Building Blocks of JavaScript

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What is JavaScript?

- JavaScript is a scripting (interpreted) language.
  - versatile,
  - high-level programming language.
- JavaScript has major role in web development.
  - JavaScript allows developers to add dynamic and interactive elements to websites, enhancing user experience.
  - Earlier, JavaScript was used for only front-end development.
  - Node.JS environment allows to create server side applications also using JavaScript as a programming language.

History of JavaScript?

- JavaScript is a scripting language created by Netscape.
- The original name for JavaScript was LiveScript.
    - The name was changed when Java became popular.
- Similar Script was created by Microsoft called JScript.
- European Computer Manufacturers Association (ECMA) provides standard for scripting languages.
- JavaScript is also called ECMAScript, but browser still refers it as JavaScript.

JavaScript vs Java

JavaScript

- Need browser to run and text editor to build programs.
- Variables are untyped.
- Has objects, but no class (class was added but syntactic sugar).
- Events and event handlers.
- Source code is interpreted.

Java

- Needs JRE to run and JDK to build programs.
- Variables are typed.
- Pure object oriented (objects and class).
- Events and event handlers.
- Source code is translated to byte code, which is run.

JavaScript and EcmaScript

- JavaScript is an implementation of the ECMAScript standard.
- The ECMAScript only defines
  - The syntax/characteristics of the language and
  - A basic set of commonly used objects such as Number, Date, Regular Expression, etc.
- Browsers typically support additional objects such as
  - Window,
  - Frame,
  - Form,
  - DOM,
  - Services.

Key Characteristics of JavaScript

- Statements in JavaScript resemble statements in Java:
  - Because both languages borrowed heavily from the C language.
- JavaScript is platform-independent.
  - Client-side JavaScript executes on the user's browser.
  - Server-side JavaScript executes on Node environment (V8 Engine).
    - V8 JavaScript Engine is open-source, developed by The Chromium Project for the Google Chrome Browser.
- JavaScript is Object Oriented.
- JavaScript is Event driven.
- JavaScript supports asynchronous execution and asynchronous programming.

Use Cases of JavaScript

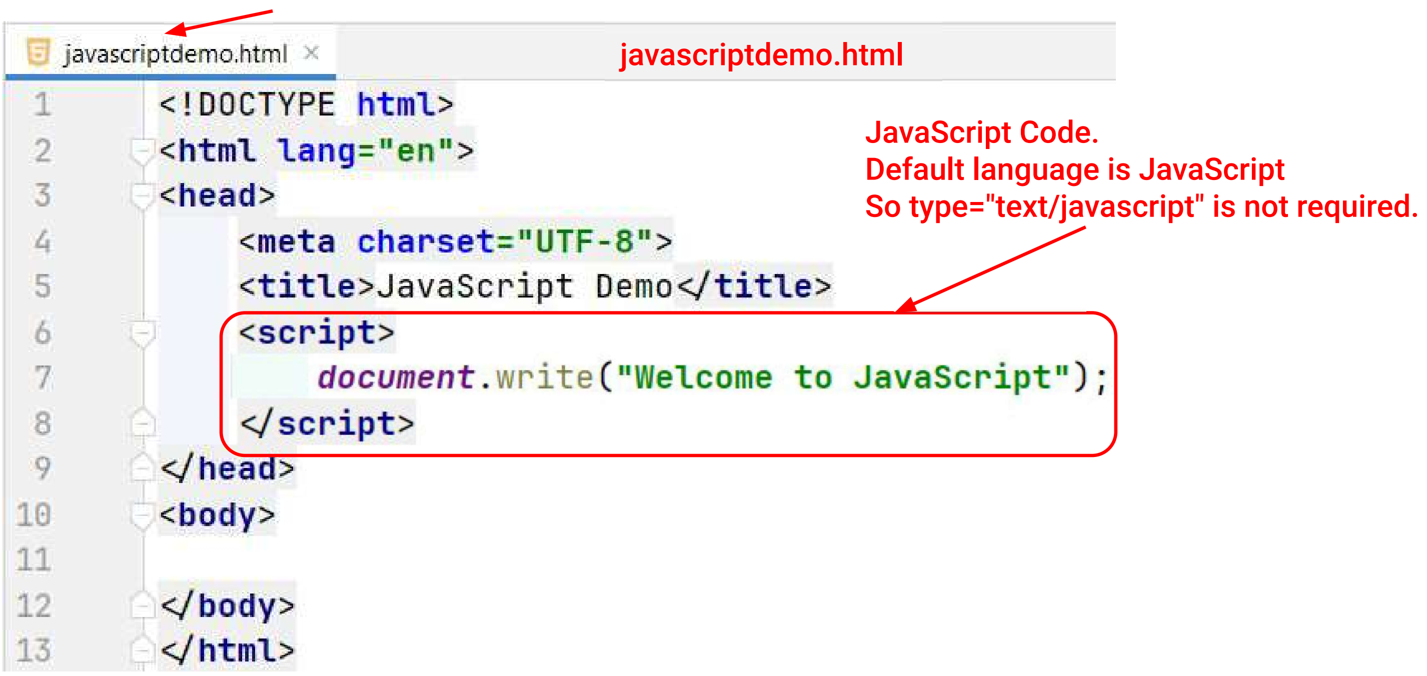
- JavaScript is a versatile language.
- Web development:
    - Core language for creating dynamic and interactive web pages.
    - Modern frontend frameworks are based on that or support JavaScript.
- Server-side development:
    - Node.js allows using JavaScript for server-side scripting.
- Mobile App Development:
    - JavaScript is used in frameworks like React Native for building cross platform applications.
- Game Development:
    - Used in conjunction with HTML5 for browser-based games.

How to Run JavaScript in a Browser

- JavaScript code is included within <script> tags in HTML document:
-
```
<script type="text/javascript">
    document.write("<h1>Hello World!</h1>") ;
</script>
```
- Understanding of the code
    - We could use other script, type="text/jscript"
    - Script: javascript is the default.
    - Semicolon is optional. But, needed if we put two or more statements on the same line.

Example: Using JavaScript

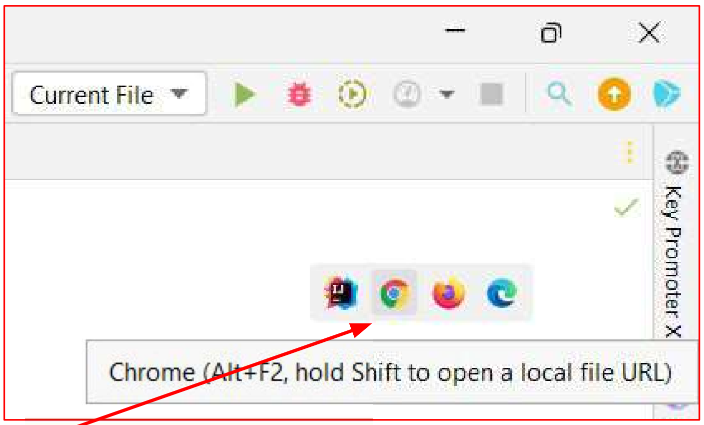
Create HTML File using IntelliJ Idea



javascriptdemo.html
javascriptdemo.html
JavaScript Code.
Default language is JavaScript
So type="text/javascript" is not required.

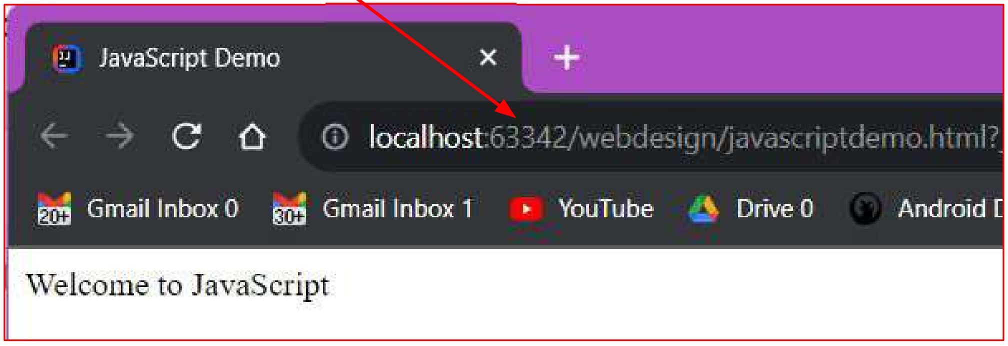
```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>JavaScript Demo</title>
    <script>
        document.write("Welcome to JavaScript");
    </script>
</head>
<body>

</body>
</html>
```

Run File in Browser



Chrome (Alt+F2, hold Shift to open a local file URL)

IntelliJ Idea allows to run HTML file directly from the IDE.
The IDE opens a port to serve HTML files.



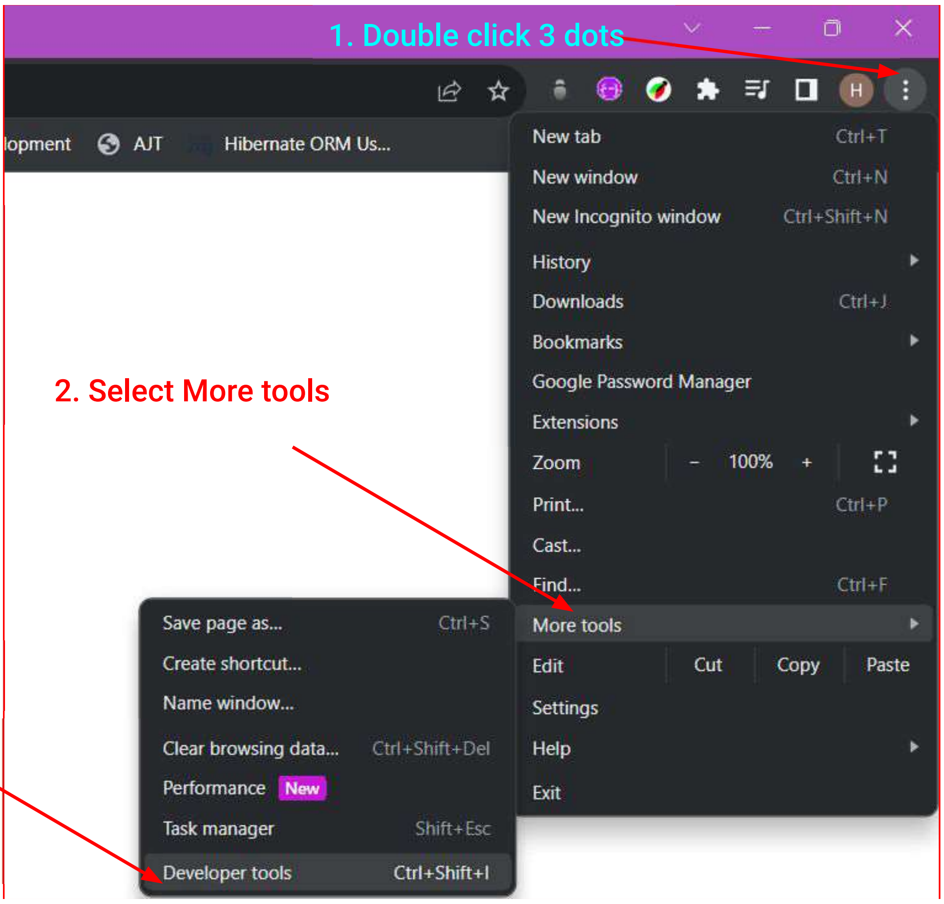
localhost:63342/webdesign/javascriptdemo.html?

Welcome to JavaScript

Writing JavaScript Code Directly in Browser

- Open Developer Tools in web browser:
- Two ways:
    - Using menu.
    - Ctrl + Shift + I (shortcut)

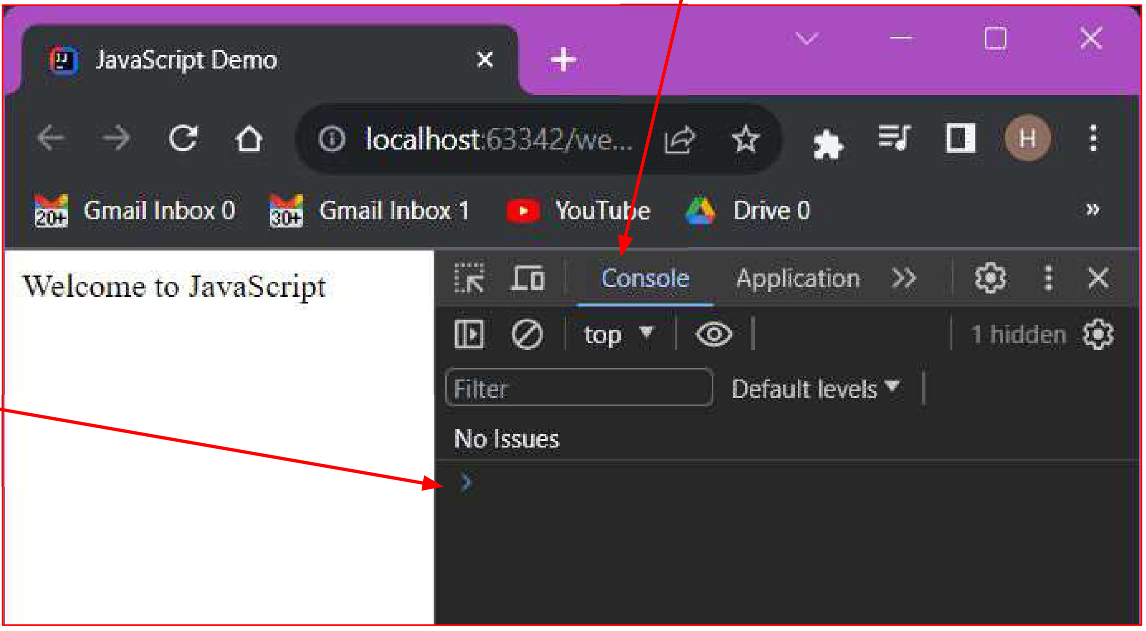
3. Click Developer tools



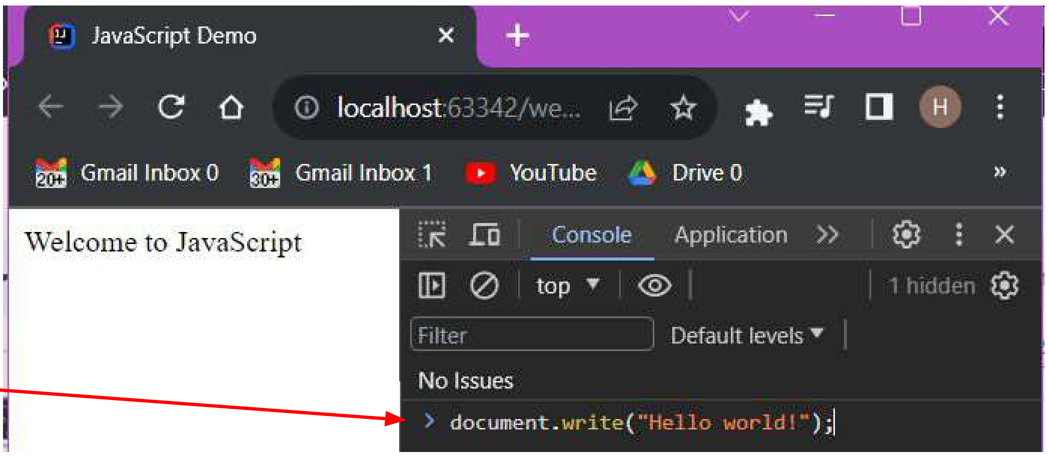
Write JavaScript Code Directly in Browser

1. Select Console tab

2. Write JavaScript statements directly here on console terminal.



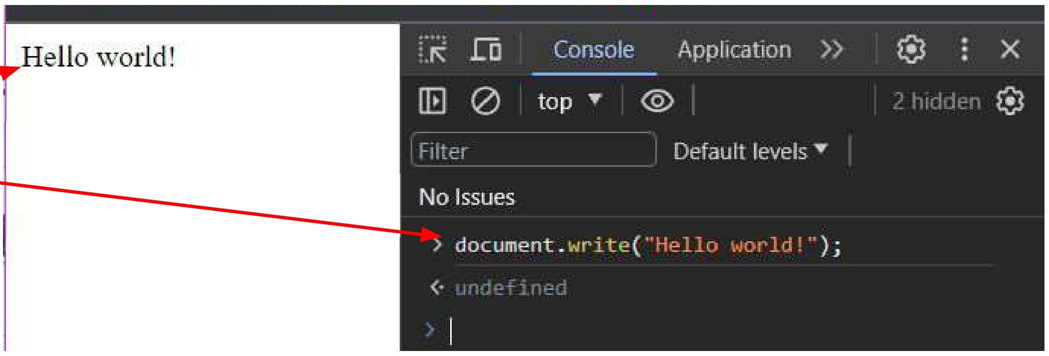
1. Write JavaScript statement. Hit ENTER key.



Welcome to JavaScript

```
> document.write("Hello world!");
```

2. Browser executes JavaScript and shows output.



Hello world!

```
> document.write("Hello world!");
< undefined
>
```

Options to Associate JavaScript Code with Webpage

- We can write JavaScript code inline with form fields.
- We can place JavaScript code in <head> portion.
  - JavaScript functions should be defined in the <head>.
  - This make sure that the function is loaded before it is needed.
- We can place JavaScript code anywhere inside <body>.
- We can place JavaScript code in a separate .js file.
  - In HTML file, we write the following to use JavaScript available in a separate file:
    - <script src="myjs.js"></script>
  - The .js file (myjs.js) does not require to include <script> element again.

JavaScript Language

- JavaScript is dynamically typed language.
- It’s syntax is similar to Java language.
- JavaScript supports:
    - variables, arrays, objects.
    - control structures (if else, switch)
    - loop constructs (for while, for in, for of)
    - error handling using try catch.
    - inbuilt objects.
    - inbuilt functions.

Variables in JavaScript Language

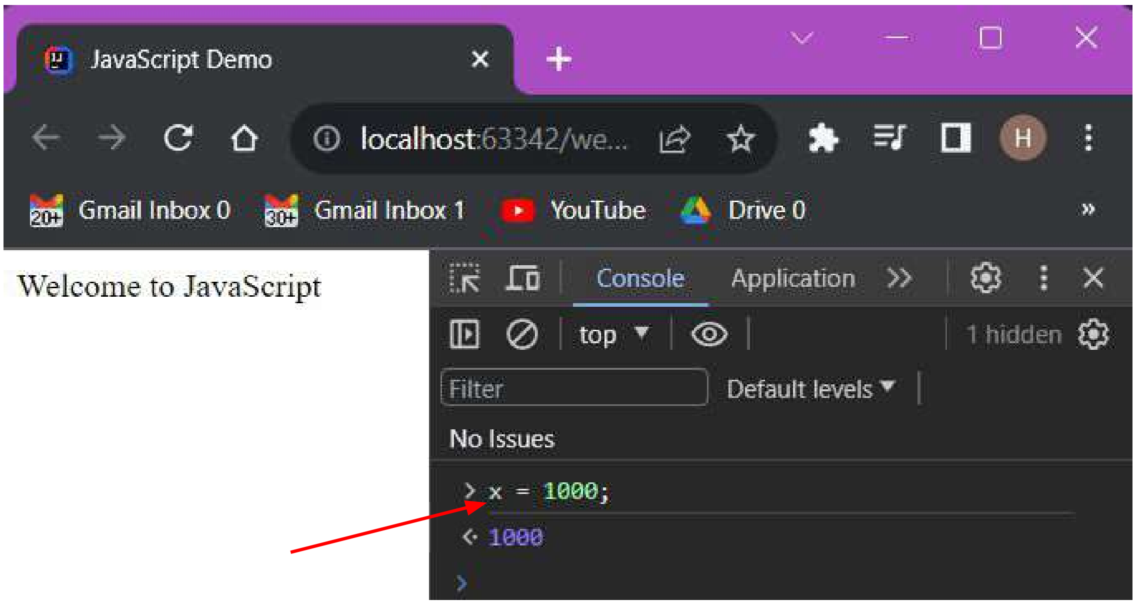
- JavaScript is dynamically typed language.
    - var n = “JavaScript”;
      n = 1.5;
      n = 1;
- The word var is optional.
- Variables are not typed (they can hold values of any data type)
- Variable names are case sensitive.
- Variables names must begin with a letter or underscore.

Global Variables vs Local Variables in JavaScript

- Local Variables:
    - Variables declared within a function are local to that function
    - Local variables are accessible only within that function.
- Global variables:
    - Variables declared outside a function are global.
    - Global variables are accessible from anywhere on the page.
        - To access say variable x, we can write window.x.

Example: Variable

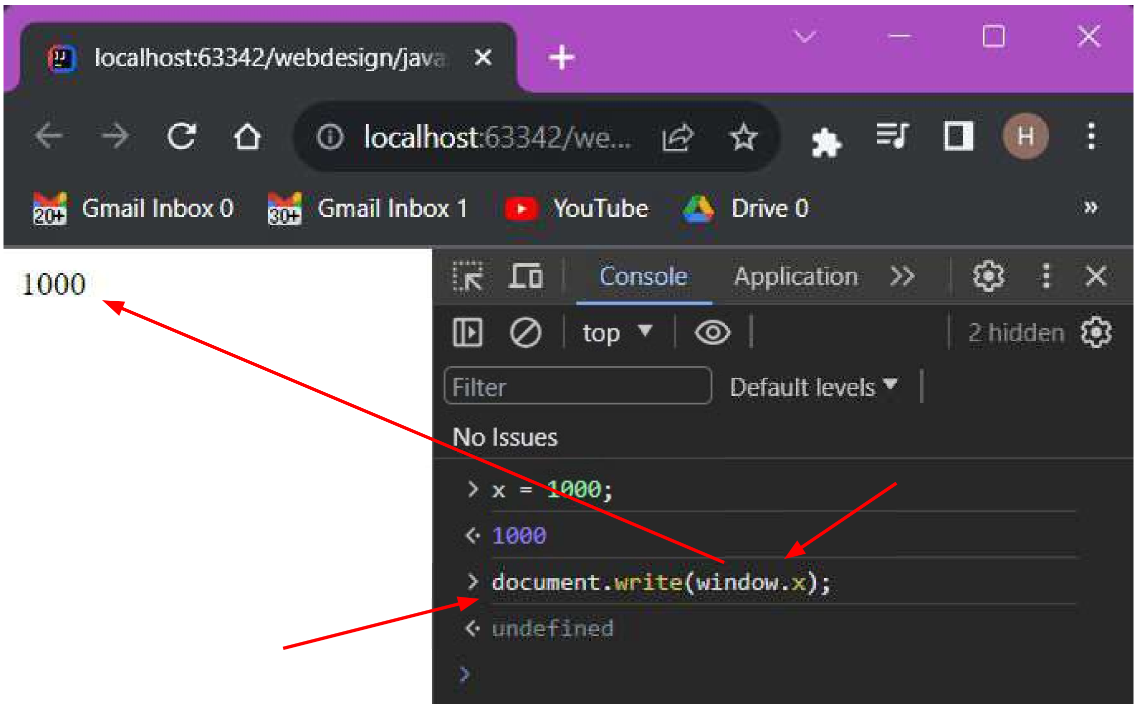
Declaring Global Variable



Welcome to JavaScript

```
> x = 1000;
< 1000
>
```

Using Global Variable



1000

```
> x = 1000;
< 1000
> document.write(window.x);
< undefined
>
```

Datatypes in JavaScript

- Primitive data types:
  - Number: integer and floating-point numbers.
  - Boolean: true or false.
  - String: a sequence of characters.
- Composite data types (or Complex data types)
  - Object: a named collection of data.
  - Array: a sequence of values (an array is actually a predefined object)
- Special data types:
  - null: the only value is null – to represent nothing.
  - undefined: the only value is undefined – to represent the value of an uninitialized variable.

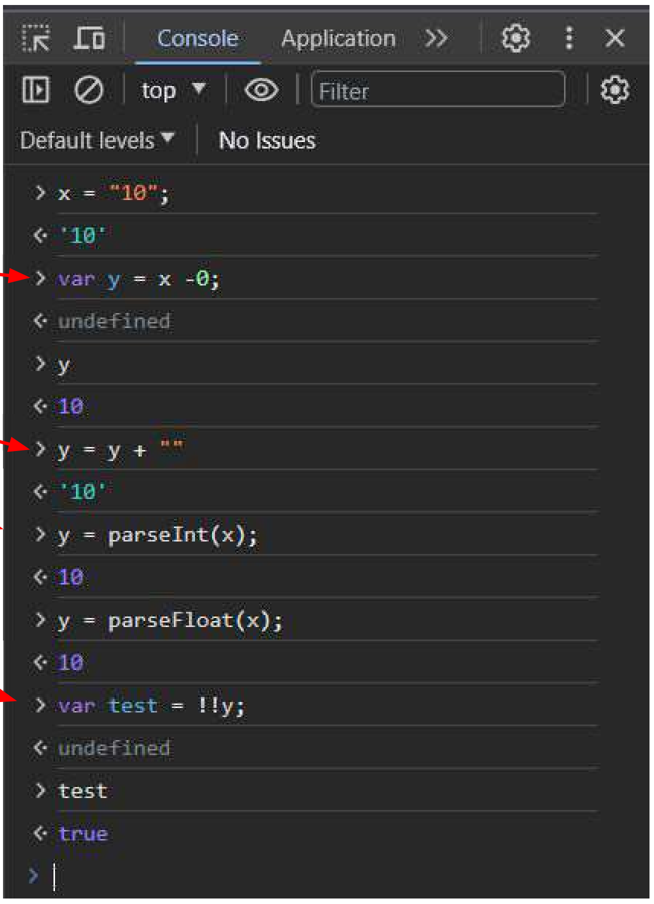
Boolean

- Booleans are either true or false.
- 0, "0", empty strings, undefined, null, and NaN are false.
- All other values are true.

Example: Datatype and Type Conversion

Type Conversion

- Converting a value **to a number**:
  - var numberVar = someVariable **– 0**;
- Converting a value **to a string**:
  - var stringVar = someVariable **+ ""**;
- Converting a string to a number:
  - **parseInt**("123");
    OR **parseFloat**("123.45");
- Converting a value **to a boolean**:
  - var boolVar = **!!**someVariable;



```
> x = "10";
< '10'
> var y = x -0;
< undefined
> y
< 10
> y = y + ""
< '10'
> y = parseInt(x);
< 10
> y = parseFloat(x);
< 10
> var test = !!y;
< undefined
> test
< true
>
```

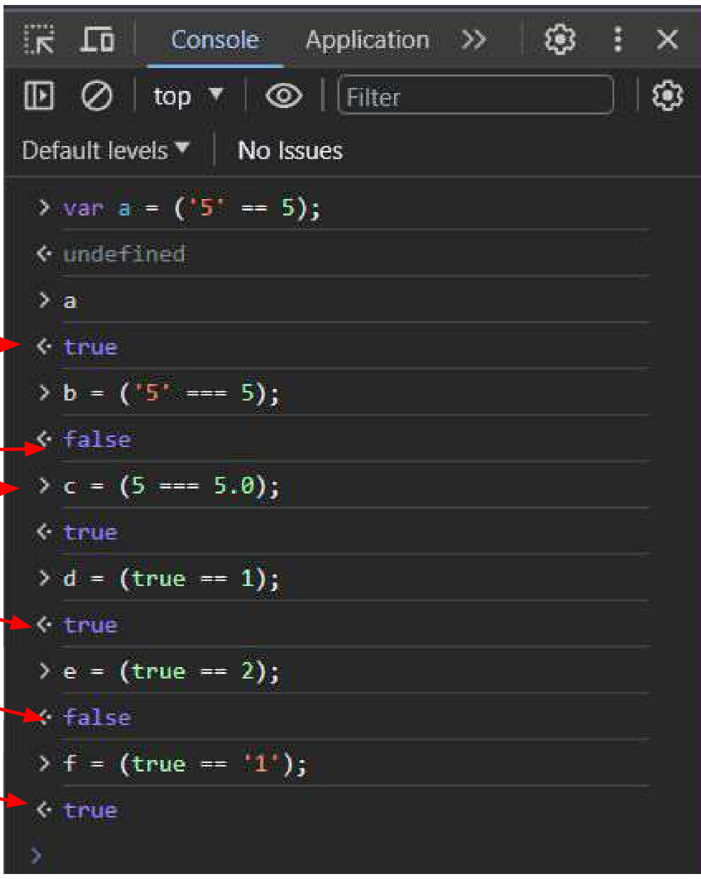
Important Operators

- The conditional operator (?:):
    - condition ? value_if_true : value_if_false
- Special equality test:
    - == and != try to convert their operands present on both the sides to the same type before performing the test.
    - === and !== do not convert operands to the same type.

Example: == and === Operators

Important Operators: == vs ===

- Type conversion is performed before comparison in use of == comparison.
    - var a = ("5" == 5); // true
- No implicit type conversion.
    - var b = ("5" === 5); // false
- var c = (5 === 5.0); // true
- var d = (true == 1); // true
    - (true is converted to 1)
- var e = (true == 2); // false
    - (true is converted to 1)
- var f = (true == "1") // true



```
> var a = ('5' == 5);
< undefined
> a
< true
> b = ('5' === 5);
< false
> c = (5 === 5.0);
< true
> d = (true == 1);
< true
> e = (true == 2);
< false
> f = (true == '1');
< true
>
```

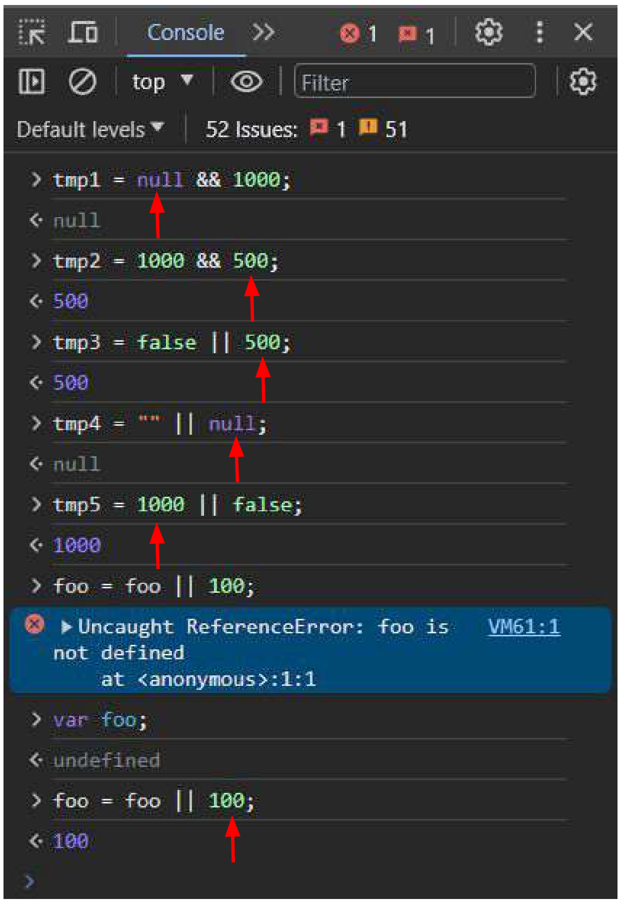
Important Operators: && and ||

- Important information: The && and || operators are heavily used in React while conditionally rendering.
- Usage of (firstThing && secondThing)
    - If the first thing is true then only perform the second thing.
    - Example, If API response has come (first thing), then render the response (second thing)
- Usage of (firstThing || secondThing)
    - If the first thing is false then only perform the second thing.
    - Example, if an API URL is not initialized, then initialize API URL.

Example: && and || Operators

Important Operators: && and ||

- tmp1 = null && 1000;   // tmp1 is null
- tmp2 = 1000 && 500;   // tmp2 is 500
- tmp3 = false || 500;   // tmp3 is 500
- tmp4 = "" || null;   // tmp4 is null
- tmp5 = 1000 || false;   // tmp5 is 1000
- var foo;
  foo = foo || 100;
  // If foo is null, undefined, false, zero, NaN,
  // or an empty string are falsy values.

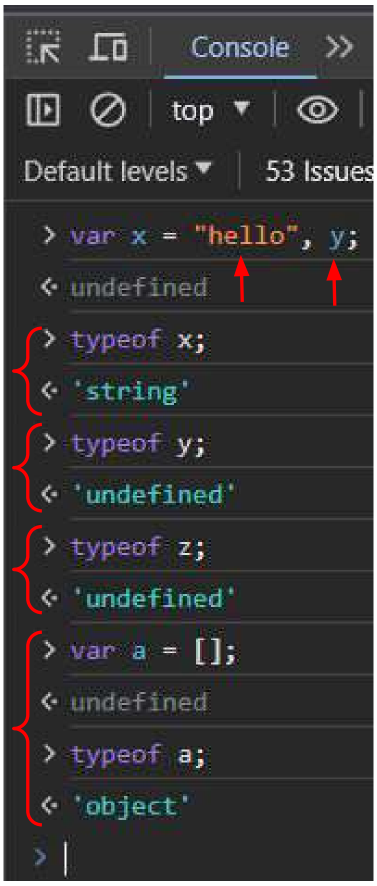


```
> tmp1 = null && 1000;
< null
> tmp2 = 1000 && 500;
< 500
> tmp3 = false || 500;
< 500
> tmp4 = "" || null;
< null
> tmp5 = 1000 || false;
< 1000
> foo = foo || 100;
✖ ▶Uncaught ReferenceError: foo is      VM61:1
  not defined
      at <anonymous>:1:1
> var foo;
< undefined
> foo = foo || 100;
< 100
>
```

Example: typeof Operator

typeof Operator

- The typeof operator (unary) tells the type of its operand.
  - Returns a string which can be number, string, boolean, object, function, undefined, and null.
- var x = "hello", y;
- typeof x;
- typeof y;
- typeof z;
- var a = [];
  - An array is internally stored as an object.



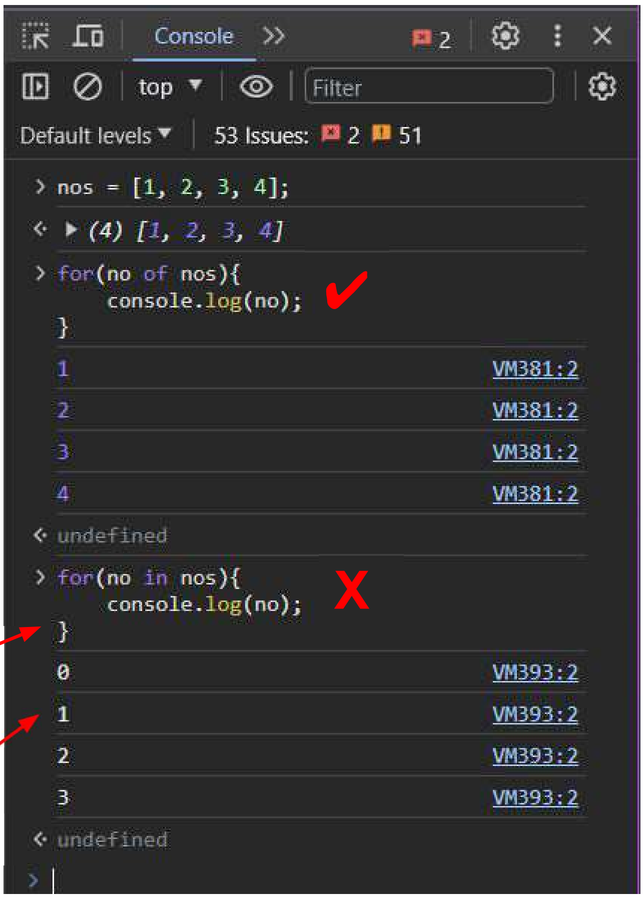
```
> var x = "hello", y;
< undefined
> typeof x;
< 'string'
> typeof y;
< 'undefined'
> typeof z;
< 'undefined'
> var a = [];
< undefined
> typeof a;
< 'object'
>
```

Example: Loop Constructs

Important Loop Constructs

- for … of loop (elements of array)
  - The for...of loop is used to iterate over iterable objects such as arrays, strings, maps, sets, etc.
- for … in loop (members in object)
  - The for...in loop is used to iterate over the enumerable properties of an object.
- Be careful to use the right loop construct when working with array.
  - The for...in provides keys.

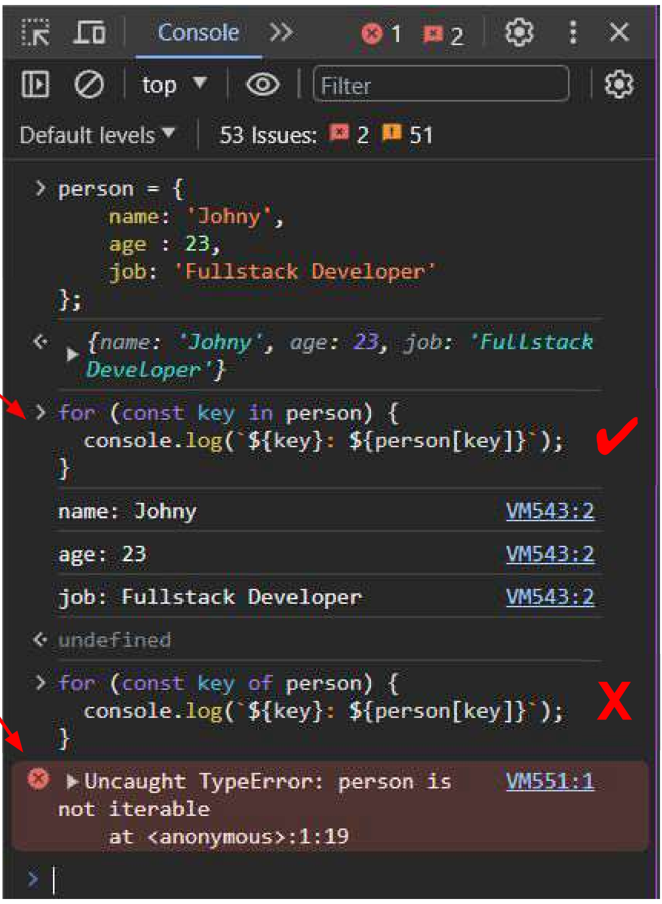
These are keys (indexes) of the array



```
> nos = [1, 2, 3, 4];
< ▶ (4) [1, 2, 3, 4]
> for(no of nos){
      console.log(no);
  }
  1                                  VM381:2
  2                                  VM381:2
  3                                  VM381:2
  4                                  VM381:2
< undefined
> for(no in nos){
      console.log(no);
  }
  0                                  VM393:2
  1                                  VM393:2
  2                                  VM393:2
  3                                  VM393:2
< undefined
>
```

Important Loop Constructs

- While working with object, we can use only for … in loop construct.
- Object is not iterable, so for … of loop construct cannot be used.



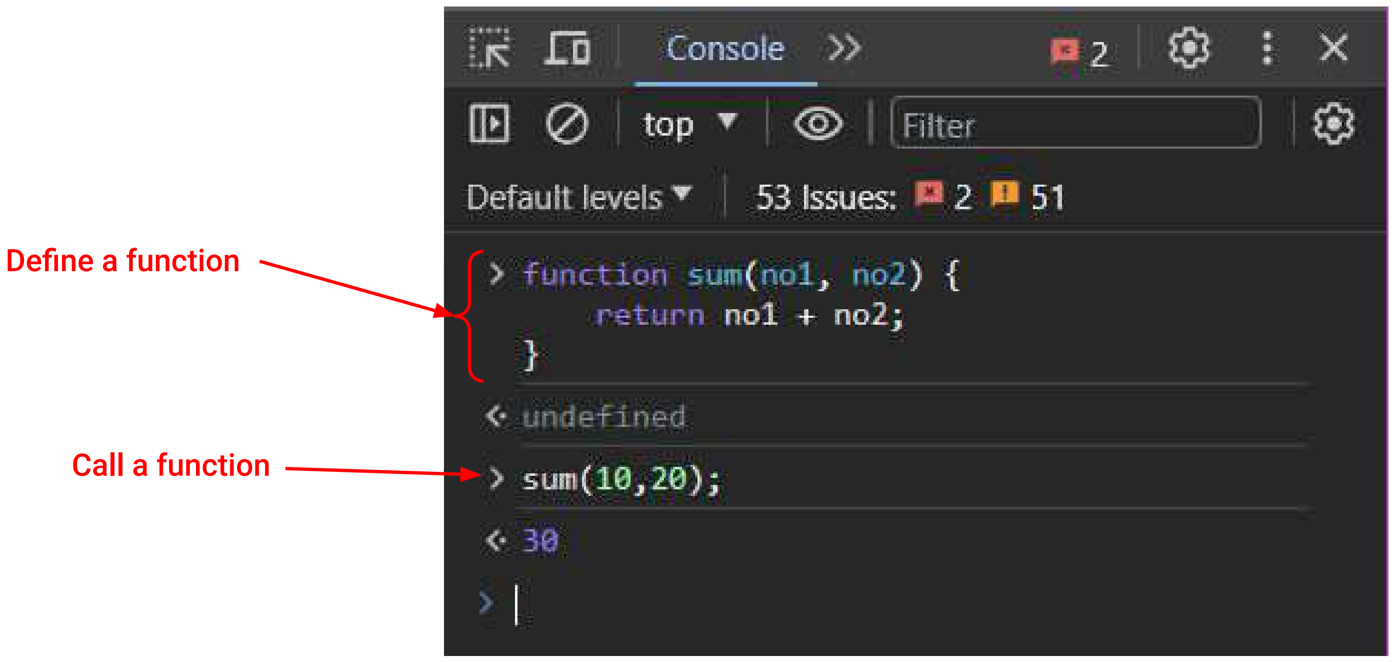
```
> person = {
      name: 'Johny',
      age : 23,
      job: 'Fullstack Developer'
  };
< ▸ {name: 'Johny', age: 23, job: 'Fullstack
  Developer'}
> for (const key in person) {
    console.log(`${key}: ${person[key]}`);
  }
  name: Johny                              VM543:2
  age: 23                                  VM543:2
  job: Fullstack Developer                 VM543:2
< undefined
> for (const key of person) {
    console.log(`${key}: ${person[key]}`);
  }
⊗ ▸Uncaught TypeError: person is          VM551:1
  not iterable
      at <anonymous>:1:19
>
```

Functions

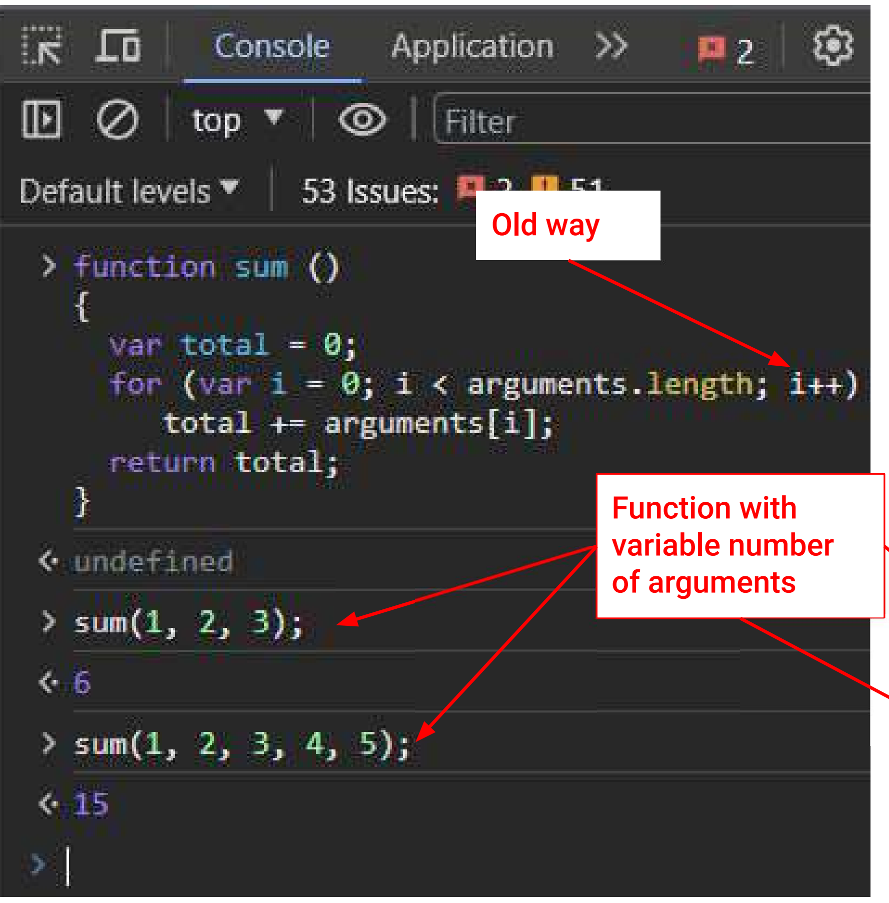
- Functions should be defined in the <head> of an HTML page, to ensure that they are loaded first.
- The syntax for defining a function is:
  function functionName(arg1, …, argN) { statements }
- The function may contain return value statements.
- Any variables declared within the function are local to it.
- The syntax for calling a function is just
  functionName(arg1, …, argN);
- Simple parameters are passed by value, objects are passed by reference.

Example: Functions

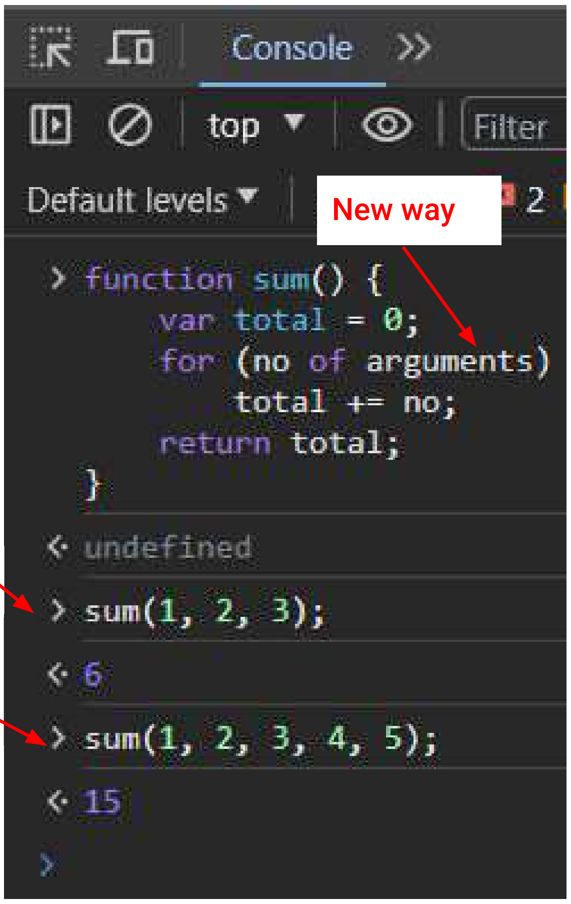
Function with Fixed Number of Arguments



```
> function sum(no1, no2) {
      return no1 + no2;
  }
< undefined
> sum(10,20);
< 30
>
```



```
> function sum ()
  {
    var total = 0;
    for (var i = 0; i < arguments.length; i++)
       total += arguments[i];
    return total;
  }
<· undefined
> sum(1, 2, 3);
<· 6
> sum(1, 2, 3, 4, 5);
<· 15
```

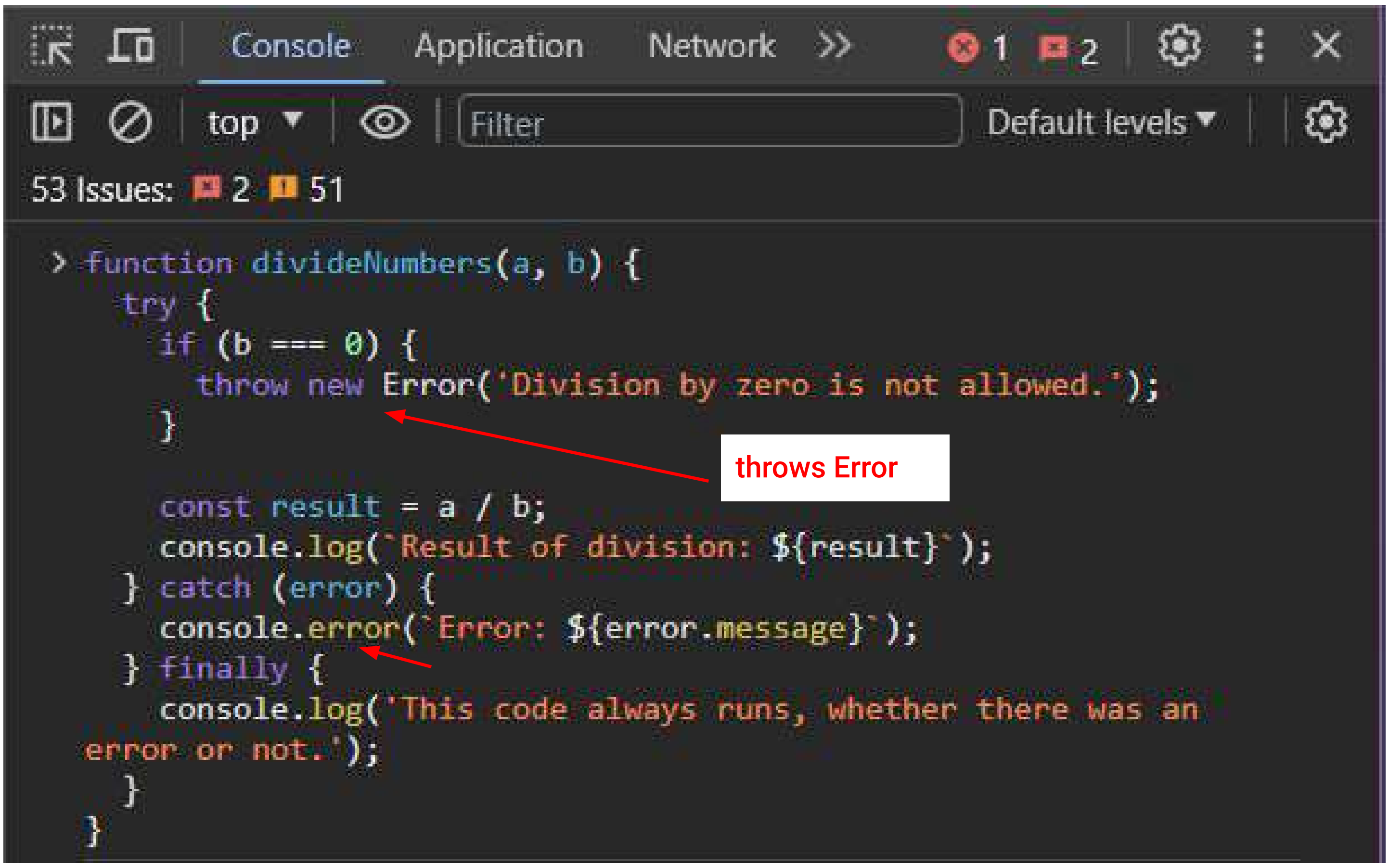


```
> function sum() {
       var total = 0;
       for (no of arguments)
           total += no;
       return total;
  }
<· undefined
> sum(1, 2, 3);
<· 6
> sum(1, 2, 3, 4, 5);
<· 15
```

try catch finally for Exception Handling

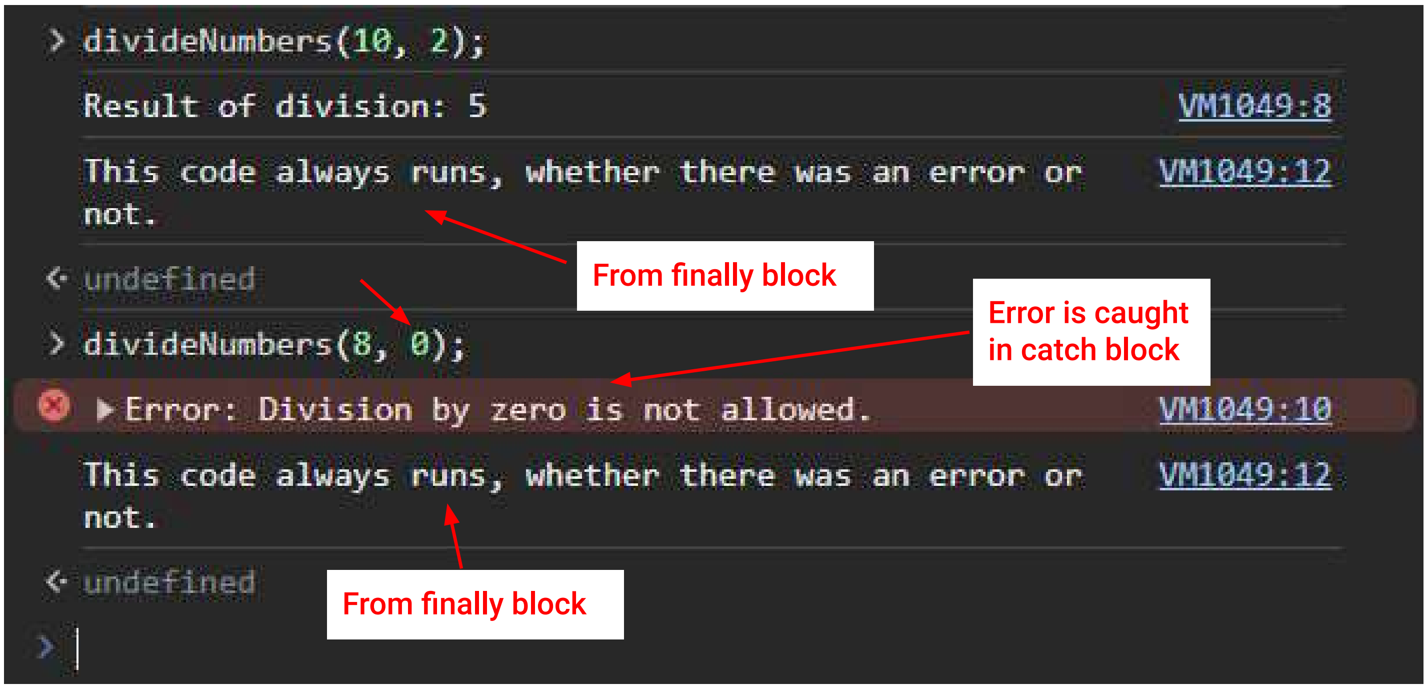
- Exception handling in JavaScript is almost the same as in Java.
- The throw expression creates and throws an exception.
- try {
    // statements to try
  } catch (e) {   // Notice: no type declaration for e
    // exception handling statements
  } finally {   // optional, as usual
    // code that is always executed
  }

Example: try-catch-finally



```
> function divideNumbers(a, b) {
    try {
      if (b === 0) {
        throw new Error('Division by zero is not allowed.');
      }

      const result = a / b;
      console.log(`Result of division: ${result}`);
    } catch (error) {
      console.error(`Error: ${error.message}`);
    } finally {
      console.log('This code always runs, whether there was an
  error or not.');
    }
  }
```

Testing Exception Handling



```
> divideNumbers(10, 2);
  Result of division: 5                                         VM1049:8
  This code always runs, whether there was an error or          VM1049:12
  not.
<· undefined
> divideNumbers(8, 0);
⊗ ▶Error: Division by zero is not allowed.                      VM1049:10
  This code always runs, whether there was an error or          VM1049:12
  not.
<· undefined
> |
```

The this keyword

- The this is a keyword and not a variable, so its value cannot be changed.
- In JavaScript, this refers to an object.
- To which object, this refers depends on how it is used.
  - In an object method, this refers to the object.
  - Alone, this refers to the global object.
  - In a function, this refers to the global object.
  - In a function, in strict mode, this is undefined.
  - In an event, this refers to the element that received the event.
  - Methods like call(), apply(), and bind() can refer this to any object.

References

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