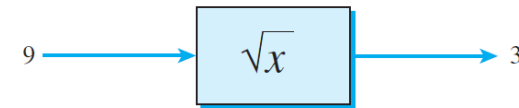


Abstraction and Functions

- Black Box
- Container for a sequence of actions
- Use the function by name

A Black box view of the square root function



turtle module

- Many of the additional parts of Python functionality are found in **modules** – an optional part of Python that implements an abstraction that is designed to make program easier.

```
>>> import turtle
>>> turtle
<module 'turtle' from '/Library/Frameworks/Python.framework/Versions/3.3/lib/python3.3/turtle.py'>
>>> |
```

- Every object in Python has 3 important characteristics:
 - An identity
 - A type
 - A value
- Some Python objects have special values called *attributes*
- Some Python objects have *methods*

Turtle Attributes

position	The coordinates of the turtle on the screen
heading	The direction the turtle is facing
color	The color of the turtle
tail position	The turtle's tail can be up or down

Table 1.2 Turtle attributes

5

Summary of turtle methods

Name	Parameter(s)	Description
<code>Turtle</code>	None	Creates and returns a new turtle object
<code>forward</code>	Distance	Moves the turtle forward
<code>backward</code>	Distance	Moves the turtle backward
<code>right</code>	Angle	Turns the turtle clockwise
<code>left</code>	Angle	Turns the turtle counterclockwise
<code>up</code>	None	Picks up the turtle's tail
<code>down</code>	None	Puts down the turtle's tail
<code>color</code>	Color name	Changes the color of the turtle's tail
<code>fillcolor</code>	Color name	Changes the color that the turtle will use to fill a polygon
<code>heading</code>	None	Returns the current heading
<code>position</code>	None	Returns the current position
<code>goto</code>	x, y	Moves the turtle to position x, y
<code>begin_fill</code>	None	Remembers the starting point for a filled polygon
<code>end_fill</code>	None	Closes the polygon and fills it with the current fill color
<code>dot</code>	None	Leaves a dot at the current position

Table 1.3 Summary of simple turtle methods

6

Defining Functions

We are not limited to the function the author of Python give us. We can write our own functions to add our own abstractions to the Python language

Iteration (for loops)

- Repeat a sequence of steps
- Use a for statement
- Range