JavaScript

.NET

JavaScript (JS) programming language conforms to the ECMAScript specification. JavaScript is a high-level language that is just-in-time compiled, has curly-bracket syntax, dynamic typing, prototype-based object-orientation, and First-class functions (they are treated like a variable).

HTTPS://EN.WIKIPEDIA.ORG/WIKI/JAVASCRIPT

Create Sample .HTML and .js docs

Create a .html document and create the HTML template inside (use ‘doc’ shortcut).

This can be used to experiment with the examples in the presentation.

The .js file and the .html file should be in the same folder.

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-
width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>JS Example Document</title>
</head>
<body>
    <script src="functions1.js"></script>
    <script src="function2.js"></script>
</body>
</html>
```

Debugging in Chrome

https://javascript.info/debugging-chrome

All modern browsers and most other environments support ***Debugging Tools***.

Debugging Tools is a special UI in ***developer tools*** that makes debugging in the browser much easier. It allows you to trace the code step-by-step to see what is happening.

Chrome has many features and most other browsers have a similar process.

Follow this tutorial to learn how to debug in Chrome (or any other browser).

JavaScript – Overview

https://www.w3schools.com/js/default.asp

JavaScript was invented by Brendan Eich in 1995 and became an ECMA standard in 1997. ***ECMAScript*** is the official name of ***JavaScript***.

It's one of the 3 languages all web developers learn:

1. ***HTML*** defines the content of web pages.
2. ***CSS*** specifies the layout of web pages.
3. ***JavaScript*** is for programing the behavior of web pages.

JS is well-known as the scripting language for web pages, but many desktop and server programs use JavaScript also. Node.js, jQuery, Angular, React, Vue and many others are examples of programs that use JS or are libraries of JS.

Is there an official JS reference?

Nope. We'll use these.

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide

The Modern JavaScript Tutorial

https://en.wikipedia.org/wiki/JavaScript

https://javascript.info/

JavaScript – Overview

https://developer.mozilla.org/en-US/docs/Web/JavaScript

JavaScript (JS) is a prototype-based, multi-paradigm, single-threaded, dynamic, case-sensitive, interpreted (just-in-time compiled) programming language that supports object-oriented, imperative, and declarative (functional) programming styles.

JavaScript is separate from the Java programming language.

Although both "Java" and "JavaScript" are registered trademarks of Oracle, the two languages have different syntax, semantics, and uses.

JS Versions

https://www.w3schools.com/js/js_versions.asp

It is important to understand that ***JavaScript*** has changed over time and will continue to change in the future. The major additions to ***EMCAScript*** have been:

- EMCA3. try/catch handling, better string handling, and numeric output formatting were introduced.
- ES6. classes, 'let' and 'const', iterators, and arrow functions.
- ECMAScript 2017. Async Functions.

Since ES6 it was decided to release a new version every year with iterative improvements.

Ver	Official Name	Description
ES1	ECMAScript 1 (1997)	First edition
ES2	ECMAScript 2 (1998)	Editorial changes
ES3	ECMAScript 3 (1999)	Added regular expressions Added try/catch Added switch Added do-while
ES4	ECMAScript 4	Never released
ES5	ECMAScript 5 (2009) Read More	Added "strict mode" Added JSON support Added String.trim() Added Array.isArray() Added Array iteration methods Allows trailing commas for object literals
ES6	ECMAScript 2015 Read More	Added let and const Added default parameter values Added Array.find() Added Array.findIndex()
	ECMAScript 2016 Read More	Added exponential operator (**) Added Array.includes()
	ECMAScript 2017 Read More	Added string padding Added Object.entries() Added Object.values() Added async functions Added shared memory
	ECMAScript 2018 Read More	Added rest / spread properties Added asynchronous iteration Added Promise.finally() Additions to RegExp

Declaring Variables (*var, let, and const*)

https://developer.mozilla.org/en-US/docs/Learn/Getting_started_with_the_web/JavaScript_basics
https://developer.mozilla.org/en-US/docs/Learn/JavaScript/First_steps/Variables#The_difference_between_var_and_let

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JS creates variables in three ways. '***let*** ', '***var***', and '***const***'

Originally, only ***var*** existed. The design of ***var*** can be confusing. With hoisting, a variable can be initialized before being declared. You can also redeclare a variable multiple times with ***var***.

let was created to fix issues with ***var.***

Use ***let*** (rather than ***var***) unless you need to support versions of IE below v11. ***var*** is function or globally scoped and ***let*** is block scoped.

With ***const***, a variable can be declared that cannot be altered later. Otherwise, it's just like ***let***.

```
1  myName = 'Chris';
2
3  function logName() {
4    console.log(myName);
5  }
6
7  logName();
8
9  var myName;
```

```
1  var myName = 'Chris';
2  var myName = 'Bob';
```

Variable Declaration Rules

https://javascript.info/variables#a-variable

- Variables objects with helper methods. (more)
- You don't have to declare variable types in JavaScript.
- Numbers don't need quotes, but strings and chars do.
- You an declare multiple variables in one line.
- camelCase is conventionally used for variables
- Variables cannot start with a number.
- Variables are case-sensitive.
- Conventionally, chars (0-9, a-z, A-Z) are used for variables.
- Don't use JS keywords.
- Place ***"use strict";*** at the top of .js files to enforce newer conventions (like declaring a variable before defining it).
- Declare an unchanging variable with ***const***.
- Use ALL CAPS for const variables known before compile-time.
- Use meaningful names for variables.
- JS is ***dynamically typed***. This means a variable can be a string and then be a number and then be a float.

```
1  let user = 'John', age = 25, message = 'Hello';
```

```
1  const myBirthday = '18.04.1982';
```

```
1  "use strict";
2
3  num = 5; // error: num is not defined
```

```
1  const COLOR_RED = "#F00";
```

```
2  let message = "hello";
3  message = 123456;
```

Scope – Global, Function, Block

https://www.w3schools.com/js/js_scope.asp

Block Scope: let and const provide **Block Scope**.
Block scope means that variables declared inside a { } block cannot be accessed from outside the block.

```
{
  let x = 2;
}
// x can NOT be used here
```

Variables declared with var do not have ***block scope***. With var, variables declared inside a { } block can be accessed from outside the block.

```
{
  var x = 2;
}
// x CAN be used here
```

- ***Function Scope:*** Variables declared within a JavaScript function, become local to the function.
- ***Global Scope:*** A variable declared outside a function has ***Global Scope***.

Primitive DataTypes

https://javascript.info/types

Datatype	Example	Details
Number (int)	let num = 10;	Operations include *, /, +, -, %, etc. Also includes ***NaN*** (not a number) and ***infinity***
Number(floating point)	let num1 = 7087.542	
BigInt	1234567890789012345678 90n;	Represents any value > -2^53 or < 2^53. Use 'n' at the end of a ***BigInt***.
String	let str1 = "there"; let str2 = 'tiger'; let str3 = `Hey ${str1}, ${str2}`;	Surrounded by quotes. 'str', "str", and `str` (backticks) are valid. Use `str ${otherStr}` for string interpolation. JS has no ***char*** type.
Boolean	let isBool = true; let isTrue = 2>1; //an expression	Only has 2 values.
null	let age = null;	A special value which represents "nothing", "empty" or "value unknown". ***null*** is not a reference to an object.
undefined	let x; //x is undefined	"value is not assigned".

Object Data Type (and Misc.)

https://javascript.info/types

Datatype	Example	Details

Object	//use a constructor
	let john = new User();
	//build a 1-time use object
	let user = {
	  name: "John",
	  age: 30
	};
		Objects are used to store collections of data and more complex entities in a key-value pair format.

typeof operator	Console.log(typeof x); Console.log(typeof(x));	Returns a string of the type of the argument. It's useful when processing different types differently.
Symbol	let id = Symbol("id");	Object property ***keys*** may only be either of ***string*** type, or of ***symbol*** type. Symbols are guaranteed to be unique.

Operands and Operators

https://developer.mozilla.org/en-US/docs/Learn/JavaScript/First_steps/A_first_splash
https://javascript.info/operators#terms-unary-binary-operand

An ***operand*** is the value on which ***operators*** act.

In the expression '5 * 2' there are two operands: the left operand is 5 and the right operand is 2.

JavaScript ***operators*** allow us t o perform tests, do math, concatenate strings, etc. A ***unary*** operator has a single operand (let x = 4;). A ***binary*** operator has two operands (let x = y + z;).

You can also use the + operator to add and join text strings together. In JS, if one operand is a string, the other is converted to a string. (Ex. let new = "hello" + 4;) // 'hello4'

Use ***PEMDAS*** for order of operations: Parentheses, Exponents, Multiplication, Division, Addition, Subtraction.

What is the result of this expression? 10/(3+2)*4+5**2+6-9

Operator	Name	Example
+	Addition	6 + 9
-	Subtraction	20 - 15
*	Multiplication	3 * 7
/	Division	10 / 5

```
1  let name = 'Bingo';
2  name;
3  let hello = ' says hello!';
4  hello;
5  let greeting = name + hello;
6  greeting;
```

Operators

https://javascript.info/operators

Operator	Example	Description
%	6%4 == 2	% is ***modulus*** and gives the remainder.
++	If a = 5, a++ === 6	++ increments by 1. - - decrements by 1. Placed before the variable, ++ or - - occurs before the action. Placed after the variable, ++ or - - happens after the action.
- -	a = 5, a- - == 4	
**	a == 4, b == 3; ***a**b == 64***.	** is the exponent operator. ***a*** is multiplied by itself ***b*** times.
+=	let n = 2; n += 5 == 7	Modify-in-place. Shorthand notation to add, subtract, multiply or divide then save the result to the ***left-hand variable;***
-=	let n = 2; n -= 5 == -3	
*=	let n = 2; n *= 5 == 10	
/=	let n = 10; n /= 5 == 2	

Operator precedence

https://javascript.info/operators#operator-precedence
https://developer.mozilla.org/en/JavaScript/Reference/operators/operator_precedence

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Execution order is defined by operator precedence. Parentheses have the highest precedence. (1 + 2) * 2 = 6.

Every operator has a corresponding precedence number. The operator with the higher number executes first. If the precedence is the same, the execution order is from left to right.

You can also chain assignments.
In ***a = b = c = 2 + 2;*** a, b, and c == 4.

Precedence	Name	Sign
...	...	...
17	unary plus	+
17	unary negation	-
15	multiplication	*
15	division	/
13	addition	+
13	subtraction	-
...	...	...
3	assignment	=

=, ==, and === Operators

https://javascript.info/object#copying-by-reference

=	==	===
Assignment	Equality (with type coersion)	Strict equality
Let a = { }; Let c = { }; let b = a; let d = “13”; let e = 13	a == b //true	a === b //true
	a == c //false	a === c //false
	d == e //true	d === e //false

Operator	Name	Example

`===`	Strict equality (is it exactly the same?)	`5 === 2 + 4 // false`
		`'Chris' === 'Bob' // false`
		`5 === 2 + 3 // true`
		`2 === '2' // false; number versus string`

`!==`	Non-equality (is it not the same?)	`5 !== 2 + 4 // true`
		`'Chris' !== 'Bob' // true`
		`5 !== 2 + 3 // false`
		`2 !== '2' // true; number versus string`

`<`	Less than	`6 < 10 // true` `20 < 10 // false`
`>`	Greater than	`6 > 10 // false` `20 > 10  // true`

Truthy vs Falsy

https://javascript.info/logical-operators
https://developer.mozilla.org/en-US/docs/Glossary/Truthy
https://developer.mozilla.org/en-US/docs/Glossary/Falsy

```
1  if (true)
2  if ({})
3  if ([])
4  if (42)
5  if ("0")
6  if ("false")
7  if (new Date())
8  if (-42)
9  if (12n)
10 if (3.14)
11 if (-3.14)
12 if (Infinity)
13 if (-Infinity)
```

A ***truthy*** value is a value that is considered ***true*** when viewed in a ***Boolean*** context. All values are ***truthy*** unless they are defined as ***falsy***.

`false`	The keyword false
`0`	The number zero
`-0`	The number negative zero
`0n`	BigInt, when used as a boolean, follows the same rule as a Number. `0n` is *falsy*.
`""`	Empty string value
null	null - the absence of any value
undefined	undefined - the primitive value
NaN	NaN - not a number

A ***falsy*** value is a value that is considered false when viewed in a Boolean context.

```
1 if (false)
2 if (null)
3 if (undefined)
4 if (0)
5 if (-0)
6 if (0n)
7 if (NaN)
8 if ("")
```

Type Conversion

https://javascript.info/type-conversions

Most of the time, ***operators*** and ***functions*** automatically convert the values given to them to the correct type. The three most widely used conversions are to ***string***, to ***number***, and to ***boolean.***

<table>
<tr><th>String(x)</th><th colspan="2">Number(x)</th><th colspan="2">Boolean(x)</th></tr>
<tr><td rowspan="6">Any value can be converted to a string.</td><td>If the input is…</td><td>The result is….</td><td>Input</td><td>Result</td></tr>
<tr><td>undefined</td><td>NaN</td><td rowspan="5">0
null
undefined
NaN
“”
‘’</td><td rowspan="5">false</td></tr>
<tr><td>null</td><td>0</td></tr>
<tr><td>true / false</td><td>1 / 0</td></tr>
<tr><td>String that’s not a number.</td><td>Whitespaces are ignored.
An error gives ***NaN***.</td></tr>
<tr><td>string</td><td>An empty ***string*** becomes 0.</td><td>anything else</td><td>true</td></tr>
</table>

JavaScript – Math object Functions

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Math

JavaScript has a built-in Math object which contains a small library of mathematical functions and constants.

Function	Description	Example
Math.random();	returns a floating-point, pseudo-random number in the range 0 to < 1	Math.random()*10; //3.229976827519583
Math.abs(x);	returns the absolute value of a number	Math.abs(-10 – 6.3); //16.3
Math.pow(x,y);	returns x to the power of y	Math.pow(7, 3); //343
Math.floor(x);	returns the largest integer less than or equal to a given number	Math.floor(5.05) //5
Math.ceil(x);	rounds a number up to the next largest whole number or integer.	Math.ceil(11.324); //12
Math.max(a,b,…z)	returns the largest of zero or more numbers	Math.max(1, 3, 2); //3

Map

https://javascript.info/map-set#map
https://javascript.info/weakmap-weakset#weakmap

Map
Map is a collection of ***key-value*** data items, just like an ***Object***.
Any type of key is possible, even ***Object.***
Insertion order is used for iteration order.

```
let map = new Map();

map.set('1', 'str1');   // a string key
map.set(1, 'num1');     // a numeric key
map.set(true, 'bool1'); // a boolean key

// remember the regular Object? it would convert ke
// Map keeps the type, so these two are different:
alert( map.get(1)   ); // 'num1'
alert( map.get('1') ); // 'str1'

alert( map.size ); // 3
```

Weak Map

https://javascript.info/weakmap-weakset#weakmap

WeakMap
WeakMap keys must be objects
There is no way to get all ***keys*** or ***values*** from a ***weak map***
If you remove all other references to an ***object key***, the ***object*** is removed from memory and the ***WeakMap()***.
WeakMap does not support iteration or the methods ***keys(), values(), entries()***

```
let john = { name: "John" };

let weakMap = new WeakMap();
weakMap.set(john, "...");

john = null; // overwrite the reference

// john is removed from memory!
```

```
let weakMap = new WeakMap();

let obj = {};

weakMap.set(obj, "ok"); // works fine (object key)

// can't use a string as the key
weakMap.set("test", "Whoops"); // Error, because "test" is not an object
```

Set

https://javascript.info/map-set#set

Set

A ***Set*** is a special type collection – "set of ***values***" (without ***keys***), where each ***value*** must be unique.

A ***Set*** is analogous to an ***array*** of strings with code to check for duplicate names.

```
let set = new Set();

let john = { name: "John" };
let pete = { name: "Pete" };
let mary = { name: "Mary" };

// visits, some users come multiple times
set.add(john);
set.add(pete);
set.add(mary);
set.add(john);
set.add(mary);

// set keeps only unique values
alert( set.size ); // 3

for (let user of set) {
  alert(user.name); // John (then Pete and Mary)
}
```

Weak Set

https://javascript.info/weakmap-weakset#weakset

Weak Set
Just like ***Set*** but only ***Objects*** are allowed.
An object exists in the set while it is reachable from somewhere else.
Being “weak”, it serves as additional storage. But only for “yes/no” facts. (use ***.has(obj)*** helper function).
WeakSet is not iterable and does not support ***.size()***, or ***.keys()***

```
let visitedSet = new WeakSet();

let john = { name: "John" };
let pete = { name: "Pete" };
let mary = { name: "Mary" };

visitedSet.add(john); // John visited us
visitedSet.add(pete); // Then Pete
visitedSet.add(john); // John again

// visitedSet has 2 users now

// check if John visited?
alert(visitedSet.has(john)); // true

// check if Mary visited?
alert(visitedSet.has(mary)); // false

john = null;

// visitedSet will be cleaned automatically
```

User Interaction in a browser – alert, prompt, confirm

https://javascript.info/alert-prompt-confirm

The browser functions ***alert()***, ***prompt()*** and ***confirm()*** allow interaction with the user. You can get input from the user through a pop-up window to which you can print instructions, warnings, or get answers to a question.

alert(message)	prompt(title, [default])	confirm()
This shows a message and pauses script execution until the user presses “OK”.	Shows a ***modal*** window with a text message, an input field for the visitor, and the buttons OK/Cancel. Default is the initial value for the input field.	The function confirm shows a ***modal*** window with a question and two buttons: OK and Cancel.

JSON and JSON Methods

https://javascript.info/json

JSON (JavaScript Object Notation) was initially made for JavaScript, but now is available anywhere. ***JSON*** is used for data exchange. JavaScript provides two ***JSON*** methods:

- JSON.stringify() to convert objects into a ***JSON*** string.
- JSON.parse() to convert ***JSON*** back into an object.

In this example, the method ***JSON.stringify(student)*** takes the object and converts it into a string. The ***JSON*** string is called a JSON-encoded, ***serialized***, or ***stringified*** object. It is ready to be sent over HTTP or stored in a file, etc.

```
let student = {
  name: 'John',
  age: 30,
  isAdmin: false,
  courses: ['html', 'css', 'js'],
  wife: null
};

let json = JSON.stringify(student);

alert(typeof json); // we've got a string!

alert(json);
/* JSON-encoded object:
{
  "name": "John",
  "age": 30,
  "isAdmin": false,
  "courses": ["html", "css", "js"],
  "wife": null
}
*/
```

JSON.parse

https://javascript.info/json#json-parse

JSON.parse decodes a ***JSON*** 'stringified' string.

The ***JSON*** may be as complex as necessary. Objects and arrays can include other objects and arrays, but they must obey the same ***JSON*** format.

```
5    let userData = '{ "name": "John", "age": 35,
6    "isAdmin": false, "friends": [0,1,2,3] }';
7
8    let user = JSON.parse(userData);
9
10   alert( user.friends[1] ); // 1
```