



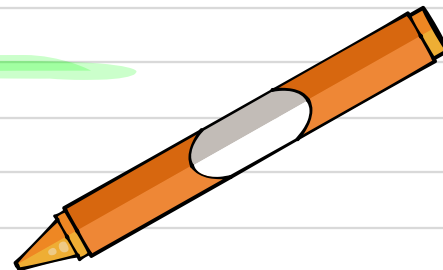
# Tech Mentorship Unit 6

Booleans, Comparison Operators, and Logical Operators



01

# Booleans



# What is a Boolean?

A Boolean is a data type with two possible values: True or False



True

1

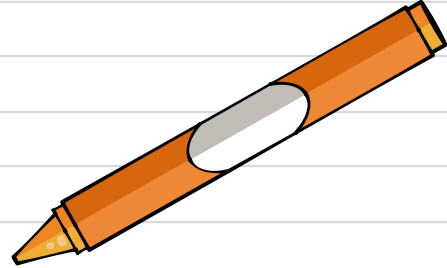
False

0



**02**

# **Comparison Operators**



# What are Comparison Operators?

**Comparison operators** are special characters that allow us to compare values and check the relationship between them.

>

Greater Than

<

Less Than

==

Equal to

>=

Greater Than or Equal to

<=

Less than or Equal to

!=

Not Equal to

# Comparison Operators in Action Pt.1

01

$10 > 4$

Answer:

02

$11 == 4$

Answer:

03

$3 < 3$

Answer:

04

$4 == 4$

Answer:

05

$4 < 12$

Answer:

06

$6 > 6$

Answer:

# Comparison Operators in Action Pt.1

01

$10 > 4$

Answer: True

02

$11 == 4$

Answer: False

03

$3 < 3$

Answer: False

04

$4 == 4$

Answer: True

05

$4 < 12$

Answer: True

06

$6 > 6$

Answer: False

## Comparison Operators in Action Pt.2

01

$10 \geq 10$

Answer:

02

$2 \neq 3$

Answer:

03

$10 \leq 3$

Answer:

04

$5 \geq 10$

Answer:

05

$5 \neq 5$

Answer:

06

$9 \leq 9$

Answer:



## Comparison Operators in Action Pt.2

01

$10 \geq 10$

Answer: True

02

$2 \neq 3$

Answer: True

03

$10 \leq 3$

Answer: False

04

$5 \geq 10$

Answer: False

05

$5 \neq 5$

Answer: False

06

$9 \leq 9$

Answer: True

# Comparison Operators in Python

```
main.py x +
main.py
1 #=====
2 # Test out the ">" & ">=" Logical Operator in Python
3
4 print("5 is greater than 2:", 5 > 2)
5 print("5 is greater than or equal to 5:", 5 >= 5)
6 print()
7
8 #=====
9 # Test out the "<" & "<=" Logical Operator in Python
10
11 print("5 is less than 10:", 5 < 10)
12 print("3 is less than or equal to 3", 3 <= 3)
13 print()
14
15 #=====
16 # Test out the "==" & "!=" Logical Operator in
   Python
17
18 print("5 equals 6:", 5 == 6)
19 print("10 does not equal 7", 10 != 7)
```

```
Shell x >_ Console x +
5 is greater than 2: False
5 is greater than or equal to 5: True

5 is less than 10: True
3 is less than or equal to 3 True

5 equals 6: False
10 does not equal 7 True
> □
```

Notice how we can use  
**Booleans**  
and **Comparison**  
**Operators** in Python





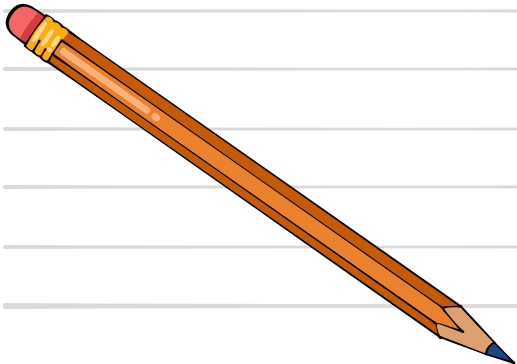
03

# Logical Operators



# What are Logical Operators

**Logical operators** are special keywords used to combine multiple conditions and determine the overall truth value of the combined conditions.



## And

The and operator in Python evaluates to True only if both conditions on its left and right are True; otherwise, it evaluates to False.

## Or

It evaluates to True if at least one of the conditions is True. If both conditions are False, it evaluates to False.

## Not

The not operator is used to negate or reverse the value of a condition.

# **“and” Operator in Action**



**True and True**

Answer: True

**True and False**

Answer: False

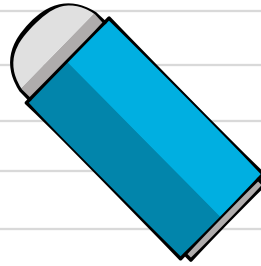


**False and True**

Answer: False

**False and False**

Answer: False



# **“or” Operator in Action**



**True or True**

Answer: True

**True or False**

Answer: True

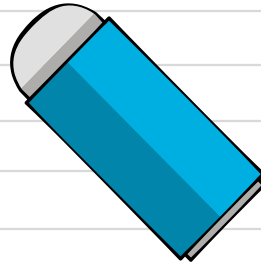


**False or True**

Answer: True

**False or False**

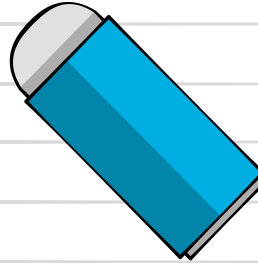
Answer: False



# **"Not" Operator in Action**

**Not True**

Answer: False



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Not False**

Answer: True

# Logical Operators in Python

Take a Look at how we  
can use Booleans and  
Comparison Operators  
in Python



```
Tech Mentorship
SamuelTrujillo1

main.py
1 #=====
2 # Test out the "and" Logical Operator in Python
3
4 print("True and True is:", True and True)
5 print("True and False is:", True and False)
6 print("False and True is:", False and True)
7 print("False and False is:", False and False)
8 print()
9
10 #=====
11 # Test out the "or" Logical Operator in Python
12
13 print("True or True is:", True or True)
14 print("True or False is:", True or False)
15 print("False or True is:", False or True)
16 print("False or False is:", False or False)
17 print()
18
19 #=====
20 # Test out the "not" Logical Operator in Python
21
22 print("not True is:", not True)
23 print("not False is:", True and False)
```





04

# Comparison & Logical Operators





# Both Operators Together Pt.1

$$5 > 2 \text{ and } 10 < 5$$

$$5 > 2$$

$$10 < 5$$

T and F

False

Solve the Left Side  
First

Then Solve the right  
Side

Apply to the  
booleans with the  
"and"

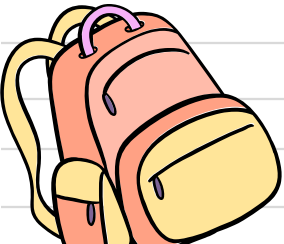
The Overall  
Statement is False

**5 > 2: True**

**5 > 2: False**

**T and F: F**

**5 > 2 and 10 < 5: F**



# Both Operators in Python Pt.1

Here is the previous slide in Python

A screenshot of a VS Code editor interface. The top bar shows the user 'Tech Mentorship SamuelTrujillo1' and a green play button. The left sidebar has a tab for 'main.py'. The editor window shows the following code:

```
1 #=====
2 # 5 > 2 and 10 < 5 in Python
3 print(5 > 2 and 10 < 5)
```

The right sidebar has a tab for '>\_ Console' showing the output:

```
False
> []
```

There are several annotations: a grey rectangular box above the play button, a blue arrow pointing from the text above to the 'main.py' tab, a blue wavy line below the code editor, and a grey rectangular box below the console output.



## Both Operators Together Pt.2

$$3 \neq 3 \text{ or } 5 \leq 5$$

**$3 \neq 3$**

**$5 \leq 5$**

**F or T**

**True**

Solve the Left Side  
First

Then Solve the right  
Side

Apply to the  
booleans with the  
"and"

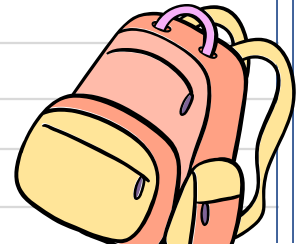
The Overall  
Statement is True

**$3 \neq 3$ : False**

**$5 \leq 5$ : True**

**F or T: True**

**$3 \neq 3$  or  $5 \leq 5$ : True**



# Both Operators in Python Pt.2

Here is the previous slide in Python

A screenshot of a VS Code editor window. The top bar shows the 'Tech Mentorship' workspace and the user 'SamuelTrujillo1'. A green play button is visible in the top bar. The editor has two tabs: 'main.py' and 'Shell'. The 'main.py' tab is active, showing a Python script with three lines: a comment, a comment about the operators, and a print statement. The 'Shell' tab is also open, showing the output 'True' and a prompt character. There are some redaction boxes in the image: a grey box over the top bar, a white box over the 'main.py' tab, and a white box over the 'Shell' tab. A blue wavy line is drawn at the bottom of the image.

```
1 #=====
2 # 3 != 3 or 5 <= 5 in Python
3 print(3 != 3 or 5 <= 5)
```

True



## Both Operators Together Pt.3

$\text{not}(5 \leq 2 \text{ and } 4 == 4)$

$5 \leq 2$

$4 == 4$

F and T

$\text{not}(F)$

Solve the Left Side  
First

Then Solve the right  
Side

Apply to the  
booleans with the  
“and”

Apply the “not”

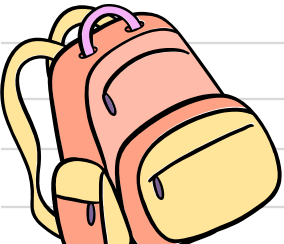
$5 \leq 2$ : False

$4 == 4$ : True

F and T: F

$\text{not}(F)$ : T

$\text{not}(5 \leq 2 \text{ and } 4 == 4)$ : True



# Both Operators in Python Pt.3

Here is the previous slide in Python

A screenshot of a VS Code editor interface. The top bar shows the 'Tech Mentorship' workspace and a green play button. The editor has two tabs: 'main.py' and 'Shell'. The 'main.py' tab is active, showing a Python script with four lines. The 'Shell' tab is also active, showing the output 'True'. There are several redaction boxes: a grey box at the top right, a brown box on the left side of the code editor, and a grey box at the bottom left of the code editor. A blue wavy line is drawn at the bottom of the image.

```
1 #=====
2 # not( 5 <= 2 and 4 == 4 ) in Python
3 print(not (5 <= 2 and 4 == 4))
4
```

True

# Practice & Review

**01**

**not( 7 < 2 or 5 != 5 )**

Answer: True

**02**

**Not ( True ) and True**

Answer: False

**03**

**4 > 3 and 2 != 1**

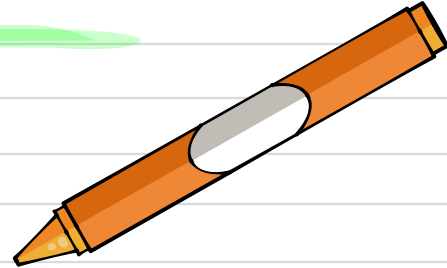
Answer: True





05

# Boolean Algebra Challenges



# Boolean Algebra Formulas

Drawing on similarities with traditional math allows us to do more complex Boolean Algebra

Treat variables as either 0 or 1  
(AKA F/T)

Treat 'or' like addition

Treat 'and' like multiplication

Name	AND form	OR form
Identity law	$1A = A$	$0 + A = A$
Null law	$0A = 0$	$1 + A = 1$
Idempotent law	$AA = A$	$A + A = A$
Inverse law	$A\bar{A} = 0$	$A + \bar{A} = 1$
Commutative law	$AB = BA$	$A + B = B + A$
Associative law	$(AB)C = A(BC)$	$(A + B) + C = A + (B + C)$
Distributive law	$A + BC = (A + B)(A + C)$	$A(B + C) = AB + AC$
Absorption law	$A(A + B) = A$	$A + AB = A$
De Morgan's law	$\overline{AB} = \bar{A} + \bar{B}$	$\overline{A + B} = \bar{A}\bar{B}$