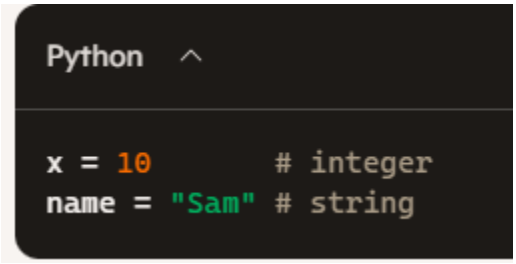
Variables in Python

Variables are containers for storing data values.

- **Declaration**: No need to declare type explicitly.



Rules:

- Must start with a letter or underscore.
- Cannot start with a number.
- Case-sensitive (Name ≠ name).

Keywords in Python

Keywords are reserved words that have special meaning.

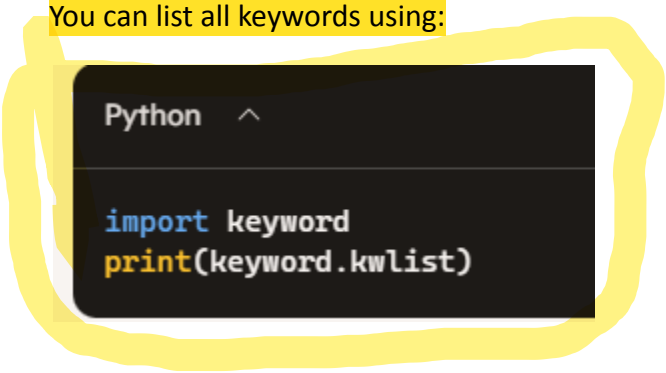
As of Python 3.11, there are **35 official keywords** in the language2. These are reserved words that have special meaning and cannot be used as variable names, function names, or identifiers.

🗝️ **Examples of Python Keywords**

Here are some commonly used ones:

- **Control flow**: if, else, elif, for, while, break, continue, pass
- **Functionality**: def, return, lambda, yield
- **Error handling**: try, except, finally, raise, assert
- **Boolean & logic**: True, False, None, and, or, not, is, in
- **Class & scope**: class, global, nonlocal, del, from, import, as
- **Concurrency**: async, await

You can list all keywords using:



Data Types in Python

Python has several built-in data types:

Category	Data Types	Example
Numeric	int, float, complex	10, 3.14, 2+3j
Sequence	str, list, tuple	"hello", [1,2], (3,4)
Set	set, frozenset	{1,2,3}
Mapping	dict	{"a": 1, "b": 2}
Boolean	bool	True, False
Binary	bytes, bytearray, memoryview	b"hello"
None Type	NoneType	None

🔄 Type Conversion in Python

Python supports **implicit** and **explicit** type conversion.

✅ **Implicit Conversion**

Python automatically converts types when needed:

```python
x = 10        # int
y = 2.5       # float
z = x + y     # float (Python converts x to float)
```

✍️ **Explicit Conversion (Type Casting)**

You manually convert types using built-in functions:

```python
int("5")        # Converts string to int
float("3.14")   # Converts string to float
str(100)        # Converts int to string
list("abc")     # Converts string to list
```

Operators

➕ **1. Arithmetic Operators**

Used for basic mathematical operations.

```python
a = 10
b = 3

print(a + b)  # 13 (Addition)
print(a - b)  # 7  (Subtraction)
print(a * b)  # 30 (Multiplication)
print(a / b)  # 3.33 (Division)
print(a % b)  # 1  (Modulus: remainder)
print(a ** b) # 1000 (Exponentiation: 10^3)
print(a // b) # 3  (Floor Division: drops decimal)
```

🧮 2. Comparison Operators

Used to compare values; returns True or False.

```
x = 5
y = 8

print(x == y)  # False
print(x != y)  # True
print(x > y)   # False
print(x < y)   # True
print(x >= y)  # False
print(x <= y)  # True
```

🔀 3. Logical Operators

Used to combine conditional statements.

Python

```
a = True
b = False

print(a and b) # False
print(a or b)  # True
print(not a)   # False
```

4. Assignment Operators

Used to assign values to variables.

Python

```python
x = 10
x += 5  # x = x + 5 → x becomes 15
x *= 2  # x = x * 2 → x becomes 30
print(x)
```

5. Bitwise Operators

Operate on binary numbers.

Python

```python
a = 5      # 0101 in binary
b = 3      # 0011 in binary

print(a & b)  # 1 (AND)
print(a | b)  # 7 (OR)
print(a ^ b)  # 6 (XOR)
print(~a)     # -6 (NOT)
print(a << 1) # 10 (Left shift)
print(a >> 1) # 2  (Right shift)
```

For Bitwise NOT(~)

🧮 Step-by-Step: How `1011` = −5 in 2's Complement

✅ Step 1: Understand the context

We're working with **4-bit binary numbers**. In 2's complement, the **leftmost bit** is the **sign bit**:

- `0` means positive
- `1` means negative

So `1011` starts with `1` → it's a **negative number**.

🔄 Step 2: Invert the 2's complement to find the original positive value

To find the decimal value of a 2's complement negative number:

1. **Invert all bits** of `1011`:

```
Code ^
1011 → 0100
```

2. **Add 1** to the inverted bits:

```
Code ^
0100 + 1 = 0101
```

3. **Convert to decimal**:

```
Code ^
0101 = 5
```

So, 1011 is the 2's complement representation of **−5**.

🔍 6. Identity & Membership Operators

Identity (`is`, `is not`)

Python

```python
x = [1, 2]
y = x
z = [1, 2]

print(x is y)      # True (same object)
print(x is z)      # False (same content, different object)
```

Membership (`in`, `not in`)

Python

```python
nums = [1, 2, 3]
print(2 in nums)      # True
print(4 not in nums)  # True
```

Comments in Python

Purpose: Comments are used to explain code, make it readable, or temporarily disable parts of it. Python ignores comments during execution.

✅ **Single-line Comment**

Use # at the beginning of the line:

```python
# This is a single-line comment
x = 5  # This sets x to 5
```

✅ Multi-line Comment

Use triple quotes ''' or """:

```
"""
This is a multi-line comment.
It can span several lines.
"""
```

📥 Input Function: input()

Purpose: Takes user input from the keyboard. Always returns a string.

✅ Basic Usage

```
name = input("Enter your name: ")
print("Hello", name)
```

✅ Type Conversion

Convert input to other types using int(), float(), etc.:

```
age = int(input("Enter your age: "))
print("You will be", age + 1, "next year.")
```

📤 Output Function: print()

Purpose: Displays text, variables, and results on the screen.

✅ Basic Usage

```
print("Welcome to Python!")
```

✅ Printing Multiple Items

Python

```python
name = "Sam"
age = 25
print("Name:", name, "Age:", age)
```

✅ Formatted Output

Use f-strings for cleaner formatting:

Python

```python
print(f"Hello {name}, you are {age} years old.")
```