

# Numbers

## Textbook

# Numbers

## Foundation

You are making great progress with understanding data types and variables! Now we need to put them into use.



## More Data Types

As mentioned in the last lesson, there are a few more ways you can declare a number in python.

### Integers

- `int`: Integers are used for whole numbers, positive or negative.

```
age = 24
```

```
siblings = 3
```

```
temperature = -50
```

If you have really large numbers, normally they would look like this:

1,000

1,000,000

You **cannot** use commas in integers like this in Python. So if you want to separate the zeroes in larger numbers you can use the underscore.

```
total = 1_000
```

```
large_number = 1_000_000
```

**Note:** You cannot use more than one underscore in a row.

## Floats

- [float](#): This is a number, positive or negative, with one or more decimals.

```
gpa = 4.0
```

```
pizza_slices = 2.5
```

```
dessert_slices = -1.75
```

To be clear, even though `4.0` and `4` are the same value, 4 is an example of an integer and 4.0 is a float.

## Scientific Notation

If the float literal contains the letter `e`, it means that its value is [scaled](#), that is, it's multiplied by a **power of 10** while the exponent is placed directly after the letter. The exponent must be an integer.

$aE_b$

is treated as a value equal to:

$a \times 10^b$

Let's see an example.

```
1 total = 4.56e3
2 print(total)
```

Try it!

This will print out the following

```
4560.0
```

You can think of the variable named total to hold  **$4.56 \times 10^3$**

This syntax is called *scientific notation* and is used to denote a number whose absolute value is extremely large (close to infinity) or extremely small (close to zero).

Here are some examples of correct float literals:

Float	Written Value	Value
1.3	one and three tenths	1.3
5.0	five point zero	5.0

0.1	one tenth	0.1
2e3	two thousand	2000
5e-1	five tenths	0.5
-1.1E-1	minus eleven hundredths	-0.11

## The Inaccuracy of Float Numbers in Programming

Because of the way computers process information through binary, the accuracy of decimal numbers is *slightly* off.

Try the following code to see the inaccuracy.

```
1 print(1.2 - 1)
```

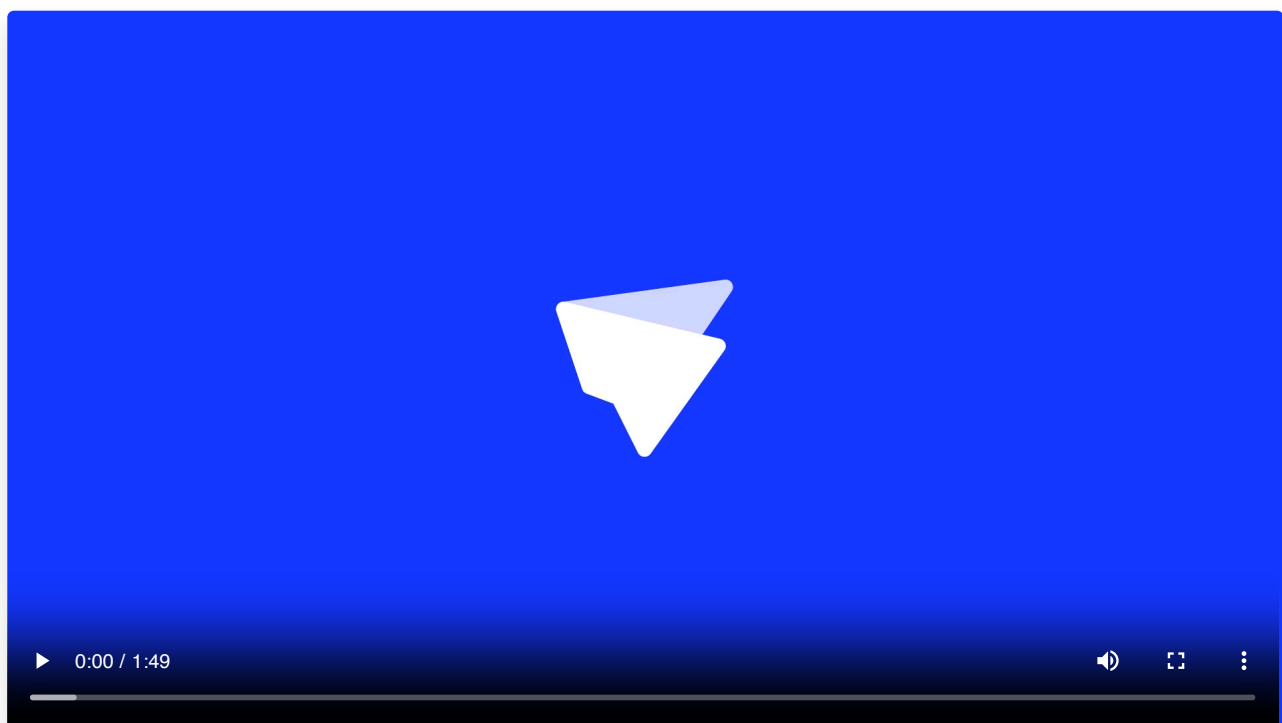
Try it!

You would expect this to print `.2`

But it actually prints out `0.19999999999999996`

This inaccuracy is a normal case encountered when handling floating-point numbers. It's a problem caused by the way floating-point numbers are represented with binary. They use a fixed number of binary digits to represent a decimal number. It is difficult to represent some decimal number in binary, so in many cases, it leads to small roundoff errors.

Most decimals (or floats) are accurate to 28 places after the decimal. For most use cases, this is accurate enough.



## Checkpoint

---

### Numbers

Declare and print out numeric variables.

Create **two** variables.

One variable should hold an **integer**, and one should hold a **float**.

#### Requirements:

- Create a variable that holds an integer.
- Create a variable that holds a float.

### Questions (8)

---

#### 1. Which of the following is an example of a float?

MULTIPLE CHOICE

Choose the correct answer:

- A. 14.0
- B. 14
- C. "14"
- D. 14j

#### 2. Which of the following are examples of an integer? Select all that apply.

SELECT MULTIPLE

Select all that apply:

- A. 35
- B. 42.3
- C. 9
- D. 4.0
- E. 5j

#### 3. What is the benefit of using a float?

MULTIPLE CHOICE

Choose the correct answer:

- A. It lets us avoid using decimals.
- B. It's a less accurate number.
- C. There is no benefit.
- D. It lets us use decimals.

**4. Edit the text box below to debug (fix) the code:**

DEBUG CODE

**Code to Debug:**

```
1 bananas == 400
```

**5. Debug the following code. Assume you were trying to assign the variable to the float 6.7.**

DEBUG CODE

**Code to Debug:**

```
1 height = "6.7"
```

**6. Which data type is used for numbers with one or more decimals?**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. String
- B. Integer
- C. Float
- D. Boolean

**7. If a variable named 'temperature' is assigned a value of -10, which data type would it be?**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. String
- B. Integer
- C. Float
- D. Boolean

**8. True or False: Both 4.0 and 4 are considered the same data type in Python.**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. True
- B. False

## Challenges (5)

### 1. Feet in a Meter

In track and field, distances are measured in meters. A meter is part of the metric system for measuring distance. One time around a track is 400 meters. 4 times around the track is 1600 meters which is equal to a mile.

There are 3.28084 feet in a meter. Assign that number to a float variable called `feet_in_meters` and **print it**.

#### Requirements:

- Create a variable named `feet_in_meters` and assign in the value you found from your Google search.
- Print the variable.

### 2. Sale Trick

Did you know that stores will use psychology tricks to encourage you to buy things there? They play soft music in the store to create a relaxed environment where you will want to take your time. Grocery stores put essential items like milk and eggs in the back of the store so you will have to walk past all the other items to get there, making it more likely you'll buy more.

Another example is to charge one cent less, making the main number price seem lower.

For example: instead of charging \$5 for a shirt, they will charge \$4.99.

Create the following **4 variables** and assign them to integers that might match their price:

`hamburger`

`candy`

`movie_ticket`

`video_game`

Below each variable, create **another variable** and assign it to floats that might match a price you would see in a store.

You should have a **total of 8 variables**.

#### Requirements:

- Variable named `hamburger` set to an integer.
- Variable named `candy` set to an integer.
- Variable named `movie_ticket` set to an integer.
- Variable named `video_game` set to an integer.
- 4 new variables assigned to the store price (a float).

### 3. Outdoors and Indoors

We all spend some time both outdoors and indoors. Which do you prefer?

For this challenge, you will have **4 total variables--two with integers and two with floats**.

1. Create a variable named `rank_outdoors` . Assign it an integer value **1-10** with 1 being "I hate being outside" and 10 being "I love being outside."
2. Create another variable named `rank_indoors` and assign it an **integer** as well.
3. Create another variable named `time_outdoors` and assign it to a **float** to depict what percentage of your day you think you spend outside.
4. Create another variable named `time_indoors` and assign it to a **float** to depict what percentage of your day you think you spend inside.
5. **Print** all variables in print statements.

#### Requirements:

- Create a variable named `rank_outdoors` and assign an integer to it.
- Create a variable named `rank_indoors` and assign an integer to it.
- Create a variable named `time_outdoors` and assign a float to it.
- Create a variable named `time_indoors` and assign a float to it.
- Print out each variable in a separate print statement.

### 4. Specific Answers

You are filling out a survey about yourself. The survey asks for an answer rating yourself from 1 to 5 on different questions. Usually, these kinds of surveys require you to answer with a whole number 1-5. But sometimes your TRUE answer is something in between the whole numbers.

Create **5 variables** and assign them to **integers** that answer the following five questions.

Beneath each variable, create **another variable** and assign it to a **float** that more accurately answers the question.

Answer the following questions on a scale from 1 to 5. 1 being "Not at all like me" and 5 being "Very much like me."

1. "I enjoy working in teams."
2. "I like to try new things."
3. "I love to be outside."
4. "I want to travel the world."
5. "School can be way hard for me."

You should have a total of **10 variables**.

#### Create the Following

1. 5 variables set to an integer 1-5
2. 5 variables set to a float (a decimal value)

#### Requirements:

- 5 variables set to an integer 1-5
- 5 variables set to a float (a decimal value)

## 5. How many pets?

You wanted to find out the average number of pets your friends have. You asked **8 friends** and found out how many pets they each have.

1. Here is your list: of **4, 6, 2, 2, 19, 5, 3, and 11**. Find the average number of pets your friends have by using the calculator on your computer. **Remember, to find the average you need to add all the numbers together, then divide by the total amount of numbers.**
2. Create a float variable called `average_pets` and assign the average of those eight numbers to it, then print the variable.

(Hint: It is possible to actually do the math in Python code, but this challenge is just looking for a variable set to a specific float value. Make sure you are **only printing that one specific float value.**)

Above and Beyond: Try the challenge again with real numbers from people in your class!

### Requirements:

- Create a variable named `average_pets` and assign it the value you came up with on the calculator.
- Print the `average_pets` variable.



## Answer Keys & Solutions

### Checkpoint Solutions

#### Numbers

```
1 pumpkins = 3
2 scarecrows = 1.2
3
4 print(pumpkins)
5 print(scarecrows)
```

### Questions

1. Which of the following is an example of a float?

MULTIPLE CHOICE

Correct Answer:

- |         |             |
|---------|-------------|
| A. 14.0 | ✓ Correct   |
| B. 14   | ✗ Incorrect |
| C. "14" | ✗ Incorrect |
| D. 14j  | ✗ Incorrect |

#### Explanation:

Floats have decimal places.

2. Which of the following are examples of an integer? Select all that apply.

SELECT MULTIPLE

Correct Answers:

- |         |             |
|---------|-------------|
| A. 35   | ✓ Correct   |
| B. 42.3 | ✗ Incorrect |
| C. 9    | ✓ Correct   |
| D. 4.0  | ✗ Incorrect |
| E. 5j   | ✗ Incorrect |

**Explanation:**

Integers do not have decimal values.

**3. What is the benefit of using a float?**

MULTIPLE CHOICE

**Correct Answer:**

- A. It lets us avoid using decimals. ✗ Incorrect
- B. It's a less accurate number. ✗ Incorrect
- C. There is no benefit. ✗ Incorrect
- D. It lets us use decimals. ✓ Correct

**Explanation:**

Floats allow for more accurate calculations.

**4. Edit the text box below to debug (fix) the code:**

DEBUG CODE

**Incorrect Code:**

```
1 bananas == 400
```

**Correct Solution:**

```
1 bananas = 400
```

**Explanation:**

Variables use one equals sign

**5. Debug the following code. Assume you were trying to assign the variable to the float 6.7.**

DEBUG CODE

**Incorrect Code:**

```
1 height = "6.7"
```

**Correct Solution:**

1 | height = 6.7

**Explanation:**

Floats do not use quotation marks.

**6. Which data type is used for numbers with one or more decimals?**

MULTIPLE CHOICE

**Correct Answer:**

- |            |             |
|------------|-------------|
| A. String  | ✗ Incorrect |
| B. Integer | ✗ Incorrect |
| C. Float   | ✓ Correct   |
| D. Boolean | ✗ Incorrect |

**Explanation:**

When a number has a decimal, it's not considered an integer

**7. If a variable named 'temperature' is assigned a value of -10, which data type would it be?**

MULTIPLE CHOICE

**Correct Answer:**

- |            |             |
|------------|-------------|
| A. String  | ✗ Incorrect |
| B. Integer | ✓ Correct   |
| C. Float   | ✗ Incorrect |
| D. Boolean | ✗ Incorrect |

**Explanation:**

If the number doesn't have a decimal, it's not a float.

**8. True or False: Both 4.0 and 4 are considered the same data type in Python.**

MULTIPLE CHOICE

### Correct Answer:

A. True

✗ Incorrect

B. False

✓ Correct

### Explanation:

One is an integer and one is a float.

## Challenges

### 1. Feet in a Meter

#### Solution:

```
1 feet_in_meters = 3.28084
2 print(feet_in_meters)
```

### 2. Sale Trick

#### Solution:

```
1 hamburger = 3
2 hamburger_store = 2.99
3
4 candy = 1
5 candy_store = .99
6
7 movie_ticket = 5
8 movie_store = 4.98
9
10 video_game = 20
11 game_store = 19.95
```

### 3. Outdoors and Indoors

#### Solution:

```
1 rank_outdoors = 10
2 rank_indoors = 3
3 time_outdoors = 2.5
4 time_indoors = 6.0
5
6 print(rank_outdoors)
7 print(rank_indoors)
8 print(time_outdoors)
9 print(time_indoors)
```

## 4. Specific Answers

Solution:

```
1 answer1 = 3
2 real_answer1 = 3.5
3
4 answer2 = 5
5 real_answer2 = 5.1
6
7 answer3 = 4
8 real_answer3 = 4.4
9
10 answer4 = 4
11 real_answer4 = 4.5
12
13 answer5 = 2
14 real_answer5 = 2.3
```

## 5. How many pets?

Solution:

```
1 average_pets = 6.5
2 print(average_pets)
```