Module 61-12: Option GIS-Python

Introduction to Python

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> GIS for developers

Why Python for geodata?

- **Free**: no added costs for licensing
- **For coders**: fully programmable geodata manipulation
- **Modular**: libraries adapted to different use-cases
- **Efficiency**: optimized for Big Data analytics
- **Extensibility**: possibility to extend or reuse multiple libraries
- **Flexibility**: options for lots of formats/standards/approaches
- **Open Source**: code reuse/reproducibility/open science
- **Integration:** supported by other tools as QGIS/ArcGIS etc.

> How do we run python?

Different options

In this course:

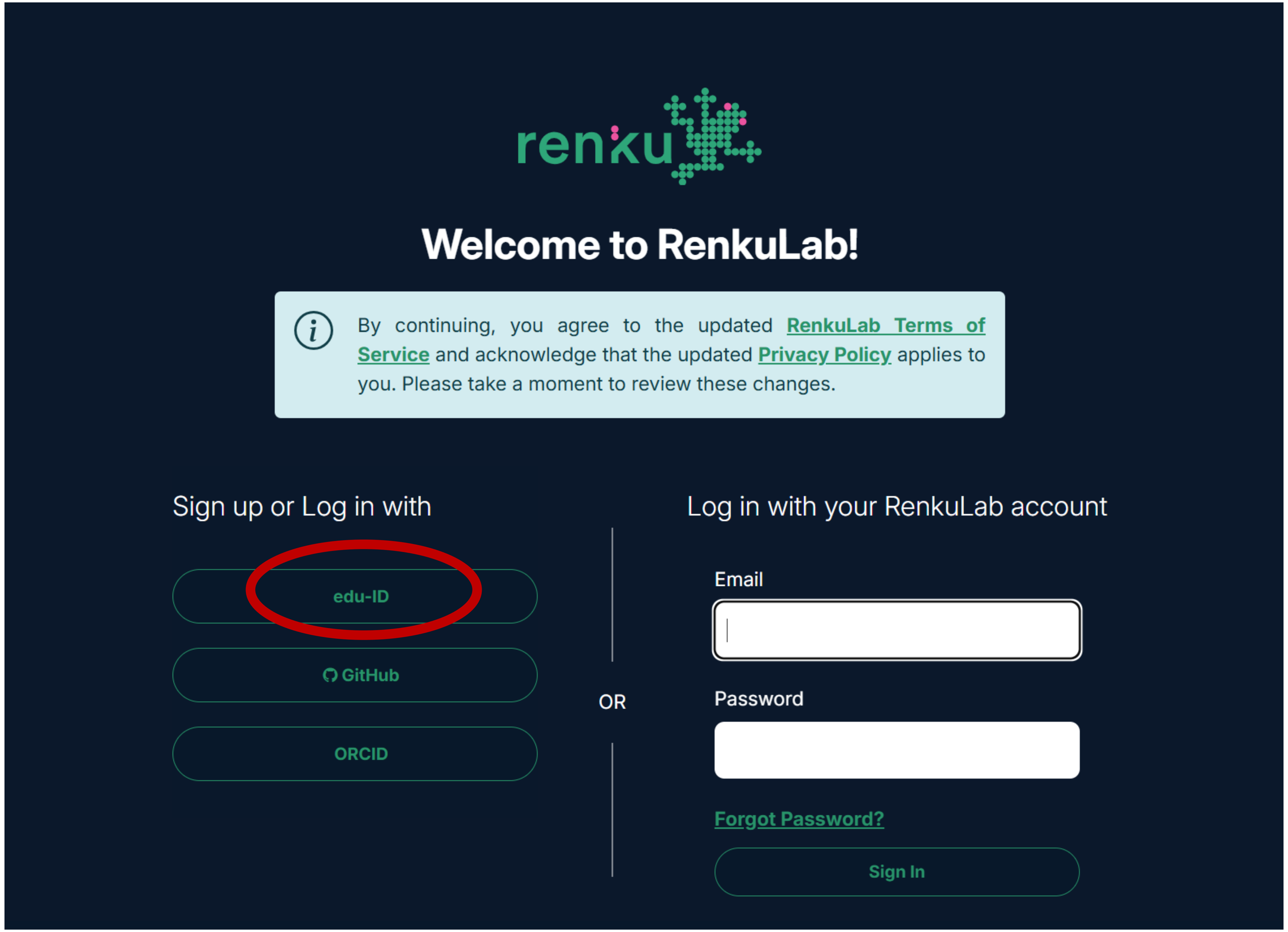
Option 1. Online notebook: Jupyter Python in renkulab.io

Option 2. Online IDE: VSCodium in renkulab.io

Option 3. VS Code in Local installation

> Options 1 & 2: renkulab.io

Log in with your hevs edu-ID account



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Sign up or Log in with

Log in with your RenkuLab account

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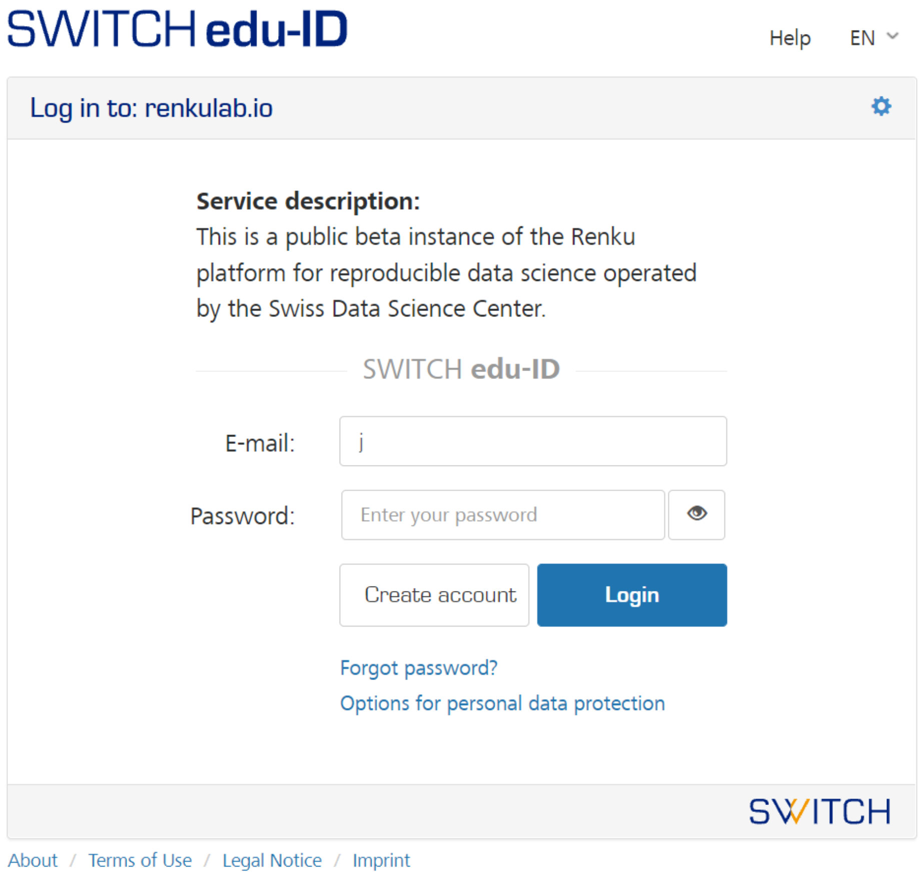

SWITCH edu-ID

Log in to: renkulab.io

Service description:
This is a public beta instance of the Renku platform for reproducible data science operated by the Swiss Data Science Center.

SWITCH edu-ID

E-mail: j

Password: Enter your password

Create account
Login
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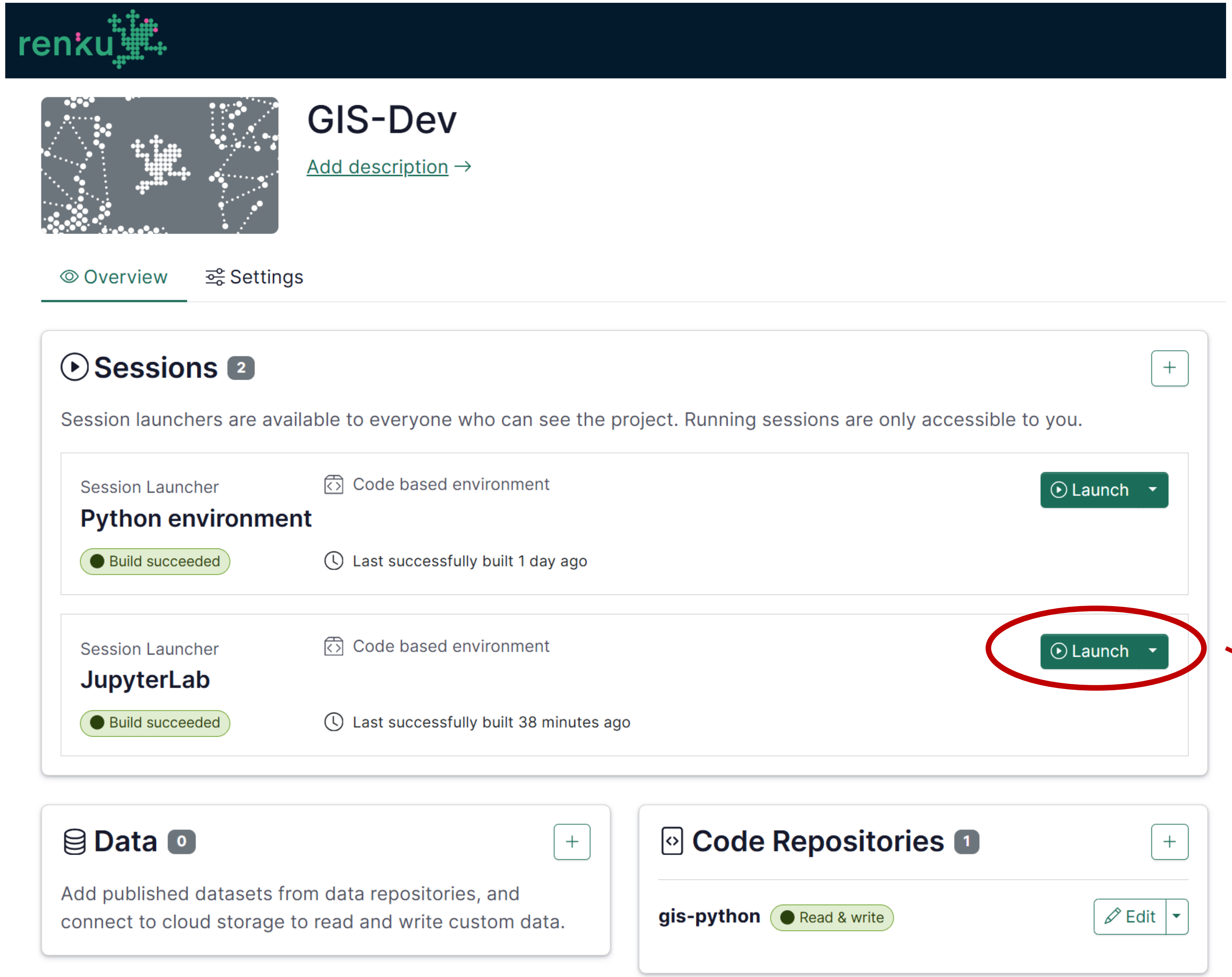
> renkulab.io

Got to this project:

https://renkulab.io/p/jean-paul.calbimonte/gis-dev



GIS-Dev

Add description →

Sessions 2

Session launchers are available to everyone who can see the project. Running sessions are only accessible to you.

Session Launcher
Python environment
Code based environment
Build succeeded
Last successfully built 1 day ago

Session Launcher
JupyterLab
Code based environment
Build succeeded
Last successfully built 38 minutes ago

Data 0

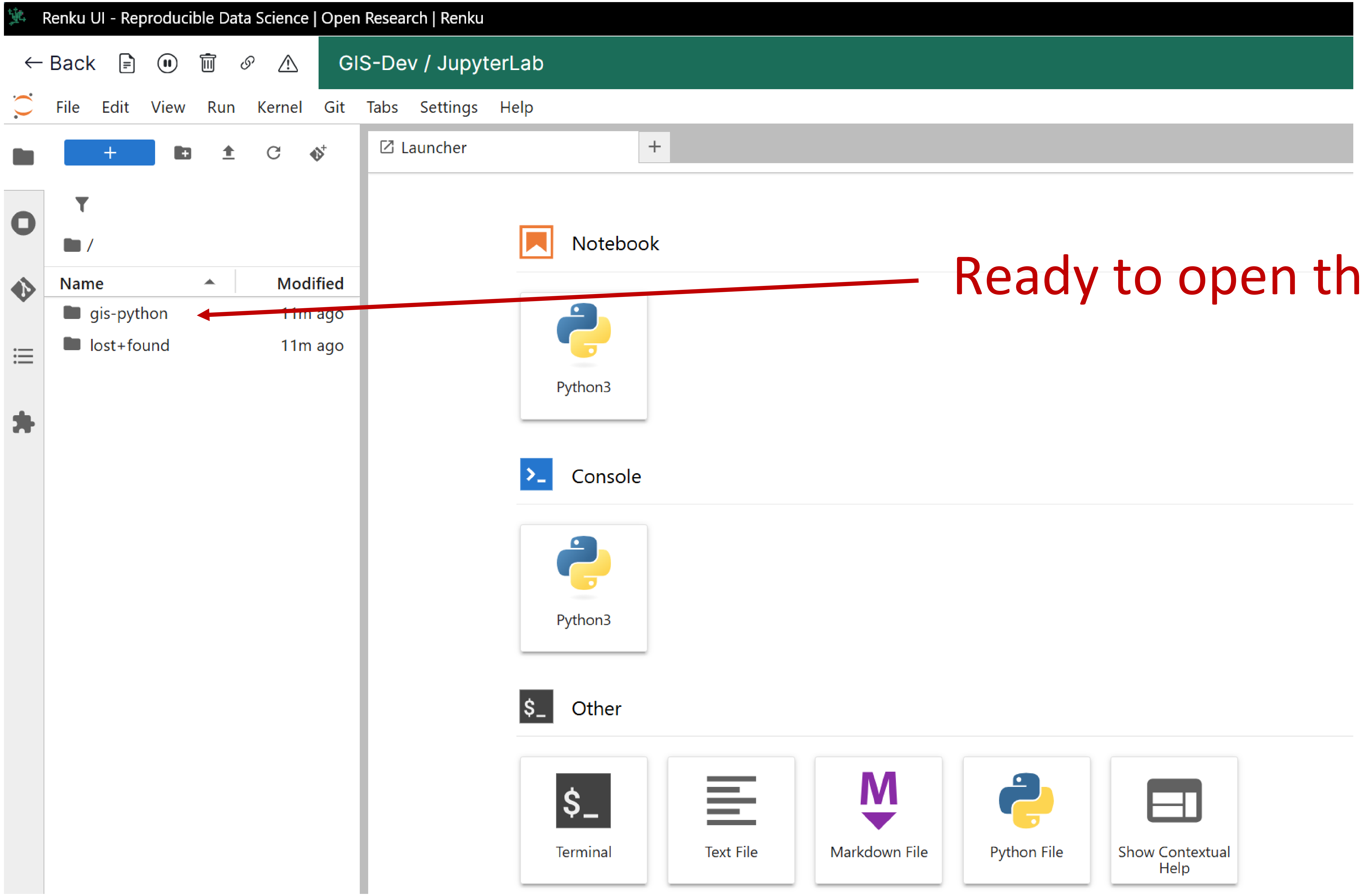
Add published datasets from data repositories, and connect to cloud storage to read and write custom data.

Code Repositories 1

gis-python Read & write

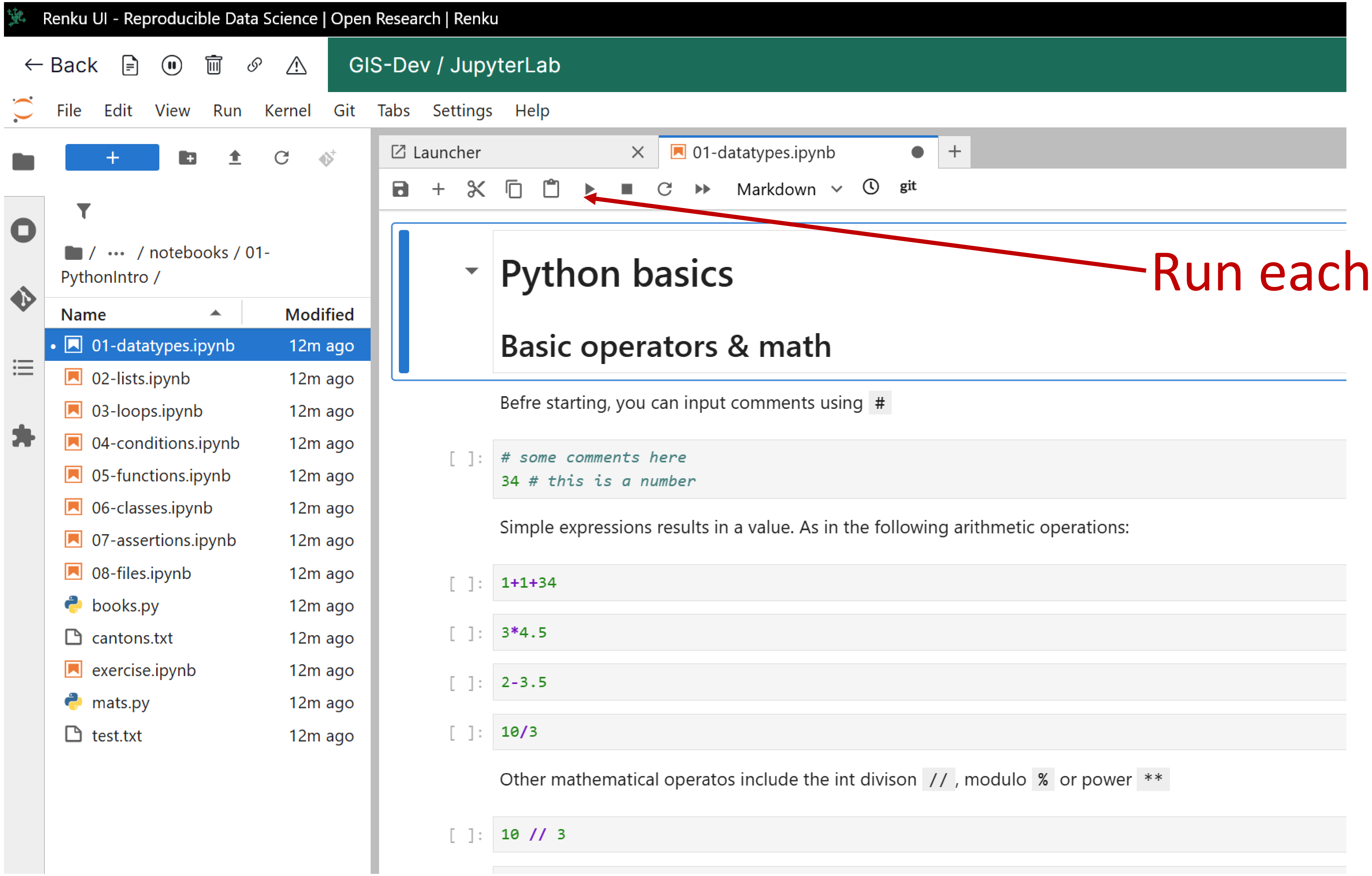
Option 1: Launch a Jupyter Notebook session

> renkulab.io Option 1: using Jupyter Lab



Ready to open the notebooks

> renkulab.io Option 1: using Jupyter Lab



Python basics

Basic operators & math

Befre starting, you can input comments using `#`

```
[ ]: # some comments here
     34 # this is a number
```

Simple expressions results in a value. As in the following arithmetic operations:

```
[ ]: 1+1+34
[ ]: 3*4.5
[ ]: 2-3.5
[ ]: 10/3
```

Other mathematical operatos include the int divison `//`, modulo `%` or power `**`

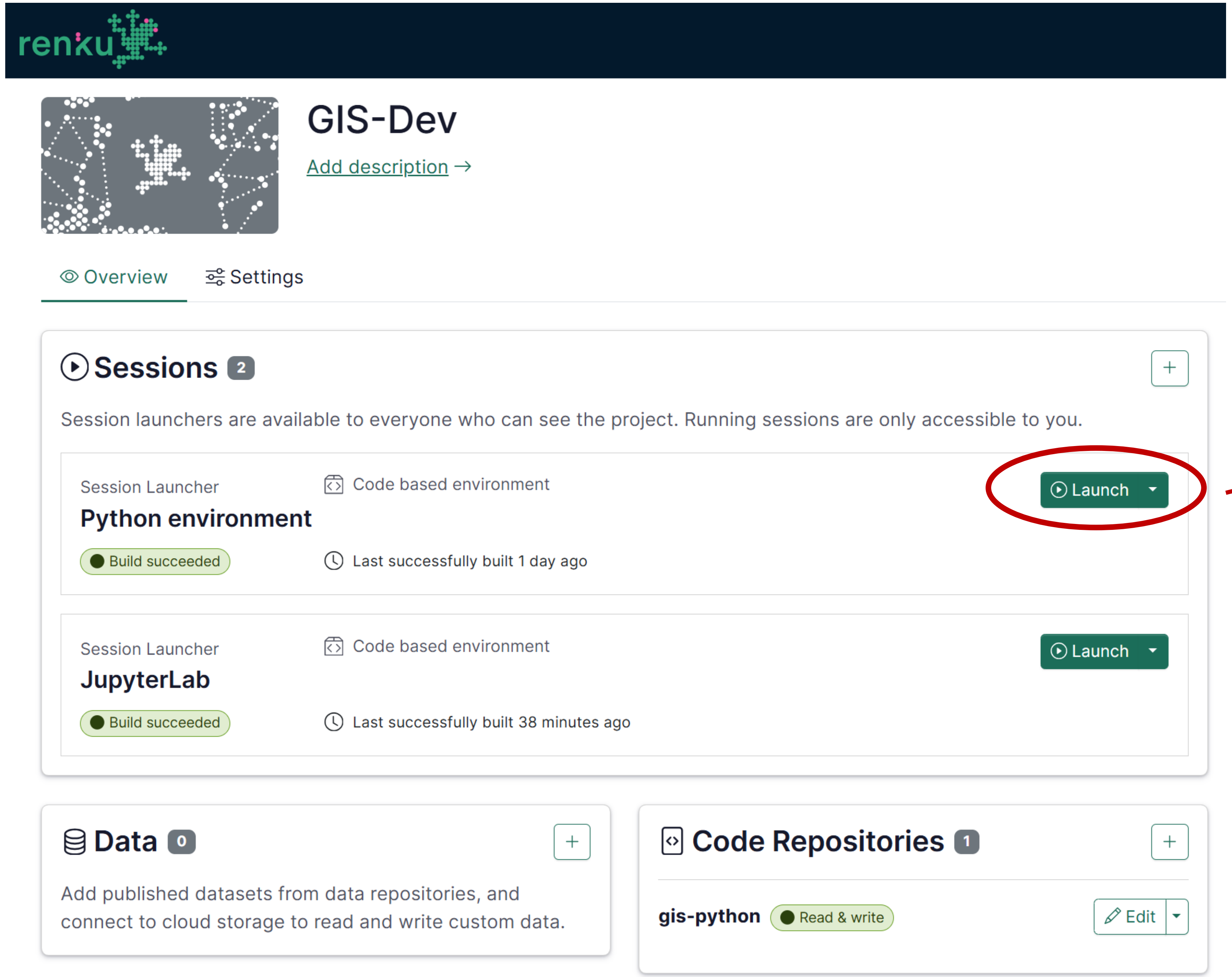
```
[ ]: 10 // 3
```

Run each cell

> renkulab.io

Got to this project:

https://renkulab.io/p/jean-paul.calbimonte/gis-dev



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GIS-Dev

Add description →

Overview | Settings

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● Build succeeded
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Launch

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Launch

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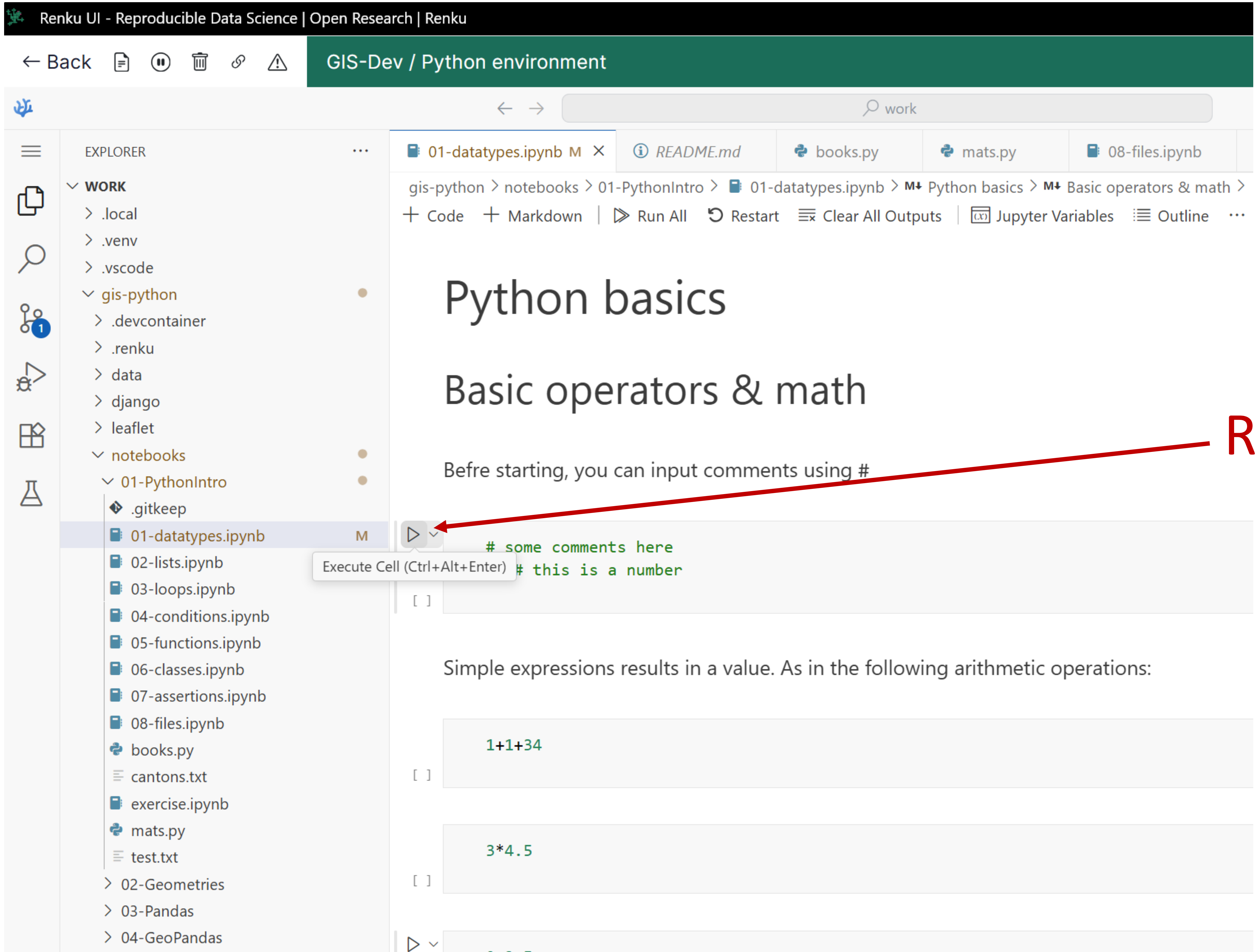
Add published datasets from data repositories, and connect to cloud storage to read and write custom data.

Code Repositories 1

gis-python ● Read & write
Edit

Option 2: Launch a VS Codium session

> renkulab.io Option 2: using VS Codium online



Python basics

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1+1+34
```

[ ]

```
3*4.5
```

[ ]

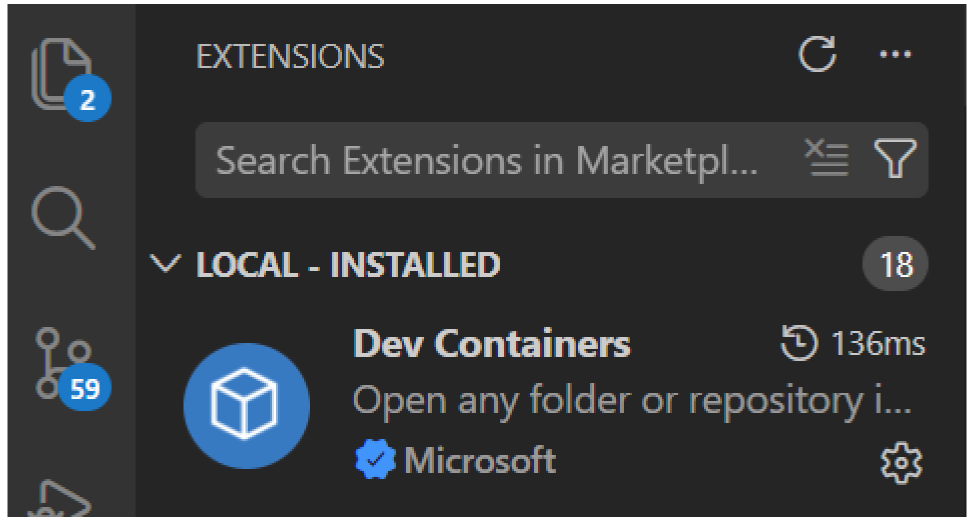
Run each cell

> Option 3: VSCode on your machine

You will need:

- VSCode

  with Dev Containers extension



EXTENSIONS

Search Extensions in Marketpl...

LOCAL - INSTALLED 18

Dev Containers 136ms

Open any folder or repository i...

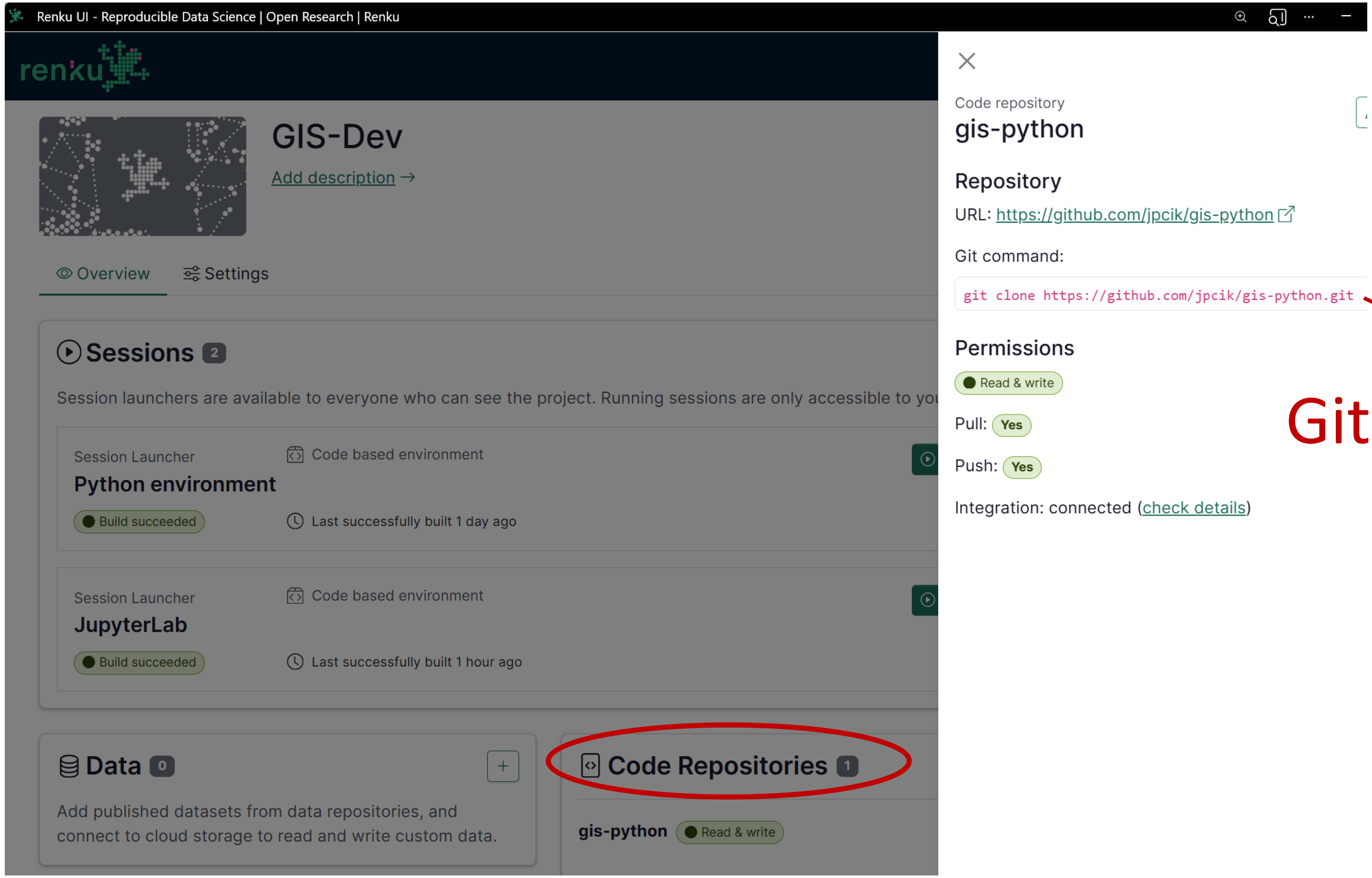
Microsoft

- Docker Desktop

> Option 3: VSCode on your machine

Got to this project:

https://renkulab.io/p/jean-paul.calbimonte/gis-dev



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JupyterLab
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Last successfully built 1 hour ago

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Add published datasets from data repositories, and connect to cloud storage to read and write custom data.

Code Repositories 1

gis-python Read & write

Code repository
gis-python

Repository

URL: https://github.com/jpcik/gis-python

Git command:

```
git clone https://github.com/jpcik/gis-python.git
```

Permissions

Read & write

Pull: Yes

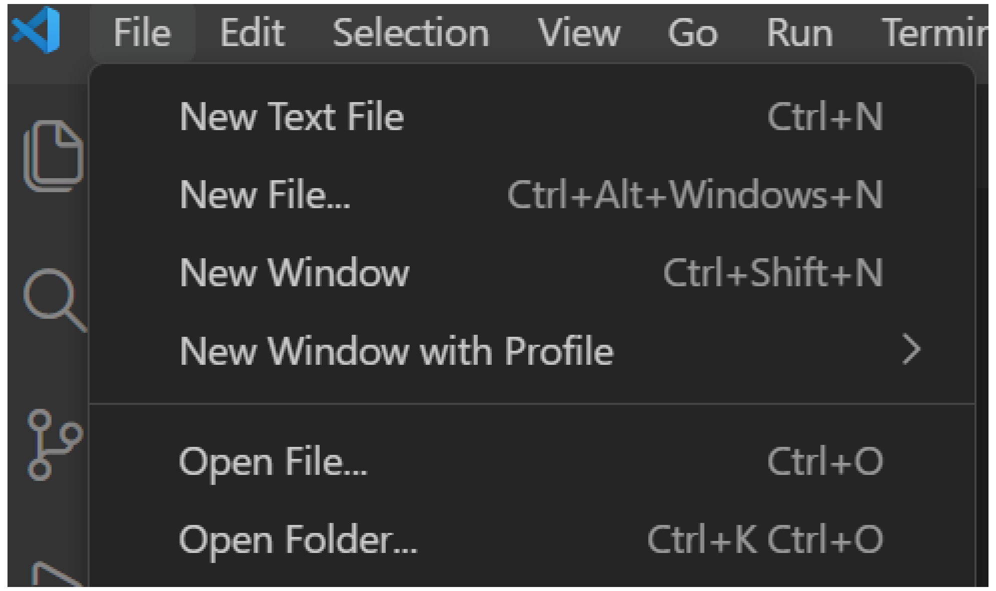
Push: Yes

Integration: connected (check details)

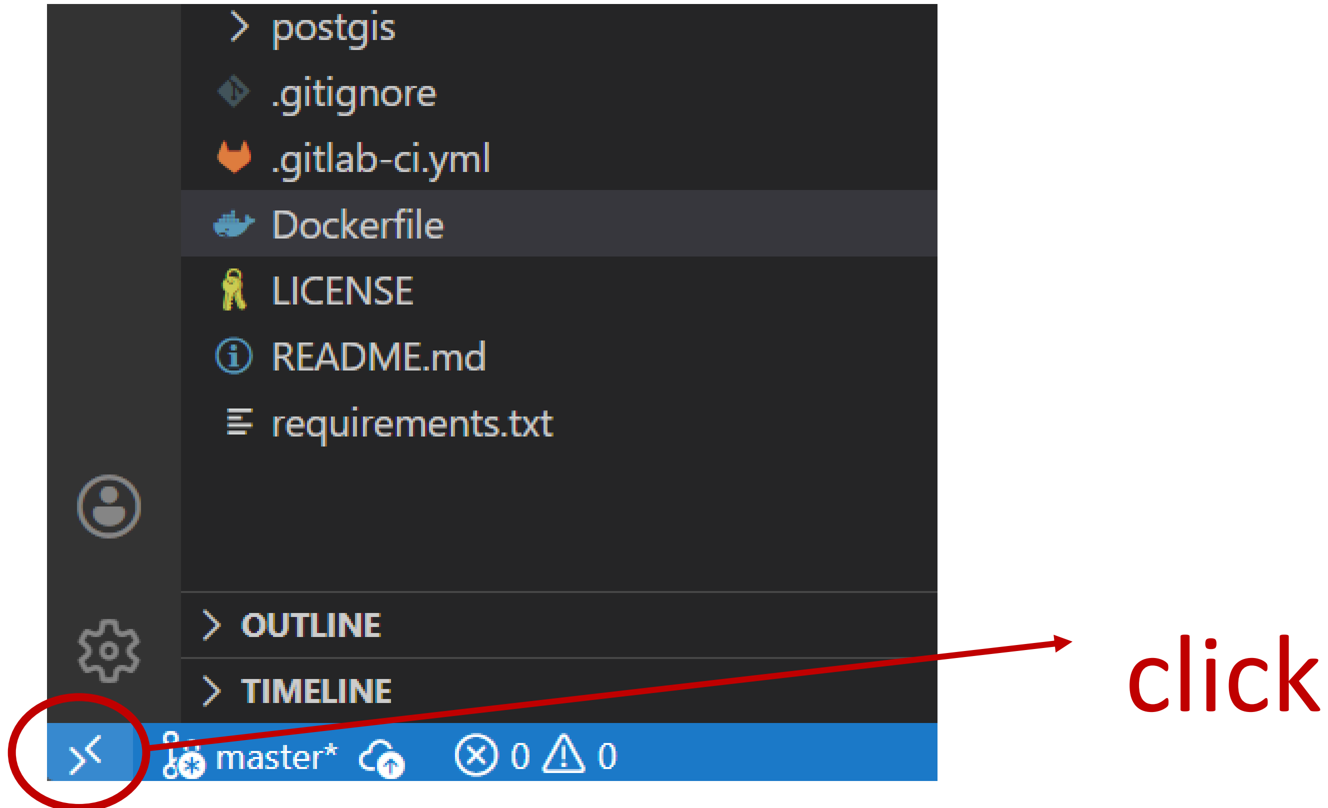
Git clone the repository in your machine

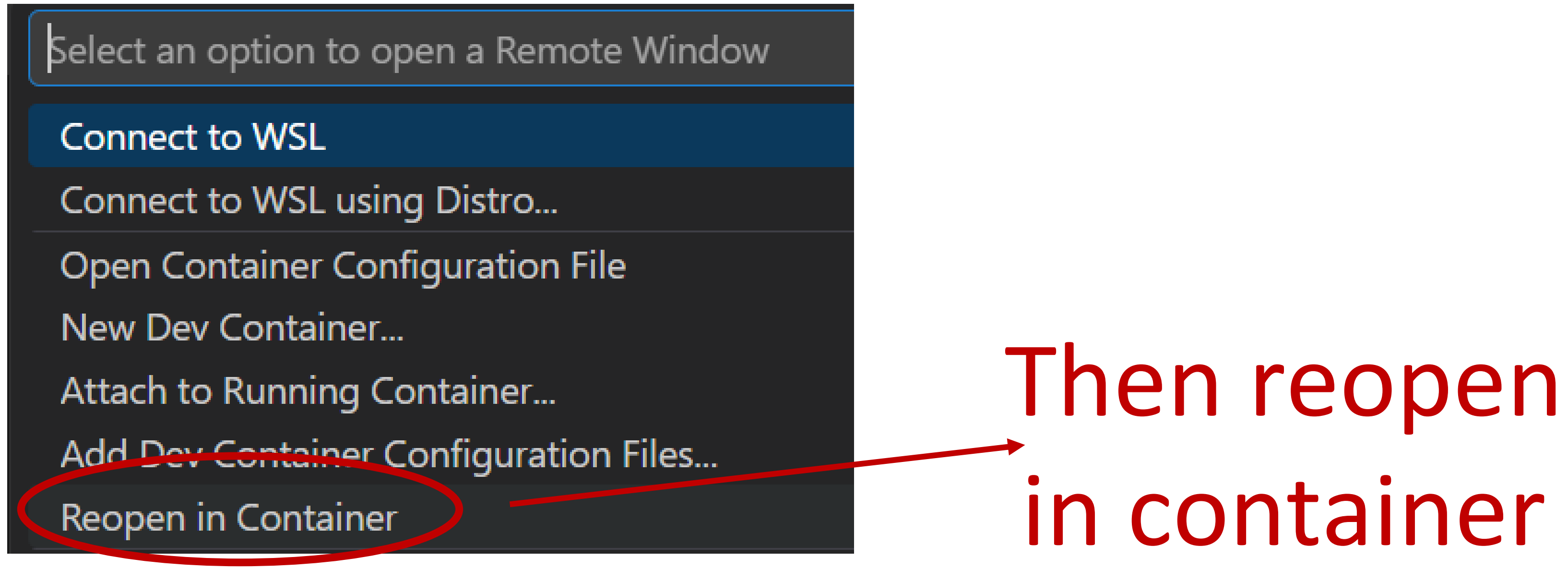
> Option 3: VSCode on your machine

Open the folder in VSCode



Click on the bottom corner button

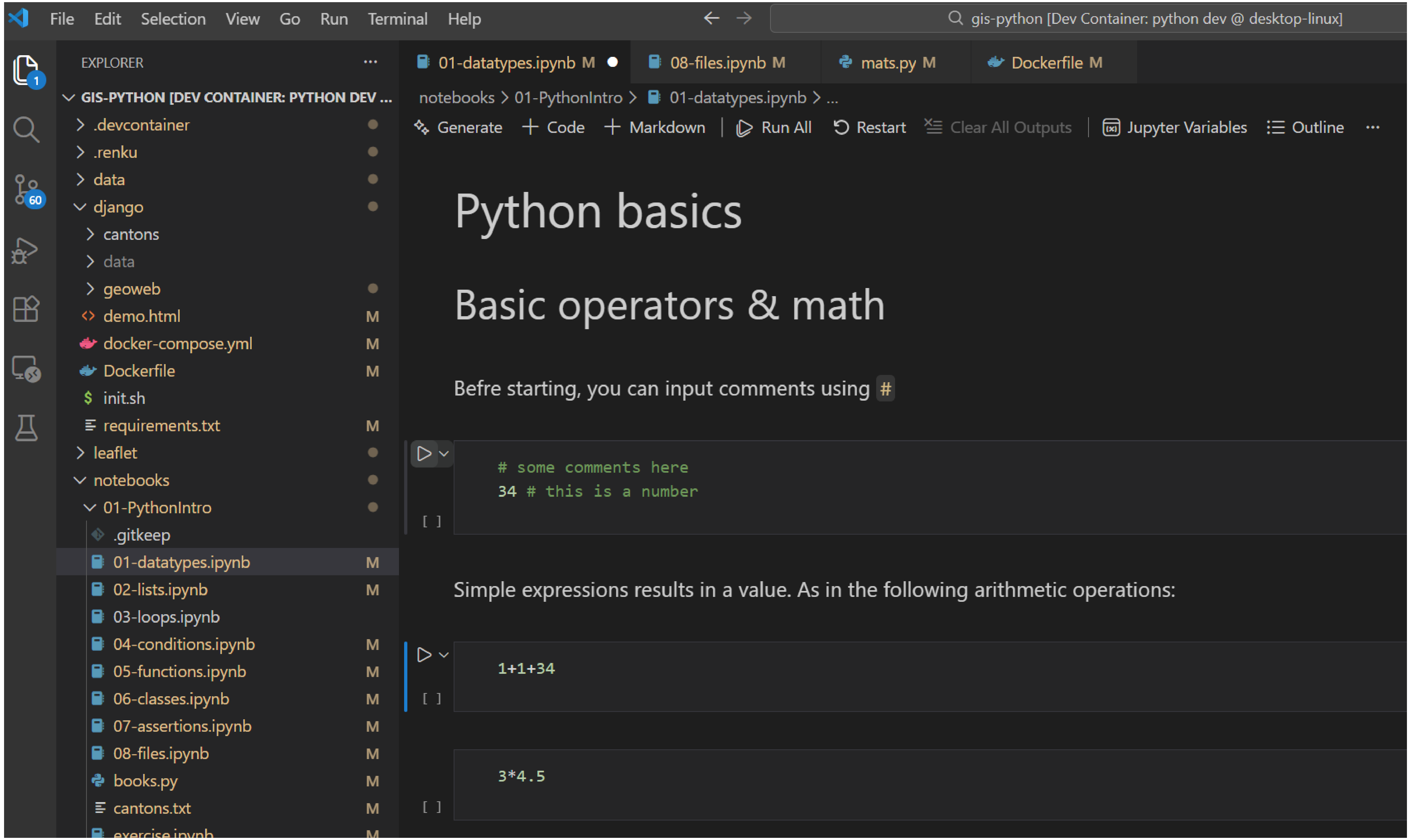




Select an option to open a Remote Window
Connect to WSL
Connect to WSL using Distro...
Open Container Configuration File
New Dev Container...
Attach to Running Container...
Add Dev Container Configuration Files...
Reopen in Container
Then reopen
in container

> Option 3: VSCode on your machine

You are ready to go



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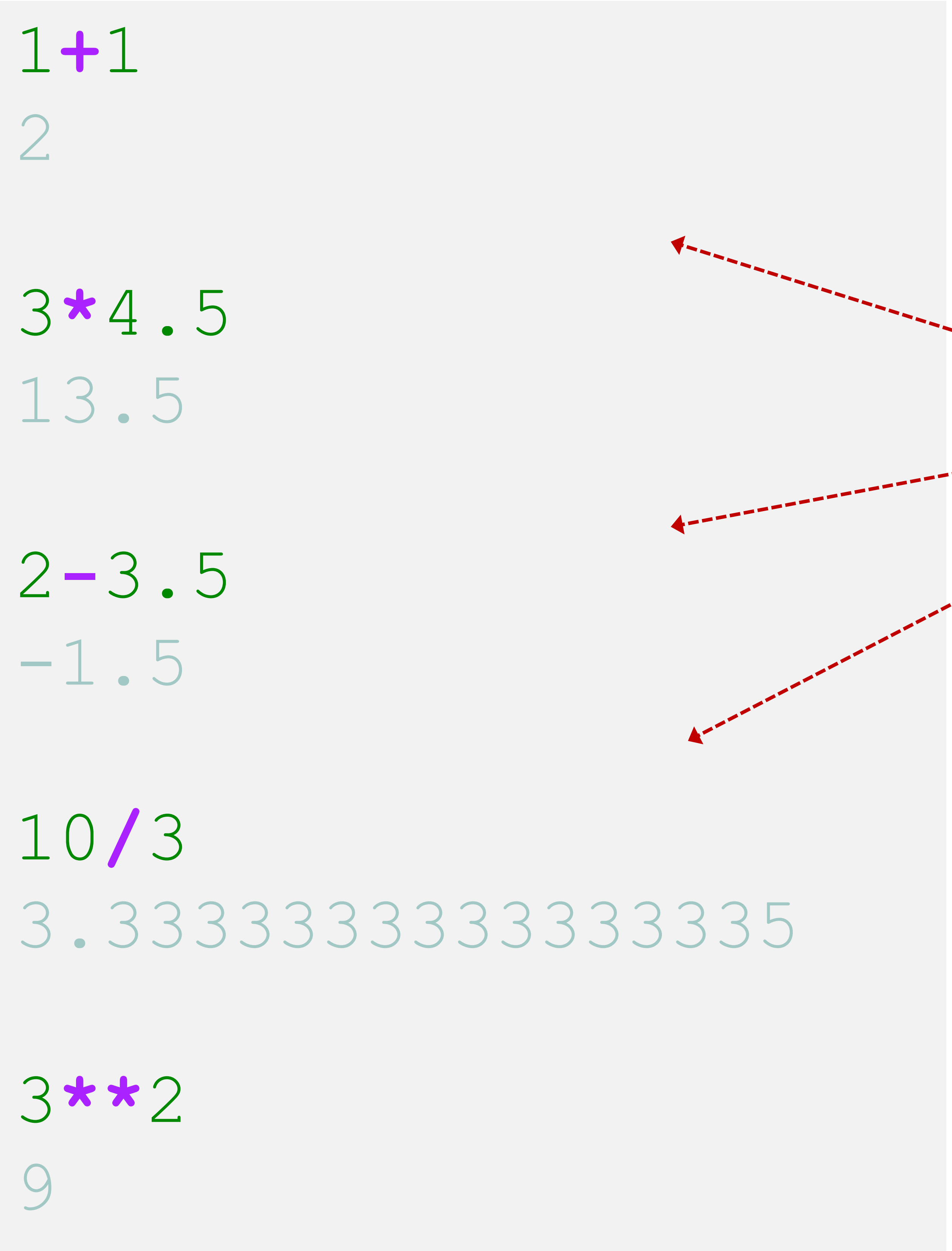
```
3*4.5
```

> Learning Python

Basics of Python

> Basic operators



```
1+1
2

3*4.5
13.5

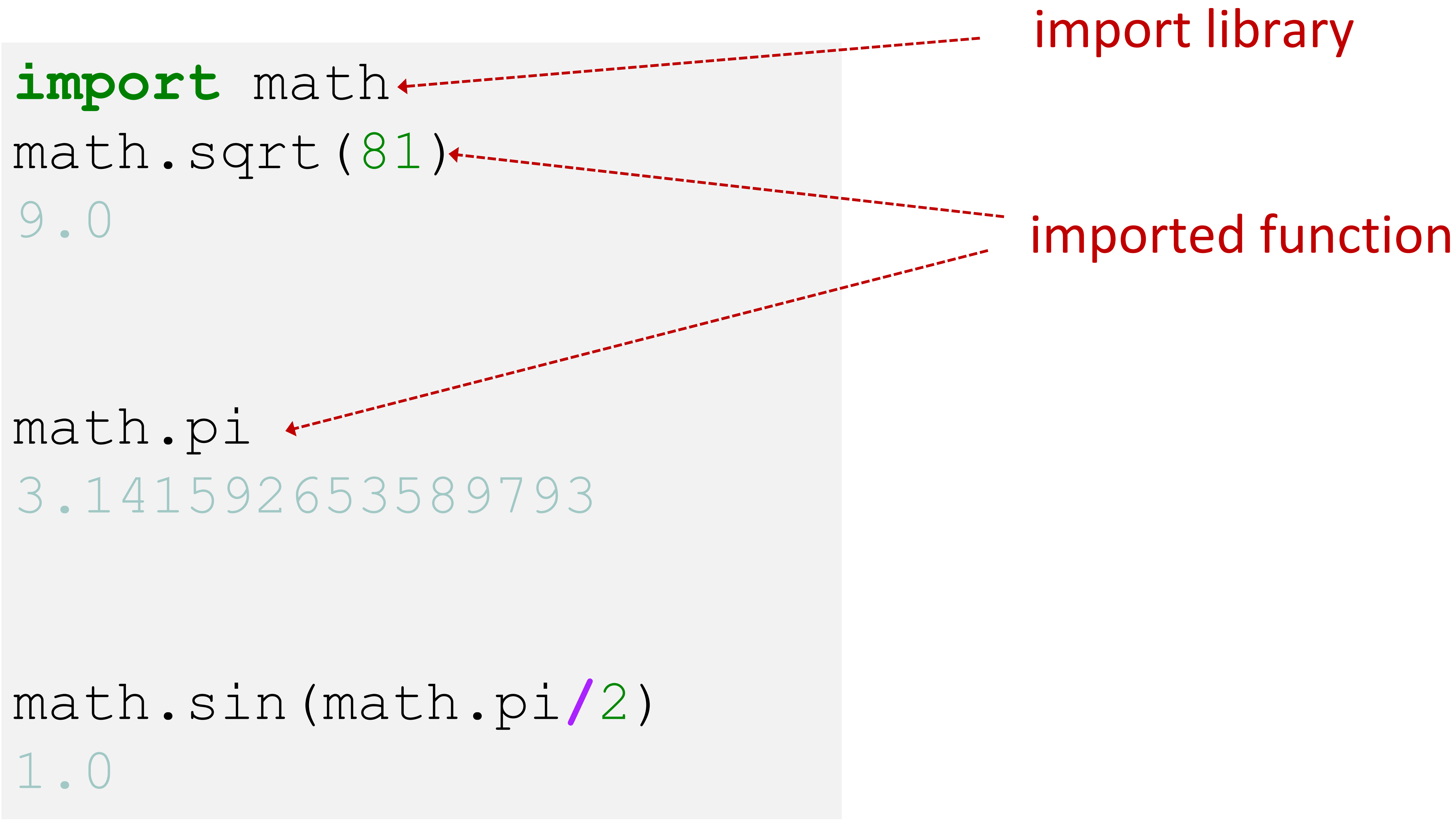
2-3.5
-1.5

10/3
3.3333333333333335

3**2
9
```

basic arithmetic operations

> Math functions



```
import math
math.sqrt(81)
9.0


math.pi
3.141592653589793


math.sin(math.pi/2)
1.0
```

import library

imported function

> Variables & Basic types

```
a=1
b=2.4
a+b
3.4
```

int

float

```
a==b
False
a==1
True
```

bool

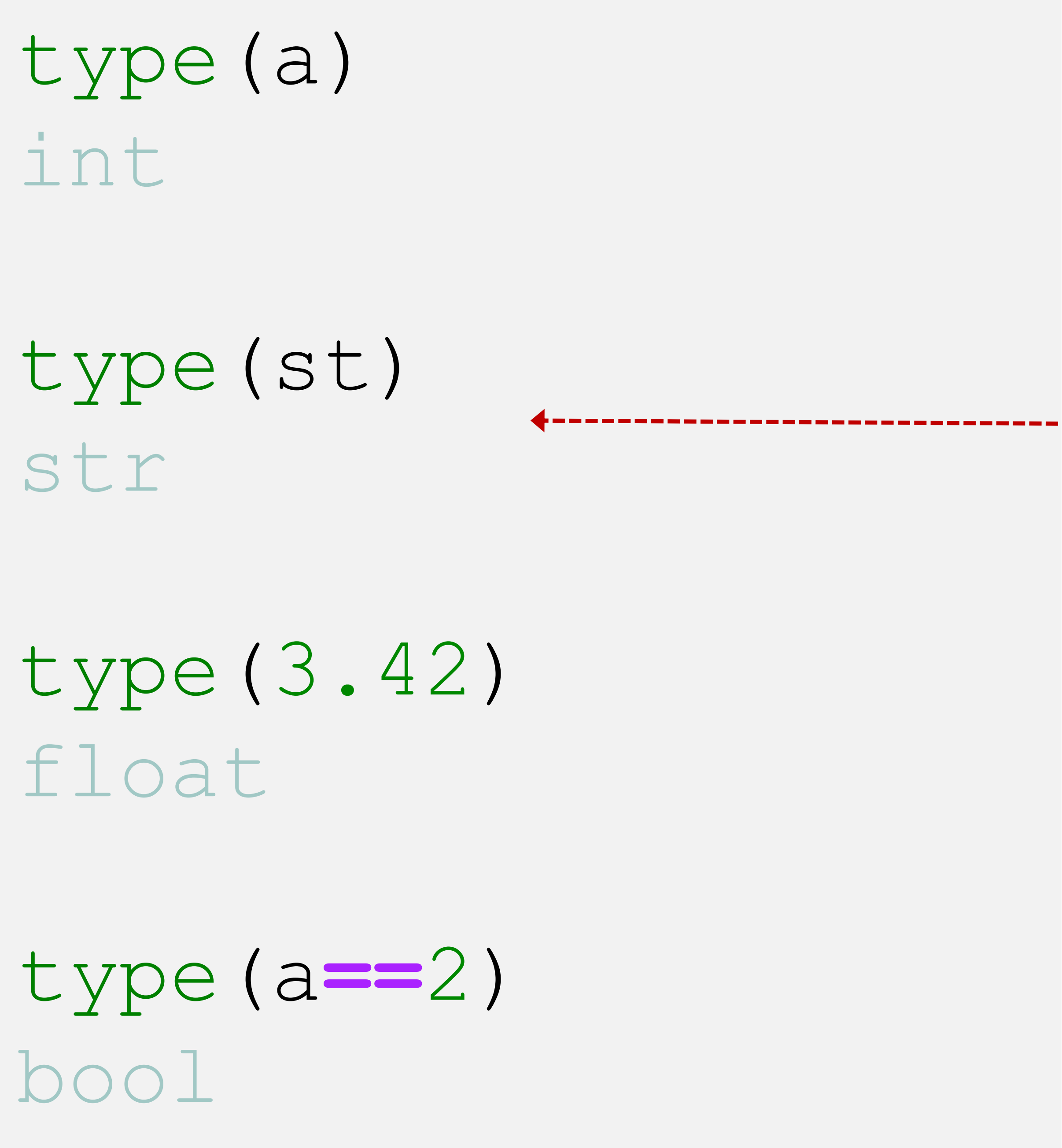
```
st='we like GIS'
print(st)
we like GIS
```

str

```
b=st
print(b)
we like GIS

print('This is number',a,'followed by this string:',b)
This is number 1 followed by this string: we like GIS
```

> Basic types



```
type(a)
int

type(st)
str

type(3.42)
float

type(a==2)
bool
```

int

str

float

bool

> Lists

```
[3,4,6,2,1]
[3, 4, 6, 2, 1]
```

unidimensional

```
[[2,3],[5,6],[4,3]]
[[2, 3], [5, 6], [4, 3]]
```

multidimensional

```
list=[3,4.5,6,2,2.1]
len(list)
5

list[2]
6
list[-1]
2.1
```

indices

```
type(list[1])
float
```

types

> Lists

```
list=[3,4.5,6]
del list[2]
print(list)
[3, 4.5]
```

remove item

```
list.append(44)
print(list)
[3, 4.5, 44]
```

append item

```
list.reverse()
print(list)
[44, 4.5, 3]
```

reverse list

```
list.sort()
print(list)
[3, 4.5, 44]
```

sort list

```
list[0]=55
print(list)
[55, 4.5, 44]
```

replace item

> Lists & Loops

```
string='strange'
len(string)
7

print(string[2])
r

for ch in string:
   print(ch)
s
t
r
a
n
g
e
```

iterate over chars

```
count=0
for ch in string:
    print(ch,count)
    count=count+1
print(count)
s 0
t 1
r 2
a 3
n 4
g 5
e 6
7
```

> Loops

```
range(4)
range(0, 4)

for i in range(4):
    print(i)
0
1
2
3
```

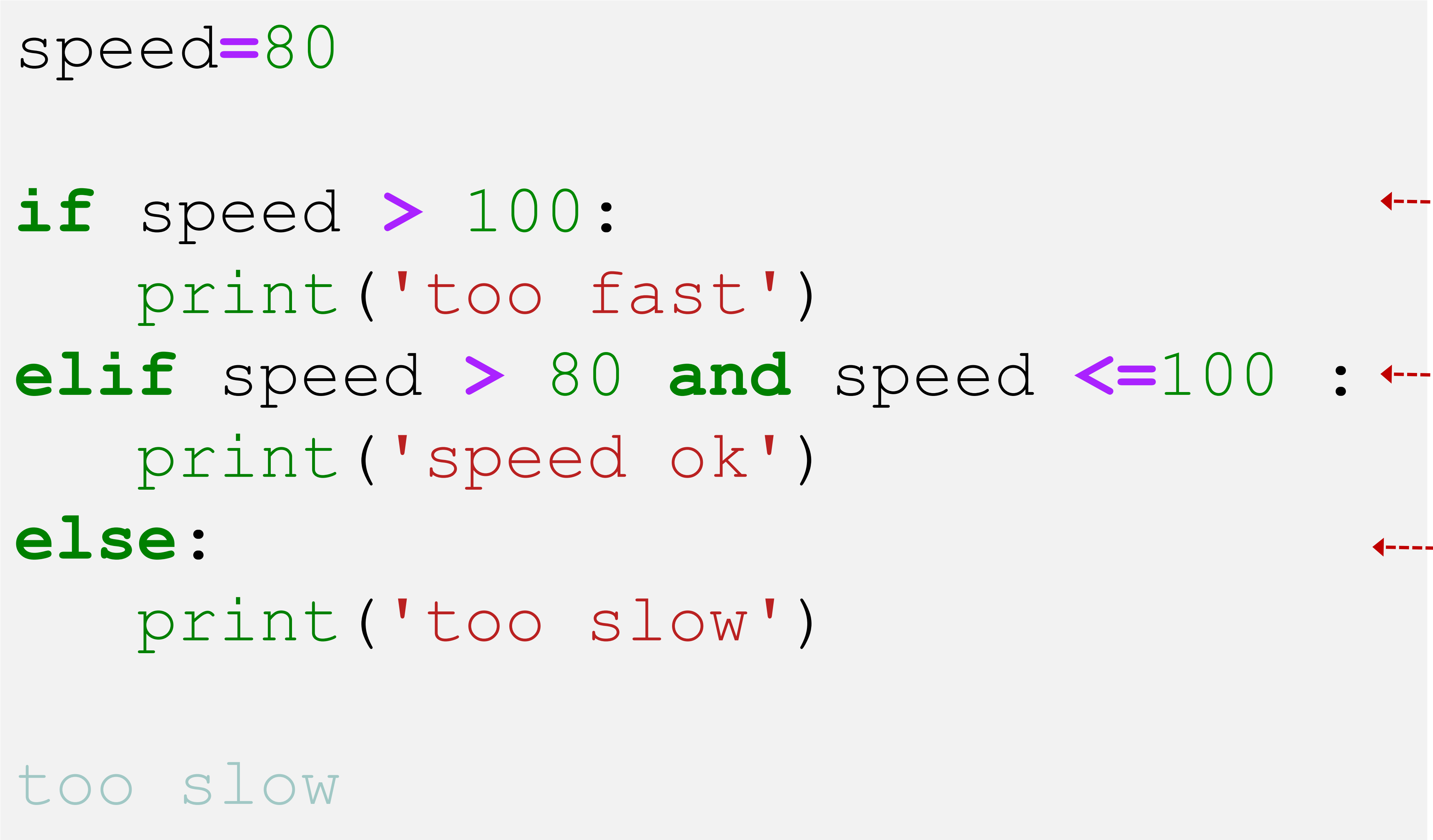
iterate range

```
for i in range(2,14,3):
    print(i)
2
5
8
11
```

range with step

```
name='Aladdin'
for i in range(len(name)):
    print(name[i])
A
l
a
d
d
i
n
```

> Conditions



```
speed=80

if speed > 100:
    print('too fast')
elif speed > 80 and speed <=100 :
    print('speed ok')
else:
    print('too slow')
```

```
too slow
```

if

elif

else

> Conditions

```
exam1 = 3.5
exam2 = 'B'

if (exam1 >=4 and exam2 == 'A'):
   print('grades are great')
elif exam1 < 4 and exam2 == 'B':
   print('grades are poor')
else:
   print('grades are mixed')
```

```
grades are poor
```

> Functions

```
def calculateArea(length,height):
    return length*height


calculateArea(5,4)
20


calculateArea('a',4)
'aaaa'
```

> Functions

```
def countLetters(strings, letter):
    count=0
    for str in strings:
        count=count+str.count(letter)
    return count



countLetters(['day','pasta','lasagna'],'a')
6
```

> Classes

```
class Vehicle(object):
    wheels=0

    def __init__(self,wheels,maxSpeed=0):
        self.wheels=wheels
        self.maxSpeed=maxSpeed

    def fasterThan(self,otherVehicle):
        return self.maxSpeed > otherVehicle.maxSpeed



v1=Vehicle(2)
print(v1.maxSpeed)
0
```

'constructor'

method

instantiation

> Classes

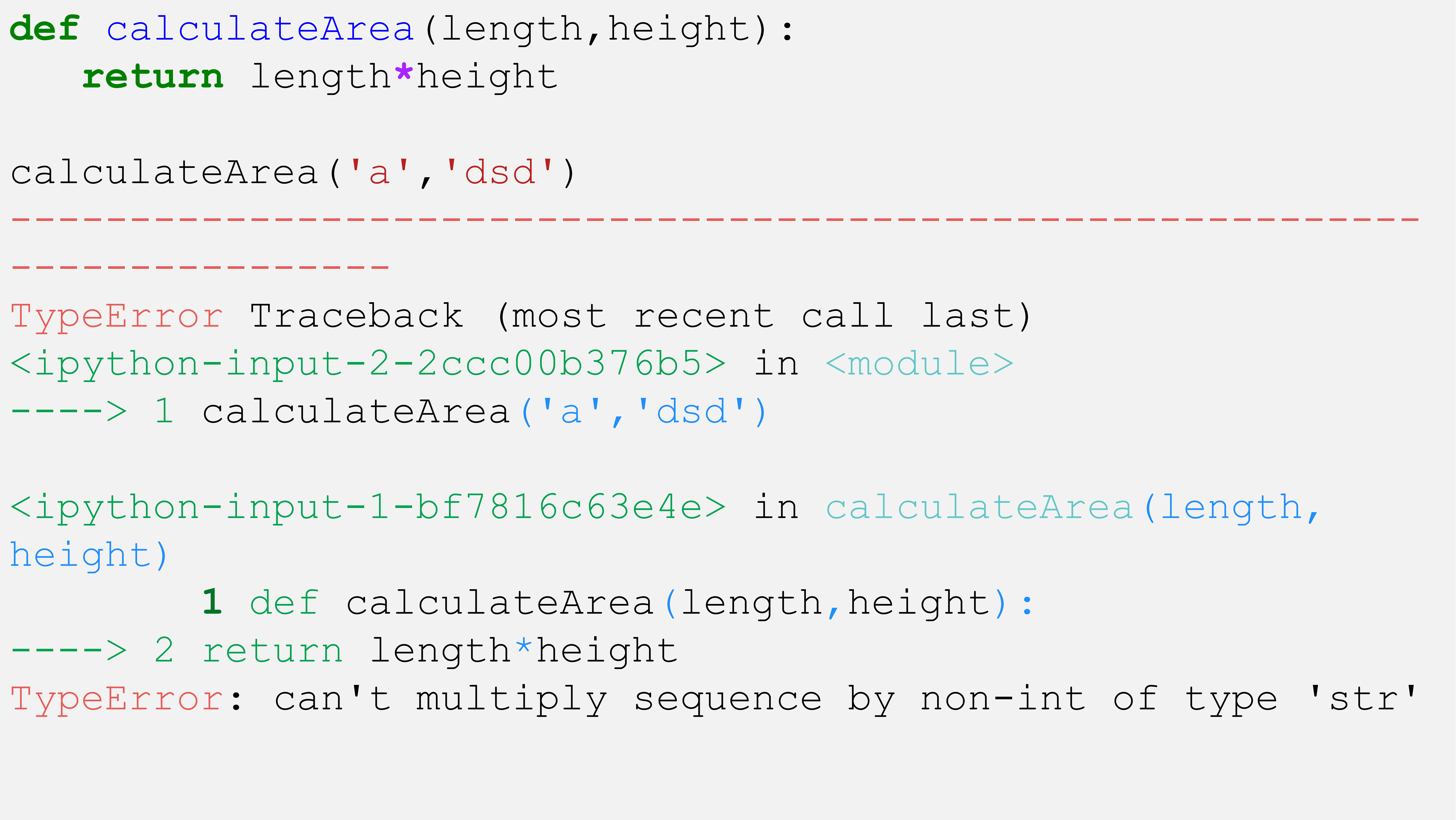
```
class Bike(Vehicle):
    def __init__(self,maxSpeed=0):
        self.wheels=2
        self.maxSpeed=maxSpeed



b1=Bike(30)
b1.wheels
b1.maxSpeed
30
```

```
b2=Vehicle(4,80)
b1.fasterThan(b2)
False
```

> Error

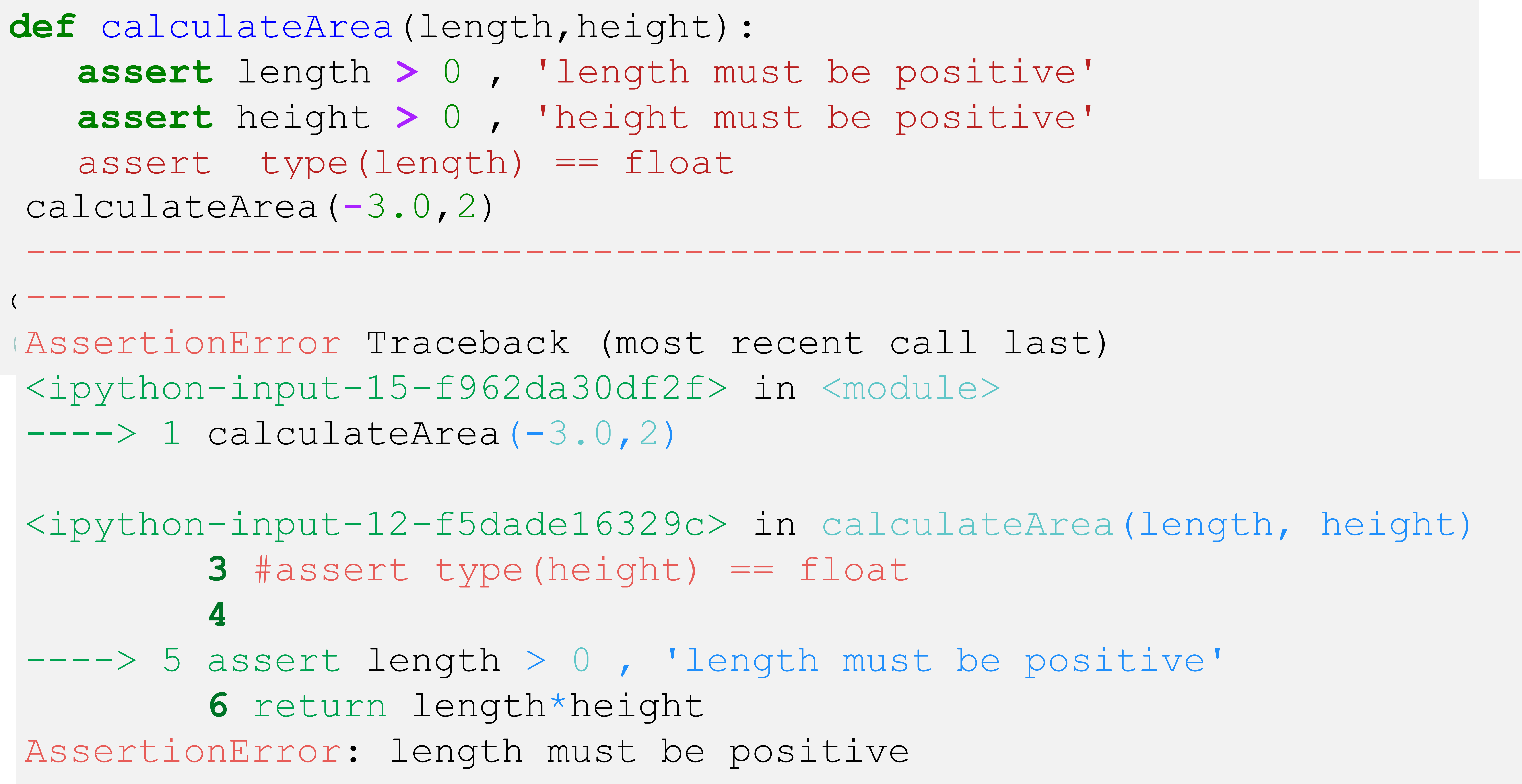


```
def calculateArea(length,height):
   return length*height

calculateArea('a','dsd')
-----------------------------------------------------------
----------------
TypeError Traceback (most recent call last)
<ipython-input-2-2ccc00b376b5> in <module>
----> 1 calculateArea('a','dsd')

<ipython-input-1-bf7816c63e4e> in calculateArea(length,
height)
        1 def calculateArea(length,height):
----> 2 return length*height
TypeError: can't multiply sequence by non-int of type 'str'
```

> Assertions



```
def calculateArea(length,height):
   assert length > 0 , 'length must be positive'
   assert height > 0 , 'height must be positive'
   assert  type(length) == float
 calculateArea(-3.0,2)
 ------------------------------------------------------------
 ---------
 AssertionError Traceback (most recent call last)
 <ipython-input-15-f962da30df2f> in <module>
 ----> 1 calculateArea(-3.0,2)

 <ipython-input-12-f5dade16329c> in calculateArea(length, height)
       3 #assert type(height) == float
       4
 ----> 5 assert length > 0 , 'length must be positive'
       6 return length*height
 AssertionError: length must be positive
```

> Questions?

Thank you for your attention.

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3960 Sierre

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