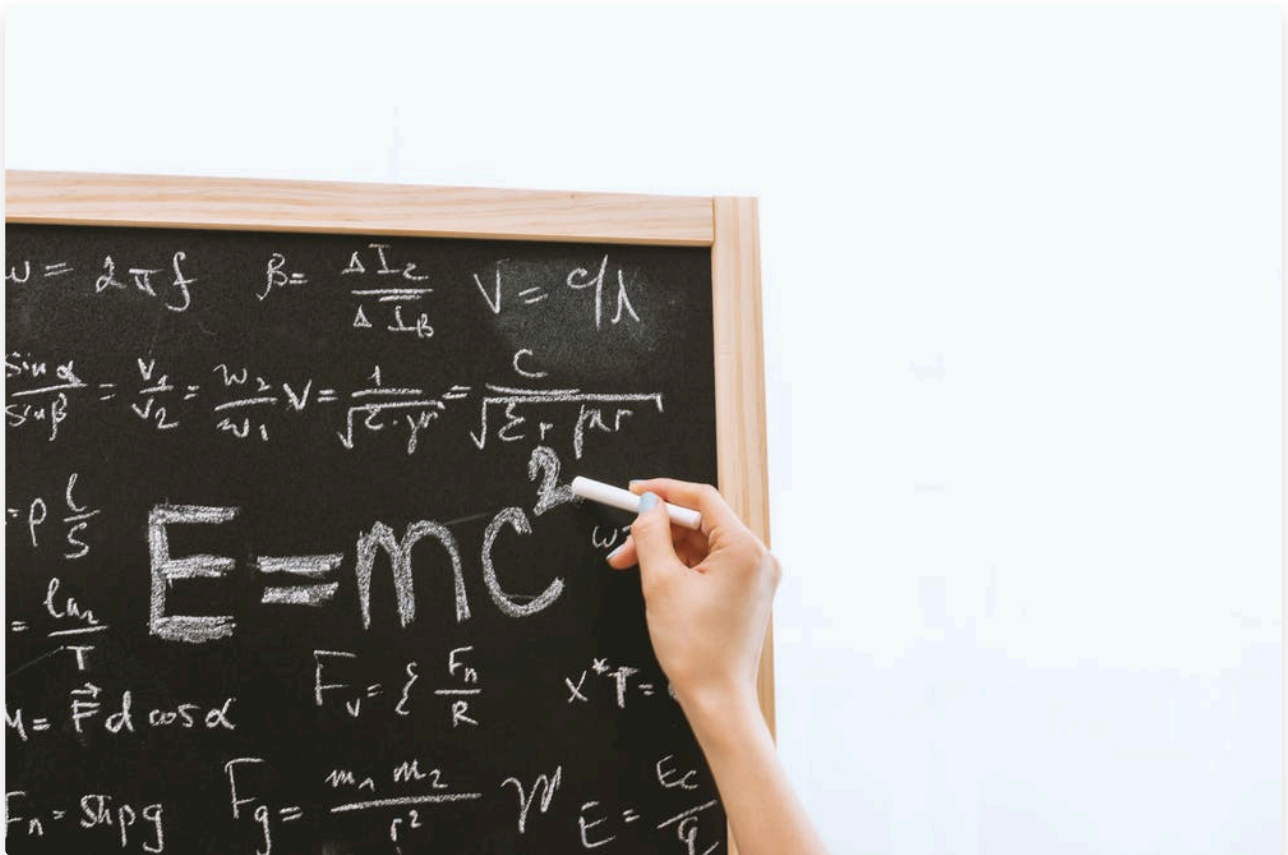


# Python Math

## Textbook

# Python Math



You can use math in programming for subtraction, multiplication, division, and more. We will stick with these four basic functions for now. The following examples show you how to use math with variables.

1. Addition: `c = a + b`
2. Subtraction: `c = a - b`
3. Multiplication: `c = a * b`
4. Division: `c = a / b`
5. Exponent `c = a ** b` ( $c = a$  to the power of  $b$ )
6. Floor Division `c = a // b` (rounds the result down to the nearest whole number)

## Math examples

The answers to the math examples below are represented with the comment `# Output is...`

```
1 number_spiders = 10
2 number_legs = 8
3
4 total_legs = number_spiders * number_legs
5 print(total_legs) # output is 80
```

Try it!

You can also perform arithmetic inside the print statement itself.

```
1 number_butterflies = 25
2
3 print(number_butterflies + 15) # output is 40
```

Try it!

## Division

What is the relationship between integers and floats when dividing? Try out the following example.

```
1 bees = 16
2 flowers = 2
3
4 answer = bees / flowers
5 print(answer)
```

Try it!

This will return `6.0` instead of 6.

When you divide integers, you will get a float.

## Order of Operations

There is a certain order to execute math statements. This designated order is called the order of operations.

Take the following arithmetic statement. How do you know what order to perform the calculations?

```
fruits = (3 × 5) 4 + 9 - 5 (4 - 3)
```

Depending on the order that you do the calculations, you'll get different answers. So what is the correct order?

The designated order is as follows.

1. Parentheses
2. Exponents / Floor Division
3. Multiplication / Division
4. Addition / Subtraction

When we have multiple examples of multiplication or division in the statement, perform them in turn from left to right. The same goes for times when we have multiple examples of addition and subtraction in a statement. Start from the left and do them in order from left to right.

We won't get into the specifics of exponents in this lesson.

So let's visit this equation again.

```
fruits = (3 * 5) 4 + 9 - 5 (4 - 3)
```

We do what's inside the parentheses first, so it simplifies to this.

```
fruits = 15 * 4 + 9 - 5 * 1
```

Next, since there are not exponents, we do multiplication and division in order from left to right so it simplifies to this.

```
fruits = 60 + 9 - 5
```

Once we are through with all the multiplication and division, we do addition and subtraction in order from left to right. In this problem, we start with addition since it is first, then we do the subtraction.

```
fruits = 64
```

Following the order of operations will help guide you to get the correct answer when using math in Python.

**What do you do if you have multiple instances of the same level in your equation?** For example, what if you have a division AND a multiplication value in your equation? Which comes first?

In these situations, you go from left to right. Perform the left-most instance first, and move through the equation to the right.

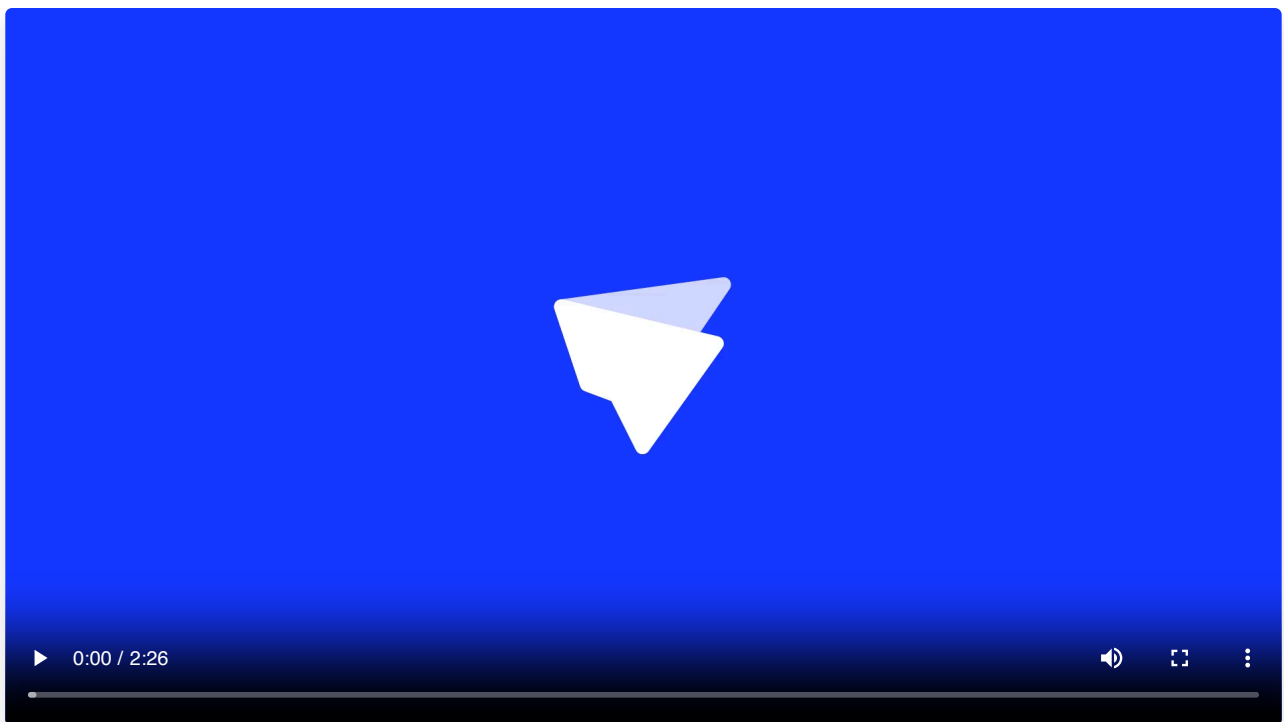
This rule is called [left-sided binding](#).

## Feedback

Getting feedback on your code is incredibly important because it helps you catch errors and find ways to make your programs run smoother, things you might easily miss on your own. Plus, fresh eyes from others can often reveal clever new solutions and better approaches, ultimately leading to much stronger and more reliable code.

## Analyze Solutions

Now that you've practiced solving problems, it's time to become a detective for your own answers! When you find a solution, don't just stop there. Your next important step is to assess the reasonableness of that solution. This means taking a moment to estimate what a sensible answer might be *before* you even calculate, using easy "benchmark" numbers to get a rough idea. After you've done your calculations, always check your work carefully for any small errors. Finally, verify your possible solutions by clearly explaining the methods you used to get them. This crucial step of evaluating your results based on the original problem's context helps you confirm whether your answer truly makes sense in the real world, ensuring your solutions are not just correct, but also logical and practical.



## Checkpoint

### Python Math

Create a print statement and multiply the following variables inside the print statement:

```
caterpillars = 3
```

```
leaves = 25
```

Remember! When referencing a variable, it must be **spelled exactly** the same as when it was declared!

### Requirements:

- Create a print statement that multiplies the variables.

## Questions (14)

### 1. Which symbol is used for multiplication in Python?

MULTIPLE CHOICE

Choose the correct answer:

- A. x
- B. X
- C. \*
- D. ^

**2. Which symbol is used for division in Python?**

Choose the correct answer:

- A. /
- B. \
- C. |
- D. -

**3. What is the output of this code?**

```
rocks = 15 print(rocks / 3)
```

Choose the correct answer:

- A. 7.0
- B. 3.0
- C. 5.0
- D. 15

**4. In the order of operations, what statement comes first?**

Choose the correct answer:

- A. multiplication
- B. division
- C. addition
- D. parentheses
- E. subtraction

**5. In the order of operations, what statement comes last?**

Choose the correct answer:

- A. parentheses
- B. multiplication/division
- C. addition/subtraction

MULTIPLE CHOICE

**6. True or False: You can do arithmetic in any order and still get the correct answer.**

**Choose the correct answer:**

- A. True
- B. False

MULTIPLE CHOICE

**7. What will the following print out?**

```
print(5 + 3 * 4 + 3)
```

**Choose the correct answer:**

- A. 20
- B. 35
- C. 15
- D. 48

MULTIPLE CHOICE

**8. If the value of 'a' is 20 and 'b' is 5, what will be the output of the following code?**

```
c = a * b print(c)
```

**Choose the correct answer:**

- A. 100
- B. 20
- C. 25
- D. 4

MULTIPLE CHOICE

**9. Which of the following arithmetic operations is correctly represented in Python?**

**Choose the correct answer:**

- A. addition:  $c = a - b$
- B. subtraction:  $c = a + b$
- C. multiplication:  $c = a \# b$
- D. division:  $c = a / b$

**10. What is the output of the following code?**

```
apples = 10 oranges = 5 print(apples + oranges)
```

**Choose the correct answer:**

- A. 5
- B. 10
- C. 15
- D. 105

**11. If 'x' is assigned the value 15 and 'y' is assigned the value 3, what is the result of the following operation in Python?**

MULTIPLE CHOICE

```
z = x / y print(z)
```

**Choose the correct answer:**

- A. 18
- B. 5
- C. 45
- D. 5.0

**12. What is the output of the following code?**

```
a = 7 b = 3 print(a * b)
```

**Choose the correct answer:**

- A. 10
- B. 21
- C. 4
- D. 2

**13. If one spider has 8 legs, which of the following expressions calculates the total number of legs for 15 spiders?**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. `total_legs = 15 * 8`
- B. `total_legs = 15 + 8`
- C. `total_legs = 15 - 8`
- D. `total_legs = 15 / 8`

**14. If 'a' is assigned the value 18 and 'b' is assigned the value 2, what is the result of the following operation in Python?**

MULTIPLE CHOICE

`c = a / b` `print(c)`

**Choose the correct answer:**

- A. 20
- B. 9
- C. 36
- D. 9.0

## Challenges (6)

### 1. Adding Numbers

Create **two variables** that take inputs and print the result of them added together.

Don't forget that inputs are automatically accepted as a string!

In order to convert them into an integer so you can do math with the input, you need to use this code: `int( )` .

```
int(input("What is your first number?"))
```

For example:

Inputs: `2` , `5`

Output: `7`

Another example:

Inputs: `100` , `23`

Output: `123`



## 2. Number Neighbors

Write a program that takes in **one number as the input**. Print the number one less than and one greater than that input with a comma separating the two.

Then, to concatenate the outputs with a comma you will need to convert the variables back into a string.

The output needs to be in this format: **"number,number"**

For example

Input: 5

Output: 4,6

Another example:

Input: 8

Output: 7,9

Hint--Use concatenation to get the two numbers separated with a comma.

**Notice there is not a space after the comma in your output!**

Remember that inputs are automatically accepted as strings. So to do math with you input, you need to change it to an integer. Then, to concatenate it with a comma you will need to convert it back into a string.

## 3. Group Gift

You want to get an awesome gift for someone like a parent, teacher, or coach! But it's too expensive for you to buy on your own. So you want to ask other people to help you work together to be able to buy it!

Create a program that calculates how much money you would have depending on how many people help and how much money you ask each person to bring.

1. Create **2 inputs**: one for the number of people who will help and one for the amount of money each person brings.
2. Create a **print statement that calculates how much money you will have total**.

For example: if **20** people each brought **2** dollars each, your output would be **40**.

Inputs: 20 , 2

Output: 40

Another example:

Inputs: 3 , 5

Output: 15

## 4. Inheritance

Your great uncle just passed away leaving a large sum of money for an inheritance. The problem is that he did not say who would be included on the will and who wouldn't! So your family is left to decide how to split the money. This is a challenging situation and you need to make sure each person gets EXACTLY the same amount or else fighting might break out among family members. You have a large family with many aunts and uncles, cousins, and relatives.

The inheritance amount is **\$48682.76**.

Create an input for how many family members will split the inheritance.

Create a **print statement** that will determine how much money each person would get.

For example:

Input: `32`

Output: `If 32 people split the inheritance, each person would get 1521.33625 dollars.`

Another example:

Input: `4`

Output: `If 4 people split the inheritance, each person would get 12170.69 dollars.`

Keep in mind you will need to use conversion to use **floats**, **integers**, and **strings** correctly for this challenge.

## 5. What's the Century?

Write a program that takes in a year as an integer. **Print the century** that year was in.

For example, the year 1905 was in the 20th century, so the input `1905` would output `20`.

*Hint: the 1777 is considered the eighteenth century and 1812 is considered the nineteenth century.*

For example:

Input: `1905`

Output: `20`

Another example:

Input: `1860`

Output: `19`

**Hint:** try dividing by 100. Then convert to an integer to drop the decimal

**Hint:** integers will always be whole numbers and not decimals, so if you convert to an integer, it will drop the decimal.

## 6. Debugging Challenge 2

Detective Buggy is in charge of buying all of the food for a party, and his friends will pay him back. He wrote a program to calculate totals for him.

Copy and paste his code into your editor and fix all of the bugs in his code!

Note: there aren't any bugs in the math logic, just conversion errors between variable types and syntax errors.

#Find out how many people are coming to dinner

```
num_people = input("How many people are coming to dinner? ")
```

```
num_people = num_people
```

#Hamburgers are \$1.29 each, rolls are \$0.49, and corn is \$0.80. Total up the items

```
hamburger_price = 1.29
```

```
rolls_price = 049
```

```
corn_price = 0.80
```

#Ask how many of each everyone will eat

```
hamburger_count = int(input("How many hamburgers will everyone have? "))
```

```
rolls_count = bool(input("How many rolls will everyone have? "))
```

```
corn_count = str(input("How many pieces of corn will you have? "))
```

#Calculate the total (there are no bugs below this line)

```
total = 0
```

```
total = total + (hamburger_count * hamburger_price * num_people)
```

```
total = total + (rolls_count * rolls_price * num_people)
```

```
total = total + (corn_count * corn_price * num_people)
```

#Calculate how much each person owes with and without change (there are no bugs below this line)

```
noChange = int(total / num_people)
```

```
change = float(total / num_people)
```

```
print("Each person owes $" + str(noChange) + " without change, or $" + str(change) + " if change is included.")
```

For example:

Inputs: 10 , 10 , 10 , 10

Output: Each person owes \$25 without change, or \$25.8 if change is included.

Another example:

Inputs: 5 , 5 , 5 , 5

Output: Each person owes \$12 without change, or \$12.9 if change is included.

## Answer Keys & Solutions

### Checkpoint Solutions

#### Python Math

```
1 caterpillars = 3
2 leaves = 25
3
4 print(caterpillars * leaves)
```

### Questions

#### 1. Which symbol is used for multiplication in Python?

MULTIPLE CHOICE

Correct Answer:

- A. x ✗ Incorrect
- B. X ✗ Incorrect
- C. \* ✓ Correct
- D. ^ ✗ Incorrect

#### Explanation:

This symbol is also called an asterisk.

#### 2. Which symbol is used for division in Python?

MULTIPLE CHOICE

Correct Answer:

- A. / ✓ Correct
- B. \ ✗ Incorrect
- C. | ✗ Incorrect
- D. - ✗ Incorrect

#### Explanation:

This symbol is also called a forward slash.

### 3. What is the output of this code?

MULTIPLE CHOICE

Correct Answer:

- A. 7.0 ✗ Incorrect
- B. 3.0 ✗ Incorrect
- C. 5.0 ✓ Correct
- D. 15 ✗ Incorrect

#### Explanation:

Rocks is divided by 3.

### 4. In the order of operations, what statement comes first?

MULTIPLE CHOICE

Correct Answer:

- A. multiplication ✗ Incorrect
- B. division ✗ Incorrect
- C. addition ✗ Incorrect
- D. parentheses ✓ Correct
- E. subtraction ✗ Incorrect

#### Explanation:

The acronym for the order of operations would be PMDAS

### 5. In the order of operations, what statement comes last?

MULTIPLE CHOICE

Correct Answer:

- A. parentheses ✗ Incorrect
- B. multiplication/division ✗ Incorrect

C. addition/subtraction

✓ Correct

**Explanation:**

The acronym for the order of operations would be PMDAS

**6. True or False: You can do arithmetic in any order and still get the correct answer.**

MULTIPLE CHOICE

**Correct Answer:**

A. True

✗ Incorrect

B. False

✓ Correct

**Explanation:**

The order of operations matters.

**7. What will the following print out?**

MULTIPLE CHOICE

**Correct Answer:**

A. 20

✓ Correct

B. 35

✗ Incorrect

C. 15

✗ Incorrect

D. 48

✗ Incorrect

**Explanation:**

Do multiplication first, then do addition.

**8. If the value of 'a' is 20 and 'b' is 5, what will be the output of the following code?**

MULTIPLE CHOICE

**Correct Answer:**

A. 100

✓ Correct

B. 20

✗ Incorrect

C. 25

✗ Incorrect

D. 4

✗ Incorrect

**Explanation:**

This symbol \* means multiplication

**9. Which of the following arithmetic operations is correctly represented in Python?**

MULTIPLE CHOICE

**Correct Answer:**

A. addition:  $c = a - b$

✗ Incorrect

B. subtraction:  $c = a + b$

✗ Incorrect

C. multiplication:  $c = a \# b$

✗ Incorrect

D. division:  $c = a / b$

✓ Correct

**Explanation:**

The forward slash is for division

**10. What is the output of the following code?**

MULTIPLE CHOICE

**Correct Answer:**

A. 5

✗ Incorrect

B. 10

✗ Incorrect

C. 15

✓ Correct

D. 105

✗ Incorrect

**Explanation:**

What is  $10 + 15$ ?

11. If 'x' is assigned the value 15 and 'y' is assigned the value 3, what is the result of the following operation in Python?

MULTIPLE CHOICE

Correct Answer:

- A. 18 ✗ Incorrect
- B. 5 ✗ Incorrect
- C. 45 ✗ Incorrect
- D. 5.0 ✓ Correct

**Explanation:**

The forward slash is for division

12. What is the output of the following code?

MULTIPLE CHOICE

Correct Answer:

- A. 10 ✗ Incorrect
- B. 21 ✓ Correct
- C. 4 ✗ Incorrect
- D. 2 ✗ Incorrect

**Explanation:**

This symbol \* means multiplication

13. If one spider has 8 legs, which of the following expressions calculates the total number of legs for 15 spiders?

MULTIPLE CHOICE

Correct Answer:

- A. `total_legs = 15 * 8` ✓ Correct
- B. `total_legs = 15 + 8` ✗ Incorrect
- C. `total_legs = 15 - 8` ✗ Incorrect



D. `total_legs = 15 / 8`

✗ Incorrect

### Explanation:

Each spider has 8 legs, and we have 15 of them.

14. If 'a' is assigned the value 18 and 'b' is assigned the value 2, what is the result of the following operation in Python?

MULTIPLE CHOICE

### Correct Answer:

A. 20

✗ Incorrect

B. 9

✗ Incorrect

C. 36

✗ Incorrect

D. 9.0

✓ Correct

### Explanation:

What is 18 divided by 2?

## Challenges

### 1. Adding Numbers

#### Solution:

```
1 pumpkin_seeds = int(input("How many pumpkin seeds do you have?"))
2 beans = int(input("How many beans do you have?"))
3
4 print(pumpkin_seeds + beans)
```

### 2. Number Neighbors

#### Solution:

```
1 number = int(input("Pick a number"))
2
3 low_neighbor = number - 1
4 high_neighbor = number + 1
5
```

```
6 print(str(low_neighbor) + "," + str(high_neighbor))
```

### 3. Group Gift

Solution:

```
1 money_per_person = int(input("How much did you ask each person to bring?"))
2
3 people = int(input("How many people are helping?"))
4
5 total_money = money_per_person * people
6
7 print(total_money)
```

### 4. Inheritance

Solution:

```
1 inheritance = 48682.76
2
3 people = int(input("How many people will split the inheritance?"))
4
5
6 money_per_person = inheritance / people
7
8 print("If " + str(people) + " people split the inheritance, each person would get " +
  str(money_per_person) + " dollars.")
```

### 5. What's the Century?

Solution:

```
1 year = int(input("What year is it?"))
2
3 century = int(year/100)
4
5 current_century = century + 1
6
7 print(current_century)
```

### 6. Debugging Challenge 2

Solution:

```
1 #Find out how many people are coming to dinner
2 num_people = int(input("How many people are coming to dinner? "))
```

```
3 #You need to buy the food! Hamburgers are $1.29 each, rolls are $0.49, and corn is
  $0.80. Total up the items
4 hamburger_price = 1.29
5 rolls_price = 0.49
6 corn_price = 0.80
7 #Ask how many of each everyone will eat
8 hamburger_count = int(input("How many hamburgers will everyone have? "))
9 rolls_count = int(input("How many rolls will everyone have? "))
10 corn_count = int(input("How many pieces of corn will everyone have? "))
11 #Calculate the total
12 total = 0
13 total = total + (hamburger_count * hamburger_price * num_people)
14 total = total + (rolls_count * rolls_price * num_people)
15 total = total + (corn_count * corn_price * num_people)
16 #Calculate how much each person owes
17 noChange = int(total / num_people)
18 change = float(total / num_people)
19 print("Each person owes $" + str(noChange) + " without change, or $" + str(change) +
  " if change is included.")
```