Class terminology

member variables - the data that belongs to a class

Ex. PairCalculator has two member variables: value1 and value2

accessors - methods which expose member variables

Ex. the method getVal1 and getVal2 in PairCalculator

setters - methods which change the values of member variables

Exercise: try implementing setVal1 and setVal2 in PairCalculator

Best practice is to give access to member variables only through methods! This enforces **encapsulation**

Classes are types!

Ex. pair = PairCalculator(10,2) # pair has type *PairCalculator*

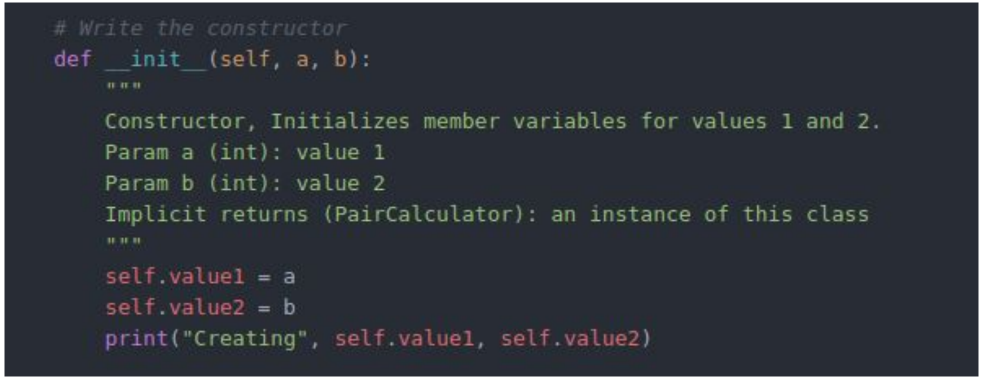
Ex. win = GraphWin(“Hi”, 200, 200) # win has type *GraphWin*

Ex. float, int, str, bool are called **built-in types** because they are included as part of the Python language. Classes allow us to define our own types!

Classes: constructor vs methods

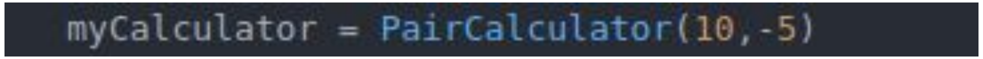
The constructor (ctor) is invoked when you create an instance of a class

Defining the constructor



```
# Write the constructor
def __init__(self, a, b):
    """
    Constructor, Initializes member variables for values 1 and 2.
    Param a (int): value 1
    Param b (int): value 2
    Implicit returns (PairCalculator): an instance of this class
    """
    self.value1 = a
    self.value2 = b
    print("Creating", self.value1, self.value2)
```

Using the constructor
(uses class name!)

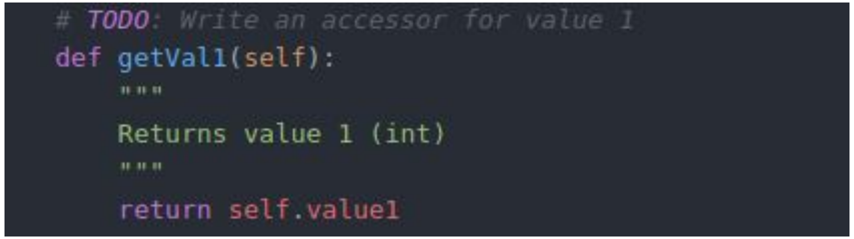


```
myCalculator = PairCalculator(10,-5)
```

Classes: constructor vs methods

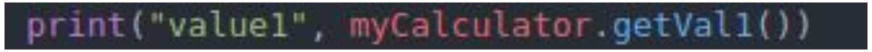
Methods determine what you can do with a class (aka the **class interface**)

Defining the method



```
# TODO: Write an accessor for value 1
def getVal1(self):
    """
    Returns value 1 (int)
    """
    return self.value1
```

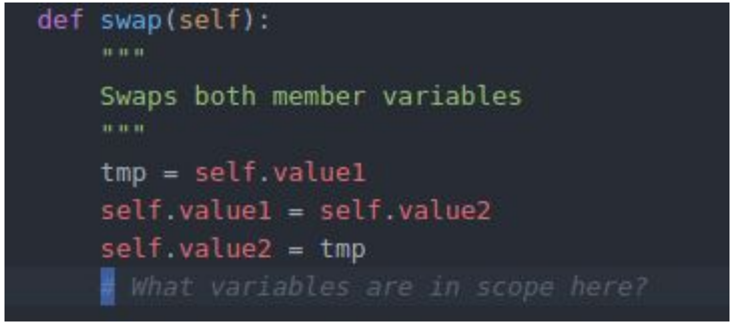
Using the method
(All methods use "dot")



```
print("value1", myCalculator.getVal1())
```

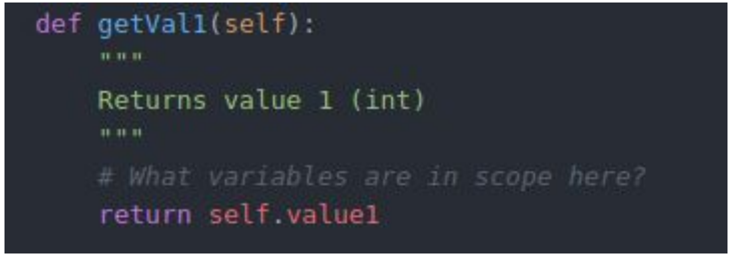
Classes: method scope

Methods have member variables, parameters, and local variables in scope



```python
def swap(self):
    """
    Swaps both member variables
    """
    tmp = self.value1
    self.value1 = self.value2
    self.value2 = tmp
    # What variables are in scope here?
```

tmp
self
self.value1
self.value2

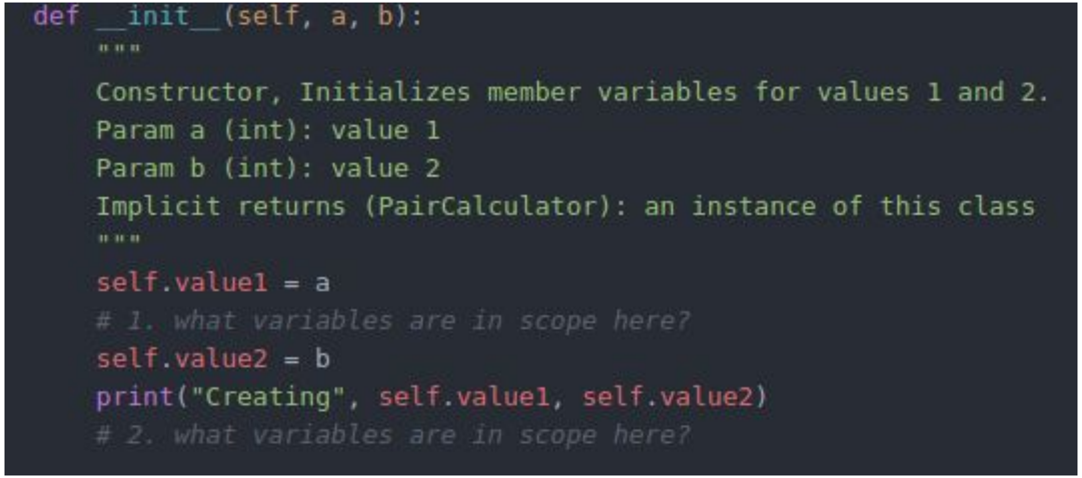


```python
def getVal1(self):
    """
    Returns value 1 (int)
    """
    # What variables are in scope here?
    return self.value1
```

self
self.value1
self.value2 (still in scope even though we don’t use it!!!)

Classes: method scope

Methods have member variables, parameters, and local variables in scope



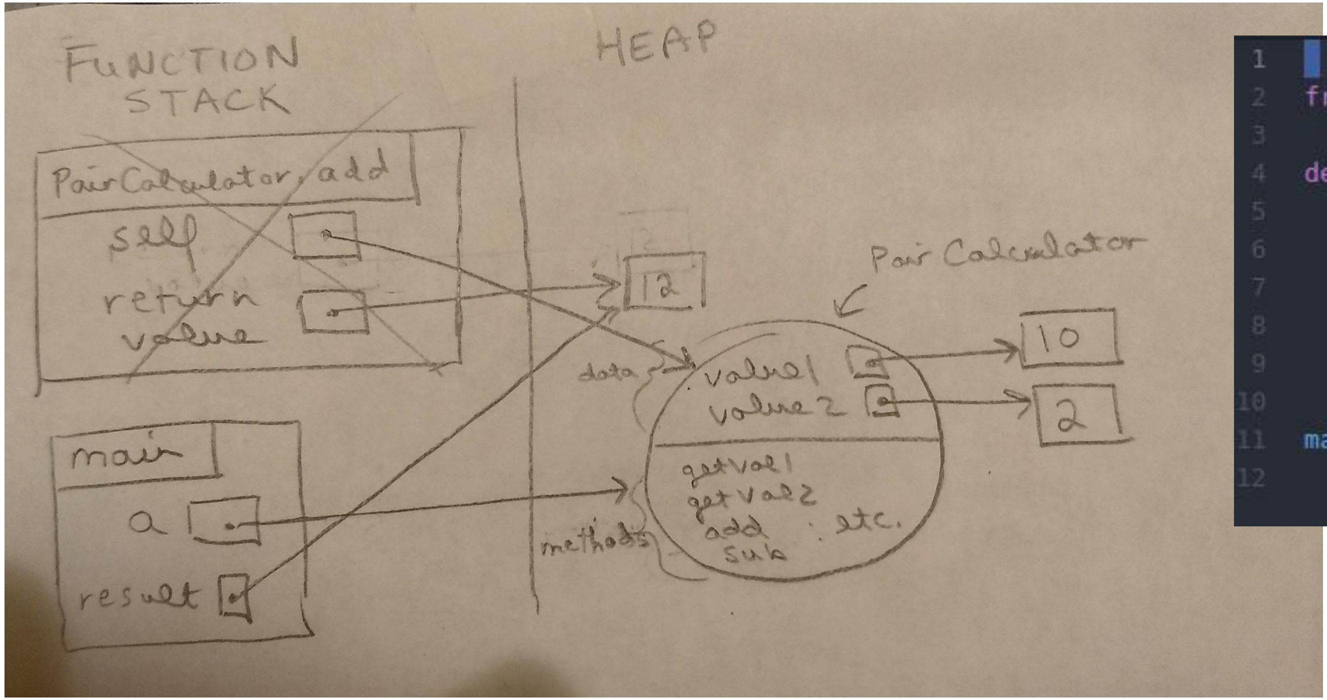
```
def __init__(self, a, b):
    """
    Constructor, Initializes member variables for values 1 and 2.
    Param a (int): value 1
    Param b (int): value 2
    Implicit returns (PairCalculator): an instance of this class
    """
    self.value1 = a
    # 1. what variables are in scope here?
    self.value2 = b
    print("Creating", self.value1, self.value2)
    # 2. what variables are in scope here?
```

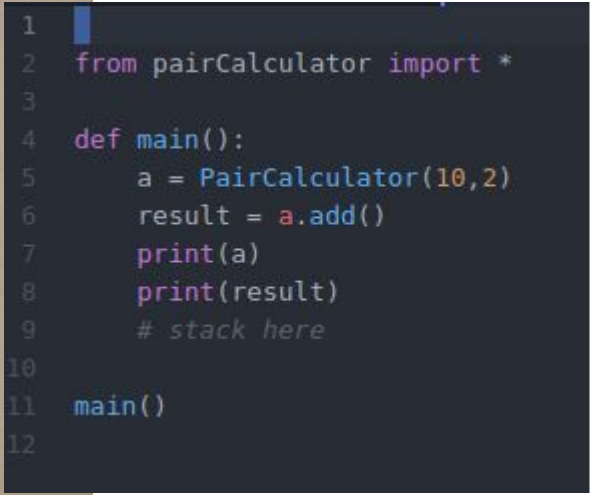
1. self, a, b, self.value1 (self.value2 has not been created yet!)

2. self, a, b, self.value1, self.value2

Classes: function stack

Method calls get their own function frame, same as non-class functions

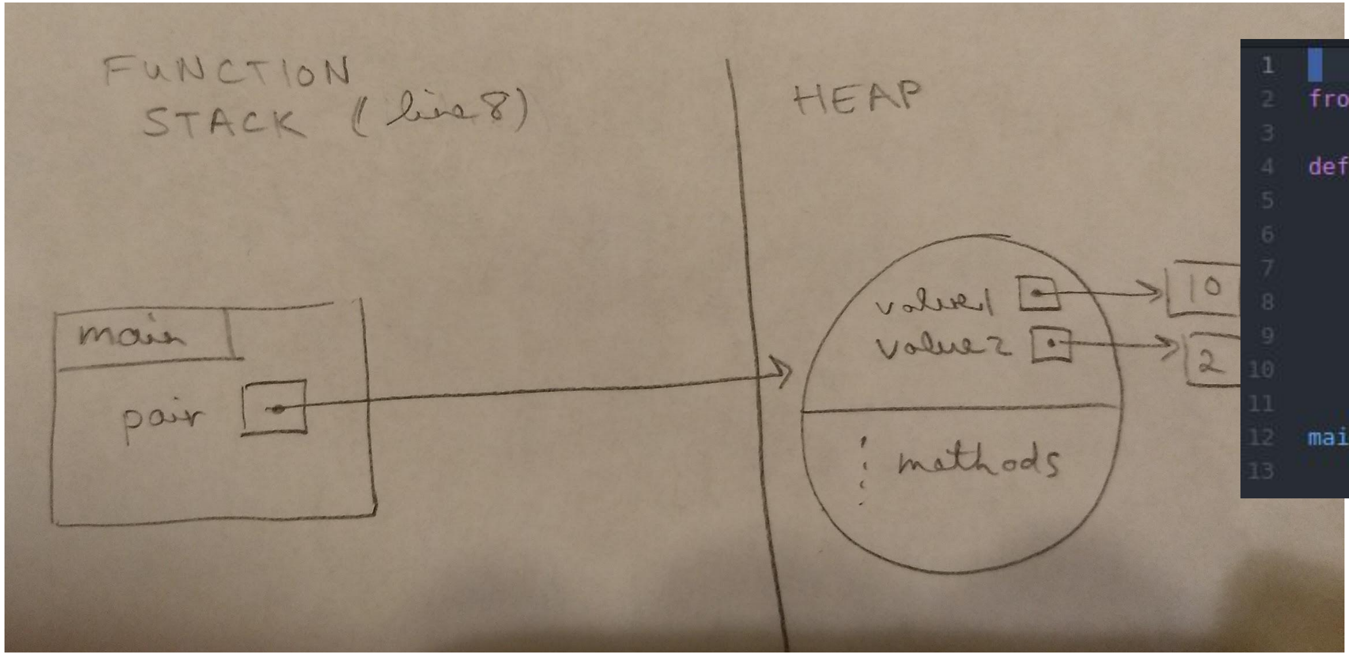


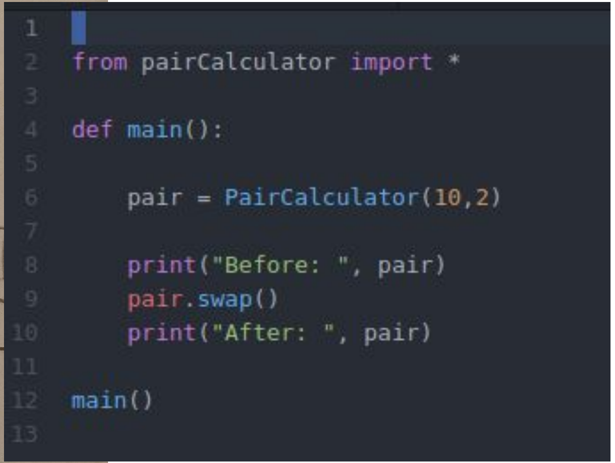


```python

from pairCalculator import *

def main():
    a = PairCalculator(10,2)
    result = a.add()
    print(a)
    print(result)
    # stack here

main()
```

Classes: function stack

Method calls get their own function frame, same as non-class functions

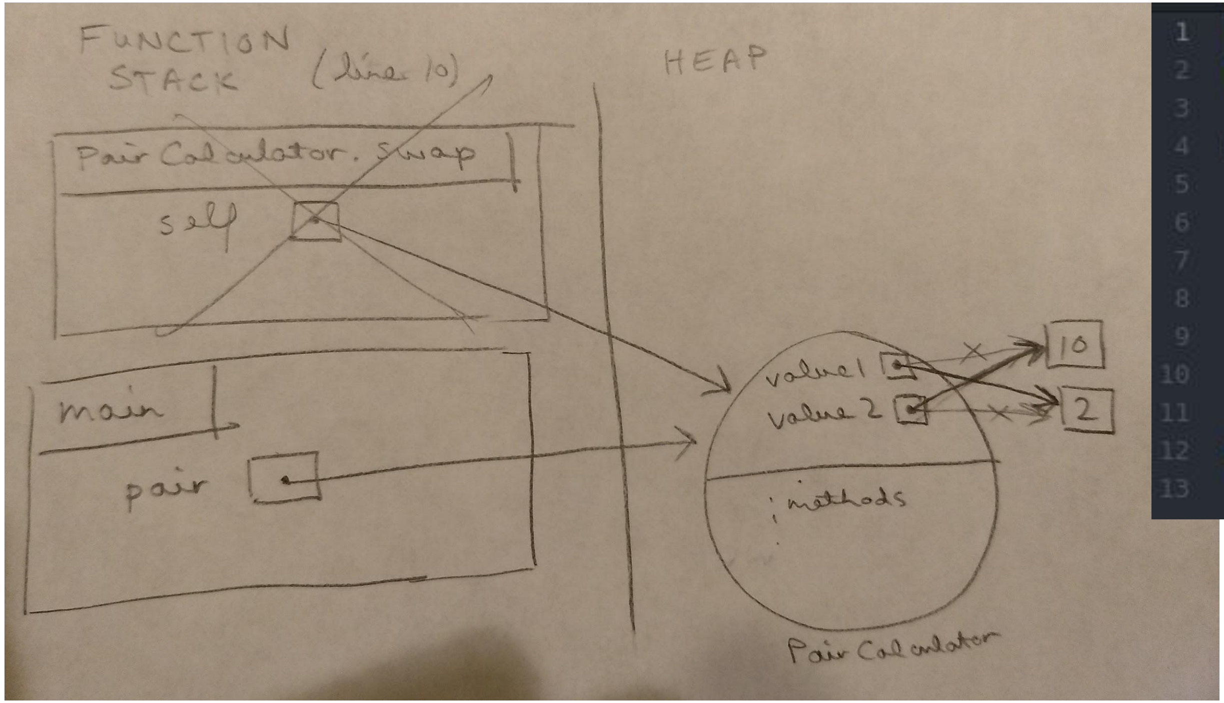


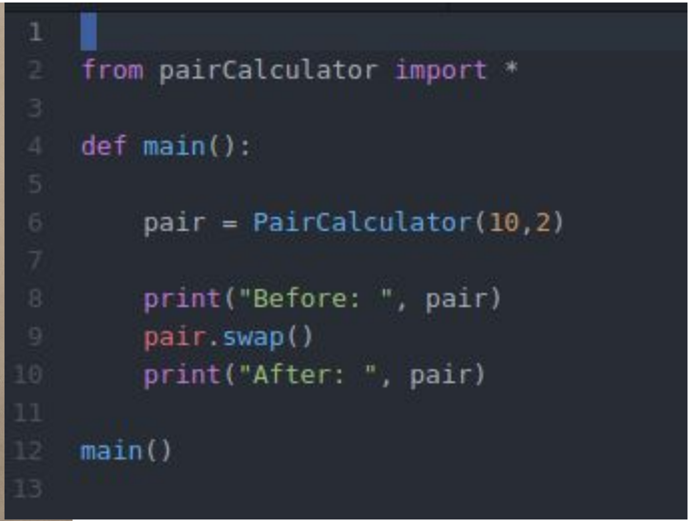


```

from pairCalculator import *

def main():

    pair = PairCalculator(10,2)

    print("Before: ", pair)
    pair.swap()
    print("After: ", pair)

main()

```

Classes: function stack

Method calls get their own function frame, same as non-class functions



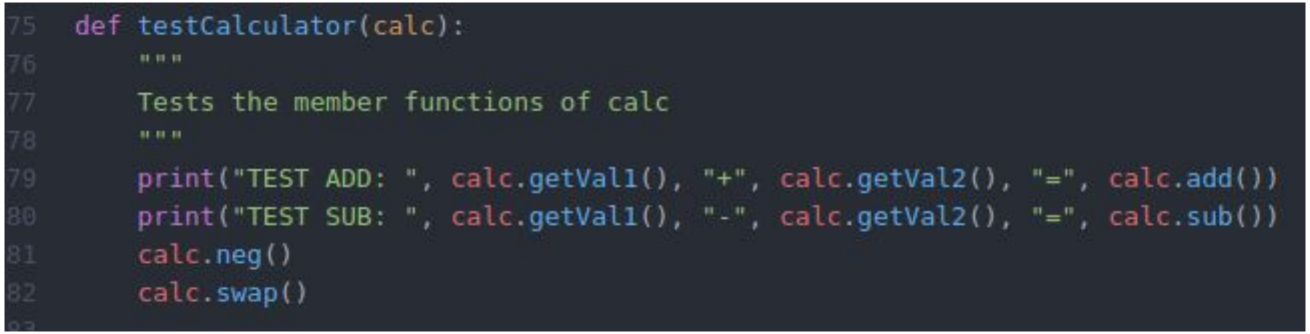

```python

from pairCalculator import *

def main():

    pair = PairCalculator(10,2)

    print("Before: ", pair)
    pair.swap()
    print("After: ", pair)

main()

```

Classes are mutable!

Recall: lists are mutable

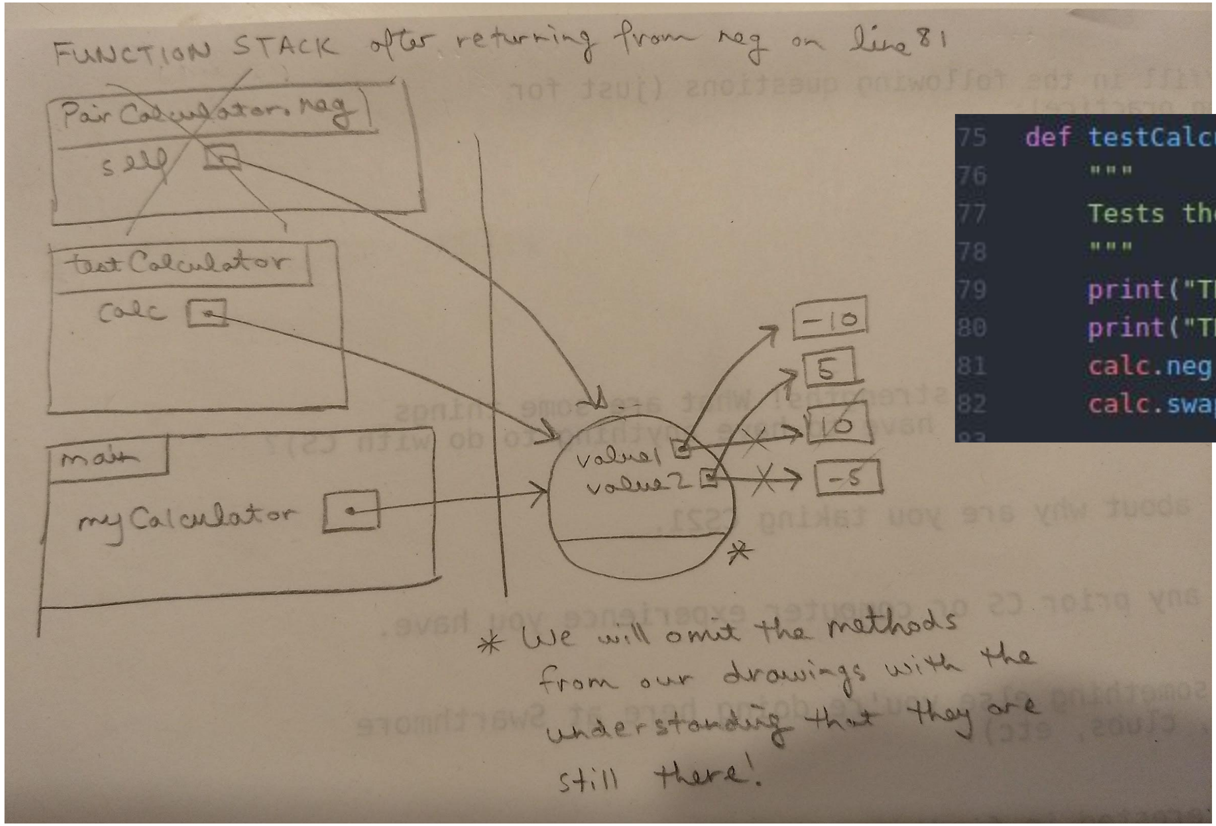
So are classes! e.g. changes to a class inside a function persist after the function returns

Ex: testCalculator() in PairCalculator.py

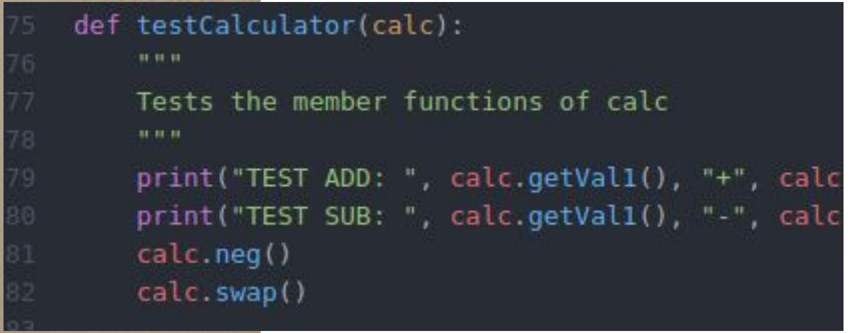


```
def testCalculator(calc):
    """
    Tests the member functions of calc
    """
    print("TEST ADD: ", calc.getVal1(), "+", calc.getVal2(), "=", calc.add())
    print("TEST SUB: ", calc.getVal1(), "-", calc.getVal2(), "=", calc.sub())
    calc.neg()
    calc.swap()
```

Classes are mutable!



* We will omit the methods from our drawings with the understanding that they are still there!



```
75  def testCalculator(calc):
76      """
77      Tests the member functions of calc
78      """
79      print("TEST ADD: ", calc.getVal1(), "+", calc
80      print("TEST SUB: ", calc.getVal1(), "-", calc
81      calc.neg()
82      calc.swap()
```

Classes are mutable!

Recall: lists are mutable

So are classes! e.g. changes to a class inside a function persist after the function returns

Ex: testCalculator() in PairCalculator.py