS – STRING CONCATENATION

To concatenate, or combine, two strings you can use the + operator.

Example

Merge variable `a` with variable `b` into variable `c`:

```
a = "Hello"  
b = "World"  
c = a + b  
print(c)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, file, settings, and run. A green 'Run >' button is on the right. Below the icons, the code is displayed:

```
a = "Hello"  
b = "World"  
c = a + b  
print(c)
```

On the right side of the editor, the output window displays the result:

```
HelloWorld
```

/PYTHON STRINGS – STRING CONCATENATION

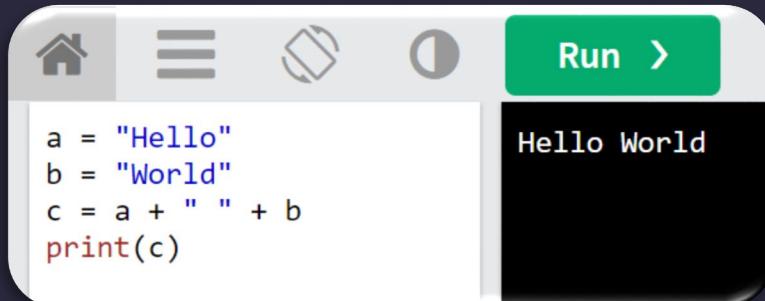
EXAMPLE:

Example

To add a space between them, add a " " :

```
a = "Hello"  
b = "World"  
c = a + " " + b  
print(c)
```

[Try it Yourself »](#)





<Format - String>



/PYTHON STRINGS – String Format



String Format

As we learned in the Python Variables chapter, we cannot combine strings and numbers like this:

Example

```
age = 36  
txt = "My name is John, I am " + age  
print(txt)
```

The screenshot shows a Python code editor interface. On the left, there is a code editor window with the following Python code:

```
age = 36  
txt = "My name is John, I am " + age  
print(txt)
```

On the right, there is a terminal window showing the output of running the code. The output includes a traceback:

```
Traceback (most recent call last):  
  File "demo_string_format_error.py", line 2, in <module>  
    txt = "My name is John, I am " + age  
TypeError: must be str, not int
```

Try it Yourself »

/PYTHON STRINGS – String Format



But we can combine strings and numbers by using the **format()** method!

The **format()** method takes the passed arguments, formats them, and places them in the string where the placeholders **{}** are:

Example

Use the **format()** method to insert numbers into strings:

```
age = 36
txt = "My name is John, and I am {}"
print(txt.format(age))
```

[Try it Yourself »](#)

A screenshot of a code editor window. The window has a dark theme with light-colored code. At the top, there are icons for file, edit, and run. A green button labeled "Run >" is visible. The code area contains the following Python code:

```
age = 36
txt = "My name is John, and I am {}"
print(txt.format(age))
```

To the right of the code, the output is displayed in a black box:

My name is John, and I am 36

/PYTHON STRINGS – String Format



The `format()` method takes unlimited number of arguments, and are placed into the respective placeholders:

Example

```
quantity = 3
itemno = 567
price = 49.95
myorder = "I want {} pieces of item {} for {} dollars."
print(myorder.format(quantity, itemno, price))
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and help, followed by a green 'Run' button with a play icon. To the right, it says 'Result Size: 650'. Below the toolbar, the code is displayed in a light gray area:

```
quantity = 3
itemno = 567
price = 49.95
myorder = "I want {} pieces of item {} for {} dollars."
print(myorder.format(quantity, itemno, price))
```

To the right of the code, the output is shown in a dark gray box:

```
I want 3 pieces of item 567 for 49.95 dollars.
```



/PYTHON STRINGS – String Format



You can use index numbers **{0}** to be sure the arguments are placed in the correct placeholders:

Example

```
quantity = 3
itemno = 567
price = 49.95
myorder = "I want to pay {2} dollars for {0} pieces of item {1}."
print(myorder.format(quantity, itemno, price))
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are navigation icons: a house, three horizontal lines, a square, a circle, and a 'Run' button with a play arrow. To the right of the run button is the text 'Result Size: 497 x 332'. Below the editor area, there is a green button with the text 'Get your own website!'. The code in the editor is:

```
quantity = 3
itemno = 567
price = 49.95
myorder = "I want to pay {2} dollars for {0} pieces of item {1}."
print(myorder.format(quantity, itemno, price))
```

The output window below the editor shows the result of running the code:

```
I want to pay 49.95 dollars for 3 pieces of item 567
```



- □ ×

/PYTHON STRINGS – String Format



Learn more about String Formatting in
our [String Formatting](#) chapter.





<Escape Characters>



/PYTHON STRINGS – Escape Character



To insert characters that are illegal in a string, use an escape character.

An escape character is a backslash \ followed by the character you want to insert.

An example of an illegal character is a double quote inside a string that is surrounded by double quotes:



/PYTHON STRINGS – Escape Character



Example

You will get an error if you use double quotes inside a string that is surrounded by double quotes:

```
txt = "We are the so-called "Vikings" from the north."
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file operations (Home, New, Open, Save, Run), a result size indicator (Result Size: 497 x 332), and a button to "Get your own website". Below the toolbar, the code area contains the following text:

```
txt = "We are the so-called "Vikings" from the north."  
  
#You will get an error if you use double quotes inside a  
string that are surrounded by double quotes:
```

The line `txt = "We are the so-called "Vikings" from the north."` is highlighted in red, indicating a syntax error. To the right, the output window displays the error message:

```
File "demo_string_escape_error.py", line 1  
    txt = "We are the so-called "Vikings" from the north."  
                         ^  
SyntaxError: invalid syntax
```



/PYTHON STRINGS – Escape Character



Code	Result	Try it
\'	Single Quote	Try it »
\\"	Backslash	Try it »
\n	New Line	Try it »
\r	Carriage Return	Try it »
\t	Tab	Try it »
\b	Backspace	Try it »
\f	Form Feed	
\ooo	Octal value	Try it »
\xhh	Hex value	Try it »





<PYTHON BOOLEANS>



/PYTHON BOOLEANS – Boolean Values



Booleans represent one of two values: **True** or **False**.

Boolean Values

In programming you often need to know if an expression is **True** or **False**.

You can evaluate any expression in Python, and get one of two answers, **True** or **False**.



/PYTHON BOOLEANS – Boolean Values



When you compare two values, the expression is evaluated and Python returns the Boolean answer:

Example

```
print(10 > 9)
print(10 == 9)
print(10 < 9)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are several icons: a house (Home), three horizontal lines (File/Menu), a document (Edit), and a circle with a dot (Run). To the right of these is a green button labeled "Run ➤". Below the icons, the code is displayed in a white text area:

```
print(10 > 9)
print(10 == 9)
print(10 < 9)
```

To the right of the code area is a black output window containing the results of the print statements:

```
True
False
False
```



/PYTHON BOOLEANS – Boolean Values



When you run a condition in an if statement, Python returns **True** or **False**:

Example

Print a message based on whether the condition is **True** or **False**:

```
a = 200
b = 33

if b > a:
    print("b is greater than a")
else:
    print("b is not greater than a")
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. On the left, the code is written:

```
a = 200
b = 33

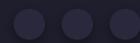
if b > a:
    print("b is greater than a")
else:
    print("b is not greater than a")
```

On the right, the output window displays the result of running the code:

```
b is not greater than a
```



/PYTHON BOOLEANS – Evaluate Values and Variables



The **bool()** function allows you to evaluate any value, and give you **True** or **False** in return,

Example

Evaluate a string and a number:

```
print(bool("Hello"))
print(bool(15))
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, file, and run. Below the code area, the status bar shows "True" and "True".

```
print(bool("Hello"))
print(bool(15))
```

Run >

True
True

/PYTHON BOOLEANS – Evaluate Values and Variables

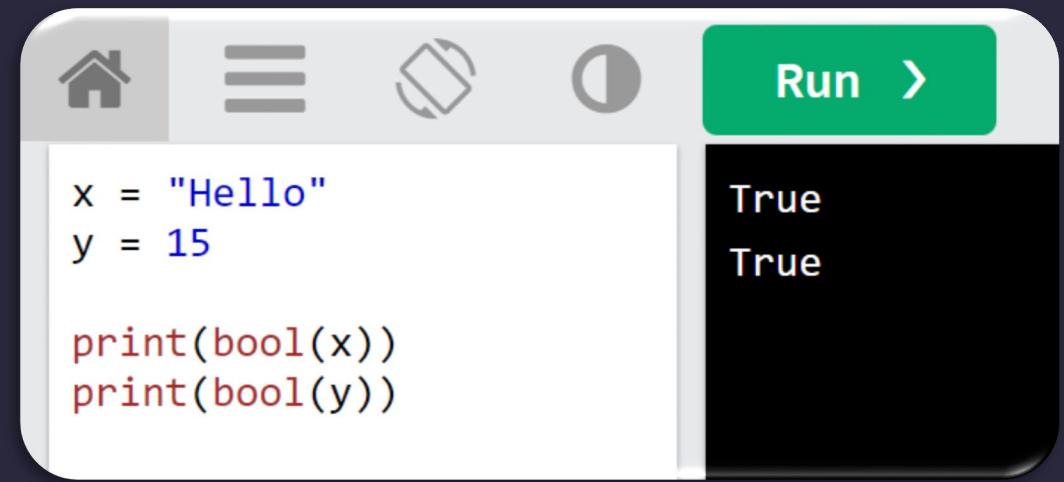


Example

Evaluate two variables:

```
x = "Hello"  
y = 15  
  
print(bool(x))  
print(bool(y))
```

[Try it Yourself »](#)



The image shows a screenshot of a Python code editor. At the top, there are several icons: a house (Home), three horizontal lines (File/Menu), a document (Edit), a circular arrow (Run), and a circle with a dot (Stop). To the right of these is a green button labeled "Run >". Below the icons, the code is displayed in a white text area:

```
x = "Hello"  
y = 15  
  
print(bool(x))  
print(bool(y))
```

To the right of the code area is a black sidebar where the output of the code is shown:

```
True  
True
```



/PYTHON BOOLEANS – Most Values are True



Almost any value is evaluated to **True** if it has some sort of content.

Any string is **True**, except empty strings.

Any number is **True**, except **0**.

Any list, tuple, set, and dictionary are **True**, except empty ones.



/PYTHON BOOLEANS – Most Values are True



Example

The following will return True:

```
bool("abc")
bool(123)
bool(["apple", "cherry", "banana"])
```

[Try it Yourself »](#)



A screenshot of a Python code editor interface. At the top, there are icons for home, file, edit, and run, followed by a green 'Run >' button. Below the icons is a code block containing three print statements that call the bool() function with different inputs: a string, an integer, and a list. To the right of the code block is a black output window displaying the results of the runs: 'True', 'True', and 'True' respectively.

```
print(bool("abc"))
print(bool(123))
print(bool(["apple", "cherry", "banana"]))
```

True
True
True

/PYTHON BOOLEANS – Some Values are False



In fact, there are not many values that evaluate to **False**, except empty values, such as `()`, `[]`, `{}`, `""`, the number `0`, and the value **None**. And of course the value **False** evaluates to **False**.

Example

The following will return False:

```
bool(False)  
bool(None)  
bool(0)  
bool("")  
bool(())  
bool([])  
bool({})
```

[Try it Yourself »](#)

A screenshot of a Python code editor interface. At the top, there are icons for home, menu, and refresh, followed by a green "Run >" button. Below the code area, there is a status bar with a progress bar and some text. The code area contains the following Python code:

```
print(bool(False))  
print(bool(None))  
print(bool(0))  
print(bool(""))  
print(bool(()))  
print(bool([]))  
print(bool({}))
```

The output area shows the results of running the code:

```
False  
False  
False  
False  
False  
False  
False  
False
```

/PYTHON BOOLEANS – Some Values are False



One more value, or object in this case, evaluates to **False**, and that is if you have an object that is made from a class with a **`__len__`** function that returns **0** or **False**:

Example

```
class myclass():
    def __len__(self):
        return 0

myobj = myclass()
print(bool(myobj))
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, file, and run. A green "Run" button is visible. The code area contains the same Python code as the example box. To the right, the output window displays the word "False".

```
class myclass():
    def __len__(self):
        return 0

myobj = myclass()
print(bool(myobj))
```

False

/PYTHON BOOLEANS – Functions can Return a Boolean



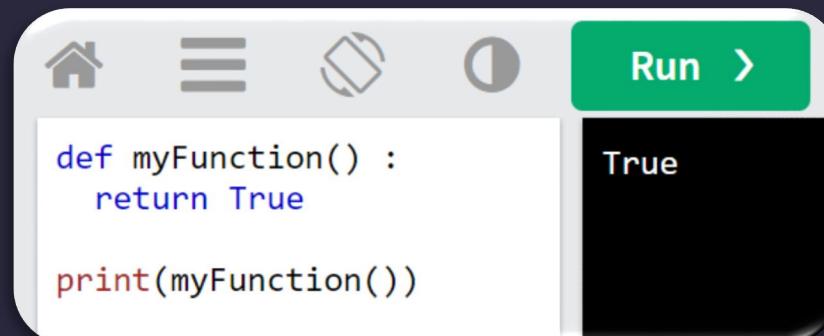
You can create functions that returns a Boolean Value:

Example

Print the answer of a function:

```
def myFunction() :  
    return True  
  
print(myFunction())
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, and run. A green "Run >" button is visible. The code area contains the following Python script:

```
def myFunction() :  
    return True  
  
print(myFunction())
```

The output window to the right displays the result: "True".

/PYTHON BOOLEANS – Functions can Return a Boolean

You can execute code based on the Boolean answer of a function:

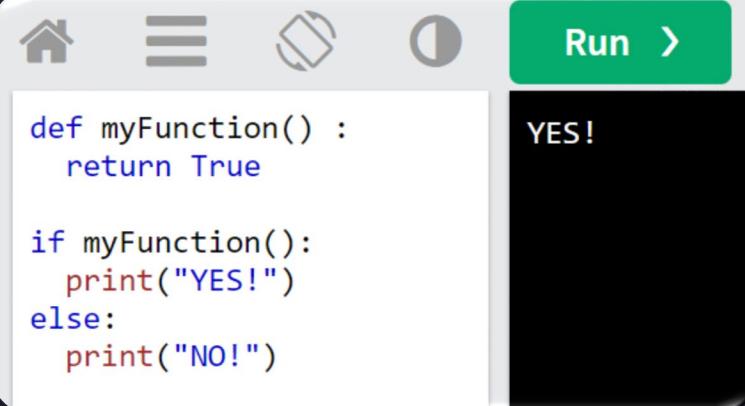
Example

Print "YES!" if the function returns True, otherwise print "NO!":

```
def myFunction():
    return True

if myFunction():
    print("YES!")
else:
    print("NO!")
```

[Try it Yourself »](#)



The image shows a screenshot of a Python code editor. On the left, there is a code editor window with the following Python code:

```
def myFunction():
    return True

if myFunction():
    print("YES!")
else:
    print("NO!")
```

On the right, there is a terminal or output window displaying the result: "YES!". Above the code editor, there is a toolbar with icons for home, menu, file, and run, followed by a green "Run >" button.

/PYTHON BOOLEANS – Functions can Return a Boolean

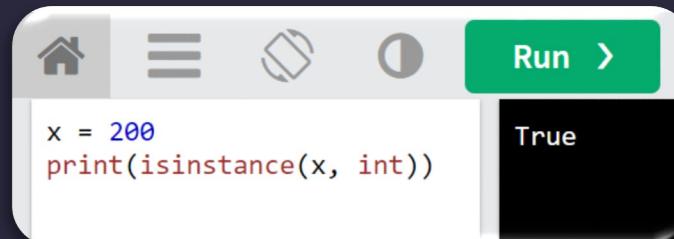
Python also has many built-in functions that return a boolean value, like the **isinstance()** function, which can be used to determine if an object is of a certain data type:

Example

Check if an object is an integer or not:

```
x = 200  
print(isinstance(x, int))
```

[Try it Yourself »](#)

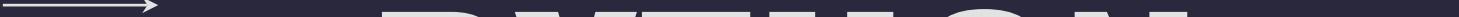


The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green "Run >" button is visible. Below the editor area, the code is displayed:

```
x = 200  
print(isinstance(x, int))
```

To the right of the code, the output is shown in a black box:

True



<PYTHON OPERATORS>



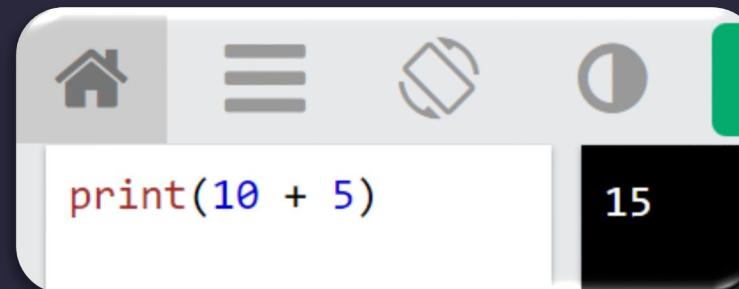
/PYTHON OPERATORS – Functions can Return a Boolean

Operators are used to perform operations on variables and values.

In the example below, we use the + operator to add together two values:

Example

```
print(10 + 5)
```

[Run example »](#)

/PYTHON OPERATORS



Python divides the operators in the following groups:

- Arithmetic operators
- Assignment operators
- Comparison operators
- Logical operators
- Identity operators
- Membership operators
- Bitwise operators



/PYTHON OPERATORS - Python Arithmetic Operators

Python Arithmetic Operators

Arithmetic operators are used with numeric values to perform common mathematical operations:

Operator	Name	Example	Try it
+	Addition	$x + y$	Try it »
-	Subtraction	$x - y$	Try it »
*	Multiplication	$x * y$	Try it »
/	Division	x / y	Try it »
%	Modulus	$x \% y$	Try it »
**	Exponentiation	$x ** y$	Try it »
//	Floor division	$x // y$	Try it »



/PYTHON OPERATORS - Python Arithmetic Operators



Python Assignment Operators

Assignment operators are used to assign values to variables:

Operator	Example	Same As	Try it
=	<code>x = 5</code>	<code>x = 5</code>	Try it »
+=	<code>x += 3</code>	<code>x = x + 3</code>	Try it »
-=	<code>x -= 3</code>	<code>x = x - 3</code>	Try it »
*=	<code>x *= 3</code>	<code>x = x * 3</code>	Try it »
/=	<code>x /= 3</code>	<code>x = x / 3</code>	Try it »
%=	<code>x %= 3</code>	<code>x = x % 3</code>	Try it »



/PYTHON OPERATORS - Python Arithmetic Operators



//=	<code>x //= 3</code>	<code>x = x // 3</code>	Try it »
**=	<code>x **= 3</code>	<code>x = x ** 3</code>	Try it »
&=	<code>x &= 3</code>	<code>x = x & 3</code>	Try it »
=	<code>x = 3</code>	<code>x = x 3</code>	Try it »
^=	<code>x ^= 3</code>	<code>x = x ^ 3</code>	Try it »
>>=	<code>x >>= 3</code>	<code>x = x >> 3</code>	Try it »
<<=	<code>x <<= 3</code>	<code>x = x << 3</code>	Try it »



/PYTHON OPERATORS - Python Arithmetic Operators



Python Comparison Operators

Comparison operators are used to compare two values:

Operator	Name	Example	Try it
<code>==</code>	Equal	<code>x == y</code>	Try it »
<code>!=</code>	Not equal	<code>x != y</code>	Try it »
<code>></code>	Greater than	<code>x > y</code>	Try it »
<code><</code>	Less than	<code>x < y</code>	Try it »
<code>>=</code>	Greater than or equal to	<code>x >= y</code>	Try it »
<code><=</code>	Less than or equal to	<code>x <= y</code>	Try it »

/PYTHON OPERATORS - Python Arithmetic Operators



Python Logical Operators

Logical operators are used to combine conditional statements:

Operator	Description	Example	Try it
and	Returns True if both statements are true	<code>x < 5 and x < 10</code>	Try it »
or	Returns True if one of the statements is true	<code>x < 5 or x < 4</code>	Try it »
not	Reverse the result, returns False if the result is true	<code>not(x < 5 and x < 10)</code>	Try it »



/PYTHON OPERATORS - Python Identity Operators



Python Identity Operators

Identity operators are used to compare the objects, not if they are equal, but if they are actually the same object, with the same memory location:

Operator	Description	Example	Try it
is	Returns True if both variables are the same object	x is y	Try it »
is not	Returns True if both variables are not the same object	x is not y	Try it »



/PYTHON OPERATORS - Python Membership Operators

Python Membership Operators

Membership operators are used to test if a sequence is presented in an object:

Operator	Description	Example	Try it
in	Returns True if a sequence with the specified value is present in the object	x in y	Try it »
not in	Returns True if a sequence with the specified value is not present in the object	x not in y	Try it »



/PYTHON OPERATORS - Python Bitwise Operators



Python Bitwise Operators

Bitwise operators are used to compare (binary) numbers:

Operator	Description	Example	Try it
in	Returns True if a sequence with the specified value is present in the object	x in y	Try it »
not in	Returns True if a sequence with the specified value is not present in the object	x not in y	Try it »





<PYTHON LIST>



/PYTHON LIST

```
mylist = ["apple", "banana", "cherry"]
```



List

- Lists are used to store multiple items in a single variable.
- Lists are one of 4 built-in data types in Python used to store collections of data, the other 3 are Tuple, Set, and Dictionary, all with different qualities and usage.
- Lists are created using square brackets:

Example

Create a List:

```
thislist = ["apple", "banana", "cherry"]
print(thislist)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green 'Run' button is highlighted. Below the editor area, the code is displayed in a light gray background:

```
thislist = ["apple", "banana", "cherry"]
print(thislist)
```

To the right of the code, the output is shown in a black terminal-like window:

```
['apple', 'banana', 'cherry']
```

/PYTHON LIST - List Items



List Items

- List items are ordered, changeable, and allow duplicate values.
- List items are indexed, the first item has index **[0]**, the second item has index **[1]** etc.

Ordered

- When we say that lists are ordered, it means that the items have a defined order, and that order will not change.
- If you add new items to a list, the new items will be placed at the end of the list.



Note: There are some list methods that will change the order, but in general: the order of the items will not change.



Changeable

- The list is changeable, meaning that we can change, add, and remove items in a list after it has been created.



/PYTHON LIST - List Items



Allow Duplicates

The list is changeable, meaning that we can change, add, and remove items in a list after it has been created.

Example

Lists allow duplicate values:

```
thislist = ["apple", "banana", "cherry", "apple", "cherry"]
print(thislist)
```

[Try it Yourself »](#)

A screenshot of a code editor interface. At the top, there are icons for file, edit, run, and settings. To the right of these is a green 'Run' button with a play icon. Further to the right is a status bar that says 'Result Size: 481 x 332' and a button that says 'Get your own v'. Below the toolbar, the code is displayed in a white text area:
thislist = ["apple", "banana", "cherry", "apple", "cherry"]
print(thislist)
The output is shown in a black text area to the right:
['apple', 'banana', 'cherry', 'apple', 'cherry']



/PYTHON LIST - List Items – Data Types



List Items – Data Types

List items can be of any data type:

Example

String, int and boolean data types:

```
list1 = ["apple", "banana", "cherry"]
list2 = [1, 5, 7, 9, 3]
list3 = [True, False, False]
```

The image shows a screenshot of a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green 'Run' button is visible. Below the toolbar, the code is written in a text area:

```
list1 = ["apple", "banana", "cherry"]
list2 = [1, 5, 7, 9, 3]
list3 = [True, False, False]

print(list1)
print(list2)
print(list3)
```

To the right of the code area is a black terminal window displaying the output of the printed lists:

```
['apple', 'banana', 'cherry']
[1, 5, 7, 9, 3]
[True, False, False]
```



[Try it Yourself »](#)



/PYTHON LIST - List Items – Data Types



A list can contain different data types:

Example

A list with strings, integers and boolean values:

```
list1 = ["abc", 34, True, 40, "male"]
```

[Try it Yourself »](#)

The image shows a screenshot of a Python code editor. At the top, there are icons for home, file, edit, and run, followed by a green 'Run >' button. Below the icons is the Python code:
list1 = ["abc", 34, True, 40, "male"]
print(list1)
The output window to the right displays the result of running the code: ['abc', 34, True, 40, 'male'].

/PYTHON LIST - type()



From Python's perspective, lists are defined as objects with the data type 'list':

```
<class 'list'>
```

Example

What is the data type of a list?

```
mylist = ["apple", "banana", "cherry"]
print(type(mylist))
```

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. Below that, the code is written in a white box:

```
mylist = ["apple", "banana", "cherry"]
print(type(mylist))
```

To the right of the code, the output is displayed in a black box:

```
<class 'list'>
```



[Try it Yourself »](#)



/PYTHON LIST - The list() Constructor



It is also possible to use the `list()` constructor when creating a new list.

Example

Using the `list()` constructor to make a List:

```
thislist = list(("apple", "banana", "cherry")) # note the double  
round-brackets  
print(thislist)
```

[Try it Yourself »](#)

['apple', 'banana', 'cherry']



/PYTHON LIST - Python Collections (Arrays)

Python Collections (Arrays)

There are four collection data types in the Python programming language:

- **List** is a collection which is ordered and changeable. Allows duplicate members.
 - **Tuple** is a collection which is ordered and unchangeable. Allows duplicate members.
 - **Set** is a collection which is unordered, unchangeable*, and unindexed. No duplicate members.
 - **Dictionary** is a collection which is ordered** and changeable. No duplicate members.





<PYTHON TUPLES>



/PYTHON LIST - Python Collections (Arrays)

Tuple

Tuples are used to store multiple items in a single variable.

Tuple is one of 4 built-in data types in Python used to store collections of data, the other 3 are List, Set, and Dictionary, all with different qualities and usage.

A tuple is a collection which is ordered and unchangeable.



/PYTHON LIST



Example

Create a Tuple:

```
thistuple = ("apple", "banana", "cherry")
print(thistuple)
```

[Try it Yourself »](#)

('apple', 'banana', 'cherry')



/PYTHON TUPLES – Tuples Items



Tuple Items

Tuple items are ordered, unchangeable, and allow duplicate values.

Tuple items are indexed, the first item has index **[0]**, the second item has index **[1]** etc.

Ordered

When we say that tuples are ordered, it means that the items have a defined order, and that order will not change.

Unchangeable

Tuples are unchangeable, meaning that we cannot change, add or remove items after the tuple has been created.



/PYTHON LIST -



Allow Duplicates

Since tuples are indexed, they can have items with the same value:

Example

Tuples allow duplicate values:

```
thistuple = ("apple", "banana", "cherry", "apple", "cherry")
print(thistuple)
```

Try it Yourself »



```
('apple', 'banana', 'cherry', 'apple', 'cherry')
```

/PYTHON LIST -



Tuple Length

To determine how many items a tuple has, use the `len()` function:

Example

Print the number of items in the tuple:

```
thistuple = ("apple", "banana", "cherry")
print(len(thistuple))
```

[Try it Yourself »](#)

A screenshot of a Python code editor interface. At the top, there are icons for home, file, edit, run, and settings. Below that is a code editor window containing the following Python code:

```
thistuple = tuple(("apple", "banana", "cherry"))
print(len(thistuple))
```

The code editor has a status bar at the bottom right showing the number '3'.

/PYTHON LIST



Create Tuple With One Item

To create a tuple with only one item, you have to add a comma after the item, otherwise Python will not recognize it as a tuple.

Example

One item tuple, remember the comma:

```
thistuple = ("apple",)  
print(type(thistuple))
```

```
#NOT a tuple  
thistuple = ("apple")  
print(type(thistuple))
```

[Try it Yourself »](#)

```
thistuple = ("apple",)  
print(type(thistuple))  
  
#NOT a tuple  
thistuple = ("apple")  
print(type(thistuple))
```

The output shows the results of running each code snippet. The first snippet runs successfully, returning <class 'tuple'>. The second snippet is labeled '#NOT a tuple' and returns <class 'str'>, indicating it was not recognized as a tuple.



/PYTHON LIST



Tuple Items - Data Types

Tuple items can be of any data type:

Example

String, int and boolean data types:

```
tuple1 = ("apple", "banana", "cherry")
tuple2 = (1, 5, 7, 9, 3)
tuple3 = (True, False, False)
```

Try it Yourself »



The screenshot shows a Python code editor interface with the following code:

```
tuple1 = ("apple", "banana", "cherry")
tuple2 = (1, 5, 7, 9, 3)
tuple3 = (True, False, False)

print(tuple1)
print(tuple2)
print(tuple3)
```

The output window displays the results of the print statements:

```
('apple', 'banana', 'cherry')
(1, 5, 7, 9, 3)
(True, False, False)
```

/PYTHON TUPLE - type()



The tuple() Constructor

From Python's perspective, tuples are defined as objects with the data type 'tuple':

Example

What is the data type of a tuple?

```
mytuple = ("apple", "banana", "cherry")
print(type(mytuple))
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for home, file, edit, and run, followed by a green 'Run' button. Below the code input area, the output window displays the results of the execution.

```
mytuple = ("apple", "banana", "cherry")
print(type(mytuple))
```

<class 'tuple'>

<Access Tuple Items>



/PYTHON TUPLE - Access Tuple Items



You can access tuple items by referring to the index number, inside square brackets:

Example

Print the second item in the tuple:

```
thistuple = ("apple", "banana", "cherry")
print(thistuple[1])
```

[Try it Yourself »](#)

```
Run >
thistuple = ("apple", "banana", "cherry")
print(thistuple[1])
banana
```



Note: The first item has index 0.

/PYTHON TUPLE - Negative Indexing



Negative Indexing

Negative indexing means start from the end.

-1 refers to the last item, -2 refers to the second last item etc.

Example

Print the last item of the tuple:

```
thistuple = ("apple", "banana", "cherry")
print(thistuple[-1])
```

Try it Yourself »



```
thistuple = ("apple", "banana", "cherry")
print(thistuple[-1])
```

cherry

/PYTHON TUPLE – Range of Indexes



Range of Indexes

You can specify a range of indexes by specifying where to start and where to end the range.

When specifying a range, the return value will be a new tuple with the specified items.

Example

Return the third, fourth, and fifth item:

```
thistuple = ("apple", "banana", "cherry", "orange", "kiwi", "melon",
             "mango")
print(thistuple[2:5])
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings, followed by a green 'Run' button and a status bar indicating 'Result Size: 497 x'. Below the toolbar, the code is displayed in a white box:

```
thistuple = ("apple", "banana", "cherry", "orange",
             "kiwi", "melon", "mango")
print(thistuple[2:5])
```

Below the code, a note in green text explains the range:

#This will return the items from position 2 to 5.
#Remember that the first item is position 0,
#and note that the item in position 5 is NOT included

To the right of the code box, the result is shown in a black box:

```
('cherry', 'orange', 'kiwi')
```



Note: The search will start at index 2 (included) and end at index 5 (not included).

/PYTHON TUPLE – Range of Indexes



Remember that the first item has index 0.

By leaving out the start value, the range will start at the first item:

Example

This example returns the items from the beginning to, but NOT included, "kiwi":

```
thistuple = ("apple", "banana", "cherry", "orange", "kiwi", "melon",
            "mango")
print(thistuple[:4])
```



```
('apple', 'banana', 'cherry', 'orange')
```



[Try it Yourself »](#)





<Update Tuples>



/PYTHON TUPLE – Update Tuples



- Tuples are unchangeable, meaning that you cannot change, add, or remove items once the tuple is created.
- But there are some workarounds.

Change Tuple Values

Once a tuple is created, you cannot change its values. Tuples are **unchangeable**, or **immutable** as it also is called.



But there is a workaround. You can convert the tuple into a list, change the list, and convert the list back into a tuple.



/PYTHON TUPLE – Update Tuples



Example

Convert the tuple into a list to be able to change it:

```
x = ("apple", "banana", "cherry")
y = list(x)
y[1] = "kiwi"
x = tuple(y)

print(x)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green 'Run' button is visible. The code area contains the following Python code:

```
x = ("apple", "banana", "cherry")
y = list(x)
y[1] = "kiwi"
x = tuple(y)

print(x)
```

To the right of the code area, the output window displays the result of running the code:

```
("apple", "kiwi", "cherry")
```



/PYTHON TUPLE – Update Tuples



Add Items

Since tuples are immutable, they do not have a build-in `append()` method, but there are other ways to add items to a tuple.

- 1. Convert into a list:** Just like the workaround for changing a tuple, you can convert it into a list, add your item(s), and convert it back into a tuple.

Example

Convert the tuple into a list, add "orange", and convert it back into a tuple:

```
thistuple = ("apple", "banana", "cherry")
y = list(thistuple)
y.append("orange")
thistuple = tuple(y)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, file, settings, and run, followed by a green "Run >" button and a "Result Size" dropdown set to "Large". Below the editor area, the code is displayed:

```
thistuple = ("apple", "banana", "cherry")
y = list(thistuple)
y.append("orange")
thistuple = tuple(y)

print(thistuple)
```

To the right of the code, the output is shown in a black box:

```
('apple', 'banana', 'cherry', 'orange')
```



/PYTHON TUPLE – Update Tuples



2. Add tuple to a tuple. You are allowed to add tuples to tuples, so if you want to add one item, (or many), create a new tuple with the item(s), and add it to the existing tuple:

Example

Create a new tuple with the value "orange", and add that tuple:

```
thistuple = ("apple", "banana", "cherry")
y = ("orange",)
thistuple += y

print(thistuple)
```

[Try it Yourself »](#)



```
thistuple = ("apple", "banana", "cherry")
y = ("orange",)
thistuple += y

print(thistuple)
```

Result Size: 6

('apple', 'banana', 'cherry', 'orange')

Note: When creating a tuple with only one item, remember to include a comma after the item, otherwise it will not be identified as a tuple.

/PYTHON TUPLE – Remove Items



Note: You cannot remove items in a tuple.

Tuples are **unchangeable**, so you cannot remove items from it, but you can use the same workaround as we used for changing and adding tuple items:

Example

Convert the tuple into a list, remove "apple", and convert it back into a tuple:

```
thistuple = ("apple", "banana", "cherry")
y = list(thistuple)
y.remove("apple")
thistuple = tuple(y)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, file, settings, and run. A green 'Run' button is visible. The code area contains the following Python code:

```
thistuple = ("apple", "banana", "cherry")
y = list(thistuple)
y.remove("apple")
thistuple = tuple(y)

print(thistuple)
```

To the right of the code, the output window displays the result of running the code:

```
('banana', 'cherry')
```



/PYTHON TUPLE – Remove Items



Or you can delete the tuple completely

Example

The `del` keyword can delete the tuple completely:

```
thistuple = ("apple", "banana", "cherry")
del thistuple
print(thistuple) #this will raise an error because the tuple no
longer exists
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file operations (Home, New, Open, Save, Run, etc.) and a 'Run' button. To the right, it says 'Result Size: 567 x 399' and 'Get your own website'. The code area contains the following Python code:

```
thistuple = ("apple", "banana", "cherry")
del thistuple
print(thistuple) #this will raise an error because the tuple no
longer exists
```

Below the code, the output window displays a traceback:

```
Traceback (most recent call last):
File "demo_tuple_del.py", line 3, in <module>
    print(thistuple) #this will raise an error because the tuple no
NameError: name 'thistuple' is not defined
```



<Unpacking Tuples>



/PYTHON TUPLE – Unpacking a Tuple



When we create a tuple, we normally assign values to it. This is called "packing" a tuple:

Example

Packing a tuple:

```
fruits = ("apple", "banana", "cherry")
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green 'Run' button is visible. Below the editor area, the code is displayed in a white box:

```
fruits = ("apple", "banana", "cherry")
print(fruits)
```

To the right of the code, the output is shown in a black box:

```
('apple', 'banana', 'cherry')
```

/PYTHON TUPLE – Unpacking a Tuple



But, in Python, we are also allowed to extract the values back into variables. This is called "unpacking":

Example

Unpacking a tuple:

```
fruits = ("apple", "banana", "cherry")  
  
(green, yellow, red) = fruits  
  
print(green)  
print(yellow)  
print(red)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings, followed by a green 'Run >' button. Below the toolbar, the code is displayed:

```
fruits = ("apple", "banana", "cherry")  
  
(green, yellow, red) = fruits  
  
print(green)  
print(yellow)  
print(red)
```

To the right of the code, the output window displays the results of the print statements:

```
apple  
banana  
cherry
```

Note: The number of variables must match the number of values in the tuple, if not, you must use an asterisk to collect the remaining values as a list.

/PYTHON TUPLE – Using Asterisk*



If the number of variables is less than the number of values, you can add an * to the variable name and the values will be assigned to the variable as a list:

Example

Assign the rest of the values as a list called "red":

```
fruits = ("apple", "banana", "cherry", "strawberry", "raspberry")
(green, yellow, *red) = fruits
print(green)
print(yellow)
print(red)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. The code is as follows:

```
fruits = ("apple", "banana", "cherry", "strawberry", "raspberry")
(green, yellow, *red) = fruits
print(green)
print(yellow)
print(red)
```

The output window displays the results of the print statements:

```
apple
banana
['cherry', 'strawberry', 'raspberry']
```

Result Size: 567 x 35

/PYTHON TUPLE – Using Asterisk*



If the asterisk is added to another variable name than the last, Python will assign values to the variable until the number of values left matches the number of variables left.

Example

Add a list of values the "tropic" variable:

```
fruits = ("apple", "mango", "papaya", "pineapple", "cherry")

(green, *tropic, red) = fruits

print(green)
print(tropic)
print(red)
```

[Try it Yourself »](#)



```
Run >
```

Result Size:

```
fruits = ("apple", "mango", "papaya", "pineapple", "cherry")
(green, *tropic, red) = fruits
print(green)
print(tropic)
print(red)
```

```
apple
['mango', 'papaya', 'pineapple']
cherry
```



<Loop Tuples>



/PYTHON TUPLE – Loop Through a Tuple



You can loop through the tuple items by using a for loop.

Example

Iterate through the items and print the values:

```
thistuple = ("apple", "banana", "cherry")
for x in thistuple:
    print(x)
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for home, menu, file, and run, followed by a green 'Run' button. Below the buttons is a code block containing the following Python code:

```
thistuple = ("apple", "banana", "cherry")
for x in thistuple:
    print(x)
```

To the right of the code block is a black rectangular area displaying the output of the code: "apple", "banana", and "cherry" on separate lines.



Learn more about for loops in our [Python For Loops Chapter](#).

INDEX.HTML

/PYTHON TUPLE – Loop Through the Index Numbers

You can also loop through the tuple items by referring to their index number.

Use the `range()` and `len()` functions to create a suitable iterable.

Example

Print all items by referring to their index number:

```
thistuple = ("apple", "banana", "cherry")
for i in range(len(thistuple)):
    print(thistuple[i])
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings, followed by a green 'Run >' button. Below the toolbar, the code is displayed in a white text area:

```
thistuple = ("apple", "banana", "cherry")
for i in range(len(thistuple)):
    print(thistuple[i])
```

To the right of the code area is a black sidebar containing the output of the program:

apple
banana
cherry

/PYTHON TUPLE – Using a While Loop



You can loop through the list items by using a **while** loop.

Use the **len()** function to determine the length of the tuple, then start at 0 and loop your way through the tuple items by referring to their indexes.

Remember to increase the index by 1 after each iteration.

Example

Print all items, using a **while** loop to go through all the index numbers:

```
thistuple = ("apple", "banana", "cherry")
i = 0
while i < len(thistuple):
    print(thistuple[i])
    i = i + 1
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and settings. A green 'Run' button is visible. The code area contains the following Python script:

```
thistuple = ("apple", "banana", "cherry")
i = 0
while i < len(thistuple):
    print(thistuple[i])
    i = i + 1
```

To the right of the code, the output is displayed in a black box:

```
apple
banana
cherry
```

Learn more about while loops in our [Python While Loops Chapter](#).





<Join Tuples>



/PYTHON TUPLE – JOIN TWO TUPLES



To join two or more tuples you can use the + operator:

Example

Join two tuples:

```
tuple1 = ("a", "b" , "c")
tuple2 = (1, 2, 3)

tuple3 = tuple1 + tuple2
print(tuple3)
```

[Try it Yourself »](#)

The screenshot shows a code editor interface with a toolbar at the top featuring icons for home, file, edit, and run, followed by a green 'Run' button. Below the toolbar, there are two code snippets. The left snippet contains the following Python code:tuple1 = ("a", "b" , "c")
tuple2 = (1, 2, 3)

```
tuple3 = tuple1 + tuple2
print(tuple3)
```

The right snippet shows the output of running this code, which is a single tuple containing all elements from both tuple1 and tuple2: ('a', 'b', 'c', 1, 2, 3).

/PYTHON TUPLE – MULTIPLY TUPLES



If you want to multiply the content of a tuple a given number of times, you can use the * operator:

Example

Multiply the fruits tuple by 2:

```
fruits = ("apple", "banana", "cherry")
mytuple = fruits * 2

print(mytuple)
```

```
fruits = ("apple", "banana", "cherry")
mytuple = fruits * 2

print(mytuple)
```

Result Size

('apple', 'banana', 'cherry', 'apple', 'banana', 'cherry')



<Tuple Methods>



/PYTHON TUPLES – TUPLE METHODS



Python has two built-in methods that you can use on tuples.

Method	Description
<code>count()</code>	Returns the number of times a specified value occurs in a tuple
<code>index()</code>	Searches the tuple for a specified value and returns the position of where it was found



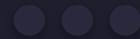


<PYTHON SETS>



/PYTHON SETS –

```
myset = {"apple", "banana", "cherry"}
```



Set

- Sets are used to store multiple items in a single variable.
- Set is one of 4 built-in data types in Python used to store collections of data, the other 3 are List, Tuple, and Dictionary, all with different qualities and usage.
- A set is a collection which is unordered, unchangeable*, and unindexed.

*** Note:** Set items are unchangeable, but you can remove items and add new items.



/PYTHON SETS



Sets are written with curly brackets.

Example

Create a Set:

```
thisset = {"apple", "banana", "cherry"}  
print(thisset)
```

[Try it Yourself »](#)



The screenshot shows a browser window with a code editor. The code is as follows:

```
thisset = {"apple", "banana", "cherry"}  
print(thisset)  
  
# Note: the set list is unordered, meaning: the items will  
# appear in a random order.  
  
# Refresh this page to see the change in the result.
```

The output on the right side of the editor shows the result: `{'banana', 'cherry', 'apple'}`. Above the editor, there are standard browser navigation icons (Home, Back, Forward, Stop) and a green "Run" button. To the right of the output, it says "Result Size: 497 x".

Note: Sets are unordered, so you cannot be sure in which order the items will appear.

/PYTHON SETS



Set Items

Set items are unordered, unchangeable, and do not allow duplicate values.

Unordered

Unordered means that the items in a set do not have a defined order.

Set items can appear in a different order every time you use them, and cannot be referred to by index or key.



Unchangeable

Set items are unchangeable, meaning that we cannot change the items after the set has been created.

* Once a set is created, you cannot change its items, but you can remove items and add new items.

/PYTHON SETS



Duplicates Not Allowed

Sets cannot have two items with the same value.

Example

Duplicate values will be ignored:

```
thisset = {"apple", "banana", "cherry", "apple"}  
  
print(thisset)
```

[Try it Yourself »](#)



A screenshot of a Python code editor interface. At the top, there are icons for file, edit, and run, followed by a green 'Run >' button and a 'Result Size:' dropdown set to '1'. Below the toolbar, the code is written in a syntax-highlighted editor. The code defines a set named 'thisset' containing four elements: 'apple', 'banana', 'cherry', and 'apple'. A call to 'print(thisset)' is shown below. To the right of the editor, the output window displays the result: a set containing three unique elements: 'banana', 'cherry', and 'apple'.

```
thisset = {"apple", "banana", "cherry", "apple"}  
  
print(thisset)
```

{'banana', 'cherry', 'apple'}

/PYTHON SETS - Set Items - Data Types



Set items can be of any data type:

Example

String, int and boolean data types:

```
set1 = {"apple", "banana", "cherry"}  
set2 = {1, 5, 7, 9, 3}  
set3 = {True, False, False}
```

[Try it Yourself »](#)

The screenshot shows a Python code editor interface with a toolbar at the top featuring icons for home, file, edit, run, and settings. A green 'Run' button is highlighted. Below the toolbar, the code is displayed in a white text area:

```
set1 = {"apple", "banana", "cherry"}  
set2 = {1, 5, 7, 9, 3}  
set3 = {True, False, False}  
  
print(set1)  
print(set2)  
print(set3)
```

To the right of the code, the output is shown in a black text area:

```
{'cherry', 'apple', 'banana'}  
{1, 3, 5, 7, 9}  
{False, True}
```

/PYTHON SETS - Set Items - Data Types



A set can contain different data types:

Example

A set with strings, integers and boolean values:

```
set1 = {"abc", 34, True, 40, "male"}
```

[Try it Yourself »](#)

```
set1 = {"abc", 34, True, 40, "male"}  
print(set1)
```

```
{True, 34, 40, 'male', 'abc'}
```



/PYTHON SETS – type()



From Python's perspective, sets are defined as objects with the data type 'set':

```
<class 'set'>
```

Example

What is the data type of a set?

```
myset = {"apple", "banana", "cherry"}  
print(type(myset))
```

The screenshot shows a Python code editor interface. On the left, there is a code editor window containing the following Python code:

```
myset = {"apple", "banana", "cherry"}  
print(type(myset))
```

To the right of the code editor is a terminal window showing the output of the code execution:

```
<class 'set'>
```



[Try it Yourself »](#)



/PYTHON SETS – The `set()` Constructor



It is also possible to use the `set()` constructor to make a set.

Example

Using the `set()` constructor to make a set:

```
thisset = set(("apple", "banana", "cherry")) # note the double  
round-brackets  
print(thisset)
```

[Try it Yourself »](#)

```
thisset = set(("apple", "banana", "cherry"))  
print(thisset)  
# Note: the set list is unordered, so the result will  
display the items in a random order.
```

Result Size: 497 x

{'apple', 'cherry', 'banana'}





<Access Set Items>



/PYTHON SETS – Access Items



You cannot access items in a set by referring to an index or a key.

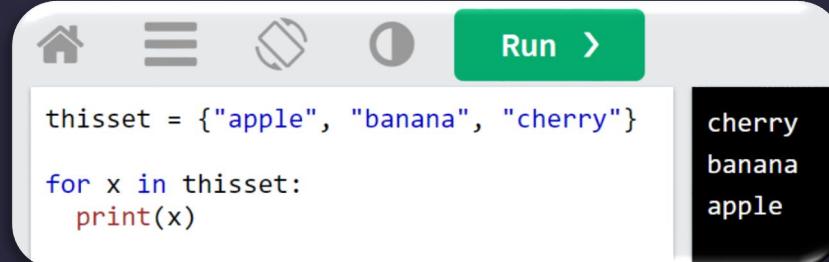
But you can loop through the set items using a for loop, or ask if a specified value is present in a set, by using the in keyword.

Example

Loop through the set, and print the values:

```
thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
    print(x)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for home, file, edit, and run, followed by a green 'Run >' button. Below the icons, the code is displayed in a white text area:

```
thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
    print(x)
```

To the right of the code area, the output is shown in a black box:

```
cherry  
banana  
apple
```

/PYTHON SETS – Access Items



You cannot access items in a set by referring to an index or a key.

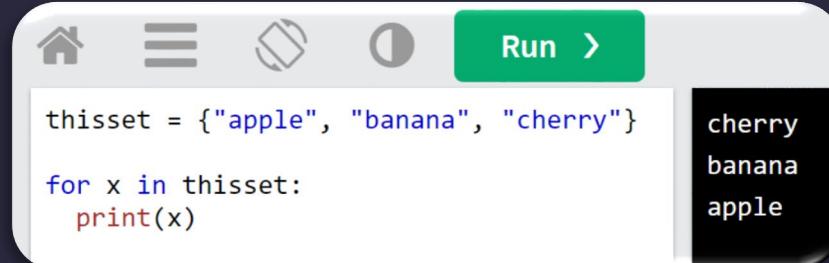
But you can loop through the set items using a for loop, or ask if a specified value is present in a set, by using the in keyword.

Example

Loop through the set, and print the values:

```
thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
    print(x)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for home, file, edit, and run, followed by a green 'Run >' button. Below the icons, the code is displayed in a white text area:

```
thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
    print(x)
```

To the right of the code area, the output is shown in a black box:

```
cherry  
banana  
apple
```

/PYTHON SETS – Access Items



Example

Check if "banana" is present in the set:

```
thisset = {"apple", "banana", "cherry"}  
  
print("banana" in thisset)
```

[Try it Yourself »](#)



Run >

```
thisset = {"apple", "banana", "cherry"}  
  
print("banana" in thisset)
```

True





<Add Set Items>



/PYTHON SETS – Add Items



Once a set is created, you cannot change its items, but you can add new items.

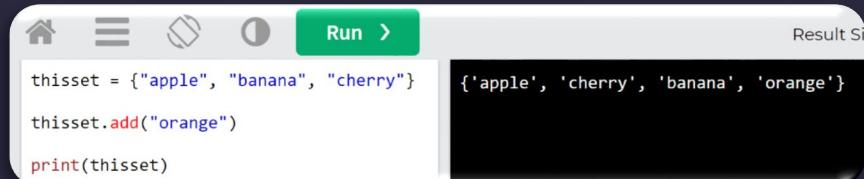
To add one item to a set use the `add()` method.

Example

Add an item to a set, using the `add()` method:

```
thisset = {"apple", "banana", "cherry"}  
  
thisset.add("orange")  
  
print(thisset)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. At the top, there are icons for file, edit, run, and result. A green 'Run >' button is visible. Below the editor area, the code is displayed:

```
thisset = {"apple", "banana", "cherry"}  
thisset.add("orange")  
print(thisset)
```

The result pane to the right shows the output of the code:

```
{'apple', 'cherry', 'banana', 'orange'}
```

/PYTHON SETS – Add Sets



To add items from another set into the current set, use the update() method.

Example

Add elements from `tropical` into `thisset`:

```
thisset = {"apple", "banana", "cherry"}  
tropical = {"pineapple", "mango", "papaya"}  
  
thisset.update(tropical)  
  
print(thisset)
```



[Try it Yourself »](#)



The screenshot shows a code editor interface with a toolbar at the top. The code in the editor is:

```
thisset = {"apple", "banana", "cherry"}  
tropical = {"pineapple", "mango", "papaya"}  
  
thisset.update(tropical)  
  
print(thisset)
```

The output window to the right displays the result of running the code:

```
Result Size: 756 x 3  
{'apple', 'mango', 'cherry', 'pineapple', 'banana', 'papaya'}
```

/PYTHON SETS – Add Any Iterable



The object in the **update()** method does not have to be a set, it can be any iterable object (tuples, lists, dictionaries etc.).

Example

Add elements of a list to at set:

```
thisset = {"apple", "banana", "cherry"}  
mylist = ["kiwi", "orange"]  
  
thisset.update(mylist)  
  
print(thisset)
```

[Try it Yourself »](#)



```
Run >  
thisset = {"apple", "banana", "cherry"}  
mylist = ["kiwi", "orange"]  
  
thisset.update(mylist)  
  
print(thisset)
```

{'banana', 'cherry', 'apple', 'orange', 'kiwi'}

<Remove Set Items>



/PYTHON SETS – Remove Set Items



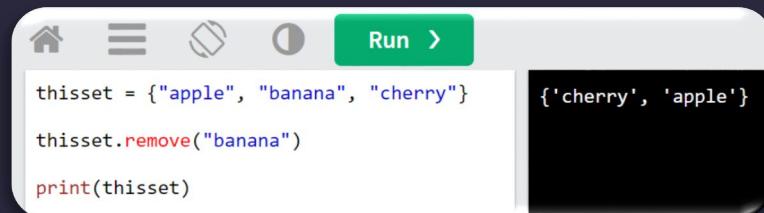
To remove an item in a set, use the `remove()`, or the `discard()` method.

Example

Remove "banana" by using the `remove()` method:

```
thisset = {"apple", "banana", "cherry"}  
  
thisset.remove("banana")  
  
print(thisset)
```

[Try it Yourself »](#)



```
Run >  
  
thisset = {"apple", "banana", "cherry"}  
  
thisset.remove("banana")  
  
print(thisset)
```

{'cherry', 'apple'}

/PYTHON SETS – Remove Set Items



Note: If the item to remove does not exist, `remove()` will raise an error.

Example

Remove "banana" by using the `discard()` method:

```
thisset = {"apple", "banana", "cherry"}  
  
thisset.discard("banana")  
  
print(thisset)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface. The code in the editor is:

```
thisset = {"apple", "banana", "cherry"}  
thisset.discard("banana")  
print(thisset)
```

The output window to the right displays the result of running the code:

```
{'apple', 'cherry'}
```

/PYTHON SETS – Remove Set Items



Note: If the item to remove does not exist, **discard()** will NOT raise an error.

You can also use the **pop()** method to remove an item, but this method will remove the last item. Remember that sets are unordered, so you will not know what item that gets removed.

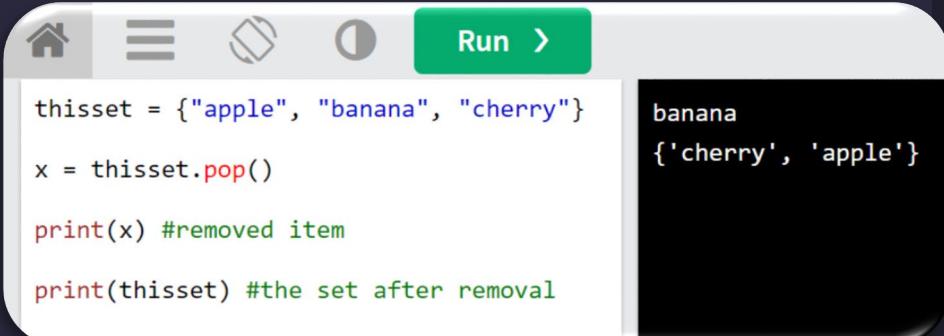
The return value of the **pop()** method is the removed item.

Example

Remove the last item by using the **pop()** method:

```
thisset = {"apple", "banana", "cherry"}  
  
x = thisset.pop()  
  
print(x)  
  
print(thisset)
```

[Try it Yourself »](#)



```
thisset = {"apple", "banana", "cherry"}  
  
x = thisset.pop()  
  
print(x) #removed item  
  
print(thisset) #the set after removal
```

banana
{'cherry', 'apple'}



/PYTHON SETS – Remove Set Items



Note: Sets are *unordered*, so when using the **pop()** method, you do not know which item that gets removed.

Example

The **clear()** method empties the set:

```
thisset = {"apple", "banana", "cherry"}  
  
thisset.clear()  
  
print(thisset)
```

[Try it Yourself »](#)

A screenshot of a code editor window. The code in the editor is:

```
thisset = {"apple", "banana", "cherry"}  
  
thisset.discard("banana")  
  
print(thisset)
```

To the right of the editor is a black sidebar containing the output of the code:

```
{'apple', 'cherry'}
```



/PYTHON SETS – Remove Set Items



Example

The `del` keyword will delete the set completely:

```
thisset = {"apple", "banana", "cherry"}  
  
del thisset  
  
print(thisset)
```

[Try it Yourself »](#)

A screenshot of a Python code editor interface. At the top, there are navigation icons: a house, three horizontal lines, a gear, and a circular arrow. To the right of these is a green 'Run' button with a play icon. On the far right, it says 'Result Size: 696 x 522' and 'Get your own website'. The main area shows a code snippet:

```
thisset = {"apple", "banana", "cherry"}  
del thisset  
  
print(thisset) #this will raise an error because the set no longer exists
```

To the right of the code, a black box displays the output of the run:

```
Traceback (most recent call last):  
  File "demo_set_del.py", line 5, in <module>  
    print(thisset) #this will raise an error because the set no longer exists  
NameError: name 'thisset' is not defined
```





<Loop Sets>



/PYTHON SETS – Loop Items



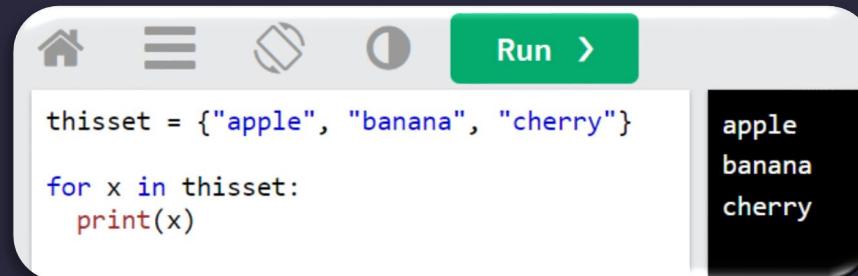
You can loop through the set items by using a **for** loop:

Example

Loop through the set, and print the values:

```
thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
    print(x)
```

[Try it Yourself »](#)



The image shows a screenshot of a Python code editor. At the top, there are icons for home, menu, file, and run. A green 'Run' button is visible. The code area contains the following Python code:

```
thisset = {"apple", "banana", "cherry"}  
  
for x in thisset:  
    print(x)
```

To the right of the code, the output window displays the results of the execution:

```
apple  
banana  
cherry
```



<Join Sets>



/PYTHON SETS – Join Two Sets



There are several ways to join two or more sets in Python.

You can use the **union()** method that returns a new set containing all items from both sets, or the **update()** method that inserts all the items from one set into another:

Example

The **union()** method returns a new set with all items from both sets:

```
set1 = {"a", "b", "c"}  
set2 = {1, 2, 3}  
  
set3 = set1.union(set2)  
print(set3)
```

[Try it Yourself »](#)

```
set1 = {"a", "b", "c"}  
set2 = {1, 2, 3}  
  
set3 = set1.union(set2)  
print(set3)
```

{'a', 1, 2, 'b', 'c', 3}



/PYTHON SETS – Join Two Sets



Example

The `update()` method inserts the items in `set2` into `set1`:

```
set1 = {"a", "b", "c"}  
set2 = {1, 2, 3}  
  
set1.update(set2)  
print(set1)
```

[Try it Yourself »](#)

```
set1 = {"a", "b", "c"}  
set2 = {1, 2, 3}  
  
set1.update(set2)  
print(set1)
```

{3, 2, 'c', 'b', 1, 'a'}



Note: Both `union()` and `update()` will exclude any duplicate items.



/PYTHON SETS – Keep ONLY the Duplicates



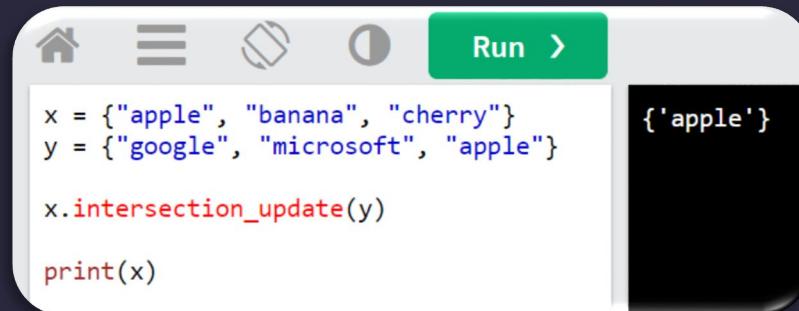
The **intersection_update()** method will keep only the items that are present in both sets.

Example

Keep the items that exist in both set `x`, and set `y`:

```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
x.intersection_update(y)  
  
print(x)
```

[Try it Yourself »](#)



```
Run >  
  
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
x.intersection_update(y)  
  
print(x)
```

{'apple'}

/PYTHON SETS – Keep ONLY the Duplicates



The **intersection()** method will return a new set, that only contains the items that are present in both sets.

Example

Return a set that contains the items that exist in both set `x`, and set `y`:

```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
z = x.intersection(y)  
  
print(z)
```

[Try it Yourself »](#)



The screenshot shows a Python code editor interface with the following code:

```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
z = x.intersection(y)  
  
print(z)
```

The code is run, and the output window displays the result: `'apple'`.

/PYTHON SETS – Keep All, But NOT the Duplicates

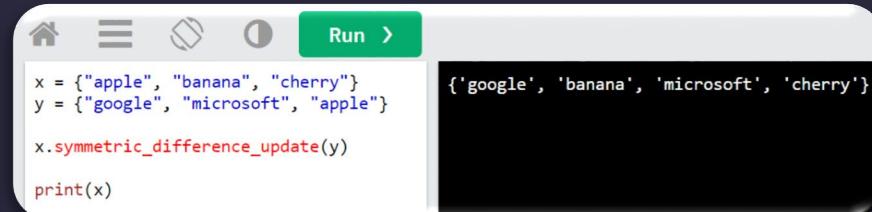
The **`symmetric_difference_update()`** method will keep only the elements that are NOT present in both sets.

Example

Keep the items that are not present in both sets:

```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
x.symmetric_difference_update(y)  
  
print(x)
```

[Try it Yourself »](#)



```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
x.symmetric_difference_update(y)  
  
print(x)
```

{'google', 'banana', 'microsoft', 'cherry'}

/PYTHON SETS – Keep All, But NOT the Duplicates

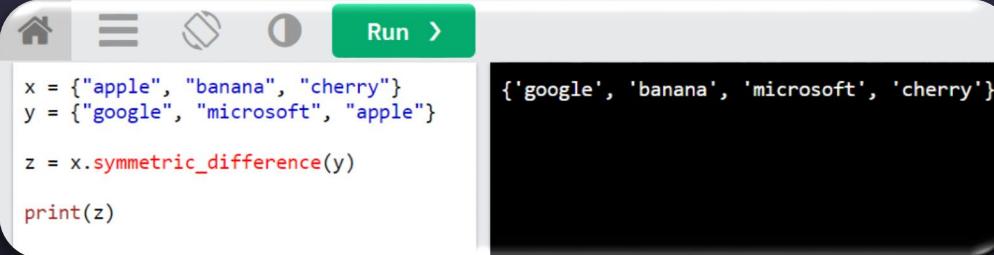
The **symmetric_difference()** method will return a new set, that contains only the elements that are NOT present in both sets.

Example

Return a set that contains all items from both sets, except items that are present in both:

```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
z = x.symmetric_difference(y)  
  
print(z)
```

Try it Yourself »



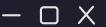
The screenshot shows a Python code editor interface. At the top, there are navigation icons: a house (Home), three horizontal lines (File), a gear (Settings), and a circular arrow (Run). To the right of these is a green 'Run' button with a white arrow. Below the icons, the code is displayed in a light gray text area:

```
x = {"apple", "banana", "cherry"}  
y = {"google", "microsoft", "apple"}  
  
z = x.symmetric_difference(y)  
  
print(z)
```

To the right of the code area is a dark gray output window displaying the results of the execution:

```
{'google', 'banana', 'microsoft', 'cherry'}
```





/PYTHON SETS – Set Methods



Python has a set of built-in methods that you can use on sets.

Method	Description
<code>add()</code>	Adds an element to the set
<code>clear()</code>	Removes all the elements from the set
<code>copy()</code>	Returns a copy of the set
<code>difference()</code>	Returns a set containing the difference between two or more sets
<code>difference_update()</code>	Removes the items in this set that are also included in another, specified set
<code>discard()</code>	Remove the specified item
<code>intersection()</code>	Returns a set, that is the intersection of two other sets
<code>intersection_update()</code>	Removes the items in this set that are not present in other, specified set(s)
<code>isdisjoint()</code>	Returns whether two sets have a intersection or not
<code>issubset()</code>	Returns whether another set contains this set or not
<code>issuperset()</code>	Returns whether this set contains another set or not



/PYTHON SETS – Set Methods



<u>pop()</u>	Removes an element from the set
<u>remove()</u>	Removes the specified element
<u>symmetric_difference()</u>	Returns a set with the symmetric differences of two sets
<u>symmetric_difference_update()</u>	inserts the symmetric differences from this set and another
<u>union()</u>	Return a set containing the union of sets
<u>update()</u>	Update the set with the union of this set and others



