

# Getting Started with Python Programming (QGIS3)

## QGIS Tutorials and Tips



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# Getting Started With Python Programming (QGIS3)

QGIS has a powerful programming interface that allows you to extend the core functionality of the software as well as write scripts to automate your tasks. QGIS supports the popular Python scripting language. Even if you are a beginner, learning a little bit of Python and QGIS programming interface will allow you to be much more productive in your work. This tutorial assumes no prior programming knowledge and is intended to give an introduction to python scripting in QGIS (PyQGIS).

## Overview of the task

We will load a vector point layer representing all major airports and use python scripting to create a text file with the airport name, airport code, latitude and longitude for each of the airport in the layer.

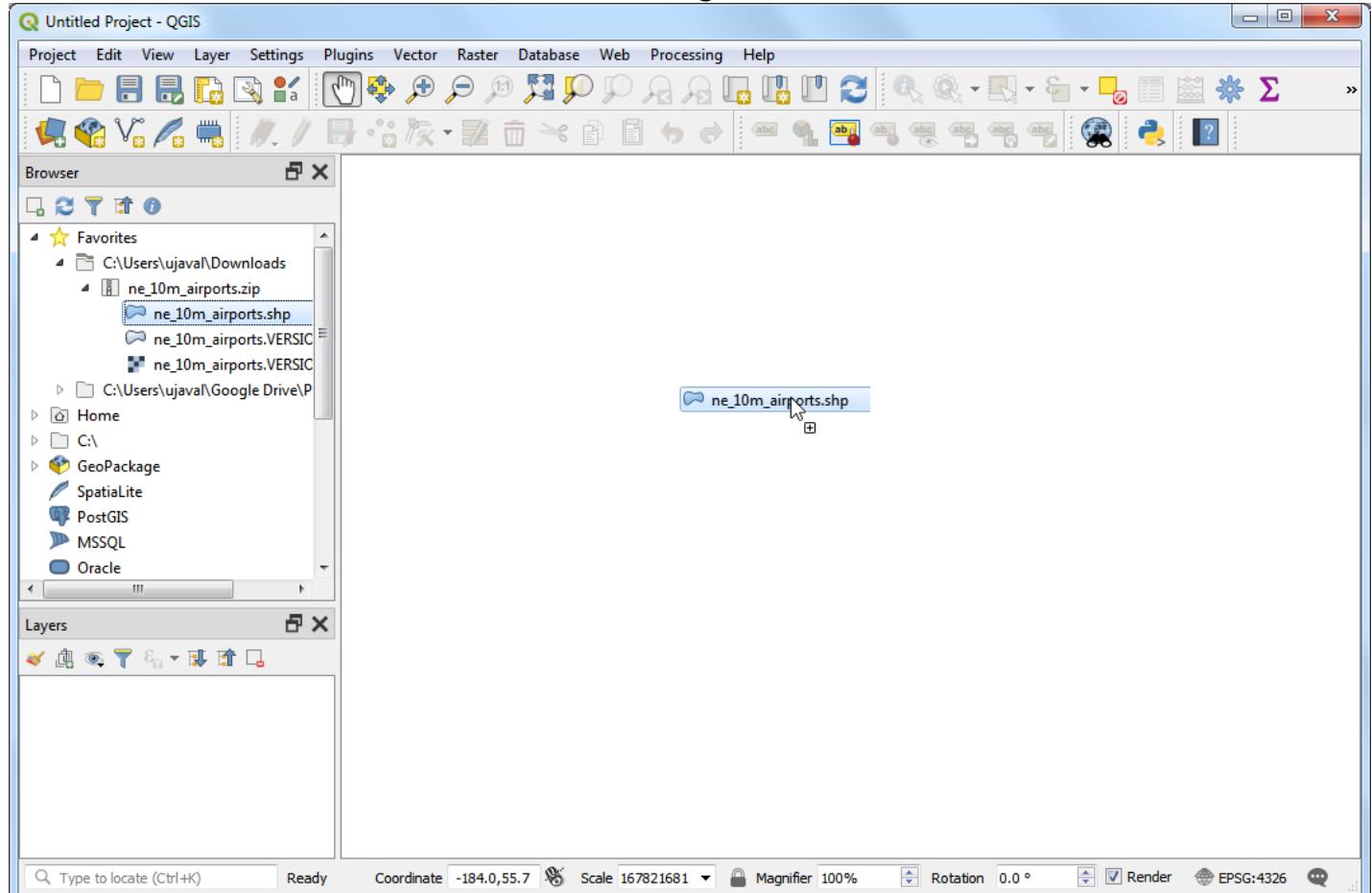
## Get the data

We will use the [Airports](#) dataset from Natural Earth.

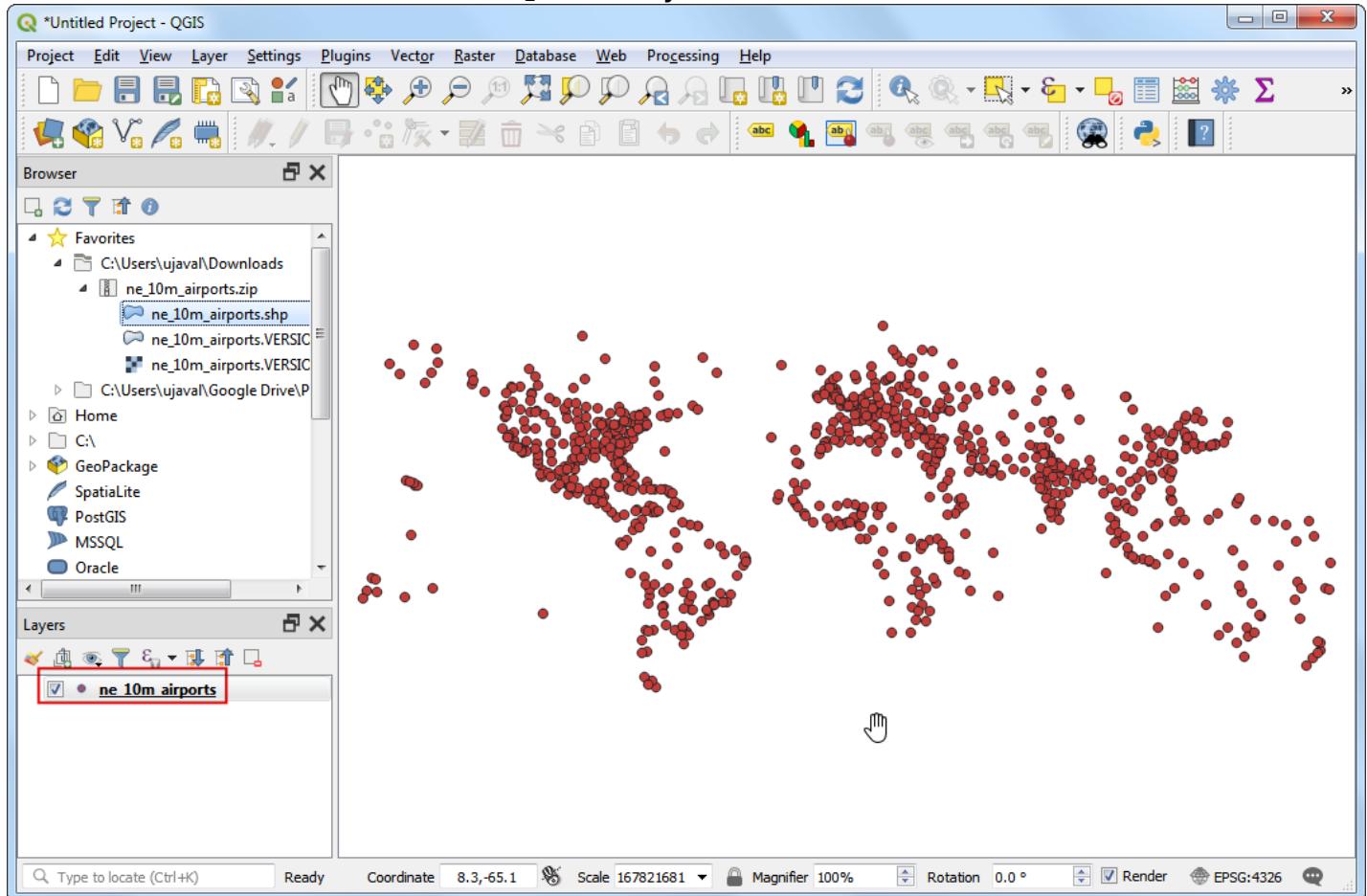
Download the [Airports shapefile](#).

## Procedure

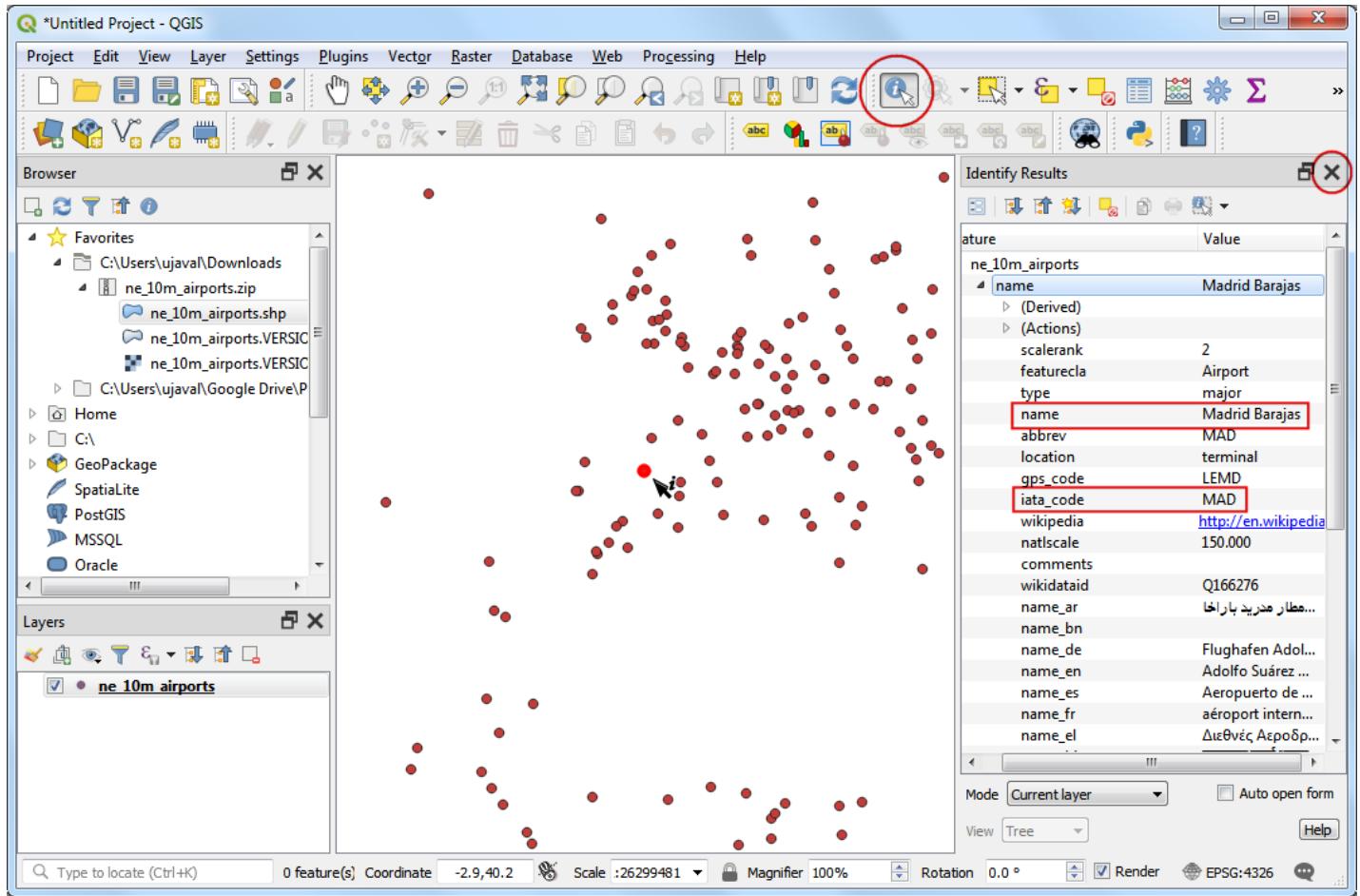
1. Locate the `ne_10m_airports.zip` file in the QGIS Browser and expand it. Select the `ne_10m_airports.shp` file and drag it to the canvas.



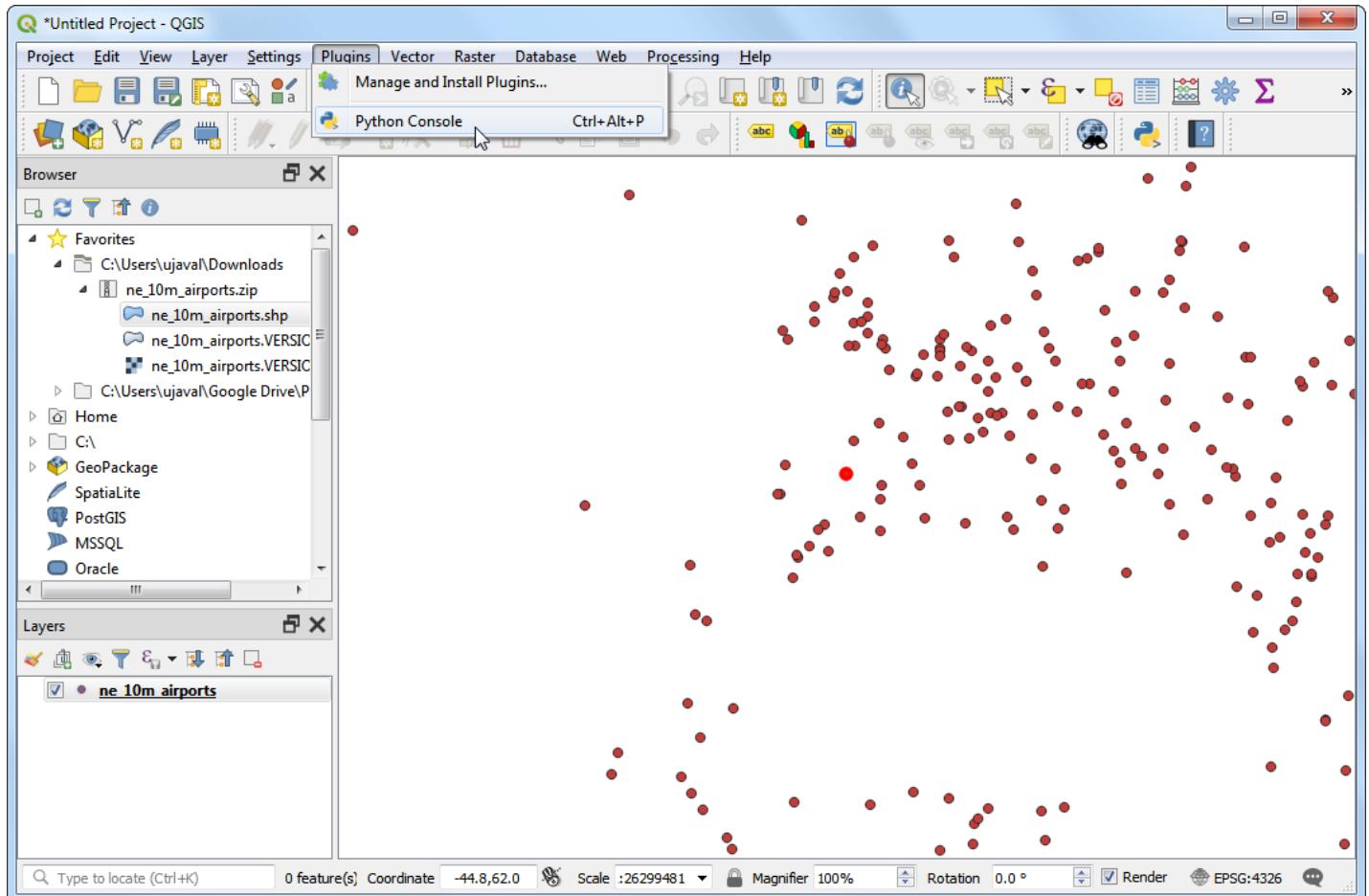
2. You will see the ne\_10m\_airports layer loaded in QGIS.



3. Select the Identify tool and click on any of the points to examine the available attributes. You will see that the name of the airport and its 3 digit code are contained in the attributes `name` and `iata_code` respectively. You can close the Identify window.

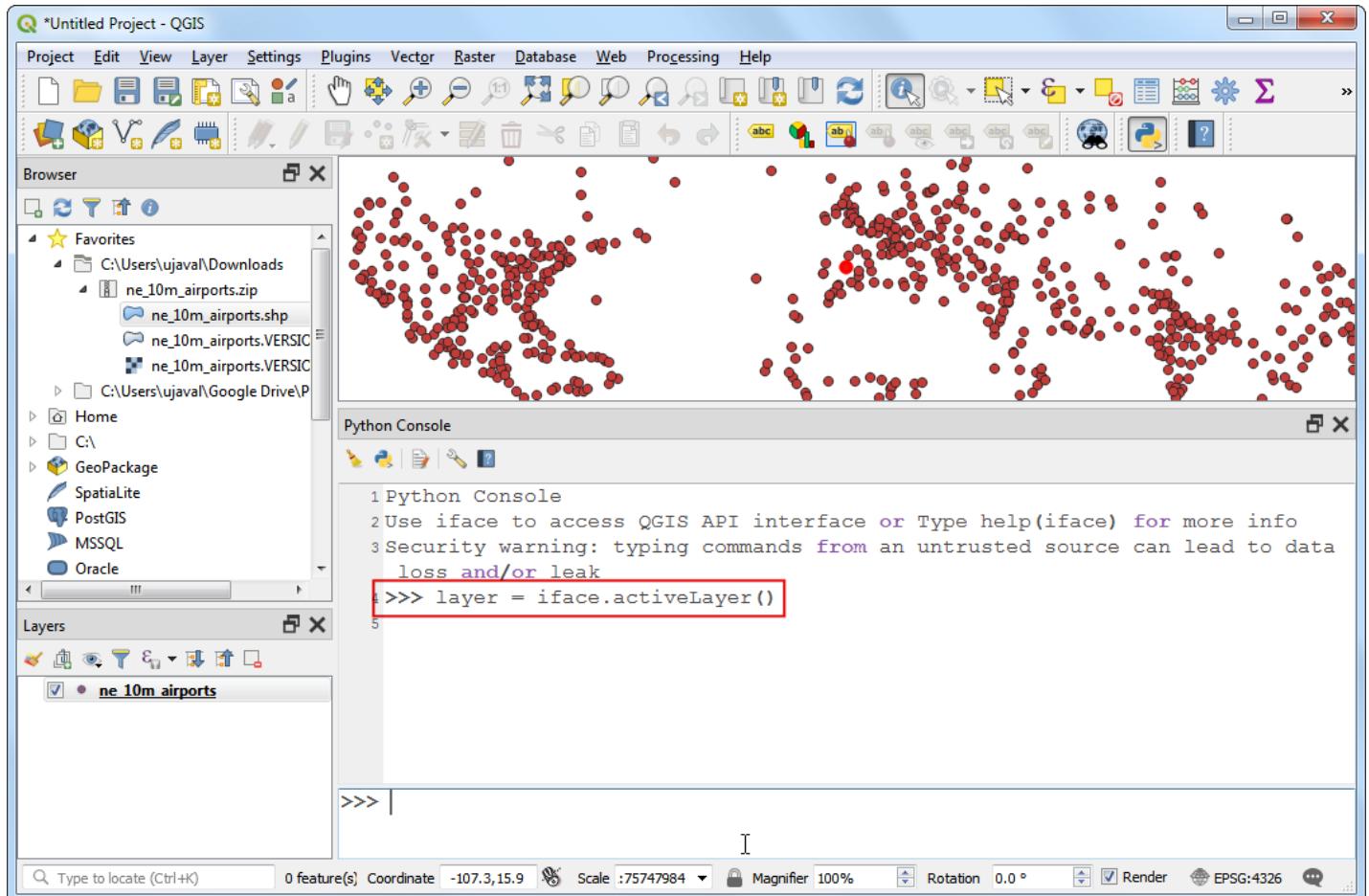


4. QGIS provides a built-in console where you can type python commands and get the result. This console is a great way to learn scripting and also to do quick data processing. Open the Python Console by going to Plugins > Python Console.



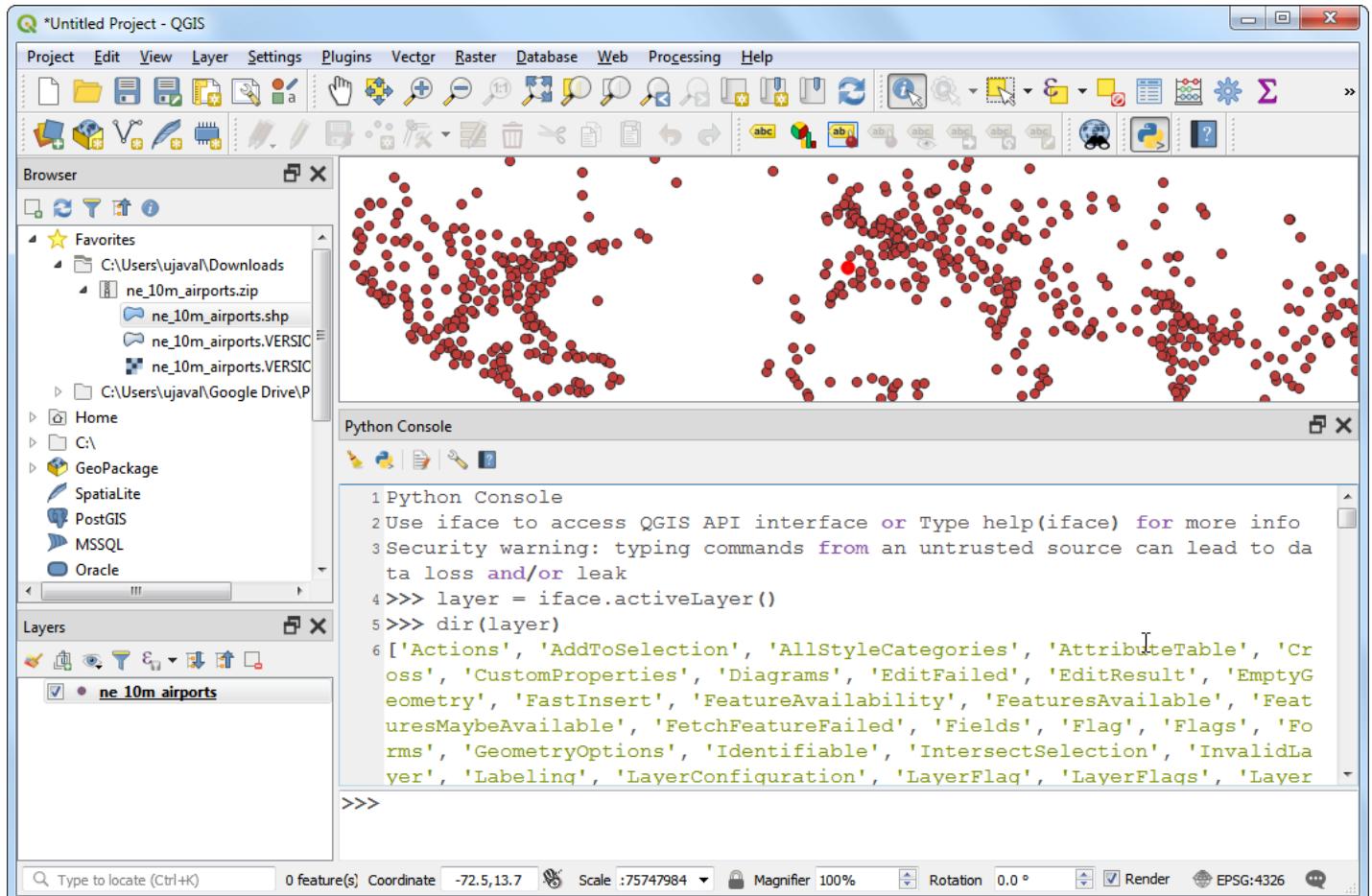
5. You will see a new panel open at the bottom of QGIS canvas. You will see a prompt like `>>>` at the bottom where you can type commands. For interacting with the QGIS environment, we must use the `iface` variable. To access the currently active layer in QGIS, you can type the following and press Enter. This command fetches the reference to the currently loaded layer and stores it in the `layer` variable.

```
layer = iface.activeLayer()
```



6. There is a handy function called `dir()` in python that shows you all available methods for any object. This is useful when you are not sure what functions are available for the object. Run the following command to see what operations we can do on the `layer` variable.

```
dir(layer)
```



7. You will see a long list of available functions. For now, we will use a function called `getFeatures()` which gets you the reference to all features of a layer. In our case, each feature will be a point representing an airport. You can type the following command to iterate through each of the features in the current layer.

### Note

Indentation (or number of spaces before each statement) is very important in Python. If you get error in this step, make sure you have added 2 spaces before typing the second line.

```
for f in layer.getFeatures():
    print f
```

The screenshot shows a Python console window titled "Python Console". The main area contains a scrollable list of method names for the `QgsFeature` class, starting with `tShortName` and ending with `writeStyle`. The list is very long, indicating many methods available for interacting with vector features.

```

tShortName', 'setSimplifyMethod', 'setSubLayerVisibility', 'setSubsetString',
'setTitle', 'setValid', 'shortName', 'signalsBlocked', 'simplifyDrawingCanBeApplied',
'simplifyMethod', 'source', 'sourceCrs', 'sourceExtent',
'sourceName', 'splitFeatures', 'splitParts', 'startEditing', 'startTime',
'staticMetaObject', 'statusChanged', 'storageType', 'styleChanged',
'styleManager', 'styleURI', 'subLayers', 'subsetString',
'subsetStringChanged', 'symbolFeatureCountMapChanged', 'thread',
'timerEvent', 'timestamp', 'title', 'tr', 'translateFeature',
'triggerRepaint', 'type', 'undoStack', 'undoStackStyles',
'uniqueStringsMatching', 'uniqueValues', 'updateExpressionField',
'updateExtents', 'updateFeature', 'updateFields', 'updatedFields',
'vectorJoins', 'willBeDeleted', 'wkbType', 'writeCommonStyle',
'writeCustomProperties', 'writeCustomSymbology', 'writeLayerXml', 'writeSl

```

8. As you will see in the output, each line contains a reference to a feature within the layer. The reference to the feature is stored in the `f` variable. We can use the `f` variable to access the attributes of each feature. Type the following to print the name and `iata_code` for each airport feature.

```

for f in layer.getFeatures():
    print(f['name'], f['iata_code'])

```

The screenshot shows the Python console output. It displays a series of feature references, each preceded by a line number from 2673 to 2682. Each reference is formatted as <qgis.\_core.QgsFeature object at 0x...>. This indicates that the `print` statement is outputting memory addresses rather than the feature's attributes.

```

2673 <qgis._core.QgsFeature object at 0x0000000004DDBDC8>
2674 <qgis._core.QgsFeature object at 0x0000000004DDBEE8>
2675 <qgis._core.QgsFeature object at 0x0000000004DDBDC8>
2676 <qgis._core.QgsFeature object at 0x0000000004DDBEE8>
2677 <qgis._core.QgsFeature object at 0x0000000004DDBDC8>
2678 <qgis._core.QgsFeature object at 0x0000000004DDBEE8>
2679 <qgis._core.QgsFeature object at 0x0000000004DDBDC8>
2680 <qgis._core.QgsFeature object at 0x0000000004DDBEE8>
2681 <qgis._core.QgsFeature object at 0x0000000004DDBDC8>
2682 <qgis._core.QgsFeature object at 0x0000000004DDBEE8>
2683

```

9. So now you know how to programatically access the attribute of each feature in a layer. Let's see how we can access the coordinates of the feature. The coordinates of a vector feature can be accessed by calling the `geometry()` function. This function returns a geometry object that we can store in the variable `geom`. You can run `asPoint()` function on the geometry object to get the x and y coordinates of the point. If your feature is a line or a polygon, you can use `asPolyline()` or `asPolygon()` functions. Type the following code at the prompt and press Enter to see the x and y coordinates of each feature.

```

for f in layer.getFeatures():
    geom = f.geometry()
    print(geom.asPoint())

```

```

Python Console
890 <qgis._core.QgsFeature object at 0x0000000004DDBF78>
891 <qgis._core.QgsFeature object at 0x0000000004DDBE58>
892 <qgis._core.QgsFeature object at 0x0000000004DDBF78>
893 <qgis._core.QgsFeature object at 0x0000000004DDBE58>
894 <qgis._core.QgsFeature object at 0x0000000004DDBF78>
895 <qgis._core.QgsFeature object at 0x0000000004DDBE58>
896 <qgis._core.QgsFeature object at 0x0000000004DDBF78>
897 <qgis._core.QgsFeature object at 0x0000000004DDBE58>
898 <qgis._core.QgsFeature object at 0x0000000004DDBF78>
899 <qgis._core.QgsFeature object at 0x0000000004DDBE58>
900

```

>>>

10. What if we wanted to get only the x coordinate of the feature? You can call the `x()` function on the point object and get its x coordinate.

```

for f in layer.getFeatures():
    geom = f.geometry()
    print(geom.asPoint().x())

```

```

Python Console
3572 <QgsPointXY: POINT(126.80239286027584455 37.55730053995078066)>
3573 <QgsPointXY: POINT(11.0991032762581181 60.19357831713861628)>
3574 <QgsPointXY: POINT(-47.9207885133625382 -15.86999850028242776)>
3575 <QgsPointXY: POINT(-46.65911553021956593 -23.62685882700999684)>
3576 <QgsPointXY: POINT(-43.24838137906830582 -22.81234371250064186)>
3577 <QgsPointXY: POINT(-3.56902665458862778 40.46812827339225294)>
3578 <QgsPointXY: POINT(-66.00422997575475392 18.43807707349493086)>
3579 <QgsPointXY: POINT(17.93072990169158487 59.6511203397372114)>
3580 <QgsPointXY: POINT(106.65429615117163564 -6.12660295597290183)>
3581 <QgsPointXY: POINT(23.94711605540731014 37.93623312992536967)>
3582

```

>>>

11. Now we have all the pieces that we can stitch together to generate our desired output. Type the following code to print the name, iata\_code, latitude and longitude of each of the airport features. Here we are using the `.format()` method which gives more control on printing multiple variables. The `.2f` notation is to limit the coordinates to 2 decimals.

```

for f in layer.getFeatures():
    geom = f.geometry()
    print('{},{}, {:.2f}, {:.2f}'.format(f['name'], f['iata_code'], geom.asPoint().y(), geom.asPoint().x()))

```



A screenshot of a Python console window titled "Python Console". The window has a toolbar with icons for file operations and help. The main area displays a series of numerical values, each preceded by a line number (5462 through 5472) and followed by a red double greater-than symbol (>>>). The values represent coordinates and other data extracted from a shapefile.

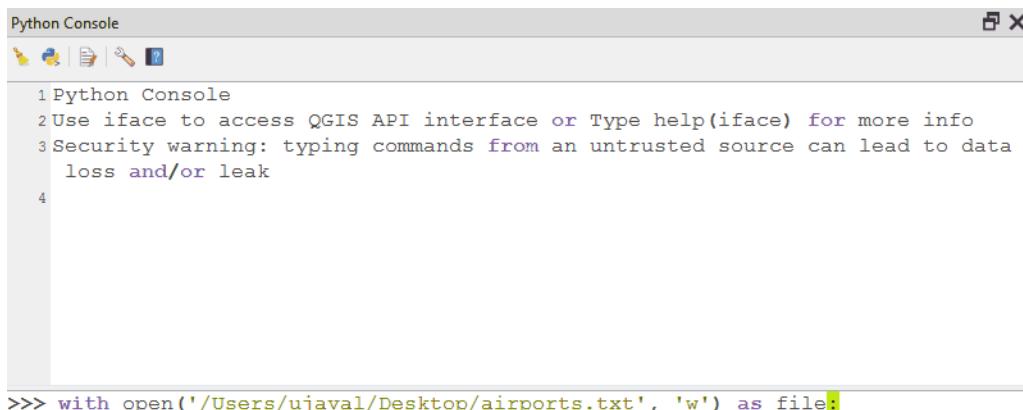
```
5462 126.80239286027584
5463 11.099103276258118
5464 -47.92078851336254
5465 -46.659115530219566
5466 -43.248381379068306
5467 -3.569026654588628
5468 -66.00422997575475
5469 17.930729901691585
5470 106.65429615117164
5471 23.94711605540731
5472
```

12. You can see the output printed on the console. A more useful way to store the output would be in a file. You can type the following code to create a file and write the output there. Replace the file path with a path on your own system. Note that we add \n at the end of our line formatting. This is to add a newline after we add the data for each feature.

### Note

There are 2 levels of code blocks below. Do make sure to add 4 spaces to the code starting line 3.

```
with open('/Users/ujaval/Desktop/airports.txt', 'w') as file:
    for f in layer.getFeatures():
        geom = f.geometry()
        line = '{} ,{} ,{:2f} ,{:2f}\n'.format(f['name'], f['iata_code'], geom.asPoint().y(), geom.
        file.write(line)
```



A screenshot of a Python console window titled "Python Console". The window has a toolbar with icons for file operations and help. The main area displays a series of numbers and text, each preceded by a line number (1 through 4) and followed by a red double greater-than symbol (>>>). The text includes instructions for using the QGIS API interface and a security warning about untrusted source code.

```
1 Python Console
2 Use iface to access QGIS API interface or Type help(iface) for more info
3 Security warning: typing commands from an untrusted source can lead to data
   loss and/or leak
4
```

```
>>> with open('/Users/ujaval/Desktop/airports.txt', 'w') as file:
```

13. You can go to the output file location you specified and open the text file. You will see the data from the airports shapefile that we extracted using python scripting.

airports - Notepad

File Edit Format View Help

Sahnewal,LUH,30.85,75.96  
Solapur,SSE,17.63,75.93  
Birsa Munda,IXR,23.32,85.32  
Ahwaz,AWZ,31.34,48.75  
Gwalior,GWL,26.29,78.22  
Hodeidah Int'l,HOD,14.76,42.97  
Devi Ahilyabai Holkar Int'l,IDR,22.73,75.81  
Gandhinagar,ISK,19.97,73.81  
Chandigarh Int'l,IXC,30.67,76.80  
Aurangabad,IXU,19.87,75.40  
Faisalabad Int'l,LYP,31.36,72.99  
Omsk Tsentralny,OMS,54.96,73.32  
Novosibirsk Tolmachev,OVB,55.01,82.67  
Zaporozhye Int'l,OZH,47.87,35.30  
Simpang Tiga,PKU,0.46,101.45  
Rota Int'l,ROP,14.17,145.24  
Surgut,SGC,61.34,73.41  
Tiruchirappalli,TRZ,10.76,78.71  
Turbat Int'l,TUK,25.99,63.03  
Quetta Int'l,UET,30.25,66.95  
Zahedan Int'l,ZAH,29.48,60.90  
Abdul Rachman Saleh,MLG,-7.93,112.71  
Barnaul,BAX,53.36,83.55  
Adampur,NULL,31.43,75.76