

# Basics of JS

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## JavaScript - An Introduction

JavaScript is a text-based programming language used both on the client-side and server-side. It allows you to make web pages that are interactive in nature. JavaScript gives web pages interactive elements that engage a user. Suppose you want a user to pause or play a music video, you need interactive buttons, which send the command of pausing and playing to your website. Common examples of JavaScript that you might use every day include the search box on Amazon, songs on music websites or a profile search box on Instagram.

To recap, JavaScript adds a certain behavior to your websites.

For many years, JavaScript was only functional on some browsers. Microsoft's Internet Explorer had no support for JavaScript until much later. Instead, Microsoft created its own proprietary client-side script called JScript. In the early days of Web development, programmers who wished to create dynamic websites were often forced to choose one browser family over the other. This was less than ideal because it made the Internet less universally accessible.

## What can it do for you?

1. JavaScript loads content into the document (DOM) if and when the user needs it, without having the need to reload the entire web page — this is commonly referred to as Ajax. **(You will learn this soon enough)**
2. JavaScript can test for what is possible in your browser and react accordingly — this is called Principles of unobtrusive JavaScript. It is also known as defensive scripting.

3. JavaScript can help fix browser problems or patch holes in browser support. Common use of this is fixing CSS.
4. While JavaScript is a client-side language, some of its most powerful features involve asynchronous interaction with a remote server. Asynchronous simply means that JavaScript is able to communicate with the server in the background without interrupting the user interaction taking place in the foreground.

Take a search engine for example. Today, search engines almost all have an autocomplete function. The user begins typing a word into the search box and a list of possible search terms or phrases appears below. The experience is seamless. Suggested search terms appear without reloading the page.

In the background, JavaScript reads the letters as the user types, sends those letters to a remote server and the server sends suggestions back.

The software on the server side analyzes the words and runs algorithms to anticipate the user's search term. Such programs are diabolically large and complex. The JavaScript on the client's machine is as simple and small as possible so as not to slow down the user's interaction. The communication between JavaScript and the server-side program is limited by the user's bandwidth. This is why developers prioritize efficiency in JavaScript functions and make the amount of data communicated between the programs as small as possible.

Only once the user selects a search term does the entire page reload and produce the search results. Engines such as Google have reduced or eliminated the need to reload, even for that step. They simply produce results using the same asynchronous process, **which you will learn in the Backend Development part of this course.**

## JS DATA TYPES

There are **7 data types** available in JavaScript. You need to remember that JavaScript is **loosely typed**(or **dynamic language**), so any value can be assigned to variables in JavaScript.

According to latest ECMAScript standard there are **6 primitive data types** and **1 object** -

- **Number** - represents integer and floating values
- **String** - represents textual data
- **Boolean** - logical entity with values as 'true' and 'false'
- **Undefined** - represents variable whose value is not yet assigned
- **Null** - represents intentional absence of value
- **Symbol** - represents unique value
- **Object** - represents key value pair

All of them except Object have **immutable values**, i.e. the values which cannot be changed.

Some important information about the data types have been described below -

- **Number** represents variables whose value is either an integer or float. It can have numbers in the range between  $-(2^{53}-1)$  and  $(2^{53}-1)$ . Other than integer and float numbers, it has three symbolic values: +Infinity, -Infinity, and NaN. It uses 2 constants - Number.MAX\_VALUE and Number.MIN\_VALUE. Both of these constants lie between +Infinity and -Infinity. Eg., 10, -25.2, 8.321.
- **String** represents textual data. String contains elements that can be accessed using the **index**. The **first element has index 0**. Eg., "hello", "1234", "12here". You can access each element of the string like - str="HelloWorld", then str[1] will output 'e' on the console.

## SOME IMPORTANT VALUES

Below are some important values that are defined in brief-

- **undefined**

'undefined' is the value assigned to the variable that has not yet been assigned any value. We can also **explicitly assign an 'undefined' value** to a variable, but that does not make any sense due to its meaning.

Eg., `var a;` defines a variable that has not been assigned any value. If you write on the console as - `console.log(a);`, then 'undefined' is printed.

- **null**

'null' is the value that represents a reference that points to a non-existent object or address. This means that there is an absence of a value. The **data type for null value is "Object"**.

- **NaN**

'NaN' means **Not-A-Number**. So, if any *expression fails to return a number*, then 'NaN' is printed on the console. Eg., `(12 - "abc")` cannot be evaluated to a number, so 'NaN' is printed on the console. The **data type for 'NaN' is "Number"**.

- **Infinity**

**Infinity** is a variable in global scope. Its **value is greater than any other number**. It literally works as Infinity, i.e. it has the same property as in Mathematics. Any numeric expression evaluated to a number outside the range of the number, prints 'Infinity' on the console.

## typeof OPERATOR

'typeof' operator is used to **return the name of the data type to which the value belongs to**. It returns the name of the data type in the form of a string. There are two syntax for using **typeof** operator -

```
typeof operand
```

OR

```
typeof (operand)
```

The parentheses are optional. Operand can be a **variable** or **some value** or **an expression**. Below are some of the data types and their return values of 'typeof' -

S.No.	Data Type	Return value of 'typeof'
1.	Number	"number"
2.	String	"string"
3.	Boolean	"boolean"
4.	Undefined	"undefined"
5.	Null	"object"
6.	Symbol	"symbol"
7.	Object	"object"

#### **EXTRA:**

**You can read *typeof* in detail from the below link -**

**<https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/typeof>**

## **OPERATORS IN JS**

**Operators** are used to perform some action on operands. Operand can be of any data type, eg. number, boolean, string, etc..

Some of the operators are described below -

### **- Arithmetic Operators**

Arithmetic operators take numerical values as operands and evaluate them to a single numerical value. Some of the arithmetic operators are -

- **Addition(+)** - It adds the numerical operands and is also used for string concatenation. It will add numerical and string operand to a number if the string can be converted to a number. Else it concatenates them.
- **Subtraction(-)** - It subtracts the two numeric operands. If any one of them is not a number or cannot be converted to a number, then '**NaN**' is printed.

- **Division(/)** - It divides the first operand with the second operand. If the second operand is '+0' or '-0', then '**Infinity**' and '**-Infinity**' are printed respectively. If they are not divisible '**NaN**' is printed. Try dividing 0 by 0 and see what happens!
- **Multiplication(\*)** - It multiplies the two numeric operands. Any number multiplied with Infinity prints '**Infinity**'. See what happens when **Infinity** is multiplied with 0.
- **Remainder(%)** - It finds the remainder left after division. If one of the operands is '**Infinity**' or '**NaN**', then '**NaN**' is printed.

**EXTRA:**

*You can learn more about arithmetic operator from this link -*

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Arithmetic\\_Operators](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Arithmetic_Operators)

## - Assignment Operators

**Assignment operators** are used to **assign value of the right operand/expression to the left operand**. The simplest assignment operator is **equal (=)**, which assigns the right operand value to left operand.

Eg., `var x=10; var y=x;` will assign value 10 to y.

Other assignment operators are **shorthand operations of other operators**. They are called **compound assignment operators**. Some of them with their meaning (i.e. the extended version of these operations) are provided below -

S.No.	Name	Shorthand Operator	Meaning
1.	Addition Assignment	<code>x +=y</code>	<code>x = x + y</code>
2.	Division Assignment	<code>x /=y</code>	<code>x = x / y</code>
3.	Exponentiation Assignment	<code>x **=y</code>	<code>x = x ** y</code>
4.	Right Shift Assignment	<code>x &gt;&gt;=y</code>	<code>x = x &gt;&gt; y</code>
5.	Bitwise XOR Assignment	<code>x ^=y</code>	<code>x = x ^ y</code>

### **EXTRA:**

To look for other assignment operators, visit the link below -

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Assignment\\_Operators#Overview](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Assignment_Operators#Overview)

## - **Increment and Decrement Operator**

The **increment operator** increments the value of the numeric operand by one.

The **decrement operator** decreases the value of the numeric operand by one.

There are two ways to use increment and decrement -

- **Using postfix (x++ or x--)** - the value is returned first and then the value is incremented or decremented.
- **Using prefix (++x or --x)** - the value is first incremented or decremented and then returned.

Eg., `var x=10; console.log(++x);` will print **11** on the console.

## - **Comparison Operators**

The **comparison operators** are used to **compare two values with each other**.

The **equality operator (==)** is used to **compare the two values**, if they are equal or not. But the values are not directly compared. First, **they are converted to the same data type and then the converted content is compared**.

Eg., `"1" == 1` evaluates to `true`, even though the first one is a 'string' and the other is a 'number'.

There is another comparison operator (**===**) known as a **strict equality operator**. It **checks both the data type and the content**. If the data type is not equal, it returns false.

So `"1" === 1` now evaluates to `false`.

Other comparison operators are -

- **Inequality (!=)** - It returns the opposite result of the equality operator.
- **Strict Inequality (!==)** - It returns the opposite result of the strict equality
- **Greater Than (>)** - It returns true if left operand is greater than the right one
- **Greater Than or Equal (>=)** - It returns true if the left operand is greater than or equal to the right one.
- **Less Than (<)** - It returns true if left operand is less than the right one
- **Less Than or Equal (<=)** - It returns true if the left operand is less than or equal to the right one.

**EXTRA:**

*You can get a more detailed comparison and working of equality operators from the link below -*

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Comparison\\_Operators](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Comparison_Operators)

## - Logical Operators

The **logical operators** use boolean values as their operands. These operands are mostly expressions that evaluate to **'true'** or **'false'**.

There are three logical operators -

- **Logical AND (&&)** - returns **'true'** if both operands/expression are true, else **'false'**. If the first expression is false, the second expression is not evaluated and **'false'** is returned. Eg., `false && true` returns `false`.
- **Logical OR (||)** - returns **'true'** if any of the operands/expression is true, else **'false'**. Eg., `false || true` returns `true`.
- **Logical NOT (!)** - returns the opposite boolean value to which the expression is evaluated to. Eg., `!false` returns `true`.

**EXTRA:**



*The below link provides a detailed view of the logical operators -*

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Logical\\_Operators](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Logical_Operators)

## - Bitwise Operators

The **bitwise operators** treat operands as sequences of 32 bits binary representation(0 and 1).

The several bitwise operators are -

- **Bitwise AND (&)** - returns 1 for each bit position where both bits are 1s. Eg., (5 & 13 = 5) is evaluated as (0101 & 1101 = 0101).
- **Bitwise OR (|)** - returns 1 for each bit position where either bit is 1. Eg., (5 | 13 = 13) is evaluated as (0101 | 1101 = 1101).
- **Bitwise XOR (^)** - returns 1 for each bit position where either bit is 1 but not both. Eg., (5 ^ 13 = 8) is evaluated as (0101 ^ 1101 = 1000).
- **Bitwise NOT (~)** - returns the inverted bits of operand. This means that 0 becomes 1 and vice versa.
- **Left Shift (<<)** - shifts bits to the left and inserts 0s from right.
- **Sign-propagating Right Shift (>>)** - shifts bits to the right and inserts either 0s or 1s from the left according to the sign of the number ('0' for positive and '1' for negative).
- **Zero-fill Right Shift (>>>)** - shifts bits to the right and inserts 0s from left.

**EXTRA:**

*You can get details of bitwise operator from the below link -*

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Bitwise\\_Operators](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Bitwise_Operators)

**NOTE:** You need to be careful while working with operators because they work in precedence. So you might use round brackets to group them according to your priority of execution. Also, the round brackets (called as **grouping operator**) has the highest precedence. You can check the link below to see the precedence of the operators -

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Operator\\_Precedence#Table](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Operators/Operator_Precedence#Table)

### **EXTRA:**

*You can read about all the operators from the link below -*

[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Expressions\\_and\\_Operators#Operators](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Expressions_and_Operators#Operators)

## CONDITIONALS

**Conditional statements** are used to *run different sets of statements according to the conditions*. This means that based upon different conditions, we can perform different actions. These are the same as used in other languages.

Some of the conditional statements have been described below -

### - **If statements**

The '**if**' statement specifies a block of statements (JavaScript code) that gets executed when the '**condition**' specified in the 'if' statement evaluates to true.

The syntax for the 'if' statement is -

```
if (condition) {  
    ...STATEMENTS...  
}
```

First, the condition is evaluated and if it is **true**, then the statements inside it are executed. Else if the condition is **false**, statements inside '**if**' are not executed.

### - **if-else Statements**

The '**if**' statement specifies a block of statements (JavaScript code) that gets executed when the '**condition**' specified in the '**if**' statement evaluates to true. Else, if the **condition is false** then the statements inside the '**else**' block are **executed**.

The syntax for the 'if-else' statement is -

```
if (condition) {
    ...STATEMENTS...
} else {
    ...SOME OTHER STATEMENTS...
}
```

## - else-if statements

The above two works for only two options i.e. whether the condition is **true** or **false**. Using **else-if** we can define **more than one conditions** and form a chain. The first condition that returns **true** gets executed, else the last 'else' block is executed.

```
if (condition - 1) {
    ...STATEMENTS...
} else if (condition - 2) {
    ...SOME OTHER STATEMENTS...
}...
...
...
else if (condition - (n)) {
    ...SOME OTHER STATEMENTS...
} else {
    ...EXECUTE IF NO CONDITION IS SATISFIED...
}
```

Now the first condition is checked. If it evaluates to **true**, it gets executed and other '**else-if**' blocks are not checked. If the first condition is **false**, then the second condition is checked.

Like this, each '**if**' condition is checked one by one, until one is **true** or '**else**' block is reached. If any one of them is **true**, the block associated with it gets executed. Else the '**else**' block is executed.

## - Switch statements

The **switch** statements are similar to **else-if** statements, but **works on a single expression**. This expression evaluates to different values which decide which block of code needs to be executed.

The syntax for 'switch' statement is -

```
switch (expression) {
```

```

case choice1:
    Run
    if expression = choice1
    break;
case choice2:
    run
    if expression = choice2
    break;
...
...
...
case choice(n):
    run
    if expression = choice(n)
    break;
default:
    run
    if no choice is found
}

```

The expression gives some result which is checked against the choices. If any of them matches, its set of statements get executed. Else the last '**default**' block gets executed.

We have provided a '**break**;' statement after each case is completed, to stop the execution of the '**switch**' block. If **break** is not present, then the case after the one that matches also gets executed until '**break**;' is found or switch block does not end.

### **EXTRA:**

*You can read about these conditional statements from the link below -*

[https://developer.mozilla.org/en-US/docs/Learn/JavaScript/Building\\_blocks/conditionals](https://developer.mozilla.org/en-US/docs/Learn/JavaScript/Building_blocks/conditionals)

## **LOOPS**

**Loops** are used to do **something repeatedly**. Let's say that you need to print 'n' numbers, then you can use a loop to do so. There are many different kinds of loops, but they almost do the same thing. Their use varies depending on the type of situation, where one loop will be easy to implement over another.

The various loops that JavaScript provide are described below -

#### - **for statement**

A **for** loop is used to ***repeat something until the condition evaluates to false***. The syntax for '**for**' loop is -

```
for ( [initializationStatement] ; [condition] ; [updateStatement] )
{
    ... STATEMENTS ...
}
```

The **initializationStatement** used to initialize loop counters.

The **condition** is the expression that is evaluated to boolean value 'true' or 'false'.

The **updateStatement** is used to update the loop counters.

Some points to remember about for loop in JS are -

- The **initializationStatement** is optional and you can initialize these statements before the 'for' loop.
- You can provide more than one **initializationStatement** using **comma**( "," )as separator.
- The loop executes until the condition becomes false. If you omit the '**condition**', then it is evaluated to be true.
- The **updateStatement** is also optional and can be present inside the loop. If you do not provide any update, the loop will execute infinitely.

Eg., for(var i=0; i<=10; i++) { ... }; is loop where we have initialization, condition and update statements.

Another example where there is no initializer, the loop will look like this -

for( ; i<=10; i++) { ... };. Here you can see a semicolon(;) at the start and then the condition. You need to provide semicolons for each part of the loop, even if the options are missing. Eg., for(vari=0; ; i++);

#### - **while statement**

The **while** statement ***executes the statements until the condition is not false***. The syntax for '**while**' loop is -

```
while (condition) {
    ...STATEMENTS...
}
```

First, the **condition** is evaluated and if it is **true**, then the statements are executed and again the **condition** is tested. The execution stops when the **condition** returns **false**.

**NOTE:** You have to provide an update expression inside the loop, so that it does not repeat infinitely.

#### - **do...while statement**

The **do-while** loop is similar to while loop, except that **the statements are executed at least once**. The syntax for '**do-while**' loop is-

```
do {  
    ...STATEMENTS...  
} while (condition);
```

First, the statements are executed without checking the **condition**. After that the **condition** is checked and if it is **true** the statements are executed again.

## Advantages of JS

1. JavaScript is fast and reliable on the client side, as it runs immediately within the browser. It is unhindered by network calls to a backend server, unless outside resources are utilized.
2. It is very easy to learn and implement
3. It is a popular scripting language, accepted universally on the web.
4. JavaScript plays nicely with other languages and can be used in a huge variety of applications.
5. Using JavaScript, we may create rich interfaces.
6. It adds dynamic nature to your web pages and provides a direct interface between actions made by the user with the desired effect.

## Disadvantages of JS

1. Since the script code is executed on a user's computer, in some cases it may be exploited for phishing or hacking purposes. A skilled programmer can inject malicious code into the script.
2. JavaScript is sometimes interpreted differently by different browsers. This makes it somewhat difficult to write cross-browser code.