**basic Python concepts** like arithmetic, data types, operators, functions, randomness, floating-point math, sets, and more.

**✅ 1. Basic Arithmetic and Conversion**

python

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x = 3

y = 6

z = 8

x + y # 9

40 + 2.32 # 42.32

int(3.167) # 3

float(300) # 300.0

* +, -, \*, /, \*\*, % are basic operators.
* int() and float() convert between types.

**✅ 2. Strings and Tuples**

python

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'Hello' + 'Earth' # 'HelloEarth'

x, y, z # (3, 6, 8)

x+1 , y\*3 # (4, 18)

* Strings can be concatenated.
* Comma-separated values return a tuple.

**✅ 3. Modulo and Exponentiation**

python

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y % 2 # 0

z \*\* 2 # 64

z \*\* 5 # 32768

2 \*\* 10 # 1024

* % gives remainder.
* \*\* is the power operator.

**✅ 4. Floating-Point Division**

python

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result = 1 / 3.0 # 0.333...

* Float division returns a decimal value.

**✅ 5. str(), repr() and print()**

python

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repr('Groot') # "'Groot'" (formal, includes quotes)

str('Groot') # 'Groot' (informal)

print('Groot') # Groot (output)

* repr() is used for debugging.
* str() is for readable format.
* print() shows output on screen.

**✅ 6. Boolean and Comparison Operators**

python

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1 < 2 # True

5.0 + + 5.0 # 10.0

x < y < z # True (chained comparison)

1 == 2 < 3 # False (evaluates left to right)

math.floor(3.4) # 3

math.floor(-3.4) # -4

math.trunc(-2.8) # -2

* == checks value equality.
* math.floor() rounds **down**, even for negative numbers.
* math.trunc() removes the decimal part (towards 0).

**✅ 7. Large Numbers and Scientific Notation**

python

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99999999999 \* 2.1 # 2.099999999979e+11

2 \*\* 1000 # Big integer

* Python handles very large integers.
* e+27 means "× 10^27" (scientific notation).

**✅ 8. Complex Numbers**

python

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2 + 1j # (2+1j)

(2+3j) \* 2 # (4+6j)

* j denotes the imaginary part in complex numbers.

**✅ 9. Number Bases**

python

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0o20 # 16 (Octal)

0xff # 255 (Hex)

0b1000 # 8 (Binary)

oct(64) # '0o100'

hex(64) # '0x40'

bin(64) # '0b1000000'

* 0o, 0x, 0b represent octal, hex, binary.
* oct(), hex(), bin() convert to string representations.

**✅ 10. Base Conversion Using int()**

python

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int('64', 8) # 52 (octal 64 to decimal)

int('64', 16) # 100 (hex 64 to decimal)

**✅ 11. Bitwise Shift Operator**

python

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x = 1

x << 2 # 4 (Binary shift left: 0001 -> 0100)

* << shifts bits to the left (multiply by 2^n).

**✅ 12. Random Module**

python

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random.random() # Random float 0.0 - 1.0

random.randint(1,100) # Random int in range

random.choice(l1) # Random item from list

random.shuffle(l1) # Shuffles the list in-place

**⚠️ 13. Floating-Point Inaccuracy**

python

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0.1 + 0.1 + 0.4 # 0.6000000000000001

(0.1 + 0.1 + 0.1) - 0.3 # 5.55e-17

* Due to **binary floating-point representation**, small errors can occur.

python

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from decimal import Decimal

Decimal('0.1') + ... # Decimal('0.3')

* Use Decimal for **precise decimal arithmetic**.

**✅ 14. Fractions**

python

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from fractions import Fraction

Fraction(2, 7) # Fraction(2, 7)

* Useful for exact arithmetic.

**✅ 15. Set Operations**

python

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setone = {1,2,3,4}

setone & {1,3} # {1, 3} (intersection)

setone | {9} # Union: {1,2,3,4,9}

setone - setone # set()

**✅ 16. Type Checking**

python

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type({}) # dict

type(True) # bool

* Python has built-in types: int, float, bool, dict, list, set, etc.

**✅ 17. Boolean Logic and Identity**

python

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True == 1 # True

False == 0 # True

True is 1 # False (value equals, but not same object)

True + 4 # 5 (True = 1)

* is checks **object identity**.
* == checks **value equality**.