

Python



Lesson 4
linear equation with two variables

linear equation with two variables in math

$$10x + 3y = 16$$

$$3x - y = 1$$

$$x=? \ y=?$$

Solve for one of the variables in terms of the other variable by rearranging the equation.

$$10x + 3y = 16$$

$$> 10x = 16 - 3y$$

$$> x = (16 - 3y)/10$$

Substitute this expression for x into another equation that involves both x and y.

$$3((16-3y)/10) - y = 1$$

$$3/10(16 - 3y) - y = 1$$

$$3/10(16 - 3y) = y + 1$$

$$16 - 3y = 10/3(y + 1)$$

$$16 - 3y = 10y/3 + 10/3$$

$$10y/3 + 3y = 16 - 10/3$$

$$(10/3 + 3)y = 16 - 10/3$$

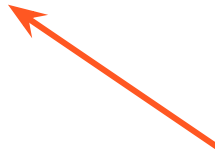
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Solve linear equation with Python

There are more than one way to solve linear equation with two variables.

The way we will learn today:

Using *symbolic math* **library**



- A library in Python is a collection of **ready-made code** that people have written to help you solve different kinds of problems. It's like a big warehouse of tools that you can use to build things.
- Using a library can save you a lot of time and effort because you don't have to write everything from scratch. It's like having a recipe for a cake that you want to bake, you don't have to figure out how to make everything from scratch, you just follow the recipe.

Library

```
from sympy import symbols, Eq, solve
```

```
x, y = symbols('x y')
```

```
eq1 = Eq(2*x + 3*y, 7)
```

```
eq2 = Eq(x - y, 1)
```

```
sol = solve((eq1, eq2), (x, y))
```

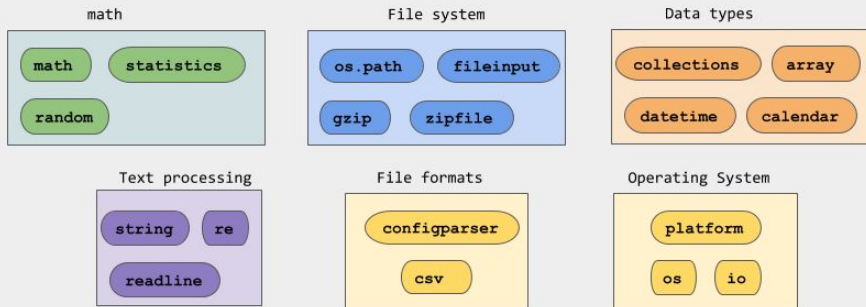
```
print("x = ", sol[x])
```

```
print("y = ", sol[y])
```

We will use library **sympy** today.

Python

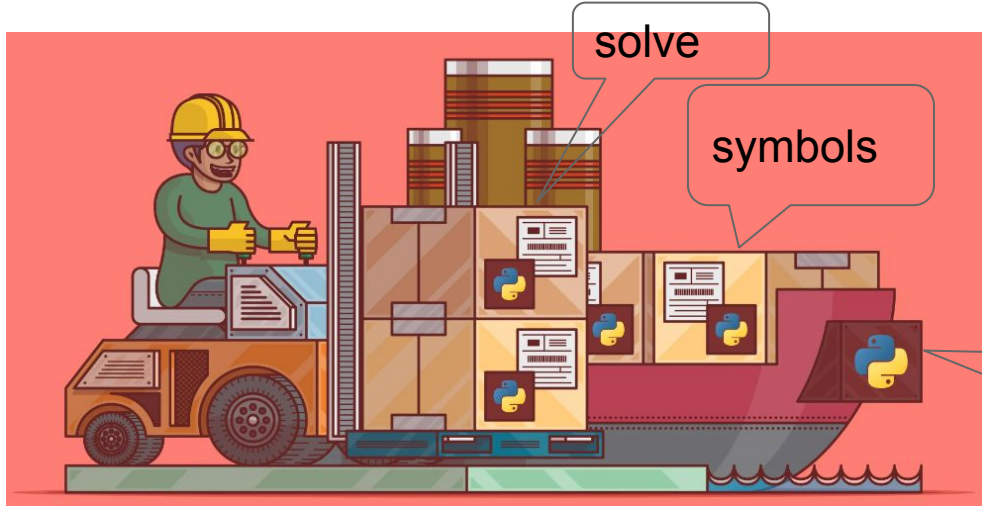
Python Standard Libraries



import

Imagine you have a lot of toys in your room, and you want to play with one specific toy, like a toy car. You could just search through all your toys until you find the car, but that would take a lot of time and energy.

Instead, you could ask your mom or dad to bring you the toy car from the toy box.



```
from sympy import symbols, Eq, solve
```

```
x, y = symbols('x y')
```

```
eq1 = Eq(2*x + 3*y, 7)
```

```
eq2 = Eq(x - y, 1)
```

```
sol = solve((eq1, eq2), (x, y))
```

```
print("x = ", sol[x])
```

```
print("y = ", sol[y])
```

This is kind of like what the **"import"** statement does in Python. It tells Python to bring in a specific tool or function that you want to use in your code, so you don't have to search through all the code to find it.

Read the 1st Line of Code

`from` libraryName `import` tool_In_This_Library, another_Tool_In_ThisLibrary

```
from sympy import symbols, Eq, solve
```

```
x, y = symbols('x y')  
eq1 = Eq(2*x + 3*y, 7)  
eq2 = Eq(x - y, 1)  
sol = solve((eq1, eq2), (x, y))
```

```
print("x = ", sol[x])  
print("y = ", sol[y])
```

What should you do to use the `sqrt` from `math` library?

```
# Import the sqrt function from the math  
from math import sqrt
```



symbols() function

Use symbols() function to tell python what is your variable.

```
from sympy import symbols, Eq, solve
```

```
x, y = symbols('x y')
```

```
eq1 = Eq(2*x + 3*y, 7)
```

```
eq2 = Eq(x - y, 1)
```

```
sol = solve((eq1, eq2), (x, y))
```

```
print("x = ", sol[x])
```

```
print("y = ", sol[y])
```

x and y are your variables.

What if you want
to create 3
variables, x, y
and z?



Eq() function

```
from sympy import symbols, Eq, solve
```

```
x, y = symbols('x y')
```

```
eq1 = Eq(2*x + 3*y, 7)
```

```
eq2 = Eq(x - y, 1)
```

```
sol = solve((eq1, eq2), (x, y))
```

```
print("x = ", sol[x])
```

```
print("y = ", sol[y])
```

The Eq() function in Python is a part of the sympy library and is used to express an equation.

In math: $2x + 3y = 7$

In python: `Eq(2*x + 3*y, 7)`

Name an equation as eq1:

`eq1 = Eq(2*x + 3*y, 7)`

Question

Name two variables as x and y.

Name a number sentence as s.

$$S = 5x * x + y / 2$$

Write the above in python



solve() function

The solve() function in Python is a part of the sympy library and is used to solve equations

```
from sympy import symbols, Eq, solve

x, y = symbols('x y')
eq1 = Eq(2*x + 3*y, 7)
eq2 = Eq(x - y, 1)
sol = solve((eq1, eq2), (x, y))

print("x = ", sol[x])
print("y = ", sol[y])
```

solve() function with one variable

Imagine you have a math problem or formula like " $2x + 3 = 7$ ". You can use the `solve()` function to figure out what value of x makes this equation true.

```
from sympy import symbols, solve

# Define the symbol x
x = symbols('x')

# Solve the equation 2x + 3 = 7
solution = solve(2*x + 3 - 7)

# Print the solution
print(solution)
```

In this example, we first use the `symbols()` function to define the symbol x that we want to solve for. Then, we use the `solve()` function to solve the equation $2x + 3 = 7$ for x . The result will be the value of x that makes the equation true.

In this case, the solution will be 2, because $2*2 + 3 = 7$.

Question

Name a variable as x .

Name a number sentence as s .

The number sentence is $5x + 3 = 13$.

Solve the number sentence s and print the result.



solve() function with two variables

```
from sympy import symbols, Eq, solve
```

```
x, y = symbols('x y')
```

```
eq1 = Eq(2*x + 3*y, 7)
```

```
eq2 = Eq(x - y, 1)
```

```
sol = solve((eq1, eq2), (x, y))
```

```
print("x = ", sol[x])
```

```
print("y = ", sol[y])
```

Equations

Variables

Pass two **arguments** to solve() function - the equations and variables.

Solve() function will return the results and save it to **sol**.

Sol has two values:

The first value is **sol[x]**.

The second is **sol[y]**.

Question

This is what you have now:

```
from sympy import symbols, solve, Eq
```

```
x, y = symbols('x y')
```

```
eq1 = Eq(x+y, 10)
```

```
eq2 = Eq(3x*x+y, 12)
```

Please finish the code. And print out the values of x and y.



What you learned

1. Library
2. Import
3. `symbols()` function
4. `Eq()` function
5. `solve()` function

Homework 1 - 10 minutes video time

1. Read this code and guess what this piece of code is about?

Hint: sqrt is the short name of square number

2. Create a file and write a piece of code to calculate a 200×200

```
# Import the sqrt function from the math
from math import sqrt
```

```
# Use the sqrt function directly
```

```
x = sqrt(4)
```

```
print(x)
```



Homework 2 - 10 minutes video time



Calculate square without using any library:

- The user needs to input a value, like 10.
- Print out the result 100.

Extension:

if the use input 10, your code needs to print out “10*10=100”. If the use input 20, your code needs to print out “20*20=400”.

Homework 3 - 10 minutes video time

1. Solve the equation with solve() function:
 - Name one variable as x.
 - Solve the number sentence: $3x + 100 = 999$
 - Print out the result.
2. Solve the equations with solve() function:
 - Number sentence 1: $x+y=100$
 - Number sentence 2: $2x+y=111$
 - Print out the results of x and y

