61A Lecture 3

Friday, September 5

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- Project 1 due Wednesday 9/17 at 11:59pm.

Multiple Environments

Life Cycle of a User-Defined Function

What happens?

Def statement:

Call expression:

Calling/Applying:

Life Cycle of a User-Defined Function

What happens?

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```
>>> def square( x ):
        return mul(x, x)
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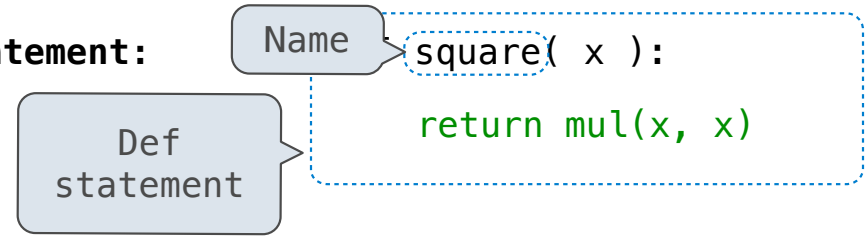

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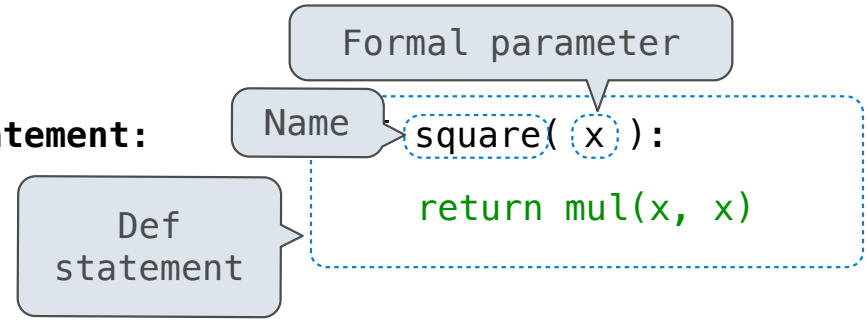

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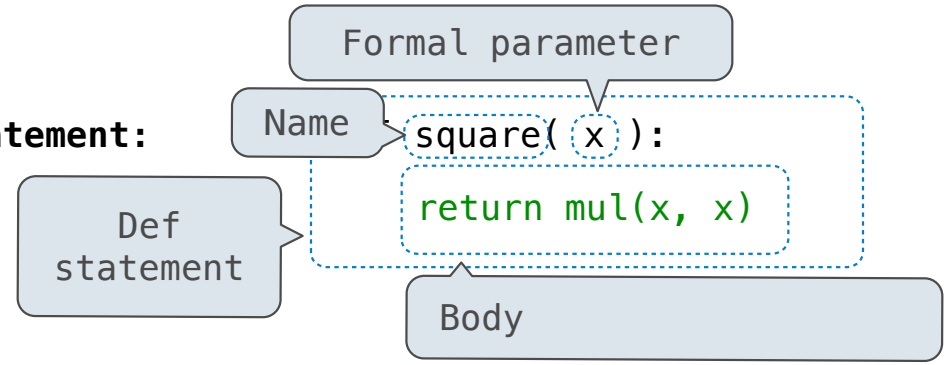

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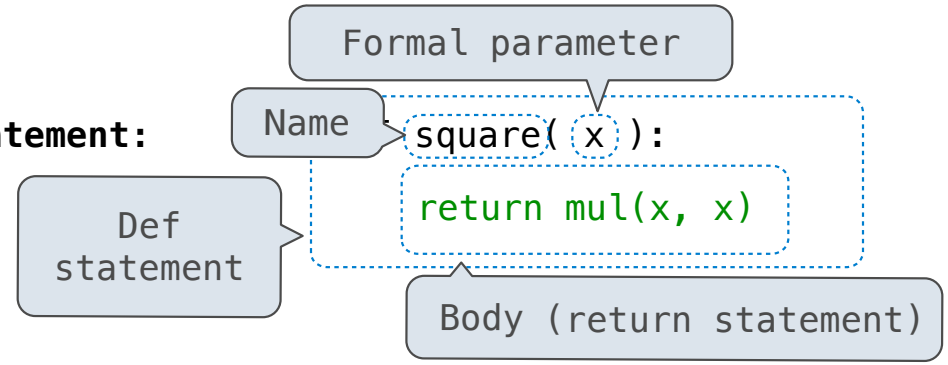

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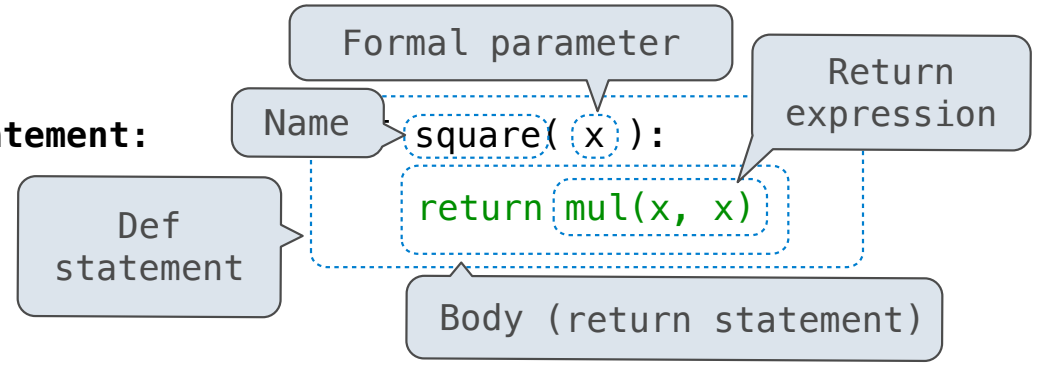

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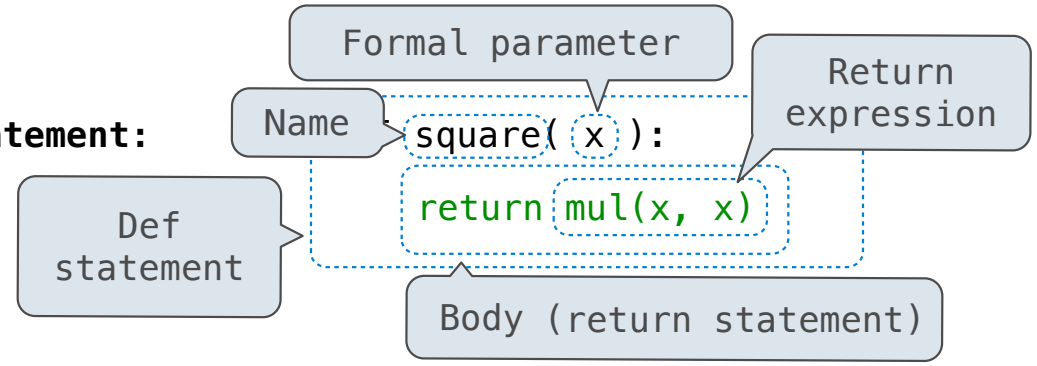

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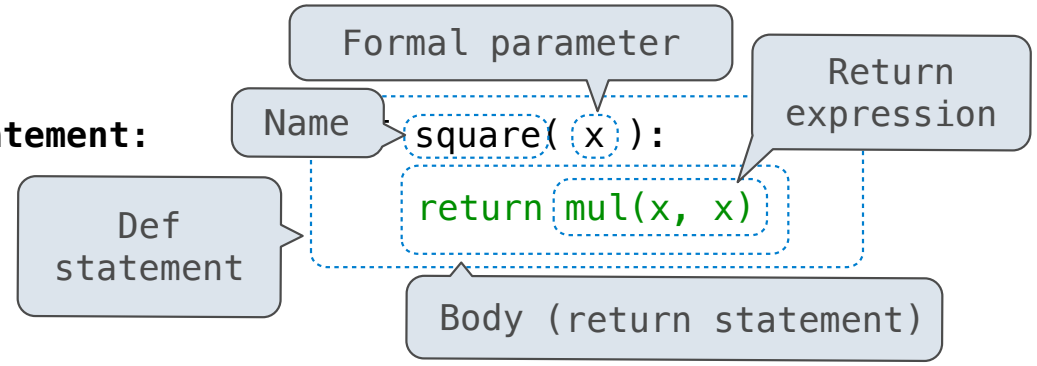

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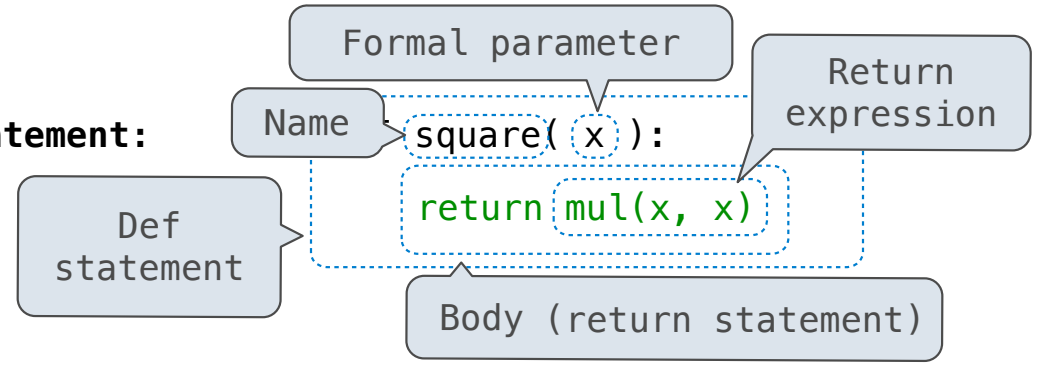

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Call expression: square(2+2)

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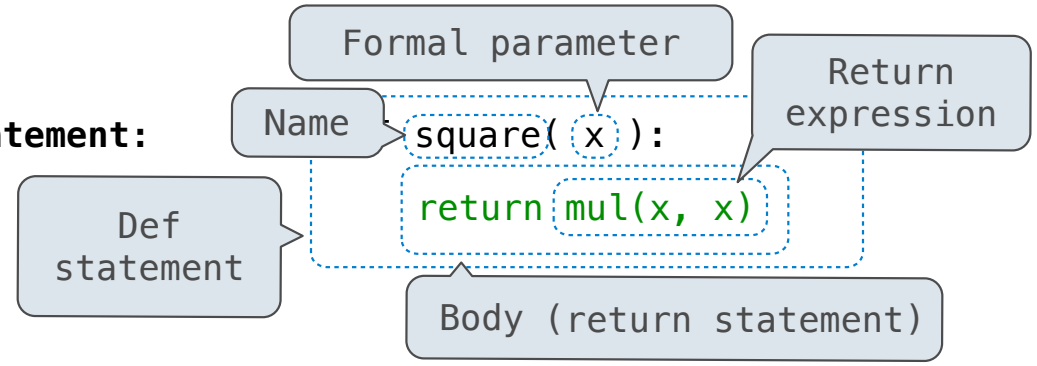

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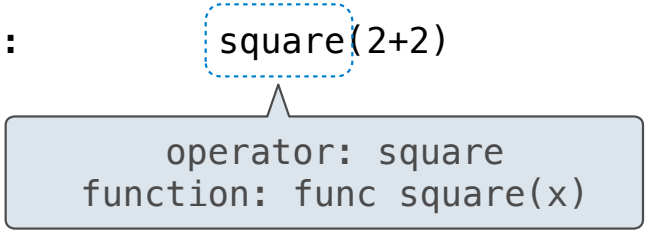

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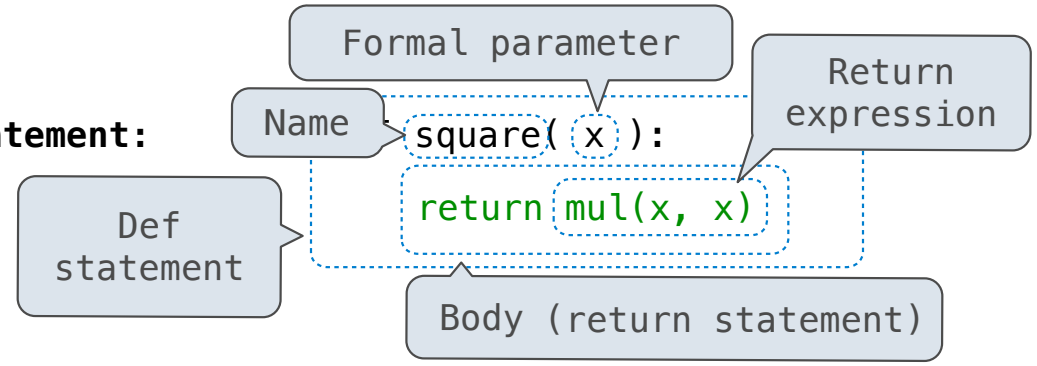

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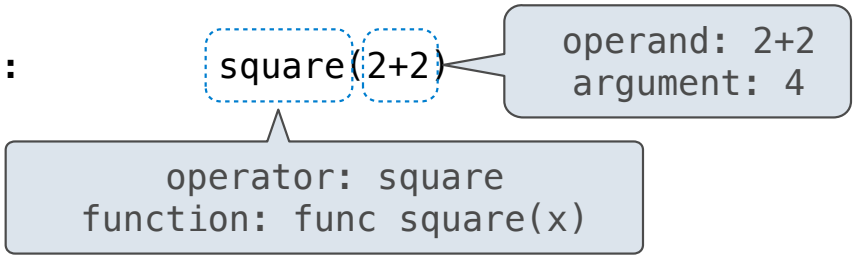

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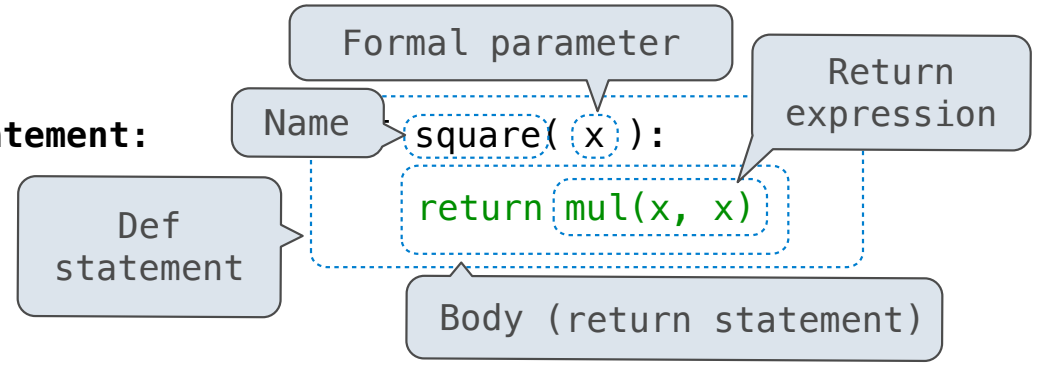

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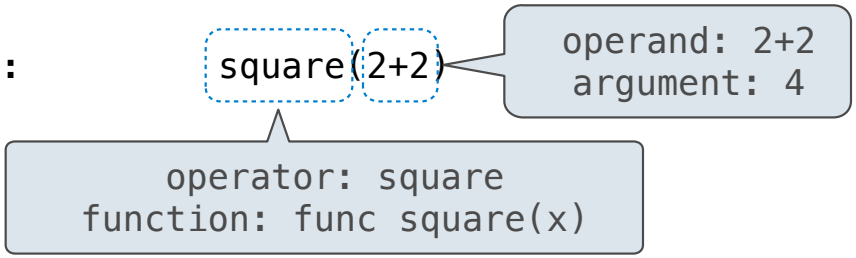

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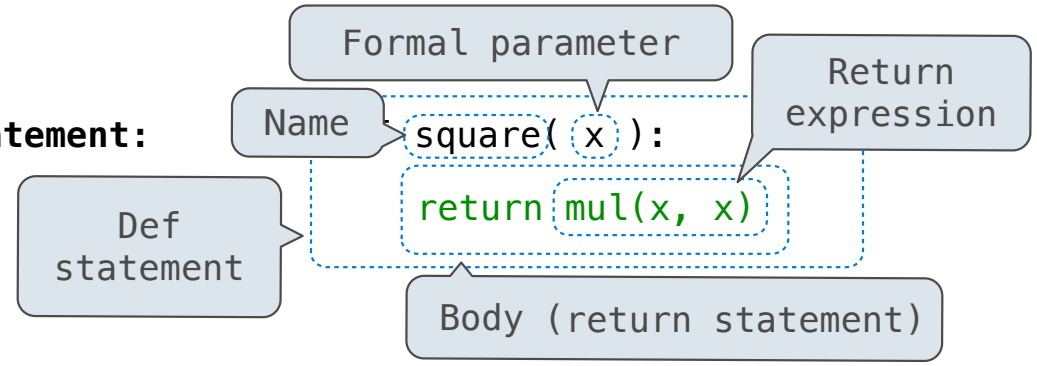

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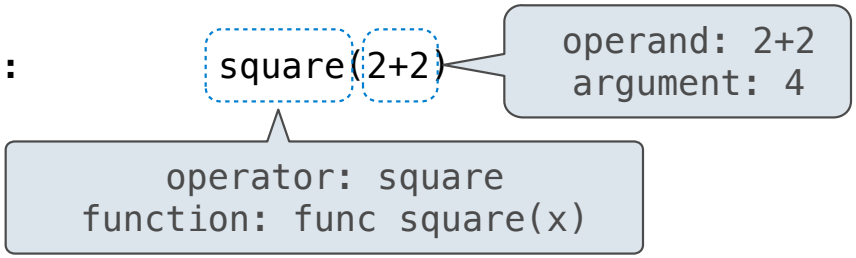

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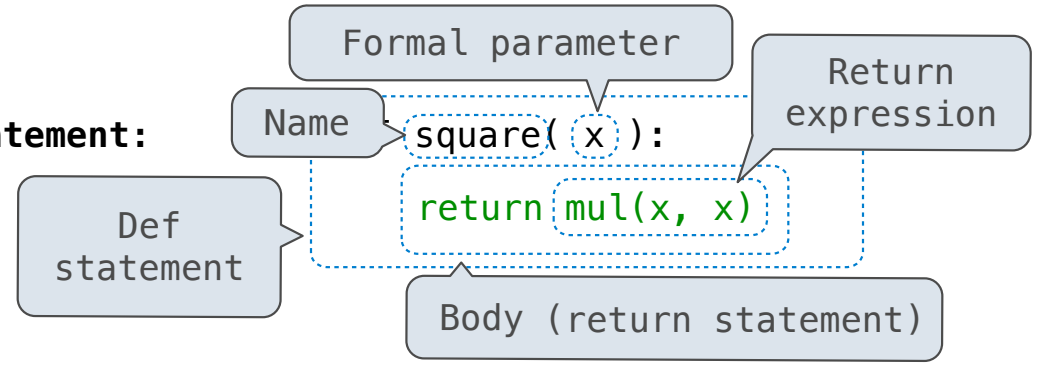

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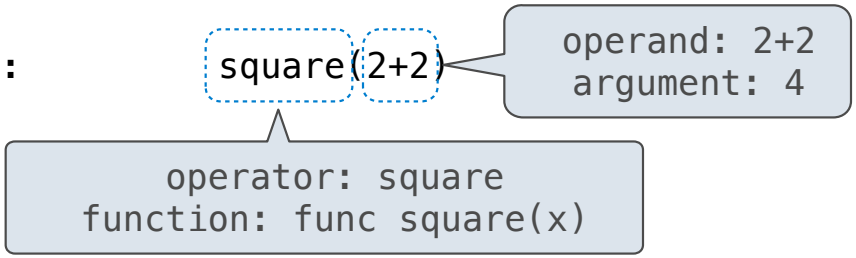

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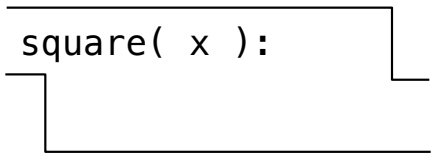

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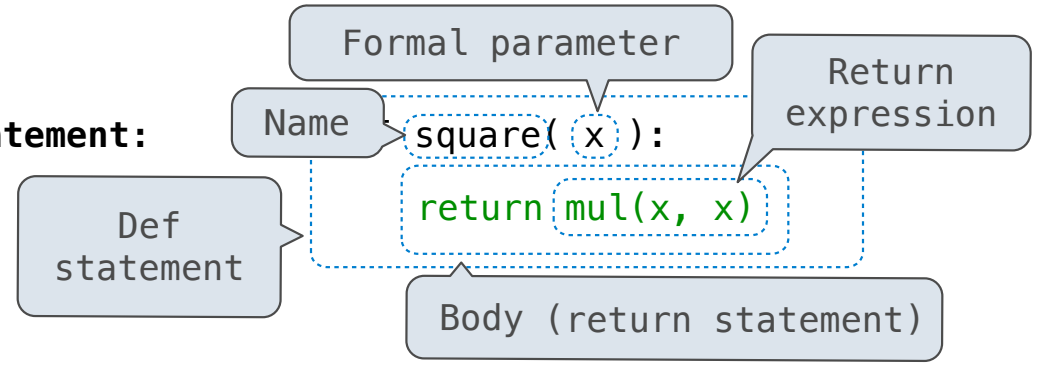

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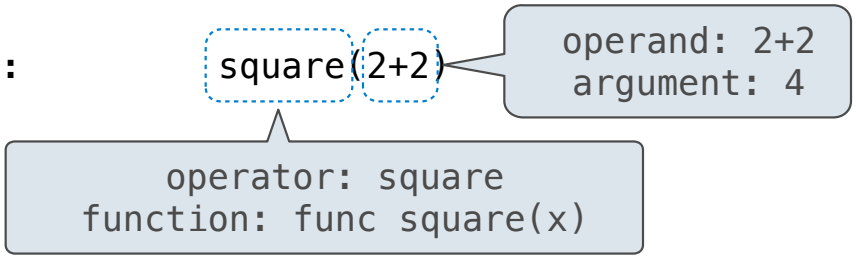

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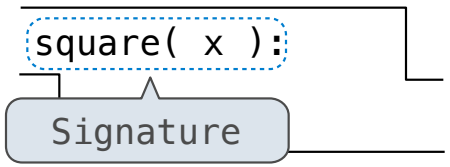

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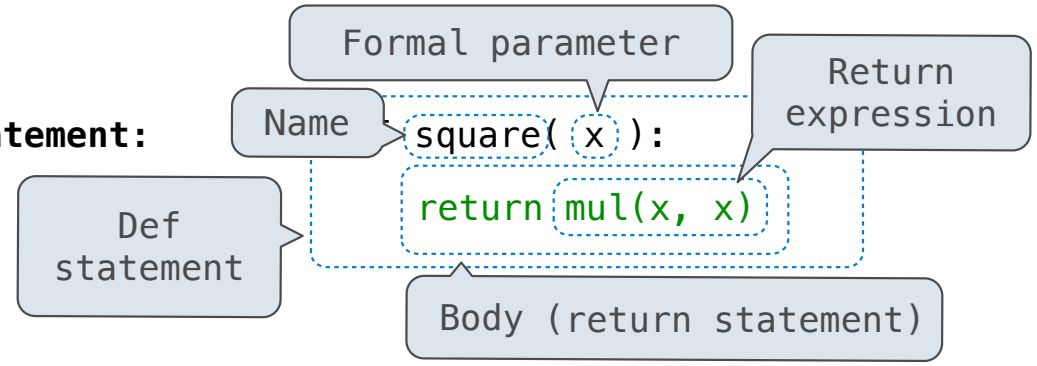

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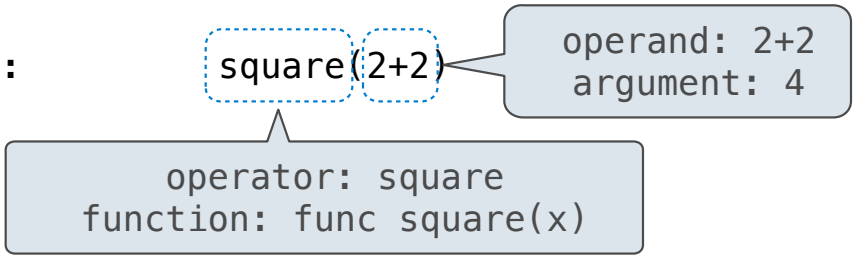

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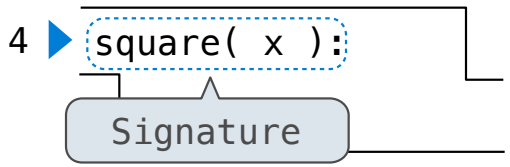

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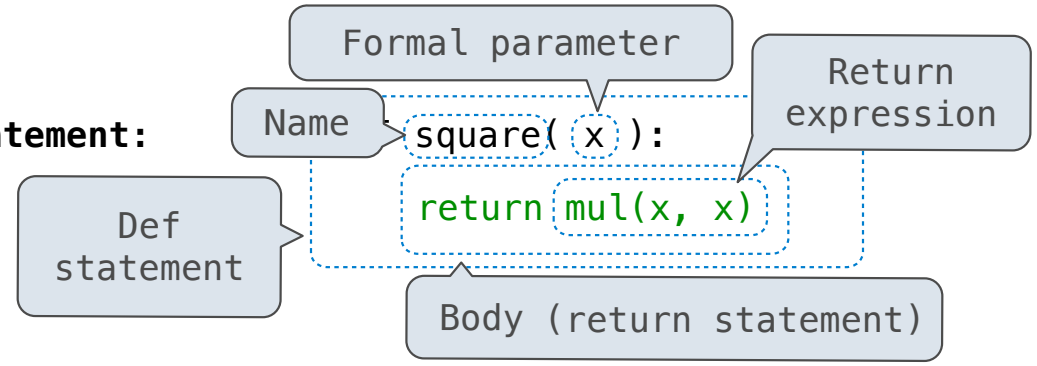

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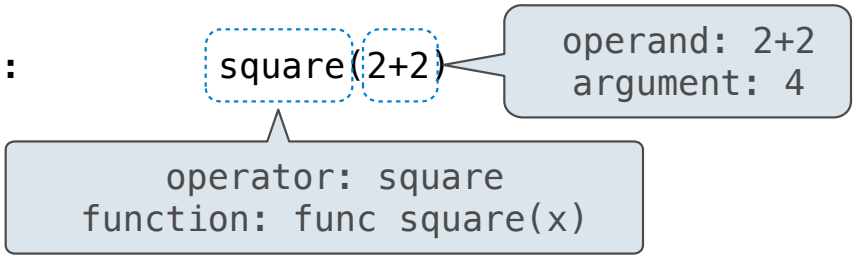

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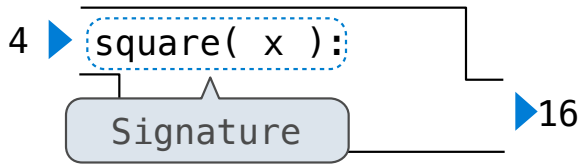

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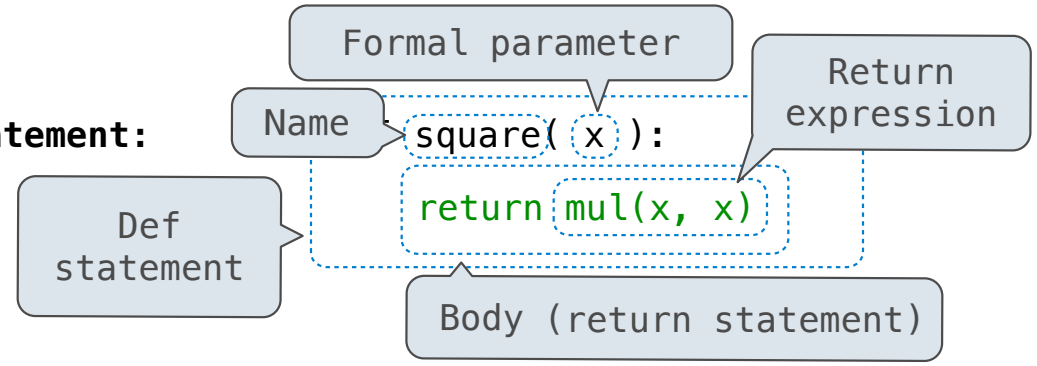

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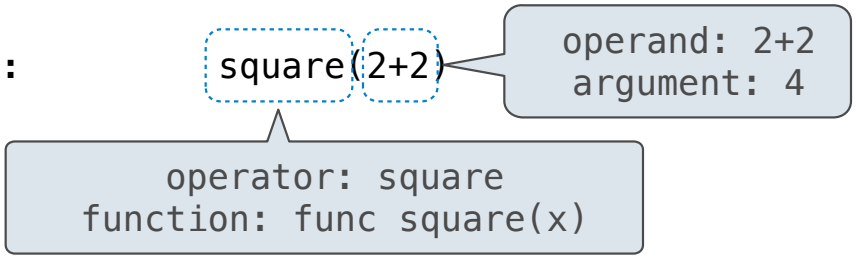

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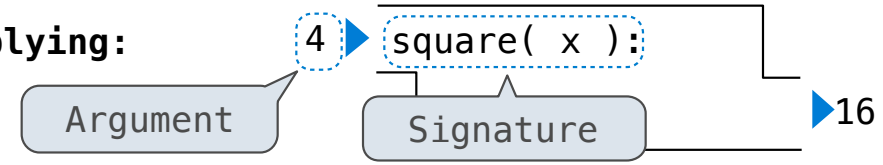

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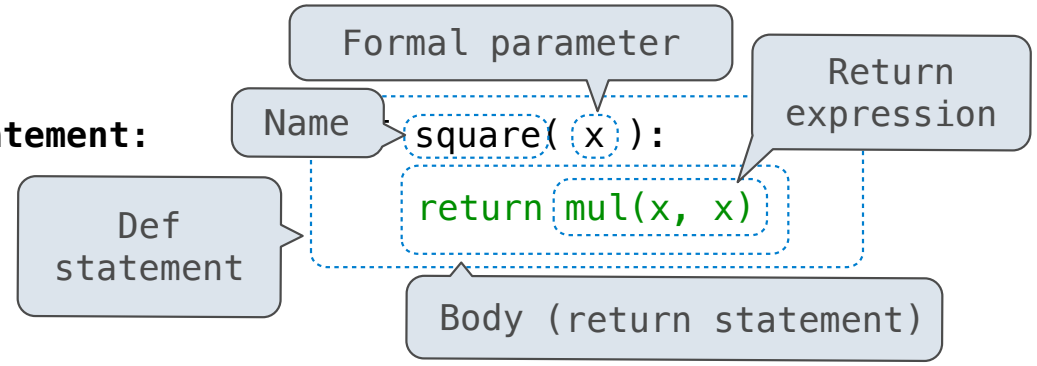

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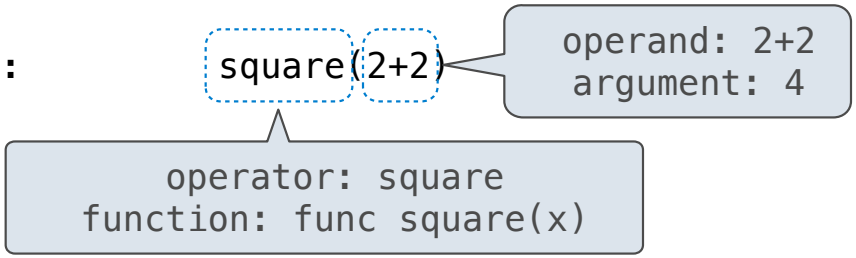

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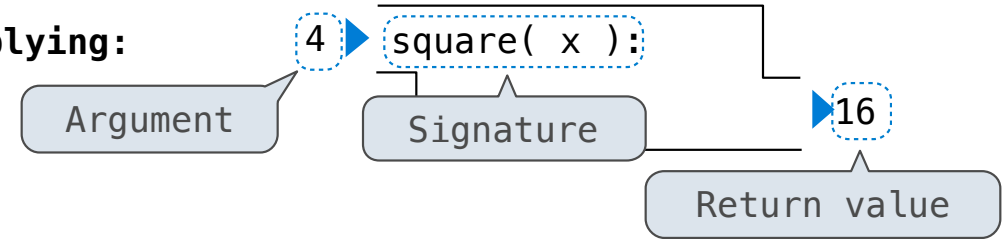

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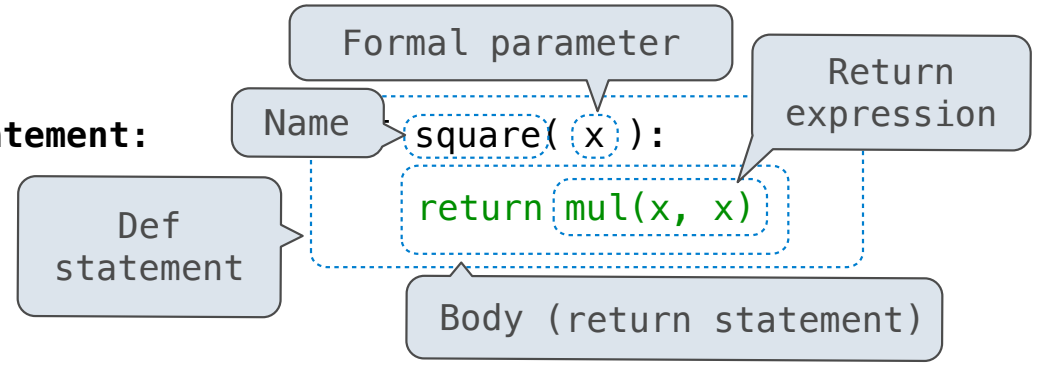

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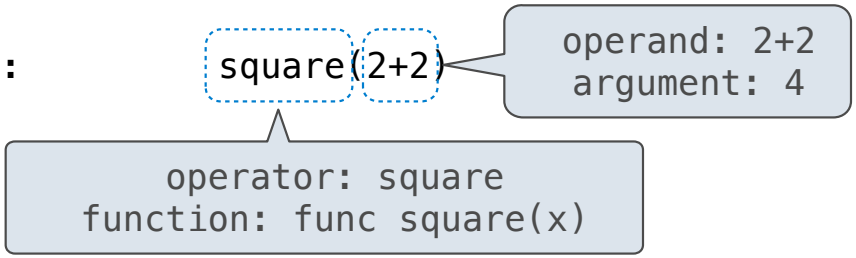

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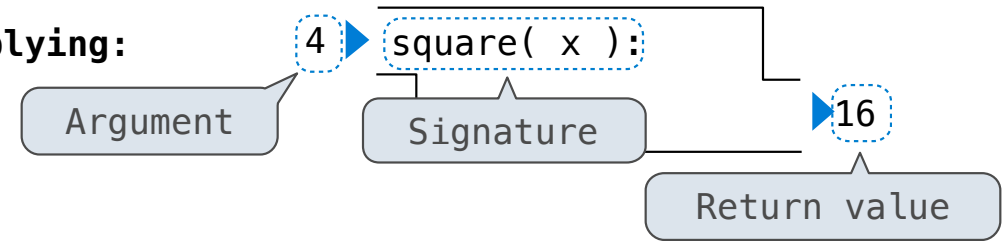

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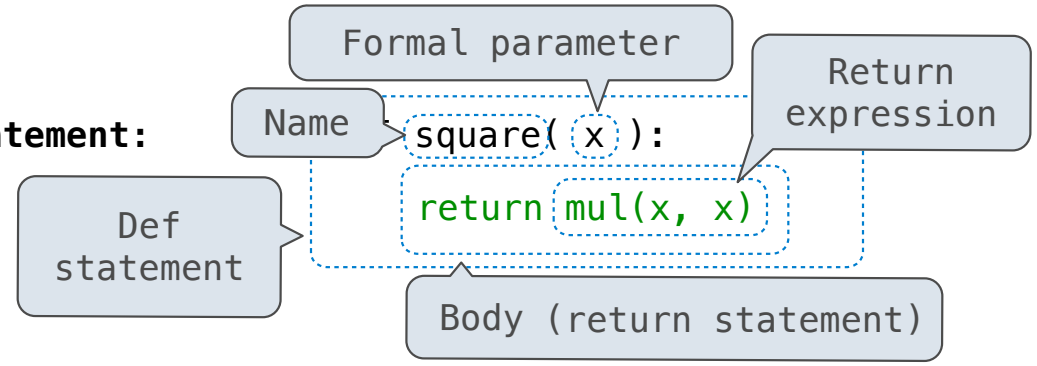

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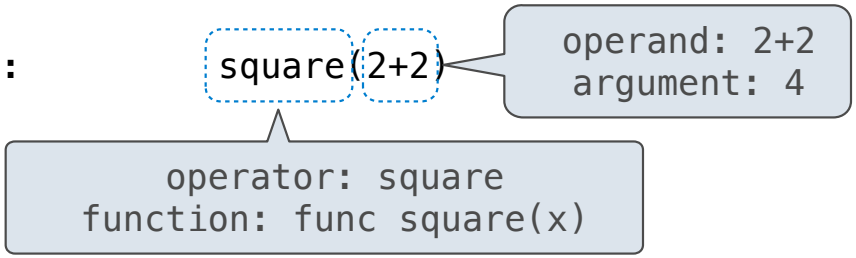

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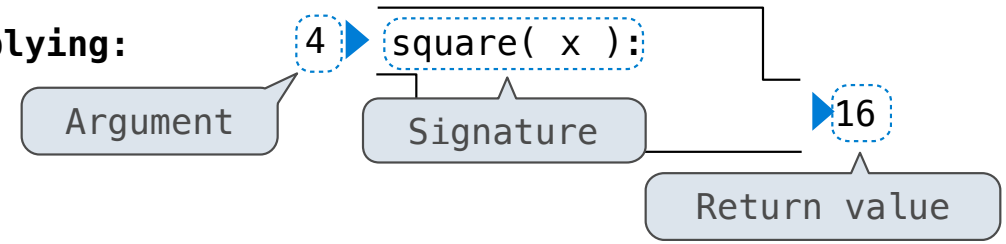

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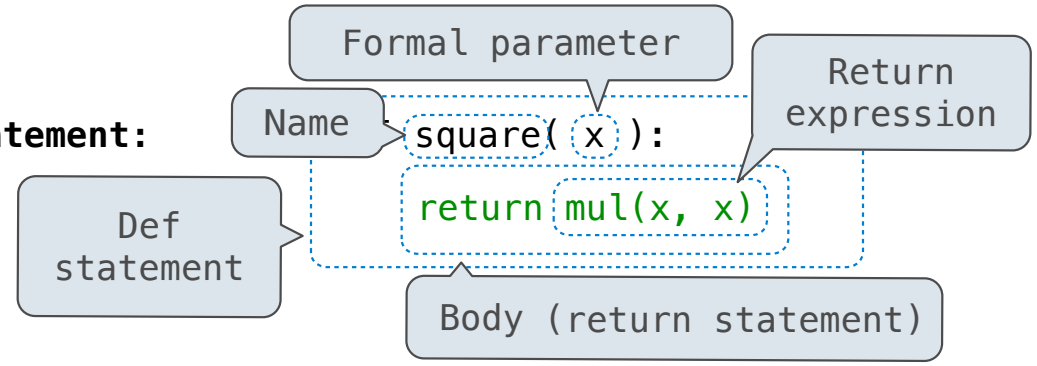
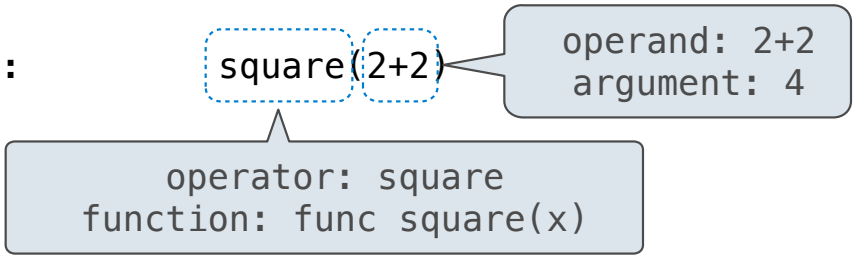
Life Cycle of a User-Defined Function

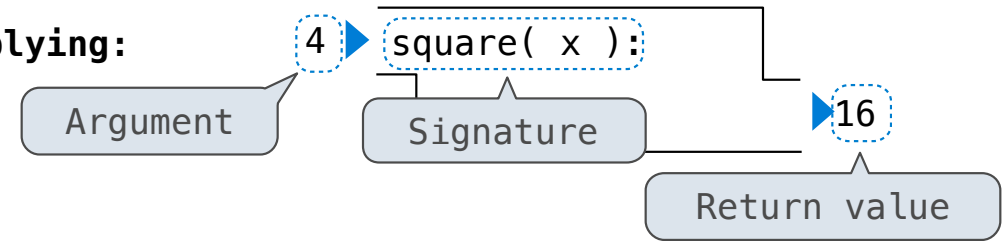
Def statement:



Call expression:



Calling/Applying:



What happens?

A new function is created!

Name bound to that function in the current frame

Operator & operands evaluated

Function (value of operator) called on arguments (values of operands)

A new frame is created!

Parameters bound to arguments

Body is executed in that new environment

Multiple Environments in One Diagram!

```
1 from operator import mul
2 def square(x):
3     return mul(x, x)
4 square(square(3))
```

Interactive Diagram

Multiple Environments in One Diagram!

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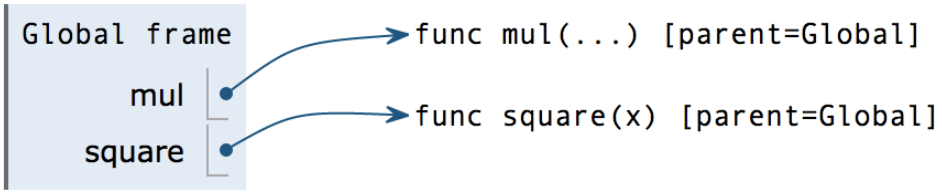

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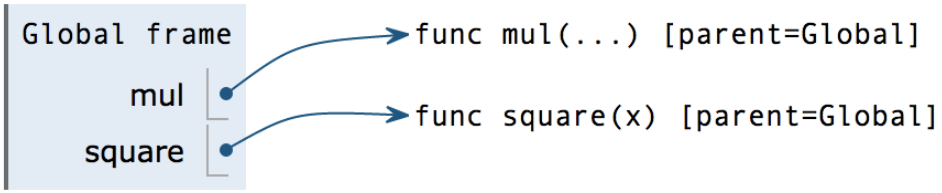


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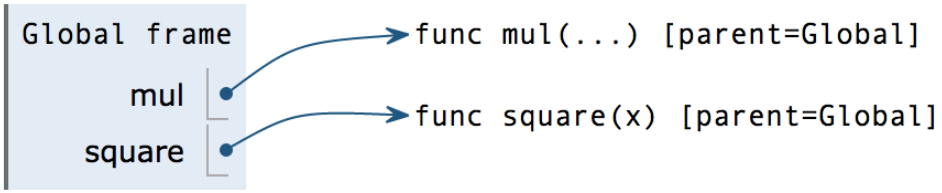

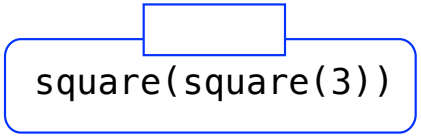

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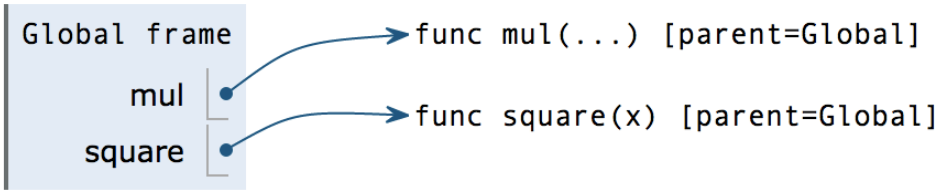

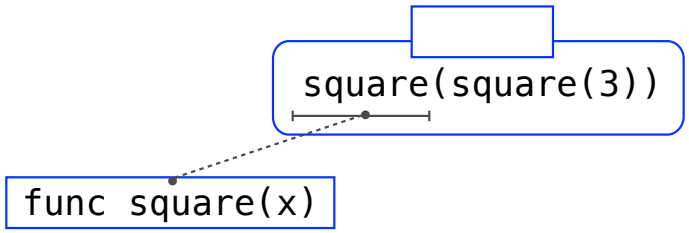

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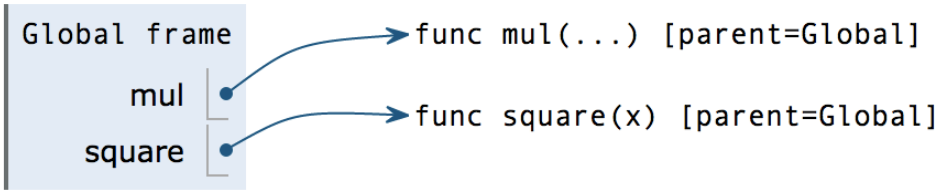

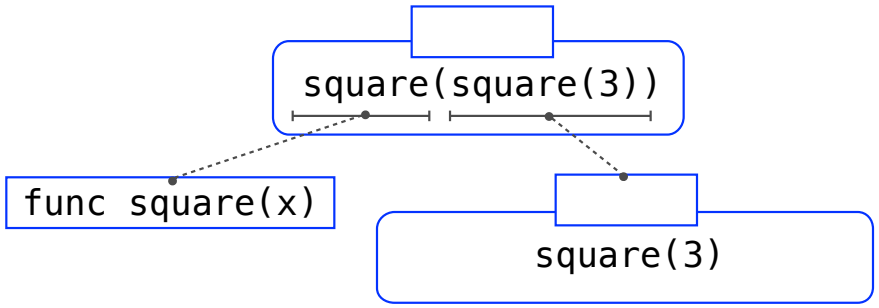

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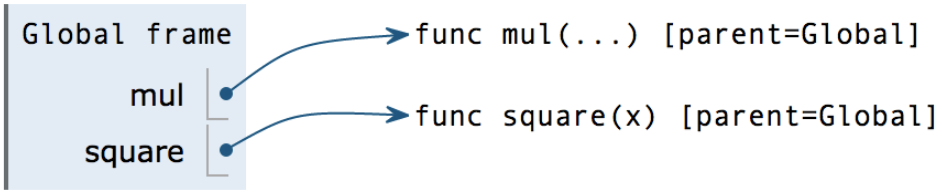

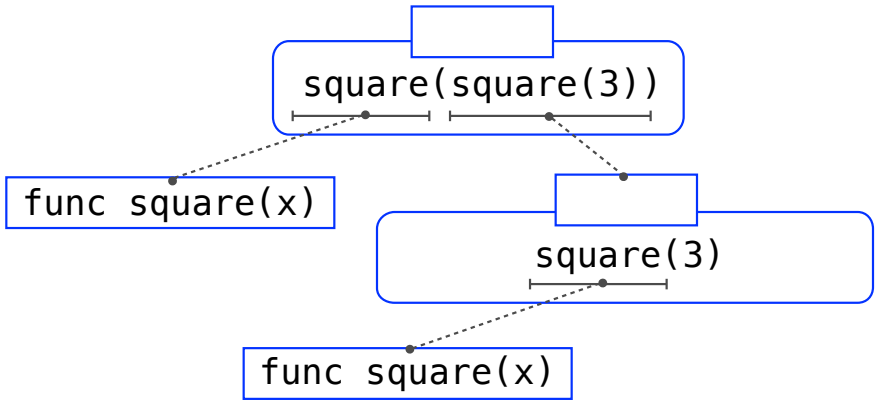

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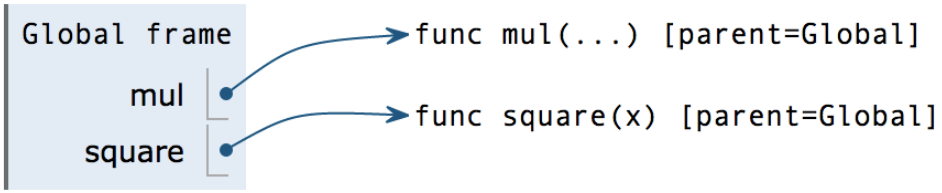

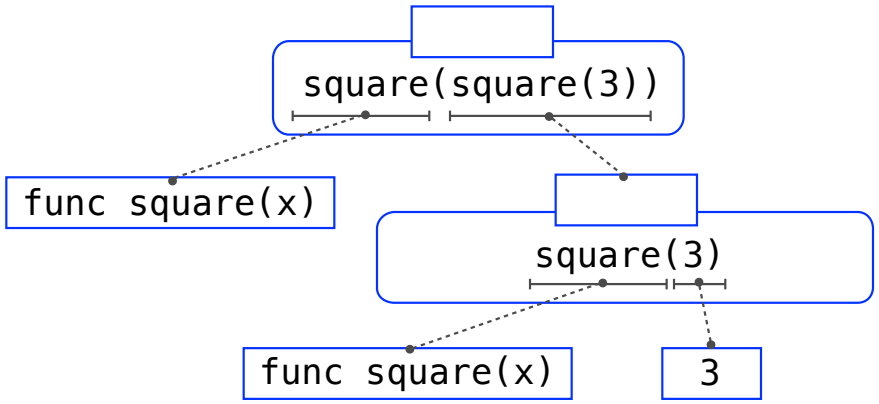

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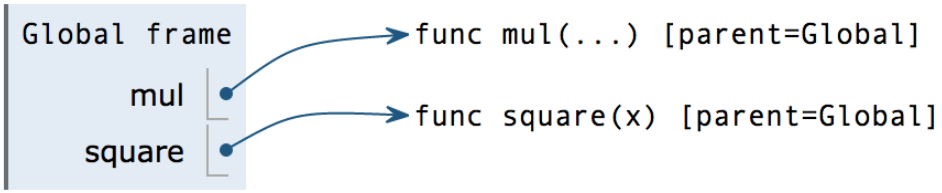

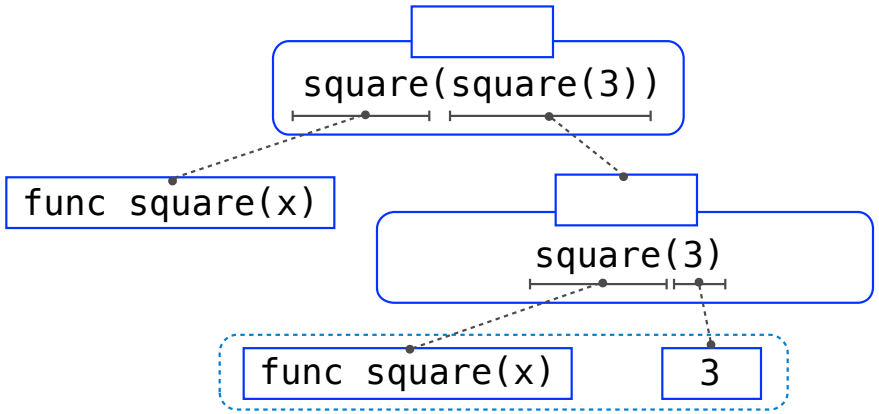

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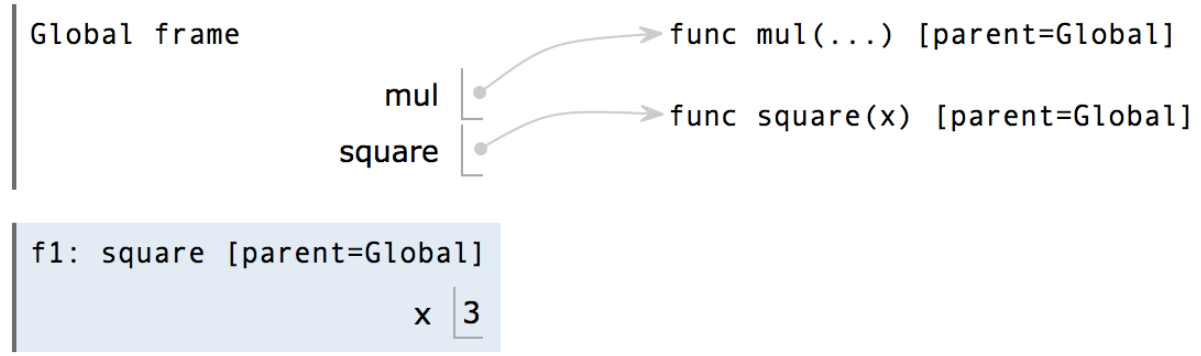

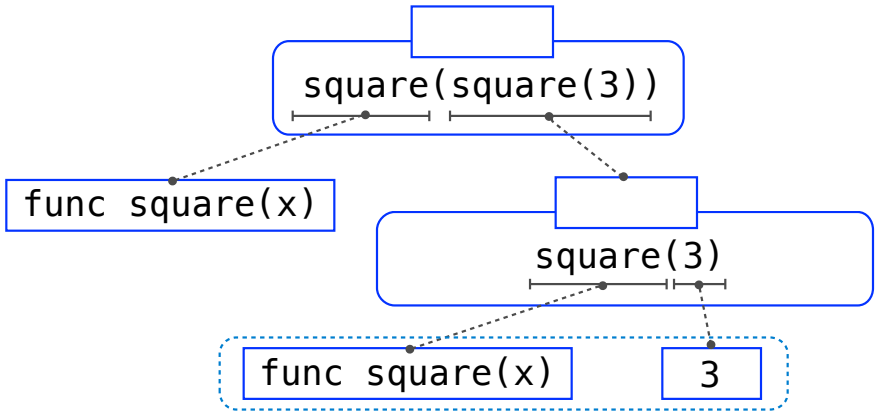

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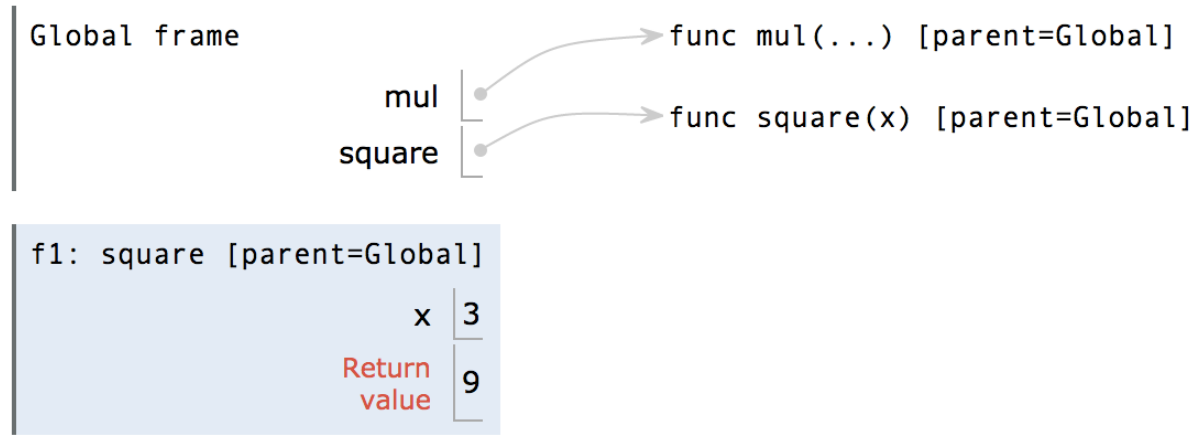

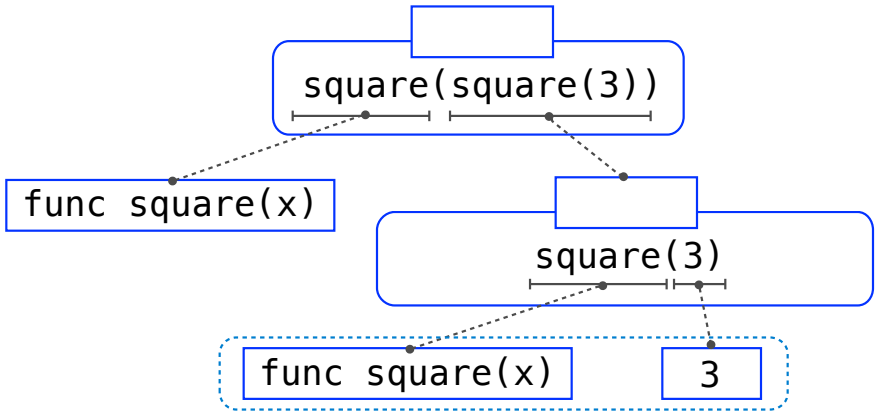

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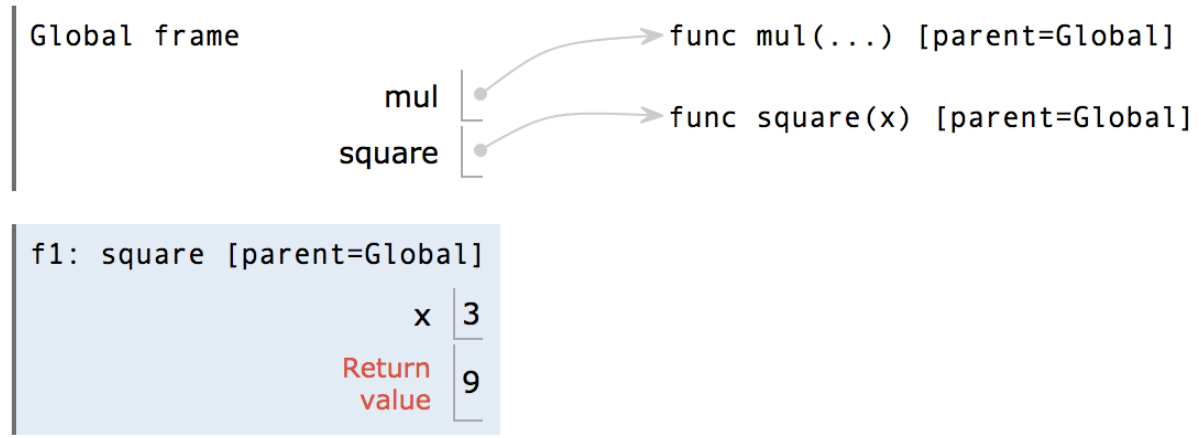

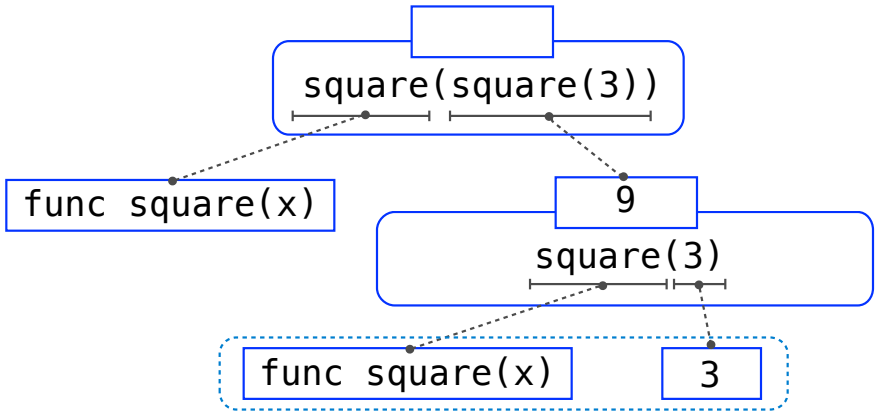

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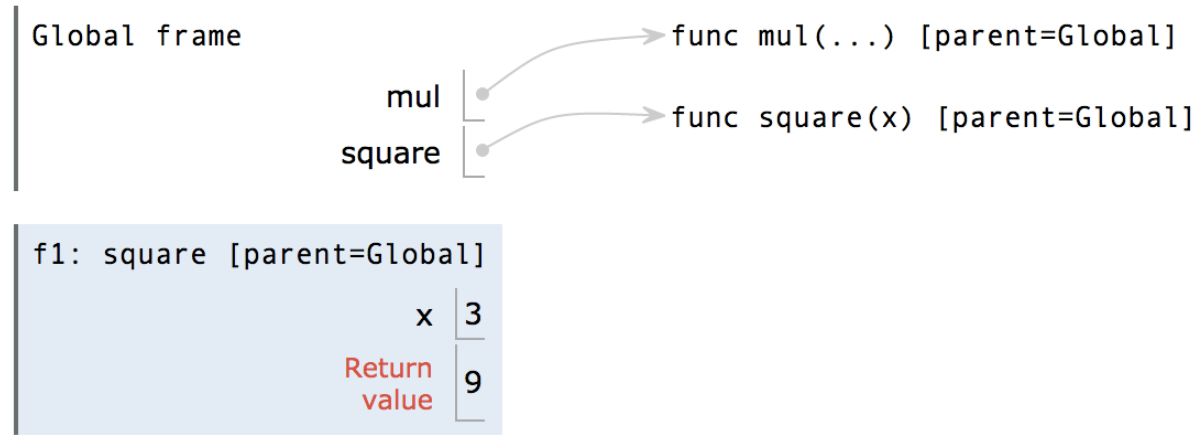

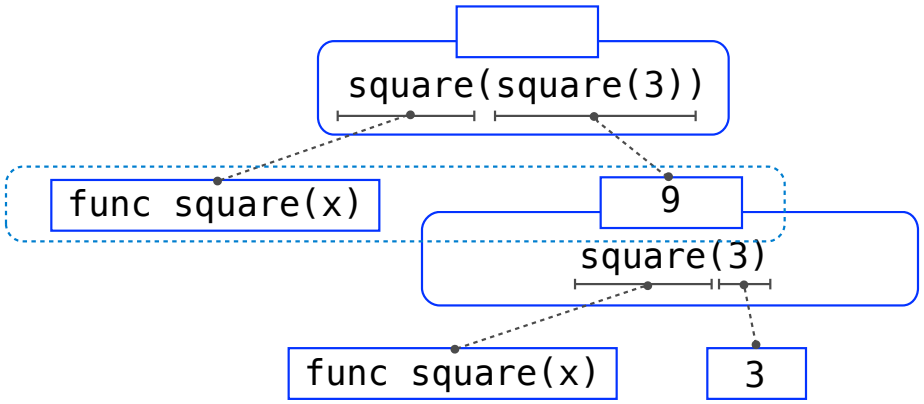

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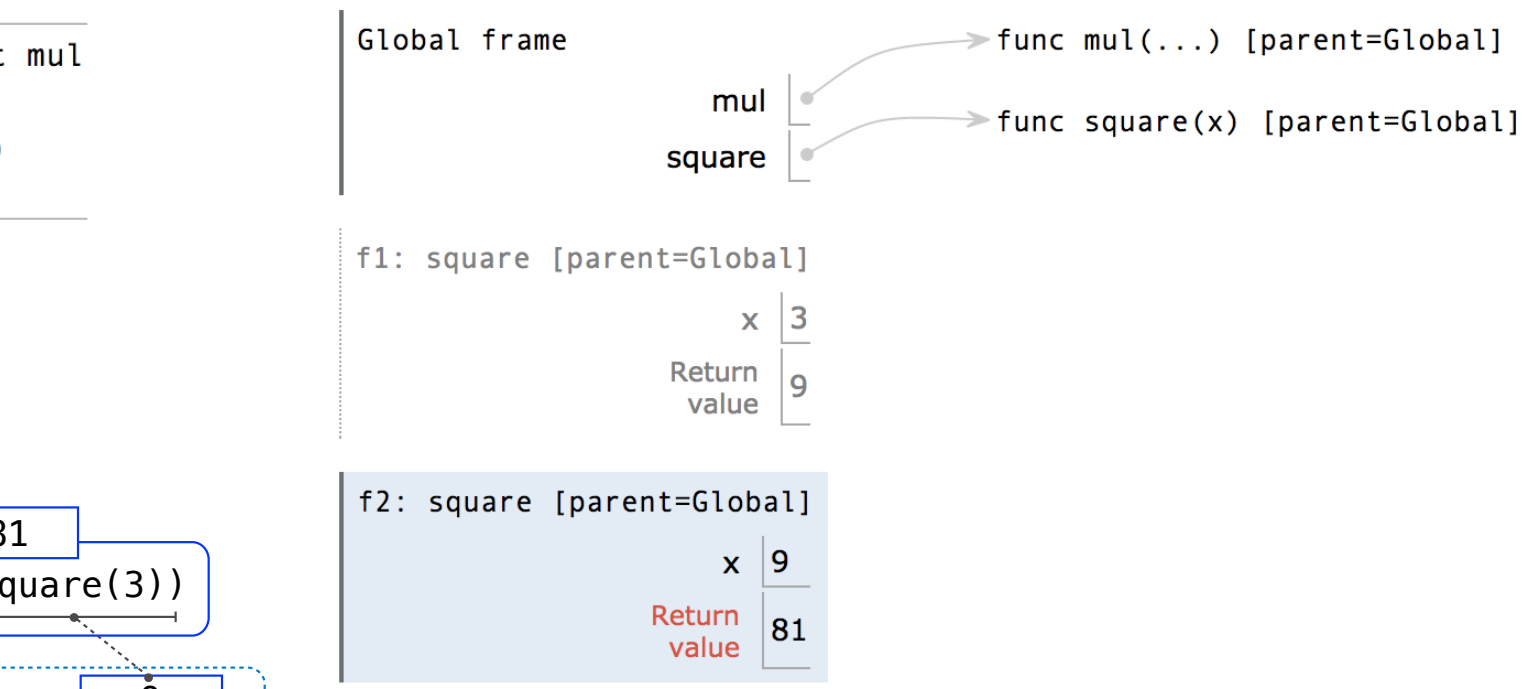

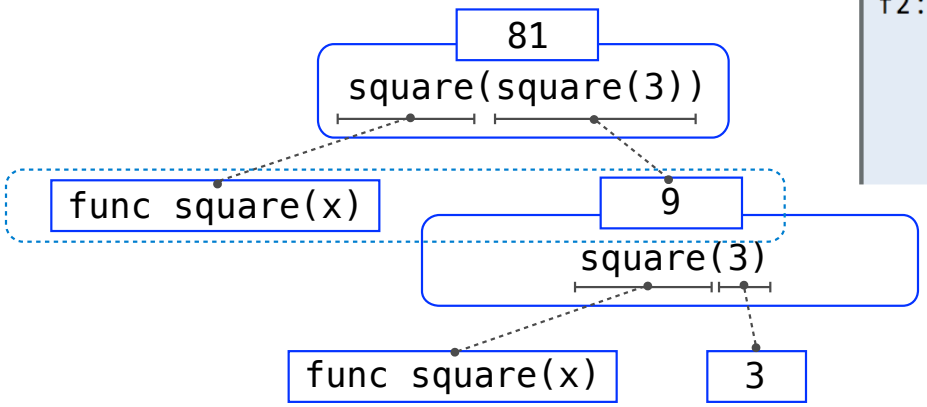

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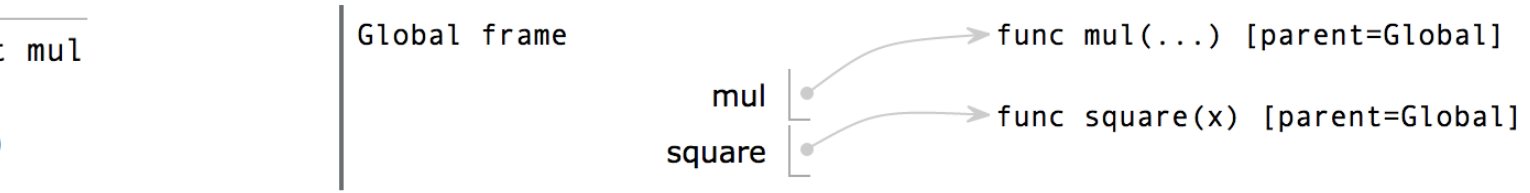

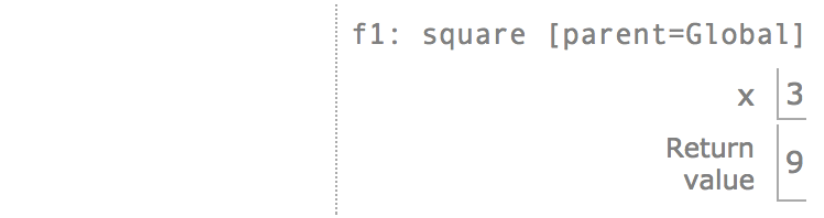

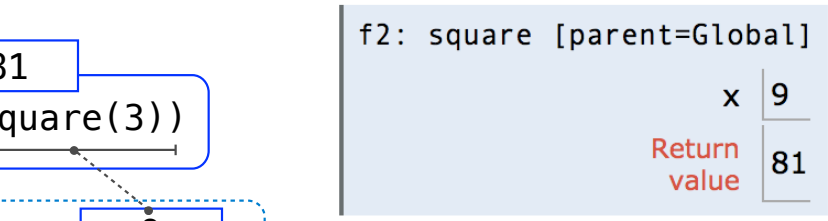

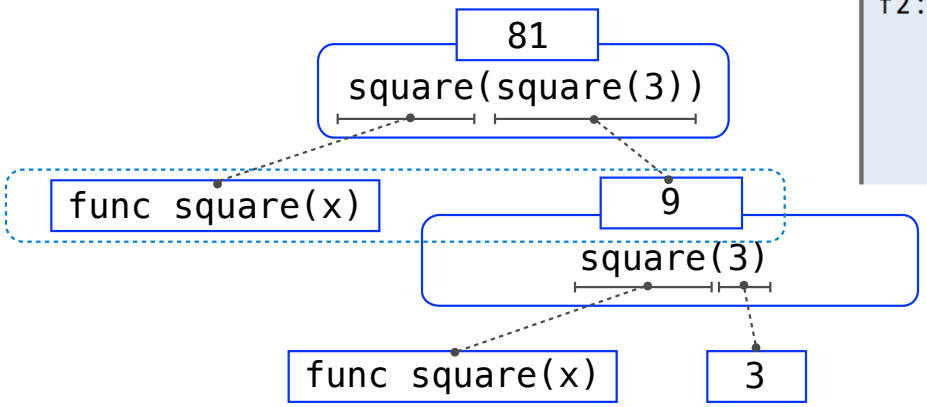

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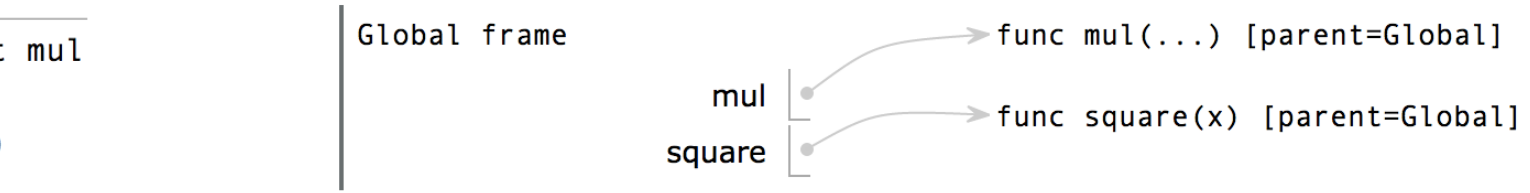

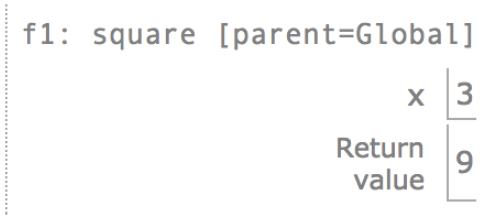

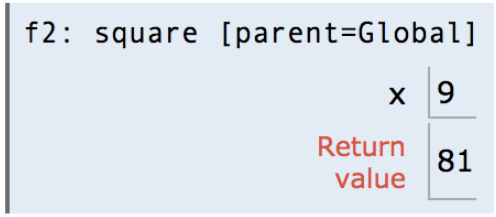

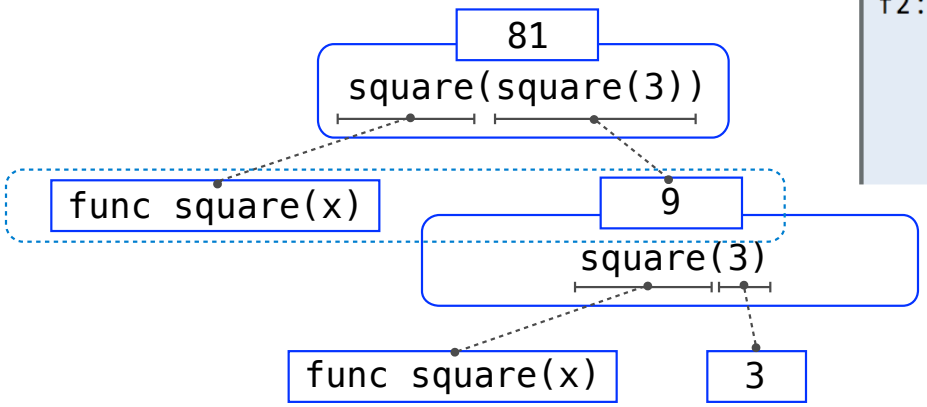

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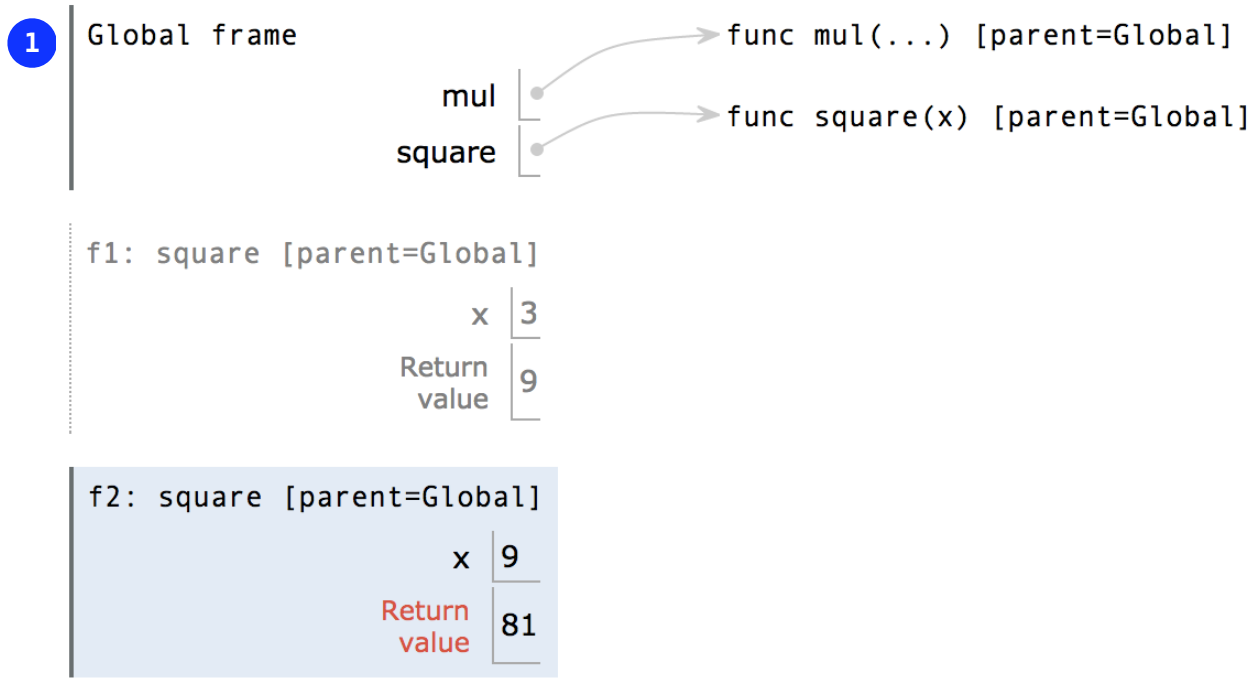

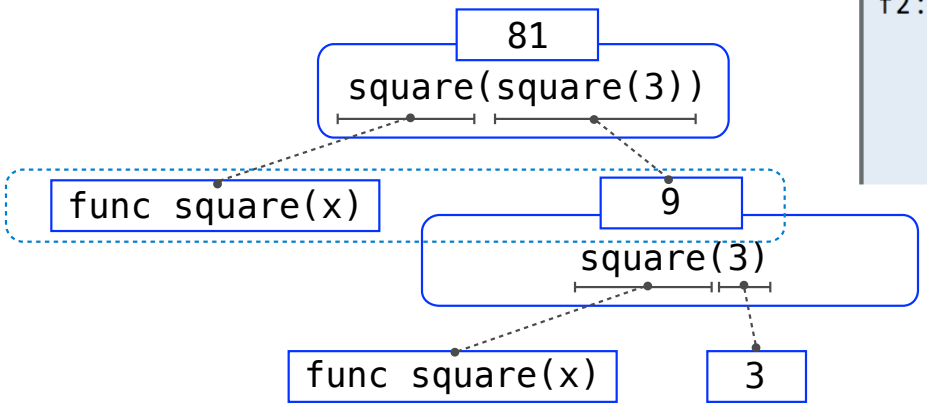

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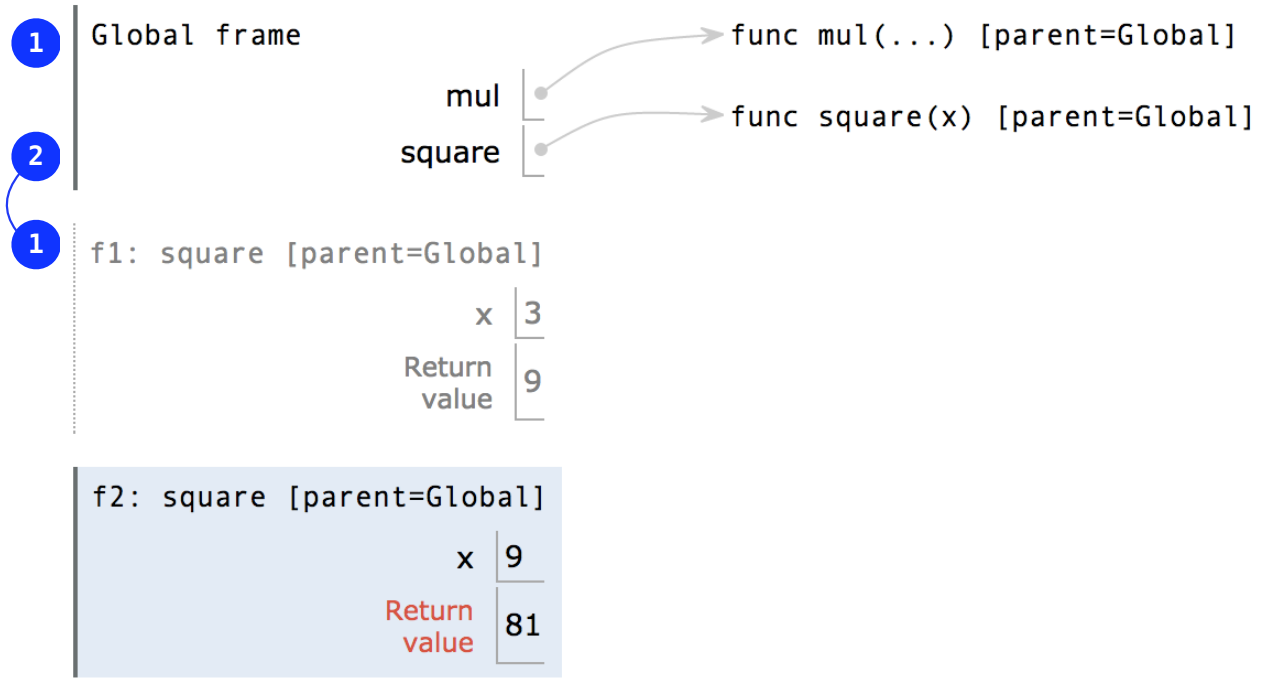

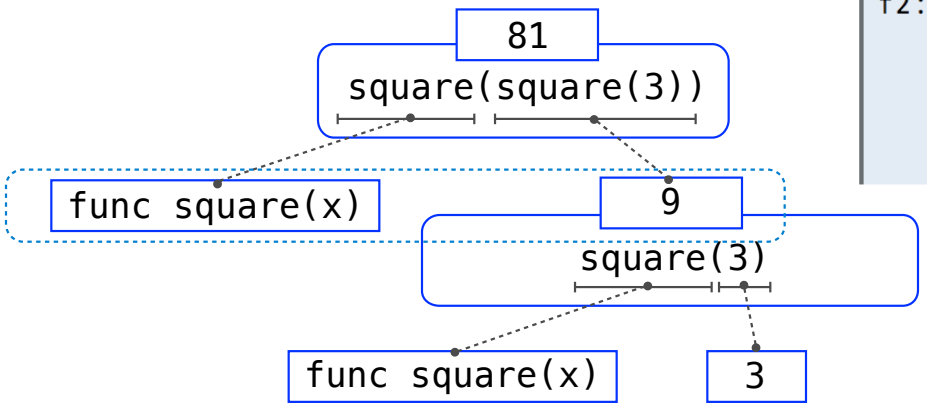

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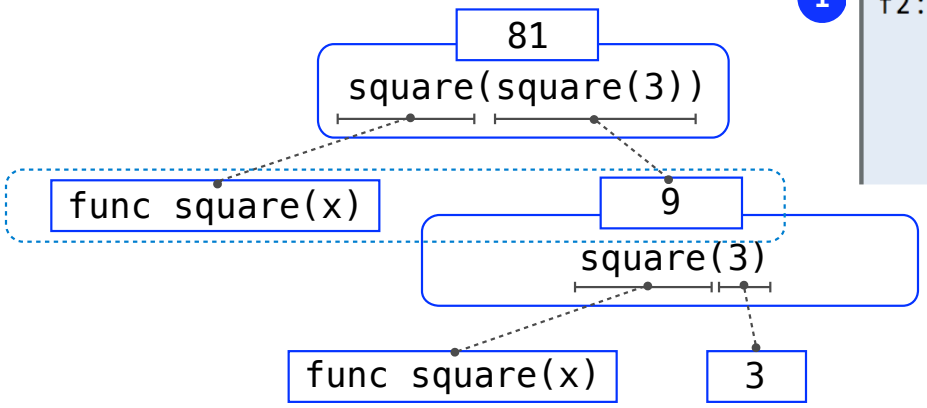

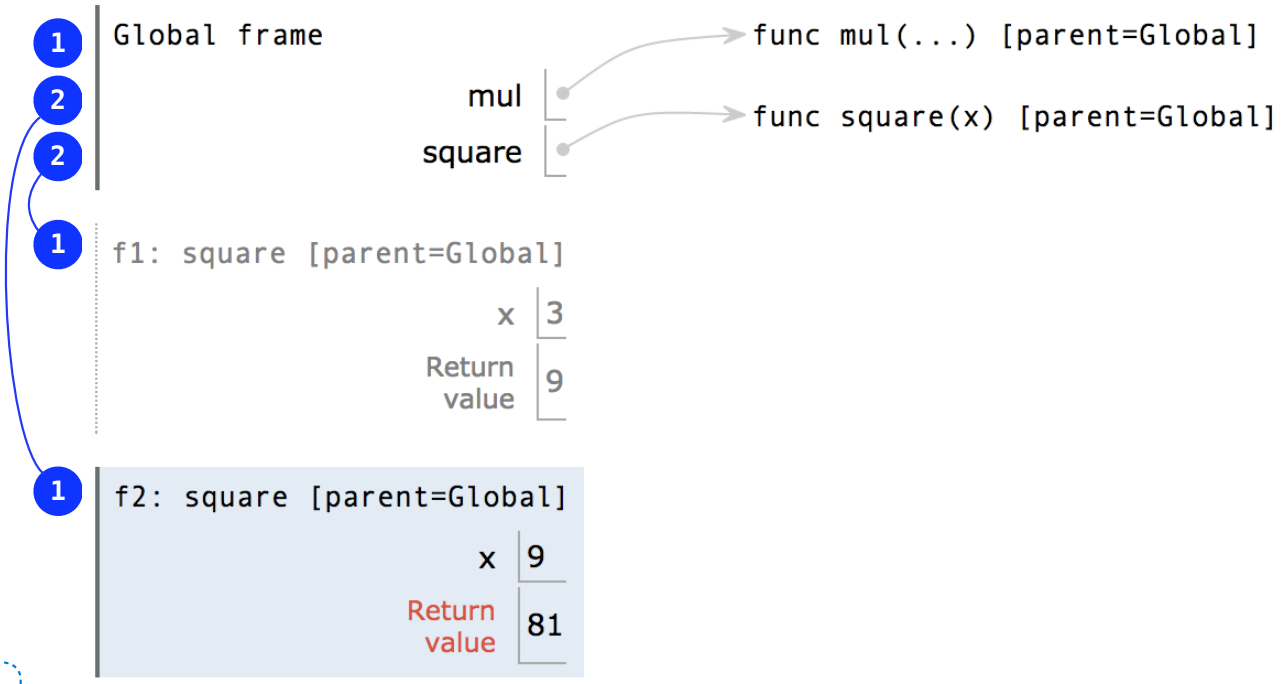

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Names Have No Meaning Without Environments

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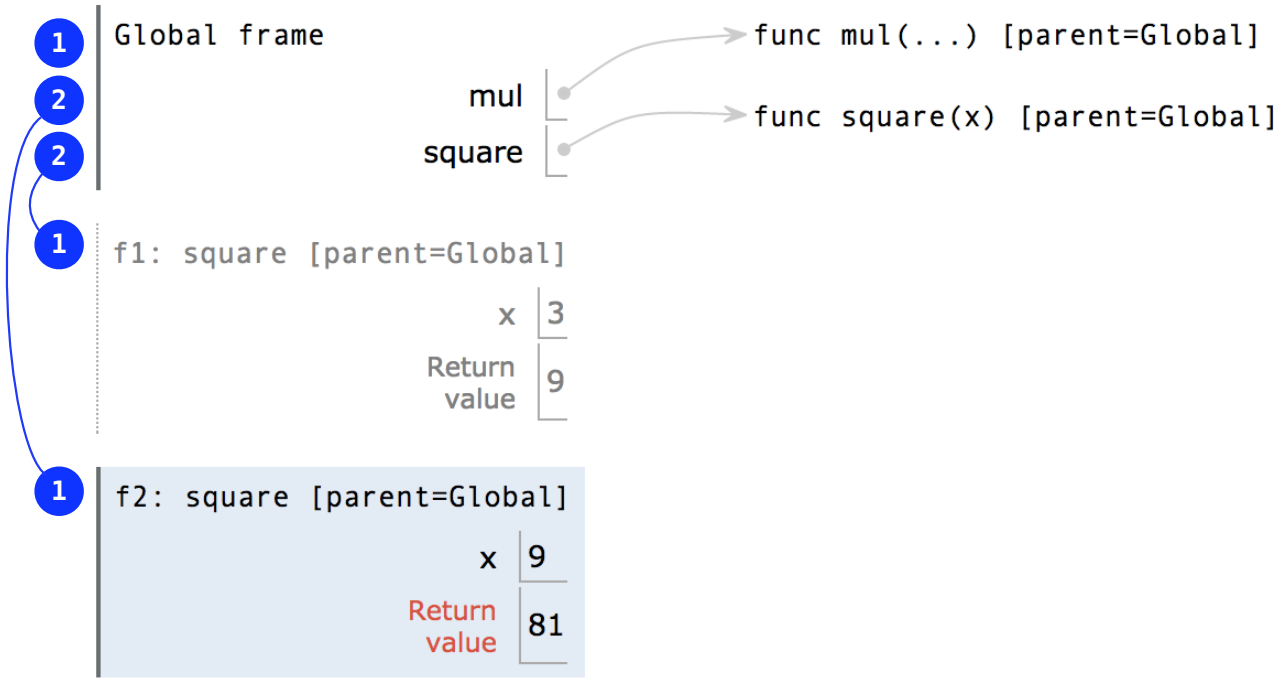

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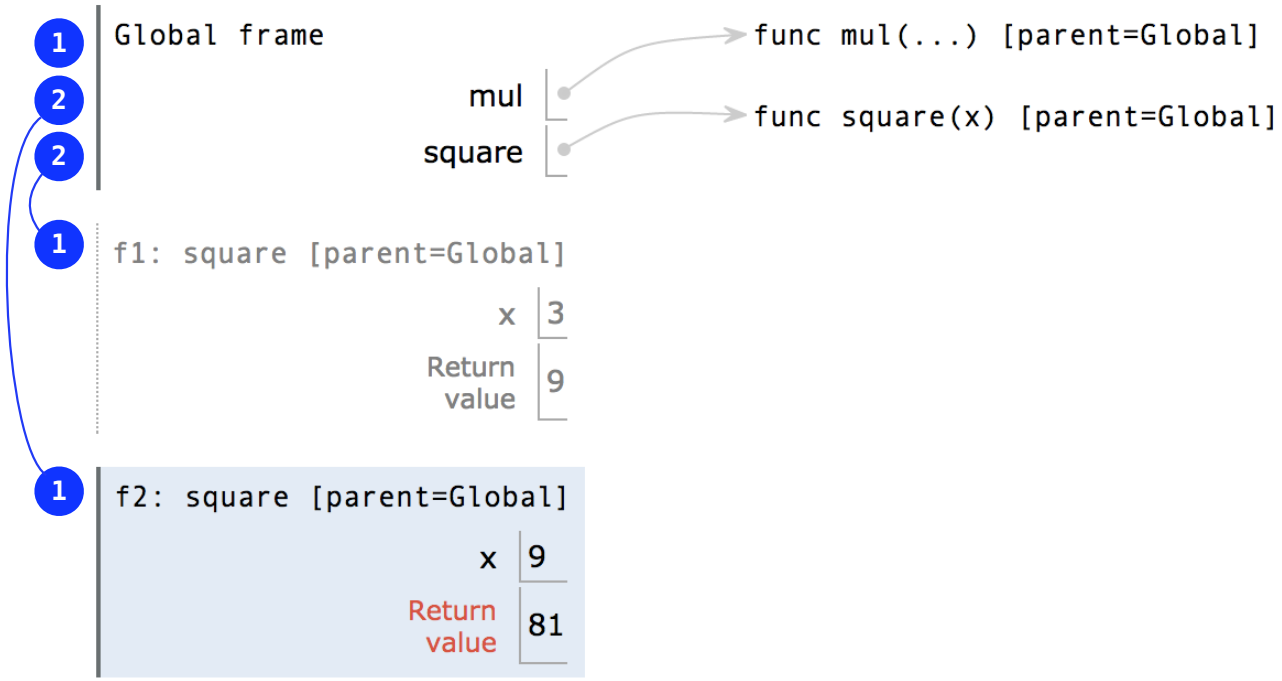

Every expression is evaluated in the context of an environment.

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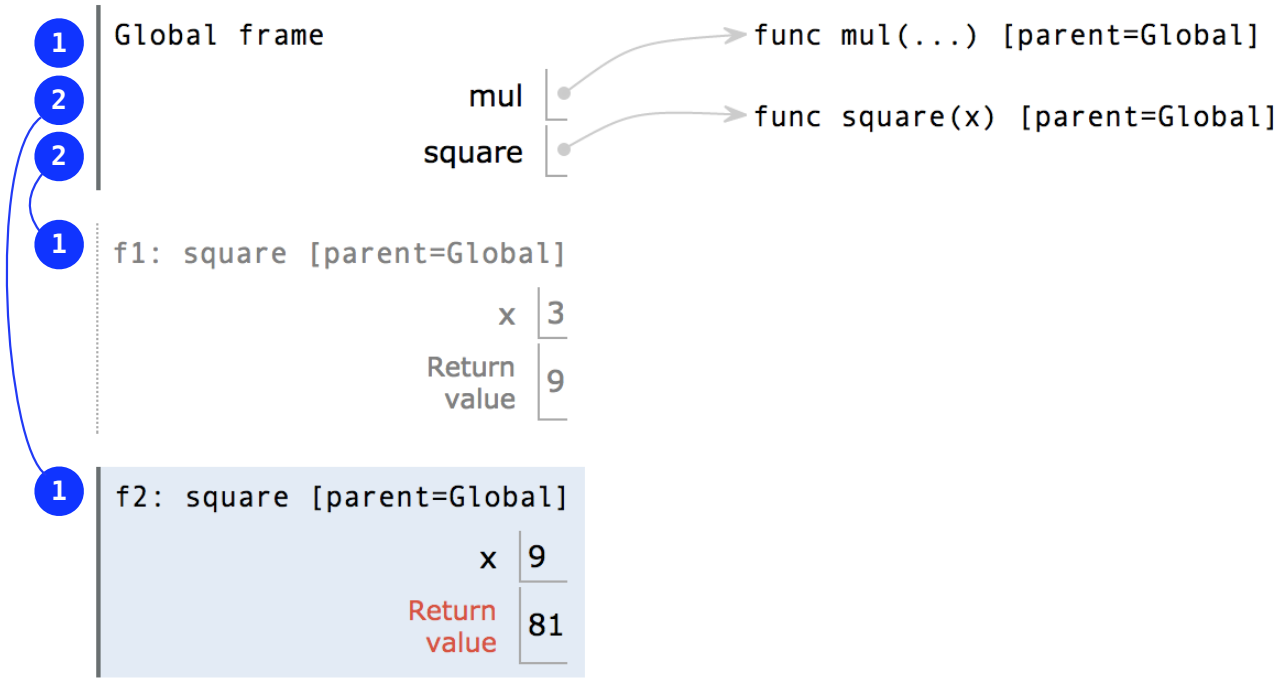

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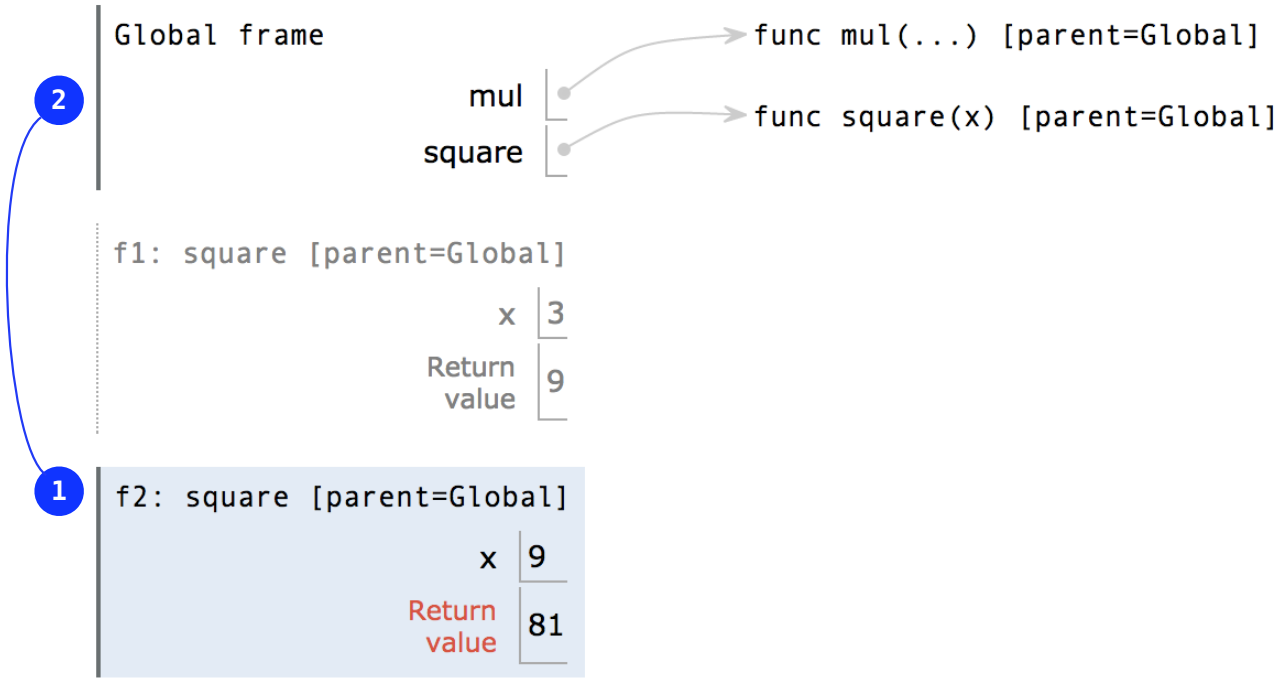

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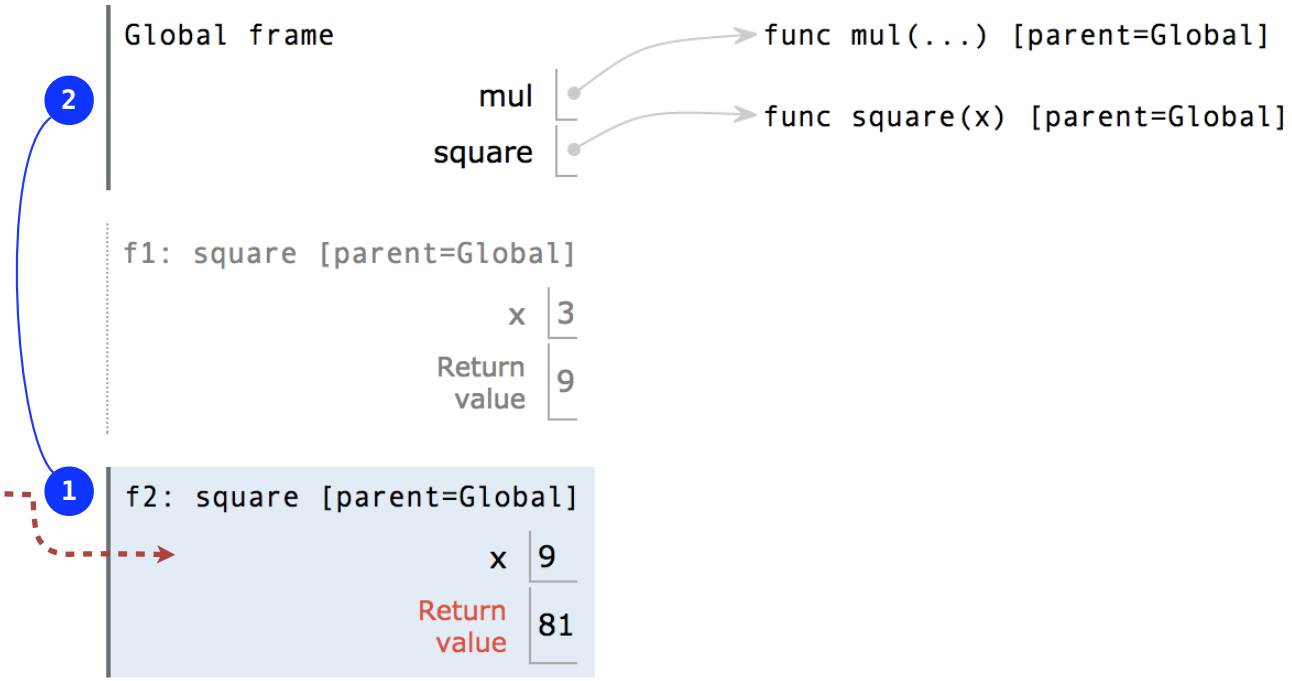

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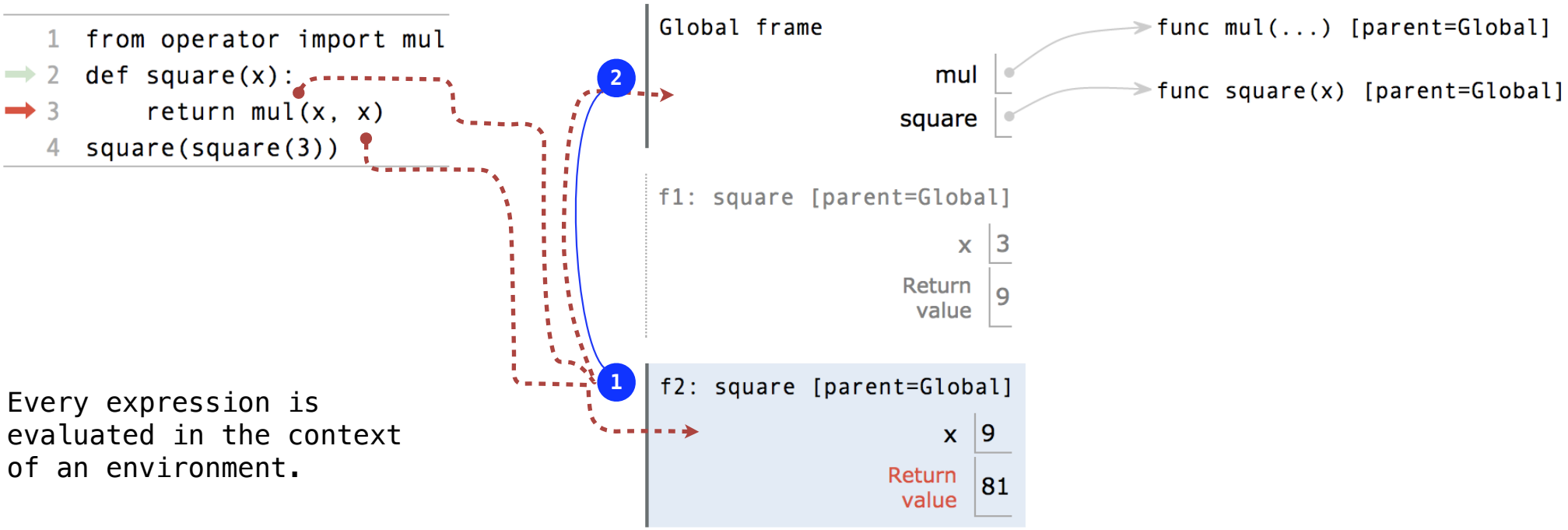

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Interactive Diagram

Names Have Different Meanings in Different Environments

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Interactive Diagram

Names Have Different Meanings in Different Environments

A call expression and the body of the function being called are evaluated in different environments

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Interactive Diagram

Names Have Different Meanings in Different Environments

A call expression and the body of the function being called are evaluated in different environments

```
1 from operator import mul
2 def square(square):
3     return mul(square, square)
4 square(4)
```

Every expression is evaluated in the context of an environment.

A name evaluates to the value bound to that name in the earliest frame of the current environment in which that name is found.

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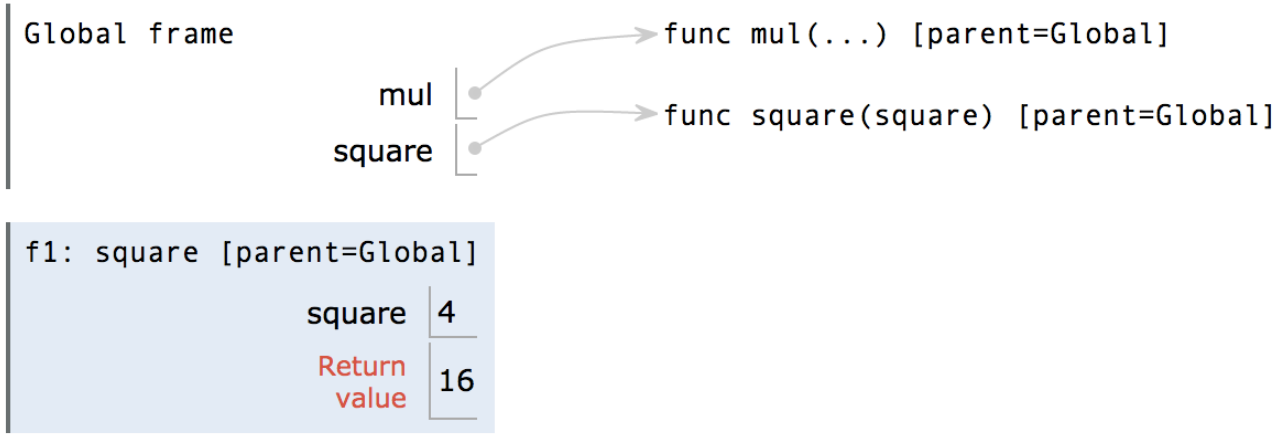

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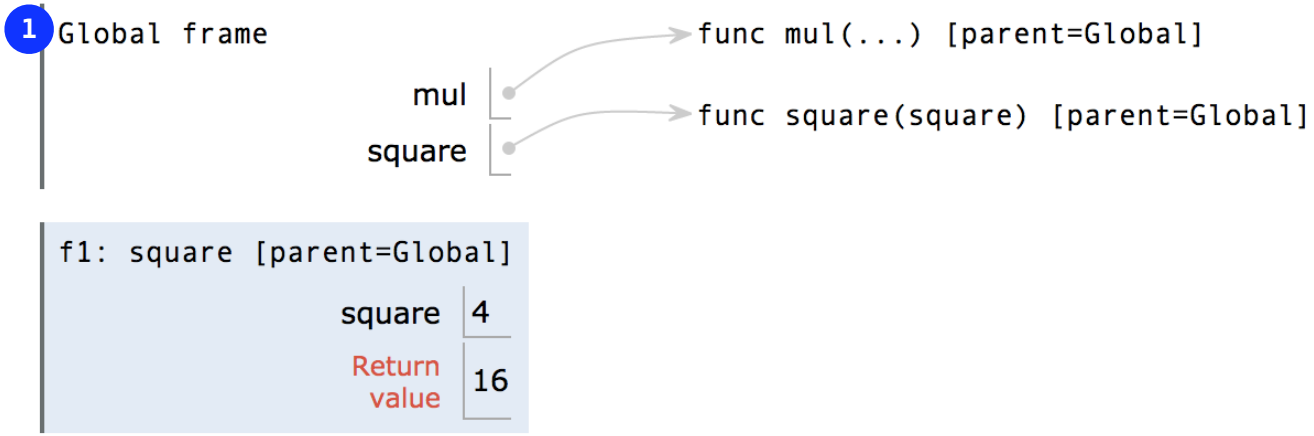

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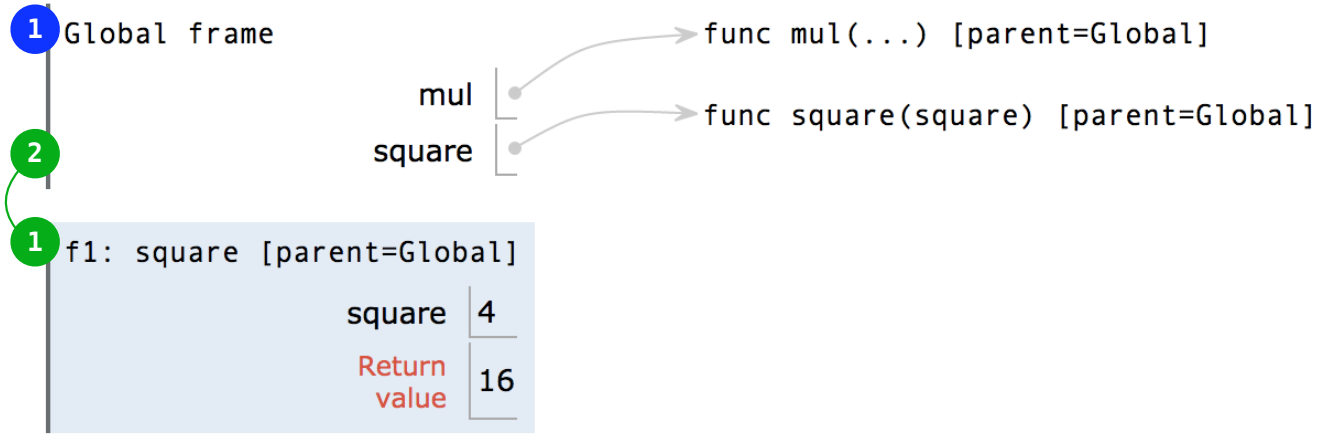

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Interactive Diagram

Miscellaneous Python Features

Operators

Multiple Return Values

Docstrings

Doctests

Default Arguments

(Demo)

Conditional Statements

Statements

A ***statement*** is executed by the interpreter to perform an action

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Compound statements:

```
<header>:
    <statement>
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    ...
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    <statement>
    <statement>
    ...
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```

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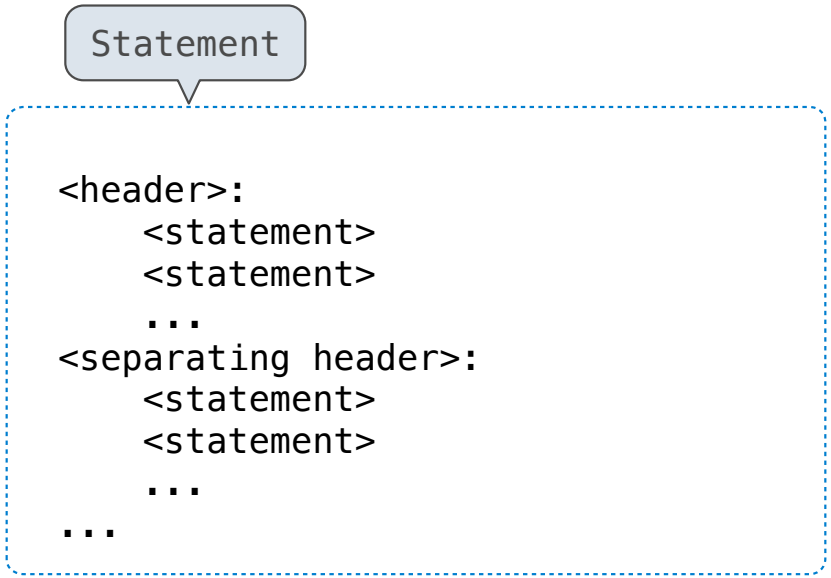

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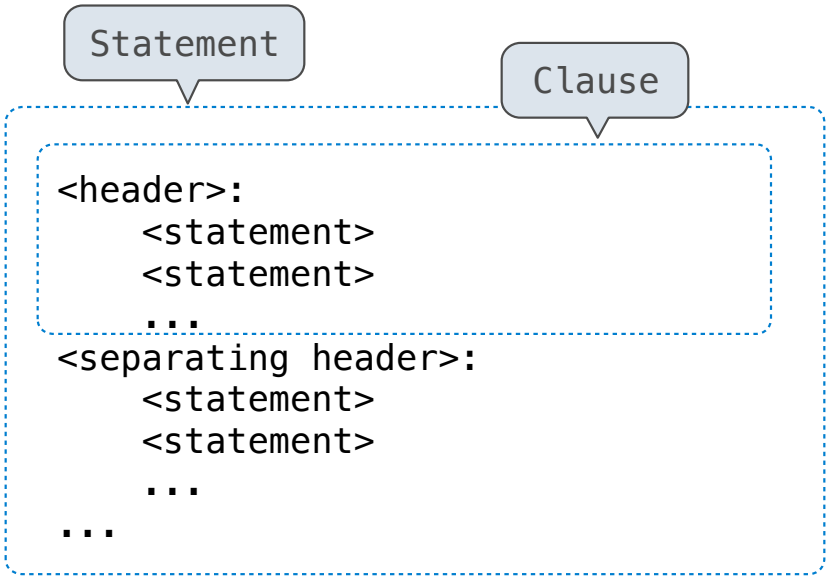

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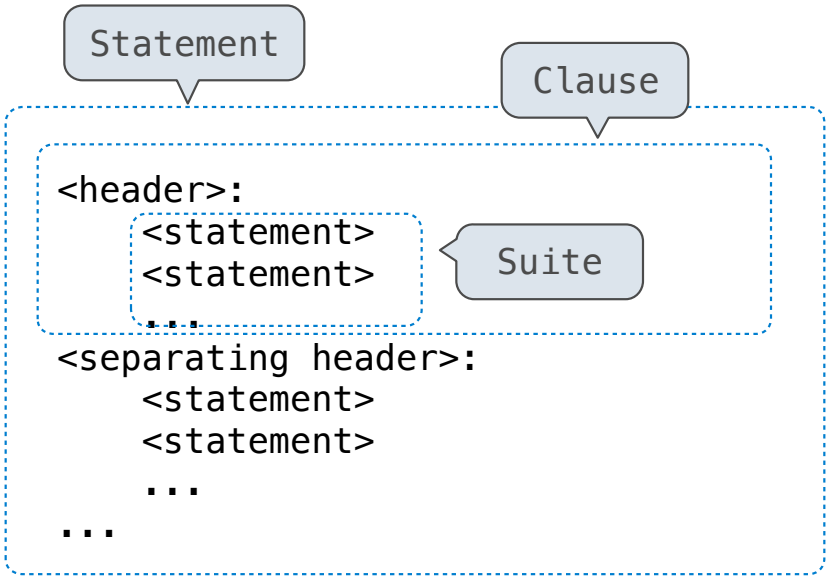

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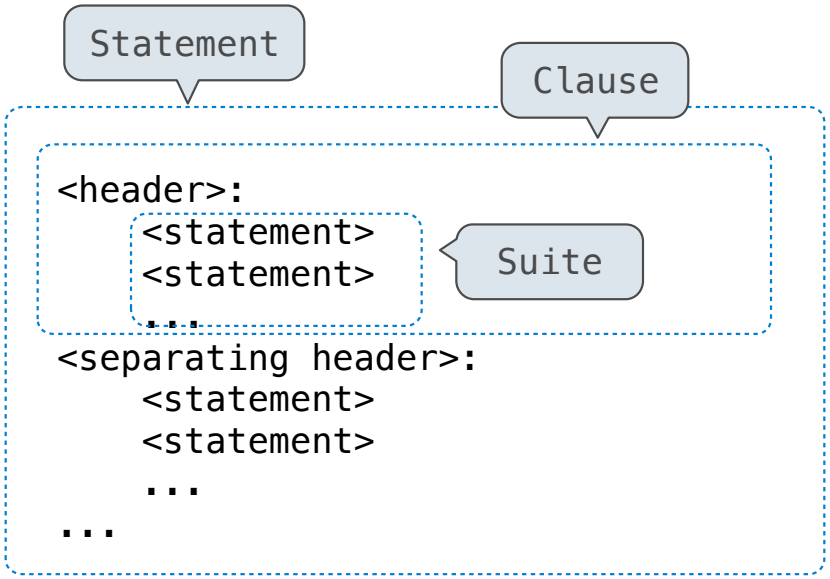

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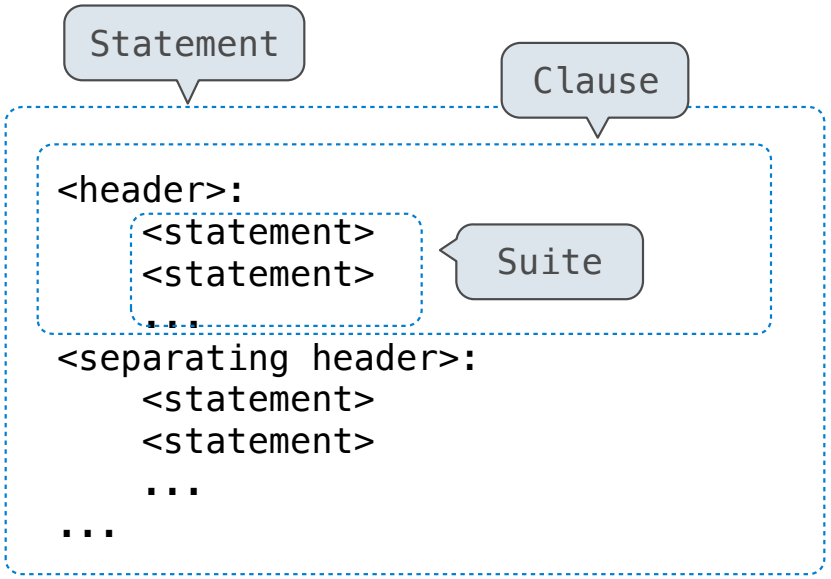

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The header of a clause "controls" the suite that follows

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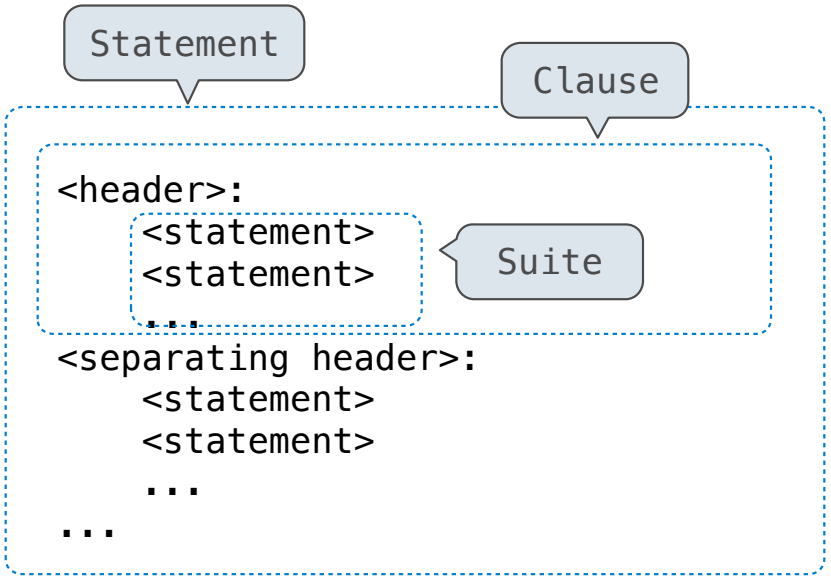

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def statements are compound statements

Compound Statements

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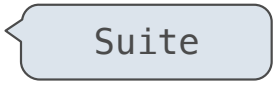

A suite is a sequence of statements

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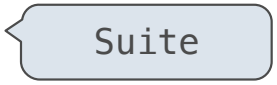

A suite is a sequence of statements

To “execute” a suite means to execute its sequence of statements, in order

Compound Statements

Compound statements:

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    ...
...
```

Suite

A suite is a sequence of statements

To “execute” a suite means to execute its sequence of statements, in order

Execution Rule for a sequence of statements:

- Execute the first statement
- Unless directed otherwise, execute the rest

Conditional Statements

(Demo)

Conditional Statements

(Demo)

```
def absolute_value(x):
    """Return the absolute value of x."""
    if x < 0:
        return -x
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Conditional Statements

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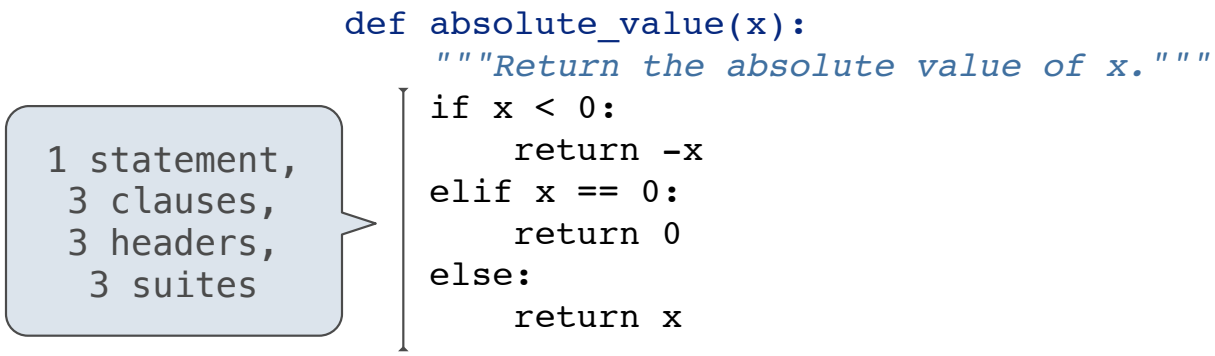
1 statement,
3 clauses,
3 headers,
3 suites

Conditional Statements

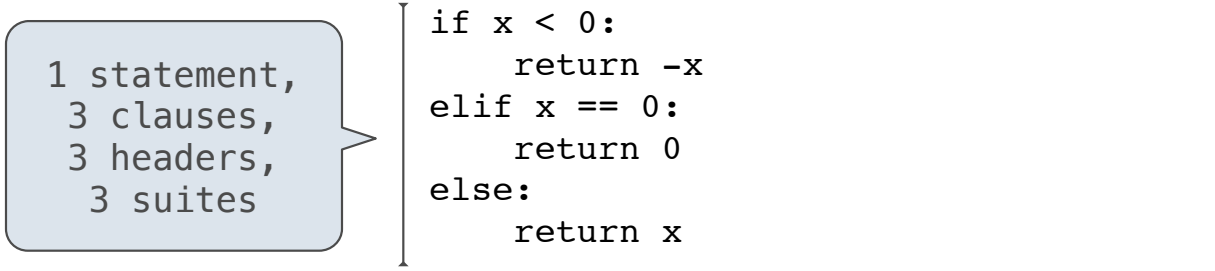
(Demo)



Execution Rule for Conditional Statements:

Conditional Statements

(Demo)

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Execution Rule for Conditional Statements:

Each clause is considered in order.

1. Evaluate the header's expression.

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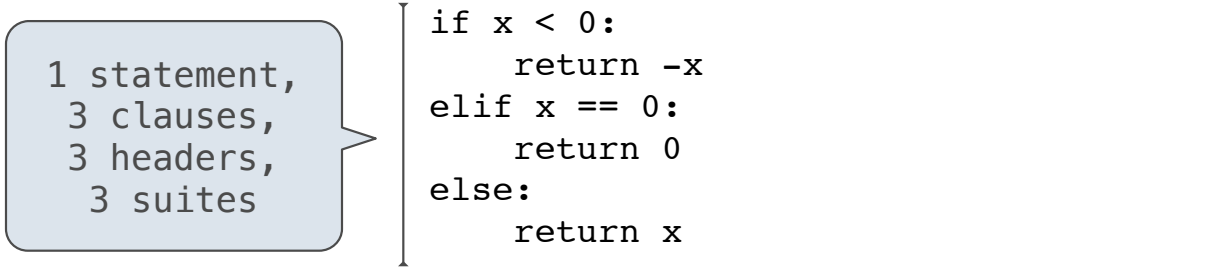
Conditional Statements

(Demo)

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Conditional Statements

(Demo)

1 statement,
3 clauses,
3 headers,
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Execution Rule for Conditional Statements:

Each clause is considered in order.

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   execute the suite & skip the remaining clauses.

Syntax Tips:

1. Always starts with "if" clause.
2. Zero or more "elif" clauses.
3. Zero or one "else" clause,
   always at the end.

Boolean Contexts

George Boole

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def absolute_value(x):
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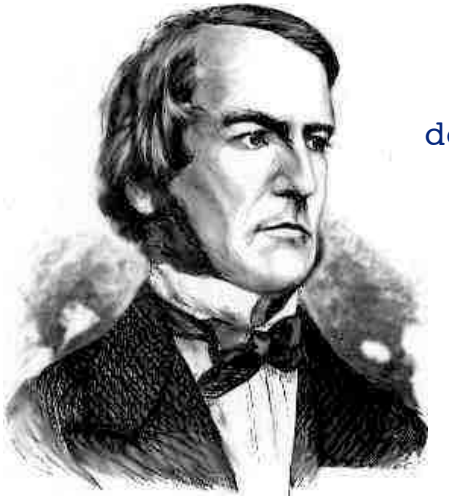

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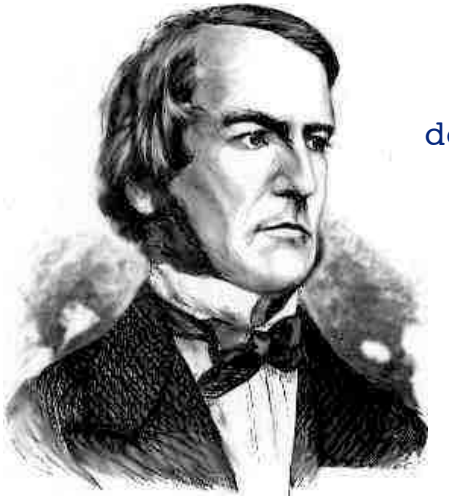

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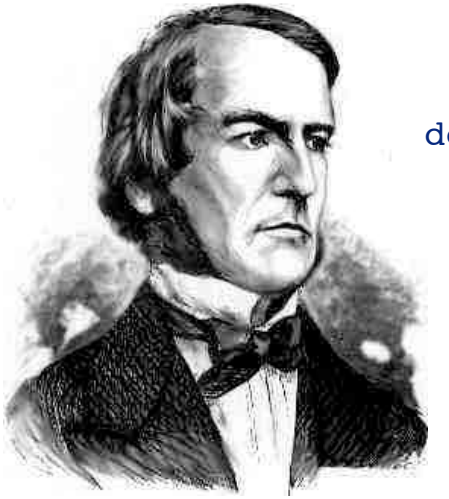

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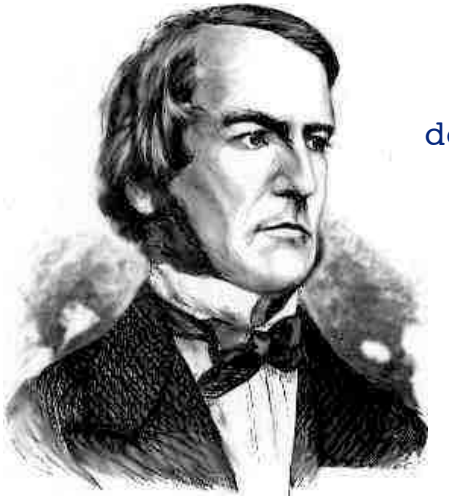

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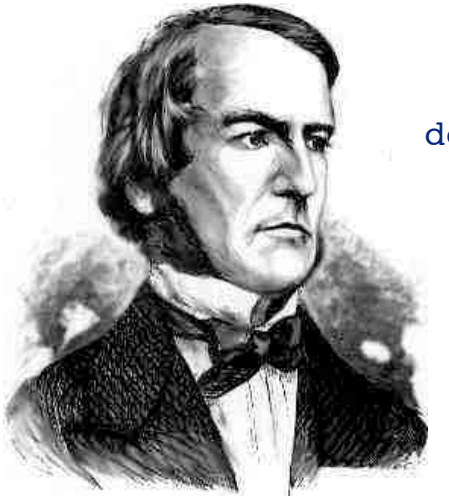

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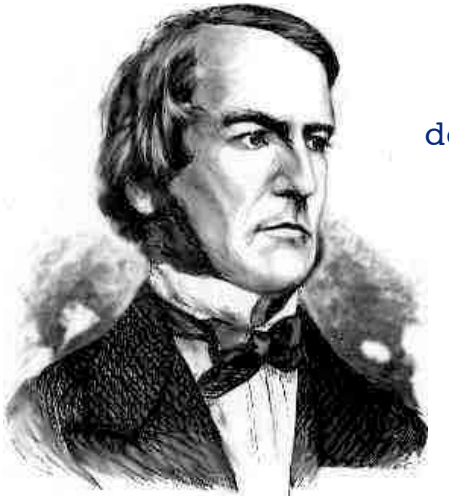

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Read Section 1.5.4!

Reading: http://composingprograms.com/pages/15-control.html#conditional-statements

Iteration

While Statements

(Demo)

While Statements

(Demo)

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1  i, total = 0, 0
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While Statements

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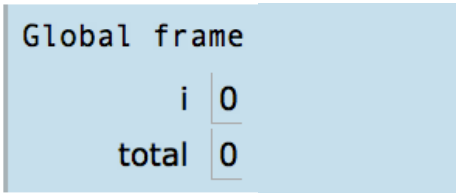

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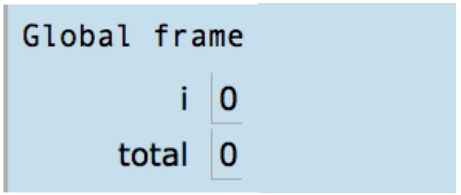

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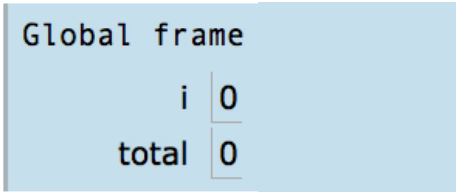

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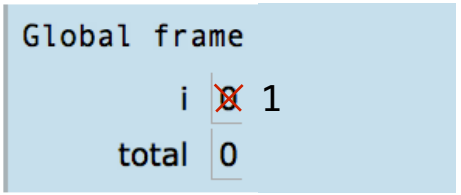

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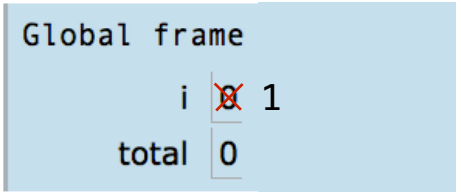

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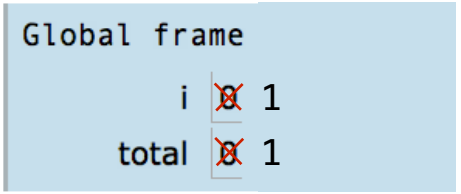

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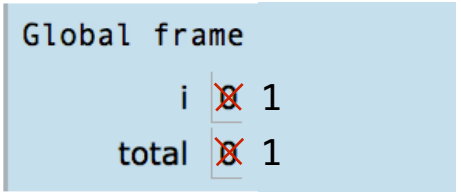

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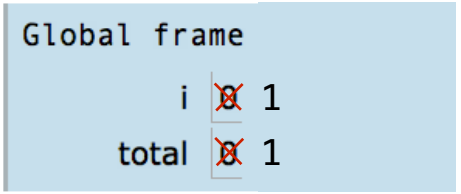

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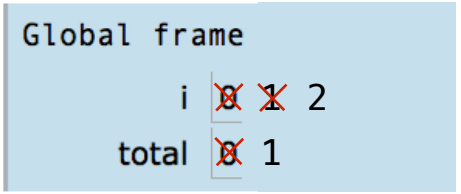

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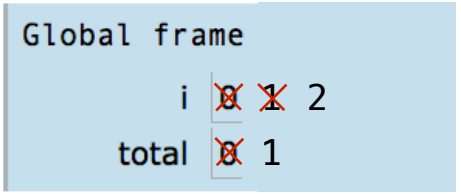

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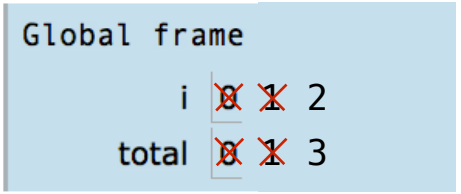

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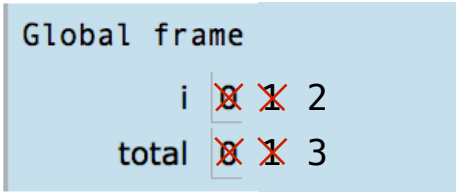

Execution Rule for While Statements:

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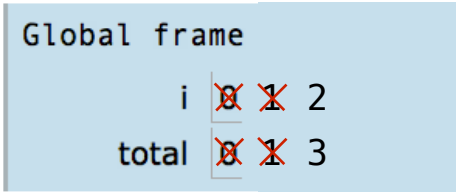

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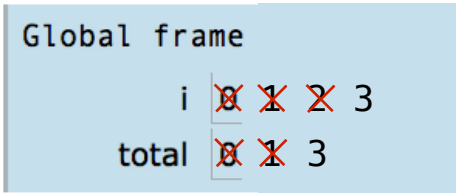

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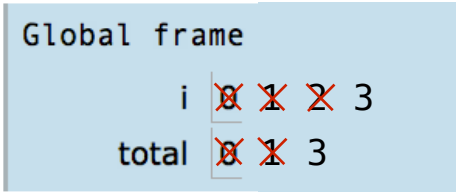

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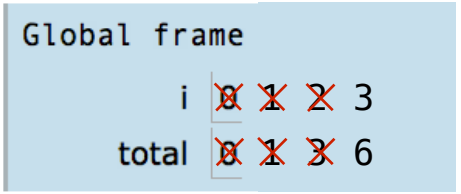

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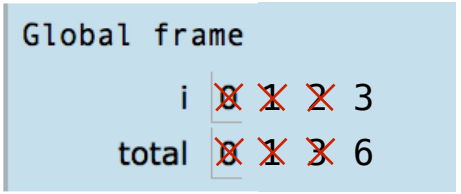

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